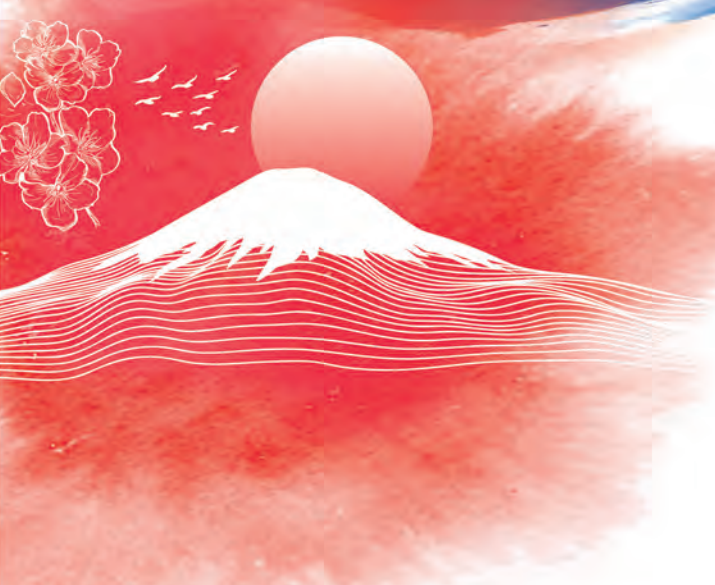# ICSU 2023
11th JKJSC

International Conference STROKE UPDATE 2023
& 11th Japan–Korea Joint Stroke Conference

November 16(Thu) - 18(Sat), 2023
Paradise Hotel, Busan, Korea

ABSTRACT BOOK

JStS

Korean Stroke Society

KOREA TOURISM ORGANIZATION

bto BUSAN TOURISM ORGANIZATION

Program at a glance

Day 1: November 16 (Thu)

Room	Room 1 (GBR), 2F	Room 2 (Capri), 2F	Poster (Sydney), 2F
08:00			
09:00	[Symposium 1] Cardioembolic Stroke	[Scientific Session 1]	
10:00			
	Coffee Break (10:40-11:00)		
11:00	[Plenary Session 1]		
12:00	[Luncheon Symposium 1] Amgen Korea	[Luncheon Symposium 2] Lixiana	
13:00	[Satellite Symposium 1] Samjin pharm		[Poster Session 1]
	Coffee Break (13:30-13:50)		
14:00	[Symposium 2] SVD	[Scientific Session 2]	
15:00			
	Coffee Break (15:30-15:50)		
16:00	[Symposium 3] Genetics		
17:00			

Day 2: November 17 (Fri)

Room	Room 1 (GBR), 2F	Room 2 (Capri), 2F	Poster (Sydney), 2F
08:00	[Breakfast Symposium 1] VIATRIS KOREA	[Breakfast Symposium 2] Organon Korea Co., Ltd.	
09:00	[Symposium 4] Reperfusion Therapy	[Scientific Session 3]	
10:00			
	Coffee Break (10:40-11:00)		
11:00	[Plenary Session 2]		
12:00	[Luncheon Symposium 3] Sanofi Aventis Korea	[Luncheon Symposium 4] Eliquis	
13:00	[Satellite Symposium 2] MYUNG-IN PHARM.	[Satellite Symposium 3] Korea Otsuka Pharmaceutical.	[Poster Session 2]
	Coffee Break (13:30-13:50)		
14:00	[Symposium 5] Acute Stroke Care System in Asia	[Scientific Session 4]	
15:00			
	Coffee Break (15:30-15:50)		
16:00	[Symposium 6] AI & Informatics	[Policy Session] (For Korean Only)	
17:00	[Resident Session] (For Korean Only)		
18:00	Presidential Dinner (Invitation Only)		

Day 3: November 18 (Sat)

Room	Room 1 (Sicily), 1F	Room 2 (Sydney), 2F	Room 3 (Panorama), 16F
08:00			
09:00	[Symposium 7] Quality Improvement in Stroke Care	[Nursing Symposium] (For Korean Only)	
10:00			[Poster Blitz Session] (For Korean Only)
	Coffee Break (10:40-11:00)		
11:00	[Symposium 8] Intracranial Artery Stenosis	[Debate Session] (For Korean Only)	
12:00			
13:00	[Luncheon Symposium 5] Daewoong Bio		
14:00		[Genesis-K Symposium 1]	
15:00		Coffee Break (15:35-15:55)	
16:00		[Genesis-K Symposium 2]	
17:00			
18:00			
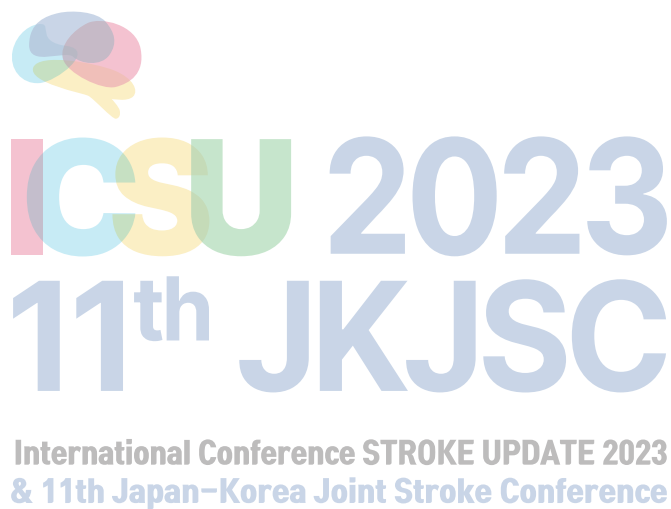
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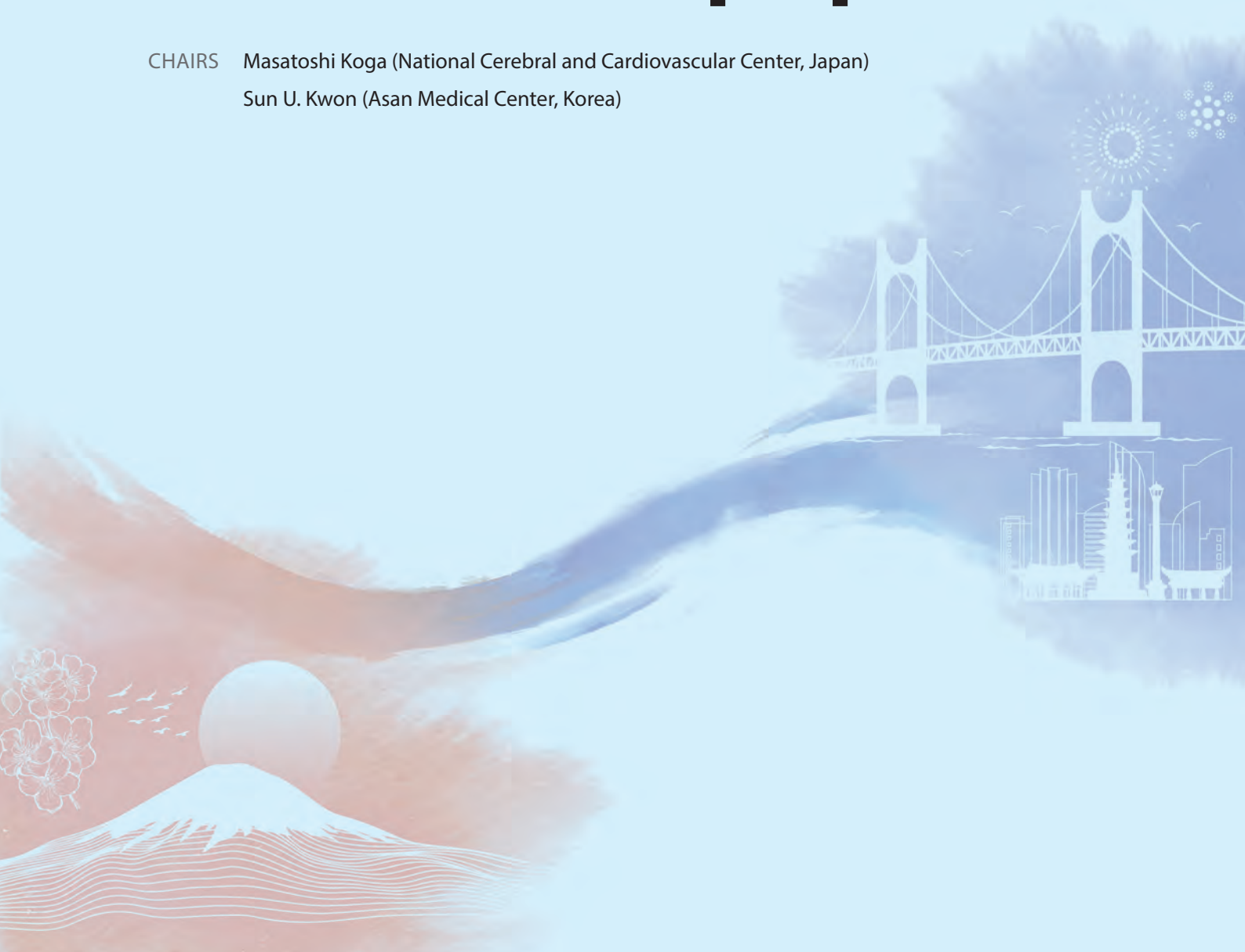
ICSU 2023
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International Conference STROKE UPDATE 2023
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November 16 (Thu) 09:00-10:40 | Room 1

Symposium 1.
Cardioembolic Stroke [ENG]

CHAIRS   Masatoshi Koga (National Cerebral and Cardiovascular Center, Japan)

Sun U. Kwon (Asan Medical Center, Korea)

Imaging and blood biomarkers of CE stroke: State-of-the art

Woo-Keun Seo

Samsung Medical Center, Korea

Ischemic stroke is a heterogeneous disease with a various etiology. The precise identification of etiology of stroke is the principal step of approaching to the stroke management. Cardioembolic stroke which covers about one fourth of all ischemic stroke, is a peculiar subtype of ischemic stroke because the etiology of cardioembolic stroke is not the brain or brain artery per se but the organ outside brain system. Therefore, stroke doctors frequently encounter situation that coerces them into deciding to do special cardiac tests for their patients when the etiology of stroke was presumed as cardioembolic stroke. In that context, identification of the presumable cardioembolic stroke is important issue.

A comprehensive approach is required to suspect cardioembolic etiology among stroke patients including stroke images and blood biomarkers. Image markers included specific pattern on diffusion-weighted images and thrombus signal MR or CT. Blood biomarkers include BNP, fibrinogen etc. In this session, we will discuss about these issues. In addition, lipid-metabolic biomarkers of cardioembolic stroke such as free fatty acid will be discussed.

Atrial cardiopathy and cardiac biomarkers in stroke

Yuji Ueno

University of Yamanashi, Japan

About 25% of ischemic stroke have no identifiable causes even after standard diagnostic evaluation, which are defined as cryptogenic stroke or embolic stroke of undetermined source. Recent advances suggest that the left atrial degeneration, including chamber dilation, remodeling, fibrosis, and damage to endothelial cells, being able to induce thrombus generation and cause embolism, even in patients without atrial fibrillation (AF), which can be a pathogenesis of atrial cardiopathy (AC). Several potential biomarkers, including P-wave terminal force in lead V1, N-terminal pro-brain natriuretic peptide, and left atrial enlargement, have shown as indicative of AC. However, the established criteria of AC are yet to be elucidated.

On the other hand, above cardiac biomarkers are essential to determine the pathogenesis of stroke especially in cryptogenic stroke, even if it does not reach the diagnosis of AC. Recently, we conducted two registries enrolling cryptogenic stroke (CHALLENGE ESUS/CS and CRYPTON-ICM), and explored the impact of these biomarkers in cryptogenic stroke. In CHALLENGE ESUS/CS, we identified different clinical characteristics of patients in which AF was detected in early and delayed stages of admission after stroke, and spontaneous echo contrast and large infarct > 3.0cm in diameter were independently associated with early and delayed stages of admission, respectively. In CRYPTON-ICM, left appendage flow velocity on transesophageal echocardiography < 37.5 cm/s predicted occult AF on insertable cardiac monitoring.

In this lecture, overview of atrial cardiopathy and new knowledges from CHALLENGE ESUS/CS and CRYPTON-ICM registry studies are presented.
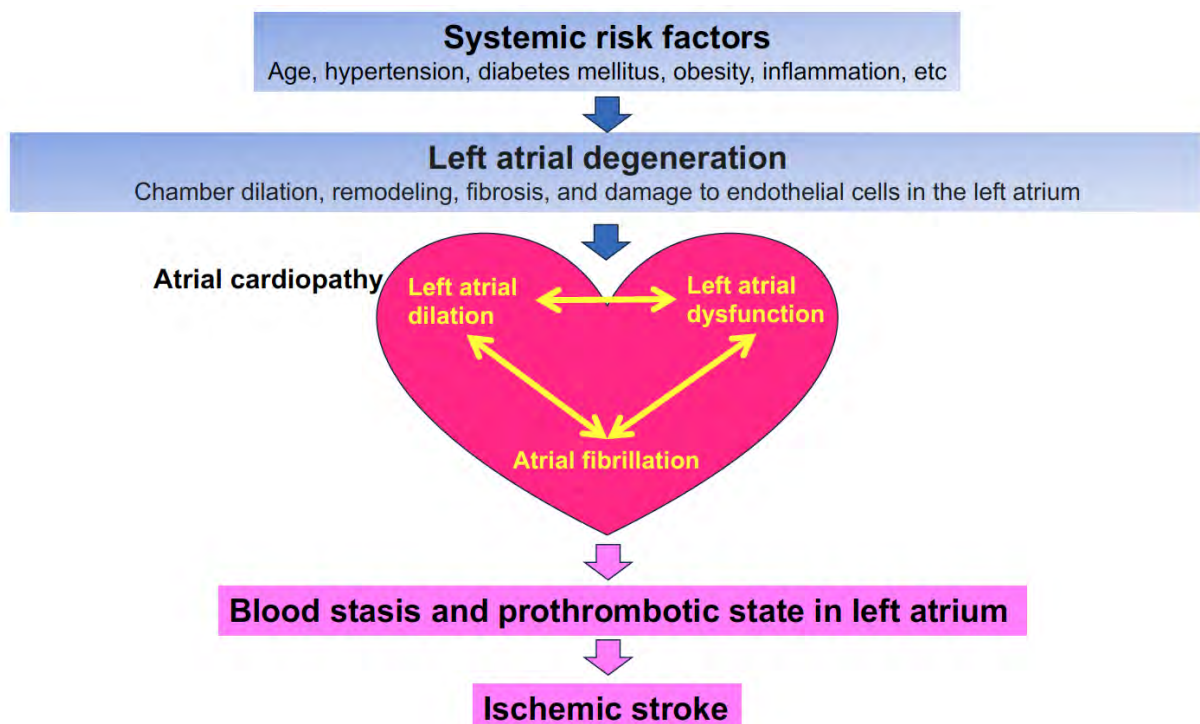
Factor XI inhibitor: A next generation prospect to prevent thromboembolic stroke

Mike Sharma

McMaster University/ PHRI, Canada

In spite of advances in antiplatelet therapy, the immediate post stroke period remains a high-risk period for stroke recurrence and monotherapy with aspirin remains the standard for long term antithrombotic treatment for secondary prevention. Factor Xa inhibitors have made a substantial contribution to the ability to prevent stroke in the setting of atrial fibrillation but are associated with a risk of systemic hemorrhage. As a result, low dosing regimens predominate in Asia. There is an unmet need for antithrombotic therapy that addresses the short- and long-term risk of recurrence with improved safety. Factor XI is a coagulation factor that is activated primarily by thrombin and serves to drive thrombus growth but has a minor role in hemostasis. Individuals with genetic factor XI deficiency have significantly lower risk of ischemic stroke and deep venous thrombosis than those with normal levels. Mendelian randomization studies demonstrate a direct correlation between the risk of stroke and FXI levels without an increased risk of intracerebral hemorrhage with low levels. Spontaneous bleeding in FXI deficient individuals is rare and generally confined to tissues with high intrinsic fibrinolytic activity such as the nasopharynx and the genitourinary tract. These characteristics make FXI a tempting target for prevention of thromboembolism. Phase 2 trials with antisense oligonucleotides and monoclonal antibodies that inhibit FXIa or reduce FXI levels have shown that treatment is associated with lower rates of venous thromboembolism and low rates of bleeding compared to low molecular weight heparin in patients undergoing total knee arthroplasty. Two small molecule inhibitors (asundexain and milvexian) of FXIa have undergone phase 2 dose finding trials in stroke patients. In both trials the FXIa inhibitor was added to antiplatelets, similar to the dual pathway approach used in COMPASS that was associated with a > 40% reduction in the risk of ischemic stroke. In PACIFIC-STROKE asundexian was not associated with a significant increase in the risk of ISTH major hemorrhage when combined with antiplatelets in the acute post stroke period. Asundexian doses that inhibited > 90% of FXI activity had a significantly lower risk of bleeding than apixaban in patients with atrial fibrillation. The OCEANIC STROKE trial will test the efficacy and safety of asundexian added to standard antiplatelets for the secondary prevention of stroke in patients with TIA or stroke. Similarly, milvexian added to dual antiplatlets in patients with stroke or high risk TIA did not significantly increase the risk of bleeding and was associated a trend to a decreased risk of ischemic stroke. Milvexian is being tested for efficacy in the LIBREXIA STROKE trial. Parallel trials will compare these agents to FX inhibitors in patients with atrial fibrillation. Epidemiologic, mendelian randomization and phase 2 trials all suggest that FXI inhibition holds great promise for stroke prevention with improved safety.

Reperfusion integrated care for optimizing the management of stroke and associated heart disease

Yohei Tateishi

Nagasaki University Hospital, Japan

The aim of integrated care to optimize the management of ischemic stroke is to improve the prognosis in patients with acute ischemic stroke by applying a patient-centered multidisciplinary approach. My presentation will focus on integrated care in the context of reperfusion therapy for acute ischemic stroke. I propose the "Acute ABC Method" for consideration.

A. Assessment of cortical symptoms: Early administration of reperfusion therapy may improve outcomes in patients with acute ischemic stroke. Paramedic assessment showed an increased positive predictive value of conjugate gaze deviation for detecting large vessel occlusion (LVO) compared with paralysis or aphasia (58%, 29%, and 46%, respectively). Implementation of an optimized workflow focused on the detection of conjugate gaze deviation by emergency department nurses resulted in a reduction in door-to-puncture (DTP) time (76 minutes vs. 68 minutes, p=0.014). Collaborative synergy between physicians, nurses, and paramedics is the first step in providing integrated care to facilitate high-quality reperfusion therapy.

B. Best reperfusion with intravenous thrombolysis and endovascular therapy: Assessing the quality of integrated care in reperfusion therapy focuses on the rapid achievement of reperfusion. A notable example of collaboration between physicians, nurses, and radiologic technologists is the concept of "direct transfer to the angiography suite," which has had a significant time-saving effect, reducing DTP time by approximately 20 minutes.

C. Comprehensive management of cardiac complications: When a patient with chronic heart failure has a stroke, the functional outcome is 1.2 times worse and the mortality rate escalates to twice that of stroke patients without heart failure. In our hospital, when patients with cardioembolic stroke developed heart failure during hospitalization, about half had a modified Rankin Scale (mRS) score of 5 or 6, and one in five died at 3 months. Furthermore, one of the independent predictors of mRS 5 or 6 at 3 months after successful recanalization with endovascular thrombectomy was the development of heart failure during hospitalization (odds ratio 13.86, 95% confidence interval 2.56-70.01, p=0.002). Inadequate management of heart failure treatment, comorbidities, nutrition, and rehabilitation in stroke patients can lead to frailty, sarcopenia, and incomplete functional recovery, thereby increasing susceptibility to adverse outcomes such as heart failure, pneumonia, fall-related fractures, and death after stroke. To break this vicious cycle, integrated care by nurses, cardiologists, dieticians, and rehabilitation therapists is important.

In the acute phase of ischemic stroke, accelerated reperfusion is of paramount importance for patients with LVO. Subsequently, diligent efforts are required to prevent and manage heart failure during hospitalization. To improve overall patient outcomes, integrated care should be initiated during the acute phase of stroke.
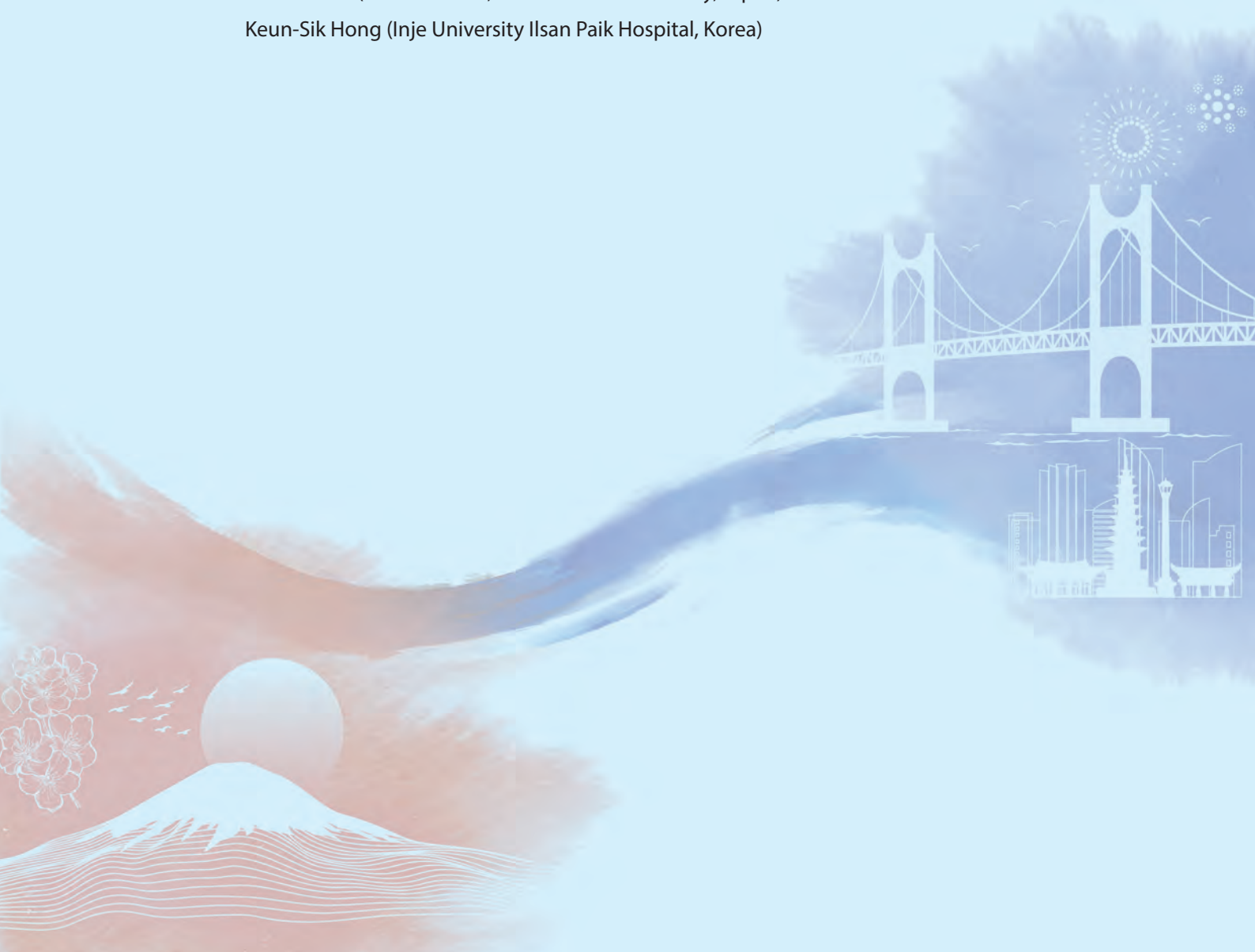
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International Conference STROKE UPDATE 2023
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November 16 (Thu) 09:00-10:40 | Room 2

Scientific Session 1 [ENG]

CHAIRS   Kozue Saito (Stroke Center, Nara Medical University, Japan)

Keun-Sik Hong (Inje University Ilsan Paik Hospital, Korea)

Evidence of inflammatory cell infiltration in central blood of human ischemic stroke and negative role of innate immunity

Seong-Joon Lee[1], So Young Park[1], Min Kim[1], Jin Soo Lee[1], Ji Man Hong[1]

[1]Neurology, Ajou University School Of Medicine, Suwon, Korea, Republic of

Purpose

The role of cellular immunity is known to be important during the hyperacute phase of large vessel occlusion. By ischemic blood probing during mechanical thrombectomy, we aimed to evaluate the role of cellular immunity in human ischemia-reperfusion process. We also aimed to evaluate the association between cellular immunity and post-mechanisal thrombectomy (MT) hemorrhagic transformation.

Methods

From September, 2021 to June 2023, we have enrolled 19 ischemic stroke patients with large vessel occlusion of the anterior circulation (ICA to MCA M1) who underwent MT. From them, microcatheter aspiration is performed from (1) within the core of the occluded vascular segment, before recanalization (distal), and (2) proximal carotid artery (proximal). RNA transcriptome sequencing is performed for each blood samples, and differentially Expressed Genes (DEG) analysis and gene-enrichment analysis was performed between distal and proximal blood to identify genes selectively upregulated in blood of human brain ischemic environment. It was also performed between distal blood of patients without hemorrhagic transformation (HT) after MT.

Results

In the 19 ischemic stroke patients, we revealed 193 statistically significant upregulated genes and 43 downregulated genes in distal blood compared to proximal blood. Using gene-enrichment analysis, aterial blood of ischemic core was enriched with processes such as cell adhesion, cell junction assembly, integrin mediated signaling pathway among others, and upregulated integrin binding as a molecular function among others. When aterial blood of ischemic core of 7 patients with HT and 13 patients without HT were compared, 193 statistically significant upregulated genes and 43 downregulated genes were identified. In the HT group, there was upregulation of genes associated with neutrophil granulation, but downregulation of abundance in gene ontology biological processes such as "response to virus" or "response to external stimulus" related to interferon associated innate immune processes.

Conclusions

The current results show that ischemic stroke due to large vessel occlusion results in upregulated inflammatory cell recruitment, adhesion, and related signaling. However, the innate immunity may be both deleterious or protective for hemorrhagic transformation. The current study results may be the basis for identification of beneficial inflammatory milieu.

Acknowledgement

Single-cell level comparative analysis of monocytic compositions and associated biological processes in early stages of intraparenchymal hemorrhage, severe ischemic stroke, and subarachnoid hemorrhage

Bosco Seong Kyu Yang[1], Han-Gil Jeong[1], Karoliina Ruhno[2], Dong-Wan Kang[3,4], Sowon Choi[2], Do Yeon Kim[3,4], Jun Yup Kim[5], Young Deok Kim[6], Si Un Lee[6], Seung Pil Ban[6], Beom Joon Kim[5], Jae Seung Bang[6], Moon-Ku Han[5], Hyun Je Kim[2,7,8], Hee-Joon Bae[5], O-Ki Kwon[6], Chang Wan Oh[6]

[1]Division Of Neurocritical Care, Department Of Neurosurgery And Neurology, Seoul National University Bundang Hospital, Seongnam, Korea, Republic of

[2]Department Of Biomedical Sciences, Seoul National University, Seoul, Korea, Republic of

[3]Department Of Public Health, Seoul National University Bundang Hospital, Seongnam, Korea, Republic of

[4]Department Of Neurology, Gyeonggi Provincial Medical Center, Icheon, Korea, Republic of

[5]Department Of Neurology, Seoul National University College Of Medicine, Cerebrovascular Disease Center, Seoul National University Bundang Hospital, Seongnam, Korea, Republic of

[6]Department Of Neurosurgery, Seoul National University College Of Medicine, Seoul National University Bundang Hospital, Seongnam, Korea, Republic of

[7]Department Of Microbiology And Immunology, Seoul National University College Of Medicine, Seoul, Korea, Republic of

[8]Genomic Medicine Institute, Seoul National University, Seoul, Korea, Republic of

Purpose

Monocytes are key components in the pathogenesis of early brain injuries due to peripheral immune response in stroke and in determining tissue and clinical outcomes. Different subpopulations of monocytes—classical, intermediate, and non-classical —play differing roles in the injury. Mechanisms of primary injuries differ among stroke subtypes, as will the ensuing monocytic differentiations and biological courses leading to sterile local and systemic inflammation. Therefore, this study intends to compare monocytic compositions and associated biological processes in early stages of different stroke varieties: intraparenchymal hemorrhage (ICH), severe ischemic stroke (IS), and subarachnoid hemorrhage (SAH).

Methods

Peripheral blood mononuclear cells were isolated from blood samples of 1 ICH, 4 IS, and 3 SAH patients requiring admission to neurological intensive care unit within 72 hours of admission. Single-cell RNA sequences were generated, aligned, and integrated with Tabula Sapiens data. Seurat framework was followed for quality control and normalization, and clusters were manually annotated. Per-stroke monocyte subpopulation subtype compositions were compared with moderated ANOVA tests using the propeller method. Monocytes' differentially expressed genes from stroke subtypes were identified using Wilcoxon Rank Sum test, and upregulated genes were used to identify associated biological pathways via enriched signaling pathway analysis.

Results

Stroke subtypes had statistically significant differences in monocytic compositions. The proportion of classical monocytes was uniformly elevated in all subtypes compared to control, ranging from 33% to 47%, with ICH showing a higher proportion of

non-classical monocytes (38%) compared to IS (11%) and SAH (8%). Associated biological processes also varied, with monocytes from ICH and IS mostly involved in antigen processing and presentation, and those from SAH involved in chemotactic responses.
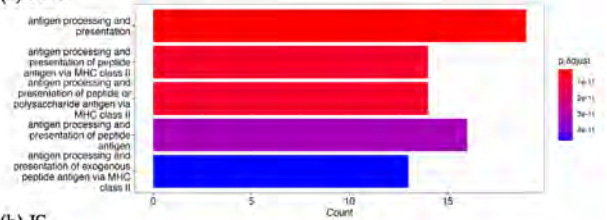
Conclusions

Different modes of early brain injuries from stroke are associated with distinct monocytic compositions and varying monocytic biological responses. These findings suggest that individualized approach may be necessary with immunotherapies targeting peripheral immune responses after stroke.
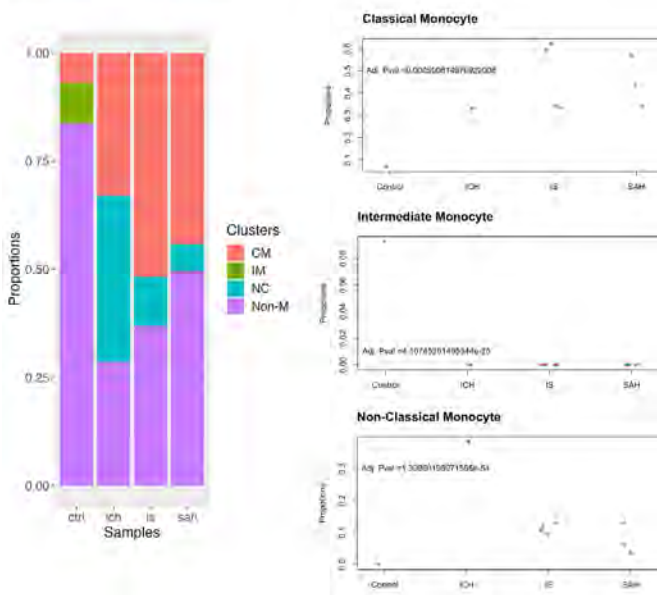
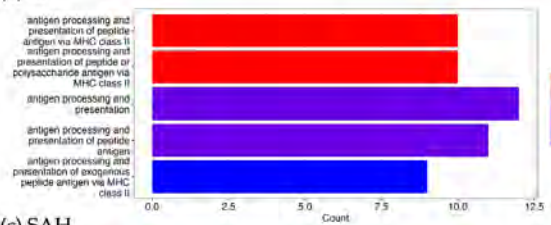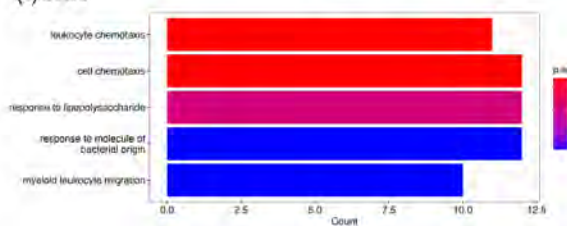# Rho-kinase inhibitor: Possible target for neuroprotection in the era of mechanical thrombectomy

Yoichi Morofuji[1], Shinsuke Nakagawa[2], Kazuaki Okamura[1], Kei Sato[1], Tsuyoshi Izumo[1], Takayuki Matsuo[1]

[1]Department Of Neurosurgery, Nagasaki University, Nagasaki, Japan
[2]Department Of Pharmacology, Fukuoka University, Fukuoka, Japan

Purpose

Attempts to develop new drugs for acute ischemic stroke are still struggling; however, mechanical thrombectomy is now at the forefront of the treatment of large-vessel acute ischemic stroke. Selective intra-arterial access has opened a new avenue for neuroprotection in acute ischemic stroke that has the potential to maximize the local benefits while minimizing systemic effects.

Methods

We investigated the effect of fasudil, rho-kinase inhibitor, on blood-brain barrier (BBB) against ischemia-reperfusion injury. We used in vitro BBB models with rat primarily cultured brain capillary endothelial cells, astrocytes and pericytes, and subjected cells to either normoxia or 6-h oxygen glucose deprivation (OGD)/24-h reoxygenation.

Results

Fasudil inhibited the decreases in TEER induced by 6-h OGD/24-h reoxygenation and decreased the endothelial permeability for sodium fluorescein through the BBB model. Immunocytochemical and western blot analyses showed that fasudil increased the expression of claudin-5, the main functional protein of tight junctions under 6-h OGD/24-h reoxygenation as well as normoxia.

Conclusions

Our data indicate that rho-kinase inhibitor fasudil strengthens the barrier integrity in BBB. Since mechanical thrombectomy is now the gold standard for acute ischemic stroke treatment, neuroprotective strategies via the intra-arterial route during mechanical thrombectomy are highly anticipated.

Gene-specific promoter methylation changes differently occurred in autosomes or X chromosome by the radiophenotypes of cerebral small vessel diseases

Jeeyeon Kim[1], Keunsoo Kang[2], Jei Kim[1]

[1]Epigenetics Laboratory, Department Of Neurology And Daejeon-Chungnam Regional Cardiocerebrovascular Disease Center, College Of Medicine And Hospital, Chungnam National University, Daejeon, Korea, Republic of
[2]Microbiology, College Of Science & Technology, Dankook University, Cheonan, Korea, Republic of

Purpose

Cerebral small vessel diseases (SVD) exhibited as different radiophenotypes including lacunar infarction, microbleed and white matter hyperintensity (WMH). Epigenomic biomarkers related with the individual radiophenotypes of cerebral small vessel diseases had not been well known, yet. We performed an epigenome wide association study (EWAS) to determine the epigenomic markers related with the individual radiophenotypes of the SVD.

Methods

For the present EWAS, we included total 32 patients (men:women=17:15, 63.4±9.2 years) having SVD classified into only old lacune (5 patients), only microbleed (7), only WMH (5), all (8) and none (7) radiophenotypes by the previous criteria of magnetic resonance imaging. Then, using DNA of peripheral blood of the patients, we performed EPIC 850K methylation array (Illumina, USA) to evaluate gene-specific promoter methylation changes by the individual radiophenotypes. We tried to identify gene specific promoter methylation changes occurred in old lacune, microbleed, WMH, and all radiophenotypes by comparison with no radiophenotype patients from the EPIC methylation data.

Results

By the criteria of <0.05 p-value and 15% methylation difference level, gene-specific promoter hypomethylation (167 genes) were 4 times more frequent than gene-specific promoter hypermethylation genes (47) on the comparison by the presence of SVD of the EPIC methylation data. On the comparison individual SVD with none SVD radiophenotype patients, old lacune and WMH patients had 3-7 gene-specific promoter hypermathylations located in autosome. However, microbleed and all SVD radiophenotype patients showed 17 promoter hypermethylation and 140 promoter hypomethylation genes located in X-chromosome. About half (34) of 76 gene specific promoter hypomethylations located in X-chromosome of the microbleed patients were also identified of the 79 promoter hypomethylation of all SVD radiophenotype patients.

Conclusions

The difference of the gene-specific promoter methylation changes between autosome and X-chromosome between the SVD radiophenotypes showed the importance of the gene-specific promoter hypomethylations occurring in X-chromosome, even though we need more future studies to verify the significance of the X-chromosome inactivation or hypomethylation in the larger patients set.

Peripheral blood mononuclear cells preconditioned by oxygen-glucose deprivation cause microglial phenotype conversion by secretome after cerebral ischemia

Masahiro Hatakeyama[1], Yutaka Otsu[1], Natsuki Akiyama[1], Takeshi Kanayama[1], Itaru Ninomiya[1], Osamu Onodera[1], Takayoshi Shimohata[2], Masato Kanazawa[1]

[1]Department Of Neurology, Brain Research Institute, Niigata University, Niigata, Japan
[2]Department Of Neurology, Gifu University Graduate School Of Medicine, Gifu, Japan

Purpose

Cell therapy has developed over recent years to facilitate functional recovery in patients with stroke. Although we have shown that the peripheral blood mononuclear cells preconditioned by oxygen-glucose deprivation (OGD-PBMC) administration are a therapeutic strategy for ischemic stroke, recovery mechanisms remain largely unknown. Thus, we hypothesized that cell-cell communication between PBMCs by themselves and resident cells in the host brain is necessary for a polarizing protective phenotype. To test this hypothesis, we investigated the therapeutic mechanisms of OGD-PBMCby secretome against ischemic stroke.

Methods

We prepared PBMCs from humans and rats by centrifugation and cultured PBMCs under OGD conditions for 18 h. We compared levels of cytokines and exosomal miRNA in conditioned media under normoxic and OGD conditions. Then, we performed western blotting and Luminex assay to assess the expression levels of hypoxia-inducible factor-1alpha (HIF-1α) and vascular endothelial growth factor (VEGF) in OGD-PBMC with miR-155-5p antisense oligonucleotide (ASO) inhibitor. Next, we cocultured OGD-PBMCs and microglia under normoxic condition with or without miR-155-5p ASO inhibitor, then we performed western blotting to assess the expression level of VEGF in microglia. Finally, we administered OGD-PBMC to rats 7 days after cerebral ischemia and performed microscopic analysis to evaluated the VEGF expression.

Results

The expression of miR-155-5p decreased in the condition media of OGD-PBMCs compared to that of normoxic PBMCs (P = 0.011). The expression of HIF-1α and secretion of VEGF increased in OGD-PBMC with miR155-5p ASO compared to that without ASO (P = 0.011, 0.042, respectively). The expression of VEGF in the microglia cocultured with OGD-PBMCs increased compared to that without OGD-PBMCs (P = 0.025). Moreover, the expression of VEGF in the microglia cocultured with OGD-PBMCs was higher with miR-155-5p ASO than without it (P = 0.049). The numbers of VEGF-positive microglia increased in the border area within the ischemic core at 21 days following administration (i.e., 28 days after cerebral ischemia) in the OGD-PBMC administration group compared to the control group (P < 0.001).

Conclusions

OGD-PBMCs may cause phenotype conversion in resident microglia by the secretome, including reduction of exosomal miR-155-5p, after cerebral ischemia.

Microembolic signals of transcranial doppler in acute stroke with active cancer patients are associated with D-dimer, CRP level, multiple lesions, and mortality at 3 months.

Sono Toi[1,2], Megumi Hosoya[2], Eiko Higuchi[2], Kentaro Ishizuka[2], Takao Hoshino[2], Tsutsumi Yukiko[3], Kazuo Kitagawa[2]

[1]Medicine, Tokyo Womens Medical University Adachi Medical Center, Tokyo, Japan
[2]Neurology, Tokyo Womens Medical University, Tokyo, Japan
[3]Neurology, St Lukes International Hospital, Tokyo, Japan

Purpose

To clarify the characteristics and the predictive value for survival of microembolic signals (MES) using transcranial Doppler (TCD) examination in acute cerebral infarction in patients with active cancer

Methods

Between 2017 and 2022, 1089 patients within seven days from onset of acute cerebral infarction were registered in Tokyo Women's Medical University (TWMU) Stroke registry. Among them, successful TCD examination was performed in 370 patients with ischemic territory in internal carotid artery (ICA). Among those 370 patients, 33 patients with active cancer were analyzed in this study. In addition to routine blood tests, echocardiography and MRI, TCD examination was performed through the temporal bone window for middle cerebral artery (MCA) at the affected side and continuously monitored for 1 hour to detect MES. Presence and number of MES was evaluated. Active cancer was defined as a diagnosis of cancer within 6 months prior to enrollment, any treatment for cancer within the previous 6 months, or recurrent or metastatic cancer.

Results

In 33 patients with successful TCD with active cancer, the mean age was 70 years (IQR; 63-78), 25 men (75%), BMI 21.6 (IQR; 20-24), NIHSS 3 (1-6), mRS at discharge 1 (1-4), respectively. The most common types of cancer were lung cancer (24%), pancreatic cancer (24%), and intestinal cancer (18%). MES was positive in 14 of 33 patients (42.4%). Presence and number of MES were significantly associated with both D –dimer (P<0.001) and CRP level (P=0.012). Presence of MES was also associated with multiple ischemic lesions and three territory signs in MRI DWI. Among 33 patients, 9 died until 3 months. Stroke recurrence occurred in only one patient. In the Kaplan-Meier analysis, patients with MES were significantly more likely to die (Log rank test P= 0.037) compared with those without MES. In Cox multivariate analyses, MES positive was significantly associated with all-cause death with MES negative group as a reference after adjusted for age, sex, NIHSS, D-dimer and CRP levels (Adjusted Hazard ratio and 95% confidential interval; 12.19, 1.45-216.85, P=0.020)

Conclusions

MES in acute ischemic stroke with active cancer was associated with D-dimer, CRP levels and multiple and three territory ischemic lesions. Furthermore, MES can predict short-term survival after ischemic stroke in active cancers.

Coagulation factor expression and composition of arterial thrombi in cancer-associated stroke

Joonsang Yoo[1], Il Kwon[2], Sungeun Kim[2], Young Dae Kim[2], Hyo Suk Nam[2], Ji Hoe Heo[2]

[1]Department Of Neurology, Yongin Severance Hospital, Yonsei University College Of Medicine, Yongin, Korea, Republic of

[2]Department Of Neurology, Severance Hospital, Yonsei University College Of Medicine, Seoul, Korea, Republic of

Purpose

Cancer is associated with an increased risk of stroke. Tumor cells activate platelets, induce a coagulation cascade, and generate thrombin. The composition of thrombi may reflect the mechanism of thrombosis, aiding the determination of the treatment strategy. Here we investigated the composition and expression of coagulation factors in the thrombi of patients with cancer-associated stroke.

Methods

Stroke patients who underwent endovascular thrombectomy between September 2014 and June 2020 and whose cerebral thrombi were obtained were divided into those with cancer-associated stroke (cancer group) and propensity score-matched patients without cancer (control group). Immunohistochemistry was performed of the thrombi, and the composition and expression of coagulation factors were compared between groups.
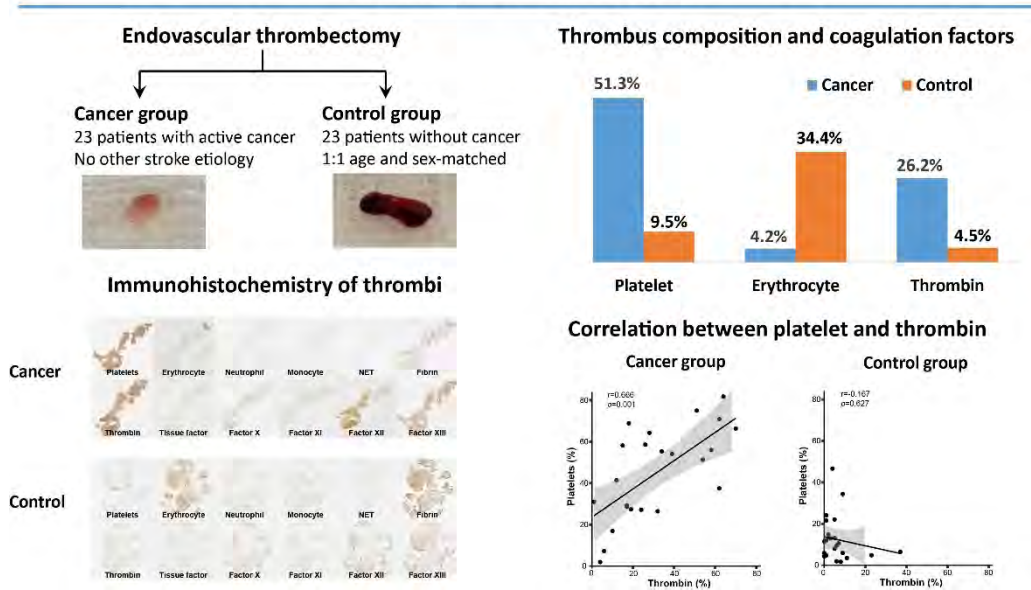
Results

This study included 23 cancer patients and 23 matched controls. Platelet composition was significantly higher in the cancer group than in the control group (median [interquartile range], 51.3% [28.0–61.4] vs. 9.5% [4.8–14.0], $P < 0.001$). Among coagulation factors, thrombin (26.2% [16.2–52.7] vs. 4.5% [1.3–7.2], $P < 0.001$) and tissue factors (0.60% [0.34–2.06] vs. 0.37% [0.22–0.60], $P = 0.024$) were higher and factor X was lower (1.25% [0.39–3.60] vs. 2.33% [1.67–4.48] $P = 0.034$) in the cancer group. There was a positive correlation between thrombin and platelets in the cancer group ($r = 0.666$, $P = 0.001$) but not in the control group ($r=-0.167$, $P = 0.627$).

Conclusions

Cerebral thrombi in patients with cancer-associated stroke showed higher proportions of platelets, thrombin, and tissue factors, suggesting their key roles in arterial thrombosis in cancer and providing a therapeutic perspective for preventing stroke in patients with cancer-associated stroke.

Coagulation factor expression and composition of arterial thrombi in cancer-associated stroke

Endovascular thrombectomy

Cancer group
23 patients with active cancer
No other stroke etiology

Control group
23 patients without cancer
1:1 age and sex-matched

Immunohistochemistry of thrombi

Cancer

Platelets | Erythrocyte | Neutrophil | Monocyte | NET | Fibrin
Thrombin | Tissue factor | Factor X | Factor XI | Factor XII | Factor XIII

Control

Platelets | Erythrocyte | Neutrophil | Monocyte | NET | Fibrin
Thrombin | Tissue factor | Factor X | Factor XI | Factor XII | Factor XIII

Thrombus composition and coagulation factors

■ Cancer ■ Control

Platelet: 51.3% / 9.5%
Erythrocyte: 4.2% / 34.4%
Thrombin: 26.2% / 4.5%

Correlation between platelet and thrombin

Cancer group
r=0.666
p=0.001
Platelets (%) vs Thrombin (%)

Control group
r=-0.167
p=0.627
Platelets (%) vs Thrombin (%)

[OP008]

Corrected QTc interval combined with troponin value and mortality in acute ischemic stroke

Sung-Ho Ahn[1], Ji-Sung Lee[2], Mi-Sook Yun[1], Jung-Hee Han[2], Soo-Young Kim[2], Sang-Hyun Lee[1], Min-Gyu Park[1], Kyung-Pil Park[1], Dong-Wha Kang[2], Jong S. Kim[2], Sun U. Kwon[2]

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Purpose

Cardiac biomarkers including, elevated troponin (ET) and prolonged heart rate-corrected QT (PQTc) interval on electrocardiography are known to frequent and have a prognostic significance in patients with acute ischemic stroke (AIS). However, it is still challenging to practically apply the results for appropriate risk stratification. This study evaluate whether combining ET and PQTc interval can better assess the long-term prognosis in AIS patients.

Methods

In this prospectively registered observational study between May 2007 and December 2011, ET was defined as serum troponin-I ≥ 0.04 ng/mL and PQTc interval was defined as the highest tertile of sex-specific QTc interval (men ≥ 469 msec or women ≥ 487 msec).

Results

Among the 1,668 patients (1018 [61.0%] men; mean age 66.0 ± 12.4 years), patients were stratified into four groups according to the combination of ET and PQTc intervals. During a median follow-up of 33 months, ET (hazard ratio [HR]: 4.38, 95% confidence interval [CI]: 2.94–6.53) or PQTc interval (HR: 1.53, 95% CI: 1.16–2.01) alone or both (HR: 1.77, 95% CI: 1.16–2.71) was associated with increased all-cause mortality. Furthermore, ET, PQTc interval alone or both was associated with vascular death, whereas only ET alone was associated with non-vascular death. Comorbidity burden, especially atrial fibrillation and congestive heart failure, and stroke severity gradually increased both with troponin value and QTc-interval.

Conclusions

In patients with AIS, combining ET and PQTc interval on ECG enhances risk stratification for long-term mortality while facilitating the discerning ability for the burden of comorbidities and stroke severity.

Acknowledgement

Headaches During Pregnancy is Associated with the Risk of Subsequent Stroke: based on the Korean National Health Insurance Service database

Ki-Woong Nam[1], Chi Kyung Kim[2]

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Purpose

Primary headache is a known risk factor for stroke in women and usually improves during the first trimester of pregnancy. However, despite this, some women develop headaches during pregnancy (G-HA), and the effect of this headache on subsequent stroke is unknown. In this study, we evaluated the association between G-HA and stroke after pregnancy in women.

Methods

Based on the Korean National Health Insurance Service database, we included women hospitalized for delivery between 2012 and 2013. G-HA was defined as a headache diagnosed during pregnancy. Primary outcome was any stroke that occurred during the observational periods from delivery to December 31, 2020. All diseases were identified based on data registered in the database using the International Classification of Disease-10th Revision-Clinical Modification codes.

Results

Of 906,187 pregnant women, G-HA was found in 56,813 (6.3%). During the observational periods, the G-HA (+) group had a significantly higher risk of any stroke [adjusted hazard ratio (aHR) = 1.59, 95% confidence interval (CI): 1.30-1.95], ischemic stroke (aHR = 1.50, 95% CI: 1.12-2.01), hemorrhagic stroke (aHR = 1.63, 95% CI: 1.23-2.15), and intracerebral hemorrhage (aHR = 1.63, 95% CI: 1.19-2.23) than the G-HA (-) group. When analyzed considering the interaction with history of headache, G-HA showed a significant association with hemorrhagic stroke, but lost its effect on ischemic stroke.

Conclusions

We demonstrated that G-HA was associated with subsequent stroke occurrence in pregnant women. However, the relationship between G-HA and ischemic stroke is mitigated by a history of pre-pregnancy headache.

Free fatty acid and atrial fibrillation-associated stroke: Lipidomic-GWAS study

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Purpose

Stroke can occur due to a wide range of etiologies, and atrial fibrillation is one of the crucial causes among them. Recently, our group reported that elevated free fatty acid levels were predictive the atrial fibrillation-associated stroke using the registry data. In this lipidomic- Genome-wide Association Study (GWAS) study, we leveraged multi-omics data to explore the link between several domains of lipidomics and the presence of AF in acute stroke patients to identify predictors of stroke caused by atrial fibrillation and explore their mechanisms.

Methods

A total of 483 stroke patients with AF (391 patients without AF and 92 patients with AF) were extracted from a prospectively collected stroke registry. Clinical, radiological, and cardiological data were collected. We conducted lipidomic profiling using ultra-performance liquid chromatography-mass spectrometry and explored the lipid components that were related to AF using fold change analyses and clustering. Genotyping was conducted on DNA samples using the Illumina Global Screening Array MD BeadChips. Exploring by trait comparison and colocalization were performed.

Results

Among the lipidomics domains, the FFAs class had an obvious positive association with AF. LPC, PC, and TAG lipid classes distinguished stroke with AF from those without it. In terms of FFA, long-chain fatty acids with 14-24 carbons and unsaturated FFAs distinguished AF. We classified the participants into three distinctive groups using clustering analysis with FFAs and the proportion of AF was different across the groups. GWASs that were performed to explore the genetic variation leveraging FFAs distribution on AF, provided two loci that were associated with the clustered groups of FFA metabolites: rs12136096 ($\beta = 0.821$, s.e. = 0.024, P = $1.25 \times 10{-7}$) near MIR548F3 that was associated with FFA 20:1, FFA 20:2, FFA 22:5, and FFA 22:6; a locus with rs60603116 ($\beta = -0.799$, s.e. = 0.024, P = $2.35 \times 10{-7}$) near RPL37A that was associated with FFA 22:5 and FFA 22:6. In the FFA metabolite-QTL analysis GWAS, a total of 254 variant-FFA metabolite pairs passed a level of suggestive significance. Among those, rs28456, an intronic variant in FADS2, and rs3770088, an intronic variant on POLR1A, were leading variants that were involved in the PPAR-G-related signaling pathway.

Conclusions

Elevated FFA, especially long-chain unsaturated FFA is highly associated with atrial fibrillation-associated stroke. This relationship was considered to be regulated by the PPAR-G-related signaling pathway.
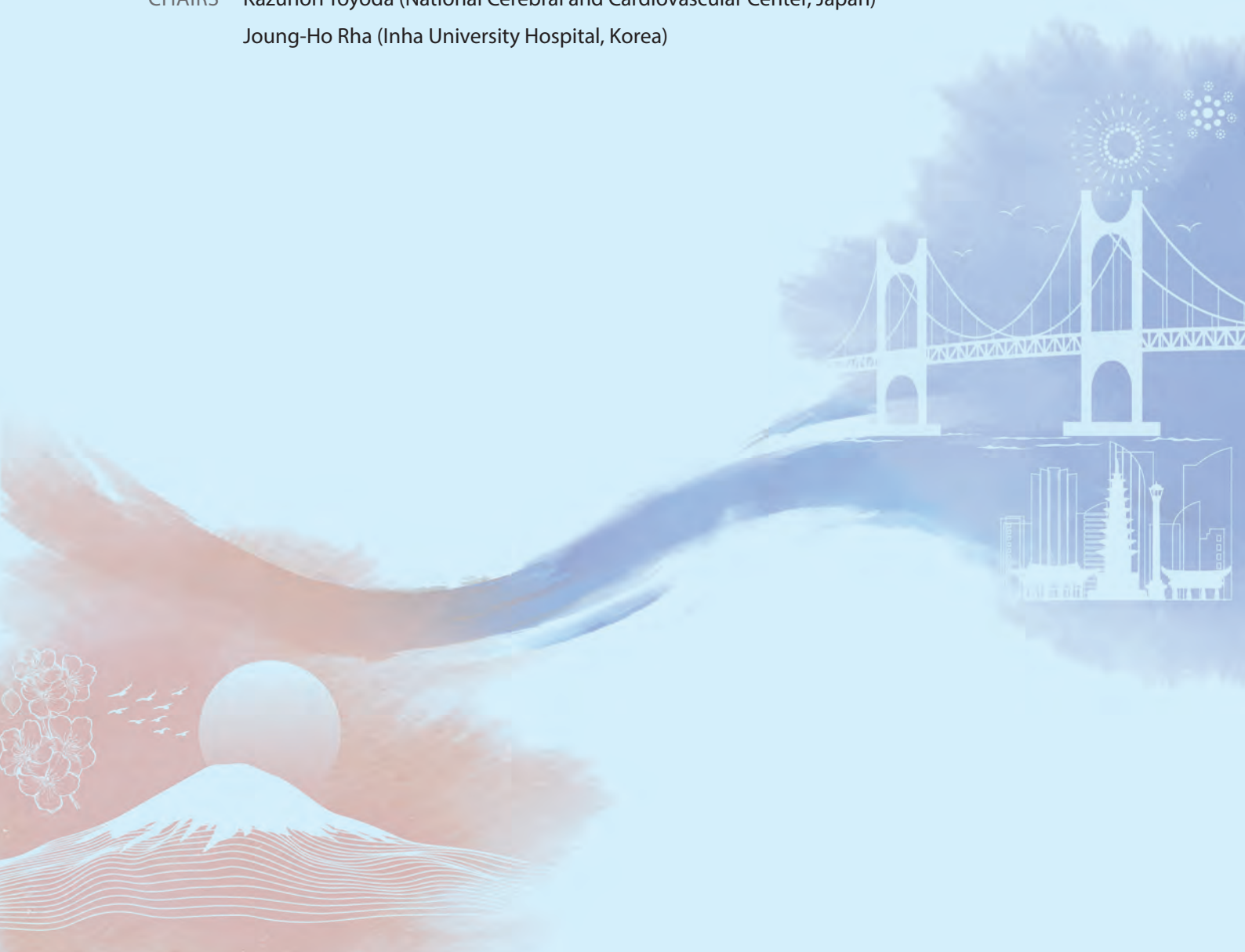
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International Conference STROKE UPDATE 2023
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November 16 (Thu) 11:00-12:00 | Room 1

Plenary Session [ENG]

CHAIRS   Kazunori Toyoda (National Cerebral and Cardiovascular Center, Japan)

Joung-Ho Rha (Inha University Hospital, Korea)

Expanding indication for acute endovascular thrombectomy

Shinichi Yoshimura

Hyogo Medical University, Japan

Background

Endovascular therapy (EVT) has become a standard treatment for acute stroke caused by large vessel occlusion (LVO). Guidelines recommend EVT for patients with an occlusion site in the middle cerebral artery segment 1 or internal carotid artery, for which imaging findings indicate that the size of the infarct area is not large, as defined by an Alberta Stroke Program Early Computed Tomographic Score (ASPECTS) of at least 6.

RESCUE-Japan LIMIT

We conducted a randomized controlled trial (RCT) to assess the efficacy of EVT in patients with a large ischemic core (ASPECTS 3 to 5). Patients were randomly assigned in a 1:1 ratio to receive EVT with medical care or medical care alone within 6 hours after they were last known to be well or within 24 hours if there was no early change on fluid-attenuated inversion recovery images. As a result, the primary outcome, the percentage of patients with a modified Rankin scale (mRS) score of 0 to 3 at 90 days, was 31.0% in the EVT group and 12.7% in the medical-care group (relative risk, 2.43; 95% CI, 1.35 to 4.37; P = 0.002). Thus, this trial demonstrated the efficacy of EVT on the functional outcome of patients with a large ischemic core.

Other RCTs: In 2023, three RCTs regarding the efficacy of EVT in patients with a large ischemic core were reported. Two of them, SELECT 2 and ANGEL-ASPECT, showed efficacy, but one, TESLA, did not. A meta-analysis of RCTs, including two ongoing trials, is planned.

Subanalyses of RESCUE-Japan LIMIT

Our study included several subanalyses, which were reported as follows: 1) ASPECTS threshold, 2) Differences in CT- or DWI-ASPECTS, 3) Number of passes, 4) Time course, and 5) Cost-Effectiveness. Additionally, ongoing research is exploring other subanalyses.

RCTs regarding basilar artery occlusion: There were four randomized controlled trials (RCTs) investigating the efficacy of EVT for basilar artery occlusion. Among these trials, two demonstrated efficacy, while two did not. The discrepancy between these two groups may be attributed to differences in exclusion criteria; notably, the two successful trials utilized PC-ASPECTS as an exclusion criterion, whereas the other two did not.

Other targets

The scope for expanding the indications of EVT includes targets such as medium vessel occlusion (MeVO) and low NIHSS. Several RCTs addressing these targets are currently in progress.

Discussions

The Japan Stroke Society's guidelines have already broadened the indications for EVT to include large ischemic regions based on the results of the four reported RCTs. Furthermore, it is anticipated that further modifications will be made following the meta-analysis of ongoing RCTs in the near future.

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Luncheon Symposium 1.
Amgen Korea [ENG]

CHAIRS   Kwang Ho Lee (Sungkyunkwan University School of Medicine, Korea)

Yong-Seok Lee (SMG-SNU Boramae Medical Center, Korea)

The lowest, the best strategy with evolocumab in atherosclerotic stroke patients

Bum Joon Kim

Asan Medical Center, Korea

The paradigm for stroke management, particularly in cases of large artery atherosclerosis, has shifted towards lower-risk profiles. Analyzing subgroups within the Fourier study, which encompassed over 5000 patients with prior strokes, revealed promising results regarding Evolocumab's impact. Evolocumab demonstrated a significant reduction in composite cardiovascular outcomes, with a hazard ratio of 0.85. Notably, this effect was amplified in patients who had experienced a recent stroke within one year of randomization.

In contrast to coronary artery disease, intracranial atherosclerosis is predominantly managed medically, without vessel lumen re-expansion procedures. Hence, meticulous control of risk factors is imperative, particularly for minimizing stenosis burden and stabilizing plaque formation. Research indicates a strong correlation between LDL-cholesterol levels and plaque vulnerability, as observed through high-resolution vessel wall MRI. Recent evidence has shown the beneficial impact of Evolocumab in lowering LDL-cholesterol levels in coronary artery disease patients, suggesting potential parallels in those with intracranial or extracranial atherosclerosis.

Concerns have arisen regarding the reduction of LDL-cholesterol in individuals with a high risk of bleeding, stemming from the association of high-dose statins with bleeding events in stroke patients. However, it is reassuring that lowering LDL-cholesterol with Evolocumab did not elevate the risk of intracerebral hemorrhage in major clinical trials. Notably, Asian patients face a higher risk of intracranial bleeding compared to the white population. Given Evolocumab's non-association with increased intracranial bleeding risk, it may emerge as a favorable option for patients at heightened risk of bleeding complications.

This assessment underscores the evolving landscape of stroke management, advocating for aggressive risk factor control, plaque stabilization, and the potential role of Evolocumab in improving outcomes for atherosclerotic stroke patients, even in cases with high bleeding risk.

The earliest, the best strategy with evolocumab in atherosclerotic stroke patients

Minwoo Lee
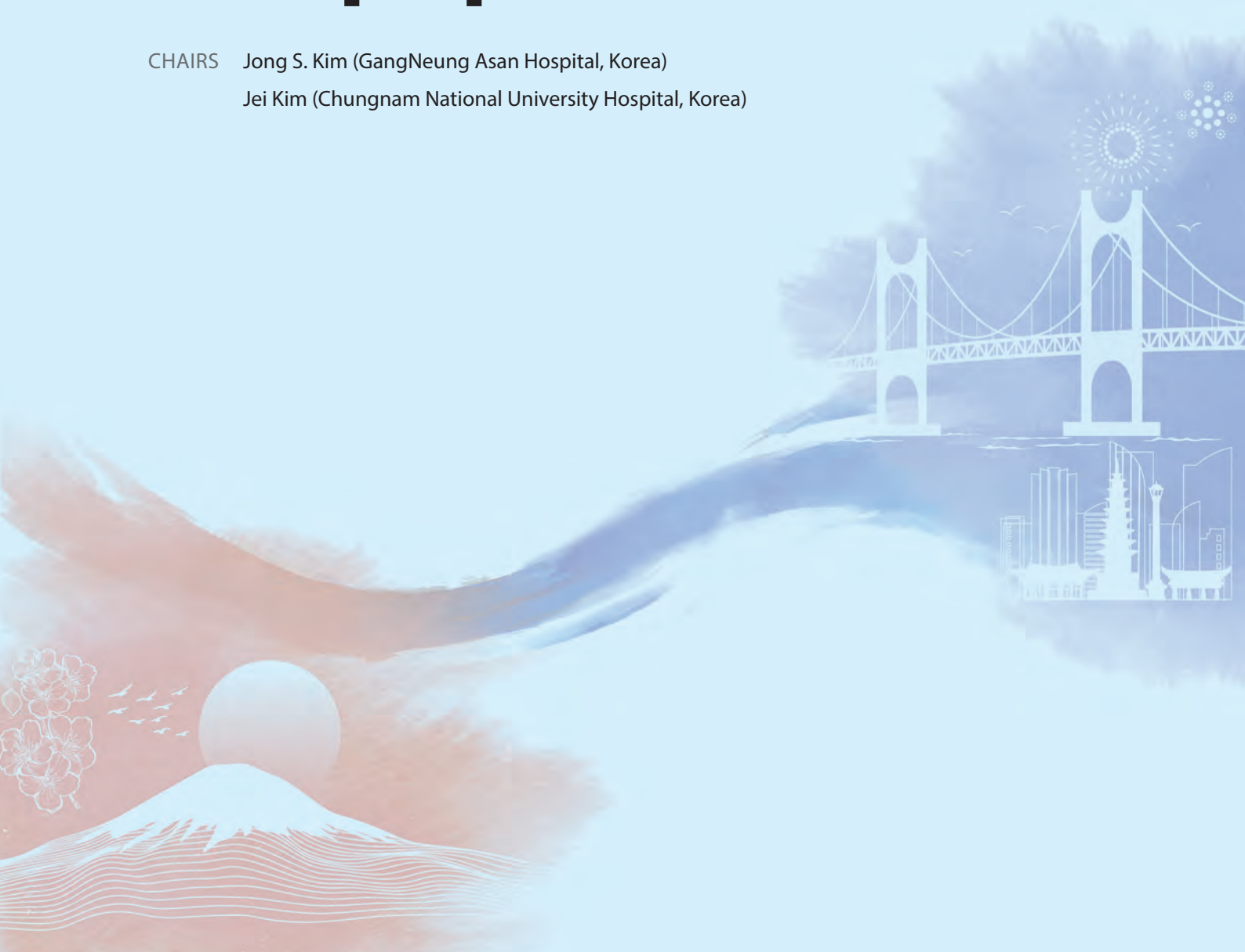
Hallym University Sacred Heart Hospital, Korea

November 16 (Thu) 12:00-13:00 | Room 2

Luncheon Symposium 2.
Lixiana [ENG]

CHAIRS   Jong S. Kim (GangNeung Asan Hospital, Korea)

Jei Kim (Chungnam National University Hospital, Korea)

Secondary stroke prevention: What do real world data on NOACs suggest?

Ki-Woong Nam

SMG-SNU Boramae Medical Center, Korea

Atrial fibrillation (AF) is a major risk factor for ischemic stroke and its prevalence is rapidly increasing with worldwide aging population. Generally, AF-related stroke has a more severe and worse prognosis compared to stroke caused by other mechanisms. Therefore, primary and secondary prevention of stroke are crucial issues for patients with AF. Previously, warfarin has been used as the standard treatment for this purpose. However, warfarin presents challenges in maintaining drug concentration within the optimal therapeutic range for an extended period and carries a high risk of bleeding complications.

Since the development of non-vitamin K oral anticoagulants (NOACs), several pivotal randomized controlled trials (RCTs) and real-world data have demonstrated that NOACs are safe and non-inferior to warfarin in the primary prevention of stroke in patients with nonvalvular AF. However, despite the fact that stroke requires careful attention not only in its occurrence but also in terms of recurrence, there has been insufficient RCT or real-world data comparing NOACs and warfarin for secondary prevention of stroke in patients with AF-related stroke.

Here, we would like to share our analysis based on Korean National Health Insurance data regarding the effectiveness and safety of NOACs and warfarin in terms of thromboembolic complications in Korean patients with nonvalvular AF and acute ischemic stroke.
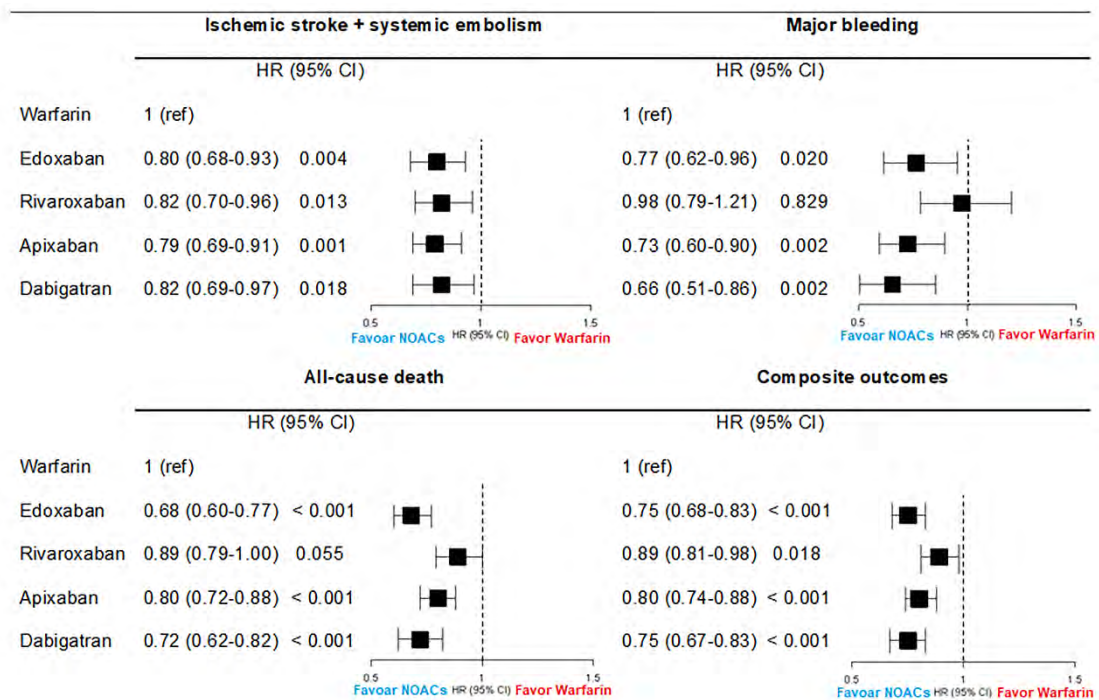
Anticoagulation strategy in elderly patients with AF: Focusing on Edoxaban

Jun Yup Kim

Seoul National University Bundang Hospital, Korea

Ischemic stroke and systemic embolism are the major potentially preventable complications of atrial fibrillation (AF) leading to severe morbidity and mortality. Anticoagulation using vitamin K antagonists (VKA) or non-vitamin K oral anticoagulants (NOACs) is mandatory for stroke prevention in AF. Following approval of the four NOACs dabigatran, rivaroxaban, apixaban, and edoxaban, the use of VKA is declining steadily. Increasing age with thresholds of 65 and 75 years is a strong risk factor when determining annual stroke risk in AF patients. Current recommendations strengthen the importance of anticoagulation and detection of bleeding risks, of which older age is an important one. While patients aged ≥ 75 years are usually underrepresented in randomized clinical trials, they represent almost 40% of the trial populations in the large NOAC approval studies. Therefore, a sufficient amount of data is available to assess the efficacy and safety for this patient cohort in that specific indication. But anticoagulation are underused in the elderly patients because of the fear of bleeding complication. Balancing risks and benefits of antithrombotic strategies in older population is crucial.

Analyzing the elderly subgroups of the NOAC trials demonstrates that these patients are actually not harmed by NOACs, but that there is evidence with additional clinical net benefit for edoxaban. If elderly patients do meet the predefined dose reduction criteria for edoxaban, they have lower embolic and bleeding risks compared with VKA. If they do not meet the predefined dose reduction criteria for edoxaban, they still have a clinical net benefit compared with VKA. If combined antithrombotic therapy is required after PCI, acetylsalicylic acid should only be given peri-procedurally, and until further studies become available, the NOAC dose approved for stroke prevention in AF should be used without empiric dose reduction in most patients; however, individual decisions have to be made in the very old. At the moment, the full effective doses of edoxaban have shown at least a similar safety profile regarding bleeding compared with VKA.

Elderly patients have a high risk of stroke and bleeding, so balanced anticoagulation treatment is very important. The 2021 EHRA Guide and 2022 KHRS Guideline recommend edoxaban for elderly patients with AF. This is because edoxaban has proven its effectiveness and safety in elderly patients through real world data, including the ENGAGE AF TIMI 48 phase 3 RCT. Additionally, elderly patients have reduced cognitive function, so their addiction is also important for better outcomes. Edoxaban is expected to play a positive role in improving patients' compliance with QD drugs. Lastly, based on the ELDERCARE Trial, 15 mg has been added to the dosage for stroke prevention, allowing edoxaban to provide three treatment options of 60, 30, and 15 mg for elderly AF patients with a high risk of bleeding. Based on the guideline, 15mg treatment options, edoxaban can be recommended for elderly AF patients with a high risk of bleeding.

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International Conference STROKE UPDATE 2023
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Satellite Symposium 1.
Samjin pharm [ENG]

CHAIR   Hee-Jung Song (Chungnam National University Sejong Hospital, Korea)

Optimal treatment strategy for large artery atherosclerlosis after acute ischemic stroke

Yerim Kim

Kangdong Sacred Heart Hospital, Korea

Introduction

Two extensive randomized controlled studies (CHANCE and POINT trial) indicate that dual antiplatelet therapy (DAPT; aspirin and clopidogrel) is advantageous for reducing the risk of future ischemic events in minor stroke or TIA. Nevertheless, there is limited data available regarding the effectiveness of this method when treating stroke patients with symptomatic large artery atherosclerosis (LAA). We will undertake several research to investigate the effect of DAPT in patients with LAA.

Methods and Results

In a Korean multicenter stroke registry database (Clinical Research Collaboration for Stroke in Korea), a total of 5934 patients with symptomatic large artery atherosclerotic occlusive disease were treated either with clopidogrel plus aspirin (n=2903, 49%) or aspirin (n=3031, 51%). The hazards of the primary outcome with combination over aspirin only were significantly reduced in the per-protocol and as-treated analyses (hazard ratio, 0.71; 95% CI, 0.57–0.88; P=0.002 and hazard ratio, 0.81; 95% CI, 0.69–0.96; P=0.02, respectively), but there was borderline significance in the intention-to-treat analysis (hazard ratio, 0.86; 95% CI, 0.74–1.01; P=0.06). Combination therapy was beneficial for all-cause death in all analyses but did not reduce recurrent stroke. In the recent meta-analyses including 10 trials of 5,004 patients, comparing to mono antiplatelet therapy, DAPT significantly reduced IS recurrence (5.99 vs. 9.55%, 95% CI: −5–0%). The safety endpoints including ICH (0.28 vs. 0.32%, RD: 0%, 95% CI: −0–0%) and major bleeding (0.73 vs. 0.51%, RD: 0%, 95% CI: −0–0%) did not differ significantly.

