Korean Stroke Society

2024 대한뇌졸중학회
춘계학술대회

2024. 4. 20(토)

롯데호텔 제주

연수평점: 6점

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

인 사 말

안녕하세요, 존경하는 대한뇌졸중학회 회원 여러분

작년 ICSU를 여러 회원님들의 관심과 성원속에 잘 치뤘고 추운 겨울을 보내고 따뜻한 봄에 제주 롯데호텔에서 대한뇌졸중학회 춘계 학회를 개최합니다.

항상 많은 관심과 격려속에 대한뇌졸중학회는 해마다 발전을 해 왔었고 올해 하늘을 비상하는 청룡의 해인 갑진년에도 더욱더 비상하는 대한뇌졸중학회가 되겠습니다.

올해도 외국의 저명한 연자 2분을 초청하였습니다. 대만의 Meng Lee와 thrombectomy등 급성기 뇌경색 임상 연구의 권위자인 Pittsburgh 대학의 Raul G. Nogueira 교수가 방문하여 좋은 강의를 해줄 예정입니다.

오랜만에 아름다운 섬 제주에서 바다와 산 풍요로운 자연을 벗 삼아 일상에서 지친 심신을 제주 롯데호텔에서 열리는 학회에 참석하여 재 충전할 수 있는 기회가 되기를 바라겠습니다.

이번 춘계학회는 전공의, 전임의 그리고 뇌졸중에 관심이 있으신 모든 분들이 관심을 가질 수 있는 주제와 관심사를 중심으로 명망이 있는 연자들을 초청하였습니다.

기나긴 이번 겨울의 추위를 멀리 보내고 따뜻한 봄을 맞이하여 제주도에서 열리는 이번 춘계 학회에 진료와 연구로 바쁘시겠지만 알차게 준비한 강의를 통해 학문의 깊이를 넓힐 수 있는 기회가 됨은 물론 회원 여러분들 간의 친목을 도모하는 기회가 될 수 있도록 회원 여러분들의 많은 참여와 관심을 부탁드리며 아름다운 섬 제주에서 만나 뵙기를 바라겠습니다. 감사합니다.

대한뇌졸중학회 회장 김용재 드림

2024 대한뇌졸중학회 춘계학술대회

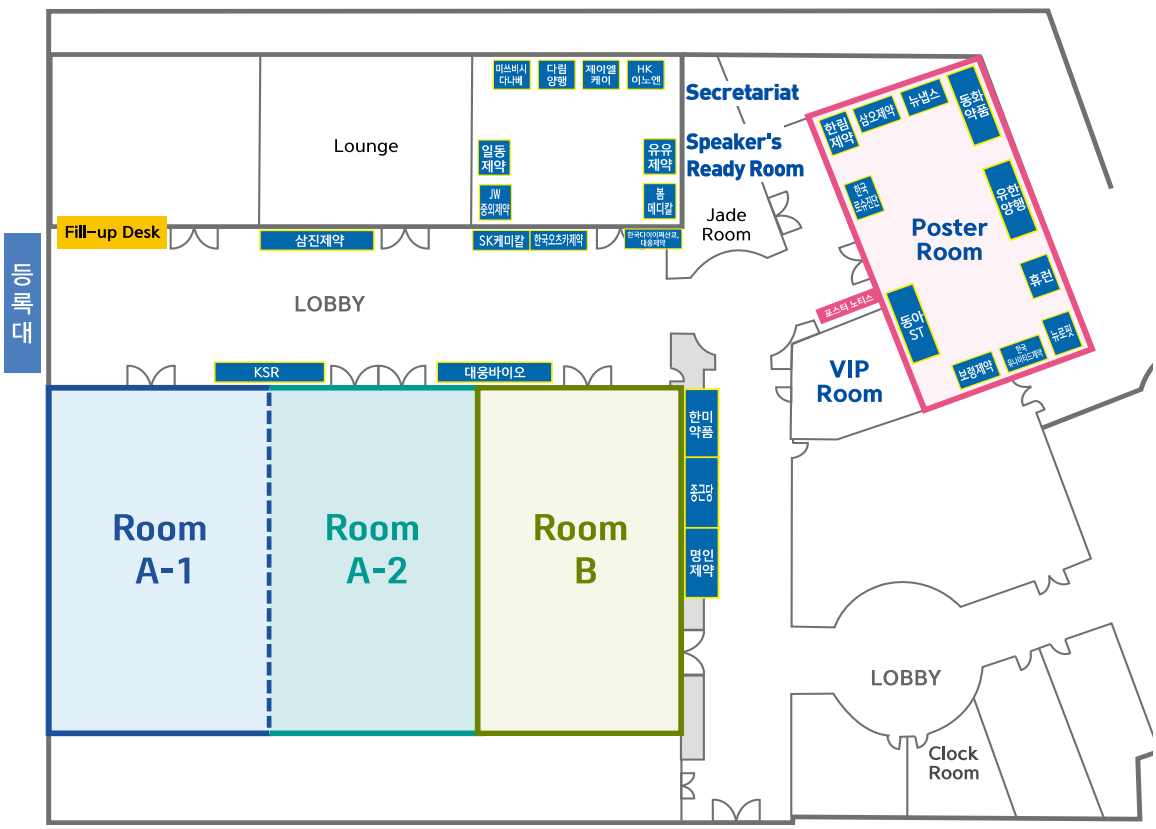
Program at a glance

일시: **2024**년 **04**월 **20**일 (토), **08:50-18:00**

장소: **롯데호텔 제주**

Time	Room A-1 (Crystal Ballroom 1)	Room A-2 (Crystal Ballroom 2)	Room B (Crystal Ballroom 3)
07:40-08:40		평의원회	
08:50-09:00	Opening Remark		
09:00-10:20	Focused Session 1. Uncommon causes of stroke		Scientific Session 1
10:20-10:40	Break		
10:40-11:40	Invited Speaker Session		Nursing Symposium
11:40-12:40	Plenary Session		
12:20-12:40	General Assembly		
12:40-13:40	Symposium 1 Symposium 2		Symposium 3 Symposium 4
13:40-14:00	Break		
14:00-15:00	Focused Session 2. Updated strategies to risk factors		Scientific Session 2
15:00-15:30	Poster Presentation Professor-Led Poster Tour (@ Poster Room)		전공의 발표
15:30-16:00			연구활성화위원회
16:00-17:20	Focused Session 3. AI and digital health innovations in medicine		질향상위원회 / 정책위원회
17:20-17:30	Break		
17:30 -18:10	Special Session		

Room A-1 (Crystal Ballroom 1)	Room A-2 (Crystal Ballroom 2)	Room B (Crystal Ballroom 3)



Daily program | Room A |

08:50-09:00	**Opening Remark**	김용재 (대한뇌졸중학회 회장)	
Focused Session 1. Uncommon causes of stroke		좌장: 홍근식 (인제의대 신경과), 박만석 (전남의대 신경과)	
09:00-09:20	Cancer-related stroke	유준상 (연세의대 신경과)	2
09:20-09:40	Antiphospholipid antibody syndrome	양욱진 (서울의대 신경과)	3
09:40-10:00	Moyamoya disease	정종원 (성균관의대 신경과)	4
10:00-10:20	Dissection	허준녕 (중앙의대 신경과)	5
10:20-10:40	**Break**		
Invited Speaker Session		좌장: 배희준 (서울의대 신경과), 김용재 (가톨릭의대 신경과)	
10:40-11:10	Blood pressure and cholesterol lowering for secondary stroke prevention	Meng Lee (Chang Gung Memorial Hospital, Taiwan)	8
11:10-11:40	Smoking cessation therapy	서홍관 (국립암센터 가정의학과)	14
Plenary Session		좌장: 김경문 (성균관의대 신경과)	
11:40-12:20	Mechanical thrombectomy for large ischemic infarcts: The end of a journey?	Raul G. Nogueira (Univ. of Pittsburgh, USA)	16
12:20-12:40	**General Assembly**		
Symposium 1		좌장: 윤병우 (을지의대 신경과)	
12:40-13:10	The role of cerebrolysin in ischemic stroke	권혁성 (한양의대 신경과)	18
Symposium 2		좌장: 이광호 (성균관의대 신경과)	
13:10-13:40	Unmet needs regarding the use of NOACs : Neurologist's perspectives	김범준 (울산의대 신경과)	20
13:40-14:00	**Break**		
Focused Session 2. Updated strategies to risk factors		좌장: 이경열 (연세의대 신경과), 손성일 (계명의대 신경과)	
14:00-14:20	Emerging incretin-based therapies for obesity management	손장원 (가톨릭의대 내분비내과)	22
14:20-14:40	Updated strategies for dyslipidemia	장준영 (울산의대 신경과)	24
14:40-15:00	Concerns about bone health status in stroke patients	김경민 (연세의대 내분비내과)	26
15:00-16:00	**Poster Presentation Professor-Led Poster Tour (@ Poster Room)**		
Focused Session 3. AI and digital health innovations in medicine		좌장: 유경호 (한림의대 신경과), 서우근 (성균관의대 신경과)	
16:00-16:20	Novel AI models: Introduction and applications	박성호 (인제의대 신경과)	28

16:20-16:40 AI models at the forefront in neuroimaging field 조환호 (인천대학교) ····· 29

16:40-17:00 Digital twins transforming stroke patient care 남효석 (연세의대 신경과) ····· 30

17:00-17:20 Pioneering hospital-based smart healthcare solutions 이민우 (한림의대 신경과) ····· 31

17:20-17:30 **Break**

Special Session 좌장: 김응규 (인제의대 신경과),이진수 (아주의대 신경과)

17:30-17:50 New frontiers in stroke and neuroendovascular therapies
Raul G. Nogueira (Univ. of Pittsburgh, USA) ····· 34

17:50-18:10 First-in-Class digital therapeutics 'VIVID Brain' 강동화 (울산의대 신경과) ····· 35

Daily program | Room B |

Scientific Session 1 좌장: 김동억 (동국의대 신경과), 박종무 (을지의대 신경과)

09:00-09:10 Concomitant large artery steno-occlusion of major cerebral arteries raises the risk of recurrent stroke and death in acute ischemic stroke patients with atrial fibrillation 국형석 (서울의대 신경과) ····· 38

09:10-09:20 Impact of temporary discontinuation of anticoagulation on outcomes in patients with acute ischemic stroke and atrial fibrillation 김재국 (을지의대 신경과) ····· 40

09:20-09:30 Influence of prior antiplatelet or anticoagulation on significant hemorrhagic complications after mechanical thrombectomy 김홍남 (아주의대 신경과) ····· 41

09:30-09:40 Long-term outcome of rescue stenting for acute intracranial atherosclerotic stenosis related large vessel occlusion 박형종 (계명의대 신경과) ····· 42

09:40-09:50 Clinical and imaging differences between subtypes of cancer-related stroke 김형준 (성균관의대 신경과) ····· 43

09:50-10:00 Demystifying DWI lesion volume changes in acute ischemic stroke 김낙훈 (서울의대 신경과) ····· 44

10:00-10:10 Associated factor with cranial nerve palsy in cavernous sinus dural arteriovenous fistula
이규봉 (울산의대 신경과) ····· 46

10:10-10:20 Hemodynamic contribution of carotid atherosclerosis to cerebral white matter lesions
양욱진 (서울의대 신경과) ····· 47

10:20-10:40 **Break**

Nursing Symposium 좌장: 박태환 (서울의료원 신경과), 조아현 (가톨릭의대 신경과)

10:40-11:10 Blood pressure control and fluid management in acute stroke 정혜선 (충남의대 신경과) ····· 50

15:18-15:21 The brainstem score on diffusion-weighted imaging before mechanical thrombectomy in acute basilar artery occlusion is a reliable predictor for prognosis — 성준호 (동아의대 신경과) ····· 82

15:21-15:24 Ischemic stroke in a patient complicated by bacterial meningitis from an asymptomatic parapharyngeal abscess — 박현빈 (동아의대 신경과) ····· 83

15:24-15:27 Patient with dural arteriovenous fistula after mechanical thrombectomy for acute ischemic cerebral infarction — 박준혁 (조선의대 신경과) ····· 85

연구활성화위원회 — 좌장: 권순억 (울산의대 신경과)

15:30-15:40 기계학습을 이용한 뇌졸중 환자의 예측 모델 개발 연구 — 박성호 (인제의대 신경과) ····· 88

15:40-15:50 혈전성상연구모임 — 박형종 (계명의대 신경과) ····· 89

15:50-16:00 디지털 및 차세대 연구기술 교류회 — 허준녕 (중앙의대 신경과) ····· 90

질향상위원회 / 정책위원회 (Session 1) — 좌장: 배희준 (서울의대 신경과), 정통령 (보건복지부 공공보건정책관)

16:00-16:10 인적 네트워크의 현황과 향후 일정 — 류창우 (경희의대 영상의학과) ····· 92

16:10-16:20 인적네트워크의 문제점과 향후 개선점 및 나아갈 방향 — 박형종 (계명의대 신경과) ····· 93

16:20-16:30 권역심뇌혈관질환센터 기반 병원전단계 네트워크사업 — 김대현 (동아의대 신경과) ····· 94

16:30-16:50 의료개혁 추진을 위한 심뇌혈관질환관리 정책 추진 방향 — 신희성 사무관 (보건복지부 질병정책과) ····· 95

16:50-17:10 **Panel discussion**

차재관 (동아의대 신경과), 박희권 (인하의대 신경과), 정해웅 (인제의대 영상의학과), 정철규 (서울의대 영상의학과), 이경복 (순천향의대 신경과), 정근화 (서울의대 신경과)

질향상위원회 / 정책위원회 (Session 2) — 좌장: 나정호 (인하의대 신경과), 김승현 (한양의대 신경과)

17:10-17:20 SC/TSC 2주기 인증 현황 — 이건주 (고려의대 신경과) ····· 100

17:20-17:30 SC/TSC 3주기 규정개정 관련 — 김진권 (연세의대 신경과) ····· 101

17:30-17:40 Stroke neurologist 인증의 준비과정 — 박수현 (순천향의대 신경과) ····· 102

17:40-17:50 국내 타 인증의 심사프로세스 현황 — 고상배 (서울의대 신경과) ····· 104

17:50-18:00 **Panel discussion**

허성혁(질향상위), (경희의대 신경과), 곽재규(신경과의사회), (삼육서울병원 신경과), 김태정 (신경집중치료학회), (서울의대 신경과), 백장현 (KSIN), (성균관의대 신경과)

Poster Presentation | Room A |

대한뇌졸중학회
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2024 대한뇌졸중학회

춘계학술대회

| Room A |

Focused Session 1.

Uncommon causes of stroke

| 좌 장 |

홍근식 (인제의대 신경과), **박만석** (전남의대 신경과)

Cancer-related stroke

유 준 상

연세의대 신경과

Cancer and stroke represent significant causes of mortality in Korea, increasingly gathering attention within the medical and academic community. As cancer survival rates improve, the incidence of stroke in patients with a history or presence of cancer is on the rise. While only about 5% of stroke patients have concurrent cancer, autopsy studies reveal that up to 14.6% of cancer patients exhibit brain lesions. The presence of active cancer elevates the risk of stroke, initially related to the cancer itself and later associated with effect of cancer treatments such as chemotherapy or radiotherapy.

Cancer-related strokes exhibit distinct characteristics, including embolic pattern strokes in multiple territories without other discernible causes, relatively few conventional vascular risk factors, and notably elevated serum D-dimer levels. Various mechanisms have been proposed to explain the increased incidence of stroke in cancer patients, including paradoxical embolisms due to cancer-related venous thrombosis, hypercoagulability, and nonbacterial thrombotic endocarditis. Recent studies focusing on thrombi from cancer patients suggest higher proportion of platelets and thrombin, with a comparatively lower proportion of erythrocytes.

Recurrence of thromboembolic events is common in cancer patients, often correlating with poor survival rates, especially in cases of metastasis or cryptogenic strokes. While clear clinical guidelines for reperfusion therapy in patients with cancer-associated stroke are lacking, it is generally considered safe and effective. However, long-term prognosis tends to be poor. The secondary prevention of stroke in cancer patients remains underdeveloped. Traditionally, low-molecular weight heparin, targeting venous thromboembolism common in cancer patients, has been the mainstay of treatment. However, recent studies indicate that NOACs may offer comparable efficacy of low-molecular weight heparin, and antiplatelet agents are also believed to be beneficial based on their mechanisms of action.

This lecture aims to delve into these issues, providing a comprehensive overview of the intersection between cancer and stroke, including the unique features of cancer-related strokes, underlying mechanisms, and considerations for treatment and secondary prevention.

Antiphospholipid antibody syndrome

양 욱 진

서울의대 신경과

Antiphospholipid syndrome (APS) is a condition characterized by the presence of antiphospholipid antibodies (aPL), leading to thrombosis or recurrent miscarriages. Despite its highest prevalence in individuals in their 30s, APS can affect all age groups, including those over 70 years. Ischemic strokes and transient ischemic attacks are among the most common clinical manifestations of APS, accounting for approximately 20-45% of cases. Yet, significant knowledge gaps persist concerning both the diagnosis and treatment of APS-related stroke. Current stroke guidelines offer some treatment recommendations for APS-related stroke but lack comprehensive diagnostic guidance and criteria for testing. This oversight may contribute to the underdiagnosis and insufficient diagnostic efforts for APS-related strokes by clinicians. Our single-center studies have suggested that aPL testing is often reserved for younger patients under 50 with cryptogenic stroke, despite similar positivity rates in older populations. These patients often had smaller lesion sizes and smaller total infarct volumes, with less relevant arterial occlusion. Given these findings, a broader application of aPL testing in cryptogenic stroke cases may be reasonable, particularly for those with milder neurological manifestations. Importantly, age should not be the sole determinant for testing eligibility. Current treatment guidelines, which generally recommend warfarin, are largely based on historical data and expert consensus than on recent, high-quality evidence. The role of antiplatelet drugs other than aspirin, such as clopidogrel, remains underexplored. Considering the clinical challenges associated with warfarin use, evaluating its necessity is crucial. A multicenter clinical trial in Korea is currently underway to address these gaps.

References

1. Hwang JJ, Shin SH, Kim YJ, et al. Epidemiology of Antiphospholipid Syndrome in Korea: a Nationwide Population-based Study. J Korean Med Sci. 2020;35(5):e35.
2. Kleindorfer DO, Towfighi A, Chaturvedi S, et al. 2021 Guideline for the Prevention of Stroke in Patients With Stroke and Transient Ischemic Attack: A Guideline From the American Heart Association/American Stroke Association. Stroke. 2021;52(7):e364-e467.
3. Yang W, Kang MK, Ha SY, et al. Current status and role of antiphospholipid antibody testing in cryptogenic stroke. Eur J Neurol. 2022;29(3):753-760.
4. Yang W, Kang DW, Kim JM, Jung KH, Lee SH. Neuroimaging features of antiphospholipid antibody-related stroke compared with atrial fibrillation-related stroke. Sci Rep. 2022;12(1):11686.

Moyamoya disease

정 종 원

성균관의대 신경과

Moyamoya disease is a rare cause of stroke, radiologically characterized by progressive stenosis of the terminal portion of the internal carotid arteries and compensatory capillary collaterals. The discovery that RNF213, which encodes an unconventional E3 ubiquitin ligase, is the major susceptibility gene for moyamoya disease in people from east Asia has opened new avenues for investigation into the mechanisms of disease and potential treatment targets. MRI or MRA (≥1•5 Tesla) must show the following three findings: bilateral stenosis or occlusion of the terminal portion of the intracranial internal carotid artery by MRA; bilateral arterial shrinkage of the terminal portion of the intracranial internal carotid artery or horizontal portion of the middle cerebral artery by heavy T2-weighted MRI; and abnormal vascular networks by MRA or two or more flow voids at least in one hemisphere by MRI in the base of the brain or around the ventricle. A definitive diagnosis of moyamoya disease is made based on these findings, using either conventional catheter angiography or MRI or MRA. When the two characteristic findings, intracranial artery stenosis or occlusion and moyamoya vessels, are accompanied by various systemic diseases and conditions, moyamoya syndrome is diagnosed instead of moyamoya disease. Despite insight into the genetic and pathophysiological basis of moyamoya disease and moyamoya syndrome, disease-specific drug treatment is not currently available. Bypass surgery for moyamoya disease is offered to prevent strokes. When considering which patients with moyamoya disease to operate on, those who are symptomatic should receive surgery regardless of collateral flow and hemodynamic reserve because of the need for additional blood flow. However, conservative treatment could be considered for patients without misery perfusion in the symptomatic hemisphere or for patients older than 60 years, due to comorbidities, potential overlay of intracranial atherosclerosis, and increased risk of complications. Through the development of relevant cellular and animal models, the next challenge is to further understand how the different pathways contribute to the emergence of moyamoya angiopathy, which would be of major importance in the identification of therapeutic targets in patients with moyamoya disease.

Dissection

허 준 녕

중앙의대 신경과

Cerebral artery dissection occurs when there is a tear in the wall of a cervical or intracranial artery, leading to a hematoma within the artery wall. Cerebral artery dissection is an uncommon cause of stroke, responsible for about 1 to 2% of all ischemic strokes. However, it is more common (up to 25%) for the young population with stroke. Trauma is considered as the major etiology behind the dissection, while underlying arteriopathies such as connective tissue disorders like Ehlers-Danlos syndrome IV can be related.

The "pearl and string sign" is one of the characteristic findings in the diagnosis of cerebral artery dissection as it represents a focal narrowing with a distal dilatation. This sign, along with other imaging findings like intimal flap, double lumen, and fusiform aneurysmal dilatation, plays a significant role in identifying and confirming the presence of cerebral artery dissection. Advanced diagnostic imaging studies such as vessel-wall MRI or digital subtraction angiography (transfemoral cerebral angiography) may be required to appropriately diagnose the dissection.

One of the reasons why the management of cerebral artery dissection is challenging is due to its highly dynamic clinical course. It can manifest in various forms, including arterial stenosis, occlusion, and aneurysm, which in turn can lead to both ischemic strokes and hemorrhagic events. Therefore, a profound understanding of dissection is essential for the effective treatment of patients.

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| **Room A** |

Invited Speaker Session.

| 좌 장 |

배희준 (서울의대 신경과), **김용재** (가톨릭의대 신경과)

Blood pressure and cholesterol lowering for secondary stroke prevention

Meng Lee

Chang Gung Memorial Hospital, Taiwan

Disclosures

- Meng Lee received honorarium from J&J, Boehringer Ingelheim and Daiichi Sankyo (< 1000 USD)

Blood Pressure Lowering for Secondary Stroke Prevention

- Recurrent stroke has declined over decades, with blood pressure control as a leading cause
- Most individual randomized clinical trials did not significantly show that blood pressure lowering therapy reduces recurrent stroke in patients with stroke or TIA

Hong et al. Circulation 2011; Yusuf et al. NEJM 2008; Kitagawa et al. JAMA Neurology 2019.

PROGRESS

- Perindopril compared with placebo achieved differential SBP reduction of 5 mmHg but did not significantly reduce recurrent stroke (0.95, 0.78-1.17)
- Combination of perindopril plus indapamide compared with placebo achieved differential SBP reduction of 12 mmHg and significantly reduce recurrent stroke (0.59, 0.49-0.71)

PROGRESS Collaborative Group. Lancet 2001.

PRoFESS

- Telmisartan compared with placebo achieved differential SBP reduction of 3.8 mmHg but did not significantly reduced recurrent stroke (0.95, 0.87-1.03)

Yusuf et al. NEJM 2008.

SPS3

- Active treatment group lowering BP < 120/80 mmHg compared with control group lowering SBP < 140/90 mmHg achieved differential SBP reduction of 6.5 mmHg but did not significantly reduced recurrent stroke (0.83, 0.66-1.04)

SPS3 Study Group. Lancet 2013.

RESPECT

- Active treatment group lowering SBP below 130 mmHg compared with control group lowering SBP to 130-139 mmHg achieved differential SBP reduction of 11 mmHg but did not significantly reduced recurrent stroke (0.75, 0.50-1.11)

Kitagawa et al. JAMA Neurol 2019.

Meta-analysis of RCTs

- 10 RCTs with 40,710 patients with stroke or TIA
- 6 trials compared antihypertensive drug(s) vs placebo or no antihypertensive therapy; 4 compared a lower BP target vs a higher BP target
- Average SBP reduction was 6.7 mmHg and DBP reduction was 2.8 mmHg between active treatment and comparator groups

Hsu et al. JAMA Neurol. 2023.

Risk of Recurrent Stroke

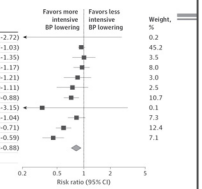
- Pooled results from the 10 included trials showed that more intensive vs less intensive blood pressure lowering therapy was associated with a reduced risk of recurrent stroke (RR, 0.83; 95% CI, 0.78-0.88, number needed to treat in 3 years, 58)

Hsu et al. JAMA Neurol 2023.

Figure 1. Risk of Recurrent Stroke

Source	More intensive BP lowering Events, No.	Total, No.	Less intensive BP lowering Events, No.	Total, No.	Differential SBP reduction, mm Hg	Risk ratio (95% CI)	Weight, %
Mant et al,[21] 2016	0	266	3	263	2.9	0.14 (0.01-2.72)	0.2
Yusuf et al,[2] 2008	880	10 146	934	10 186	3.8	0.95 (0.87-1.03)	45.2
Eriksson et al,[18] 1995	74	372	69	348	4	1.00 (0.75-1.35)	3.5
PROGRESS Collaborative Group,[4] 2001 (single)	157	1281	165	1280	5	0.95 (0.78-1.17)	8.0
Dutch TIA Trial Study Group,[17] 1993	52	732	62	741	5.8	0.85 (0.60-1.21)	3.0
Kitagawa et al,[3] 2019	39	633	52	630	6.5	0.75 (0.50-1.11)	2.5
Liu et al,[20] 2009	159	2840	219	2825	6.8	0.72 (0.59-0.88)	10.7
Bath et al,[22] 2017	1	41	3	42	10.6	0.34 (0.04-3.15)	0.1
Benavente et al,[5] 2013	125	1501	152	1519	11	0.83 (0.66-1.04)	7.3
PROGRESS Collaborative Group,[4] 2001 (combination)	150	1770	255	1774	12	0.59 (0.49-0.71)	12.4
Liu et al,[19] 2005	67	762	147	758	14	0.45 (0.35-0.59)	7.1
Total		20 344		20 366		0.83 (0.78-0.88)	
Total events	1704		2061				

Heterogeneity: $\chi^2_{10} = 47.52$; $P < .001$; $I^2 = 79\%$
Test for overall effect: $z = 6.12$; $P < .001$



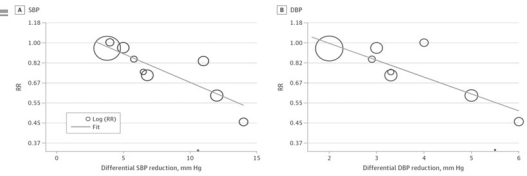
Risk ratio with 95% CI of recurrent stroke with more intensive compared with less intensive blood pressure (BP)-lowering therapy in patients with stroke or transient ischemic attack (TIA). PROGRESS indicates Perindopril Protection Against Recurrent Stroke Study. SBP, systolic blood pressure.

Risk of Recurrent Stroke (Meta-regression)

- A 5 mmHg greater SBP reduction was associated with an RR of 0.90 and a 10 mmHg greater SBP reduction with an RR of 0.67
- A 3 mmHg greater DBP reduction was associated with an RR of 0.84 and a 5 mmHg greater DBP reduction with an RR of 0.60.

Hsu et al. JAMA Neurol 2023.

Figure 2. Meta-Regression of Recurrent Stroke



Meta-regression of included trials to explore the association between magnitude of differential systolic blood pressure (SBP) reduction (A) and differential diastolic blood pressure (DBP) reduction (B) vs recurrent stroke rate. RR indicates risk ratio.

Table 2. Association Between Different Reduction Magnitude of SBP and DBP and Recurrent Stroke Risk

Differential BP reduction magnitude	No. of events/No. of population (%)		RR (95% CI)	NNT in 3 y
	More intensive	Less intensive		
Differential SBP reduction magnitude				
≤4 mm Hg[2,18,21]	954/10 784 (8.8)	1006/10 797 (9.3)	0.95 (0.87-1.03)	NA
≤5 mm Hg[2,4,18,21]	1111/12 065 (9.2)	1171/12 077 (9.7)	0.95 (0.88-1.02)	NA
>5 mm Hg[3-5,17,19,20,22]	593/8279 (7.2)	890/8289 (10.7)	0.67 (0.60-0.74)	28 (23-36)
>7 mm Hg[4,5,19,22]	343/4074 (8.4)	557/4093 (13.6)	0.62 (0.54-0.70)	19 (16-25)
>11 mm Hg[4,19]	217/2532 (8.5)	402/2532 (15.9)	0.54 (0.46-0.63)	14 (12-17)
Differential DBP reduction magnitude				
≤2 mm Hg[2,21]	880/10 412 (8.5)	937/10 499 (8.9)	0.94 (0.86-1.03)	NA
≤3 mm Hg[2,4,17,18,21]	1163/12 797 (9.1)	1233/12 818 (9.6)	0.94 (0.87-1.02)	NA
>3 mm Hg[3,4,19,20,22]	416/6046 (6.9)	676/6029 (11.2)	0.61 (0.55-0.69)	23 (20-29)
>4 mm Hg[4,19,22]	218/2573 (8.5)	405/2574 (15.7)	0.54 (0.46-0.63)	14 (12-17)

Other Outcomes

- More intensive blood pressure lowering therapy was associated with a reduced risk of major cardiovascular events, ischemic stroke, hemorrhagic stroke, fatal or disabling stroke, and cardiovascular death

Hsu et al. JAMA Neurol 2023.

Subgroup analysis

- More intensive blood pressure lowering therapy was associated with a greater risk reduction of recurrent stroke in trials with patients enrolled within 3-5 years from stroke (RR, 0.67; 95% CI, 0.59-0.75) than patients enrolled within 6 months from stroke (RR, 0.93; 95% CI, 0.86-1.00; P < .001 for interaction; I^2 = 95%)

Hsu et al. JAMA Neurol 2023.

- Physiologically, intensive (SBP target < 120 mmHg) compared with standard (SBP target < 140 mmHg) blood pressure lowering therapy was associated with increased, not decreased, cerebral perfusion in participants with a history of cardiovascular disease

Dolui et al. JAMA Neurol 2022.

Cholesterol Lowering for Secondary Stroke Prevention

- An elevated low-density lipoprotein cholesterol (LDL-C) level is a risk factor for cardiovascular disease, including ischemic stroke
- For patients with a history of ischemic stroke, an elevated LDL-C level is associated with an increased risk of subsequent major cardiovascular events

Yaghi et al. Stroke 2015; Lau et al. *J Am Heart Assoc* 2021.

- In addition to their LDL-C lowering effects, statins may exhibit cardiovascular protection via their pleiotropic effects
- The antithrombotic effect of statins may provide additional reduction in ischemic events but may increase the risk of intracranial hemorrhage in patients with ischemic stroke

Tousoulis et al. J Am Coll Cardiol 2014; Violi et al. *Circulation* 2013; Sanz-Cuesta et al. *Stroke* 2021.

SPARCL

- 4731 patients with a stroke or TIA within one to six months before study entry were randomly assigned to 80 mg of atorvastatin per day or placebo
- During a follow-up of 4.9 years, 265 patients (11.2%) receiving atorvastatin and 311 patients (13.1%) receiving placebo had a recurrent stroke (HR, 0.84; 95% CI 0.71 to 0.99)
- The mean LDL cholesterol level during the trial was 73 mg/dL among patients receiving atorvastatin and 129 mg/dL among patients receiving placebo

Amarenco et al. N Engl J Med 2006.

TST

- 2860 patients with ischemic stroke or TIA and having evidence of atherosclerosis were randomly assigned to a target LDL cholesterol level of less than 70 mg/dL or to a target range of 90 mg to 110 mg/dL
- During a follow-up of 3.5 years, 103 patients (7.2%) in a lower target group and 126 patients (8.8%) in a higher target group had a recurrent stroke (HR, 0.82; 95% CI 0.63 to 1.07)
- LDL-C level of 65 mg/dL was found in the lower-target group with only 24% of patients in this target group receiving high-intensity statins, while 41% of patients in this group received combined statins plus ezetimibe

Amarenco, Kim, et al. N Engl J Med. 2020.

FOURIER (Subgroup)

- Subgroup of patients with history of ischemic stroke and additional risk factors were randomly assigned to PCSK9 inhibitor evolocumab plus statins or placebo plus statins
- During a follow-up of 2.1 years, 95 patients (3.5%) receiving PCSK9 inhibitor plus statins and 105 patients (4.0%) receiving placebo plus statins had a recurrent stroke (HR, 0.89; 95% CI 0.68 to 1.17)

Giugliano et al. Stroke 2020.

Meta-analysis of RCTs

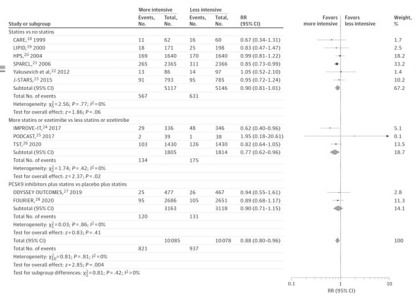
- 11 RCTs with 20,163 patients with stroke or TIA
- 6 trials compared statins vs no statins, 3 compared more statins or ezetimibe vs less statins or ezetimibe, and 2 compared PCSK9 inhibitors plus statins vs placebo plus statins
- The final mean LDL-C level was 79 mg/dL in the groups that received more intensive LDL-C lowering and 119 mg/dL in the groups that received less intensive LDL-C lowering

Lee et al. JAMA Neurol 2022.

Risk of Recurrent Stroke

- Pooled results from the 11 included trials showed that more intensive vs less intensive LDL-C–lowering statin-based therapies were associated with a reduced risk of recurrent stroke (RR, 0.88; 95% CI, 0.80-0.96, number needed to treat in 4 years, 90)
- The benefit associated with these LDL-C–lowering therapies was not different among LDL-C–lowering strategies (statins vs no statins: RR, 0.90; 0.81-1.01; more statins or ezetimibe vs less statins or ezetimibe: RR, 0.77; 0.62-0.96; and PCSK9 inhibitors plus statins vs placebo plus statins: RR, 0.90; 0.71-1.15; P = .42 for interaction)

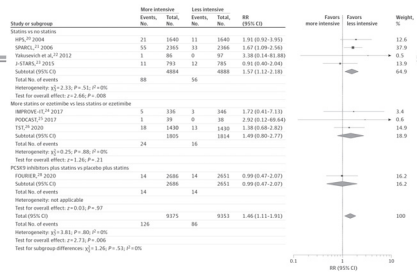
Lee et al. JAMA Neurol 2022.



Risk of Hemorrhagic Stroke

- Pooled results from 8 trials showed that more intensive LDL-C–lowering statin-based therapies were associated with an increase in hemorrhagic stroke (RR, 1.46; 95% CI, 1.11-1.91; number needed to harm, 242)

Lee et al. JAMA Neurol 2022.



- The risk of hemorrhagic stroke might not be associated with LDL-C levels or the magnitude of LDL-C–lowering therapies, but it might be associated with the antithrombotic properties possessed by statins that alter both coagulation and platelet activation

Violi et al. Circulation 2013.

Other Outcomes

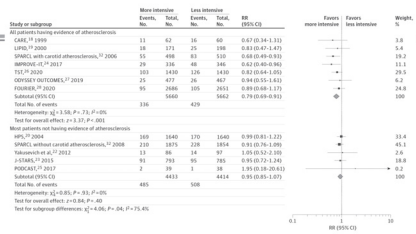
- More intensive LDL-C–lowering statin-based therapies were associated with a reduced risk of major cardiovascular events, recurrent ischemic stroke and myocardial infarction, but with a higher risk for new-onset diabetes

Lee et al. JAMA Neurol 2022.

Evidence of Atherosclerosis

- More intensive LDL-C–lowering statin-based therapies were associated with a reduced risk of recurrent stroke in trials with all patients having evidence of atherosclerosis (RR,0.79; 95% CI,0.69-0.91) but not in trials with most patients not having evidence of atherosclerosis (RR, 0.95; 95% CI, 0.85-1.07; P = .04 for interaction; I^2 = 75%)

Lee et al. JAMA Neurol 2022.



Target of LDL-C Levels

- The IMPROVE-IT Trial found LDL-C levels of 51 mg/dL among patients who received ezetimibe plus simvastatin vs 68mg/dL among those who received simvastatin alone; ezetimibe plus simvastatin compared with simvastatin alone was associated with a reduced risk of recurrent stroke
- The TST Trial found LDL-C levels of 65 mg/dL in the lower-target group vs 96 mg/dL in the higher-target group; the lower-target group compared with higher-target group was associated with a reduced risk of major cardiovascular events
- Based on these findings, it might be reasonable to lower LDL-C below 70 mg/dL with statin-based therapies for patients with ischemic stroke and evidence of atherosclerosis

Bohula et al. Circulation 2017; Amarenco, Kim et al. *N Engl J Med* 2020.

- In the TST Trial, although the lower-target strategy was superior to the higher-target strategy in the French population, the benefit of the lower target was not shown for either major cardiovascular events or in recurrent stroke when South Korean patients were analyzed separately; whether the benefit associated with more intensive LDL-C–lowering statin-based therapies for secondary stroke prevention should be generalized to Asian populations is not known

Amarenco, Kim, et al. N Engl J Med 2020; Kim. *J Stroke* 2021.

Take Home Message

- More intensive blood pressure lowering therapy might be associated with a reduction of recurrent stroke, and the larger the magnitude of differential blood pressure reduction, the larger the reduction of cerebrovascular events in patients with stroke or TIA
- More intensive LDL-C–lowering statin-based therapies might be associated with a reduced risk of recurrent stroke in patients with ischemic stroke or TIA, but this reduced risk might be confined to patients with evidence of atherosclerosis and LDL-C levels < 70 mg/dL might be a reasonable target for these patients
- Evidence from randomized clinical trials support more intensive blood pressure lowering for secondary stroke prevention chronically and more intensive LDL-C lowering for secondary stroke prevention in patients with evidence of atherosclerosis

Smoking cessation therapy

서 홍 관

국립암센터 가정의학과

흡연은 뇌졸중의 위험을 높인다. 흡연은 LDL 콜레스테롤을 높이고, HDL 콜레스테롤을 낮춘다. 담배연기에 들어 있는 일산화탄소는 산소 농도를 낮춰 심박동수를 높이고 혈압을 높인다. 뇌졸중의 약 절반은 혈압과 관련이 있다. 담배의 화학물질들은 혈액의 응고상태를 높인다. 이러한 흡연의 효과는 동맥경화를 일으킨다. 동맥경화가 일어나면 혈행 속도가 늦어지고 혈전이 발생할 확률이 높아진다.

우리나라에서 가장 흔한 질병은 '흡연'이라는 질병이다. 우리나라도 채택하고 있는 국제질병분류(ICD-10)에서도 F17.x 담배로 인한 정신적 행동적 장애라는 질병으로 분류되어 있다. 환자가 병원을 방문하는 시점에서는 건강에 관심이 많기 때문에 의사의 금연권고를 심각하게 받아들인다. 특히 심장질환처럼 치명적이며 흡연과 직접적인 관련이 있는 문제를 가지고 있을 때는 결정적인 계기가 될 수 있다.

의료인에 의한 금연 권고의 가장 중요한 효과는 금연을 시도하고자 하는 동기를 주는 것이다. 간단한 금연 권고와 더불어 약물요법과 같은 효과적인 방법을 결합함으로써 흡연율을 떨어뜨릴 수 있다는 점을 주목해야 한다.

금연방법에는 5A를 실천하면 된다. 약물요법은 니코틴대체제, 부프로피온, 바레니클린이 있다.

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| **Room A** |

Plenary Session.

| 좌 장 |

김경문 (성균관의대 신경과)

Mechanical thrombectomy for large ischemic infarcts: The end of a journey?

Raul G. Nogueira

Univ. of Pittsburgh, USA

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| **Room A** |

Symposium 1.

| 좌 장 |

윤병우 (을지의대 신경과)

The role of cerebrolysin in ischemic stroke

권 혁 성

한양의대 신경과

Cerebrolysin is a mixture of low molecular weight peptides and amino acids derived from pigs' brain with potential neuroprotective and neurorestorative effects. The safety and efficacy of cerebrolysin have been demonstrated in diverse neurological diseases, including acute ischemic stroke, brain traumatic injury, Alzheimer's disease, and Parkinson's disease. Both in vitro and in vivo studies suggest a broad therapeutic window of Cerebrolysin after the onset of ischemia in rats. These studies demonstrate that a protective effect can still be attained despite treatment commencing 48 hours after the onset.

