2025 대한뇌졸중학회
춘계학술대회

2025. 4. 25(금)

그랜드 하얏트 서울

연수평점: 6점

대한뇌졸중학회
Korean Stroke Society

2025 대한뇌졸중학회
춘계학술대회

인 사 말

안녕하세요, 존경하는 대한뇌졸중학회 회원 여러분

지난 일년 간의 의료사태로 인해 모든 회원님들이 여러모로 어려운 시기를 겪고 계시리라고 생각합니다. 그러나 이러한 어려움들은 반드시 이겨내고 헤쳐 나아갈 수 있다고 생각하며 그리 함께 노력해야 하겠습니다.

이런 어려운 와중에도 의학과 학문에 대한 연구와 발전은 끊김 없이 유지되어야 하고 지속되어야 하겠습니다.

대한뇌졸중학회에서는 회원 여러분들을 위해 이번 춘계학회에서도 변함없이 여러가지 알찬 프로그램으로 구성해 보았습니다.

그랜드 하얏트 서울에서 열리는 이번 대한뇌졸중학회 춘계학술대회는 전공의, 전임의 그리고 전문의와 뇌졸중에 관심이 있으신 모든 분들이 흥미를 갖을 수 있는 주제와 관심사를 중심으로 분야별 유수한 연자들을 초청하였습니다.

이번 춘계학술대학회는 그간의 의료사태로 인해 진료와 당직업무로 힘드시겠지만, 그렇다고 소홀히 할 수 없는 새로는 지식탐구와 학문연구를 위해 알차게 준비한 세션들이라고 자부합니다. 이번 학회를 통해 학문의 깊이를 넓힐 수 있는 기회가 됨은 물론 회원간 친목을 도모하는 장이 될 수 있도록 회원 여러분들의 많은 참여와 관심을 부탁드립니다.

감사합니다.

대한뇌졸중학회 회장 황성희 드림

2025 대한뇌졸중학회

춘계학술대회

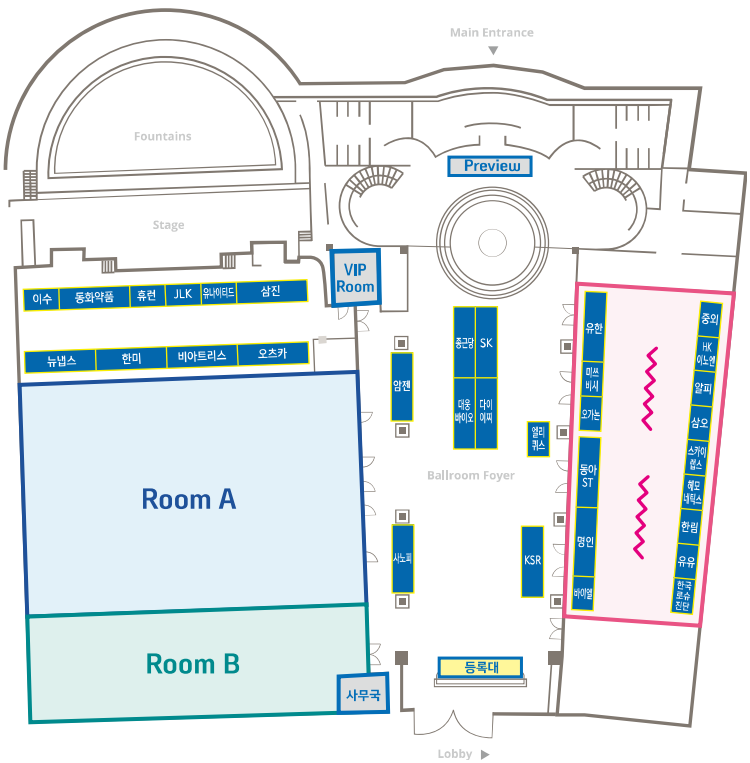
Program at a glance

일시: **2025**년 **04**월 **25**일 (금), **08:30-18:30**

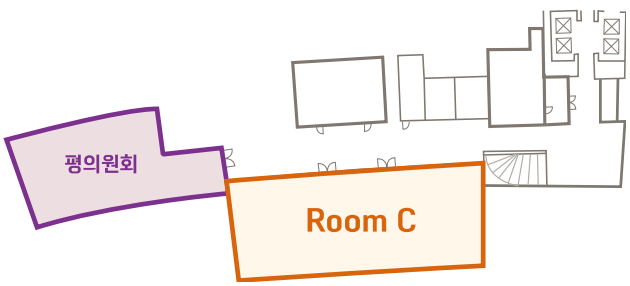
장소: **서울 그랜드하얏트**

Time	Room A (Grand Ballroom)	Room B (Grand Ballroom)	Room C (Namsan 1+2)
08:25-08:30	Opening Remark		
08:30-10:10	연구회세션(심장색전)	연구회세션(재관류)	
10:10-10:30	Coffee Break		
10:30-12:00	Acute Stroke Management	Nursing Session	Scientific Session 1
12:00-13:00	Symposium 1,2	Symposium 3,4	
13:00-13:20	Coffee Break		
13:20-13:40	General Assembly, 뇌졸중학회 정책, 보험관련 보고		
13:40-14:10	Plenary Session		
14:10-14:30	Coffee Break		
14:30-16:00	Metabolism and Stroke	Debate Session	Scientific Session 2
16:00-17:30	BTC Symposium	연구회세션(유전체연구회)	
17:30-18:30	Poster Session (@ Poster room)		

1F Grand Ballroom



2F Namsan Rooms



Daily program | Room A |

08:25-08:30 **Opening Remark** 황성희 (대한뇌졸중학회 회장)

연구회 Session – 심장색전연구회. From Guidelines to Innovations: Comprehensive Stroke Prevention in Atrial Fibrillation
좌장: 나정호 (인하의대 신경과), 김응규 (인제의대 신경과)

08:30-08:55 AF-focused stroke prevention and treatment guidelines 장윤경 (이화의대 신경과) ····· 2

08:55-09:20 Detecting and managing cardioembolic stroke with AI and digital health 김주원 (성균관의대 심장내과) ····· 3

09:20-09:45 Next-generation oral anticoagulants: A paradigm shift in stroke prevention 정다다 (고려의대 신경과) ····· 4

09:45-10:10 Preventing AF-related stroke through lifestyle modifications 이응준 (서울의대 신경과) ····· 5

10:10-10:30 Coffee Break

Acute Stroke Management: Mobile Stroke Unit 좌장: 김경문 (성균관의대 신경과), 차재관 (동아의대 신경과)

10:30-11:00 Half the battle: Nelonemdaz in acutes stroke 권순억 (울산의대 신경과) ····· 8

11:00-11:30 What determines the transition from oligemia to infarction, and how? 김동억 (동국의대 신경과) ····· 9

11:30-12:00 Closing the prehospital gaps in acute stroke care, the why? and how?
Yongchai Nilanont (Mahidol University Siriraj Hospital, Thailand) ····· 10

Symposium 1 좌장: 이경열 (연세의대 신경과)

12:00-12:30 Optimizing antiplatelet strategies for stroke patient : Clopidogrel or aspirin? 김재국 (을지의대 신경과) ····· 12

Symposium 2 좌장: 윤병우 (을지의대 신경과)

12:30-13:00 How to reduce the risk of atherosclerotic stroke with evolocumab 은미연 (경북의대 신경과) ····· 14

13:00-13:20 Coffee Break

13:20-13:25 General Assembly

13:25~13:40 뇌졸중학회 정책, 보험관련 보고 이경복 (정책이사) ····· 16

Plenary Session 좌장: 황성희 (한림의대 신경과)

13:40-14:10 Past, present, and future of stroke registries: Insights from 17 years of experience
배희준 (서울의대 신경과) ····· 18

14:10-14:30 Coffee Break

Metabolism and Stroke (대사증후군과 연관된 신약)
좌장: 김용재 (김용재뇌맑은신경과의원 신경과), 홍근식 (인제의대 신경과)

14:30-14:55 Upcoming multi-agonists for cardio-metabolic disorder 정창희 (울산의대 내분비내과) ····· 22

14:55-15:20 지방간 및 레스메티롬 강성희 (고려의대 소화기내과) ····· 23

15:20-15:45 Beyond LDL: LP(a) as the new therapeutic target in ASCVD 김병진 (성균관의대 순환기내과) ····· 24

15:45-16:00 **Panel Discussion**
김치경 (고려의대 신경과), 김성헌 (강원의대 신경과), 나현욱 (충남의대 신경과)

BTC Symposium. Digital Innovation for Advancing Precision Stroke Medicine (뇌졸중 정밀의료 향상을 위한 디지털 혁신)
좌장: 허지회 (차의대 신경과), 유경호 (한림의대 신경과)

16:00-16:20 Precision medicine research for stroke using multi-omics of the genome: Focusing on big data utilization
(유전체 다중오믹스를 통한 뇌졸중 정밀의학 연구: 빅데이터활용을 중심으로) 성주헌 (서울대 보건대학원) ····· 28

16:20-16:40 Digital transformation of acute stroke care: Focused on AI, robotics, IoT and smart hospital
(중증 뇌졸중 치료를 위한 디지털대전환: AI, 로봇, IoT 및 스마트병원) 이민우 (한림의대 신경과) ····· 29

16:40-17:00 Federated learning and AI in medical data: Future potential and challenges
(연합학습 AI와 의료데이터의 미래 가능성과 도전 과제) 신수용 (카카오헬스케어) ····· 30

17:00-17:20 Digital healthcare 2025 : Age of generative AI (디지털 의료 2025: 생성형 AI의 시대)
나군호 (네이버 헬스케어연구소) ····· 31

17:20-17:40 AI-powered stroke diagnostics: Legal and regulatory perspectives (뇌졸중 진단보조 AI와 법적 규제)
박상철 (서울대 법학과) ····· 32

17:30-18:30 **Poster Presentation (@ Poster room)**

Daily program | Room B |

연구회 Session – 재관류치료연구회. On-Going Topics in Endovascular Treatment of Acute Stroke
좌장: 김병문 (연세의대 영상의학과)

08:30-08:55 Optimal core assessment for eligibility in endovascular treatment 백성현 (서울의대 영상의학과) ····· 34

08:55-09:20 Decision-making in endovascular thrombectomy for distal medium vessel occlusion:
Anatomical landmark and technical consideration 서정화 (동아의대 신경과) ····· 36

09:20-09:45 Rescue stenting in endovascular thrombectomy: When, how, and then? 백장현 (성균관의대 신경과) ····· 37

09:45-10:10 Blood pressure management after endovascular treatment:
Insight from secondary analyses of the OPTIMAL-BP trial 정재욱 (연세의대 신경과) ····· 38

10:10-10:30 Coffee Break

Nursing Symposium 좌장: 조아현 (가톨릭의대 신경과), 정진만 (고려의대 신경과)

10:30-10:50 The assessment of stroke symptoms related to brain lesions (NIHSS평가 포함) 이준원 (인제의대 신경과) ····· 44

10:50-11:10 In-hospital management including blood pressure, fluid, and blood sugar 김종욱 (서울의대 신경과) ····· 51

11:10-11:30 Nursing care in stroke unit — 정원제 (삼성서울병원) ····· 52

11:30-11:50 Discharge education for stroke patient — 한정희 (서울아산병원) ····· 53

Symposium 3 — 좌장: 이광호 (성균관의대 신경과)

12:00-12:30 Efficacy and safety "Cerebrain" in stroke patients — 김범준 (울산의대 신경과) ····· 56

Symposium 4 — 좌장: 이병철 (한림의대 신경과)

12:30-13:00 Optimal antiplatelet therapy after ischemic stroke — 김준엽 (서울의대 신경과) ····· 58

13:00-13:20 Coffee Break

13:20-13:25 General Assembly

13:25~13:40 뇌졸중학회 정책, 보험관련 보고 — 이경복 (정책이사) ····· 60

Plenary Session — 좌장: 황성희 (한림의대 신경과)

13:40-14:10 Past, present, and future of stroke registries: Insights from 17 years of experience
배희준 (서울의대 신경과) ····· 62

14:10-14:30 Coffee Break

Debate Session. Beyond the Debate: Diverse Perspectives on Therapeutic Dilemmas
좌장: 이경열 (연세의대 신경과), 박종무 (을지의대 신경과)

14:30-15:00 Antiplatelet and anticoagulation therapy strategies for patients with atrial fibrillation undergoing carotid artery stenting: triple antithrombotics, alternative revascularization (CEA), etc
안상준 (가톨릭관동의대 신경과) ····· 66

Panel Discussion
강현구 (전북의대 신경과), 허준녕 (연세의대 신경과), 노상미 (가톨릭의대 신경과), 구민우 (시화병원 신경과)

15:00-15:30 Management plan of neurologic deterioration: Triple antiplatelet agent, induced hypertension, agatroban, etc
정혜선 (충남의대 신경과) ····· 68

Panel Discussion
배정훈 (중앙의대 신경과), 김도연 (서울의대 신경과), 이성준 (아주의대 신경과), 정수 (한양의대 신경과)

15:30-16:00 In cases of hemorrhagic conversion with AF: Timing of NOAC initiation and acute phase management
은미연 (경북의대 신경과) ····· 69

Panel Discussion
이민환 (가톨릭의대 신경과), 정해봉 (중앙의대 신경과), 이동환 (을지의대 신경과), 우호걸 (경희의대 신경과)

연구회 Session - 유전체연구회 — 좌장: 최재철 (제주의대 신경과), 박광열 (중앙의대 신경과)

16:00-16:30 뇌졸중 유전자 패널에서 발견되는 변이의 스펙트럼과 해석 — 김영은 (한양의대 진단검사의학과) ····· 72

16:30-17:00 젊은 뇌졸중 환자에서 흔한 유전변이 — 이건주 (고려의대 신경과) ····· 73

17:00-17:30 뇌졸중 치료제에서 고려해야 할 유전변이 — 이정윤 (순천향의대 신경과) ····· 74

17:30-18:30 **Poster Presentation (@ Poster room)**

Daily program | Room C |

Scientific Session 1

좌장: 정근화 (서울의대 신경과), 황양하 (경북의대 신경과)

Scientific Session 2

좌장: 안성환 (조선의대 신경과), 박경필 (부산의대 신경과)

15:40-16:00 Coffee Break

Poster Presentation | Room A |

2025 대한뇌졸중학회

춘계학술대회

| Room A |

연구회 Session - 심장색전연구회.

From Guidelines to Innovations: Comprehensive Stroke Prevention in Atrial Fibrillation

좌장: 나정호 (인하의대 신경과), **김응규** (인제의대 신경과)

대한뇌졸중학회
Korean Stroke Society

AF-focused stroke prevention and treatment guidelines

장 윤 경

이화의대 신경과

The 2024 European Society of Cardiology (ESC) Guidelines for the management of atrial fibrillation (AF) introduce the AF-CARE framework, emphasizing a comprehensive, patient-centered approach: C (Comorbidity and risk factor management), A (Avoidance of stroke and thromboembolism), R (Reduction of symptoms through rate and rhythm control), E (Evaluation and dynamic reassessment). This framework prioritizes addressing comorbidities such as hypertension, heart failure, diabetes, and obesity to prevent AF progression and enhance patient outcomes. Shared decision-making is highlighted, involving patients, families, caregivers, and healthcare teams to ensure individualized care that aligns with patient preferences. For diagnosis, electrocardiographic confirmation of clinical AF is essential, followed by risk stratification using the CHA_2DS_2-VA score to guide anticoagulation therapy. Direct oral anticoagulants are preferred for most patients due to their favorable safety profile. Stroke prevention is prioritized, with rhythm control as a first-line treatment for suitable patients. For those with persistent symptoms despite medication, catheter ablation is recommended. Rate control strategies, including beta-blockers, digoxin, and calcium channel blockers, are employed to manage heart rate and symptoms. Ongoing education for patients, families, and providers supports informed decision-making and dynamic reassessment, optimizing patient outcomes and quality of life.

Detecting and managing cardioembolic stroke with AI and digital health

김 주 원

성균관의대 심장내과

Next-generation oral anticoagulants: A paradigm shift in stroke prevention

정 다 다

고려의대 신경과

As our understanding of the coagulation cascade deepens and clinical needs evolve, anticoagulant therapy is entering a new era focused not only on efficacy but also on safety, precision, and personalization. Traditional agents such as vitamin K antagonists and direct oral anticoagulants (DOACs) have significantly improved stroke prevention and thrombosis management. However, important challenges remain—particularly in patients with high bleeding risk, impaired renal function, or cancer-associated thrombosis.

A new paradigm is emerging through the selective targeting of upstream coagulation factors, especially activated Factor XI (FXIa) and Factor XII (FXIIa). These factors are implicated in thrombosis but play minimal roles in physiological hemostasis. As highlighted in recent work by *Philippou and Stavrou (2023)*, their inhibition represents a promising strategy for "hemostatic-sparing anticoagulation"—providing effective thromboprophylaxis with a reduced risk of bleeding.

This lecture will explore key scientific and clinical trends shaping next-generation anticoagulant therapy

Preventing AF-related stroke through lifestyle modifications

이 응 준

서울의대 신경과

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia and a major risk factor for ischemic stroke. AF-related strokes tend to be more severe, disabling, and recurrent compared to other subtypes. While anticoagulation therapy remains the cornerstone for stroke prevention in AF, growing evidence supports the critical role of lifestyle modification in reducing both AF burden and stroke risk.

This lecture will explore the emerging concept of an integrated approach to AF management, emphasizing the importance of risk factor modification alongside pharmacologic treatment. Key lifestyle-related risk factors—such as obesity, hypertension, diabetes, sleep apnea, smoking, alcohol intake, and sedentary behavior—have been shown to contribute to both the development and progression of AF. Furthermore, addressing these modifiable factors can improve rhythm control outcomes and reduce thromboembolic complications, including stroke.

Recent clinical studies, such as the ARREST-AF and LEGACY trials, have demonstrated that structured weight loss and aggressive risk factor management significantly improve AF outcomes and may indirectly lower stroke risk. Additional strategies, including optimal blood pressure control, glycemic management, and treatment of sleep-disordered breathing, will be discussed with practical recommendations for clinical implementation.

Attendees will gain a comprehensive understanding of how personalized lifestyle interventions can be incorporated into AF care pathways. By highlighting real-world evidence and patient-centered strategies, this session aims to encourage a paradigm shift from reactive to proactive care—ultimately improving long-term cardiovascular and cerebrovascular outcomes in patients with AF.

2025 대한뇌졸중학회

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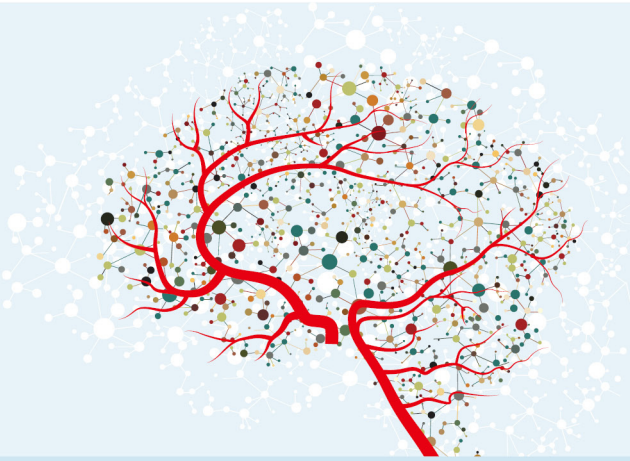

| Room A |

Acute Stroke Management: Mobile Stroke Unit

좌장: 김경문 (성균관의대 신경과), **차재관** (동아의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Half the battle: Nelonemdaz in acutes stroke

권 순 억

울산의대 신경과

What determines the transition from oligemia to infarction, and how?