Conclusion

For individuals diagnosed with symptomatic LAA, DAPT proved more effective than MAPT in preventing recurrent ischemic strokes, without a corresponding rise in the risk of bleeding. However, additional research is required to determine the most suitable DAPT protocols and the ideal duration of treatment for this specific patient population.
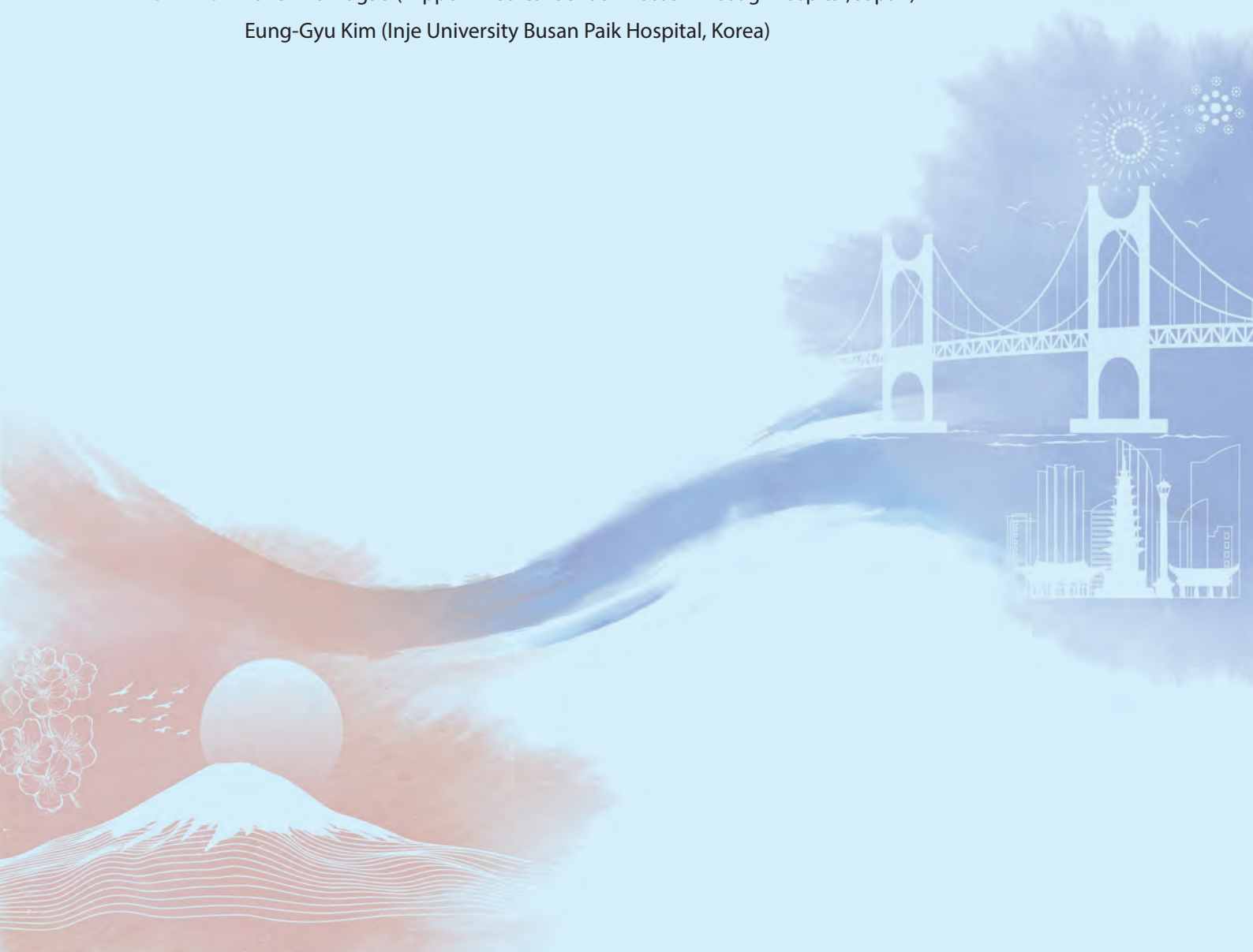
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**International Conference STROKE UPDATE 2023
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Symposium 2. SVD [ENG]

CHAIRS   Takehiko Nagao (Nippon Medical School Musashi-Kosugi Hospital, Japan)

Eung-Gyu Kim (Inje University Busan Paik Hospital, Korea)

Noncontrast MRI of BBB and glymphatic function in cerebral small vessel disease

Danny JJ Wang, PhD, MSCE
University of Southern California, USA

Background

Blood-brain barrier (BBB) plays a critical role in the delivery of oxygen and nutrients to the brain, clearance of toxic metabolites, and protection of the central nervous system (CNS) from infection. Compromised or impaired BBB function is implicated in a number of serious CNS diseases, such as multiple sclerosis (MS), stroke, brain tumors, CNS infection, Alzheimer's disease (AD) and cerebral small vessel disease (cSVD). The glymphatic system (GS) is a recently discovered brain-wide perivascular fluid transport system in the CNS. This system was thought to clear interstitial fluid (ISF) of waste products from the brain via the ISF-cerebrospinal fluid (CSF) exchange facilitated by the aquaporin-4 (AQP4) water channels expressed at the vascular endfeet of astrocytes. A growing number of studies have demonstrated that the impairment of glymphatic transport was associated with several neurological diseases, including cSVD and AD. Additionally, GS dysfunction is related to sleep disorder as well as tau and beta-amyloid (Aβ) protein accumulations, which underlie the pathogenesis of cognitive impairment and dementia. Microvasculature BBB water exchange is a key component of the glymphatic theory, which contributes to 31% of entire water inflow through both perivascular space and microvasculature BBB.

Methods

Currently, assessment of BBB permeability and glymphatic function mainly relies on dynamic contrast enhanced (DCE) MRI using Gd-based contrast agents (GBCAs). However, there methods require intravenous and intrathecal injection of GBCAs respectively. Recently, non-contrast MRI methods have emerged to assess BBB water exchange, including diffusion-weighted (DW) ASL for measuring the rate of water exchange (kw) across the BBB. In addition, a novel method named "diffusion tensor image analysis along the perivascular space (DTI-ALPS)" was proposed by using diffusion MRI for non-invasive evaluation of the clearance function of the GS. This talk reviews recent DW ASL and DTI-ALPS studies on aging, cognitive decline, cSVD and AD.

Results

Recent studies by our group and others using DW ASL reported reduced BBB water exchange rate kw in aging, cognitive decline and cSVD, and decreased kw was associated with Aβ in CSF or PET as well as impaired neurocognitive functions. In particular, reduced BBB water exchange rate in CADASIL and in heterozygous HTRA1 mutation-related cSVD was observed (Fig. 1), indicating that a common pathophysiological mechanism may underlie both forms of hereditary cSVD. A growing number of clinical studies have applied DTI-ALPS to investigate GS function in normal aging, cSVD, stroke, dementia, etc. In particular, the ALPS index was shown to correlate with the conventional DCE MRI method using intrathecal injection of GBCA, conventional MRI biomarkers of cSVD, as well as the clinical assessments of cognitive impairment. In the MarkVCID cohort of aged subjects with vascular cognitive impairment and dementia (VCID), we also observed correlations between BBB water exchange rate kw, CBF and DTI-ALPS.

Summary and Discussion

Accumulating evidence suggests that BBB and GS dysfunction is a core mechanism in cSVD and a number of neurological

disorders. Emerging noncontrast MRI methods have been developed to assess BBB and GS function and helped unveil the underlying biological mechanisms of cSVD and other neurologic disorders.
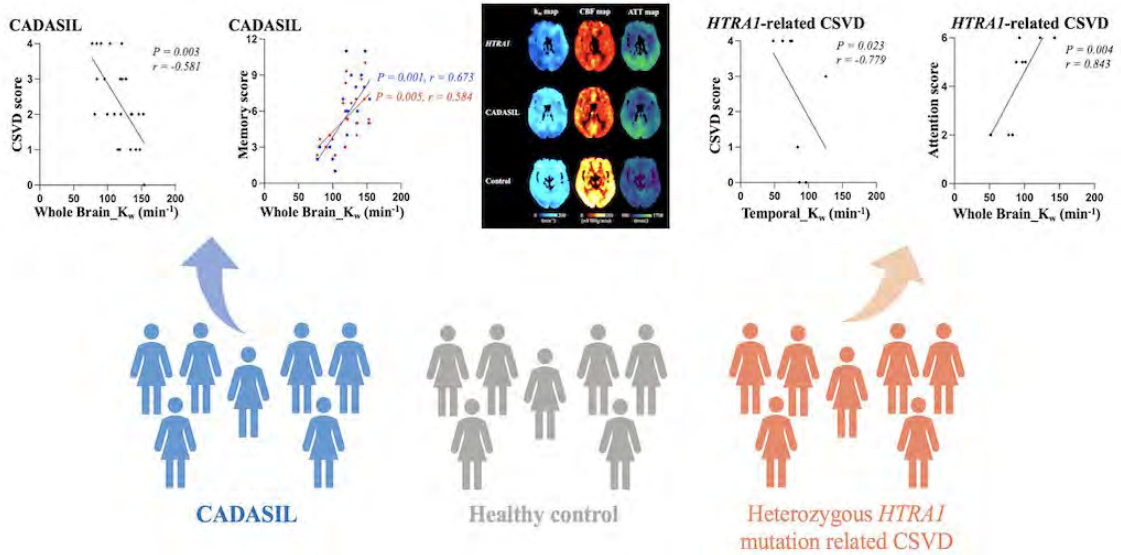
Fig. 1. Li et al. reveal a reduced BBB water exchange rate in CADASIL and heterozygous HTRA1 mutation-related cSVD. A common pathophysiological mechanism may underlie both forms of hereditary CSVD. (Li et al *Brain* 2023)

Clonal hematopoiesis in cerebral small vessel disease

Chi Kyung Kim

Korea University Guro Hospital, Korea

Novel drug discovery in cerebral small vessel disease

Yusuke Yakushiji

Kansai Medical University, Japan

Cerebral small vessel disease (SVD) is the most common age-related pathological process of the arteries, arterioles, venules, and capillaries of the brain caused by vascular risk factors related to vasculopathy or endothelial dysfunction. It is still difficult to directly observe cerebral micro vessels in vivo, but advances in understanding of age-related MRI findings in the brain allow us to non-invasively estimate small vessel burden. These findings (i.e., SVD biomarkers) include lacunes, cerebral microbleeds (CMBs), white matter hyperintensity (WMH), and perivascular space (PVS), which often coexist and relate to each other. So far, in clinical setting, the SVD or their biomarkers are recognized in patients with stroke (especially in lacunar stroke and primary intracerebral hemorrhage), and dementia disorders (especially in vascular dementia and cerebral amyloid angiopathy). Recently, other symptoms including vascular parkinsonism, impaired balance, falls, and behavioral symptoms (i.e., depression, apathy, and personality change) are also considered to be associated with SVD. Effective prevention and treatment of such common geriatric brain diseases requires a better understanding of the pathogenesis and mechanisms of asymptomatic SVD progression.

Over the past 20 years, intensive research has been carried out on SVD. However, despite the above-mentioned public health importance of SVD, there are few proven treatments for the disease. The reasons for this seem to be that SVD is a heterogeneous disease concept that can arise from various diseases, and that there is a wide variety of image markers used for diagnosis. Such tragic delay might partially be due to the fact that SVD is a heterogeneous disease concept that can arise from a variety of diseases. In order to resolve these concerns, SVD has been grouped by background pathology and is currently divided into six types from type 1 SVD to type 6 SVD. The two most common types are arteriolosclerosis caused by aging, hypertension, and other conventional vascular risk factors (i.e., type 1 SVD) and cerebral amyloid angiopathy (CAA) caused by vascular deposition of β-amyloid (i.e., type 1 SVD). In this session, I will discuss the development of promising treatments for type 1 and type 2 SVD. Regarding preventing progression of type 1 SVD, antihypertensive therapy would be the most important medications. The most convincing data come from the SPRINT-MIND trial showing that intensive blood pressure lowering to a systolic of 120 mmHg was associated with both reduced WHM progression. One interesting agent is cilostazol, a phosphodiesterase 3 inhibitor that inhibits platelet aggregation andimproves endothelial dysfunction. However, its effectiveness has been demonstrated in preventing recurrence of ischemic stroke in Asia, and there is little evidence targeting SVD in humans. The phase-2 LACI2 trial revealed that cilostazol were well tolerated and safe even in UK stroke patients, and indicated that cilostazol appeared to have efficacy to reduce recurrent stroke and cognitive impairment after lacunar stroke. Regarding type-2 SVD, several animal model studies demonstrated that cilostazol could reduce the vascular amyloid burden without increasing cerebral micro-hemorrhages. Regarding intracerebral hemorrhage, representative hemorrhagic SVD, the FASTEST trial is now ongoing to determine potential benefit of rFVIIa, reflecting the pressing need to develop therapeutic strategies against hematoma enlargement, a powerful but modifiable prognostic factor in patients with intracerebral hemorrhage.

Risk of antithrombotics-associated bleeding in cerebral small vessel disease: BAT2

Kaori Miwa

National Cerebral and Cardiovascular Center, Japan

Although antithrombotic therapy substantially reduces the risk of subsequent vascular events, bleeding risk is clinically the main safety concern. Individualized prediction of bleeding risk may guide treatment decisions. However, the existing bleeding risk score including only clinical variables pointed out the limited performance. Prediction of bleeding risk based on patient characteristics including image (ex, MRI) biomarkers may offer improved performance. Covert vascular brain injury, such as cerebral small vessel disease (SVD) is an independent predictor of future stroke. The spectrum of cerebral SVD includes white matter hyperintensities, lacunes, cerebral microbleeds, superficial siderosis, and perivascular spaces, which commonly coexist and all reflect vascular vulnerabilities that suggest a significant stroke risk. In a clinical setting, the predictive value of comprehensive SVD for bleeding risk remains uncertain. We investigated whether the features of SVD, which is available on rapid visual assessment of clinical MRI scans, predict the risk of major bleeding in patients taking antithrombotic agents.

The prospective, multicenter, observational study (BAT2 [Bleeding with Antithrombotic Therapy study 2]) enrolled patients with cerebrovascular or cardiovascular diseases who were taking oral antiplatelets or anticoagulants. Multimodal brain MRI was performed at baseline under prespecified conditions, which covered the burden of SVD (white matter hyperintensities, cerebral microbleeds, lacunes, enlarged perivascular spaces, cortical superficial siderosis) with central reading. We developed Cox regression analyses models to predict the risks of major bleeding, selecting candidate predictors on clinical relevance and MRI findings using backward elimination. Performance was assessed with the Harrell's c statistic and calibration plots, adjusted for optimism using bootstrapping. Major bleeding occurred in 93 of 5250 patients (mean age 71 ± 11 years, 33% women) during median follow-up of 2.0 years. The risk score model included the variables of age of 75 years or older, lacunes (1 to 4, 5 or more), deep cerebral microbleeds (1 to 4, 5 or more), antithrombotic treatment (warfarin, direct oral anticoagulant [DOAC], dual antiplatelet therapy, antiplatelet and warfarin or DOAC). Optimism-adjusted c index was 0.72 (95% CI 0.66–0.77) with a calibration slope of 0.91 (0.69–1.17) for the major bleeding model.

Based on readily available SVD features, the BAT2 scores exhibit a predictive value for the risks of major bleeding in patients taking antithrombotic agents. In this symposium, I will discuss SVD and risk scores, including recent research findings.

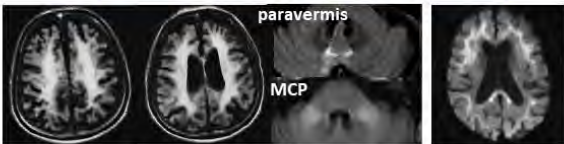# Vascular and non-vascular leukoencephalopathy

Yi-Chu Liao

Taipei Veterans General Hospital, and National Yang Ming Chiao Tung University, Taiwan

Leukodystrophies and inherited leukoencephalopathies constitute a group of disorders affecting white matter in the brain with diverse genetic causes and heterogenous presentations. Emphasis has recently been placed on adult-onset leukoencephalopathies because of the accessibility of brain MRI and genetic testing. Today, I would like to introduce the most frequently encountered leukoencephalopathies in the clinical practice.

I will start with the most prevalent inherited stroke worldwide, cerebral autosomal dominant arteriopathy with subcortical infarct and leukoencephalopathy (CADASIL) caused by cysteine-altering mutations in the NOTCH3 gene. The second most common cause of inherited cerebral small vessel disease (cSVD) is the autosomal dominantly inherited cSVD caused by heterozygous mutations in the high-temperature requirement protein A1 gene (HTRA1-AD cSVD), accounting for approximately 5% of hereditary cSVD in Taiwan. Fabry's disease, the only treatable inherited stroke, demands more clinical attention. Treatment options for Fabry's disease include recombinant alpha-galactosidase A, the enzyme deficient in patients with Fabry's disease, and migalastat hydrochloride, an oral pharmacologic chaperone that corrects the folding of mutated alpha-Gal A in individuals with
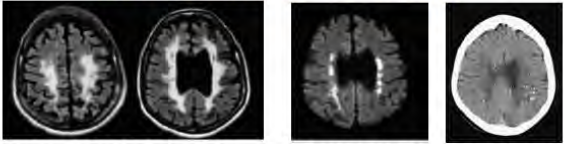

Footnote: cSVD = cerebral small vessel disease, CMBs = cerebral microbleeds, CT = computed tomography, DWI = diffusion weight imaging, FLAIR = Fluid-attenuated inversion recovery, WMH = white matter hyperintensity, PVS = perivascular space

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**International Conference STROKE UPDATE 2023
& 11th Japan−Korea Joint Stroke Conference**

Scientific Session 2 [ENG]

CHAIRS   Makoto Nakajima (Kumamoto University, Japan)

Byung Moon Kim (Severance Hospital, Korea)

Enhancing stroke patient support: Hotline program for patient telephone counseling

Baik-Kyun Kim[1], Dong-Wan Kang[1,2,3], Do Yeon Kim[1,2,3], Jung Hyun Park[1,3], Ji-Seok Woo[4], Young-Hee Kim[4], Hyun-Sook Kim[4], Min-Ju Moon[4], Hyung Seok Guk[2], Nakhoon Kim[2], Sang-Won Choi[2], Hakyeu Ahn[2], Bosco Seong Kyu Yang[2], Jun Yup Kim[2], Jihoon Kang[2], Moon-Ku Han[2], Hee-Joon Bae[2,4], Beom Joon Kim[2,4]

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Purpose

Recognizing the continuous demand, we established a stroke patient hotline program to inform patients and their caregivers about stroke management and teach them the symptoms of stroke which require admission to emergency.

Methods

A stroke patient hotline was established at the Gyeonggi Regional Cerebrovascular Center, in June 2016. The hotline included patients diagnosed with acute stroke or selected outpatients at high risk of recurrent stroke and provided stroke education to patients or their caregivers. Based on a pre-established manual, consulting nurses managed hotline calls and made decisions about emergency room referrals with consulting stroke physicians when necessary. The study described consultation types and details, and hotline system satisfaction from June 2016 to December 2020.

Results

A total of 6,851 patients were registered and 1,173 patients (18%) of those patients had 3,356 hotline consultations. The monthly consultation volume increased from 29.2 cases in 2016 to 92.3 cases in 2020, on average. Consultation types were constituted with stroke symptoms (22.3%), followed by blood pressure or glucose control inquiries (12.8%), and surgery/procedure questions (12.6%). When comparing unexpected outpatient clinic visits from and after the hotline system, it decreased from 103 cases before the hotline to 81 cases after. In 2019-2020, the consultant recommended patients to visit the hospital in 9.6%, and among them, two patients underwent intra-arterial thrombectomy. Ten-point scaled satisfactory ratings with the hotline were collected and the proportion of 9-10 points increased from 64% in 2019 to 69% in 2020.

Conclusions

The stroke hotline program provided efficient and immediate consultation for stroke patients, reduced unexpected outpatient clinic visits, and offered the consultation with high satisfaction. Continuous monitoring and feedback of patients could enhance the management of post-stroke patients by reducing unnecessary healthcare costs.

Order	Loci selection criteria	Selected loci
1	Antiplatelets, anticoagulants, statins and anti-hypertensives associated loci in (CPIC) guideline	CYP2C19, SLCO1B1, CYP2C9, CYP4F2
2	LoE 1 or 2 loci in PharmGKB DB	VKORC1, ADD1, ABCG2, CYP2D6, CES1
3	Loci with clinical relevance to stroke	APOE, NOTCH3
4	Loci mentioned in more than 3 previous studies	• Mentioned in multiple studies : PTGS1, ITGA2, NTRK1, ECHS1, P2RY12, ITGB3, GP1a, ABCB1, etc
5	DOAC-associated loci of PharmGKB DB LoE 3 or 4	
6	Loci mentioned in 2 previous studies	• DOAC-associated : ABCB1, ABCG2, CYP3A4, CYP3A5, CES1, CES1P2, VKORC, etc (18 loci)
7	DOAC-associated loci not reported in PharmGKB DB	

Illumina Asian Screening Array-24

V1.0 Bead chip

+

Self-production Probe including 24 loci

* **Abbreviations**
Clinical Pharmacogenetics International Consortium, CPIC
Pharmacogenomics Knowledgebase, PharmGKB
Level of evidence, LoE
Direct oral anticoagulants, DOAC

Acute stroke management and outcomes in Korea compared 2013-2014 with 2018

Jun Yup Kim[1], Do Yeon Kim[1], Jihoon Kang[1], Beom Joon Kim[1], Seong-Eun Kim[1], Hong-Kyun Park[2], Yong-Jin Cho[2], Jong-Moo Park[3], Kyungbok Lee[4], Ji Sung Lee[5], Juneyoung Lee[6], Young Uk Kwon[7], In Ok Bae[8], Gui Ok Kim[8], Hee-Joon Bae[1]

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[8]Quality Assessment Department, Health Insurance Review And Assessment Service, Wonju, Korea, Republic of

Purpose

The quality of acute stroke care can be improved through the nationwide compulsory quality assessment. Acute stroke quality assessment (ASQA) covers most acute stroke patients treated in acute care hospitals in Korea. We evaluated the changes of acute stroke management and outcomes between 2013/2014 and 2018 in Korea.

Methods

We compared the most recent available ASQA data from 2018 with the data from 2013/2014. Patients with ischemic stroke (IS), subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH), who were admitted via emergency rooms within 7 days of onset at hospitals treating 10 or more cases during the each 3-month (2013, 2014) and 6-month (2018) survey period were selected. We grouped 2013 and 2014 into one group and compared them with 2018.

Results

A total of 19,599 acute stroke cases in 2013/2014 and 28,286 cases in 2018 were enrolled at 216 and 248 nationwide hospitals, respectively. Age of stroke patients increased slightly (67.1±13.5 vs 68.2±13.8, p<0.001), and the proportion of stroke types slightly increased ICH and decreased SAH. The proportion of severe stroke was decreased. The number of hospitals equipped with stroke units increased. Mean bed size increased, but there was no difference in the number of stroke specialists by hospital. IVT and EVT were performed in 8.7% and 5.3% among IS patients in 2013/2014, respectively. In 2018, IVT rates decreased to 6.3% (p<0.001), and EVT rates increased to 9.8% (p <0.001). In particular, IVT rates significantly decreased from 1.3% to 0.2% in those over 80 years of age, and EVT rates increased from 0.7% to 2.4%. Decompressive surgery rates in ICH patients decreased slightly from 28.0% to 25.2% (p=0.009). In SAH, clipping rates decreased from 34.7% to 24.3% (p<0.001), and coiling rates increased significantly from 39.8% to 53.0% (p<0.001). One-year mortality significantly decreased from 22.0% to 18.2% in all stroke patients (p<0.001). Mortality decreased at 1 month and 3 months, also, and decreased in all patients with IS, ICH, and SAH.

Conclusions

This study showed that while stroke patients had improved outcomes from 2013/2104 to 2018 in Korea, there is still room for improvement, particularly in IVT rates.

[OP013]

Actual resources for stroke care in rural areas and outlying islands of Japan: A survey of Jichi Medical University Graduates

Takafumi Mashiko[1], Yuhei Anan[1], Kosuke Matsuzono[1], Tadashi Ozawa[1], Reiji Koide[1], Ryota Tanaka[1], Shigeru Fujimoto[1]

[1]Neurology, Jichi Medical University, Tochigi, Japan

Purpose

In the face of Japan's rapidly aging society, achieving equalization in stroke care is an urgent challenge. Specifically for ischemic stroke, the acute phase necessitates the prompt provision of reperfusion therapy following onset, while the chronic phase requires securing healthcare resources to maintain the appropriate preventive and treatment strategies established during the acute phase in specialized hospitals. This study aimed to elucidate the current status and challenges of healthcare resources in rural areas and outlying islands, which are essential for stroke care.

Methods

A questionnaire survey was conducted via mail to 859 graduates of Jichi Medical University practicing in all 47 prefectures after graduation. Responses from urban areas and duplicate facilities were excluded from the analysis.

Results

A total of 385 responses were received, resulting in a response rate of 44.8%. Of these, 236 responses were analyzed. The survey covered 204 facilities in rural areas and 32 on outlying islands. Among the respondents, 188 identified as general internists, while only 10 specified neurology or neurosurgery as their specialty. They collectively treated 4,569 stroke patients annually, with 2,860 cases being ischemic strokes. Intravenous tissue plasminogen activator (IV-tPA) was administered to only 95 (3.3%) patients, and mechanical thrombectomy was performed on only 27 (0.94%) individuals. CT scanners were available in 116 facilities, while 61 facilities had MRI scanners. Carotid ultrasound examination was feasible in 174 facilities, and PT-INR measurements could be performed on the same day in 164 facilities. Approximately 60% of facilities could use direct oral anticoagulants (DOACs) at either standard or low doses. Despite the lack of stroke awareness programs in nearly 90% of the facilities, respondents acknowledged the need for stroke education. Additionally, around 70% of facilities recognized the necessity of telestroke.

Conclusions

Even in rural area and outlying island, there is a demand for stroke care, primarily led by general internists. These healthcare professionals exhibit high intrinsic motivation. Expanding telestroke and improving stroke education systems, in conjunction with infrastructure development, are crucial for enhancing stroke care in these regions.

CADASIL Registry in East Asia (CADREA): Protocol for an international prospective cohort study

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Purpose

Recent advancements in genomic research have revealed that 9 individuals per 1,000 population in East Asia and 3.4 individuals per 1,000 population worldwide carry cysteine-altering NOTCH3 variants in the epidermal growth factor-like repeat domains, which are the underlying cause of cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL). Compared to CADASIL patients in Western countries, Asian patients exhibit several differences, including: (1) different predominant pathogenic NOTCH3 variants, (2) a higher prevalence of hemorrhagic stroke, and (3) a lower prevalence of white matter hyperintensities in the anterior temporal pole. Therefore, it is necessary to conduct large-scale clinical studies in East Asia to establish clinical evidence for CADASIL patients in this region. We here investigate clinical, genetic, and neuroradiological characteristics of CADASIL patients in Japan, Korea, and Taiwan.

Methods

The current CADREA (CADASIL Registry in East Asia) study will recruit 1,000 CADASIL patients diagnosed based on the results of NOTCH3 genetic testing. From September, 2023, physicians in participating facilities will register clinical data, including age, gender, race, medical history, social history, medication history, family history, scores of the Montreal Cognitive Assessment and Trail Making Test, and detailed information on stroke events, into an Electronic Data Capture system called Research Electronic Data Capture (REDCap). Brain MRI data will be independently evaluated by the Central Evaluation Committee. Each patient will undergo annual evaluations for two years. The study will examine genotype-phenotype correlations, particularly in the frequency of stroke events and changes in cognitive function and imaging biomarkers.

Results

The CADREA study will uncover the natural history of CADASIL patients in East Asia, providing basic data for future clinical trials.

Conclusions

Findings in the CADREA study may have implications for understanding the unique characteristics of CADASIL in Asian populations and inform potential interventions and treatments.

Acknowledgement

This is a protocol paper.

Novel vessel features of reversible cerebral vasoconstriction syndrome identified by computerized quantitative analysis

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Purpose

Previous studies have shown that reversible cerebral vasoconstriction syndrome (RCVS) rarely involves the intracranial internal carotid artery (ICA). We aimed to investigate the intracranial vessel features of RCVS and the involvement of the intracranial ICA by computerized quantitative analysis.

Methods

Computerized analysis of the time of flight-magnetic resonance angiography (TOF-MRA) images provided quantitative vessel features at every 0.2841 mm interval point of the vessel's centerline. The mean value and standard deviation were calculated as the quantified value of the vessel feature of the centerline point in each vessel, and the features were identified for each vessel and overall vessel. The vessel features that reflect the size and shape of the vessel include area, minimum diameter, maximum diameter, and luminal circularity. In addition, radiomics image feature were analyzed to compare difference in vascular features between RCVS and controls.

Results

A total of 100 patients with RCVS and 100 subjects with controls were included. Of the total 100 patients with RCVS, 90 patients underwent follow-up TOF-MRA. The area (Rt. ICA: 21.23 ± 4.38 for the initial vs. 22.85 ± 4.06 for the control, p=0.007, Lt. ICA: 21.97 ± 5.07 for the initial vs. 23.79 ± 4.39 for the control, p=0.007), minimum diameter (Rt. ICA: 4.75 ± 0.52 for the initial vs. 5.01 ± 0.45 for the control, p<0.001, Lt. ICA: 4.79 ± 0.47 for the initial vs. 5.04 ± 0.47 for the control, p<0.001), and maximum diameter (Rt. ICA: 5.57 ± 0.64 for the initial vs. 5.73 ± 0.58 for the control, p=0.070, Lt. ICA: 5.64 ± 0.68 for the initial vs. 5.85 ± 0.63 for the control, p=0.021) of the intracranial ICA in initial TOF-MRA were significantly decreased compared to controls. Initial TOF-MRA was significantly decreased compared to control in both voxel volume (6646.21 ± 1267.53 for the initial vs. 7174.98 ± 1583.97 for the follow up, p=0.010), intensity (1365.33 ± 631.80 for the initial vs. 1537.11 ± 307.73 for the follow up, p=0.016), and heterogeneity (2196.45 ± 527.46 for the initial vs. 2384.00 ± 524.09 for the follow up, p=0.012) in radiomics image features.

Conclusions

Our findings suggested a novel finding that intracranial ICA involvement is strongly associated with RCVS. Furthermore, computerized quantitative analysis may be helpful in the diagnosis of patients with probable RCVS in whom a typical vasoconstriction finding is not observed on cerebral angiography.

RAPID for ANGIO in balloon occlusion test

Hikaru Nakamura[1], Kazuaki Okamura[1], Yoichi Morofuji[1], Tsuyoshi Izumo[1], Takayuki Matsuo[1]

[1]Neurosurgery, Nagasaki University Graduate School Of Biomedical Sciences, Nagasaki, Japan

Purpose

A balloon occlusion test (BOT) is widely performed before surgery, since it is sometimes necessary to occlude the parent artery in the treatment of giant cerebral aneurysms, neck tumors or skull base tumors. The most popular method to evaluate cerebral blood flow during BOT is SPECT, but there are problems related to manpower, transportation to the SPECT room, and handling and management of radioisotopes. The purpose of the current study was to verify whether RAPID for Angio can replace SPECT with various problems.

Methods

Thirty-two consecutive patients who underwent BOT from June 2021 and Augsut 2023 were included in this study. BOT procedures were performed with SIEMENS ARTIS icono D-Spin. 5.2Fr Selecon MP catheter II (Terumo) was placed into the internal carotid artery on the affected side and balloon occlusion was performed. The presence of neurological symptoms, mean blood pressure, mean stump pressure, and rSO2 are measured for 15 minutes. If neurologically tolerant, RAPID for ANGIO is performed at 7.5 minutes after the start of BOT, and the balloon is deflated after 15 minutes. The patient is then moved to the SPECT room, the balloon is inflated again, and SPECT study using 99mTc-HMPAO is performed. Images were analyzed by one neurosurgeon and one neuroradiologist. Image concordance rates were calculated by comparing SPECT CBF images with CBV, CBF, MTT, and TMAX parameters obtained with RAPID for Angio.

Results

The 32 patients included 29 patients with unruptured aneurysms, 1 patient with common carotid artery dissection, 1 patient with neck tumor, 1 patient with pituitary apoplexy, and 1 patient with direct CCF. The mean age was 61.8 years, and 25 patients were neurologically resistant. In total, twenty-three patients were analyzed for which both RAPID for ANGIO and SPECT results were available. The image concordance rate with SPECT-CBF for each RAPID parameter was 51.9% for CBV, 52.3% for CBF, 68.2% for MTT, and 87.6% for TMAX. Significantly, TMA showed a high image concordance rate with SPECT-CBF.

Conclusions

The TMAX of RAPID for Angio reflects SPECT-CBF in great detail, and SPECT can be substituted for RAPID in BOT.

[OP018]

Fully automated detection of large vessel occlusion on computed tomography angiography using deep learning

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Purpose

A few of automated large vessel occlusion (LVO) detecting software has been utilized in clinical settings. However, external evaluations of the software revealed only moderate sensitivity, limiting their applicability. Herein, a fully automated deep learning algorithm for detecting LVO in CT angiography (CTA) was devised and validated.

Methods

We used 2,051 CTA images of ischemic stroke patients from three Korean university hospitals to train (n = 1,442; 24.6% had LVO) and validate (n = 629; 19.4% had LVO) two deep learning algorithms: 1) vessel segmentation on maximal intensity projection images, and 2) LVO detection using merged vessel segmentation mask. LVO included intracranial internal carotid artery (ICA), M1-middle cerebral artery (MCA), or proximal M2-MCA occlusion. We externally validated the algorithm in 388 ischemic stroke patients (14.4% had LVO) from a multicenter cohort. Using 2,000 stratified bootstrap samples, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) and their 95% confidence intervals were calculated.

Results

We used 2,051 CTA images of ischemic stroke patients from three Korean university hospitals to train (n = 1,442; 24.6% had LVO) and validate (n = 629; 19.4% had LVO) two deep learning algorithms: 1) vessel segmentation on maximal intensity projection images, and 2) LVO detection using merged vessel segmentation mask. LVO included intracranial internal carotid artery (ICA), M1-middle cerebral artery (MCA), or proximal M2-MCA occlusion. We externally validated the algorithm in 388 ischemic stroke patients (14.4% had LVO) from a multicenter cohort. Using 2,000 stratified bootstrap samples, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) and their 95% confidence intervals were calculated.

Conclusions

We developed fully deep learning-based LVO detection algorithms on CTA. External validation demonstrated robust performance of the algorithm. In addition, the algorithm has the potential to detect LVO in patients with a history of coli embolization and moyamoya disease, for whom previous software was inapplicable. A fully deep learning algorithm detecting LVO in CTA can aid less experienced physician. In turn, the algorithm may facilitate early transfer to endovascular treatment capable stroke centers, thereby improving stroke outcomes.

Predicting infarct core volume in patients with acute ischemic stroke on CT Perfusion among various image slice thicknesses

Chuluunbaatar Otgonbaatar[1], Huijin Song[2], Keun-Hwa Jung[3], Inpyeong Hwang[4], Kyu Sung Choi[4], Dong Hyun Yoo[4], Chul-Ho Sohn[1,4]

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Purpose

We aimed to study the optimal slice thickness on the quantification of CT perfusion-derived infarct core volume in patients with acute ischemic stroke compared with diffusion-weighted imaging (DWI)-derived infarct core volume.

Methods

A total of 91 (mean age ± standard deviation [SD], 69.73 ± 12.36 years, 51 males) patients with acute ischemic stroke underwent both CT perfusion and DWI were enrolled. The CT perfusion images were resampled with 1-mm, 3-mm, 5-mm, 7-mm, and 10-mm slice thickness using the Cercare Medical Neurosuite (Cercare Medical, Aarhus, Denmark). The CT perfusion maps were processed using a fully automated RAPID software. The CT perfusion-derived infarct core volume was defined as a relative cerebral blood flow (rCBF) < 20 – 38% and relative cerebral blood volume (rCBV) < 34 – 42%. Olea Sphere was used to quantify DWI-derived infarct core volume) with a threshold of apparent diffusion coefficient of 620 x 10-6 mm/s. The optimal slice thickness for the quantification of CT perfusion-derived infarct core volume was defined as those that showed the lowest mean absolute error, narrowest bias and 95% limits of agreement, and largest ICC against DWI-derived infarct core volume.

Results

The mean time from CT perfusion to DWI was 42.10 ± 28.62 min. The mean absolute error for 3-mm (14.23 ± 17.05 mL), 5-mm (15.22 ± 17.28 mL), and 7-mm (14.97 ± 18.33 mL) slice thickness was lower than 1-mm (15.09 ± 19.71 mL) and 10-mm (18.54 ± 27.80 mL) slice thickness in CT perfusion-derived infarct core volume with the use of rCBF < 30%. The mean absolute error, Bland-Altman analysis, and interclass correlation coefficient (ICC) showed rCBF < 38% accurately predicted infarct core volume compared with rCBF < 30% among different slice thicknesses. Bland-Altman analysis and ICC demonstrated that 3-mm (-34.93 to 44.51, ICC = 0.961), 5-mm (-37.03 to 45.81, ICC = 0.959), and 7-mm (-35.09 to 44.13, ICC =0.960) slice thickness resulted in narrower bias and 95% limits of agreement, and larger ICC in the quantification of infarct core volume than 1- (-36.68 to 49.33, ICC = 0.951) and 10-mm (-35.09 to 44.13, ICC = 0.904) slice thickness with rCBF < 38%.

Conclusions

Our study demonstrated that the 3-, 5-, and 7-mm slice thickness in CT perfusion provided the accurate prediction of infarct core volume at both commonly used threshold and optimal threshold compared with 1- and 10-mm slice thickness.

Accelerated brain atrophy after ruptured aneurysmal subarachnoid hemorrhage

Sungpil Joo[1]

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Purpose

Brain atrophy may be accelerated after brain injury compared with normal aging. The purpose of this paper is to quantitatively measure brain volume after subarachnoid hemorrhage (SAH) to confirm the progression of brain atrophy over time and to investigate related risk factors in patients.

Methods

A total of 1226 patients presented with SAH and underwent surgery during the period from January 2010 to December 2020. Sixty-two of these patients were enrolled in this study. We measured the brain volume in a specific section using computed tomography images performed during each time period and investigated factors that may affect volume change.

Results

The difference in volume at 6 months versus 12 months and at 12 months versus 24 months was statistically significant, with p-values of 0.007 and 0.045, respectively. By univariate analysis, only age and sex showed a significant correlation with brain atrophy (p-values of 0.021 and 0.001, respectively). By multivariate analysis, a significant correlation was found with brain atrophy and sex, the presence of intracerebral hemorrhage (ICH), and diabetes (p-values of 0.034, 0.017, and 0.044, respectively).

Conclusions

Brain volume decreased by 4.14% at 12 months and 7.33% at 24 months after SAH. Brain atrophy is accelerated after SAH, especially with old age (> 65 years), ICH, diabetes, and in female individuals.

Representative case of brain volume changes. Intracranial free space is increased in patients with subarachnoid hemorrhage over time
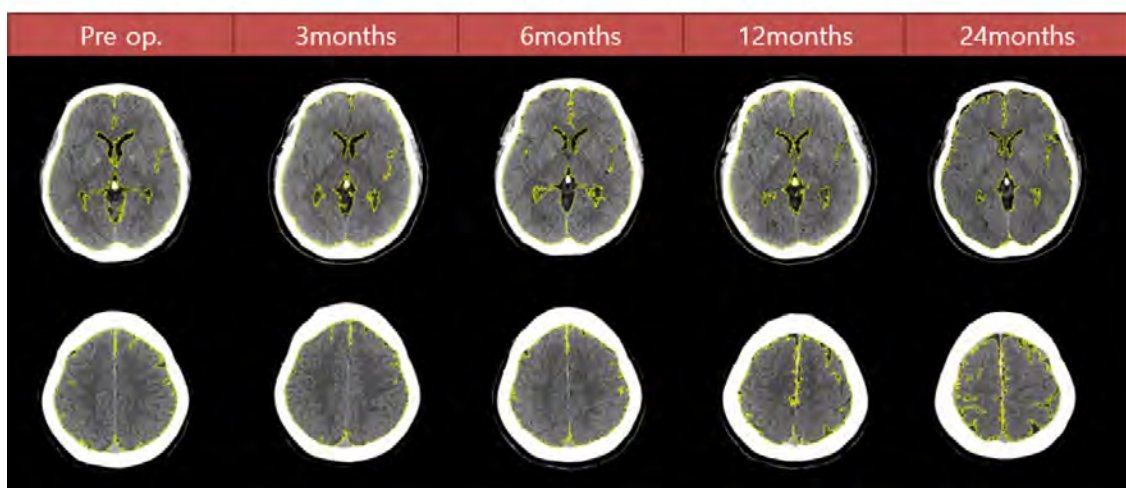
| Pre op. | 3months | 6months | 12months | 24months |

November 16 (Thu) 15:50-17:30 | Room 1

Symposium 3. Genetics [ENG]

CHAIRS Sung-Chun Tang (National Taiwan University Hospital, Taiwan)

Jay Chol Choi (Jeju National University Hospital, Korea)

Genomics of MRI-markers of cSVD

Stephanie Debette

University of Bordeaux, France

Current status of international genome BIOBANKs and the importance of genomics in cardio & cerebrovascular diseases

Yoichiro Kamatani

Laboratory of Complex Trait Genomics, Japan

Mendelian randomization & drug discovery in cSVD

Keon-Joo Lee

Korea University Guro Hospital, Korea

Mendelian Randomization (MR) is revolutionizing the landscape of drug discovery and repurposing particularly in the context of cerebral small vessel disease (cSVD). cSVD, a prevalent condition affecting vascular brain health, often results in debilitating neurological outcomes such as stroke and dementia. Traditional interventions, including optimal blood pressure, have shown potential in mitigating cSVD progression, but their efficacy remains underexplored in large randomized clinical trials. Enter MR: a powerful genetic epidemiology tool that simulates the rigor of clinical trials without their associated challenges. By leveraging genetic variants as instrumental variables, MR minimizes unmeasured confounding and reverse causation, fortifying the causal links between interventions and outcomes. The proliferation of genome-wide association studies, especially those centered on vascular risk factors and cSVD phenotypes provides a robust foundation for MR. Notably, as an example, MR studies have suggested that an increase in HDL cholesterol might be beneficial, and potential therapeutic targets like CETP inhibitors have been identified to counteract associated cSVD risks. MR emerges as a beacon, promising to reshape research methodologies and accelerate the quest for effective therapeutic interventions in cSVD. This talk will delve into the transformative potential of MR, highlighting its pivotal role in the future of drug discovery for cSVD and vascular brain health.

A peptide hormone adrenomedullin for CADASIL: AMCAD trial

Masafumi Ihara

National Cerebral and Cardiovascular Center, Japan

OBJECTIVE

There is no disease-modifying therapy for CADASIL. AdrenoMedullin (AM), a vasoactive peptide hormone, has anti-inflammatory, angiogenic and oligodendroglial cell differentiation-promoting effects and ameliorates the pathophysiology of chronic cerebral hypoperfusion models, and is therefore expected to be effective against CADASIL.

Methods

The AMCAD (AdrenoMedullin for CADASIL) study is a phase II study designed to assess the safety and efficacy of AM in CADASIL patients. A total of 60 CADASIL patients were treated with intravenous AM for 8 hours x 14 days and followed for 180 days. The primary endpoint is the rate of change in cerebral blood flow in the frontal lobe as assessed by arterial spin labelling at 28 days post-treatment compared to pre-treatment. Secondary endpoints included diffusion indices in white matter fibre tracts assessed by diffusion tensor imaging, cerebral blood flow assessed by head SPECT imaging and cognitive function (MoCA, trail-making test, WAIS-IV, etc.) compared with pre-AM treatment.

CONCLUSION

Intravenous AM therapy is expected to be a safe and effective treatment for CADASI
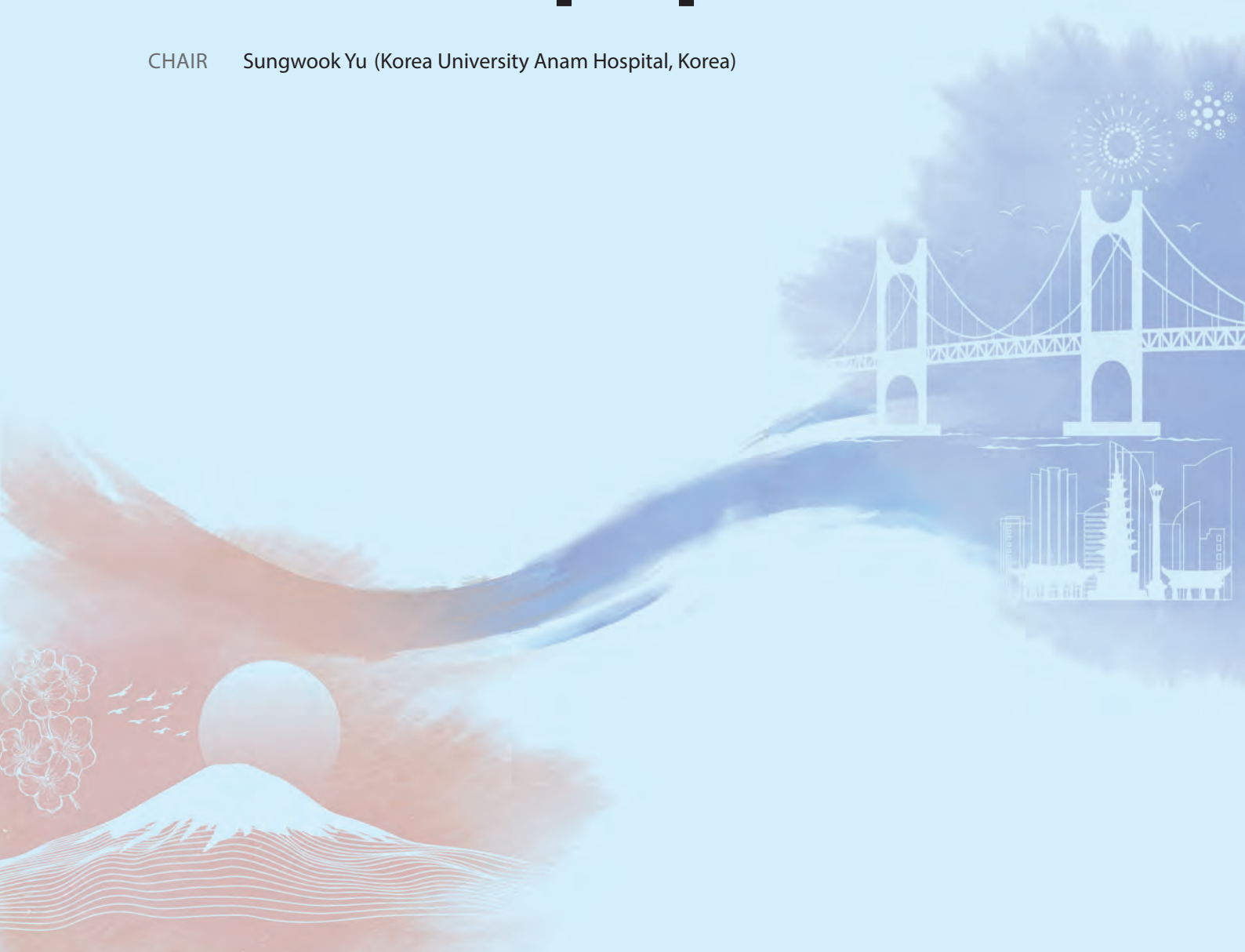
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**International Conference STROKE UPDATE 2023
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Breakfast Symposium 1.
VIATRIS KOREA [ENG]

CHAIR   Sungwook Yu (Korea University Anam Hospital, Korea)

Lowering risk of stroke by statin use: Atorvastatin benefits

Tae-Jin Song

Ewha Womans University Seoul Hospital, Korea

Statin drugs, like atorvastatin, are primarily used to lower cholesterol levels, particularly low-density lipoprotein (LDL) cholesterol, which is often referred to as "bad cholesterol." By reducing LDL cholesterol, statins can help decrease the risk of atherosclerosis, a condition where fatty deposits (plaques) build up in the arteries. Atherosclerosis can lead to heart attacks, strokes, and other vascular events.

Here are some of the potential benefits of atorvastatin, and statins in general, in lowering the risk of stroke:

Lowering LDL Cholesterol: Atorvastatin effectively reduces LDL cholesterol. Elevated LDL levels are a significant risk factor for stroke and heart disease. Stabilizing Plaques: Statins not only reduce the size of atherosclerotic plaques but also make them less prone to rupture. A ruptured plaque can lead to a blood clot, which can block an artery and cause a stroke. Anti-inflammatory Effects: Statins have anti-inflammatory properties that may help reduce inflammation in the arteries, thereby reducing the risk of plaque rupture and subsequent clot formation. Improved Endothelial Function: The endothelium is the inner lining of blood vessels. Statins can help improve the function of the endothelium, promoting the relaxation of blood vessels and improving blood flow. Reduction in C-reactive Protein (CRP): CRP is a marker of inflammation in the body, and elevated levels are associated with an increased risk of stroke and heart disease. Some studies have shown that statins can reduce levels of CRP. Antithrombotic Effects: Statins may reduce the risk of clot formation (thrombosis) by affecting platelet aggregation and other mechanisms.

It's worth noting that the benefits of statins, including atorvastatin, in stroke prevention can vary based on the individual's overall risk profile, including the presence of other risk factors such as hypertension, diabetes, smoking, and a history of vascular events.

While atorvastatin and other statins have demonstrated benefits in reducing the risk of stroke, they also have potential side effects. It's essential to discuss with a healthcare provider whether the potential benefits of taking a statin outweigh the possible risks for any given individual.

The SPARCL trial demonstrated that atorvastatin can reduce the risk of subsequent stroke in patients who have already experienced a stroke or TIA. The results led to a greater appreciation of the role of statins in secondary prevention after a cerebrovascular event. However, as always, the decision to start a statin like atorvastatin should be based on a thorough evaluation of the patient's individual risk and benefit profile, taking into account the potential side effects of the medication.

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Breakfast Symposium 2.
Organon Korea Co., Ltd. [ENG]

CHAIR   Kyungbok Lee (Soonchunhyang University Seoul Hospital, Korea)

The benefit of Ezetimibe/Atorvastatin FDCs for ischemic stroke patients with hypercholesterolemia

Kwang-Yeol Park

Chung-Ang University Hospital, Korea

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Symposium 4.
Reperfusion Therapy [ENG]

CHAIRS   Kenichi Todo (Osaka University Graduate School of Medicine, Japan)

Ji Hoe Heo (Severance Hospital, Korea)

Reperfusion therapy in minor stroke

Pooja Khatri

University of Cincinnati, USA

Minor ischemic stroke patients have presented some unique challenges for reperfusion therapy eligibility. They were largely excluded from pivotal trials that established intravenous thrombolysis (on the basis of deficits judged as nondisabling at presentation) and endovascular therapy (on the basis of NIHSS <6 at presentation).

Regarding intravenous thrombolysis, the subsequent PRISMS trial showed no evidence of benefit of intravenous alteplase for patients with ischemic stroke presenting with NIHSS 0-5 and deficits that were not clearly disabling, although it was prematurely halted. The recent published ARAMIS trial also showed no evidence of benefit of alteplase, and specially showed its noninferiority to dual antiplatelet therapy. It remains to be seen whether this therapy may show benefit in patients with higher risk for disability or neurological worsening, such as those large vessel occlusions, perfusion deficits, or acute diffusion restriction on MRI, or if using Tenecteplase, which may have lower risk for intracranial hemorrhage.

Regarding endovascular therapy, two ongoing trials (ENDOLOW and IN EXTREMIS) are underway to address the question of whether to treat patients with large vessel occlusion and NIHSS 0-5 with immediate thrombectomy upon clinical presentation, and a third is being initiated (STEP-Indication Expansion). This is an area of substantial equipoise. There are relative risks and technical challenges of the thrombectomy in this context, as occlusions are often associated with underlying chronic intracranial stenosis, and complications can dramatically worse an otherwise relatively mild stroke deficit. But there is also the opportunity to prevent a significant neurological decline and lead to better outcomes than waiting for decline and later doing rescue therapy. Nonrandomized data do not clearly suggest a favored approach, and randomized data are eagerly awaited. In the meantime, we must prioritize enrollment in trials when available and make our best clinical judgments while considering factors including degree of disability, blood pressure and collateral status, clinical and cerebral perfusion stability, and thrombus and anatomical characteristics.

Tenecteplase on the move

Hiroyuki Kawano, M.D., **Teruyuki Hirano, M.D.**

Kyorin University, Japan

Alteplase is currently the only thrombolytic agent for patients with acute ischemic stroke (AIS) approved by regulatory agencies. Recently, tenecteplase has emerged as a new thrombolytic agent. Tenecteplase is a genetically modified form of alteplase, with higher fibrin specificity and a longer half-life, and is more resistant to plasminogen activator inhibitor than alteplase. Some randomized-controlled clinical trials (RCTs) reported that tenecteplase has higher recanalization rates, better early neurological improvement, and be at least as safe as alteplase. Easier intravenous tenecteplase administration with a single bolus is advantageous in the setting of AIS.

In the latest ESO recommendation, 1) For AIS patients of <4.5 hours who are eligible for intravenous thrombolysis (IVT), tenecteplase 0.25 mg/kg can be used as a safe and effective alternative to alteplase 0.9 mg/kg., 2) For AIS patients with large vessel occlusion of <4.5 hours who are eligible for IVT, tenecteplase 0.25 mg/kg is recommended over alteplase 0.9 mg/kg., and 3) For patients with AIS of unknown onset or awakening from sleep who are eligible for IVT, there is continued uncertainty over the potential benefits and harms of tenecteplase compared with alteplase.

In Japan, no drug company has or intends to obtain the license to supply tenecteplase. Currently, we are conducting the investigator-initiated trial (The Tenecteplase versus alteplase For LArge Vessel Occlusion Recanalization (T-FLAVOR) trial) to test the hypothesis that tenecteplase 0.25 mg/kg is superior to alteplase 0.6 mg/kg (the standard dose in Japan) in achieving recanalization on the initial angiogram when administered within 4.5 hours of stroke onset in patients planned for mechanical thrombectomy. Primary efficacy outcome is substantial angiographic recanalization or absence of retrievable thrombus on the initial angiography.

Several ongoing RCTs that are addressing unmet needs will provide further evidence for the use of intravenous tenecteplase.

EVT in BAO

Hyungjong Park

Keimyung University Dongsan Hospital, Korea

Endovascular thrombectomy (EVT) has become the standard treatment option in anterior circulation with large vessel occlusion (LVO). Despite of considering one of the devastating neurological conditions with high risk of disability and mortality in basilar artery occlusion (BAO), evidence from randomized controlled trials in BAO is still lacking until recently. Two randomized control trials (RCTs) including BASCIS (Basilar Artery International Cooperation Study) and BEST (Basilar Artery Occlusion Endovascular Intervention Versus Standard Medical Treatment) showed non-significant trend toward benefit of EVT but failed to demonstrate the superiority of EVT over best medical treatment (BMT). Recently, two positive RCTs including the ATTENTION (Endovascular Treatment for Acute Basilar Artery Occlusion) and BAOCHE (Basilar Artery Occlusion Chinese Endovascular Trial) have been announced. These two RCTs showed that EVT is beneficial for basilar artery occlusion within 24 hours of symptom onset and treatment effect was similar to that of RCTs in anterior circulation. In this session,
I would like to talk about the current evidence and patients' selection of EVT in BAO.

Effect of intensive BP lowering vs. conventional BP lowering after successful IA thrombectomy

Hyo Suk Nam

Severance Hospital, Korea

The optimal level of blood pressure (BP) control after successful recanalization with intra-arterial thrombectomy (IAT) in acute ischemic stroke is unclear. We investigated whether intensive BP management during the first 24 hours after successful recanalization leads to better clinical outcomes compared to conventional BP management for patients with large cerebral artery occlusion. The OPTIMAL-BP trial was a multicenter, randomized, open-label, blinded end-point evaluation trial. The trial included patients with acute ischemic stroke who were treated with IAT due to large vessel occlusion and who achieved successful recanalization (a modified Treatment In Cerebral Infarction score of ≥2b) and elevated systolic BP ≥140 mmHg within 2 hours of successful recanalization. Participants received intensive BP management (targeting systolic BP <140 mmHg) or conventional management (targeting systolic BP between 140-180 mmHg) for 24 h after enrolment. The primary outcome was functional independence at 3 months (a modified Rankin Scale score <3). Of 305 patients included in the primary analysis, mean age was 73.1 ± 11.5 years, and 123 (40.3%) were women. The intensive treatment group had a lower proportion of patients achieving a favorable outcome (39.4%) compared to the conventional group (54.4%) (an adjusted odds ratio of 0.56 [95% CI 0.33 - 0.96], P = 0.034). Symptomatic intracerebral hemorrhage (P = 0.816) and death related to the index stroke (P = 0.307) were similar.

Intensive blood pressure lowering during the first 24 hours after successful recanalization may be harmful in acute ischemic stroke patients who have undergone intra-arterial thrombectomy. The main findings are consistent with those of the ENCHANTED2/MT, which showed that death or disability at 3 months occurred more frequently in the more intensive treatment group than in the less intensive treatment group. In previous observational studies and meta-analyses, elevated BP was associated with increased risks of ICH and worse outcomes in patients with successful reperfusion after EVT. This evidence suggesting that lowering BP could be beneficial prompted the hypothesis for this trial. However, our findings suggest that actively lowering BP to levels of SBP <140 mmHg in patients with a baseline BP ≥140 mmHg is harmful. The restricted cubic spline curve showed a sharp increase in the likelihood of dependent or dead outcome as BP decreased in the intensive group. Although the occluded artery was recanalized in our participants, some areas in the ischemic brain may have already been damaged or were in an oligemic state within an ischemic penumbra zone. Cerebral vessels in these areas may not have a sufficient autoregulatory function to compensate for sudden decreases in BP.
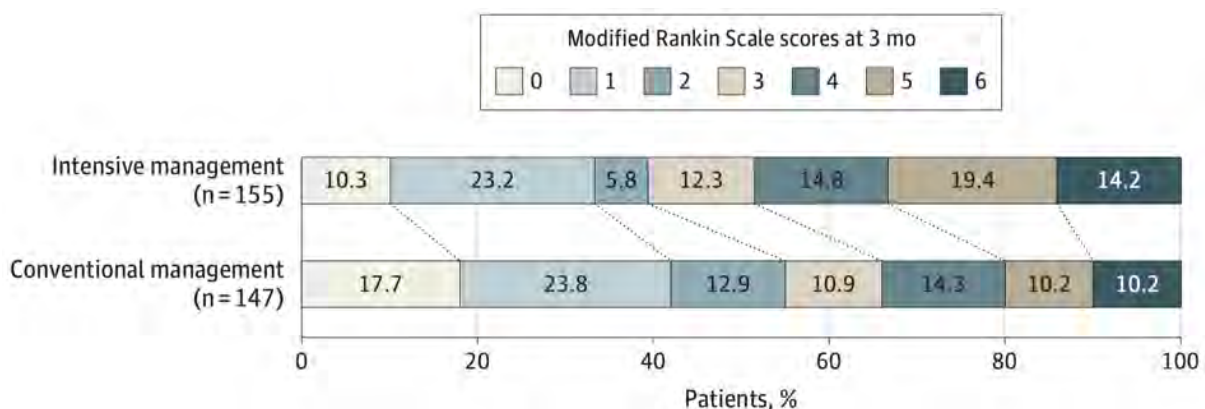
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**International Conference STROKE UPDATE 2023
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November 17 (Fri) 09:00-10:40 | Room 2

Scientific Session 3 [ENG]

CHAIRS   Hiroshi Yamagami (NHO Osaka Medical Center, Japan)

Seung-Hoon Lee (Seoul National University Hospital, Korea)

Small vessel disease burden predicts incident stroke, dementia, death, and functional outcome in independent outpatients with vascular risk factors

Kazuo Kitagawa[1], Sono Toi[1], Megumi Hosoya[1], Takao Hoshino[1], Hiroshi Yoshizawa[1]

[1]Department Of Neurology, Tokyo Women's Medical University, Tokyo, Japan

Purpose

Total small vessel disease (SVD) score is used to measure the burden of SVD. Whether total SVD scores predict long-term functional outcome in outpatients with vascular risk factors remains unclear. This study aimed to clarify the predictive value of the total SVD score for incident stroke, dementia, mortality, and functional outcomes in independent outpatients with vascular risk factors.

Methods

We derived data from The Tokyo Women's Medical University Cerebrovascular Disease registry, a prospective observational registry in which 1011 patients with evidence of cerebral vessel disease on magnetic resonance imaging were consecutively enrolled and underwent cognitive examinations. The patients were followed up until March 2023. The primary outcomes were incident stroke, dementia, acute coronary syndrome, and all-cause death. Secondary outcomes were functional outcomes, pneumonia and falls.

Results

After excluding those with a modified Rankin scale score >1, Mini-mental State Examination score < 24, and missing T2* images, 692 patients were included in the analysis. The total SVD score was independently associated with stroke, dementia, and all-cause death but not with coronary heart disease. The cut-off values of the total SVD score for stroke, dementia, and all-cause death were 1, 4 and 1, respectively. The total SVD score was related to poor functional outcome. The total SVD score was associated with pneumonia but not with falls during the follow-up period.

Conclusions

The total SVD score could predict not only incident stroke and dementia but also mortality and poor functional outcomes. Our results suggest intensive medical control of patients with a total SVD score >1 to prevent vascular events and cognitive impairment and to maintain independent activities of daily living.

Predictors of incomplete occlusion after flow diverter treatment

Kazuaki Okamura[1], Yoichi Morofuji[1], Hikaru Nakamura[1], Nobutaka Horie[2], Tsuyoshi Izumo[1], Takayuki Matsuo[1]

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[2]*Neurosurgery, Hiroshima University, Hiroshima, Japan*

Purpose

With the approval of Flow Diverter (FD) in Japan in 2015, the treatment of unruptured cerebral aneurysms (especially side wall aneurysms) reached a new turning point. Furthermore, in 2020, the PREMIER study in the U.S. demonstrated the efficacy and safety of the pipeline treatment for small and medium-sized aneurysms. The number of patients benefiting from this expanded indication is steadily on the rise.

Methods

Between July 2019 and August 2023, 46 patients who underwent FD treatment were retrospectively identified. The mean age was 63 years, male to female ratio was 1:9, mean aneurysm diameter was 13.3 mm, and the sites were C1 (3 cases: 6.5%), C2 (20 cases: 43%), C3 (3 cases: 6.5%), C4 (12 cases: 26%), C5 (3 cases: 6.5%), and V4 (5 cases: 11%). FD devices included Pipeline in 44 cases, FRED in 2 cases, and 2 FDs in 3 cases (7.5%); FD implantation was successful in all cases, Adjunctive Coiling was performed in 19 cases (41%), Post PTA in 34 cases (74%), and revision in 3 cases (6.5%).

Results

The complete occlusion rate was 75% (O'Kelly-Marotta (OKM) Grading Scale A: 3.7%, B: 10.7%, C: 10.7%, D: 75.0%) in 28 patients after one year.

Perioperative complications (2 puncture site complications, 1 transient diplopia worsening, and 1 venous thrombosis of the lower extremities) were observed in 5 of 46 patients. One case of cerebral hemorrhage due to ruptured aneurysm (2 years after surgery) was also observed as a delayed complication. There were no cases of perioperative severe stroke or death.

Although FD treatment of side wall aneurysms is extremely useful, about 25% of cases result in incomplete occlusion, and the literature shows a higher rate of incomplete occlusion than Western results. We analyzed 7 cases of incomplete occlusion and demonstrated imaging evidence that residual blood flow along the microcatheter used during adjunctive coiling contributed to incomplete occlusion.

Adjunctive coiling has been shown to increase the occlusion rate, but it can also be a factor in incomplete occlusion.

Conclusions

In this presentation, we will discuss four cases of incomplete occlusion caused by microcatheters, including a review of the literature.

Impacts and limitations arising from the induction of flow diverters

Yoichi Morofuji[1], Tsuyoshi Izumo[1], Kazuaki Okamura[1], Minoru Morikawa[2], Takayuki Matsuo[1]

[1]*Department Of Neurosurgery, Nagasaki University, Nagasaki, Japan*
[2]*Department Of Radiology, Nagasaki University, Nagasaki, Japan*

Purpose

The management of large/giant cerebral aneurysms has often presented challenges with regards to treatment complications and efficacy, both in direct surgical approaches and endovascular interventions. In this study, we investigate the evolving trends and issues in treatment selection before and after the introduction of a flow diverter (FD) at our institution.

Methods

Amongst a total of 909 cases of cerebral aneurysms treated at our institution from January 2013 to May 2023, 64 cases (7%) with an aneurysm diameter of 15 mm or greater underwent treatment. We retrospectively analyzed the aneurysm's location, mode of onset, treatment method, and treatment outcomes.

Results

The cohort of 64 large/giant cerebral aneurysms had an average age of 63 years (ranging from 19 to 86 years), comprising 19 males and 45 females, with a mean aneurysm diameter of 23 mm (ranging from 15 to 40 mm). The predominant origin site was the internal carotid artery, with 50 cases in this location, 11 cases in the posterior circulation, and 3 in other sites. Among these, 8 cases were ruptured aneurysms, 35 were symptomatic, and 21 were asymptomatic. There were no discernible changes in patient demographics before and after the introduction of FD

Prior to FD introduction, treatment modalities consisted of combined treatments in 7 cases, involving bypass surgery and endovascular treatment (parent artery occlusion (PAO)), direct surgery in 20 cases, and endovascular treatment in 10 cases. Subsequently, after the introduction of FD, there was a notable shift in treatment approaches, with 10 cases undergoing direct surgery and 17 cases receiving endovascular treatment (comprising 16 FD cases and 1 PAO case). Among the 16 patients who underwent FD placement, no perioperative complications were observed. However, one patient experienced the occurrence of a new aneurysm at the distal site of FD placement, and another patient presented with delayed bleeding.

Conclusions

The management of large/giant cerebral aneurysms has witnessed a significant transformation, with a substantial shift towards the utilization of flow diverters (FD). The treatment outcomes have demonstrated favorable results. Currently, direct surgical intervention is reserved for cases involving hemorrhage, bifurcation aneurysms, and thrombosed aneurysms.

The Interhospital disparity of the groin puncture-to-recanalization time: The Korean Stroke Registry

Eung-Joon Lee[1], Han-Yeong Jeong[1], Keun-Hwa Jung[1]

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Purpose

Procedural time (PT), groin puncture to recanalization, affect outcomes of acute ischemic stroke patients undergoing mechanical thrombectomy (MT). However, only a few studies have evaluated PT in the real-world. Therefore, this study used a nationwide acute stroke registry to investigate the interhospital disparities in procedural time and analyze the significant factors associated with longer procedural time.

Methods

Patients with acute ischemic stroke who underwent MT between January 2015 and December 2021 were included. PT was calculated, and its interhospital disparity was evaluated using the Gini coefficient for 54 hospitals. We investigated the association between PT and the clinical outcome of the patients identified by modified Rankin scale score (mRS) at discharge. Finally, multivariate models were used to identify factors significantly associated with procedural time of >60 min.

Results

Using the Korean Stroke Registry, we analyzed 5,432 patients who underwent MT from 54 hospitals. The mean PT was 56.0±37.6 min, and PT was significantly shorter in patients who achieved a favorable outcome (mRS score at discharge 0-2) compared to those who did not (50.1±33.3 vs. 59.9±39.8, $p<0.001$). High interhospital inequality of PT (Gini coefficient > 0.5) persisted over the observation period. After adjusting for confounders, older age (adjusted odds ratio [aOR]=1.01; 95% confidence interval [CI], 1.01–1.02), longer prehospital delay (aOR=1.07; 95%CI, 1.04–1.09) were found to independently predict PT of >60 min. On the contrary, atrial fibrillation (aOR=0.80; 95%CI 0.70-0.91), prior statin use (aOR=0.85, 95% CI 0.74-0.95), and admission at tertiary referral hospital (aOR=0.68, 95%CI 0.60-0.76) were significantly, negatively associated with PT>60 min.

Conclusions

Shorter PT was significantly associated with good clinical outcomes in acute ischemic stroke patients. However, there was a wide disparity between hospitals and no improvement during the observation period. A deeper understanding of individual patients and policy support to under-resourced hospitals are needed to improve the PT.
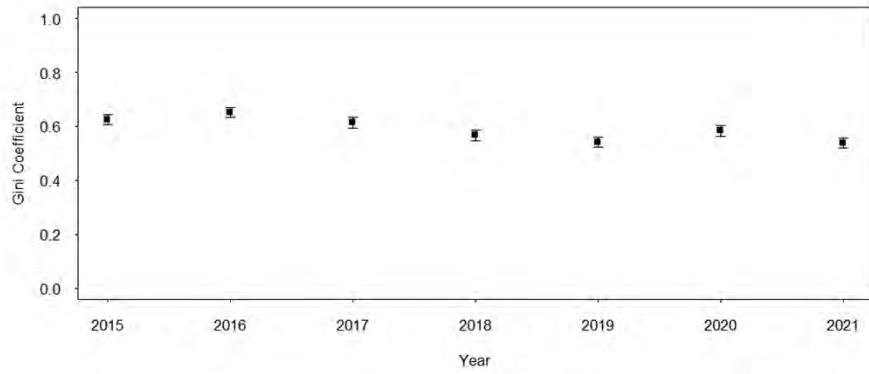
Acknowledgement

Figure. The interhospital disparity of procedural time during the observation period

The efficacy and safety of stent-assisted coil embolization with the semi-jailing technique in patients with unruptured intracranial aneurysm

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Purpose

The aim of this study is to evaluate efficacy and safety of SAC using open-cell or closed-cell stent in patients with unruptured intracranial aneurysm.

Methods

The data of patients treated with SAC between December 2013 and May 2022 was retrospectively investigated. Clinical, aneurysmal, outcomes were compared between patients with and without SJT. Primary outcome was 1-year complete occlusion defined as the Raymond-Roy occlusion classification class 1. Safety outcomes included permanent deficits and mortality. Subgroup analysis was also performed regarding open-cell or closed-cell stent.

Results

Among 320 patients with SAC, 220 patients undertook SJT (68.8%). Median age of patients were 61.0 years (inter quartile rage, 50.3–71.0 years) and 73 were male (22.8%). 1-year complete occlusion was obtained in 221 patients (69.1%). Permanent deficits andmortality were observed in 3 (0.9%) and 1 (0.3%) patients, respectively. Compared to non-SJT, SJT was significantly related to 1-year complete occlusion (73.2% vs. 60.0%, adjusted odds ratio 1.85, 95% confidence interval 1.11–3.09, p = 0.02). Safety outcomes showed no significant difference between SJT and no-SJT. Although the difference showed no significance, SJT with open-cell stent (adjusted OR 2.16, 95% CI,1.11–4.12, interaction P = 0.34) had a high proportion of 1-year complete occlusion.

Conclusions

The results of this study showed the efficacy and safety of SJT in unruptured intracranial aneurysm patients treated with SAC.

Revascularization patterns and characteristics after erythropoietin pretreatment and multiple burrholes in acute stroke patients with perfusion impairment

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Purpose

Transdural collaterals, originating mainly from the extracalvarial superficial temporal artery (STA) and intracalvarial middle meningeal artery (MMA) via the external carotid artery (ECA), have been observed after revascularization surgery. However, we do not fully understand where these collaterals come from in stroke patients with perfusion insufficiency. Therefore, we studied the revascularization patterns and characteristics based on the origin of these collaterals.

Methods

We employed erythropoietin pretreatment and performed multiple burrholes under local anesthesia to achieve transdural revascularization in acute stroke patients with perfusion insufficiency. After a 6-month period, we reassessed transfemoral cerebral angiography to evaluate the revascularization patterns. The collaterals were categorized into intracalvarial ECA-dominant (originating from the middle meningeal artery), extracalvarial ECA-dominant (originating from the superficial temporal or occipital artery), and balanced groups. We compared various imaging parameters among these groups.

Results

A total of 87 patients with 103 treated hemispheres participated. Among them, 57.3% were classified as intracalvarial ECA-dominant, 20.4% as extracalvarial ECA-dominant, and 22.3% as balanced. Most of the hemispheres with intracalvarial or extracalvarial collaterals (vs. balanced collaterals) showed successful recanalization (78/80 [97.5%] vs. 12/23 [52.1%]), p<0.001). No statistically significant differences were found between the groups. Interestingly, intracalvarial ECA-dominant revascularization was significantly associated with specific changes in ECA blood flow, leading to the conversion to a low-resistance ECA Doppler sonography waveform.

Conclusions

Our findings suggest that intracalvarial ECA-dominant revascularization plays a crucial role in the formation of transdural collaterals following combination therapy. These distinct changes in ECA hemodynamics can be non-invasively identified through bedside ultrasound studies.

Quantifying temporal changes of symptomatic intracranial arterial disease with high-resolution vessel wall imaging

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Purpose

High-resolution vessel wall imaging (HR-VWI) can visualize vascular wall composition, allowing for a more accurate diagnosis of intracranial arterial disease (ICAD). We sought to explore the temporal changes of symptomatic ICAD patients who underwent serial HR-VWI.

Methods

We recruited consecutive ICAD-related ischemic stroke patients admitted between 2016 and 2019 and had subsequent HR-VWI follow-ups. On HR-VWI, we manually segmented the lumen area (LA), total vessel area (TVA), and enhancing area (EA) of the culprit lesion's most stenotic part in the perpendicular section on T1-weighted, proton density, and post-contrast T1-weighted sequences. We defined the area stenosis as $[1-LA/TVA]\times100(\%)$ and the enhancing proportion as $EA/TVA\times100(\%)$. Enhancement ratio of the enhancing lesion was also quantified. Three raters independently quantified the imaging using ITK-SNAP with acceptable inter-rater reliability.

Results

A total of 208 patients (age 57±14, male 58%) with 469 HR-VWIs (2-6 scans per patient) were included. The causes of ICAD were atherosclerosis (69%), dissection (24%), vasculitis (3%), moyamoya disease (1%), and other causes (2%). The median follow-up duration was 9.0 months (interquartile range: 3.9-13.2 months), and the maximum follow-up duration was 41.3 months. Among patients with atherosclerosis, area stenosis aggravated, stable, and improved in 7%, 77%, and 16%, respectively, with an overall rate of 0.23±0.07% improvement per month. Among patients with dissection, area stenosis aggravated, stable, and improved in 2%, 49%, and 49%, respectively, with an overall rate of 2.11±0.26% improvement per month (Figure, P-for-difference < 0.01). The temporal changes of the enhancing proportion and enhancement ratio were different between atherosclerosis and dissection (Figure, P < 0.01).

Conclusions

ICAD lesions had dynamic changes over time; the temporal changes of atherosclerosis and dissection are distinct. Serial HR-VWI can offer insights for a more accurate diagnosis of the underlying pathologies of ICADs.
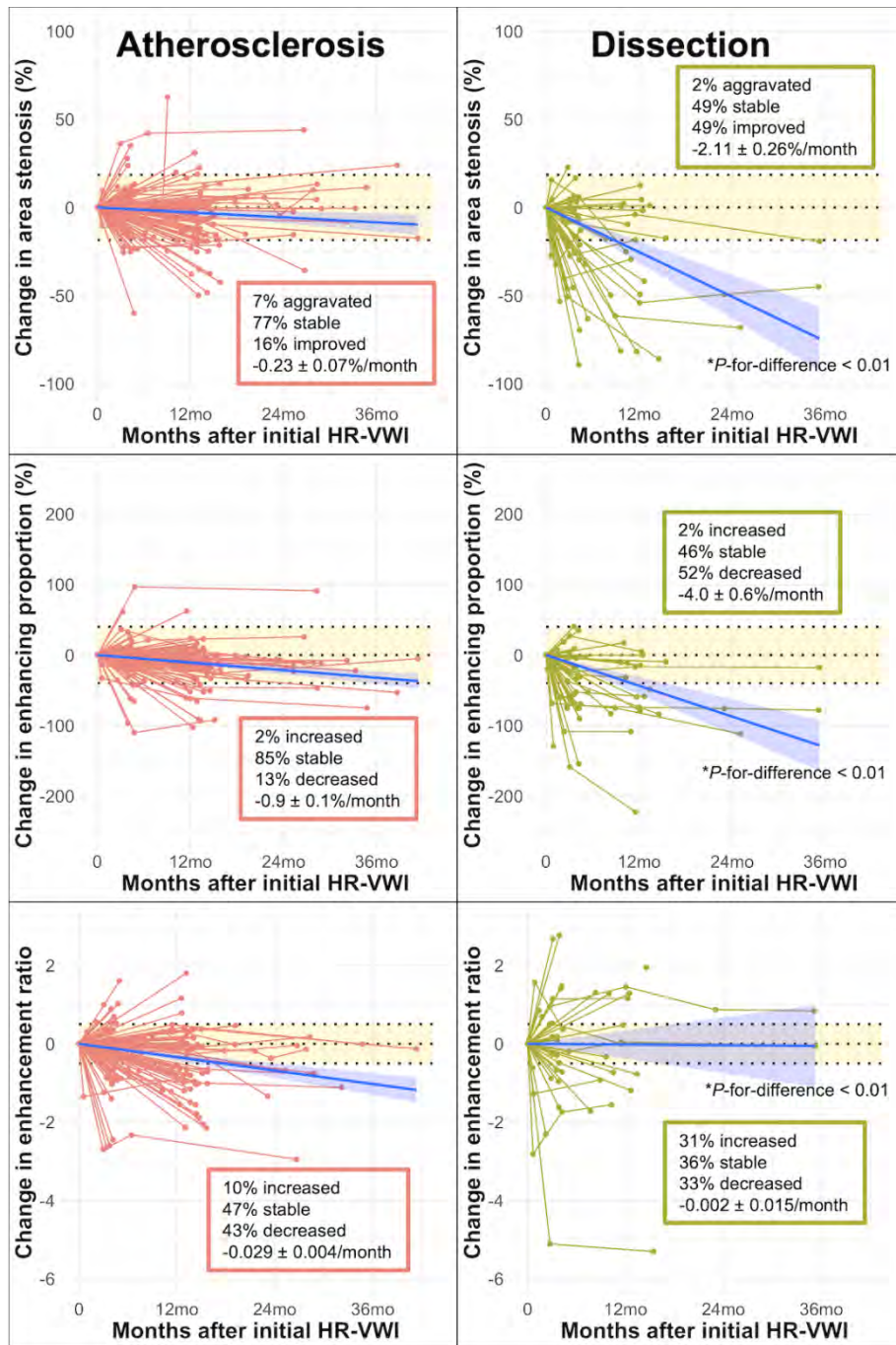
Exploratory plasma lipidomics profiling in extracranial and intracranial atherosclerotic disease among patients with acute ischemic stroke

Darda Chung[1], Youngae Jung[2], Jong-Won Chung[1], Chi Kyung Kim[3], Kyungmi Oh[3], Min-Jeong Shin[4], Oh Young Bang[1], Geum-Sook Hwang[2], Gyeong-Moon Kim[1], Woo-Keun Seo[1]

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Purpose

The apparent differences in risk factors for intracranial atherosclerosis disease (ICAD) and extracranial atherosclerosis disease (ECAD) are still unclear. Our hypothesis was that lipid metabolism may play an important role in the development of ICAD and ECAD, and there may be distinct metabolic differences between the two forms of cerebral atherosclerosis. In this study, we performed exploratory plasma lipidomics profiling in patients with ICAD or ECAD and those without atherosclerosis to compare the risk factors for ICAD and ECAD.