In CASTA trial, a multi-national, double-blind, randomized, placebo-controlled study, the primary and secondary endpoints did not show a significant difference between patients with acute ischemic stroke assigned to Cerebrolysin and those assigned to placebo. But, a favorable outcome trend was observed in severely affected patients (NIHSS score>12).[1] A meta-analysis, comparing Cerebrolysin to placebo in two studies of identical design (CARS-1 and CARS-2), showed promising results on the NIHSS sore at day 21 (P = 0.001).[2] Another meta-analysis showed the beneficial effect of Cerebrolysin on NIHSS changes from baseline.[3] Even following the treatment with alteplase, the addition of Cerebrolysin might decrease the rate of symptomatic hemorrhagic transformation and decrease in the NIHSS score. Moreover, combining Cerebrolysin with a rehabilitation program may yield a potential synergistic effect in the subacute stage of stroke. Further well-designed randomized controlled trials are needed to confirm the efficacy and safety of Cerebrolysin in patients with acute ischemic stroke.

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| Room A |

Symposium 2.

| 좌 장 |

이광호 (성균관의대 신경과)

Unmet needs regarding the use of NOACs : Neurologist's perspectives

김 범 준

울산의대 신경과

Ischemic stroke associated with atrial fibrillation (AF) is more severe compared to other subtypes due to the formation of large thrombi originating from the left atrial appendage. Risk stratification is crucial for secondary stroke prevention, traditionally assessed through the CHADS2-VASC score. However, as a vascular neurologist, I recognize that ischemic stroke in AF patients can stem from various mechanisms. The CHADS2-VASC score has limitations in accurately predicting AF-related strokes, warranting a more comprehensive approach focusing on stroke mechanisms. For non-AF strokes in AF patients, lesion pattern analysis becomes critical in identifying the true stroke culprit. Patients with small vessel disease or large artery atherosclerosis alongside AF may require different secondary prevention strategies.

Moreover, the risk of AF-related stroke itself must be considered. While the CHADS2-VASC score predicts all strokes in AF patients, its factors also encompass small vessel disease or atherosclerosis, rendering it less specific for cardioembolic strokes. The risk of AF-related stroke may be influenced by the local mechanical environment and systemic coagulation status. Factors such as left atrial size, left atrial appendage characteristics, and appendage orifice flow velocity are known to impact stroke risk. Additionally, the presence of a hypercoagulable state indicated by elevated D-dimer levels is associated with embolic stroke risk, guiding treatment strategies to reduce embolic strokes.

Anticoagulation remains the cornerstone of secondary stroke prevention. However, unanswered clinical questions persist in the anticoagulation era. What strategies are effective for AF-stroke patients with concomitant atherosclerosis? How should individuals at high risk of future intracerebral hemorrhage be managed? When is the optimal time to initiate anticoagulation after an AF-related stroke? These questions are subjects of ongoing research. Furthermore, attention should be directed beyond anticoagulation to include rate and rhythm control strategies. Emerging evidence suggests that early rhythm control may confer benefits in reducing subsequent strokes.

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| Room A |

Focused Session 2.

Updated strategies to risk factors

| 좌 장 |

이경열 (연세의대 신경과), **손성일** (계명의대 신경과)

Emerging incretin-based therapies for obesity management

손 장 원

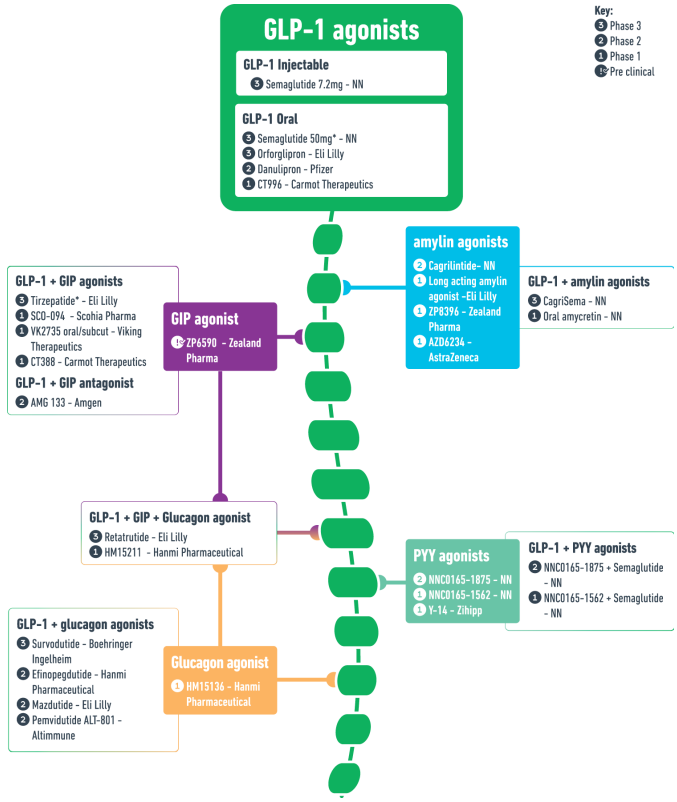
가톨릭의대 내분비내과

Obesity is a significant risk factor for health issues like type 2 diabetes and cardiovascular disease. It often proves resistant to traditional lifestyle interventions, prompting a need for more precise therapeutic strategies. This has led to a focus on signaling pathways and neuroendocrine mechanisms to develop targeted obesity treatments.

Recent developments in obesity management have been revolutionized by introducing novel Glucagon-like peptide-1 (GLP-1) based drugs, such as semaglutide and tirzepatide. These drugs are part of an emerging class of nutrient-stimulated hormone-based therapeutics, acting as incretin mimetics to target G-protein–coupled receptors like GLP-1, glucose-dependent insulinotropic polypeptide (GIP), and Glucagon (GCG). These receptors are vital in regulating body fat and energy balance. The development of multi agonists, including GLP-1–GCG and GIP–GLP-1–GCG receptor agonists, especially with the potential for GCG receptor activation, marks a significant advancement in the field.

In a move to improve patient convenience, semaglutide has been formulated as an orally available tablet with an absorption enhancer, overcoming the need for injections. Despite its lower oral bioavailability and specific intake requirements, this development marks a step forward in drug administration. Additionally, the advent of small molecules such as orforglipron, which can interact with the GLP-1 receptor and offer greater resistance to gastrointestinal breakdown, is a groundbreaking advancement previously deemed unachievable.

In this lecture, I will cover the development and clinical efficacy of various GLP-1-based therapeutics, exploring the challenges and future directions in obesity management.



Int J Obes (2024). https://doi-org-ssl.proxy.cuk.ac.kr/10.1038/s41366-024-01473-y

Updated strategies for dyslipidemia

장 준 영

울산의대 신경과

The contents of the lecture include introduction of lipoprotein metabolism and pathophysiology of atherosclerosis, mechanism of various lipid lowering agents, treatment target of lipid profiles, monitoring and follow up of lipids, liver function, muscle enzyme, and renal function on statin therapy, and finally residual cardiovascular risk management in dyslipidemia focusing on triglyceride (TG)-rich lipoproteins and lipoprotein a [Lp(a)].

Statin inhibits HMG-COA reductase and decreases cholesterol synthesis in the liver. As a compensatory mechanism, the number of LDL receptor on the liver cell is increased, which in turn results in increased uptake of LDL from the blood, and decreased plasma concentrations of LDL. The PCSK9 inhibitor blocks the binding of PCSK9 to the LDL-receptor, thus preventing LDL-receptor internalization. Ezetimibe inhibits the Niemann-Pick C1 like 1 (NPC1L1) protein, thereby preventing the transport of sterols into enterocytes.

According to the 2020 guidelines from the European Society of Cardiology, target levels of the lipid profile are tailored to the individual's total cardiovascular risk level. The primary objective is to lower LDL cholesterol below the tailored target level. For patients classified as having very high cardiovascular risk, it is recommended to achieve LDL cholesterol reduction of equal to or greater than 50%, with LDL levels below 55 mg/dl. Once the target LDL level is reached, adjustments to lipid-lowering therapy may be considered in alignment with secondary targets. These secondary targets include non-HDL cholesterol below 85 mg/dl and apolipoprotein B below 65 mg/dl for very high-risk patients. Very-high risk patients include those with clinically documented atherosclerotic cardiovascular disease (ASCVD), such as previous myocardial infarction, stable angina, coronary revascularization, stroke, transient ischemic attack, and peripheral artery disease. Additionally, very-high risk patients are identified through ASCVD documentation on imaging, which includes significant plaque observed on coronary angiography, multivessel coronary disease with more than 50% stenosis, or significant plaque detected on carotid ultrasound. Individuals with diabetes mellitus and target organ damage, at least three major risk factors, type 1 diabetes mellitus with a long duration, severe chronic kidney disease with an estimated glomerular filtration rate below 30, and a calculated 10-year cardiovascular disease risk equal to or more than 10% are also classified as very-high risk patients.

Among various parameters, the ratio of total cholesterol to HDL cholesterol was identified as the most potent predictor for the occurrence of a first-ever cardiovascular event. In a meta-analysis involving 62,000 participants across 8 randomized controlled trials (RCTs), on-treatment LDL cholesterol, non-HDL cholesterol, and apolipoprotein B were found to be associated with major cardiovascular events at 1 year. Notably, the association was strongest for non-HDL cholesterol compared to LDL cholesterol or apolipoprotein B.

Residual cardiovascular risk factors are defined as the risk of cardiovascular events that persists despite achieving treatment goals for LDL cholesterol, blood pressure, and blood glucose as recommended by current guidelines. These residual cardiovascular

risk factors include LDL cholesterol levels greater than 100 mg/dL, high-sensitivity C-reactive protein levels exceeding 2 mg/L, triglyceride levels surpassing 200 mg/dL, HDL cholesterol levels below 40 mg/dL, and lipoprotein(a) levels exceeding 50 mg/dL. Management of hypertriglyceridemia should be considered to mitigate the residual cardiovascular risk. Additionally, management of high lipoprotein(a) levels should be contemplated in patients experiencing recurrent cardiovascular events despite optimal management of traditional risk factors.

Concerns about bone health status in stroke patients

김 경 민

연세의대 내분비내과

Osteoporosis is a significant concern for stroke patients due to the increased likelihood of fractures, especially hip fractures, resulting from decreased mobility and balance issues. Post-stroke bone fractures can delay recovery and increase healthcare expenses. Risk factors for bone fractures after a stroke include osteoporosis, advanced age, being female, and a prior history of fractures. The majority of fractures occur in the lower limbs, with post-stroke motor changes increasing the risk of fractures due to bone loss.

BMD is an essential measure for evaluating the risk of fractures. Research indicates substantial bone loss in stroke patients, especially in limbs affected by paralysis, indicating that stroke itself may contribute to bone loss. Early osteoporosis screening is critical, with tools such as DXA scans recommended for evaluating BMD.

Osteoporosis management in stroke patients should involve multiple approaches. Early mobilization and customized physical therapy programs are essential for improving mobility and minimizing bone loss. Depending on individual BMD assessments and risk factors, pharmacological treatments such as bisphosphonates, calcium, and vitamin D supplements may be required. Strategies to prevent falls, including home modifications and the use of assistive devices, are crucial for reducing the risk of fractures. Regular monitoring of bone health through BMD tests and reevaluation of fall risk factors is recommended to adjust management plans as needed. Collaboration between neurologists, endocrinologists, and rehabilitation specialists is critical for effectively preventing and treating osteoporosis and fractures in stroke patients.

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2024 대한뇌졸중학회

춘계학술대회

| Room A |

Focused Session 3.

AI and digital health innovations in medicine

| 좌 장 |

유경호 (한림의대 신경과), **서우근** (성균관의대 신경과)

Novel AI models: Introduction and applications

박 성 호

인제의대 신경과

With the arrival of the big data era and technological progress, the development of hardware for data storage and computation, as well as the expansion and increase in data types and volumes, have led to the creation of models capable of learning more complex patterns. Large Language Models (LLMs) like ChatGPT have astounded people by clearly demonstrating the 'law of scale', which shows how the increase in data quantity leads to a qualitative transformation from quantity to quality. As more data is processed and complex networks are constructed, AI has gained an 'emergent ability' to recognize and learn complex patterns independently. This has led to a demand for leveraging AI's capabilities, resulting in significant transformations across various industries, especially in healthcare. AI models are broadly categorized into discriminative models and generative models, with most of the models described above being generative. However, applying generative models in the healthcare sector, which directly impacts human lives, requires careful and conservative consideration to ensure safe and effective application. This includes demands for accurate evaluation of model performance and the need for model explainability in the healthcare sector. Therefore, it is more practical to apply discriminative models in healthcare at present. This lecture aims to discuss the advantages and disadvantages of each model type, the most appropriate situations for applying different models, and considerations from a clinician's perspective when evaluating these applications.

AI models at the forefront in neuroimaging field

조 환 호

인천대학교

In this lecture, we discuss the technical background and characteristics of language models (especially transformers), which are driving innovation in various fields, and applications of transformers and vision transformers in recent medical image and neuroimaging fields.

Language modeling fundamentally performs tasks to represent words as numbers, based on the Distributional Hypothesis in Linguistics, which suggest that "semantically similar words tend to occur in the same environment or context." This led to the development of n-gram models and research on vector semantics and embedding techniques to more efficiently represent the meaning of words. Algorithms like word2vec were devised for word embedding, utilizing self-supervised learning based on the context of words.

Humanity has continued research on artificial intelligence models capable of predicting the probability of the next word through sequences of sentences, understanding the meaning of documents, classification, etc., and models suitable for sequential data processing, such as the Markov chain, have emerged. Subsequently, neural network-based models such as RNN and LSTM were developed. However, these models had internal limitations in processing information, and to overcome this, attention mechanism was devised, leading to the emergence of transformers utilizing self-attention techniques.

Transformers create context-based embeddings for learning the meaning of words, showing state-of-the-art performance. Through the embedding of transformers, various NLP tasks became possible, and the concept of the foundation model began to be used. As the success of transformers spreads, their application areas expand beyond the field of natural language processing to other fields, including medical image analysis.

When applying transformers to vision data, the inherent difference between images (static data) and text data (sequential data) initially posed limitations. To overcome this, images were divided into batches and treated like sequential data, resulting in the birth of the vision transformer (ViT). ViT has the significant advantage of overcoming the inability of the traditional CNN method to reflect distance association and is gaining attention as the next-generation image data processing model.

The application of transformers in the field of neuroimaging includes various tasks such as diagnosis, segmentation, detection, and report generation, and we will introduce several cases at the end of this lecture.

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Digital twins transforming stroke patient care

남 효 석

연세의대 신경과

A digital twin is a virtual model designed to accurately reflect a physical object. The digital twin concept was first introduced in manufacturing to refine the design and operations of intricate systems, including aircraft engines and industrial machinery. It has now expanded to a wider array of applications including infrastructure, buildings, and even entire cities. Digital twins offer real-time data and insights on a physical object or system's performance and behavior, facilitating immediate problem identification and inefficiency resolution. This enables proactive maintenance and system optimization.

Historically, the digital twin concept introduced by NASA's space program in the 1960s, simulated spacecraft for real-time troubleshooting of flight issues. This approach proved vital during the Apollo 13 mission, allowing NASA to simulate onboard conditions and safely return the crew to Earth after a malfunction. The term "digital twin" was officially coined in 2005 by Michael Grieves in the context of product lifecycle management.

A health digital twin is a virtual representation of an individual's health status, integrating real-time data across various sources to simulate and predict health outcomes. In healthcare, digital twins now target not only devices and equipment but also processes, populations, and patients. Digital twins can be developed for different scales, such as the whole body, a single organ, or cellular level, to analyze specific conditions or environments, like cancer or critical care. Digital twin enables personalized healthcare by allowing for precise diagnosis, treatment planning, and proactive health management. Twins can be active (receiving real-time data), passive (using data for offline models), or semi-active (a passive twin enhanced with animations and dynamic elements).

It has been suggested that digital twins can be used to prevent cardiometabolic diseases, including diabetes, heart disease, and stroke. There exist a significant potential of the digital twin principle to advance stroke research. However, a few study was conducted in the stroke field. In this lecture, I want to discuss current concept of digital twin in health care and potential application of digital twin in stroke research.

Pioneering hospital-based smart healthcare solutions

이 민 우

한림의대 신경과

In the rapidly evolving field of healthcare, the integration of smart technology into hospital systems represents a critical advancement toward improving patient outcomes and operational efficiency. This talk will delve into the innovative approaches to smart healthcare solutions implemented at Hallym University Sacred Heart Hospital, with a particular emphasis on the development of a digitally enhanced stroke unit. As a stroke neurologist, I will share our journey in transforming our hospital into a leading example of a smart hospital, demonstrating the power of digital innovation in healthcare settings.

At the core of our transformation was the challenge of establishing a state-of-the-art stroke unit within the constraints of a limited budget. Our solution was the integration of the MobiCare system, a wireless EKG monitoring system, which has been pivotal in enabling continuous and real-time monitoring of stroke patients without the need for costly infrastructure. This system facilitated the efficient management of patient care but also significantly reduced the budget for stroke unit establishment.

The implementation of the MobiCare system within our stroke unit exemplifies how smart healthcare solutions can be both accessible and impactful, even in resource-limited settings. By leveraging technology to optimize patient monitoring and care processes, we have enhanced the quality of stroke care delivered to our patients. Furthermore, our experience highlights the potential for other hospitals to adopt similar smart healthcare technologies, thereby broadening the reach of advanced medical care.

This presentation will explore the strategic decisions, challenges, and outcomes of integrating smart healthcare solutions at Hallym University Sacred Heart Hospital. Attendees will gain insights into the practical aspects of developing a digitally smart hospital environment and the transformative impact of such innovations on patient care, particularly in the management of acute stroke patients.

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| **Room A** |

Special Session.

| 좌 장 |

김응규 (인제의대 신경과), **이진수** (아주의대 신경과)

New frontiers in stroke and neuroendovascular therapies

Raul G. Nogueira

Univ. of Pittsburgh, USA

First-in-Class digital therapeutics 'VIVID Brain'

강 동 화

울산의대 신경과

Visual field defect (VFD) is a significant sequelae of stroke, however currently, there is no effective treatment available. Visual perceptual learning may restore visual field defect (VFD) in chronic stroke through the blindsight channel, but its responsiveness differs by each person. In this multicenter, randomized, controlled trial, we aimed to investigate efficacy and safety of a personalized VPL-based digital therapeutics (VIVID Brain) for treating poststroke VFD.

Stroke outpatients with VFD (> 3 months poststroke) were randomized into VIVID Brain training or control groups and received VFD assessments using Humphrey Visual Field (HVF) tests at baseline and 12-week follow-up. The training group received a personalized visual discrimination training consisting of orientation and rotation directions through a virtual reality head mount display device, five days a week for twelve weeks involving 360 trials per day.

With high compliance rate, VIVID Brain training led to clinically meaningful improvement in whole field (mean 194 degrees2) and defective hemifield (mean 158 degrees2), surpassing those in the control group (whole field, P=0.003; defective hemifield, P=0.002). The 12-week change in HVF scores significantly improved in the training group compared to those in the control group (whole field, P=0.031; defective hemifield, P=0.011). According to within-group analyses, HVF scores improved after 12 weeks in the training group (whole field, P=0.005; defective hemifield, P=0.001), but not in the control group (whole field, P=0.88; defective hemifield, P=0.835).

This trial suggests our VPL-based digital therapeutics as a promising, non-invasive, personalized treatment for stroke-induced VFD. VIVID Brain significantly improved poststroke VFD both in whole field and defective hemifield.

Clinical Trial Registration: ClinicalTrials.gov, NCT05525949

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| **Room B** |

Scientific Session 1.

| 좌 장 |

김동억 (동국의대 신경과), **박종무** (을지의대 신경과)

Concomitant large artery steno-occlusion of major cerebral arteries raises the risk of recurrent stroke and death in acute ischemic stroke patients with atrial fibrillation

Hyung Seok Guk[1], Do Yeon Kim[1], Keun-Sik Hong[2], Joon-Tae Kim[3], Byung-Chul Lee[4], Soo Joo Lee[5], Jee-Hyun Kwon[6], Jun Lee[7], Dong-Ick Shin[8], Jay Chol Choi[9], Tai Hwan Park[10], Kyusik Kang[11], Dong-Eog Kim[12], Kyung Bok Lee[13], Sung-Il Sohn[14], Keon-Joo Lee[15], Juneyoung Lee[16], Ji Sung Lee[17], Hee-Joon Bae[18,1], Other On Behalf Of The East-Af And Crcs-K Investigators[1]

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Purpose: Cerebral atherosclerosis is common in acute ischemic stroke patients with AF, but its prognostic significance in such patients remains unclear. We evaluate the effect of concomitant large artery steno-occlusion [cLASO] on recurrence and death in these populations.

Methods: We collected data from participants on the EAST-AF (East Asian ischemic STroke with Atrial Fibrillation) Part II study, a prospective multi-center cohort. cLASO was evaluated across 26 segments of major cerebral arteries. The risk of recurrence and death were evaluated based on the presence, severity (mild 1-49%; moderate-to-severe 50-99%; occlusion) and relevance (potential to cause infarction or post-thrombectomy residual stenosis) using cause-specific hazard model and Cox proportional hazard model, respectively.

Results: From 2,035 participants (male 54.8%, mean age 74.9), 64.2% had cLASO. Among these, 38.4% had mild, 29.9% had moderate-to-severe stenosis and 31.7% had occlusion; 44.6% had relevant steno-occlusion. Antithrombotics and statin were prescribed in 94% (antiplatelet only 9%, anticoagulant only 72.4%, combined 12.6%) and 87%, respectively. Over a median 756 days

of follow-ups, about half of 3-year recurrence (3-year 7.0 %) and one-fourth of death (3-year 24.5%) occurred within 3 months. The incidence of recurrence and death varies significantly by cLASO profiles. By adjusting known risk factors, cLASO raised the risk of recurrence (1.97 [1.60-2.42], P<0.01) and death (1.30 [1.00-1.69], P=0.048). >50% or relevant steno-occlusion conferred significantly higher risks of recurrence (2.35 [1.46-3.78], P<0.01; 3.73 [2.83-4.92], P<0.01) and death (1.48 [1.09-2.02], P<0.01; 1.46 (1.06-2.01) P=0.02).;

Conclusions: cLASO, especially with higher degree or relevant, significantly raises the risk of recurrent stroke as well as death in acute ischemic stroke patients with AF. Further research on risk stratification and preventive strategies is necessary in these populations.

Impact of temporary discontinuation of anticoagulation on outcomes in patients with acute ischemic stroke and atrial fibrillation

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Purpose: We investigated the frequency and consequences of procedure-related interruption of anticoagulation in acute ischemic stroke (AIS) patients with atrial fibrillation (AF).

Methods: We enrolled 2,431 AIS patients with AF across 15 hospitals from 2018 to 2021, all;of whom were prescribed anticoagulants at discharge. Our prospective data collection;involved information on prescribed anticoagulants, vascular events, bleeding episodes, and mortality for up to 3 years. We conducted a matched case-control study (1:3 ratio, matched by;age, sex, and discharge modified Rankin Scale score) to assess the impact of temporary anticoagulant interruptions.

Results: The cohort, with an average age of 75 and 55% male, predominantly used nonvitamin K antagonist oral anticoagulants (NOACs) (92.6%) at discharge. The incidence rate of procedure-related interruption was 4.56 per 100 person-years. During the median follow-up period of 1.92 years following the index stroke, 179 patients experienced 199 procedure-related interruptions. More than one third of patients were discontinued anticoagulation due to procedure within 6 months of the index stroke. Procedure related interruption increased the risk of the composite outcome (recurrent stroke, myocardial infarction, and death) by sixfold compared to those who did not discontinue anticoagulation. Anticoagulant interruptions more than 5 days increased the risk of recurrent stroke by 8 times compared to those of 4 days or less.

Conclusions: Discontinuation of anticoagulants in AIS patients with AF is not uncommon. Notably, interruptions lasting more than 5 days are particularly risky, emphasizing the critical importance of minimizing temporary discontinuations to improve patient outcomes.

Influence of prior antiplatelet or anticoagulation on significant hemorrhagic complications after mechanical thrombectomy

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Purpose: This study aimed to evaluate the influence of prior antiplatelet (AP) or anticoagulation (AC) on post procedural subarachnoid hemorrhage (SAH) or hemorrhagic transformation (HT) in acute ischemic stroke patients undergoing endovascular treatment (EVT)

Methods: We retrospectively reviewed 720 consecutive patients who had undergone EVT between January 2011 and May 2016 from the ASIAN KR registry. Patients receiving AP or AC at the time of EVT were included. The primary outcome was the occurrence of significant post procedural hemorrhage, classified as fisher grade 3-4 SAH or parenchymal hematoma type 2 HT. Functional outcomes (3 month mRS) were also compared as secondary outcomes.

Results: Among the 720 patients included, 98 (13.6%) were receiving AC and 197 (27.4%) were receiving AP. Significant post procedural hemorrhage occurred in 27 (13.8%, p=0.041) of the antiplatelet group, and 11 (11.2%, p=0.671) of the AC group[SL1];, as compared to the no antithrombotics group (38 [8.6%]). In multivariable analysis, antiplatelet use was associated with a significant increase in post procedural hemorrhage (Odds ratio: 1.999, 95% confidence interval [1.100 − 3.632], p=0.023) when age, sex, medical history of HTN, DM, ASPECTS score, successful recanalization and administration of tPA were included as covariables. Anticoagulation use was not associated with a significant increase in post procedural hemorrhage (Odds ratio: 1.059 , 95% confidence interval [0.473 − 2.368], p=0.890). Patients with post procedural SAH or HT had significantly worse functional outcomes(mRS3 - 6) at 3month after discharge compared to those without (83.3% vs. 44.8%, p<0.001).

Conclusions: The prior use of anticoagulant did not increase the risk of post procedural SAH or HT, whereas patients taking antiplatelet showed a higher risk of post procedural SAH or HT.

Long-term outcome of rescue stenting for acute intracranial atherosclerotic stenosis related large vessel occlusion

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Purpose: Rescue stenting (RS) is a widely accepted rescue option after failed first-line mechanical thrombectomy (MT) for acute ischemic stroke (AIS) due to intracranial atherosclerotic stenosis (ICAS)-related large vessel occlusion (LVO). However, the long-term outcomes (≥12 months) after RS have not yet been elucidated.

Methods: We conducted a pooled analysis from a multi-center registry of ICAS-LVO patients undergoing RS, assessing clinical outcome, symptomatic intracranial hemorrhage (SICH), good functional outcome (modified rankin scale 0-2), stroke recurrence at 3 months at ≥ 12 months, and stent patency

Results: Among 154 patients, successful recanalization was achieved in 132 patients (85.7%) after RS. Good functional outcome at 3 months was observed in 51.3% of patients, which slightly increasing to 53.2% at the final assessment (median, 33 months; interquartile range [IQR], 13–91 months). SICH occurred in 8.4% of patients within 3 months, reducing to 0.8% thereafter. The mortality rate was similar in 3 months (8.4%) and final follow up (8.7%). Stroke recurrence was 0.6 % within 3 months and 3.2% later. The stented vessel was patent in 81.1% of patients at the first follow-up (median, 3 days; IQR, 1–125 days) and 96.7% at the final follow-up (median, 18 months; IQR, 13–68 months).

Conclusions: RS is a safe and effective option, not only for treating AIS due to ICAS-LVO, but also for preventing stroke recurrence in the long term. In addition, the long-term patency of RS appears to remain durable, particularly when it remains patent during the initial follow-up.

Clinical and imaging differences between subtypes of cancer-related stroke

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Purpose: The mechanism of cancer-related stroke is known to be hypercoagulability due to tissue factor-dependent pathways and tissue factor-independent pathways by extracellular vesicles and inflammatory cytokines. This cancer-related hypercoagulability causes multiple embolic strokes due to intravascular coagulopathy, cardioembolism due to non-bacterial thrombotic endocarditis (NBTE), and paradoxical embolism due to intra- and extra-cardiac shunt in patients with deep vein thrombosis.; ;This study aims to investigate the clinical and imaging features and prognosis of intravascular coagulopathy, NBTE, and paradoxical embolization as a mechanism of cancer-related stroke.

Methods: We enrolled 169 patients admitted to Samsung Medical Center from January 2019 to December 2023 with ischemic stroke that occurred within 7 days. All of these patients had cryogenic stroke and active cancer. Laboratory tests also confirm their hypercoagulable state, which is defined as a D-dimer concentration of >3 ug/mL. These patients had D-dimer measured in blood samples, transthoracic echocardiography (TTE) to confirm NBTE, and bubble testing with TTE and transcranial doppler to confirm shunt. Patients with confirmed shunt on bubble test were categorized into the paradoxical embolism group, patients with confirmed NBTE on TTE were categorized into the NBTE group, and patients with neither shunt nor NBTE were categorized into the intravascular coagulopathy group.

Results: Of a total of 169 patients, 40 had intra- and extra-cardiac shunts and 11 had NBTE. D-dimer levels were higher in the intravascular coagulopathy and NBTE groups than in the paradoxical embolism group (p=0.002), but there was no significant difference between the intravascular coagulopathy group and the NBTE group. In the diffusion MRI analysis, the paradoxical embolism group (3.14 ± 1.11) and NBTE group (3.81 ± 1.22) had larger maximal diameters among diffusion MRI lesions compared to the intravascular coagulopathy group (1.21 ± 0.71) (p=0.021). And the number of acute lesions on diffusion MRI was significantly higher in the intravascular coagulopathy group (7.8 ± 3.2) compared to the paradoxical embolism group (5.1 ± 2.1) and the NBTE group (4.8 ± 3.1) (p=0.025). Large vessel occlusion was significantly more prevalent in the NBTE group compared to the other groups (p=0.041). No significant difference in 3-month favorable outcome was observed between the 3 groups.

Conclusions: In this study, different clinical and image features are observed in cancer-related stroke according to the detailed classification of cancer related stroke mechanism, but no difference in patient prognosis is observed.

Demystifying DWI lesion volume changes in acute ischemic stroke

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Purpose: We have reported that the infarction volume on DWI shows dynamic changes during acute stroke admission. We further analyzed the associations between the patient's characteristics and early DWI volume changes.

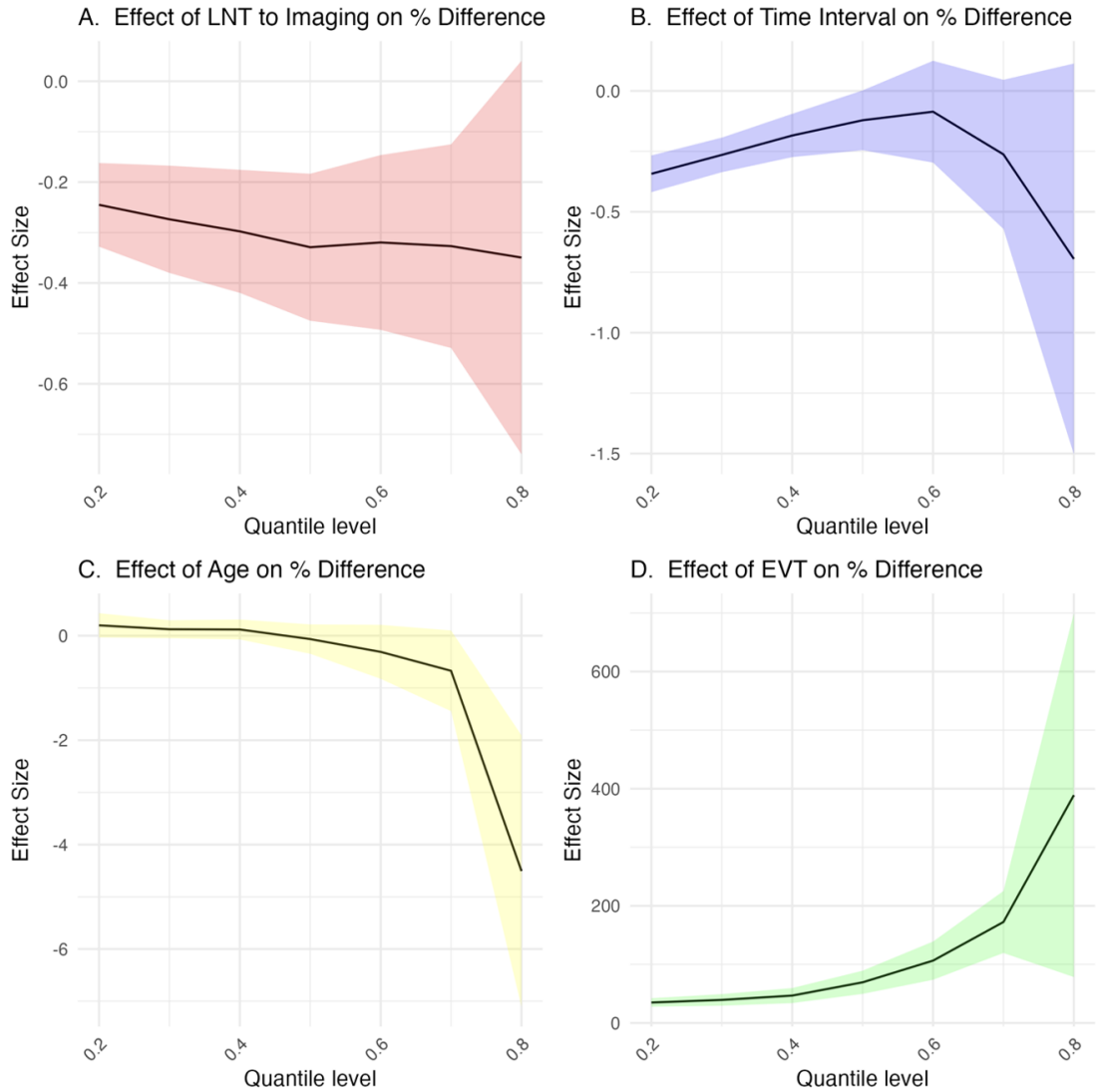
Methods: We analyzed cases from a prospective stroke registry (2005–2022) involving patients who underwent multiple DWIs during hospitalization. DWI lesion volumes were automatically measured using the JBS-01K (JLK Inc., South Korea). Multivariable quantile regression incorporating variables such as age, medical history, smoking status, endovascular thrombectomy (EVT), initial glucose level, blood pressure, lesion volume, stroke etiology, and timing of DWIs was conducted to evaluate their impact on DWI lesion volume change over the quantiles of volume changes.

Results: The study included 7125 patients, 61% male, with a mean age of 68 ± 13.5) and a median initial NIHSS of 3 (IQR 1–7). Intravenous thrombolysis was administered in 10.3% of cases, while 13.2% received EVT. The median interval between initial and follow-up DWIs was 86 hours (IQR 66.0–105.1). Initial and follow-up lesion volumes had medians of 0.85 ml (IQR 0.23–4.52) and 1.73 ml (IQR 0.50-8.56), respectively. EVT and cardioembolic stroke etiology were positively associated with volume change, while age, initial lesion volume, interval between DWIs, and time from last seen well to imaging had negative associations. (Table) Both time metrics consistently showed negative effects while age was associated with a larger negative effect size in the higher quantiles. (Figure A-C) EVT demonstrated a larger positive effect in the higher quantiles. (Figure D) ;

Conclusions: We documented that age and time metrics were correlated with decreasing lesion volume, whereas EVT and cardioembolism with increasing volume.

Table 1: Multivariable Quantile Regression Analysis of Factors Affecting DWI Lesion Change

Variables	20th percentile	30th percentile	40th percentile	50th percentile	60th percentile	70th percentile	80th percentile
Age	0.20 (-0.03, 0.43)	0.12 (-0.05, 0.30)	0.12 (-0.07, 0.31)	-0.07 (-0.35, 0.22)	-0.31 (-0.83, 0.21)	-0.67 (-1.44, 0.10)	-4.51 (-7.11, -1.91)
HTN	-2.99 (-8.44, 2.47)	-3.01 (-8.02, 2.01)	-3.86 (-9.32, 1.60)	-6.41 (-14.29, 1.48)	16.50 (-30.85, -2.15)	-25.61 (-46.12, -5.11)	-19.21 (-70.68, 32.26)
Hyperlipidemia	2.69 (-2.19, 7.58)	2.11 (-2.90, 7.12)	6.77 (1.27, 12.28)	8.75 (1.90, 15.51)	7.74 (-3.50, 18.98)	6.50 (-10.53, 23.52)	-2.00 (-44.43, 40.43)
Diabetes Mellitus	-4.10 (-9.61, 1.40)	-6.08 (-11.67, -0.49)	6.96 (-13.66, -0.26)	-11.51 (-18.48, -4.53)	-14.62 (-27.77, -1.47)	-24.83 (-42.18, -7.48)	-64.70 (-118.27, -11.12)
Smoking	-1.14 (-6.29, 4.02)	-2.49 (-6.90, 1.93)	-4.21 (-9.27, 0.86)	-6.04 (-13.00, 0.91)	-4.75, (-17.26, 7.76)	-2.41 (-20.89, 16.06)	-47.22 (-105.51, 11.07)
EVT	34.90 (27.66, 42.14)	39.32 (29.43, 29.20)	46.73 (33.90, 59.56)	69.42 (49.67, 89.17)	106.38 (73.79, 138.98)	172.40 (119.50, 225.31)	389.06 (78.45, 699.67)
glc	0.01 (-0.03, 0.05)	0.02 (-0.02, 0.06)	0.02 (-0.05, 0.09)	0.04 (-0.01, 0.09)	0.03 (-0.08, 0.13)	0.09 (-0.04, 0.23)	0.00 (-0.45, 0.46)
sBP	0.20 (0.11, 0.29)	0.21 (0.13, 0.29)	0.24 (0.14, 0.35)	0.33 (0.19, 0.46)	0.52 (0.32, 0.72)	0.63 (0.33, 0.93)	1.11 (0.31, 1.91)
Stroke etiology: CE	8.89 (2.40, 15.39)	14.15 (7.00, 21.30)	20.17 (10.60, 29.74)	33.07 (23.49, 42.66)	59.50 (36.56, 82.44)	100.87 (73.35, 128.40)	285.83 (162.29, 409.37)
Time interval from the initial to followup DWI	-0.34 (-0.42, -0.27)	-0.26 (-0.34, -0.19)	-0.18 (-0.27, -0.10)	-0.12 (-0.25, 0.00)	-0.09 (-0.30, 0.12)	-0.26 (-0.57, 0.05)	-0.70 (-1.50, 0.11)
Initial DWI lesion volume	-0.12 (-0.24, -0.01)	-0.29 (-0.37, -0.20)	-0.51 (-0.64, -0.37)	-0.78 (-0.94, -0.62)	-1.35 ('1.68, -1.02)	-2.24 (-2.69, -1.80)	-4.29 (-5.43, -3.15)
Time from last seen well to imaging	-0.25 (-0.33, -0.16)	-0.27 (-0.38, -0.17)	-0.30 (-0.42, -0.18)	-0.33 (-0.47, -0.18)	-0.32 (-0.49, -0.15)	-0.33 (-0.53, -0.13)	-0.35 (-0.74, 0.04)



Associated factor with cranial nerve palsy in cavernous sinus dural arteriovenous fistula

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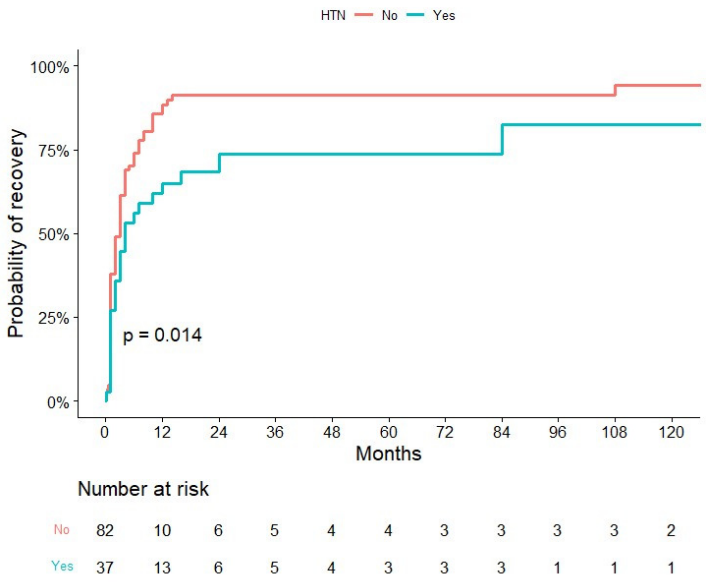
Purpose: This retrospective study aimed to identify factors associated with cranial nerve (CN) palsy in patients with cavernous sinus dural arteriovenous fistulas (CSDAVF) and analyze the overall prognosis of;CN palsy following endovascular treatment (EVT).

Methods: A retrospective analysis was conducted on 196 patients diagnosed with CSDAVF who underwent EVT. Clinical and imaging variables were collected, including demographics, vascular risk factors, CN palsy characteristics, angioarchitecture, treatment details, and follow-up outcomes. Statistical analyses were performed to identify factors associated with initial CN palsy, aggravation of CN palsy post-EVT, and persistence of CN palsy during follow-up.