김 동 억

동국의대 신경과

It remains unclear why unilateral proximal carotid artery occlusion (UCAO) causes benign oligemia in mice, yet leads to various outcomes (asymptomatic-to-death) in humans. We hypothesized that inhibition of nitric oxide synthase (NOS) both transforms UCAO-mediated oligemia into full infarction and expands pre-existing infarction. Using 900 mice, we i) investigated stroke-related effects of UCAO with/without intraperitoneal administration of the NOS inhibitor (NOSi) Nω-nitro-L-arginine methyl ester (L-NAME, 400 mg/kg); ii) examined the rescue effect of the NO-donor, molsidomine (200 mg/kg at 30 minutes); and iii) tested the impact of antiplatelet medications. To corroborate preclinical findings, we conducted clinical studies. UCAO alone induced infarction rarely (~2%) or occasionally (~14%) in C57BL/6 and BALB/c mice, respectively. However, L-NAME+UCAO induced large-arterial infarction in ~75% of C57BL/6 and BALB/c mice. Six-hour laser-speckle imaging detected spreading ischemia in ~40% of C57BL/6 and BALB/c mice with infarction (vs. none without) by 24-hours. In agreement with vasoconstriction/microthrombus formation shown by intra-vital-microscopy, molsidomine and the endothelial-NOS-activating antiplatelet cilostazol attenuated/prevented progression to infarction. Moreover, UCAO without L-NAME caused infarction in ~22% C57BL/6 and ~31% ApoE knock-out mice with hyper-glycemia/hyperlipidemia, which associated with ~60% greater levels of symmetric dimethylarginine (SDMA, an endogenous NOSi). Further, increased levels of glucose and cholesterol associated with significantly larger infarct volumes in 438 UCAO-stroke patients. Lastly, Mendelian randomization identified a causative role of NOS inhibition (elevated SDMA concentration) in ischemic stroke risk (OR = 1.24; 95% CI, 1.11−1.38; P = 7.69×10-5). In conclusion, NOS activity determines the fate of hypoperfused brain following acute UCAO, where SDMA could be a potential risk predictor.

Closing the prehospital gaps in acute stroke care, the why? and how?

Yongchai Nilanont

Mahidol University Siriraj Hospital, Thailand

Stroke is a leading cause of death and disability worldwide, particularly in low- and middle-income countries. In Thailand, the stroke rate is approximately 1,880 cases per 100,000 people. From nationwide data, about 5% of patients with acute ischemic stroke die, and 70% are left with disabilities when discharged. When calculated using the Disability-Adjusted Life Years (DALYs) metric, stroke remains the leading cause of health loss in Thailand. This is expected to rise due to the aging population.

At Siriraj Hospital, Mahidol university,Thailand, statistics from the "acute stroke fast track protocol" showed that only 60% of patients arrive within 3 hours of symptom onset. Delays were often due to factors outside the hospital, such as onset to activate and activate to door. Our data demonstrated that the bottle neck in treating acute ischemic stroke are as follows: lack of neurologists, prehospital delay and ineffective interhospital transfer. Research has shown that using Mobile Stroke Unit (MSU), emergency vehicles equipped with a special computerized tomography (CT) scanners and a stroke teleconsultation system to perform brain imaging, provide two-way communication, exchange patients' critical medical information with remote neurologist to decide on treatment plan and order of thrombolytic treatment on-site. Furthermore, this new treatment approach can provide information to the stroke unit team for immediate intervention: mechanical thrombectomy. This approach may shift the focus to "onset to needle time" as the new standard for stroke care.

Recently, we were able to showed that the use of MSUs reduced the time to open the blocked blood vessels by fifty percent, tripled the chance of receiving thrombolytic therapy and/or mechanical thrombectomy and doubled the chance of getting a good recovery (mRS 0-2). This new treatment paradigm can improved the quality of stroke care especially in remote areas.

2025 대한뇌졸중학회

춘계학술대회

| Room A |

Symposium 1

좌장: 이경열 (연세의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Optimizing antiplatelet strategies for stroke patient : Clopidogrel or aspirin?

김 재 국

을지의대 신경과

2025 대한뇌졸중학회

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Symposium 2

좌장: 윤병우 (을지의대 신경과)

대한뇌졸중학회
Korean Stroke Society

How to reduce the risk of atherosclerotic stroke with evolocumab

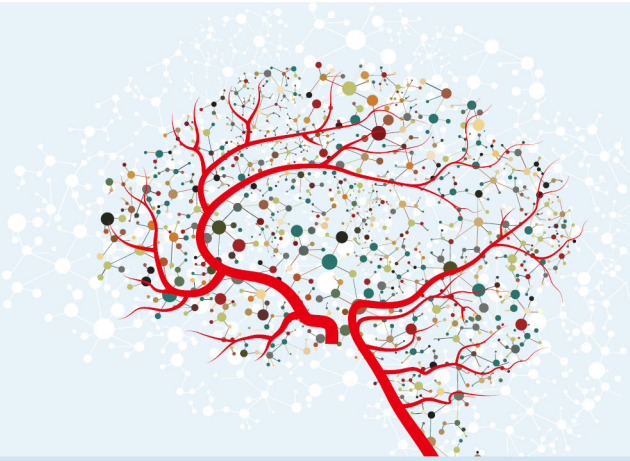
은 미 연

경북의대 신경과

Atherosclerotic stroke is a significant contributor to global stroke burden, particularly in patients with established cardiovascular risk factors. Despite the use of high-intensity statins, a substantial proportion of patients continue to have elevated low-density lipoprotein cholesterol (LDL-C), which is a well-established risk factor for recurrent ischemic events. Evolocumab, a monoclonal antibody that inhibits proprotein convertase subtilisin/kexin type 9 (PCSK9), offers an effective therapeutic option to further reduce LDL-C levels beyond what is achievable with statins alone.

Clinical trials such as the FOURIER study and its stroke-specific sub-analyses have demonstrated that evolocumab significantly reduces the risk of ischemic stroke in patients with atherosclerotic cardiovascular disease. Moreover, emerging real-world evidence supports the early use of PCSK9 inhibitors in high-risk populations, including those with symptomatic intracranial or extracranial atherosclerosis.

This lecture will review the mechanisms of PCSK9 inhibition, summarize key clinical trial data, and provide practical guidance on patient selection, timing of initiation, and monitoring strategies. Special attention will be given to Asian populations and stroke-specific considerations, including cerebral atherosclerosis and statin intolerance. Through an evidence-based approach, clinicians will gain insights into optimizing lipid-lowering strategies with evolocumab to reduce the risk of atherosclerotic stroke and improve long-term neurological outcomes.



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춘계학술대회

| Room A |

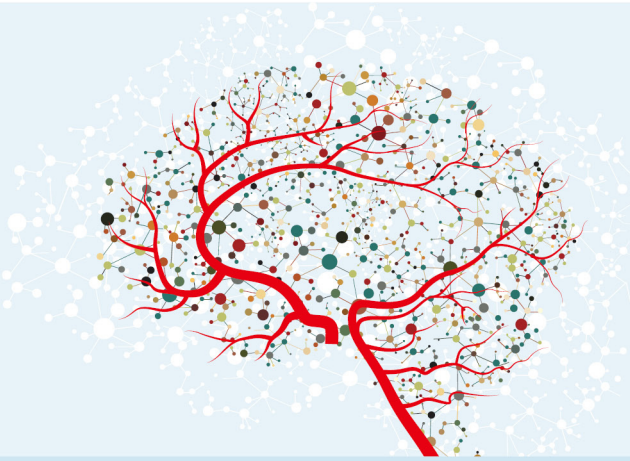
General Assembly

대한뇌졸중학회
Korean Stroke Society

뇌졸중학회 정책, 보험관련 보고

이 경 복

정책이사



2025 대한뇌졸중학회

춘계학술대회

| Room A |

Plenary Session

좌장: 황성희 (한림의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Past, present, and future of stroke registries: Insights from 17 years of experience

배 희 준

서울의대 신경과

Stroke was the second leading cause of death in Korea, ranking behind cancer and ahead of ischemic heart disease. The expected growth of stroke burden in Korea in early 2000s led to the initiation of a government-funded clinical research project, the CRCS (Clinical Research Center for Stroke), with the goal of developing and implementing national stroke guidelines. The 5th section of CRCS (CRCS-5) developed a multicenter, prospective, stroke registry and began collection of data in 2008 for stroke epidemiology and quality of care research, building on the legacy of the Korean Stroke Registry (KSR), which had been established in 1999 with the primary purpose of understanding the epidemiology and clinical characteristics of stroke in Korea.

CRCS-5 was renamed CRCS-K (Clinical Research Collaboration for stroke in Korea) at the end of the CRCS project in 2015, and since 2017, it has been supported by the Korean National Institute of Health (NIH) and known as the CRCS-K-NIH registry. To date, approximately 127 000 cases have been registered from 20 university hospitals or regional stroke centers, and more than 250 articles have been published based on the registry.

A recent analysis of 10-year secular trends demonstrated overall improvements in stroke care and outcomes, while also identifying areas in need of further enhancement. This large-scale, high-quality dataset provides opportunities to explore and compare treatment disparities using the comparative effectiveness research methods, to design and conduct registry-based randomized clinical trials, and to connect the registry data with other sources including national claims data, neuroimaging, or genetic data. It also serves as a platform for international collaboration.

Today, the CRCS-K-NIH functions not only as a stroke registry but also as a dynamic research network. In this presentation, we will discuss what we have accomplished, what we are currently undertaking, and what we can achieve in the future through this collaborative platform.

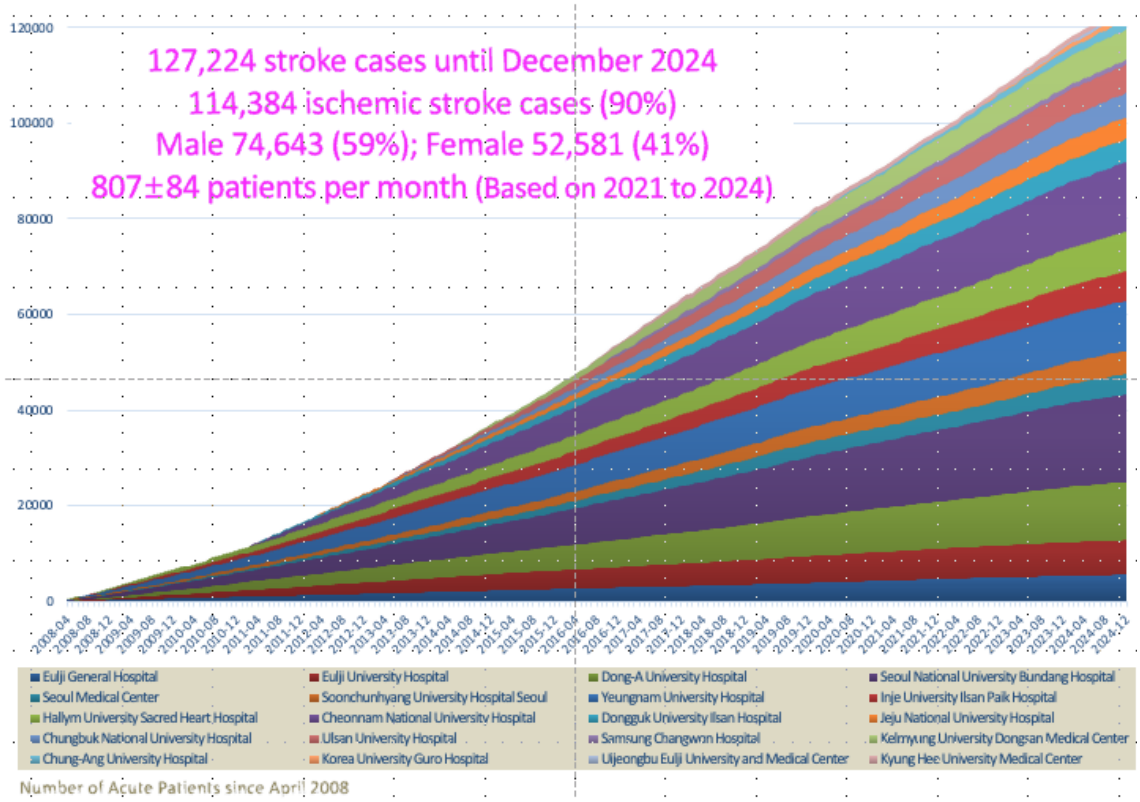


Figure. Number of Registered Cases Over 17 years

2025 대한뇌졸중학회

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| Room A |

Metabolism and Stroke
(대사증후군과 연관된 신약)

좌장: 김용재 (김용재뇌맑은신경과의원 신경과), **홍근식** (인제의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Upcoming multi-agonists for cardio-metabolic disorder

정 창 희

울산의대 내분비내과

The increasing prevalence of cardio-metabolic diseases, such as diabetes, obesity, and cardiovascular disorders, demands more effective therapeutic strategies. Traditional single-target treatments often fall short in addressing the complex nature of these conditions. Multi-agonists, which simultaneously target multiple receptors, offer a promising new approach.

Multi-agonists, including dual and triple agonists, can activate receptors like GLP-1 (glucagon-like peptide-1), GIP (glucose-dependent insulinotropic polypeptide), and glucagon. This multi-pathway engagement provides comprehensive benefits such as improved glycemic control, enhanced weight loss, and cardiovascular protection. For instance, dual GLP-1/GIP agonists have shown superior efficacy in reducing HbA1c levels and body weight compared to traditional GLP-1 receptor agonists. Triple agonists targeting GLP-1, GIP, and glucagon receptors are also under investigation, showing promising results in early trials.

The development of these multi-agonists involves sophisticated design to ensure selective receptor activation and minimal side effects, utilizing advanced drug delivery systems and molecular engineering.

This lecture will cover the latest advancements in multi-agonist therapies for cardio-metabolic diseases, discussing their mechanisms, clinical efficacy, and potential to transform future treatment strategies. Attendees will gain a comprehensive understanding of the challenges and opportunities in this innovative field.

지방간 및 레스메티롬

강 성 희

고려의대 소화기내과

Over the past decades, the understanding of nonalcoholic fatty liver disease (NAFLD) has evolved, leading to new terminology: MASLD (Metabolic dysfunction-associated steatotic liver disease), which better reflects its metabolic underpinnings. MASLD is diagnosed with evidence of hepatic steatosis plus at least one metabolic risk factor, excluding other causes like alcohol or viral hepatitis. Subtypes include MASL (simple steatosis), MASH (steatohepatitis), and MASLD-related fibrosis.

Therapeutic strategies have advanced beyond lifestyle modification. Pioglitazone and high-dose vitamin E have shown histologic improvements but carry long-term safety concerns. GLP-1 receptor agonists such as Semaglutide and Tirzepatide show promise in NASH resolution and fibrosis improvement.

A novel agent, Resmetirom, a liver-targeted THR-β agonist, recently received FDA approval after strong efficacy and safety results in phase 3 trials (MAESTRO NASH, MAESTRO-NAFLD-1). It has demonstrated efficacy in reducing hepatic fat content, improving liver histology (both MASH resolution and fibrosis improvement), and ameliorating biomarkers of liver damage without significant effects on body weight or glucose metabolism.

Also, Resmetirom significantly reduces liver fat, LDL-C, apoB, and improves liver stiffness. It mimics thyroid hormone activity in hepatocytes, enhancing lipid oxidation and reducing de novo lipogenesis with minimal side effects.

Beyond LDL: LP(a) as the new therapeutic target in ASCVD

김 병 진

성균관의대 순환기내과

심혈관질환(CVD)은 전 세계적으로 주요한 사망 및 장애 원인 중 하나이며, 국내에서도 예외가 아니다. 기존의 다양한 심혈관 위험인자에 대한 연구와 약물 치료의 발전에도 불구하고, 여전히 상당한 잔여 심혈관 위험이 존재한다. 이러한 잔여 위험 요인 중 하나로 지목되는 것이 lipoprotein(a) [Lp(a)]이다. Lp(a)는 1963년 유전학자인 Käre Berg에 의해 처음 발견되었으며, 이후 60년 이상 연구가 지속되면서 Lp(a)의 생물학적 특성과 병태생리가 점차 밝혀졌다. Lp(a)는 저밀도지단백(LDL) 유사 입자로, apolipoprotein B-100(apoB-100)에 apolipoprotein(a) [apo(a)]가 단일 이황화결합으로 결합된 형태를 가지고 있다. Lp(a)는 동맥경화 촉진, 혈전 형성, 염증 반응 유발이라는 세 가지 주요 병리학적 특성을 가지며, 이는 심혈관질환 발생과 진행에 중요한 역할을 한다. 관찰 연구 및 멘델리안 무작위배정 연구에서는 Lp(a) 농도가 높은 경우 심혈관 사건의 발생률이 증가함을 보고하였다. EPIC-Norfolk 연구에서는 Lp(a) 수치가 높은 환자에서 관상동맥질환 위험이 1.5~2배 증가함을 확인하였으며, UK Biobank 연구에서는 LPA 유전자 변이에 의해 Lp(a) 수치가 증가한 개인은 심혈관 질환 위험이 유의하게 높았다. Mendelian randomization연구에서도 LPA 유전자의 변이를 기반으로 한 연구에서 Lp(a) 수치 증가가 관상동맥질환과 직접적인 인과관계를 가진다는 점을 확인하였다. 이러한 연구들은 Lp(a) 감소가 심혈관 사건 예방에 중요한 역할을 할 수 있음을 시사한다.

Lp(a) 수치는 유전적 요인의 영향을 크게 받으며, 환경적 요인의 영향은 제한적이다. Lp(a) 수치의 약 90%는 LPA 유전자에 의해 결정되며, Kringle-IV(K-IV) 반복 개수와 단일염기다형성(SNP)이 수치 변동에 영향을 미친다. 성인기의 Lp(a) 수치는 5세 이전에 결정되며, 인종 간에도 차이를 보인다. 예를 들어, UK Biobank 연구에 따르면, Lp(a) 농도의 중간값은 중국인 16 nmol/L, 백인 19 nmol/L, 남아시아인 31 nmol/L, 흑인 75 nmol/L로 나타났다. 한국에서도 다양한 코호트 연구에서 Lp(a) 수치가 보고되었으며, 일반적으로 Lp(a) 중간값이 대략 15-20 mg/dL로 측정되었다.

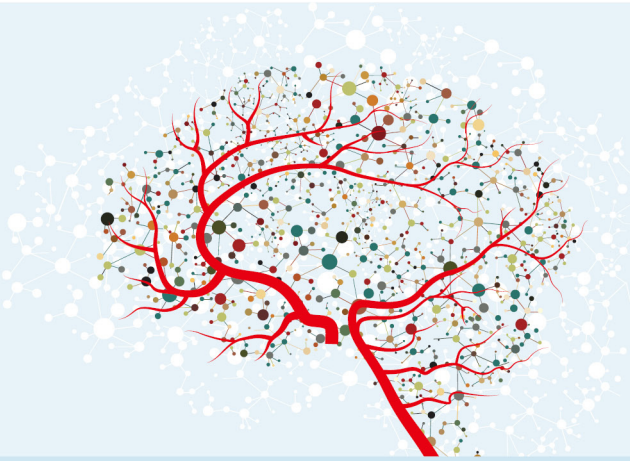
Lp(a) 검사는 현재 다양한 방법으로 수행되지만, isoform-sensitive 및 isoform-insensitive 검사 간의 차이가 존재하며, Lp(a) 단위(nmol/L vs. mg/dL) 또한 표준화가 부족하다. WHO/IFCC에서는 nmol/L 단위를 권장하고 있으며, 국제적으로는 isoform-insensitive 검사의 활용이 증가하고 있다. 국내에서 Lp(a) 검사의 활용이 점차 증가하고 있지만, 아직 검사 대상과 기준이 명확히 정리되지 않았다. 비록 한국인 대상 연구들의 불충분한 과학적 증거에도 최근 꾸준히 연구 결과들이 발표되었다. 한 예로, 한국의 대규모 건강검진 코호트 연구에서는 Lp(a) ≥ 50 mg/dL(≒120 nmol/L) 그룹에서 심혈관질환 및 전체 사망 위험이 유의미하게 증가하는 것으로 나타났다. 또한, Lp(a)와 관상동맥 석회화(CAC) 및 죽상경화성 심혈관질환(ASCVD)의 연관성에서도 Lp(a) ≥ 50 mg/dL 그룹에서 죽상경화성 심혈관 질환의 유병에 대한 오즈비가 36% 증가하는 것으로 나타났다. 이러한 상황에서 Lp(a) 저하 치료제의 임상연구가 활발히 진행 중이라 멀지않아 Lp(a) 검사 및 관리에도 현재보다 적극적인 움직임이 필요한 때이다. 따라서 국내에서도 이러한 표준화된 검사법을 도입하고, 임상적 해석의 일관성을 높이는 것이 필요하다.