Methods

Subjects were patients with acute ischemic stroke who were prospectively enrolled in the Korea University Stroke Registry between 2014 and 2016. Mass-spectrometry–based lipidomics profiling was performed. The multivariate analysis such as principal component analysis (PCA) and partial least squares discriminant analysis (PLS-DA) were performed to extract potential discriminatory components, and clustering analysis was performed to identify potential discriminatory pattern. Metabolites with a variable importance in the projection (VIP) score >1 were considered to be the metabolites responsible for the differences between the control and atherosclerosis groups.
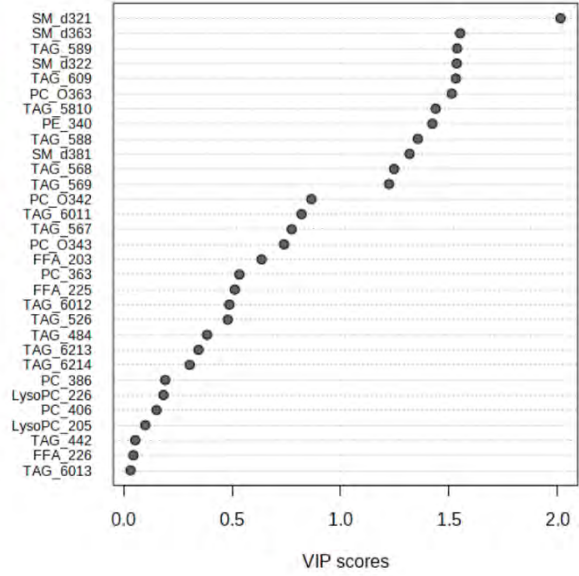
Results

Of a total of 807 patients, 442 subjects (mean age of 65.8 years, 60.2% males) were finally enrolled in this study. The levels of triacylglycerols (TAGs) were higher in patients with ICAD or EAD than those without atherosclerosis, whereas the levels of sphingomyelin (SM), phosphatidylcholine-O-acyl (PC-O), and phosphoethanolamine (PE) were lower in the atherosclerotic group. Similarly, the ECAD group was more likely to have higher levels of TAGs and lower levels of SM and PC-O compared to the non-ECAD group. In particular, among patients with ECAD, the symptomatic group was more likely to have distinctly higher level of TAGs than the asymptomatic group. Meanwhile, the ICAD group was more likely to have lower levels of PC-O and PE compared to the non-ICAD group. Among the metabolomes identified as higher in the atherosclerotic group, TAGs showed a positive correlation with the modified Rankin scale at discharge and at 3 months in symptomatic ECAD group.

Conclusions

Deterioration of cell membrane integrity due to altered phospholipid metabolism may be related to the development of ICAD, meanwhile impaired hepatic lipid metabolism may be associated with the development of ECAD. The TAG levels may be associated with early functional outcome in patients with acute ischemic stroke and atherosclerosis.

	VIP score	ECAD	ICAD	non_ATHERO
SM d32:1	2.015			
SM d36:3	1.552			
* TAG 58:9	1.538			
SM d32:2	1.535			
* TAG 60:9	1.532			
PC O-36:3	1.513			
* TAG 58:10	1.439			
PE 34:0	1.423			
* TAG 58:8	1.356			
* SM d38:1	1.318			
* TAG 56:8	1.247			
* TAG 56:9	1.223			
PC O-34:2	0.865			
* TAG 60:11	0.820			
* TAG 56:7	0.775			
PC O-34:3	0.739			
FFA 20:3	0.636			
PC 36:3	0.533			
FFA 22:5	0.512			
TAG 60:12	0.487			
TAG 52:6	0.480			
TAG 48:4	0.384			
TAG 62:13	0.345			
TAG 62:14	0.304			
PC 38:6	0.191			
LysoPC 22:6	0.183			
PC 40:6	0.151			
LysoPC 20:5	0.099			
TAG 44:2	0.053			
FFA 22:6	0.045			
TAG 60:13	0.031			

High

Low

VIP scores plot (x-axis: VIP scores, 0.0 to 2.0):

SM_d321
SM_d363
TAG_589
SM_d322
TAG_609
PC_O363
TAG_5810
PE_340
TAG_588
SM_d381
TAG_568
TAG_569
PC_O342
TAG_6011
TAG_567
PC_O343
FFA_203
PC_363
FFA_225
TAG_6012
TAG_526
TAG_484
TAG_6213
TAG_6214
PC_386
LysoPC_226
PC_406
LysoPC_205
TAG_442
FFA_226
TAG_6013

Global tortuosity index is associated with the burden of intracranial atherosclerosis in stroke patients

Mi-Yeon Eun[1,2], Ha-na Song[3], Jong-un Choi[3,4], Hwan-ho Cho[5], Hyung Jun Kim[3], Jong-Won Chung[3], Tae-Jin Song[6], Jin-Man Jung[7], Oh-young Bang[3], Gyeong-moon Kim[3], Hyun-jin Park[8,9], Woo-Keun Seo[3,4]

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Purpose

Cerebrovascular tortuosity may influence the initiation and progression of atherosclerosis by altering hemodynamics. However, a marker that can measure the cerebrovascular tortuosity of the whole brain has not yet been developed. Our aim was to evaluate the effect of global intracranial arterial tortuosity, assessed by automated arterial labelling software, on the burden of intracranial atherosclerotic stenosis (ICAS) in patients with acute ischemic stroke.

Methods

We retrospectively analyzed data on patients with acute ischemic stroke from a hospital-based stroke registry between January 2017 and December 2019. Patients were classified according to ICAS burden: Group 1, no ICAS; Group 2, one ICAS; Group 3, two or more ICAS. Using in-house vessel analyzer software, we extracted vessel geometric features from time-of-flight magnetic resonance angiography images. Global tortuosity index (GTI) was defined as the standardized mean curvature of intracranial arteries of whole cerebral arteries measured on TOF MRA. Univariate and multivariate ordinal logistic regression analyses were performed.

Results

Of the 516 patients included, 274 patients had no ICAS, 140 patients had one ICAS, and 102 patients had two or more ICAS. GTI increased with ICAS burden (-0.12 in group 1; -0.02 in group 2; 0.33 in group 3; P-value <0.001). After adjustment for age, sex, vascular risk factors, and standardized mean arterial area, GTI was independently associated with ICAS burden [common odds ratio (OR), 1.33; 95% confidence interval (CI), 1.09-1.62]. The degree of association increased when the arteries were confined into basal cerebral arteries composing the Circle of Willis (common OR, 1.49; 95% CI, 1.22-1.82).

Conclusions

GTI is associated with ICAS burden in patients with ischemic stroke, suggesting a role for vascular tortuosity in intracranial atherosclerosis.

Detecting middle cerebral artery stenosis in transcranial doppler using a convolutional neural network

Dong-Woon Ko[2], Yosep Park[3], Yong-Jae Kim[1]

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[2]*Ceo, Radiko Co, Seoul, Korea, Republic of*
[3]*Ceo, Ellixion Co, Seoul, Korea, Republic of*

Purpose

Intracranial atherosclerotic stenosis (ICAS) is a major cause of ischemic stroke worldwide, with the middle cerebral artery (MCA) being the most common site of ICAS. Ultrasound detection of ICAS is useful in identifying at-risk patients, and transcranial Doppler (TCD) can reliably rule out ICAS. However, manual interpretation of TCD data can be subject to inter- and intra-observer variability.

Methods

To address this issue, we developed an automated method using neural networks to detect MCA stenosis from TCD audio signals. Specifically, we used a convolutional neural network (CNN) trained on a dataset of TCD and corresponding ICAS degrees generated by a panel of experts. We evaluated the performance of the CNN using receiver operating characteristic (ROC) analysis.

Results

The CNN achieved an area under the ROC curve (AUC) of 0.92, indicating high accuracy in assessing ICAS. In fact, the CNN outperformed individual experts in terms of accuracy and agreement with the consensus scores. Specifically, the accuracy of MCA stenosis was 0.95, the precision was 0.93, the recall was 0.91, and the f1 score was 0.92.

Conclusions

Our results suggest that CNN-based deep learning methods can be a reliable and efficient tool for ICAS assessment in TCD. This approach has the potential to reduce inter- and intra-observer variability and improve the diagnostic accuracy of ICAS assessments. Nonetheless, further studies are needed to validate the use of this approach in a larger and more diverse patient population.

Plenary Session 2 [ENG]

CHAIRS   Yoshiaki Itoh (Osaka Metropolitan University Graduate School of Medicine, Japan)

Hee-Joon Bae (Seoul National University Bundang Hospital, Korea)

Lessons learned from stroke genomics across ancestries: Opportunities for drug discovery and risk prediction

Stephanie Debette

University of Bordeaux, France

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Luncheon Symposium 3.
Sanofi Aventis Korea [ENG]

CHAIRS   Byung-Woo Yoon (Uijeongbu Eulji Medical Center, Korea)

Jong-Moo Park (Uijeongbu Eulji Medical Center, Korea)

Early antithrombotic treatment of acute ischemic stroke

Keun-Hwa Jung

Seoul National University Hospital, Korea

Stroke imposes a great deal of social burden due to its high incidence, mortality and disability rates. Stroke survivors carry a high risk of cardiovascular event recurrence. Stroke is more challenging to manage than other vascular diseases due to the variety of mechanisms. Appropriate antithrombotic strategy should be based on the best understanding of the pathophysiological mechanism leading to the cerebral ischemia. Actually, we have a lot of options in choosing antithrombotic agents. Antiplatelet agent is preferred for lesions characterized by atherosclerosis and endothelial injury, whereas anticoagulants are favored for cardiogenic embolism and other thrombophilic conditions. This talk would like to focus on the regimen and timing of antiplatelet treatment in the acute ischemic stroke. Immediately after ischemic stroke or transient ischemic attack (TIA), there is an opportunity to institute treatments that can prevent stroke recurrence or progression. Previously, aspirin was the only antiplatelet therapy with a proven efficacy for preventing early recurrent stroke. While aspirin is certainly safe and inexpensive, its efficacy is modest, therefore, large clinical trials have investigated more effective antiplatelet regimens. Combination therapy with aspirin and clopidogrel targeting for additive and alternative antiplatelet pathways has been tested in an attempt to improve prevention of stroke recurrence, but yielded negative results. Investigators pointed out the unaffordable bleeding tax to dual antiplatelet therapy (DAPT) opposed to modest efficacy as a main reason for the negative results. We could maximize the efficacy by targeting the early time and appropriate mechanism, and minimize the safety concern by targeting small ischemic lesion and short duration. There have been early treatment approaches such as EXPRESS study, FASTER trial and EARLY trial. These trials suggested that DAPT appeared to be safe and effective in reducing stroke recurrence and combined vascular events. In 2013, CHANCE trial demonstrated for the first time the greater benefit of DAPT with clopidogrel plus aspirin over aspirin monotherapy when initiated within 24 hours of symptom onset in patients with minor stroke or high-risk TIA. Currently, DAPT with clopidogrel plus aspirin is recognized and recommended as a standard management for patients with minor stroke or high-risk TIA. The POINT trial later replicated and reinforced the CHANCE trial results in a broader ethnic population. Another potent antiplatelet, ticagrelor monotherapy have been investigated in SOCRATES trial, but this regimen was not more effective than standard antiplatelet therapy. Robust evidence for DAPT, and failure of SOCRATES, demonstrated that DAPT is the right choice for minor stroke and high-risk TIA. For patients with more severe stroke and higher risk TIA, the THALES trial results were comparable to the POINT and CHANCE trials in supporting the role of DAPT with ticagrelor and aspirin. A time-course analysis of pooled data from POINT and CHANCE together provided fine-tuning of benefits and risks and proposed an optimal duration of DAPT of 21 days.

Secondary prevention and long-term management strategies in stroke patients

Hye Seon Jeong
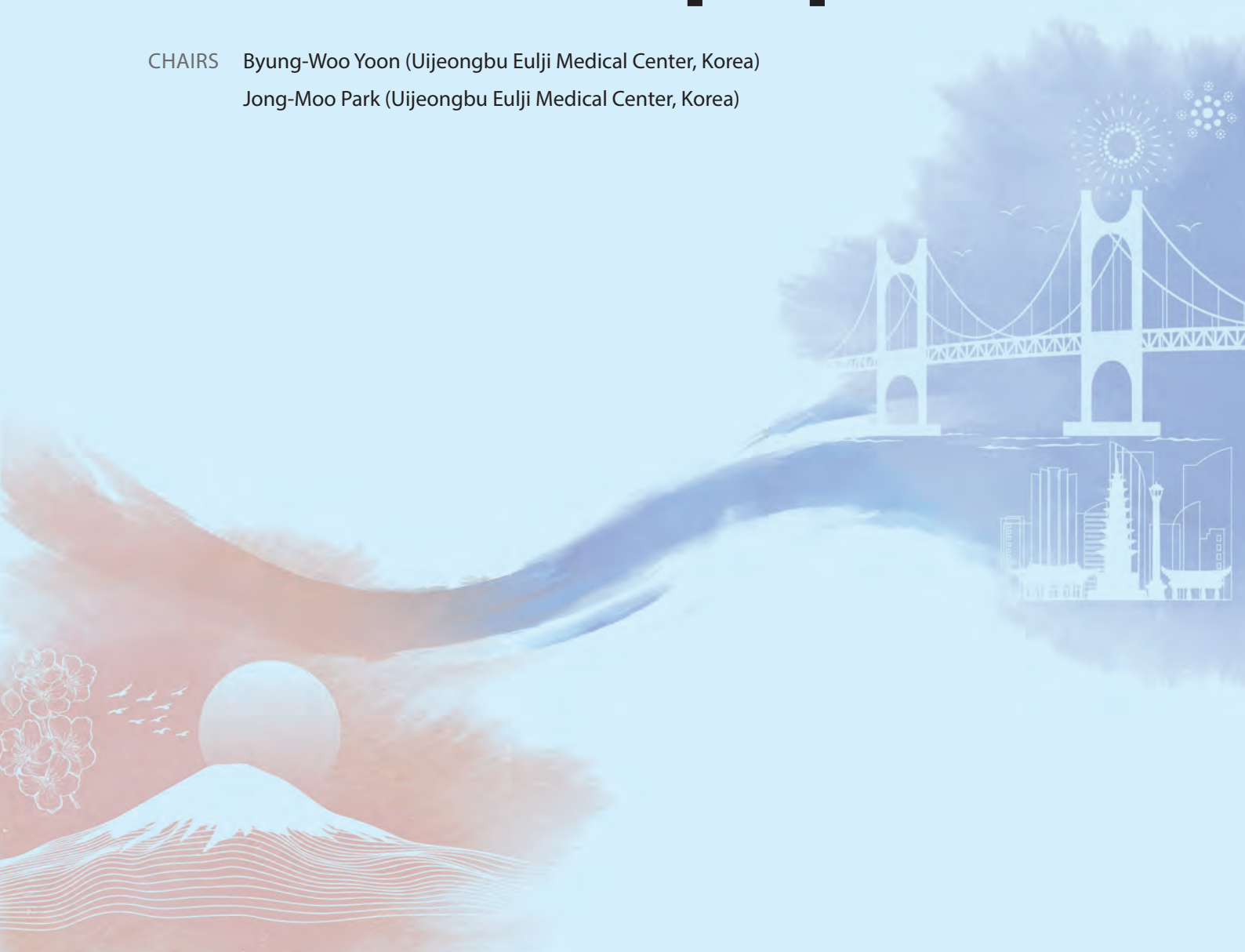
Chungnam National University Hospital, Korea

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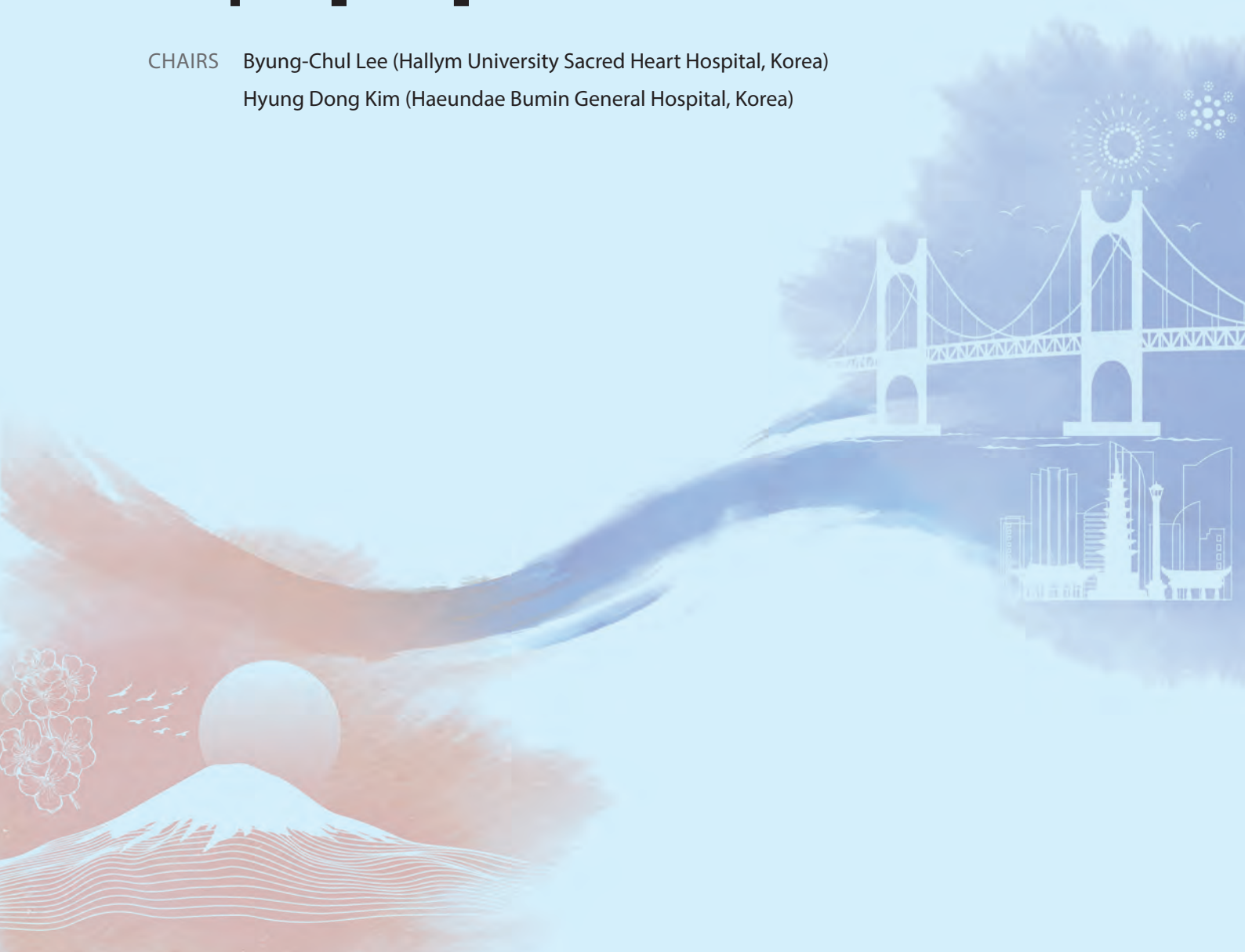**International Conference STROKE UPDATE 2023
& 11th Japan-Korea Joint Stroke Conference**

November 17 (Fri) 12:00-13:00 | Room 2

Luncheon Symposium 4.
Eliquis [ENG]

CHAIRS   Byung-Chul Lee (Hallym University Sacred Heart Hospital, Korea)

Hyung Dong Kim (Haeundae Bumin General Hospital, Korea)

Better patient care for secondary stroke prevention

Jun Young Chang

Asan Medical Center, Korea

Dosing strategies for long-term persistence and adherence

Jinkwon Kim

Yonsei University College of Medicine, Yongin Severance Hospital, Korea

Stroke is a major global cause of mortality, morbidity and disability. Along with strict control of cardiovascular risk factors and lifestyle modification, the consistent use of evidence-based medications is a cornerstone of the prevention of stroke for patients with prior stroke or those at high risk. Non-valvular atrial fibrillation (AF) is the most common cause of cardioembolic stroke, and maintaining proper anticoagulant treatment is crucial for primary and secondary prevention of AF-related thromboembolism. Compared to classical anticoagulant of warfarin, the development of Non-vitamin K antagonist oral anticoagulant has brought many improvements in drug compliance and side-effect reduction. However, in clinical practice, a significant number of patients with AF still exhibit inadequate adherence to anticoagulant treatment. As the saying goes, 'Drugs don't work in patients who don't take them.' Epidemiological data have showed a clear association between insufficient adherence to anticoagulant treatment and an increased risk of thromboembolism. To achieve improved adherence to anticoagulation treatment among the high-risk patients with AF and ultimately improve long-term clinical outcomes, continued research and concerted efforts are indispensable.
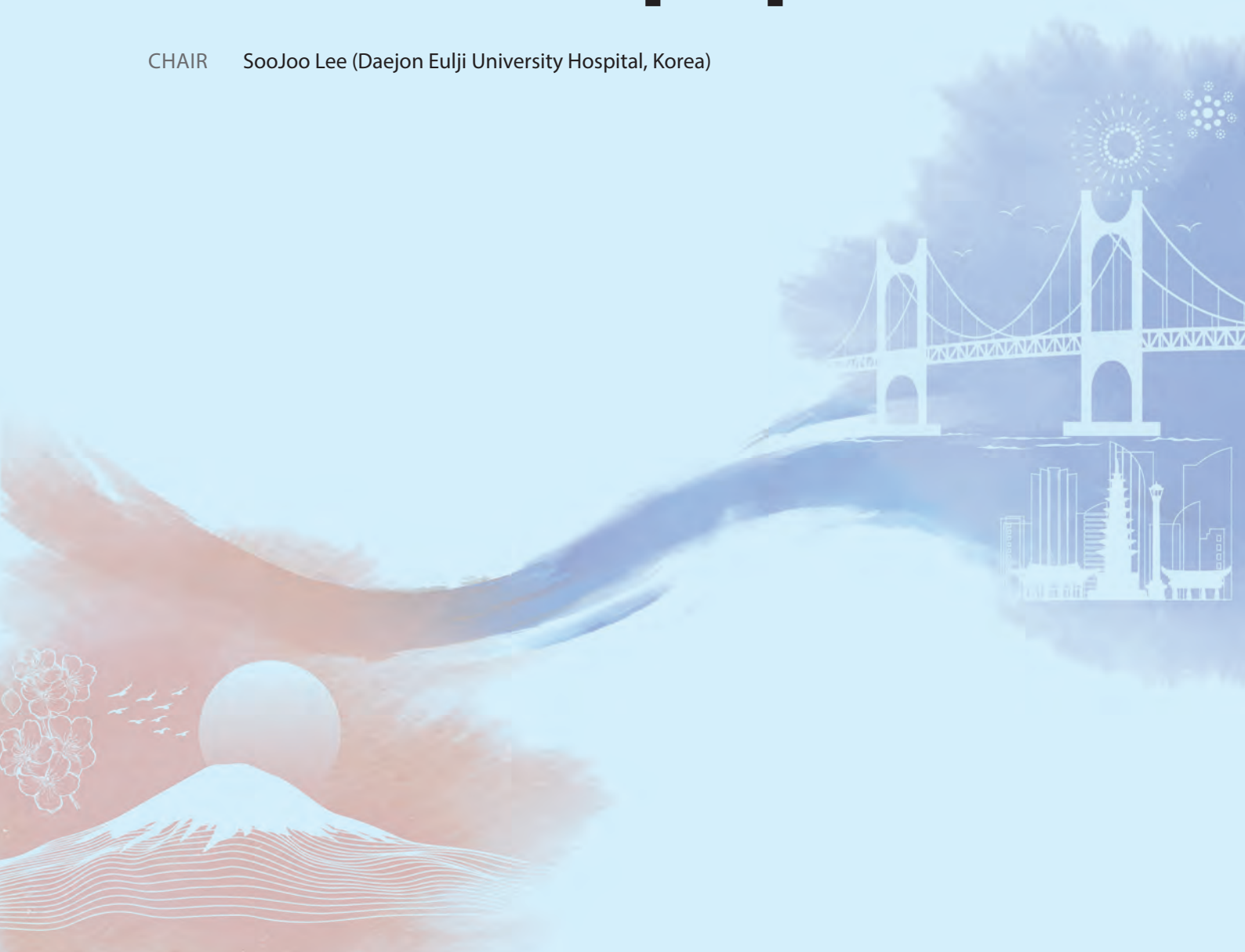
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Satellite Symposium 2.
MYUNG-IN PHARM. [ENG]

CHAIR   SooJoo Lee (Daejon Eulji University Hospital, Korea)

The role of triflusal in preventing ischemic stroke

Joonsang Yoo

Yongin Severance Hospital, Korea

Atherosclerosis is a primary cause of ischemic stroke. Platelets play a pivotal role in ischemic stroke induced by atherosclerosis, and antiplatelet drugs suppress platelet activation and aggregation, contributing significantly to the secondary prevention of ischemic stroke. Triflusal irreversibly inhibits cyclooxygenase-1, reducing thromboxane A2 production, has a comparable antiplatelet effect to aspirin. Triflusal does not require oxidation by the hepatic CYP system for the generation of active metabolites. Multiple clinical studies have shown that Triflusal offers a similar cardiovascular event prevention effect in patients with ischemic stroke and acute MI as aspirin. In the MAESTRO trial conducted in Korea, triflusal showed similar efficacy to clopidogrel in poor metabolizers of clopidogrel. Moreover, Triflusal has demonstrated fewer hemorrhagic complications compared to aspirin and has proven safety in long-term use. Considering the significance of hemorrhagic complications in patients with ischemic stroke, Triflusal can be anticipated as an excellent alternative to aspirin especially in patients at high risk of hemorrhagic complications..
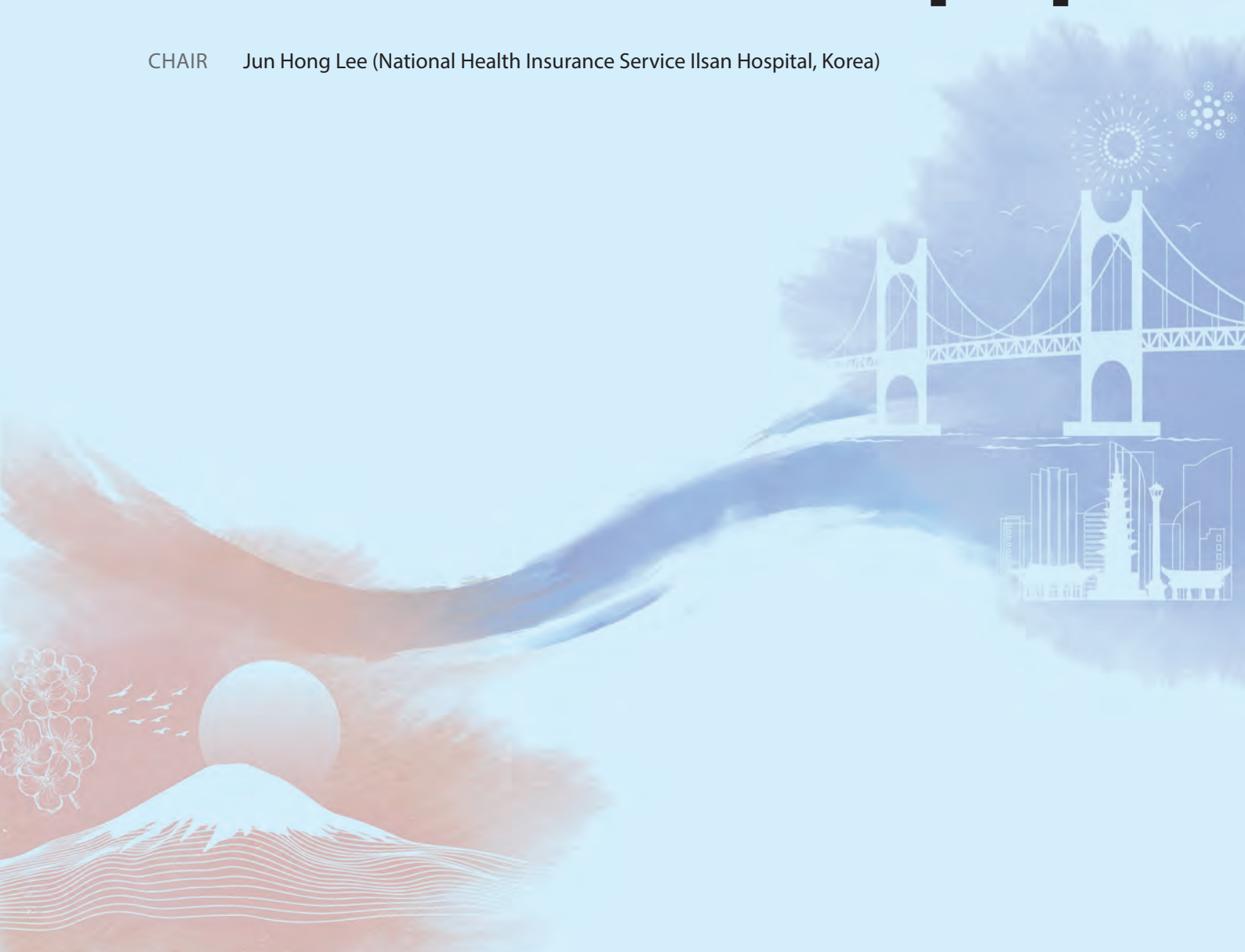
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November 17 (Fri) 13:00-13:30 | Room 2

Satellite Symposium 3.
Korea Otsuka Pharmaceutical. [ENG]

CHAIR   Jun Hong Lee (National Health Insurance Service Ilsan Hospital, Korea)

Treatment of small vessel disease high burden patients in the light of current therapeutic possibilities

Hyuk Sung Kwon

Hanyang University Guri Hospital, Korea

Cerebral small vessel disease (SVD) is a common cause of stroke (especially lacunar stroke), vascular dementia and is associated with disability, mood disorder, and mortality. Signs of SVD on neuroimaging include white matter hyperintensities (WMH), lacunes, prominent perivascular spaces, and cerebral microbleeds. Although understanding the pathogenesis of SVDs are improved, there is a lack of specific treatment beyond managing of traditional cardiovascular risk factors.

Because SVD is a neurogliovascular disorder involving endothelial cells, astrocytes, neurons, oligodendrocytes, and secondary Wallerian degeneration, targeting these pathological processes may slow the progression of SVD. Cilostazol is a phosphodiesterase III inhibitor that has antiplatelet and vasodilatory properties. In addition, cilostazol also inhibits vascular smooth muscle proliferation, protects the vascular wall and endothelium in vivo and in vitro, and ameliorated gliovascular damage. Previous trial showed cilostazol might be superior to aspirin for secondary prevention of ischemic stroke and was associated with fewer hemorrhagic events (CSPS2). These effects seem to be more prevalent in lacunar stroke among stroke subtypes. Also, there was a study looking for the efficacy and safety of cilostazol in patients with ischemic stroke at high risk of cerebral hemorrhage (PICASSO). Recently, results of trials to see the efficacy of cilostazol in patients with symptomatic cerebral SVD (LACI-2) and in patients with moderate to severe WMH (CHALLENGE) were published.

Still, there is lack of evidence for effective preventive or disease-modifying treatment for SVDs. With analyzing the previous studies, possibilities of therapeutic effects are lighted.

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Symposium 5.
Acute Stroke Care System in Asia [ENG]

CHAIRS   Kazuo Kitagawa (Tokyo Women's Medical University, Japan)

Jae-Kwan Cha (Dong-A University Hospital, Korea)

Progress and direction in stroke center in Korea

Sang Joon An

Catholic Kwandong University International St. Mary's Hospital, Korea

Recent development of academic accreditation system for stroke center in Japan

Shigeru Fujimoto

Jichi Medical University, Japan

In Japan, the Japan Stroke Society and the Japan Circulation Society are jointly developing a five-year plan to overcome stroke and cardiovascular diseases. The first five-year plan was launched in 2016 and the second five-year plan shifted to 2021. In the first five-year plan, the accreditation system for primary stroke centers was launched. The conditions for accreditation of primary stroke center (PSC) are:

1. In response to requests from regional medical institutions and emergency teams, stroke patients can be accepted 24 hours a day, 365 days a year, and doctors in charge of acute stroke treatment can start treatment (including rt-PA intravenous therapy) as soon as possible after the patient is delivered.

2. Head CT or MRI scan, general blood test and coagulographic examination, electrocardiogram can be performed.

3. Have a stroke unit (SU)

4. Physicians engaged in stroke treatment (not required to be full-time, excluding first-term residents) work in a 24H/7D system.

5. Have at least one full-time stroke specialist

6. When neurosurgical procedures are required, neurosurgeons can respond quickly

7. It is desirable to be able to perform mechanical thrombectomy, and if not, have a procedure for emergency transfer of patients to which mechanical thrombectomy therapy is indicated with a nearby primary stroke center where mechanical thrombectomy therapy is always available.

8. Control the quality of stroke care by regularly acquiring clinical indicators

In addition, the core facilities in the PSC that can stably perform mechanical thrombectomy therapy at any time have been accredited as PSC core facilities in the second five-year plan. Currently, 960 PSCs have been certified, and the data in the annual report has begun to be used as an indicator for medical care plans in each region. In order to enhance seamless medical and welfare cooperation for stroke patients and their families, a "stroke consultation desk" was first established at the the PSC core facilities.Stroke consultation desks are expected to provide accurate information and consultation support to patients and their families at acute care medical institutions, and to become the core of seamless cooperation between medical care and welfare in the community. Currently, 251 facilities have established stroke consultation desks and have begun analyzing annual reports.

Acute stroke care system in Taiwan: Past and future

Cheng-Yang Hsieh

Tainan Sin Lau Hospital, Taiwan

Treatment for acute stroke has advanced rapidly worldwide in the past two decades, and Taiwan is no exception. However, the entire healthcare system, including the pre-hospital emergency medical technicians, in-hospital medical personnel, health insurance coverage, and policy makers, have to adapt themselves to deliver the most updated and evidence-based treatment to the stroke patients. In the development of acute care system in Taiwan can be divided as the following four stages:

Stage 1 (2003-2010): The introduction of intravenous alteplase to Taiwan in 2003 have transform the acute care for stroke. That is, from an untreatable disease to an emergent disease which is treatable and needs to be treated on time. Stroke centers, mainly lead by neurologists, have been set up rapidly around the island to administrate more alteplase for stroke patients.

Stage 2 (2011-2015): During this stage, the government regulators adopted several quality indicators in their annual hospital accreditation to monitor and facilitate the improvement the treatment quality among stroke centers in Taiwan. Although the quality indicators improved as expected, some first-line physicians argued about side effects of alteplase (e.g., symptomatic intracranial hemorrhage) and were reluctant to cooperate such accreditation.

Stage 3 (2016-2022): In 2016, Taiwan's National Health Insurance (NHI) started to reimburse endovascular therapy (EVT), as well as the extra physician fee when administrating intravenous alteplase for acute stroke. Given the numerous evidences of intravenous alteplase bridging with EVT in acute stroke, Taiwan sees another wave of boom in stroke treatment. However, the restricted time-window of alteplase (≤ 3 hours) and EVT (≤ 8 hours in anterior circulation stroke) still limited the numbers of stroke patients who can receive such an effective treatment.

Stage 4 (2023 and after): After the efforts made by Taiwan Stroke Society and other allied medical societies, the NHI finally agrees extend the time window for alteplase (to ≤ 4.5 hours) and EVT (≤ 24 hours in anterior circulation stroke). And again, stroke centers in Taiwan need to adapt themselves to accommodate more eligible stroke patients.

Finally, I will discuss the limitations and future perspectives of Taiwan in the field of acute stroke care. And I hope that the sharing our experiences will help other countries in their healthcare systems for acute stroke.

Acute stroke care system in Vietnam

Huy Thang Nguyen

The People's 115 Hospital, Vietnam

Low-middle income countries, such as Vietnam have a greater burden from stroke than high-income countries.

Stroke is the leading cause of death and disability in Vietnam. The incidence and prevalence of stroke was reportedly 161 and 415 per 100 000 people, respectively. Based on an estimate stroke incidence rate of 161 per 100 000 persons per year in Vietnam, the year 2021 estimate of new patients with stroke was 157 295, based on a population estimate of 98.32 million people.

In Vietnam, hospitals are classified based on ownership (public or private), scope of service (general or specialty hospital), and functional capacity (special class, class I, class II, and class III). According to the classification, hospitals of class II or class III can establish stroke units to implement intravenous thrombolysis treatment for patients with acute stroke. Special class and class I hospitals can establish a stroke department and stroke center to perform endovascular thrombectomy, endovascular intervention, and cranial surgery.

Within 5 years from 2016, following the implementation of Circular 47 from the Ministry of Health and the ANGELS program in Vietnam, the number of stroke units has increased from 12 stroke units in 2016 to a total of 81 (Table 1) in 2021 (Figure 1).

In 2010, the rate of recanalization treatment, which includes both intravenous thrombolysis and endovascular therapy, was only 2%. However, by 2021, this rate had increased significantly to 18%. If in 2012, all stroke units in Vietnam had only 100 patients receiving alteplase, by 2020, during the first quarter (Q1) through the fourth quarter (Q4), a total of 1,125 stroke patients received intravenous alteplase treatment across 6 to 11 participating hospitals. Vietnam lacked an effective pre-hospital paramedical triage system.

Future directions for stroke care in Vietnam include the development of national guidelines for stroke diagnosis and treatment. We aim to build a stroke map to assist prehospital emergency care in selecting the nearest hospital in the treatment of patients with acute stroke. Continued education and tracking of stroke metrics in the prehospital, emergency department, hospital. We also have a plan to implement telemedicine in the pre-hospital setting and to enhance the management of stroke care quality based on data.
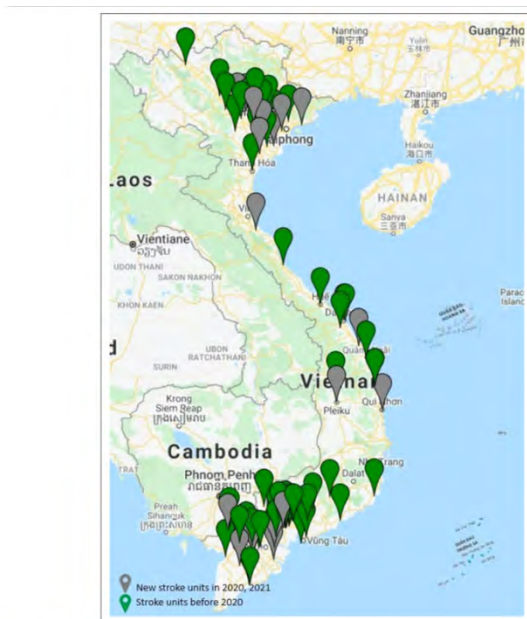
Figure 1. Map of Vietnam with stroke units before 2020 and during 2020 and 2021.

Table 1. Number of Hospitals with Specialized Stroke Treatment Facilities in Vietnam

	2016	2021	
	Number	Number	Percentage
Comprehensive stroke center	1	6	7.4
Stroke department	2	8	9.9
Stroke units	9	67	82.7
Total	12	81	100

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Scientific Session 4 [ENG]

CHAIRS   Ryo Itabashi (Iwate Medical University, Japan)

Dong-Eog Kim (Dongguk University Ilsan Hospital, Korea)

Beta-blockers may prevent death after acute ischemic stroke

<u>Keon-Joo Lee</u>[1], Seong-Eun Kim[2], Hyung Suk Guk[2], Beom Joon Kim[2], Moon-Ku Han[2], Joon-Tae Kim[3], Kang-Ho Choi[3], Dong-Ick Shin[4], Jae-Kwan Cha[5], Dae-Hyun Kim[5], Dong-Eog Kim[6], Jong-Moo Park[7], Kyusik Kang[8], Soo Joo Lee[9], Jae Guk Kim[9], Mi-Sun Oh[10], Kyung-Ho Yu[10], Byung-Chul Lee[10], Keun-Sik Hong[11], Yong-Jin Cho[11], Jay Chol Choi[12], Tai Hwan Park[13], Sang-Soon Park[13], Jee-Hyun Kwon[14], Wook-Joo Kim[14], Jun Lee[15], Kyung Bok Lee[16], Sung-Il Sohn[17], Jeong-Ho Hong[17], Ji Sung Lee[18], Juneyoung Lee[19], Hee-Joon Bae[2]

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Purpose

Although elevated heart rate is known to be associated with post-stroke mortality, whether beta-blockers have benefit is still unclear. We conducted a study focusing on high-risk patients with increased heart rates during acute stage after stroke.

Methods

We combined a comprehensive multicenter registry of acute ischemic stroke patients (CRCS-K) with the National Health Insurance Service database. We selected patients with a heart rate of ≥100 bpm between days 3-7 after symptom onset. These patients were grouped based on whether they were prescribed beta-blockers by day 8. Cox's proportional hazard model with inverse-probability of treatment weighting based on propensity score was used to adjust for potential imbalances. The primary outcome was a composite of stroke recurrence, myocardial infarction, and mortality within one year after the stroke. Given the high rate of beta-blocker discontinuation, we also conducted additional analyses for mortality regarding persistent use of beta-blocker along with landmark analyses at 2-month, 1-year, and 2-year intervals.

Results

Of the 5,049 patients, 1,623 (32.1%) were prescribed beta-blockers by day 8. The beta-blocker use did not significantly affect the primary outcome within the first year (IPTW adjusted HR [95% CI], 0.98 [0.86-1.12]). However, patients who continuously used beta-blockers for more than 2 months showed a decreased risk of mortality (adjusted HR, 0.88 [0.78-0.99]). Landmark analysis further indicated that continuous use of beta-blockers significantly reduced the risk of mortality at 8-day to 2-month (IPTW adjusted HR [95% CI], 0.80 [0.69-0.93]) and 2-month to 1-year (IPTW adjusted HR [95% CI], 0.80 [0.68-0.94]) intervals.

Conclusions

Our results indicate that beta-blockers may potentially lower post-stroke mortality in acute ischemic stroke with increased heart rate, with continuous usage being a key factor.

The inter-hospital disparity of door-to-needle and door-to-puncture time in acute ischemic stroke: The Korean Stroke Registry

Han-Yeong Jeong[1], Eung-Joon Lee[2], Jayoun Kim[3], Nan Hee Park[3], Min Kyoung Kang[4], Dongwhane Lee[5], Jinkwon Kim[6], Yo Han Jung[7], Sungwook Yu[8], Wook-Joo Kim[9], Han-Jin Cho[10], Kyung Bok Lee[11], Tai Hwan Park[12], Mi Sun Oh[13], Ji Sung Lee[14], Joon-Tae Kim[15], Byung-Woo Yoon[5], Jong-Moo Park[5], Hee-Joon Bae[16], Keun-Hwa Jung[2]

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Purpose

Recanalization therapy, including intravenous thrombolysis (IVT) and endovascular thrombectomy (EVT), has been proven to reduce disability in ischemic stroke patients. However, the disparities in these stroke treatments between hospitals have not been well examined. In this study, the authors investigated the discrepancies in stroke treatment across hospitals in South Korea using the nationwide, prospective, multicenter Korean Stroke Registry (KSR).

Methods

We collected data on patients with acute cerebral infarction from 61 hospitals in the KSR from 2012 to 2021. We analyzed the time between hospital visits and receiving IVT (door-to-needle time, DNT) or IAT (door-to-puncture time, DPT). Gini coefficients over the years were calculated to investigate the inter-hospital disparities. Factors associated with DNT>45min and DPT>90min were analyzed.

Results

During this period, 13,037 and 10,654 patients underwent IVT and EVT, respectively. The median DNT was 39min (interquartile range [IQR] 24min) and the median DPT was 104min (IQR 59min). Despite the median DPT gradually decreasing, the Gini coefficient of DNT and DPT did not change significantly throughout the period (Gini coefficient>0.3), confirming the persistence of inter-hospital disparity. Factors associated with DNT>45 min included previous stroke, previous anticoagulation therapy, mild stroke, premorbid disability, and out-of-hours visits. Factors associated with DPT>90 min included unclear-onset stroke, previous stroke, mild stroke, premorbid disability, and out-of-hours visit. In contrast, history of atrial fibrillation, tertiary referral hospitals, hospitals participating in the KSR quality improvement program, and prior IVT treatment were negatively associated with DPT>90 min. DPT<90 min was associated with functional independence (modified Rankin Scale 0-2) at discharge after thrombectomy.

Conclusions

We found no significant improvement in the disparities in stroke treatment between hospitals in Korea. Efforts by hospitals and governments to improve inter-hospital disparity should continue.

Effect of very early statin administration on stroke recurrence in patients with acute ischemic stroke

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Purpose

Earlier statin use in patients with acute coronary syndrome decreased the risks of major adverse events. However, it is not clear whether early statin administration is effective in reducing the risk of recurrent events in patients with acute ischemic stroke (AIS) and whether the effect varies depending on ischemic stroke subtypes.

Methods

From a multicenter prospective stroke registry database (CRCS-K), patients admitted within 24 hours after AIS between January, 2011 and December, 2020 were included. The following patients were excluded: those without statin prescription during hospitalization; those with inaccurate statin administration information; those with stroke subtypes of other determined or undetermined etiology. Eligible patients were divided into quintiles based on the time between hospital arrival and the first statin administration (FSA). The primary outcome was recurrent stroke occurring between 24 hours and 90 days after stroke onset. Inverse probability of treatment weighting (IPTW) was used to reduce baseline between-group differences. IPTW adjusted

Kaplan-Meier estimates and Cox proportional hazards model with interaction terms were used to assess trend of incidence between the groups and different effect between stroke subtypes, respectively.

Results

Among the 22,980 patients (male, 60%; age, 68±12 years), median (IQR) FSA time from hospital arrival was 0 (0-1.1) hours in Q1 to 49 (34-125) hours in Q5. In IPTW analysis, the event rate of recurrent stroke was 8.3%, 8.0%, 9.2%, 8.9%, 10.1% from Q1 to Q5, respectively (P for trend= 0.006). The association between hospital arrival to FSA time and risk of recurrent stroke differed among stroke subtypes (P for interaction <0.001). The large artery atherosclerosis subtype showed a tendency to have a lower risk of early stroke recurrence as the time of statin administration was earlier: IPTW-adjusted hazard ratio (95% CI) using Q5 as a reference was 0.79 (0.61-1.01), 0.79 (0.66-0.93), 0.89 (0.75-1.07), 0.94 (0.79-1.13) from Q1 to Q4, respectively.

Conclusions

Our study results suggest that the effect of early statin administration in reducing the early risk of recurrent stroke in patients with AIS may vary depending on ischemic stroke subtypes.

Multivariable prediction model for hemorrhagic transformation following reperfusion therapy using machine learning

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Purpose

Symptomatic hemorrhagic transformation (sHT) represents the most concerning complication associated with reperfusion therapies, including intravenous thrombolysis (IVT) and endovascular thrombectomy (EVT), in patients receiving those therapies for acute ischemic stroke. We aimed to develop and validate a multivariable prediction model to identify sHT following EVT utilizing machine learning (ML).

Methods

Between June 2021 and June 2023, we enrolled patients from a prospectively collected multicenter stroke registry who had undergone repression therapies involving EVT and/or IVT. The data set was split into a training (N = 3,785, 80%) and internal validation (N = 946, 20%) cohort. Employing five distinct ML models following the k-nearest neighbor imputation of 35 variables obtainable upon admission, we endeavored to predict sHT, defined as hemorrhagic transformation with any neurologic worsening. We reported feature importance, ability for discrimination, and decision curve analysis.

Results

A total of 4,731 patients with a mean age of 71 years (standard deviation 13 years), with a gender distribution of 59% male, median NIH Stroke Scale of 12 (interquartile range 16), 63% EVT alone, and 37% bridging were included. Overall, 857(18%) had sHT, more often in bridging (19%) as compared with EVT alone (16%). The gradient-boosted decision tree machine learning model emerged as the optimal performer, boasting a discriminative capability for predicting sHT (area under the curve 0.84, 95% confidence interval 0.81–0.87). Overall model performance proved to be moderate (F1-score 0.65 ± 0.004), with decision curve analyses indicating a greater mean net benefit at lower treatment thresholds (up to 0.8).

Conclusions

The ML-based sHT prediction model is potentially useful in informing shared decision-making processes associated with EVT and identifying the most relevant features in the emergency setting.

Motor function evaluated by MDS-UPDRS is associated with cerebral small vessel disease severity and can predict mortality and functional outcome in patients with vascular risk factors

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Purpose

The purpose of this study is to examine the association of motor function evaluated by MDS-Unified Parkinson's Disease Rating Scale (UPDRS) Part 3 with cerebral small vessel disease (SVD)severity and to clarify the predictive values of motor function on mortality and functional outcome.

Methods

We derived data from The Tokyo Women's Medical University Cerebrovascular Disease registry, a prospective observational registry in which 1011 patients with evidence of cerebral vessel disease on magnetic resonance imaging were consecutively enrolled from 2015 to 2019. The patients were followed up until March 2023. Among those patients, 590 participants agreed to have an examination of motor function with MDS-UPDRS Part 3. As sub-items, we classified them into rigidity, tremor, bradykinesia, and gait difficulty/postural instability. As cerebral SVD, we evaluated the severity of white matter hyperintensity (WMH), presence of lacune, cerebral microbleeds (CMB) and enlarged perivascular space (EPVS). Primary outcomes are all-cause death and functional outcome as defined with modified rankin Scale (mRS) score.

Results

The average age of the 590 patients was 69 years old and 59% of men.The average MDSUPDRSPART3 scorewas 3.8 points. Significant association was observed between MDS-UPDRS Part 3 score and all four SVD signs; severity of WMH, presence of lacunes, CMB and EPVS. The relationship between MDS UPDRS Part 3scores and WMH severity remained significant even after adjusted for confounding factors (P=0.016). Regarding the MDS UPDRS Part 3 sub-item, a significant association was found between WMH severity and rigidity, bradykinesia,and gait difficulty/postural instability. After excluding four patients owing to refusal for follow-up, 586 patients were followed up. Mean follow-up period was 4.5 years, and 29 patients died. Survival analysis showed that those with highest Part 3 score groups (score >5) was significantly more likely to die (P<0.001) than those with lowest (score 0) and middle (score 1-4) groups. Cox multivariate analyses showed that highest Part 3 score group was significantly associated with all-cause death compared with the lowest and middle Part 3 score groups, which was used as a reference (adjusted hazard ratio 2.82; 95% CI, 1.32-6.99). mRS distribution at the last visit in Part 3 score tertile groups showed that highest Part 3 score group was associated with poor functional outcome.

Conclusions

Motor function evaluated by MDS UPDRS Part 3 was associated with SVD severity and can predict mortality and poor functional outcome.

Association between systolic blood pressure drop with blood pressure medication and poor functional outcomes after successful endovascular treatment within 24-hour period: Findings from the OPTIMAL-BP randomized clinical trial

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Purpose

In recent randomized controlled trials, patients with intensive blood pressure (BP) management after successful endovascular treatment (EVT) have poorer functional outcome compared to those with conventional BP management. These trials indicated intensive BP management often lead to unexpected drops in systolic BP (SBP). Additionally, variations in the upper SBP limits of groups among the trials led to notable differences in the use of intravenous (IV) BP medication. We aimed to determine whether unexpected BP drop with IV BP medication was associated with poor outcomes.

Methods

This study utilized the data of the Outcome in Patients Treated with Intra-arterial thrombectomy-optiMAL Blood Pressure control (OPTIMAL-BP) study, which was a multicenter randomized controlled trial. All patients in primary analysis of the OPTIMAL-BP were eligible. All recorded BP value was used. Patients were categorized into four groups based on a BP drop (defined as at least one event of SBP<100mmHg), and the use of IV BP medication. The primary outcome was a shift in the distribution of the modified Rankin Scale.

Results

302 patients were included. Among them, 86(28.5%) experienced BP drop and 141(46.7%) received BP medications. Among patients with BP drop, BP medication was administered in 49(57.0%). Patients who experienced both BP drop and BP medication had significantly worse functional outcomes compared to those who had neither BP drop nor BP medication (adjusted common odds ratio, aOR=2.08, 95%CI:1.12–3.87, p-value=0.02). However, patients who experienced BP drop without BP medication had no significant difference in functional outcome compared to those who had neither BP drop nor BP medication (aOR=1.32, 95%CI:0.67–2.60).

Conclusions

BP drop with BP medication within 24-hour after successful EVT was associated with poor functional outcome at 3 months. On the other hand, a natural BP drop without BP medication was not detrimental. These observations underscore the importance of meticulous BP management, especially considering the oligemic state.

[OP037]

Longitudinal measurement of serum neurofilament light chain in patients with CADASIL

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Purpose

Serum neurofilament light chain (NfL) levels have been shown to be strongly associated with MRI markers of cerebral small vessel disease, cognitive deficits, and disability in cross-sectional studies of patients with cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL). This study aimed to investigate the longitudinal changes in serum NfL levels and their correlation with disease progression in patients with CADASIL.

Methods

We prospectively enrolled a group of CADASIL patients and assessed their clinical symptoms, cognitive function, brain MRI, and serum NfL levels at baseline and after a three-year follow-up. We measured cortical thickness, white matter hyperintensity volume, number of lacunar infarctions, and number of cerebral microbleeds on brain MRI. Global cognitive function was evaluated using the Seoul Neuropsychological Screening Battery dementia version (SNSB-D), with a maximum score of 300. We used linear mixed-effects models to investigate associations between changes in serum NfL levels and changes in cognitive function and MRI markers.

Results

At baseline, we examined 59 CADASIL patients between October 2018 and August 2019, and 51 patients completed the three-year follow-up, including clinical assessment, brain MRI, and serum NfL measurement. At baseline, the log-transformed serum NfL level showed significant correlations with age, glomerular filtration rate, SNSB-D score, and cortical thickness. During the three-year follow-up, there was a significant increase in mean serum NfL levels (19.04 ± 1.90 pg/ml vs. 30.84 ± 3.41 pg/ml, P<0.001). Changes in serum NfL levels were also significantly associated with age, changes in SNSB-D score, and cortical thickness. After adjusting for age, changes in serum NfL levels could predict changes in cortical thickness (P <0.001) or SNSB-D score (P <0.001).

Conclusions

Over a three-year follow-up period, changes in serum NfL levels were strongly correlated with changes in global cognitive function and cortical thickness measured on brain MRI. Longitudinal measurements of serum NfL could serve as a valuable blood biomarker for monitoring disease progression in patients with CADASIL.

Acknowledgement

The impact of statin therapy duration on risk of developing new-onset diabetes mellitus and recurrent vascular events in ischemic stroke patients based on linked data

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Purpose

While statin therapy has been shown to be beneficial in reducing cardiovascular events, several studies have reported that statin therapy is associated with increased risk of development of new onset diabetes mellitus (NODM). Therefore, our aim was to evaluate the impact of stain therapy on vascular outcomes and risk of NODM in patients with ischemic stroke. Furthermore, we investigated the relationship between stroke mechanisms, treatment duration and outcomes in ischemic stroke patients using a linked dataset.

Methods

We identified 20,250 patients with acute ischemic stroke without prior history of DM and without prior statin therapy before stroke from a large linked dataset. The patients included in the study were divided into two groups: statin users and statin non-users. Outcomes included NODM and vascular outcomes including recurrent ischemic stroke and acute myocardial infarction (AMI).

Results

Of 20,250 patients (12,535 male [61.9%]; mean age, 65.1 years), a total of 13,706 (67.7%) patients were prescribed a statin after index stroke. Regarding the risk of NODM, a duration-response relationship was observed between the use of statins and NODM: with longer duration of statin therapy, the risk of NODM substantially increased (HR 1.42, 95% CI, 1.28-1.58, P < 0.001). Among those who were prescribed statins for more than 4 years, statin user group had an approximately 1.8-fold higher risk of NODM compared to the statin non-user group. In vascular outcomes, the use of statin after ischemic stroke demonstrated a significant reduction in the risk of recurrent ischemic stroke by 54% (HR 0.46, 95% CI, 0.43-0.50, P < 0.001). In addition, this beneficial effect of statin therapy on vascular outcomes was observed consistently across all stroke mechanisms.

Conclusions

This study demonstrated that long-term statin therapy (≥ 4 yeas) following ischemic stroke increased the occurrence of NODM. Despite the increased risk of NODM, statin therapy has shown a consistent and beneficial effect in reducing major cardiovascular events, such as recurrent ischemic stroke and AMI in ischemic stroke patients across all mechanisms.

Covert atrial fibrillation detected by an insertable cardiac monitor and detection-related factors

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Purpose

Long-term arrhythmia monitoring using an insertable cardiac monitor (ICM) can detect atrial fibrillation (AF), which is one of the causes of embolic stroke of undetermined source (ESUS). However, lots of patients are not willing to undergo insertion of ICM because of invasiveness, removal procedure after detection, and its cost. Atrial cardiopathy, a term used to describe atrial structural and functional disorder preceding AF, has been considered as one of the causes of ESUS. Some biomarkers have been reported as a atrial cardiopathy. To determine the predicting factors of AF detected by ICM and its number of those biomarkers.

Methods

We enrolled 35 ESUS patients (24 males (69%), mean 65 years) who underwent insertion of ICM between December 2016 and July 2023. We retrospectively analyzed the detection rate of AF. We compared the relationship between AF and biomarkers such as patient PTFV1, left atrial diameter (LAD), PAC beats on Holter ECG monitoring, BNP, and CHA2DS2-VASc score.

Results

The median monitoring duration was 719 days (interquartile range, 100 to 1002), and median CHA2DS2-VASc score was 4 points (interquartile range, 3 to 5). AF was detected in 13 patients (37%) and the median time from onset to detection of 105 days (interquartile range, 41 to 335). Compared with non-AF group, AF group showed older age (median 74 vs. 67 years, p=0.047), higher level of PTFV1 (median 4464 vs. 1623 μV, p=0.0008), large number of PAC (median 246 vs. 56 beats/day, p=0.022), higher CHA2DS2-VASc score (median 5 vs 3 points, p=0.048). LAD and BNP were not significantly different between these two groups. AF detection rate were 80% in patients with 3 or 4 biomarkers, 33% with 1 or 2 biomarkers, and zero in patient without biomarker. Duration of onset to detection AF was shorter for patients with multiple biomarkers (within 180 days for 3 or 4 biomarkers and 600 days for 1 or 2 biomarkers. p<0.0001).

Conclusions

AF was detected in approximately 40% of ESUS patients with ICM inserted. The higher the number of biomarkers, the higher the early detection rate of covert AF.

Effectiveness of denosumab on bone mineral density in patients with osteoporosis and stroke

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Purpose

Stroke patients are susceptible to osteoporosis due to decreased mobility, reduced bone load, and various endocrine, nutritional, and pharmacological factors. Osteoporosis is a significant concern in stroke patients due to the high risk of falls and fractures. Recently, denosumab, a monoclonal antibody, has been injected to patients with osteoporosis. It has been shown to increase bone mineral density (BMD) by inhibiting osteoclast activity responsible for bone resorption. However, the effects of denosumab in stroke patients with osteoporosis have not been reported. Therefore, this study aims to compare the BMD response to denosumab between stroke patients and control subjects with osteoporosis.

Methods

Ninety-six patients with osteoporosis were included from January 2020 to May 2023. They consisted of 24 stroke patients (23 cerebral infarction and 1 cerebral hemorrhage) and 72 control subjects. Osteoporosis was diagnosed in all patients using dual-energy x-ray absorptiometry (DXA). The mean time of DXA examination after stroke was 12.3 days (range, 6-22 days). After osteoporosis diagnosis, denosumab was injected subcutaneously twice six months interval along with daily oral vitamin D supplementation. Follow-up DXA examination was performed, and areal BMD was obtained at 12 months after the first denosumab injection. The independent and paired t-tests were used to compare BMD change between stroke patients and control subjects with osteoporosis and in each group.

Results

There were no significant intergroup difference in clinical characteristics and areal BMD before injection except higher proportion of women in the control subjects. There At 12 months after denosumab injections, Areal BMD in lumbar spine increased significantly in both groups compared with baseline (p<.001). Areal BMD in femoral neck and total hip increased significantly after injections in control subjects relative to baseline (p<.001). There was no significant difference of areal BMD in one-third radius after injections in both groups. The changes of femoral neck and total hip areal BMD in control subjects (6.1±10.1%/4.5±7.8%) after injections were significantly higher than those (0.3±12.5%/0.3±8.3%) in the control subjects (p=.025). However, there was no significant differences of areal BMD change in the lumbar spine and one-third radius between the two groups (Figure 1).

Conclusions

Denosumab therapy significantly increased areal BMD in the lumbar spine and hip in the control subjects and in the lumbar spine in stroke patients. Considering the high risk of hip fractures in the stroke patients with osteoporosis, other osteoporosis treatments are needed to increase areal BMD in the hip.

November 17 (Fri) 15:50-17:30 | Room 1

Symposium 6. AI & Informatics [ENG]

CHAIRS   Teruyuki Hirano (Kyorin University, Japan)

Nam-Jong Paik (Seoul National University Bundang Hospital, Korea)

Patient characterization and predictive modeling using deep learning with electronic health records and clinical text

Jihad S. Obeid

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The widespread adoption of electronic health records (EHRs) and recent advances in artificial intelligence (AI) compounded by the democratization of high-performance computing have led to a significant rise in data-driven biomedical research. Examples include the characterization of specific clinical phenotypes and predictive modeling for patient outcomes. Moreover, due to the abundance of EHR information within unstructured clinical notes, researchers have developed a wide range of natural language processing pipelines for information extraction. Substantial strides in AI have resulted in powerful tools for tapping into the breadth of information in text-based medical records. Examples include deep learning and large language models for information extraction. Working with these models is far less daunting than it used to be, thanks to machine learning open-source frameworks—such as PyTorch and Google's TensorFlow.

During this presentation, we will describe a research infrastructure in an academic medical center in the U.S. for using EHR data in local and federated network settings, as well as several use cases for AI-based research with focus on unstructured data in medical records. Both traditional machine learning algorithms and more advanced deep learning methods have been used in a variety of clinical use cases for analyzing historical provider notes. For example, we have achieved reasonable accuracy in the automated identification of patients with altered mental status in clinical notes with an area under the receiver operator characteristic curve (AUC) of 0.99. In another clinical domain, we used a similar approach for the early identification of risk for suicidal behavior based on historical clinical notes one month or more prior to a suicidal behavior event (AUC = 0.88). We will discuss the differences between e-phenotyping (namely, the identification of patients with specific clinical characteristics within the EHR) and predictive tasks and examine the impact of pre-training models with self-supervised learning algorithms, and the advent of large language models.
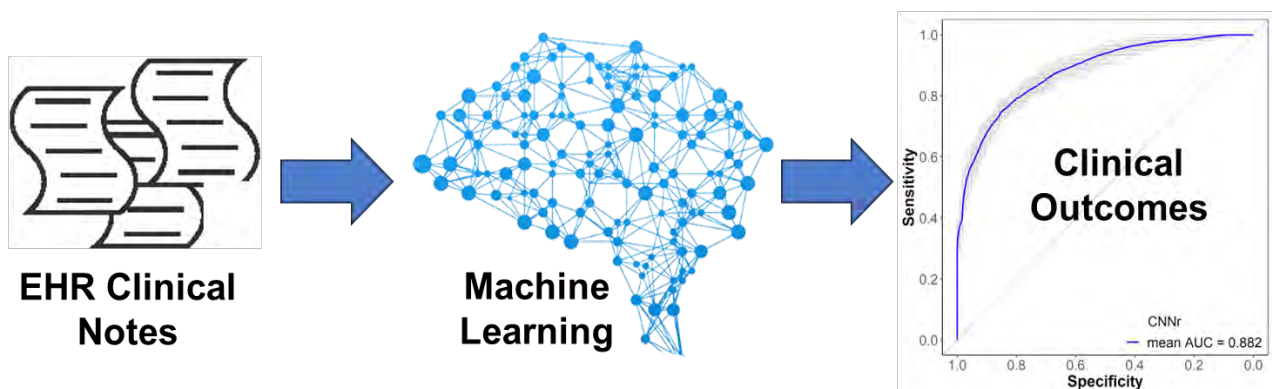
Diffusion models for brain MRI reconstruction

Jong Chul Ye

Korea Advanced Institute of Science and Technology, Korea

Diffusion models have become a popular approach for image generation and reconstruction due to their numeruous advantages. However, most diffusion-based inverse problem-solving methods only deal with 2D images, and even recently published 3D methods do not fully exploit the 3D distribution prior. To address this, we propose a novel approach using two perpendicular pre-trained 2D diffusion models to solve the 3D inverse problem. By modeling the 3D data distribution as a product of 2D distributions sliced in different directions, our method effectively addresses the curse of dimensionality. Our experimental results demonstrate that our method is highly effective for 3D medical image reconstruction tasks, including MRI Z-axis super- resolution, and compressed sensing MRI. Our method can generate high-quality voxel volumes suit- able for medical applications.

Clinical study using Fukuoka Stroke Registry, a largest acute stroke registry in Japan

Tetsuro Ago, **Ryu Matsuo, Masahiro Kamouchi, Takanari Kitazono**

Department of Medicine and Clinical Science, Graduate School of Medical Sciences, Kyushu University, Japan

We established the Fukuoka Stroke Registry (FSR) in 2007 and continuously registered 17,074 acute stroke patients, in cooperation with seven regional core stroke centers located in the Fukuoka Prefecture, Japan (J Atheroscler Thromb 2023;30:1095). We collected various clinical information, including risk factors and their control status, laboratory/radiological data, treatment contents, genome and serum on admission, and long-term outcomes through telephone survey up to 15 years. The FSR receives a high evaluation from home and abroad by its high consent (89%) and followed-up (85%) rates and by diagnostic accuracy and standardized clinical practice. We have published more than fifty papers regarding the association between 1) post-stroke outcomes (neurological improvement or deterioration, assessed by changes of NIHSS, during hospitalization, and functional outcomes at 3 months, assessed by modified Rankin Scale) and sex (Stroke 2015;46:471), smoking status (Stroke 2020;51:846), post-stroke blood pressure (Hypertension 2014;63:54), blood pressure variability (Stroke 2015;46:1832), pre-stroke glycemic control (Stroke 2011;42:2788), insulin resistance (Neurology 2018;90:e1470), pancreatic β cell function (Stroke 2021;52:2621), proteinuria (Neurology 2012;78:1909), and ESUS (JAMA Netw Open 2018;1:e182953), and 2) that between long-term stroke recurrence or death and sex (Cerebrovasc Res 2023;52:409), blood pressure variability (Stroke 2022;53:70), diabetes (Eur J Neurol 2013;20:921), renal function (Stroke 2023;54:1268), TIA scores (Stroke 2014;45:418), and left atrial size (J Am Heart Assoc 2017;6). The FSR also contributed to genomic epidemiology (Nat Genet 2007;39:212, Stroke 2009;40:1245, Stroke 2017;48:253, Nat Genet 2018;50:524, Circulation 2019;139:295, Stroke 2020;51:759, Nature 2022;611:115) and environmental epidemiology regarding the association between ischemic stroke and Asian dust (Stroke 2012;43:3085) or PM2.5 (Stroke 2016;47:3032). Moreover, it also produced results of proteomic research regarding VEGF (BMC Neurol 2013;13:32), RANTES (Brain Res 2013;1517:122), S100A12 (J Neurol Sci 2014;340:75), and adiponectin (Metabolism 2014;63:1093). These results are giving helpful hints for our basic research aiming stroke prevention and post-stroke functional recovery (J Atheroscler Thromb 2023;30:1085). In this presentation, we would like to introduce the FSR and some of its achievements.

Artificial intelligence in stroke

Sohei Yoshimura

National Cerebral and Cardiovascular Center, Japan

Background

There has been some reports that indicate stroke registry data analyzed by machine learning (ML) could predict patients' outcomes with high accuracy. However, few reports examined large-scale acute stroke registry data using ML, and there no easy-to-use systems that can adapt the results to individual cases.

Aims

The aim of our study was developing outcome prediction formulas by ML algorism using the data of Japan Stroke Data Bank (JSDB), which is a nationwide acute stroke registry with individual data and have accumulated approximately 260,000 cases from more than 100 facilities nationwide over the past 23 years.

Methods

The derivation cohort used data of acute stroke patients registered in JSDB from 2016 to 2019. ML algorithm was used to develop a formula for predicting stroke outcomes at discharge. The results were compared with manual-made formulas using a logistic regression (LR) model and Scoring model. The results were validated using JSDB data in 2020. Favorable functional outcome was defined as mRS 0-2.

Results

ML algorithm could predict favorable functional outcome with an area under curve (AUC) 0.907 [95%CI 0.903-0.913], sensitivity 81.5%, specificity 84.0%, and positive predictive value (PPV) 83.9%. In validation cohort, each statistical value was significantly higher than that calculated using LR model (AUC 0.858 [0.853-0.864], sensitivity 84.3%, specificity 69.6%, and PPV 75.2%) and that using Scoring model (AUC 0.730 [95%CI 0.723-0.737], sensitivity 72.6%, specificity 68.6%, PPV 71.7%). Premorbid mRS, Japan coma scale (JCS), NIHSS total score, NIHSS subs-core of lower limbs, stroke classification, and age were the top six important factors for ML algorithm.

Conclusion

ML algorithm using the data of JSDB was able to predict favorable functional outcome in acute stroke patients at discharge with higher accuracy than LR model and scoring model. Premorbid mRS, stroke classification, JCS, NIHSS total score, NIHSS sub-score of lower limbs at admission, and age were important factors for ML method.

ROC mRS0-2 vs. mRS 3-6

> ML model
AUC 0.901 (95%CI 0.897-0.905),
> LR model
AUC 0.858 (95%CI 0.853-0.864),
> Scoring model using JCS
AUC 0.730 (95%CI 0.723-0.737),

> Validation cohort
— ML model
— LR model
— Scoring model
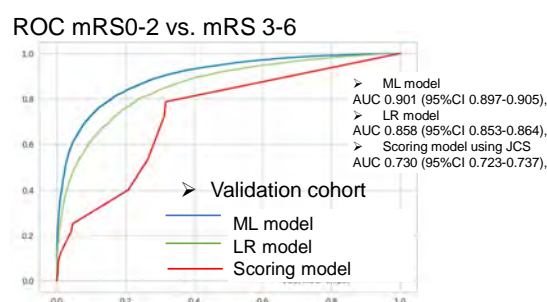
Wearable rehabilitation robot

Won-Seok Kim

Seoul National University Bundang Hospital, Korea

Stroke is the leading cause of disability in developed countries. Timely stroke treatment and early rehabilitation are crucial achieving favorable functional outcomes. However, a significant portion of patients with stroke requires long-term rehabilitation. Since a single conventional rehabilitation approach cannot guarantee a full recovery, repetitive, intensive rehabilitation have been recognized as a significant factor in the recovery process. Therefore, rehabilitation robots, designed to deliver intensive rehabilitation with reduced therapist involvement, have been developed and utilized in stroke rehabilitation over the past decade. Gait and arm rehabilitation using nonportable exoskeletal or end-effector type robots are now widely employed and have demonstrated clinical efficacy in randomized clinical trials and meta-analyses. However, these non-portable, ground-based rehabilitation robots have limitations in adapting to variable environments during rehabilitation and assisting or compensating for functions in patients with chronic stroke, who have minimal potential for recovery of motor impairments. With recent advancement in soft materials, batteries, and sensors, soft wearable robots have gained active attention and research interest in stroke rehabilitation. In this presention, I will introduce the concept of wearable rehabilitation robots and provide a brief overview of the technologic aspects of soft wearable robots. Additionally, I will discuss the clinical efficacy of wearable rehabilitation robots and their potential integration with other technologies, such as brain-computer interfaces based on my modest experiences in wearable rehabilitation robot research.
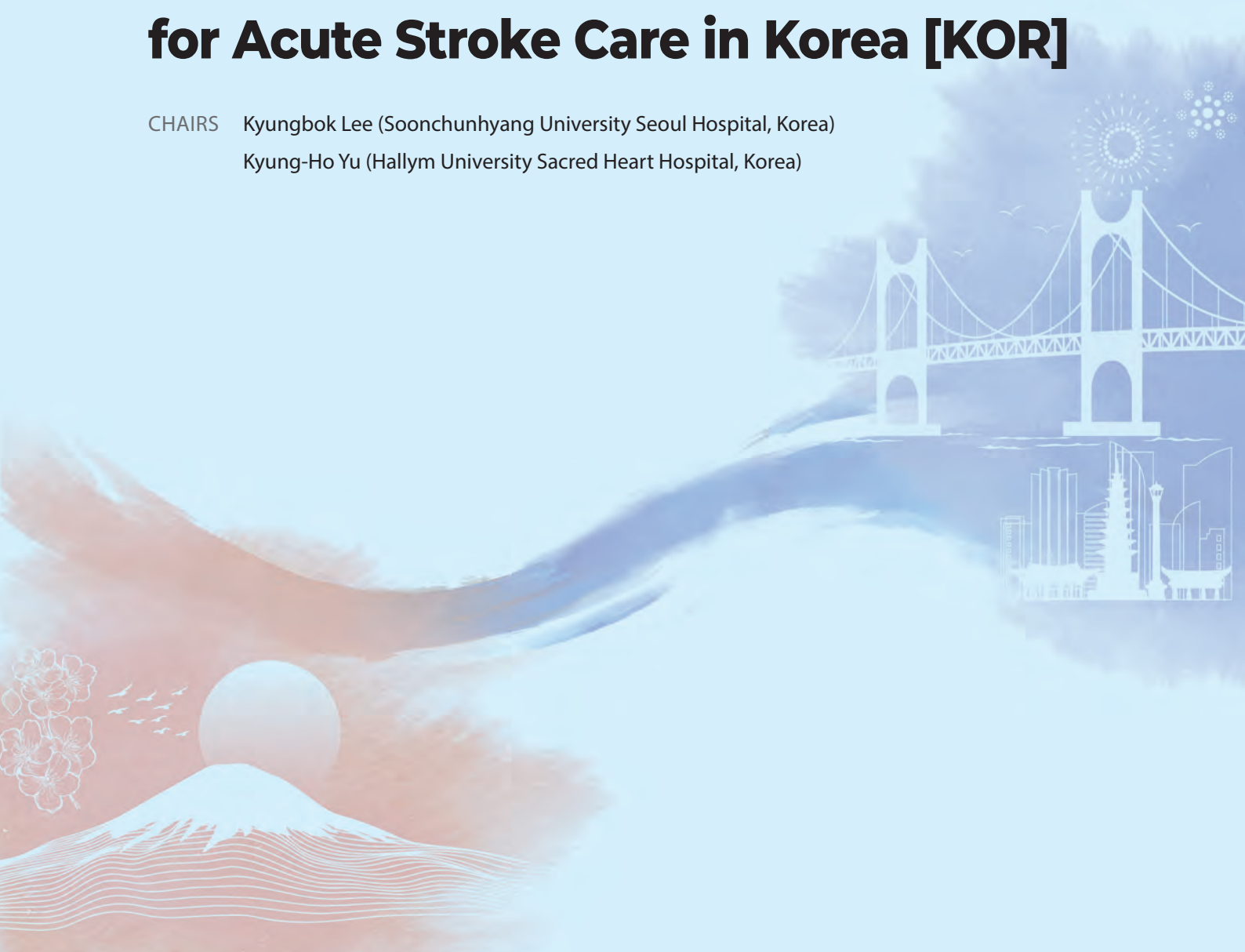
ICSU 2023
11th JKJSC

**International Conference STROKE UPDATE 2023
& 11th Japan–Korea Joint Stroke Conference**

November 17 (Fri) 15:50-17:30 | Room 2

Policy Session.
Present and Future of Telemedicine for Acute Stroke Care in Korea [KOR]

CHAIRS   Kyungbok Lee (Soonchunhyang University Seoul Hospital, Korea)

Kyung-Ho Yu (Hallym University Sacred Heart Hospital, Korea)

Telemedicine for stroke care in Alberta region, Canada

Brian H Buck

University of Alberta, Canada

Alberta is Canada's fourth largest province by area covering 661K km2 (ie. 6.6x larger than South Korea) yet is relatively sparsely populated with 4.7 million persons whose health is provided by a single health authority (Alberta Health Services). More than one-third of Albertans live in rural (< 1,000 persons) or small urban centers (<100,000 persons) without direct access to stroke specialists. This vast geography creates challenges for the timely delivery of acute stroke care, particularly to individuals living in more remote centers. To address these challenges, the Alberta Telestroke program was established in 2007 and at present consists of 14 active spoke sites and 2 comprehensive "hub" stroke centers (Foothills, Calgary and University of Alberta Hospital, Edmonton) (see Figure 1) with approximately 20 stroke neurologists covering telestroke call. Recently there have been several new initiatives introduced into the Alberta Telestroke program to help ensure those in rural areas have access to rapid reperfusion therapy. These telestroke initiatives include: a system-wide quality improvement project to reduce DTNs, the implementation of a LAMS-based "rural field call" that allows for direct triage to a CSC, and a mobile stroke unit focused on rural settings. This session will provide an overview of the telestroke system in Alberta along with data highlighting outcomes of rural stroke initiatives as well as describing plans to utilize the telestroke networks to improve rural patient access to stroke clinical trials.