Results: Initial CN palsy was present in 73% of patients, with the orbital pattern being most common. Factors associated with initial CN palsy included ipsilateral inferior petrosal sinus occlusion, contralateral feeders, and CSDAVF type (proliferative or restrictive). Aggravation of CN palsy post-EVT occurred in some patients but mostly resolved during follow-up. Hypertension, initial gross extraocular movement limitation, and retreatment were associated with a lower likelihood of complete resolution of CN palsy. Comparison with previous studies revealed discrepancies in outcomes, particularly regarding the association between CSDAVF type and CN palsy resolution.

Conclusions: Our study provides insights into factors associated with CN palsy in CSDAVF patients and highlights the importance of addressing persistent CN palsy post-EVT. Factors such as hypertension, initial gross extraocular movement limitation, and retreatment were identified as prognostic factors for persistent CN palsy. Further research is warranted to validate these findings and improve patient outcomes.



Hemodynamic contribution of carotid atherosclerosis to cerebral white matter lesions

Wookjin Yang[1,2], Keun-Hwa Jung[1,2], Kyung-Il Park[1,2], Matthew Chung[1,2], Jiyeon Ha[1,2], Eung-Joon Lee[1,2], Han-Yeong Jeong[1,2], Jeong-Min Kim[1,2], Seung-Hoon Lee[1,2]

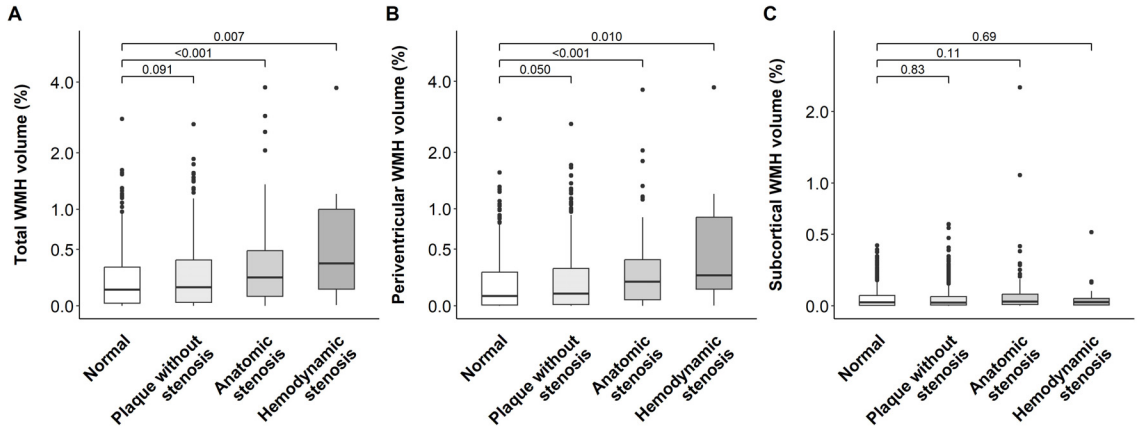
[1]Department Of Neurology, Seoul National University Hospital, Seoul, Korea, [2]Department Of Neurology, Seoul National University College Of Medicine, Seoul, Korea

Purpose: Carotid atherosclerosis is associated with white matter hyperintensity (WMH), potentially resulting in cognitive and gait problems. However, the mechanisms underlying this connection remain unclear. We assessed the relationship between patterns of carotid atherosclerosis and regional WMH, offering insights into the mechanisms underlying this association.

Methods: We reviewed data from consecutive healthy individuals participating in a health check-up program, who chose to undergo both optional carotid doppler ultrasonography and brain magnetic resonance imaging between January 2015 and June 2021. Automatic segmentation and quantification were conducted to measure total, periventricular, and subcortical WMH volumes. Carotid atherosclerosis stage was defined as follows: normal, no atherosclerotic evidence; plaque without stenosis, atherosclerotic plaque without stenosis; anatomic stenosis, angiographic stenosis without sonographic flow alteration; and hemodynamic stenosis, sonography-measured hemodynamically significant stenosis. These stages were then analyzed for the association with regional WMH volumes using linear regression.

Results: In total, 1,058 participants were eligible (median age, 62 years; 602 men [56.9%]). Total and periventricular WMH volumes increased with the development of anatomic and subsequent hemodynamic stenosis; however, only hemodynamic stenosis was independently associated with total (B [95% confidence interval], 0.240 [0.057-0.423]; β, 0.078; p=0.010) and periventricular WMH volumes (0.232 [0.066-0.399]; 0.083; p=0.006). The degree of hemodynamic stenosis, but not the plaque extent and anatomic stenosis, was significantly associated with the total (0.178 [0.033-0.323]; 0.072; p=0.016) and periventricular WMH volumes (0.176 [0.044-0.308]; 0.078; p=0.009). Subcortical WMH was not associated with carotid atherosclerosis. Coexisting intracranial atherosclerosis accentuated the effect of extracranial atherosclerosis on increases in total and periventricular WMH volumes, whereas intracranial atherosclerosis alone did not affect WMH volumes.

Conclusions: Hemodynamic compromise may be a key factor linking carotid atherosclerosis and WMH, mainly affecting the periventricular white matter.


A
Total WMH volume (%)
0.007
<0.001
0.091
4.0
2.0
1.0
0.5
0.0
Normal
Plaque without stenosis
Anatomic stenosis
Hemodynamic stenosis
B
Periventricular WMH volume (%)
0.010
<0.001
0.050
4.0
2.0
1.0
0.5
0.0
Normal
Plaque without stenosis
Anatomic stenosis
Hemodynamic stenosis
C
Subcortical WMH volume (%)
0.69
0.11
0.83
2.0
1.0
0.5
0.0
Normal
Plaque without stenosis
Anatomic stenosis
Hemodynamic stenosis

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Nursing Symposium.

| 좌 장 |

박태환 (서울의료원 신경과), **조아현** (가톨릭의대 신경과)

Blood pressure control and fluid management in acute stroke

정 혜 선

충남의대 신경과

In the treatment of acute stroke, blood pressure control is crucial for maintaining cerebral blood flow. Additionally, hypovolemia in stroke patients can lead to decreased cerebral blood flow and should be corrected rapidly. This lecture aims to explore the goals of blood pressure control in patients with acute stroke and the rationale behind them, as well as to explore optimal fluid resuscitation strategies to correct hypovolemia and improve patient outcome.

Stroke scales (NIHSS, mRS..등)

안 상 준

가톨릭관동의대 신경과

Background: Stroke remains a leading cause of disability and mortality worldwide, presenting an urgent need for prompt and accurate assessment to guide therapeutic decisions and prognostication. Nurses play a pivotal role in the initial assessment and ongoing management of stroke patients. Mastery of stroke assessment scales, including the National Institutes of Health Stroke Scale (NIHSS) and the Modified Rankin Scale (mRS), is essential for enhancing patient outcomes and streamlining care processes. This lecture aims to equip nurses with a comprehensive understanding of various stroke scales, with a focus on NIHSS and mRS, enhancing their competence in stroke assessment and contributing to improved patient care.

Objectives: To elucidate the importance of stroke scales in the clinical setting and their impact on patient outcomes. To provide a detailed overview of the NIHSS and mRS, including their components and application. To demonstrate the practical use of NIHSS and mRS in assessing stroke severity, progression, and recovery.

Methods: The lecture will employ a mix of neurological scale teaching and real cases. Participants will take lectures that can be used in the clinical field through education and case application of neurological scale.

Results: Nurses will gain a deep understanding of the NIHSS and mRS scales, enabling them to accurately assess stroke patients and effectively contribute to the multidisciplinary team's efforts. Enhanced knowledge and application of these scales are expected to lead to improved patient assessment, more tailored interventions, and better-informed prognostic discussions, ultimately improving stroke care and patient outcomes.

Conclusion: Stroke scales such as NIHSS and mRS are indispensable tools in the nursing management of stroke patients. This lecture will provide nurses with the knowledge and skills necessary to proficiently use these scales. By integrating these tools into their practice, nurses will significantly contribute to the multidisciplinary care team, enhancing patient assessment, care planning, and outcome evaluation in stroke patients.

Keywords: Stroke Scales, NIHSS, mRS, Nursing, Stroke Assessment, Patient Outcomes, Stroke Management.

Brain MRI/A, CTA and perfusion imaging

이 상 헌

고려의대 신경과

Background: The primary objective in managing acute cerebral infarction is twofold: to definitively diagnose the presence or absence of cerebral infarction and to revive reversible ischemic brain tissue, whose functionality can be restored upon unblocking the obstructed blood vessel. Consequently, accurately identifying reversible ischemic brain tissue stands as a pivotal aspect of treatment. Modern medical practice heavily relies on brain imaging tests to gauge the extent of cerebral infarction.

Methods: Prominent imaging modalities employed in clinical settings include magnetic resonance imaging (MRI) / magnetic resonance angiography (MRA), computed tomography (CT) / computed tomography angiography (CTA), and MR perfusion / CT perfusion. In line with this, the study endeavored to explore the characteristics and clinical utility of each imaging method by analyzing patient cases.

Results: In CT imaging, the degree of tissue absorption determines image brightness, with higher absorption yielding brighter images and lower absorption resulting in darker images. This property is quantified by the Hounsfield number, a relative value calculated through a multiplication factor. CT scans are the quickest and most readily available images for stroke patients, facilitating the diagnosis of acute cerebral hemorrhage and guiding initial antithrombotic treatment. In MR diffusion-weighted imaging (DWI), water molecule movement, a key indicator, varies under different conditions. Severe restriction in water molecule diffusion within lesion fluid compared to normal brain tissue manifests as a stronger signal on DWI, making it highly sensitive in detecting brain damage caused by cerebral infarction. DWI, based on the T2WI SE EPI technique, produces images of varying b values, including b(0) DWI, b(1000) DWI, and Apparent diffusion coefficient map. Fluid attenuated inversion recovery technique effectively suppresses cerebrospinal fluid signal, highlighting intravascular signal changes due to slowed blood flow in cerebral cortical blood vessels. It sensitively reveals cortical signal changes often overlooked in T2WI. Perfusion abnormalities are identified through parameters like T0 (time to arrival), Time to peak (TTP), Mean transit time (MTT), Cerebral blood volume (CBV), and Cerebral blood flow (CBF). These parameters aid in discerning vascular occlusion and collateral blood flow, with TTP particularly sensitive to occlusion and MTT providing clear delineation of perfusion abnormalities. MR perfusion offers high-resolution images and detailed soft tissue contrast, with recent advancements minimizing the need for contrast agents, utilizing endogenous MR Perfusion techniques like Magnetization Transfer techniques. Perfusion CT, often performed concurrently with emergency CT to rule out cerebral hemorrhage, swiftly generates images, guiding the treatment course for acute ischemic cerebral infarction.

Conclusions: In the contemporary medical field, imaging diagnosis plays a paramount role in definitively diagnosing cerebral infarction and tailoring appropriate treatment. It's imperative to select the optimal imaging test based on the patient's condition and interpret results accurately, as this significantly influences treatment strategies for cerebral infarction patients.

Stroke medications

김 형 준

성균관의대 신경과

Cerebral infarction, a major cause of disability and mortality worldwide, arises from various etiologies, necessitating a nuanced approach to pharmacological treatment. This review explores current therapeutic strategies tailored to the underlying causes of cerebral infarction, including large artery atherosclerosis, small artery occlusion, cardio-embolism, cancer related stroke, and cerebral venous thrombosis.

For secondary prevention, antiplatelet agents such as aspirin alone, clopidogrel, or the combination of aspirin with dipyridamole are recommended to prevent recurrent strokes. Dual antiplatelet therapy (DAPT) with aspirin and clopidogrel may be used for a short period (usually around 21 days to 3 months) after a stroke or transient ischemic attack (TIA), especially in cases of high risk of recurrence. Statins are also prescribed to lower cholesterol levels, stabilize atherosclerotic plaques, and reduce the risk of stroke. High-intensity statin therapy is often recommended following a stroke or TIA due to atherosclerosis. Stroke prevention medications for atrial fibrillation (AF) focus primarily on anticoagulation to prevent the formation of blood clots that can lead to stroke. The choice of anticoagulant is influenced by the patient's risk factors, the presence of contraindications, and the potential for drug-drug interactions. There are the DOACs of dabigatran, rivaroxaban, apixaban, and edoxaban, and vitamin K antagonists such as warfarin. For non-valvular AF, DOACs are preferred because they are safer and similar or better efficacy has been observed compared to warfarin. Cancer-related stroke, or stroke occurring in patients with cancer, involves complex mechanisms such as hypercoagulability, nonbacterial thrombotic endocarditis, tumor emboli, and treatment-related factors. LMWH, such as enoxaparin, is often the first-line treatment for cancer-associated thrombosis, including venous thromboembolism (VTE) and, by extension, its role in stroke prevention in cancer patients. LMWH is preferred over oral anticoagulants due to its predictable pharmacokinetics, reduced risk of bleeding in certain cancer populations, and not requiring routine blood monitoring.

Understanding the action of stroke medications and appropriate medication based on stroke etiology is critical for secondary prevention of stroke.

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Symposium 3.

| 좌 장 |

이병철 (한림의대 신경과)

Potential benefit of Cilostazol: From small vessel disease to post-stroke cognitive impairment

이 민 우

한림의대 신경과

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Symposium 4.

| 좌 장 |

김종성 (울산의대 신경과)

Clinical evidence of Ginkgo biloba ext. in patients with cognitive decline

박 희 권

인하의대 신경과

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Scientific Session 2.

| 좌 장 |

김대현 (동아의대 신경과), **권형민** (서울의대 신경과)

Efficacy and safety of visual perceptual learning-based digital therapeutics (VIVID Brain) for treating post-stroke visual field defects: A prospective multicenter randomized controlled trial

Eun Namgung[1], Bum Joon Kim[2], Jee Hyun Kwon[3], Moon-Ku Han[4], Hahn Young Kim[5], Jin-Man Jung[6], Jaseong Koo[7], Keun-Sik Hong[8], Jae Guk Kim[9], Kwang-Yeol Park[10], Kyung-Ho Yu[11], A-Hyun Cho[12], Jun Young Chang[2], Jeong Jin Park[5], Hee-Joon Bae[4], Sun U. Kwon[2], Byung Joo Lee[13], Moonju Cho[14], Gyeong-Moon Kim[15], Dong-Wha Kang[2,14]

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Purpose: Visual field defects (VFDs) are a devastating poststroke complication characterized by unseen parts of visual field. Visual perceptual learning, enhanced visual performance through repetitive training, may restore VFDs in chronic stroke, but its responsiveness differs by each person. In this multicenter, randomized controlled trial, we aimed to investigate the efficacy and safety of a personalized visual perceptual learning-based digital therapeutics using the virtual reality (VIVID Brain) for treating post-stroke VFDs.

Methods: Stroke outpatients with VFDs after three months poststroke were enrolled and randomized into VIVID Brain training or control groups. The VIVID Brain training group received a personalized visual discrimination training, consisting of orientation and rotation directions, through a virtual reality head mounted display device, five days a week for twelve weeks involving 360 trials per day, while the control group did not. The two groups received VFD assessments using Humphrey Visual Field (HVF) tests at baseline and 12-week follow-up. The final analysis included 81 patients who completed the study (VIVID Brain training, n=41; control n=41). The efficacy measures included improved visual area (sensitivity $\geq$ 6dB) and changes in the HVF scores during the 12-week period.;

Results: With high compliance rate, the VIVID Brain training led to clinically meaningful improvement in the whole field (mean 194 degrees2) and defective hemifield (mean 159 degrees2), surpassing those in the control group (whole field, P=0.003; defective

hemifield, P=0.002). The 12-week improvement in the HVF scores was significantly greater in the training group than in the control group (whole field, P=0.031; defective hemifield, P=0.011). According to within-group analyses, the HVF scores improved after 12 weeks in the training group (whole field, P=0.005; defective hemifield, P=0.001), but not in the control group (whole field, P=0.880; defective hemifield, P=0.835).

Conclusions: The current trial underscores the potential efficacy of our tailored virtual-reality based digital therapeutics, leveraging visual perceptual learning, as a non-invasive treatment for stroke-induced VFDs. Our newly developed VIVID Brain software showed clinically significant improvement in both whole and defective visual fields of poststroke VFDs.

Smartphone-based speech therapy for post-stroke dysarthria: A pilot randomized controlled trial evaluating efficacy and feasibility

Tae-Jin Song[1]

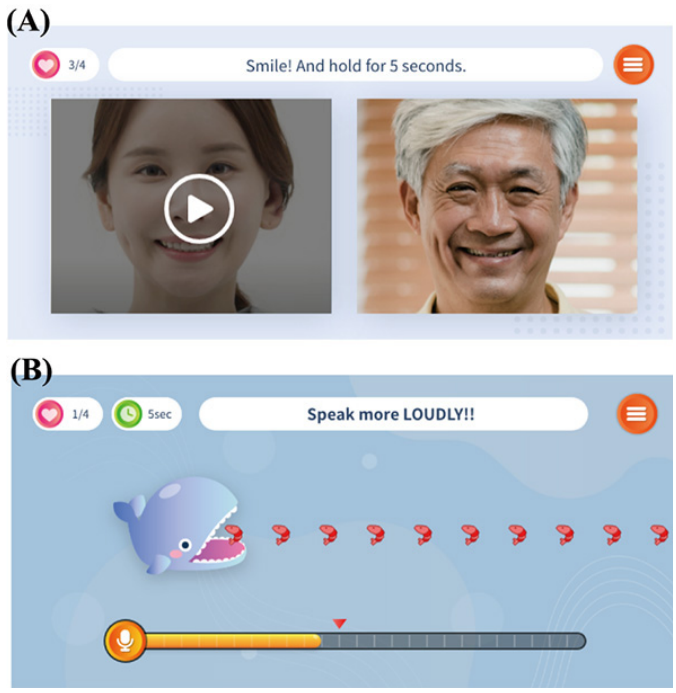
[1]Neurology, Ewha University College Of Medicine, Seoul, Korea

Purpose: Dysarthria is a common post-stroke speech disorder affecting communication and psychological well-being. Traditional speech therapy is effective but often poses challenges in terms of accessibility and patient adherence. Emerging smartphone-based therapies may offer promising alternatives for the treatment of post-stroke dysarthria.;This study aimed to assess the efficacy and feasibility of smartphone-based speech therapy for improving speech intelligibility in patients with acute and early subacute post-stroke dysarthria. This study also explored the impact of the intervention on psychological well-being, user experience, and overall feasibility in a clinical setting.

Methods: Participants were divided into two groups for this randomized, evaluator-blinded trial. The intervention group used a smartphone-based speech therapy application for one hour per day, five days per week, for four weeks, with guideline-based standard stroke care. The control group received standard guideline-based stroke care and rehabilitation. Speech intelligibility, psychological well-being, quality of life, and user acceptance were assessed using repeated-measures Analysis of variance.

Results: In this study, 40 patients with post-stroke dysarthria were enrolled, 32 of whom completed the trial (16 in each group). The intervention group showed significant improvements in speech intelligibility compared with the control group. This was evidenced by improvements from baseline ($F_{1, 30} = 34.35$; $P < .001$), between-group differences ($F_{1, 30} = 6.18$; $P = .02$), and notable time-by-group interactions ($F_{1, 30} = 6.91$; $P = .01$). Regarding secondary outcomes, the intervention led to improvements in the percentage of correct consonants over time ($F_{1, 30} = 5.57$; $P = .03$). In addition, significant reductions were noted in the severity of dysarthria in the intervention group over time ($F_{1, 30} = 21.18$; $P < .001$), with a pronounced group effect ($F_{1, 30} = 5.52$; $P = .03$) and time-by-group interaction ($F_{1, 30} = 5.29$; $P = .03$). Regarding quality of life, significant improvements were observed as measured by three-level EuroQol five-dimensional questionnaire ($F_{1, 30} = 13.25$; $P < .001$) and EuroQol visual analog scale ($F_{1, 30} = 7.74$; $P = .009$) over time. The adherence rate to the smartphone-based application was 64%, with over half of the participants completing all the sessions. The usability of the application was rated high (system usability score=80.78). In addition, the intervention group reported increased self-efficacy in using the application compared with the control group ($F_{1, 30} = 10.81$; $P = .003$).m

Conclusions: The smartphone-based speech therapy application significantly improved speech intelligibility, articulation, and quality of life in patients with post-stroke dysarthria. These findings indicate that smartphone-based speech therapy can be a useful assistant device in the management of post-stroke dysarthria, particularly in the acute and early subacute stroke stages (ClinicalTrials.gov NCT05146765).


(A)
3/4
Smile! And hold for 5 seconds.
(B)
1/4
5sec
Speak more LOUDLY!!

Characteristics of high-performance low-volume hospitals in acute stroke care

Han-Yeong Jeong[1], Seong-Eun Kim[2], Kyungbok Lee[3], Jong-Moo Park[4], Hong-Kyun Park[5], Yong-Jin Cho[5], Jun Yup Kim[2], Beom Joon Kim[2], Tae Jung Kim[6], Soo Joo Lee[7], Jonguk Kim[8], Tai Hwan Park[9], Ji Sung Lee[10], Juneyoung Lee[11], Philip B. Gorelick[12], Hee-Joon Bae[2]

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Purpose: The correlation between larger patient volumes and better outcomes in stroke centers is well-established. However, in areas with low population density, stroke patients often rely on low-volume hospitals for timely care. This study aims to evaluate the performance of these hospitals and identify the characteristics that contribute to superior outcomes despite their lower stroke volumes.

Methods: We analyzed data from the 8th assessment of Acute Stroke Quality Assessment Program;in 2018, reimbursement claims, and death certificate records, encompassing 248 hospitals nationwide. Hospitals treating fewer than 100 stroke patients annually were categorized as low-volume. High-performance hospitals were defined as those with a defect-free care rate exceeding 75%. The primary outcome was the 1-year mortality rate.

Results: Among 28,572 patients enrolled, 2,521 (8.8%) were treated in low-volume hospitals. They were primarily general hospitals, mostly located in non-capital areas. None were certified stroke centers. Only 49.2% could provide 24-hour intravenous thrombolysis, and 19.4% offered endovascular thrombectomy. The 1-year mortality rate for acute stroke patients was notably higher in low-volume hospitals (24.8%) compared to high-volume hospitals (17.6%, adjusted $p < 0.01$). Among low-volume hospitals, those identified as high-performance (N=42) exhibited significantly lower 1-year mortality rates (21.1%) compared to their low-performance (N=82) counterparts (26.9%, adjusted $p = 0.036$). No significant differences were observed in the number of hospital beds or annual stroke admissions between high- and low-performance low-volume hospitals. However, a notable difference in the number of physicians, particularly neurologists, was observed ($p = 0.01$).

Conclusions: This study highlights the role of low-volume hospitals in stroke care, especially in regions with limited access to larger hospitals and suggests that improvements in performance, including human resources, may contribute to improving patient outcomes.

Reduced alcohol consumption and major adverse cardiovascular events among individuals with previously high alcohol consumption

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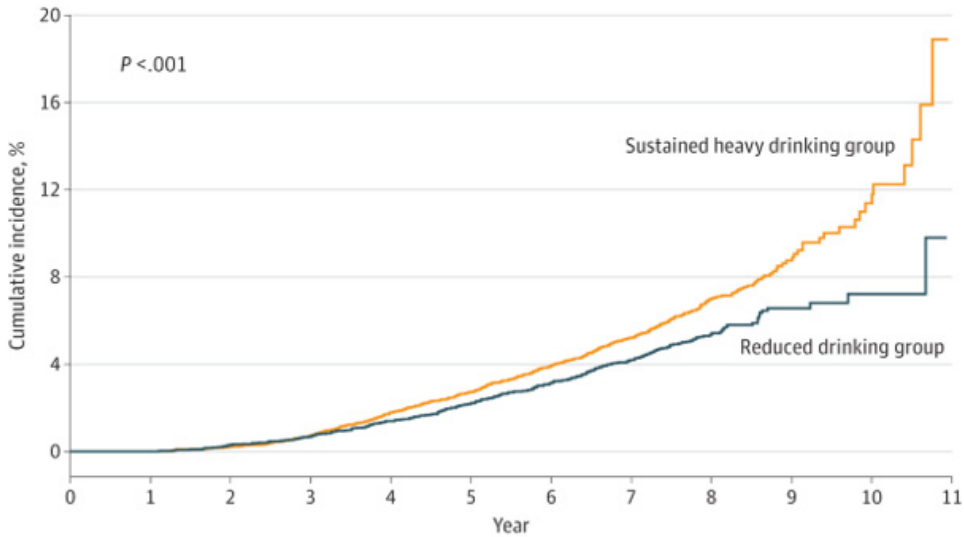
Purpose: To investigate the association between reduced alcohol consumption and risk of major adverse cardiovascular events (MACEs) in individuals who drink heavily across different CVD subtypes.

Methods: This cohort study analyzed data from the Korean National Health Insurance Service–Health Screening database and self-reported questionnaires. The nationally representative cohort comprised Korean citizens aged 40 to 79 years who had national health insurance coverage on December 31, 2002, and were included in the 2002 to 2003 National Health Screening Program. People who drank heavily who underwent serial health examinations over 2 consecutive periods (first period: 2005-2008; second period: 2009-2012) were included and analyzed between February and May 2023. Heavy drinking was defined as more than 4 drinks (56 g) per day or more than 14 drinks (196 g) per week for males and more than 3 drinks (42 g) per day or more than 7 drinks (98 g) per week for females.;Habitual change in heavy alcohol consumption during the second health examination period. People who drank heavily at baseline were categorized into 2 groups according to changes in alcohol consumption during the second health examination period as sustained heavy drinking or reduced drinking.;The primary outcome was the occurrence of MACEs, a composite of nonfatal myocardial infarction or angina undergoing revascularization, any stroke accompanied by hospitalization, and all-cause death.

Results: Of the 21 011 participants with heavy alcohol consumption at baseline (18 963 males [90.3%]; mean [SD] age, 56.08 [6.16] years) included in the study, 14 220 (67.7%) sustained heavy drinking, whereas 6791 (32.2%) shifted to mild to moderate drinking. During the follow-up of 162 378 person-years, the sustained heavy drinking group experienced a significantly higher incidence of MACEs than the reduced drinking group (817 vs 675 per 100 000 person-years; log-rank;P = .003). Reduced alcohol consumption was associated with a 23% lower risk of MACEs compared with sustained heavy drinking (propensity score matching hazard ratio [PSM HR], 0.77; 95% CI, 0.67-0.88). These benefits were mostly accounted for by a significant reduction in the incidence of angina (PSM HR, 0.70; 95% CI, 0.51-0.97) and ischemic stroke (PSM HR, 0.66; 95% CI, 0.51-0.86). The preventive attributes of reduced alcohol intake were consistently observed across various subgroups of participants.

Conclusions: Results of this cohort study suggest that reducing alcohol consumption is associated with a decreased risk of future CVD, with the most pronounced benefits expected for angina and ischemic stroke.



No. at risk

Sustained group	6791	6791	6777	6742	6670	6606	6525	6406	2404	632	221
Reduced group	6791	6791	6771	6744	6696	6643	6578	6467	2235	537	185

Contemporary insights of stroke care from Korean multicenter stroke registry

Do Yeon Kim[1], Tai Hwan Park[2], Yong-Jin Cho[3], Jong-Moo Park[4], Kyung Bok Lee[5], Minwoo Lee[6], Juneyoung Lee[7], Hyung Seok Guk[1], Joon-Tae Kim[8], Byung-Chul Lee[6], Soo Joo Lee[9], Jee-Hyun Kwon[10], Jun Lee[11], Dong-Ick Shin[12], Jay Chol Choi[13], Kyusik Kang[14], Dong-Eog Kim[15], Sung-Il Sohn[16], Chulho Kim[17], Hee-Joon Bae[1]

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Purpose: Contemporary stroke care trends are critical for health policy, resource allocation, and research. This study utilizes the Clinical Research Collaborations for Stroke in Korea- National Institute for Health (CRCS-K-NIH) registry to provide up-to-date contemporary insights, aiming to inform stroke care improvements.

Methods: The CRCS-K-NIH is a nationwide stroke registry established in 2008 and has collected acute ischemic stroke (AIS) patients from 18 stroke centers across Korea in 2021. The registry ensures data fidelity through web-based registration, informed consent, regular registrar training, and data quality audits.

Results: In 2021, 8,855 AIS and TIA cases were newly registered and the total number of AIS and TIA cases became 95,492 from 2008 to 2021. The study revealed a higher male-to-female sex ratio (1.5) in Korea compared to the US and Sweden, with a mean patient age (men, 67 years; women, 73 years) slightly lower than Japan but similar to the US. Hypertension was the most common risk factor (67%) similar to other countries, and relatively higher prevalence of diabetes (35%) and current smoking (21%) were observed that he need for improved smoking cessation efforts are noted. The lower atrial fibrillation (AF) prevalence (19%) than that of Western countries and stable proportion in 2021 despite an aging population suggested effective primary prevention. Among stroke subtypes, the high proportion of large artery atherosclerosis (38%) was observed, possibly due to prevalent intracranial arterial disease in East Asians and advanced vessel imaging techniques. Compared to other countries, intravenous thrombolysis (IVT) rate (12% in 2017-2019) was relatively low and was accelerated by COVID-19 pandemic in 2021 (10%). Delayed door-to-puncture time (108 minutes) and center disparity were noted that urgent action is needed. In 2021, aspirin plus clopidogrel

for minor stroke (64%) and direct oral anticoagulation (DOAC) for AF patients (78%) were actively implemented, however the further investigation on increased usage of DOAC in non-AF cardioembolic stroke is needed. The proportion of early neurological deterioration (13%), and cumulative incidence of recurrent stroke at 3 months (3%) were similar to other countries.r

Conclusions: This study's findings provide essential insights into the current state of stroke care in Korea, highlighting progress and identifying challenges within the context of updated clinical guidelines and external factors like the pandemic. The data underscore the importance of ongoing, real-world data collection to guide policy and clinical practice towards enhancing stroke care outcomes.

Temporal trends in public stroke awareness in Korea, 2009-2023

Eung-Joon Lee[1], Min Kyoung Kang[2], Han-Yeong Jeong[1], Keun-Hwa Jung[1]

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Purpose: The time delay between stroke symptom onset and hospital presentation is a major factor that hinders the use of thrombolysis in Korea and still has not improved significantly. This may be related to poor recognition of stroke risk factors (RF) and symptoms, or to a lack of awareness of time-sensitive stroke treatments. We describe the public knowledge of the appropriate response after a stroke, as well as changes over time in knowledge of stroke warning signs (WS) and RF.

Methods: A total of 1,000 and 1,012 Survey respondents were randomly sampled according to regional demographic characteristics in 2009 and 2023, respectively. They were asked structured, open-ended, and close-ended questions to assess stroke awareness. Temporal trends in WS/RF knowledge were analyzed using logistic regression adjusting for age, sex, education, income, and vascular risk factors (VRF).

Results: In 2023, 48.9% of participants (495/1,012) said they would call 911 if they experienced stroke symptoms, compared with 32.5% (325/1,000) in 2009. Multivariate logistic analysis showed that younger age (20-39 years, adjusted odds ratio [aOR] 0.42, p<0.001) and unhealthy behaviors (aOR 0.72, p=0.021) were significantly negatively associated with the appropriate response after stroke onset. In 2023, 40.4% of participants (409/1,012) could name ≥2 WS, compared with 37.8% (378/1,000) in 2009 (p=0.230). While there was an overall increase in WS knowledge, a significant decrease was observed among participants earning more than $30,000 per year (interaction p=0.011) and those without a VRF (interaction p<0.001). In 2023, 40.2% of participants (407/1,012) knew ≥2 RF, compared with 51.4% (514/1,000) in 2009 (p<0.001). This decline in RF knowledge was disproportionately larger in participants with VRF (aOR of 0.33 for knowledge in 2023 compared with 2009 in participants with VRF, p=0.034 for the interaction between VRF and study year). Furthermore, in terms of sources of information, television (59.1%) and newspapers/magazines (33.1%) were the most common in 2009, whereas in 2023 the internet (63.0%) and television (48.5%) were the most common.

Conclusions: Public awareness of the appropriate response following the onset of stroke symptoms is better than in 2009, but still suboptimal. Awareness of stroke RF was rather lacking in high-risk groups. Appropriate targeting of vulnerable groups and consideration of communication methods are essential to improve public stroke awareness.

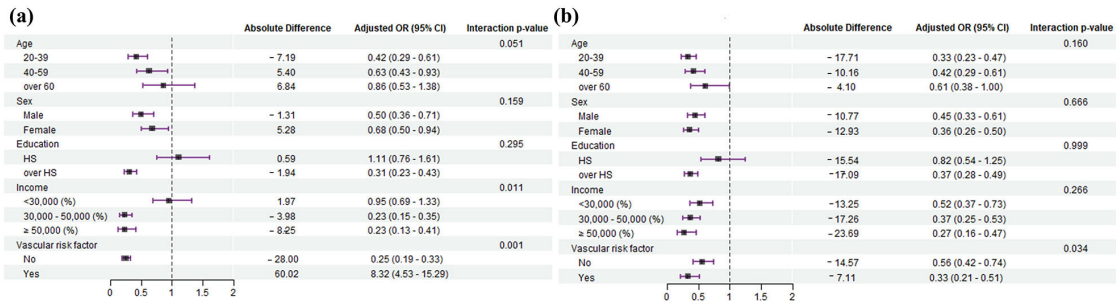

Figure 1. Changes in stroke warning sign (A) and risk factor (B) knowledge in 2023 versus 2009 by demographics.

Abbreviations: OR, odds ratio; CI, confidence interval; HS, highschool;

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| **Room B** |

전공의 발표

| 좌 장 |

조아현 (가톨릭의대 신경과)

Impact of systolic blood viscosity on deep white matter hyperintensities in acute ischemic stroke patients

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Purpose: Elevated blood viscosity (BV), a critical determinant in blood rheology, is a contributing factor in cerebrovascular diseases. The specific influence of BV on small vessel disease burden remains unexplored. This study aims to examine the relationship between BV and regional white matter hyperintensity (WMH) volume in patients with acute ischemic stroke (AIS). ;

Methods: We enrolled a cohort of 302 patients with acute ischemic stroke (AIS) or transient ischemic attack who were admitted to a hospital within 7 days of symptom onset in this study. We measured whole BV using a scanning capillary-tube viscometer and categorized systolic blood viscosity (SBV) into three groups based on established references. We quantified and normalized WMH volumes utilizing automated localization and segmentation software by NEUROPHET Inc. We performed multivariable logistic regression analysis to assess the correlation between SBV and WMH.

Results: The mean subject age was 66.7±13.4 years, and 38.7% (n = 117) of the participants were female. Among a total of 302 patients, patients with higher deep WMH volume (T3) were typically older and had an atrial fibrillation, strokes of cardioembolic or undetermined etiology, elevated levels of C-reactive protein (CRP), diastolic blood viscosity and SBV. A multivariable adjustment revealed a significant association between high SBV and increased deep-WMH volume (OR 2.846, 95% CI; 1.352-5.990).

Conclusions: Elevated SBV is more likely to be associated with deep WMH volume in patients with AIS. These findings reveal novel therapeutic strategies focusing on blood rheology to enhance cerebral microcirculation in stroke management.

Increased infarct volume is associated with poor functional recovery independent of early neurological deterioration

Jeongmin Cha[1], Nakhoon Kim[1], Yoona Ko[1], Dong-Wan Kang[1,2], Wi Sun Ryu[3], Jun Yup Kim[1,4], Moon Ku Han[1,4], Hee-Joon Bae[1,4], Beom Joon Kim[1,4]

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Purpose: To investigate the kinetics association betweenof Diffusion-Weighted Imaging (DWI) lesion dynamicss in Acute Ischemic Stroke (AIS) patients and experiencing early neurological deterioration (END) or subsequent functional recuperation.

Methods: Consecutive AIS patients admitted between January 2011 and December 2022 were collected from a prospective stroke registry (Figure 1). END, defined as measurable worsening of neurological function within three weeks post-onset, was systematically monitored. Initial and follow-up DWI scans were performed, with the lesion volumes automatically quantified using the JBS-01K (JLK Inc., Korea). Multivariable models were constructed to analyze the associations between infarct volume change and functional recovery or END using ordinal logistic or quantile regression models, adjusting for covariates.

Results: Among 4207 patients, 13.2% (n=557) encountered END. The median absolute initial and follow-up DWI lesion volumes were greater in the END group. Moreover, the median DWI lesion volume changes were significantly higher in the END versus the non-END group (Table 1). Associations with END were observed for the 25th percentile (OR coefficient from quantile regression 0.53; 95% CI, 0.30299 − 0.77), 50th percentile (OR 1.39; 95% CI 1.05-1.74), and 75th percentile (OR 3.42; 95% CI, 2.47 − 4.36) of DWI lesioninfarct volume differences change (Figure 2). Furthermore, the study highlightedWe documented that AIS patients, experiencing a DWI volume increase was associated with poorer functional recovery at 3 months after stroke in the relative increse of 25-50 percentle (21.4 − 80.5%; common OR, 1.48 [95% CI, 1.18 − 1.86], 50 − 75 percentile (80.5 − 222.5%; 1.77 [1.41 − 2.22], 75 − 90 pct (222.5 − 700.4%; 1.91 [1.49 − 2.57]) and ≥ 90 percentile (≥700.4, 1.95 [1.49-2.57) compared to the group of 10 − 25 percentilebeyond the 75th;percentile (>XX % from the baseline), wereas associated with poorer functional recovery at 3 months after stroke [common OR, 1.314.32; 95% CI, 1.05 − 1.643.63-5.14], irrespective of the occurrence of END.

Conclusions: An increase of;infarction volume is strongly associated with early neurological deterioration and functional recovery after an ischemic stroke.