최근 여러 국가 및 주요 지침에서 Lp(a)의 임상적 중요성을 강조하고 있다. 2022년 유럽동맥경화학회(EAS) consensus statement는 모든 성인에서 적어도 한 번 Lp(a) 검사를 시행할 것을 권고하며, 청소년에서도 허혈성 뇌졸중 병력 또는 조기 ASCVD 가족력이 있는 경우 검사를 고려해야 한다고 제시했다. 2021년 캐나다 심장학회(CCS) 지침에서도 생애 한 번의 Lp(a) 검사를 권장하며, 2019년 미국 국립지질협회(NLA) 역시 특정 고위험군에서 Lp(a) 검사를 권장하고 있다. 또한 인접 국가인 중국에서도 고위험군에서

LP(a)검사를 권장하고 있다. 그러나 한국에서는 아직 Lp(a)에 대한 명확한 검사 및 치료 기준이 확립되지 않았으며, 한국지질동맥경화학회 진료지침 제5판에서도 Lp(a)는 "향후 연구가 필요한 심혈관계 바이오마커"로 언급되는 정도에 머물러 있다.

Lp(a) 감소를 위한 약물 개발은 ASO(antisense oligonucleotide) 기반 치료제와 siRNA(small interfering RNA) 기반 치료제, 그리고 경구용 제제로 나뉜다. ASO 치료제는 RNase H 매개 분해를 통해 LPA mRNA를 직접 분해하여 Lp(a) 생성을 억제한다. Pelacarsen은 2상 연구에서 Lp(a)를 80%까지 감소시키는 효과를 보였으며, 현재 진행 중인 3상 연구인 Lp(a)HORIZON trial에서 주요 심혈관 사건 감소 여부를 평가하고 있다. siRNA 기반 치료제는 RISC(RNA-induced silencing complex)를 통해 LPA mRNA를 절단하여 Lp(a) 생성을 차단한다. Olpasiran은 OCEAN(a)-DOSE 연구에서 75mg 용량으로 95% 이상의 Lp(a) 감소 효과를 확인하였으며, 3상 연구인 OCEAN(a)-Outcomes trial이 진행 중이다. Lepodisiran은 1상 연구에서 608mg 단일 투여 후 Lp(a) 97% 감소를 보였으며, 효과가 1년 이상 지속됨을 확인하였다. 현재 3상 연구인 ACCLAIM-Lp(a) trial이 진행 중이다. 또한 Zerlasiran은 2상 연구에서 80% 이상의 Lp(a)감소 효과를 보였고, 3상 연구를 준비 중이다. 한편, 경구용 제제 중 Muvalaplin은 Lp(a)의 apo(a)-apoB 결합을 방해하여 Lp(a) 형성을 억제하는 기전으로 작용하며, 2상 KRAKEN 연구에서 Lp(a)를 최대 85%까지 감소시키는 효과를 보였다.

현재 진행 중인 3상 연구들의 결과에 따라 Lp(a) 치료제의 심혈관 보호 효과가 확립될 것으로 기대된다. 그러나 몇 가지 해결해야 할 과제도 존재한다. Lp(a) 감소가 실제로 심혈관 사건 감소로 이어지는지 확인이 필요하며, siRNA 및 ASO 기반 치료제의 장기적인 면역 반응 및 부작용 여부도 평가해야 한다. 또한, Lp(a) 치료의 필요성을 결정할 수 있는 임상 가이드라인 정립이 필요하다. Lp(a) 치료제는 특정 고위험군 환자에서 적용 가능성이 높으며, 특히 기존 LDL-C 조절에도 불구하고 심혈관 질환의 위험이 높은 환자군에서 효과적인 치료 옵션이 될 가능성이 크다. 향후 연구들은 Lp(a) 치료제의 임상적 유용성을 확립하고, 효과적인 심혈관 질환 예방 전략을 마련하는 데 중요한 역할을 할 것이다.



2025 대한뇌졸중학회

춘계학술대회

| Room A |

BTC Symposium.

Digital Innovation for Advancing Precision Stroke Medicine (뇌졸중 정밀의료 향상을 위한 디지털 혁신)

좌장: 허지회 (차의대 신경과), **유경호** (한림의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Precision medicine research for stroke using multi-omics of the genome: Focusing on big data utilization (유전체 다중오믹스를 통한 뇌졸중 정밀의학 연구: 빅데이터활용을 중심으로)

성 주 헌

서울대 보건대학원

질병 유전체 연구는 유전체 및 다중오믹스 연구의 폭발적으로 확대 되고 있다. 표준화된 연구결과의 데이터화와 공개, 대규모 바이오뱅크 (UK바이오뱅크, All of Us, China Kadoori Cohort, FinnGen, TOPMed 등)의 원자료개방 등은 생물학적 정보의 보고로, 지금까지 경험하지 못했던 새로운 연구환경이 조성되고 있다. 이 발표에서는유전체와 다중오믹스 자료원, 특히 공개된 자료원들을 활용하여 질병유전체 연구가 어떻게 수행될 수 있는지를 소개하고자 한다. 또한, 뇌졸중 연구에서 이러한 접근이 어느정도의 현실성을 가질 수 있는지를 논의하고자 한다.

유전체 데이터는 일반인구의 분포와 인구집단별 변이빈도를 평가할 수 있는 gnomAD 등이 있고, 특히 young age stroke 등 희귀변이의 중요성이 높은 분야에서 활용도가 높다. 새로 발견된 변이들은 ClinVar/ClinGen등의 표준적인 pathogenicity 평가 DB를 참조하며, 나아가 Alphamissense 등의 새로운 분석방법을 적용하여 변원성의 정도를 추가로 평가할 수 있다. 유전체 연구에서 발굴된 변이의 기전적인 평가를 위해서는 우선 유전자발현과의 관련성 연구가 필요하다. GTeX, eQTL 등의 유전변이-유전자발현 관련 database가 널리 활용된다. 최근에 인공지능분석을 기반으로 개발된 GET 등의 분석방법은 실제의 유전자 발현실험을 대치할 수 있을 정도의 정확도 높은 기능적 평가가 가능할 것으로 예상된다. 나아가, UKBB등에 제공되는 질병-유전체-단백체-대사체 정보는 질환별, 위험요인별, 유전형별로 단백체-대사체 정보를 평가할 수 있게 해주며, 보다 정밀한 기전적인 이해를 위한 핵심자료원이 되고 있다. 최근에는 유전체분석의 결과 (예: 2022년 Nature에 간행된 stroke GWAS 연구)를 통해서도 치료표적을 검증하는 다양한 분석방법이 개발되고, 이러한 방법에 기초할 때 새로운 치료표적인 실제로 임상시험에 성공할 확률이 3배 (GWAS 연구기반) 혹은 8배 (NGS기반의 분석) 높아지는 것으로 보고되고 있다.

결론적으로, 대규모의 유전체-오믹스 자료원의 확대와 빠르게 개발되고 있는 다양한 분석방법론들은 뇌졸중 연구에서도 질병유전체 연구를 임상적인 함의를 가진 연구로 전환할 수 있는 새로운 환경을 제시하고 있다. 이러한 환경을 이해하고 활용하여 성과를 거두는 것은 연구자의 권한이며 책임이기도 하다.

Digital transformation of acute stroke care: Focused on AI, robotics, IoT and smart hospital (중증 뇌졸중 치료를 위한 디지털대전환: AI, 로봇, IoT 및 스마트병원)

이 민 우

한림의대 신경과

Digital transformation has emerged as a pivotal driver reshaping healthcare delivery globally, with acute stroke care representing one of its most dynamic application fields. In Korea, rapid advancements in artificial intelligence (AI), robotics, Internet of Things (IoT), and smart hospital technologies have significantly enhanced stroke management outcomes. AI algorithms, such as RAPID AI and Viz.ai, are revolutionizing diagnostic speed and precision, enabling earlier identification and stratification of stroke patients for effective treatment. Robotics have expanded capabilities in telemedicine and remote interventions, providing specialized stroke expertise to underserved regions. Concurrently, IoT integration facilitates real-time patient monitoring, optimizing clinical decision-making through continuous data collection. The evolution of smart hospitals integrates these technologies cohesively, creating an interconnected, responsive healthcare environment tailored for acute stroke management. Korea's experience illustrates a model for comprehensive stroke care through digital transformation, emphasizing innovation-driven strategies to reduce time to intervention, enhance patient safety, and improve clinical outcomes. This presentation explores Korea's pioneering role and ongoing challenges in digitalizing stroke care, offering insights and future perspectives on fully realizing the benefits of technology-driven healthcare.

Federated learning and AI in medical data: Future potential and challenges (연합학습 AI와 의료데이터의 미래 가능성과 도전 과제)

신 수 용

카카오헬스케어

최근 생성형 AI(GenAI)의 성능이 극적으로 향상되면서, 인공지능 의료기기(AIMD)로 개발되거나 임상 현장에서 의료기기 소프트웨어(SaMD)로 빈번하게 사용되고 있다. 본 발표에서는 이러한 생성형 AI가 임상 목적뿐만 아니라 연구 목적으로도 활용되는 사례를 카카오헬스케어의 경험을 바탕으로 소개하고자 한다. 카카오헬스케어는 개별 병원의 의료 정보를 구조화하고 표준화하여 다기관 연구를 용이하게 하는 연구 데이터 플랫폼인 HRS(Healthcare data Research Suite)를 개발하여 병원들에게 제공하고 있는데, HRS 내부에서 다양한 생성형 AI 기술을 활용하고 있다. 첫째, HRS는 의사가 자유로운 텍스트 형식으로 작성한 임상 보고서, 즉 병리 보고서, 영상의학 보고서, 검사 보고서 등을 대규모 언어 모델(LLM)을 사용하여 필요한 정보를 추출하여 구조화하고 있다. HRS는 이미 여러 병원에 배포되었으며, 배포된 병원들에게 병리와 특수 검사 보고서 등에 대해서 95% 이상의 정확도를 보장하고 있다. 둘째, SNOMED-CT, LOINC, RxNorm 및 ICD 코드와 같은 국제 표준 임상 용어를 병원의 내부 코드 및 위 NER 프로세스에서 추출된 개체에 자동으로 매핑하는 LLM 기반 솔루션을 개발하여 매핑 범위와 속도를 향상시키고 있다. 마지막으로, 구조화되고 표준화된 의료 데이터를 사용하여 다기관 연구를 촉진하는 연합 학습(FL)을 Google Whitepaper에 case report로 소개된 내용을 위주로 설명하고자 한다.

Digital healthcare 2025 : Age of generative AI (디지털 의료 2025: 생성형 AI의 시대)

나 군 호

네이버 헬스케어연구소

디지털 헬스케어의 2025년 주요 트렌드를 소개하는바, 주요 키워드로는 생성형 AI, 수직 계열화, 음성 기술이 있다. 특히 2022년 11월 ChatGPT로 시작된 생성형 AI는 의료 문서 작성, 임상 연구 지원 등에 활용되고 있다. 수직 계열화의 사례들은 물론 최근 음성 기술은 의료진의 업무 효율성 향상에 기여하고 있다. 네이버는 사내 병원 운영, AI 기반 헬스케어 서비스 개발, 의료 AI 연구 등을 통해 디지털 헬스케어 분야에 적극 참여하고 있다. 특히 HyperCLOVA와 같은 특화 AI 모델 개발에 주력하고 있다.

AI-powered stroke diagnostics: Legal and regulatory perspectives (뇌졸중 진단보조 AI와 법적 규제)

박 상 철

서울대 법학과

This lecture provides an overview of the legal and regulatory issues surrounding AI-powered stroke diagnostics. It begins by examining how Korea's domestic regulatory frameworks—such as product approval by the Ministry of Food and Drug Safety (MFDS), novel health technology assessment by NECA, and insurance reimbursement registration by the Health Insurance Review and Assessment Service (HIRA)—apply to AI-based Software as a Medical Device (AI SaMD). It also explores the implications of the newly implemented Digital Medical Device Act. For companies exporting AI SaMD to the U.S. and EU, the lecture addresses regulatory challenges under the U.S. FDA's Food, Drug & Cosmetic Act, the application of the EU Medical Device Regulation (MDR), and the complications arising from overlapping requirements with the EU AI Act. In the Korean context, with the AI Framework Act set to take effect next January, both developers of AI-powered stroke diagnostic devices and the medical institutions and professionals deploying them will fall under its scope. The lecture examines its possible regulatory overlaps with existing MFDS frameworks and proposes strategies for effective compliance.

2025 대한뇌졸중학회

춘계학술대회

| Room B |

연구회 Session – 재관류치료연구회.

On-Going Topics in Endovascular Treatment of Acute Stroke

좌장: 김병문 (연세의대 영상의학과)

대한뇌졸중학회
Korean Stroke Society

Optimal core assessment for eligibility in endovascular treatment

백 성 현

서울의대 영상의학과

Background:

The landscape of acute ischemic stroke treatment has evolved with the success of recent large-core trials, demonstrating that endovascular thrombectomy (EVT) benefits patients with extensive infarction. These six pivotal trials—RESCUE-Japan LIMIT, ANGEL-ASPECT, SELECT2, TESLA, TENSION, and LASTE—have expanded eligibility criteria, challenging previous paradigms that excluded patients with large ischemic cores. As imaging is central to patient selection, defining and accurately measuring the ischemic core has become a critical issue in clinical decision-making.

Imaging Modalities for Core Assessment:

Ischemic core estimation is primarily performed using three imaging techniques:

- Non-contrast CT (NCCT) – Assessed using Alberta Stroke Program Early CT Score (ASPECTS).
- CT Perfusion (CTP) – Estimates core based on cerebral blood flow (CBF) thresholds.
- Diffusion-weighted MRI (DWI) – Identifies infarcted tissue through restricted diffusion.

Each method has advantages and limitations, influencing the interpretation of core volume and eligibility for EVT. Challenges in Ischemic Core Estimation:

[ASPECTS Limitations]

- While widely used in clinical trials, ASPECTS shows limited reliability and reproducibility due to interobserver variability and its insensitivity to early ischemic changes.

[CTP Pitfalls]

- Overestimation and underestimation are frequent due to standardization issues, threshold variability, and time-dependent changes.
- The "ghost core" phenomenon can lead to misinterpretation, as infarcted tissue evolves dynamically over time.
- Different software algorithms yield varying core volume estimations, impacting treatment decisions

[DWI Considerations]

- DWI is considered the most reliable reference standard for ischemic core measurement.

- Although highly sensitive to early ischemic injury, DWI may not fully capture viable tissue that can be salvaged through reperfusion therapy
- DWI lesion reversal is frequently observed, particularly in patients who achieve early reperfusion, challenging the assumption that all DWI hyperintense areas represent permanently infarcted tissue

Interpretation and Clinical Implications:

The variability in core estimation techniques directly affects patient selection for EVT. While trials such as DAWN and DEFUSE 3 have set imaging-based criteria (e.g., CBF <30% on CTP or ASPECTS ≤5 on NCCT), new large-core trials incorporate more flexible definitions, allowing for wider treatment applicability. These studies have demonstrated functional benefits of EVT in patients previously deemed ineligible, emphasizing the need for refined core assessment strategies.

Conclusion:

Accurate ischemic core estimation remains a major challenge in acute stroke management. Understanding the strengths and limitations of ASPECTS, CTP, and DWI is essential for optimizing patient selection and avoiding inappropriate exclusion from EVT. Future efforts should focus on standardizing CTP thresholds, improving ASPECTS reliability, and integrating multimodal imaging approaches to refine stroke triage and maximize treatment benefit.

Trial name	Imaging eligibilty	Initial ASPECTS median (IQR)	Estimated Infarct core median (IQR)
RESCUE-Japan LIMIT	NCCT or DWI ASPECTS 3-5 Within 6 hours after LNT, FLAIR-DW mismatch	3 (3-4)	94 (66-152)
ANGEL-ASPECT	NCCT or DWI ASPECTS 3-5 ASPECTS 0-2 and core 70mL-100mL ASPECTS ≥6 (>6h) and core 70mL-100mL	3 (3-4)	60.5 (29-86)
SELECT2	NCCT ASPECTS 3-5 ASPECT ≥6 and CTP core ≥50ml	4 (3-4)	74 (50-111.5)
TENSION	NCCT or DWI ASPECTS 3–5	4 (3-5)	205·8 (139·1)*
LASTE	NCCT or DWI ASPECTS 0–5 (4–5 if >80 y)	2 (1-3)	132 (104-185)
TESLA	NCCT ASPECTS 2–5	2 (1-3)	166 (103-216)

*mean (SD)

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Decision-making in endovascular thrombectomy for distal medium vessel occlusion: Anatomical landmark and technical consideration

서 정 화

동아의대 신경과

Endovascular thrombectomy (EVT) for distal medium vessel occlusions (MeVOs) remains a topic of ongoing debate, particularly concerning its safety and efficacy in anatomically complex vascular territories. In contrast to large vessel occlusions (LVOs), which involve relatively accessible and robust arteries, distal MeVOs—such as M2–M4, A2–A3, and P2–P3 segments—are characterized by smaller vessel diameters, increased tortuosity, and variable collateral circulation. These anatomical challenges significantly complicate device navigation and clot retrieval, increasing the risk of vessel injury, dissection, and symptomatic intracranial hemorrhage(ICH).

Recent trials, including ESCAPE-MeVO and DISTAL, have not demonstrated a significant functional benefit of EVT over best medical management, while highlighting a higher incidence of hemorrhagic complications among EVT-treated patients. These findings underscore the importance of a landmark-driven, individualized approach to patient selection. Ideal EVT candidates for distal MeVO should be assessed based on vessel caliber, branching patterns, tortuosity, and collateral status—parameters best evaluated through advanced imaging techniques.

Current thrombectomy devices, primarily developed for LVOs, lack the flexibility required for safe navigation in distal vessels. Both ESCAPE-MeVO and DISTAL reported elevated rates of symptomatic ICH in EVT arms (5.4% vs. 2.2% in ESCAPE-MeVO), emphasizing the need for mini-stentrievers, more flexible aspiration catheters, and enhanced navigation systems to improve procedural safety and efficacy.

Not all distal MeVOs are equally amenable to EVT. Decision-making should prioritize disabling neurological deficits, eloquent cortex involvement, and significant penumbra identified on imaging, rather than broad inclusion criteria.

In conclusion, EVT for distal MeVO stroke demands a highly selective, anatomy-aware strategy. Until dedicated devices and optimized protocols become available, clinical judgment should emphasize patient safety, imaging-driven selection, and procedural feasibility to maximize outcomes and minimize complications.

Rescue stenting in endovascular thrombectomy: When, how, and then?

백 장 현

성균관의대 신경과

In recent years, the use of rescue stenting in the endovascular management of acute intracranial large-vessel occlusion (LVO) has garnered increasing attention. Although conclusive evidence from randomized controlled trials remains unavailable, an expanding corpus of retrospective studies and clinical experience suggest that emergent stenting may offer substantial benefits, particularly when conventional thrombectomy techniques fail to achieve adequate recanalization. This approach, commonly referred to as "rescue stenting," is gaining recognition for its potential efficacy not only in cases involving underlying intracranial atherosclerosis (ICAS), but also in certain embolic occlusions that are resistant to traditional mechanical thrombectomy.

Rescue stenting may be necessary not only for occlusions associated with ICAS but also in embolic cases where the vessel remains critically narrowed or re-occluded following multiple retrieval attempts. The success of this method is largely contingent upon the prompt and accurate identification of the underlying etiology of the occlusion. Various clinical and angiographic characteristics, such as truncal-type occlusion, persistent fixed stenosis after the initial thrombectomy, or absence of a clear embolic source, can indicate ICAS and inform the decision to proceed with stenting. Early recognition of these indicators during the procedure facilitates a more tailored and potentially effective therapeutic approach.

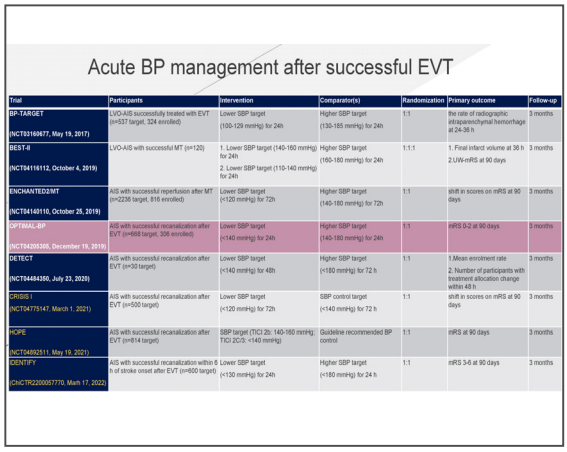
Importantly, emergent stenting in the context of ICAS-related LVO significantly differs from elective intracranial stenting. It requires the selection of stents capable of navigating acute, unstable lesions, and the adaptation of procedural strategies without prior antiplatelet preparation. As patients undergoing rescue stenting are typically not pre-treated with antiplatelets, the intra-procedural use of antithrombotic agents, such as glycoprotein IIb/IIIa inhibitors, becomes essential. Furthermore, a carefully considered post-procedural antiplatelet regimen is crucial to balance the risks of hemorrhagic transformation and stent thrombosis. Vigilant monitoring of acute in-stent thrombosis and re-occlusion during the immediate post-procedural period is vital to ensure favorable outcomes.