Figure 1. Alberta Telestroke Network (2023)

Role of telemedicine in prehospital stroke care and transportation system in Korea

Mi Sun Oh

Hallym University Sacred Heart Hospital, Korea

Telemedicine has been known and utilized for several years. Within the realm of acute stroke care, telestroke, called stroke telemedicine, has expanded its scope to encompass a range of services, including prehospital care, inter-facility coordination, intra-facility hospital-based services, stroke telerehabilitation, and ambulatory telestroke support. Particularly, prehospital stroke care requires efficient communication between Emergency Medical Services (EMS) and acute stroke teams to reduce treatment times and enhance the efficiency of patient care.

Our innovation, the Brain Saver-ED, in mobile telemedicine integrated with a cloud platform, facilitating real-time messaging, audio alerts, and prenotification to receiving hospitals by EMS. Additionally, it allows for monitoring vital signs through the Internet of Medical Things (IoMT) during the transport of acute stroke patients. The Brain Saver-ED assists EMS personnel in rapidly assessing acute stroke patients, determining the most suitable transport hospitals, and promptly notifying stroke teams at the designated stroke centers. Similarly, within the hospital setting, this module enables acute stroke teams to prepare for the patient's arrival with advanced notice, while data sharing ensures that all teams have access to critical information regarding stroke patients and their outcomes.

In this context, I will outline various initiatives and potential opportunities for optimizing digital healthcare in prehospital stroke care. Furthermore, I will discuss our experiences in developing and implementing the Brain Saver-ED within the prehospital stroke care and transportation system in South Korea.

Refer system of mechanical thrombectomy eligible patients assisted by AI program and telemedicine

Jin Soo Lee

Ajou University Hospital, Korea

In the treatment of acute ischemic stroke, reperfusion therapy is the most effective treatment for minimizing cell death in cerebral infarction. However, this reperfusion treatment is quite time-limited. If cell death has already progressed, not only is it irreversible, but the risk of cerebral hemorrhage increases due to damage to the surrounding blood-brain barrier, so late treatment may be even dangerous. Reperfusion treatment includes intravenous thrombolysis and endovascular thrombectomy. For a stroke reperfusion treatment, (1) stroke is diagnosed through a meticulous neurological examination, (2) a treatment strategy is established through brain imaging, and then (3) reperfusion treatment is performed.

For an effective stroke treatment, rapid transfer to a hospital with neurological experts is necessary. This transfer is also divided into two types: a case where the patient is transferred directly to a specialized hospital capable of reperfusion treatment, and a case where the patient is transferred to a nearby non-specialized hospital and then transferred back to a specialized hospital for reperfusion treatment. In the former case, the role of emergency medical services (EMS) personnel is important. They must be able to recognize stroke well, and especially be aware of the symptoms that appear in large vessel occlusions that require endovascular thrombectomy. However, in the latter case, the stroke specialist hospital is far away, so once the patient is transferred to a non-specialized hospital, a non-neurological expert must diagnose the stroke through neurological examination and make a quick decision, but if he or she does not have sufficient training, it will be quite difficult.

Even non-neurological experts can suspect a stroke to some degree because unilateral paralysis occurs in many cases. At this time, since hemorrhagic stroke must be distinguished, in most cases, non-contrast brain CT is performed in the emergency room. Compared to intracerebral hemorrhage, which is clearly visible in white color, it is difficult to detect changes in early cerebral infarction on CT scans. In the case of a neurological specialist, if a stroke is diagnosed through an accurate neurological examination and a CT scan confirms that there is no intracranial hemorrhage, intravenous thrombolytic treatment is immediately started according to various inclusion/exclusion criteria. However, endovascular thrombectomy can only be performed if an intracranial large vessel is occluded, and the patient has such severe symptoms. In a non-specialized hospital, it is difficult to transfer to a specialized hospital for reperfusion treatment based only on suspicion of large vessel occlusion. Because the emergency rooms of most stroke specialty hospitals are very crowded with patients in Korea, if there are too many patients who are not indicated for endovascular thrombectomy, patients who need endovascular thrombectomy may not be able to be transferred. Additional MRI procedures have been shown to cause a delay of about 2 hours in transferring patients to thrombectomy-capable hospitals, which could be a factor in excluding patients for endovascular thrombectomy due to the delay. One way to solve this problem is to use artificial intelligence, which has recently made great progress. A program to predict large vessel occlusion in non-contrast CT using AI has been developed and can be used with permission from the Korean Ministry of Food and Drug Safety. Using this, it can help non-neurological physicians in non-specialized hospitals make rapid decisions. If CT scans are made possible in mobile stroke unit ambulances like in the United States or Australia, it will be possible to efficiently transfer patients directly to hospitals specializing in reperfusion treatment without having to visit non-specialized hospitals.

Barriers to telemedicine application for emergency treatment and transportation in rural areas of Korea

Daihai Choi

CHA Gumi Medical Center, Korea

Telemedicine in Korea ; Focus on EMS

1987 Implementation of Medical Insurance System

1979: Operation of Nighttime Emergency Patient Reporting Center (Organized by the Korean Medical Association, Seoul)

1982: Guidelines for Operation of 119 Ambulance and Nighttime Emergency Patient Reporting Center in Seoul Area1989: Establishment of the Korean Society of Emergency Medicine, Establishment of the Department of Emergency Medicine, Commencement of Specialist Training, National Health Insurance Implemented for All Citizens

1991: Promulgation of Emergency Medical Management and Operation Rules (Presidential Decree), Selection of Emergency Medical Centers and Designated Emergency Hospitals, Establishment of Criteria for Emergency Medical Technicians and Ambulances, Installation and Operation of 11 Emergency Patient Information Centers in 129 branches of the Korean Red Cross nationwide.

Medical Oversight

refers to the medical act, sanctioned by law, in which a licensed physician provides necessary emergency treatment and medical interventions to a patient from the scene to arrival at the hospital. communicated protocol and verbally or visually through telecommunication to on-site emergency medical practitioners (such as 119 responders and transporters). When required, it may be conducted indirectly through established protocols, involving verbal or visual calls. This process is subject to quality control."

Medical oversight content : 01. CPR Delay 02. Cardiac Arrest – ALS 03. Chest Pain - NTG, ECG, Tachycardia-Valsalva Maneuver, Bradycardia-IV 04. Refusal of Transport 05. Hypoglycemia - 50% DW IV 06. Trauma - IV fluid, Pain control(AAP) 07. Altered Mental Status 08. Stroke Symptoms - Stroke score 09. Respiratory Distress 10. Intoxication 11. Syncope 12. Behavioral Issues and Suicide 13. Pregnant Women - Field Delivery 14. Allergy and Anaphylaxis – Epinephrine(Epipen) 15. Non-Traumatic Shock 16. Fever 17. Burns 18. Refusal of Transport 19. Pediatric- Seizures, Airway Obstruction, CPR Delay 20. Other (Disaster and Mass Casualty) - KSDM

Medical oversight problem : Protocol revision, Legal challenges, Security and privacy concerns, Patient awareness and attitudes, Lack of reimbursement, Infrastructure challenges, Lack of education (EMS and Physician), Integration challenges, Quality Control

Conclusion : It is essential to have elements such as Sharing the Concept of Localizing Pre-Hospital Interventions, Collaboration and Information Sharing between Attending Physicians and Paramedics, Regular Feedback System, Teamwork within the Ambulance Team, Legal Protection for Complaint Prevention, Sorting, Analyzing Pre-Hospital Data, and Quality Control

日刊경북신문   2016년 07월 13일 수요일 004면 사회

응급처치 능력 향상 Case-Study 개최

한차원 높은 응급의료 상담서비스로 도민감동 실현

경상북도는 12일 오후 도청 6층 회의실에서 119구급대원 '응급처치 대응능력 향상을 위한 구급상황관리 Case-Study'를 개최했다.

구급상황관리 Case-Study는 소방본부 119구급상황관리센터 주관으로 도내 현장구급대원과 구급상황관리요원이 참가해 '도민이 감동하는 응급의료 서비스 구현'을 목표로 하는 연구·토론의 장이다.

소방본부 119구급상황관리센터는 심정지 등 중증환자에 대한 적절한 응급처치 지도와 응급병원 선정과 같은 병원 전 단계에서 100% 환자소생을 목표로 전문화된 부서로

일평균 약 200여건의 응급상황을 상담 처리하고 있는 도내 구급활동 전담 컨트롤타워 역할을 하고 있다.

이번 Case-Study 주제는 최근 다양한 신규질병이 등장함에 따라 이에 즉각 대응하고 새로운 응급의료 전문지식 등 상담기법 우수사례를 공유하고 동국대 경

주병원 응급의학과장인 최대해 교수를 초빙해 응급의료 발전방안을 모색했다.

회의는 참석 직원별 Case-Study를 통한 사례토의, 다수사 상자 발생 시 경북응급의료지원센터와의 업무협의,

우수사례 발표, 분임토의 순으로 진행되었으며, 한차원 높은 응급의료서비스 제공으로 도민감동 실현을 위해 머리를 맞댔다.

경북도 우재봉 소방본부장은 "구급상황관리센터가 도민들에

게 한발 더 다가서기 위해서는 다양한 응급상황에서의 처치능력을 배양함으로써, 한차원 높은 응급의료서비스를 제공해야 한다. 때 도민안전을 위해 최선을 다해줄 것"을 당부했다.

강창호기자

120

Policy Session. Present and Future of Telemedicine for Acute Stroke Care in Korea
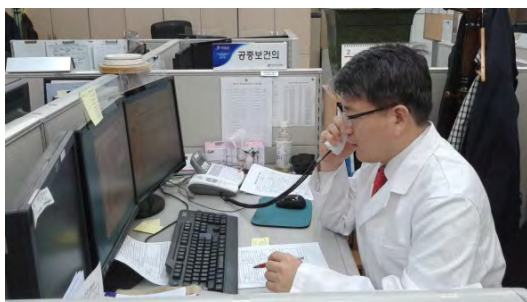
Digital transformation in healthcare and the future of acute stroke care

Seong-ji Kang

WELT, Korea

Can sudden symptoms, such as acute strokes, really come without any prior warning signs? If we were to transition from the episodic care-based healthcare system to continuous care, it might be possible to predict and intervene in these abrupt symptoms in advance. By harnessing the digital technologies deeply embedded in our daily lives, we can constantly manage diseases, and envision a future where predictive-based stroke management becomes achievable through the utilization of AI.

ICSU 2023
11th JKJSC

International Conference STROKE UPDATE 2023
& 11th Japan–Korea Joint Stroke Conference

November 17 (Fri) 17:30-18:30 | Room 1

Resident Session [KOR]

CHAIRS   Man Seok Park (Chonnam National University Hospital, Korea)

Keun-Hwa Jung (Seoul National University Hospital, Korea)
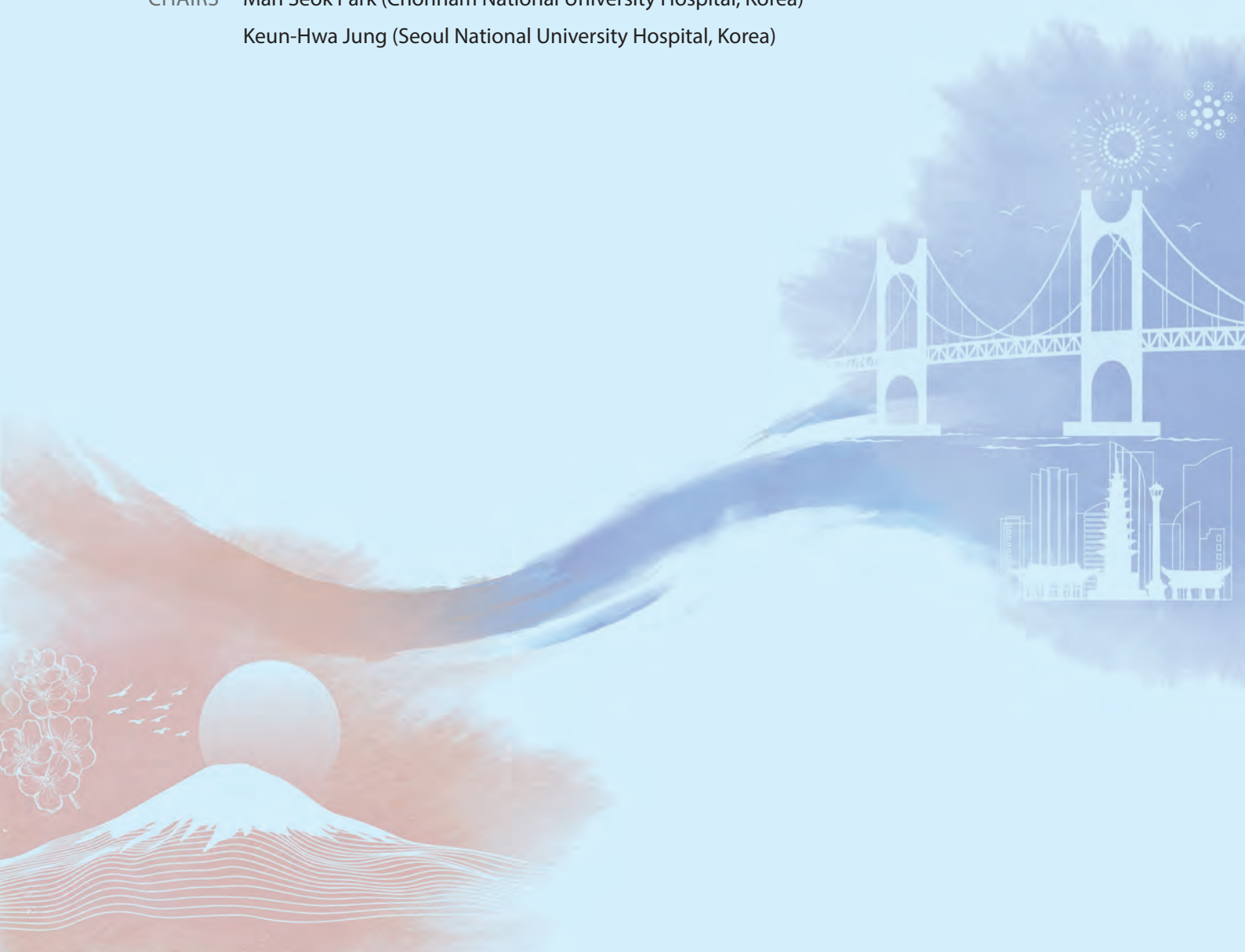
Choice of fluids in severe stroke patients

Sang-Bae Ko

Seoul National University Hospital, Korea

Patients with acute stroke are required to maintain adequate intravascular volume to minimize the risk of dehydration, which is often related to neurological deterioration. There are various forms of therapeutic fluid in the market, including colloids and crystalloids. Theoretically, colloids, whether they are natural or synthetic, stay longer in the intravascular space, helping to maintain intravascular volume. A commonly used crystalloid fluid is 0.9% saline, a non-balanced crystalloid which a non-physiological high concentration of chloride. Balanced crystalloids such as Ringer's lactate (similar to Hartmann solution in Korea) and plasma solution are also available for clinical use. Although they have slight differences in terms of specific ion concentrations, balanced crystalloid solutions have more physiologically normal chloride concentration. That is often associated with better renal outcomes or less metabolic acidosis. Here, we will review how to manage acute stroke patients using an optimal fluid solution.

Medical management of IICP in malignant stroke

Tae Jung Kim

Seoul National University Hospital, Korea

Malignant stroke commonly denotes a substantial stroke within the middle cerebral artery (MCA) region, which may also encompass the adjacent territories of the anterior or posterior cerebral arteries. This condition manifests as rapid brain swelling within the initial 48 hours following the onset of symptoms. The subsequent alterations in intracranial pressure (ICP) can induce shifts in brain tissue, potentially resulting in the occurrence of brain herniation. Therefore, several interventions that can treat increased ICP and optimize cerebral perfusion pressure with ICP monitoring are required.

A step-wise algorithms for ICP control provides a standardized approach to the management of ICP. In addition, treatment duration and weaning of therapies should occur in a stepwise fashion as well as avoid rebound ICP crisis. These algorithm includes head elevation, controlled hyperventilation, surgical decompression, osmotherapy, proper sedation, targeted temperature management, and coma therapy. There are medical intervention and surgical intervention, and aggressive medical and surgical treatment for controlling increased ICP and brain edema is necessary to prevent detrimental outcomes after malignant stroke.

GI problems in malignant stroke

Soo-Hyun Park

Kangdong Sacred Heart Hospital, Korea

Stroke can severely affect various vital organs' functions and deteriorate disease outcomes. Complications of the gastrointestinal tract (GIT) are commonly observed in stroke patients. Previous studies have demonstrated GIT complications in stroke patients, such as dysphagia, gastrointestinal bleeding, constipation by severe bowel obstruction, intestinal microbiota changes, and inflammation. A recent study showed that 19.6% of patients experience swallowing problems and that 75.4% of dysphagia is associated with a high risk of death during hospital admissions.

Especially, over-activated immune cells after stroke are the major cause to increased intestinal inflammation and may induce damage to epithelial cell barriers. The post-stroke damage of the intestinal barriers may allow the translocation and dissemination of microflora to systemic organs and cause sepsis. The GIT complications after stroke modify the disease pathogenesis and are associated with an unfavorable functional outcome. Therapeutic regimens have been clinically explored in stroke but require careful interpretation in multi-center clinical trials. The therapeutic options to treat these GIT complications are very limited and further research is required to develop novel treatments.

We review the epidemiology, pathophysiology, diagnosis, management, and prevention of the most common gastrointestinal complications associated with ischemic stroke. Also, we might help to maintain GIT homeostasis and improve neurological outcomes in stroke patients.

Massive colonic dilatation

Plain abdominal radiographs obtained before (A) and after (B) treatment.

J Clin Neurol. 2021;17:e48

뇌졸중 홈페이지 활용 팁

Minwoo Lee

Hallym University Sacred Heart Hospital, Korea

ICSU 2023
11th JKJSC

**International Conference STROKE UPDATE 2023
& 11th Japan–Korea Joint Stroke Conference**

Symposium 7.
Quality Improvement in Stroke Care
[ENG]

CHAIRS   Toshiho Ohtsuki (Kindai University Hospital, Japan)

             Sung-Il Sohn (Keimyung University Dongsan Hospital, Korea)

Establishment & performance improvement of stroke center in Korea

Sung Hyuk Heo

Kyung Hee University Hospital, Korea

Efforts to continuously improve the quality of care provided to patients in all medical areas, including stroke, are very important. Quality improvement in stroke care involves various strategies and initiatives aimed at enhancing the overall care and outcomes for stroke patients. These improvements can occur at various levels, including pre-hospital care, evidence-based treatment protocols and clinical pathways, stroke unit and center establishment, registry operation, rehabilitation, and long-term management including secondary prevention.

To improve the overall quality of individual hospitals, stroke unit certification program began in 2012 and stroke center certification program started in 2018. Currently, two types of stroke center certification program (primary and thrombectomy-capable stroke centers) are available in Korea, and as of April 2023, there are a total of 84 certified stroke centers. In addition, we are developing comprehensive stroke center certification program.

In addition, we have a high-quality representative multicenter, prospective stroke registry (Korean Stroke registry, KSR) containing data from more than 150,000 Korean stroke patients. Therefore, the KSR committee provides individual and overall data of performance indicators, and the hospitals continuously participating in KSR project can get reward for some evaluation items in stroke center certification.

In conclusion, we are working to establish a stroke safety net where stroke patients can be treated safely no matter where they occur across the country.
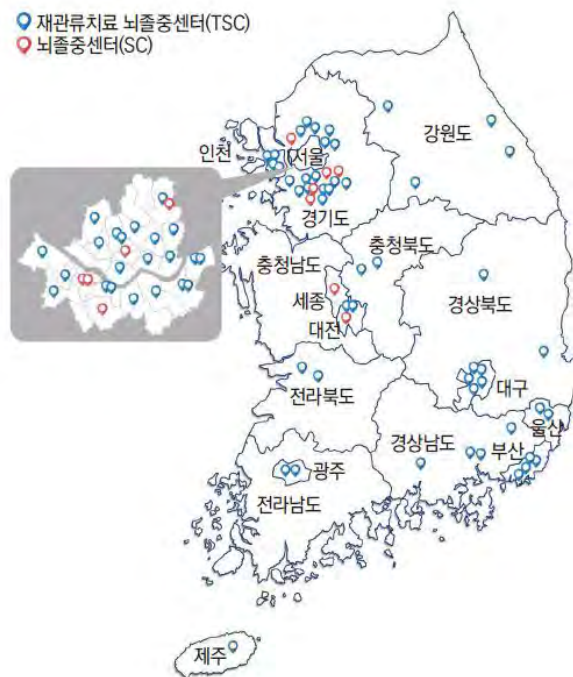
The Korean Stroke Society certified Stroke Centers (CSC statement writing group, J Korean Neurol Assoc 2023, in press)

Stroke care system in the EVT era in Japan

Yasuhiro Nishiyama

Nippon Medical School, Japan

Japan has made significant progress in stroke care, particularly in the era of endovascular thrombectomy (EVT). The stroke care system in Japan reflects a comprehensive and well-organized approach to the management of acute ischemic stroke, including EVT.

Emergency Medical Services (EMS): EMS plays a critical role in the stroke care system. When a stroke is suspected, EMS personnel are trained to quickly assess the patient's condition and transport them to the most appropriate stroke center. In particular, EMS has implemented and is attempting to standardize a system of observing 6 items to select large vessel occlusion (LVO): pulse irregularity, eye position, hemispatial neglect, aphasia, facial paralysis, and superior extremity. Japan has a well-developed network of EMS providers that ensures rapid response times.

Primary Stroke Centers (PSCs): Primary Stroke Centers are hospitals with the infrastructure and expertise to diagnose and initiate treatment for stroke patients, including intravenous thrombolysis (tPA). These centers are the first point of care for many stroke patients.

PSC-Core: PSC-Cores are specialized facilities with the ability to perform mechanical thrombectomy (MT). Japan has established a network of PSC centers throughout the country to ensure access to this advanced treatment. To date, MT for acute ischemic stroke due to large vessel occlusion in the anterior circulation has been shown to be beneficial in addition to standard treatment, including intravenous thrombolysis, in eligible patients. The administration of intravenous thrombolysis prior to MT is therefore recommended by international guidelines. However, its value in combination with endovascular treatment in patients admitted directly to endovascular centers is controversial. The worldwide shortage of alteplase and tenecteplase has increased the relevance of this issue. Recently, a meta-analysis including the SKIP trial in Japan comparing the clinical outcomes of intravenous thrombolysis plus endovascular therapy with endovascular therapy alone in patients admitted to a facility where MT was available was reported, providing another piece of evidence that will be of great importance for future EVT guidelines. RCT evidence on the benefit of MT beyond 24 hours is expected to be developed in the future.

Another important issue is finding the source of the embolism: atrial fibrillation, the main cause of LVO, is not present on admission, but may be found as paroxysmal atrial fibrillation on closer examination during hospitalization.

Because of the often paroxysmal and asymptomatic nature of atrial fibrillation, it may not be detected using traditional monitoring techniques. Strategies to detect AF have included in-hospital monitoring, serial ECG, Holter monitoring, long-term ambulatory monitoring, and monitoring with insertable cardiac monitors (ICMs). ECG monitoring with an ICM has been superior to conventional monitoring for the detection of AF, but the problem is that it is invasive for the patient.

At the conference, I will present our prospective clinical study using a new device, a long-term continuous and non-invasive patch-type electrocardiographic monitoring system, and its usefulness in detecting covert AF as an embolic source in inpatients with cryptogenic stroke.

Transforming stroke care in Thailand: The path for improvement

Nijasri C. Suwanwela

Chulalongkorn Stroke Center, Bangkok, Thailand

Stroke is a major health problem in Thailand. It is the number one cause of death and long-term disability in both men and women. The number of new stroke cases is estimated to be around 250,000 per year. The prevalence of stroke is found to be 1.88% among adults aged 45 years and older. Stroke is more prevalent in men, and the mean age of stroke onset is 65 years. Hypertension, diabetes, dyslipidemia, metabolic syndrome, and atrial fibrillation are major risks for stroke in the Thai population. The evolution from predominantly rural to urbanized industrial communities results in an increasing prevalence of these risk factors. Similar to other parts of the world, ischemic stroke is the leading cause of most strokes, but there is a higher proportion of hemorrhagic stroke when compared to Caucasian populations. Among patients with ischemic stroke, lacunar stroke accounts for almost half, followed by atherosclerotic disease. Intracranial atherosclerosis is also prevalent in the Thai population.

For acute treatment, intravenous thrombolysis has been used in Thailand for over 25 years. Its cost is reimbursed by the national healthcare system. With the introduction of the stroke fast track system, prompt stroke treatment across the country is warranted. Additionally, the landscape of stroke care in Thailand is evolving, with endovascular treatment becoming increasingly accessible as more interventionists receive training. Stroke units are becoming the standard of care in large regional and provincial hospitals, ensuring that patients receive the specialized attention they require. Furthermore, some centers have adopted the Telestroke system, harnessing technology to improve the reach and quality of stroke care.

To further enhance the transformation of stroke care in Thailand, the country has implemented an accreditation system for stroke centers. This accreditation system ensures that healthcare facilities meet specific criteria and standards for stroke care, elevating the quality of stroke care and providing a framework for continuous improvement. Accredited stroke centers are equipped to offer comprehensive care, from rapid diagnosis to advanced treatments and rehabilitation services, thus strengthening the nation's capacity to combat the impact of strokes.

In conclusion, Through the adoption of advanced treatments, the establishment of stroke units, the implementation of the Telestroke system, and the accreditation of stroke centers, the nation is poised to make significant strides in reducing the burden of stroke and enhancing the quality of life for those affected by this debilitating condition. This holistic approach to transforming stroke care underscores Thailand's dedication to addressing this major health issue.

Quality improvement for stroke care using a value based approach

Deidre Anne De Silva

Singapore General Hospital, Singapore

# Improving stroke systems of care in the Philippines

Maria Epifania Collantes

University of the Philippines College of Medicine, Philippines

The Philippines is an archipelagic nation with 7,100 islands. With over 109 million Filipinos living in the country, only 5% are aged 65 and above. Stroke remains the leading cause of disability and death in the Philippines. Estimates of the true stroke prevalence vary between 0.9% to 2.6% of the population.

The identified barriers to stroke care included lack of health care resources, maldistribution of health facilities, inadequate training on stroke treatment among health care workers, poor stroke awareness, insufficient government support and health insurance coverage. Contributing further to this challenge are the geographically isolated and disadvantaged areas limiting access to health facilities.

The Stroke Society of the Philippines (SSP) in cooperation with the Department of Health and the World Stroke Organization launched the nationwide stroke education training to doctors and nurses on acute stroke treatment, setting up Acute Stroke Ready Hospitals and Acute Stroke Units. Thrombolysis training and simulation coupled with adaptation of standard stroke protocols improved the stroke time lines. Identification of stroke referral centers, setting up of stroke registry and the ongoing stroke unit certification will utilize data to assess, monitor and evaluate the effectiveness of the treatment and referral pathways. Stroke awareness and healthy lifestyle campaigns involved the public participation for the prevention and rapid stroke response. The SSP's strong linkage with the government paved the way to the passage of the National Stroke Policy for prevention, treatment and management of stroke. These consolidate and strengthen the efforts for improving stroke care in the country.
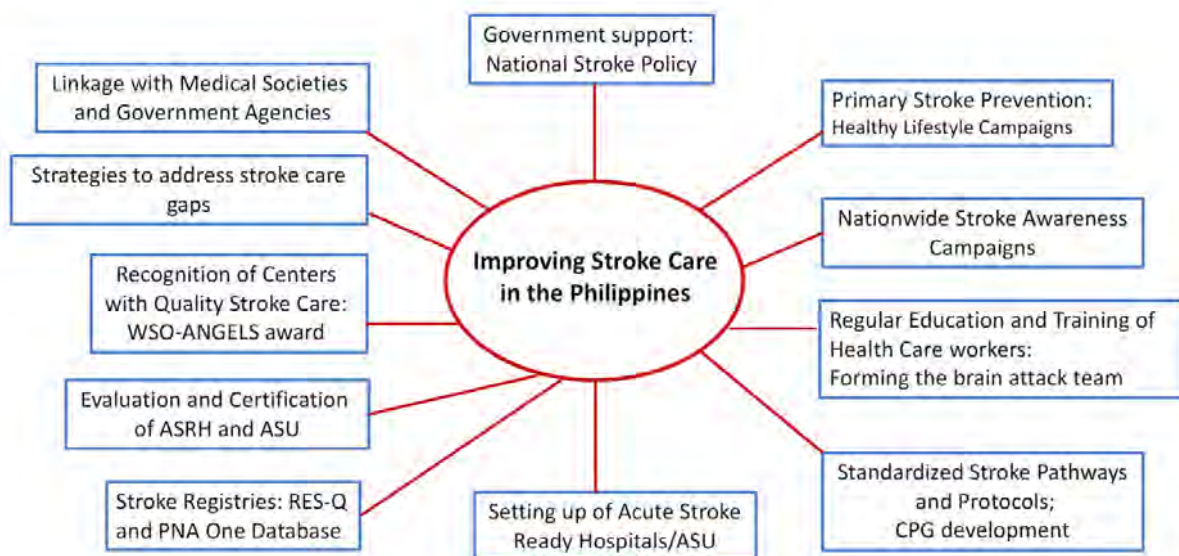
November 18 (Sat) 09:00-10:40 | Room 2

Nursing Symposium [KOR]

CHAIRS   Sang Min Sung (Pusan National University Hospital, Korea)

Ji Man Hong (Ajou University Hospital, Korea)

NIHSS를 이용한 신경학적평가

Hyunyoung Huh

Dong-A University Hospital, Korea

Assessment of the neurological status in acute stroke patients is a very important for early detection of neurological deterioration and appropriate treatment.

The National Institute of Health Stroke Scale (NIHSS) is an indicator developed by the National Institute of Health in 1989 and is considered the best tool to reflect the neurological status of stroke patients. In Korea, the Korean version of the NIHSS is called the K-NIHSS.

The NIHSS test is not complicated and can be performed while lying on a bed, and highly related to prognosis because it has high sensitivity and specificity.

The evaluation items include the patient's level of consciousness, eye movement, visual field loss, motor loss, speech communication ability, dysarthria, sensory impairment, and indifference.

A total of 15 questions are asked, and the score ranges from 0 to 42, with higher scores indicating more serious patients. In general, there is a report that a score of 16 or more predicts severe disability or death, and a score of 6 or less predicts good recovery.

And stroke symptoms can be evaluated overall in a relatively short time, and it is easy to communicate among medical staff by quantifying the symptoms and objectively evaluating them.

Nurses are the closest medical personnel to patients and play an important role in neurological evaluation of patients.

Through this lecture, I hope to understand NIHSS and use it appropriately in practice.

Promotion and standardization of rehabilitation nursing activities for the early rehabilitation of acute phase stroke patients

Chae Won Kim

Severance Hospital, Korea

1. Background for selecting the subject: While nurses at stroke intensive care units, where treatment is given to acute phase stroke patients, engage in general care nursing, they are also related to the neurological state, treatment, and rehabilitative treatment of the patients. Hence, these nurses play a pivotal role in the entire process of the treatment of patients with acute stroke. In the case of stroke patients, the likelihood of complications increases even just as a result of immobility and bed rest, which is why many studies suggest that early rehabilitation be carried out as soon as possible. However, research into the domain of early rehabilitation is still insufficient. Therefore, we aim to promote early rehabilitation nursing for acute phase stroke patients by identifying and applying well-grounded and evidence-based best-practice information on early rehabilitation nursing.

2. Intervention Process

2.1.   Identification of best practices and deduction of the protocol through literature review (evidence-based research; 2015 AVERT III)

In the early rehabilitation process, early mobilization helps to reduce the occurrence of complications that may result from immobility. In addition, according to empirical evidence based on the brain plasticity and recovery model, early mobilization is especially significant as it is closely related to the small "window of opportunity" that actively opens during the first 24 hours from the onset of stroke. Through intervention of early mobilization, we were able to identify statistically meaningful differences, whereby the duration from the onset of stroke to the initial mobilization in the control and intervention groups declined, the frequency of mobilization increased, and depressive symptoms were reduced. The protocol for early mobilization was deduced and applied on the basis of the AVERT III research protocol.

2.2.   Implementation of team training on the overall concept of rehabilitation nursing and contents of early rehabilitation (: including nurses' aides)

2.2.1.   Rehabilitation nursing goes beyond general care nursing that involves "doing things" for the patients. Rehabilitation nursing can be referred to as "therapeutic nursing" whereby nurses help the patients to "cope with their illness and find adaptation strategies by themselves" by assisting the patients' rehabilitation process, providing daily care, and giving emotional support.

2.2.2.   Restructuring of the brain based on such experiences as early task-specific training plays an important role in the progression of the patients' recovery.

2.2.3.   Implementation of team training on bed mobilization in accordance with the protocol and ROM (range of motion), implementation of relevant nursing activities.

3. Intervention protocol for early rehabilitation

3.1.   (3< baseline NIHSS <16) To commence within 24 hours from the occurrence of stoke of acute stroke patients.

3.2.   For early mobilization, activities out of the bed should be carried out at least three (3) times per day including daily care, with the intensity and frequency thereof to be gradually increased in accordance with each patient's functional phase.

Reference
Langhorne P, Wu O, Rodgers H, Ashburn A, Bernhardt J. A Very Early Rehabilitation Trial after stroke (AVERT): a Phase III, multicentre, randomised controlled trial. Health Technol Assess. 2017 Sep;21(54):1-120.

Neurovascular anatomy and reperfusion therapy

Jonguk Kim

Inha University Hospital, Korea

Cerebral angiography (transfemoral cerebral angiography, TFCA; digital subtraction angiography, DSA) is known to have been first performed on humans in 1927 by Egas Moniz in Portugal. However, it began to be applied in clinical practice in the 1980s. Beyond cerebral angiography in the diagnosis of vascular disease, the role of cerebral angiography in the treatment of ischemic stroke has evolved from intra-arterial thrombolysis (1998) to mechanical thrombectomy and angioplasty. For mechanical thrombectomy, trials using first-generation devices (Merci and Penumbra) in the early 2010s failed to demonstrate a significant outcome improvement compared to conventional IV thrombolysis, but the success of subsequent trials with Stent-retriever in 2015 (MR CLEAN, ESCAPE, EXTEND-IA, SWIFT-PRIME, and REVASCAT) made it an important part of modern acute ischemic stroke treatment after.

Diagnostic angiography can be used to identify occlusions in distal branches that are difficult to catch with non-invasive CT or MR angiography, to look for subtle luminal abnormalities such as arterial dissection or vasculitis, or to check the collaterals status. It is most accurate examination for investigating lumen and has the advantage of providing 3D and real-time images. Also, it provides the oppotunity to obtain additional images at any angle and depth the examiner desires, depending on the findings during exam. However, the examiner should be alert for nephrotoxicity or allergic reactions to the contrast agent, thrombus or arterial dissection from the catheter, and hematoma in the femoral artery.

In this course, I will introduce the anatomy of the cerebral vasculature as seen in cerebral angiography, the process of cerebrovascular interventions, and the preparation and post-procedure care.

NCU nursing care of the stroke patients

Han-Bin Lee

Seoul St. Mary's Hospital, Korea

Neurological examination is of paramount importance in the evaluation and monitoring of patients in the neurological intensive care unit. Changes in standardized examinations such as the NIH Stroke Scale, Glasgow Coma Scale (GCS) are often confounded by the milieu of medications used in the NICU, which should be considered when examining patients. Frequent bedside examinations are not sufficient to detect and prevent secondary brain injury.

Multimodal neuromonitoring is often used in severe stroke patients when there is no reliable neurological examination. The multiple neuromonitoring devices that can be used to collect bedside data in the neurocritical care unit.

Integration of multimodality monitoring with advanced informatics tools will most likely enhance our assessments compared to the clinical examinations alone.

From a nursing perspective, this lesson reviews commonly used multimodal methods in neurological intensive care units and practical recommendations for their use.

November 18 (Fri) 10:00-11:00 | Room 3

Poster Blitz Session [KOR]

CHAIR   Pil-Wook Chung (Kangbuk Samsung Hospital, Japan)

Evolocumab, PCSK9 inhibitor, in acute ischemic stroke patient undergoing mechanical thrombectomy: Early outcomes and safety.

Jonguk Kim[1], Ulchan Hong[1], Joung-Ho Rha[1], Cindy W. Yoon[1], Jin Woo Bae[2], Hee Kwon Park[1]

[1]Department Of Neurology, Inha University Hospital, Incheon-Si, Korea, Republic of
[2]Department Of Neurosurgery, Inha University Hospital, Incheon-Si, Korea, Republic of

Purpose

Lipid-lowering therapies, mainly statins, are mainstays in reducing recurrence after acute ischemic stroke (AIS). Evolocumab, a Proprotein convertase subtilisin-kexin type 9 (PCSK9) inhibitor, is a promising lipid-lowering agent known to decrease LDL cholesterol and mitigate vascular events alongside statins. However, its effects on the early functional outcomes post-mechanical thrombectomy (MT) remain unclear. This study aimed to assess the efficacy and safety of off-label early use of PCSK9 inhibitors in AIS patients undergoing MT.

Methods

We retrospectively analyzed patients who had MT at a regional stroke center from January 2018 to April 2023. Our primary outcome was discharge functional outcomes (NIHSS and mRS). Secondary outcomes included early neurologic deterioration (END), symptomatic intracerebral hemorrhage (sICH), 3-month functional outcomes, 3-month recurrence rate, and lipid profiles.

Results

Of 263 patients (mean age 69.1±11.9, men 42.6%), 42 were administered Evolocumab periprocedurally. While baseline characteristics were mostly similar between the two groups, the Evolocumab group demonstrated improved discharge outcomes, with a lower mean NIHSS (8.8±6.8 vs. 12.4±9.8, p=0.02) and a higher percentage of patients with discharge mRS ≤ 3 (52.4% vs. 36.2%, p=0.049). The 3-month follow-up show a non-significant trend towards an improved outcome in the Evolocumab group. Multivariable analysis indicated that Evolocumab had a potential but subtle effect on favorable discharge outcomes (aOR 0.064). Notably, Evolocuamb users exhibited fewer instances of END and sICH, although they did not reach statistical significance. Additionally, the Evolocumab group revealed potential benefits in total and LDL cholesterol reduction over time.

Conclusions

Early use of Evolocumab in AIS patients undergoing MT appeared to be safe and associated with better short-term functional outcomes and notable LDL reductions. The potential benefit of the PCSK9 inhibitor shown here warrants further prospective studies with a larger sample size.

Comparison of Discharge mRS Proportions between Evolocumab user and non-user

Comparison of 3-month mRS Proportions between Evolocumab user and non-user

Impact of exercise habit changes on myocardial infarction after acute ischemic stroke: A nationwide population-based study

Dong A Ye[1], Myun Kim[1], Mi Sun Oh[1], Minwoo Lee[1]

[1]Neurology, Hallym University Sacred Heart Hospital, Anyang, Korea, Republic of

Purpose

Stroke and myocardial infarction (MI) share common risk factors. Exercise has known benefits for cardiovascular health and can mitigate these risks, yet the impact of exercise habit changes after an ischemic stroke on subsequent MI risk is not fully understood. We aimed to investigate the effects of exercise habit changes on the risk of MI after acute ischemic stroke using the Korean National Health Insurance Services Database.

Methods

This study included 224,764 patients with a new diagnosis of ischemic stroke between 2010 and 2016 who underwent two serial biannual health checkups. The participants were divided into four categories according to their exercise habit changes: persistent non-exercisers, new exercisers, exercise dropouts, and exercise maintainers. The primary outcome was new diagnosis of incident MI. Multivariable Cox proportional models were used to assess the effects of changes in exercise habits on the risk of MI.

Results

After a median of 4.25 years of follow-up, 6,611 (2.94%) of MI cases were observed. After adjusting for covariates, exercise dropouts, new exercisers, and exercise maintainers were significantly associated with a lower risk of incident MI than persistent non-exercisers (adjusted hazard ratio [aHR] 0.937; 95% confidence interval [CI] 0.878–1.000, aHR 0.849; 95% CI 0.792–0.911, aHR 0.746; 95% CI 0.696–0.801, respectively). The effects of alterations in exercise behavior were uniformly observed in both genders, with greater prominence in individuals aged over 65 years. Notably, regardless of the level of physical activity after a stroke, engaging in physical activity was associated with a significant reduction in the occurrence of MI compared to individuals who did not exercise at all after the stroke.

Conclusions

In this nationwide cohort study, commencing or sustaining moderate-to-high intensity exercise following an ischemic stroke corresponded with a diminished likelihood of subsequent MI development. Advocating for physical activity in ambulatory stroke survivors could potentially attenuate their prospective risk of MI.

Acute ischemic stroke due to bilateral carotid artery occlusion in Erdheim-Chester disease: A case report

Yun Young Choi[1], Jae Wook Jung[1], Hyo Suk Nam[1]

[1]Neurology, Severance Hospital, Seoul, Korea, Republic of

Purpose

Erdheim-Chester disease (ECD) is a rare non-Langerhans cell histiocytosis characterized by the multisystemic dissemination of histiocytes throughout the body. Although various central nervous system involvements are commonly observed, ischemic stroke is a rare clinical manifestation of ECD. This report introduces an exceptional case of both internal carotid artery occlusion and hemispheric infarction in a patient with ECD.

Results

A 69-year-old woman was admitted for sudden loss of consciousness. The patient had previously been diagnosed with BRAF-wild-type ECD, with an open bone biopsy on the C6 vertebrae revealing an aggregation of CD 163+ histiocytes. Four months prior to her last admission, a cerebrospinal fluid (CSF) study and brain magnetic resonance imaging (MRI) were conducted because of a new onset restricted movement in her right eye. CSF analysis revealed no abnormalities and an enhancing lesion at the right orbital apex owing to ECD was observed on the MRI with no significant cerebral artery stenosis or occlusion.

Upon her last admission, she was in a semi-comatose state. Brain MRI and MRA revealed extensive acute infarction in both internal carotid arteries (ICA) territories and occlusion of both ICAs. Due to her unstable hemodynamic status, she was intubated and placed in the intensive care unit. Despite hyperosmolar therapy, follow-up CT scans showed signs of brain herniation and she eventually passed on following respiratory failure and septic shock.

Conclusions

Neurologic complications of ECD are mostly attributed to brain tissue infiltration by foamy histiocytes. Although periarterial thickening of the carotid artery had been reported in 7 – 12 % of patients, ischemic stroke due to the bilateral carotid occlusion has not been reported. Periarterial infiltration could interfere with blood circulation or increase blood hypercoagulability - factors that could increase susceptibility of individuals to ischemic stroke. Further studies investigating the risk of ischemic stroke in patients with ECD are warranted.
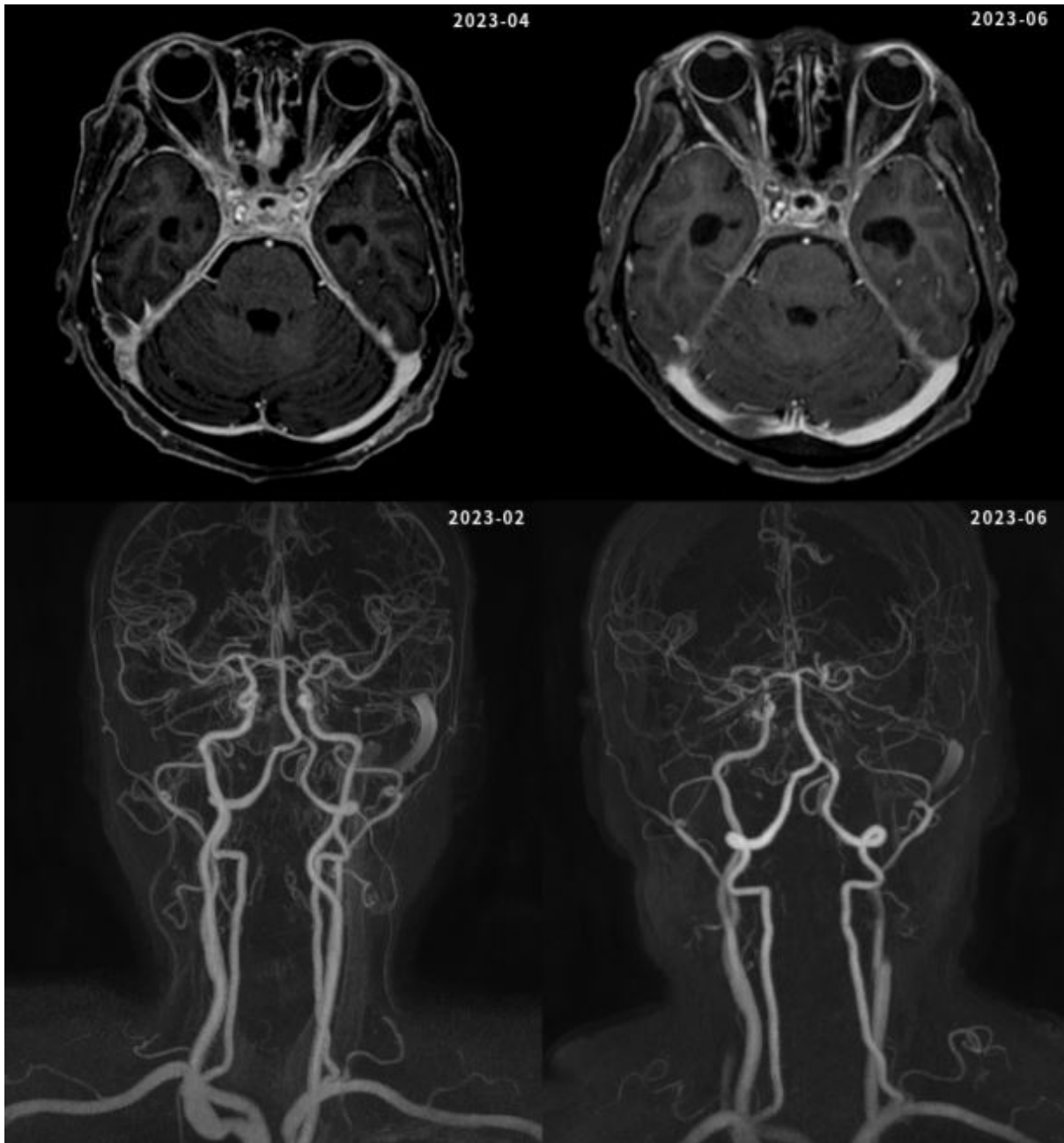
Acknowledgement

November 18 (Sat) 11:00-12:40 | Room 1

Symposium 8.
Intracranial Artery Stenosis [ENG]

CHAIRS   Yoshiki Yagita (Kawasaki Medical University, Japan)

Jeong Eun Kim (Seoul National University Hospital, Korea)

Hemodynamics in symptomatic intracranial atherosclerotic disease

Xinyi Leng

The Chinese University of Hong Kong, Hong Kong

Various factors can affect the mechanisms and risks of stroke in patients with intracranial atherosclerotic disease (ICAD). In the Stroke Risk and Hemodynamics in Intracranial Atherosclerotic Disease (SOpHIA) study, a cohort study conducted at 3 teaching hospitals in Hong Kong and Mainland China, we investigated the clinical implications of the hemodynamic features of symptomatic ICAD, using a computational fluid dynamics (CFD) model to simulate blood flow across an ICAD lesion based on CT angiography (CTA). We revealed significantly higher risk of stroke recurrence in patients with symptomatic ICAD, who had a larger pressure gradient and higher wall shear stress across the lesion as quantified by the CFD model. Subgroup analyses of the SOpHIA study revealed the potential roles of these hemodynamic metrics in governing the stroke mechanisms, lesion evolution and the optimal target for blood pressure management in symptomatic ICAD patients. External validation of the findings are warranted, for generalization and possible clinical applications of the findings in Chinese and other populations.

Anti-platelet treatment for intracranial atherosclerosis

Tomoyuki Ohara

Department of Neurology, Kyoto Prefectural University of Medicine, Japan

East Asian population have a higher incidence of intracranial atherosclerosis (ICAS). Therefore, the development of treatment strategies in secondary prevention of symptomatic ICAS is critical in East Asian countries including Korea and Japan. However, secondary prevention for symptomatic ICAS is still challenging since stroke patients with symptomatic ICAS have a higher recurrence rate compared to those with other stroke etiologies despite intensive antiplatelets and vascular risk factor managements.

Current evidence of antiplatelets for symptomatic ICAS are mostly derived from clinical trials in East Asian countries. Among antiplatelets, cilostazol may be a key antiplatelet agent for secondary prevention for symptomatic ICAS due to possible effect for stabilization of ICAS and less hemorrhagic risk. Notably, the TOSS trial conducted in Korea showed the progression of intracranial atherosclerotic stenosis was less frequent in dual antiplatelet therapy (DAPT) with aspirin and cilostazol than in aspirin alone, although there was no difference in stroke recurrence rate between the two treatment groups. On the other hand, the CATHARSIS trial from Japan failed to show that DAPT with aspirin and cilostazol was superior to aspirin alone in prevention of ICAS progression in stroke patients with symptomatic ICAS. Recently, the subanalysis of CSPS.com showed long term DAPT including cilostazol (at least 6 months) was superior to a single antiplatelet therapy with clopidogrel or aspirin for secondary stroke prevention without increasing bleeding risk during a median of 1.4 years in patients with symptomatic ICAS (hazard ratio, 0.47; 95% CI, 0.23–0.95). In terms of DAPT with aspirin and P2Y12 inhibitors (clopidogrel or ticagrelor), DAPT appeared to be more effective for secondary stroke prevention in patients with symptomatic ICAS up to 90 days after the index events based on the subanalysis of CHANCE and THALES trial. However, the use of DAPT should be limited within the first month after the index event, considering a balance of efficacy and hemorrhagic risk.

Stenting for intracranial atherosclerosis

Dongwhane Lee

Uijeongbu Eulji Medical Center, Korea

Non-atherosclerotic intracranial stenosis

Shuhei Okazaki

Osaka University Graduate School of Medicine, Japan

In East Asia, intracranial stenosis stands as the leading cause of ischemic stroke. Traditionally, atherosclerosis caused by cholesterol accumulation in arterial walls was considered the main cause of intracranial stenosis. However, recent advances in brain imaging techniques, such as high-resolution MRI vessel wall imaging, and breakthroughs in genetic studies have revealed that intracranial stenosis caused by non-atherosclerotic mechanisms is more prevalent than previously thought.

The presentation begins with an overview of the diseases that cause non-atherosclerotic intracranial stenosis, including intracranial artery dissection, infectious vasculitis, autoimmune vasculitis, reversible cerebral vasoconstriction syndrome, and moyamoya disease. Diagnostic techniques and treatments for each disease are described.

Additionally, the concept of RNF213-related vasculopathy will be introduced, which encompasses a wide range of vascular disorders including coronary artery disease, pulmonary hypertension, peripheral artery disease, intracranial artery stenosis, and moyamoya disease. In Japan and Korea, the p.R4810K variant of the RNF213 gene was found in 80-90% of moyamoya disease patients, 20-35% of intracranial artery stenosis patients, and 1-2% of the healthy population. Recent studies have revealed novel and distinctive features of RNF213-related vasculopathy. This overview presents our current findings, possible mechanisms, and future prospectives on RNF213-related vasculopathy.

Bypass surgery in intracranial artery stenosis

Sung Ho Lee

Seoul National University Hospital, Korea

In randomized clinical trials, including the Extracranial-Intracranial (EC-IC) Bypass Study, Carotid Occlusion Surgery Study (COSS), and Randomized Evaluation of Carotid Occlusion and Neurocognition (RECON) trial, cerebral bypass surgery for carotid occlusive disease failed to demonstrate any significant benefits. The primary reason for this failure was its inability to overcome the limitations associated with perioperative morbidity. Despite numerous controversies, such as the short follow-up period and the lack of experience among participating surgeons highlighted in these clinical trials, the use of vascular anastomosis for carotid occlusive artery stenosis has decreased. Furthermore, it is worth noting that even major treatment guidelines do not recommend bypass surgery for intracranial artery stenoocclusion.

Nonetheless, several studies have reported that a specific subgroup of patients with progressive and/or intractable symptoms may derive some benefit from cerebrovascular readjustment. Additionally, it has been documented that bypass surgery can have a positive impact, even when intra-arterial thrombolysis is not feasible in patients with acute progressive cerebral ischemia. Furthermore, a substantial body of research results has been published regarding efforts to reduce perioperative complications, which are considered the major contributing factor to the failure to prove the efficacy of bypass surgery in the COSS trial. Additionally, positive results related to the role of indirect bypass, as seen in moyamoya disease, are expected to be reported in the future.

In conclusion, at present, primary application of bypass surgery for intracranial artery stenosis is not deemed appropriate. However, it appears that it could provide assistance to patients with stenosis where drug therapy has limitations, provided that suitable candidates are carefully selected, and efforts are made to minimize surgical complications.

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International Conference STROKE UPDATE 2023
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November 18 (Sat) 11:00-12:40 | Room 2

Debate Session.
What is the Best Treatment for Intracranial Arterial Disease: Case and Debate [KOR]

CHAIRS   Jun Lee (Yeungnam University Medical Center, Korea)

Sang Hyun Suh (Gangnam Severance Hospital, Korea)
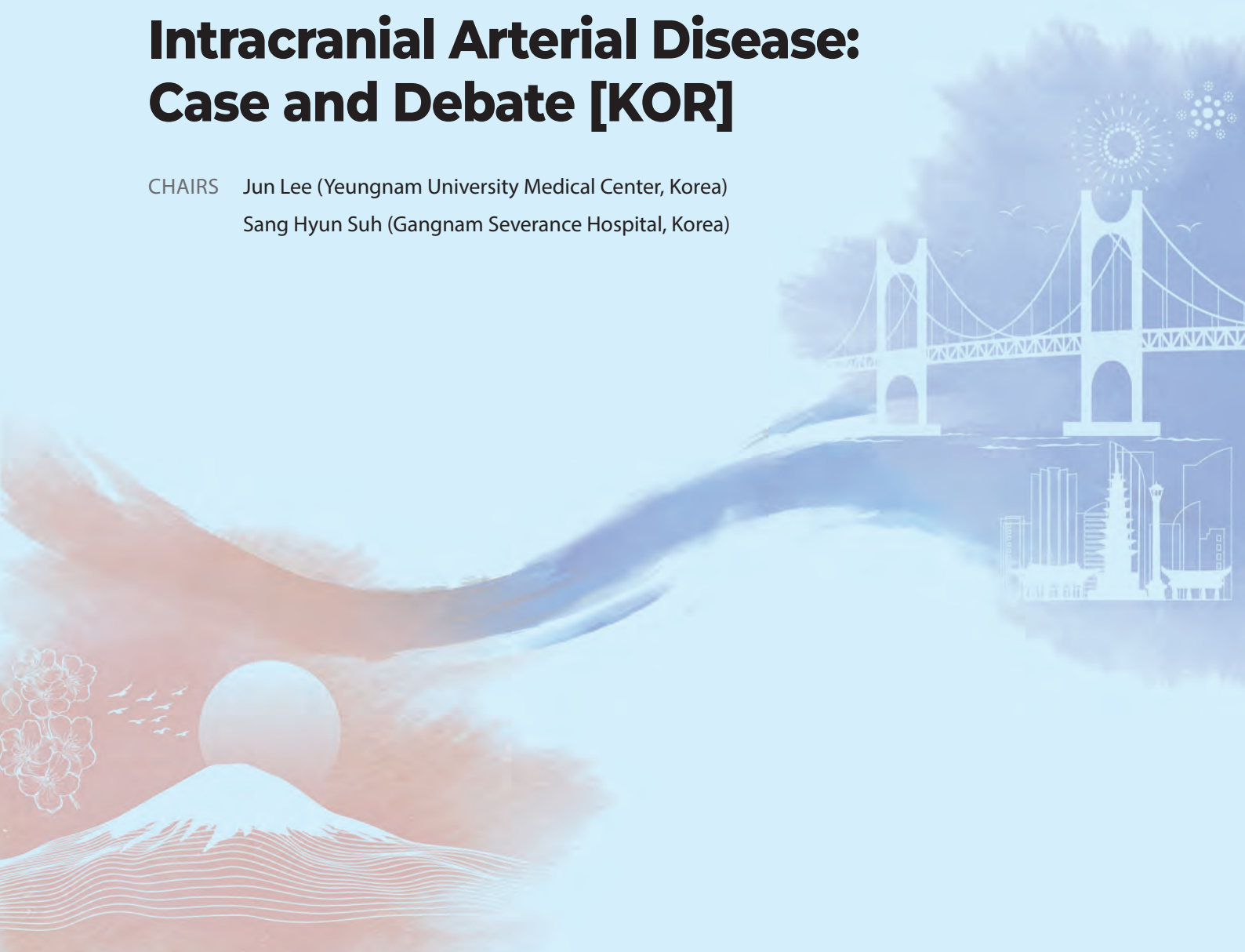
Overview of intracranial arterial disease: Emerging concept

Beom Joon Kim

Seoul National University Bundang Hospital, Korea

Intracranial arterial disease (ICAD) is a significant risk factor for ischemic stroke, but no treatment and management strategies have been developed. ICAD is more prevalent in Asian and Black communities than in Caucasians and is more difficult to detect than extracranial carotid artery atherosclerosis or coronary artery disease due to its smaller diameter and skull-enclosing location. This session, intended for residents, fellows and doctors practicing in the real world, will provide an overview of the concept of ICAD and address the various treatment strategies that can be employed to approach and manage it. The first session will review recent advancements in the concept and diagnostic approach of ICAD and present a difficult to diagnose and treat case. In subsequent sessions, lecturers will propose their own approach to this case and provide a summary of the state of the art. Through this session, which will be presented in Korean, the audience will be able to implement the most recent clinical knowledge in the real world clinical practice.

Indvidualized medical approach: Principles never change

Ho Geol Woo

Kyung Hee University Hospital, Korea

Intracranial atherosclerotic stenosis (ICAS) represents a major cause of ischemic stroke worldwide, and patients affected by this condition are exposed to a high risk for future strokes and other major cardiovascular events, despite best medical therapy (BMT) available. Endovascular therapy (EVT) and BMT may be used to prevent recurrent ischemic stroke caused by ICAS. However, there is no consensus on the best treatment for people with ICAS.

According to ESC guideline, in patients with an ischemic stroke or transient ischemic attack (TIA) related to an ICAS, BMT including aggressive vascular risk factor control, such as lipid management and lifestyle changes (i.e., increased physical activity), improves outcomes, although uncertainty exists regarding target levels of blood pressure (BP) and low-density lipoprotein (LDL) in this specific population. Guideline also suggest that patients with symptomatic ICAS should be considered as a very-high-risk population and target levels of LDL cholesterol should be achieved according to ESC/EAS guidelines (LDL< 55mg/dl). Furthermore, guideline suggest that even in the subacute phase of stroke due to ICAS, strict BP control probably should be initiated to prevent recurrence and stenosis progression.

In patients with an acute ischemic stroke or TIA related to high-grade ICAS causing severe hemodynamic compromise, guideline cannot make a recommendation regarding the use of permissive or induced hypertension over conventional BP management during the acute phase, based on current evidence. However, expert consensus statement suggested that induced arterial hypertension was considerable as a rescue treatment option in patients with high-grade symptomatic ICAS and clinical or imaging signs of hemodynamic compromise, only after other more conservative measures to improve cerebral hemodynamics have been tried.

Furthermore, in patients with an ischemic stroke or TIA related to a high-grade ICAS, guideline recommend against EVT (angioplasty and/or stenting) or neurosurgical procedures added to BMT as first-line treatment. However, expert consensus statement suggested that EVT was considerable as a rescue therapy in selected patients with symptomatic high-grade ICAS after clinical recurrence despite BMT. Also, guideline suggest that dual antiplatelet therapy (DAPT) over single antiplatelet therapy in patients with an ischemic stroke or TIA related to ICAS. Although the optimal duration of DAPT is not clear according to current evidence, expert consensus statement suggested that DAPT are used up to day 90 after the index event.

In patients undergoing mechanical thrombectomy for an acute ischemic stroke due to an Intracranial atherosclerotic disease (ICAD)-related intracranial arterial occlusion, whether angioplasty and/or stenting after initial mechanical thrombectomy improves outcome, remains unknown. Expert consensus statement suggested EVT (angioplasty and/or stenting) may be used as a rescue therapy after unsuccessful mechanical thrombectomy in patients with an acute ischemic stroke suspected to be caused by underlying ICAD.

According to recent systemic review, compared to BMT, EVT probably results in a higher rate of 30-day death or stroke (risk ratio (RR) 3.07, 95% confidence interval (CI) 1.80 to 5.24), 30-day ipsilateral stroke (RR 3.54, 95% CI 1.98 to 6.33), 30-day ischemic stroke

(RR 2.52, 95% CI 1.37 to 4.62), and 30-day hemorrhagic stroke (RR 15.53, 95% CI 2.10 to 115.16). EVT was also likely associated with a worse outcome in one-year death or stroke (RR 1.69, 95% CI 1.21 to 2.36), one-year ipsilateral stroke (RR 2.28, 95% CI 1.52 to 3.42), one-year ischemic stroke (RR 2.07, 95% CI 1.37 to 3.13), and one-year hemorrhagic stroke (RR 10.13, 95% CI 1.31 to 78.51). There were no significant differences between EVT and BMT in 30-day TIA, 30-day death, one-year TIA, and one-year death. No data on restenosis and health-related quality of life for meta-analysis were available from the included trials.

There is not enough evidence as to provide any specific recommendation in ICAD patients, and further RCTs are needed to shed light on the utility of this promising therapy.

Intracranial stenting: A new hope

Byung Hyun Baek

Chonnam National University Hospital, Korea

Intracranial stenosis is a common vascular disease in stroke patients and accounts for 30% to 50% of ischemic stroke in Asians. Patients with intracranial atherosclerotic stenosis (ICAS) were at particularly high risk of recurrent stroke, prompting the development of percutaneous transluminal angioplasty and stenting (PTAS). However, the Stenting vs Aggressive Medical Management for Preventing Recurrent Stroke in Intracranial Stenosis (SAMMPRIS) and the Vitesse Intracranial Stent Study for Ischemic Stroke Therapy (VISSIT) trials showed no benefit of stenting compared with medical therapy.

The SAMMPRIS and VISSIT studies found that endovascular therapy was more suitable for patients with drug-refractory, non-perforating arterial cerebral infarction, and avoiding intervention in the acute phase (≥3 weeks) of ischemic stroke may reduce perioperative complications.

The results of the follow-up Wingspan Stent System Post Market Surveillance (WEAVE) trail further showed that the use of stents for intracranial stenosis under the Food and Drug Administration (FDA) approved indications has a low perioperative stroke and mortality (2.6%). The Wingspan One-year Vascular Events and Neurologic Outcomes (WOVEN) trail, which analyzed angiography, clinical events and neurological outcomes at 1 year after Wingspan stenting, showed that combined 1-year stroke and mortality (8.5%) were lower than those in the active medical therapy arm alone (12.2%) in the SAMMPRIS trial.

Recently, the results of the multicenter, randomized controlled clinical trial (CASSISS) showed that for patients with symptomatic, severe ICAS, stent plus medical therapy was equivalent to medical therapy alone in preventing stroke or death. The findings do not support the additional of PTAS to medical therapy for the treatment of patients with symptomatic intracranial atherosclerotic stenosis.

Issues remain despite short of expectations of PTAS. A recent study conducted in China, comparing drug-eluting stent and bare-metal stent, drug-eluting stents reduced the risks of in-stent stenosis and ischemic stroke recurrence in patients with symptomatic high-grade ICAS. Further examination of safety and efficacy of other endovascular treatment methods (angioplasty alone or other self-expandable stents that are off-label used) is warranted. Meanwhile, we await newer insights from ongoing new trials (NCT02689037, NCT02802072).

In conclusion, more efforts should be needed to find proper patient selection for PTAS and reduce postoperative complications.

STA-MCA bypass surgery: Resurrection from ashes

Si Un Lee

Seoul National University Bundang Hospital, Korea

Background: Treatment of cerebral infarction has been rapidly increasing in recent decades. Currently, intra-arterial thrombectomy (IAT) is the prescribed treatment for patients with large vessel occlusion cerebral infarction within 24 h after symptom onset. In contrast, extracranial-to-intracranial (EC-IC) bypass for IAT-ineligible patients has not been extensively utilized as it did not demonstrate any benefit over medical treatment in two randomized controlled trials, the EC-IC Bypass Trial (EIBT) and the Carotid Occlusion Surgery Study (COSS). Nevertheless, despite recent rapid technological and instrumental advances, IAT still presents a relatively high failure probability and a contraindication of approximately 10%–20% of all cases. Currently, in these cases, based on evidence-based medicine, the only potential treatment involves medical therapy including induced hypertension treatment and dual antiplatelet therapy. However, EC-IC bypass (EIB) has proven effective in a large number of patients. However, the efficacy of EIB remains insufficiently studied, lacking both well-defined indications and imaging-based validation.

Methods: In this study, urgent EIB and elective EIB were separately performed in patients with large vessel occlusion (LVO) in the acute and chronic phases of ischemia. The effectiveness of EIB was analyzed in each group, with the intention of establishing radiological evidence using RAPID software.

Results: Analysis of stroke rates in patients with symptomatic LVO revealed rates of 2.3% and 4.7% for the urgent EIB and elective EIB groups, respectively. Notably, major complications were absent during the study period. The analysis of perfusion using RAPID software demonstrated consistent and significant increases in perfusion for both groups, notably pre-surgery, post-surgery, and at the 6-month follow-up.

Conclusion: Urgent and elective EIB interventions in symptomatic LVO patients, conducted during acute and chronic phases, respectively, effectively augmented perfusion and exhibited a reduced incidence of stroke.

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Luncheon Symposium 5. Daewoong Bio [ENG]

CHAIRS   Dae-Il Chang (Kyung Hee University Hospital, Korea)

                Yun-Hee Kim (Sungkyunkwan University School of Medicine, Korea)

The role of cerebrolysin in the treatment of ischemic stroke

Chi Kyung Kim

Korea University Guro Hospital, Korea

Poster Session 1 [ENG]

CHAIRS   Jinkwon Kim (Yongin Severance Hospital, Korea)

Bang-Hoon Cho (Korea University Anam Hospital, Korea)

Bum Joon Kim (Asan Medical Center, Korea)

Seung-Jae Lee (Soonchunhyang University Bucheon Hospital, Korea)

Chi Kyung Kim (Korea University Guro Hospital, Korea)

Joonsang Yoo (Yongin Severance Hospital, Korea)

Ho Geol Woo (Kyung Hee University Hospital, Korea)

Mi Sun Oh (Hallym University Sacred Heart Hospital, Korea)

Factors predicting hospital-to-hospital transfer delay for patients with acute ischemic stroke

Min Kim[1], Hee-Kwon Park[2], Jae-Kwan Cha[3], Jin Soo Lee[1]

[1]Neurology, Ajou University School Of Medicine, Suwon, Korea, Republic of
[2]Neurology, Inha University School Of Medicine, Incheon, Korea, Republic of
[3]Neurology, Donga University School Of Medicine, Busan, Korea, Republic of

Purpose

An early hospital visit is closely associated with improved outcomes for patients with acute ischemic stroke. Swift arrival and appropriate treatment could result in a more favorable prognosis. Many stroke patients first visit at a primary stroke center and may later be transferred to a hospital offering specialized stroke care, such as a thrombectomy-capable center or a comprehensive stroke center, depending on their therapeutic guidelines. Our study purpose was to investigate the factors influencing hospital-to-hospital transfer time.

Methods

We included patients who presented to three thrombectomy-capable centers or a comprehensive stroke-equivalent centers; Dong-A University Hospital, Inha University Hospital, and Ajou University Hospital, within 12 hours of symptom onset between 2018 January and 2022 December. Patients who were transferred from primary visit hospital to the above three centers were only included. Patients with an mRS score of 3 or higher before the onset of symptoms were excluded. A total of 177 patients were enrolled in the study. As it is challenging to ascertain the precise time of a patient's hospital-visiting or transfer time to first hospital in the current retrospective study, we utilized the time of the initial imaging time conducted in the first hospital visit. To determine the duration of hospital transfer (hospital transfer time), we measured the time it took for patients to arrive at the thrombectomy-capable center or comprehensive stroke center from the start of brain imaging at the first-visit hospital. Median time of the hospital transfer time was 144 minutes; and early transfer was defined as the time ≤144 minutes whereas delayed transfer as the time >144 minutes.

Results

There were 89 patients in the early transfer group and 88 in the delayed transfer group. In each group, there was no statistically significant difference in the time from symptom onset to the first imaging at the first visit hospital (138.53 ± 114.85 min vs. 128.28 ± 97.84 min, p=0.5237). Based on a portal internet site map (NAVER), there was a significant difference in the distance between each hospital (26.76 ± 28.92 km vs. 77.13 ± 77 km, p<0.001). As defined, hospital transfer time was significantly longer in the delayed transfer group (96.9 ± 30.96 min vs. 248.95 ± 123.34 min, p<0.001). In terms of imaging protocols, cases where both CT and MR were performed at the first visit hospital were significantly frequent in the delayed transfer group (34.8% vs. 64.77% in case with both CT and MR, p<0.001). In a logistic regression model, distance between transfer hospital (odds ratio, 1.02, 95% confidence interval, 1.01–1.03; p<0.001) and both CT and MRI taken at the first-visit hospital (odds ratio 3.54, 95% confidence interval, 1.75–7.15; p=0.0004) were independent predictor for delayed transfer.

Conclusions

When both CT and MR are performed in the first-visit hospital and the distance between hospitals is longer, the transfer time to the reperfusion therapy-capable stroke centers can be prolonged.

Mortality predictors based on blood volume, Glasgow coma scale and neutrophil lymphocyte ratio in intracerebral hemorrhagic stroke

Neysa Azalia Efrimaisa[1]

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Purpose

Stroke is the highest cause of death in Indonesia after cancer and heart disease. Hemorrhagic strokes often cause neurological symptoms due to space-occupying effects or increased intracranial pressure and an inflammatory response from bleeding which causes the mortality rate in hemorrhagic strokes to be very high, complications and long-term disability, requiring palliative therapy. This study aims to determine the volume of bleeding, Glasgow Coma Scale (GCS) and neutrophil lymphocyte ratio (NLR) as mortality predictors and to model the distribution factor components that will be used in compiling a predictor score for intracerebral hemorrhagic mortality within 14 days of hospitalization.

Methods

Observational analytic study using a prospective cohort research design at dr. Zainoel Abidin Regional General Hospital, Banda Aceh, Indonesia in December 2022-April 2023. Data analysis was carried out using multivariate tests and logistic regression.

Results

Of the 200 study samples, bleeding volume (OR 7.3), GCS (OR 26.7) and NLR (OR 2.5) were found to be predictors of death in intracerebral hemorrhagic stroke patients with p = 0.000. Modeling of bleeding volume, GCS and NLR has a total score of 0 to 7. Where each score has a risk of mortality sequentially from the lowest score which is 0.4%, 10%, 23%, 44%, 53%, 74%, 89% and 95% in intracerebral hemorrhagic stroke patients within 14 days of hospitalization.

Conclusions

Expansion of the hematoma after ICH is associated with a poor outcome, apart from the space pressure and bleeding sites which causes a worse level of consciousness, also because of an inverse relationship with neutrophils. Bleeding volume, GCS and NLR can be predictors of mortality in intracerebral hemorrhagic stroke patients within 14 days of hospitalization.

Acknowledgement

The author declares that this paper is purely the result of research work and is not the result of plagiarism and is original from the author's own ideas.

INTRACEREBRAL HEMORRHAGIC STROKE

Hematoma Expansion

Disorders of Blood Flow

Increased intracranial pressure

BBB damage

Bleeding Volume
> 30mL

Brain Edema

Neurochemical Injuries

GCS
< 9

NLR
> 8,4

↓ATP
↑Lactic acid

Necrosis and cytotoxicity

Inflammation

Free Radicals

Excitocity

MORTALITY PREDICTORS

Evolocumab, PCSK9 inhibitor, in acute ischemic stroke patient undergoing mechanical thrombectomy: Early outcomes and safety.

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Purpose

Lipid-lowering therapies, mainly statins, are mainstays in reducing recurrence after acute ischemic stroke (AIS). Evolocumab, a Proprotein convertase subtilisin-kexin type 9 (PCSK9) inhibitor, is a promising lipid-lowering agent known to decrease LDL cholesterol and mitigate vascular events alongside statins. However, its effects on the early functional outcomes post-mechanical thrombectomy (MT) remain unclear. This study aimed to assess the efficacy and safety of off-label early use of PCSK9 inhibitors in AIS patients undergoing MT.

Methods

We retrospectively analyzed patients who had MT at a regional stroke center from January 2018 to April 2023. Our primary outcome was discharge functional outcomes (NIHSS and mRS). Secondary outcomes included early neurologic deterioration (END), symptomatic intracerebral hemorrhage (sICH), 3-month functional outcomes, 3-month recurrence rate, and lipid profiles.

Results

Of 263 patients (mean age 69.1±11.9, men 42.6%), 42 were administered Evolocumab periprocedurally. While baseline characteristics were mostly similar between the two groups, the Evolocumab group demonstrated improved discharge outcomes, with a lower mean NIHSS (8.8±6.8 vs. 12.4±9.8, p=0.02) and a higher percentage of patients with discharge mRS ≤ 3 (52.4% vs. 36.2%, p=0.049). The 3-month follow-up show a non-significant trend towards an improved outcome in the Evolocumab group. Multivariable analysis indicated that Evolocumab had a potential but subtle effect on favorable discharge outcomes (aOR 0.064). Notably, Evolocuamb users exhibited fewer instances of END and sICH, although they did not reach statistical significance. Additionally, the Evolocumab group revealed potential benefits in total and LDL cholesterol reduction over time.

Conclusions

Early use of Evolocumab in AIS patients undergoing MT appeared to be safe and associated with better short-term functional outcomes and notable LDL reductions. The potential benefit of the PCSK9 inhibitor shown here warrants further prospective studies with a larger sample size.

Comparison of Discharge mRS Proportions between Evolocumab user and non-user

Comparison of 3-month mRS Proportions between Evolocumab user and non-user

The effectiveness and safety of bridging reperfusion therapy in posterior circulation stroke compared to anterior circulation stroke.

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Purpose

Combination of intravenous fibrinolytic therapy and endovascular thrombectomy (bridging therapy, BT) is recommended in the emergent management of acute ischemic stroke. However, in certain situation such as posterior circulation stroke (PCS), there are still concerns about the risk of bleeding complication. This study aims to compare the effectiveness and safety of BT in anterior circulation stroke (ACS) and PCS.

Methods

A total of 3067 patients treated with BT between January 2011 to November 2021 in multicenter stroke registry database were enrolled in this study. Clinical characteristics, time to treatment, stroke severity and subtype were compared between ACS and PCS. We prospectively captured early neurological deterioration (END) including stroke progression and symptomatic

intracranial hemorrhage during hospitalization. Functional outcome and mortality were compared at discharge, 3 months and 1 year.

Results

The patients received BT included 2817 ACS (85.3%) and 419 PCS (13.7%). The patients with PCS had more male, lower proportion of cardioembolism, higher blood pressure and increased C-reactive protein (CRP) than those with ACS. The median of National Institute of Stroke Scale was slightly higher in PCS than in ACS (15 VS 14, P=0.014). Door-to-needle time (38 min VS 33 min, P=0.01) and door-to-puncture time (104 min VS 100 min, P=0.02) were delayed in PCS than ACS. END occurred comparably 21.0% in ACS and 21.3% in PCS. However, stroke progression was higher in PCS (16.9% VS 12.0%, P<0.001) while symptomatic intracranial hemorrhage was lower in PSC (2.2% VS 5.0%, P=0.004). In-hospital mortality was higher in PCS (9.8% VS 6.0%, P=0.001) which may be mediated by increased CRP. The proportion of functional independence (modified Rankin Scale 0-2) was not different in ACS and PCS: 38.0% VS 33.4% at discharge, 47.2% VS 43.3% at 3 months, and 48.5% VS 45.7% at 1 year.

Conclusions

Although BT in PCS was provided in patients with severe stroke and later time compared to that in ACS, it was associated with more stroke progression but lesser symptomatic intracranial hemorrhage. These results suggest that intravenous thrombolysis should be actively considered before endovascular thrombectomy in PCS.