Figure 1: Study profile

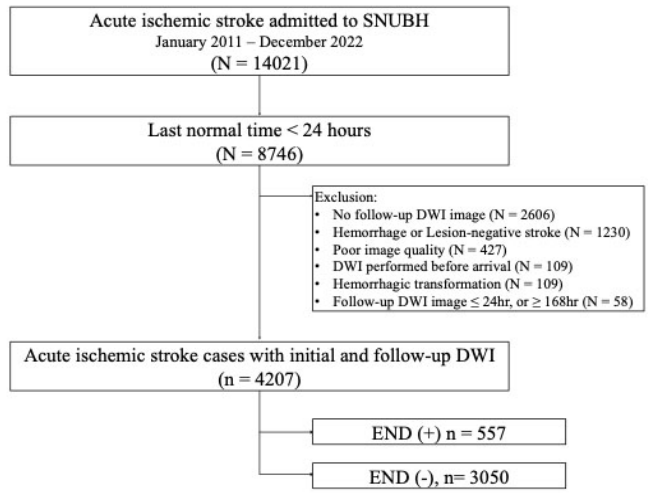
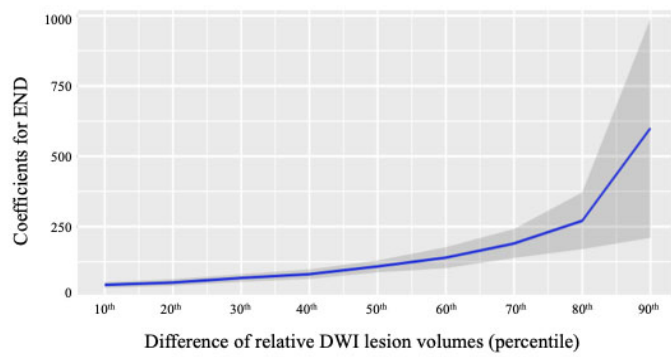


Table 1: Baseline Characteristics

Variables	END (-)	END (+)	p-value
Case (n)	3650	557	
Demographic characteristics			
Age (mean (SD))	68.52 (13.58)	69.58 (12.58)	0.09
Male (%)	2261 (61.9)	325 (58.3)	0.12
Initial NIHSS (median [IQR])	4.00 [1.00, 8.00]	5.00 [2.00, 9.00]	<0.01
TOAST classification (%)			<0.01
Large artery atherosclerosis	1284 (35.2)	268 (48.1)	
Small vessel disease	618 (16.9)	76 (13.6)	
Cardioembolism	1004 (27.5)	114 (20.5)	
Other/Un-determined etiology	744 (20.4)	99 (17.8)	
Vascular risk factors			
Hypertension (%)	2546 (69.8)	391 (70.2)	0.87
DM (%)	1149 (31.5)	196 (35.2)	0.09
Hyperlipidemia (%)	1407 (38.5)	198 (35.5)	0.19
Atrial fibrillation (%)	896 (24.5)	109 (19.6)	0.01
Smoking (%)	1362 (37.3)	200 (35.9)	0.56
Fuctional outcomes			
Initial DWI volume, mL (median [IQR])	0.96 [0.28, 4.94]	1.09 [0.37, 5.17]	0.03
Follow-up DWI volume, mL (median [IQR])	2.14 [0.56, 11.07]	4.19 [1.40, 20.19]	<0.01
DWI volume difference (median [IQR])	0.71 [0.09, 4.99]	2.33 [0.73, 11.46]	<0.01
mRS score 0 or 1 at 3 months (%)	2218 (61.0)	148 (26.7)	<0.01

Figure 2: END and the Change of DWI Lesions



Under-management of stroke risk factors in young age population

Yoona Ko[1], Beom Joon Kim[1], Kyusik Kang[2], Soo Joo Lee[3], Jae-Kwan Cha[4], Tai-Hwan Park[5], Kyungbok Lee[6], Jun Lee[7], Keun-Sik Hong[8], Byung-Chul Lee[9], Dong-Eog Kim[10], Man-Seok Park[11], Jay Chol Choi[12], Jee Hyun Kwon[13], Dong-Ick Shin[14], Sung-Il Sohn[15], Chulho Kim[16], Kwang-Yeol Park[18], Kyungmi Oh[17], Heejoon Bae[1]

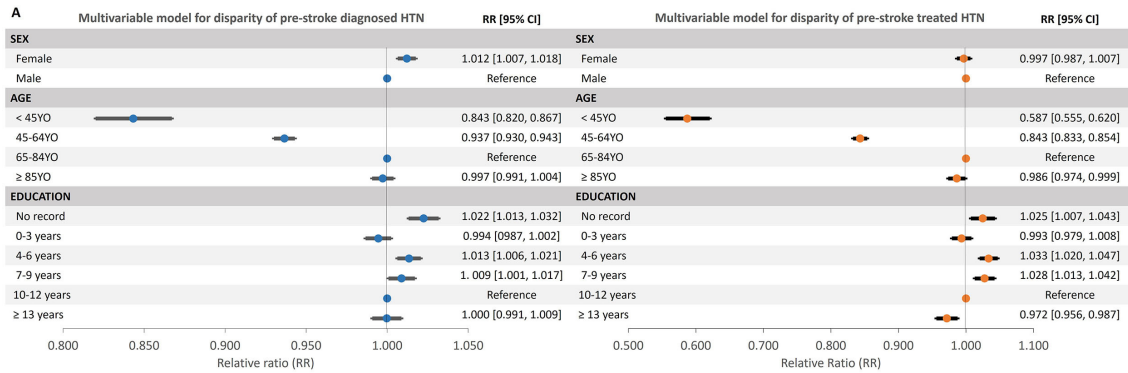
[1]Neurology, Seoul National University Bundang Hospital, SeongNam, Korea, [2]Neurology, Nowon Eulji Medical Center, Seoul, Korea, [3]Neurology, Daejeon Eulji Medical Center, Daejeon, Korea, [4]Neurology, Dong-A University Hospital, Busan, Korea, [5]Neurology, Seoul Medical Center, Seoul, Korea, [6]Neurology, Soonchunhyang University Seoul Hospital, Seoul, Korea, [7]Neurology, Yeungnam University Medical Center, Daegu, Korea, [8]Neurology, Inje University Ilsan Paik Hospital, Goyang, Korea, [9]Neurology, Hallym University Sacred Heart Hospital, Anyang, Korea, [10]Neurology, Dongguk University Ilsan Hospital, Goyang, Korea, [11]Neurology, Chonnam National University Hospital, Gwangju, Korea, [12]Neurology, Jeju National University Hospital, Jeju, Korea, [13]Neurology, Ulsan University Hospital, Ulsan, Korea, [14]Neurology, Chungbuk National University Hospital, Cheongju, Korea, [15]Neurology, Keimyung University Dongsan Hospital, Daegu, Korea, [16]Neurology, Hallym University Chuncheon Sacred Heart Hospital, Gangwon-Do, Korea, [17]Neurology, Korea University Guro Hospital, Seoul, Korea, [18]Neurology, Chung-Ang University Hospital, Seoul, Korea

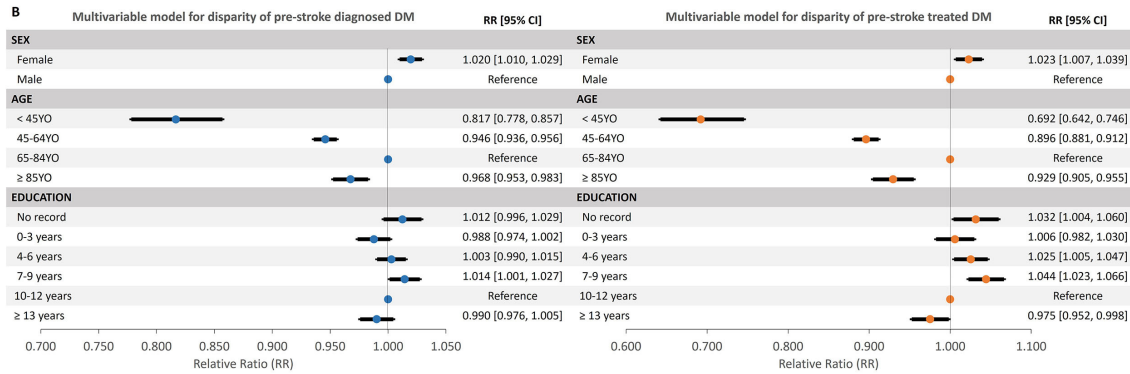
Purpose: The proportion of young age stroke patients is increasing.;However, the contributing factors are not yet clearly understood.

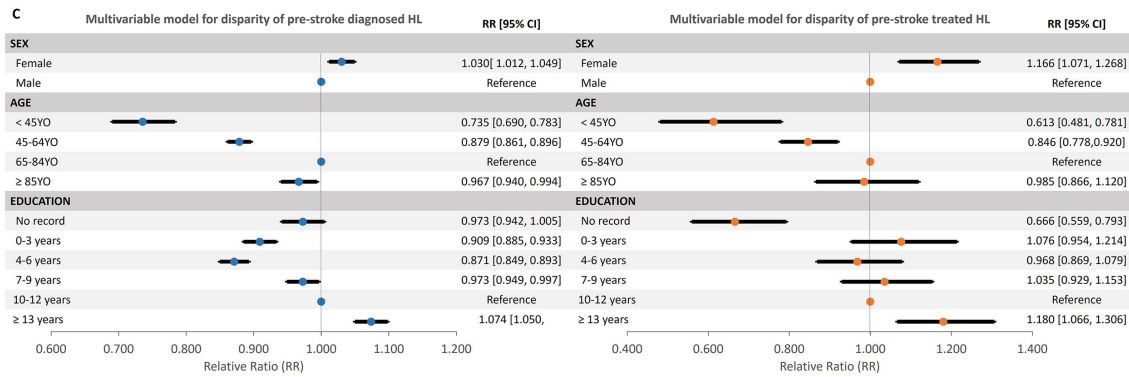
Methods: A prospective, multicenter, nationwide stroke registry (CRCS-K) was utilized to analyze acute stroke admissions during the years 2008 to 2022. The major risk factors for stroke, hypertension, diabetes, dyslipidemia, and atrial fibrillation were selected and analyzed for diagnosis and treatment prior to stroke onset. Poisson regression models with double sandwich variance estimators were used to examine the associations between baseline characteristics and the diagnosis or treatment of major risk factors before the index stroke, adjusted for relevant covariates.

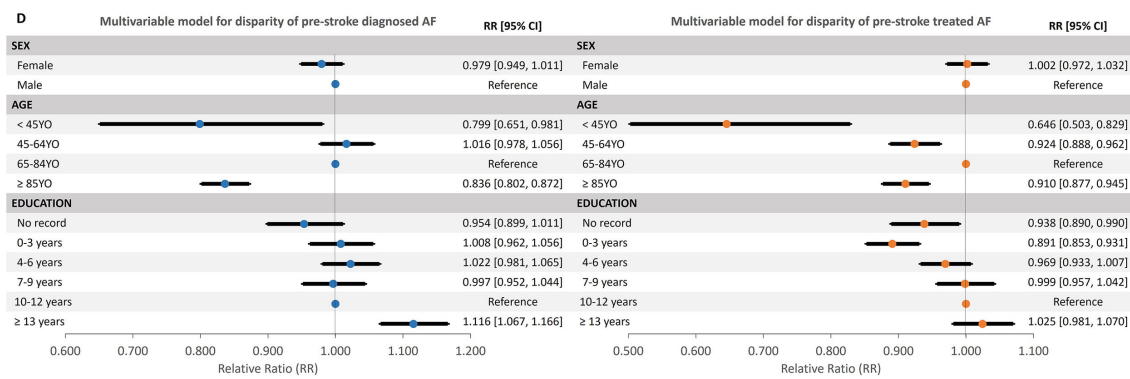
Results: A total of 96,855 admissions with acute ischemic stroke were included in this study. Major risk factors were diagnosed before the index stroke in 91% for hypertension, 88% for diabetes, 67% for hyperlipidemia, and 52% for atrial fibrillation. Stroke risk factors were treated before the index stroke in 76% for hypertension, 73% for diabetes, 10% for hyperlipidemia and 24% for atrial fibrillation. Younger stroke patients with less than 45 years old are consistently less likely to be diagnosed and treated for all the selected major stroke risk factors (see Figure).

Conclusions: Our study confirms that younger stroke patients tend not to receive the necessary diagnosis and treatment before the stroke. A targeted medical approach is warranted to prevent stroke at a younger age of onset.


A
Multivariable model for disparity of pre-stroke diagnosed HTN
RR [95% CI]
SEX
Female 1.012 [1.007, 1.018]
Male Reference
AGE
< 45YO 0.843 [0.820, 0.867]
45-64YO 0.937 [0.930, 0.943]
65-84YO Reference
≥ 85YO 0.997 [0.991, 1.004]
EDUCATION
No record 1.022 [1.013, 1.032]
0-3 years 0.994 [0987, 1.002]
4-6 years 1.013 [1.006, 1.021]
7-9 years 1. 009 [1.001, 1.017]
10-12 years Reference
≥ 13 years 1.000 [0.991, 1.009]
0.800 0.850 0.900 0.950 1.000 1.050
Relative ratio (RR)
Multivariable model for disparity of pre-stroke treated HTN
RR [95% CI]
SEX
Female 0.997 [0.987, 1.007]
Male Reference
AGE
< 45YO 0.587 [0.555, 0.620]
45-64YO 0.843 [0.833, 0.854]
65-84YO Reference
≥ 85YO 0.986 [0.974, 0.999]
EDUCATION
No record 1.025 [1.007, 1.043]
0-3 years 0.993 [0.979, 1.008]
4-6 years 1.033 [1.020, 1.047]
7-9 years 1.028 [1.013, 1.042]
10-12 years Reference
≥ 13 years 0.972 [0.956, 0.987]
0.500 0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)


B
Multivariable model for disparity of pre-stroke diagnosed DM
RR [95% CI]
SEX
Female 1.020 [1.010, 1.029]
Male Reference
AGE
< 45YO 0.817 [0.778, 0.857]
45-64YO 0.946 [0.936, 0.956]
65-84YO Reference
≥ 85YO 0.968 [0.953, 0.983]
EDUCATION
No record 1.012 [0.996, 1.029]
0-3 years 0.988 [0.974, 1.002]
4-6 years 1.003 [0.990, 1.015]
7-9 years 1.014 [1.001, 1.027]
10-12 years Reference
≥ 13 years 0.990 [0.976, 1.005]
0.700 0.750 0.800 0.850 0.900 0.950 1.000 1.050
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated DM
RR [95% CI]
SEX
Female 1.023 [1.007, 1.039]
Male Reference
AGE
< 45YO 0.692 [0.642, 0.746]
45-64YO 0.896 [0.881, 0.912]
65-84YO Reference
≥ 85YO 0.929 [0.905, 0.955]
EDUCATION
No record 1.032 [1.004, 1.060]
0-3 years 1.006 [0.982, 1.030]
4-6 years 1.025 [1.005, 1.047]
7-9 years 1.044 [1.023, 1.066]
10-12 years Reference
≥ 13 years 0.975 [0.952, 0.998]
0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)


C
Multivariable model for disparity of pre-stroke diagnosed HL
RR [95% CI]
SEX
Female 1.030[1.012, 1.049]
Male Reference
AGE
< 45YO 0.735 [0.690, 0.783]
45-64YO 0.879 [0.861, 0.896]
65-84YO Reference
≥ 85YO 0.967 [0.940, 0.994]
EDUCATION
No record 0.973 [0.942, 1.005]
0-3 years 0.909 [0.885, 0.933]
4-6 years 0.871 [0.849, 0.893]
7-9 years 0.973 [0.949, 0.997]
10-12 years Reference
≥ 13 years 1.074 [1.050,
0.600 0.700 0.800 0.900 1.000 1.100 1.200
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated HL
RR [95% CI]
SEX
Female 1.166 [1.071, 1.268]
Male Reference
AGE
< 45YO 0.613 [0.481, 0.781]
45-64YO 0.846 [0.778,0.920]
65-84YO Reference
≥ 85YO 0.985 [0.866, 1.120]
EDUCATION
No record 0.666 [0.559, 0.793]
0-3 years 1.076 [0.954, 1.214]
4-6 years 0.968 [0.869, 1.079]
7-9 years 1.035 [0.929, 1.153]
10-12 years Reference
≥ 13 years 1.180 [1.066, 1.306]
0.400 0.600 0.800 1.000 1.200 1.400
Relative Ratio (RR)


D
Multivariable model for disparity of pre-stroke diagnosed AF
RR [95% CI]
SEX
Female 0.979 [0.949, 1.011]
Male Reference
AGE
< 45YO 0.799 [0.651, 0.981]
45-64YO 1.016 [0.978, 1.056]
65-84YO Reference
≥ 85YO 0.836 [0.802, 0.872]
EDUCATION
No record 0.954 [0.899, 1.011]
0-3 years 1.008 [0.962, 1.056]
4-6 years 1.022 [0.981, 1.065]
7-9 years 0.997 [0.952, 1.044]
10-12 years Reference
≥ 13 years 1.116 [1.067, 1.166]
0.600 0.700 0.800 0.900 1.000 1.100 1.200
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated AF
RR [95% CI]
SEX
Female 1.002 [0.972, 1.032]
Male Reference
AGE
< 45YO 0.646 [0.503, 0.829]
45-64YO 0.924 [0.888, 0.962]
65-84YO Reference
≥ 85YO 0.910 [0.877, 0.945]
EDUCATION
No record 0.938 [0.890, 0.990]
0-3 years 0.891 [0.853, 0.931]
4-6 years 0.969 [0.933, 1.007]
7-9 years 0.999 [0.957, 1.042]
10-12 years Reference
≥ 13 years 1.025 [0.981, 1.070]
0.500 0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)

Association between changes in smoking habits and incident fracture after acute ischemic stroke

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

Purpose: Post-stroke survivors, particularly the older population, are at an increased risk of falls and incident fractures. Smoking is a widely recognized risk factor for fractures. However, the association between changes in smoking habits before and after an index stroke and increased risk of fracture remains unelucidated.

Methods: Using the Korean National Health Insurance program, patients with ischemic stroke between 2010–2016 were enrolled. Individuals were classified by smoking habits: "never smoker," "former smoker," "smoking quitter," "new smoker," and "sustained smoker." The primary outcome was the composite outcome of the vertebral, hip, and any fractures. Multivariate Cox proportional hazard regression analysis was used.

Results: Among 177,787 patients with health screening data within two years before and after ischemic stroke, 14,991 (8.43%) patients had any fractures. After multivariate adjustment, the sustained smokers had a significantly increased risk of composite primary outcomes of any, vertebral, and hip fractures (adjusted HR(aHR) 1.222, 95% CI 1.124–1.329any; aHR 1.27, 95% CI 1.13–1.428; aHR 1.502, 95% CI 1.218–1.853, respectively). Additionally, the new smoker group exhibited a similar or higher risk of any fractures and hip fractures (aHR 1.218, 95% CI 1.062–1.397; aHR 1.772, 95% CI 1.291–2.431, respectively).

Conclusions: Sustained smokers had a significantly increased risk of vertebral and hip fractures after an ischemic stroke. The risk of any and hip fractures were higher in new smokers after ischemic stroke. As post-stroke fractures are detrimental to the rehabilitation process of patients with stroke, physicians should actively advise patients to stop smoking.

Delayed door to puncture time during off-duty hours is associated with unfavorable outcomes after mechanical thrombectomy in the early window of acute ischemic stroke

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[1]Department Of Neurology, College Of Medicine, Dong-A University, Busan, Korea

Purpose: The impact of off-duty hours mechanical thrombectomy on outcomes remains a subject of controversy. This study aimed to investigate the impact of door-to-puncture time (DTPT) delays in patients who underwent mechanical thrombectomy for acute ischemic stroke (AIS) during off-duty hours in both the early and late time windows

Methods: Among patients with AIS who presented to the emergency department at Dong-A university hospital from 2014 to 2022, those who underwent mechanical thrombectomy within 24 hours of acute anterior circulation occlusion were selected. The patients were divided into two groups: those who arrived within 6 hours of symptom onset and received the procedure within 8 hours (early window), and those who received the procedure between 8 hours and 24 hours after symptom onset (late window). Additionally, patients were grouped according to whether they arrived during standard working hours or not. The study assessed the association between the onset-to-puncture time (OTPT) and poor outcomes, measured by the 90-day modified Rankin scores (mRS). Specifically, the analysis focused on the impact of delayed DTPT in patients during off-duty hours on outcomes measured by the 90-day mRS scores.;

Results: Among the eligible patients, a total of 501 AIS patients underwent mechanical thrombectomy for acute anterior circulation occlusion within 24 hours. Of these, 395 patients (78.8%) fell into the early window category, and 316 patients (63.1%) underwent the procedure during off-duty hours. In the early window, for every 60-minute increase in OTPT, the probability of occurrence a poor outcome at 90 days significantly increased in the fully adjusted model (OR=1.21; 95% CI, 1.02 to 1.43; p=0.03). In the early window, delayed procedures during off-duty hours (exceeding 103 minutes of DTPT) were identified as an independent predictor of poor outcomes (OR=1.95; 95% CI, 1.12 to 3.42; p=0.02). However, in the late window, there was no association between DTPT and outcomes at 90 days, and the impact of DTPT delays during off-hours was not observed.

Conclusions: In AIS patients undergoing mechanical thrombectomy, the timing from onset to puncture significantly affects post-procedure outcomes, particularly in the early window. Additionally, off-duty hours play a notable role in patients undergoing delayed procedures, particularly when DTPT exceeds 103 minutes in the early window. This study highlights the pronounced impact of off-duty time on mechanical thrombectomy outcomes, especially during the early window when time delays are most critical.

Impact of pleural effusion on clinical outcomes in patients with ischemic stroke

Unchang Heo[1], Joonggoo Kim[1]

[1]Neurology, Jeju National University Hospital, Jeju, Korea

Purpose: Pleural effusions can be observed in initial computed tomography in patients with acute ischemic stroke; however, the impact on clinical outcomes is not well characterized. This study aims to demonstrate the clinical outcomes of acute ischemic stroke patients with pleural effusion.

Methods: All patients who underwent acute ischemic stroke between 2021 and 2023 at a tertiary care university hospital were included in this observational, cross-sectional analysis.

Results: Of 1,137 patients who underwent acute ischemic stroke during the study period, 961 (84.5%) patients had no pleural effusion and 178 (15.6%) patients had pleural effusion. After propensity matching, the mortality of patients with pleural effusion was 7.3% higher than those with no pleural effusion ($p < 0.001$). Neurointensive care unit (NICU) stay was longer for those with pleural effusions (8 [IQR 6–11] days, 3 [IQR 2–7] days for those without pleural effusion, $p < 0.001$). Patients with pleural effusions had a higher incidence of early neurological deterioration; (END, 21 [11.8%] with pleural effusions, 66 [6.8%] without pleural effusions). Patients with pleural effusion were more likely to be associated with congestive heart failure and atrial fibrillation (22.1% vs. 5.7% and 34.6% vs. 17.5%)

Conclusions: Pleural effusions are highly associated with worse outcomes, including increased mortality, longer length of NICU stay, and higher END rates. These insights may be of stroke neurologists alike to foster research into innovative methods for preventing and treating pleural effusions to improve outcomes for patients with acute ischemic stroke.

The brainstem score on diffusion-weighted imaging before mechanical thrombectomy in acute basilar artery occlusion is a reliable predictor for prognosis

Junho Seong[1], Hye-In Chung[1], Dae-Hyun Kim[1], Jae-Kwan Cha[1]

[1]Neurology, Dong-A University Hospital, Busan, Korea

Purpose: In this study, we aimed to assess the utility of measuring the Brainstem Score (BSS) on pre-procedural DWI in acute basilar artery occlusion (ABAO) patients to predict the outcomes after mechanical thrombectomy. Additionally, we sought to determine whether the effectiveness of BSS in predicting outcomes is comparable to that of the Critical Area Perfusion Score (CAPS) on perfusion MRI using RAPID.

Methods: This study targeted patients who underwent mechanical thrombectomy at the Stroke Center of Dong-A University Hospital, from 2013 to 2023. Among them, patients who had ABAO and had undergone pre-procedural MRI were selected. The size of ischemic lesion on DWI and BSS was measured for all patients. A separate analysis was conducted for patients who had perfusion MRI analyzed using RAPID. For the group that underwent perfusion MRI analysis, we prespecified a CAPS and the patients were dichotomized into favorable (CAPS $\leq$3) and unfavorable (CAPS>3) groups. Also, the hypoperfusion intensity ratio (HIR) was measured. The primary end point was a poor outcome at 90 days (modified Rankin scale, mRS>2). The impact of the lesion size on DWI, BSS, CAPS, and HIR on the mRS at 90 days after procedure was analyzed using multiple logistic regression.

Results: During the study, 71 patients had ABAO and underwent mechanical thrombectomy after undergoing MRI. Comparing the group with poor outcomes at 90 days to the group with good outcomes, the former had significantly larger ischemic lesion volumes on DWI (p=0.02), higher initial NIHSS scores (p<0.05), and higher DWI BSS (p<0.01). In the multivariate logistic regression analysis, DWI BSS (OR=12.90; 95% CI, 2.51-66.40; p<0.01) emerged as an independent predictor of poor outcomes at 90 days, even after adjusting for NIHSS, DWI volume, and successful recanalization. Among the 71 subjects, 26 had measurements of CAPS and HIR on perfusion analysis. In the group with poor outcomes, 13 (50%) patients had higher DWI BSS (p<0.01), HIR (p<0.01), and CAPS (p=0.03) than the group with good outcomes. In this subgroup, even after adjusting for HIR and CAPS, DWI BSS remained a valid independent predictor for predicting functional outcomes at 90 days, but CAPS (OR=4.20; 95% CI, 0.79-222.70; p>0.05) did not function as an independent predictor.u

Conclusions: In this study, quantifying the degree of brainstem involvement using DWI BSS before mechanical thrombectomy in ABAO patients emerged as a useful imaging marker for predicting post-procedural outcomes. Its predictive ability is not only comparable to but even superior to CAPS on perfusion MRI.

Ischemic stroke in a patient complicated by bacterial meningitis from an asymptomatic parapharyngeal abscess

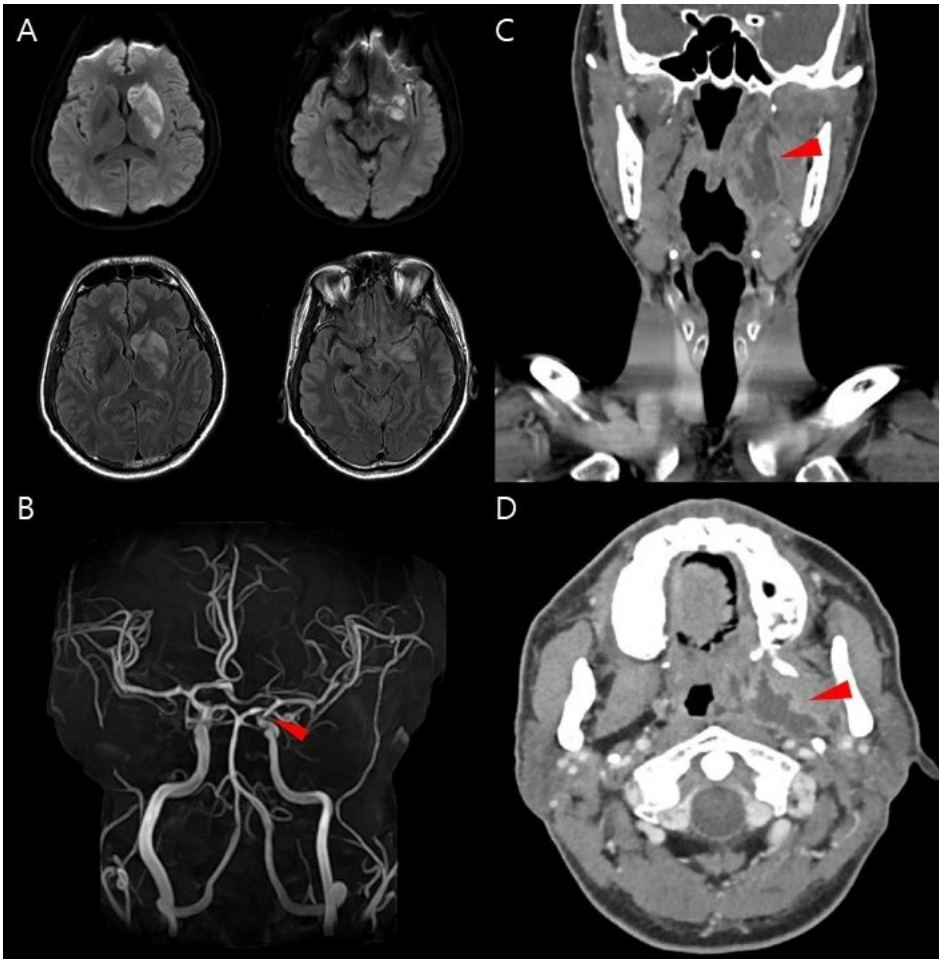
Hyeonbin Park[1], Kangwoo Kim[1], Dae-Hyun Kim[1,2], Jae-Kwan Cha[1,2], Yoonkyung Lee[1,2]

[1]Neurology, Dong-A University Hospital, Busan, Korea, [2]Busan Regional Cardiocerebrovascular Center, Dong-A University Hospital, Busan, Korea

Purpose: Infectious diseases are one of the causes of other determined etiologies in the Trial of ORG 10172 in Acute Stroke Treatment classification for stroke subtype. The mechanisms causing stroke in bacterial meningitis are known as cerebral vasospasm, vasculitis, the coagulation cascade, and the inflammatory response.

Methods: A 45-year-old previously healthy man presented with two weeks of fever and headache, and one day of altered mentality with right hemiplegia. Two weeks prior, he had visited an outpatient clinic and was prescribed acetaminophen, clarithromycin, and methylprednisolone, but symptoms did not improve. Brain magnetic resonance imaging (MRI) showed a left parapharyngeal abscess with intracranial extension and left basal ganglia and medial temporal infarction. Narrowing of the left cavernous sinus internal carotid artery and A1 artery was observed. Cerebrospinal fluid (CSF) analysis showed pleocytosis (5319/mm3), low CSF glucose (2mg/dL; serum glucose 111mg/dL), and elevated CSF protein (181.88 mg/dL), consistent with bacterial meningitis. Ceftriaxone, vancomycin, ampicillin, and dexamethasone were administered. The patient exhibited no overt symptoms suggestive of infection; thus, neck, chest, and abdomen-pelvis CT scans, and an echocardiogram screening were conducted to ascertain the infectious source. A lobular cystic mass in the left parapharyngeal space extending to the left medial pterygoid muscle (6×4×7 cm) from the #38 tooth was observed. Extraction of #38 and incision and drainage were performed, and culture found Staphylococcus epidermidis. Antibiotics were changed to cefepime and vancomycin. Following treatment, the patient's neurologic symptoms were slightly improved.

Conclusions: This case illustrates that vasculitis from bacterial meningitis due to a parapharyngeal abscess may occur without any symptoms. Pain and odynophagia are common symptoms of a parapharyngeal abscess, but in rare cases, silent deep neck infections may occur. It can also be a cause of bacterial meningitis, so it is necessary to carefully evaluate the cause of the infection.


A
C
B
D

Patient with dural arteriovenous fistula after mechanical thrombectomy for acute ischemic cerebral infarction

Jun Hyeok Park[1], Ju Hee Im[1], Hyeo Seo Moon[1], Ju Hye Kim[1], Byoung Wook Hwang[1], Min A Lee[1], Seong Hwan Ahn[1]

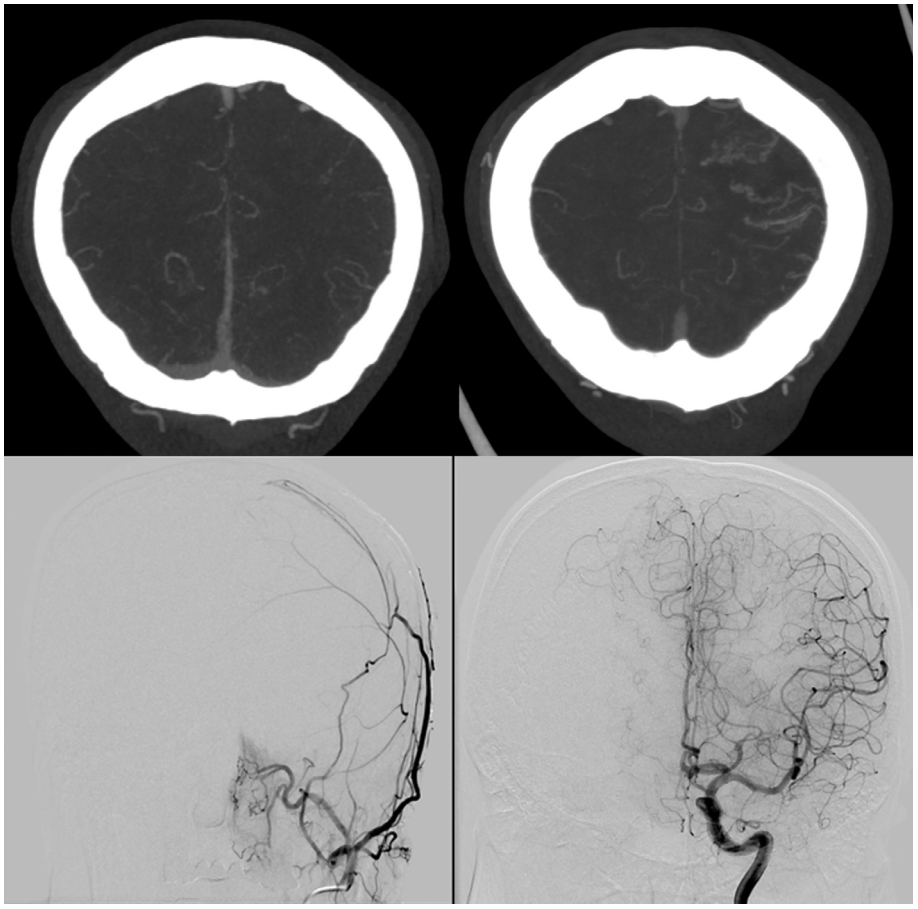
[1]Department Of Neurology, Chosun University Hospital, Gwangju, Korea

Purpose: Purpose: Dural arteriovenous fistula (DAVF) is a rare vascular malformation in the central nervous system, which can manifest with variable clinical symptoms depending on the lesion's location, including intracranial hemorrhage and neurological deficits. The exact cause of DAVF remains uncertain, but it may develop secondary to trauma, venous thrombosis, or other underlying vascular conditions. We report the case of a patient with DAVF following mechanical thrombectomy for acute ischemic stroke.

Methods: ...

Results: A 61-year-old man presented to the emergency room with symptoms of partial seizures and right hemiplegia that had started 30 minutes before admission. He had a history of hypertension and atrial fibrillation, and had received mechanical thrombectomy for right middle cerebral artery infarction nine months prior to admission. There was no history of trauma before or after symptoms began to manifest. Initial vital signs showed high blood pressure at 151/106 mmHg, while other parameters including heart rate, respiratory rate, and body temperature were within normal limits. Upon neurological examination, he showed sensory aphasia, dysarthria, right hemiparesis(GIII/GIV) (initial National Institutes of Health Stroke Scale [NIHSS] score, 7). Brain CT revealed a hypodense lesion with petechial hemorrhage in the left frontal lobe. Brain CT angiography demonstrated early opacification of venous channels around infarcted lesion and dural sinuses. Electroencephalogram demonstrated generalized slowing in the left hemisphere with no epileptic discharges. Brain MRI presented vasogenic edema with hemorrhage, dilation of ventricles and cisterns, and diffuse widening of cortical sulci in the left MCA territory. Considering the patient's neurological deficits and highly suspicious lesions indicative of DAVF on imaging studies, digital subtraction angiography (DSA) was performed to confirm the diagnosis. Dural AVF that was not detected on the DSA and MR angiography nine months ago was confirmed. We decided to perform intra-arterial embolization for treatment. The patient was discharged following improvement in symptoms and absence of seizure recurrence, with plans for outpatient follow-up.

Conclusions: We reported the case of dural AVF after mechanical thrombectomy. The possibility of misdiagnosis arises due to overlapping symptoms with other neurological conditions or vascular abnormalities, leading to potential delays in diagnosing DAVF. Therefore, rapid identification and accurate diagnosis of DAVF are crucial for better prognosis.



대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| Room B |

연구활성화위원회

| 좌 장 |

권순억 (울산의대 신경과)

기계학습을 이용한 뇌졸중 환자의 예측 모델 개발 연구

박 성 호

인제의대 신경과

Background: The presence of a diffusion-weighted imaging (DWI) – fluid-attenuated inversion recovery (FLAIR) mismatch holds potential value in identifying candidates for recanalization treatment. However, the visual assessment of DWI–FLAIR mismatch (DFM) is subject to limitations due to variability among raters, which affects accuracy and consistency. To overcome these challenges, we aimed to develop and validate a deep learning-based classifier to categorize DFM.

Methods: We screened all acute ischemic stroke patients who underwent DWI and FLAIR imaging from a multicenter stroke registry. To establish reliable ground truth labels for DFM, five stroke neurologists performed joint reviews until consensus was reached, followed by independent reviews. The labels obtained were then converted into two binary label sets: Label Set I (DF match vs. DF non-match) and Label Set II (DF match vs. DF mismatch), for which Convolutional Neural Network (CNN)-based binary classification algorithms were developed. The performance of the developed models was assessed on both an internal test set and external validation sets, which included data from Keimyung University Dongsan Hospital (KM) and Yeungnam University Hospital (YN).

Results: A total of 2,369 patients from the derivation set, 350 from KM, and 329 from YN were included in the analysis. The Fleiss' Kappa statistic for agreement among multiple raters on the final labels was 0.911, indicating substantial inter-rater reliability. For Label Set I, the Area Under the Curve (AUC) for the internal test set was 0.862 (95% Confidence Interval (CI): 0.841–0.884). The AUCs for the external validation sets, KM and YN, were 0.829 (95% CI: 0.785–0.873) and 0.835 (95% CI: 0.790–0.879), respectively. For Label Set II, the AUC for the internal test set was 0.934 (95% CI: 0.911–0.957). For the external validation sets, KM and YN, the AUCs were 0.883 (95% CI: 0.829–0.938) and 0.913 (95% CI: 0.876–0.951), respectively. The calibration slope revealed a minimal difference between the predicted and observed probabilities of DFM. The Brier score for the internal test set was 0.02.

Conclusions: A deep learning-based classifier for DFM can be used to diminish subjectivity and support targeted decision-making in the treatment of acute stroke patients.

혈전성상연구모임

박 형 종

계명의대 신경과

디지털 및 차세대 연구기술 교류회

허 준 녕

중앙의대 신경과

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| Room B |

질향상위원회 / 정책위원회
(Session 1)

| 좌 장 |

배희준 (서울의대 신경과), **정통령** (보건복지부 공공보건정책관)

인적 네트워크의 현황과 향후 일정

류 창 우

경희의대 영상의학과

중증·응급 심뇌혈관질환 진료협력 네트워크 시범사업(이하 '네트워크 시범사업') 이 사업참여 선정 과정을 거쳐 24년 2월 26일부터 개시하였고 2026년 12월까지 3년간 운영된다.

이 사업의 목적은 중증·응급 심뇌혈관질환 치료에 필요한 신속한 진단-이송-최종치료 병원 결정을 위한 의료기관 간, 전문의 간 소통과 의사결정을 활성화하는 네트워크 구축에 있다. 네트워크 시범 사업에 참여하게 되면, 각 기관은 네트워크 구성·운영·유지를 위한 연차별 지원금을 매년 사전에 일괄 지급받고 연차별 성과평가에 따라 추가지원금을 차등 지급받게 된다. 이러한 보상체계를 통해 참여 의료기관 및 전문의 간 신속한 소통과 의사결정을 통한 치료 골든아워 사수, 심뇌혈관질환 치료성과 향상을 기대하고 있다.

최종 확정된 네트워크의 수는 권역 네트워크 10개 팀, 인적 네트워크 55개 팀으로 인적네트워크 중 뇌졸중 네트워크는 총 33개 네트워크가 선정되었다. 뇌졸중 네트워크에는 책임전문의의 전문분야에 따라 신경외과 21팀, 신경과 7팀, 영상의학과 5팀으로 나뉘고 참여전문의의 전문과는 각 팀마다 다양하게 분포되어 있다. 총 192 의료기관의 706명의 전문의가 참여하였다. 지역에 따라 서울 6, 인천/경기 7, 강원도 2, 충북 1, 충남 3, 전북 2, 전남 2, 경북 2, 경남 6, 제주 2개팀으로 분포하고 있다.

각 네트워크의 성과는 향후 연간 3개의 성과평가 지표와 1개의 모니터링 지표로 평가하게 될 것이다. 향후 시범사업의 성과에 따라 네트워크 운영이 정식으로 진료수가에 반영될 가능성이 있을 것으로 보이며 중증 뇌혈관질환의 전국적인 데이터수집에 기여할 것으로 판단된다.

인적네트워크의 문제점과 향후 개선점 및 나아갈 방향

박 형 종

계명의대 신경과

권역심뇌혈관질환센터 기반 병원전단계 네트워크사업

김 대 현

동아의대 신경과

It is crucial to reduce the time from symptom onset to recanalization to enhance outcomes for patients with acute ischemic stroke. Ideally, when a stroke occurs, the patient or a witness should promptly call for an ambulance. If an ambulance is called, it is of the utmost importance that the emergency medical service (EMS) paramedics quickly recognizes stroke patients and transport them to hospitals capable of providing acute stroke care. Prehospital notification involves a telephone consultation with stroke experts, allowing for a streamlined process that bypasses the emergency department to reduce the time to imaging and intervention. This prenotification can facilitate earlier mobilization of the stroke team, activating stroke care processes at the receiving hospital even before the patient arrives.

In Korea, a significant proportion of patients with acute stroke are unable to be admitted to hospitals capable of acute treatment and undergo interhospital transfer to designated stroke centers. Recently, a prehospital network project based on regional cardiocerebrovascular center (RCCS) was implemented to improve treatment outcomes by shortening the time from disease onset to arrival at the final treatment medical institution. This pilot project is a network support compensation system based on network composition and operational performance to screen and rapidly transport patients with cardiovascular disease at the pre-hospital stage.

To achieve this goal, RCCSs need to establish a network and strengthen the cooperation system among medical institutions in the region. RCCSs should institute a hotline system with EMS paramedics for accurate diagnosis and selection of transfer hospitals. Hospitals within the network should also maintain a 24/7, 365-day emergency cardiovascular disease on-call system.

의료개혁 추진을 위한 심뇌혈관질환관리 정책 추진 방향

신 희 성

보건복지부 질병정책과

목차

1. 주진상황
2. 주진방향
3. 진행상황
4. 진행상황(선정결과)
5. 신속 의사결정 플랫폼
6. 향후계획

1. 추진 상황

"생명과 지역을 살리는 의료개혁" 발표. ('24.2.1. 국민과 함께하는 민생토론회)

- 내년부터 의대 입학정원을 늘려 의사를 늘립니다.
- 병원 육성, 필수의사 확보 등 지역의료를 강화합니다.
- '진료는 소신껏, 사고에는 보상을' 안전망을 만듭니다.
- 고위험 진료 등은 노력에 걸맞게 공정하게 보상합니다.

대한민국정부

필수의료 정책 4대 패키지

① 의료인력 확충

② 지역의료 강화

③ 의료사고 안전망 구축

④ 보상체계 공정성 제고

1. 추진 상황

필수의료 정책 4대 패키지

① 의료인력 확충

② 지역의료 강화

③ 의료사고 안전망 구축

④ 보상체계 공정성 제고

심뇌혈관질환 관리 정책과 직접적인 관련

"네트워크 활성화"

"필수의료 집중인상"

1. 추진 상황

○ 尹 대통령 국무회의 발언(4.2.)