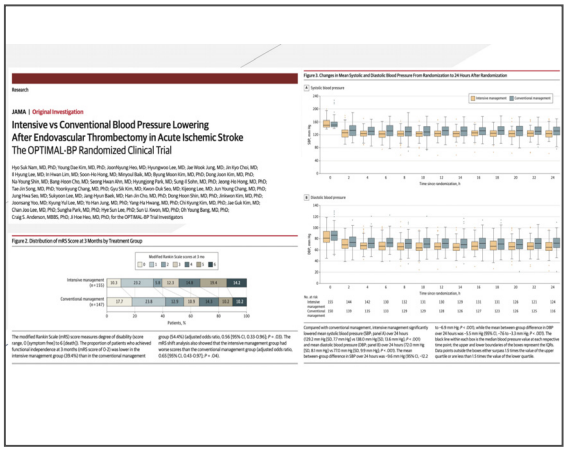
This lecture will comprehensively examine the evolving role of rescue stenting in the management of acute LVO. It will begin with a summary of clinical outcomes from recent literature, followed by an in-depth discussion of the clinical scenarios and angiographic patterns where rescue stenting is most commonly indicated. The lecture will also address optimal stent selection, procedural techniques, and best practices for both intra- and postprocedural antithrombotic management. By integrating current evidence and practical insights, this session aims to equip clinicians with an up-to-date and practical framework for incorporating rescue stenting into acute stroke intervention protocols.

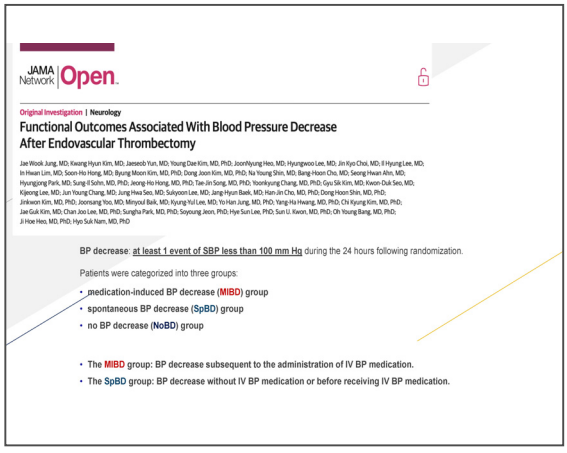
Blood pressure management after endovascular treatment: Insight from secondary analyses of the OPTIMAL-BP trial

정 재 욱

연세의대 신경과







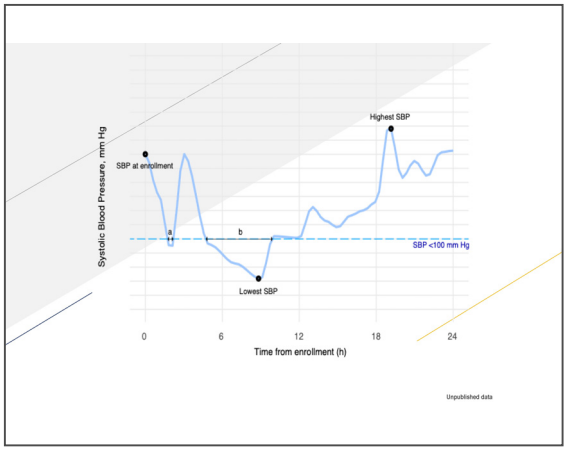


Table 2. Variables of BP Management and Decrease

Variable*	Total	MIBD (n = 47)	SpBD (n = 39)	NoBD (n = 216)	P value
BP management (n = 302)					
Nicardipine, No. (%)	133 (44.0)	46 (97.9)	1 (2.6)	86 (39.8)	<.001
Labetalol	10 (3.3)	3 (6.4)	1 (2.6)	6 (2.8)	.39
Both	2 (0.7)	2 (4.3)	0 (0)	0 (0)	NA
Nicardipine dosage, median (IQR), mg	20.0 (5.0–49.4)	21.3 (13.1–54.1)	1.3 (1.3–1.3)	17.9 (4.4–46.9)	.15
Labetalol dosage, median (IQR), mg	3.8 (1.3–8.4)	2.5 (2.5–2.5)	7.5 (7.5–7.5)	3.1 (1.3–9.7)	.79
Total dosage, median (IQR), mg	20.0 (5.0–49.4)	21.3 (10.6–54.3)	1.3 (1.3–1.3)	17.9 (4.4–46.9)	.15
Interval between enrollment and initial administration of BP medication, median (IQR), h	0.8 (0.0–2.0)	0.5 (0.0–1.6)	9.5 (8.8–10.3)	0.8 (0.0–2.1)	.07
Duration of BP medication use, , median (IQR), h	4.0 (1.3–7.5)	4.8 (2.1–8.3)	0.9 (0.6–1.2)	3.5 (0.8–7.3)	.07
BP decrease (n = 86)					
No. of BP decreases, median (IQR)	1.5 (1.0–3.0)	1.0 (1.0–3.0)	2.0 (1.0–2.5)	NA	.59
Interval between enrollment and first BP decrease, median (IQR), h	5.6 (2.0–12.0)	6.3 (3.4–11.6)	4.0 (2.6–11.0)	NA	.20
Longest duration of sustained BP decrease, median (IQR), min	40.4 (12.3–78.0)	34.9 (13.5–53.9)	57.9 (18.1–131.6)	NA	.06
Cumulated time of BP decrease, median (IQR), min	50.7 (15.3–154.6)	34.9 (14.5–94.3)	82.3 (20.0–221.1)	NA	.07

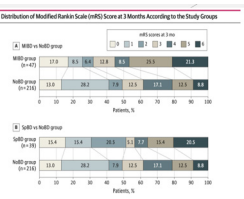
Abbreviations: BP, blood pressure; MIBD, medication-induced BP decrease; NA, not applicable; NoBD, no BP decrease; SpBD, spontaneous BP decrease.

* Statistical values of total dosages and duration were calculated in patients who received BP medication. For statistical analysis, the dose of labetalol divided by 10 was equated to the dose of nicardipine and then summed.

- BP decreases induced by intravenous BP medication within 24 hours after successful EVT were associated with poor outcomes at 3 months.
- Lowering SBP below 100 mm Hg using intravenous BP medication may cause harm and underscore the importance of meticulous BP management.

Jung, et al. JAMA Network Open. 2024

Figure. Distribution of Modified Rankin Scale (mRS) Score at 3 Months According to the Study Groups



Comparison of mRS scores between the medication-induced blood pressure (BP) decrease (MIBD) group (A) and spontaneous BP decrease (SpBD) group (B) with the no BP decrease (NoBD) group. The median mRS score at 3 months was 4 (IQR, 1.5-5) in the MIBD group, 2 (IQR, 1-5) in the SpBD group, and 3 (IQR, 1-4) in the NoBD group. The mRS score ranges from 0 to 6, in which 0 denotes no symptoms and 6 represents death.

Table 3. Primary and Secondary Outcomes

Outcome	No./No. total (%)			MIBD vs NoBD, OR (95% CI)*		SpBD vs NoBD, OR (95% CI)*		
	MIBD (n = 47)	SpBD (n = 39)	NoBD (n = 216)	Unadjusted	Adjusted	P value	Unadjusted	Adjusted	P value
Primary outcome									
Functional independence at 3 mo (mRS score 0-2)	15/47 (31.9)	20/39 (51.3)	106/216 (49.1)	0.49 (0.24-0.94)	0.45 (0.20-0.98)	.05	1.09 (0.55-2.17)	1.41 (0.58-3.49)	.46
Primary safety outcomes									
Symptomatic intracerebral hemorrhage	5/47 (10.6)	6/39 (15.4)	15/216 (6.9)	1.60 (0.50-4.37)	1.89 (0.54-5.88)	.29	2.44 (0.82-6.47)	2.75 (0.76-9.46)	.11
Mortality associated with index stroke within 3 mo	7/47 (14.9)	3/39 (7.7)	10/216 (4.6)	3.60 (1.24-9.96)	5.15 (1.42-19.4)	.01	1.72 (0.37-5.94)	1.90 (0.34-9.04)	.43
Secondary outcomes									
Shift of mRS score (shift analysis)	NA	NA	NA	2.14 (1.20-3.84)	2.06 (1.11-3.85)	.02	1.42 (0.76-2.65)	1.25 (0.62-2.54)	.53
Excellent recovery in NIHSS score at 24 h	7/46 (15.2)	9/38 (23.7)	46/216 (21.3)	0.66 (0.26-1.50)	0.56 (0.21-1.34)	.22	1.15 (0.48-2.51)	0.76 (0.28-1.94)	.58
Successful reperfusion at 24 h	39/43 (90.7)	32/34 (94.1)	192/209 (91.9)	0.86 (0.30-3.12)	0.66 (0.21-2.52)	.50	1.42 (0.38-9.20)	0.88 (0.19-6.39)	.88
Malignant cerebral edema	4/47 (8.5)	4/39 (10.3)	6/216 (2.8)	3.26 (0.90-11.9)	4.22 (0.89-19.0)	.06	4.00 (0.98-14.7)	4.08 (0.73-22.0)	.10

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Research

Impact of intensive blood pressure lowering after multiple-attempt endovascular thrombectomy: A secondary analysis of the OPTIMAL-BP trial

Jae Wook Jung[1], Kwang Hyun Kim[1], Jaeseob Yun[1], Young Dae Kim[1,2], JoonNyung Heo[1], Hyungwoo Lee[1], Jin Kyo Choi[1], Il Hyung Lee[1,3], In Hwan Lim[1], Soon-Ho Hong[1], Minyoul Baik[1,4], Byung Moon Kim[2], Dong Joon Kim[1], Na Young Shin[1], Bang-Hoon Cho[1], Seong Hwan Ahn[4,5], Hyungjong Park[4,5], Sung-Il Sohn[1], Jeong-Ho Hong[1], Tae-Jin Song[4], Yoonkyung Chang[1], Gyu Sik Kim[4], Kwon-Duk Seo[4,5], Kijeong Lee[4], Jun Young Chang[4,5], Jung Hwa Seo[4,5], Sukyoon Lee[1], Jang-Hyun Baek[1,2], Han-Jin Cho[1,3], Dong Hoon Shin[1,4], Jinkwon Kim[1,3], Joonsang Yoo[1], Kyung-Yul Lee[1,4], Yo Han Jung[1,4], Yang-Ha Hwang[1,3], Chi Kyung Kim[1,3], Jae Guk Kim[1,3], Chan Joo Lee[1,3], Sungha Park[1,3,5], Hye Sun Lee[1,3], Sun U Kwon[1], Oh Young Bang[1,3], Ji Hoe Heo[1] and Hyo Suk Nam[1]; and for the OPTIMAL-BP trial investigators

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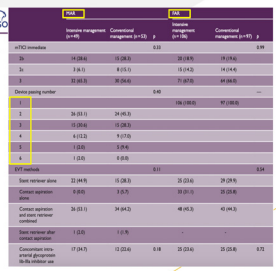
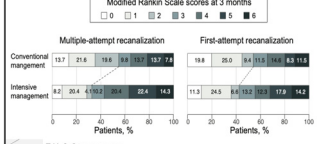
Whether conventional and intensive BP managements differentially affect outcomes according to multiple-attempt recanalization (MAR) and first-attempt recanalization (FAR) groups.



Modified Rankin Scale scores at 3 months



- Patients with MAR showed intensive 24-h BP management decreased the likelihood of 3-month functional independence.
- However, intensive BP management did not reduce sICH rates within 36-h post-reperfusion in acute ischemic stroke.

Table 3. Primary outcomes.

	MAR					FAR					
	Intensive mangement (n=49)*	Conventional mangement (n=53)*	Risk difference, % (95% CI)	Effect size (95% CI)	p value	Intensive mangement (n=136)*	Conventional mangement (n=97)*	Risk difference, % (95% CI)	Effect size (95% CI)	p value	p for interaction
Primary outcomes											
mRS 0–2 (functional independence)†, No./total (%)	16/49 (32.7)	28/51 (54.9)	−22.2 (−41.2, −3.3)	0.33 (0.12, 0.90)	0.01	45/106 (42.5)	52/96 (54.2)	−11.7 (−25.4, 2.0)	0.73 (0.38, 1.40)	0.34	0.21
Symptomatic ICH†, No./total (%)	6/49 (12.2)	5/53 (9.4)	2.8 (−9.3, 14.9)	1.34 (0.36, 5.24)	0.61	8/106 (7.6)	7/96 (7.3)	2.6 (−7.0, 7.5)	0.88 (0.29, 2.72)	0.82	0.55
Death related to index stroke†, No./total (%)	3/49 (6.1)	3/51 (5.9)	0.2 (−9.1, 9.6)	1.46 (0.20, 11.4)	0.70	9/106 (8.5)	5/96 (5.2)	3.3 (−3.6, 10.2)	1.71 (0.50, 6.59)	0.41	0.19

ICH: intracerebral hemorrhage; mRS: modified Rankin Scale; NIHSS: National Institutes of Health Stroke Scale.
*Data are presented as number (percentage) of patients for categorical variable and median (IQR) for ordinal or continuous variables.
†Treatment effects are analyzed with binary logistic regression adjusted for age, sex, onset to randomization time, and NIHSS score immediately prior to endovascular thrombectomy.

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Research

Intensive blood pressure lowering in acute stroke with intracranial stenosis post-thrombectomy: A secondary analysis of the OPTIMAL-BP trial

Kwang Hyun Kim[1], Jaeseob Yun[1], Jae Wook Jung[1], Young Dae Kim[1], JoonNyung Heo[1], Hyungwoo Lee[1], Jin Kyo Choi[1], Il Hyung Lee[1], In Hwan Lim[1], Soon-Ho Hong[1], Minyoul Baik[1], Byung Moon Kim[2], Dong Joon Kim[1], Na Young Shin[1], Bang-Hoon Cho[1], Seong Hwan Ahn[4], Hyungjong Park[4], Sung-Il Sohn[1], Jeong-Ho Hong[1], Tae-Jin Song[4], Yoonkyung Chang[1], Gyu Sik Kim[4], Kwon-Duk Seo[4], Kijeong Lee[4], Jun Young Chang[4], Jung Hwa Seo[4], Sukyoon Lee[1], Jang-Hyun Baek[1,2], Han-Jin Cho[1,3], Dong Hoon Shin[1,4], Jinkwon Kim[1,3], Joonsang Yoo[1], Kyung-Yul Lee[1,4], Yo Han Jung[1,4], Yang-Ha Hwang[1,3], Chi Kyung Kim[1,3], Jae Guk Kim[1,3], Chan Joo Lee[1,3], Sungha Park[1,3,5], Hye Sun Lee[1,3], Sun U Kwon[1], Oh Young Bang[1,3], Ji Hoe Heo[1] and Hyo Suk Nam[1]; for the OPTIMAL-BP Trial Investigator

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- Selected anterior circulation ischemic stroke.
- Patients with isolated extracranial internal carotid artery (ICA) occlusion were excluded.

Definition of ICAS-related LVO

(1) over 50% fixed focal stenosis post-recanalization
(2) residual stenosis with distal hypoperfusion
(3) stenosis with reocclusion.

Table 2. Primary and secondary outcomes.

Clinical variables	ICAS-related LVO				Embolic LVO				P for interaction
	Intensive management (n=32)	Conventional management (n=27)	Adjusted effect estimate (95% CI)*	P	Intensive management (n=47)	Conventional management (n=46)	Adjusted effect estimate (95% CI)*	P	
Primary outcome									
Favorable outcome at 3 months (mRS score 0–2), No. (%)	12/32 (37.5)	15/27 (55.6)	0.49 (0.14 to 1.75)	0.27	20/67 (29.9)	28/66 (42.4)	0.64 (0.28 to 1.45)	0.29	0.68
Primary safety outcomes									
sICH, No. (%)	2/32 (6.3)	1/27 (3.7)	1.43 (0.15 to 27.47)	0.76	8/67 (11.9)	8/66 (12.1)	1.12 (0.37 to 3.34)	0.84	0.73
Mortality related to the index stroke within 3 months, No. (%)	1/32 (3.1)	0/27 (0)	2.28 (0.04 to 497.6)	0.68	7/67 (10.4)	6/66 (9.1)	1.23 (0.36 to 4.23)	0.75	0.33
Secondary outcomes									
mRS score reduction (shift analysis)	NA	NA	0.62 (0.23 to 1.65)	0.35	NA	NA	0.76 (0.41 to 1.39)	0.37	0.27
NIHSS score at 24h, median (IQR)	9 (6–16)	8 (4.5–16)	1.02 (0.39 to 2.67)	0.96	13 (8–19)	9.5 (4.25 to 17)	1.37 (0.86 to 2.90)	0.14	0.40
Early neurological improvement, No. (%)	3/32 (9.4)	3/27 (11.1)	0.98 (0.15 to 6.20)	0.99	9/67 (13.4)	19/66 (28.8)	0.40 (0.16 to 1.00)	0.049	0.30
Successful reperfusion at 24h, No. (%)	21/31 (67.7)	22/24 (91.7)	0.07 (0.01 to 0.68)	0.02	61/62 (95.3)	61/64 (98.4)	7.35 (0.40 to 135.24)	0.18	0.04
Favorable outcome at 1 month, No. (%)	10/32 (31.3)	10/26 (38.5)	1.19 (0.29 to 4.84)	0.81	18/65 (27.7)	27/66 (40.9)	0.60 (0.26 to 1.40)	0.24	0.47
EQ-5D-3L score, median (IQR)	0.29 (0.06–0.91)	0.72 (0.34–0.96)	−0.15 (−0.35 to 0.06)	0.15	0.48 (0.0–0.87)	0.68 (0.06–0.92)	−0.03 (−0.17 to 0.10)	0.64	0.29
Malignant cerebral edema, No. (%)	0/32 (0)	0/27 (0)	NA	NA	8/67 (11.9)	0/66 (0)	17.54 (2.11 to 2278.4)	0.004	NA
Infarction volume, median (IQR), mL	12.2 (6.8–26.8)	14.3 (7.3–31.7)	−11.08 (−38.08 to 15.93)	0.41	39.4 (10.2–161.9)	23.2 (5.9–55.0)	33.64 (5.73 to 66.56)	0.045	0.07

ICAS: intracranial atherosclerotic stenosis; LVO: large vessel occlusion; BP: blood pressure; OR: odds ratio; CI: confidence interval; mRS: modified Rankin scale; sICH: symptomatic intracerebral hemorrhage.
*Treatment effects are reported as proportional ORs (95% CI) for the mRS score reduction (shift analysis) and NIHSS score at 24h using ordinal logistic regression, mean differences (95% CI) for the EQ-5D-3L score and infarction volume using linear regression, and ORs (95% CI) for the other outcome variables using binary logistic regression.

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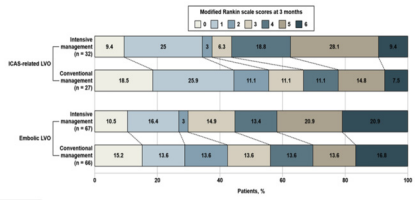

- The presence of ICAS did not significantly alter the harmful effect of intensive BP management on favorable outcome at 3 months.
- After successful EVT, intensive BP management for 24 h should be avoided, whether ICAS is present or not.