Case series of IV tirofiban infusion after IV thrombolysis and endovascular treatment in acute ischemic stroke with large artery occlusion: Single center experience

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Purpose

The safety of tirofiban after IV-rtPA remain unclear. Some reports showed intra-arterial tirofiban infusion after IV-rtPA would be safe and feasible as a rescue therapy. Carotid artery stenting(CAS) was often needed as a rescue therapy of endovascular treatment(EVT). However, after using IV-rtPA, it was difficult to use an antithrombotic agent within 24 hours, so it was hesitant to perform CAS even if CAS was necessary as a rescue therapy.

Methods

We are presenting 4 cases with IV tirofiban infusion after rescue CAS as a EVT after IV-rtPA infusion in patients with acute ischemic stroke.

Results

All 4 cases were successfully performed CAS during EVT. All cases were achieved good recanalization over TICI 2b. After EVT, IV tirofiban was started at an average of 3 hours after IV-rtPA use and continued for 24hours. There were no hemorrhagic complications associated with use of IV tirofiban after IV-rtPA. In-stent thrombosis and stent occlusion were not showed CT angiography at 7 day later.

Conclusions

If EVT after IV-rtPA requires CAS, the IV tirofiban infusion would be safe and help prevent in-stent thrombosis and occlusion.

Determination of biological potential of pteryxin on pulmonary arteries with their antiplatelet aggregation mechanism with their molecular mechanism

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Purpose

Pteryxin is a coumarin derivative occurring in Apiaceae plants, including the dried roots of Peucedanum praeruptorum as well as from Pteryxia terebinthina. Pteryxin exhibits neuroprotective, anti-obese and antioxidant effects in medicine. The half-life of pteryxin has been shown to be 1.463 h, and without long-term accumulation in tissues. Pteryxin has vasorelaxant, and antiobesity potential in medicine.

Methods

Biological potential of pteryxin in isolated tracheas and pulmonary arteries has been investigated in the scientific research work. Present work investigated the biological importance of pteryxin in isolated tracheas and pulmonary arteries through scientific data analysis of different research work. Further, biological importance of pteryxin for their antiplatelet aggregation activity has also been investigated in the present work through scientific data analysis of different research work.

Results

Biological effects of pteryxin in isolated rabbit tracheas and pulmonary arteries has been investigated in the scientific research work and found that pteryxin produced significant relaxant effects in tracheal preparations constricted with acetylcholine. The relaxant response to pteryxin was significantly more potent than that in preparations constricted with acetylcholine. Pteryxin could be relaxing the smooth muscle of tracheas and pulmonary arteries. In another scientific research work, pteryxin isolated from the root of Formosan Peucedanum japonicum showed strong antiplatelet aggregation activity in vitro.

Conclusions

Present work signified the therapeutic potential of pteryxin on pulmonary arteries with their Antiplatelet aggregation potential in medicine.

Acknowledgement

Early recurrent cerebral infarction and patent foramen ovale

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Purpose

Patent foramen ovale (PFO) can play a role in cerebral infarction through paradoxical embolism in some patients and PFO closure with antiplatelet therapy is superior to antithrombotic therapy alone for prevention of recurrent cerebral infarction. Patients with a PFO related cerebral infarction were reported to have a low risk of early recurrent cerebral infarction.

Results

A 48-year-old man with hypertension and dyslipidemia was admitted due to vertigo and left limb ataxia 7 hours ago. Initial brain MRI showed acute cerebral infarction in the left superior cerebellar artery territory and MR angiography was unremarkable. Transesophageal echocardiography using contrast revealed the PFO with a grade 3 shunt. He received dual antiplatelet therapy. On the fourth day of hospitalization, he had aphasia and right arm weakness and the second MRI showed recurrent infarction in the left middle cerebral artery territory. The results of Holter monitor tests and blood laboratory tests were unremarkable. On the tenth day of hospitalization, he was treated with the PFO closure with the Amplatzer device. Six months after stroke onset, his neurological symptoms improved and the modified Rankin scale score was 2.

Conclusions

We report a patient who had early recurrent cerebral infarction and PFO. Early PFO closure might be a necessary intervention for certain patients.

Acute cholecystitis during hospitalization for acute ischemic stroke

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Purpose

Acute cholecystitis (AC) is very rare in patients with acute ischemic stroke but can be life-threatening if not treated promptly. The aim of our study was investigate clinical patterns of the patients diagnosed with AC during hospitalization for acute ischemic stroke.

Methods

The patients diagnosed with AC during hospitalization for acute ischemic stroke, admitted for a 42-month period in one stroke center, were enrolled. Clinical characteristics and outcomes were analyzed.

Results

Among 4185 patients with acute ischemic stroke, 11 patients (0.3%) were diagnosed with AC during hospitalization. The mean age of the patients was 76.7 years. All patients had multiple comorbidities. The stroke subtype was large artery atherosclerosis in 4 patients, cardioembolism in 4 patients, more than 2 causes in 3 patients. The median value of the initial National Institutes of Health Stroke Scale score was 10 (range 1-23). The median total fasting time was 4 days. The symptom of AC was fever in 11 patients (100%) and pain in 7 patients (64%). Six patients (55%) were in shock. Eight patients (72%) were diagnosed with acalcuous cholecystitis. The median time from stroke onset to AC diagnosis was 11 days. All patients received antibiotics therapy and percutaneous transhepatic gall bladder drainage procedure and the symptoms of AC improved. The median mRS score at 3 months was 5 (range 3-6).

Conclusions

The patients, diagnosed with AC during hospitalization for acute ischemic stroke, tend to have advanced age, multiple comorbidities, severe stroke, acalculous cholecystitis, and poor clinical outcome.

Influence of cerebral microbleeds on hemorrhagic transformation after successful recanalization through endovascular treatment in patients with acute ischemic stroke arising from large artery occlusion

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Purpose

This prospective cohort study aimed to investigate the relationship between the presence and burden of cerebral microbleeds (CMBs) and the occurrence of hemorrhagic transformation (HT) following successful recanalization by endovascular treatment (EVT) in patients diagnosed with acute ischemic stroke resulting from large vessel occlusion (LVO).

Methods

A total of 132 patients with acute ischemic stroke, who underwent successful recanalization by EVT for emergent LVO, were enrolled in this study. CMBs and HT were assessed using T2*-MRI with a validated scale by an experienced neuroradiologist. The primary outcome measure was the occurrence of HT following EVT. We examined the association between the presence and burden of CMBs and HT. The secondary outcome was defined as a poor functional outcome, with modified Rankin Scale score ranging from 3 to 6, assessed at 3 months after stroke onset.

Results

Among the 132 patients (mean age 66.9±14.0 years, 68.9% male), 24 (18.2%) exhibited CMBs, and 59 (44.7%) developed HT. A total of 47 patients (49.2%) experienced a poor functional outcome, and the mortality rate was 11.3%. Statistical analysis revealed a significant association between the presence of CMBs and the occurrence of HT after EVT in patients who achieved successful recanalization (77.8% vs. 38.9%; P=0.002). Moreover, the presence of CMBs was significantly correlated with a higher likelihood of a poor functional outcome (77.8% vs. 42.9%; P=0.007). However, there was no observed association between the presence of CMBs and mortality (16.7% vs. 8.25%; P=0.426).

Conclusions

This study demonstrates that the presence of CMBs is significantly associated with the occurrence of HT and a poor functional outcome following EVT in patients who have achieved successful recanalization. However, the presence of CMBs does not appear to impact mortality rates in these patients.

Association between substantia nigra degeneration and functional outcome in patients with basal ganglia infarction

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Purpose

Cerebral infarction leads to subsequent and delayed neuronal degeneration. Prior research has identified that as many as 43.5% of individuals with basal ganglia infarction undergo secondary neuronal degeneration within the substantia nigra (SN). Nonetheless, the clinical implications of SN degeneration remain unclear.

Methods

The study included 350 patients with acute ischemic stroke in the basal ganglia, who underwent follow-up diffusion-weighted imaging between 4 and 30 days after symptom onset. SN degeneration was identified as a hyperintensity lesion detected in the SN on diffusion-weighted imaging. The study defined poor functional outcome as a Medical Research Council score of 3-6 at 90 days after discharge and assessed its relationship with the presence of SN degeneration.

Results

Among the 350 patients diagnosed with basal ganglia infarction (with a median age of 74.0 years, and 53.7% being male), SN degeneration was identified in 115 paients. The proportion of poor outcome was 80% (92/115 patients) in patients with SN degeneration, which was significantly higher compared to patients without SN degeneration (57%, 135/235 patients) (p<0.001). SN degeneration was notably more prevalent among patients with poor functional outcome, in contrast to those with good outcome (p<0.001). The multivariable logistic regression analysis demonstrated a significant relationship between SN degeneration and the poor functional outcome, with an odds ratio of 2.52 (95% confidence interval 1.11–5.72, p=0.026).

Conclusions

The study found that SN degeneration in patients with basal ganglia infarction was associated with poor functional outcome at 3 months after discharge, suggesting its potential role as both a predictor of poor clinical outcomes and a therapeutic target.

Therapeutic normothermia for malignant ischemic stroke : A case report

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Purpose

TTM in ischemic stroke does not contribute to the improvement of stroke survival rate and functional recovery, but is known to be effective in reducing cerebral edema and intracranial pressure. Also, in the treatment of ischemic stroke, studies on TTM applying hypothermia have been actively conducted, but there are not many studies or cases on TTM applying therapeutic normothermia maintaining at close to 36℃.

Methods

An 82-year-old female patient with left hemiparesis Gr I/IV- arrived at the emergency room 50 minutes after symptom onset. Diffusion-weighted imaging (DWI) showed the small lesion, while the much larger area in the time to peak(TTP) map in right Middle Cerebral Artery(MCA) territory. TOF MRA and conventional angiography showed right distal internal carotid artery (dICA) occlusion. The dICA occlusion in this patient can be classified as L-type occlusion.

Intravenous – tissue Plasminogen Activator(IV- tPA) was admini-stered and then, endovascular thrombectomy(EVT) was performed. Conventional angiography showed Thrombolysis in Cerebral Infarction (TICI) grade 3 after EVT. On hospital day 2, the right MCA lesion showed more extension and midline shifting of 9.8 mm was also observed. As a non-surgical treatment, TTM and hyperosmolar therapy were performed. TTM was performed for 10 days, with the aim of maintaining a target body temperature of 36℃.

Results

The distance from the midline to the pineal body was measured by using brain CT, 10th day (2.1mm) findings were observed. At the end of the rewarming period, there was no obvious evidence of infection.

Conclusions

In this case, therapeutic normothermia was performed for acute malignant ischemic stroke, and successfully controlled cerebral edema and intracranial pressure elevation. However, unlike therapeutic hypothermia, there are not many cases of therapeutic normothermia research yet, and there is no clear treatment period or optimal temperature for therapeutic normothermia. In addition, there is controversy over how to establish clear temperature criteria for between therapeutic hypothermia and normothermia, and there are no RCT studies that have revealed which therapy is more effective in ischemic stroke. We suggest that Therapeutic normothermia is also an effective treatment method for ischemic stroke.
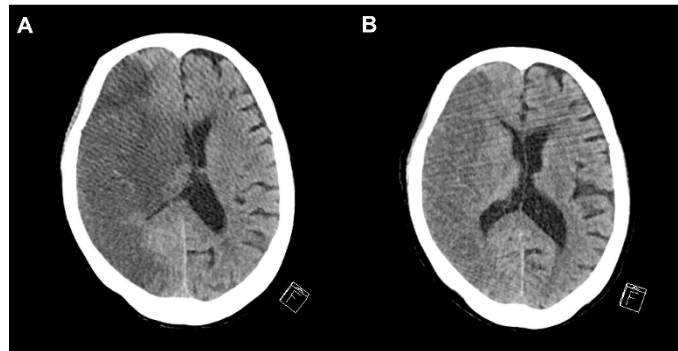
Fig 4. *Distance from the midline to the pineal body.* ***A****: CT image in 2nd day after stroke onset (9.8mm)* ***B****: CT image in 10th day after stroke onset (2.1mm)*

Prognostic factors associated with functional outcome after endovascular therapy in acute ischemic stroke with large infarction core

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Purpose

Endovascular therapy (EVT) has become the treatment of choice for acute ischemic stroke with large vessel occlusion. EVT had been proven effective for patients with expanded time from stroke onset. Also, recent trials showed that patients with large cerebral infarction had better functional outcome with EVT than with medical care alone. This study was aimed at identifying prognostic factors affecting functional outcome of patients with large core anterior circulation territory infarction after EVT.

Methods

127 patients of acute stroke with large ischemic core treated with EVT were retrospectively included from Chonnam National University Hospital (CNUH) registry. We divided patients into two groups based on modified Rankin scale (mRS) at 3 months. A multivariate logistic regression analysis was used to identify clinical and imaging variables affecting functional outcome.

Results

79 men (62%) and 48 (38%) women were included, with a mean age of 72 years (range 37-95) and a mean initial National Institutes of Health Stroke Scale (NIHSS) score of 14 (range 5-24). The recanalization rate was 87.40%.

The group with good functional outcome (mRS 0-2) consists of 39 patients (31%) and the other group with poor functional outcome (mRS > 2) has 88 patients (69%). In univariate analysis, good functional outcome group was younger (P < 0.001) and had better collateral grade before EVT (P 0.007), fewer atrial fibrillation (P 0.02), fewer post-procedure hemorrhagic transformation (P 0.002), lower initial NIHSS score (P < 0.001), and lower initial SBP (P 0.024) compared to poor functional outcome group.

Factors associated with good functional outcome (mRS 0-2) were initial NIHSS score (OR 0.9 [95% CI 0.77-0.98], P 0.028) and absence of post-procedure hemorrhagic transformation (OR 0.4 [95% CI 0.16-0.96], P 0.041) in multivariate logistic regression analysis.

Conclusions

Low initial NIHSS score and absence of post-procedure hemorrhagic transformation are favorable prognostic factors of EVT in acute stroke with large ischemic core.

Predicting functional outcomes in acute ischemic stroke: An application of the machine learning model and SHAP interpretation

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Purpose

Predicting the prognosis of acute ischemic stroke (AIS) is crucial in a clinical setting for establishing suitable treatment plans. This study aimed to develop and validate a machine learning (ML) model that predicts the functional outcome of AIS patients and provides interpretable insights.

Methods

We included AIS patients from a multicenter stroke registry in this prognostic study. ML-based methods were utilized to predict 3-month functional outcomes, which were categorized as either favorable [modified Rankin Scale (mRS) ≤ 2] or unfavorable (mRS ≥ 3). The SHapley Additive exPlanations (SHAP) method was employed to identify significant features and interpret their contributions to the predictions of the model.

Results

The dataset comprised a derivation set of 3,687 patients and two external validation sets totaling 250 and 110 patients each. Among them, the number of unfavorable outcomes was 1,123 (30.4%) in the derivation set, and 93 (37.2%) and 32 (29.1%) in external sets A and B, respectively. Among the ML models used, the eXtreme Gradient Boosting model demonstrated the best performance. It achieved an area under the receiver operating characteristic curve (AUC-ROC) of 0.790 (95% CI: 0.775–0.806) on the internal test set and 0.791 (95% CI: 0.733–0.848) and 0.873 (95% CI: 0.798–0.948) on the two external test sets, respectively. The key features for predicting functional outcomes were the initial NIHSS, early neurologic deterioration (END), age, and white blood cell count. The END displayed noticeable interactions with several other features.

Conclusions

ML algorithms demonstrated proficient prediction for the 3-month functional outcome in AIS patients. With the aid of the SHAP method, we can attain an in-depth understanding of how critical features contribute to model predictions and how changes in these features influence such predictions

Extracranial ICA dissecting aneurysm as a source of embolic stroke: A case report

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Purpose

Extracranial internal carotid artery (ICA) dissection can be the cause of stroke through thromboembolic or hemodynamic mechanisms. This report details a case of embolic stroke resulting from a large thrombosed extracranial ICA dissecting aneurysm, which was managed through mechanical thrombectomy and long-term dual-antiplatelet therapy.

Methods

A 62-year-old male presented to the emergency department with right-sided weakness and language disturbance. He was last known to be well at 23:00 the previous night and was found unresponsive by his family at 08:40 the next morning. Initial neurologic evaluation revealed an NIHSS score of 19, comprised of drowsiness, global aphasia, dysarthria, and right-sided weakness. Past medical history included hypertension but no evidence of preceding neck trauma.

Contrast-enhanced computed tomography angiography (CTA) showed a proximal occlusion of the left middle cerebral artery (MCA). In contrast to the 9 mm enhanced portion of the left cervical ICA, the wall's diameter was dilated to 2.5 cm with calcification, suggesting a chronic dissecting aneurysm with thrombosis. Subsequent diffusion-weighted imaging (DWI) on MRI revealed an acute infarct in the left MCA territory. Mechanical thrombectomy was performed based on clinical-diffusion mismatch, perfusion-diffusion mismatch, and onset to puncture time. During the mechanical thrombectomy, transfemoral angiography showed a filling defect in the left cervical ICA, consistent with the CTA findings, and an M2 occlusion in the left MCA. The M2 occlusion was fully recanalized after two passes with a stent-retriever.

Post-thrombectomy, the patient's NIHSS score improved to 13, primarily due to an improvement in right-sided motor weakness. Comprehensive cardiac evaluations, including 24-hour continuous cardiac monitoring, transthoracic echocardiography, transesophageal echocardiography, and bubble study with transcranial Doppler ultrasound, did not identify any alternative embolic sources. The patient was subsequently discharged to a rehabilitation center with a regimen of dual antiplatelet therapy and high-dose statins.

Results

Six months later, the patient could walk unassisted but still experienced moderate to severe aphasia. A follow-up MRI showed that the enhanced portion inside the dissecting aneurysm had increased from 9 mm to 18 mm, probably due to the recanalization of the previously thrombosed segment, without further dilation of the total diameter of the aneurysm.

Conclusions

Large thrombosed extracranial ICA dissecting aneurysms can be a source of embolic strokes. When indicated, mechanical thrombectomy could be delivered safely and effectively as an option for acute treatment. Long-term antiplatelet therapy would serve as an effective strategy for secondary prevention.

Brain frailty and outcomes of acute minor ischemic stroke with large-vessel occlusion

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Purpose

The influence of imaging features of brain frailty on outcomes were investigated in acute ischemic stroke patients with minor symptoms and large- vessel occlusion (LVO).

Methods

Methods: This was a retrospective analysis of a prospective, multicenter, nationwide registry of consecutive patients with acute (within 24 h) minor (NIHSS score = 0–5) ischemic stroke with anterior circulation LVO (acute minor LVO). Brain frailty was stratified according to the presence of an advanced white-matter hyperintensity (WMH) (Fazekas grade 2 or -3), silent/old brain infarct, or cerebral microbleeds. The primary outcome was a composite of stroke, myocardial infarction, and all-cause mortality within 1 year.

Results

Results: In total, 1067 patients (age =: 67.2±13.1 years [mean±SD],61.3% males) were analyzed. The proportions of patients according to the numbers of brain frailty burdens were as follows: no burden in 49.2%, one burden in 30.0%, two burdens in 17.3%, and three burdens in 3.5%. In the Cox proportional- hazards analysis, the presence of more brain frailty burdens was associated with a higher risk of 1-year primary outcomes, but after adjusting for clinically relevant variables there were no significant associations between burdens of brain frailty and 1-year vascular outcomes. For individual components of brain frailty, an advanced WMH was independently associated with an increased risk of 1-year primary outcomes (adjusted hazard ratio [aHR] = 1.33, 95% confidence interval [CI] =1.03-1.71) and stroke (aHR = 1.32, 95% CI = 1.00–1.75).

Conclusions

Conclusion: The baseline imaging markers of brain frailty were common in acute minor ischemic stroke patients with LVO. An advanced WMH was the only frailty marker associated with an increased risk of vascular events. Further research is needed into the association between brain frailty and prognosis in patients with acute minor LVO.

Impact of intracranial atherosclerotic stenosis on functional outcomes following intensive versus conventional blood pressure management after revascularization in acute ischemic stroke due to large vessel occlusion

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Purpose

The optimal target for blood pressure (BP) control following successful reperfusion for acute ischemic stroke due to large vessel occlusion (LVO) remains unclear, particularly in relation to the presence of intracranial atherosclerotic stenosis (ICAS). We aimed to assess whether the presence of ICAS affects outcomes based on BP control during the 24 hours after successful reperfusion following endovascular thrombectomy (EVT).

Methods

We conducted a secondary analysis of the OPTIMAL-BP (Outcome in Patients Treated With Intraarterial Thrombectomy - optiMAL Blood Pressure Control) trial. The OPTIMAL-BP trial showed that intensive BP management was associated with worse functional outcomes than conventional BP management in patients with acute ischemic stroke who achieved successful reperfusion after EVT. Post-procedural cerebral vessel status was assessed using digital subtraction angiography. Patients who exhibited a residual stenosis of 50% or more, or required further interventions including angioplasty or stenting, were considered to have LVO associated with ICAS. Functional outcomes were assessed using the modified Rankin Scale (mRS) at 3 months and poor functional outcome was defined as mRS ≥3.

Results

Among the 302 included patients (mean age 73.0, 40.4% female, mean National Institutes of Health Stroke Scale score prior to EVT 12.7), 155 underwent intensive BP control while 147 received conventional BP control. Multivariable logistic regression indicated that ICAS was significantly associated with poor outcomes in the intensive BP control group (adjusted odds ratio [aOR] 2.89, 95% confidence intercval [CI] 1.13-7.39, p=0.027). However, this association was not significant in the conventional BP control group (aOR 1.67, 95% CI 0.68-4.09, p=0.262). Symptomatic intracranial hemorrhage was not found to be significantly associated with ICAS in either treatment group (Intensive group: aOR 0.44, 95% CI 0.09-2.12, p=0.304; Conventional group: aOR 0.65, 95% CI 0.11-3.93, p=0.641). Mortality rates at 3-months did not differ significantly based on ICAS presence in either treatment group (Intensive group: aOR 0.87, 95% CI 0.28-2.68, p=0.809; Conventional group: aOR 0.64, 95% CI 0.12-3.31, p=0.593).

Conclusions

When intensive BP management was employed in patients with successful reperfusion after EVT, the presence of ICAS was associated with poor functional outcomes. Therefore, careful consideration is essential for BP management following successful revascularization in patients with ICAS.

Masquerade of a stroke case for thrombolysis

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Purpose

To bring alertness of CT brain screening while doing thrombolysis call

Methods

A 45 year right handed woman, admitted to Emergency Department on Aug 2 2023 because of sudden onset right side weakness and numbness at 17:30, associated with right side headache. She also had one episode of nausea and vomiting of undigested food. There was no recent history of neck pain or head injury. Her past health was unremarkable.

Upon admission, the Glasgow coma scale was full, the right upper limb and lower limb was in MRC grade 4. NIHSS was 3 and iv tPA call was triggered. Systolic blood pressure was 110 mmHg. There was no absolute contraindication upon history checking, Howvever, Computerized tomography of brain showed suspicious hyperintense signal in cervicomedullary junction. (fig.) Urgent Computerized tomography of brain and neck vessels was performed and showed features suggestive of spinal arteriovenous malformation. There are more than one prominent arteries (anterior spinal artery and right vertebral artery) feeding into a tuft of intervening vessels which acts as nidus at right cervcomedulary junction

The thrombolysis was then withheld and patient was then transferred to neurosurgical unit

Results

This case illustrated a rare scenario of spinal arteriovenous malformation (AVM) mimicking posterior circulation ischemic stroke. The administration of intravenous thrombolysis will cause deleterious outcome, and it is considered to be an absolute contraindication for such therapy. Rather, if the AVM lesion is showing decompensated condition, urgent neurosurgical intervention should be contemplated.

Conclusions

Therefore, high level of suspicion and careful screening of Computerized tomographic (CT) images screening, to cervicomedulary level should be done in correct clinical context.
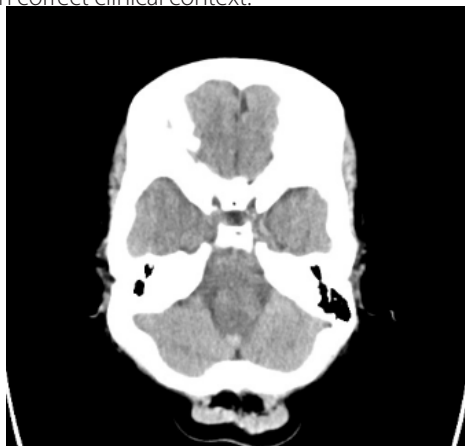
Two endovascular treatment cases with isolated posterior cerebral artery occlusion

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Purpose

The safety and efficacy of endovascular treatment (EVT) in patients with ischemic stroke due to isolated posterior cerebral artery (PCA) occlusion are controversial. A recent multicenter study reported that successful EVT was associated with early NIHSS improvement and a similar rate of functional independence, despite a higher rate of symptomatic ICH compared to medical treatment. We present two successful EVT cases with isolated PCA occlusion.

Methods

Case 1

A 71-year-old woman presented visual disturbance occurred 5 hours ago. She had a medication history of hypertension. Initial neurological medication revealed homonymous hemianopsia, sensory decrease, ataxia in left side, and asomatognosia with NIHSS score 8. Non-contrast brain CT was negative for hemorrhage. CT angiography revealed occlusion of P2 segment of right PCA(Figure 1-A). Rescue EVT was applied and successful recanalization was achieved. After EVT, patient presented improvement of neurological symptoms except for ataxia and sensory decrease in left side with NIHSS of 4. Follow-up brain MRI revealed ischemic lesions in right thalamus and medial temporal lobe with hemorrhagic transformation MRA confirmed the recovery of PCA flow(Figure 1-B). She was discharged with mRS 3 due to ataxia. The three months mRS score was 3.

Results

Case 2

A 68-year-old man presented hemianopsia and gait disturbance occurred 1.5 hours ago. He had a medication history of hyperlipidemia. Neurological examination revealed revealed homonymous hemianopsia, facial palsy in left side, left sided weakness (GII/GIII), tactile neglect and asoamatognosia with NIHSS of 11. There was no intracranial hemorrhage in the non-contrast brain CT. CT angiography revealed occlusion of P2 segment of right PCA(Figure 1-C). Immediate IV thrombolysis was applied followed by rescue endovascular treatment. After EVT, the NIHSS score was improved from 11 to 4 point, and hemianopsia completely resolved. Follow-up brain MRI revealed diffusion restriction in left thalamus and occipital lobe and MRA confirmed the recovery of PCA flow(Figure 1-D). She was discharged with mRS 3. The three months mRS score was 0.

Conclusions

We reported two cases of acute isolated PCA occlusion with significant neurological deficit successfully treated with rescue EVT. In the case of isolated PCA occlusion with high NIHSS score, rescue management such as endovascular treatment could be considerable. Multicenter and randomization trial is highly warranted.
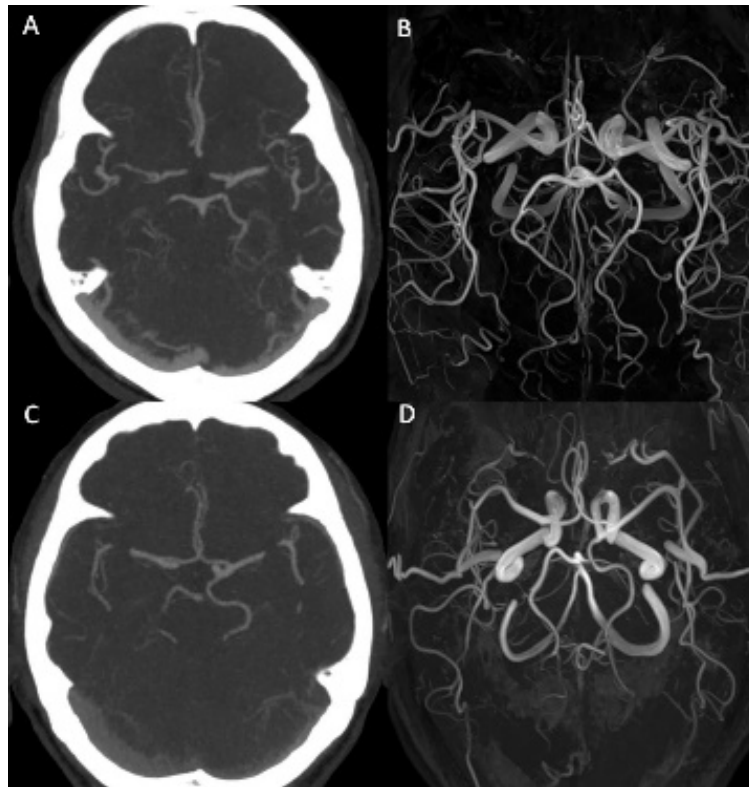
Bilateral vertebral arteries dissection after cervical chiropractic manipulation

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Purpose

Vertebral artery dissection is a rare cause of ischemic stroke in old age patient, but relatively common cause of ischemic stroke in young age. Minor trauma is often potentially cause vertebral artery dissection including blunt trauma.

Methods

Here we report rare case of bilateral vertebral arteries dissection cause by cervical chiropractic manipulation.

Results

A 26 years old men admitted to neurology because of abrupt onset dizziness. Previously he received chiropractic treatment for his cervical pain. Diffusion MRI showed acute multiple infarction on cerebellum, pons and thalamus. Abnormalities suggestive of dissection were detected in both vertebral arteries on brain CT angiography. There were no neurological deficit and symptoms improved after admission. Thus, medical treatment using aspirin and intravenous hydration was continued. Brain Vessel wall MRA was performed to confirm the dissection. There were long segmental submucosal hemorrhage and stenosis of V3 and V4 segment of right vertebral artery and V4 segment of left vertebral artery. After 3 months later, follow up MRA show relatively well preserved vascular lumen of both distal vertebral arteries.

Conclusions

Vertebral artery dissection is estimated that the cause of 25% of young age ischemic stroke. The majority of vertebral artery dissection occur in Segment V3~V4. The prognosis of vertebral artery dissection is relatively benign. Up to 80% of patient achieved a full recovery. However, in some cases, death can occur due to extensive brainstem infarction or subarachnoid hemorrhage. It is important to confirm vertebral artery dissection in patients with neck pain and dizziness who had precipitated minor trauma or chiropractic treatment history.

Factors associated with early neurologic deterioration in successfully recanalized patients treated with thrombectomy.

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Purpose

Early neurologic deterioration (END) in patients undergoing thrombectomy has been reported to be common with the incidence ranging 10–35%. The predictors of END in previous reports were age, high or low baseline NIHSS, recanalization failure, large atherosclerosis subtype, baseline higher glucose, systolic blood pressure, lower collateral grade, or lower Alberta Stroke Program Early CT Score (ASPECTS), etc. However, there are little data regarding predictors of END in successfully recanalized patients. Thus, our study aims to investigate the factors associated with END in patients successfully recanalized by thrombectomy.

Methods

We initially retrospectively recruited 295 patients with emergent large vessel occlusion treated with thrombectomy in Soonchunhyang University Bucheon Hospital between January 2012 and April 2023. Among them, 44 patients with posterior circulation stroke, 2 patients with cancer-related stroke, and 3 patients with incomplete data were excluded. From the remaining 246 patients, 70 patients with recanalization failure (cerebral infarction perfusion scale 0–2a) further excluded. Finally, we analyzed a total of 176 patients successfully recanalized by thrombectomy. END was defined as ≥4-point increase in NIHSS score in the first 72 hours after thrombectomy. Using the baseline CT angiographies (CTA), collateral status was dichotomized as poor (≤ 50% filling of the occluded territory) or good (> 50% filling). In addition, based on the post-thrombectomy CT performed within 24 hours after thrombectomy, contrast accumulation (CA) ASPECTS was counted. On the basis of the diffusion-weighted images performed 2–5 days after thrombectomy, ASPECTS was counted. Multivariate logistic regression analysis was performed to confirm the predictors associated with END. Variables with univariate $p < 0.2$ were included in the multivariate analysis. Odds ratios (ORs) and 95% confidence intervals (CIs) were obtained. Values of $p < 0.05$ were considered statistically significant.

Results

Among the 176 patients, 33 (18.8%) experienced END. In the univariate analysis, END was associated with no use of statin (p=0.040), number of passes (p<0.001), longer procedural time (p=0.019), the presence of CA (p<0.001). The number of passes positively correlated with procedural time (pearson correlation coefficient r=0.751, p<0.001), and negatively correlated with CA ASPECTS (r=-0.309, p<0.001). Multivariate logistic model demonstrated that number of passes ≥4 (OR 4.084, 95% CI 1.186–14.062) and postprocedural CA (OR 17.692, 95% CI 2.222–140.869) were independently associated with END.

Conclusions

Our data suggests that operation-related factors like number of passes or CA may determine the occurrence of END in successfully recanalized patients.

Endovascular thrombectomy in patients with acute ischemic stroke with multivessel occlusions : Case reports.

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Purpose

Acute ischemic stroke caused by multivessel occlusions is a rare but devastating disease. Whether multi-target mechanical thrombectomy for multivessel occlusions is beneficial remains unknown. We describe 2 cases of acute multivessel occlusion successfully treated with bilateral thrombectomy.

Methods

Case 1 : A 74-year-old man presented with right motor weakness for 10 hours. Brain magnetic resonance imaging and angiography revealed multiple embolic infarction and occlusion of right M1 and left M2. Case 2 : A 66-year-old man presented with right motor weakness for 1 hours. Head and neck computed tomography angiography (CTA) revealed occlusion of left M1. Cerebral angiography showed occlusion of the left M1 and left anterior cerebral artery.

Results

Our patients had been successfully recanalization (mTici grade 3) but mRS score was 4 at 90-day follow-up.

Conclusions

Multivessel occlusions are a challenging condition for endovascular treatment, and the optimal sequence has not yet been established: priority to the first symptomatic ischemic side, or priority to the largest penumbra area (based of CT scan perfusion study or MRI diffusion/FLAIR mismatch), or priority to the expected faster and easier-to-treat occlusion. Prospective studies would be needed to determine the best sequence for the endovascular treatment of multivessel occlusions.

Case 1   Case 2
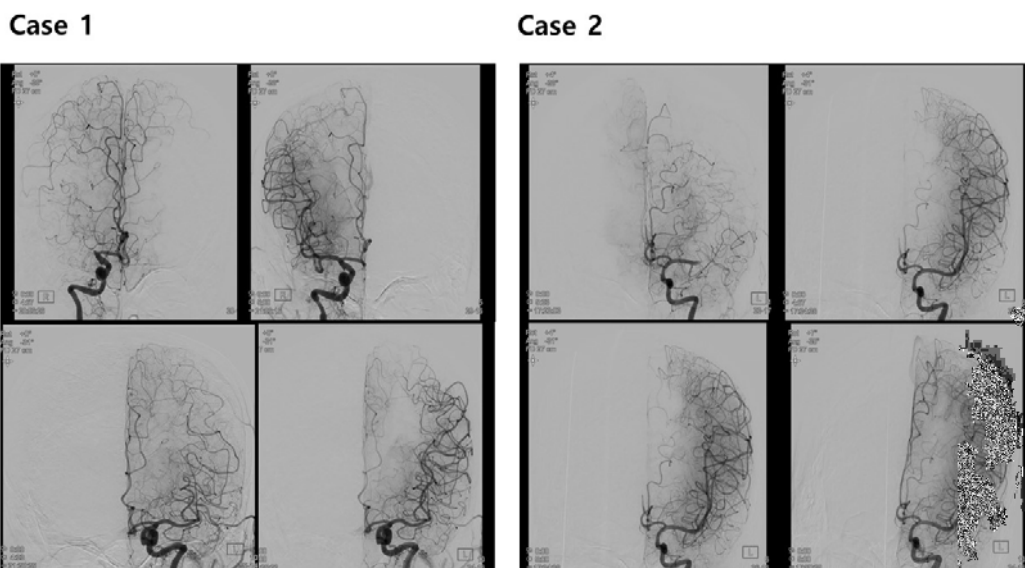
Acute anterior spinal cord infarction after bronchial artery embolization

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Background & Significance

Bronchial artery embolization (BAE) is a well-established therapeutic procedure for controlling hemoptysis in various pulmonary conditions. The bronchial arteries typically originate from the descending thoracic aorta at the level of T5-T6 vertebrae. The ventral and dorsal portions of the spinal cord are supplied by arteries draining into the anterior and posterior spinal arteries respectively. At the thoracic level, anterior radiculomedullary (feeder) arteries anastomose with the anterior spinal artery. These arteries usually originate from the posterior intercostal artery or the intercostobronchial trunk. Rarely, the feeder arteries may arise from the bronchial artery itself. In BAE procedure, particle embolization of bronchial artery may lead to inadvertent embolization of the feeder artery leading to anterior spinal cord infarction. We presents a case of anterior spinal cord infarction following bronchial artery embolization.

CASE REPORT

A 61-year-old man presented to the emergency room with hemoptysis. The patient had been treated for pulmonary tuberculosis 25 years ago and had a history of BAE surgery after multiple massive hemoptyses. Invasive aspergillosis in the anterior segment of the left upper lobe was confirmed on chest CT, and BAE was performed. Immediately after the procedure, the patient complained of left leg weakness. There was no pain, and the dorsalis pedis pulse was intact. The muscle strength grade was 4/2 for hip flexion, 4/1 for knee flexion, 4/1 for knee extension, 5/1 for ankle dorsiflexion, and 5/1 for ankle plantar flexion without spasticity. DTRs were normoactive, and the pathologic reflexes were negative. The sensory examination showed that pain and temperature senses decreased under the T10 level but more prominently on the right side. Position and vibration sense were intact. Decreased Sphincter function of the Anus and bladder tone was observed. A brain MRI was unremarkable. A spine MRI scan revealed abnormal high T2 signals in the T3-5 anterior spinal cord segments [figure1]. Considering that the symptoms occurred immediately after BAE, anterior spinal cord infarction was diagnosed.

Conclusions or Comments

Anterior Spinal cord infarction following bronchial artery embolization is an uncommon yet significant complication with potentially devastating sequelae. Careful analysis of the vascular anatomy and intermittent angiography during embolization may help prevent this serious complication.

figure1 :
Sagittal MRI images showing high signal (arrow) on T2-weighted image (A) and reduced diffusivity (arrowheads) on DWI image (B) and ADC map image (C).

Delayed refractory cerebral vasoconstriction syndrome after stenting for bilateral carotid arteries.

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Purpose

Cerebral autoregulation (CA) is a physiological mechanism that helps maintain a stable cerebral blood flow (CBF) despite fluctuations in systemic blood flow. After carotid artery stenting (CAS) impaired CA of CBF has known to lead cerebral vasoconstriction syndrome (CVS). Especially, uncontrolled hypertension with high fluctuation can contribute the development CVS after CAS.

Methods

We reported the case of delayed refractory CVS after bilateral carotid artery stenting.

Results

A 68-year-female patient admitted neurology department because of occlusion of right central retinal artery. She had a history of hypertension, diabetes, and chronic kidney disease with hemodialysis. On brain magnetic resonance (MR) imaging and angiography, severe bilateral carotid arteries stenosis with no acute cerebral infarction was noted. The decision for CAS was made on the right side, which was considered symptomatic. CAS on the right side was successful but recurrent and transient right hemiparesis was developed because of physiological blood pressure decline after CAS. Thus, secondary CAS on the left side was decided for treating transient ischemic attack (TIA) after 7 days of first CAS. After secondary CAS, TIA completely resolved and the patient was discharged. Average blood pressure (BP) during admission was 110/80mmHg. After 15 days of discharge, aphasia was developed and the patient visited the emergency room. She had a uncontrolled high systolic BP during hemodialysis after discharge.

On brain MR imaging and angiography, diffusion high signal on left anterior cerebral artery territory with vasoconstriction of multiple bilateral cerebral arteries, which is indicative of CVS was noted. Aggressive blood pressure control for CVS was done, but CVS was sustained and generalized tonic-clonic seizure was developed. Therefore, intra-arterial (IA) nimodipine to each constricted vessel was decided. Despite IA nimodipine injection, CVS was repeatedly recurred and mental status deteriorated into stupor. On follow-up brain MR imaging and angiography, vasogenic edema on the left cerebral hemisphere with significant mass effect with sustained CVS was noted. Anti-edema treatment including intravenous hypertonic saline, steroid, continuous renal replace treatment and hypothermia using surface cooling device was done. However, after 15 days of secondary admission, the patient was died despite anti-edema treatment.

Conclusions

CA is the essential mechanism for stable CBF after CAS. However, under condition of uncontrolled hypertension following CAS, CA could be a double-wedged sword.

Serum erythropoietin is positively correlated with cerebral collateral flow in acute stroke

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Purpose

Erythropoietin (EPO), which is associated with anemia, had been recognized as to have neuroprotective effects in ischemic stroke. When there is stenosis or narrowing of the main cerebral blood vessel, the prognosis is favorable if the collateral blood circulation is well developed in acute stroke. We investigated the correlation between the degree of serum EPO level and cerebral collateral flow.

Methods

Subjects diagnosed as acute ischemic stroke between Jan of 2020 and March of 2022 were enrolled. Assessment of cerebral collateral circulation were made according to Mass system from brain CT perfusion study and divided into good collateral group (GC, Mass 3-5) or poor collateral groups (PC, Mass 1-2). Serum EPO level was determined with chemiluminescence immunoassay method. Correlation coefficient analysis was conducted to determine correlation between serum erythropoietin level and GC. Receiver operation characteristic (ROC) curve analysis was conducted to determine cut off value of EPO for GC.

Results

Total 56 subjects were enrolled (GC 22, PC 34). The characterisitics between the two groups were well balanced except that the frequency of chronic heart failure, hospitalization days and modified Rankin Score were higher in PC group ($p<0.05$), whereas the frequency of chronic kidney disease, initial EPO were higher in GC group ($p<0.05$). The cut off level of serum EPO for GC was 9.1 mIU/mL from ROC curve in our study (Figure 1).

Conclusions

A higher level of serum EPO (>9.1 mIU/mL) could be a marker of a GC in acute ischemic stroke patients and implicate good clinical outcomes.

Figure 2. ROC curve of serum erythropoietin and good collateral

High serum erythropoietin level showed positive correlation with GC when adjusting other variable such as CHF, NIHSS, CKD, ASPECT and HOD were corrected (r=0.712, p=0.04)
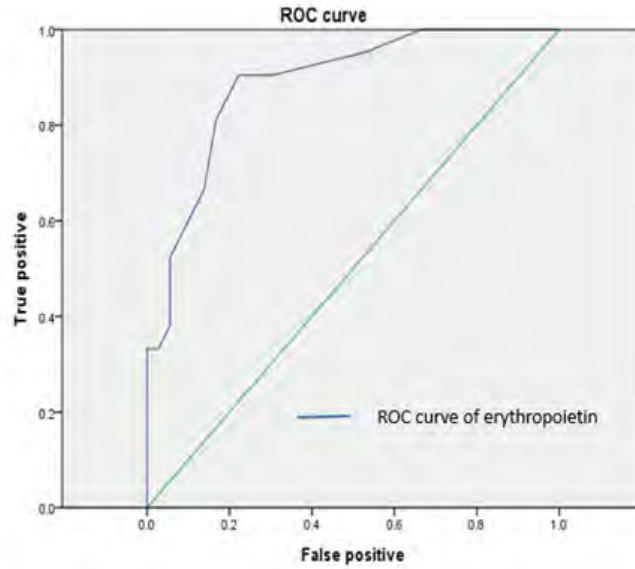
ROC, Receiver operation characteristic; CHF, chronic heart failure; NIHSS, National Institute of health stroke scale; CKD, chronic kidney disease; ASPECT, Alberta Stroke Program Early CT Scor HOD, hospitalization day.

Diabetes status and outcomes of endovascular therapy for acute ischemic stroke due to large vessel occlusion

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Purpose

It remains controversial whether diabetes can predict stroke outcome. We aimed to investigate the association between diabetes status and outcomes of EVT (endovascular therapy) for acute ischemic stroke due to large vessel occlusion.

Methods

We used data of TREAT-AIS, a multicenter prospective registration in Taiwan, for the present study. Adult patients who underwent EVT for acute ischemic stroke were recruited. Diabetes status was classified as no diabetes, pre-diabetes (HbA1c [Glycated Hemoglobin] 5.7-6.4%), unrecognized diabetes (newly diagnosed after stroke with HbA1c 6.5% or higher), and diabetes history (diagnosed before stroke). The outcomes of interest included poor outcome (defined with a modified Rankin Scale score 3-6) at 3 months, SICH (symptomatic intracranial hemorrhage, defined with a type 2 parenchymal hemorrhage with neurologic deterioration of ≥ 4 points on the National Institutes of Health Stroke Scale from baseline ≤ 36 hours of EVT), stroke early deterioration (defined with increase of NIHSS ≥ 2 points within 72 hours), and all-cause death at 3 months. Multivariate logistic regression models including confounders of age, sex, stroke severity, recanalization status, and time to recanalization were used to determine the OR (odds ratios) and 95% CIs (confidence intervals).

Results

A total of 1,097 patients were included for analyses. Of the patients, 340 (31.0%), 331 (30.2%), 88 (8.0%), and 338 (30.8%) were no diabetes, pre-diabetes, unrecognized diabetes, and diabetes history, respectively. Using no diabetes as the reference, only diabetes history was significantly associated with poor outcome at 3 months (OR, 2.58; 95% CI, 1.67-3.98), SICH (OR, 3.28; 95% CI, 1.15-9.36), stroke early deterioration (OR, 1.96; 95% CI, 1.18-3.27), and death at 3 months (OR, 2.68; 95% CI, 1.62-4.44). Either pre-diabetes or unrecognized diabetes was not associated with any of those four outcomes.

Conclusions

Diabetes history, but not pre-diabetes or unrecognized diabetes, was associated with outcomes of EVT for acute ischemic stroke due to large vessel occlusion compared to no diabetes.

Adherence and barrier to early positive airway pressure therapy (PAP) in patient with acute phase of ischemic stroke

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Purpose

Sleep apnea is a risk factor for cerebrovascular and cardiovascular diseases, and the effective treatment is PAP. However, there are currently no guidelines on when to start PAP treatment. This study aims to examine adherence in patients who initiated positive airway pressure therapy within 7 days after acute ischemic stroke.

Methods

Acute stroke patients within 5 days of symptom onset and with a STOP-Bang score of 3 or higher on the sleep questionnaire were screened. After getting informed consent, we conducted type 1 polysomnography (PSG). Patients whose Apnea-Hypopnea Index (AHI) of 5 or higher were provided with PAP therapy within 7 days of stroke onset during hospitalization. Adherence and clinical data were assessed at the 3-month follow-up.

Results

From Dec. 2021 to May 2023, 146 patients agreed to participate in this study. Type 1 PSG was conducted in 138 of them and 133 (96.4%) were diagnosed with OSA. Among them, 75 initiated PAP therapy during the hospitalization. Three months later, 44 patients (58.7%) performed good adherence to PAP, while 31 patients dropped out of treatment.

Conclusions

The adherence of early PAP (started within 7 days of stroke) at the 3 months is tolerable, and these results are not inferior when compared to previous studies started PAP treatment after subacute to chronic stage of stroke.

Impact of exercise habit changes on myocardial infarction after acute ischemic stroke: A nationwide population-based study

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Purpose

Stroke and myocardial infarction (MI) share common risk factors. Exercise has known benefits for cardiovascular health and can mitigate these risks, yet the impact of exercise habit changes after an ischemic stroke on subsequent MI risk is not fully understood. We aimed to investigate the effects of exercise habit changes on the risk of MI after acute ischemic stroke using the Korean National Health Insurance Services Database.

Methods

This study included 224,764 patients with a new diagnosis of ischemic stroke between 2010 and 2016 who underwent two serial biannual health checkups. The participants were divided into four categories according to their exercise habit changes: persistent non-exercisers, new exercisers, exercise dropouts, and exercise maintainers. The primary outcome was new diagnosis of incident MI. Multivariable Cox proportional models were used to assess the effects of changes in exercise habits on the risk of MI.

Results

After a median of 4.25 years of follow-up, 6,611 (2.94%) of MI cases were observed. After adjusting for covariates, exercise dropouts, new exercisers, and exercise maintainers were significantly associated with a lower risk of incident MI than persistent non-exercisers (adjusted hazard ratio [aHR] 0.937; 95% confidence interval [CI] 0.878–1.000, aHR 0.849; 95% CI 0.792–0.911, aHR 0.746; 95% CI 0.696–0.801, respectively). The effects of alterations in exercise behavior were uniformly observed in both genders, with greater prominence in individuals aged over 65 years. Notably, regardless of the level of physical activity after a stroke, engaging in physical activity was associated with a significant reduction in the occurrence of MI compared to individuals who did not exercise at all after the stroke.

Conclusions

In this nationwide cohort study, commencing or sustaining moderate-to-high intensity exercise following an ischemic stroke corresponded with a diminished likelihood of subsequent MI development. Advocating for physical activity in ambulatory stroke survivors could potentially attenuate their prospective risk of MI.

Effect of targeted temperature management after successful endovascular reperfusion therapy in patients with acute basilar artery occlusion

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Purpose

Even undergoing endovascular reperfusion therapy (ERT), patients with acute basilar artery occlusion (BAO) still have a high morbidity and mortality rate. Targeted temperature management (TTM) improved clinical outcomes in experimental animal ischemic stroke models. TTM appears to be a promising candidate treatment for acute BAO. We investigated the clinical effects of TTM after successful endovascular reperfusion therapy in patients with acute basilar artery occlusion.

Methods

A retrospective analysis was performed in a prospective registry at a single comprehensive stroke center. We enrolled patients with acute ischemic stroke in the acute BAO an initial National Institutes of Health Stroke Scale ≥10) who had successfully revascularization achieved. Patients with BAO underwent a mild TTM (35-6°C) protocol, which included mechanical ventilation and 24-48-hour hypothermia. Patients with BAO who did not perform TTM were treated according to the medical management protocol. Mental status, neurologic deterioration, cerebral edema, hemorrhagic transformation, good clincal outcome (GCO, 3-month modified Rankin Scale, ≤3), mortality, and safety were compared among the group.

Results

Of the 35 patients who met the study inclusion criteria, 9 patients were assigned to the TTM group and 22 to the non-TTM group. Intravenous thrombolysis was used in 1 (11.1%) of the patients in the TTM group and in 9 (36.0%) of those in the non-TTM group. Good functional status at 90 days occurred in 0 patients in the TTM group and in 12 (48.0%) in the non-TTM group. Symptomatic intracranial hemorrhage occurred in 2 patients (22.2%) in the TTM group and in 3 (12.0%) in the non-TTM group. Although mortality was not statistically different among the group, morbidity was significantly higher in the TTM group.

Conclusions

Although a small number of patients were evaluated, in patients with acute BAO who received successful revascularization by ERT, TTM may increase neurological deterioration and reperfusion injury and lead to worsened clinical outcomes.

Association between genetic polymorphisms in fibrinogen genes and bleeding risk in patients treated with direct oral anticoagulants

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Purpose

Fibrinogen is one of important factor for hemostasis. Fibrinogen consists of 3 polypeptide chains—Aα, Bβ and γ—which are encoded by fibrinogen alpha chain (FGA), fibrinogen beta chain (FGB) and fibrinogen gamma chain (FGG) genes, respectively. The fibrinogen gene family is clustered on chromosome 4 and spans ~50 kb, comprising FGB, FGA and FGG. As several single nucleotide polymorphisms (SNPs) of fibrinogen genes are reportedly related to fibrinogen levels. We aimed to investigate the association between polymorphisms in fibrinogen genes and bleeding risk in Direct oral anticoagulants (DOAC)-treated patients.

Methods

Patients treated with DOACs from June 2018 to December 2021 were enrolled in the study. Genotyping was done for rs2070011, rs6050, and rs2070022 in fibrinogen alpha chain (FGA); rs1800788, rs4220, and rs4463047 in fibrinogen beta chain (FGB); and rs2066865 and rs1800792 in fibrinogen gamma chain (FGG), along with F2 rs5896 and F10 rs5960. Multivariable logistic regression analysis was performed to investigate the risk factors for bleeding and to develop a risk scoring system.

Results

A total of 468 patients were included in the analysis, 14 of whom experienced major bleeding and 36 experienced clinically relevant non-major bleeding. In the multivariable analysis, overdose, anaemia, F2 rs5896, and FGG rs1800792 were found to be significantly associated with bleeding risk. Specifically, patients with the TT genotype of F2 rs5896 and the CC genotype of FGG rs1800792 had 2.1 times (95% confidence interval [CI] 1.1–3.9) and 2.7 times (95% CI 1.2–5.9) higher bleeding risk than the C allele and T allele carriers, respectively. Based on the risk scoring system, patients with 0, 1, 2, 3, 4, and 5 points were predicted to have 5.2%, 10.8%, 22.4%, 32.3%, 42.3%, and 61.8% of bleeding risk, respectively.

Conclusions

We propose a new bleeding risk scoring system that incorporates clinical (anaemia and overdose) and genetic risk factors (F2 rs5896 and FGG rs1800792).

Predictors	Crude OR (95% CI)	Adjusted OR (95% CI)	Attributable risk (%)
Female	1.03 (0.56–1.88)		
Age ≥65 (years)	0.91 (0.48–1.70)		
Overdose	5.11 (1.44–18.10)	6.19 (1.67–23.05)**	83.86
Anaemia	2.28 (1.25–4.16)	2.29 (1.23–4.28)**	56.43
F2 rs5896 TT	1.91 (1.06–3.45)	2.09 (1.13–3.85)*	52.04
FGA rs2070011 CC	1.92 (1.000–3.70)		
FGG rs1800792 CC	2.72 (1.25–5.90)	2.67 (1.20–5.94)*	62.58

OR: odds ratio; CI: confidence interval. *$P<0.05$; **$P<0.01$. Multivariable analysis was performed with the factors with $P<0.05$ in the univariate analysis along with sex and age.

ABCG2 gene polymorphisms may affect the bleeding risk in patients on apixaban and rivaroxaban

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Purpose

Direct oral anticoagulants (DOACs) are widely used for stroke prevention in atrial fibrillation. However, they have a bleeding complication. Breast cancer resistance protein, encoded by ABCG2, is known to be an efflux transporter of apixaban and rivaroxaban among DOACs. This study aimed to investigate the association between gene variants and bleeding complications during treatment with ABCG2 substrates (apixaban and rivaroxaban).

Methods

Patients treated with apixaban and rivaroxaban were enrolled from June 2018 to December 2021. Five single nucleotide polymorphisms (SNPs) of ABCG2 were selected. Previously studied genes (ABCB1, CYP3A4, and CYP3A5) were further analyzed as possible confounders. Finally, a total of 16 SNPs were examined in this case–control study. The outcome was defined as major bleeding and clinically relevant non-major bleeding. Two models were constructed using the multivariable analysis.

Results

Among 293 patients, 64 were cases. The mean age of the patients was 68.8 years, and males comprised 62.5% of the study population. Model I revealed that a history of bleeding, concurrent use of proton pump inhibitor (PPI), ABCG2 rs3114018, and ABCB1 rs1045642 were significantly associated with bleeding complications; the AORs (95% CI) were 6.209 (2.210–17.442), 2.385 (1.064–5.349), 2.188 (1.156–4.142), and 3.243 (1.371–7.671), respectively. Model II showed that modified HAS-BLED score, concurrent use of PPI, ABCG2 rs3114018, and ABCB1 rs1045642 were significantly associated with bleeding complications.

Conclusions

The modified HAS-BLED score, a history of bleeding, concurrent use of PPI, ABCG2 rs3114018, and ABCB1 rs1045642 were significantly associated with the risk of bleeding complications in patients on apixaban and rivaroxaban, after adjusting for other confounders. These findings can be used to develop individualized treatment strategies for patients taking apixaban and rivaroxaban.

Variables	Unadjusted OR (95% CI)	Model I Adjusted OR (95% CI)	Model II Adjusted OR (95% CI)
Female	1.284 (0.730–2.257)		
Age ≥ 65 (years)	1.086 (0.593–1.988)		
Weight < 65 (kg)	1.165 (0.668–2.032)		
Creatinine clearance < 50 (mL min^{-1})	1.273 (0.642–2.527)		
Modified HAS-BLED score[a]	1.425 (1.092–1.859)**		1.347 (1.018–1.782)*
History of stroke/TIA/thromboembolism	1.908 (1.090–3.340)*		
History of bleeding	6.582 (2.436–17.783)***	6.209 (2.210–17.442)***	
Concurrent use of PPI	2.221 (1.057–4.666)*	2.385 (1.064–5.349)*	2.359 (1.079–5.156)*
ABCG2 rs2622604 T allele carrier	2.095 (1.181–3.717)*		
ABCG2 rs3114018 A allele carrier	1.983 (1.105–3.557)*	2.188 (1.156–4.142)*	2.335 (1.250–4.360)**
ABCB1 rs1045642 AA genotype carrier	2.538 (1.159–5.559)*	3.243 (1.371–7.671)**	3.167 (1.349–7.436)**

Association between genetic polymorphisms and bleeding in patients on direct oral anticoagulants

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Purpose

The purpose of our study is to investigate the effects of apolipoprotein B (APOB) and APOE gene polymorphisms on bleeding complications in patients receiving direct
oral anticoagulants (DOACs).

Methods

A total of 16 single nucleotide polymorphisms (SNPs) in 468 patients were genotyped. Six SNPs of ABCB1 (rs3842, rs1045642, rs2032582, rs1128503, rs3213619,
and rs3747802), one SNP of CYP3A5 (rs776746), seven SNPs of APOB (rs1042034, rs2163204, rs693, rs679899, rs13306194, rs13306198, and rs1367117), and two SNPs of APOE (rs429358 and rs7412) were analyzed by a TaqMan genotyping assay. Multivariable logistic regression analysis with selected variables was performed for the construction of a risk scoring system. Two risk scoring systems were compared (demographic factors only vs. demographic factors and genetic factors).

Results

In the multivariable analyses, two models were constructed; only demographic factors were included in Model I and both demographic factors and genetic factors in Model II. Rivaroxaban and anemia showed significant association with bleeding in both models. Additionally, ABCB1 rs3842 variant homozygote carriers (CC) and APOB rs13306198 variant allele carriers (AG, AA) had a higher risk of bleeding risk compared with that of wild-type allele carriers (TT, TC) and wild-type homozygote carriers (GG), respectively. Whereas the area under the receiver operating characteristic curve (AUROC) value using demographic factors only was 0.65 (95% confidence interval (CI): 0.56–0.74), the AUROC increased to 0.72 by adding genetic factors (95% CI: 0.65–0.80). The predicted bleeding risks of bleeding in patients with 0, 1, 2, 3, 4, 5, 6, 7 and 8 points from the logistic regression curve were 0.8%, 2.0%, 5.4%, 5.2%, 12.5%, 26.9%, 47.0%, 64.3% and 82.3%, respectively.

Conclusions

The study results can be used for enhancing individualized treatment strategies in patients taking DOACs, helping clinicians predict the bleeding risk.

dbSNP rsID	Grouped Genotype	Bleeding (n = 50)	No Bleeding (n = 418)	p
ABCB1				
rs3842 (T>C)	TT, CT	40 (80.0)	379 (90.7)	0.02
	CC	10 (20.0)	39 (9.3)	
rs1045642 (A>G)	AA	7 (14.0)	42 (10.1)	0.39
	AG, GG	43 (86.0)	375 (89.9)	
rs2032582 (A>C)	AA, AC	37 (79.0)	331 (79.6)	0.36
	CC	13 (26.0)	85 (20.4)	
rs1128503 (A>G)	AA, AG	40 (80.0)	339 (81.1)	0.85
	GG	10 (20.0)	79 (18.9)	
rs3213619 (A>G)	AA, AG	50 (100.0)	413 (99.5)	1.00
	GG	0 (0.0)	2 (0.5)	
rs3747802 (A>G)	AA	43 (86.0)	368 (88.2)	0.64
	AG, GG	7 (14.0)	49 (11.8)	
CYP3A5				
rs776746 (C>T)	CC, CT	46 (92.0)	396 (95.7)	0.28
	TT	4 (8.0)	18 (4.3)	
APOB				
rs1042034 (C>T)	CC	34 (68.0)	233 (55.9)	0.10
	CT, TT	16 (32.0)	184 (44.1)	
rs2163204 (T>G)	TT, GT	50 (100.0)	413 (99.0)	0.49
	GG	0 (0.0)	4 (1.0)	
rs693 (G>A)	GG	49 (98.0)	369 (88.3)	0.04
	AG, AA	1 (2.0)	49 (11.7)	
rs679899 (G>A)	GG, AG	12 (24.0)	119 (28.5)	0.50
	AA	38 (76.0)	298 (71.5)	
rs13306194 (G>A)	GG, AG	49 (98.0)	413 (98.8)	0.49
	AA	1 (2.0)	5 (1.2)	
rs13306198 (G>A)	GG	37 (74.0)	381 (91.1)	<0.01
	AG, AA	13 (26.0)	37 (8.9)	
rs1367117 (G>A)	GG	42 (84.0)	324 (77.5)	0.29
	AG, AA	8 (16.0)	94 (22.5)	
APOE				
rs429358 (T>C)	TT	43 (88.0)	329 (79.5)	0.27
	CT, CC	7 (14.0)	85 (20.5)	
rs7412 (C>T)	CC	42 (89.4)	345 (85.2)	0.44
	CT, TT	5 (10.6)	60 (14.8)	

Comparative efficacy of oral anticoagulants using zebrafish thrombosis model

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Purpose

Despite the widespread utilization of oral anticoagulant agents for thrombosis prophylaxis, the comparative efficacy of these pharmaceuticals remains largely undocumented. The aim of this study was to evaluate the effectiveness of non-vitamin K antagonist oral anticoagulants (NOACs) – namely, rivaroxaban, apixaban, edoxaban, and dabigatran – against the conventional agent warfarin.

Methods

Thrombosis induction in larval zebrafish (5 days post-fertilization) was accomplished using the MicroPoint® system (Andor Technology, Tokyo, Japan). Thrombosis was elicited without any prior treatment, thus establishing a thrombus group as the control group. Employing a rosebengal-micropoint system, a photosensitizer known as rosebengal was administered in conjunction with laser exposure. Transgenic fluorescence zebrafish lines were thoughtfully selected to incite real-time photothrombosis within the dorsal vein of the caudal region. Subsequently, the quantification of thrombus burden, macrophage presence, and post-thrombotic behavioral evaluation (specifically, measuring the moving distance) were conducted utilizing the DanioVision® tracking system (Noldus, Wageningen, Netherlands).

Results

The pre-treatment with NOACs and warfarin exhibited a substantial inhibitory effect on thrombosis in larval zebrafish, as indicated by fibrinogen fluorescence sum intensity (expressed in arbitrary units; control=7.6×10^6, rivaroxaban=1.2×10^6, apixaban=1.5×10^6, edoxaban=1.2×10^6, dabigatran=8.6×10^5, and warfarin=1.7×10^6; all $P < .001$). Concerning the immune response following thrombosis, a less pronounced increase in macrophage count was observed in the NOACs and warfarin groups compared to the control (measured as macrophage number per 200x magnification area under the microscope; control=44, rivaroxaban=27, apixaban=27, edoxaban=24, dabigatran=29, and warfarin=42; all $P < .001$). In the behavioral assessment, the control group exhibited a marked reduction in moving distance compared to the wild-type, with all NOACs surpassing the efficacy of warfarin (measured in millimeters per 5 minutes; wild-type=283.5, control=135.5, rivaroxaban=265.3, apixaban=289.7, edoxaban=258.4, dabigatran=277.7, and warfarin=209.9; all $P < .001$).

Conclusions

Our investigation has demonstrated the efficacy of oral anticoagulants in inhibiting thrombus formation, with NOACs being particularly noteworthy in eliciting post-thrombotic alterations, irrespective of the specific type among the four NOACs considered.

In mice models of focal ischemic stroke, short-term high aspartame intake did not enhance infarct volume or stroke mortality

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Purpose

To investigate if short-term high consumption of aspartame could increase cerebral infarct volume and mortality in mouse models of focal ischemic stroke.

Methods

Eleven-week-old male C57BL/6N mice (n=90) received one of the following three treatments for 7 days: phosphate-buffered saline (PBS), aspartame 200 mg/kg in PBS, and aspartame in Zero Coke (with the final dose of aspartame being 200 mg/kg). Thereafter, either transient middle cerebral artery occlusion for 1 hour (1h-tMCAO; n=27, 9/group) or common carotid artery occlusion (CCAO)-related hemispheric ischemia with cerebral autoregulatory dysfunction (CCAO+CAD; n=63, 21/group) was induced. To measure the infarct volume, 2,3,5-Triphenyltetrazolium chloride staining was performed at 24 hours after tMCAO and 6 days after CCAO+CAD.

Results

1h-tMCAO-related 24-hour mortality and infarct volume (of survived animals) did not differ significantly among the three groups (both $p>0.05$): PBS (5/9 death and $93.7\pm30.0mm^3$), aspartame in PBS (2/9 death and $102\pm50.0mm^3$), and aspartame in Zero Coke (4/9 death and $111.4\pm17.4mm^3$). CCAO+CAD-related mortality 6-day mortality did not show inter-group differences ($p>0.05$): PBS (n=9/21, 42.9 %), aspartame in PBS (n=12/21, 57.1 %), and aspartame in Zero Coke (n=8/21, 38 %). Among the survived, infarct volume did not significantly differ, either ($p>0.05$): PBS ($60.8\pm68.0mm^3$), aspartame in PBS ($58.5\pm68.0mm^3$), and aspartame in Zero Coke ($54.2\pm48.3mm^3$).

Conclusions

Short-term high consumption of aspartame did not increase cerebral infarct volume and stroke-related mortality in our experimental setting.

Potential new biomarkers for acute arterial thrombosis

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Purpose

There is no blood biomarker diagnostic of arterial thrombosis. We investigated if arterial thrombosis per se was associated with alterations in complete blood count (CBC) and white blood cell (WBC) differential count in mice.

Methods

Twelve-week-old C57Bl/6 mice were used for FeCl3-mediated carotid thrombosis (n=72), sham-operation (n=79), or non-operation (n=26).

Results

Monocyte count (/µL) at 30-min after thrombosis (median 160 [interquartile range 140-280]) was ~1.3-fold higher than at 30-min after sham-operation (120 [77.5-170]), and 2-fold higher than in non-operated mice (80 [47.5-92.5]). At day-1 and -4 post-thrombosis, compared with 30-min, monocyte count decreased by about 6% and 28% to 150 [100-200] and 115 [100-127.5], which however were about 2.1-fold and 1.9-fold higher than in sham-operated mice (70 [50-100] and 60 [30-75], respectively). Lymphocyte counts (/µL) at 1- and 4-days after thrombosis (mean±SD; 3513±912 and 2590±860) were ~38% and ~54% lower than those in the sham-operated mice (5630±1602 and 5596±1437, respectively), and ~39% and ~55% lower than those in non-operated mice (5791±1344). Post-thrombosis monocyte-lymphocyte-ratio (MLR) was substantially higher at all three time-points (0.050±0.02, 0.046±0.025, and 0.050±0.02) vs. sham (0.003±0.021, 0.013±0.004, and 0.010±0.004). MLR was 0.013±0.005 in non-operated mice.

Conclusions

This is the first report on acute arterial thrombosis-related alterations in CBC and WBC differential parameters.

In vitro screening of phase I clinical compounds that disrupt the binding between PSD95 and nNOS

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Purpose

Interaction among NMDAR-PSD95-nNOS proteins is linked with neuronal cell death after ischemic stroke. Nerinate (NA-1) is a clinical-stage peptide drug that disrupts the binding between PSD95 and nNOS. Recently, in a phase-III clinical trial (Efficacy and safety of nerinetide for the treatment of acute ischaemic stroke), a single intravenous dose of NA-1 did not improve the proportion of patients achieving favorable 3-month functional outcomes after endovascular thrombectomy compared with patients receiving placebo. To identify "non-peptide" novel drugs that disrupt the binding between PSD-95 and nNOS.

Methods

Partial sequences of $PSD95_{1-392}$ and $nNOS_{1-299}$ were cloned into pGEX-GST or pET-His plasmid vectors respectively, and the recombinant proteins were expressed in E-coli Top10 competent cells. 30nM of GST-PSD95 and His-nNOS recombinant proteins were mixed at room temperature (RT) for 30 min, and labeled with 20 µg/mL of Glutathione donor beads or Ni Chelate acceptor beads, respectively. Lastly, 10µM of clinical compounds dissolved in DMSO were treated for 30 minutes at RT. AlphaScreen assay was performed in a final volume of 80 µL in 96-well ½ area plates using an EnSpire® Multimode Plate Reader (PerkinElmer, Waltham, MA) equipped with AlphaScreen optical detection module. To validate assays, a positive control compound ZL006 (12.8 µM, IC50), a compound known to disrupt PSD95-nNOS protein interaction, was included in all experiments. A total of 3,120 phase I clinical compounds were purchased from the Korea Chemical Bank of Korea Research Institute of Chemical Technology.

Results

Of 75 compounds that we have tested, 54 compounds were initially found to be effective in disrupting the binding of PSD95-nNOS significantly when compared with DMSO control group (Mann Whitney U test, $P < 0.05$).

Conclusions

Additional screening and confirmatory testing are ongoing. Further results and in vitro / in vivo neuroprotective effects will be presented at the Conference.

Neuroprotective effects of ginseng gintonin in a mouse model of focal ischemic stroke

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Purpose

Gintonin is a ginseng-derived lysophosphatidic acid receptor (LPAR) ligand. Previous studies showed the beneficial roles of gintonin in mouse models of neurogenerative diseases such as Alzheimer's disease and Parkinson's disease. We investigate whether gintonin has neuroprotective effects in a mouse model of focal ischemic stroke.

Methods

C57BL/6N mice were treated orally with saline (n=50) or gintonin 150 (n=65) or 300 (n=20) mg/kg once daily for 1 week. Among the 150 mg/kg group animals, 15 randomly selected mice were pretreated with intraperitoneal administration of an LPAR antagonist (Ki16425, 30 mg/kg) before the oral treatment. Then, all mice underwent common carotid artery occlusion (CCAO)-related hemispheric ischemia after inducing cerebral autoregulatory dysfunction (CAD). We compared post-ischemic survival rates (Log-rank test) and final infarct volumes (student's t-test) at 1 week.

Results

Gintonin 150mg/kg (vs. saline) increased the 1-week survival rate (35/50 [70%] vs. 23/50 [46%], p=0.009) and reduced the infarct size ($92.20\pm14.53mm3$ vs. $138.70\pm16mm3$, p=0.005). Gintonin 300mg/kg tended to increase the survival rate (12/20 [60%], p=0.18 vs. saline) and did not significantly reduce the infarct size (40 ± 36 mm3, p=0.75). Pretreatment with the LPA receptor antagonist abolished the gintonin 150mg/kg-mediated improvement in post-stroke survival (6/15 [40%], p=0.61 vs. saline) and the reduction of infarct size ($197.81\pm31.97mm3$, p=0.88 vs. saline).

Conclusions

Gintonin increased post-stroke survival and decreased infarct volume in mice, probably through LPAR inhibition.

Ovariectomy- and monocyte deficiency-related effects on the mortality and infarct volume in a mouse model of focal ischemic stroke

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Purpose

We recently developed a new in vivo model of focal ischemic stroke, which is generated by inducing hemispheric ischemia by common carotid artery occlusion (CCAO) in mice with cerebral autoregulatory dysfunction (CAD). Clinical and preclinical studies reported conflicting results regarding neuroprotective effects of estrogen and monocyte deficiency in ischemic stroke. To observe ovariectomy (OVX)- and monocyte deficiency-related effects on stroke mortality and infarct volume using the new mouse model.

Methods

We performed either sham or OVX surgery in 12 C57BL/6N mice (n=6 and 6, respectively) and 23 CCR2-/- mice (n=12 and 11, respectively), and induced ischemic stroke using the new method. At 24 hours poststroke, brain was harvested and sliced in 2-mm thickness for 2,3,5-triphenyl-tetrazolium chloride staining and infarct volume measurement. Dead animals were excluded from the infarct volume analysis

Results

The ratio of uterus weights to the body weight was significantly higher in the sham group compared with the OVX group in both C57BL6N mice (48.8 ± 4.20 and 23.9 ± 2.54, respectively; P<0.05 by t-test) and CCR2^{-/-} mice (59.3 ± 4.16 and 24.7 ± 3.40, respectively; P<0.05 by t-test), indicating that OVX modeling was executed proficiently. However, CCAO+CAD-related (24-hour) mortality did not differ significantly between the sham group and the OVX group in both C57BL6N mice (1/6 and 2/6, respectively; P>0.05 by Wilcoxon test) and CCR2^{-/-} mice (2/12 and 4/11, respectively; P>0.05 by Wilcoxon test). Moreover, infarct volume did not differ significantly between the sham group and the OVX group in both C57BL6N mice (172.4 ± 44.12 mm^3 and 63.0 ± 10.13 mm^3, respectively; P>0.05 by t-test) and CCR2^{-/-} mice (138.6 ± 33.09 mm^3 and 159.0 ± 61.65 mm^3, respectively; P>0.05 by t-test).

Conclusions

Estrogen or monocyte (deficiency) related effects on ischemic stroke were not observed in our new mouse model. Further experiments are being performed.

A replication study of nerinetide in mice

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Purpose

Nerinetide (NA-1), a postsynaptic density protein-95 inhibitor, is a clinical-stage stroke neuroprotectant. Recently, in a phase-III clinical trial (Efficacy and safety of nerinetide for the treatment of acute ischaemic stroke [ESCAPE-NA1]), a single intravenous dose of NA-1 did not improve the proportion of patients achieving favorable 3-month functional outcomes after endovascular thrombectomy compared with patients receiving placebo. Thus, we conducted a preclinical replication study to test therapeutic efficacy of NA-1 in a mouse model of transient middle cerebral artery occlusion (tMCAO).

Methods

After 30-minute or 60-minute tMCAO with laser Doppler flowmetry (LDF) monitoring, mice were randomly assigned to a group treated with either vehicle (n=10 and 21, respectively) or 10 nM/g NA-1 (n=10 and 21, respectively), which was intravenously administered once via penile vein in a volume of 200 μL at the beginning of recanalization. In a different set of mice (n=6 for vehicle and n=6 for NA-1), we performed tMCAO and then allowed animals to wake up before reperfusion at 60 minutes to account for continuous anesthesia-related confounding. At 1-day poststroke, brain was harvested and sliced in 2-mm thickness for 2,3,5-triphenyl-tetrazolium chloride (TTC) staining and infarct volume measurement after neurological scoring.

Results

LDF data indicated that stroke modeling was executed proficiently, without inter-group differences. The vehicle group and the NA-1 group showed similar infarct volumes at 1 day after either 30 minutes (32.5 ± 6.4 mm^3 and 44.7 ± 8.7 mm^3; t-test P=0.27) or 60 minutes of tMCAO (113.4 ± 7.6 mm^3 and 108.2 ± 7.6 mm^3; P=0.63). Awakening between occlusion and reperfusion did not change the negative results: 109.4 ± 11.7 mm^3 and 115.8 ± 10.6 mm^3 (P=0.69). Neurological scores did not show significant inter-group differences, either (all P>0.05).

Conclusions

We were unable to reproduce neuroprotective effects of NA-1 to reduce infarct volume at 1 day after tMCAO for 30 or 60 minutes. We suggest that implementation of multicenter animal studies is warranted to enhance the reproducibility and generalizability of preclinical observations.

Focused ultrasound-assisted blood-brain barrier opening enables targeted microglia modulation for ischemic stroke therapy

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Purpose

Ischemic stroke remains challenging to treat beyond its initial stages, and research on mitigating secondary damage after stroke is underrepresented. Novel avenues for stroke intervention have emerged which is focused on control of brain inflammation, particularly microglial activation, as a potential strategy to address secondary damage. However, an effective means of regulating microglia activation has yet to be established.

Methods

In this study, we explore a promising approach to mitigate stroke-induced damage by utilizing advanced blood-brain barrier (BBB) permeable nanoparticles designed to target microglia. Leveraging ultrasound/microbubble (US/MB) technology, we comparatively assess intracranial nanoparticle drug delivery in a photothrombotic ischemic stroke model.

Results

Our experimental results demonstrate the successful localization of Evans Blue staining in the cerebral cortex through the application of US/MB. Green fluorescent protein (GFP) vector-loaded nanoparticles are administered via intravenous (IV), intrathecal (IT), and US/MB-assisted IV routes (US/MB/IV) respectively. The US/MB/IV administration exhibits a significantly increased distribution of GFP, compared to those of IV delivery only. And the microglial distribution of the GFP-nanoparticles was similar to those of IT route administration.

Nanoparticles loaded with mir146a-5p, a regulator of microglial inflammatory responses, and their administration via the IV route with ultrasound/microbubble assistance were performed. mir146a-5p nanoparticle with US/MB/IV approach shows smaller cerebral infarct volume and reduction of inflammatory factors.

Conclusions

This study suggest that focused ultrasound-mediated BBB disruption increase localized drug delivery of miR146a-5p-loaded nanoparticles. And this new targeted intervention can be used as a neuroprotective strategy with therapeutic implications for ischemic stroke treatment.