尹, 연이틀 대화 메시지 "과감한 재정 지원 필수적"

"필수·지역의료 별도 지원 필요"
'2000명' 이어 투자까지 약속

○ 성태윤 정책실장 발언(3.27.)

대통령실 "지역·필수의료 특별회계 신설... 안보만큼 과감한 투자"

성태윤 정책실장 "내년 예산, '의료개혁 5대 재정사업' 중심 편성"
고위관계자, 증원 규모 조정엔 "2000명 이미 배정된 상황"

▷ 어려운 현재 상황에도 불구,

심뇌혈관질환 관리 정책의 공격적이고 담대한 추진을 위한 환경이 잘 마련됨

2. 추진상황

○ 5대 핵심전략을 중심으로 하는 제3차 심뇌혈관질환관리 종합계획 발표('23.7)

1. 추진상황

○ 종합계획 발표 이후 이행 실적

'23.7.	종합계획 발표
'23.10.	심뇌혈관질환 문제해결형 네트워크 시범사업 공모
'23.11.	중앙심뇌혈관질환센터 공모
'23.12.	기관 간 네트워크(7개), 인적 네트워크(52개) 선정
'23.12.	서울대병원 중앙심뇌혈관질환센터 지정(5년)
'24.2.	기관 간 네트워크 재심사 통한 추가 및 확정
	기관 간 네트워크 10개(65개 병원), 인적 네트워크 55개(1,317명)
'24.2.	인적 네트워크 사용 위한 신속의사결정플랫폼 개통

1. 추진상황

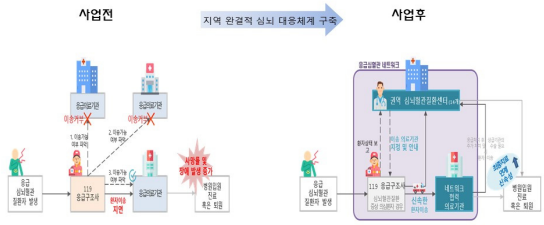
○ 향후 계획

'24~	네트워크 시범사업 운영 · 보완 · 평가(3년)
'24~	지역심뇌혈관질환센터 지정 기준 마련, 공모, 지정 (30개 내외, 3년 간 최종 70개 목표)
'24~	심뇌 레지스트리 고도화 사전 연구 및 본사업(2025)
'24~	심뇌 R&D 추진
'25~	권역심뇌혈관질환센터 추가 지정(2개소 내외)

* 심장수술 등 고난도 수술 수가 개선 병행(보험급여과)

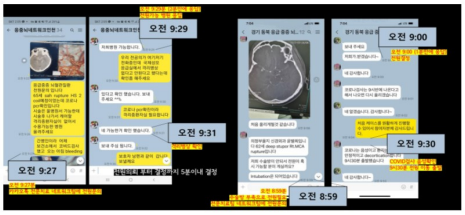
2. 추진방향

응급심뇌혈관질환 네트워크, 신속 의사결정 플랫폼 구축으로
환자의 신속 이송·치료 가능



2. 추진방향

○ (실제사례) 사적 네트워크 활용 사례를 토대로 신속 의사결정 플랫폼 개발



3. 진행상황

○ 응급 심뇌혈관질환 네트워크 시범사업 참여기관 선정

사업명	권역심뇌혈관질환센터 기반 응급심뇌혈관질환 네트워크 시범사업	심뇌혈관질환 인적 네트워크 시범사업
시범사업 공고	보건복지부 공고 제2023 - 711호 「권역심뇌혈관질환센터 기반 응급심뇌혈관질환 네트워크 시범사업」 의 참여 네트워크 주모를 다음과 같이 실시하오니, 관련 의료기관의 적극적인 참여를 바랍니다. 2023년 10월 26일 보건복지부장관	보건복지부 공고 제2023 - 711호 「심뇌혈관질환 인적 네트워크 시범사업」 의 참여 인적 네트워크 주모를 다음과 같이 실시하오니, 관련 심뇌혈관질환 전문의의 적극적인 참여를 바랍니다. 2023년 10월 26일 보건복지부장관
신청대상	권역심뇌혈관질환센터가 지정된 응급의료기관 및 지역 소방본부 · 소방서 등과 네트워크 구성	심뇌혈관질환 전문의 중 서로 다른 의료기관에 소속된 심뇌혈관질환 전문의 등 최소 7인 이상 네트워크 구성
사업기간	2024.1.1~2026.12.31. (3년)	
선정기준	정량평가 및 정성평가 심의	
선정방법	선정평가단의 심의를 거쳐 평가점수가 70점이상(100점 만점) 선정	

4. 진행상황(선정결과)

☐ 기관 네트워크

기반 권역센터	권역	참여기관수
강원대학교병원	강원	5
경북대학교병원	대구 · 경북	6
동아대학교병원	부산	5
분당서울대학교병원	경기	8
인하대학교병원	인천	6
전남대학교병원	광주 · 전남	3
중남대학교병원	중남	6
울산대학교병원	울산	4
원광대학교병원	전북	5
충북대학교병원	충북	5

○ 총 신청 네트워크 12개 기관 중 70점 이상인 **7개 네트워크 선정**
○ 70점 미만 기관 재심사 후 **3개 기관 추가 선정**
○ **총 10개 권역심뇌센터 기반 네트워크 최종 선정**

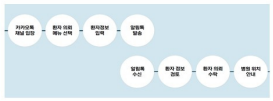
☐ 인적 네트워크

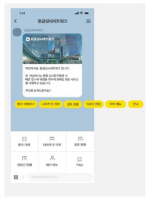
목표질환	신청 네트워크	선정 네트워크
급성심근경색증	14	14
급성대동맥증후군	6	6
뇌졸중	33	33
급성심근경색증 + 급성대동맥증후군	2	2
뇌졸중 + 급성심근경색증 + 급성대동맥증후군	1	0

○ 56개 신청 네트워크 중 70점 이상인 **52개 팀 선정**
○ 70점 미만 4개 네트워크 재심사 후 **3개 팀 추가 선정**
○ **총 55개 인적 네트워크 시범사업 참여팀으로 선정**

5. 신속 의사결정 플랫폼

신속한 이송·전원을 위한 심뇌혈관질환 의료기관,
전문의간 의사결정 및 소통에 특화된 플랫폼 개발 완료





5. 신속 의사결정 플랫폼

○ 신속의사결정플랫폼 개통 이후 실제 활용 현황

기준 : 시범사업 시작 2.26(월) ~ 3.17(일) 23:59 까지

☐ 의뢰-수락 비율(%)

전체 매칭완료/ 의뢰건수	11/11
	100%

☐ 의뢰-수락 세부현황

	질환명	의뢰시간	매칭시간	소요시간(hr:m)	의뢰 병원명	의뢰 소재지	수락 병원명	수락 소재지
1	허혈성 뇌졸중	2024-02-27 13:47:54	2024-02-27 14:34:13	0:46:19	의료법인 백제병원	충남 논산시	충남대학교병원	대전 서구
2	허혈성 뇌졸중	2024-02-28 14:38:49	2024-02-28 14:44:01	0:05:12	강원특별자치도속초의료원	강원 속초시	강릉아산병원	강원 강릉시
3	허혈성 뇌졸중	2024-03-01 17:52:26	2024-03-01 17:58:30	0:06:04	가톨릭대학교서울성모병원	서울 서초구	고려대학교구로병원	서울시 동작구
4	심근경색	2024-03-06 13:25:00	2024-03-06 13:30:57	0:05:57	제주 서귀포의료원	제주 서귀포시	제주대학교병원	제주 제주시
5	허혈성 뇌졸중	2024-03-06 21:33:28	2024-03-06 21:39:28	0:06:00	강남세브란스병원	서울 강남구	강동성심병원	서울 강동구
6	허혈성 뇌졸중	2024-03-10 13:26:59	2024-03-10 13:28:11	0:01:12	충북대학교병원	충북 청주시	청주성모병원	충북 청주시
7	허혈성 뇌졸중	2024-03-12 16:20:44	2024-03-12 16:26:01	0:05:17	강원특별자치도속초의료원	강원 속초시	강릉아산병원	강원 강릉시
8	허혈성 뇌졸중	2024-03-14 12:55:30	2024-03-14 13:01:01	0:05:31	명지의료재단명지병원	충북 제천시	건국대충주병원	충북 청주시
9	허혈성 뇌졸중	2024-03-14 15:26:00	2024-03-14 15:28:43	0:02:43	영훈의료재단 유성선병원	대전 유성구	충남대병원	대전 중구
10	허혈성 뇌졸중	2024-03-15 11:52:49	2024-03-15 11:54:03	0:01:14	칠석의료재단사랑의병원	경기도 안산시	닐천시화병원	경기도 시흥시
11	허혈성 뇌졸중	2024-03-17 15:43:25	2024-03-17 15:49:01	0:05:36	광주보훈병원	광주 광산구	전남대병원	광주 동구

* 자료출처 : 플랫폼 로그기록

5. 신속 의사결정 플랫폼

○ 네트워크 시범사업 출범 후 보완사항 & 보완 예정인 사항

- 운영지침 유연 적용
- 홍보
- 외부의뢰자 기능

6. 향후계획

○ 사전지원금(50%, 기관), 지원금(100%, 인적) 지급 (4월 중)
○ 플랫폼 기능 개선

7. 별첨

☐ **심장내과 전문의 간담회 개최(24.2.7. 박민수 보건복지부 2차관님 참석)**

○ ST분절 비상승 심근경색증(NSTEMI)은 현재 조고위험군만 수가가 인정되고 있는데, NSTEMI이 STEMI에 비해 중가주세이고 고령층이 많으므로, NSTEMI 중재시술에 대한 급여 확대 필요
○ 현재 관상동맥 중재시술의 수가는 단일혈관과 추가혈관으로만 급여가 되고 있으므로, 4가지 혈관 중류별로 재분류하여 수가 산정 필요
○ 경피적 대동맥판막삽입술(TAVI)에 대한 수가 인상 필요
○ 건강보험심사평가원의 건강보험 수가 조정 관련 업무 부담이 가중하므로, 심사제도의 합리적 개선 필요

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| Room B |

질향상위원회 / 정책위원회 (Session 2)

| 좌 장 |

나정호 (인하의대 신경과), **김승현** (한양의대 신경과)

SC/TSC 2주기 인증 현황

이 건 주

고려의대 신경과

SC/TSC 3주기 규정개정 관련

김 진 권

연세의대 신경과

The Korean Stroke Society (KSS) has been implementing a Stroke Center (SC) certification program since 2018, in response to advances in stroke treatment technologies and the evolving needs of the acute stroke care delivery system. The active participation and efforts from numerous hospitals and medical professionals yielded significant results, including the integration of the Stroke Center Certification by KSS into the quality evaluation standards for stroke management by the Health Insurance Review & Assessment Service's by 2020. In 2021, acknowledging the crucial role of mechanical thrombectomy in acute stroke management, the KSS introduced a certification system for Thrombectomy-capable Stroke Centers (TSC). The experiences and insights gained from evaluating and certifying SC and TSC have led to the development of revised certification standards, set to be implemented in the latter half of 2024. This presentation aims to provide a brief overview of the prior and revised certification standards.

Stroke neurologist 인증의 준비과정

박 수 현

순천향의대 신경과

The certification system for Stroke Neurologists has established precedents in foreign countries and has been acknowledged as necessary by the Korea Stroke Society for several years.1,2 Recently, with the government's thrust to establish an essential medical system (e.g., human network pilot projects), there has been a continuous demand for the establishment of stroke centers and specific staffing requirements (fig. 1). Consequently, it has been decided to pursue stroke certification targeted at neurologists with the Korean Neurological Association serving as the certification main agent and operational proceedings conducted in collaboration with a Joint Task Force Team with the Korea Stroke Society. Considering that neurologists in training have experience diagnosing and treating more than 100 cases of acute stroke, it is presumed that all neurologists inherently possess basic competency in stroke care. Therefore, the stroke certification criteria have been designed to be easily attainable for any neurologist seeking certification. Additionally, the regulations surrounding stroke certification aim to improve hospital treatment and work environments for certified professionals. Ultimately, regulations have been established to ensure an adequate number of certified stroke specialists within the staffing structure of stroke centers. This introduction aims to outline these developments and the rationale behind them.

References

1. Adams HP Jr, Biller J, Juul D, Scheiber S. Certification in vascular neurology: a new subspecialty in the United States. Stroke. 2005 Oct;36(10):2293-2295.
2. Meretoja A, Acciarresi M, Akinyemi RO, Campbell B, Dowlatshahi D, English C, Henninger N, Poppe A, Putaala J, Saini M, Sato S, Wu B, Brainin M, Norrving B, Davis S. Stroke doctors: Who are we? A World Stroke Organization survey. Int J Stroke. 2017 Oct;12(8):858-868.

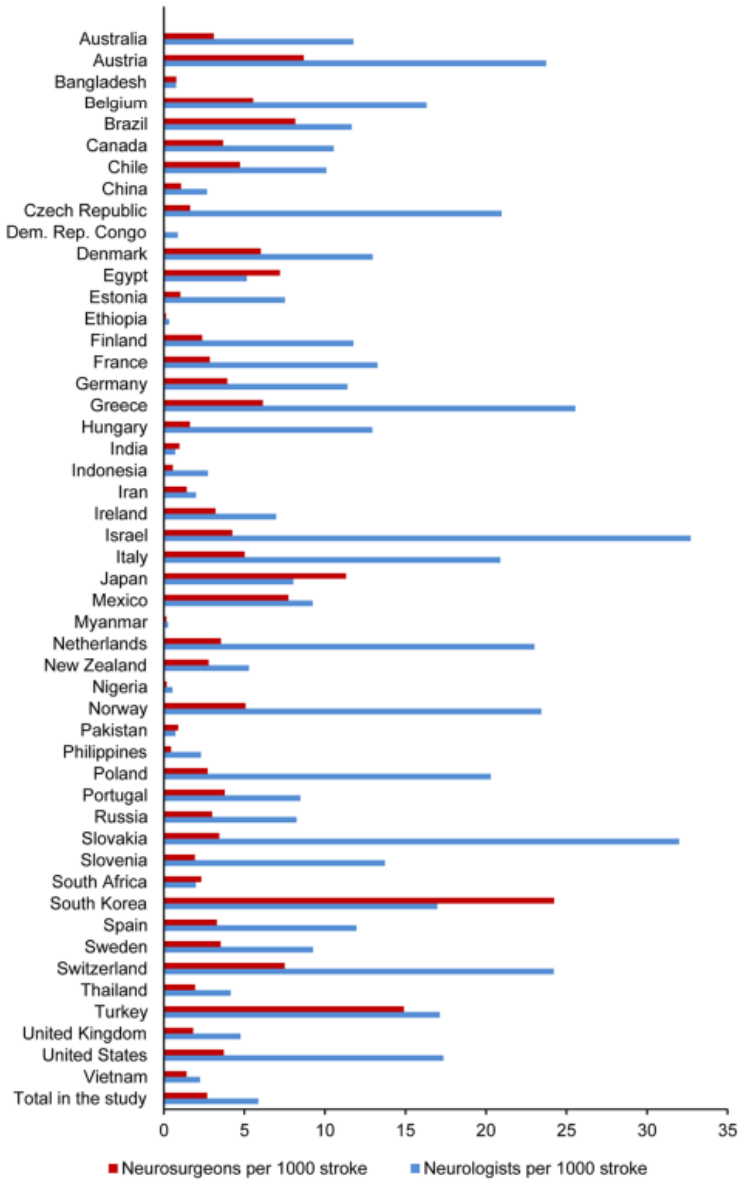


Figure 1. Number of neurologists and neurosurgeons per 1000 annual incident stroke patients

국내 타 인증의 심사프로세스 현황

고 상 배

서울의대 신경과

Aligned with governmental policies, the special certification program is currently gaining attention within numerous specialized medical societies. Among these, stroke certification stands out as it is particularly important for vascular neurologists. To streamline this process, there is a practical imperative within the field to review certification processes from other societies. In this endeavor, we will succinctly outline the core certification processes within neurological fields and subsequently propose a tentative framework for preparing stroke-certified doctors.

Key word; Certification, Stroke neurologists, Certified doctor

대한뇌졸중학회
Korean Stroke Society

2024 대한뇌졸중학회

춘계학술대회

| Room A |

Poster Presentation

SMART-M for predicting long-term mortality after ischemic stroke based on nomogram

Tae Jung Kim[1], Ji Sung Lee[3], Mi Sun Oh[2], Ji-Woo Kim[4], Soo-Hyun Park[5], Kyung-Ho Yu[2], Byung-Chul Lee[2], Byung-Woo Yoon[6], Sang-Bae Ko[1]

[1]Neurology & Critical Care Medicine, Seoul National University Hospital, Seoul, Korea,[2]Neurology, Hallym University Sacred Heart Hospital, Anyang, Korea,[3]Clinical Epidemiology And Biostatistics, Asan Medical Center, Seoul, Korea,[4]Analysis Of Bigdata, Health Insurance Review And Assessment Service, Wonju, Korea,[5]Neurology, Soonchunhyang University Seoul Hospital, Seoul, Korea,[6]Neurology, Uijeongbu Eulji Medical Center, Uijeongbu, Korea

Purpose: Predicting long-term mortality is crucial for providing insights into long-term prognosis and can serve as a prognostic tool to determine the suitable approach to medical care. We aimed to establish and validate methods for predicting mortality following ischaemic stroke at 1-year and 5-year.

Methods: We utilized data from the linked dataset comprising the administrative claims database sourced from the Health Insurance Review and Assessment Service (HIRA) and the registry provided by the Clinical Research Center for Stroke (CRCS) for acute stroke patients within 7 days of onset between January 2008 and December 2014. The outcome was all-cause mortality following an ischemic stroke. Clinical variables linked to long-term mortality in patients with ischemic stroke were determined. A nomogram was constructed using a multivariable logistic regression model. We calculate the C-statistic to assess performance of the risk prediction model.

Results: This study included 42,737 patients with acute ischemic stroke, with a mean age of 66.6 years and 59.2% being male. The patients were randomly divided into developing (n = 29,916) and validation (n = 12,291) groups. Various factors were found to be correlated with long-term mortality in patients with ischemic stroke. These factors include age, sex, body mass index, stroke severity, stroke mechanisms, onset to door time, prestroke dependency, history of stroke, diabetes mellitus, hypertension, coronary artery disease, chronic kidney disease, cancer, smoking, fasting glucose level, previous statin therapy, thrombolytic therapy, discharge medications, and discharge modified Rankin Scale. A predictive system, called the SMART-M (Stroke Measures Analysis of Prognostic Testing – Mortality), was created based on the construction of a nomogram utilizing the aforementioned features. The C-statistics of the nomogram in the developing and validation groups were 0.806 (95% confidence interval, 0.802–0.812) and 0.803 (95% confidence interval, 0.795–0.811), respectively.

Conclusions: SMART-M method has good performance for predicting long-term mortality in ischemic stroke patients. This method could assist healthcare providers in long-term prognostication for making management decisions and providing counseling.

Score System Using Nomogram for Predicting Functional Outcome at 3 Months and 1 Year in Ischemic Stroke Patients

Hak-Rim Lee[1], Nak-Hoon Son[4], Jonghong Kim[2], Hyungjong Park[2], Sung-Il Sohn[2], Beom Joon Kim[3], Jihoon Kang[3], Hee-Joon Bae[3], Moon-Ku Han[3], Jun Yup Kim[3], Jeong-Ho Hong[1,2]

[1]Department Of Ai/statistics, Biolink Inc., Dalseo-Gu, Daegu, Korea,[2]Department Of Neurology, Keimyung University School Of Medicine, Keimyung University Dongsan Medical Center, Dalseo-Gu, Daegu, Korea,[3]Department Of Neurology, Cerebrovascular Center, Seoul National University Bundang Hospital, Seongnam, South Korea, Bundang-Gu, Seongnam, Korea,[4]Department Of Statistics, Keimyung University, Dalseo-Gu, Daegu, Korea

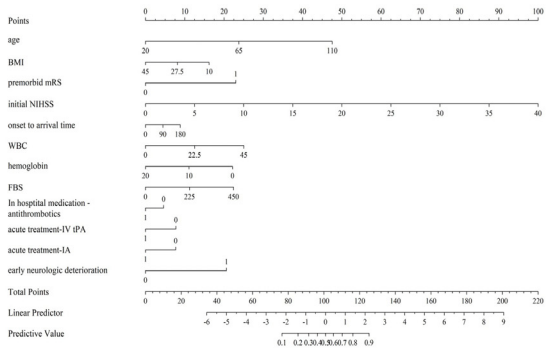
Purpose: Predicting short and long-term functional outcome following acute ischemic stroke is very helpful in planning long-term care. We developed nomogram scoring system that predict functional outcomes at 3 months and 1 year at the time of admission and discharge.

Methods: This study was a retrospective study conducted on patients with acute ischemic stroke within 7 days of symptom onset at a tertiary university hospital from May 2014 to August 2021. The unfavorable outcome was defined as a modified Rankin Scale(mRS) score of ≥;3. Variables were collected from clinical data readily available in most hospitals and were selected through univariate logistic regression. The final model was created through multivariate logistic regression. Scoring system using nomogram was developed for each final models. For external validation, data were collected retrospectively from January 2011 to August 2021 at another tertiary university hospital. To prevent reproduction by chance, the subjects were separated into 4 groups and then sensitivity analysis was performed.

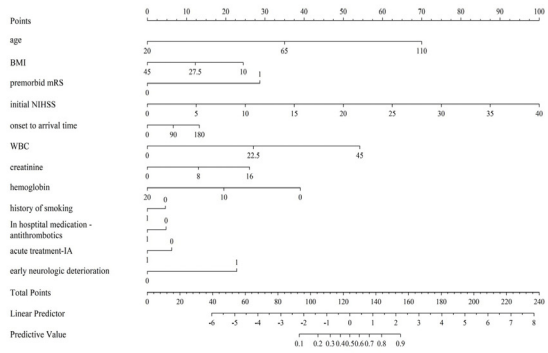
Results: Among 2,868 patients;(mean age, 69 years; 56.8% males), 811 (28.3%) and 832 (29.0%) patients had an unfavorable outcome at 3 months and 1 year. The area under the receiver-operating-characteristic (AUC) at admission was 0.883 at 3 months and 0.868 at 1 year. The AUC outcome at discharge was 0.947 for 3-month and for 1 year is 0.915. For the external validations, the average AUC of the 3-month at admission was 0.896 at 3 months and 0.887 at 1 year at admission. The average AUC outcome at discharge was 0.940 for 3-month and for 1 year is 0.923. After sensitivity analysis for each group, we can conclude that the results of each AUC are significant.

Conclusions: This scoring system prediction is quick and easy to utilize in the clinical setting. It can also help patients make a variety of decisions, especially at discharge.

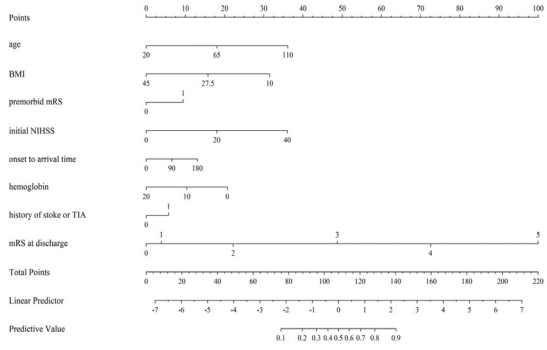
■ 3-month at admission



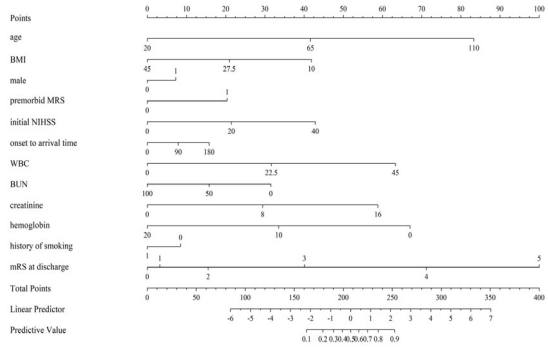
■ 1-year at admission



■ 3-month at discharge



■ 1-year at discharge



Standard Versus Intensive Blood Pressure Control in Acute Ischemic Stroke Patients Successfully Treated With Endovascular Thrombectomy: A Systemic Review and Meta-Analysis of Randomized Controlled Trials

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Purpose: The optimal blood pressure (BP) control after successful endovascular thrombectomy (EVT) in acute ischemic stroke (AIS) with large vessel occlusion (LVO) remains debatable. We conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) that evaluate the efficacy and safety of standard BP control (with systolic BP ≤180 mm Hg) versus intensive BP control (systolic BP <140 mm Hg) during the 24 hours after successful EVT in AIS with LVO.

Methods: PubMed, Scopus, the Cochrane Central Register of Controlled Trials, and Embase were searched to identify relevant trials. The crude odds ratio (OR) and 95% confidence interval (CI) were calculated and estimates using random-effects models were pooled. This meta-analysis followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (PROSPERO ID: CRD42023450673).

Results: Four RCTs involving 1,559 participants were included. Regarding efficacy outcomes, intensive BP control was associated with a lower likelihood of functional independence (OR: 0.68; 95% CI: 0.51-0.91 for modified Rankin Scale [mRS] ≤2) and walking without assistance (OR: 0.65; 95% CI: 0.53-0.81 for mRS ≤3). For safety outcomes, consistent with the efficacy findings, intensive BP control was significantly associated with severe disability or death (mRS 5 or 6) (OR: 1.34; 95% CI: 1.07-1.69). However, there were no significant differences including all-cause mortality, any intracerebral hemorrhage (ICH), symptomatic ICH, parenchymal hematoma type 2, and stroke recurrence.

Conclusions: ; While all four RCTs were conducted to demonstrate the superiority of intensive BP control over standard BP control, standard BP control may be beneficial for the outcome after EVT for AIS with LVO without increasing adverse safety outcomes. Caution should be needed with the application of intensive BP control during the 24 hours following successful recanalization after EVT.

Trends in Dual Antiplatelet Therapy of Aspirin and Clopidogrel and Outcomes in Ischemic Stroke Patients Non-eligible for POINT/CHANCE Trial Treatment

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Purpose: Recent clinical trials established benefit of dual antiplatelet therapy with aspirin and clopidogrel(DAPT-AC) in early-presenting patients with minor ischemic stroke. However, the impact of these trials over time on the use and outcomes of DAPT-AC among the patients with non-minor or late-presenting stroke who do not meet the eligibility criteria of these trials has not been delineated.

Methods: In a multi-center stroke registry, this study examined yearly changes from April 2008 to August 2022 in DAPT-AC usage for non-cardioembolic stroke patients ineligible for CHANCE/POINT clinical trials due to NIHSS scores >4 or late arrival beyond 24h of onset. Exclusion criteria were: 1) treated with acute reperfusion therapy or carotid revascularization such as endarterectomy or carotid artery stenting; 2) treated with anticoagulation. To identify changes in the trend of DAPT-AC proportion and adjusted event rates, join point regression was estimated by using the Joinpoint Regression Program.

Results: A total of 32,118 patients(age, 68.1±13.1years; male, 58.5%) with a median NIHSS of 4(IQR 1-7) were analyzed. In 2008, DAPT-AC was used in 33.0%, other antiplatelet regimens in 62.7%, and no antiplatelet agents in 4.3%. The frequency of DAPT-AC use was relatively unchanged through 2013, when the CHANCE trial was published, and then increased steadily, reaching 78% in 2022, while other antiplatelet regimens decreased to 17.8% in 2022(Ptrend;<0.001). From 2011-2022, clinical outcomes non-significantly improved, with an average relative risk reduction of 2% per year for the composite of stroke, myocardial infarction, and all-cause mortality, both among patients treated with DAPT-AC and patients treated with mono- and other dual antiplatelet regimens.

Conclusions: Use of DAPT-AC in stroke patients ineligible for recent DAPT clinical trials increased markedly and steadily after CHANCE trial publication in 2013, reaching deployment in nearly 4 of every 5 patients by 2022. The secondary prevention effects in patients with ischemic stroke seem to be gradually improving, possibly due to the enhancement of risk factor control. Further research is needed to explore the use of DAPT-AC in patients who are not candidates for DAPT-AC.

Efficacy of delayed human recombinant erythropoietin initiation in acute ischemic stroke: A single center study

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Purpose: Human recombinant erythropoietin (EPO) has demonstrated positive 3-month outcomes, irrespective of tissue plasminogen activator (tPA) use in the acute ischemic stroke. Despite variations in dosage and duration, the consensus is on initiating treatment within the first 6 hours. This study aims to investigate the impact of delayed EPO treatment beyond 6 hours on 3-month outcomes.

Methods: Fifty-three acute ischemic stroke patients confirmed by MRI within 48 hours were categorized into Groups A (<6 hours onset), B (6-24 hours onset), and C (24-48 hours onset). EPO, administered as 20,000 U within 3 hours and subsequently every 24 hours (totaling 100,000 units), followed standard protocols. Neurological and functional outcomes were assessed using the modified Rankin Scale (mRS) at admission and 3 months post-diagnosis. Statistical analyses utilized SPSS, employing repeated-measure ANOVA and the Cochran Q test.

Results: Groups A, B, and C (18, 18 and 17 patients) exhibited no significant baseline differences other than the number of hyperlipidemia patients. All groups showed benefits in mRS at 3 months, with significant improvements in Groups A and B, while Group C showed no significance (Group A mRS, from 2.53 to 1.77; Group B mRS, 2.57 to 2.19, Group C mRS, 2.58 to 2.37; p =0.002) (Table 1). Except for an initial influenza-like syndrome, no significant side effects were observed.

Conclusions: Delayed EPO initiation before 24 hours from onset positively impacted 3-month outcomes. But efficacy declined with delayed initiation, emphasizing the importance of early administration. This study supports EPO benefits beyond the tPA window, advocating for early initiation. Further research on larger cohorts and dosage/long-term administration is warranted.

Table 1. mRS change from baseline to 3 months after EPO treatment

	Group A (n=18)	Group B (n=18)	Group C (n=17)	P value
Characterisitics				
Age, mean (sd)	72.3 (11.6)	73.3 (16.9)	71.5 (10.7)	0.072
Male, (n, %)	10 (55.6)	11 (61.1)	9 (52.9)	0.059
Hypertension, (n, %)	13 (72.2)	14 (77.7)	12 (70.6)	0.054
Diabetes Mellitus (n, %)	7 (38.9)	6 (33.3)	6 (35.2)	0.053
Dyslipidemia, (n, %)	10 (55.6)	9 (50.0)	8 (47.1)	0.039
Atrial fibrillation, (n, %)	2 (11.1)	2 (11.1)	2 (11.8)	0.389
Previous stroke (n, %)	3 (16.7)	3 (16.7)	3 (17.6)	0.118
CKD (eGFR <50 mL/min /1.73m²), (n, %)	5 (27.8)	6 (33.3)	5 (29.4)	0.061
Cancer, (n, %)	0	0	0	N/A
Deep venous thromobosis, (n, %)	0	0	0	N/A
Rheumatoid disease, (n, %)	0	1 (5.6)	0	0.373
HFrEF, (n, %)	1 (5.6)	1 (5.6)	1 (5.9)	0.882
Dementia, (n, %)	7 (38.9)	8 (44.4)	7 (41.1)	0.537
Functional outcome				
Initial NIHSS, mean (sd)	8.44 (1.21)	8.39 (0.98)	8.51 (1.13)	0.789
mRS at baseline, mean (sd)	2.53 (0.52)	2.57 (0.46)	2.58 (0.43)	0.586
mRS at 3months, mean (sd)	1.77 (0.43)	2.19 (0.51)	2.37 (0.46)	0.009
mRS change, mean (sd)	-0.76 (0.13)	-0.38 (0.11)	-0.21 (0.10)	0.002

mRS, modified Rankin Scale; EPO, human recombinant erythropoietin; sd, standard deviation; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HFrEF, heart failure with reduced ejection fraction (<40%); NIHSS, National Institute of health stroke scale; N/A, not applicable.

Effect of nurse's detection of neurological deterioration on the prognosis of patients with acute cerebral infarction

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Purpose: There is little evidence about the factors related to the detection of neurological deterioration by nurses. We examined the related factors and therapeutic outcomes of nurses' detections of patient's neurological deterioration.

Methods: This was a descriptive retrospective study. We included 549 adult stroke patients who were admitted to the acute stroke unit of a tertiary hospital between May 2018 and December 2019 and had changes in neurological symptoms that were detected by stroke nurses. We measured the following outcomes: stroke lesion progression, early neurological deterioration (END; increase in the total national institutes of health stroke scale score of 2 points or more, increase in the limb weakness score of 1 point or more, or decrease in the alertness score of 1 point or more), and additional clinical management (increasing intravenous fluids, diagnostic imaging, or neuro-intervention). Data was analyzed by logistic regression.

Results: A total of 651 new or aggravating symptoms were detected by nurses. The most detected symptom was motor aggravations (49.2%). Symptoms were commonly detected during the day shift (51.0%) and by scheduled neurochecks (71.3%). Of 132 patients who underwent diagnostic imaging by nurses' detection, 63.6% cases had stroke lesion progression. Nursing experience over 4 years was positively associated with finding stroke lesion progression (OR: 2.49, 95% CI=1.09-5.67). END was found in 70.7%, and it was significantly higher during scheduled neurochecks (OR:2.65, 95% CI=1.04-6.72) and in the group of large artery atherosclerosis (OR: 2.19, 95% CI=1.06-4.49) Additional clinical management was provided to 49.9% of detection, and scheduled neurocheks (OR: 4.76, 95% CI=2.18-10.39) and changes of alertness (OR: 2.89, 96% CI=1.51-5.26) were the significant factors.

Conclusions: Stroke nurses were able to detect a large number of stroke lesion progression and END as well as to provide additional clinical management. Systematic guidelines for qualification of stroke nurses may be beneficial.

The Risk of Ischemic Stroke Incidence in Korean Cancer Patients: Insights from National Health Insurance Data

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Purpose: While nationwide studies have been conducted on the risk of stroke in cancer patients, there are limitations in generalizing the results to other races, continents, or countries. We aimed to conduct a nationwide study in Korea and compare it with similar studies in Western countries to analyze differences.

Methods: We recruited 91,424 patients diagnosed with cancer from the Korean NHIS data between 2011 and 2015, and enrolled 182,848 controls. These participants were followed up for five years. Hazard ratios (HRs) for ischemic stroke occurrence in the patient group compared to the control group were compared four times during the follow-up period (at 6 months, 1 year, 3 years, and 5 years).

Results: For all types of cancer except colorectal cancer, gall bladder cancer, bile duct cancer, and head & neck cancer, the increase in initial (6-month) cumulative incidence (CI) was higher compared to long-term follow-up (1 year, 3 years, 5 years), and the risk of ischemic stroke was higher compared to the control group. In lung cancer, pancreatic cancer, and liver cancer, the risk of ischemic stroke increased significantly compared to the cancer-free group after long-term follow-up, while it did not increase in thyroid cancer, stomach cancer, colorectal cancer, gallbladder cancer, bile duct cancer, and head & neck cancer.

Conclusions: The results of the study in stomach, colorectal, and liver cancer differed from previous Western findings. This could be attributed to unaccounted variables in the insurance system such as individual characteristics of cancer patients , age and risk factor distribution for each subtype of cancer, the process of screening and diagnosing cancer, as well as the treatment methods and prognosis of diagnosed patients.

Evaluating the impact of additional antithrombotic therapy on net clinical outcomes in patients with atrial fibrillation, stroke, and atherosclerosis

Darda Chung[1], Bang Hoon Cho[1], Kyung-Hee Cho[1], Sung Wook Yu[1], Woo-Keun Seo[2]

[1]Neurology, Korea University Anam Hospital, Seoul, Korea,[2]Neurology, Samsung Medical Center, Seoul, Korea

Purpose: The balance between the reduction in major adverse cardiovascular events and the increase in major bleeding associated with adding antithrombotic therapy in stroke patients taking anticoagulation for atrial fibrillation with concomitant atherosclerosis is controversial.;This study utilized data from a multicenter stroke registry to evaluate the net clinical outcomes of adding antithrombotic therapy in patients already taking an oral anticoagulant;for atrial fibrillation and stroke.

Methods: Subjects were recruited from patients enrolled in the Korean ATrial fibrillaTion EvaluatioN regisTry in Ischemic strOke patieNts (K-ATTENTION) nationwide multicenter registry between 2013 and 2015.The net clinical outcome was assessed using 2 endpoints: a composite endpoint of major adverse cardiovascular events (stroke recurrence, acute myocardial infarction, and cardiovascular death) and major hemorrhagic events.;Cox proportional hazards models were employed to elucidate the relationship between clinical factors and each specified outcome.

Results: A total of 2,257 patients (mean age 72.73 ± 9.74, 52.9% male) were ultimately enrolled in the study. Net clinical outcomes were observed in 195 of the total patients, of which 165 were major adverse cerebrovascular events and 33 were major bleeding events.;Antithrombotic therapy hazard ratio [95% confidence interval]; 0.704 [0.504-0.984], p=0.040), diabetes (0.735 [1.545-0.990], p=0.043), and creatinine clearance (0.990 [0.984-0.996], p=0.001);were inversely associated;with net clinical outcomes. Meanwhile, the use of oral anticoagulants (1.488 [1.043-2.123], p=0.029) and higher platelet counts (1.001 [1.000-1.003], p=0.017) were positively associated with the occurrence of net clinical outcomes.;A trend toward interaction was observed between atherosclerosis and antithrombotic treatment regarding the occurrence of net clinical outcomes (p=0.052).

Conclusions: In patients already taking an oral anticoagulant;for atrial fibrillation and stroke;the addition of antithrombotic therapy for atherosclerosis can potentially contribute to reducing the incidence of net clinical outcomes.

Duration of Diabetes Mellitus and the Risk of Incident Dementia Among Ischemic Stroke Patients

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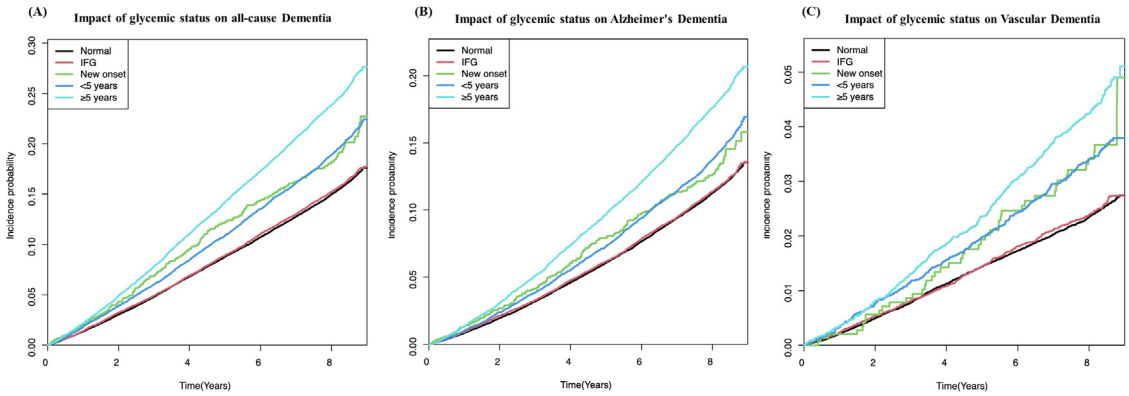
[1]Department Of Neurology, Inha University Hospital, Incheon, Korea,[2]Department Of Statistics And Actuarial Science, Soongsil University, Seoul, Korea,[3]Department Of Neurology, Soonchunhyang University Seoul Hospital, Seoul, Korea,[4]Department Of Medicine, Seoul National University College Of Medicine, Seoul, Korea,[5]Division Of Cardiology, Department Of Internal Medicine, Dongtan Sacred Heart Hospital, Hwaseong, Korea,[6]Institute Of New Frontier Research Team, Hallym University College Of Medicine, Chuncheon, Korea,[7]Department Of Neurology, Hallym University Sacred Heart Hospital, Anyang, Korea

Purpose: Diabetes mellitus (DM) is a recognized risk factor for dementia among individuals who have survived a stroke. Yet, the influence of DM duration on the likelihood of developing new-onset dementia within this group is not well understood. Therefore, our research aims to clarify the relationship between the duration of DM and the risk of developing all-cause dementia, which includes Alzheimer's disease (AD) and vascular dementia (VaD), in patients with a history of stroke.

Methods: Leveraging the Korean National Health Insurance Database (K-NHID), this retrospective cohort study 118,790 individuals with a stroke history but no previous dementia diagnosis, monitored from 2009 to 2018. We classified diabetic status into five categories: normoglycemia, impaired fasting glucose (IFG), newly diagnosed DM, and established DM with durations of less than 5 years and 5 years or more. The primary endpoint was the incidence of dementia, adjusting for a range of demographic and clinical factors.