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Mediation of Time-Related Blood Pressure Variability on Intensive Blood Pressure Lowering and Functional Outcomes Post-Endovascular Therapy: A Post-hoc Analysis of the OPTIMAL-BP Trial

	Model 1	P value	Model 2	P value	Model 3	P value
90-day mRS	1.24 (1.11-1.38)	<0.001	1.19 (1.07-1.34)	0.002	1.17 (1.04-1.32)	0.007
90-day mRS 0-2	0.84 (0.73-0.96)	0.009	0.86 (0.74-1.01)	0.069	0.88 (0.74-1.04)	0.133
Symptomatic hemorrhage	1.18 (1.00-1.41)	0.064	1.15 (0.95-1.38)	0.142	1.15 (0.95-1.40)[a]	0.163
Final infarction volume (β, 95% CI) [b]	26.51(8.37-44.65)	0.004	23.15(5.85-40.45)[c]	0.009	21.24 (3.99-38.48)[d]	0.016

Model 1: age, sex
Model 2: age, sex, NIHSS, final infarction volume
Model 3: age, sex, TOAST, Smoking, DM, HT, Hyperlipidemia, initial NIHSS, final infarction volume, symptomatic hemorrhage, degree of recanalization (mTICI), mean SBP
OR per 0.1 units increment for TR

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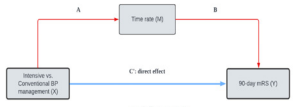
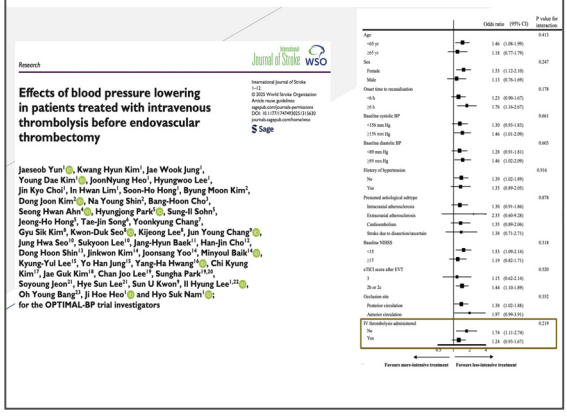


	Unadjusted analysis			Adjusted analysis		
Pathway	Measure	Value (95% CI)	P-value	Measure	Value (95% CI)	P-value
A (X→ M)[a]	β	0.36 (0.25-0.47)	<.001	β	0.38 (0.26-0.50)	<.001
B (M→ Y)[a]	cOR	1.27 (1.14-1.41)	<.001	acOR	1.17 (1.05-1.31)	0.005
C (X→ Y)	cOR	1.78 (1.19-2.66)	0.005	acOR	1.58 (1.00-2.49)	0.050
C' (X + M → Y)	cOR	1.41 (0.92-2.15)	0.114	acOR	1.33 (0.82-2.15)	0.253
Proportion of total effect mediated (%) (95% CI)[b]		45.27 (15.88 - 93.46)			40.93 (3.93 - 90.85)	
Indirect effect (95% CI)[b]		0.063 (0.024 - 0.102)			0.030 (0.003 - 0.068)	

Chang, et al. Accepted.



Research

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WSO

Effects of blood pressure lowering in patients treated with intravenous thrombolysis before endovascular thrombectomy

International Journal of Stroke
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Sage

Jaeseob Yun[1], Kwang Hyun Kim[1], Jae Wook Jung[1], Young Dae Kim[1], JoonNyung Heo[1], Hyungwoo Lee[1], Jin Kyo Choi[1], In Hwan Lim[1], Soon-Ho Hong[1], Byung Moon Kim[2], Dong Joon Kim[3], Na Young Shin[3], Bang-Hoon Cho[3], Seong Hwan Ahn[4], Hyungjong Park[5], Sung-Il Sohn[6], Jeong-Ho Hong[7], Tae-Jin Song[8], Yoonkyung Chang[9], Gyu Sik Kim[9], Kwon-Duk Seo[9], Kijeong Lee[9], Jun Young Chang[9], Jung Hwa Seo[10], Sukyoon Lee[10], Jang-Hyun Baek[11], Han-Jin Cho[12], Dong Hoon Shin[13], Jinkwon Kim[14], Joonsang Yoo[14], Minyoul Baik[14], Kyung-Yul Lee[15], Yo Han Jung[15], Yang-Ha Hwang[16], Chi Kyung Kim[17], Jae Guk Kim[18], Chan Joo Lee[19], Sungha Park[19,20], Soyoung Jeon[21], Hye Sun Lee[21], Sun U Kwon[1], Il Hyung Lee[1,22], Oh Young Bang[23], Ji Hoe Heo[1] and Hyo Suk Nam[1]; for the OPTIMAL-BP trial investigators

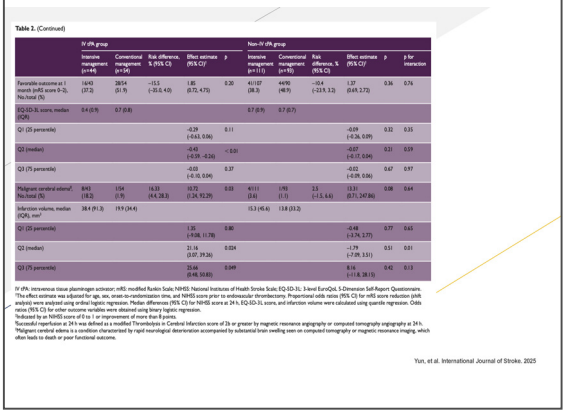

Table 2. (Continued)

	IV rtPA group					Non-IV rtPA group				
	Intensive management (n=44)	Conventional management (n=34)	Risk difference, % (95% CI)	Effect estimate (95% CI)[c]	p	Intensive management (n=111)	Conventional management (n=93)	Risk difference, % (95% CI)	Effect estimate (95% CI)[c]	p	p for interaction
Favorable outcome at 1 month (mRS score 0–2), No.total (%)	16/43 (37.2)	20/34 (51.9)	−15.5 (−35.0, 4.0)	1.85 (0.72, 4.75)	0.20	41/107 (38.3)	44/90 (48.9)	−10.4 (−23.9, 3.2)	1.37 (0.69, 2.72)	0.36	0.76
EQ-5D-3L score, median (IQR)	0.4 (0.9)	0.7 (0.8)				0.7 (0.9)	0.7 (0.7)				
Q1 (25 percentile)				−0.28 (−0.63, 0.06)	0.11				−0.09 (−0.26, 0.09)	0.32	0.35
Q2 (median)				−0.43 (−0.91, −0.26)	< 0.01				−0.07 (−0.17, 0.04)	0.21	0.59
Q3 (75 percentile)				−0.03 (−0.10, 0.04)	0.37				−0.02 (−0.09, 0.06)	0.67	0.97
Malignant cerebral edema[a], No.total (%)	8/43 (18.2)	1/34 (2.9)	16.33 (44.4, 28.3)	10.72 (1.34, 92.29)	0.03	4/111 (3.6)	1/93 (1.1)	2.5 (−1.5, 6.6)	13.31 (0.71, 247.86)	0.08	0.64
Infarction volume, median (IQR), mm³	38.4 (91.3)	19.9 (34.4)				15.3 (45.6)	13.8 (33.2)				
Q1 (25 percentile)				1.20 (−0.08, 11.78)	0.80				−0.48 (−3.79, 2.77)	0.77	0.65
Q2 (median)				21.16 (3.07, 39.26)	0.024				−1.79 (−7.09, 3.51)	0.51	0.01
Q3 (75 percentile)				32.64 (0.48, 50.83)	0.049				8.16 (−11.8, 38.15)	0.42	0.13

IV rtPA: intravenous tissue plasminogen activator; mRS: modified Rankin Scale; NIHSS: National Institutes of Health Stroke Scale; EQ-5D-3L: 3-level EuroQol, 5-Dimension Self-Report Questionnaire.
[a]The effect estimate was adjusted for age, sex, onset-to-randomization time, and NIHSS score prior to endovascular thrombectomy. Proportional odds ratios (95% CI) for mRS score reduction (shift analysis) were analyzed using ordinal logistic regression. Median differences (95% CI) for NIHSS score at 24 h, EQ-5D-3L scores, and infarction volume were calculated using quantile regression. Odds ratios (95% CI) for other outcome variables were estimated using binary logistic regression.
[b]Indicated by an NIHSS score of 8 or more, or improvement of more than 8 points.
[c]Successful reperfusion at 24 h was defined as a modified TICI (modified Thrombolysis in Cerebral Infarction) score of 2b or greater by magnetic resonance angiography or computed tomography angiography at 24 h.
[d]Malignant cerebral edema is a condition characterized by rapid neurological deterioration accompanied by substantial brain swelling seen on computed tomography or magnetic resonance imaging, which often leads to death or poor functional outcome.

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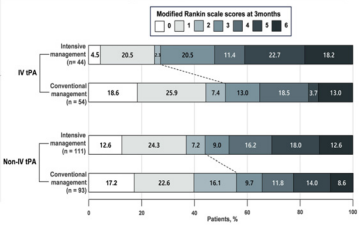

- These results suggested that intensive BP lowering for 24h after EVT may negatively impact outcomes, particularly in patients who received IV tPA before EVT.

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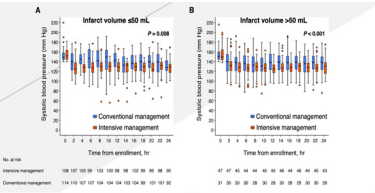
Blood Pressure Management Based on Infarct Volume After Successful Endovascular Thrombectomy

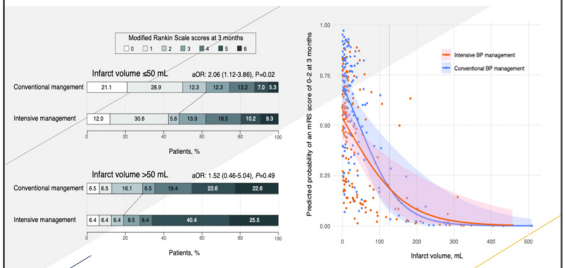
	Infarct volume ≤50 mL			Infarct volume >50 mL		
	Conventional (n=114)	Intensive (n=108)	P value	Conventional (n=31)	Intensive (n=47)	P value
Age, median (IQR), y	75.0 (66.0-82.0)	75.5 (65.5-81.0)	0.738	69.0 (63.5-80.0)	80.0 (67.5-84.0)	0.062
Sex (men), No. (%)	65 (57.0)	66 (61.1)	0.535	22 (71.0)	26 (55.3)	0.164
Hypertension	90 (78.9)	85 (78.7)	0.965	20 (64.5)	36 (76.6)	0.246
Diabetes	43 (37.7)	43 (39.8)	0.749	17 (54.8)	22 (46.8)	0.488
Hyperlipidemia	44 (38.6)	37 (34.3)	0.502	10 (32.3)	24 (51.1)	0.101
Coronary artery obstructive disease	14 (12.3)	11 (10.2)	0.622	2 (6.5)	7 (14.9)	0.304
Atrial fibrillation	51 (44.7)	51 (47.2)	0.710	17 (54.8)	26 (55.3)	0.967
Congestive heart disease	6 (5.3)	5 (4.6)	0.828	1 (3.2)	2 (4.3)	<0.999
Previous stroke history	25 (21.9)	25 (23.1)	0.828	5 (16.1)	11 (23.4)	0.436
Active cancer	4 (3.5)	8 (7.4)	0.199	1 (3.2)	1 (2.1)	<0.999
Smoking	21 (18.4)	28 (25.9)	0.178	8 (25.8)	11 (23.4)	0.809
IV-tPA	40 (35.1)	26 (24.1)	0.073	13 (41.9)	18 (38.3)	0.748
NIHSS score just before EVT >15	34 (29.8)	37 (34.3)	0.479	20 (64.5)	30 (63.8)	0.951
ASPECTS ≥6	114 (100.0)	105 (99.1)	0.482	25 (80.6)	38 (82.6)	0.827
mTICI immediate			0.986			0.158
2b	23 (20.2)	21 (19.4)		9 (29.0)	13 (27.7)	
2c	13 (11.4)	12 (11.1)		9 (29.0)	6 (12.8)	
3	78 (68.4)	75 (69.4)		13 (41.9)	28 (59.6)	

Jung, et al. On revision



	Infarct volume ≤50 mL			Infarct volume >50 mL		
	Conventional (n=114)	Intensive (n=108)	P value	Conventional (n=31)	Intensive (n=47)	P value
Infarct volume, median (IQR), mL	8.9 (4.6-22.0)	10.8 (4.4-21.8)	0.852	103.8 (60.1-184.7)	146.1 (80.5-235.7)	0.230
Any ICH, No. (%)	49 (43.0)	44 (40.7)	0.835	25 (80.6)	39 (83.0)	0.793
Type of hemorrhagic transformation, No. (%)			0.208			0.112
HI 1	21 (18.4)	15 (13.9)		2 (6.5)	12 (25.5)	
HI 2	13 (11.4)	8 (7.4)		6 (19.4)	9 (19.1)	
PH 1	10 (8.8)	11 (10.2)		3 (9.7)	6 (12.8)	
PH 2	2 (1.8)	7 (6.5)		12 (38.7)	10 (21.3)	

Jung, et al. On revision



- Mean infarct volume = 51.9 mL
- Infarct volume ≤50 mL: Conventional group better
- Infarct volume >50 mL: No differences
- Increased infarct volume,

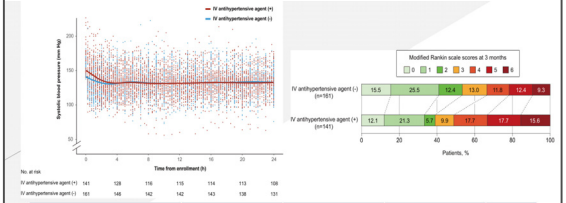
⇩

- Decrease in the difference of achieving mRS 0-2 between BP managements.

Jung, et al. On revision

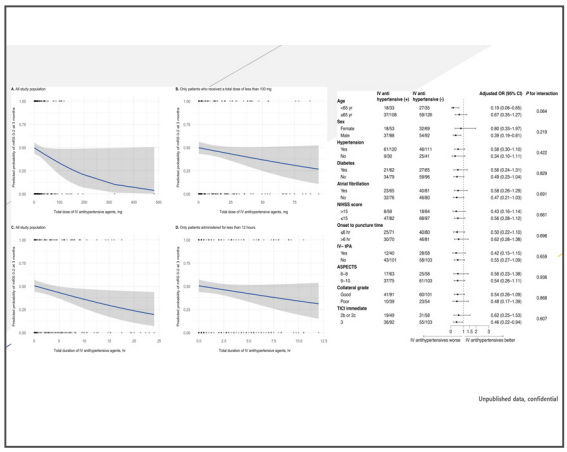
Association between intravenous antihypertensives and functional outcome after successful endovascular thrombectomy in acute ischemic stroke

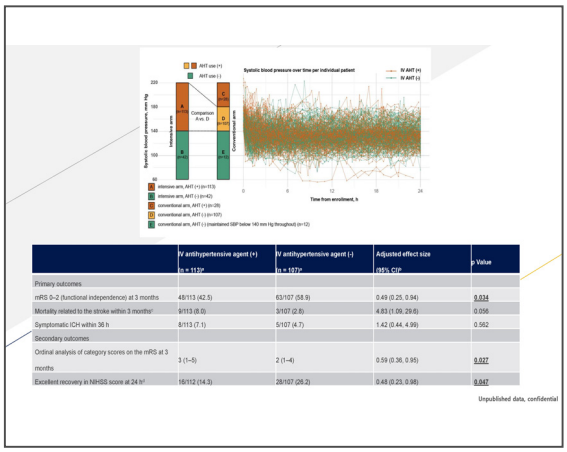
Unpublished data, confidential



	IV antihypertensive agent (+) (n = 141)[a]	IV antihypertensive agent (-) (n = 161)[a]	Adjusted effect size (95% CI)[a]	p Value
Primary outcomes				
mRS 0–2 (functional independence) at 3 months	55/141 (39.0)	86/161 (53.4)	0.52 (0.29, 0.91)	0.024
Mortality related to the stroke within 3 months[c]	14/141 (9.9)	6/161 (3.7)	2.86 (1.00, 9.13)	0.058
Symptomatic ICH within 36 h	15/141 (10.6)	11/161 (6.8)	1.61 (0.69, 3.85)	0.272
Secondary outcomes				
Ordinal analysis of category scores on the mRS at 3 months	4 (1–5)	2 (1–4)	0.64 (0.42, 0.97)	0.027
Excellent recovery in NIHSS score at 24 h[c]	18/140 (12.9)	44/160 (27.5)	0.44 (0.23, 0.83)	0.013

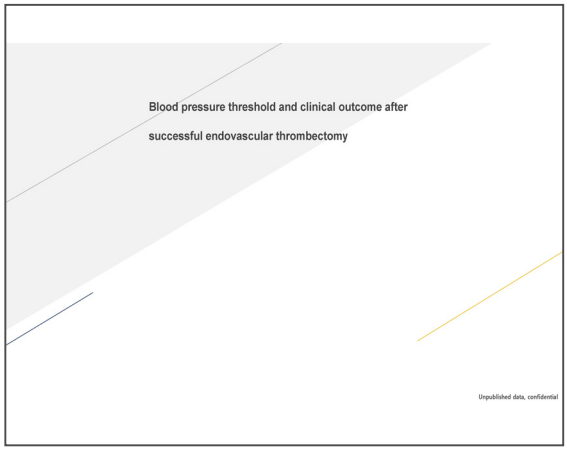
Unpublished data, confidential

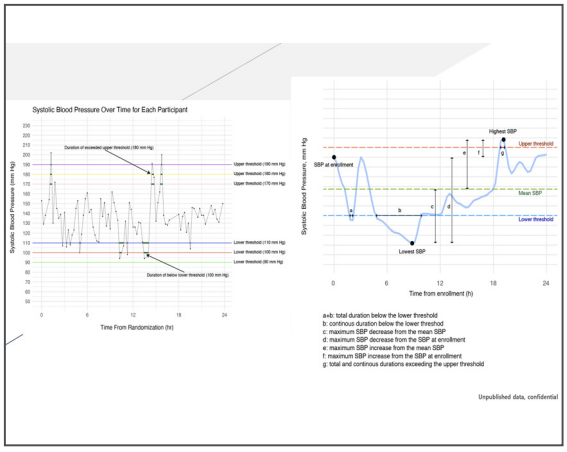


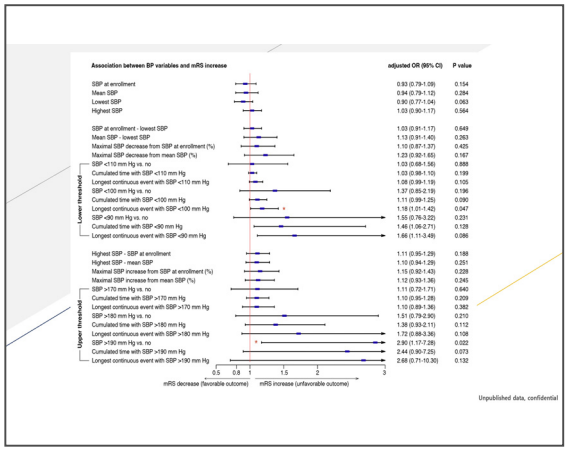


	IV antihypertensive agent (+) n = 113*	IV antihypertensive agent (-) n = 107*	Adjusted effect size (95% CI)*	p Value
Primary outcomes				
mRS 0–2 (functional independence) at 3 months	48/113 (42.5)	63/107 (58.9)	0.49 (0.25, 0.94)	0.034
Mortality related to the stroke within 3 months‡	9/113 (8.0)	3/107 (2.8)	4.83 (1.09, 29.6)	0.056
Symptomatic ICH within 36 h	8/113 (7.1)	5/107 (4.7)	1.42 (0.44, 4.99)	0.562
Secondary outcomes				
Ordinal analysis of category scores on the mRS at 3 months	3 (1–5)	2 (1–4)	0.59 (0.36, 0.95)	0.027
Excellent recovery in NIHSS score at 24 h‡	16/112 (14.3)	28/107 (26.2)	0.48 (0.23, 0.98)	0.047