Hydrocephalus impairs glymphatic pathway and meningeal lymphatic drainage in a rat model

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Purpose

Besides its traditional role of protecting the brain, cerebrospinal fluid (CSF) plays a more significant role in maintaining homeostasis by clearing metabolic waste produced by brain activity. We put forward a hypothesis that chronic CSF circulation failure conditions, like normal pressure hydrocephalus (NPH), may be a critical contributing factor in neurodegenerative diseases associated with the buildup of metabolic waste.

Methods

To investigate this, we examined the glymphatic pathway and meningeal lymphatic drainage in a rat model with hydrocephalus induced by kaolin injection. We conducted time-dependent evaluations involving the injection of tracers intraparenchymally or intra-cisterna magna, as well as intra-ventricular Evans Blue injection. Additionally, we assessed dorsal and ventral meningeal lymphatic drainage and drainage into the peripheral cervical lymph nodes.

Results

The results revealed delayed glymphatic pathway and lymphatic drainage in the kaolin-induced hydrocephalus model.

Conclusions

Based on these findings, our research suggests that CSF circulatory failure, as seen in conditions like NPH, could be an initial or exacerbating factor in neurodegenerative diseases, leading to the accumulation of metabolic waste, such as in Alzheimer's disease (AD). This research could help identify risk factors and gain insights into the underlying pathophysiology of neurodegenerative diseases, potentially leading to the development of novel therapeutic strategies.

Is the mechanism of synchronous cardio-cerebral infarction (CCI) different from that of metachronous CCI?

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Purpose

Cardio-cerebral infarction (CCI) is the occurrence of acute ischemic stroke (AIS) and myocardial infarction (MI) at the same time (synchronous) or one after other (metachronous). This study aimed to investigate the differences in the underlying mechanisms between synchronous and metachronous CCI by analyzing clinical characteristics through a single-center case series study.

Methods

This study analyzed AIS patients registered in the Clinical Research Collaboration for Stroke in Korea (CRCS-K) prospective registry at Dong-A University Stroke Center from January 2019 to December 2022. Patients with synchronous and metachronous CCI (MI after AIS within 72 hours) were included. Severity at admission and modified Rankin Scale (mRS) at 3 months after treatment were assessed.

Results

Among 3,319 AIS patients, 12 (0.36%) were diagnosed with acute CCI (Male:8, Mean age=69.6±14.0). Of these, 6 (0.18%) had synchronous CCI, while the other 6 had metachronous CCI. Synchronous CCI group exhibited a lower neurological severity at admission compared to metachronous CCI (median NIHSS:3.5 vs 12.5). Among the 12 cases, 7 (58%) had ST-elevation myocardial infarction (STEMI), with 5 (83%) out of the synchronous CCI cases presenting as STEMI. Two cases of new-onset atrial fibrillation occurred exclusively in cases of synchronous CCI. Also, one case of synchronous CCI showed a thrombus in the left ventricle.

Conclusions

Acute CCI is rare and can manifest with varying degrees of severity. Our study suggests that AIS in synchronous CCI may be secondary to embolism caused by preceding MI. In contrast, metachronous CCI exhibited a diverse mechanisms, including secondary myocardial injury resulting from preceding severe AIS.

Identifying vulnerable for stroke treatment in Gyeonggi province

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Purpose

This study aims to identify regional disparities and vulnerable areas in stroke care across the intermediate medical service zones of Gyeonggi Province.

Methods

Applying the data from the Korea National Cardio-cerebrovascular Disease Management Commission, this study included 4,427 acute stroke patients admitted to hospitals in Gyeonggi Province in 2018. We evaluated 1) quality indicators of stroke care such as rates of defect-free care, intravenous thrombolysis (IVT), endovascular thrombectomy (EVT), acute reperfusion therapy (any of IVT and EVT), 2) in-region stroke treatment rates and 3) 1-year mortality of the province and 12 intermediate medical service zones, comparing with the national average and with each other. Vulnerable areas were identified by 1) tallying the number of quality indicators below the national average and 2) visualizing distribution of indicators with categorizing each indicator into higher (ranks 1-4), middle (ranks 5-8), and lower (ranks 9-12) ranks.

Results

Despite having a fewer qualified stroke centers and stroke specialists, the province showed higher rates of defect-free care (84.6% vs. 80.7%), in-region acute stroke treatment (57.8% vs. 51.0%) and slightly lower rates of 1-year mortality (16.2% vs. 17.3%) than the national averages. Regional disparities were identified, with the highest defect-free care and acute reperfusion therapy being 1.4 and 3.3 times higher than the lowest, respectively. Nine out of twelve regions fell below the national average for EVT, seven for IVT and reperfusion, and five for in-region acute stroke treatment. With all quality indicators of stroke care below the national average and its linkage to the highest 10-year mortality rate, Pyeongtaek appears to particularly underscore the urgent need for improvements in acute stroke care.

Conclusions

This study revealed regional disparities in stroke care across intermediate medical service zones in Gyeonggi Province and identified vulnerable areas. Therefore, establishing a tailored support plan for these vulnerable areas is necessary.

Figure 1. Quality indicators of stroke care. (A) Defect-free care rate, (B) Intravenous thrombolysis rate, (C) Endovascular treatment rate, (D) Acute reperfusion therapy rate, (E) 1-year mortality after stroke, (F) Proportion of in-region stroke treatment

A. Defect-free care rate

B. Intravenous thrombolysis rate

C. Endovascular treatment rate

D. Acute reperfusion therapy

E. 1-year mortality after stroke

F. In-region acute stroke treatment
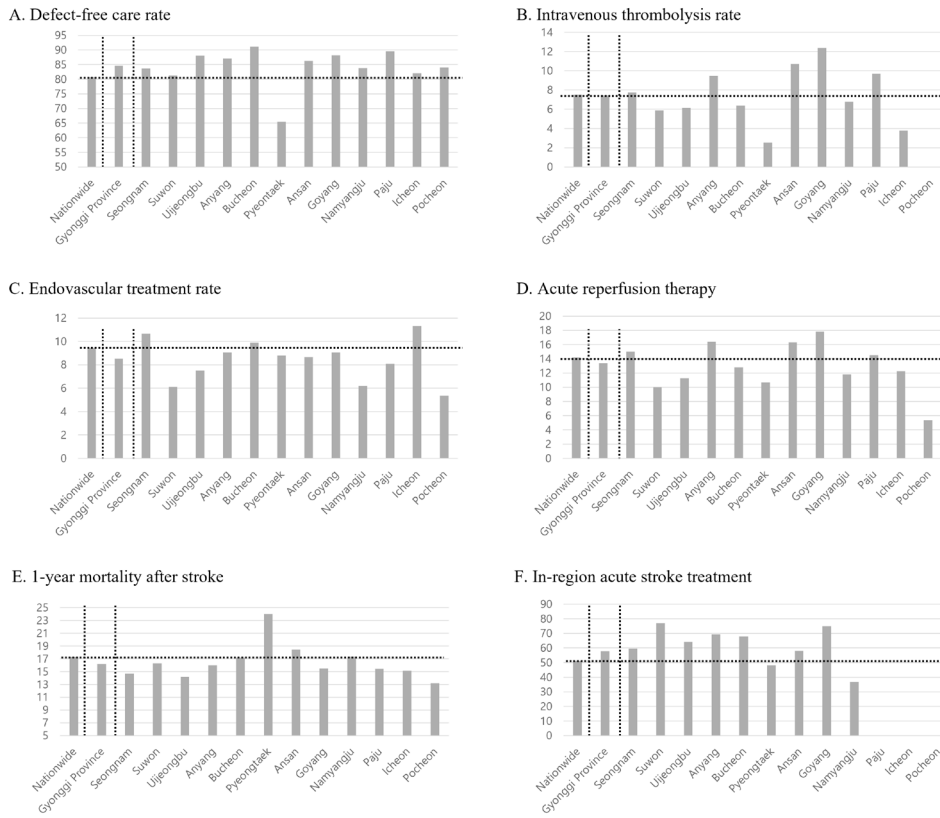
Decreasing rates of intravenous thrombolysis for acute ischemic stroke in Korea

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Purpose

IV thrombolysis is a proven treatment for acute ischemic stroke (AIS), but it is still underutilized in real-world clinical practice. Using a nationwide multicenter stroke registry, we aimed to determine whether there are significant trends in the rate of IV thrombolysis in different patient populations.

Methods

This study assessed patients with AIS or transient ischemic attack (TIA) registered prospectively in the Clinical Research Center for Stroke-Korea (CRCS-K) registry between 2008 and 2022. Trends in IV thrombolysis rate were respectively analyzed for all patients (Cohort 1), patients who arrived at the hospital within 4.5 hours of onset (Cohort 2), and patients potentially eligible for IV thrombolysis (Cohort 3), using joinpoint regression analysis. We further examined trends in IV thrombolysis rates according to the presence of cortical symptoms suggestive of large vessel occlusion on neurological examination by the on-call neurologist.

Results

A total of 96072 patients (30604 patients in Cohort 2 and 15000 patients in Cohort 3) were included in this analysis. The mean age of included patients increased from 67.3 to 69.8 years, and the proportion of patients arriving within 4.5 hours of onset increased from 23.5% to 31.3% over the 15-year period. The rate of IV thrombolysis for all included patients increased until 2011 (annual percent change (APC) [95% CI], 18.6% [10.8% to 39.7%]), followed by a significant decrease from 2014 to 2022 (APC [95% CI], -5.1% [-8.9% to -2.7%]). IV thrombolysis rates in cohorts 2 and 3 also showed a comparable decrease over the period (APC [95% CI], -2.8% [-3.8% to -2.0%] from 2012 to 2022 for Cohort 2 and -2.5% [-4.4% to -1.0%] from 2013 to 2016 for Cohort 3). The decline in IV thrombolysis rates was more pronounced in patients with stroke symptoms suggestive of large vessel occlusion at hospital arrival (APC [95% CI], -2.7% [-3.8% to -1.6%] from 2014 to 2022 in patents without cortical symptom; -4.5% [-5.6% to -3.6%] from 2013 to 2022 in patients with cortical symptom).

Conclusions

In Korea, the use of IV thrombolysis has declined over the past decade, even in patient arriving within 4.5 hours of onset and those who are potentially eligible for IV thrombolysis. The decreasing trend in IV thrombolysis was more pronounced in patients with suspected large vessel occlusion at hospital arrival. Urgent interventions to increase IV thrombolysis rates are needed to improve acute stroke care in Korea.

Association between depression and incident stroke and cardiovascular outcomes after percutaneous coronary intervention: A nationwide population study

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Purpose

Depression is an increasingly recognized risk factor for adverse cardiovascular outcomes, with numerous studies demonstrating a complex bi-directional relationship between the two. In patients undergoing percutaneous coronary intervention (PCI), the interplay of mental and physical health is particularly salient due to the potential for psychological stressors to influence postoperative outcomes. This study aimed to provide a robust evaluation of the association between depression and cardio-cerebrovascular outcomes in patients undergoing PCI using the National Health Insurance Program in Korea (K-NHIS) database.

Methods

Using the claims database of K-NHIS, this study enrolled participants who underwent PCI between 2010 and 2017. Participants were categorized into two cohorts based on the presence or absence of a depression diagnosis within five years prior to their PCI. The outcome measures were all-cause mortality, recurrent myocardial infarction necessitating another PCI, subsequent PCI or Coronary Artery Bypass Grafting (CABG), and all-cause stroke. A multivariable Cox proportional hazard regression analysis was employed to derive adjusted hazard ratios (aHRs) and 95% confidence intervals (CIs) for each outcome measure. Subgroup analysis was carried out on several factors, including duration of depression diagnosis (greater than five years or less), presence of anxiety, age (older than 65 years or younger), sex, body mass index (greater than 25 or less), and the occurrence of myocardial infarction at the time of the PCI procedure.

Results

Among 373,534 participants who underwent PCI, 219,361 patients who participated in national health check-ups that included a depression questionnaire within two years prior to PCI were included. After the exclusion of individuals with previous stroke history or missing variables, 164,198 patients remained for final analysis. Of these, 28,560 patients were diagnosed with depression, with 19,703 of these diagnoses occurring less than five years prior. A significant association was found between a diagnosis of depression and an increased risk of all-cause death and stroke, adjusting for confounders such as age, sex, income, alcohol consumption habits, exercise habits, previous history of hypertension, diabetes, dyslipidemia, Body Mass Index (BMI), and the presence of myocardial infarction at the time of PCI (adjusted Hazard Ratio [aHR] 1.265, 95% Confidence Interval [CI] 1.221-1.310 and aHR 1.300, 95% CI 1.224-1.380, respectively). Patients with a longer duration of depression had numerically higher aHRs. However, the presence of depression was not found to be associated with an increased risk of myocardial infarction (MI) with PCI and PCI or Coronary Artery Bypass Grafting (CABG). Additionally, the presence of anxiety did not interact with the outcomes. Remarkably, the impact of depression on stroke and mortality were more prominent in participants under the age of 65.

Conclusions

The findings from our nationwide cohort study reveal a significant association between depression and adverse cardiovascular outcomes, specifically all-cause mortality and stroke, in patients post-PCI. However, no association was found between depression and increased risk of myocardial infarction requiring subsequent PCI or CABG. These results underscore the importance of integrated care models that consider both mental and physical health in managing patients undergoing PCI.

Clinical characteristics and the possible stroke mechanisms of the embolic stroke of unknown sources in Korea: The real world study of the embolic stroke of undetermined sources (ROS-ESUS)

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Purpose

Ischemic stroke is a heterogeneous disease entity with diverse etiologies, but the non-negligible proportion of stroke remains as the stroke of undetermined etiology or cryptogenic stroke. The embolic stroke of unknown sources (ESUS) is a subgroup with non-lacunar stroke and undetermined etiology. The clinical implication of this special category is derived from the ambiguity of diagnostic workups and the lack of evidence for appropriate treatment. Therefore, we had the ambition to clarify the clinical characteristics and the real-world state of treatment of stroke patients with ESUS based on the nationwide multi-center database.

Methods

Data from ESUS patients were collected by a nationwide multicenter registry of 19 centers in Korea between January 1, 2014, and December 31, 2019. Eligibilities for Inclusion were above 20 years old, acute stroke within seven days from the onset of symptoms, and non-lacunar infarction. The patients were excluded if they had atherosclerotic cerebral arterial stenosis of the

symptom-relevant arteries, active cancer, or the patients with transient ischemic attack without evidence of acute infarction on brain images. The clinical characteristics, neurological outcomes, and comorbid diseases were described.

Results

A total of 5,853 patients were enrolled (mean age 66.0, male 60%). A majority of subjects were older than 60 years (69.1%). Previous history of stroke was noted in 19.2% and the proportion of patients with hypertension (61%), diabetes mellitus (29%), dyslipidemia (39%), coronary artery disease (11%), and current smoker (26%). The baseline National Institute of Health Stroke Scale was 4.71. The proportion of the favorable functional outcome was 69.9% at discharge and 74.2% at 3 months. Diagnostic workups were performed including transthoracic echocardiography (85.8%), transesophageal echocardiography (24.3%), Holter electrocardiogram (74.5%), shunt study using transcranial Doppler (30.8%), and implantable loop recorder (1.4%). The overall outcomes a considerable proportion of subjects had low to medium sources of cardioembolism including patent foramen ovale (17.3%), hypokinetic left ventricle (9.13%), complex aortic arch atheroma (5.6%), or mitral annulus calcification (4.25%). In a subset with brain images, non-significant stenosis at the corresponding artery to symptoms was found in 33%.

Conclusion

A lot of patients with ESUS had probable potential sources of cardioembolism or non-significant cerebral atherosclerotic stenosis. Further studies are requested to clarify the culprit of the index stroke events among the possible etiologies.

The usefulness of global longitudinal peak strain and left atrial volume index in predicting atrial fibrillation in patients with ischemic stroke

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Purpose

Detection of atrial fibrillation (AF) is crucial for preventing recurrence in patients with ischemic stroke. We aimed to examine whether the left atrial volume index (LAVI) and global longitudinal peak strain (GLPS) are associated with AF in patients with ischemic stroke.

Methods

We prospectively analyzed 678 consecutive patients with ischemic stroke. LAVI and GLPS were assessed using three-dimensional transthoracic echocardiography with speckle-tracking imaging. Logistic regression analysis examined the independent association between LAVI, GLPS, and AF. To evaluate the predictive value of LAVI and GLPS for the presence of AF, we used optimism-corrected c-statistics calculated by 100 bootstrap repetitions and the net reclassification improvement (NRI).

Results

The mean patient age was 68 ± 13 years (men, 60%). Patients with AF (18%) were a higher LAVI (41.7 ml/m^2 vs. 74.9 ml/m^2, $P < 0.001$) and a higher GLPS than those without AF (-14.0 vs. -17.3, $P < 0.001$). Among the 89 patients classified with embolic stroke of unknown source, the probable cardioembolic group had higher GLPS (n = 17, -14.6 vs. -18.6, respectively; $P = 0.014$) than the other groups (n = 72). Adding GLPS to age, hypertension, and the LAVI significantly improved the NRI, with an overall NRI improvement of 6.1 % ($P = 0.03$).

Conclusions

The LAVI and GLPS with speckle-tracking imaging echocardiography may help identify patients with AF.

Ischemic stroke induced by longer episodes of trigeminal autonomic cephalalgias.

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Purpose

Migraine with aura increases a risk of stroke. Although stroke-like symptoms can occur during migraine aura, infarction by vascular occlusion is extremely rare. Three patients with a history of migraine without aura were reported that new-onset, severe and prolonged episodes of trigeminal autonomic cephalalgias (TACs) to resist against O_2 inhalation and indomethacin induced ischemic stroke.

Methods

Neither cardiogenic embolism due to atrial fibrillation or patent foramen ovale, CADASIL/MELAS, large/medium vessel occlusion by arteriosclerosis, dissection or reversible vasospasms, vasculitis, coagulation/platelet aggregation abnormalities, nor antiphospholipid antibody were detected.

Results

Case 1: A 65-year-old woman had a 2-hour perforating headache from the left eyebrow to back of the eye with facial flushing and profuse sweating every morning for 2 weeks. For ten days before admission, she had complained of dysarthria and dysphagia. The patient finally had the most serious 6-hour TACs and felt difficulty in sitting up. Inattention by anxiety was noted with left eye Horner's phenomenon, truncal and left limb ataxia, and hypoesthesia of the right extremities. Lateral medullary infarct was detected on DWI/FLAIR with bilateral vertebral arteries hypoplastic ending to the PICAs and the basilar artery connecting to remnant primitive trigeminal artery. Combined treatment with antiplatelets, propranolol and anti-CGRP antibody had led to no 6-month recurrence.

Case 2: A 31-year-old woman presented one-week sustained TACs; throbbing facial to occipital pains with running tears, nasal congestion, nausea, and vomiting, followed by sudden double vision and gate instability. She showed left internuclear ophthalmoplegia and truncal ataxia. Two DWI-positive infarcts were observed in the mid-pons without vertebrobasilar artery disease. Antiplatelets, smoking and oral contraceptives cessation, and amitriptyline have prevented recurrent events for 1 year.

Case 3: A 38-year-old man experienced two episodes of left limb weakness after a half-day perforating headache from the back of the right eye to the occipital area, accompanied by facial sweating and flushing, lacrimation, and anxiety 3 and 4 months ago. Discontinued effective prophylactic valproic acid, propranolol, and anti-CGRP monoclonal antibody, he had the harshest TACs lasting 16 hours, followed by ataxic hemiplegia and dysarthria. Although there was no basilar occlusion, DWI/FLAIR mismatch detected ischemic lesions on the upper pons, which intravenous thrombolysis could attenuate.

Conclusions

The three cases suggested that critical and prolonged TACs might finally induce ischemic stroke due to small or medium vessel occlusion and platelet aggregation, while migraine with brainstem aura, hemiplegic migraine, or usage of triptans or ergot alkaloids were ruled out.

[PP055]

Various application of current devices in treatment of mechanical thrombectomy for cerebral arterial occlusion.

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Purpose

Mechanical thrombectomy known to be (MT), has been treated by using stent retriever and become the standard care to restore blood flow in patients experiencing an acute ischemic stroke both in anterior and posterior cerebral circulations.

This paper aims to investigate the various application in terms of efficacy and safety of a current stent retriever, aspiration catheter and distal access guiding catheter in thrombectomy.

The devices have become revolutionary to achieve ideal clinical outcome, therefore understating the conceptual framework of each new devices can support the procedures better for functional and safety outcomes of the patients. Furthermore, this article may address to provide ideas in selection of current generation devices and technical refinements in mechanical thrombectomy.

Methods

This review is a critical analysis of the principal of new designed stent retriever, aspiration catheter and distal access guiding catheter currently available in the market. : EmboTrap III, EmboVac, Cerebase DA, Enterprise II stent (CERENOVUS, Johnson&Johnson Medical Devices, CA, USA)

Results

A various thrombectomy devices have distinct features and mechanism actions.

The EmboTrap lll Revascularization Device(EmboTrap, CERENOVUS, Johnson&Johnson Medical Devices, CA, USA) stent retriever was designed unique with dual-layer segmented design with its 4 major advantages. The distal small cell dense mesh is designed to reduce distal embolism. The presence of closed cell inner channel gives excellent kink resistance and minor flow restoration under stenting expansion. Proximal tapered shape makes easy re-loading and minimize the interference or the proximal stent mesh against the direct suction force on the clot when using the combined technique.

EmboVac Aspiration Catheter, (CERENOVUS, Johnson&Johnson Medical Devices, CA, USA)

Excellent kink resistance with thin wall design gives more durability. This characteristic prevents kink when the Embovac is bent up to 5 mm. Since the wall thickness of the distal tip is less than 0.005", it will not be ovalized even if it bends up up to 5mm. It also increases compatibility with other products and makes it easier to inject contrast media.

Cerebase DA, (CERENOVUS, Johnson&Johnson Medical Devices, CA, USA) have 5 design benefits. Compare with competitive products, Cerebase DA has shortest distal tip. This Dextrous(DEX) tip is soft, compliant and rounded distal edges to facilitate tight turns similar with aspiration catheters.

Continuous stainless-steel braid-wire reinforcement and 12 segments relates to the polymer jackets on outside of the catheter gives smooth transition zones and proximal shaft stiffness. While maintaining the stability, the rounded off distal tip ensures safety advance in small and curved vasculature.

Like Embovac, Cerebase DA also has excellent kink resistance. Although it was tested to bent up to 6mm, it does not become ovalized unlike the other devices. These features allow Cerebase DA to approach petrocarvernous.

Conclusions

The mechnical thrombectomy using embotrap III based on Cerebase is another effective and option. Rescue stent using Enterprise II also played an important role in increasing the final recanalization rate.

Acknowledgement

There is no conflict of interest.

[PP056]

Analysis of risk factors for subarachnoid hemorrhage after mechanical thrombectomy in acute ischemic stroke with middle cerebral artery occlusion

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Purpose

Mechanical thrombectomy(MT) has been proven for patients with acute ischemic stroke secondary to a large vessel occlusion. According to the guideline of acute ischemic stroke published from the American Heart Association/American Stroke Association, MT may be reasonable for occlusion at M2 or M3 segment. Complications associated with MT include vasospasm, arterial dissection, subarachnoid hemorrhage(SAH). Although, many studies reported SAH after MT, few of studies showed risk factors for SAH. We presented the risk factors for SAH after MT in acute ischemic stroke with middle cerebral artery(MCA) occlusion.

Methods

We retrospectively reviewed the medical records of patients treated with mechanical thrombectomy from April 2019 to December 2022. Of these patients, we selected patients with MCA occlusion. We collected data of patients' past history, procedure records, and outcomes. We analyzed data and identified the risk fators causing procedure-related risk fators. Not only this, we divided three groups based on location of retrievable stent deployment (M1, M2, M3), and searched the differences of outcomes.

Results

72 patients were included this study. Patients with SAH and without SAH were 12 and 60, respectively. Procedural time (p-value 0.029) and numbers of passes through the occluded site (p-value 0.038) were the risk factors related with SAH. There were no differences between SAH and no-SAH group in terms of prognosis (modifided Rankin Scale, mortality). Also, none of differences were found related to retrievable stent deployment groups.

Conclusions

Procedural time and numbers or passes were the risk factors related to SAH after MT. SAH and location of stent deployment didn't affect outcomes and prognosis. Therefore, we cautiously suggest that there is no need to worry too much about SAH after MT.

Analysis of pain and complication after cerebral angiography and intervention

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Purpose

We aim to determine the frequency of local, systemic, and neurological complications, including pain, that may occur after transfemoral cerebral angiography and interventional treatment, and identify the factors causing their occurrence.

Methods

1) Among patients undergoing transfemoral cerebral angiography, data are collected through interviews and questionnaires from those who voluntarily consent after explaining the purpose of the study. 2) Evaluation items are investigated 1 day, 1 week (±1 day), 1 month (±1 day), and 3 months (±1 day) after cerebral angiography. 3) Evaluations conducted after 1 and 3 months to check for complications that last more than a week are confirmed through a questionnaire through wired/wireless connection if it is difficult for the patient to visit.

Results

A total of six medical institutions in the Busan, Ulsan, and Gyeongnam regions began recruiting subjects for the complications of cerebral angiography starting in September 2019. Subjects were finally registered in December 2020 and were followed up thereafter. A total of 506 research subjects were registered during the study period at 6 institutions, and 493 research subjects were analyzed, excluding 13 subjects. The 493 registered people had an average age of 62, and 267 (54%) were men. Cerebral angiography was performed in 328 patients (66.5%) for diagnostic purposes only, in 39 patients (7.91%) for treatment purposes only, and in 126 patients (25.6%) for both diagnosis and treatment. Most of the diagnoses for the procedure were ischemic stroke in 177 patients (35.9%), unruptured cerebral aneurysm in 215 patients (43.6%), and asymptomatic cerebrovascular stenosis/occlusion disease in 94 patients (19.1%).

Local complications occurring on the first day after the procedure included local pain in 128 patients (25.96%) and hematoma in 12 patients (2.43%). Systemic complications included new headache in 50 patients (10.14%), acute nephropathy or dysuria in 17 patients (3.45%), pruritus/runny nose in 11 patients (2.33%), and new dizziness in 7 patients (1.42%). Nausea/vomiting/hypotension occurred rarely in 5 patients. Neurological complications included hemiplegia in 12 patients (2.43%), sensory changes in 13 patients (2.64%), and dizziness in 9 patients (1.83%). Many of the neurologic symptoms disappeared within 24 hours (n=18, 3.65%), there were 12 cases (2.43%) of persistent cases, but there were no deaths.

Local complications reported 3 months after the procedure were hematoma and pain in 7 patients (1.45%) and 1 patient (0.21%), and systemic complications included new headache in 14 patients (2.89%) and new dizziness in 10 patients (2.07%), respectively.

Conclusions

This study analyzed the frequency and course of various local, systemic, or neurological complications related to cerebral angiography. Compared to previous studies, the study was planned to closely investigate pain-related complications and their prognosis after cerebral angiography, and as a result, it was confirmed that local or systemic complications occurred very rarely.

Endovascular treatment of intracranial vertebral artery dissecting aneurysms: Comparison of multiple stent and flow-diversion or stent-assisted coiling

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Purpose

Vertebral arteries are prone to dissection, which develops into a dissecting aneurysm. This aneurysm is mainly formed in fusiform shape, but sometimes aneurysm can also be formed in saccular shape.

To investigate the effect and safety of multiple stent in the treatment of unruptured dissecting aneurysms of the vertebral artery in comparison with flow diversion.

Methods

We conducted a retrospective study of patients with dissecting aneurysm using TFCA. Diagnosis of a dissecting aneurysm is classically represented as an angiographic pearl and string sign, the dilatation of the lumen adjacent to a stenotic segment and sudden angiographic change when angiography was followed up in a short term.

Of 250 dissecting aneurysm patients with endovascular treatment, 175 patients conducted the multiple stent, 42 patients conducted the flow-diversion, and 33 patients conducted the stent-assisted coil embolization.

Results

Of 250 dissecting aneurysm patients with endovascular treatment, 175 patients conducted the multiple stent, 42 patients conducted the flow-diversion, and 33 patients conducted the stent-assisted coil embolization. A mean follow-up of 4.3 years, recanalization occurred in three patients with multiple stents (1.7%), one with flow-diversion (2.3%), and one with stent-assisted coil embolization (3.0%, p=0.124).

Conclusions

In the treatment of dissecting aneurysm, multiple stenting showed equivalent results compared to other endovascular treatment. Therefore, multiple stenting should be considered when treating a dissecting aneurysm of vertebral artery.

Preprocedural D-dimer level as a predictor of first-pass recanalization and functional outcome in endovascular treatment of acute ischemic stroke

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Purpose

We aimed to evaluate the association between preprocedural D-dimer levels and endovascular and clinical outcomes.

Methods

We retrospectively reviewed patients with acute intracranial large vessel occlusion who underwent mechanical thrombectomy. Plasma D-dimer levels were measured immediately before the endovascular procedure. Endovascular outcomes included successful recanalization, first-pass recanalization (first-pass effect [FPE] and modified FPE [mFPE]), thrombus fragmentation, and the number of passes of thrombectomy device. Clinical outcome was assessed at 3 months using the modified Rankin Scale.

Results

Two hundred-fifteen patients were included. Preprocedural D-dimer levels were lower in patients with FPE (606.0 ng/mL [interquartile range, 268.0–1062.0]) than in those without (879.0 ng/mL [437.0–2748.0]; P = 0.002). Preprocedural D-dimer level was the only factor affecting FPE (odds ratio, 0.92 [95% confidence interval, 0.85–0.98] per 500 ng/mL; P = 0.022). D-dimer levels did not differ significantly based on successful recanalization and thrombus fragmentation. The number of passes of thrombectomy device was higher (P = 0.002 for trend), and the puncture-to-recanalization time was longer (P = 0.044 for trend) as D-dimer levels increased. Patients with favorable outcome had a significantly lower D-dimer level (495.0 ng/mL [290.0–856.0]) than those without (1189.0 ng/mL [526.0–3208.0]; P < 0.001). Preprocedural D-dimer level was an independent factor for favorable outcome (adjusted odds ratio, 0.88 [0.81–0.97] per 500 ng/mL; P = 0.008).

Conclusions

Higher preprocedural D-dimer levels were significantly associated with poor endovascular and unfavorable functional outcome.

Comparative efficacy of early mechanical thrombectomy and standard medical therapy in anterior circulation large vessel occlusion ischemic strokes: a prospective single-center study

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Purpose

Anterior circulation large vessel occlusion (AC-LVO) ischemic strokes present a distinct challenge in acute management, necessitating precise interventions. This single-center prospective study aimed to investigate the specific impact of early mechanical thrombectomy (MT) versus standard medical therapy (SMT) on clinical outcomes in AC-LVO ischemic stroke cases.

Methods

We conducted a meticulous study involving 75 AC-LVO ischemic stroke patients presenting within 6 hours of symptom onset at a single comprehensive stroke center. Patients were divided into two groups: Group MT (n=38) received early mechanical thrombectomy, while Group SMT (n=37) received standard medical management, including intravenous thrombolysis and aggressive medical therapy. The primary outcome measure was the modified Rankin Scale (mRS) score at 90 days. Secondary outcomes included the National Institutes of Health Stroke Scale (NIHSS) score on admission, successful recanalization rates (thrombolysis in cerebral infarction [TICI] 2b/3), symptomatic intracranial hemorrhage rates, and 90-day mortality rates. All results were reported with 95% confidence intervals (CI).

Results

In Group MT, 84% of patients achieved successful recanalization (TICI 2b/3) within a median time of 57 minutes (95% CI [0.78, 0.90]). Conversely, Group SMT exhibited a significantly lower recanalization rate of 16% (95% CI [0.08, 0.24]). At 90 days, 68% of patients in Group MT achieved favorable functional outcomes (mRS 0-2) compared to only 32% in Group SMT (95% CI [0.27, 0.45]). The mean NIHSS score on admission was significantly lower in Group MT (12) compared to Group SMT (17) (95% CI [-7.01, -1.22]). Symptomatic intracranial hemorrhage rates were comparable between the two groups (Group MT: 7%, Group SMT: 8%) (95% CI [-0.07, 0.05]). The 90-day mortality rate was lower in Group MT (16%) compared to Group SMT (30%) (95% CI [-0.28, -0.01]).

Conclusions

This study underscores the profound benefits of early mechanical thrombectomy in AC-LVO ischemic stroke patients. Rapid recanalization, improved functional outcomes, reduced NIHSS scores on admission, and lower mortality rates were observed in the MT group compared to SMT. The risk of symptomatic intracranial hemorrhage was comparable between the two groups. These findings emphasize the critical importance of timely assessment and consideration of mechanical thrombectomy as the primary intervention for AC-LVO ischemic strokes in specialized stroke centers. This research has significant implications for improving clinical practice and patient outcomes in this challenging patient population.

[PP062]

A case of filter retrieval with an aspiration catheter for filter occlusion in an emergency CAS

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Purpose

Treatment strategies for acute extracranial internal carotid artery occlusions vary substantially across stroke centers because of the lack of randomized controlled trial data. This report details a case of emergency carotid artery stenting (CAS) involving filter occlusion, which was successfully managed using an aspiration catheter.

Methods

An 81-year-old man presented with repeated recurrent left-hand weakness within 24 hours. He had a clinical history of laryngeal cancer that was treated with radiation therapy. Ultrasonography performed one month before showed severe stenosis of the right internal carotid artery (ICA). MRA revealed the occlusion of right ICA at the cervical portion. Considering his clinical course and MRI findings, the right ICA occlusion may have occurred within 24 hours. Subsequently, diagnostic angiography and CAS were planned. Right common carotid angiography revealed ICA near occlusion. FilterWire EZ was delivered to the distal of the stenotic lesion for distal protection. Carotid Wallstent was delivered to the stenotic lesion and deployed. Carotid angiogram showed flow stagnation in the ICA. It was expected to be due to the plugging of the filter by a large amount of atherosclerotic plaque. Consequently, the decision was made to employ an aspiration catheter. We successfully retrieved the FilterWire using an aspiration catheter under proximal control with Optimo balloon guide catheter.

Results

The patient tolerated the procedure without any complications and had a good outcome.

Conclusions

In cases where high volumes of plaque are expected, the use of an aspiration catheter instead of a capture sheath is an option to reduce the risk of distal embolization.

Progressive intracranial artery dissection with hemodynamic instability rescued by emergent stenting

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Purpose

Intracranial artery dissection (ICAD) is a relatively common cause of young and middle-aged stroke, especially in the anterior circulation. Little is known about the natural course and optimal treatment strategies of ICAD with ischemic symptoms. Intracranial stenting is recommended when recurrent stroke is developed in patients with intracranial atherosclerotic stenosis despite best medical therapy.

Methods

We report a case of ICAD who underwent emergent stenting due to fluctuating symptoms associated with progression of dissection.

Results

A 33-year-old man without common risk factors for stroke was admitted complaining of left sided weakness 30 minutes ago. He suddenly lost consciousness while playing a video game. Initial brain CT showed no hemorrhage and intravenous tPA was administered. Even though severe stenosis was present in the right distal internal carotid artery (ICA), his symptoms improved 1 day later. However, fluctuating cortical symptoms including gaze preference to the right side and decreased mentality developed. Perfusion MRI showed decreased perfusion in the right ICA territory and migration of dissection into the right distal middle cerebral artery (MCA). Emergent TFCA revealed slowing blood flows even though intra-arterial tirofiban was administered. Enteprise stent was deployed in the right distal M1 position of MCA. After stenting, fluctuating weakness and consciousness improved.

Conclusions

Although there is still no consensus about the intracranial stenting, emergent stenting may be option of treatment in patients with hemodynamic instability due to ICAD.

Which one to treat first? : Heart of brain? – A case of synchronous cardiocerebral infarction

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Purpose

A cardiocerebral infarction or a simultaneous acute myocardial infarction and acute ischemic stroke is a rare event with no clear recommendations for proper treatment due to the rarity of the scenario. We report a case of cardiocerebral infarction treated with primary percutaneous coronary intervention (PCI) followed by endovascular treatment (EVT).

Methods

An 84-year-old male was transferred from another hospital for decreased mentality with right hemiparesis. He had visited the hospital for chest pain. While waiting for examination, he suddenly collapsed with desaturation and was transferred for proper management. Computed tomography angiography showed left proximal ICA occlusion and the left anterior cerebral artery with the left middle cerebral artery supplied via the anterior communicating artery. Electrocardiography indicated anterior wall ST elevation myocardial infarction (STEMI). Portable echocardiography findings suggested left anterior descending (LAD) artery territorial insult.

Results

After a discussion with the attending cardiologist, we decided on intervention for STEMI first. After loading dual antiplatelet agents, PCI was done. After the procedure, we did EVT on the left ICA. The first pass effect was achieved by aspiration thrombectomy.

Conclusions

Synchronous myocardial infarction and acute ischemic stroke is rare but may be fatal due to the narrow therapeutic time window. Careful discussion with the expert on cardiac status is essential for this challenging situation.

Successful recanalization after direct brachial approach for acute basilar artery occlusion: A case report

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Purpose

Endovascular thrombectomy (EVT) for treatment of acute stroke with large artery occlusion have been widely performed. Earlier reperfusion has been associated with the favorable functional outcome after EVT. However, the efficacy of EVT for acute basilar occlusion remains uncertain in contrary to the anterior circulation. Placement of guide catheter via femoral route may be difficult particularly in the elderly due to tortuousity of the arteries. The transbrachial approach could be an alternative because of proximity of the vertebral artery to the brachial artery. We report a case of the acute stroke with basilar occlusion which was successfully recanalized after endovascular thrombectomy via direct brachal access.

Methods

A 74-year-old man visited emergency room presenting with loss of consciousness 1 hour ago. Initial neurological examination revealed stuporous mental status and quadriparesis, fixed both eye movement. It had been revealed that hypodense lesions in both cerebellum and pons on brain computed tomography and distal basilar artery occlusion on brain computed tomography angiography.

Results

After administration of intravenous tissue plasminogen activator, an EVT was planned. Initial trial of distal access to right brachiocephalic trunk via right femoral artery route was failed due to tortuous right iliac artery. Also, the right brachiocephalic trunk has an acute angle arising from aortic arch, the selection of right brachiocephalic trunk was failed. We achieved the modified thrombolysis in cerebral infarction (mTICI) grade 3 of basilar artery after the aspiration technique of EVT with the success of direct brachial approach to select right vertebral artery. The patient had been fully recovered after EVT. There is no complication related with direct brachial access such as hematoma.

Conclusions

Direct brachial approach for the acute basilar occlusion in endovascular thrombectomy might be a good alternative to the conventional femoral artery approach, particularly in the tortuous arterial route to the vertebral artery.

Spontaneous revascularization of early stent thrombosis after carotid artery stenting

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Purpose

Early carotid stent thrombosis is extremely rare and reported to bring about devastating complications. Coagulopathy, inadequate antiplatelet therapy, resistance to antiplatelet agents, and vasospasm are causes of thrombosis. Natural course of stent thrombosis has not been identified.

Results

A 56-year-old man with hypertension, diabetes mellitus, and hyperlipidemia was admitted due to left hemiplegia and dysarthria 1 hour before. Initial NIH stroke scale (NIHSS) was 11 and emergency CT brain was unremarkable. He was treated with intravenous t-PA. Right proximal carotid artery stenosis and right middle cerebral artery (MCA) occlusion by CT angiography was successfully opened by carotid stent placement and mechanical thrombectomy. NIHSS was improved from 11 to 3. Brain MRI showed acute cerebral infarction with hemorrhage transformation in the right MCA territory. Three days after endovascular therapy, carotid reocclusion was detected by carotid duplex sonography and CT angiography. Right MCA was still recanalized and symptoms was improved, no additional treatment was added to the dual antiplatelet therapy. Eighteen months after stroke onset, CT angiography showed spontaneous recanalization of occluded right carotid artery by stent thrombosis and his modified Rankin scale score was 2.

Conclusions

We report a patient who had a spontaneous revascularization of early stent thrombosis after carotid artery stenting.

The impact of the initial angiographic appearance of middle cerebral artery occlusion on endovascular revascularization therapy for clinical outcome.

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Purpose

Clinical outcome of endovascular revascularization therapy(EVT) for acute middle cerebral artery(MCA) occlusion is relevant in managing acute ischemic stroke patients and often difficult to determine in the acute phase. We aim to investigate whether the angiographic appearance of the MCA occlusion is related to its clinical course and outcome.

Methods

Patients with MCA occlusions who underwent EVT in our center from March 2018 to June 2022 were studied. Demographics, clinical and radiological variables and outcome measures, including etiological classification of stroke, were collected. We reviewed consecutive patients with acute MCA occlusion associated with ICAS who underwent intracranial stenting and balloon angioplasty after initial mechanical thrombectomy. Underlying intracranial atherosclerosis was estimated according to the presence of stenosis after recanalization. Patients were assigned to groups based on the appearance of the occlusion observed in the first angiogram as "tapered" or "non-tapered" at the internal carotid artery(ICA)-MCA bifurcation. Differences were investigated among the groups.

Results

44 patients met the inclusion criteria. 30 (68.4%) were "tapered" and 14 (31.6%) non-tapered. Tapered presented lower mean baseline NIHSS [14.0 (8.0–17.0) vs. 7.5 (6.0–13.0) p = 0.044]), and received intravenous thrombolysis was more prevalent in the without stump group (71.4% vs. 16.7%, p = 0.001). There were no significant differences in procedure time, technique, and devices. However, the successful revascularization rate was significantly lower in the non-tapered group (57.1% vs. 100%, p = 0.001). Additionally, the immediate re-occlusion rate after the first endovascular reperfusion therapy was a higher tendency in the non-tapered group (71.4% vs. 36.7%, p = 0.068). However, no significant association was found between periprocedural complications including intracerebral hemorrhage and mortality.

Conclusions

The angiographic appearance of MCA occlusion in EVT patients may determine its etiology, predict the likelihood of successful recanalization and the risk of reocclusion.

[PP068]

Iron status and outcomes after mechanical thrombectomy in stroke

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Purpose

In patients treated with mechanical thrombectomy (MT) stroke, the effect of systemic iron status has not been explored thus far to assess clinical outcomes. We investigated the predictive value of systemic iron status in evaluating clinical outcomes in acute stroke patients treated with MT.

Methods

We enrolled 747 patients with large vessel occlusion (LVO) treated with MT in this study. The primary outcome measure was a poor outcome at 3 months, defined as a modified Rankin Scale score of 3–6. All enrolled patients were measured serum iron, ferritin, transferrin, and total iron-binding capacity (TIBC) levels. Iron status were analyzed as both categorical (in quartiles) and continuous (using a 2-log transformation) variables.

Results

High ferritin level was significantly associated with a poor outcome at 3 months in LVO patients treated with MT (OR = 1.60, 95% CI [1.14–2.23], p = 0.006). The mortality rate was also significantly higher in the high ferritin group than in the low ferritin group (OR = 2.22, 95% CI [1.22–4.06], p = 0.009). Low iron or transferrin levels showed an association with a poor outcome at 3 months. However, these differences were not statistically significant (OR = 0.73, 95% CI [0.53–1.01], P = 0.065; OR = 0.86, 95% CI [0.62–1.20], p = 0.386, respectively). TIBC was not associated with a poor outcome at 3 months.

Conclusions

Our findings suggest that high serum ferritin level is associated with a poor outcome at 3 months after MT in patients with LVO. Baseline ferritin level can be an independent predictor of functional outcome after MT.

Acknowledgement

Successful retrograde stent-assisted coil embolization of ruptured vertebral artery dissecting aneurysm through the left posterior communicating artery in a patient with acute subarachnoid hemorrhage.

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Purpose

Advanced endovascular technology and techniques allow interventional neurosurgery to utilize novel ways of posterior circulation approach in the setting of acute subarachnoid hemorrhage, especially when routine approaches are not eligible.

Methods

Trans-circulation embolization through the communicating arteries of the circle of Willis has been previously described as a bailout in cases where direct coil embolization is not feasible.

Results

Here we describe a distinctive case where a retrograde stent-assisted coil embolization of the dissecting aneurysm at the vertebrobasilar junction was performed using the right posterior communicating artery (Pcom) in a patient with bilateral occlusions of the vertebral arteries, which seemed to be chronic. Initial anterograde access to the left vertebral artery through the ipsilateral occipital artery had failed. This was done using a co-axial system with multiple concentric catheters to minimize the ledge effect and achieve smooth and safe transition of the catheters from anterior to posterior circulations. A combination of stent placement, coil embolization and additional stent placement for flow diversion effect helped embolization of the dissecting aneurysm while minimizing re-bleeding and expansion of dissection. The ruptured aneurysm with the daughter sac had complete occlusion. The subarachnoid hemorrhage is believed to be due to a ruptured dissecting aneurysm at the vertebrobasilar junction and competing flow.

Conclusions

Hence, the patient was started on neuro-intensive care. The case underscores the complexity of posterior circulation hemorrhagic events, the beneficial role of retrograde endovascular approaches in patients with bilateral vertebral occlusions, and the necessity of additional studies that identify optimal therapeutic methods of treating posterior circulation hemorrhage and their effectiveness and safety.

Delayed ischemic events with low-dose prasugrel medication for stent-assisted coil embolization in intracranial aneurysm patients

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Purpose

Much emphasis has been put on the use of antiplatelet medication for prevention of ischemic events in the treatment of cerebral aneurysms with stent assistance. In this regard, the effectiveness and safety of a low-dose prasugrel regimen during the periprocedural period was recently reported. The purpose of this study was to present the outcomes of patients on low-dose prasugrel regimens during the follow-up period after stent-assisted coil embolization (SAC) of cerebral aneurysms.

Methods

For the 396 consecutive patients undergoing SAC procedures, low-dose prasugrel therapy (5 mg prasugrel and 100 mg aspirin) was recommended for 3 months after the endovascular treatment. We focused on delayed ischemic events during the follow-up period beyond 1 month after treatment. The mean follow-up period was 24.6 ± 11.3 months.

Results

In this cohort of low-dose prasugrel regimen, cerebral infarction occurred in 1 patient (0.3%; 95% confidence interval [CI], 0%–1.8%) beyond 1 month after SAC. No intracranial hemorrhage occurred. Overall ischemic events occurred in 14 patients (3.5%; 95% CI, 2.1%–5.9%), all within 6 months of the coiling procedure. All the patients showed transient symptoms. The events occurred within 2 months after cessation of prasugrel in 11 patients (78.6%). Apparently, prasugrel maintenance for 6 months resulted in lower ischemic events as compared to 3 months.

Conclusions

For patients undergoing SAC, a low-dose prasugrel regimen was effective in prevention of delayed ischemic events. Transient ischemic events often occurred within 2 months of ceasing prasugrel medication.

Safety and efficacy of low-dose prasugrel in the endovascular treatment of unruptured aneurysms in the elderly (≥75 years)

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Purpose

The effectiveness and safety of low-dose prasugrel (PSG) premedication for endovascular treatment of unruptured intracranial aneurysms (UIAs) have been widely reported. In this study, we evaluated the clinical outcomes of elderly patients (≥75 years) treated with PSG.

Methods

A total of 200 patients with 209 UIAs who were administered PSG as premedication (20 mg loading and 5 mg maintenance with 100mg aspirin) between March 2018 and December 2021 were retrospectively enrolled. Among them, 39 patients were aged 75 years or over (elderly group), and 161 patients were aged under 75 (control group). Patients' clinical data were collected, and outcomes were compared between the two groups.

Results

Of the 200 patients with PSG, nine cases (4.5%) had overall complications (seven ischemic, two hemorrhagic). In the comparison between the elderly group and the control group, no significant differences were observed in the overall complication rates (elderly group vs. control group; 2.6% vs. 5.0%, $P = 1.00$). Moreover, the rates of poor clinical outcome were comparable (2.6% vs. 1.2%, $P = 0.48$). The subgroup analysis of the patients with stent-assisted procedures revealed no significant differences in complication rates (0% vs. 1.6%, $P = 1.00$) or poor clinical outcomes (0% vs. 0%, $P = 1.00$) during maintenance with aspirin 100 mg or PSG 5 mg.

Conclusions

The complication rates in the elderly treated with low-dose PSG premedication were similar to those in the control. Low-dose PSG premedication could be prescribed without any additional risk for the endovascular treatment of UIAs in elderly patients.

Moyamoya disease associated with use of nilotinib: A case report

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Purpose

To discuss the presentation, pathophysiology and management of a Chronic Myeloid Leukemia (CML) patient maintained on Nilotinib presenting with Moyamoya disease

Methods

This is a case report and review of literature

Results

This is a case of a 31 year old Filipino male, known case of Chronic Myeloid Leukemia since 2009, initially maintained on Imatinib but shifted to Nilotinib 150mg 2 tablets twice a day for 3 years. This patient presented initially with difficulty seeing the right side of his vision, followed by stuttering of speech, and eventually developed decreased verbal output and right sided weakness over the course of several months. On consult, an initial CT scan revealed an infarct, and a subsequent MRI was suggestive of Moyamoya disease. An angiogram was done confirming the diagnosis. He eventually underwent indirect revascularization. Moyamoya is a cerebrovascular disease characterized by stenosis of the internal carotid artery, its proximal middle cerebral artery, and anterior cerebral artery branches, with resulting collateralization of vessels in the brain parenchyma. There have been several reports of CML patients presenting with stroke-symptoms after several years of use of Nilotinib. These cases, however, have been limited to patients in the older age groups, with other significant vascular risk factors. Our patient developed Moyamoya syndrome, presenting as stroke in the young at 31 years old after 3 years of use of Nilotinib. To the author's knowledge, this is also the first reported case from the Philippines of a patient developing Moyamoya syndrome after prolonged use of Nilotinib.

Conclusions

Moyamoya is a significant cause of stroke, especially in Asian countries. While the association has not been established, case reports of Moyamoya and other cerebrovascular events with the use of Nilotinib are concerning. Further studies are needed to establish if there is a time-dependent association with cerebrovascular events and Nilotinib use. More research should also be put into determining if the use of Nilotinib alone increases risk, even in the absence of other major cerebrovascular risk factors. Given its benefits both as a second and first line treatment for patients with CML, Nilotinib's possible association with increased risk of cerebrovascular events should be an important consideration in treatment planning for physicians.
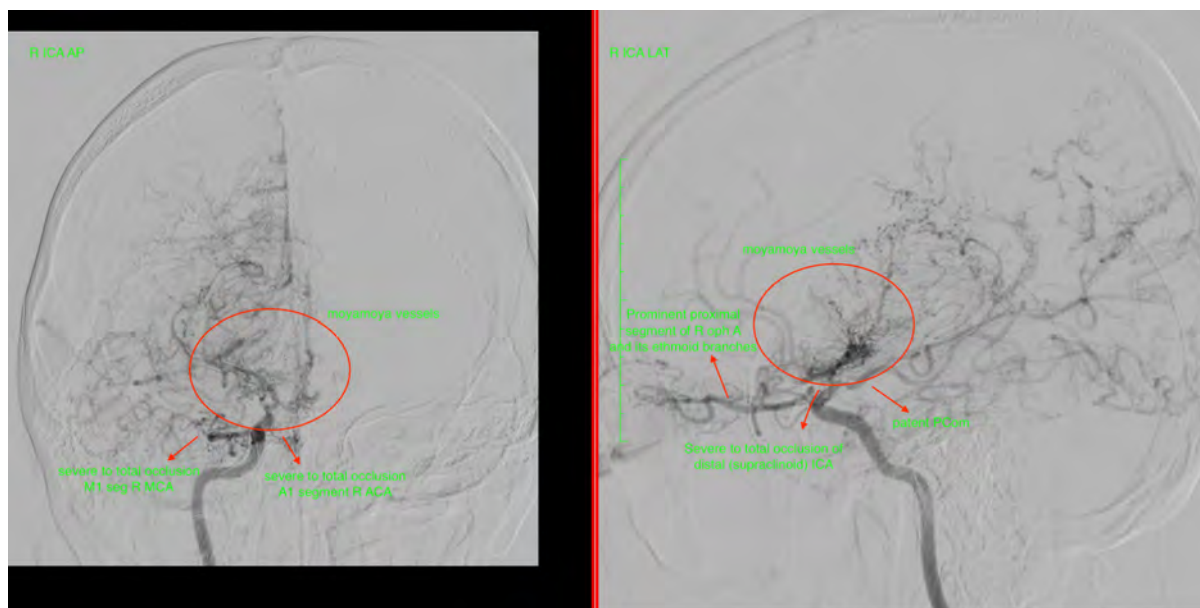
Top of basilar occlusion manifested only as unilateral internuclear opthalmoplegia : A case report

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Purpose

We present a case of top of basilar occlusion (TOB) with small infarction manifested only as unilateral internuclear opthalmoplegia (INO). A 71-years-old woman presented a right INO. Imaging studies revealed an occlusion of the top of basilar artery and small acute infarctions on the right posterior pons and left frontal lobe. TOB was recanalized after direct oral anticoagulant (DOAC) administration. In the patient with a TOB with underlying atherosclerosis and cardioembolic source, we can expect that small infarction may occur even if cerebral infarction occurs, and recanalization may occur after DOAC administration.

Methods

BAO is rare, accounting for approximately 1% of strokes.It can have a variety of clinical manifestations ranging from transient weakness or paresthesia to near-complete paralysis. In the case of TOB, unilateral INO rarely appears alone. Herein, we present a case of TOB who had small infarction manifested only as unilateral INO.

Results

A 71-years-old woman presented to the hospital with vertigo and gait disturbance. The patient presented right INO. Brain computed tomography angiography (CTA) revealed an occlusion of the top of basilar artery. Diffusion weighted magnetic resonance imaging showed small acute infarctions on the right posterior pons and left frontal lobe. According to sick sinus syndrome, DOAC with apixaban 5mg twice a day was started. Since then, opthalmoplegia and vertgo have gradually improved. Follow-up brain CTA showed recanalization of previous occlusion site and antegrade blood flow.

Conclusions

The clinical presentation of BAO ranges from mild transient symptoms to devastating strokes. The mortality rate related to a serious condition is approximately 40%. Unlike in the anterior circulation, the blood flow stasis and congestion proximal to the occlusion site may more easily occur in TOB. It is because of an occlusion of the single path end-artery. The extent of the infarct that results from BAO depends mainly on the collaterals.

In our case, we hypothesized that atherosclerosis on the distal segment of basilar artery has been accompanied by collateral flows to posterior cerebral artery and superior cerebellar artery territory from anterior inferior cerebellar artery and posterior inferior cerebellar artery, followed by small infarction after top of basilar occlusion.

Significant miRNAs as potential biomarkers to differentiate moyamoya disease from intracranial atherosclerotic disease

Hyesun Lee[1], Mina Hwang[1], Hyuk Sung Kwon[1], Hongil Kim[1], Euihyun Sung[2], Young Seo Kim[2], Hyun Young Kim[2], Soo Jeong[2], Kyung Chul Noh[3], Hye-Yeon Choi[3], Ho Geol Woo[4], Sung Hyuk Heo[4], Seong-Ho Koh[1], Dae-Il Chang[4]

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Purpose

Moyamoya disease (MMD) and intracranial atherosclerotic disease (ICAD) have similar angiographic characteristics but exhibit distinct mechanisms and require different treatments. Accurate diagnosis is important for increasing the likelihood of good prognosis; therefore, it is necessary to identify biomarkers to differentiate between these two diseases.

Methods

We analyzed plasma micro-ribonucleic acids (miRNAs) in 10 patients with MMD or ICAD from two hospitals. The diagnosis of MMD was based on the guidelines of the Research Committee on MMD and RNF213 polymorphisms. We extracted miRNAs and synthesized cDNA that were used for miRNA PCR array analysis. Bioinformatics, including gene ontology (GO) pathway analyses, were also used.

Results

The miRNA array results revealed differential gene expression patterns between the MMD and ICAD groups. A total of 84 miRNAs were inspected and five miRNAs (hsa-miR-100-5p, hsa-miR-10b-5p, hsa-miR-150-5p, hsa-miR-30a-5p, and hsa-miR-7-5p) were significantly downregulated in the MMD group ($p < 0.05$). In addition, three miRNAs (hsa-miR-100-5p, hsa-miR-10b-5p, and hsa-miR-150-5p) showed fold-regulation surpassing ±2.00 values. Bioinformatic analysis revealed that these three miRNAs are related to various genes and pathways involved in biological processes and molecular functions.
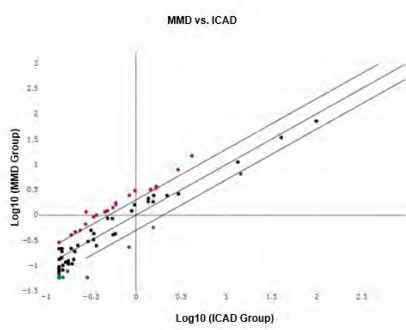
Conclusions

We found that these three miRNAs (hsa-miR-10b, hsa-miR-100, and hsa-miR-150) in plasma possess the potential to differentiate between patients with MMD and those with ICAD, which may help pave the way for early diagnosis and prompt treatment.
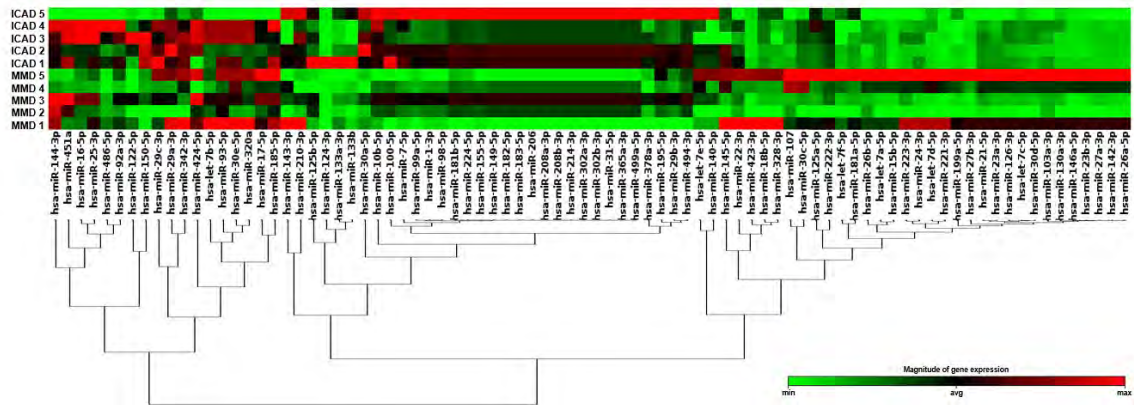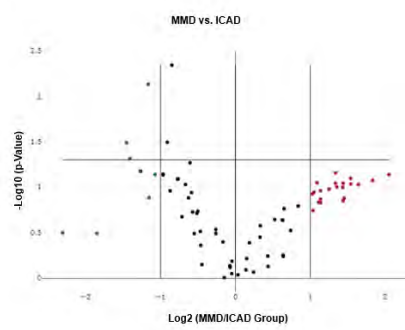
November 17 (Fri) 13:00-13:50 | Poster Room

Poster Session 2 [ENG]

CHAIRS   Chulho Kim (Hallym University Chuncheon Sacred Heart Hospital, Korea)

Jun Young Chang (Asan Medical Center, Korea)

Sung Hyuk Heo (Kyung Hee University Hospital, Korea)

Yerim Kim (Kangdong Sacred Heart Hospital, Korea)

Han-Bin Lee (Seoul St. Mary's Hospital, Korea)

Moo-Seok Park (Ewha Womans University Seoul Hospital, Korea)

Keon-Joo Lee (Korea University Guro Hospital, Korea)

Hyungjong Park (Keimyung University Dongsan Hospital, Korea)

[PP076]

The relationship between ischemic lesion volume change and neurologic deterioration: Insights from big data analysis

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Purpose

Understanding the dynamics of Diffusion-Weighted Imaging (DWI) lesions in Acute Ischemic Stroke (AIS) patients who experience early neurologic deterioration (END) remains a critical yet insufficiently explored area.

Methods

From a prospective stroke registry, we collected consecutive AIS patients who were admitted between 01/2011 and 12/2022. END was systematically surveyed during the period using the following definition: a measurable worsening of neurological function or any increase of NIHSS score within three weeks after the onset. Initial and follow-up DWIs were taken during routine clinical care, and the volumes of DWI lesions were automatically measured using JBS-01K (JLK Inc), a fully automated and validated deep learning algorithm using 3D U-net. Quantile regression models were used to investigate the association between END and the change in DWI lesion volumes, adjusting for relevant covariates.

Results

A total of 6862 patients were included (61% male, mean age 67.6 ± 13.5 years). Initial and follow-up median [IQR] DWI lesion volumes were 0.84 [0.21 – 4.89] mL and 1.63 [0.44 – 8.56] mL, respectively. Absolute change in DWI lesion volume had a median value of 0.35 [0 – 2.51] mL, measured over an interval of 86.5 [65.8 – 105.9] hours. (Figure A) END was noted in 12.1% (832) cases. The median DWI lesion volume change was significantly higher in patients with END (1.68 [0.44 – 7.95] mL) compared to those without (0.26 [-0.01 – 1.98] mL). The median of DWI volume changes was significantly associated with the END (, 1.23 and 95% CI, 1.00 – 1.47) as well as significant coefficients for 25th percentile (0.44, 0.32 – 0.57) and for 75th percentile (3.42, 2.47 – 4.36) of DWI lesion volume difference. (Figure B)

Conclusions

AIS patients who had END may experience a significant increase in ischemic lesions on the subsequent DWI.
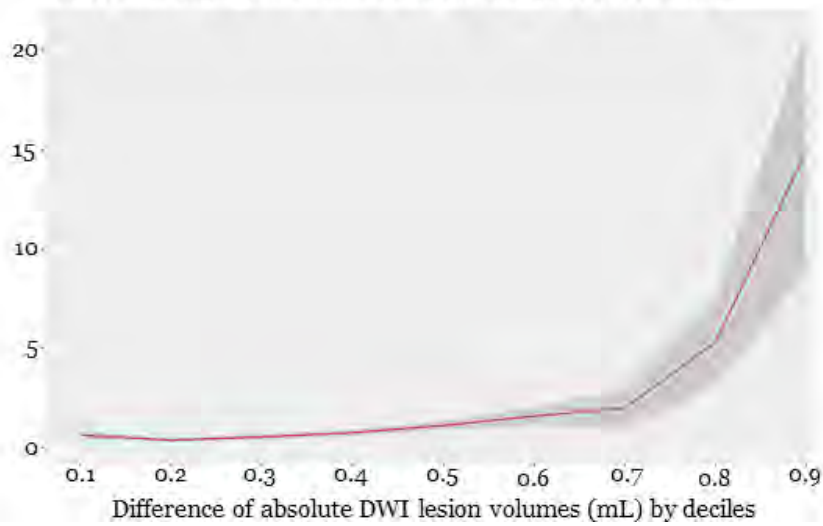
Figure

Histogram of difference of absolute DWI lesion volumes (mL)
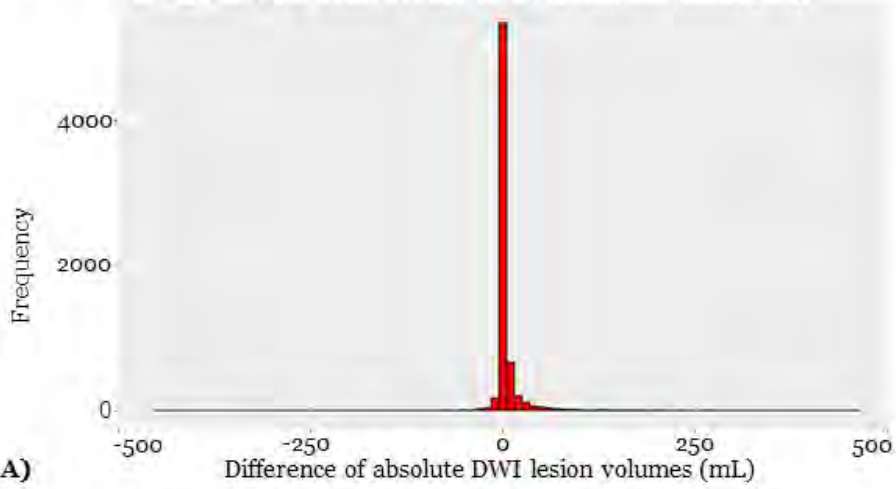
(Panel A)

Early neurologic deterioration and the change of DWI lesions

(Panel B)

Exploring the association between DWI lesion change in acute stroke and functional recovery: Application of an automated software to 6000 cases

Nakhoon Kim[1], Dong-Wan Kang[2,3], Yoona Ko[1], Jeongmin Cha[1], Wi-Sun Ryu[4], Jun Yup Kim[1], Moon-Ku Han[1], Hee-Joon Bae[1], Beom Joon Kim[1]

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Purpose

The change in DWI lesion volume in acute ischemic stroke has not been investigated in detail. We aimed to investigate the effect of DWI lesion growth or regression within ten days of onset on functional recovery after ischemic stroke.

Methods

From a prospective stroke registry, we retrieved acute ischemic stroke cases who had more than two DWIs during in-hospital care between 2005 and 2022. The DWI lesion volume was automatically measured using JBS-01K (JLK Inc., South Korea), a fully automated and validated deep learning algorithm using 3D U-net. The association between categorized DWI lesion volume change (10, 25, 50, and 75 percentiles corresponding to -40%, 0%, 56%, and 212% of volume change) and functional recovery was assessed using multivariable ordinal logistic regression analysis taking lower modified Rankin scale (mRS) as a dependent variable, adjusting for relevant covariates.

Results

A total of 6426 patients with ischemic stroke who underwent follow-up DWIs were included. A male was 62%, mean age of 67.9±13.3, and a median of initial NIHSS 4 [IQR 2-7]. The median of interval between the initial and follow-up DWI was 33.11 hours [IQR 18.60 – 52.40]. The median of the initial DW lesion volume was 1.39 ml [IQR 0.41-7.24], and the median of the follow-up DW lesion volume was 2.10 ml [IQR 0.58-10.22]. DWI lesion volume was regressed in 1790 cases (27.9%); 129 cases (14%) of EVT and 1661 cases (30%) of non-EVT cases. Relatively, DWI lesion volume was decreased in 96 cases (14%) of IVT and 1694 cases (29%) of non IVT cases. Compared with patients with 25-50 percentile strata, the adjusted odds ratios (OR) of having favorable functional recovery for < 10th, 10-25th, 50-75th, and ≥75th percentile were 1.25 [95% CI 1.06 – 1.49], 0.97 [0.83 – 1.12], 0.71 [0.62 – 0.80], and 0.58 [0.50 – 0.69], respectively (Figure).

Conclusions

We found that approximately a quarter of patients with ischemic stroke had an interval regression of infarct volume on DWI, which is independently associated with favorable outcomes.

Machine learning-based differentiation of intracranial arterial diseases using cerebrovascular morphometry

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Purpose

Stroke is a heterogeneous disease with diverse etiologies and the pathological conditions of intracranial arteries, so-called intracranial arterial diseases (ICADs), can cause stroke directly. Although atherosclerosis has been regarded as a dominant cause of ICADs, recent investigation proved that non-atherosclerotic ICADs such as moyamoya disease or cerebral arterial dissection are major contributors to ICADs.

Our ambition is to differentiate ICADs by machine learning techniques with the features of cerebrovascular morphometry which provides detailed morphological features of cerebral arteries using automated analysis of MR angiography.

Methods

Subjects were selected from a prospectively collected hospital-based stroke registry. Among the patients who registered in this stroke registry, we selected the patients with ICADs such as intracranial atherosclerosis (ICAS), moyamoya disease (MMD), and intracranial arterial dissection (IAD). The morphological features of each group were compared among ICADs and presented as a map that showed the standardized score of each feature at each chunk (structural and functional group of cerebral arteries). Cerebrovascular-cardiovascular disease-free controls were selected. We produced machine learning models to differentiate each group.

Results

The subjects were composed of 112 ICAS, 83 MMD, 86 IAD, and 120 controls. The heatmap showing the standardized value of each feature at each chunk according to the disease category revealed a distinct signature (Figure). ML-based models to discriminate each ICAD group from normal control showed excellent discriminating performance. However, only a modest performance appeared from the models that were to differentiate among ICAS, MMD, IAD, and normal control.

Conclusions

Machine learning-based approaches using the morphological features of cerebral vasculature could be helpful to discriminate pathological intracranial arterial disease from normal control. However, differentiation among different disease categories needs further amelioration.

[PP079]

Automated prediction of large vessel occlusion in non-contrast brain computed tomography via feature engineering of net water uptake and clot sign

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Purpose

For patients with ischemic stroke, early recognition of large vessel occlusion (LVO) is crucial for timely interventions. While computed tomography (CT) or magnetic resonance (MR) angiography remains the gold standard for LVO diagnosis, they have several limitations including limited accessibility and procedural delays. In addition, vague, atypical, or progressive neurologic symptoms result in delayed diagnosis and poor outcomes. We aimed to develop and validate a machine learning algorithm (JBS-05L, JLK Inc., Republic of Korea) for predicting LVO using features extracted from non-contrast CT (NCCT).

Methods

2,833 patients who simultaneously underwent NCCT and CT angiography from seven hospitals were included. The presence of LVO was confirmed by consensus between two experienced neurologists. For model training and validation, 2,738 from five hospitals were divided 9:1 while maintaining the LVO proportion (training: 17%, validation: 16%). As an external dataset, patients from the remaining two hospitals were set aside. After registration of a standard template with a region mask (basal ganglia, insular, M1-M3, and M4-6 used in the ASPECTS [Alberta stroke program early CT score]) onto the NCCT, net-water uptake (NWU) and related parameters of each region were extracted. In addition, we developed an automated clot sign detection model using 631 NCCT images and clot sign masks manually segmented. Upon exploration of the importance and discriminative power of each feature, we used the selected features to train an Extra Trees binary classifier for predicting LVO. We evaluated the sensitivity, specificity, and overall efficacy of the algorithm.

Results

For the training dataset mean age was 71.4±12.3 years and 59% were male. In the internal validation dataset, the algorithm achieved an area under the curve (AUC) of 0.86 with a sensitivity of 82%, specificity of 84%, positive predictive value (PPV) of 51%, and negative predictive value (NPV) of 96%. When applied to the external dataset comprised of 95 patients (25 LVO), the algorithm maintained comparable AUC of 0.89 with a sensitivity of 80%, specificity of 88%, PPV of 71%, and NPV of 92% without any threshold optimization. Permutation analysis demonstrated that the p value of NMW difference between striatocapsular regions is the most important feature in predicting LVO, followed by clot sign and relative insular NWU.

Conclusions

Our algorithm, JBS-05L, provides a reliable and rapid prediction of LVO with considerable accuracy. By enabling angiography-independent LVO prediction, JBS-05L has the potential to expedite the follow-up process for patients, thereby increasing the likelihood of positive outcomes.

Automated detection of intracranial hemorrhage using deep learning: a confirmatory clinical trial

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Purpose

Acute intracranial hemorrhage (ICH) is a critical medical condition that necessitates immediate and precise evaluation and treatment. In this retrospective confirmatory clinical trial, we aimed to externally validate commercially available artificial intelligence (AI) software (JBS-04K, JLK Inc., Republic of Korea) detecting ICH on non-contrast brain computed tomography (CT).
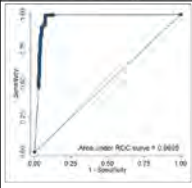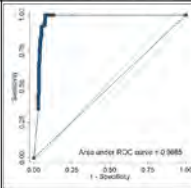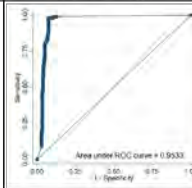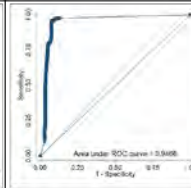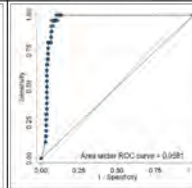
Methods

The AI software was trained using 53,045 brain CT scans from six university hospitals to develop an ensemble AI algorithm that takes variable ICH subtypes into account. A weighted ensemble model was constructed by combining separate models trained on all ICH, subdural hematoma (SDH), subarachnoid hemorrhage (SAH), and small-lesion ICH cases. We externally validated the AI algorithm on 1,370 subjects from a tertiary hospital (1,144 with ICH and 226 without ICH). Three experienced neurologists reached a consensus on the presence of ICH. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the area under the receiver operating characteristics curve (AUC) were determined.

Results

The mean age was 63.9±15.8 (range: 20–94) and 54.9% were male. Sensitivity, specificity, PPV, NPV, and AUC for all ICH were, 0.987 (95% confidence interval [CI], 0.978 – 0.993), 0.885 (0.836 – 0.923), 0.977 (0.967 – 0.985), 0.930 (0.888 – 0.960), and 0.958 (0.938 – 0.980), respectively. In addition, the AI software showed excellent performance in all ICH subtype; AUCs for intraparenchymal hemorrhage, intraventricular hemorrhage, SAH, SDH, and epidural hemorrhage were 0.970, 0.969, 0.953, 0.947, and 0.958, respectively. In 43 subjects (31 with ICH and 12 without ICH) with discordant diagnoses between raters, AI algorithms demonstrated a sensitivity and specificity of 0.93 and 0.71, respectively. The majority of cases overlooked by AI consisted of subacute or chronic SDH and small SAH in the basal cistern.

Conclusions

This confirmatory clinical trial demonstrated the AI software's high accuracy in diagnosing ICH. In addition, the AI software may help physicians in diagnosing difficult ICH cases. However, more research is required to address the infrequent manifestation of ICH, which is a well-known "long tail" problem in field of AI.

	Intraparenchymal hemorrhage	Intraventricular hemorrhage	Subarachnoid hemorrhage	Subdural hemorrhage	Epidural hemorrhage
Receiver operating characteristic curve					
Sensitivity	99.7% (99.1% − 100%)	100% (98.9% − 100%)	98.7% (96.7% − 99.6%)	97.7% (95.0% − 99.1%)	100% (86.8% − 100%)
Specificity	88.5% (83.6% − 92.3%)	88.5% (83.6% − 92.3%)	88.5% (83.6% − 92.3%)	88.5% (83.6% − 92.3%)	88.5% (83.6% − 92.3%)
Positive predictive value	96.7% (95.3% − 97.9%)	92.7% (89.5% − 95.2%)	92.1% (88.6% − 94.8%)	90.6% (86.5% − 93.8%)	50% (35.8% − 64.2%)
Negative predictive value	99.0% (96.5% − 99.9%)	100% (98.2% − 100%)	98.0% (95.1% − 99.5%)	97.1% (93.8% − 98.9%)	100% (98.2% − 100%)
Area under curve	0.970 (0.953 − 0.986)	0.969 (0.950 − 0.987)	0.953 (0.923 − 0.970)	0.947 (0.923 − 0.970)	0.958 (0.935 − 0.981)

Utilization trends and association with clinical outcomes of perfusion imaging for acute ischemic stroke in South Korea

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Purpose

Perfusion imaging (PI) is useful for a triage of endovascular treatment (EVT) in acute ischemic stroke (AIS). We are to investigate utilization trends and potential determinants of PI as a treatment-decision imaging, and association with EVT rates and clinical outcomes in real-world practice. Of which, we tried to identify if any differences exist according to the time window.

Methods

We retrospectively analyzed data from a prospectively collected nationwide acute stroke registry in South Korea. PI as a treatment-decision imaging was defined as follows: (1) PI performed before EVT, or (2) PI performed within 3 hours after presentation to emergency department in patients who did not undergo EVT. Study period was divided into three epochs: 2011-2014, 2015-2017, and 2018-2021. Based on the elapsed time from onset to arrival, the population was divided into two groups: the early (within 0-6 hours) and late window (within 6-24 hours). EVT rates and clinical outcomes were assessed in patients with anterior large vessel occlusion (aLVO).

Results

During 2011-2021, decreasing trends in PI utilization rates (36.9% to 30.1%) were observed in 49,449 patients with AIS presenting within 24 hours after stroke onset; 48.4% to 32.4% in the early window and 23.5% to 27.8% in the late window. Older age, atrial fibrillation, aLVO, and severe stroke severity were associated with higher PI utilization rates in the late window; younger age and male sex were in the early window. In patients with aLVO, PI utilization led to increased likelihood of receiving EVT in the late window, and reduced risk of symptomatic intracranial hemorrhage and tended to improved 3-month mRS distribution in the early window. In patients with aLVO who received EVT, regardless of the time window, PI utilization was associated with lower likelihood of symptomatic ICH and tended to decrease 3-month mortality.

Conclusions

PI utilization trends differ between the early and late windows, which reflect different roles of PI within each window in real-world practice. Regarding functional outcomes, the utility and necessity of PI for EVT triage remains unclear.