Results: Among 118,790 participants (average age 64.26 ± 9.95, 48% male), 16.7% developed dementia over an average follow-up period of 7.3 ± 2.3 years. Significantly, individuals with a history of diabetes mellitus (DM) for over five years exhibited a 46.6% higher risk of developing all-cause dementia compared to those without DM, with an adjusted hazard ratio (aHR) of 1.466 (95% confidence interval [CI], 1.408-1.527). In particular, the risks of developing Alzheimer's disease (AD) and vascular dementia (VaD) were increased by 43.4% and 51.4%, respectively, for individuals with a DM duration exceeding five years (aHR 1.434, 95% CI 1.366-1.505 for AD and aHR 1.514, 95% CI 1.365-1.679 for VaD). Further subgroup analysis revealed that those under the age of 65 with an extended duration of DM faced a significantly increased risk of dementia.

Conclusions: Our findings demonstrate a significant association between extended duration of DM following a stroke and an increased risk of developing all-cause dementia, including AD and VaD. These results emphasize the proactive dementia prevention approaches in stroke survivors, particularly those with long-standing DM.


(A)
Impact of glycemic status on all-cause Dementia
Normal
IFG
New onset
<5 years
≥5 years
Incidence probability
Time(Years)
(B)
Impact of glycemic status on Alzheimer's Dementia
Normal
IFG
New onset
<5 years
≥5 years
Incidence probability
Time(Years)
(C)
Impact of glycemic status on Vascular Dementia
Normal
IFG
New onset
<5 years
≥5 years
Incidence probability
Time(Years)

Congenital Absence of the Bilateral Internal Carotid Arteries

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Purpose: Congenital absence of the bilateral internal carotid arteries (ICA) is a very rare occurence. Recognition of this rare anomaly is important, when considering intracranial endovascular interventions in the event of thromboembolic events with re-vascularization, transsphenoidal surgery, and the surveillance and detection of associated cerebral aneurysms.

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.; A brain MR angiography was subsequently performed, which revealed non-visualization of bilateral ICAs, prominent bilateral vertebral arteries, and prominent basilar and posterior communicating arteries (PCOMs). The PCOMs were supplying both middle cerebral arteries (MCAs) and the anterior cerebral arteries (ACAs) via the circle of Willis.

Results: Brain CT showed the absence of the both carotid canals which confirmed the agenesis of both ICAs. Brain 99mTc-ethyl-cysteinate dimer single-photon emission computed tomography (99mTc-ECD SPECT) showed mild reduced resting brain perfusion in the bilateral MCA territories.; The patient's symptom resolved spontaneously during admission and was attributed to either transient ischemic attacks or migraine headaches.

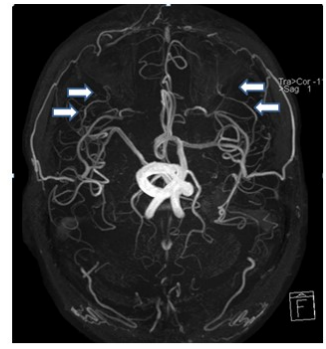
Conclusions: Recognition of the absence of bilateral ICAs is important when planning intracranial vascular intervention, as both cerebral hemispheres may be dependent on a basilar artery. It is also important to recognize the intercavernous collateral pathway when planning transphenoidal hypophyseal surgery. Although most patients remain asymptomatic, the association with a high prevalence of aneurysm is an indication for clinical and radiological surveillance for these patients.

Fig. 1a.

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 (arrow head) with the A2 segment being reformed via the anterior communicating artery (arrow).

Fig. 1b.

Brain MRA reveals anomalous origin of the both ophthalmic arteries derived from the ipsilateral middle meningeal arteries (arrows).



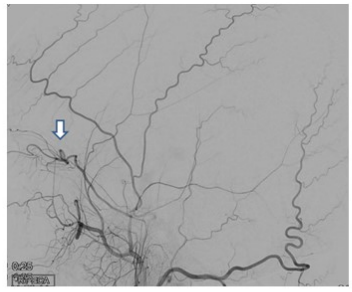
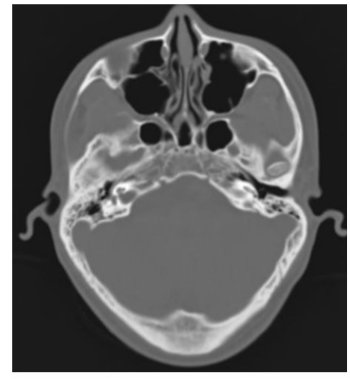


Fig. 1c.

Tranfemoral cerebral angiography reveals reveals anomalous origin of the right ophthalmic arteries derived from the ipsilateral middle meningeal artery (arrow).

Fig. 1d.

Brain computed tomography (CT) in bone window at the skull base shows a lack of bilateral bony carotid canals.



Endovascular thrombectomy in patient with in hospital ischemic stroke

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Purpose: Acute ischemic stroke arising within a hospital (IHS) represents a critical emergency and may stem from various etiologies including cancer, cardiac or surgery-related, infectious causes, as well as discontinuation of antithrombotic medications pre- and post-surgery. Given its occurrence within a hospital, expedited administration of intravenous thrombolysis is feasible, yet its contraindications necessitate consideration. Therefore, we investigated the prognosis of endovascular treatment in patients with IHS and assessed independent risk factors influencing treatment outcomes.

Methods: We conducted a retrospective analysis of all patients who underwent endovascular treatment for acute cerebral infarction between 2012 and 2022 at Asan Medical Center in Seoul. Among these patients, favorable short-term outcomes (modified Rankin scale (mRS) scores of 0-2 at 3 months) were observed in cases of IHS. We also compared the outcomes of endovascular treatment between in-hospital and out of hospital onset acute ischemic stroke (OHS) cases.

Results: The IHS group exhibited a younger age, higher prevalence of active cancer, and a lower frequency of intravenous thrombolysis administration. Despite a shorter symptom onset to recanalization time, there was no significant differences in the rates of successful recanalization (mTICI 2b-3) or symptomatic intracerebral hemorrhage between the two groups (p=0.078 and p=0.785, respectively). At the 3-month follow-up, the IHS group has a poorer prognosis (28.6% vs 44.3%, p=0.002). Multiple logistic regression analysis revealed age (aOR 0.97, CI 0.96-0.99), initial stroke severity (NIHSS) (aOR 0.84, CI 0.81-0.88), and symptomatic intracerebral hemorrhage (aOR 0.09, CI 0.02-0.41) and in-hospital cerebral infarction (aOR 0.44, CI 0.21-0.88) as independent factors associated with an unfavorable prognosis. Only successful recanalization (aOR 6.7, CI 2.64-16.9) was a favorable prognostic factor.

Conclusions: The IHS group exhibited a worse prognosis compared to the OHS group, despite achieving a shorter time from symptom onset to recanalization. This disparity is attributed to the unfavorable prognosis associated with active cancer, which constitutes a notable portion of in-hospital cerebral infarction cases. Furthermore, it is suggested that enhancing successful recanalization rates and minimizing symptomatic intracerebral hemorrhage incidents could lead to improved outcome.

Rationale and design of the clinical trial to obtain the highest efficacy of dual antiplatelet therapy after carotid artery stenting in high bleeding risk patients (CHET): prospective multicenter randomized trial

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[1]Neurology, Samsung Medical Center, Seoul, Korea

Purpose: Dual antiplatelet therapy (DAPT) with aspirin and a clopidogrel reduces ischemic events in patients undergoing carotid artery stenting (CAS), but these benefits come at the expense of increased risk of bleeding when compared with aspirin or clopidogrel mono antiplatelet. The benefit of DAPT may be reduced, especially in patients with underlying medical conditions that increase the risk of bleeding. It is unclear whether mono antiplatelet might maintain anti-ischemic efficacy while reducing the bleeding risk compared with DAPT after implantation of the CAS.

Methods: The CHET trial is a prospective, open-label, multi-center, and randomized study designed to test the superiority of safety (clinically relevant bleeding) and non-inferiority of efficacy (composite of cardiovascular death, myocardial infarction, cerebrovascular events, and major bleeding) of a mono antiplatelet compared with aspirin plus clopidogrel after 1 month DAPT in patients undergoing CAS with high bleeding risk.;High bleeding risk was defined as a risk of BARC type 3 or 5 greater than 4%/year or a risk of intracranial hemorrhage greater than 1%/year.

Results: A total of 1556 patients will be randomized to 1 of the 2 DAPT duration groups. Randomization will be stratified by investigational center only for patients who are free of clinically relevant bleeding, stroke, myocardial infarction, and cardiovascular death at the time of DAPT administration for one month after CAS. The primary end point is a clinically relevant bleeding (Bleeding Academic Research Consortium [BARC] type 2,3 or 5) at 11 months after the randomization. The key secondary end point is a composite of cardiovascular death, myocardial infarction, cerebrovascular events, and major bleeding (BARC type 3 or 5).

Conclusions: The CHET trial aim to examine the superiority of mono antiplatelet with one of any available aspirin or clopidogrel versus conventional DAPT of a clopidogrel plus aspirin in a patients who receiving CAS with high bleeding risk.

Changes in clinical outcomes of carotid artery stenting over 20 years

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[1]Neurology, Samsung Medical Center, Seoul, Korea

Purpose: In recent years, the age of patients undergoing carotid stenting has been increasing due to the growing elderly population. In the past, the CREST study compared carotid artery stenting (CAS) to carotid artery endarterectomy (CEA) and showed a more favorable outcome with CEA in patients over 70 years of age. However, with the recent development of various drugs and aggressive risk factor control, the efficacy and safety profile of CAS is better than before. Therefore, we aim to investigate the effectiveness and safety of carotid stenting by analyzing the outcomes of patients who underwent CAS at Samsung medical center over a 20-year period.

Methods: From January 2003 to October 2022, 975 patients who underwent carotid stenting at Samsung medical center were finally enrolled in the study. Carotid stenting was performed when patients with symptomatic carotid atherosclerotic disease had a stenosis of $\geq$ 50% and patients with asymptomatic carotid atherosclerotic disease had a stenosis of $\geq$ 70%. Periprocedural complication was analyzed as ipsilateral ischemic stroke and ipsilateral hemorrhagic stroke occurring within 30 days after the CAS, and clinical outcome was analyzed as ipsilateral ischemic stroke, myocardial infarction, and hemorrhage with BARC 2-5 from 30 days to 1 year after CAS.

Results: Comparing the first 10 years to the second 10 years, periprocedural complications, 30-365 days ipsilateral ischemic stroke, and 30-365 days MI were significantly reduced in the second 10 years compared to the first, while 30-365 days BARC 2-5 hemorrhage was not significantly different. Similar results were observed in the analysis of only patients aged 70 years and older.

Conclusions: In the comparison of CAS in the previous decade with CAS in the most recent decade, there was a decrease in periprocedural complications and ipsilateral ischemic stroke in the most recent decade, and no significant difference in hemorrhage with BARC 2-5.

Subadventitial Arterial Dissection Presenting with Normal Initial Angiography

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Purpose: Magnetic resonance angiography (MRA) is a commonly utilized diagnostic tool for detecting an arterial dissection. A subintimal dissection tends to present with stenotic lesions, whereas a subadventitial dissection often exhibits aneurysmal dilatation. We present a case of a subadventitial dissection of the internal cerebral artery (ICA), notable for its normal appearance in the initial MRA.

Methods: Not applicable.

Results: A 58-year-old male presented to the outpatient clinic complaining of mild headache and tongue deviation to the left side which had occurred 5 days ago. He had no history of any physical trauma, medical illness or taking medication. Vital signs upon examination revealed a blood pressure of 146/96 mmHg, a body temperature of 36.1 °C, and a body mass index of 20.6. Neurological examination revealed left deviation of the protruded tongue without associated muscle atrophy. Results of laboratory tests including hemoglobin, erythrocyte sedimentation rate, C-reactive protein, and connective tissue disease-associated autoantibodies were unremarkable. Initial MRA exhibited a normal appearance of the left ICA. However, a double lumen with aneurysmal dilatation of the left distal cervical ICA was found in the T2-weighted and T1-weighted images with gadolinium enhancement. Intramural hematoma with aneurysmal dilatation was found in the subsequent high-resolution vessel-wall magnetic resonance imaging (MRI). A week later, conventional angiography revealed dissecting aneurysm in the late arterial phase, suggesting progression of subadventitial dissection into intimal tear. He was discharged with antiplatelet medication.

Conclusions: In a subadventitial dissection without intimal tear, the true lumen of the affected artery could remain preserved without impaired blood flow. The absence of a channel into the false lumen could lead into a normal appearance on MRA. Physicians should maintain vigilance and consider the possibility of arterial dissection even if the suspected lesion appears normal on MRA, as vascular wall pathology can still be detected on MRI.

Superior sagittal sinus dural arteriovenous fistula (DAVF) mimicking multiple microbleeds

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Purpose: Intracranial dural arteriovenous fistulas (DAVFs) are rare acquired disease resulting from abnormal shunting between intracranial dural arteries and venous system. Typically arising from structural weakness of the dural and a coinciding trigger factor, DAVFs can present with similar clinical and imaging characteristics to sinus thrombosis.

Methods: A 75-year-old male with a history of hypertension, atrial fibrillation and dyslipidemia presented with left leg weakness. Initial MRI showed no definite acute ischemic lesion. However, numerous microbleeds-like appearance with dilated cortical and intramedullary veins predominantly at high frontal and parietal lobes. Catheter angiography revealed DAVFs of the superior sagittal sinus and cortical venous drainage and the patient sugbsequnelty underwent Onyx embolization on both middle meningeal arteries and transcranial coil embolization on superior sagittal sinus.

Results: Follow-up MRI performed 1 month after the procedure showed decreased intraparenchymal and leptomeningeal hypervascularities, with a slight disappearance of dilated cortical and intramedullary veins observed on susceptibility weighted images after embolization.

Conclusions: Increased venous pressure in intracranial DAVFs can cause dilatation of cortical and intramedullary veins mimicking multiple microbleeds.

Multifocal dural arteriovenous fistula presenting with the first time seizure

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Purpose: Dural arteriovenous fistula(DAVF) is a rare vascular disease and it has been reported with various clinical manifestations in the previous reports. The clinical signs and symptoms vary depending on the location of the fistula and venous drainage characteristics, and the various presentations challenge clinicians in diagnosis of a DAVF. Furthermore, there may be no specific findings on the initial CT image, and it may mimic other cerebral vascular diseases, resulting in delayed diagnosis and posing challenges to prompt diagnosis.

Methods: A 17-year-old male patient presented to the emergency room with a seizure. He had no history of seizures or family history prior to admission. Before the seizure, he had been experiencing a headache for 3 days with poor oral intake. The seizure was of the generalized tonic-clonic type and lasted for 5 minutes, accompanied by postictal confusion. Due to multiple seizure episodes, sedatives were administered, and he was in a semi-comatose state. A brain CT scan revealed no hemorrhages, but CT angiography showed engorgement of multiple intracranial and cortical veins without definite evidence of cerebral venous thrombosis in the arterial phase. To lower intracranial pressure, first, emergency EVD insertion was conducted. Following that, extensive coil embolization with Onyx embolization was performed, with the procedure carried out in two sessions to accommodate the patient's condition.

Results: After embolization, there were significantly fewer feeding arteries for multifocal DAVFs, and the patient's mental status improved to drowsiness, allowing for a tolerable transfer to rehabilitation.

Conclusions: The patient's initial CT scan showed no signs of hemorrhage, but CT angiography revealed vessel engorgement mimicking cerebral venous thrombosis. When clinical presentation, neurological examination, or initial CT images are less helpful in differentiation, rapid further evaluation is crucial. After obtaining information about DAVF, prompt endovascular repair should be considered for patients experiencing symptoms that significantly affect their quality of life.

Association between tissue factor and successful recanalization in patients undergoing endovascular therapy

Haram Joo[1], Hyungwoo Lee[1], Hyo Suk Nam[1], Ji Hoe Heo[1], Young Dae Kim[1]

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Purpose: Tissue factor (TF) is known to be the cellular initiator of blood coagulation and plays a key role in;thrombosis. In this study, we determined the association between radiologic outcomes and tissue factor detected in human thrombus retrieved from cerebral arteries of patients with acute ischemic stroke due to large vessel occlusion.

Methods: This study was a retrospective study using the SMART-CLOT registry. We quantitatively analysed the thrombus components including TF. We collected the radiologic outcomes including successful recanalization (a modified treatment in cerebral infarction (mTICI) score of 3). We investigated whether there was a difference in the radiologic outcomes by the proportion of thrombus components including TF.

Results: For this analysis, 145 patients were enrolled. When we compared radiologic outcomes between patients with successful recanalization and those without, there were no significant differences in the occlusion sites, the number of passages, or hemorrhagic transformation between groups. However, compared to the patients without successful recanalization, patients who had successful recanalization had lower levels of TF (15.9 vs. 32.2, $p<0.005$).

Conclusions: As the proportion of TF increased, the chance of successful recanalization decreased. Considering the role of TF on the arterial damage and inflammation, our results suggest that;TF could be a potential marker of poor prognosis in endovascular therapy.

Automated rating of Fazekas scale in fluid-attenuated inversion recovery (FLAIR) MRI of ischemic stroke patients using deep learning

Eun-Tae Jeon[1], Seung Min Kim[2], Jin-Man Jung[1,3]

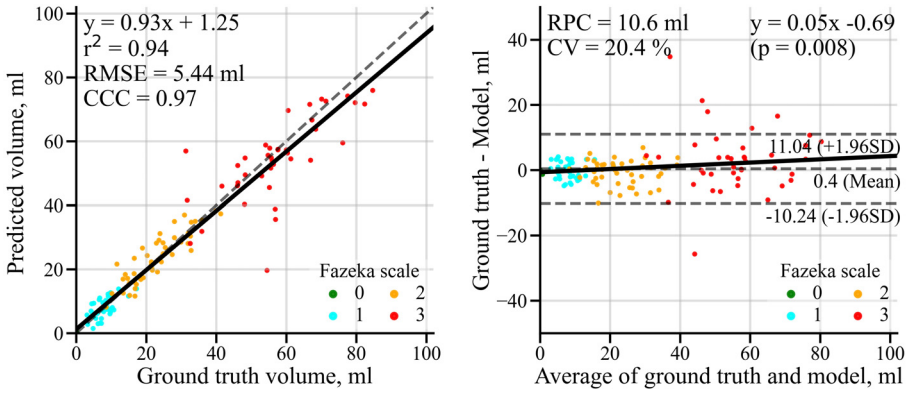
[1]Department Of Neurology, Korea University Ansan Hospital, Ansan, Korea,[2]Department Of Neurology, Veterans Health Service Medical Center, Seoul, Korea,[3]Korea University Zebrafish Translational Medical Research Center, Korea University Ansan Hospital, Ansan, Korea

Purpose: White matter lesions (WMLs) represent cerebral small vessel disease, associated with various underlying mechanisms. Their clinical significance includes links to future stroke, cognitive decline, and mortality, particularly in stroke patients. While the Fazeka scale is commonly used for WML assessment, its subjective nature poses limitations. Recent advancements in deep learning offer promising approaches for WML segmentation, aiming to integrate quantitative and structural qualitative characteristics, crucial for accurate diagnosis and treatment evaluation in stroke patients. Therefore, the aim of the study is the development of a deep learning pipeline integrating the segmentation of WMLs and the automatic rating of the Fazeka scale in patients with ischemic stroke.

Methods: This study is a substudy of a multi-center randomized double-blind controlled trial (RCT), involving patients within 6 months of experiencing ischemic stroke or transient ischemic attack, and those with symptomatic or asymptomatic ICH or multiple cerebral microbleeds were included. Additionally, patients meeting the criteria from stroke registries at three tertiary hospitals were included. We developed a two-step deep learning pipeline for automatic Fazeka scale prediction from T2 FLAIR images: [1]WMLs segmentation using a U-net-based residual network (uResNet), and (2) Fazeka scale rating using a 3-dimensional convolutional neural network (3D CNN). The inferred raw probability volume of WMLs obtained through uResNet was used to train a 3D CNN.

Results: This study included 313 patients from the RCT and 108 from the stroke registry in the analysis. The number of patients with Fazeka scores 0, 1, 2, and 3 were 97 (23.0%), 102 (24.2%), 119 (28.3%), and 103 (24.5%), respectively. Overall, uResNet achieved an AUPRC of 0.81 (95% CI, 0.55–0.95) and a Dice score of 0.73 (95% CI, 0.49–0.87) in the test set. The absolute error between true and predicted WML volumes was 3.1 ml (95% CI, 0.0 ml–15.9 ml). No significant volume differences were observed across Fazeka scale subgroups. In the agreement analysis, the R-squared value was 0.94, the concordance correlation coefficient was 0.97, and the systematic difference was 0.4 ml. The 3D CNN achieved a quadratic weighted kappa value of 0.951 through regression and 0.956 through classification tasks for Fazeka score prediction.

Conclusions: Our deep learning pipeline demonstrated accurate automatic WML segmentation and Fazekas scale grading in stroke patients. This approach offers a convenient method for evaluating WML burden using only FLAIR images in stroke patients, potentially aiding in predicting future vascular events.


y = 0.93x + 1.25
r2 = 0.94
RMSE = 5.44 ml
CCC = 0.97
Predicted volume, ml
Ground truth volume, ml
Fazeka scale
0
1
2
3
RPC = 10.6 ml
CV = 20.4 %
y = 0.05x -0.69
(p = 0.008)
11.04 (+1.96SD)
0.4 (Mean)
-10.24 (-1.96SD)
Ground truth - Model, ml
Average of ground truth and model, ml

Machine Learning-Based Classification of Diffusion-Weighted Imaging - Fluid-Attenuated Inversion Recovery Mismatch

Pum Jun Kim[1], Dongyoung Kim[1], Joonwon Lee[2], Hyung Chan Kim[3], Jung Hwa Seo[4], Suk Yoon Lee[4], Doo Hyuk Kwon[5], Hyungjong Park[6], Jaejun Yoo[1], Seongho Park[2]

[1]Department Of Electrical Engineering, Ulsan National Institute Of Science And Technology, Ulsan, Korea,[2]Department Of Neurology, Inje University Haeundae Paik Hospital, Busan, Korea,[3]Department Of Neurology, Ulsan Hospital, Ulsan, Korea,[4]Department Of Neurology, Inje University Busan Paik Hospital, Busan, Korea,[5]Department Of Neurology, Yeungnam University College Of Medicine, Daegu, Korea,[6]Department Of Neurology, Keimyung University School Of Medicine, Daegu, Korea

Purpose: The presence of a diffusion-weighted imaging (DWI) − fluid-attenuated inversion recovery (FLAIR) mismatch holds potential value in identifying candidates for recanalization treatment. However, the visual assessment of DWI−FLAIR mismatch (DFM) is subject to limitations due to variability among raters, which affects accuracy and consistency. To overcome these challenges, we aimed to develop and validate a deep learning-based classifier to categorize DFM.

Methods: We screened all acute ischemic stroke patients who underwent DWI and FLAIR imaging from a multicenter stroke registry. To establish reliable ground truth labels for DFM, five stroke neurologists performed joint reviews until consensus was reached, followed by independent reviews. The labels obtained were then converted into two binary label sets: Label Set I (DF match vs. DF non-match) and Label Set II (DF match vs. DF mismatch), for which Convolutional Neural Network (CNN)-based binary classification algorithms were developed. The performance of the developed models was assessed on both an internal test set and external validation sets, which included data from Keimyung University Dongsan Hospital (KM) and Yeungnam University Hospital (YN).

Results: A total of 2,369 patients from the derivation set, 350 from KM, and 329 from YN were included in the analysis. The Fleiss' Kappa statistic for agreement among multiple raters on the final labels was 0.911, indicating substantial inter-rater reliability. For Label Set I, the Area Under the Curve (AUC) for the internal test set was 0.862 (95% Confidence Interval (CI): 0.841−0.884). The AUCs for the external validation sets, KM and YN, were 0.829 (95% CI: 0.785−0.873) and 0.835 (95% CI: 0.790−0.879), respectively. For Label Set II, the AUC for the internal test set was 0.934 (95% CI: 0.911−0.957). For the external validation sets, KM and YN, the AUCs were 0.883 (95% CI: 0.829−0.938) and 0.913 (95% CI: 0.876−0.951), respectively. The calibration slope revealed a minimal difference between the predicted and observed probabilities of DFM. The Brier score for the internal test set was 0.02.

Conclusions: A deep learning-based classifier for DFM can be used to diminish subjectivity and support targeted decision-making in the treatment of stroke patients.

Figure 1. Receiver operating characteristic curve comparisons for internal and external test sets (KM, YN) across Label Sets I (A) and II (B)

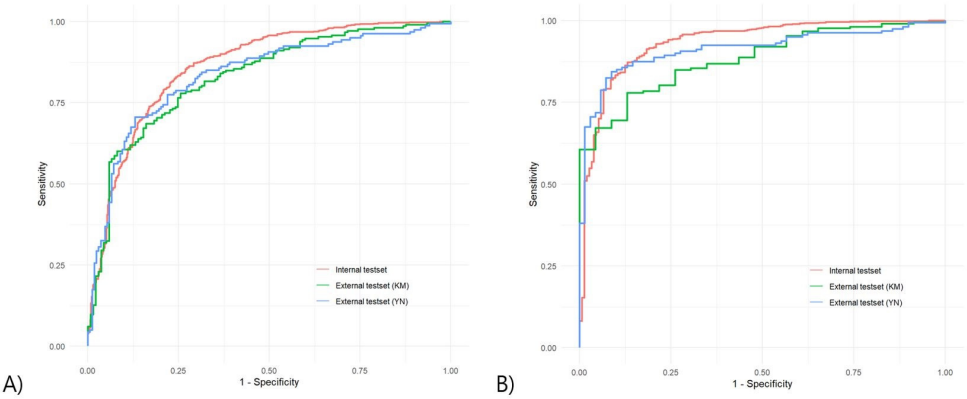
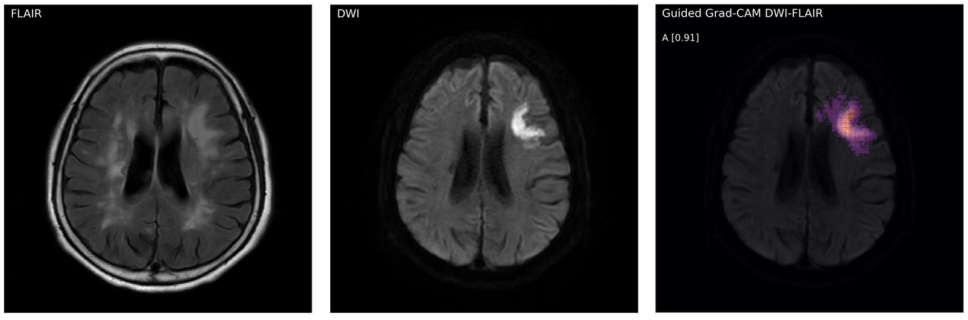
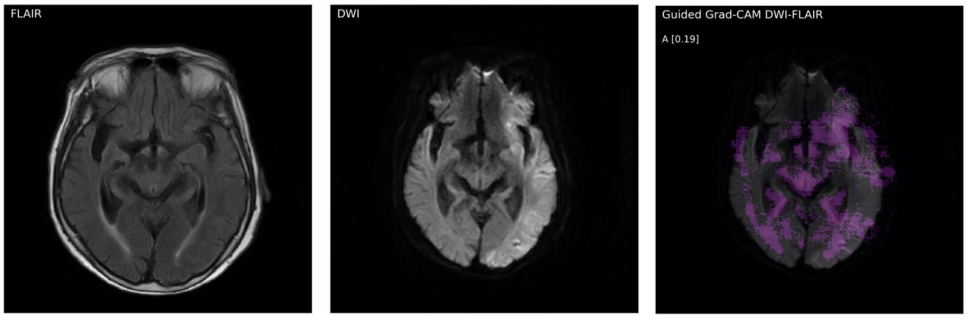


Figure 2. Guided Grad-CAM visualization of lesion in Diffusion-FLAIR match (A) and mismatch (B) Cases. Panel A illustrates a Diffusion-FLAIR match case where the Guided Grad-CAM highlights the lesion, presenting a focused pattern of attention on the abnormality. Conversely, panel B displays a Diffusion-FLAIR mismatch case, where the Guided Grad-CAM extends its attention beyond the lesion, indicating a less targeted pattern.

A)



B)



Hyperintense Acute Reperfusion Marker Sign in Patients with Diffusion Weighted Image-negative Transient Ischemic Attack

Taewoo Kim[1], Bum Joon Kim[1], Sung Hyuk Heo[2], Ho Geol Woo[2]

[1]Neurology, Asan Medical Center, Seoul, Korea,[2]Neurology, Kyung Hee University Hospital, Seoul, Korea

Purpose: Transient ischemic attack (TIA) is a transient focal cerebral dysfunction of vascular origin for which there is no definitive diagnostic tool. The hyperintense acute reperfusion marker (HARM) sign is a hyperintense signal observed on postcontrast fluid-attenuated recovery inversion images and is strongly associated with cerebral ischemic insults. The clinical significance of the HARM sign in TIA has rarely been studied, unlike that in stroke. This study investigated the relationship between the HARM sign and various clinical factors in diffusion-weighted imaging (DWI)-negative TIA. Furthermore, we investigated the relationship between the HARM sign with recurrence of TIA and ischemic stroke.

Methods: We included 329 consecutive patients with DWI-negative TIA and divided them into two groups according to the HARM sign: 299 patients in the HARM(-) group and 30 patients in the HARM(+) group. Clinical information, brain imaging, and follow-up data were gathered from medical records and phone calls and compared using the HARM sign.

Results: The patients with HARM sign were older (70.7 vs. 64.4 years, p = 0.007), had more previous TIA or stroke history within 12 months (26.7% vs. 4.0%, p < 0.001), and had higher systolic blood pressure (154.3 vs. 144.1, p = 0.022). The HARM(+) group also had a shorter symptom duration of <1 hour (63.3% vs. 38.8%, p = 0.009) and more symptomatic stenosis (50–99%) or occlusion (60.0% vs. 14.0%, p < 0.001). Among the transient neurological symptoms, only cortical symptoms were more prevalent in the HARM(+) group (30.0% vs. 8.7%, p = 0.002). The total follow-up duration of both groups was similar, and the Kaplan-Meier analysis showed a higher cumulative incidence of recurrent stroke in the HARM(+) group (log-rank test, p = 0.007). However, in the multivariate Cox analysis, the HARM sign was not independently associated with recurrent stroke, and only symptomatic stenosis or occlusion was independently associated with recurrent stroke in DWI-negative TIA cases (hazard ratio 3.412, 95% confidence interval 1.061–10.972).

Conclusions: The HARM sign was related to various clinical factors in patients with DWI-negative TIA. The HARM sign provides insight into the etiology of TIA and may be a useful imaging biomarker for predicting prognosis after TIA.

What is the Optimal rCBF Threshold for Ischemic Core on CT Perfusion?

Nakhoon Kim[1], Wi-Sun Ryu[2], Yoona Ko[1], Jeongmin Cha[1], Dong-Wan Kang[1], Do Yeon Kim[1], Jun Yup Kim[1], Jihoon Kang[1], Moon-Ku Han[1], Hee-Joon Bae[1], Beom Joon Kim[1]

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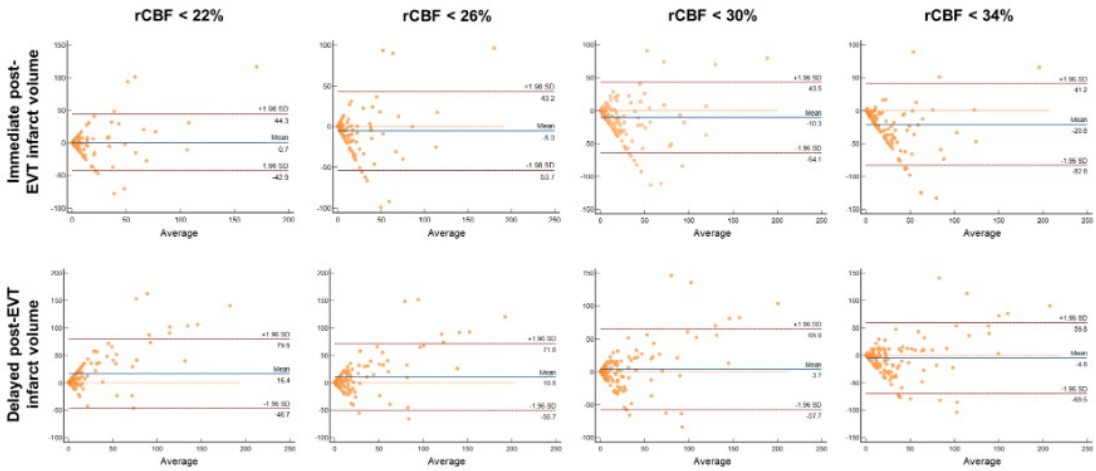
Purpose: CT perfusion imaging is crucial for measuring cerebral blood flow and informing endovascular treatment decisions in acute ischemic stroke resulting from large vessel occlusion. Yet, consensus on the ideal thresholds to define the ischemic core, which is typically associated with irreversible damage, remains elusive.

Methods: This study encompassed acute ischemic stroke patients with large vessel occlusion who achieved complete recanalization (TICI 3) post-endovascular treatment and had baseline CT perfusion and subsequent diffusion-weighted imaging between January 2015 and May 2023. We used JBS-10K to estimate ischemic core volumes using various regional cerebral blood flow thresholds from 18% to 34%. These ischemic core estimates were then correlated with both immediate and delayed post-treatment DWI volumes, utilizing concordance correlation coefficients and Bland-Altman analyses for comparison.

Results: Our study included 175 patients with acute large vessel occlusion. Median times from arrival to baseline CT perfusion, groin puncture, immediate post-endovascular treatment DWI scans, and delayed DWI scans were 24 [IQR 21–31] minutes, 37 [28–52] minutes, 1.6 [0.8–2.1] hours, and 89 [69–106] hours, respectively. An rCBF threshold of less than 22% most accurately predicted immediate post-treatment DWI volumes, while a threshold below 30% was better suited for delayed DWI volume prediction (Figure). The ideal rCBF threshold varied depending on the timing of the DWI scan.

Conclusions: We documented that the rCBF thresholds for defining the ischemic core before EVT may differ by the time of evaluating the final infarct. Our results suggest the potential necessity for personalized rCBF thresholds.


rCBF < 22%
rCBF < 26%
rCBF < 30%
rCBF < 34%
Immediate post-EVT infarct volume
Delayed post-EVT infarct volume
Average
Mean
+1.96 SD
-1.96 SD

Lobeglitazone, A Peroxisome Proliferator-Activated Receptor γ Agonist, Exhibits Anti-Inflammatory and Neuroprotective Effects in A Rat Model of Intracerebral Hemorrhage

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[1]Department Of Neurology And Critical Care Medicine, Seoul National University Hospital, Seoul, Korea

Purpose: Lobeglitazone is an oral antidiabetic medication, functions as a peroxisome proliferator-activated receptor γ (PPARγ) agonist and exhibits neuroprotective effects in neurological diseases. The aim of this study was to examine the beneficial effects and mechanisms of lobeglitazone on an experimental murine ICH model.

Methods: ICH was induced in the left striatum of Sprague-Dawley rats through the administration of 0.6 units of collagenase type IV. ICH rats were randomly allocated to three groups according to the treatments: [1]control group (distilled water); (2) lobeglitazone 2mg/kg; and (3) lobeglitazone 4mg/kg (n = 6 per group). These treatments were orally administered for 3 days following ICH. Brain edema was assessed on the third day 3 following ICH using ratio of ipsilateral to contralateral volume. Behavioral outcomes were assessed on days 1, 3, 6, and 13 after ICH using the modified neurological severity score (mNSS). Inflammatory cytokines and inflammatory cells were assessed through Western blot assay and immunohistochemistry on day 3 following ICH.

Results: The administration of lobeglitazone at a dosage of 4mg/kg led to a significant reduction in brain edema (15%, P = 0.001) compared to the control and 2mg (7%) groups, while not impacting blood glucose levels. Furthermore, the administration of lobeglitazone at a dosage of 4mg/kg resulted in the inhibition of macrophage and neutrophil infiltration in the brain (P = 0.001), as well as a decrease in the expression of various inflammatory cytokines such as interleukin-1 beta (IL-1β), extracellular signal-regulated kinase (ERK), and cyclooxygenase-2 (COX-2). The administration of lobeglitazone at a dosage of 4mg/kg resulted in a significant improvement in mNSS on day 3 and day 13 following ICH. The scores were 9.5 for the control group, 9.5 for the 2mg group, and 7.7 for the 4mg group on day 3, and 6.0 for the control group, 5.3 for the 2mg group, and 3.5 for the 4mg group on day 13 (P = 0.023).

Conclusions: The findings indicate that the PPARγ agonist lobeglitazone may exert neuroprotective effects on ICH by regulating brain edema and suppressing brain inflammation through the downregulation of the IL-1β-ERK-COX-2 pathway. Therefore, lobeglitazone has the potential to serve as a therapeutic agent for ICH.

A Case Report: Sporadic Hemiplegic Migraine with Radiological Features

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Purpose: Hemiplegic migraine is an uncommon subtype of migraine with aura which is clinically diverse, presenting a challenge for clinicians due to its potential to mimic other severe neurological diseases such as cerebrovascular disease. The onset is generally in adolescence and the overall estimated prevalence is 0.01%. Herein, we present our case demonstrating the clinical and radiological features of hemiplegic migraine.

Methods: A 22-year-old male presented to us with a history of headache and right-side hypesthesia of 30-minute duration. The headache was throbbing, rated 7 on the Numeric Rating Scale (NRS), and accompanied by nausea. He had no underlying medical conditions and was currently serving in the military. There were no recent events such as trauma, dehydration, or fever. He experienced similar pattern of headaches, occurring 2-3 times a week since he was in middle school. Neurological examination revealed motor aphasia with slight fluency impairment and right-side hypesthesia.

Results: Laboratory tests including hemogram, coagulation profile, liver and renal functions, CK, thyroid function, and serum lactate were normal. Brain magnetic resonance imaging (MRI), MR angiography, and computer tomography (CT) perfusion were performed 3 hours after symptom onset. MR angiography was normal (Figure1. (D)). Diffusion MRI suggested restriction lesions in the left cerebral hemisphere, particularly prominent venous structures in the left cerebral hemisphere were observed on susceptibility-weighted image (SWI) (Figure 1. (A), (B)). CT perfusion revealed subtle delayed and decreased cerebral perfusion in the left cerebral hemisphere (Figure 1. (C)). His echocardiogram was normal, and electroencephalogram did not show any epileptiform discharge. There were no specific findings in his cerebrospinal fluid study. He was managed conservatively and experienced gradual and complete recovery over the next day. Valproate was initiated for migraine prophylaxis, and he did not experience any further episodes of headache or focal neurological deficit.

Conclusions: The diagnosis of hemiplegic migraine lies in obtaining a detailed clinical history and excluding other possible causes for the patient's symptoms. Brain imaging during migraine attacks is usually normal. In very few cases, cortical edema may be seen in the hemisphere, and SWI during the acute phase might reveal a transient prominence of cerebral veins, as our case showed. As little is known about imaging abnormalities due to its rarity, we need to collect more cases displaying radiological characteristics associated with hemiplegic migraine.

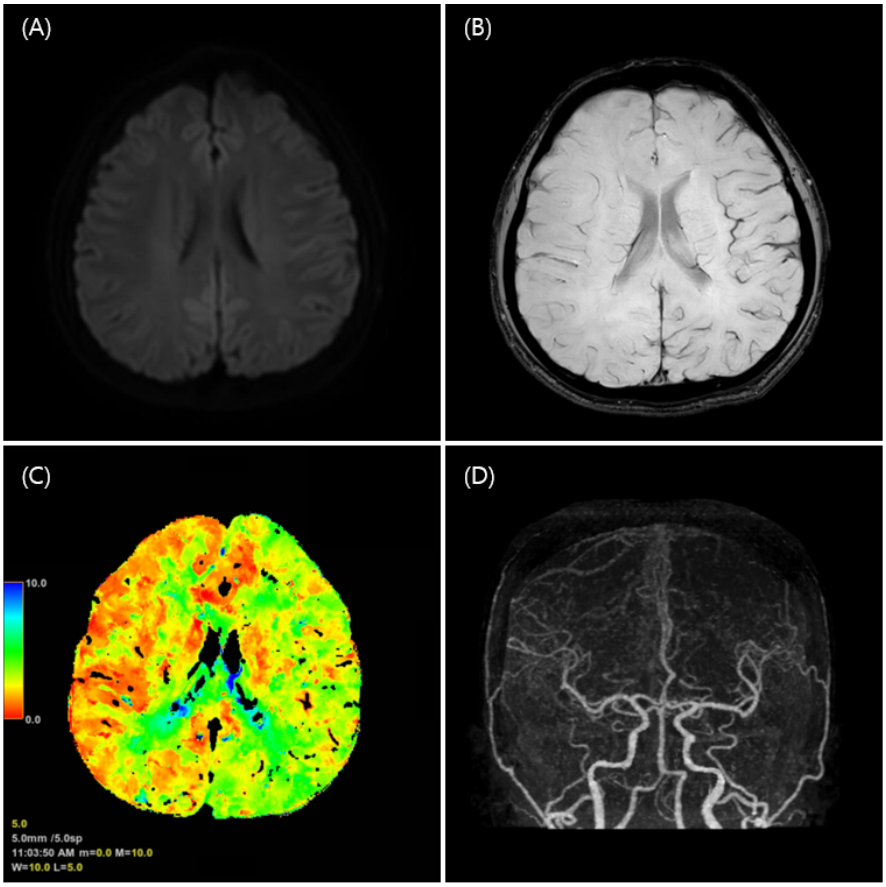

Figure 1. In the left hemisphere, restricted lesions are seen on DWI (A) and a prominence of cerebral veins on SWI (B). CT perfusion revealed subtle delaye d and decreased cerebral perfusion in the same lesion (C), while MR angiogr aphy was normal (D).