Unpublished data, confidential







2025 대한뇌졸중학회

춘계학술대회

| Room B |

Nursing Symposium

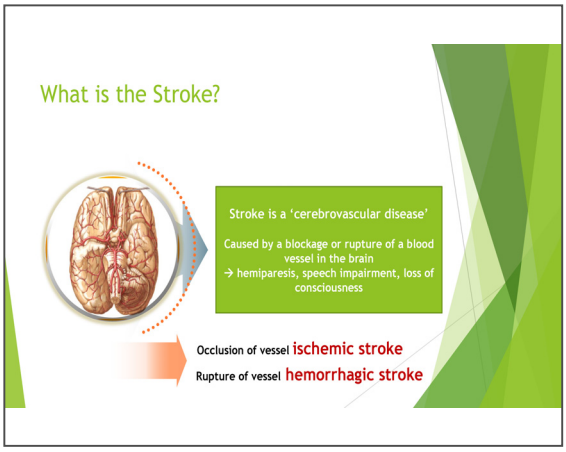
좌장: 조아현 (가톨릭의대 신경과), **정진만** (고려의대 신경과)

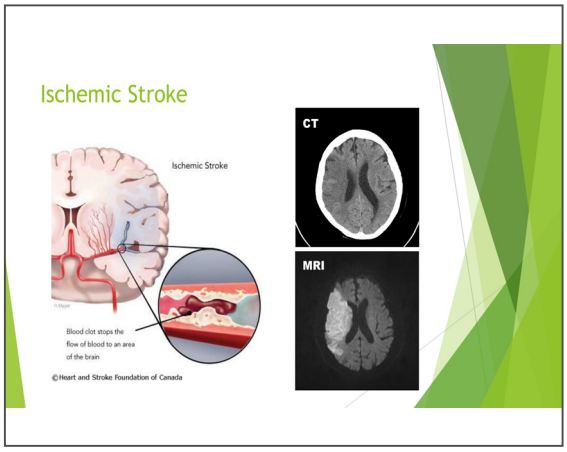
대한뇌졸중학회
Korean Stroke Society

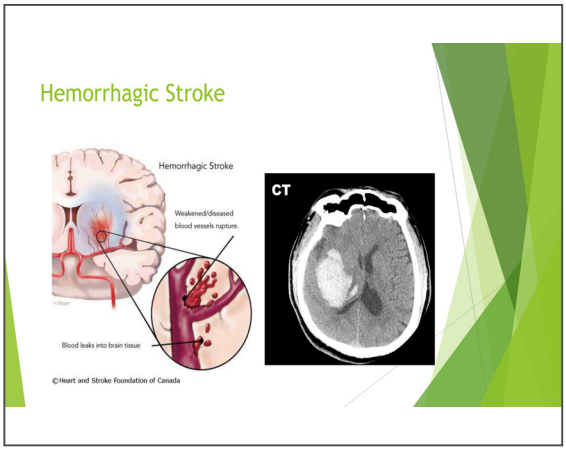
The assessment of stroke symptoms related to brain lesions (NIHSS평가 포함)

이 준 원

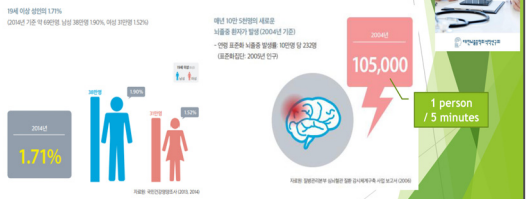
인제의대 신경과







2018년도 뇌졸중 역학보고서



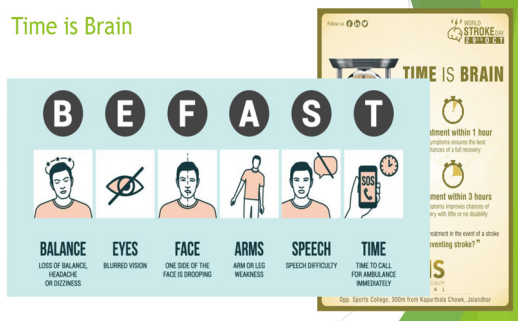
2018년도 뇌졸중 역학보고서

After Stroke..

- Stroke shortens healthy life
- Disability adjusted life years lost
  - 55-64 : 4.5(men), 4.1(women)
  - 65-74 : 3.9(men), 3.9(women)

Fast first aid is the most important!

Time is Brain



2019 AHA/ASA Guidelines

AHA/ASA Guideline

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke
A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

- Emergency evaluation

2.1. Stroke Scales

2.1. Stroke Scales
1. The use of a stroke severity rating scale, preferably the NIHSS, is recommended.

Formal stroke scores or scales such as the NIHSS (Table 4) may be performed rapidly, and may be administered by a broad spectrum of healthcare providers with accuracy. A standardized scale quantifies the degree of neurological deficit, facilitates communication, fibrinolytic or mechanical intervention, allows objective measurement of changing clin at higher risk for complications such as intracerebral hemorrhage (ICH).[76,77]

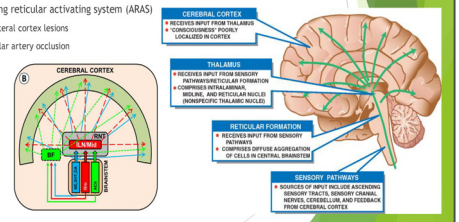
Modified Rankin Scale (mRS)

Modified Rankin Scale	
0	No symptoms
1	No significant disability. Able to carry out all usual activities, despite some symptoms.
2	Slight disability. Able to look after own affairs without assistance, but unable to carry out all previous activities.
3	Moderate disability. Requires some help, but able to walk unassisted.
4	Moderate severe disability. Unable to attend to own bodily needs without assistance, and unable to walk unassisted.
5	Severe disability. Requires constant nursing care and attention, bedridden, incontinent.
6	Dead

NIHSS

Localization & Lateralization

- Level of consciousness
  - Ascending reticular activating system (ARAS)
    - Bilateral cortex lesions
    - Basilar artery occlusion



1a - Level of Consciousness

- 0 - Alert : spontaneous eye opening
- 1 - Drowsy : eyes closed, easily aroused, rapid return to sleep without stimulation
- 2 - Stupor : minimal arousal to vigorous stimulation, purposeful response to painful stimulus
- 3 - Coma : no eye opening, no speech, no purposeful response to pain

1b - LOC Questions

- Month, age

- 0 - answers both correctly
- 1 - answers one correctly
- 2 - incorrect

1c - LOC Commands

- Open/close eyes, make a fist & let go

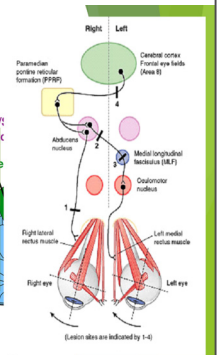
- 0 - answers both correctly
- 1 - answers one correctly
- 2 - incorrect

Localization & Lateralization

- Best gaze
  - Frontal eye field
    - MCA occlusion

Infarction
: Ipsilateral deviation

Seizure
: Contralateral deviation



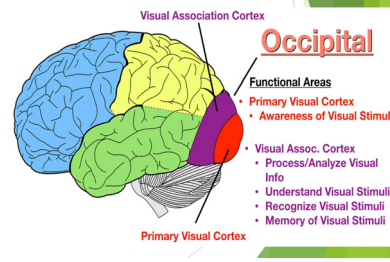
2 - Best Gaze

- Eye open - patient follows examiner's finger or face

- 0 - normal
- 1 - partial gaze palsy
- 2 - forced deviation

Localization & Lateralization

- Visual
  - Visual cortex
    - PCA occlusion



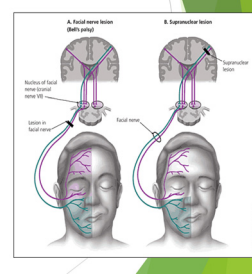
3 - Visual

- Introduce visual stimulus/threat to patient's visual field quadrants
- Cover 1 eye and hold up fingers in all quadrants

- 0 - no visual loss
- 1 - partial hemianopsia
- 2 - complete hemianopsia
- 3 - bilateral hemianopsia, cortical blindness

Localization & Lateralization

- Facial palsy
  - Supranuclear lesion (central type)
  - Facial nerve lesion (peripheral type)



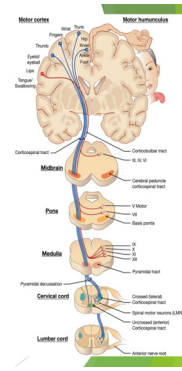
4 - Facial Palsy

- Show teeth, raise eyebrows and squeeze eyes tightly shut

- 0 - normal
- 1 - minor
- 2 - partial
- 3 - complete, bilateral

Localization & Lateralization

- Corticospinal tract
- Corticobulbar tract



5a,b - Motor Arm

- Elevate extremity to 90 degrees
- Count to 10 out loud and use fingers for visual cue

- 0 - no drift
- 1 - drift
- 2 - can't resist gravity
- 3 - no effort against gravity
- 4 - no movement
- UN - amputation, join fusion

MRC Research Council Grades	
Grade	Muscle State
0	*No contraction*
1	*Flicker or trace of contraction*
2	*Active movement with gravity eliminated*
3	*Active movement against gravity*
4	*Active movement against gravity and resistance*
5	*Normal power*

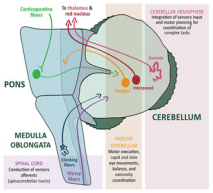
6a,b - Motor Leg

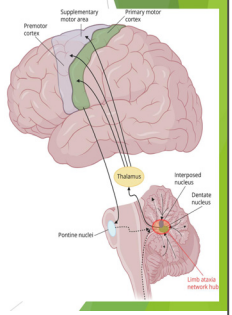
- Elevate extremity to 30 degrees
- Count to 5 out loud and use fingers for visual cue

- 0 - no drift
- 1 - drift
- 2 - can't resist gravity
- 3 - no effort against gravity
- 4 - no movement
- UN - amputation, join fusion

Localization & Lateralization

- Limb ataxia





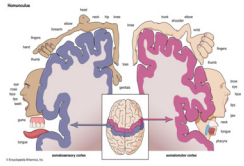
7 - Limb Ataxia

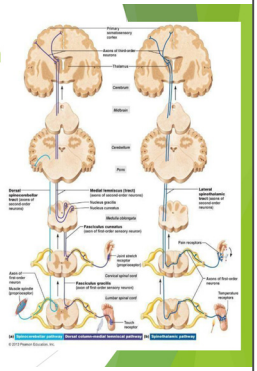
- Finger to nose, heel to shin

- 0 - absent
- 1 - present in one limb
- 2 - present in two limbs
- UN - amputation, join fusion

Localization & Lateralization

- Spinothalamic tract
- Dorsal column-medial lemniscus tract





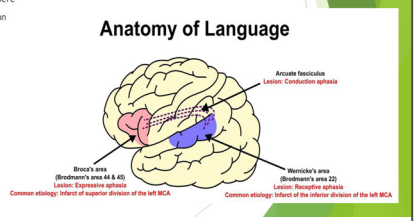
8 - Sensory

- Pin prick to face, arms, trunk, and legs - compare sharpness side to side

- 0 - normal
- 1 - partial loss
- 2 - severe loss, bilateral, coma (1a = 3)

Localization & Lateralization

- Best language
  - Dominant hemisphere
    - Lt. MCA occlusion



9 - Best Language

- Name items describe picture, and read sentences
- 0 - no aphasia
- 1 - mild to moderate aphasia
- 2 - severe aphasia
- 3 - mute, global aphasia, coma (1a = 3)

미운정 고운정

물에 빠진 생쥐

조만간 한번 뵙겠습니다

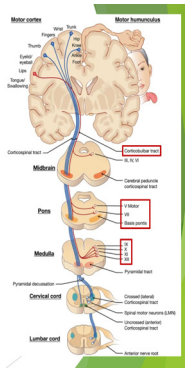
정거장과 정거장 사이

우리나라의 가을은 창으로 아름답다

Localization & Lateralization

- Dysarthria
  - Corticobulbar tract

Cranial nerve	Muscle system
V, IX, X, XI	Nasopharyngeal system
IX, X	Pharyngeal muscles
XI, XII	Tongue muscles
VII	Lips and circumoral muscles
V	Mandibular muscles
X	Larynx, intrinsic muscles
V, VII, and spinal nerves	Larynx, extrinsic muscles
XI and spinal nerves	Respiratory system



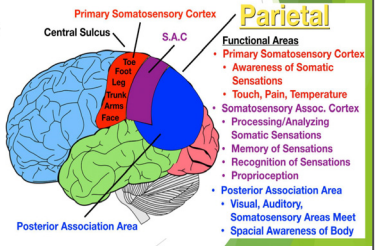
10 - Dysarthria

- Evaluate speech clarity by patient reading or repeating words on list
- 0 - normal articulation
- 1 - mild to moderate dysarthria
- 2 - near to unintelligible or worse
- UN - intubated, other physical barrier

엄마
똑딱 똑딱
오십보 백보
치약
키다리 아저씨
사공과 나룻배
공중전화

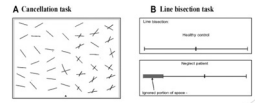
Localization & Lateralization

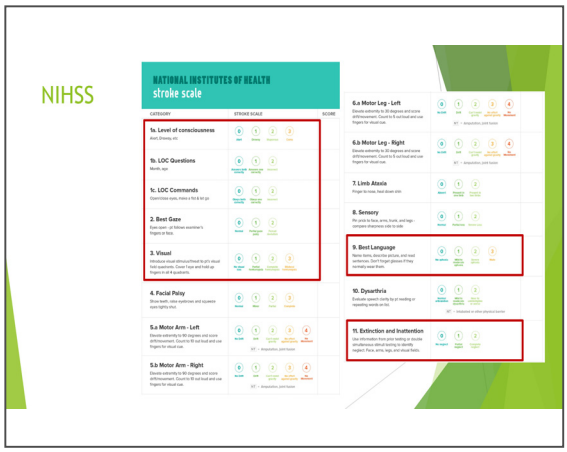
- Extinction and inattention
  - Non-dominant parietal lobe
    - Rt. MCA occlusion



11 - Extinction and Inattention

- Use information from prior testing or double simultaneous stimuli testing
- Face, arms, legs, and visual fields
- 0 - no neglect
- 1 - partial neglect
- 2 - complete neglect (visual neglect, anosognosia, asomatognosia)




NIHSS
NATIONAL INSTITUTES OF HEALTH
stroke scale
CATEGORY
STROKE SCALE
SCORE
1a. Level of consciousness
1b. LOC Questions
1c. LOC Commands
2. Best Gaze
3. Visual
4. Facial Palsy
5.a Motor Arm - Left
5.b Motor Arm - Right
6.a Motor Leg - Left
6.b Motor Leg - Right
7. Limb Ataxia
8. Sensory
9. Best Language
10. Dysarthria
11. Extinction and Inattention


KSR Stroke Scale Training & Certification
www.stroke-edu.or.kr
Introduction
Stroke Scale
E-Learning
KSR
Korean Stroke Society
Stroke Scale Training and certification
K-NIHSS
Training 1
Training 2
Certification
1a. 의식수준
BACK
Replay
NEXT

In-hospital management including blood pressure, fluid, and blood sugar

김 종 욱

서울의대 신경과

허혈성 뇌졸중의 병원 내 관리는 재관류치료를 넘어 혈압, 혈당, 체액 상태 (volume state) 등 주요 생리적 파라미터를 관리하는 것까지 포함한다. 이러한 요소는 추가적인 뇌손상 및 그에 따른 임상예후와 밀접하게 연관되어 있다. 이 강의는 허혈성 뇌졸중의 급성기 병원 단계에서 이러한 요소를 관리하는 사례에 대한 증거 기반 지견을 제공하는 것을 목적으로 한다.

혈압 조절에서 최적의 목표 혈압은 임상 상황에 따라 달라진다. 혈전용해술을 받는 환자, 기계적 혈전제거술을 받는 환자, 보존적 치료를 받는 환자에 따라 가이드라인 기반 목표치에 대해 논의하고 급성기에 선호하는 항고혈압제의 사용에 대해 살펴본다.

탈수와 수액 과부하 모두 뇌관류를 저하시켜 뇌손상 및 합병증의 위험을 증가시킨다. 상황에 따라 수액을 선택하고 삼투압을 유지하는 방법을 살펴본다.

급성기 고혈당은 뇌경색 크기 증가 및 기능적 악화와 관련 있으며, 반대로 지나치게 공격적인 혈당 감소는 저혈당으로 이어져 신경학적 상태를 악화시킬 수 있다. 뇌졸중 집중치료실과 일반 병동에 적합한 목표 혈당 수치, 인슐린 프로토콜 및 모니터링 프로토콜에 대한 현재 권장 사항을 검토한다.

Nursing care in stroke unit

정 원 제

삼성서울병원

조직화된 뇌졸중 병동(stroke unit)은 뇌졸중 환자의 생존율과 기능 회복률을 향상시키는 핵심적 치료 환경으로 자리잡고 있으며, 이러한 환경에서 간호사의 역할은 치료성과에 직결되는 중요한 요소이다. 본 강의는 급성기 뇌졸중 병동 간호의 핵심 요소를 정리하고, 환자 중심의 간호가 어떻게 구조적, 전략적으로 수행되어야 하는지를 공유하는 데 목적이 있다.

특히, 최근 다양한 연구에서 제시된 근거 기반 간호 중재들을 실제 임상에 효과적으로 접목시키는 방법에 대해 논의하며, 급성기 환자의 빠른 안정화, 2차 합병증 예방, 기능 회복 촉진을 위한 간호사의 주도적 개입의 중요성을 강조할 예정이다. 이와 함께 FeSS(Fever, Sugar, Swallowing) 프로토콜을 기반으로 한 초기 집중 간호, 산소포화도 유지, 혈압·혈당 조절, 조기 영양 시작 등 생리적 안정화를 위한 간호의 표준화가 주요 주제로 다뤄진다. 또한, 심장모니터링, 변비와 요로감염 관리, 욕창·낙상 예방, 심부정맥혈전(DVT) 예방 등 전신 합병증 관리를 위한 실제적 접근과 간호사의 판단 기준에 대해서도 소개할 예정이다.

아울러 연하장애 환자 간호에서 요구되는 자세 조정, BSST(bedside swallowing test), 구강 위생 등의 실무적 중재와, 조기 재활 및 정서적 지지를 위한 다학제 연계 간호도 함께 논의된다. 변화하는 치료 패러다임 속에서 간호사는 단순한 처치 수행자를 넘어, 다학제 팀 내 조정자(coordinator)이자 임상적 의사결정자로서의 역할을 수행해야 한다.

이번 강의는 뇌졸중 병동 간호의 방향성과 역할을 되짚어보는 기회를 제공함으로써, 향후 간호 실무의 질 향상과 환자 중심 간호 구현을 위한 토대를 마련하고자 한다.

Discharge education for stroke patient

한 정 희

서울아산병원

뇌졸중 급성기 치료와 더불어 중요한 것은 재발을 예방하기 위한 퇴원 후 관리이다. 뇌졸중 환자의 퇴원 교육 중 가장 중요한 것 중 하나는 뇌졸중 예방약제에 대한 이해이다. 퇴원 시 항혈소판제나 항응고제에 대한 복약 이행도가 낮은 경우가 많아, 이로 인한 재발 가능성에 대한 주지를 시키는 것이 중요하다. 또한 해당 약제를 중단해야 하는 경우(예: 내시경, 시술 및 수술, 치과 치료 등), 임의로 중단하지 말고 신경과 전문의과 먼저 상담하여야 함을 알려주어야 한다.

생활습관병 중 고혈압은 뇌졸중에 영향을 미치는 것 중 대표적이다. 고혈압이 있는 경우 정상 혈압 기준에 대한 내용과 함께, 꾸준한 혈압약의 복용이 중요함을 설명해야 한다. 또한 올바른 혈압기 구입 및 가정 혈압 측정 방법에 대한 교육이 필요하다.

당뇨병에 대한 관리도 중요하다. 당뇨의 경우 혈당의 정상 범주, 혈당 측정 시기, 당뇨식 방법, 저혈당 증상에 대한 교육 등이 필요하다. 자가 혈당 측정에 대한 거부감이 많아 이행도가 낮을 수 있어 이에 대한 지지가 필요하다.

고지혈증 역시 중요한 관리 요소이다. 고혈압과 당뇨, 고지혈증은 음식과 운동 관리가 동반되어야 하므로 이에 대한 설명이 필요하다. 음식은 맵고 짜지 않은 음식으로 야채를 많이 드시고, 매일 30분 이상의 유산소 운동을 하는 게 중요하다. 운동의 강도나 종류를 특정 지을 수는 없으나 무리하지 않는 선에서 강도를 조절하도록 해야 하며 이는 환자의 마비 정도, 심장, 관절 상태 등에 따라 달라질 수 있다.