A case of young onset cerebral amyloid angiopathy associated with dural grafting

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Purpose

Cerebral amyloid angiopathy (CAA) typically presents in the elderly patients with intracranial hemorrhages and dimentia. However, recent reports have revealed cases of young patients developed CAA 20-30 years after childhood neurosurgery, and it has been hypothesized that iatrogenic CAA may have been caused by amyloid-βtransmission through dural grafting or neurosurgical procedures.

Results

A 47-year-old man presented with sudden onset of motor aphasia and right hemiplegia. His past medical history was notable for left craniotomy and hematoma evacuation for a traumatic brain hemorrhage approximately 40 years ago, and dural grafting was performed.

He also had a history of three left subcortical parietal hemorrhages since the age of 42 years.

Immediate CT imaging revealed an acute left frontal intracerebral hemorrhage. His initial brain MRI connducted in our hospital demonstrated a left subcortical frontal lobe hemorrhage, as well as a left subcortical parietal lobe hemorrhage and lobar cerebral microbleeds. Cerebrospinal fluid analyses demonstrated a significantly reduced amyloid-β 42, and elevated total tau. Apolipoprotein E genotype was ε3/ε3. Whole exome sequencing did not detect mutations in genes associated with Alzheimer's disease. These findings led to a diagnosis of iatrogenic CAA.

Conclusions

Iatrogenic CAA has only been recognized relatively recently. Proposed diagnosis criteria for iatrogenic CAA, which do not require brain biopsy has been proposed, and similar reports are expected to increase in the future. We suggested considering iatrogenic CAA as a possibility in cases of young onset CAA, and we emphasize the importance of inquiring about previous neurosurgical procedures that may have transmitted amyloid-β.

Carotid web evaluated with two different types of IVUS

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[2]*Neurodegenerative Disease, Kansai Medical University Hospital, Hirakata, Japan*

Purpose

The carotid web is known as a shelf-like structure caused by fibromuscular dysplasia in the posterior wall of the origin of the internal carotid artery. We tried to evaluate this structure by using two different types of IVUS.

Methods

A 37-year-old female, who had no history of vascular risk factors, was admitted to our hospital because she had sudden onset of left-sided severe hemiplegia, dysarthria. On neurological examination, right conjugate deviation of the eyes, left hemianesthesia and hemispatial neglect were also seen. Her NIHSS was 11. Brain CT showed no hemorrhage, and CT angiography (CTA) showed M1 distal occlusion of the right middle cerebral artery. After intravenous rt-PA, as well as emergency endovascular thrombectomy, complete recanalization (TICI3) was achieved, and her symptoms rapidly improved. The diagnosis of carotid web was made based on a structure protruding from the posterior wall of the right internal carotid artery and a structure that appeared to be a septum in the short-axis CTA image. Since no other source of embolization was found, we considered the carotid web to be the origin of the embolus.

We treated the patient with anticoagulants and antiplatelet agents, and carotid artery stenting (CAS) was performed 3 weeks after the onset of stroke. The vessel wall was evaluated using two different frequencies of IVUS.

Results

Twenty MHz showed an indistinct image, which was difficult to evaluate, while 40 MHz showed a thickened vessel wall. The lesion appeared to be localized hyperechoic structure with eccentric thickening of the vessel wall.

Conclusions

The findings of the carotid web differed depending on the type of IVUS in this case. Still now, little is known about the IVUS finding of carotids web. Further study is needed to understand the pathogenesis of this difference in IVUS findings in the carotid web.

Rupture of dissecting intracranial aneurysm of distal branch of middle cerebral artery after intravenous thrombolysis

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[1]Neurology, Soonchunhyang University Seoul Hospital, Seoul, Korea, Republic of

Purpose

Aneurysms originating from branches of the middle cerebral artery (MCA) distal to the main bifurcation represent 2-7% of all MCA aneurysm, and the most common etiology is mycotic emboli, trauma, vasculitis, tumor emboli or dissection. Thrombosis of these aneurysms resulting in cerebral infarction is extremely rare.

Methods

We report a case of hyperacute ischemic stroke due to distal MCA dissecting aneurysm which was ruptured after intravenous thrombolysis.

Results

A 43-year-old healthy man presented with sudden left hemiparesis and dysarthria an hour before visiting emergency room. His motor power was MRC grade IV in the left extremities. Tissue plasminogen activator (tPA) was administered (door-to-needle time 47 min) after confirming no hemorrhagic lesion on brain computed tomography. All his neurologic symptoms disappeared within several hours. Next day, diffusion-weighted magnetic resonance imaging revealed several high signal intensities in the right insula, mid-temporal area, and corona radiate. However, an aneurysmal dilatation was detected in the right distal MCA (M2 segment) accompanied by mild subarachnoid hemorrhage in high parietal cortex. The patient's blood pressure was controlled within normal range. However, he suddenly suffered severe headache several hours later, and became comatose. Subsequent brain CT demonstrated a large intracerebral hemorrhage in the right hemisphere. The patient eventually underwent craniectomy and hematoma evacuation, but died on the 7th hospital day.

Conclusions

When performing reperfusion therapy for young patient, even if very rare, the possibility of intracranial dissection must be kept in mind. Early angiography may be helpful for rapid detecting a dissecting aneurysm and discontinuing tPA. Emergent intervention or surgical management should also be actively considered in case of bleeding from the aneurysm.

[PP085]

Retrograde venous flow into the internal jugular vein in a hemodialysis patient mimicking dural arteriovenous fistula.

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Purpose

Arterial spin labeling (ASL) and 3D time-of-flight MR angiography (TOF MRA) are the common sequences of MRI to evaluate blood flow. In the dural arteriovenous fistula (DAVF) patients, the high flow shunt and venous drainage can be detected as high signals on ASL and TOF MRA.

Methods

We present a rare case of renal failure patient on hemodialysis with jugular vein reflux mimicking DAVF.

Results

A 74-year old man was suffered from transient dizziness and taken MRI. He had arteriovenous fistula on his left forearm for hemodialysis. TOF MRA revealed hyper signal of left transverse sinus, sigmoid sinus, sinus confluence and internal jugular vein. ASL image showed bright signal on left transverse sinus. Digital subtraction angiography (DSA) proved there is no DAVF, however, the left sigmoid sinus showed stagnation. DSA after injection from left brachial artery demonstrated the retrograde venous flow into the internal jugular vein from the subclavian vein. There was no related symptoms and no cerebral venous congestion, he is under the observation.

Conclusions

ASL and TOF MRA are sensitive ways to detect DAVF, but high signals on these images sometimes caused by retrograde venous flow into jugular vein. Neurosurgeon and neuroradiologist should be aware of this specific pathophysiology of hemodialysis patients.

A case of AICA infarction initially presenting vestibular neuronitis with thrombus on labyrinthine artery

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Purpose

It is very difficult to differentiate acute labyrinthine infarction from acute viral labyrinthitis, vestibulocochlear neuritis and sudden sensorineural hearing loss. We experienced a case of acute labyrinthine infarction initially presenting vestibular neuronitis with thrombus on labyrinthin artery on SWI and progressed AICA infarction.

Methods

A 72 year old woman presented with acute onset & sustained of spontaneous vertigo. On initial neurological examination, she showed left beating spontanous nystagmus according to Alxnder's law with right catch up saccade on head impulse test. Cerebellar examination was not lateralized. There was no diffusion restiction on her brain MRI. CTA showed patent flow of vertebrobasilar artery and both AICAs. On SWI, dark signal was noted on right labyrinthine artery.

Results

Six days later, she was complaint with aggravation of vertigo, dysarthria, hearing impairment of right ear. Followed up DWI noted on right cerebellar peduncle, SWI showed dark signal on Rt AICA and CTA demostrated right AICA steno-occlusion.

Conclusions

Acute labyrinthine artery infarction is difficulte to differentiate from peripheral vestibuloapthy even though careful vestibular exmanination. We report a case initially clinically presenting vesitular neuronitis but suggesting labyrinthine artery thrombus on SWI. We suggest thoroughly evlauted SWI help to differntiated labrynthine infarction from peripheral vertigo.

Machine learning-based subtype differentiation of ischemic stroke in neuroimaging: A precision medicine approach

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Purpose

Ischemic stroke presents a complex cerebrovascular condition with distinct subtypes, each requiring customized treatment approaches. Precision and speed in identifying these subtypes are essential for enhancing patient care. This study aims to create and validate a proficient machine learning model capable of distinguishing between ischemic stroke subtypes using neuroimaging data from a diverse, multi-center cohort.

Methods

In this prospective study, we enrolled 800 ischemic stroke patients from a consortium of five renowned medical centers across Italy. To encompass the full spectrum of ischemic stroke, we meticulously acquired a comprehensive array of neuroimaging scans, including diffusion-weighted imaging (DWI), magnetic resonance angiography (MRA), and perfusion-weighted imaging (PWI). Simultaneously, we meticulously recorded detailed clinical and demographic information. Our methodology commenced with advanced image processing techniques, encompassing lesion segmentation, vessel extraction, and fine-grained feature mapping. These extracted features constituted the input for our machine learning model, which melded a convolutional neural network (CNN) for spatial pattern recognition with a recurrent neural network (RNN) to analyze temporal data trends. To establish robustness and generalizability, we subjected the model to a rigorous 10-fold cross-validation procedure. Furthermore, we gauged its performance on an external validation dataset comprising 200 ischemic stroke cases from an independent medical center. Our evaluation criteria encompassed accuracy, precision, recall, and F1-score, each scrutinized for every ischemic stroke subtype.

Results

The machine learning model demonstrated exceptional proficiency in accurately distinguishing ischemic stroke subtypes. It achieved an impressive overall accuracy of 89%, showcasing its effectiveness in classifying patients. Specifically, it excelled in subtype-specific accuracy, with large artery atherosclerosis subtype at 88%, cardioembolism at 92%, and small vessel disease at 86%. Furthermore, our model's precision, recall, and F1 scores consistently exceeded 0.85 for each subtype, underscoring its robustness and ability to correctly identify patients within each subtype category. External validation on the independent dataset from another medical center in Italy reaffirmed the model's reliability, achieving an accuracy of 87%. This external validation demonstrates that the model's performance extends beyond the original cohort and can be applied effectively in diverse clinical settings.

Conclusions

In conclusion, our prospective multi-center study demonstrates the remarkable precision of our machine learning-based approach in distinguishing ischemic stroke subtypes using neuroimaging data. The model consistently exhibits exceptional accuracy and subtype-specific performance, emphasizing its potential to assist clinicians in tailoring highly personalized

treatment strategies. This research marks a substantial advancement in the field of precision medicine for ischemic stroke patients, with the ultimate goal of improving their treatment outcomes and quality of life. The validated model is now ready for seamless integration into clinical practice, enabling more precise and effective therapeutic interventions based on the identified ischemic stroke subtype.

A novel case of CADASIL-like disease with a heterozygous HTRA1 gene mutation.

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Purpose

Hereditary forms of cerebral small vessel disease (CVSD) with genetic etiology including cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL), cerebral recessive arteriopathy with subcortical infarcts and leukoencephalopathy (CARASIL), COL4A1-related disease, Fabry disease, etc. Among the known pathogenic genes of CSVD, the HTRA1 gene is related to the pathogenesis of CARASIL. However, heterozygous HTRA1 mutations at specific sites can also lead to rare autosomal dominant cerebral artery disease (CADASIL-like disease). To date, 45 HTRA1 gene mutations have been reported, including 23 types of CADASIL-like disease caused by heterozygous HTRA1 mutations. Herein, we report a case of a patient with CADASIL-like disease caused by heterozygous HTRA1 mutation.

Methods

The patient is a 63-year-old male who presented with chronic headaches along with worsening memory loss. His neurological examination showed mild dysarthria and left lower limb motor weakness with a motor grade of 4.
Brain magnetic resonance imaging (Figure 1) showed lacunar infarction in left periventricular white matter, multiple microbleeds in bilateral cerebral hemisphere, basal ganglia, thalamus, and left cerebellar hemisphere and small vessel changes with multiple lacunar infarctions in bilateral cerebral hemisphere, subcortical white matter, basal ganglia and brainstem.

Results

Genomic DNA was extracted from buccal swab specimen. One heterozygous missense variation, c.972+1G>C was identified in exon 2 of the HTRA1 gene by whole exome sequencing.

Conclusions

Our findings of a heterozygous c.972+1G>C mutation provide novel evidence for the HTRA1 mutation in CADASIL-like disease. In a study, patients with CADASIL-like disease, compared to typical CARASIL, were found to have a later onset age, a higher prevalence of vascular risk factors, a milder clinical course, slower progression, and a lower incidence of extra-neurological symptoms similar to our patients. It is necessary to provide more theoretical support for its clinical diagnosis and treatment.
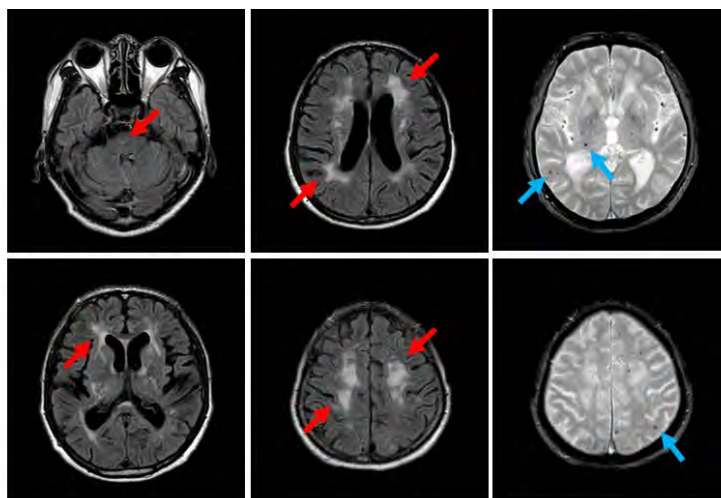
Figure 1.
Brain MRI showed showed the following results: (1) small vessel changes and multiple lacunar infarctions (red arrows) in bilateral cerebral hemisphere, subcortical white matter, basal ganglia and brainstem; (2) multiple microbleeds (blue arrows) in bilateral cerebral hemisphere, basal ganglia, thalamus, and left cerebellar hemisphere

Low temporal muscle thickness as an indicator of sarcopenia is associated with outcomes in elderly patients with acute ischemic stroke

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Purpose

Sarcopenia, an age-related disease characterized by loss of skeletal muscle mass, is associated with disability in the elderly population. However, its association with functional outcomes in patients with acute ischemic stroke (AIS) is not well established. The aim of this study was to investigate the association of temporal muscle thickness (TMT) measured at baseline magnetic resonance imaging (MRI) of the head, as a surrogate marker of sarcopenia, with outcomes in elderly patients with AIS.

Methods

The retrospective cohort study included consecutive acute (<7 days) ischemic stroke patients from May 2011 to December 2015. Among them, patients aged ≥65 years were included in this study. Patients with (1) pre-stroke modified Rankin Scale (mRS) ≥2, (2) follow-up loss at 3 months after the index stroke, and (3) no baseline MRI data were excluded. Baseline TMT of each patient was measured on the axial plane of T2-weighted or fluid-attenuated inversion recovery images. TMT was dichotomized as the lowest quartile versus the other quartiles. The association between lowest TMT quartile and outcomes was analyzed using logistic regression analysis.

Results

A total of 600 patients were included. The mean age of the patients was 75.3±6.1 years and 303 (50.5%) were male. The mean TMT was 6.7±2.1 mm and dichotomized at the value of 5.1 mm. Poor functional outcome at 3 months (mRS ≥3) was higher in the lowest TMT quartile than in the other quartiles group (59.6% vs 33.6%, p<0.001). After adjustment for covariates, the lowest TMT quartile was independently associated with poor functional outcome at 3 months (adjusted odds ratio 2.55, 95% confidence interval 1.53-4.25, p<0.001). The lowest TMT quartile also showed significant associations with secondary outcomes (Table).

Conclusions

The association of the lowest TMT quartile with poor functional outcome suggests that sarcopenia may be a poor prognostic factor for elderly patients with AIS.

Table. Associations of the Lowest Temporal Muscle Thickness Quartile with Outcomes in Elderly Patients with Acute Ischemic Stroke.

	Univariable logistic regression analysis : OR (95% CI)	P	Multivariable logistic regression analysis[a] : OR (95% CI)	P
3-mo mRS ≥3	2.91 (1.99-4.26)	<0.001	2.55 (1.53-4.25)	<0.001
3-mo mRS ≥4	3.58 (2.33-5.48)	<0.001	3.45 (1.86-6.40)	<0.001
1-y mRS ≥3	2.88 (1.95-4.26)	<0.001	2.26 (1.35-3.79)	0.002
1-y mRS ≥4	2.95 (1.91-4.54)	<0.001	2.01 (1.09-3.72)	0.03
Early neurological deterioration[b]	2.44 (1.57-3.80)	<0.001	2.63 (1.55-4.46)	<0.001

[a] Data were adjusted for age, sex, admission NIHSS, body mass index, pre-stroke mRS, previous history of stroke, hypertension, diabetes, hyperlipidemia, smoking, atrial fibrillation, stroke subtype, and revascularization therapy.

[b] Early neurological deterioration was defined as any new neurological symptoms/signs or any neurological worsening occurring during the admission and/or within 3 weeks after stroke on (1) an increment in the total NIHSS score of ≥2 points; (2) an increment in the consciousness score (1a–1c) of NIHSS ≥1; (3) an increment in the motor score (5a–6b) of NIHSS ≥1; or (4) any new neurological deficit (even if unmeasurable by NIHSS scores).

CI, confidence interval; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio.

In vivo imaging of cerebrovascular and microglial responses in ischemic stroke

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Purpose

To monitor cerebrovascular and microglial responses to common carotid artery occlusion (CCAO)-related hemispheric ischemia with cerebral autoregulatory dysfunction (CCAO+CAD), a new in vivo stroke model that we recently developed.

Methods

Cranial window implantation was performed 2 weeks before intravital imaging of ischemic brain in 9-week-old C57BL/6(n=1) or CX3CR1-GFP mice(n=1) and BALB/C mice(n=5). To visualize cerebral vessels before and 10 min, 1 h, 4 h, and 24 h after CCAO+CAD, texas-red dextran(5% w/v, 50μl) was intravenously injected and intravital microscopy imaging was performed. In this pilot study, we qualitatively analyzed the data by visual inspection

Results

In mice with cerebral infarction by 24 hours (n=4), arteriolar or venular diameter tended to be reduced (as early as at 10 min time-point) in the ischemic core region, but similar or increased in the penumbral region. In mice without cerebral infarction by 24 hours (n=3), arteriolar or venular diameter tended to be similar or increased in both core and penumbral regions. Microglial activation was more prominently observed in mice with cerebral infarction

Conclusions

This is the first report on intravital imaging of the mouse brain after CCAO+CAD. Further imaging results and quantitative data will be presented at the Conference

CT angiography early hypoperfusion growth rate correlation with collateral state and endovascular thrombectomy clinical outcome.

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Purpose

Hypoperfusion growth rate measures how quickly the area of reduced blood flow, identified on CTA scans, is expanding or evolving in response to an acute ischemic event. We hypothesized early CTA hypoperfusion growth rate is an essential collateral status determinant and a useful additional stroke outcome predictor.

Methods

Two hundred eighty-five patients with anterior circulation infarct presenting with 8 hours of stroke onset were reviewed. The early hyperfusion growth rate (EHGR) was calculated as hyperfused volume on CT perfusion imaging divided by the time from LKW to imaging. Good Collaterals were defined on CT perfusion as a hyperfusion intensity ratio < 0.4 and on CTA as collateral score > 2. The primary outcome was 90-day MRS= 0-2.

Results

Of 285 patients enrolled, 167 (85 EVT, 81 medical management only) patients met the study inclusion criteria. The optimal EHGR was < 10 ml/h; 45 EVT patients were slow, and 40 fast progression. Fast progressors had a higher median NIHSS (18 versus 12, P < 0.001), Slow progressors had better collaterals on CT perfusion; hypoperfusion intensity ratio (OR: 5.11 [2.43 - 10.76], P<0.001) and CTA collateral score (OR: 4.43 [1.83-10.73], P=0.001). EHGR independently correlated with functional independence after EVT, adjusting for age, NIHSS, time LKW to groin puncture, reperfusion (modified TICI sore of > 2b), IV-tPA. Slow progressors had higher functional independence rates (30 versus 15, P < 0.001) and had 2.5 times the likelihood of achieving modified MRS = 0-2 with EVT (OR: 2.94 [95% CI, 1.53-5.61, P=0.001 as compared to fast progressors.

Conclusions

The EHGR correlates with both collateral status and clinical outcomes after EVT

Bilateral spontaneous cervical internal carotid artery dissection with notch1 gene mutation: A case report

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Purpose

Pulsatile tinnitus, an uncommon auditory symptom, can be the only initial manifestation of cervical artery dissection (CAD). While spontaneous CAD occurrences are typically considered rare, their association with genetic predisposition remains exceptionally unusual.

Methods

This report details the extraordinary case of a 46-year-old male who presented with bilateral pulsatile tinnitus as his chief complaint.

Results

Denying any prior medical history or cerebrovascular disease, the patient reported the onset of tinnitus on the right side, with subsequent expansion to the left side within five days. Besides bilateral tinnitus, there were no neurological deficits. An audiometric evaluation revealed no evidence of hearing impairment, while a neck CT scan raised suspicion of carotid stenosis. Further assessment through MR angiography depicted severe stenosis in the distal right cervical internal carotid artery (ICA) and mild stenosis in the proximal left cervical ICA. Cerebral angiography confirmed dissections in both cervical ICAs, with the left ICA displaying diffuse fusiform dilatation accompanying intimal flaps, and the right ICA exhibiting diffuse moderate to severe stenosis followed by post-stenotic dilatation. The patient was initiated on dual antiplatelet therapy, 100mg of aspirin, and 75mg of clopidogrel. Next-generation sequencing (NGS) subsequently identified a heterozygous mutation p. Asn685Ile in the NOTCH1 gene.

Conclusions

This case underscores the exceptional and intriguing association between pulsatile tinnitus, cervical artery dissection, and genetic predisposition, adding valuable insights to the understanding of such rare clinical presentations.

Recurrent pontine infarction with thrombus in a giant vertebrobasilar dolichoectasia.

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Purpose

Intracranial dolichoectasia is an arteriopathy characterized by dilatation and abnormal elongation and tortuosity of the intracranial arteries. It may cause ischemic stroke, intracranial hemorrhage, or compression of cranial nerves and brainstem. Although the mechanism that causes ischemic stroke has not been clearly identified, it has been known to be caused by multiple mechanisms such as thrombosis, embolism, and small-artery occlusion. However, cases of ischemic stroke caused by intravascular thrombosis have been rarely reported clinically. The authors recently experienced a case of brainstem infarction caused by a thrombus in the basilar artery in a patient with vertebrobasilar dolichoectasia.

Methods

A 51-year-old woman visited the emergency room with left hemiparesis for 2 hours. Six years ago, she visited the emergency room for first unproved seizure. At that time, MRI showed a silent cerebral infarction in the left middle cerebral artery territory, and dolichoectasia in the vertebrobasilar artery was confirmed by MRA for the first time. Also, she diagnosed with hypertension, hyperlipidemia, and iron deficiency anemia. She took clopidogrel for a while, but she had voluntarily stopped taking medication five years ago. Consciousness was slightly drowsy and confused. Left hemiparesis and dysarthria according to the NIHSS of 7 was confirmed. A routine laboratory measurement was normal. No hemorrhagic lesions were observed on brain CT, tissue plasminogen activator (tPA) was injected.

Results

Brain MRI showed acute cerebral infarction in the right paramedian pontine. CT angiography showed no significant changes in the extent of the previous ectasia, but a new filling defect due to thrombus which was not previously exist along the posterior wall of the basilar artery was confirmed. The patient was taken aspirin and clopidogrel. The patient was discharged and transferred to another hospital for active rehabilitation.

One month after discharge, the patient was transferred to the emergency room when she suddenly developed dysphagia. On neurological examination, it revealed right hemiparesis and right central facial palsy. Brain DWI showed acute left paramedian pontine infarction, and on MRA, a previously identified thrombus in the mid basilar artery was observed without notable change. Among the previous medication, clopidogrel was changed to ticlopidine.

Conclusions

Intracranial dolichoectasia accounts for approximately 12% of all stroke patients and is known to occur most commonly in the vertebral artery and basilar artery. Patients with vertebrobasilar ectasia may experience cerebral infarction, transient ischemic attack, cerebral hemorrhage, subarachnoid hemorrhage, and hydrocephalus due to compression of cranial nerves, brainstem, or ventricles. The main cause of cerebral infarction in VD is cerebral small vessel disease, which is known to frequently cause lacunar infarction, especially in the pontine. However, we reported a case of recurrent pontine infarction with thrombus in a giant vertebrobasilar dolichoectasia.

Hounsfield unit as a predictor of symptomatic vasospasm and hydrocephalus in good-grade subarachnoid hemorrhage

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Purpose

Patients with good-grade subarachnoid hemorrhage often expect favorable outcomes; however, several patients may experience secondary neurological deterioration. Hydrocephalus and vasospasm are significant complications affecting subarachnoid hemorrhage prognosis. We aimed to evaluate the relationship between the incidence of symptomatic vasospasm or hydrocephalus and the Hounsfield unit value of the subarachnoid space on brain computed tomography in patients with good-grade subarachnoid hemorrhage treated with endovascular coiling.

Methods

We conducted a retrospective analysis of consecutive initially good-grade pure subarachnoid hemorrhage patients (Hunt-Hess grade I or II, modified Fisher scale I or III) with ruptured anterior circulation aneurysms treated with endovascular coiling in a single tertiary neurosurgical center between January 2010 and December 2019.

Results

The study included 108 eligible patients (34 males, mean age 60.88 ± 12.26 years): 26 (24.1%) showed symptomatic vasospasm and 31 (28.7%) developed hydrocephalus. Patients with symptomatic vasospasm had a greater proportion of those with Hunt-Hess grade II (77% vs. 51%, $P = 0.021$) and modified Fisher scale III scores (58% vs. 22%, $P = 0.001$). The hydrocephalus group presented an older mean age (65.90% vs. 58.86%, $P = 0.006$) and a greater proportion of Hunt-Hess grade II (74% vs. 51%, $P = 0.025$) and modified Fisher scale III cases (45% vs. 25%, $P = 0.037$). The mean Hounsfield unit values of the Sylvian cistern (53.23 vs. 43.99, $P < 0.001$) and basal cisterns (47.04 vs. 40.18, $P = 0.003$) were higher in the vasospasm group. In the hydrocephalus group, only the basal cistern Hounsfield unit value was significantly higher (45.60 vs. 40.32, $P = 0.016$). The area under the receiver operating characteristic curve to determine the best cut-off Hounsfield unit value for the prediction of patients with symptomatic vasospasm revealed a Sylvian cistern Hounsfield unit value of 50.375 and basal cistern Hounsfield unit value of 44.875. Multivariable logistic analysis showed that age > 70 years and Sylvian cistern Hounsfield unit value were independent predictors of any neurological complication at 1 year.

Conclusions

The Hounsfield unit value of the subarachnoid space on brain computed tomography can predict vasospasm, hydrocephalus, and long-term prognosis in good-grade subarachnoid hemorrhage patients.

Stroke mimics: Differential diagnosis based on multimodal neuroimaging

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Purpose

To learn imaging features of stroke and stroke mimics on multimodal neuroimaging for differential diagnosis

Methods

Stroke is a major cause of disability and one of the most common causes of the death. Stroke is a medical emergency, and immediate assessment, diagnosis and treatment is essential for symptom improvement and preventing morbidity and mortality. However, many other medical conditions can present symptoms similar to stroke, and these cases are referred to as "stroke mimics". It is important to differentiate stroke mimics when treating an acute suspected stroke to avoid the inappropriate use of costly and potentially harmful treatments.

Results

Advance in medical imaging such as diffusion-weighted MR imaging have allowed us to diagnose stroke more quickly than in previous eras. Nevertheless, diagnosing stroke is not always straightforward. Restricted diffusion is not characteristic findings exclusive to acute ischemic strokes, and chronologic changes in stroke lesions may show a variety of imaging findings that can overlap with those of other diseases.

Conclusions

In distinguishing stroke from their mimics, it can be helpful to being familiar with the physics of each neuroimaging examinations and imaging features of stroke mimics on multimodal neuroimaging, as well as to understand the clinical-pathophysiological-radiological correlations.

Huge arteriovenous malformation in brainstem with helical venous ectasia

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Purpose

Cerebral arteriovenous malformations(AVM) are commonly found, but rarely occur in the brainstem. Furthermore huge arteriovenous malformations greater than 3cm are known to be even rarer. We report a rare case of brainstem AVM accompanied by helical giant venous ectasia presenting progressive neurological symptoms.

Methods

A 26-year-old man with no underlying disease or family history visited the outpatient clinic with left-sided discomfort. Since 7 years ago, he could not hold an object like umbrella with his left hand because cannot maintained posture. He felt his left leg was awkward when running or going downstairs, but there was no muscle weakness. In addition, he found that the pupil did not move to the left when looking in the mirror, but he did not complain of diplopia.

Results

Neurologic examination showed bradykinesia and ataxia in the left upper and lower extremities. Left deep tendon reflex showed hyperactivity, and Hoffman's sign and Babinski's sign were positive. Also right internuclear ophthalmoplegia was founded. Brain computed tomographic angiography and magnetic resonance images showed an AVM nidus sized of 3.3 X 3.1 cm invading the right midbrain and upper pons (Spetzler-Martin grade 4). The AVM was accompanied by a venous ectasia of unusual helical shape, which was from superficial middle cerebral vein and compressing the medial globus pallidus (Figure 1).

Conclusions

This is the rare case of huge brainstem AVM with unusual helical venous ectasia which made extrapyramidal symptoms mainly. The patient's discomfort was mild, but it was an AVM with unusual size and location that difficult to treat. Since the symptoms progressed gradually from late childhood, the patient seems to have adapted easily. Brainstem AVM has a risk of surgical approach, so need to carefully decide on the treatment plan.

Congenital absence of the bilateral internal carotid arteries

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Purpose

Congenital absence of the bilateral internal carotid arteries (ICA) is an extremely unusual case. This natural absence may be consequent of agenesis, aplasia, or hypoplasia. Congenital absence of the ICA is often associated with carotid canal atresia and other abnormalities, such as anomalous origin of the ophthalmic artery, pituitary hypoplasia, sympathetic nerve dysplasia, and abnormal development of collateral circulation pathways. We report a case with congenital absence of the bilateral ICAs.

Methods

A 25-year-old man presented with headache, which occurred two years ago while in military service. There was no history of other symptoms. Recently, the headache recurred. A brain MRI was performed, which revealed an absence of the expected flow voids along the course of the petrous and cavernous segments of the both intracranial ICAs.

Results

Brain magnetic resonance angiography (MRA) reveals total non-visualization of the both ICAs, and prominent bilateral vertebral arteries, and prominent basilar and posterior communicating arteries (PCOMs). The basilar artery is tortuous to the right side. The PCOMs are supplying both middle cerebral arteries (MCAs) and the anterior cerebral arteries (ACAs) via the circle of Willis. The A1 segment of the right ACA is absent with the A2 segment being reformed via the anterior communicating artery. Tranfemoral cerebral angiography reveals anomalous origin of the right ophthalmic artery derived from the ipsilateral middle meningeal artery. Brain computed tomography (CT) in bone window at the skull base shows a lack of bilateral bony carotid canals. Brain 99mTc-ECD SPECT shows mild reduced resting brain perfusion in the bilateral MCA territories. Brain mean transit time perfusion MRI shows mild delayed perfusion in the bilateral MCA territories.

Conclusions

Although an exact cause of ICA agenesis has not been established, these variations are thought to represent the sequela from an insult to the developing embryo. Postulated causes of unilateral absence have centered on mechanical and hemodynamic stresses placed on the embryo. Development of the carotid canals at the skull base occurs in the presence of the embryonic ICA during early gestation. A small or absent carotid canal therefore indicates a congenital internal carotid abnormality, differentiating it from the acquired causes of ICA narrowing. Agenesis, aplasia, and hypoplasia should be differentiated. Agenesis is the complete developmental failure of an organ and its primordium, whereas aplasia and hypoplasia are the incomplete development of a structure. Therefore, in agenesis the bony carotid canal is absent, whereas in aplasia and hypoplasia the bony carotid canal is present. Recognition of the absence of bilateral ICAs is important when planning intracranial vascular intervention, as both cerebral hemispheres may be dependent on a basilar artery.

Two cases of pseudo-occlusion of the proximal internal carotid artery in patients with acute ischemic stroke

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Background & Significance

The term pseudo-occlusion is used when the proximal internal carotid artery (ICA) is not contrasted on CT angiography (CTA), which is a flow-related artifact due to thrombosis in the distal ICA or proximal middle cerebral artery (MCA). Proximal ICA pseudo-occlusion leads to misdiagnosis of a true ICA occlusion and makes it difficult to localize the site of arterial occlusion for mechanical thrombectomy. We report two patients with acute ischemic stroke whose CTA showed pseudo-occlusion of the proximal ICA.

Case Presentation

Case 1

A 51-year-old man with no past medical history except for smoking presented to the emergency department (ED) with right-sided weakness. On neurological examination, he presented with MRC grade 1 right hemiparesis and motor aphasia. CTA showed a beak-shaped proximal occlusion of the left ICA and a distal occlusion at the M1 segment of the left MCA. However, on the actual carotid angiogram, the proximal ICA was intact with no occlusion, and a petrous horizontal segment (C2 segment) occlusion of the left ICA was seen. For the distal ICA occlusion, stenting with mechanical thrombectomy was performed and TICI 2B/C reperfusion was achieved. CTA was performed the next day and showed in-stent reocclusion with contrast filling defect from the left proximal ICA. No further intervention was performed due to symptomatic improvement. The patient was transferred to the rehabilitation department on the 18th day of hospitalization.

Case 2

A 64-year-old man with no past medical history presented to the ED with motor aphasia. It was the only symptom that started 7 days before his visit and worsened over time. On CTA, there was no left ICA proximal to distal segment. Carotid angiogram was performed and showed para-ophthalmic segment (C4 segment) occlusion of the left ICA. Mechanical thrombectomy and stenting were performed with TICI 2B/C reperfusion by CTA the next day. His language function improved after thrombectomy, and he was transferred to the rehabilitation department on the 10th day of hospitalization.

Conclusions

Pseudo-occlusion of the proximal ICA may actually appear as occlusion of the distal portion of the ICA, and even young patients with no medical history are no exception. An interventional approach to determine the exact location and etiology of the occlusion may help in diagnosis and management.

Recurrent ischemic stroke associated with Lambl's excrescences: Two-year follow-up result.

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Purpose

Lambl's excrescence (LE), a histological term describing rare cardiac growth that develops at the valvular coaptation sites of the heart, is seen as a fine, mobile, thread-like strand on an echocardiogram. Estimates of its presence on cardiac valves range from 5% to 40%. LE has been reported as a possible cardiac source of cerebral embolism. However, it is unclear whether LEs are the causes of strokes or incidental findings, as patients with LEs frequently have accompanying cardiac and atherosclerotic risk factors.

Methods

We report a case of recurrent cerebral infarction associated with LE identified by transesophageal echocardiography (TEE) with a two-year follow-up result.

Results

A 57-year-old man visited emergency room with right side weakness and dizziness. He was a current smoker with a history of hypertension and had been taking aspirin for cerebral infarction four years ago. At that time, when he was hospitalized for cerebral concussion after falling from a height of 1.2m, two small cerebral infarctions in right temporal lobe and cerebral asymptomatic aneurysms in the left MCA bifurcation and right cavernous ICA were found.

Brain MRI showed acute small infarction in left basal ganglia and left posterior pons with multiple microbleeds. There were no stenotic vessels on brain MRA. No abnormalities were observed on transthoracic echocardiogram, 24-hour Holter monitor, and ECG. A fibrous strand with a diameter of 1 mm and a length of 5 mm, presumed to be LE, was observed at the tip of the aortic valve on TEE. No shunt findings like PFO were observed. After LE was discovered, the medications were changed to cilostazol and apixaban.

Two years later, we performed a follow up TEE, but previously observed strand was not visible. We replaced apixaban with aspirin.

Conclusions

TEE is the gold standard in detecting LEs. Therefore, a TEE should always be a part of stroke workup in embolic strokes with unknown source of emboli.

Patients with LEs who have experienced one episode of transient ischemic attack or cerebrovascular accident should be treated conservatively with antiplatelet therapy. If there is a recurrent ischemic event while on this therapy, a trial of anticoagulation therapy should be considered, along with antiplatelet therapy, before proceeding with surgical resection of the LE.

In this case, it is possible that the finding was a thrombus, not a strand, as it disappeared after anticoagulation therapy. Therefore, strands need to be distinguished from thrombi, and treatment plans should be made accordingly.

A case of cervical spinal cord infarction associated with coronavirus infectious disease (COVID)-19

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Background

Acute spinal cord ischemia syndrome (ASCIS) is a neurovascular disease caused by a narrowing or occlusion of the vessels that supplying blood to the spinal cord. The main causes are atherosclerosis, cardiac embolism, iatrogenic injury, and rarely, hypercoagulability due to vascular disease. Coronavirus disease (COVID-19) has shown many extrapulmonary manifestations, including hypercoagulability. We present the case of a young male patient who had an acute spinal cord infarction, presumably due to COVID-19-induced hypercoagulability.

Case Presentation

A 41-year-old man with no medical or trauma history presented to the emergency department with quadriplegia on day 6 of COVID-19 isolation. He had sudden onset of radiating pain in the posterior neck and upper back, with progressive weakness from bilateral upper extremities to the lower extremities. He had bilateral flaccid paralysis of the upper (MRC grade 1) and lower extremities (MRC grade 2). He could sense position and vibration, but no pain and temperature sensation. Magnetic resonance imaging (MRI) of the spine showed an anterior spinal cord lesion at levels C3 to C7 with increased signal intensity on T2-weighted imaging, and diffusion restriction on DWI, consistent with a spinal cord infarction. Cerebrospinal fluid analysis and Blood tests including autoantibody testing, showed no abnormalities except for a slight increase in complement levels. Transfemoral vertebral angiography was normal, with no visible evidence of occlusion or dissection.

Results

The patient was started on enoxaparin 1 mg/kg subcutaneously every 12 hours and intravenous methylprednisolone 1 g/day for 5 days, followed by a change to prednisolone 60 mg per day, tapered to 10 mg per week. On hospital day 3, he had shallow breathing and was unable to expectorate sputum well, requiring intubation and eventually a tracheostomy to maintain his airway. His strength gradually improved, and after three weeks he showed improvement to MRC grade 3 in the upper extremity and MRC grade 4 in the lower extremity. He remains neurologically stable and has been transferred to the Department of Rehabilitation.

Conclusion

Spinal cord infarction is so rare that there are few reports of COVID-19 associated with this condition. While a definitive causal relationship between spinal cord infarction and COVID-19 has not been established, similarities have been observed in the few reported cases to date. We expect that these precedents may serve as a guide for future evaluation of spinal cord infarction in new pandemics.

CADASIL with Intracranial hemorrhage and multiple microbleeds

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Purpose

Cerebral autosomal-dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) is a cerebral small vessel disease due to a NOTCH3 gene mutation. Common symptoms include repetitive ischemic events, headaches, cognitive issues, and mood disorders. Hemorrhagic strokes and cerebral microbleeds are rarer in CADASIL. We report a case with these features.

Methods

A 57-year-old male patient was referred to the neurology department due to a sudden onset of transient cognitive impairment that lasted for a few days. He had a history of cerebral infarction three years ago. Additionally, one year ago, he experienced an abrupt onset of aphasia and right-sided weakness, and he was diagnosed with intracranial hemorrhage in the left basal ganglia. On examinations, he complained right hand clumsiness. He had no known medical conditions, and he quit smoking and alcohol drink but he was a heavy smoker, and also a daily alcohol drinker. His family had a no history of stroke.

A magnetic resonance imaging(MRI) was performed, and it revealed tiny diffusion restrictions in the left precentral gyrus, which were thought to be incidental findings. And there were leukoencephalopathies in bilateral subcortical area and many microbleeds in both cerebral hemispheres. After hospitalization, for stroke etiology evaluations, he was newly diagnosed with diabetes at 6.7% of his glycated hemoglobin. His blood pressure was normal and low-density lipoprotein cholesterol was high at 123.

The MR angiogram(MRA) did not show any evidence of large arterial occlusion or severe stenosis, and there was no cardioembolic source found during Holter monitoring and transthoracic echocardiogram(TTE). Because the patient was relatively young and had a history of repetitive ischemic strokes with leukoencephalopathy, a hereditary cause needed to be ruled out. Therefore, CADASIL and Fabry gene studies were conducted. A few weeks later, it was confirmed that there was a NOTCH3 gene mutation.

Results

After the intracranial hemorrhage, he did not receive any medication for the prevention of ischemic stroke. Initially, dual antiplatelet therapy was prescribed during the acute phase. However, after two months, Aspirin monotherapy was initiated due to multiple microbleeds. He's been regularly monitored and remains stroke-free.

Conclusions

CADASIL is non-amyloid small vessel cerebrovascular disease. Ischemic strokes are common, while hemorrhagic strokes are less frequent. Althogh there's no standard CADASIL therapy, hypertension and cerebral microbleeds significantly increase intracranial hemorrhage risk. To prevent recurrent ischemic strokes, antiplatelet therapy and rigorous blood pressure control are crucial.
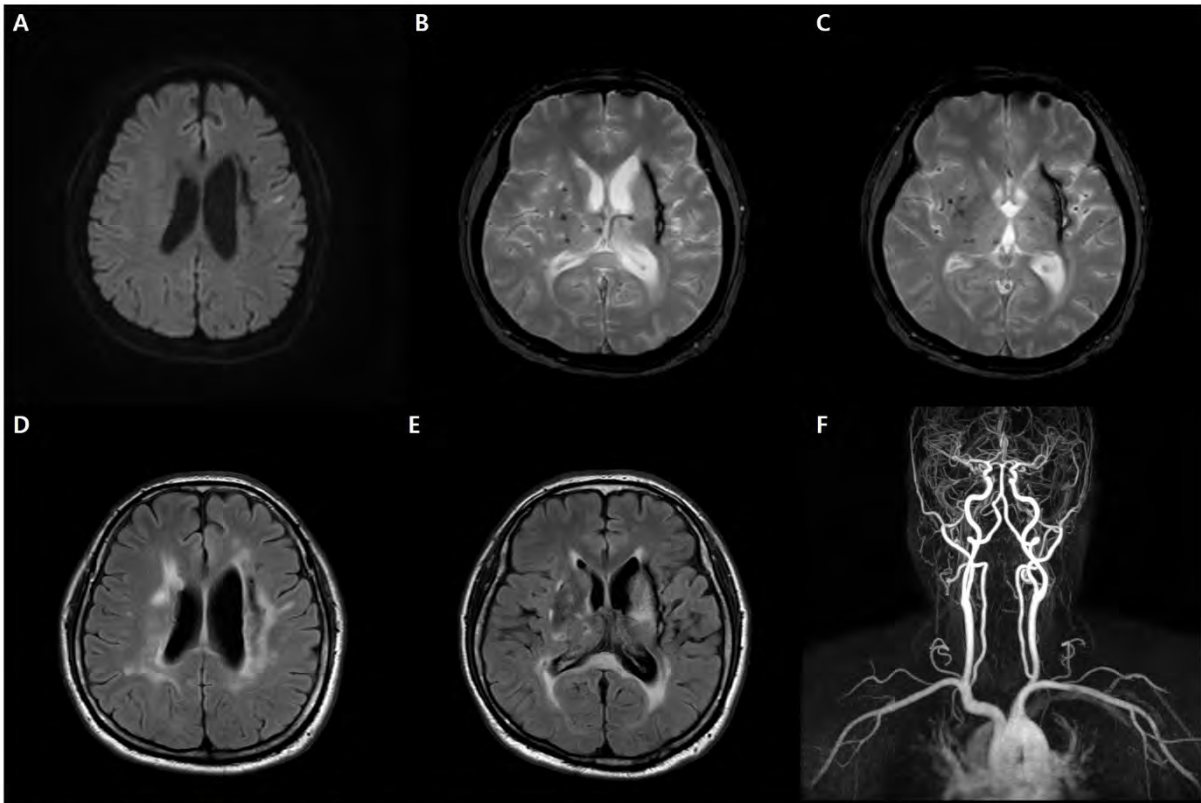
Figure 1. A The diffusion-weighted image showed diffusion restriction in the left precentral gyrus, which was considered an incidental finding. **B-C** The gradient echo image revealed multiple low signals indicative of microbleeds and an old intracranial hemorrhage in the left basal ganglia. **D-E** The T2 fluid-attenuated inversion recovery image displayed multifocal subcortical leukoencephalopathy in both cerebral hemispheres. **F** The MR angiogram did not show any definite occlusion or severe stenosis in intracranial vessels.

Ischemic stroke after ovulation induction treatment in moyamoya disease

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Purpose

Young age patients with ischemic stroke could have different etiology of stroke. Moyamoya disease is one of the common causes of stroke in young age stroke patients. Here we report a case of a patient who experience ischemic stroke after ovulation induction treatment.

Methods

A 36-year-old female was referred to neurology department complaining of recurrent thunderclap headache. She also experienced transient paresthesia on right hand. She was undergoing recent ovulation induction treatment with follicle stimulating hormone, luteinizing hormone, recombinant human chorionic gonadotropin and progesterone.

Results

Diffusion magnetic resonance imaging(MRI) showed focal diffusion restricted lesion at the left caudate nucleus. On brain computed tomography(CT) angiography, severe stenosis at both distal internal carotid arteries(ICA) and left middle cerebral artery(MCA) were noted. CT perfusion image showed delayed time-to-Maximum(Tmax) on left hemisphere. Brain vessel wall MRI revealed diffuse stenosis of both MCA and concentric focal wall enhancing change of both distal ICA and MCA. This was a finding consistent with moyamoya disease.

Conclusions

Ovulation induction treatment can cause various complications. Headache is common complication of this therapy. In this case, patient experienced a thunderclap headache. As a result, imaging was performed and moyamoya disease was diagnosed. Cerebral infarction caused by ovulation induction treatment may have various mechanisms. Possible mechanisms include hypercoagulability due to ovarian stimulation syndrome and decreased cerebral blood flow due to changes in blood vessel permeability. It is difficult to know the exact mechanism, caution is required as cerebral infarction may occur in rare cases during ovulation induction treatment when poor cerebral blood flow state.

[PP103]

Simultaneous ischemic stroke and heart attack by traumatic cerebro-cardiovascular dissections.

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Purpose

Either carotid dissection or coronary artery dissection is an extremely rare sequela after blunt trauma, that must threaten life unless it remains diagnosed. This report shows simultaneous ischemic stroke and heart attacks induced by traumatic cerebral and coronary artery dissection.

Methods

After blunt head and chest trauma in a 60-year-old cycling male by automobile traffic accident, who initially presented with chest pain by mild rib fractures and a 1-hour duration of unconsciousness by brain concussion on admission, demonstrated no ST segmental changes/pathological Q waves on ECG nor neurological focal signs without skull CT abnormality. Four days later, he suddenly showed miscalculation, dyslexia and apraxia for PC and smartphone. MRI showed a fresh DWI-high intensity infarct in the left frontal cortex. CTA and MRA never detected any complex lesion of aortic arch and intracranial and extracranial cerebral vessel stenosis/occlusion, that led to no reperfusion therapy. While he did not manifest any usual atherosclerotic risk factors, as well as coagulation disorder, antiphospholipid antibody, vasculitis, collagen diseases, and patent foramen ovale, ECG and echocardiograms found inverted T and abnormal P waves in II, III, aVf on regular sinus rhythm and the corresponding motion asynergy of myocardial inferior wall. A brief episode of increase in CK had been detected since his admission, and CT coronary angiography 2 weeks after insults revealed occlusion of the right coronary artery from #2 segment to the distal #4. Atrial fibrillation was not detected on continuous ECG monitoring.

Results

Serial MR and CT angiography could finally validate pseudoaneurysm, double lumen and flap in the left extracranial internal carotid a month after the accident when the second coronary CT angiography demonstrated partial recanalization of coronary artery segment #2-#4, that suggested coronary artery dissection to cause asymptomatic myocardial infarction, and the subsequently-apparent carotid artery dissection could play a leading role in embolic ischemic stroke. Chest pain continued for 3 weeks around the fractured ribs without ischemic pain, and his higher brain dysfunction had disappeared for a week after insults under antiplatelet medication.

Conclusions

Simultaneous occurrence of the coronary artery and carotid dissections vulnerable to low-speed blunt chest and head injury constitutes a delayed diagnostic challenge and antithrombotic medication without recanalization intervention. We must keep in mind that apparently trivial blunt trauma may cause delayed vascular injury enough to dramatically deteriorate in time, leading to life-threatening heart attack and major stroke.

Ischemic stroke in Vascular Ehlers Danlos syndrome, vasculitide?

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Purpose

Vascular Ehlers Danlos syncdrome (vEDS) is a rare genetic disoder of dysfunctional COL3A1 gene for faulty collagen, which affects the blood vessels and internal organs. vEDS can provoke arterial rupture and hemorrhagic stroke and sometimes ischemic stroke due to dissection. We report a ischemic stroke in vEDS without dissection.

Methods

A 21 year old man presented sudden onsest of left hemianopsia and left sensory change with acute infarction on right PCA territory. His MRA showed no abnormality. Studies for the risk of stroke were all negative except COL3A1 gene mutation.

Results

Even though no abbnormality on TOF image, we checked vessel wall MRI in right P1 and couldn't detect typical signs of arterial dissection but revealed focally eccentric vessel walls enhancement on Rt PCA.

Conclusions

We suggest vEDS present ishcemic stroke by vascular damage predisposing thrombotic events, not by definite dissection.

Contralateral hemiparesis in cervicomedullary junction infarction

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Purpose

The inferior margin of medulla is marked by the origin of the first pair of cervical spinal nerves. This occurs just as the medulla exits the skull through the foramen magnum and continues to cervical spine, known as the cervicomedullary junction. 75% to 90% of the corticospinal fibers cross at the pyramidal decussation to form the crossed lateral corticospinal tract just above the cervicomedullary junction.

Methods

We present a stroke patient with the right cervicomedullary junction lesion presenting contralateral hemiplegia and paresthesia.

Results

A 77-year-old man with a history of hypertension, diabetes mellitus, dyslipidemia and transient ischemic attack (TIA, 14 years ago) presented to the emergency room with an 6-hour left-sided weakness, paresthesia and dysarthria. His Initial National Institutes of Health Stroke Scale (NIHSS) score was 5 (motor; left upper 1, left lower 2, sensory 1, dysarthria 1). Neurological examination revealed the weakness in the left arm (MRC grade 3) and the left lower extremity (MRC grade 2). The patient had disproportionate weakness of the left upper and lower extremities, with greater weakness in the lower extremities than in the upper extremities. Compared with the right side, the left face (90%), left upper (50%) and lower extremities (70%) had reduced pinprick sensation. Brain computed tomography angiography showed mild stenosis in both vertebral artery V4 segments. The initial brain MRI revealed a subtle diffusion restriction at the right cervicomedullary junction which was differential diagnosed as an artifact on hospital day 1 (HD#1), and he was admitted to the stroke center for an image-negative stroke. The follow-up diffusion weighted MRI performed on HD#2 showed more pronounced diffusion restriction at the right lower anterior medulla - cervicomedullary junction [Figure 1]. The topography of the lesion and the patient's comorbidity, with a mild stenosis in the right V4 segments, favoured infarction over demyelination as the likely etiology. Electrocardiography, chest radiography and transthoracic echocardiography revealed no abnormalities. Laboratory tests showed no abnormalities other than elevated HbA1c(7.6%). The patient had been taking aspirin since the history of TIA 14 years earlier, so clopidogrel was added and he was also treated with high-dose statins. The weakness and numbness gradually improved over the course of several days. He was discharged on HD#7. NIHSS score at discharge was 1 (sensory 1).

Conclusions

This case illustrated us the contralateral hemiplegia and paresthesia in the cervicomedullary junction stroke, which presented the greater weakness in the lower extremities than in the upper extremities. Clinicians should consider the possibility of anatomic variations in the pyramidal decussation may present with different clinical manifestations.
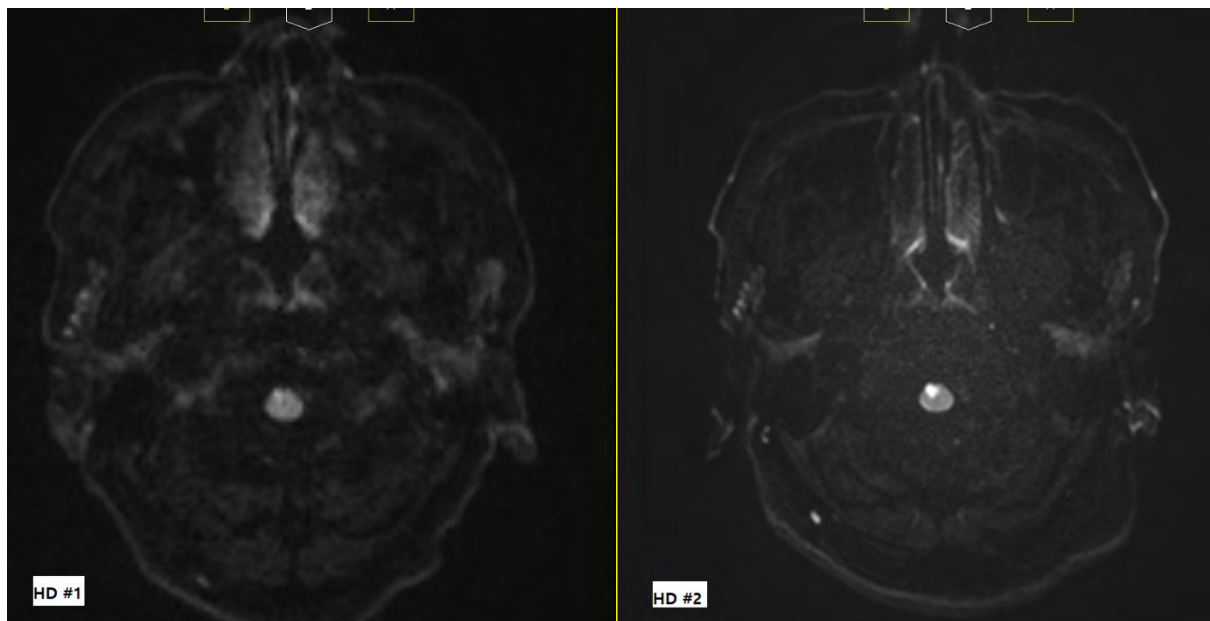
Effects of FHL2 deficiency on tPA-mediated thrombolysis and hemorrhagic complications

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Purpose

A recent study showed an inverse relationship between Four-and-a-half-LIM-domains 2 (FHL2) and venous thromboembolism. To investigate whether FHL deficiency influences arterial thrombus formation, tissue plasminogen activator (tPA)-mediated thrombolysis, tail bleeding time, and tPA-related hemorrhagic transformation.

Methods

First, arterial thrombosis was induced in 12-week-old male FHL2$^{+/+}$ mice (n=17) and FHL2$^{-/-}$ mice (n=17) by applying FeCl$_3$ on the left common carotid artery for 10 minutes. To measure thrombus volume at 30 minutes (n=10/group) or 3 hours (n=7/group) after the thrombus induction, microCT imaging was performed after intravenous injection of gold nanoparticles (2mg/kg in 200μL). Second, 32 mice (n=16/group) were treated with intravenous tPA (25 mg/kg) at 30 minutes (n=10/group) or 3 hours (n=6/group) after thrombosis, and microCT imaging was performed at baseline and post-tPA 0.5, 1, 3, and 24-hour time-points. Third, tail bleeding test was performed with (n=6 and 8, respectively) or without (n=8/group) tPA treatment. Fourth, areas of hemorrhagic transformation were measured at 24 hours after 1-hour transient middle cerebral artery occlusion with (n=5 and 6, respectively) or without (n=6 and 5, respectively) tPA treatment.

Results

Thrombus volume at 30 minutes and 3 hours did not differ significantly between the groups. When tPA therapy was initiated at 30 minutes after thrombosis, thrombus volume at 3 hours was significantly lower in FHL2$^{-/-}$ mice than in FHL2$^{+/+}$ mice (71% vs. 46% reduction from the baseline, respectively; p<0.05), When tPA treatment was delayed (i.e., started at 3 hours after thrombosis), there was no significant inter-group difference in thrombus volume. Lastly, tail bleeding times and hemorrhagic areas did not show significant inter-group differences, regardless of tPA therapy (all p>0.05).

Conclusions

FHL2 deficiency does not affect baseline arterial thrombus volume but facilitates tPA-mediated thrombolysis without hemorrhagic side effects in mice.

Ischemic stroke merging with uterine fibroids enough large to cause hypercoagulability for venous thromboembolism and hyperfibrinolysis for excessive menstration.

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Purpose

Benign gynecologic diseases are a new risk factor for stroke, whose outcomes are acceptable (1). This report shows three ischemic stroke cases, who had huge uterine fibroids with hypermenorrhea, menorrhagia and anemia, while simultaneous hypercoagulability and hyperfibrinolysis developed both deep vein thrombosis/pulmonary thromboembolism and genital bleeding tendency.

Methods

Case 1: A 47-year-old woman with excessive menstruation from uterine fibroids (8x7x6 cm) showed right arm monopalsy and motor aphasia. She had multiple cortical infarcts in the left frontal lobe, elevated TAT/d-dimer, hypoxemia, leading to chronic thromboembolic pulmonary hypertension with leg vein thrombosis. She underwent anticoagulant prophylaxis, pulmonary thromboendarterectomy followed by closure of patent foramen ovale.

Case 2: 29-year-old female presenting impaired consciousness, left hemiplegia, quadrantanopia and sensory extinction, demonstrated multiple vascular territory infarcts in the right frontal lobe. Uterine myoma (15x1x10 cm) was detected for Hb 6.6 g/dl, elevated TAT/ d-dimer, low fibrinogen, ongoing leg venous thrombosis and recurrent pulmonary thromboembolism, exclusive of intrapulmonary or intracardiac shunts. She was treated with pseudo-menopause, anticoagulation, and elective hysterectomy.

Case 3: A 47-year-old woman with uterine myoma (13x10x7 cm) with a short duration of impaired consciousness, facial and lip paresthesia demonstrated an acute perforating arterial infarction in the right thalamus, with Hb 9.4 g/dl, elevated TAT/ d-dimer, and low fibrinogen. Except for embolic stroke of undermined sources without paradoxical short-circuit, continued anticoagulant had never attenuated venous thrombosis embolism until early menopause was experienced.

Results

All three patients had recanalization without any residual cerebral stenosis, dissection, vasculitis, aortic complex lesions, and atrial fibrillation/embolus-producing cardiopathy. There were no primary platelet or coagulation disorders, acquired antiphospholipid antibodies and cancer-associated hypercoagulation with CA125 elevation. Bleeding-induced anemia, coagulation-hemostasis index TAT, consumed fibrinogen/fibrinolytic index d-dimer were detect in the 3 cases. Case 1-2 experienced definite deep vein thrombosis followed by recurrent pulmonary thrombosis. Every case noted no pulmonary arteriovenous malformation/fistula, but case 1 showed foramen ovale patency as paradoxical embolization.

Conclusions

From the iliac vein to the inferior vena cava that were not compressed by the giant myoma as assessed by color-doppler ultrasonography and contrast-enhanced CT in the supine position, prolonged standing or sitting could cause blood flow congestion below enlarged uterus, activated platelet aggregation and clot formation, which induced systematic fibrinolysis, should cause excessive menstruation. Secondary prevention for ischemic stroke and venous thromboembolism may not always be effective and safe under pseudo-menopause with gonadotropin releasing hormone antagonist.

1. Yamashiro K et al. Neurol Clin Pract 2023 e200165.

Proteomic clot analysis as a diagnostic tool of stroke mechanism in ischemic stroke patients underwent endovascular therapy

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Purpose

Clot composition analysis may help identify the underlying causes of stroke and possibly lead to individualized care for secondary stroke prevention. This study aimed to investigate the association between clot compositions and stroke mechanisms in patients with large vessel occlusion who underwent endovascular therapy based on proteomic analysis.

Methods

A total of 27 patients (cardioembolism [CE], n = 17; large artery atherosclerosis [LAA], n = 6; and cancer related, n = 4) with ischemic stroke who underwent endovascular treatment were included from July 2017 to October 2019. The clots retrieved after EVT were proteomically analyzed to identify any difference in the patterns of expressed proteins according to three stroke mechanisms. Validation experiments were performed using data-independent acquisition and parallel reaction monitoring methods.

Results

Among included patients (mean age 73.3 years), 10 (37%) patients were male. In CE mechanism, a total of 20 proteins were associated with thrombosis and hemostasis pathways, such as PLEK, ROCK2, TLN1, and RAB14. There were 9 specific proteins such as GNG2, LAMP1, and ELANE in the LAA mechanism clots, which are associated with the ubiquitin-proteasome pathway and the progression of atherosclerosis. The CR mechanism clots exhibited a significant abundance of proteins that are known to be associated with cancer proliferation and tumor migration, such as IGHG1 and VTN.

Conclusions

This study identified and verified specific protein markers of clots that can distinguish stroke mechanisms in ischemic stroke patients underwent EVT. Consequently, our results could be helpful to identify stroke mechanisms in ischemic stroke patients for secondary prevention.

"Alice's Adventures in Wonderland" syndrome repeatedly induced by the lateral temporo-occipital infarcts upon hemodynamic episodes with basilar occlusion.

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Purpose

A perceptual disorder characterized by distortions of visual perception, body schema and experience of time is called "Alice's Adventures in Wonderland" syndrome, whose name refers to Lewis Carroll's well-known children's book, where Alice feels her body growing both larger and smaller[1].

Methods

Case: 88-year-old female with hypertension, diabetes mellitus, and history of small vessel occlusive stroke. She was brought in for hematemesis to receive endoscopic hemostasis and blood transfusion for circulatory shock status. In the third day of illness, she experienced her head, arms and legs as larger and smaller, and saw surrounding things larger and smaller than they were, while she closed her eyes and could see the unfamiliar faces of elderly people. She then complained that stools in her anus came up beneath his left side of abdomen, chest and shoulder. She felt herself as unreal and sensation of her own body being split in 2-3 parts. Neurologically, she was alert, had sustained dysarthria, left hemiparesis by previous stroke. No visual field loss and visual agnosia, prosopagnosia, and environment agnosia, unilateral spatial neglect, nor another neurological defect was noted.

Results

MRI imaging demonstrated a new subcortical infarct in the right lateral temporo-occipital region, the basilar artery was occluded after the bilateral vertebral arteries branching the PICA up to the top of basilar artery. Both posterior cerebral arteries were perfused via the right posterior communicating artery from the carotid circulation. EEG showed no seizure waves, spinal tap revealed normal CSF, no emboligenic heart disease or atrial fibrillation were not detected with diffuse atherosclerotic aortic arch and carotid arteries. Cerebral SPECT showed that posterior circulating blood flow was the same as anterior one. The patient was treated with intravenous saline infusion and clopidogrel to prevent recurrence, and her symptoms improved within a week. One month later, she came to the hospital again with the same symptoms as previously with excessive hypotension by antihypertensive medication, and another mirror infarct was found in the border region between the left temporal and occipital lobes. Such symptom also gradually recovered over the course of one month.

Conclusions

Ischemic stroke with transient episode of hemodynamic hypotension enough to cause the consecutive cortical infarcts of the ipsilateral occipitotemporal lobes in the watershed of the middle and posterior cerebral artery, reproducibly showed depersonalization, partial macrosomatognosia and microsomatognosia, macropsia and micropsia; so-called Alice's Adventures in Wonderland syndrome.

1. Blom JD. Neurology Clin Pract 6;250-270, 2016.

Clinical study of sixteen patients with thalamic infarction

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Purpose

The pathophysiology of sensory impairment in thalamic infarction is unclear. The association between extents of lesions in the ventroposterior nucleus (VP) and distributions of sensory impairments after thalamic infarction was studied, and we further studied symptomatology in bilateral infarction of the anterior part of the thalamus.

Methods

Neurological symptoms and locations of lesions in consecutive 16 patients with thalamic infarction were analyzed. Locations of lesions were grouped into the four regions (region1 to 4) in the front to back direction, and is further grouped into the medial part and the lateral part in the horizontal direction (Figure 1). The territory of the thalamus was grouped into the rostral, intermediate, and caudal levels in the vertical direction.

Results

The lateral part of the region3 within the intermediate to caudal levels where the VP exists was frequently involved in 12 patients. Sensory impairmentscontralateral to the lesions were shown 14 patients. No patients showed deep sensory impairments. In these 14 patients, subjective superficial sensory impairments were noted in 8 patients. The other 6 patients showed objective sensory impairment alone. The most frequent type was the face/arm in 6 patients. In these 6 patients, sensory impairments were distributed to the distal part of the arm and the mouth surrounding in 5 patients each. Sensory impairments were distributed to the half of the body in 4 patients, the face/trunk/arm in 1 patient, the face/arm/leg in 2 patients, and the arm in 1 patient. Apathy was noted in 1 patient with bilateral lesions. Region1 was involved in 1 patient whose lesions were located bilaterally.The lesions in the anterior part in this patient spread from the lateral part to the medial part on both sides, where the polar and the paramedian arteries distributes.

Conclusions

The principal inferolateral branch supplies the VP and has no anastomosis.In ischemic conditions, blood-flow can be decreased in the inside part of the VP, which corresponds to the field of the hand and the mouth surrounding. The detection threshold of superficial sensations for hand and mouth is low. These phenomena were associated with frequent involvement limited to the face/arm. Distributions of sensory impairments were considered to depend on the detection threshold and the lower blood flow in the inside part.Apathy occurred with a lesion in the study of "polar and paramedian thalamic infarction". The extents of lesions in our patient corresponded to bilateral "polar and paramedian infarction".

A randomized-controlled trial on enhancement of endothelial function in subjects with acute cerebral infarct with hypertriglycemia (OMEGA study: Omega-3 modulation of endothelial function in hyptertriGlycemia with acute ischemic stroke

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Purpose

Omega-3 is believed to help prevent complications of cardiovascular diseases, such as fatal myocardial infarction and sudden cardiac death, by improving several cardiovascular biomarkers, including hypertriglyceridemia, vascular dysfunction, and inflammation. The aim of this study was to investigate the effects of various doses of omega-3 on hematological markers, vascular function, insulin resistance, and vascular calcification in acute ischemic stroke patients with hypertriglyceridemia.

Methods

Patients hospitalized in the neurology department for acute ischemic stroke or transient ischemic attack (TIA) with serum triglyceride levels exceeding 200 mg/dL were enrolled. Blood tests, flow-mediated dilation (FMD), and pulse wave velocity (PWV) measurements were performed before and after random allocation to the control, low-dose omega-3, high-dose omega-3, or fenofibrate group. The intervention period lasted 180 days, after which blood samples, FMD, and PWV measurements were repeated for all groups. Paired t-tests were conducted to compare the pre-medication (1st) and post-medication (2nd) effects within each group. One-way ANOVA was used to compare the pre-post differences (Diff.=pre-post) among the groups. Additionally, Two-way Repeated Measure ANOVA (RMANOVA) was employed to assess the relationship between group effects and medication effects.

Results

In both the low-dose(N=22) and high-dose omega-3(N=24) groups, as well as the fenofibrate(N=16) group, PWV, Apo B, cholesterol, and triglyceride levels significantly decreased after medication compared to before medication. LDL-C levels decreased only in the omega-3 groups(P<0.001), while fibrinogen reduction(P=0.017) and HDL increase(P=0.009) were observed in the fenofibrate group. No significant differences were found in the magnitude of medication effects among the three groups.

Conclusions

This study suggests that omega-3 may have a positive impact on hypertriglyceridemia and vascular function, contributing to the prevention of cardiovascular disease complications in acute ischemic stroke patients. Furthermore, the omega-3 group showed superior LDL-C reduction compared to the fenofibrate group. However, there were no significant differences in the magnitude of medication effects among the low-dose omega-3, high-dose omega-3, and fenofibrate groups. Given the limitation of this study being conducted on a small scale, it is suggested that further large-scale research will be needed to determine the optimal dosage of omega-3 in the future.

A literature review on rehabilitation of upper limbs in stroke.

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Purpose

Stroke is a cerebrovascular disease, ranked second and third on cause of death in Korea, and symptoms of partial paralysis, including exercise, sensation, perception and cognition, and speech disorders, appear depending on the degree of brain damage, showing seriousness. In particular, 69% of strokes experience upper extremity dysfunction, adversely affecting the performance of activities of daily living and quality of life. This study examines the upper limb intervention program of stroke and uses it as basic data for the development of effective intervention for rehabilitation and recovery of subjects.

Methods

This study is a literature review that systematically collected and analyzed intervention papers for stroke, and evaluated research trends, intervention programs, and significant results. The paper selection process is as follows. (1)Search source: Korean authorized journal Kiss, JOS, JKAN (2) Search word 'stroke therapy, rehabilitation, program' (total 3029 papers) (3) Last year 2023-2014: (980) 4) Re-search word "stroke upper limb" (5) Verification, exclusion: Duplicate, non-experiment, invasive treatment, nonconformity paper (exclusion): 22 papers selected.

Results

The trends, interventions (therapy, rehabilitation, programs), and results of stroke papers are as follows.1)Frequency by year of publication: 2021, 2015 (22.7% each), 2016, 2014 (13.6% each), 2020 (9.09%)

2)Journal by Academic: Medical (3), Cognitive Rehabilitation Society(4), Occupational Therapy (4), Aging Industry (3) , Special Rehabilitation (4), Music education Therapy (1), Digital Electronics (3)

3)In the experimental group, there were 10 papers with significant improvement in upper extremity function.

The types of intervention are as follows. (P:program, T:therapy)

: p. using motion recognition, constraint induced movement T(2). Visual and auditory double task, bimanual intensive training, Somatosensory Stimulation T, selective task-oriented activity, Functional Occupational T. Whole Body Vibration Exercise, EMG biofeedbeck.

Conclusions

conclusion of the 22 intervention studies of stroke in korea, 10 papers significantly improved upper extremity function.

Although it has been actively studied in the fields of occupational therapy and educational rehabilitation, research on intervention programs in nursing and medicine was insufficient. Stroke is accompanied by various physical disorders such as walking, posture, and dysphagia, as well as mental problems such as depression and anxiety, suggesting that an integrated rehabilitation program will be developed in the future to improve early recovery and quality of life.

key words : Stroke, Upper Limbs function, Rehabilitation, intervention, systemic review.

Effects of the electrical stimulation using a high-voltage pulsed current (HVPC) for the treatment of dysphagia after stroke: A randomized controlled study

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Purpose

Neuromuscular electrical stimulation (NMES) has been reported in several recent studies as a treatment for pharyngeal dysphagia. HVPC is characterized by a twin-peak pulse monophasic waveform, generating high voltage and a low total current, with very short pulse duration and relatively larger interpulse intervals. These characteristics allow HVPC to generate little or no electrochemical reaction between the skin and the stimulation electrodes; consequently, the resultant sensations are comfortable for the patient. The purpose of this study was to compare the effects of an NMES to the effects of conventional treatment in patients with dysphagia after stroke.

Methods

Post-stroke patients were randomly allocated to control or NMES group. The NMES group received ES intervention followed by conventional treatment (including tongue exercise, Mendelsohn maneuver, etc.). The control group received the same conventional treatment as the NMES group, without ES. Both two groups received 40-min treatment once a day, 5 days per week, for 8 weeks. Treatment sessions followed a protocol as an 8-week program of swallowing exercises for dysphagia. Outcome was assessed before and 8 weeks after treatment. We evaluated the videofluoroscopic dysphagia scale (VDS), the displacement of anterior and superior hyoid bone and larynx, and the functional oral intake scale (FOIS). To confirm feasibility and safety, blood pressure, heart rate, and percutaneous O2 saturation were also assessed before, during, and after each trial.

Results

Thirty-six subjects were enrolled in this study. Both groups exhibited improvement, but the NMES group exhibited more significant improvement in the displacement of the hyoid bone and larynx, VDS-total score, and VDS-pharyngeal score than the control group did. The average change in the superior displacement of the hyoid bone was significantly greater in the NMES group. The average change in the superior displacement of the larynx was also significantly greater in the NMES group. There was no difference between the two groups in the FOIS assessment. There were no changes in vital signs before, during, or after each test.

Conclusions

The results suggest that NMES combined with conventional treatment is superior to conventional treatment alone in patients with dysphagia following treatment for brain injury. Further investigations are necessary to examine the effects of NMES in patients with more varied types of diseases.

Effects of the ultrasound and sonic toothbrushes on oral hygiene and dysphagia in convalescent post-stroke patients: A randomized controlled study

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Purpose

Oral care can be a challenging task for those who have any impairment and loss of motor function. In stroke, patients have both sensory and motor deficits. Oral care is often overlooked during stroke rehabilitation. To evaluate the effects of ultrasound and sonic toothbrushes on the oral hygiene status in convalescent patients after stroke.

Methods

Post-stroke patients were randomly allocated to control or experimental group. The experimental group used with the ultrasound and sonic toothbrushes, and the control group used toothbrushes with power off (without ultrasound and sonic wave). Oral care was performed three minutes per session, twice a day, seven times per week, fore twelve weeks. Main Outcome Measures were Simplified Oral Hygiene Index (S-OHI), Plaque Index (PII), Gingival Index (GI), Saxon test (saliva secretion), Functional Oral Intake Scale (FOIS) and questionnaire were recorded before, and 12 weeks after each intervention.

Results

Sixty-five subjects were enrolled in this study. At baseline, oral hygiene status in post-stroke patients was poor. And also, the amount of saliva was small, dysphagia was remarkable. In both groups, all outcome measures were improved after the intervention. However, there were significant differences between the experimental and control group for OHI, PI, GI, Saxon test, FOIS and patient satisfaction, 12 weeks after the intervention.

Conclusions

These findings demonstrate that the use of ultrasound and sonic toothbrushes effectively decreased the poor oral hygiene, and increased saliva secretion. Professional prophylaxis was required to improve gingival status. Oral care with ultrasound and sonic toothbrushes, is superior to conventional treatment alone for post-stroke patients.

Feasibility of electrically actuated knee–ankle–foot–orthosis for post–stroke hemiplegic gait: a prospective pilot study

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Purpose

We aimed to investigate the feasibility of our newly developed electrically actuated knee–ankle–foot–orthosis (eKAFO) for assisting post–stroke hemiplegic gait.

Methods

This study was conducted on stroke patients aged 20 years or older who had hemiplegia and showed pathological gait pattern but were able to obey with three–step verbal commands. To be eligible for inclusion in the study, participants must have scored 2 to 4 in the Functional Ambulation Category, meaning that although the participant must have abnormal gait, he/she did not need assistance beyond a light touch to walk. The eKAFO recognizes the user's intention and assists the flexion and extension of the knee joint, respectively. The 3-minute walk (3mWT), 6-minute walk (6mWT), and 10-Meter walk (10MWT) tests were attempted over a total of six visits with participants wearing the eKAFO on the hemiplegic side. During the six visits, if the evaluation was completed at least once in the initial three sessions and at least once in the late three sessions, data from the participant were included in the analysis. The initial and final evaluations were set as pre– and post–assessments, respectively, and a Wilcoxon signed–rank test was performed.

Results

The median (interquartile range, IQR) age of all 12 participants was 65 (14), Berg Balance Scale score was 37.5 (11), Timed Up and Go Test score was 26.8 (13.7), and Dynamic Gait Index score was 15 (4.5). Of the total, 8 (66.7%) were male and 6 (50%) had right hemiparesis. Among all participants, 9, 7, and 11 performed 3mWT, 6mWT, and 10MWT at least once in pre–assessment and at least once in post–assessment, respectively. The median (IQR) time interval between pre–assessment and post–assessment was 12 (4) days, and the median (IQR) total number of visits including pre– and post–assessments was 4 (3) days. The median values of the pre- and post-assessment results of the three types of tests were 59.3/68 meters, 121.6/150.1 meters, and 13.6/10.1 seconds, respectively, showing adaptive changes with increasing number of visits, although none was statistically significant in the paired t–tests (p–value 0.11, 0.08, and 0.17).

Conclusions

Although no statistically significant changes were observed, in this pilot study, gait-related indicators tended to improve despite the small number of participants, short adaptation period, and small number of visits, suggesting that the eKAFO has the potential to assist gait in post–stroke hemiplegic community ambulators.