Investigating the Relationship Between COVID-19 Vaccination and Ischemic Stroke

Sangil Park[1], Sung Hyuk Heo[2]

[1]Neurology, Uijeongbu Eulji Medical Center, Uijeongbu, Korea,[2]Neurology, Kyung Hee University Hospital, Seoul, Korea

Purpose: In this study, the characteristics of ischemic stroke patients who experienced strokes before and after the risk period of the COVID-19 vaccine are compared, and the effect of the vaccine on ischemic stroke is examined.

Methods: This study was a single-center retrospective study of 626 patients who visited the hospital with ischemic stroke from January 2021 to March 2022. (Figure 1) The subjects of the study were investigated whether they had received a COVID-19 vaccine before the stroke occurred, and whether cerebral infarction occurred during the risk period of the COVID-19 vaccine (within 21 days after the vaccine).

Results: Of the 370 patients, 94 had a stroke within 21 days after COVID vaccination, and 276 had an ischemic stroke more than 21 days after COVID vaccination (Figure 1). The group with stroke within 21 days had significantly more peripheral arterial disease (4.3% vs 0.0%, P=0.004) and dyslipidemia (80.9% vs 66.3%, P=0.008), but significantly less atrial fibrillation (13.8% vs 23.6%, P=0.046). (Table 1) Patients who had a stroke during the vaccine risk period had an ischemic stroke after an average of 11.69 ± 6.06 days. In addition, National Institutes of Health Stroke Scale (NIHSS) (4.54 ± 4.87 vs. 4.70 ± 5.26, P=0.795) and Modified Rankin Scale (mRS) (2.29 ± 1.35 vs. 2.48 ± 1.43, P=0.249) were lower at discharge in stroke patients who had occurred during the vaccine risk period, but these differences were not statistically significant. In the Trial of Org 101072 in Acute Stroke Treatment (TOAST) classification, the proportion of large artery atherosclerosis (LAA) or other determined was statistically higher in stroke patients who occurred during the vaccine risk period (35.1% vs. 24.3%, P=0.041). (Table 2)

Conclusions: This study highlights that vaccine-associated coagulopathy can also be caused by other factors, including venous thrombosis, and can result in large arterial thrombosis, such as ischemic stroke.

Obesity paradox and initial stroke severity in cerebral artery dissection-related stroke

Jeong Yoon Song[1], Jae Young Park[1], Jun Sang Yoo[1], Yerim Kim[2], Jun Young Chang Chang[1], Dong-Wha Kang[1], Sun U. Kwon[1], Bum Joon Kim[1]

[1]Neurology, Asan Medical Center, Seoul, Korea,[2]Neurology, Kangdong Sacred Heart Hospital, Hallym University College Of Medicine, Seoul, Korea

Purpose: Obesity paradox still has controversy in stroke patients. Arterial dissection is an important cause of stroke, especially in young age stroke patients. Here we tried to investigate the association between obesity and dissection related stroke.

Methods: We enrolled acute ischemic stroke due to cerebral artery dissection based on clinical and imaging findings. Obesity was defined as body mass index more than 25 at admission. Demographics, vascular risk factors and imaging characteristics were compared between those with and without obesity. Factors associated with initial stroke severity were investigated.

Results: During the study period, 166 patients with arterial dissection were enrolled. Among them, 61(36.7%) patients showed obesity. Patients with obesity were more male (59.0%) showed a higher proportion of hyperlipidemia. Furthermore, the initial stroke severity was lower in those with obesity. From the multivariable analysis, obesity was independently associated with lower initial stroke severity (OR 0.742; 95% CI, 0.598-0.920, p=0.007).

Conclusions: Obesity may be protective for initial stroke severity in cerebral artery dissection related stroke.

	Univariable analysis		Multivariable analysis	
	Unadjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
Age (years)	1.022 (0.995-1.050)	0.112	1.020(0.990-1.051)	0.199
Gender, male (%)	0.909 (0.434-1.904)	0.800		
Hypertension (%)	1.179 (0.562-2.475)	0.663		
Diabetes Mellitus (%)	0.799 (0.213-2.988)	0.738		
Dyslipidemia (%)	0.631(0.223-1.783)	0.385		
Coronary artery disease (%)	0.000	0.999		
History of smoking (%)	1.512 (0.734-3.114)	0.262		
Body mass index (kg/m2)	0.812 (0.715-0.923)	0.001	0.789 (0.678-0.918)	0.002
Height (cm)	0.991 (0.948-1.036)	0.684		
Weight (kg)	0.955 (0.926-0.985)	0.004		
History of trauma	0.298 (0.109-0.816)	0.019	0.317(0.108-0.931)	0.037
LDL	0.996(0.986-1.005)	0.385		
HbA1c	1.290(0.807-2.063)	0.288		
Pain	0.454(0.219-0.940)	0.034	0.632(0.283-1.511)	0.320
Dissection site (intradural)	0.767(0.349-1.688)	0.510		
Stroke location (posterior circulation infarction)	3.899(1.826-8.322)	<0.001	2.120(0.885-5.082)	0.092
Long dissection	1.005(0.994-1.016)	0.379		
Dissection (multiple sites)	0.799(0.213-2.988)	0.738		
Dissection features (stenotic)‡	0.563(0.212-1493)	0.248		

Adherence and the Long-term Benefit of Early Positive Airway Pressure (PAP) Therapy after Acute Ischemic Stroke

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Purpose: Sleep disordered breathing (SDB), is under-recognized risk factor for stroke and the gold standard of managmeent of SDB is positive airway pressure (PAP) therapy. There are no clear guidelines when to start the PAP therapy after acute ischemic stroke. This study aims to examine the adherence and long-term benefit of early PAP after acute cerebrovascular events.

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, the patients underwent type 1 polysomnography (PSG). Patients whose Apnea-Hypopnea Index (AHI) was 5 or higher started PAP therapy within 7 days of stroke onset during hospitalization.

Results: From Dec. 2021 to October 2023, 191 patients agreed to participate in the study. From the type I PSG, 169 patients were diagnosed with OSA. Among them, 95 initiated PAP therapy during the hospitalization. Three months later, 45 patients (47.4%) performed good adherence to PAP and 36 individuals (37.9%) continued the good adherence to PAP therapy over 12 months. The patients who had good adherence to PAP therapy had lower glucose level (115.7 mg/dL vs. 117.6 mg/dL) and lower systolic blood pressure (128.1 mmHg vs. 130.8 mmHg).

Conclusions: The adherences of early PAP therapy at the 3 months and 12 months are tolerable. The 1 year follow-up data showed well-controlled vascualr risk factors in the good adherence group to PAP therapy.

A case of ischemic stroke related with familial atrial septal defect patient

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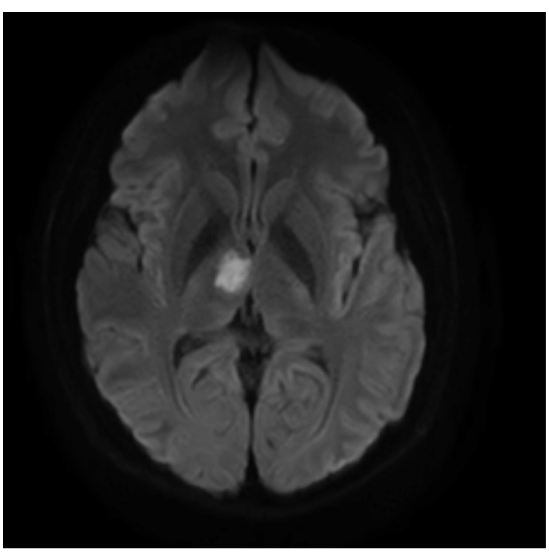
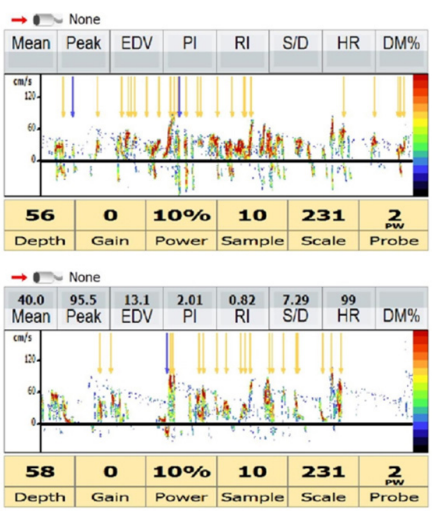
Purpose: The secundum type atrial septal defect (ASD) is a congenital heart disease and it have increased mortality and morbidity due to volume overload and paradoxical embolism. The risk of ASD varies depending on the shape and size, but the risk also varies depending on whether ASD is congenital ASD or sporadic ASD.

Methods: Here, we report a stroke that occurred in a familial ASD patient.

Results: 30-year-old female was admitted for abrupt onset dizziness and sleeping tendency. She did not have any diseases such as hypertension or diabetes that could be risk factors for stroke. Diffusion weighted MRI showed acute thalamic infarction. There was no stenosis or occlusion in vessel study. Her father and her younger brother were diagnosed familial ASD previously. TCD-PFO study showed large amount of right to left shunt flow and transesophageal echocardiography revealed secondum type atrial septal defect with atrial septal aneurysm (10.1mmX7.9mm). ASD closure was implemented using an Amplatzer septal occluder. No shunt flow was observed in the follow up TCD study after the procedure.

Conclusions: Most of congenital heart disease are sporadic form. As diagnostic methods have become precise, the diagnosis rate of familial ASD has increased. Recent study which compared the prognosis of familial and sporadic ASD report that risk of atrial fibrillation and heart failure is higher in familial type than sporadic type. For patients with familial ASD, more aggressive treatment may be considered.





Acute hyperglycemic effects in acute cerebral infarction with atrial fibrillation

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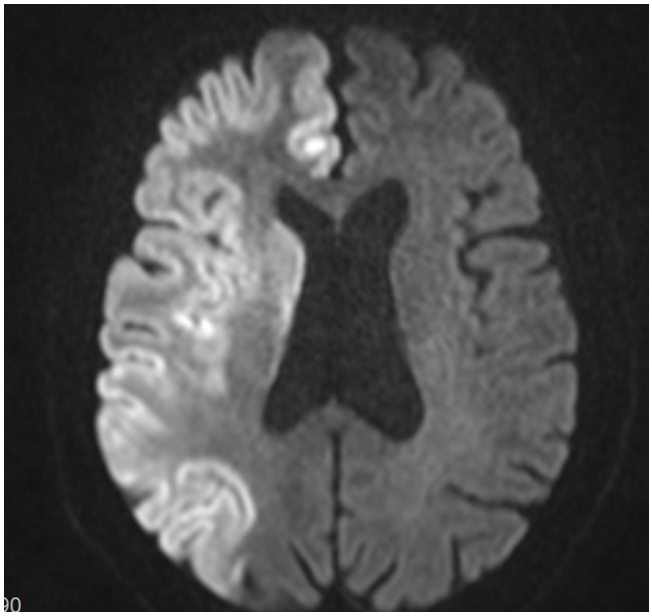
Purpose: Atrial fibrillation is the most common form of persistent arrhythmia that occurs mainly in the elderly. therefor AF with diabetes is the very high risk of cardiovascular disease, The longer diabetes persists the higher risk of thromboembolism appears to be elevated diabetes by 12% in patients with atrial fibrillation. Increased oxidative stress increase the release of free fatty acids in the blood, leading to atrial fibrillation and persistence in DM patients. Studies have already shown that diabetic patients with atrial fibrillation have a higher risk of developing cerebral infarction than non- DM patients. However, the mechanism by which sudden high glycemic condition causes acute cerebral infarction in elderly patients with atrial fibrillation has not yet been fully reported. The aim of this study was to investigate the role of sudden hyperglycemia plays a part as a risk factor for acute cerebral infarction in patients with chronic atrial fibrillation.

Methods: 87-Year-Old Female Patient taking apixaban 10 mg per day after the diagnosis of atrial fibrillation 3 months ago. She didn't take oral hypoglycemic agents for a week and became daily over 400 serum glucose for one week resulting in sudden loss of consciousness and left hemiplegia. She was diagnosed with acute right MCA cerebral infarction. Another patient was a 90-year-old male patient who was taking 10 mg of apixaban per day from a year ago. The patient did not take a hypoglycemic agents for 5 days on his own;and his blood sugar was above 300 per day. He was admitted to the emergency room with sudden vertigo and then was diagnosed with Rt. PICA infarction.

Results: Two elderly patients with atrial fibrillation experienced;acute cerebral infarctions due to abrupt;high blood sugar levels;for several days due to personal circumstances. Judging from this, it was confirmed that the size of the embolus was larger than that of the cerebral infarction observed in other atrial fibrillation patients, although it was in two cases, leaving serious aftereffects.

Conclusions: Sudden hyperglycemia has the potential trigger events by acute ischemic stroke in patients with AF. Many large epidemiological studies have shown that glycemic control within the target range is the only proven strategy for the prevention of diabetic vascular complications. The author emphasizes the need to pay more attention to avoid hyperglycemia in patients with atrial fibrillation ;



A Case of ROS1 Fusion-positive Non-small Cell Lung Cancer Initially Presented with Multiple Cerebral Infarction

Yu-Jin Kang[1], Chung Ryul Oh[2], Kang-Mo Gu[3], Hae-Bong Jeong[1]

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Purpose: Stroke is a leading cause of morbidity and mortality worldwide, with an estimated 10% of stroke patients harboring concurrent malignancies. Recent Korean studies suggest that up to 12.5% of ischemic stroke patients have either diagnosed or occult cancer, with approximately 40% of these strokes attributed to cancer-associated coagulopathy.;The etiology of strokes of undetermined origin accounts for about 30% of all strokes in the general populace but approximately 50% in cancer-related cases.;Here,;we report the case of;a young patient with recurrent cerebral infarction as the initial presentation of non-small cell lung cancer (NSCLC), characterized by lymph node metastasis without a solid tumor mass, identified through;pathology.

Case: A 31-year-old male, with a smoking history and a familial history of hypertension, presented with headaches and transient visual disturbances of right eye. Initial assessments, including imaging studies, revealed multiple cerebral infarctions;without significant arterial stenosis or occlusion. Elevated D-dimer and fibrinogen degradation products (FDP) levels suggested a hypercoagulable state. Further evaluation revealed multiple pulmonary embolisms and;mediastinal and peripulmonary lymphadenopathy. Dual antiplatelet agents and high-intensity statin;were started under the diagnosis of ischemic stroke due to sarcoidosis or cancer-related stroke.;Despite acute management, follow-up brain imaging showed increased ischemic lesions, so the antiplatelet agents were changed to a new oral anticoagulant (NOAC), and the patient was discharged in a neurologically stable condition.;However, 6 days later, the patient suddenly developed right-sided homonymous;hemianopia, and Left posterior cerebral artery occlusion was confirmed.;He;was treated with intravenous thrombolysis and intra-arterial thrombectomy. Eventually diagnosed;as;ROS1 fusion-positive;metastatic pulmonary adenocarcinoma, finally;diagnosed as a cancer-related stroke. The patient improved and is currently undergoing outpatient follow-up by using two types of tyrosine kinase inhibitors (Crizotinib and lorlatinib) and dalteparin.

Results: The intricate relationship between cancer and stroke, particularly in patients without conventional risk factors, poses significant diagnostic and therapeutic challenges. This case underscores the role of hypercoagulability as a crucial link between malignancy and stroke, emphasizing the need for a comprehensive evaluation in cases of unexplained cerebral infarctions. The recurrence of strokes despite anticoagulation highlights the complexity of managing cancer-associated thrombosis and the necessity for further research to optimize treatment strategies.

Conclusions: In young patients presenting with strokes of undetermined origin, particularly those with multifocal cerebral infarctions and elevated markers of coagulation, the possibility of an underlying malignancy should be considered. Even in lymphadenopathy, a rapid biopsy will be helpful in diagnosis and treatment.

The Influence of Evaluator Expertise on the Reliability of Verb Naming Task Assessments

Gyuri Park[1], Seong-Eun Hwang[1], Tae-Jin Song[2], Jungwan Kim[3]

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Purpose: The assessment of lexical retrieval capabilities in patients with neurologic speech- language disorders is a frequent component of various aphasia tests. Traditionally conducted by clinical neuropsychologists or speech-language pathologists, there has recently been an incursion by non-specialist evaluators such as nurses, occupational and social worker therapists into the assessment process. Given that an evaluator's proficiency and expertise can impact the reliability of assessment outcomes, this study sought to determine how evaluator expertise affects the reliability of verb naming task assessments.

Methods: The conventional Korean version of the Western Aphasia Battery has been in use for an extended period, familiar to both experts and non-experts, potentially leading to distortion effects in the results. Consequently, a new verb naming task was developed and utilized in this study. A group of 28 stroke patients was assessed using high-frequency verbs of two to three syllables that could be depicted pictorially, were not cognitive, psychological, or emotional verbs, and were not in the form "noun+하다" (to do something), selected based on their frequency in "The Frequency of Contemporary Korean Vocabulary" (Seo, 1998). Non-specialist evaluators (research nurses) conducted the assessments, which were then re-evaluated by specialist evaluators (speech-language pathologist) using video recordings. The difference in average assessment scores between expert and non-expert evaluators was analyzed using paired-sample t-tests, and interrater reliability was assessed using the interrater correlation coefficient (ICC).

Results: Statistically significant differences were found between the average scores of expert and non-expert evaluators ($t=-11.070$, $p<.001$). The expert evaluators' scores averaged 19.89±4.5, while the non-expert evaluators' scores averaged higher at 27.39±3.2, indicating a 7.5 point higher evaluation by the non-experts. The overall interrater reliability was found to be at a 'moderate' level ($ICC=.583$, $F=3.799$, $p<.001$).

Conclusions: Despite educating non-specialist evaluators on the task execution method twice, there was a slight lack of understanding regarding factors to consider during the lexical semantic processing stage, frequent provision of semantic and phonological cues, and components and principles of the task implementation method, such as the transition to the sentence completion task through the provision of semantic clues, were changed and applied. Thus, when non-experts conduct language assessments with stroke patients, precise adherence to and continuous training on the assessment manual are necessary, along with monitoring by the testing institutions.

The heterogeneous and multidimensional nature of cognitive language ability in non-aphasic stroke patients

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Purpose: This study aimed to profile in detail the language performance abilities of groups diagnosed with aphasia or non-aphasia following a stroke, as well as a control group, based on data obtained through the Digital assessment of Language and Cognition in Stroke ("ASLAN", Lee et al., 2024, under review), by examining task sub-areas.

Methods: The study involved 16 aphasic patients, 22 non-aphasic patients, and 20 normal individuals, who were assessed using seven sub-area tasks included in "ASLAN": confrontation naming-verb (30 points), defining words (15 points), verbal fluency-animal (5 points), writing sentences for situational pictures (10 points), choosing from situational pictures upon listening (20 points), choosing from situational pictures upon reading (10 points), and repetition (15 points). The total scores for each sub-area were normalized, and similarity analysis was conducted using the Euclidean Distance measurement method. The task performance abilities between aphasic vs. non-aphasic and non-aphasic vs. normal adults were compared using analysis of covariance (ANCOVA).

Results: First, comparing the performance of aphasic vs. non-aphasic stroke patients, the similarity between the two groups was 81.25%. The ANCOVA results showed no significant difference in task performance in naming animals ($F=0.488$, $p>.05$), defining words ($F=1.963$, $p>.05$)), choosing from situational pictures upon reading ($F=0.488$, $p>.05$), and repetition ($F=0.0$, $p>.05$). Second, the comparison between non-aphasic stroke patients and normal adults showed a similarity of 13.7%; however, a significant difference was found only in the task of naming animals ($F=17.797$, $p<.05$), with non-aphasic stroke patients performing significantly worse.

Conclusions: Comprehensive aphasia tests for stroke patients diagnosed with non-aphasia do not recommend language rehabilitation therapy. However, the digital language cognition performance of non-aphasic stroke patients is much more similar to that of aphasic stroke patients than to normal individuals, especially in tasks like defining words and naming animals, which are greatly influenced by frontal lobe function and word association ability, similar to aphasic patients. This suggests significant communication challenges in situations where one must convey intentions quickly and fluently within a limited time. This study highlights the need for consideration of language rehabilitation and education for non-aphasic stroke patients, given their broad linguistic spectrum.

Effect on Activating lexical Retrieval After Stroke

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Purpose: Difficulty in word retrieval in people with aphasia is the most prominent symptom(Lain,2006). The verb network strengthening treatment(Edmonds,2009) is an arbitration method aimed at improving the retrieval of various lexical corresponding to verbs by utilizing two types of thematic roles. In South Korea, verb naming performance using one type of thematic role of verbs has yet to be studied. This study aims 1) The correct response scores and response times of naming by aphasia severity according to the presence of thematic roles, 2) The effect of presenting or not presenting thematic roles on naming.

Methods: Divided into groups with fluent aphasia(P.K.WAB-R), those elicited spontaneous responses without presenting the thematic roles 8 with mild severity(mean AQ:77±1.32), 8 with moderate severity(mean AQ:65±.89) and those elicited responses after presenting the thematic roles 8 with mild severity(mean AQ:78.1±.78), 8 with moderate severity(mean AQ:66±1.56). The verbs were selected by the following criteria: 1) can be expressed in pictures, 2) exclude cognitive, psychological, and emotional verbs as well as the form of 'noun + do', 3) select high frequency(100 or more) lexical with less than three syllables. A video was presented to induce a response. The correct response rate(%) : total of 27 points. The response time : measured with an inverse efficiency score(Townsend,1983).

Results: As a result of analyzing the performance between groups according to the presence of the thematic roles by Two Way ANOVA, the group with thematic roles showed higher correct response scores($F=17.039$, $P<.001$) and faster response times($F=30.281$, $P<.001$) than the spontaneous response group. The regression analysis with dummy variables(presenting thematic roles:1, spontaneous response:0) was conducted. The explainability of correct response scores of mild and moderate groups with thematic roles were 54.3% and 43.6%, and the response times were 89.1% and 53.9%, which were statistically significant. The factor that had the greatest influence on the correct response score and response time was the presence of the thematic roles in both the mild($B=.737$, $P=.001$) ($B=-.944$, $P<.001$) and moderate($B=.66$, $P=.005$)($B=-.734$, $P=.001$) groups and the mild group was influenced most.

Conclusions: The result shows that activating lexical retrieval by presenting thematic roles allowed the participants to access verbs(Malyutina,2017) and provided lexical-semantic associations to facilitate lexical retrieval. In addition, when one thematic role was presented, it had a greater effect on the performance of naming in the mild group than in the moderate group, suggesting that the number of required thematic roles to improve lexical retrieval should vary depending on the severity of aphasia.

Comparing vocabulary production during sentence writing with and without aphasia

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Purpose: Conveying an informative message in a sentence, the process of selecting vocabulary in an abstract form and assigning semantic relations such as agent, object, and action must be prioritized (Bock & Levelt, 1994; Ha et al., 2013). Furthermore, sentence processing in written language requires higher-level cognitive processes than spoken language. We can assume that aphasia, a multi-modal language impairment due to neurological damage, is even more impaired in writing than normal adults with aging who are declined the ability semantically and syntactically. Therefore, we aimed to investigate the lexical-semantic differences in sentence writing responses between normal adults and aphasic stroke patients, and to determine whether semantic activation differs by lexical type by analyzing differences in the frequency of production by word class.

Methods: In this study, 20 normal adults(NA) (mean age: 62±6.0, mean education level: 11.4±2.72) and 15 aphasic stroke patients (AP) (mean age: 62.6±16.2, mean education level: 12.8±3.06, range of AQ: 25~86) were presented with one black and white line drawing and asked to write sentences about the picture situation. The sentence writing responses were analyzed in terms of Number of Total Words (NTW), Number of Different Words (NDW), lexical diversity (Type-Token Ratio (TTR)), and the number of production by word class (noun, verb, postposition, adjective, adverb). The Mann-Whitney U test was used for statistical analysis.

Results: The results showed that, first, the NTW (NA: 32.2±3.0, AP: 19.8±2.8) and NDW (NA: 27.2±2.5, AP: 16.3±2.3) of sentences between the two groups were significantly larger in the normal adults than in the aphasic stroke patients (NTW: U=72.0, p<.01, NDW: U=66.0, p<.01), but there was no significant difference in TTR. Second, among the word class produced in the writing responses between the groups, nouns (NA:13.5±1.2, AP:8.2±1.1), verbs (NA:7.6±0.6, AP:4.2±0.6), and adjectives (NA:0.6±0.2, AP:0.2±0. 2), were significantly larger to normal adults than the aphasic stroke patients(noun: U=64.5, p<.01, verb: U=60.0, p<.01, adjective: U=99.0, p<.05), but there was no significant difference for postpositions and adverbs.

Conclusions: These findings suggest that lexical-semantic conceptual production of primary word class such as nouns, verbs, and adjectives is the most difficult in the aphasic group, that function word production is not a key indicator to discriminate between the two groups, and that although the normal adults produced more words in written expression, lexical diversity did not differ from the patient group, suggesting that semantically key factors may vary with age when observing writing performance in the aphasic patients.

Center of Pressure-Based Machine Learning Gait Score and Clinical Risk Factors to Predict Functional Outcome in Acute Ischemic Stroke

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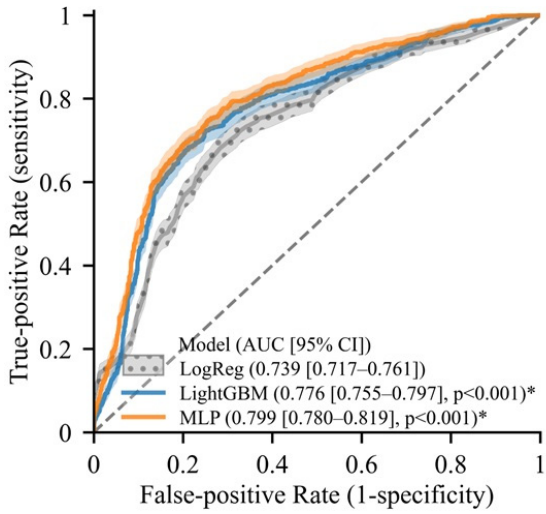
[1]Department Of Neurology, Korea University Ansan Hospital, Ansan, Korea,[2]Department Of Neurology, Kyungpook National University Chilgok Hospital, Daegu, Korea,[3]Korea University Zebrafish Translational Medical Research Center, Korea University Ansan Hospital, Ansan, Korea

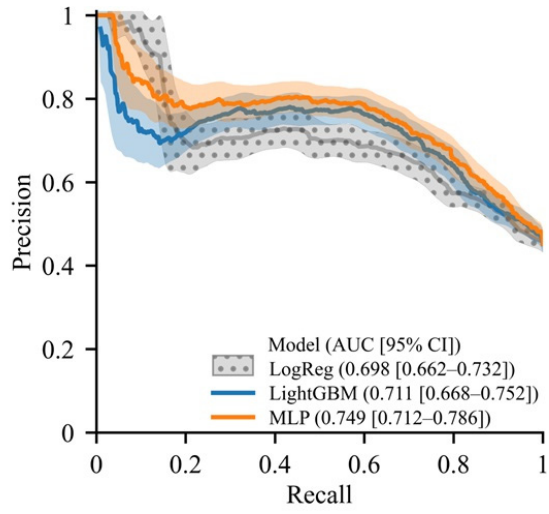
Purpose: Gait function plays a crucial role in post-stroke functional outcomes. The Center of pressure (COP) offers biomechanical insights in gait analysis. Machine learning (ML) methods have been applied to diagnosis, treatment, and outcome prediction of acute stroke patients. However, it remains unknown whether machine learning-enabled COP analysis improves outcome prediction beyond clinical risk factors. Therefore, the aim of the study is the development of an ML model utilizing initial COP-based gait information for the prediction of post-stroke functional outcomes and the investigation of the additive benefits of the gait information when combined with clinical information in the prediction of the outcome in patients with acute ischemic stroke.

Methods: In this prospective study, we assessed the gait function of acute ischemic stroke patients who were capable of a 10m walk with or without a GAIT-AI during hospitalization using a pressure-sensitive mat. Variables extracted from the COP data of each footfall were utilized to develop 3 ML models including logistic regression, LightGBM, and MLP for prediction of 3-month poor functional outcome, defined as modified Rankin scores $\geq$ 2. Output score (GAIT score) derived from ML model with best performance was extracted. Multivariable models were constructed using clinical variables and GAIT score from ML model to evaluate the improvement of model performance when adding GAIT score.

Results: Of the 185 included patients, we analyzed 10,804 pairs of consecutive footfalls, and 37.8% of these patients experienced the unfavorable outcomes. Of three ML models, MLP demonstrated the highest predictive performance as the area under the receiver operating characteristic curve (AUROC) of 0.799. In the multivariable regression, age, initial National Institute of Health Stroke Scale, initial Fall Efficacy Scale-International were associated with unfavorable outcome and the model had AUROC of 0.730. Output score derived from the ML model improved the performance of the multivariable model with an AUROC of 0.812.

Conclusions: Early gait information associated with COP measurement has the potential power and additive benefits when combined with clinical variables to predict unfavorable outcomes in acute ischemic stroke. Machine learning models have advantages in utilizing gait information for the prediction of a 3-month unfavorable outcome in acute ischemic stroke


True-positive Rate (sensitivity)
False-positive Rate (1-specificity)
Model (AUC [95% CI])
LogReg (0.739 [0.717–0.761])
LightGBM (0.776 [0.755–0.797], p<0.001)*
MLP (0.799 [0.780–0.819], p<0.001)*


Precision
Recall
Model (AUC [95% CI])
LogReg (0.698 [0.662–0.732])
LightGBM (0.711 [0.668–0.752])
MLP (0.749 [0.712–0.786])

Comprehension of figurative language in right hemisphere dysfunction, and mild cognitive impairment

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Purpose: The reduced performance of patients with right hemisphere dysfunction (RHD) in tasks involving figurative language has been emphasized in numerous studies, but there remains significant debate regarding whether this impairment is specifically linked to lesions in the right hemisphere (Cagnon et al., 2003). Moreover, recent research indicates that individuals with cognitive impairments, not exclusively RHD patients, demonstrate a decreased ability to process figurative language compared to healthy older adults. As a result, this study aimed to compare the performance on tasks assessing proverb comprehension between a group of individuals with amnestic-mild cognitive impairment (aMCI), recognized as a high-risk population for Alzheimer's disease, and a group with RHD.

Methods: The study participants comprised five RHD patients and five elderly individuals diagnosed with aMCI. To evaluate performance on proverb comprehension tasks between these two groups, a modified version of the proverbs task utilized in Kim (2008) was administered, and differences in performance were analyzed using the Mann-Whitney U test.

Results: The findings revealed no significant disparity in performance on proverb comprehension tasks between the two groups (U=4.500, p=.095). Upon examining the error patterns of both groups, it was observed that the aMCI group predominantly selected responses that described the meanings of key words in the proverbs, whereas the RHD group primarily opted for literal interpretations that failed to capture the underlying meanings of the proverbs.

Conclusions: The discovery that there is no discernible difference in performance between aMCI and RHD groups, despite distinct lesions, suggests that a functional approach, such as assessing the residual levels of cognitive and language functions involved in processing figurative language, may be more appropriate than a lesion-based approach emphasizing specific hemisphere dominance in figurative language processing. Furthermore, in addition to delving deeper into the cognitive and linguistic aspects of figurative language processing, future research should explore anatomical changes commonly observed in various groups exhibiting difficulties in processing figurative language.

Impact of systolic blood viscosity on deep white matter hyperintensities in acute ischemic stroke patients

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Purpose: Elevated blood viscosity (BV), a critical determinant in blood rheology, is a contributing factor in cerebrovascular diseases. The specific influence of BV on small vessel disease burden remains unexplored. This study aims to examine the relationship between BV and regional white matter hyperintensity (WMH) volume in patients with acute ischemic stroke (AIS). ;

Methods: We enrolled a cohort of 302 patients with acute ischemic stroke (AIS) or transient ischemic attack who were admitted to a hospital within 7 days of symptom onset in this study. We measured whole BV using a scanning capillary-tube viscometer and categorized systolic blood viscosity (SBV) into three groups based on established references. We quantified and normalized WMH volumes utilizing automated localization and segmentation software by NEUROPHET Inc. We performed multivariable logistic regression analysis to assess the correlation between SBV and WMH.

Results: The mean subject age was 66.7±13.4 years, and 38.7% (n = 117) of the participants were female. Among a total of 302 patients, patients with higher deep WMH volume (T3) were typically older and had an atrial fibrillation, strokes of cardioembolic or undetermined etiology, elevated levels of C-reactive protein (CRP), diastolic blood viscosity and SBV. A multivariable adjustment revealed a significant association between high SBV and increased deep-WMH volume (OR 2.846, 95% CI; 1.352-5.990).

Conclusions: Elevated SBV is more likely to be associated with deep WMH volume in patients with AIS. These findings reveal novel therapeutic strategies focusing on blood rheology to enhance cerebral microcirculation in stroke management.

Increased infarct volume is associated with poor functional recovery independent of early neurological deterioration

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[1]Department Of Neurology, Seoul National University Bundang Hospital, Seongnam, Kyunggido, Korea, [2]Department Of Public Health, Seoul National University Bundang Hospital, Seongnam, Kyunggido, Korea, [3]Artificial Intelligence Research Center, Jlk Inc, Gangnam, Seoul, Korea, [4]Department Of Neuroscience, College Of Medicine, Seoul National University, Jongro, Seoul, Korea

Purpose: To investigate the kinetics association betweenof Diffusion-Weighted Imaging (DWI) lesion dynamicss in Acute Ischemic Stroke (AIS) patients and experiencing early neurological deterioration (END) or subsequent functional recuperation.

Methods: Consecutive AIS patients admitted between January 2011 and December 2022 were collected from a prospective stroke registry (Figure 1). END, defined as measurable worsening of neurological function within three weeks post-onset, was systematically monitored. Initial and follow-up DWI scans were performed, with the lesion volumes automatically quantified using the JBS-01K (JLK Inc., Korea). Multivariable models were constructed to analyze the associations between infarct volume change and functional recovery or END using ordinal logistic or quantile regression models, adjusting for covariates.

Results: Among 4207 patients, 13.2% (n=557) encountered END. The median absolute initial and follow-up DWI lesion volumes were greater in the END group. Moreover, the median DWI lesion volume changes were significantly higher in the END versus the non-END group (Table 1). Associations with END were observed for the 25th percentile (OR coefficient from quantile regression 0.53; 95% CI, 0.30299 − 0.77), 50th percentile (OR 1.39; 95% CI 1.05-1.74), and 75th percentile (OR 3.42; 95% CI, 2.47 − 4.36) of DWI lesioninfarct volume differences change (Figure 2). Furthermore, the study highlightedWe documented that AIS patients, experiencing a DWI volume increase was associated with poorer functional recovery at 3 months after stroke in the relative increse of 25-50 percentle (21.4 − 80.5%; common OR, 1.48 [95% CI, 1.18 − 1.86], 50 − 75 percentile (80.5 − 222.5%; 1.77 [1.41 − 2.22], 75 − 90 pct (222.5 − 700.4%; 1.91 [1.49 − 2.57]) and ≥ 90 percentile (≥700.4, 1.95 [1.49-2.57) compared to the group of 10 − 25 percentilebeyond the 75th;percentile (>XX % from the baseline), wereas associated with poorer functional recovery at 3 months after stroke [common OR, 1.314.32; 95% CI, 1.05 − 1.643.63-5.14], irrespective of the occurrence of END.

Conclusions: An increase of;infarction volume is strongly associated with early neurological deterioration and functional recovery after an ischemic stroke.

Figure 1: Study profile

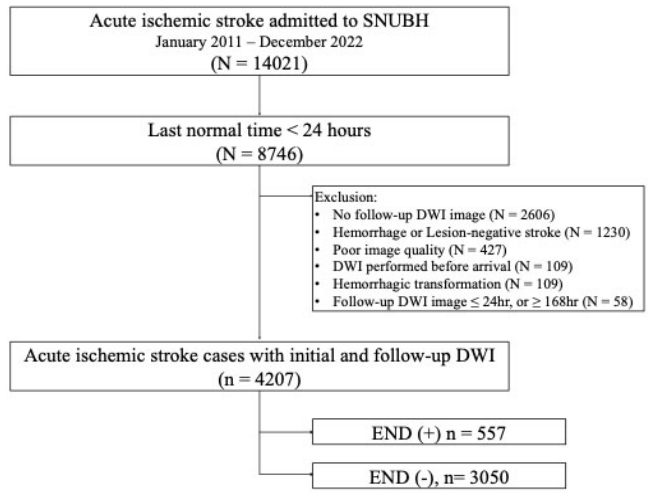
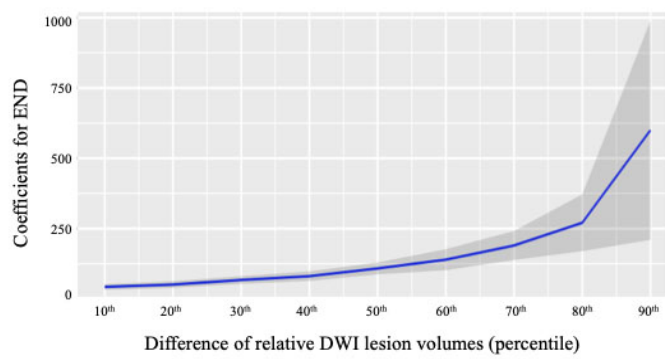


Table 1: Baseline Characteristics

Variables	END (-)	END (+)	p-value
Case (n)	3650	557	
Demographic characteristics			
Age (mean (SD))	68.52 (13.58)	69.58 (12.58)	0.09
Male (%)	2261 (61.9)	325 (58.3)	0.12
Initial NIHSS (median [IQR])	4.00 [1.00, 8.00]	5.00 [2.00, 9.00]	<0.01
TOAST classification (%)			<0.01
Large artery atherosclerosis	1284 (35.2)	268 (48.1)	
Small vessel disease	618 (16.9)	76 (13.6)	
Cardioembolism	1004 (27.5)	114 (20.5)	
Other/Un-determined etiology	744 (20.4)	99 (17.8)	
Vascular risk factors			
Hypertension (%)	2546 (69.8)	391 (70.2)	0.87
DM (%)	1149 (31.5)	196 (35.2)	0.09
Hyperlipidemia (%)	1407 (38.5)	198 (35.5)	0.19
Atrial fibrillation (%)	896 (24.5)	109 (19.6)	0.01
Smoking (%)	1362 (37.3)	200 (35.9)	0.56
Fuctional outcomes			
Initial DWI volume, mL (median [IQR])	0.96 [0.28, 4.94]	1.09 [0.37, 5.17]	0.03
Follow-up DWI volume, mL (median [IQR])	2.14 [0.56, 11.07]	4.19 [1.40, 20.19]	<0.01
DWI volume difference (median [IQR])	0.71 [0.09, 4.99]	2.33 [0.73, 11.46]	<0.01
mRS score 0 or 1 at 3 months (%)	2218 (61.0)	148 (26.7)	<0.01

Figure 2: END and the Change of DWI Lesions



Under-management of stroke risk factors in young age population

Yoona Ko[1], Beom Joon Kim[1], Kyusik Kang[2], Soo Joo Lee[3], Jae-Kwan Cha[4], Tai-Hwan Park[5], Kyungbok Lee[6], Jun Lee[7], Keun-Sik Hong[8], Byung-Chul Lee[9], Dong-Eog Kim[10], Man-Seok Park[11], Jay Chol Choi[12], Jee Hyun Kwon[13], Dong-Ick Shin[14], Sung-Il Sohn[15], Chulho Kim[16], Kwang-Yeol Park[18], Kyungmi Oh[17], Heejoon Bae[1]

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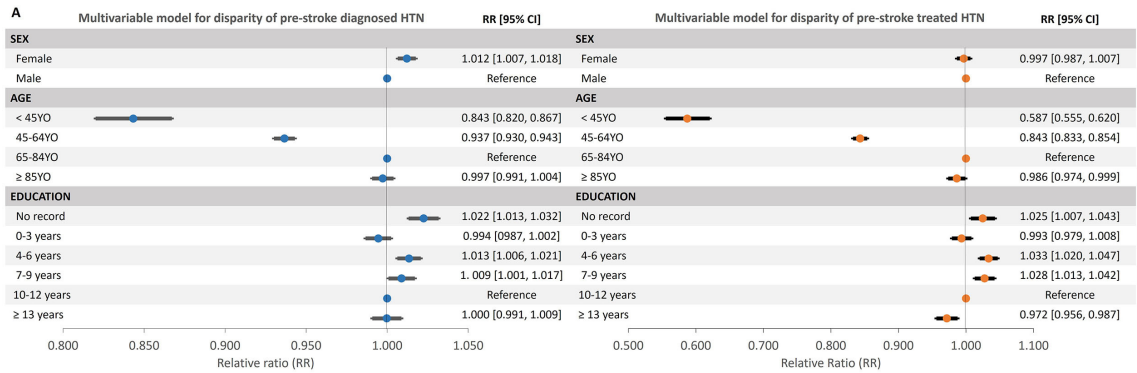
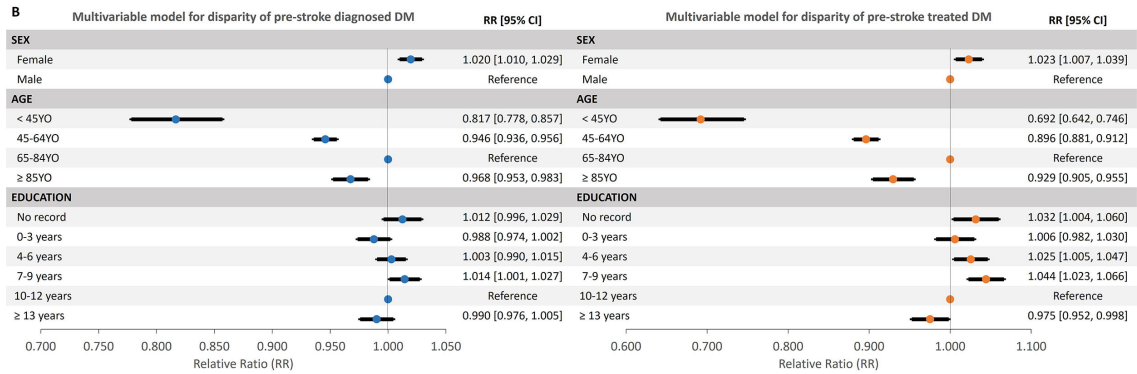
Purpose: The proportion of young age stroke patients is increasing.;However, the contributing factors are not yet clearly understood.