심방세동 등의 심장 문제가 있는 경우도 항응고제를 잘 드시면서 주기적인 외래를 내원해야 함을 교육해야 한다. 와파린은 비타민 K 상호작용이 있어 이에 대한 음식과 약물 상호작용에 대한 설명이 필요하며 주기적인 PT-INR 확인이 중요함을 교육해야 하며 최근에는 집에서 측정할 수 있는 INR 기계도 있어 환자에 맞는 INR target과 함께 안내해주는 것이 필요하기도 하다. NOAC은 반감기가 짧으므로 약물을 정해진 시간에 잘 드시는 것이 중요하며, 프라닥사의 경우 캡슐을 열어서 복용하면 생체이용률이 상승할 수 있으므로 캡슐 채로 먹어야 한다. 자렐토 고용량(15, 20mg)은 식사와 함께 천천히 흡수되어야 생체이용률을 높게 유지할 수 있어 식사와 함께 드시는 것이 좋다. NOAC을 복용하는 경우 치과치료, 내시경 등으로 인해 약물을 중단할 때는 와파린처럼 5일 이상 길게 중단할 필요가 없다. 따라서 이러한 경우 전문의 진료를 통해 중단 시기와 재개 시점에 대해 정확히 확인을 받아야 함을 안내해주어야 하겠다.

금연은 필수이다. 금연 5년 정도가 되어야 비흡연자와 비슷한 수준이라고 판단하기 때문에 이는영구적으로 되어야 한다. 금연껌, 전자담배 등은 니코틴 흡수량에 차이가 있을 수 있어 권하지 않으며 필요시 금연클리닉에 대한 정보를 제공해주어야 한다.

절주보다는 금주에 대한 교육도 필요하다. 소량의 알코올도 뇌졸중 재발에 영향을 주는 것으로 최근 많은 논문에서 보고되고 있다.

뇌졸중 발병 이후 집에서 안정을 취해야만 좋은 것으로 생각하는 경우도 있다. 안정의 시기는 뇌졸중 상태에 따라 다를 수 있으나 일상생활을 최대한 유지하도록 돕는 것이 필요하겠다. 마비 정도에 따라 낙상, 욕창, 흡인성 폐렴, 방광염 등의 합병증이 발생할 수 있어 이에 대한 간호 정보를 제공해야 한다. 시야 장애 환자의 경우 운전으로 인한 사고가 일어나는 경우도 있으므로 전문의 상담이 필요할 수 있겠다.

퇴원 후 응급실에 즉각 내원해야 하는 증상(예: F.A.S.T.)에 대한 교육과 함께 집 근처에서 뇌졸중 급성기 치료가 가능한 병원을

미리 알아두도록 정보를 제공하는 것도 중요하다.

뇌졸중은 퇴원 후 관리가 동반되어야 한다. 뇌졸중 약제의 지속적인 복용과 생활습관병 관리, 합병증 예방 및 일상생활로의 복귀를 돕는 정보를 제공하는 것이 중요하겠다.

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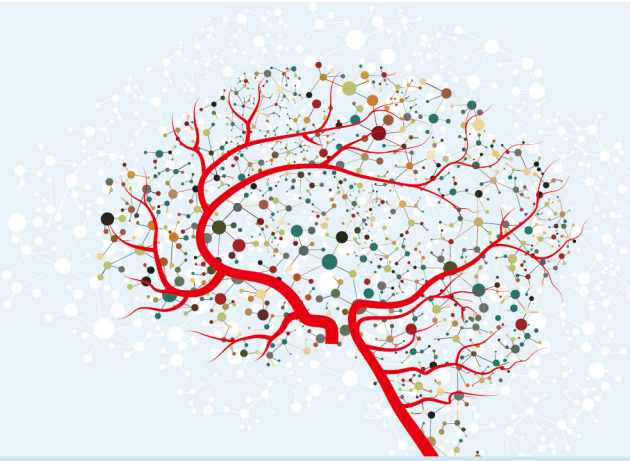


2025 대한뇌졸중학회

춘계학술대회

| Room B |

Symposium 3

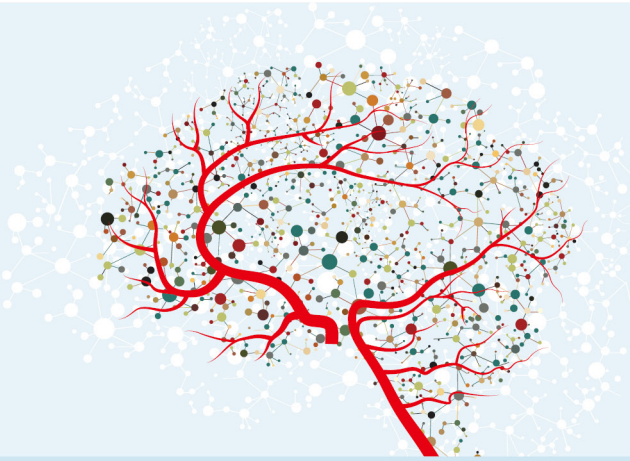
좌장: 이광호 (성균관의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Efficacy and safety "Cerebrain" in stroke patients

김 범 준

울산의대 신경과



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Symposium 4

좌장: 이병철 (한림의대 신경과)

대한뇌졸중학회
Korean Stroke Society

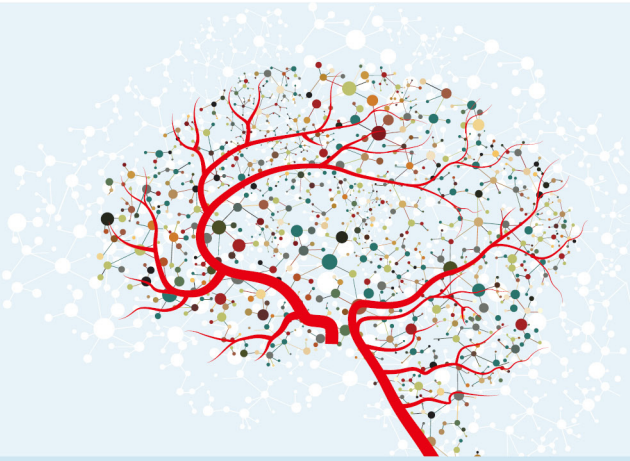
Optimal antiplatelet therapy after ischemic stroke

김 준 엽

서울의대 신경과

Stroke remains one of the leading causes of mortality and long-term disability worldwide, with ischemic stroke accounting for the majority of cases. Optimal secondary prevention strategies, particularly antiplatelet therapy, are critical in reducing recurrent stroke risk while minimizing bleeding complications. Recent clinical trials and guideline updates have provided substantial evidence supporting tailored antiplatelet regimens based on ischemic stroke etiology and patient characteristics. Dual antiplatelet therapy (DAPT) with aspirin and clopidogrel, initiated early (within 12–24 hours) and continued for 21–30 days, is recommended for patients with minor ischemic stroke or high-risk transient ischemic attack (TIA) to reduce early recurrence. Long-term DAPT, beyond 90 days, has not demonstrated additional benefit and increases the risk of hemorrhagic complications. For patients with large-artery atherosclerosis, DAPT is particularly beneficial, whereas single antiplatelet therapy (SAPT) remains the standard for long-term secondary prevention in non-cardioembolic stroke. Emerging data from trials, including CHANCE, POINT, and THALES, provide further insight into risk-benefit assessments for different patient subgroups. Korean and international guidelines, including the 2022 Korean Stroke Society recommendations and 2021 AHA/ASA guidelines, emphasize evidence-based antithrombotic strategies tailored to ischemic stroke subtypes. Clopidogrel monotherapy has been established as an effective alternative to aspirin, particularly in patients with aspirin resistance or high bleeding risk. Recent studies on novel formulations, such as clopidogrel resinate, indicate comparable efficacy and safety profiles with existing clopidogrel formulations, supporting its use in clinical practice. Understanding these therapeutic nuances is essential for clinicians to optimize patient outcomes and prevent recurrent cerebrovascular events.

Keywords: ischemic stroke, antiplatelet therapy, clopidogrel, secondary prevention



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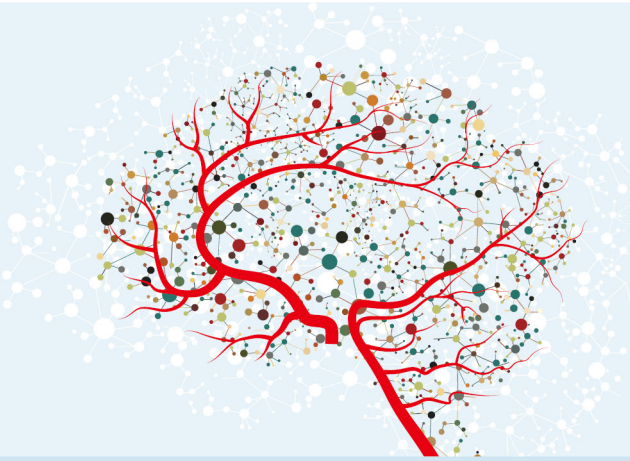
General Assembly

대한뇌졸중학회
Korean Stroke Society

뇌졸중학회 정책, 보험관련 보고

이 경 복

정책이사



2025 대한뇌졸중학회

춘계학술대회

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Plenary Session

좌장: 황성희 (한림의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Past, present, and future of stroke registries: Insights from 17 years of experience

배 희 준

서울의대 신경과

Stroke was the second leading cause of death in Korea, ranking behind cancer and ahead of ischemic heart disease. The expected growth of stroke burden in Korea in early 2000s led to the initiation of a government-funded clinical research project, the CRCS (Clinical Research Center for Stroke), with the goal of developing and implementing national stroke guidelines. The 5th section of CRCS (CRCS-5) developed a multicenter, prospective, stroke registry and began collection of data in 2008 for stroke epidemiology and quality of care research, building on the legacy of the Korean Stroke Registry (KSR), which had been established in 1999 with the primary purpose of understanding the epidemiology and clinical characteristics of stroke in Korea.

CRCS-5 was renamed CRCS-K (Clinical Research Collaboration for stroke in Korea) at the end of the CRCS project in 2015, and since 2017, it has been supported by the Korean National Institute of Health (NIH) and known as the CRCS-K-NIH registry. To date, approximately 127 000 cases have been registered from 20 university hospitals or regional stroke centers, and more than 250 articles have been published based on the registry.

A recent analysis of 10-year secular trends demonstrated overall improvements in stroke care and outcomes, while also identifying areas in need of further enhancement. This large-scale, high-quality dataset provides opportunities to explore and compare treatment disparities using the comparative effectiveness research methods, to design and conduct registry-based randomized clinical trials, and to connect the registry data with other sources including national claims data, neuroimaging, or genetic data. It also serves as a platform for international collaboration.

Today, the CRCS-K-NIH functions not only as a stroke registry but also as a dynamic research network. In this presentation, we will discuss what we have accomplished, what we are currently undertaking, and what we can achieve in the future through this collaborative platform.

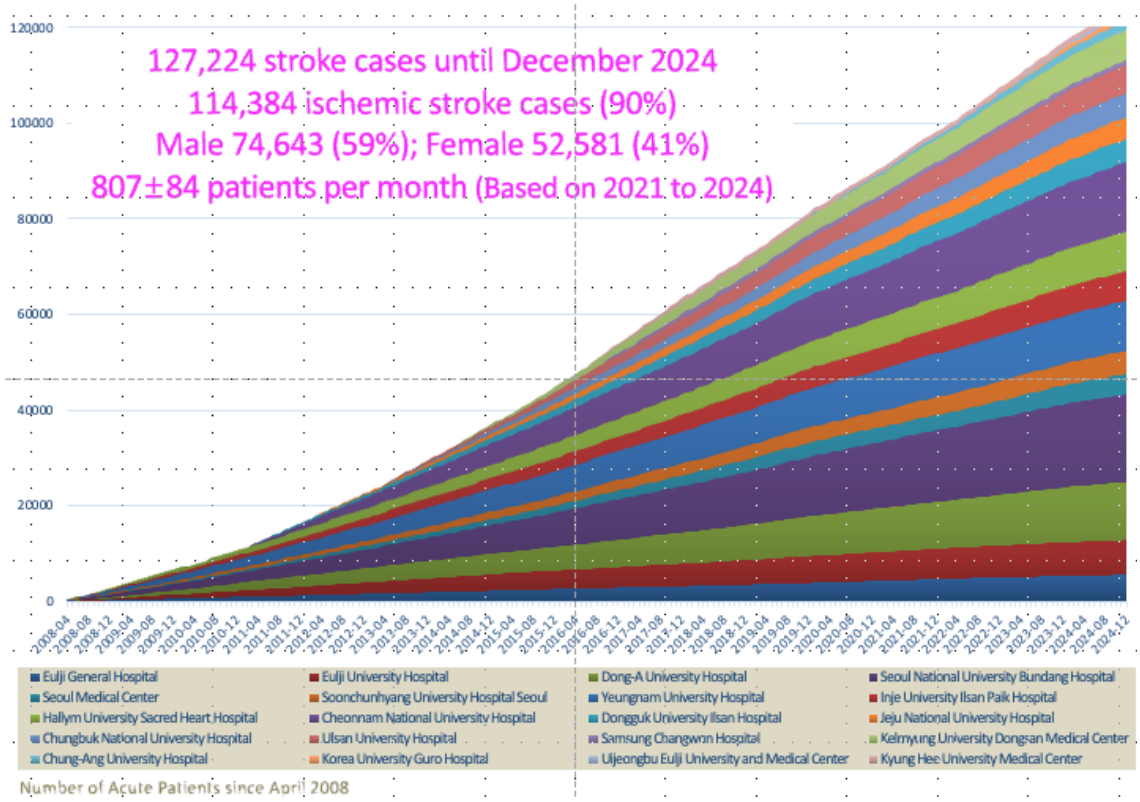
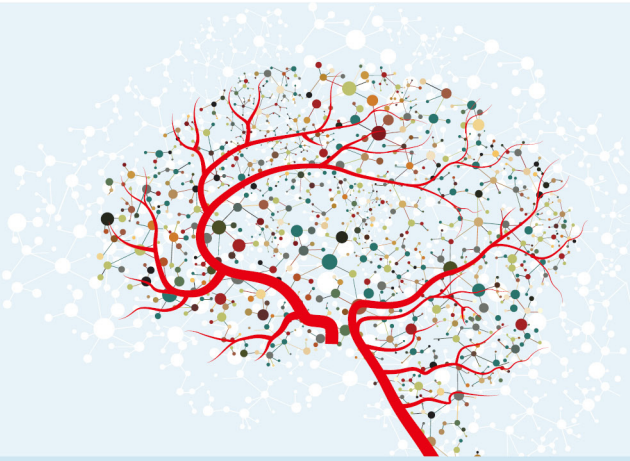


Figure. Number of Registered Cases Over 17 years



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Debate Session.

Beyond the Debate: Diverse Perspectives on Therapeutic Dilemmas

좌장: 이경열 (연세의대 신경과), **박종무** (을지의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Antiplatelet and anticoagulation therapy strategies for patients with atrial fibrillation undergoing carotid artery stenting: triple antithrombotics, alternative revascularization (CEA), etc

안 상 준

가톨릭관동의대 신경과

Atrial fibrillation (AF) is a common arrhythmia that increases the risk of stroke due to thromboembolic events. Patients with AF often require anticoagulation therapy for stroke prevention. However, when these patients undergo carotid artery stenting (CAS) for carotid artery disease, a dual antiplatelet therapy (DAPT) regimen is typically needed to prevent stent thrombosis. This creates a challenging clinical situation, as combining anticoagulation therapy with DAPT raises concerns about the increased risk of bleeding. Currently, there are no definitive guidelines on how to manage anticoagulation and antiplatelet therapy in AF patients undergoing CAS, leading to uncertainty in clinical decision-making.

In this lecture, we will review the current evidence and expert consensus on the management of anticoagulation and antiplatelet therapy in AF patients undergoing carotid artery stenting, with a particular focus on balancing the risks of stroke and bleeding. The lecture will also address the application of **triple antithrombotic therapy** (TAT) in such cases, as well as the alternative revascularization method of **carotid endarterectomy (CEA)**.

1. Management of Anticoagulation and Antiplatelet Therapy in AF Patients Undergoing CAS

For patients with AF who require carotid artery stenting, the primary objective is to minimize the risk of both stroke and stent thrombosis. The standard post-stenting therapy involves dual antiplatelet therapy (DAPT), typically comprising **aspirin** and a **P2Y12 receptor inhibitor** such as **clopidogrel**, **ticagrelor**, or **prasugrel**. However, because these patients also need anticoagulation for stroke prevention, the use of **anticoagulants** such as **warfarin** or **direct oral anticoagulants (DOACs)** is necessary. This leads to the need to balance the benefits of preventing thromboembolic events with the risks of bleeding complications.

Current clinical practice suggests that **triple antithrombotic therapy (TAT)**, which combines **anticoagulants** and **DAPT**, is often used in the immediate period following CAS in AF patients. However, the prolonged use of TAT is associated with a significantly increased risk of major bleeding, especially in older patients or those with renal dysfunction. Therefore, the general recommendation is to use **TAT for a limited duration**, generally for up to **1–3 months**, after which the patient can transition to **anticoagulation therapy** and **DAPT** or, in some cases, to **anticoagulation therapy alone**.

2. Expert Guidelines and Recommendations

While there is no single definitive guideline for anticoagulation management in AF patients undergoing CAS, expert consensus

suggests a strategy tailored to the individual patient. The key factors to consider when deciding on treatment are the patient's **stroke risk, bleeding risk, age, renal function**, and the **severity of carotid artery disease.** Several guidelines from cardiovascular and neurological societies, such as the **European Society of Cardiology (ESC)** and the **American College of Cardiology (ACC)**, have addressed anticoagulation and antiplatelet use in AF patients undergoing **percutaneous coronary intervention (PCI)**, which shares many similarities with CAS.

The main takeaways from expert guidelines include:

- **Short-term use of TAT** is preferred in high-risk cases immediately after CAS.
- **Transitioning to DAPT and anticoagulation therapy** after the acute period is recommended to reduce bleeding risks.
- In some cases, **single-antiplatelet therapy** may be sufficient for patients at high bleeding risk, after a thorough evaluation of stroke and bleeding risks.

3. Triple Antithrombotic Therapy (TAT)

Triple therapy refers to the use of **aspirin, a P2Y12 receptor inhibitor**, and an **anticoagulant**. TAT has been shown to be effective in reducing thromboembolic events, but its use in AF patients undergoing CAS should be **short-term** due to the increased risk of bleeding. Prolonged TAT use can lead to major adverse events, such as gastrointestinal bleeding, intracranial hemorrhage, and renal failure, particularly in patients with multiple comorbidities. Thus, the goal is to limit the duration of TAT and, whenever possible, to transition to a simpler regimen of either **anticoagulation** plus **single-antiplatelet therapy** or just **anticoagulation** alone after 1–3 months.

4. Alternative Revascularization: Carotid Endarterectomy (CEA)

An alternative to carotid artery stenting is **carotid endarterectomy (CEA)**, a surgical procedure that involves the removal of atherosclerotic plaque from the carotid artery. CEA has been the standard treatment for high-grade carotid artery stenosis for many years and has a proven track record in reducing stroke risk. For patients with AF who are at high risk of bleeding, CEA may be considered as a preferred option over CAS, as it generally carries a lower risk of bleeding compared to the combination of anticoagulants and DAPT.

While CEA is effective in symptomatic patients with severe stenosis, it is not without risks. It is associated with potential complications such as cranial nerve injury, restenosis, and stroke. The decision to proceed with CEA should take into account the patient's comorbidities, the complexity of the disease, and the surgeon's experience.

5. Conclusion

The management of anticoagulation and antiplatelet therapy in atrial fibrillation patients undergoing carotid artery stenting is complex and requires a personalized approach. Current evidence and expert recommendations suggest using a combination of **dual antiplatelet therapy** and **anticoagulation** therapy, with **triple therapy** used only in the short term to reduce thromboembolic events while balancing the risk of bleeding. Additionally, **carotid endarterectomy (CEA)** serves as a potential alternative revascularization strategy, particularly for patients with a high bleeding risk.