Acknowledgement

Usage of revised model of dysphagia straw (SafeStraw) compensating for Disadvantages : A case report

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Purpose

Patients with dysphagia have structural or motility abnormality in the passage of solids or liquids from the oral cavity to pharynx and esophagus to initiate the involuntary swallowing process. Dysphagia occurs commonly in aging and degenerative diseases such as stroke, Parkinson`s disease, dementia, and Amyotrophic lateral sclerosis. Patients with oral motor dysfunction have difficulty controlling suction when taking liquid. Repetitive aspiration due to dysphagia can lead to pneumonia, which can result to life-threatening complications like sepsis. Accordingly, SafeStraw (Bionix, LLC, USA, Figure 1) has been developed and used in clinical practice, and it is designed a certain dose (6.2 ml per time) during liquid intake to prevent aspiration. SafeStraw has some drawbacks when used in clinical application. Because of float(pendulum) inside the SafeStraw, it has resistance when ingesting the liquids. Patients` complaints range from the inability to initiate a swallow liquids through SafeStraw because they do not have sufficient suction power. Secondly, SafeStraw has complex structure to keep it clean. So we designed the PMC straw (Figure 2), a revised version of SafeStraw.

Methods

The pinhole is pierced in the upper third of the existing plastic straw, and the amount of inhalation can be adjusted by differ the number of the pinholes according to the degree of oral motor function of the patient. The more pinholes (we tried maximum of 10 holes), the easier suckling.

Since there are no resistance parts inside, patients with severe swallowing disorders can also easily suck up the liquid. In addition, cost-efficient materials can reduce price unit and simple structure is useful of periodic cleaning and management. Patient showed greater satisfaction in actual usage overall.

Case description: A 57-year-old woman with right intra-cranial hemorrhage had acute oropharyngeal dysphagia causing aspiration with direct cough on fluid cup. Because of the oral motor weakness, she repetitively failed to suckle dilute fluid with SafeStraw.

Considering the limitation of SafeStraw, we applied PMC straw with 4 pinholes to her instead. PMC straw facilitated the first step of swallowing without difficulty suckling.

Results

During the patient using the PMC straw daily fo the long-term, she was satisfied on cleansing and maintaining the device.

We performed rehabilitation including swallowing treatment. After 1 month progression, the result of videofluoroscopic swallowing study showed improvement from fluid cup aspiration Grade 7 to Grade 5.

Conclusions

The goal of management of oropharyngeal dysphagia is to improve food transfer and to prevent aspiration. This study devised a new type of PMC straw that is more helpful and inexpensive and clinically useful compared to existing dysphagia straw device (SafeStraw).

Figure 1. SafeStraw

Figure 2. PMC straw (a revised mdoel of SafeStraw)

Sex disparities in acute stroke treatment: A closer look at intravenous thrombolysis in South Korea

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Purpose

Sex differences in intravenous thrombolysis (IVT) use are acknowledged. Nevertheless, there has been a lack of comprehensive investigation into the sex disparity in South Korea, where the stroke care system has experienced a government-initiated reform recently.
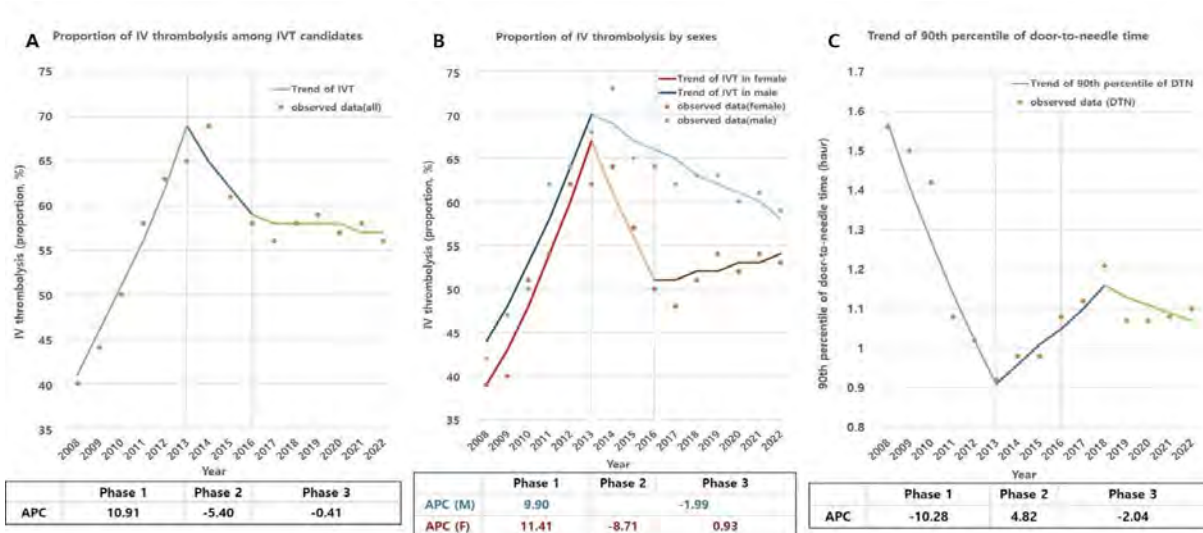
Methods

A prospective, multicenter, nationwide stroke registry (CRCS-K) was utilized to analyze acute stroke admissions during the years 2008 to 2022. IVT candidates were defined as patients with an NIHSS score of 4 or greater and who arrived at the hospital within 4.5 hours from the time last known well. The stroke care quality was measured by the 90th percentile of door-to-needle (DTN) time for IVT. The joinpoint regression model was applied to detect changes in trends of IVT utilization among the candidates.

Results

A total of 96,855 admissions, of which 43% were female, were recorded during the period. IVT candidates were 15,732(16%). The proportion of IVT among the candidates showed an increasing trend after 2008 (Phase 1), followed by a notable decline from 2013 to 2016 (Phase 2) and no significant change afterward (Phase 3, Panel A). During Phase 2, a significant decrease in IVT utilization was observed with an annual percent change(APC) of -5.40, with a greater downward trend in females (APC, -8.71) compared to males (APC, -1.99, Panel B). The 90th percentile of DTN time improved during phase 1 (APC, -10.28), and worsened thereafter (APC, 4.82, Panel C). IVT utilization was comparable between sexes in Phase 1 (adjusted OR [95% CI], 0.88 [0.76 – 1.03]), but a significant difference was noted in Phase 2 (0.77 [0.66 – 0.91]) and Phase 3 (0.82 [0.73 – 0.91]).

Conclusions

A sex disparity in the use of IVT for ischemic stroke was documented in South Korea. In line with the deterioration in the hyperacute stroke care quality, the gender disparities in the utilization of IVT were also worsening.

A	Phase 1	Phase 2	Phase 3
APC	10.91	-5.40	-0.41

B	Phase 1	Phase 2	Phase 3
APC (M)	9.90		-1.99
APC (F)	11.41	-8.71	0.93

C	Phase 1	Phase 2	Phase 3
APC	-10.28	4.82	-2.04

Communication rehabilitation utilizing eye-tracking device in a patient with 'locked-in syndrome'

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Purpose

This article shows alternative devices including eye-tracking device treatment in locked-in syndrome can be an effective method to facilitate the communication skill of the patient

Methods

A 38-year-old woman was admitted to the hospital for rehabilitation after experiencing a cerebral infarction in the right lateral medulla and left pons, as well as in the right posterior thalamus, right occipital lobe, and both cerebellar hemispheres. The patient had experienced a sudden change in mental status, leading to stupor. Brain computed tomography (CT) and transfemoral cerebral angiography (TFCA) revealed a basilar artery dissection, which caused a reduction in brainstem perfusion and led to the cerebral infarction. At the onset of the infarction, the patient had a zero grade of all muscles in extremities. Although she had intact mental alertness and enough mental endeavor to be involved in a communication program which led to communication rehab.

Results

To address the patient's communication difficulties, a comprehensive communication rehabilitation program was conducted using alternative communication devices, including an eye-tracking communication system. The eye-tracking device was used to improve communication between the patient, healthcare professionals, family members, and caregivers. The patient's communication skills were assessed at baseline and after a month of rehabilitation.

Following the rehabilitation program, the patient showed significant improvement in communication skills. At her first week of rehabilitative training, the patient only had a restrictive horizontal eye ball movement and could only select a few words in a minute. After twice a day training for four weeks, she became able to move eyeballs vertically and became able to use the eye-tracking technology to select words and phrases, specifically to complete two sentences in a minute. Additionally, the patient and family members learned to control the eye-tracking system, making the patient the best use to control devices using eye signals.

Conclusions

This case report highlights the potential benefits of using eye-tracking communication devices and comprehensive rehabilitation programs to improve communication skills in patients with locked-in syndrome. The patient in this study showed improvement in communication skills, as shown by her ability to use the eye-tracking communication system.

Startle syndrome following brainstem infarction : A case report

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Purpose

Pathologic startles are defined as reproducible exaggerated startle responses to trivial and not surprising stimuli such as sudden noises, touch. Startle syndrome may arise from genetic abnormalities, brainstem lesions, metabolic disorders, or medications. Startle syndrome is a pathologic startle reflex and a rare neurological disorder. So in this case we are reporting a case of a brainstem infarction patient who is characterized by an exaggerated startle response.

Methods

An 80-year-old woman was admitted for rehabilitation about multifocal brainstem infarction caused by vertebrobasilar artery thromboembolism.

Her Mental status was alert but there was cognitive impairment with 11+4/30 of Mini-Mental State Examination (MMSE). The patient was quadriplegia. On the mannual muscle test(MMT) power was poor grade in all extremities. During comprehensive rehabilitation treatment, the patient exhibited unvoluntary movement looks like tremor but this reaction induced by touch but not to auditory stimulation and light. These symptom lasted 1-2 seconds in all extremities with preserved consciousness.

She was unable to describe her symptom. At first she has Complex Regional Pain Syndrome(CRPS) so we suspected that the symptom was related to pain. Despite the pain treatment, there was no improvement.

Secondly, she was not taking anti-epileptic drugs, and the movement was enough for us to suspect eplipsy. Electroencephalography(EEG) examination was performed and consultation was conducted to the neurologist. Along with the suspicion of startle syndrome, the recommendation was made to use clonazepam. Upon starting clonazepam, the startle responses disappeared.

Results

The normal startle reflex, a common physiologic mechanism, consists of a symmetrical generalized myogenic flexor response with a classic rostrocaudal recruitment activation of different muscles in brainstem reflectory reaction, which can be elicited by unexpected stimuli. Startle syndrome is differentiated from the normal startle reflex by its lower threshold, higher intensity, and resistance to habituation. and the preserved consciousness distinguishes it from epileptic seizures.

There are various causes of startle syndrome, causing synaptic inhibition in the brainstem. Clonazepam is the first choice therapy which has anticonvulsant properties, are commonly prescribed to alleviate symptoms.

The EEG is necessary to differentiate it from seizures. and the electromyography(EMG) can manifest as increased muscle activity or prolonged muscle contractions following a startle stimulus.

Conclusions

In this case of patient, multifocal brainstem infarction seems to be the cause of pathologic startle reflex. Due to the patient's declining condition, there were constraints in performing EMG tests. Nonetheless, notable symptom improvement was observed with clonazepam administration.

In this case, it is meaningful that startle-syndrome can be considered in addition to focal seizure in patients with unvoluntary movement after stroke of brainstem.

Novel application of microcurrent for cerebral aneurysms in an intracranial arterial dolichoectasia mouse model

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Purpose

To investigate the therapeutic effect of microcurrent in intracranial arterial dolichoectasia (IADE) mice model.

Methods

Twenty mice were randomly allocated to five groups: healthy control (group 1-C), the IADE model (group 2-D), microcurrent applied (daily, 12 hours) before nephrectomy and continued until brain surgery for IADE prevention (group 3-M+D), microcurrent applied for 4 weeks after brain surgery for IADE treatment (group 4-D+M), and microcurrent applied for 4 weeks to evaluate toxicity (group 5-M) (Figure 1). IADE occurred in 8-week-old C57BL/6J male mice through the induction of hypertension and elastase injection into a basal cistern (Figure 1). Based on group 4, after 4 weeks of microcurrent application starting from week 0, the time of brain surgery, all five groups were euthanized and their brains were harvested. The diameter and thickness of cerebral arteries were measured on the microscopic scale (Figure 2). Using ImageJ software, the extracellular matrix components of the cerebral arterial wall, such as smooth muscle cells (SMCs), elastin, and collagen, were assessed by measuring the selected region of interest (ROI) within the image. The area of the region of interest (ROI) was measured and then divided by the area of the entire cerebral artery. This calculation allowed for the estimation of the percentage of each component present in the cerebral artery.

Results

The cerebral arterial diameter was significantly higher in group 2-D (117.79 ± 17.05) compared to group 1-C (76.64 ± 12.03), and group 3-M+D (77.29 ± 24.47). Additionally, the cerebral arterial thickness in group 2-D (9.31 ± 2.26) was significantly lower than in group 1-C (16.16 ± 1.6), and group 3-M+D (15.67 ± 2.86) (Figure 2, Table 1). The diameter of group 4-D+M (100.28 ± 25.99) was lower than that of group 2 and the thickness of group 4-D+M (12.82 ± 5.17) was higher than that of group 2-D although no significant difference was observed (Figure 2, Table 1).

The proportion of SMC and elastin in the cerebral arterial wall was significantly lower in group 2-D (SMC: 38.05 ± 10.32, elastin: 53.13 ± 9.08) compared to group 1-C (SMC: 70.93 ± 7.18, elastin: 53.13 ± 9.08), group 3-M+D (SMC: 67.03 ± 6.17, elastin: 47.22 ± 8.73) and group 4-D+M (SMC: 70.45 ± 9.35, elastin: 51.2 ± 6.82), respectively. Additionally, the proportion of collagen in the cerebral arterial wall was significantly lower in group 2-D (42.46 ± 14.12) compared to group 1-C (6.94 ± 2.76), group 3-M+D (13.31 ± 4.67), and group 4-D+M (13.3 ± 3.84), respectively (Figure 2, Table 1). However, no statistically significant differences were observed in the proportion of SMC, elastin, and collagen in cerebral arterial wall among groups 1, 3, and 4 (Figure 2, Table 1).

In group 5-M, there was no evidence of toxicity observed by histology in the liver and brain.

Conclusions

The study showed that microcurrent is effective in preventing the development of IADE and has some beneficial effects on its progression. Further study is needed.

Effects of digital mirror therapy and classic mirror box on upper-limb motor and daily function in stroke individuals: A pilot study

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Purpose

With the advancements in digital imaging and virtual reality technologies, new versions of mirror therapy (MT) have been increasingly developed in stroke rehabilitation. These new versions of MT have some advantages over classic MT, such as minimizing cervical-posture tension, increasing the possibility of performing asymmetrical or alternative movements, or providing more vivid illusions. However, their intervention effects in stroke individuals warrant further investigations. This study was to examine the effects of a version of digital MT and classic MT using a mirror box on rehabilitation outcomes in stroke individuals.

Methods

Fourteen stroke patients were randomly assigned to digital or classic MT groups. All participants received 15 1-hour training sessions for 3 to 4 weeks. Digital MT used a webcam to capture the movements of patient's non-affected hand which can be transformed into the mirror image of affected hand and presented on a screen in real time. Blinded outcome assessments were administered at pre- and post-intervention, including the Fugl-Meyer Assessment of the Upper Extremity (FMA-UE), Chedoke Arm and Hand Activity Inventory (CAHAI), Barthel Index (BI), and Motor Activity Log (MAL). Nonparametric tests were used to analyze the data.

Results

No significant between-group differences between the 2 groups were found, expect for the quality of movement subscale of MAL (P = 0.048). The digital MT group had better gains in this outcome than the classic MT. There were significant within-group improvements were found on the FMA-UE and CAHAI scores (Ps = 0.02 to 0.03) in both the digital and classic MT groups. Additionally, the digital MT group showed significant within-group improvements on the amount of use and quality of movement subscales of MAL (both Ps = 0.05).

Conclusions

Both the digital and classic MT led to similar improvements in upper-limb motor outcomes, whereas the digital MT group had more gains in using the affected hand during real-life activities. Further larger-scale research to confirm the pilot findings is needed.

Acknowledgement

[PP125]

Effects of kinesio taping for acute stroke patients with unilateral spatial neglect: A case report

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Purpose

Unilateral spatial neglect (USN) is commonly seen in acute stroke patients with a prevalence of 34%. They are unable to orient the space and pay less attention to the contralateral side of the lesion, leading to poor postural control and balance. By increasing the space between skin and muscle, kinesio taping can speed up blood and lymph circulation, intensifying the input of sensory. This study aims to investigate the effects of kinesio taping for acute stroke patients with USN.

Methods

We reported an inpatient of a 75 y/o man who suffered an infarction at the right basal ganglion revealed by magnetic resonance imaging. On the third day of onset, he presented with a left USN. During hospitalization, he received a 20-minute regular physical therapy every day. Additionally, with 15-25% tension, two I-strip kinesio tapes were applied to the left sternocleidomastoid in the lengthened position. According to Kenzo Kase's method, the kinesio tapes were applied from the insertion (mastoid of temporal bone) to the origin (manubrium; medial side of the clavicle) of the sternocleidomastoid. The star cancellation test (SCT) was used to assess visual-spatial ability and the cervical joint position error test (CJPET) was used to assess the proprioception of the head and neck. Based on the previous findings, SCT < 50 and CJPET > 7.1 cm indicated the presence of USN and impaired head-neck proprioception, respectively.

Results

After 5 days of kinesio taping intervention, the SCT improved from 45 to 53, and the CJPET improved from 20 cm to 4 cm.

Conclusions

Our preliminary findings demonstrate that kinesio taping seems to be a promising tool to improve visual-spatial ability and head-neck proprioception in acute stroke patients with USN. Future studies will focus on the effects of kinesio taping in posture control and balance for acute stroke patients with USN.

Acknowledgement

Crossed aphasia patient undergoing long term speech therapy, a case report

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Purpose

Crossed aphasia is a type of aphasia caused by cerebral hemispheric lesions on the same side of the dominant hand. It is known that the prevalence rate of crossed aphasia is very rare. In this case report, we report one case of crossed aphasia after the right middle cerebral artery(MCA) infarction. The subject received six years of speech therapy, and we would like to report a serial progress, including language evaluation results.

Methods

A 57-year-old male patient visited the emergency room with a sudden weakness of left side extremities. After the brain magnetic resonance imaging(MRI) study, acute right MCA infarction was diagnosed, and he was admitted to neurosurgery and treated for cerebral infarction. Seven weeks after the onset of symptoms, he was transferred to the Department of Rehabilitation Medicine for the treatment of language function impairment.

The patient was a high school graduate, worked as a public official. He had no history of previous stroke and brain lesion. He was right-handed and had no family history of left-handedness. There was only cerebral infarction in the right MCA territory and no brain lesion in left hemisphere in brain MRI.

At the time of transfer, in the neurologic examination, the patient showed neglect syndrome and agraphia. Brain SPECT showed large-sized perfusion defect in right fronto-temporo-parietal lobes and focal perfusion defect in right basal ganglia and right thalamus.

Korean-Western Aphasia Battery(K-WAB) showed global aphasia, 0/100 of aphasia quotient (AQ) at the time of transfer. The patient continued to receive speech therapy and follow up tests were done. Based on the initial evaluation date, K-WAB showed 0.8/100 of AQ 2 months later, 4.2/100 of AQ 3 months later, 16.1% of AQ 6 months later, 11% of AQ 14 months later, 15.4% of AQ 30 months later, 15.7% of AQ 55 months later.(table 1)

Results

In this case report, the patient met the diagnostic criteria for crossed aphasia. It was known that crossed aphasia showed rapid recovery. However, in this case, despite the patient received speech therapy 2-3 times a week for 6 years, no significant improvement in language function was observed and global aphasia continued. In contrast to anomalous crossed aphasia, all language functions are performed in the right cerebral hemisphere in mirror image crossed aphasia. Characteristics of mirror image crossed aphasia is known as severe symptom and and slow recovery. Considering patient's progress of treatment, it supports the possibility of mirror image crossed aphasia.

Conclusions

We report the case of crossed aphasia patient undergoing 6 years of speech therapy after right MCA infarction.

Table 1. The results of K-WAB on 2 months, 3 months, 6 months, 14 months, 30 months, 55 months after the time of transfer

Category	Time of transfer	2 months	3 months	6 months	14 months	30 months	55 months
Expression	N/A	0%	5%	15%	9.6%	15%	15%
Comprehension	N/A	4%	10%	27.5%	28%	29%	33.5%
Repetition	N/A	0%	1%	16%	4%	6%	6%
Naming	N/A	0%	0%	7%	3%	12%	9%
Reading	N/A	N/A	23%	15%	1%	13%	10%
Writing	N/A	N/A	3%	17%	12%	11%	21.5%
Aphasia quotient	0%	0.8%	4.2%	16.1%	11%	15.4%	15.7%
Language quotient	N/A	N/A	8.3%	17.2%	10.9%	15.4%	17.5%

(N/A: Not available)

Does concomitant large artery steno-occlusion in major cerebral arteries influence the risk of recurrence in acute ischemic stroke patients with atrial fibrillation?

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Purpose

Cerebral atherosclerosis is common in patients experiencing stroke as well as those with atrial fibrillation [AF]. Though recognized as a significant risk factor and prognostic determinant for stroke, its prognostic influence on acute ischemic stroke (AIS) patients with AF remains unclear.

Methods

This study included patients enrolled in a prospective multicenter cohort study, the EAST-AF (East Asian Ischemic Stroke Patients with Atrial Fibrillation Study)-Part II, and underwent MR angiography during hospitalization. The status of concomitant large artery steno-occlusion [cLASO] was evaluated across 26 segments of major cerebral arteries and was classified according to the degree of steno-occlusion (0%, 1-49%, 50-99%, 100%) and the clinical relevance of steno-occlusion. Relevance was determined by either (1) steno-occlusion sufficient to cause infarction in the corresponding vascular territory or (2) any residual steno-occlusion after endovascular thrombectomy. Cause-specific hazard model considering death as a competing risk was applied to

evaluate the risk of recurrence.

Results

The study analyzed a total of 916 AIS patients with AF, 71.4% (n=654) of whom had cLASO. Of these 654 patients, 32.7% exhibited <50% stenosis, 24.9% demonstrated 50-99% stenosis, and 42.4% had an occlusion. Relevant steno-occlusion was 44.2%. Compared to those without cLASO, patients with cLASO were generally older and predominantly female, with a higher likelihood of presenting traditional risk factors like diabetes and dyslipidemia and a history of stroke/TIA, and receiving antiplatelet prior to index stroke. They were also less likely to be prescribed anticoagulants at discharge. During a median follow-up period of 1095 days, 149 ischemic strokes and 203 deaths were recorded. The presence of cLASO amplified the risk of recurrent ischemic stroke by nearly two-fold (adjusted hazard ratio [95% confidence interval]: 1.98 [1.30-3.00]). Compared to individuals without cLASO, those with 50-99% stenosis and occlusion had over double the risk of recurrent ischemic stroke (2.23 [1.34-3.69] and 2.43 [1.54-3.83], respectively), although less than 50% stenosis did not exhibit this trend (1.27 [0.74-2.16]). Clinically relevant steno-occlusion escalated the risk more than threefold (3.23 [2.09-5.00]), unlike bystander steno-occlusion (1.11 [0.68-1.80]). A post hoc analysis coupling the relevance and degree of cLASO highlighted a more pronounced impact from the relevance aspect.

Conclusions

Our findings indicate that in AF patients, cLASO, especially when clinically relevant or characterized by a higher degree or occlusion, considerably elevates the risk of recurrent ischemic stroke. This necessitates further research into the pathogenesis and prevention strategies for recurrent ischemic stroke in AIS patients with AF and cLASO.

The gate-keeper system in accessing health services: Can it prevent stroke patients from out of pocket?

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Purpose

Stroke is the leading cause of disability worldwide and the second leading cause of death and reached epidemic proportions. Globally 1 in 4 adults over the age of 25 will have a stroke in their lifetime. Worldwide, it accounts for approximately 5.5 million deaths annually, while in the case of Indonesia was 876,665 residents in 2015 and increases 75,000 patients each year and is expected to increase to 6.17 million in 2030 regarding unhealthy dietary besides genetic, epidemiology, and aging factors.

Methods

Using the juridical-empirical approach, this study analyzes whether Indonesia's health service practices conformity is in line with national policy objectives. In accordance with the National Social Security Law Number 11 of 2009 concerning Article 19 of the Law concerning Social Welfare, the government is obliged to ensure equal health services access and facilities due to Universal Health Coverage. Since, coverage of health services and the community health status includes promotive, preventive, curative, and rehabilitative services by adhering to the mutual cooperation principle (gotong royong).

Results

JKN aims to protect the citizens from financial risks through the Social Security Organizing Agency (BPJS) which will cover all types of diseases (Minister of Health Regulation 28/2014). However, provisions in the National Formulary 2017 on drugs to reduce symptoms or extend the time for patients to be free of symptoms such as levodopa, bromocriptine, pergolide, selegiline, anticholinergics (benztropine), antihistamines, antidepressants, propranolol, and amantadine are limited in number. Other than that, when performing surgery, it turns out there are costs that are not covered (for example patients are required to take care classes, or patients must get drugs outside the national formulary) and eventually patients become difficult to pay for health care costs. Most of the stroke patients that rise each year cannot be handled properly. Meanwhile, patients each year that almost elderly fall into poverty because of stroke health costs. In fact, BPJS coverage has not fully covered the treatment such as only 30 days of chronic medicine. The patient must spend the cost of illness that is borne for life by 2.7 percent of total household consumption expenditure. This has an impact on reducing the quality of life of patients.

Conclusions

The result concludes that the government has not achieved the goal of eliminating Stroke disease patients from "out of pocket" yet. The government needs to overcome the health policies overlapping and develop hospital formularies due to prevention and health promotion programs. Further, national health insurance program the national health insurance program needs to be allocated more effectively for the construction of the Stroke study center and consider DBS and SBL as options for community social insurance classes to improve the quality of life of patients.

Intracranial vertebral artery dissection as the initial presentation of childhood takayasu arteritis: A case report

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Purpose

To discuss a rare case of pediatric stroke secondary to an intracranial arteriopathy arising as a complication of an undiagnosed systemic vasculitis

Methods

A 17-year-old female consulted because of sudden onset vertiginous dizziness. Ancillary history was pertinent only for a three-year history of non-resolving cervical lymphadenopathies, a previous PTB exposure, and the absence of recent neck trauma or manipulation. Neurologic examination revealed left caudal lateral pontine syndrome as manifested by ipsilateral lateral rectus palsy, peripheral facial palsy, cerebellar findings, Horner's syndrome, and contralateral hemiparesis plus sensory loss. Cranial MRI confirmed a left AICA infarction (Figure 1, A-F). Extensive work-up was then performed to determine the underlying etiology of the arterial ischemic stroke.

Results

Metabolic work-up only revealed dyslipidemia but she had normal coagulation parameters, cardiac studies, thyroid function, and blood gas. She had significant interarm pulse and BP discrepancy with normal CRP but elevated ESR. Craniocervical MRA revealed intracranial left VA dissection, chest CT angiogram showed pulmonary tuberculosis but normal vascular studies, while abdominal CT angiogram documented left renal artery stenosis (Figure 1, G-J). She tested negative for infectious vasculopathies and her lumbar puncture, SLE, and APAS panel all came back negative.

Final impression was left AICA infarct from left intracranial VA dissection from cTA. She was started on Aspirin and Atorvastatin for secondary stroke prevention, Prednisone at 1mg/kg/day for cTA, and anti-Kochs for disseminated tuberculosis.

Conclusions

TA can lead to dissection by destroying vessel elastic membranes and muscularis layer. Whereas immune suppression therapy is given in TA with the primary goal of preventing irreversible vessel damage, intracranial vertebral dissection guidelines advise antiplatelet therapy for those with cerebral infarction to prevent recurrence. This case highlights the importance of extensive work-up in pediatric stroke so that proper management may be instituted to decrease potential life-long disability and mortality from recurrent strokes.

Association between diastolic blood viscosity and small vessel burden in patients with acute ischemic stroke.

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Purpose

An elevated blood viscosity (BV), a significant determinant of blood rheology, has been documented as a contributing factor of cerebrovascular disease. However, the effect of BV on small vessel burden has not been elucidated yet. We investigated the impact of BV on regional whitematte hyperintensity (WMH) burden, and which blood viscosity is associated with cerebral small vessel burden.

Methods

We enrolled 442 patients with acute ischemic stroke or transient ischemic attack within 7 days of symptom onset. A scanning capillary-tube viscometer was used to assess whole BV. BV is divided into 3 groups according to the references. A modified Fazekas rating scale was used for scoring.

Results

The mean age was 69.5±13.4 years and 41.2% (n=182) were female. Of 442 patients, patients with elevated diastolic BV (DBV) were younger, and have more smoking habits, higher level of body mass index, WBC, total cholesterol, hemoglobin, hematocrit, LDL, crp, and diastolic BP. Those patients with elevated DBV exhibited more deep-WMH burden (i.e. Fazekas 2 or 3 scores), whereas there was no association with periventricular WMH burden (p=0.043). In addition, there was no relation between systolic BV and whole small vessel burden.

Conclusions

We found that elevated DBV may attribute more in the development of deep cerebral small vessel burden in acute ischemic stroke than SBV. The present findings may suggest new possibilities for therapeutic strategies targeting blood rheology to improve cerebral microcirculation in stroke.

Assessing new ischemic lesions on diffusion-weighted imaging following carotid interventions: A comparative analysis of CAS and CEA

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Purpose

Carotid endarterectomy (CEA) and carotid stenting (CAS) are effective in preventing strokes in patients with carotid artery stenosis, but some experience postoperative strokes or mortality. Diffusion-weighted imaging (DWI) helps detect new embolic brain lesions and compare outcomes of carotid interventions. We aim to investigate the association between DWI-detected new lesions post-intervention and procedural variables.

Methods

We retrospectively analyzed data from 159 patients undergoing CEA or CAS over six years. Stenosis severity was determined using transfemoral cerebral angiography (TFCA). New ischemic lesions were identified by comparing post-intervention DWI scans to pre-intervention images within three days. We collected cardiovascular risk factors, surgical details, and transcranial Doppler (TCD) monitoring findings.

Results

Among 164 patients, those developing acute neurological deficits post-procedure (four disabling strokes, three non-disabling strokes) underwent post-intervention DWI. We analyzed 116 patients (72 CEA, 44 CAS) with both pre- and post-procedural DWI. DWI revealed new ischemic lesions in 53 patients, with no gender difference (p = 0.579). CAS had significantly more post-intervention ischemic lesions than CEA (70.5% vs. 30.6%, p < 0.001). No associations were found between new DWI lesions and symptomatic stenosis (p = 0.624) or TFCA stenosis degree (p = 0.498). After adjusting for age and gender, CAS had a higher odds ratio for new DWI lesions (OR 6.0, 95% CI; 2.6 to 14, p < 0.001). Intraoperative TCD monitoring showed a trend with higher microembolic signals quartiles and new DWI lesions (p = 0.053), but other TCD variables had no significant associations. Shunt use during CEA predicted new DWI lesions (OR 6.92, 95% CI 1.65 to 29.98, p = 0.008).

Conclusions

CAS results in more frequent new ischemic lesions on DWI compared to CEA. Selective shunting during CEA reduces new ischemic lesions. TCD monitoring aids shunt selection, mitigating unpredictable ischemic lesions. These findings have implications for optimizing carotid intervention outcomes.

The effect of folic acid supplementation on stroke incidence in hyperhomocysteinemia patients with a background of coronary heart disease

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Purpose

Hyperhomocysteinemia leads to an increased risk of cardiovascular disease. Four out of five cardiovascular disease deaths are due to stroke. Several clinical trial studies examining the efficacy of folic acid to prevent stroke in patients with hyperhomocysteinemia and cardiovascular disease have reached inconclusive conclusions.

cardiovascular disease provides inconclusive conclusions. The aim of this evidence-based case report is to assess whether folic acid supplementation can reduce the risk of stroke in patients with a history of cardiovascular disease. can reduce the risk of stroke in patients with a history of coronary heart disease with hyperhomocysteinemia.

Methods

Scholar, Pubmed, Proquest, and Science Direct databases were used in the analysis process. The literature search identified studies based on the inclusion of homocysteine, hyperhomocysteinemia, cardiovascular disease, myocardial ischemia, myocardial infarction, folic acid, folate, stroke, and cerebrovascular disease. After obtaining articles from the three databases, all duplicate articles were excluded. The titles and abstracts were then screened according to the selection criteria. Studies that were fully reviewed were determined by reading the full article. Articles that met the selection criteria were reviewed for validity, importance, and applicability, using the Center of Evidence-Based Medicine (CEBM) critical review tool.

Results

Two systematic review studies were obtained that met the selection criteria. The Arturo study resulted in folic acid doses of 0.4 mg - 5 mg (4.26%) versus placebo (5.06%) reducing the risk of stroke with an RR value of 0.90 (95% IK 0.82 - 0.99), while the Wang study with folic acid doses of 0.8 mg to 5 mg (had an RR of 0.85 (95% CI: 0.77-0.94). Arturo's study showed that high-dose folic acid administration was not significantly different compared to (RR 0.90; 95% IK 0.66 - 1.22). In Wang's study, there was a significant reduction in stroke risk in the folic acid alone group compared with folic acid combined with other B vitamins (RR 0.80; 95% IK: 0.70-0.93). Wang showed that a low dose of folic acid (<2 mg/day) reduced the risk of stroke compared to a high dose (>2 mg/day) with a value of (RR 0.79; 95% CI 0.69 - 0.91).13 Both studies analyzed relatively homogeneous studies. From Arturo, the number needed to treat (NNT) could be calculated with a result of 125, while from Wang it was not possible to calculate the NNT.

Conclusions

Only a small difference in stroke prevention was found between folic acid administration versus placebo in the Arturo study. Whereas Wang showed no significant difference in mortality, CHD mortality, and CHD risk between the intervention group and the CHD between the intervention group and the control group. Thus, the administration of folic acid in patients with a risk and history of cardiovascular disease showed no significant clinical benefit in preventing stroke events. Administration of folic acid routinely to prevent stroke events in patients with risk or history of cardiovascular disease is not recommended.

Risk factors of stroke in young adults in Indonesia

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Purpose

Stroke is caused by non-traumatic cerebral circulation problems and results in acute, progressive, and fast brain damage. Stroke is a condition that affects more than 15 million people globally every year. The high rate of stroke has the potential to increase the prevalence across all age groups; there are a considerable number of persons suffering from stroke under the age of 50, known as "young" stroke. Vascular issues such as stenosis, rupture, occlusion, aneurysm, and arterial malformation are among the leading causes of stroke in children. The aim of this study is to identify risk factors for stroke at a young age.

Methods

Cendekia, Pubmed, Proquest, and Science Direct databases were used in the analysis process, which used real-time data and a literature review to determine results from 2017 to 2022. The results of the literature research identified one study based on inclusion criteria and helped a man who was 50 years old when he had a stroke.

Results

It was found that the incidence of easy-age stroke was more in the male gender (62%) with an age range of 18-59 years. Risk factors for stroke include hypertension, lack of exercise, fast food consumption habits, smoking habits, history of diabetes mellitus, dyslipidemia, hypercholesterolemia, hyperuricemia, heart failure, epilepsy, carotid / cerebral artery stenosis, myocardial infarction, stroke in the family and cardiomyopathy.

Conclusions

There are 3 risk factors that greatly influence the incidence of stroke at a young age, namely a history of hypertension, dyslipidemia and a history of diabetes. Therefore, to prevent stroke at a young age, it is expected to change lifestyle by consuming healthy food, avoiding smoking, alcohol, stress management and routine exercise.

The clinical significance of peripheral blood cell ratios for delayed ischemic stroke in patients with intracranial aneurysm

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Purpose

Recent multiple studies have shown that inflammation plays an important role in intracranial aneurysm (IA) formation and progression to rupture. Based on the available evidence of the roles of blood cell interactions, we attempted to explore the clinical value of inflammatory indicator including neutrophil-to-lymphocyte ratio (NLR), platelet-to-lymphocyte ratio (PLR), platelet-to-neutrophil ratio (PNR), platelet-to-white-blood-cell ratio (PWR), monocyte to lymphocyte ratio (MLR), Inflammation Response Index (SIRI) and Systemic Immune-Inflammation Index (SII), as a potential marker of delayed stroke or IA

Methods

We analyzed a prospectively collected registry of IA patients within a single center over from December 2017 to December 2020. A total of 208 patients with ruptured IA were enrolled. We analyzed inflammatory indicators including NLR, PLR, PNR, PWR, MLR, SIRI and SII, to understand their involvement in the occurrence of delayed ischemic stroke known as poor prognostic event in the ruptured IA. Logistic regression analyses were also conducted to determine whether blood cell ratios are independently associated with delayed ischemic stroke.

Results

In delayed stroke of ruptured IA analysis, delayed stroke group had higher SIRI {1.22 [0.54-3.01] vs. 1.63 [0.64-5.29]; p<0.001}, SII {504.34 [263.11-1174.11] vs. 598.15 [274.14-1983.64]; p=0.013} and lower PNR {37.43 [23.61-52.06] vs. 31.15 [17.14-42.96]; p<0.001}, PWR {20.12 [15.81-24.16] vs. 17.14 [13.04-24.72]; p<0.001}. In multivariate analysis, PWR and SIRI were independently associated with delayed stroke of ruptured IA (p < 0.001 and p = 0.011, respectively).

Conclusions

Unlike many other inflammatory markers and bioassays, peripheral blood cell ratios are inexpensive and readily available biomarkers that may be useful for risk stratification in patients with delayed stroke of cerebral aneurysm. If further studies clarify the relationship between blood cell ratio and IA, it could be a valuable biomarker for this condition. Therefore, additional large-scale prospective studies are needed to explore potential mechanisms underlying these associations.

Non-traditional lipid profiles and 1-year vascular outcomes in ischemic stroke patients with prior statin therapy and LDL-C <100 mg/dL

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Purpose

Lowering low-density lipoprotein cholesterol (LDL-C) with statin is crucial for stroke prevention. However, some stroke patients were already on statin treatment before the index event and had well-controlled LDL-C levels (<100 mg/dL) upon admission. For these patients, it is uncertain which target should be adjusted next, and non-traditional lipid profiles are recognized as contributors to residual vascular risk. Therefore, this study aimed to investigate the association between non-traditional lipid profiles and the risk of 1-year vascular events in patients who were already using statins at the time of stroke occurrence and had admission LDL-C <100 mg/dL.

Methods

This study was an analysis of a prospective, multicenter, nationwide registry of Clinical Research Center for Stroke-Korea (CRCS-K) registry. The subjects were 7028 patients with non-cardioembolic stroke within 1 week of onset whose admission LDL-C was controlled to below 100mg/dL through statin pretreatment before the index event. Each non-traditional lipid profile was divided into four quartiles (Q1, Q2, Q3, Q4), and the relative outcomes for each quartile was evaluated. Primary vascular outcome within one year was a composite of recurrent stroke, myocardial infarction (MI) and all-cause of mortality. The secondary outcomes were consisted of each individual outcome.

Results

A total of 7028 patients were included in the analysis. The initial lipid profiles, the values were as follows; LDL-C was 69.7±17.3mg/dL, High-density lipoprotein cholesterol (HDL-C) was 43.2±12.5mg/dL, Triglyceride (TG) was 116.4±72.1mg/dL, and Total cholesterol (TC) was 130.4±24.8mg/dL. Regarding the LDL/HDL ratio, when comparing to Q1 as a reference, the event rate increased as the ratio increased for Q4 (adjusted HR 1.48, 95% CI 1.19-1.83, p = 0.0004). In TC/HDL ratio, HR increased for Q2 (adjusted HR 1.21, 95% CI 1.00-1.45, p = 0.049), Q3 (adjusted HR 1.26, 95% CI 1.04-1.53, p = 0.018), and Q4 (adjusted HR 1.40, 95% CI 1.15-1.70, p = 0.0008), indicating higher vascular risk. LDL/HDL had linear correlations with primary outcome (p for overall effect = 0.0001, P for non-linear effect = 0.5882).

Conclusions

In patients whose LDL-C level is well controlled by statin treatment prior to index event, non-traditional lipid profiles can be regarded as the next focus for treatment. Particularly, higher quartiles of the LDL/HDL ratio were significantly associated with increasing the risk of 1-year composite vascular events, showing a linear correlation with the outcomes.

Acute ischemic stroke due to bilateral carotid artery occlusion in Erdheim-Chester disease: A case report

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Purpose

Erdheim-Chester disease (ECD) is a rare non-Langerhans cell histiocytosis characterized by the multisystemic dissemination of histiocytes throughout the body. Although various central nervous system involvements are commonly observed, ischemic stroke is a rare clinical manifestation of ECD. This report introduces an exceptional case of both internal carotid artery occlusion and hemispheric infarction in a patient with ECD.

Results

A 69-year-old woman was admitted for sudden loss of consciousness. The patient had previously been diagnosed with BRAF-wild-type ECD, with an open bone biopsy on the C6 vertebrae revealing an aggregation of CD 163+ histiocytes. Four months prior to her last admission, a cerebrospinal fluid (CSF) study and brain magnetic resonance imaging (MRI) were conducted because of a new onset restricted movement in her right eye. CSF analysis revealed no abnormalities and an enhancing lesion at the right orbital apex owing to ECD was observed on the MRI with no significant cerebral artery stenosis or occlusion.

Upon her last admission, she was in a semi-comatose state. Brain MRI and MRA revealed extensive acute infarction in both internal carotid arteries (ICA) territories and occlusion of both ICAs. Due to her unstable hemodynamic status, she was intubated and placed in the intensive care unit. Despite hyperosmolar therapy, follow-up CT scans showed signs of brain herniation and she eventually passed on following respiratory failure and septic shock.

Conclusions

Neurologic complications of ECD are mostly attributed to brain tissue infiltration by foamy histiocytes. Although periarterial thickening of the carotid artery had been reported in 7 – 12 % of patients, ischemic stroke due to the bilateral carotid occlusion has not been reported. Periarterial infiltration could interfere with blood circulation or increase blood hypercoagulability - factors that could increase susceptibility of individuals to ischemic stroke. Further studies investigating the risk of ischemic stroke in patients with ECD are warranted.
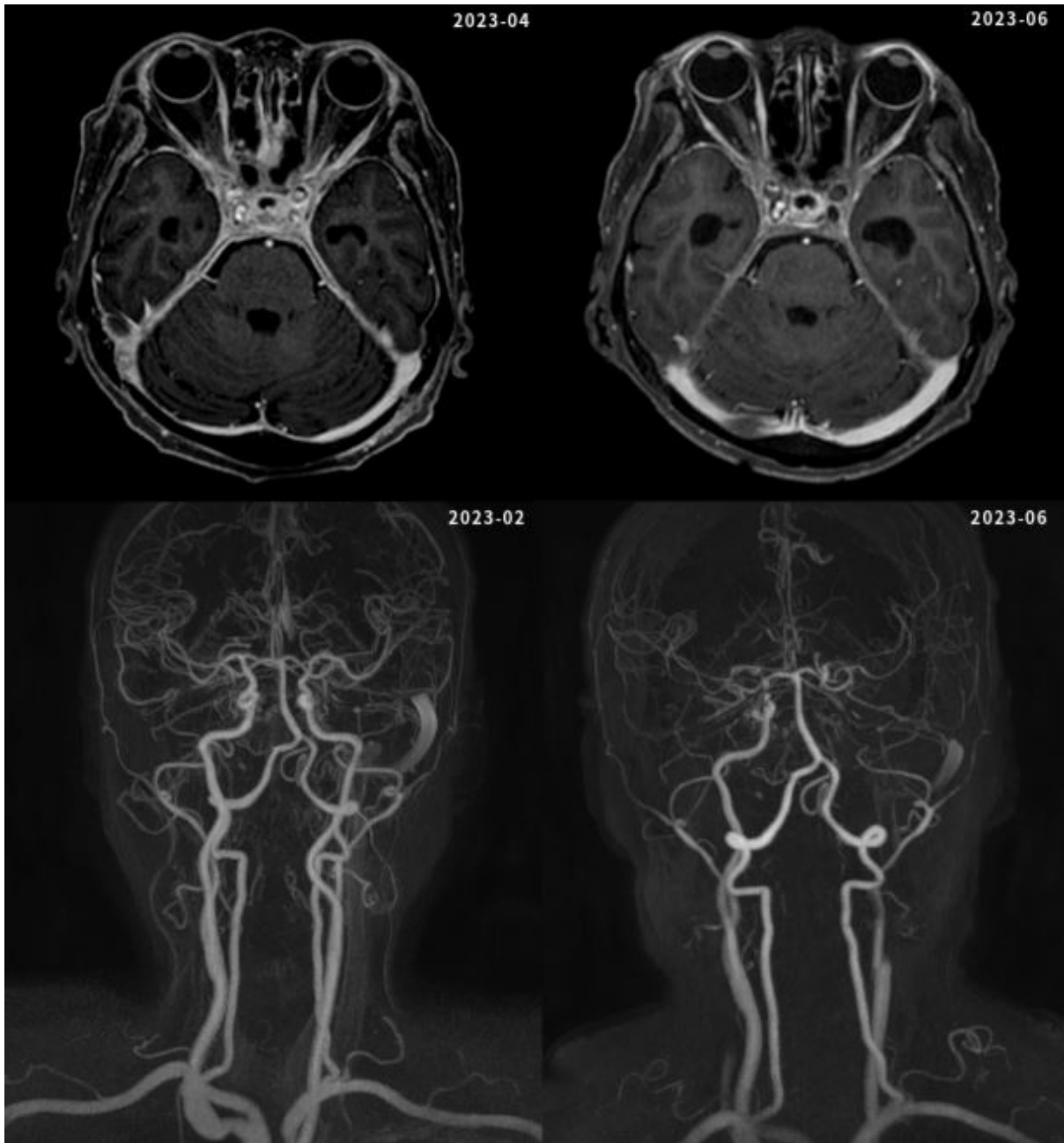
Acknowledgement

Anti-hypercholesterolemic effect of berbamine in high fat diet (HFD) and streptozotocin (STZ) induced diabetes: Phytotherapeutical importance through molecular mechanism

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Purpose

Diabetes is the disorders of carbohydrate and protein metabolism which produce elevated level of glucose and lipid level in the Human body. Role of various type of enzymes in the carbohydrate and lipid metabolism have been well documented in the scientific work, which are one of the main factors of diabetes mellitus. Berbamine is bisbenzylisoquinoline class alkaloidal compound found to be present in the various species of Berberis including Berberis amurensis.

Methods

Medicinal importance and Pharmacological activities of Berbamine have been investigated in the present study through data analysis of various research works of current scientific literature. Importance of Berbamine in high fat diet (HFD) and streptozotocin (STZ) induced diabetic rats have been investigated in the present investigation through scientific data analysis to know the anti-hypercholesterolemic effect of Berbamine. Effect of Berbamine on TC, TG, LDL-c, HMGCR and MTP has been also investigated through data analysis for their molecular mechanism. All the data have been analyzed statistically to get better molecular mechanism.

Results

Data analysis of the current scientific research work revealed the importance of Berbamine in various form of diabetes mellitus. In the scientific work, effect of berbamine on various enzymes of carbohydrate and lipid metabolism in high fat diet and STZ-induced diabetic animal have been investigated and found that berbamine improved insulin secretion. However berbamine also have positive role in the carbohydrate metabolic enzymes as it improved glycogen content in the tissues. In another scientific study, anti-hypercholesterolemic effect of berbamine has been studied in zebrafish and revealed significant effect on TC, TG and LDL-c. However mRNA expression of HMGCR and MTP in liver was also down-regulated.

Conclusions

These data analysis revealed that berbamine has anti-hypercholesterolemic effects mainly through up-regulation of cholesterol transport and inhibition of cholesterol synthesis.

Acknowledgement

Physical activity and sedentary behavior among community-dwelling stroke survivors

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Purpose

Although insufficient physical activity (PA) and sedentary behavior (SB) are established independent risk factors for stroke, stroke survivors may ultimately be at a higher risk of physical inactivity. Thus, we investigated the factors associated with PA and SB in stroke survivors in a community setting.

Methods

A cross-sectional study was performed using representative data from the Korea National Health and Nutrition Surveys from 2016 to 2020. We compared the level of moderate to vigorous aerobic PA, resistance exercise, and sedentary time between stroke survivors and controls. Then we performed a multivariate analysis to investigate the factors associated with physical inactivity and long sedentary time. The recommended level of aerobic PA was at least 150 min of moderate-intensity activity or at least 75 min of vigorous-intensity activity or an equivalent combination of moderate and vigorous-intensity activity throughout the week. The sufficient level of resistance exercise was defined as ≥2 days/week. Long sedentary time was defined as spending ≥8 h/day on SB.

Results

Physical inactivity was significantly more prevalent among stroke survivors. The older age (adjusted odds ratio [aOR]=5.448, p=0.001), and living in rural areas (aOR=1.911, p=0.020) were associated with low levels of aerobic PA. Female sex (aOR=0.427, p=0.007) was associated with a low degree of resistance exercise. Finally, living without economic activity (aOR=2.224, p=0.001), subjective unhealthy (aOR=1.458, p=0.027), a single life (aOR=1.611, p=0.049), and old age (aOR=1.231, p=0.046) were independent predictors of long sedentary time.

Conclusions

Based on these results, further research and policy studies are needed to increase the physical activity of stroke survivors.

An experience of community based pilot project using web based interhospital transfer system in acute cerebrovascular disease

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Purpose

Cerebrovascular diseases are a group of medical conditions which receiving appropriate treatment within the critical time window, often referred to as the "golden hour," is crucial. However, due to the insufficient number of medical facilities capable of providing appropriate acute care, it is important to efficiently allocate available medical resources. We have implemented a pilot project using web based interhospital transfer system for cerebrovascular disease patients within the local community.

Methods

We utilized the program 'Emergency transfer and consultation network,' which was previously used in a pilot project for remote collaborative consultations between medical facilities in medically underserved areas, conducted from National Emergency Medical Center. This collaborative program is available through a website (http://recs.nemc.or.kr) and mobile application. The pilot project was conducted from August to October 2022 and six local emergency medical institutions participated in this project. During the pilot project period, the data collected was compared and analyzed with data from the same period of the previous year.

Results

After the implementation of pilot project, the time from the decision of transfer by the attending physician until the start of transfer decreased over the years as follows: an average of 43.47 minutes in 2017, 49.22 minutes in 2018, 54.65 minutes in 2019, and 47.93 minutes in 2022. In 2022, the number of patients experiencing a delay in hospital dispatch for more than 20 minutes following a decision to transfer have showed a decrease by 28.13% (37.65% in 2017, 37.11% in 2018, 46.15% in 2019). When analyzed by disease group, it was observed that the final transfer times for patients decreased in all three categories compared to the previous period: acute myocardial infarction (38.48 minutes in 2019 to 26.00 minutes in 2022), ischemic stroke (66.33 minutes in 2019 to 44.67 minutes in 2022), and intracerebral hemorrhage (59.34 minutes in 2019 to 56.83 in 2022).

Conclusions

In the treatment of acute stroke, a system that facilitates seamless hospital transfers is essential, and the program used in this study could also be considered as one feasible alternative. In the future, further research will be needed to apply the system to a larger number of regions.

Association between onset-to-treatment time and acute stroke outcome: The Korean Stroke Registry

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Purpose

Previous randomized clinical trials suggest that the effectiveness of endovascular therapy for large vessel occlusion is time-dependent. However, in real-world practice, it is uncertain how the time to treatment affects the clinical outcome of patients with acute ischemic stroke (AIS) who receive endovascular therapy.

Methods

We conducted a retrospective cohort study using data prospectively collected from January 2015 to December 2021 in the Korean Stroke Registry. Participants were 5432 patients with acute ischemic stroke treated with endovascular-reperfusion therapy with onset-to-puncture time of 24 hours or less. Onset to arterial puncture time, and door-to-puncture time was calculated. We investigated the association between each time-related metric and the substantial reperfusion (Thrombolysis in Cerebral Infarction 2b-3) and clinical outcome of the patients identified by modified Rankin scale score (mRS) at discharge.

Results

Among 5432 patients, the mean (SD) age was 70.2 (12.0), 58.6% (3183/5432) were men, and the median pretreatment score on the National Institutes of Health Stroke Scale was 14 (Interquartile range [IQR], 9-18). Median Onset-to-Puncture time was 210 minutes (IQR, 152-301.25) and median door-to-puncture time was 95.5 minutes (IQR, 74-124). At discharge, 40.1% (2182/5432) had functional independence (mRS 0-2). After adjusting confounders, longer onset-to-puncture time delay independently, negatively predicted the functional independence at discharge (adjusted odds ratio [aOR]=0.92, 95% confidence interval [CI] 0.90-0.94, $p<0.001$). Moreover, faster door-to-puncture times were similarly associated with improved clinical outcomes (aOR=0.79, 95%CI 0.72-0.89, $p<0.001$). However, delayed onset-to-puncture time was significantly associated with in-hospital mortality (aOR=1.05, 95%CI 1.04-1.09, $p=0.021$).

Conclusions

In patients treated for AIS due to large vessel occlusion in real-world clinical practice, a shorter time to endovascular reperfusion therapy was significantly associated with better outcomes. These findings support efforts to reduce the prehospital delay and time to endovascular treatment after admitted to the hospital in stroke patients.
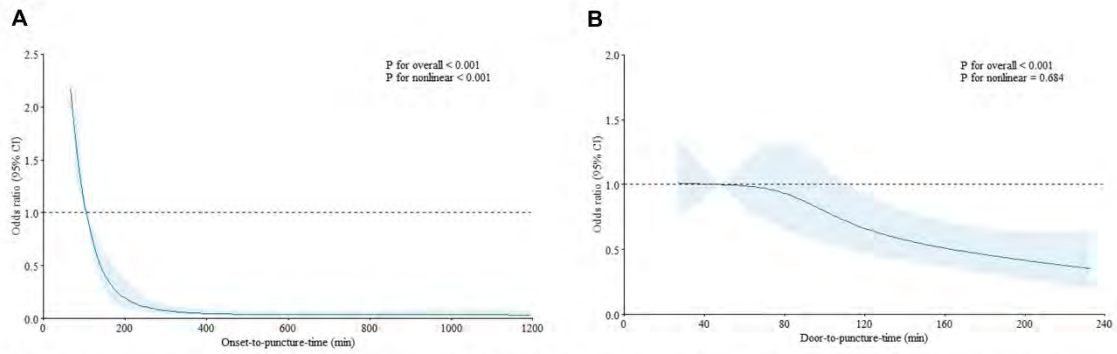
Acknowledgement

Figure. Restricted cubic spline regression plot showed an association between functional independence after acute ischemic stroke and A) onset-to-puncture time, B) Door-to-puncture time.

Two patients with spontaneous spinal epidural hematoma carrying a good prognosis without surgical operations

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Purpose

Spontaneous spinal epidural hematoma (SSEH) can produce devastating neurological deficits such as severe paraplegia and sphincter-rectal dysfunction, and this condition points to the formation of hematoma caused by the collection of blood within the epidural space of the spinal cord in the absence of traumatic or iatrogenic causes. It is characterized by progressive palsy of the extremities, sensory disturbances, and sphincter-rectal dysfunction.

Methods

Here, 2 patients who were diagnosed as having SSEH are reported. One patient showed acute myelopathy. In contrast, the other patient showed acute radiculopathy. Clinical features and radiological findings in these 2 patients are discussed.

Results

One patient showed paraplegia, numbness of both legs with acute onset, acute myelopathic signs, subsequent to back pain. Magnetic resonance imaging (MRI) showed hematoma in the posterior part of the thoracic spinal cord. Another patient showed acute numbness in the shoulder, upper part of the back, and the upper extremity on the right side after pain in the back, shoulder, and neck on the right side.Sagittal computed tomography (CT) images of the cervical bone showed a high-density area behind the spinal cord between C4 and C7. MRI analysis showedhematoma in the right diagonally posterior part of the cervical spinal cord. These 2 patients lacked traumatic or iatrogenic events, and their symptoms abated without surgical operation.

Conclusions

Two patients who were diagnosed as having SSEH were shown. Their neurological abnormalities occurred acutely at onset, secondary to back pain. The clinical features were associated with myelopathic signs in one patient and radicular signs in the other patient. The neurological findings in each patient correlated well with the location of the hematoma. Emergent surgical treatment was not adopted because progression of the neurological abnormalities was absent. Two patients carried good prognosis without surgical operations. In parallel, disappearance of the hematoma was also confirmed in the follow-up MRI analysis. SSEH is rare but should be considered in patients with myelopathy or radiculopathy with acute onset of symptoms. Our patients achieved a better clinical course after admission and showed good prognosis without being surgically operated on. MRI was useful in diagnosing SSEH in our patients. Additionally, the usefulness of multidirectional CT scans of the spinal cord was shown for the diagnosis of SSEH.

IV alteplase prior to endovascular treatment does not induce symptomatic hemorrhage but improves functional outcomes.

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Purpose

There have been varying results regarding its effectiveness in ischemic stroke with large artery occlusion who undergo endovascular treatment(EVT). Several randomized control trials showed that IV-thrombolysis improve the functional prognosis by increasing the likelihood of early recanalization and reperfusion through thrombus migration. However, other studies suggested that IV- thrombolysis can increase the risk of symptomatic intracranial hemorrhage(sICH), which may worsen the functional prognosis. This study investigated the impact of IV-thrombolysis on an ischemic stroke with endovascular treatment by quantitatively assessing the ischemic core and perfusion deficit.

Methods

2163 patients who were diagnosed with acute ischemic stroke were admitted to the Stroke Center at Dong-A University Hospital between September 2020 to May 2023. We selected patients with acute ischemic stroke of large artery occlusion in the anterior circulation who visited the hospital within 8 hours of the onset of symptoms, assessed the ischemic core and perfusion deficit quantitively using perfusion magnetic resonance imaging with the Rapid Processing of Perfusion and Diffusion (RAPD) software, and underwent EVT. A retrospective analysis was conducted for all enrolled patients and subgroups with IV-thrombolysis, and a multiple logistic regression was performed for the primary outcome.

Results

In this study, all 110 eligible patients were enrolled in the Stoke registry. Among them, 60 patients underwent IV-thrombolysis, while 50 patients did not. Patient who received IV-thrombolysis and EVT had higher chance of thrombus movement (p<0.001) and showed better 90-day modified Rankin Scale (mRS) outcome (p=0.01).

Multiple logistic regression analysis indicated that factors influencing a good functional outcome include age (OR 0.93; 95% CI 0.88 – 0.98; p<0.01), hypertension (OR 0.18; 95% CI 0.06 – 0.55; p<0.01), initial neurological severity (OR 0.81; 95% CI 0.71 -0.92; p<0.01), thrombus movement (OR 3.98, 95% CI 1.10 – 14.36; p=0.04) and IV-thrombolysis (OR 6.41, 95% CI 1.78-23.09, p<0.01). IV-thrombolysis also showed strong positive relation to thrombus movement (OR=5.45; 95% CI 2.00-14.86, p<0.01), but no statistically significant relation to sICH. For sICH, an association was found with atrial fibrillation (OR 43.45; 95% CI 1.05 – 1805.2, p=0.047) and ischemic core larger than 70mL on DWI-MR (OR 43.36; 95% CI 0.10 – 5.41, p<0.01).

Conclusions

This study showed that IV-thrombolysis was associated with good functional outcome and thrombus movement. At the same time, there was no statistically significant correlation between IV thrombolysis and sICH. These findings confirmed the utility of IV-thrombolysis in patients who underwent EVT.

Lacosamide as a rising treatment for post-hypoxic refractory myoclonus

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Purpose

Post-hypoxic myoclonus (Lance-Adams syndrome) is a sequelae of hypoxic encephalopathy due to respiratory arrest, airway obstruction, cardiac arrest, etc. , several days after the onset of hypoxic encephalopathy, that presents with functional myoclonus associated with increased cortical excitability in a few weeks. Combinations of anti-seizure medications and others such as benzodiazepines have been tried but the effect is successful. While it is known that there is no definite treatment, intravenous lacosamide had an effect in refractory post-hypoxic myoclonus.

Methods

A 24 year-old man was admitted to the emergency room with worsening bleeding and edema on his face and mandible after plastic surgery in another hospital. During the hospital stay, he had a sudden cardiac arrest due to respiratory failure, and spontaneous circulation was restored after 5 minutes of cardiopulmonary resuscitation (CPR). Then, he was admitted to the intensive care unit (ICU) for therapeutic hypothermia for 24 hours. The magnetic resonance imaging of the brain showed diffuse brain atrophy especially at the cortex of bilateral hemispheres, which seemed disproportionate to the patient's age and indicated probable sequelae of hypoxic-ischemic encephalopathy.

Results

During the thermal treatment, he developed a generalized myoclonic seizure within 12 hours from cardiac arrest. Thus, he was managed by a multidrug combination of anti-seizure medications, and myoclonus improved. However, post-hypoxic myoclonus recurred after a month of being transferred to the general word from the ICU, and was not controlled even after using intravenous sedatives, including remifentanil, dexmedetomidine and propofol, on top of the multi-drug combination therapy. Finally, refractory post-hypoxic myoclonus was successfully managed with adjunctive intravenous lacosamide treatment.

Conclusions

The treatment strategy for refractory post-hypoxic myoclonus after extensive hypoxic-ischemic brain damage still lacks a standardized regimen. In this regard, intravenous lacosamide treatment has shown potential as a therapeutic option for managing post-hypoxic myoclonus.

Association of changes in body mass index and waist circumference with cardiovascular risk in non-alcoholic fatty liver disease: A nationwide study

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Purpose

NAFLD is a hepatic manifestation of metabolic syndrome and increases the risk of cardiovascular disease. Body weight reduction through lifestyle modification has been proven to be associated with reduced amounts of hepatic fat and parenchymal inflammation, thus alleviating NAFLD. However, body weight alone is inadequate for predicting cardiometabolic risk as it does not sufficiently reflect the abdominal adiposity. Waist circumference (WC) is more closely related to abdominal obesity and predicting cardiovascular mortality than body weight. We investigated whether changes in body mass index (BMI) and WC are associated with cardiovascular risk in patients with NAFLD using a nationwide dataset.

Methods

Using the National Health Insurance Service-Health Screening Cohort (NHIS-HEALS) data in Korea, a total of 19,057 subjects who underwent two consecutive medical check-ups (2009–2010 and 2011–2012) and who had a fatty-liver index (FLI) value of ≥ 60 were included in the analysis. Changes in BMI and WC was categorized into 4 groups: decreases in both BMI and WC, increases in both BMI and WC, decreased BMI and increased WC, and increased BMI and decreased WC. Major cardiovascular events (MACE) were defined as consisting of stroke (ischemic and hemorrhagic), coronary heart disease (including unstable angina and myocardial infarction), and cardiovascular death. The occurrence of MACE was assessed during the follow-up period from January 1, 2013 and December 1, 2015.

Results

The risk of cardiovascular disease was significantly lower in the group with decreases in both BMI and WC (HR, 0.83; 95% CI, 0.69–0.99) and the group with increased BMI and de- creased WC (HR, 0.74; 95% CI, 0.59–0.94) when compared with the group with increases in both BMI and WC. The result of sensitivity analysis using 10 multiple imputed data sets was similar to that of the primary analysis. The effect of cardiovascular risk reduction among the group with increased BMI but decreased WC was particulary pronounced among those who had metabolic syndrome during the second check-up (HR, 0.63; 95% CI 0.43–0.93, p for interaction 0.02).

Conclusions

Reductions in WC were associated with a significant reduction in cardiovascular risk regardless of reductions in BMI in patients with FLI-defined NAFLD . The degree of cardiovascular risk reduction was greater among the subjects with increased BMI and decreased WC (adjusted HR, 0.74) than in subjects with decreases in both BMI and WC (adjusted HR, 0.83).

Acknowledgement

Relationship between low-density lipoprotein cholesterol and short-term stroke outcomes in pre-stroke statin users

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Purpose

Several studies have shown that decreased low-density lipoprotein cholesterol (LDL-C) was associated with unfavorable stroke outcomes in patients with acute ischemic stroke. However, there have been few considerations regarding whether such detrimental effect of low LDL-C on stroke outcomes is still observed in previous statin users. This study aims to investigate the relationship between LDL-C levels and stroke outcomes, specifically in the patients who were taking statins before the index ischemic stroke.

Methods

We included 3861 patients with acute ischemic stroke who were admitted within 7 days of symptom onset between January 2012 and December 2018. We divided the patients into two groups according to the previous use of stain (statin user and nonuser groups). The study population was also grouped into tertiles based on the LDL-C levels. The trends of proportion of unfavorable outcomes including the mortality rate across the LDL-C tertiles were assessed using linear-by-linear Chi-square test in both statin user and nonuser groups. Multivariable regression analysis was performed to identify the independent relationship between LDL-C levels and stroke outcomes.

Results

Of the 3861 patients, 934 (24.2%) and 2927 (75.8%) were in the statin user and nonuser groups, respectively. The linear-by-linear analysis demonstrated that the mortality rate at 3 months significantly decreased with the increase of LDL-C tertiles in the statin nonuser group (9.7% in tertile 1; 4.3% in tertile 2; and 3.0% in tertile 3; p for trend <0.001), but not in the statin user group (5.0% in tertile 1; 3.3% in tertile 2; and 3.9% in tertile 3; p for trend =0.402). After adjusting for confounders, multivariable analysis revealed that a lower LDL-C was an independent and significant predictor of a higher mortality rate at 3 months in the statin nonuser group (OR, 3.01; 95% CI, 1.90-4.80; p <0.001). However, such relationship was not observed in the statin user group (OR, 1.61; 95% CI, 0.44-5.90; p =0.472).

Conclusions

Unlike the statin nonusers, the detrimental effect of low LDL-C on stroke outcomes was not found in the patients who were on statins prior to the ischemic stroke.

Gene variants in young age patients with dissection in posterior circulation

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Purpose

Dissection occurs due to the intimal tear through the vasa vasorum, which leads to thromboembolic complications. The relevance of genetic alterations and dissection is yet uncertain. It is supposed that certain genetic variants associated with connective tissue disorder (CTD) may have a role in arteriopathy. We aim to present four cases of young-age patients with arterial dissection in the posterior circulation in which gene variants associated with CTD were identified.

Methods

Patients diagnosed with dissection in the vertebrobasilar artery system and who underwent the stroke gene panel from September 2020 to July 2023 were enrolled. Their clinical presentations, gene study results, and imaging findings were analyzed. The stroke gene panel included the following genes: ABCC6, ACTA2, ACVRL1, APP, ATP1A2, CACNA1A, CCM2, COL3A1, COL4A1, COL4A2, ENG, FOXC1, GLA, GUCY1A1, HTRA1, KRIT1, NOTCH3, PDCD10, RASA1, RNF213, SAMHD1, SLC2A10, SMAD4, TREX1, YY1AP1, ADA2, ANGPTL6, ATR, CBL, CBS, CEP152, CHD4, CNOT3, EPHB4, FLVCR2, GDF2, HBB, IRAG1, MYH11, NF1, PCNT, PKD1, PKD2, SETD5, SMAD9, THSD1.

Results

Among 14 patients with confirmed arterial dissection in the vertebral artery or posterior inferior cerebellar artery who underwent genetic analysis, 4 patients revealed genetic variants. Each showed variants in the COL3A1 gene, the COL4A1 gene, the ABCC6 gene, and one patient showed variants in two genes; the ACVRL1 gene and the MYH11 gene (Table). All were classified as variants of uncertain significance.

Conclusions

Vessels are prone to dissect in people with an inherited weakness of the vessel wall due to CTD. All gene variants noted in our research were suspected to be related to certain CTDs. Further investigation will be needed to confirm rather such genetic variants are pathogenic. Genetic studies in young-age patients with intracranial artery dissection should be considered to look for those at high risk of recurrent dissection due to genetic conditions, and proper genetic counseling will be needed.

Effect of prestroke antiplatelet use on stroke outcomes in acute lacunar infarction with moderate to severe white matter burden

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Purpose

White matter hyperintensities (WMH) and acute lacunar infarction (ALI) are prominent features of cerebral small vessel disease. We aimed to investigate the impact of prior antiplatelet use (APU) on stroke outcomes in ALI patients with moderate and severe WMH.

Methods

We conducted a retrospective study of 1,151 ALI patients with WMH from two university affiliated stroke centers. The quantitative WMH volume was measured using semi-automatic software. Propensity score matching (PSM) was performed to compare patients on prior APU with those without prior APU. The primary outcomes were stroke progression and poor functional outcomes (modified Rankin Scale>2) at 3months. Logistic regression analyses were used to assess the association between prior APU, WMH burden, and stroke outcomes.

Results

In the total cohort. Stroke progression was lower in the prior APU group compared with the no prior APU group (14.8% vs. 6.9%, p<0.001). Similarly, in the PSM cohort, stroke progression was reduced in the prior APU group (16.3% vs.6.9%, p<0.001). The occurrence of poor functional outcome at 3months was not significantly different between two groups tin the total cohort, but in the PSM cohort, the prior APU group had a lower proportion of poor functional outcome (30.8% vs.20.2%, p=0.002). Logistic regression analysis confirmed that prior APU was associated with reduced risk of stroke progression (OR, 0.39; 95% CI, 0.22-0.70; p=0.001) and poor functional outcome at 3months (OR, 0.37; 95% CI, 0.23-0.59; p<0.001)

Conclusions

Our study suggests that prior APU is associated with decreased stroke progression and improved functional outcomes at 3months in ALI patients with moderate to severe WMH burden. These findings highlight the potential benefits of early treatment of WMH and ALI to improve stroke outcomes. Further research is warranted to elucidate the underlying mechanisms and to validate these findings in larger, prospective studies.

Real-world data of low-density lipoprotein cholesterol (LDL-C) target achievement in patients with ischemic stroke compared with recent guidelines

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Purpose

The Korean guidelines for the management of dyslipidemia was published in september 2022, According the guideline, atherosclerotic ischemic stroke and transient ischemic attack (TIA) are classified as a high-risk group, and the target of low-density lipoprotein cholesterol (LDL-C) is suggested less than 70 mg/dL.

After releasing of the recent guideline, we investigated the lipid management in an actual clinical practice after ischemic stroke and TIA.

Methods

This study was conducted on patients who visited the outpatient department of stroke center in the department of neurology at one university hospital from Oct. 2022 to Mar. 2023. High-risk group (history of atherosclerotic ischemic stroke and TIA) patients were selected from the review of electrical medical record.

The results within 6 months prior to publication of clinical guideline were compared with those from the most recent visit. We collected the demographic data, laboratory results (LDL-C, HDL-C, TG, AST, ALT, LDH, and CK levels), the dosage of statin and/or ezetimibe, and the adverse events before and after the guideline release.

Results

A total of 504 patients were screened retrospectively. Among them, 230 patients were finally enrolled in this study (245 were atherosclerotic stroke and TIA) (mean age 71.6 years, male 56.3%). About 56.7% (131 individuals) of patients were prescribed of high intensity statin (atorvastatin 40 mg, 80 mg or rosuvastatin 20 mg), and 77 (33.3%) of patients reported a dose escalation after guideline. The number of ezetimibe prescription was increased from to 39 to 131 (56.7%).

The mean LDL-C levels before and after the publication of clinical guidelines were 70.1 mg/dL and 54.1 mg/dL, respectively. Between the periods, 101 (43.8%) and 171 (71.9%) reached the target LDL-C levels (less than 70 mg/dL), respectively. The change of AST (25.8 vs 30.1), ALT (24.4 vs 30.2), LDH (194.0 vs 193.6), and CK (121.1 vs 121.0) were not significant.

Conclusions

The recent change in aggressive treatment guidelines for dyslipidemia in high risk patients, the real world data for the LDL-C target achievement rate is not high enough. However, in the actual clinical practice, prescription rate of high-intensity statin and/or combination of ezetimibe is increased relatively short period. High-intensity statin and/or combination of ezetimibe may be also effective for LDL-C lowering in the outpatient atherosclerotic ischemic stroke.

Utilization of community-based health centers (Puskesmas) to improve accessibility of health services and early detection of stroke disease

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Purpose

Stroke is the leading cause of death in Indonesia with 131.8 deaths per 100 thousand population. 550 thousand of Indonesians are diagnosed with stroke yearly; lifestyle is one of the triggers. The highest incidence is in the age group of 55 years or above (55.2%). The burden of government social insurance financing for stroke in 2022 was the third highest after heart failure and cancer reaching $210 million due to advanced stage. The Ministry of Health carries out a preventive program that reaches remote areas through various screenings which are expected to detect stroke early through Community-Based Health Centers (Puskesmas). However, little is known about the effectiveness of Puskesmas in the framework of controlling stroke disease.

Methods

We utilize a longitudinal survey dataset from the 2014 Indonesia Family Life Survey (IFLS) to analyze and evaluate the effectiveness of the Puskesmas in improving the function of stroke disease early detection.
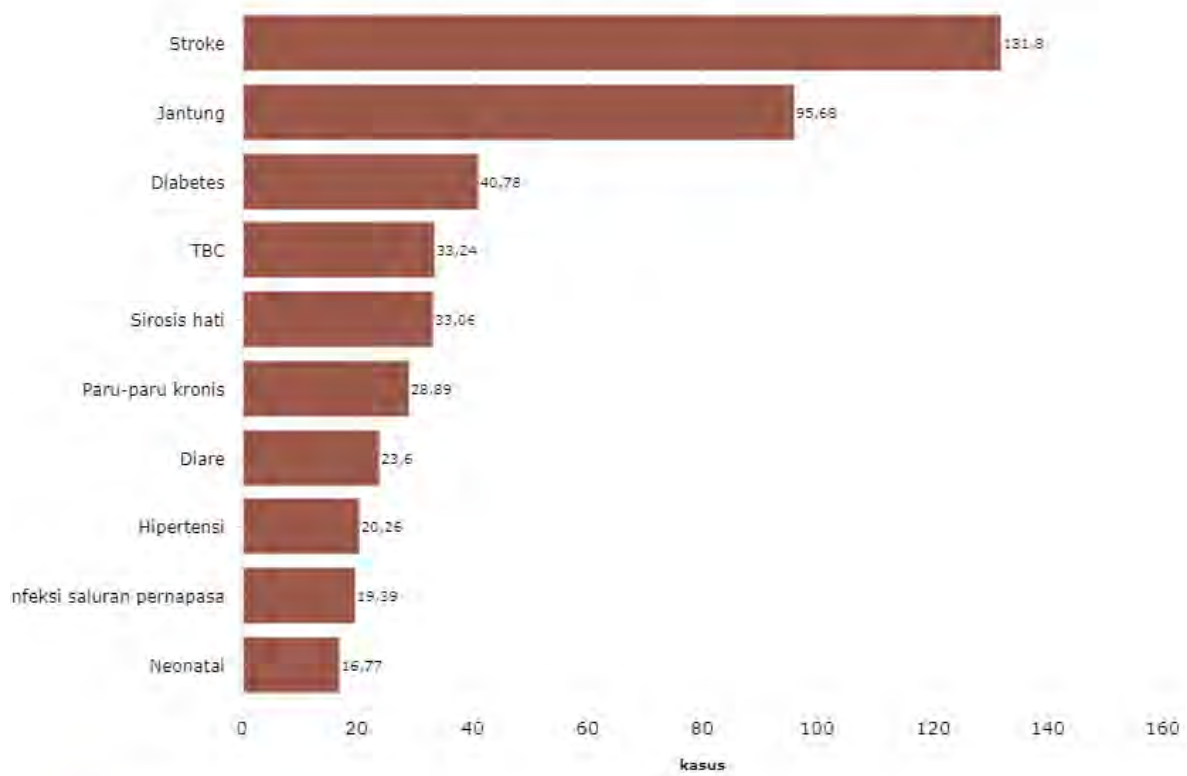
Results

The prevalence of stroke cases among observations is 10.2% and 62.56.2% of them live in urban areas. However, the percentage increases in senior citizens by two times or 3,8%, and 60% are men. Stroke causes 18% of sufferers to experience long-term disability. The elderly with stroke, whether they have government social insurance or not, tend to access treatment at the Puskesmas. Meanwhile, 56% of those who do not have insurance prefer traditional practitioners. Given that Indonesia uses the Gate-Keeper system, the first-level health facilities are at the sub-district or community level. Posyandu Lansia as an extension of Puskesmas, is a monthly village-based activity that is accessed by 16.35% of the elderly for routine health checks, obtaining food/supplements, and various meetings and counseling. The elderly with stroke are the highest accessors to the Posyandu Lansia (52.94%). Various integrated services can be accessed by the elderly from 80,353 Posyandu Lansia spread across 81,616 villages in Indonesia. Puskesmas is highly effective in improving the senior QoL in various aspects of life.

Conclusions

Puskesmas outreach program is carried out by trained cadres and medical staff. Posyandu Lansia carries out early detection of stroke disease and is very accessible in preventive programs and improving the elderly QoL through various services. It also needs to address the covered social insurance for treatment and caregivers.

10 Penyakit Penyebab Kematian Tertinggi di Indonesia (2019)*

Penyakit	kasus
Stroke	131,8
Jantung	95,68
Diabetes	40,78
TBC	33,24
Sirosis hati	33,06
Paru-paru kronis	28,89
Diare	23,6
Hipertensi	20,26
Infeksi saluran pernapasa	19,39
Neonatal	16,77

katadata   databoks

ICSU 2023
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