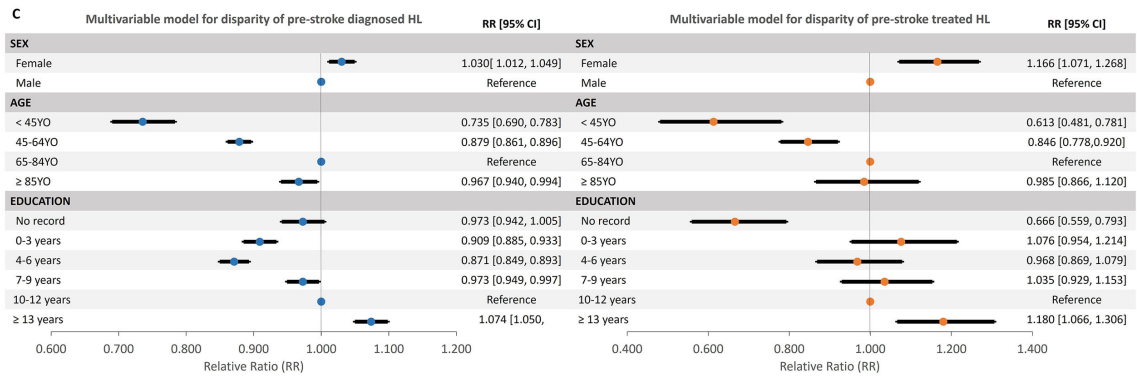
Methods: A prospective, multicenter, nationwide stroke registry (CRCS-K) was utilized to analyze acute stroke admissions during the years 2008 to 2022. The major risk factors for stroke, hypertension, diabetes, dyslipidemia, and atrial fibrillation were selected and analyzed for diagnosis and treatment prior to stroke onset. Poisson regression models with double sandwich variance estimators were used to examine the associations between baseline characteristics and the diagnosis or treatment of major risk factors before the index stroke, adjusted for relevant covariates.

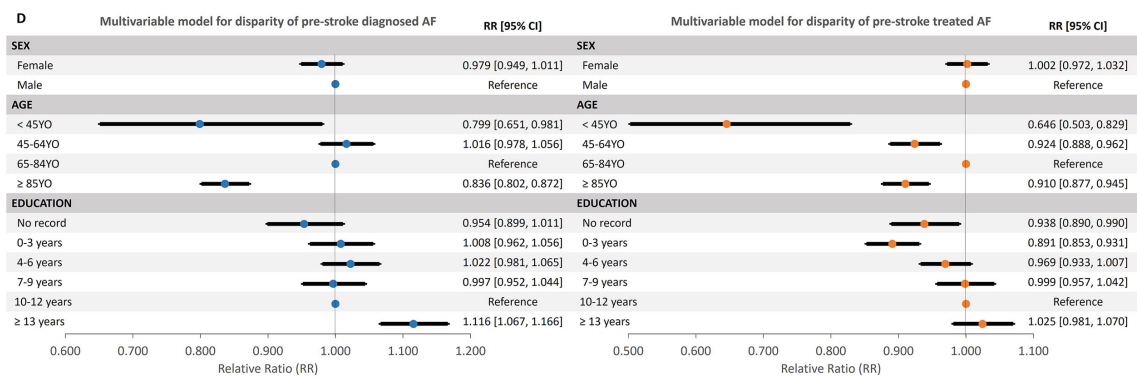
Results: A total of 96,855 admissions with acute ischemic stroke were included in this study. Major risk factors were diagnosed before the index stroke in 91% for hypertension, 88% for diabetes, 67% for hyperlipidemia, and 52% for atrial fibrillation. Stroke risk factors were treated before the index stroke in 76% for hypertension, 73% for diabetes, 10% for hyperlipidemia and 24% for atrial fibrillation. Younger stroke patients with less than 45 years old are consistently less likely to be diagnosed and treated for all the selected major stroke risk factors (see Figure).

Conclusions: Our study confirms that younger stroke patients tend not to receive the necessary diagnosis and treatment before the stroke. A targeted medical approach is warranted to prevent stroke at a younger age of onset.


A
Multivariable model for disparity of pre-stroke diagnosed HTN
RR [95% CI]
SEX
Female 1.012 [1.007, 1.018]
Male Reference
AGE
< 45YO 0.843 [0.820, 0.867]
45-64YO 0.937 [0.930, 0.943]
65-84YO Reference
≥ 85YO 0.997 [0.991, 1.004]
EDUCATION
No record 1.022 [1.013, 1.032]
0-3 years 0.994 [0987, 1.002]
4-6 years 1.013 [1.006, 1.021]
7-9 years 1. 009 [1.001, 1.017]
10-12 years Reference
≥ 13 years 1.000 [0.991, 1.009]
0.800 0.850 0.900 0.950 1.000 1.050
Relative ratio (RR)
Multivariable model for disparity of pre-stroke treated HTN
RR [95% CI]
SEX
Female 0.997 [0.987, 1.007]
Male Reference
AGE
< 45YO 0.587 [0.555, 0.620]
45-64YO 0.843 [0.833, 0.854]
65-84YO Reference
≥ 85YO 0.986 [0.974, 0.999]
EDUCATION
No record 1.025 [1.007, 1.043]
0-3 years 0.993 [0.979, 1.008]
4-6 years 1.033 [1.020, 1.047]
7-9 years 1.028 [1.013, 1.042]
10-12 years Reference
≥ 13 years 0.972 [0.956, 0.987]
0.500 0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)


B
Multivariable model for disparity of pre-stroke diagnosed DM
RR [95% CI]
SEX
Female 1.020 [1.010, 1.029]
Male Reference
AGE
< 45YO 0.817 [0.778, 0.857]
45-64YO 0.946 [0.936, 0.956]
65-84YO Reference
≥ 85YO 0.968 [0.953, 0.983]
EDUCATION
No record 1.012 [0.996, 1.029]
0-3 years 0.988 [0.974, 1.002]
4-6 years 1.003 [0.990, 1.015]
7-9 years 1.014 [1.001, 1.027]
10-12 years Reference
≥ 13 years 0.990 [0.976, 1.005]
0.700 0.750 0.800 0.850 0.900 0.950 1.000 1.050
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated DM
RR [95% CI]
SEX
Female 1.023 [1.007, 1.039]
Male Reference
AGE
< 45YO 0.692 [0.642, 0.746]
45-64YO 0.896 [0.881, 0.912]
65-84YO Reference
≥ 85YO 0.929 [0.905, 0.955]
EDUCATION
No record 1.032 [1.004, 1.060]
0-3 years 1.006 [0.982, 1.030]
4-6 years 1.025 [1.005, 1.047]
7-9 years 1.044 [1.023, 1.066]
10-12 years Reference
≥ 13 years 0.975 [0.952, 0.998]
0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)


C
Multivariable model for disparity of pre-stroke diagnosed HL
RR [95% CI]
SEX
Female 1.030[1.012, 1.049]
Male Reference
AGE
< 45YO 0.735 [0.690, 0.783]
45-64YO 0.879 [0.861, 0.896]
65-84YO Reference
≥ 85YO 0.967 [0.940, 0.994]
EDUCATION
No record 0.973 [0.942, 1.005]
0-3 years 0.909 [0.885, 0.933]
4-6 years 0.871 [0.849, 0.893]
7-9 years 0.973 [0.949, 0.997]
10-12 years Reference
≥ 13 years 1.074 [1.050,
0.600 0.700 0.800 0.900 1.000 1.100 1.200
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated HL
RR [95% CI]
SEX
Female 1.166 [1.071, 1.268]
Male Reference
AGE
< 45YO 0.613 [0.481, 0.781]
45-64YO 0.846 [0.778,0.920]
65-84YO Reference
≥ 85YO 0.985 [0.866, 1.120]
EDUCATION
No record 0.666 [0.559, 0.793]
0-3 years 1.076 [0.954, 1.214]
4-6 years 0.968 [0.869, 1.079]
7-9 years 1.035 [0.929, 1.153]
10-12 years Reference
≥ 13 years 1.180 [1.066, 1.306]
0.400 0.600 0.800 1.000 1.200 1.400
Relative Ratio (RR)


D
Multivariable model for disparity of pre-stroke diagnosed AF
RR [95% CI]
SEX
Female 0.979 [0.949, 1.011]
Male Reference
AGE
< 45YO 0.799 [0.651, 0.981]
45-64YO 1.016 [0.978, 1.056]
65-84YO Reference
≥ 85YO 0.836 [0.802, 0.872]
EDUCATION
No record 0.954 [0.899, 1.011]
0-3 years 1.008 [0.962, 1.056]
4-6 years 1.022 [0.981, 1.065]
7-9 years 0.997 [0.952, 1.044]
10-12 years Reference
≥ 13 years 1.116 [1.067, 1.166]
0.600 0.700 0.800 0.900 1.000 1.100 1.200
Relative Ratio (RR)
Multivariable model for disparity of pre-stroke treated AF
RR [95% CI]
SEX
Female 1.002 [0.972, 1.032]
Male Reference
AGE
< 45YO 0.646 [0.503, 0.829]
45-64YO 0.924 [0.888, 0.962]
65-84YO Reference
≥ 85YO 0.910 [0.877, 0.945]
EDUCATION
No record 0.938 [0.890, 0.990]
0-3 years 0.891 [0.853, 0.931]
4-6 years 0.969 [0.933, 1.007]
7-9 years 0.999 [0.957, 1.042]
10-12 years Reference
≥ 13 years 1.025 [0.981, 1.070]
0.500 0.600 0.700 0.800 0.900 1.000 1.100
Relative Ratio (RR)

Association between changes in smoking habits and incident fracture after acute ischemic stroke

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

Purpose: Post-stroke survivors, particularly the older population, are at an increased risk of falls and incident fractures. Smoking is a widely recognized risk factor for fractures. However, the association between changes in smoking habits before and after an index stroke and increased risk of fracture remains unelucidated.

Methods: Using the Korean National Health Insurance program, patients with ischemic stroke between 2010–2016 were enrolled. Individuals were classified by smoking habits: "never smoker," "former smoker," "smoking quitter," "new smoker," and "sustained smoker." The primary outcome was the composite outcome of the vertebral, hip, and any fractures. Multivariate Cox proportional hazard regression analysis was used.

Results: Among 177,787 patients with health screening data within two years before and after ischemic stroke, 14,991 (8.43%) patients had any fractures. After multivariate adjustment, the sustained smokers had a significantly increased risk of composite primary outcomes of any, vertebral, and hip fractures (adjusted HR(aHR) 1.222, 95% CI 1.124–1.329any; aHR 1.27, 95% CI 1.13–1.428; aHR 1.502, 95% CI 1.218–1.853, respectively). Additionally, the new smoker group exhibited a similar or higher risk of any fractures and hip fractures (aHR 1.218, 95% CI 1.062–1.397; aHR 1.772, 95% CI 1.291–2.431, respectively).

Conclusions: Sustained smokers had a significantly increased risk of vertebral and hip fractures after an ischemic stroke. The risk of any and hip fractures were higher in new smokers after ischemic stroke. As post-stroke fractures are detrimental to the rehabilitation process of patients with stroke, physicians should actively advise patients to stop smoking.

Delayed door to puncture time during off-duty hours is associated with unfavorable outcomes after mechanical thrombectomy in the early window of acute ischemic stroke

Hye-In Chung[1], Junho Seong[1], Dae-Hyun Kim[1], Jae-Kwan Cha[1]

[1]Department Of Neurology, College Of Medicine, Dong-A University, Busan, Korea

Purpose: The impact of off-duty hours mechanical thrombectomy on outcomes remains a subject of controversy. This study aimed to investigate the impact of door-to-puncture time (DTPT) delays in patients who underwent mechanical thrombectomy for acute ischemic stroke (AIS) during off-duty hours in both the early and late time windows

Methods: Among patients with AIS who presented to the emergency department at Dong-A university hospital from 2014 to 2022, those who underwent mechanical thrombectomy within 24 hours of acute anterior circulation occlusion were selected. The patients were divided into two groups: those who arrived within 6 hours of symptom onset and received the procedure within 8 hours (early window), and those who received the procedure between 8 hours and 24 hours after symptom onset (late window). Additionally, patients were grouped according to whether they arrived during standard working hours or not. The study assessed the association between the onset-to-puncture time (OTPT) and poor outcomes, measured by the 90-day modified Rankin scores (mRS). Specifically, the analysis focused on the impact of delayed DTPT in patients during off-duty hours on outcomes measured by the 90-day mRS scores.;

Results: Among the eligible patients, a total of 501 AIS patients underwent mechanical thrombectomy for acute anterior circulation occlusion within 24 hours. Of these, 395 patients (78.8%) fell into the early window category, and 316 patients (63.1%) underwent the procedure during off-duty hours. In the early window, for every 60-minute increase in OTPT, the probability of occurrence a poor outcome at 90 days significantly increased in the fully adjusted model (OR=1.21; 95% CI, 1.02 to 1.43; p=0.03). In the early window, delayed procedures during off-duty hours (exceeding 103 minutes of DTPT) were identified as an independent predictor of poor outcomes (OR=1.95; 95% CI, 1.12 to 3.42; p=0.02). However, in the late window, there was no association between DTPT and outcomes at 90 days, and the impact of DTPT delays during off-hours was not observed.

Conclusions: In AIS patients undergoing mechanical thrombectomy, the timing from onset to puncture significantly affects post-procedure outcomes, particularly in the early window. Additionally, off-duty hours play a notable role in patients undergoing delayed procedures, particularly when DTPT exceeds 103 minutes in the early window. This study highlights the pronounced impact of off-duty time on mechanical thrombectomy outcomes, especially during the early window when time delays are most critical.

Impact of pleural effusion on clinical outcomes in patients with ischemic stroke

Unchang Heo[1], Joonggoo Kim[1]

[1]Neurology, Jeju National University Hospital, Jeju, Korea

Purpose: Pleural effusions can be observed in initial computed tomography in patients with acute ischemic stroke; however, the impact on clinical outcomes is not well characterized. This study aims to demonstrate the clinical outcomes of acute ischemic stroke patients with pleural effusion.

Methods: All patients who underwent acute ischemic stroke between 2021 and 2023 at a tertiary care university hospital were included in this observational, cross-sectional analysis.

Results: Of 1,137 patients who underwent acute ischemic stroke during the study period, 961 (84.5%) patients had no pleural effusion and 178 (15.6%) patients had pleural effusion. After propensity matching, the mortality of patients with pleural effusion was 7.3% higher than those with no pleural effusion ($p < 0.001$). Neurointensive care unit (NICU) stay was longer for those with pleural effusions (8 [IQR 6–11] days, 3 [IQR 2–7] days for those without pleural effusion, $p < 0.001$). Patients with pleural effusions had a higher incidence of early neurological deterioration; (END, 21 [11.8%] with pleural effusions, 66 [6.8%] without pleural effusions). Patients with pleural effusion were more likely to be associated with congestive heart failure and atrial fibrillation (22.1% vs. 5.7% and 34.6% vs. 17.5%)

Conclusions: Pleural effusions are highly associated with worse outcomes, including increased mortality, longer length of NICU stay, and higher END rates. These insights may be of stroke neurologists alike to foster research into innovative methods for preventing and treating pleural effusions to improve outcomes for patients with acute ischemic stroke.

The brainstem score on diffusion-weighted imaging before mechanical thrombectomy in acute basilar artery occlusion is a reliable predictor for prognosis

Junho Seong[1], Hye-In Chung[1], Dae-Hyun Kim[1], Jae-Kwan Cha[1]

[1]Neurology, Dong-A University Hospital, Busan, Korea

Purpose: In this study, we aimed to assess the utility of measuring the Brainstem Score (BSS) on pre-procedural DWI in acute basilar artery occlusion (ABAO) patients to predict the outcomes after mechanical thrombectomy. Additionally, we sought to determine whether the effectiveness of BSS in predicting outcomes is comparable to that of the Critical Area Perfusion Score (CAPS) on perfusion MRI using RAPID.

Methods: This study targeted patients who underwent mechanical thrombectomy at the Stroke Center of Dong-A University Hospital, from 2013 to 2023. Among them, patients who had ABAO and had undergone pre-procedural MRI were selected. The size of ischemic lesion on DWI and BSS was measured for all patients. A separate analysis was conducted for patients who had perfusion MRI analyzed using RAPID. For the group that underwent perfusion MRI analysis, we prespecified a CAPS and the patients were dichotomized into favorable (CAPS $\leq$3) and unfavorable (CAPS>3) groups. Also, the hypoperfusion intensity ratio (HIR) was measured. The primary end point was a poor outcome at 90 days (modified Rankin scale, mRS>2). The impact of the lesion size on DWI, BSS, CAPS, and HIR on the mRS at 90 days after procedure was analyzed using multiple logistic regression.

Results: During the study, 71 patients had ABAO and underwent mechanical thrombectomy after undergoing MRI. Comparing the group with poor outcomes at 90 days to the group with good outcomes, the former had significantly larger ischemic lesion volumes on DWI (p=0.02), higher initial NIHSS scores (p<0.05), and higher DWI BSS (p<0.01). In the multivariate logistic regression analysis, DWI BSS (OR=12.90; 95% CI, 2.51-66.40; p<0.01) emerged as an independent predictor of poor outcomes at 90 days, even after adjusting for NIHSS, DWI volume, and successful recanalization. Among the 71 subjects, 26 had measurements of CAPS and HIR on perfusion analysis. In the group with poor outcomes, 13 (50%) patients had higher DWI BSS (p<0.01), HIR (p<0.01), and CAPS (p=0.03) than the group with good outcomes. In this subgroup, even after adjusting for HIR and CAPS, DWI BSS remained a valid independent predictor for predicting functional outcomes at 90 days, but CAPS (OR=4.20; 95% CI, 0.79-222.70; p>0.05) did not function as an independent predictor.u

Conclusions: In this study, quantifying the degree of brainstem involvement using DWI BSS before mechanical thrombectomy in ABAO patients emerged as a useful imaging marker for predicting post-procedural outcomes. Its predictive ability is not only comparable to but even superior to CAPS on perfusion MRI.

Ischemic stroke in a patient complicated by bacterial meningitis from an asymptomatic parapharyngeal abscess

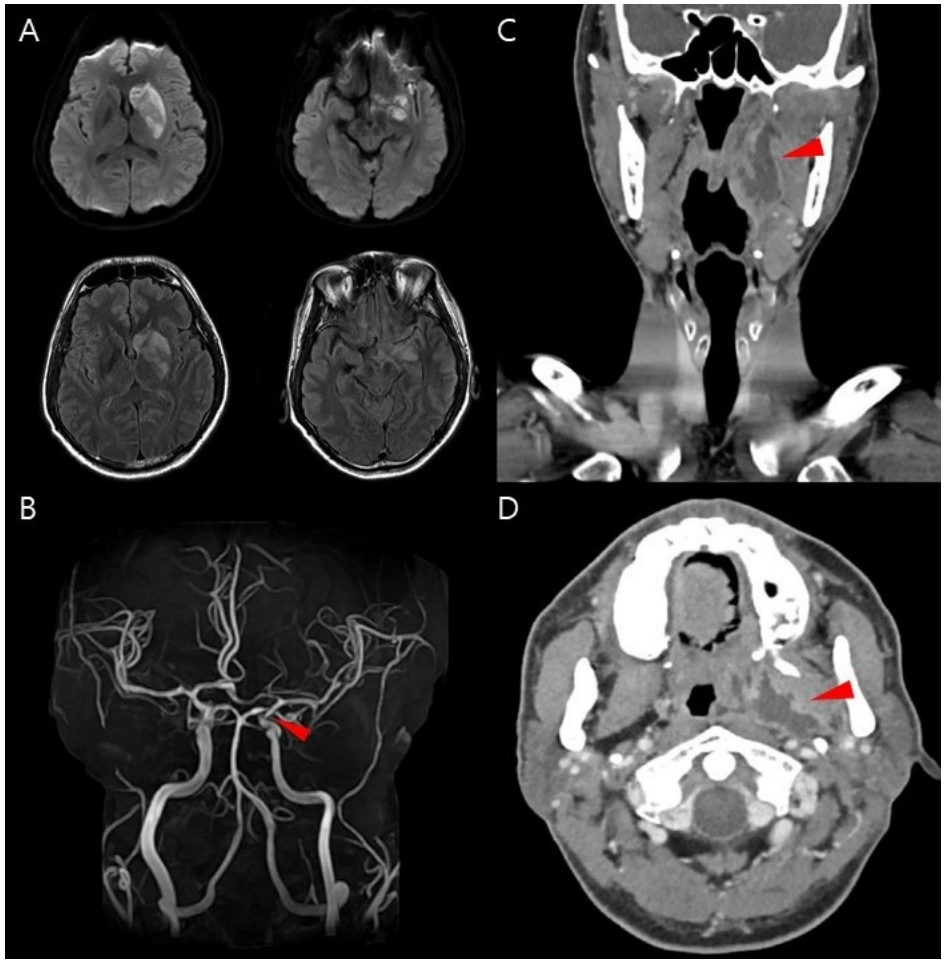
Hyeonbin Park[1], Kangwoo Kim[1], Dae-Hyun Kim[1,2], Jae-Kwan Cha[1,2], Yoonkyung Lee[1,2]

[1]Neurology, Dong-A University Hospital, Busan, Korea, [2]Busan Regional Cardiocerebrovascular Center, Dong-A University Hospital, Busan, Korea

Purpose: Infectious diseases are one of the causes of other determined etiologies in the Trial of ORG 10172 in Acute Stroke Treatment classification for stroke subtype. The mechanisms causing stroke in bacterial meningitis are known as cerebral vasospasm, vasculitis, the coagulation cascade, and the inflammatory response.

Methods: A 45-year-old previously healthy man presented with two weeks of fever and headache, and one day of altered mentality with right hemiplegia. Two weeks prior, he had visited an outpatient clinic and was prescribed acetaminophen, clarithromycin, and methylprednisolone, but symptoms did not improve. Brain magnetic resonance imaging (MRI) showed a left parapharyngeal abscess with intracranial extension and left basal ganglia and medial temporal infarction. Narrowing of the left cavernous sinus internal carotid artery and A1 artery was observed. Cerebrospinal fluid (CSF) analysis showed pleocytosis (5319/mm3), low CSF glucose (2mg/dL; serum glucose 111mg/dL), and elevated CSF protein (181.88 mg/dL), consistent with bacterial meningitis. Ceftriaxone, vancomycin, ampicillin, and dexamethasone were administered. The patient exhibited no overt symptoms suggestive of infection; thus, neck, chest, and abdomen-pelvis CT scans, and an echocardiogram screening were conducted to ascertain the infectious source. A lobular cystic mass in the left parapharyngeal space extending to the left medial pterygoid muscle (6×4×7 cm) from the #38 tooth was observed. Extraction of #38 and incision and drainage were performed, and culture found Staphylococcus epidermidis. Antibiotics were changed to cefepime and vancomycin. Following treatment, the patient's neurologic symptoms were slightly improved.

Conclusions: This case illustrates that vasculitis from bacterial meningitis due to a parapharyngeal abscess may occur without any symptoms. Pain and odynophagia are common symptoms of a parapharyngeal abscess, but in rare cases, silent deep neck infections may occur. It can also be a cause of bacterial meningitis, so it is necessary to carefully evaluate the cause of the infection.


A
C
B
D

Patient with dural arteriovenous fistula after mechanical thrombectomy for acute ischemic cerebral infarction

Jun Hyeok Park[1], Ju Hee Im[1], Hyeo Seo Moon[1], Ju Hye Kim[1], Byoung Wook Hwang[1], Min A Lee[1], Seong Hwan Ahn[1]

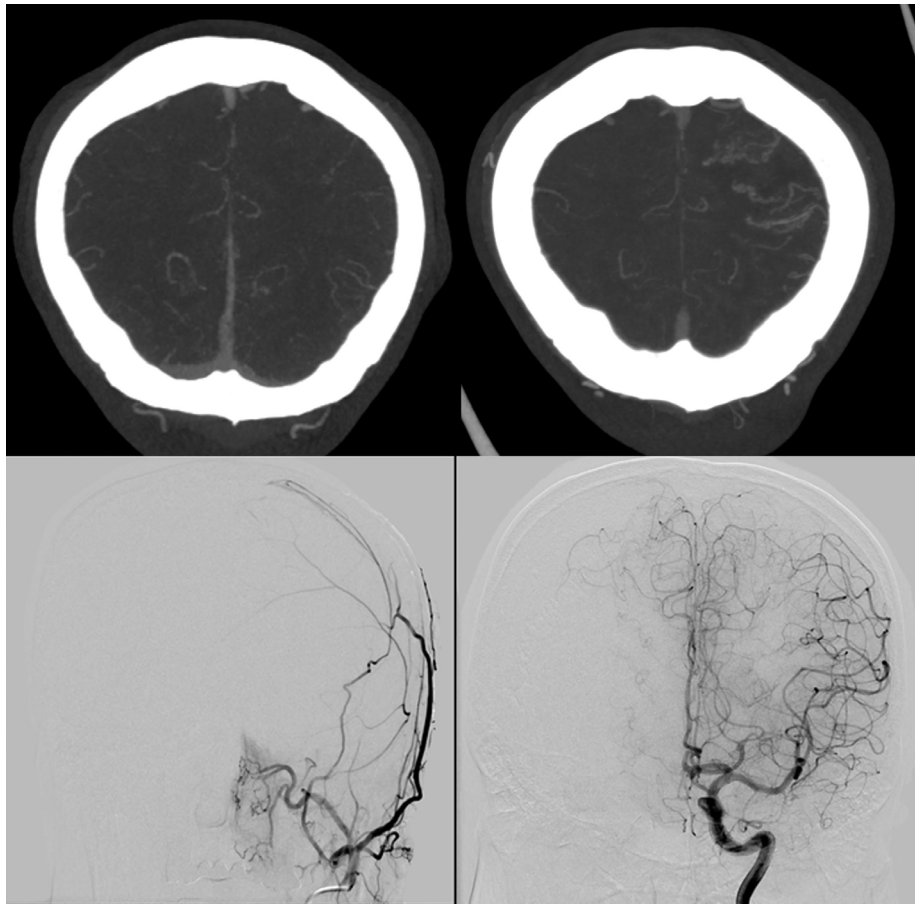
[1]Department Of Neurology, Chosun University Hospital, Gwangju, Korea

Purpose: Purpose: Dural arteriovenous fistula (DAVF) is a rare vascular malformation in the central nervous system, which can manifest with variable clinical symptoms depending on the lesion's location, including intracranial hemorrhage and neurological deficits. The exact cause of DAVF remains uncertain, but it may develop secondary to trauma, venous thrombosis, or other underlying vascular conditions. We report the case of a patient with DAVF following mechanical thrombectomy for acute ischemic stroke.

Methods: ...

Results: A 61-year-old man presented to the emergency room with symptoms of partial seizures and right hemiplegia that had started 30 minutes before admission. He had a history of hypertension and atrial fibrillation, and had received mechanical thrombectomy for right middle cerebral artery infarction nine months prior to admission. There was no history of trauma before or after symptoms began to manifest. Initial vital signs showed high blood pressure at 151/106 mmHg, while other parameters including heart rate, respiratory rate, and body temperature were within normal limits. Upon neurological examination, he showed sensory aphasia, dysarthria, right hemiparesis(GIII/GIV) (initial National Institutes of Health Stroke Scale [NIHSS] score, 7). Brain CT revealed a hypodense lesion with petechial hemorrhage in the left frontal lobe. Brain CT angiography demonstrated early opacification of venous channels around infarcted lesion and dural sinuses. Electroencephalogram demonstrated generalized slowing in the left hemisphere with no epileptic discharges. Brain MRI presented vasogenic edema with hemorrhage, dilation of ventricles and cisterns, and diffuse widening of cortical sulci in the left MCA territory. Considering the patient's neurological deficits and highly suspicious lesions indicative of DAVF on imaging studies, digital subtraction angiography (DSA) was performed to confirm the diagnosis. Dural AVF that was not detected on the DSA and MR angiography nine months ago was confirmed. We decided to perform intra-arterial embolization for treatment. The patient was discharged following improvement in symptoms and absence of seizure recurrence, with plans for outpatient follow-up.

Conclusions: We reported the case of dural AVF after mechanical thrombectomy. The possibility of misdiagnosis arises due to overlapping symptoms with other neurological conditions or vascular abnormalities, leading to potential delays in diagnosing DAVF. Therefore, rapid identification and accurate diagnosis of DAVF are crucial for better prognosis.



2024 대한뇌졸중학회 **춘계학술대회**

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대웅바이오

나는 1등을 처방합니다.

환자를 생각할 수록
효능을 따져볼 수록

나는 환자의 삶의 질을 1등으로 생각합니다.
나는 환자 가족의 마음을 1등으로 생각합니다.
나는 환자의 안전을 1등으로 생각합니다.
그래서 뇌기능개선제 누적처방 1위의
글리아타민을 처방합니다.

뇌혈관질환뇌대사개선제

글리아타민®

정/연질캡슐
주/시럽

- 인지기능 개선 [1,2,3,4,5]
- 행동장애 및 우울감 개선 [2,3,5]
- 치매 진행속도 지연작용 [5]

【원료약품 및 그 분량】

정/연질캡슐– 1정/캡슐 중 콜린알포세레이트(KP) ····· 400mg
주– 1mL 중 콜린알포세레이트(KP) ····· 250.0mg . 용제: 주사용수
시럽– 1포 중 콜린알포세레이트(KP) ·····400mg

【효능·효과】

– 뇌혈관 결손에 의한 2차 증상 및 변성 또는 퇴행성 뇌기질성 정신증후군 :
기억력저하와 착란, 의욕 및 자발성저하로 인한 방향감각장애, 의욕 및 자발성 저하, 집중력감소
– 감정 및 행동변화 : 정서불안, 자극과민성, 주위무관심
– 노인성 가성우울증

【용법·용량】

정/연질캡슐– 콜린알포세레이트로서 1회 400mg을 1일 2~3회 경구투여한다.
증상에 따라 적절히 증감한다.
주– 콜린알포세레이트로서 1일 1회 1g을 근육 또는 정맥 주사한다. 증상에 따라 적절히 증감한다.
시럽– 콜린알포세레이트로서 1회 400mg(1포)을 1일 2~3회 경구투여한다.
증상에 따라 적절히 증감한다.

【사용상의 주의사항】

다음 환자에게는 투여하지 말것
1) 이 약 및 이 약의 구성성분에 과민반응 환자
2) 임부 또는 임신하고 있을 가능성이 있는 여성

【사용기간】

정/연질캡슐– 제조일로부터 24개월
주– 제조일로부터 36개월
시럽– 제조일로부터 24개월

* 자세한 제품정보는 제품설명서를 참조하시기 바랍니다.
* 대웅바이오 홈페이지 (www.daewoongbio.co.kr) / 소비자 상담 전화번호 (080–789–0787)

once-daily Lixiana® edoxaban

릭시아나®는 비판막성 심방세동 환자에서 뇌졸중 및 전신색전증 위험 감소를 위한 3가지 용량이 있습니다.[1]

ONCE-DAILY

상용량		
릭시아나® 60mg	릭시아나® 30mg 허가사항*에 근거하여 용량 감량의 요인을 가진 환자	릭시아나® 15mg 허가사항*에 근거하여, 출혈 위험성이 높은 고령자의 경우 연령 및 상태에 따라 1일 1회 15mg 투여를 고려할 수 있음
Standard dose	Reduced dose	Very low dose

* 허가사항은 QR코드로 확인 가능합니다.

나이가 증가함에 따라 뇌졸중/전신색전증과
주요 출혈 사건의 위험이 증가합니다.[2]

References

1. 릭시아나®정(에독사반토실산염수화물) 제품설명서, 식품의약품안전처, 2023
2. Kato, Eri Toda, et al. "Efficacy and safety of edoxaban in elderly patients with atrial fibrillation in the ENGAGE AF–TIMI 48 trial." *Journal of the American Heart Association* 5.5 (2016): e003432.

Prescribing information

릭시아나정
(에독사반토실산염수화물)

P23-214-2025.07-V1

수입판매원

Daiichi-Sankyo

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프레탈이 걸어온 길,

프레탈이 걸어갈 길.

Efficacy

Safety

and

Trust

The 1st & Original Cilostazol PLETAAL

PLETAAL® SR cap. (cilostazol)

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한국오츠카제약
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[효능·효과] 1. 만성동맥폐색증(버거씨병, 폐색성 동맥경화증, 당뇨병성 말초혈관병증 등)에 따른 궤양, 동통 및 냉감 등 허혈성 제증상의 개선 2. 뇌경색(심인성뇌색전증 제외) 발증 후 재발억제

[용법·용량] **프레탈®정**은 성인 1회 100mg을 1일 2회 경구 투여합니다. 단, 연령, 증상에 따라 적절히 증감합니다. **프레탈®서방캡슐**은 성인 1회 200mg을 1일 1회 경구 투여합니다. 이 약은 식사를 피하여 공복 상태에서 복용합니다.

PLT-23-001 | 20230116 approved

Cilostazol + Ginkgo biloba ext.

복합 서방정

Renexin CR

Renexin CR Tab.

Cilostazol 200mg,
Ginkgo Biloba ext. 160mg

리넥신서방정 제품요약정보[1]

전문의약품

【제품명】 • 리넥신서방정 **【원료약품 및 그 분량】** 이 약 1정 중 유효성분 : 실로스타졸(JP)…200 mg, 은행엽건조엑스(씽규) …160 mg **【성 상】** 연두색의 타원형 서방성 필름코팅정 **【효능·효과】** 다음 질환에 대하여 실로스타졸 단독요법으로 효과가 불충분한 경우, 실로스타졸과 은행엽건조엑스 제제의 병용요법에 대한 대체요법 1. 만성동맥폐색증(버거씨병, 폐색성 동맥경화증, 당뇨병성 말초혈관병증 등)에 따른 궤양, 동통 및 냉감 등 허혈성 제증상의 개선 2. 뇌경색(심인성 뇌색전증 제외) 발증 후 재발억제 **【용법·용량】** 이 약은 서방정 정제이므로 분쇄하거나 분할 또는 씹지 않고 전체를 복용하며, 식사를 피하여 공복 상태에서 복용한다. 이 약은 1회 용량으로 실로스타졸 100밀리그램과 은행엽건조엑스 80밀리그램을 1일2회 병용투여시 효과가 충분한 성인 환자에 대하여 대체요법으로 투여한다. 통상 성인에 대하여 1일1회, 1회 1정을 경구 투여한다. **【사용상의주의사항】** 1. 경고 이 약은 실로스타졸 투여로 인해 맥박수가 증가하여 협심증이 발현될 수 있으므로 협심증의 증상(가슴통증 등)에 대한 문진을 주의깊게 실시한다(뇌경색 재발 억제효과를 검토하는 시험에서, 장기간에 걸쳐 PRP(pressure rate product)를 의미있게 상승시키는 작용이 인정되었다. 또한, 실로스타졸 투여군에서 협심증이 발현된 증례가 나타났다). 2. 다음 환자에는 투여하지 말 것. 1) 출혈(혈우병, 모세혈관 취약증, 두개내출혈, 상부소화관출혈, 요로출혈, 객혈, 초자체출혈 등) 또는 그러한 소인(활동성 소화궤양, 최근 6개월 이내에 출혈성뇌졸중, 3개월 이내에 외과수술, 증식당뇨망막병증, 조절되지 않는 고혈압)이 있는 환자(출혈을 조장할 우려가 있다) 2) 울혈성심부전 환자(증상을 악화시킬 우려가 있다) 3) 이 약 및 이 약의 구성성분에 과민반응의 병력이 있는 환자 4) 임부 또는 임신하고 있을 가능성이 있는 여성 및 수유부 3. 다음 환자에는 신중히 투여할 것. 1) 항응고제(와파린 등), 항혈소판제(아스피린, 티클로피딘 등), 혈전용해제(유로키나제, 알테플라제 등), 프로스타글란딘 E1 제제 및 그 유도체(알프로스타딜, 리마프로스트 알파덱스 등)를 투여중인 환자 2) 월경기간 중인 환자(출혈을 조장할 우려가 있다) 3) 관동맥 협착의 합병증 환자(이 약의 투여에 의한 맥박수 증가로 협심증을 유발할 가능성이 있다.) 4) 중증 신장애 환자(크레아티닌 청소율 ≤ 25 mL/분)(이 약의 대사물의 혈중농도가 상승될 수 있다.) 5) 중등도 또는 중증 간장애 환자(이 약의 혈중농도가 상승될 수 있다.) 6) 당뇨병 또는 내당능 장애가 있는 환자(출혈성 유해증상이 발현하기 쉽다.) 7) 지속적으로 혈압이 상승하고 있는 고혈압 환자(악성고혈압 등) 8) 심방이나 심실전위 환자, 심방세동이나 조동 환자, 심실빈맥, 심실세동 또는 다초점성심실이소성박동 환자, QT간격의 연장이 있는 환자 9) S자형 심실 증격이 있거나 위험이 있는 환자(특히 고령자) : S자형 심실 증격 환자에서 좌심실 유출로 폐쇄가 보고되었다. 실로스타졸 복용 시작 후 새로운 수축기 잡음 혹은 심장 증상의 발생 여부를 모니터링 한다. **【제조자】** 에스케이케미칼(주) 충청북도 청주시 흥덕구 산단로 149 **【판매자】** 에스케이케미칼(주) 경기도 성남시 분당구 판교로 310

2020.11.23 개정

RNX-1408-20202-02

※ 처방하시기 전 제품설명서 전문을 참고하십시오. 최신 허가사항에 대한 정보는 '식품의약품안전처 의약품안전나라 (https://nedrug.mfds.go.kr/index)'에서 확인할 수 있습니다.

Reference. 1. 식약처 의약품안전나라 의약품통합정보시스템. 의약품 등 정보검색(검색어: 리넥신서방정). Available at https://nedrug.mfds.go.kr/searchDrug. Accessed on 05 of Feb, 2024.

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Ginkgo Biloba ext. 160mg