In conclusion, the decision-making process should be guided by a careful assessment of the patient's risk factors, including **stroke risk, bleeding risk**, and **renal function**, with a focus on minimizing both stroke and bleeding complications. Further research is needed to refine the guidelines and optimize therapeutic strategies for these complex cases.

Management plan of neurologic deterioration: Triple antiplatelet agent, induced hypertension, agatroban, etc

정 혜 선

충남의대 신경과

Early neurological deterioration (END), which occurs within 72 hours of disease onset, is reported to have an incidence rate of about 20% in acute ischemic stroke. END is closely associated with adverse patient outcomes, significantly increasing the risk of disability and death compared to patients with stable conditions.

The causes of END can vary, but they primarily include thrombus propagation and reduced blood flow to the penumbra, which leads to further neuronal damage. To prevent and treat END caused by these mechanisms, additional antithrombotic therapy beyond aspirin and induced hypertension has been tried. In this presentation, we will review the effectiveness and safety of various treatments that have been attempted for END.

In cases of hemorrhagic conversion with AF: Timing of NOAC initiation and acute phase management

은 미 연

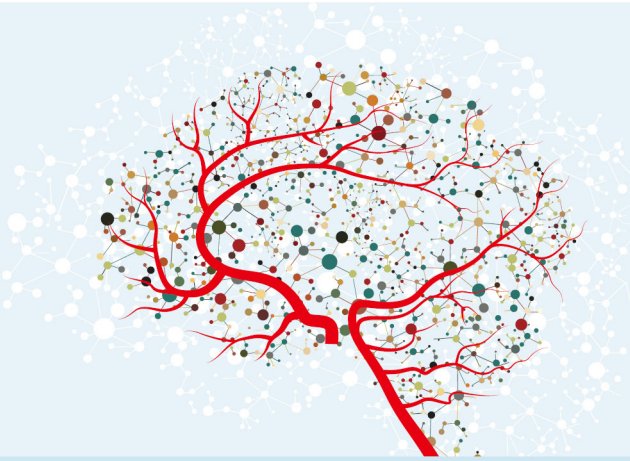
경북의대 신경과

Hemorrhagic transformation (HT) occurs relatively frequently in ischemic stroke patients with atrial fibrillation (AF), with reported incidence rates ranging from 10% to 30%, posing a major clinical dilemma in anticoagulation management. Although non-vitamin K oral anticoagulants (NOACs) are associated with a lower risk of intracranial hemorrhage compared to warfarin, the optimal timing for initiating NOACs after ischemic stroke—particularly in the presence of HT—remains unclear.

Several randomized controlled trials have explored early versus delayed NOAC initiation, with emerging evidence suggesting potential benefits of earlier administration. However, a definitive consensus is still lacking, especially in cases complicated by hemorrhagic transformation. This lecture will focus on the timing and acute-phase management strategies for NOAC initiation in AF-related stroke patients who develop HT, integrating the most recent evidence and clinical trial data.

The extent, location, and pattern of hemorrhage play a critical role in determining the safety and timing of anticoagulation. Subgroup analyses from the RAF-NOAC, CROMIS-2, and ELAN trials provide valuable insights into risk stratification based on hemorrhagic severity and ischemic recurrence potential. Factors such as the presence of cerebral microbleeds, infarct size, and concomitant antiplatelet therapy significantly influence individualized decision-making.

In addition, advances in imaging biomarkers and predictive scoring systems are improving the precision of anticoagulation timing strategies. This presentation will synthesize current guideline recommendations and real-world data, and explore potential approaches to risk-adapted decision-making in clinical practice. Ultimately, balancing the prevention of thromboembolic events against the risk of hemorrhagic complications is essential for optimizing outcomes in this high-risk population.



2025 대한뇌졸중학회

춘계학술대회

| Room B |

연구회 Session - 유전체연구회

좌장: 최재철 (제주의대 신경과), **박광열** (중앙의대 신경과)

대한뇌졸중학회
Korean Stroke Society

뇌졸중 유전자 패널에서 발견되는 변이의 스펙트럼과 해석

김 영 은

한양의대 진단검사의학과

Genetic variants can directly cause or increase susceptibility to neurologic disease. Recently new genetic technologies have enabled the identification of related genes responsible for many neurologic diseases including stroke. These advances have provided new insights into pathophysiology of monogenic and multifactorial forms of stroke. However, by adopting next-generation sequencing, genetic testing has been accompanied by new challenges in sequence interpretation. For accurate and consistent variant classification, the American College of Medical Genetics and Genomics (ACMG) and Association of Molecular Pathology (AMP) has released its latest guidelines for interpretation of sequence variants and now widely adopted into clinical practice. The guideline recommends the use of specific standard terminology—"pathogenic," "likely pathogenic," "uncertain significance," "likely benign," and "benign"—to describe variants identified in genes that cause Mendelian disorders. Moreover, this recommendation describes a process for classifying variants into these five categories based on criteria using typical types of variant evidence (e.g., population data, computational data, functional data, segregation data). Combining the genetics and pathophysiological processes underlying stroke, the discovery of new therapeutic approaches and tailored preventative interventions could be accelerated.

젊은 뇌졸중 환자에서 흔한 유전변이

이 건 주

고려의대 신경과

전 세계적으로 젊은 연령 (만 55세 혹은 60세 이하) 인구에서의 뇌졸중 환자의 발병은 증가하는 추세에 있다. 비교적 젊은 뇌졸중 환자들은 고령의 뇌졸중 환자와 비교하여 임상적 특성에 그 차이가 있다.

젊은 뇌졸중 환자에서 유전 요인은 노년기 환자에 비해 발병에 미치는 영향이 보다 크며, 이를 이해하기 위해서는 다빈도(common) 변이와 희귀(rare) 변이에 대한 이원적 접근이 필요하다. 다빈도 변이는 주로 전장유전체연관분석(GWAS)을 통해 발견되며, International Stroke Genetics Consortium의 연구에서는 ABO 유전자의 변이가 젊은 뇌졸중 발생과 연관되어 있음을 보고한 바 있다. 한편, 희귀 변이는 차세대염기서열분석(NGS)을 통해 규명할 수 있다. 대표적으로, 국내의 다기관 코호트 연구를 통해 4,000명 이상의 만 55세 이하의 뇌졸중 환자를 대상으로 단일유전자질환(monogenic disorder)과 연관된 유전자내의 빈도를 보고한바가 있다.

본 강의에서는 위와 같은 연구 결과들을 소개함으로써 젊은 뇌졸중 환자에서의 유전적 요인의 중요성을 부각시키고자 하며, 유전적 진단을 통한 접근이 젊은 뇌졸중 환자에서의 진단과 치료에 있어 어떻게 활용될 수 있을지 제시하고자 한다.

뇌졸중 치료제에서 고려해야할 유전변이

이 정 윤

순천향의대 신경과

2025 대한뇌졸중학회

춘계학술대회

| Room C |

Scientific Session 1

좌장: 정근화 (서울의대 신경과), **황양하** (경북의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Deep learning model for new cerebral infarction detection and stroke risk prediction using serial FLAIR images

Seongho Park[1]

[1]Neurology, Hanyang University Guri Hospital, Guri-Si, Gyeonggi-Do, Korea

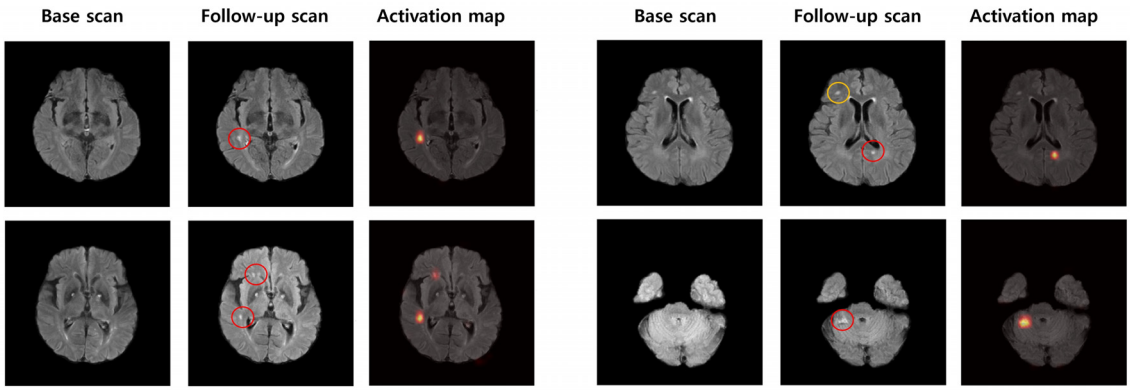
Purpose: Asymptomatic cerebral infarctions frequently remain undetected despite their significance as a risk factor for stroke recurrence. This study aimed to develop a deep learning model for detecting new cerebral infarct lesions on serial FLAIR images and evaluate its diagnostic and prognostic value.

Methods: We screened 15,267 patients who underwent MRI for suspected acute stroke between January 2006 and March 2023 across two stroke centers. Patients with at least two FLAIR images were selected, and paired images from initial and latest scans were labeled for new infarcts at corresponding slice locations. These labeled datasets were utilized to develop a deep learning model, which was subsequently validated using both internal and external datasets. Additionally, we conducted a retrospective cohort analysis of asymptomatic patients to assess the model's ability to stratify risk for future stroke events.

Results: The study included 25,451 paired images from 1,055 patients (633 in the derivation dataset and 422 in the external dataset). The model demonstrated robust performance, with an AUC of 0.894 (95% CI: 0.880-0.907) for the internal validation set and 0.898 (95% CI: 0.890-0.907) for the external dataset. In the asymptomatic cohort analysis, patients classified as high-risk by the AI model showed significantly higher cumulative stroke risk compared to low-risk patients, with a hazard ratio of 4.11 (CI: 1.40-12.1, p=0.0099).

Conclusions: The deep learning model demonstrated high diagnostic accuracy in detecting new cerebral infarct lesions and effectively predicted stroke recurrence risk in asymptomatic patients. This tool may assist in the early detection of silent infarctions and guide preventive treatment decisions.

Activation map



Serum lipoprotein(a) and recanalization outcomes after endovascular treatment in acute ischemic stroke

Sangwon Choi[1], Minwoo Lee[1], Kyung-Ho Yu[1], Byung-Chul Lee[1], Mi Sun Oh[1]

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

Purpose: Lipoprotein(a) [Lp(a)] is increasingly recognized as a contributor to atherothrombosis, but its impact on recanalization outcomes after endovascular treatment (EVT) for acute ischemic stroke (AIS) remains unclear. This study aimed to evaluate the association between serum Lp(a) levels and successful recanalization (SR) following EVT in patients with intracranial large vessel occlusion.

Methods: We retrospectively analyzed 265 patients who underwent EVT for AIS. Serum Lp(a) levels measured within 12 hours post-treatment were analyzed both as continuous variables and by tertiles. The primary outcome was SR, defined as a modified Thrombolysis in Cerebral Infarction (mTICI) score ≥2b. Logistic regression models were performed with sequential adjustments: Model 1 (unadjusted), Model 2 (adjusted for age, sex, baseline stroke severity, occlusion site, intravenous tPA, EVT method, and onset-to-puncture time), Model 3 (further adjusted for serum hs-CRP and fibrinogen levels).

Results: Among 265 patients (mean age: 70.2 ± 13.5 years, 41.7% male), 197 (74.3%) achieved SR. Higher Lp(a) levels were significantly associated with lower odds of SR in all models. In continuous analysis, the adjusted odds ratio (OR) per unit increase in Lp(a) was 0.983 (95% CI: 0.970–0.996; p=0.01) in Model 3. Tertile analysis revealed that patients in the highest tertile had significantly lower odds of SR compared to the lowest tertile, with an adjusted OR of 0.450 (95% CI: 0.213–0.950; p=0.036) in Model 3. A dose-dependent trend was observed across Lp(a) levels (p for trend <0.05).

Conclusions: Higher post-EVT Lp(a) levels were inversely associated with successful recanalization. Lp(a) may reflect an underlying prothrombotic tendency or vascular dysfunction that impairs mechanical thrombectomy efficacy. These findings highlight the potential role of Lp(a) as a post-treatment biomarker related to EVT outcomes in AIS patients.

Acute stroke imaging protocols and decision-making criteria for endovascular thrombectomy in large vessel occlusion: A nationwide survey of thrombectomy-capable stroke centers in South Korea.

Jaeseob Yun[1], Hyungjong Park[1], Hyo Suk Nam[2], Ji Hoe Heo[3], Young Dae Kim[2]

[1]Department of Neurology, Keimyung University School of Medicinekeimyung University School of Medicine, Daegu, Korea [2]Department of Neurology, Yonsei University College of Medicine, Seoul, Korea [3]Department of Neurology, Cha Bundang Medical Center, Cha University, Seongnam, Korea

Purpose: Understanding current practices in acutes ischemic stroke (AIS) imaging and decision-making criteria is essential for standardized care. However, imaging protocols and selection criteria for endovascular therapy (EVT) in South Korea remain unclear. This study aimed to investigate the current eligibility criteria and imaging-based selection practices for EVT across various time windows.

Methods: A comprehensive electronic questionnaire consisting of 58 items was distributed via e-mail to stroke neurologists, interventional neurologists, and interventional radiologists at 77 thrombectomy-capable stroke centers (TSCs) certified by the Korean Stroke Society. The questionnaire addressed acute imaging protocols and decision-making criteria for EVT across distinct time intervals from symptom onset to hospital presentation: early (< 6 hours), late (6–16 hours and 16–24 hours), and extended (24–48 hours) time windows. Responses were collected from July to November 2024.

Results: Of the 77 centers, 45 (58.4%) hospitals responded the survey. EVT was available within 24 hours of symptom onset at 44.4% of participating hospitals. For AIS imaging modalities, computed tomography (CT) based imaging was predominant modality across all time windows (71.1% in <6 hours, 51.2% in 6–16 hours, 52.4% in 16–24 hours and 40% in 24–48 hours), followed by combined CT with magnetic resonance (MR) based protocols (24.4% in <6 hours, 34.9% in 6–16 hours, 31.0% in 16–24 hours and 40% in 24–48 hours), and MR based protocol (4.4% in <6 hours, 14.0% in 6–16 hours, 16.7% in 16–24 hours and 20% in 24–48 hours). The use of perfusion imaging, including CT and MR perfusion, gradually increased with later time windows (75% in <6 hours, 81.8% in 6–16 hours, 86.4% in 16–24 hours, and 100% in 24–48 hours, P for trend <0.001). For decision-making criteria in the late and extended time windows, 47 physicians from 43 TSCs responded to the survey. Perfusion-based selection was primarily used decision-making criteria (72% in 6–16 hours, 72% in 16–24 hours, and 52% in 24–48 hours). Approximately half of these centers employed automated post-processing software, with the RAPID program being the most widely used (40%).

Conclusions: This multicenter nationwide survey highlights substantial heterogeneity in AIS imaging protocol and decision-making criteria among TSCs in South Korea. This finding demonstrates the current variability in real clinical practice and emphasize the need for standardized imaging and decision-making protocols for EVT.

Secular trends of acute stroke care and outcomes in Korea between 2013 and 2023

Jun Yup Kim[1], Do Yeon Kim[1], Jihoon Kang[1], Beom Joon Kim[1], Seong-Eun Kim[1], Juneyoung Lee[2], Yong Uk Kwon[3], Yu Ra Lee[4], Yu Jeong Lim[4], Hee-Joon Bae[1]

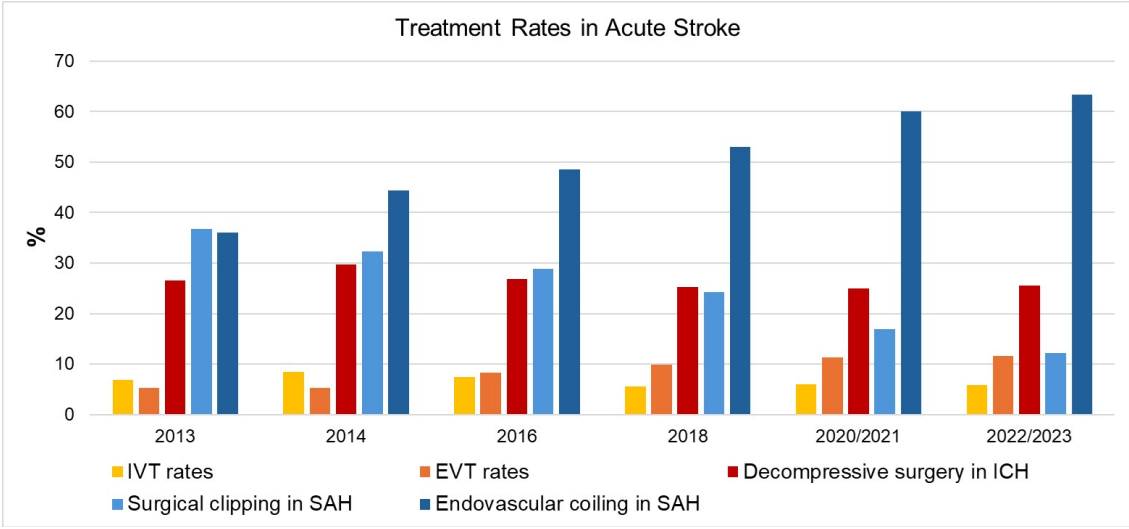
[1]Department of Neurology, Seoul National University Bundang Hospital, Seoul National University College of Medicine, Seongnam, Korea [2]Department of Biostatistics, Korea University College of Medicine, Seoul, Korea [3]Healthcare Review And Assessment Committee, Health Insurance Review And Assessment Service, Wonju, Korea [4]Quality Assessment Department, Health Insurance Review And Assessment Service, Wonju, Korea

Purpose: Stroke management in Korea has evolved significantly over the past decade, influenced by advancements in reperfusion therapies, surgical techniques, and public health initiatives. However, comprehensive analyses of nationwide trends in acute stroke care are limited. This study aimed to evaluate secular trends in acute stroke care and outcomes in South Korea from 2013 to 2023, focusing on changes in demographic profiles, prehospital care, hospital management, and mortality.

Methods: Data were extracted from the Acute Stroke Quality Assessment Program (ASQAP), linked with insurance claims and mortality data. Patients diagnosed with acute ischemic stroke (AIS), intracerebral hemorrhage (ICH), or subarachnoid hemorrhage (SAH) and admitted within 7 days of symptom onset were included. Temporal trends in key indicators such as ambulance use, reperfusion therapy, surgical management, and adjusted mortality rates were analyzed.

Results: Among 186,709 stroke episodes, the mean patient age increased (67.1 to 69.6 years), and the proportion aged ≥85 years nearly doubled. While ambulance use increased across stroke types, only one-third of AIS patients arrived within 3 hours. IV thrombolysis (IVT) rates declined after 2014 and plateaued around 6%, while endovascular thrombectomy (EVT) rates rose to 11.6%, particularly among patients with severe stroke. Statin prescription at discharge reached 92.1%, and NOAC use in atrial fibrillation-related stroke increased 18-fold after insurance reimbursement expansion. Surgical clipping for SAH declined, while coiling increased. ICH surgical intervention rates remained unchanged. Despite improvements in care, adjusted mortality did not show significant secular trends and increased slightly after 2020.

Conclusions: Over the past decade, Korea has seen progress in acute stroke care, including increased EVT use and medication optimization. However, persistent challenges remain in early hospital arrival, IVT utilization, surgical treatment for ICH, and mortality reduction. Strategic system-level efforts are needed to enhance timely access to evidence-based stroke care and improve long-term outcomes.


Treatment Rates in Acute Stroke
70
60
50
40
30
20
10
0
%
2013
2014
2016
2018
2020/2021
2022/2023
IVT rates
EVT rates
Decompressive surgery in ICH
Surgical clipping in SAH
Endovascular coiling in SAH

Association between low-density lipoprotein levels and risk of incident dementia: A distributed network analysis using common data models

Yerim Kim[1], Minwoo Lee[2]

[1]Neurology, Kangdong Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea [2]Neurology, Hallym Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea

Purpose: Background: The link between low-density lipoprotein cholesterol (LDL-C) levels and dementia risk remains unclear, with inconsistent evidence on the role of LDL-C and the effects of statin therapy on cognitive outcomes. Therefore, we aimed to explore the relationship between LDL-C levels and dementia risk, while also evaluating the impact of statin use.

Methods: Methods: We conducted a retrospective analysis of data from 11 university hospitals that participated in the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM). Participants who had a prior diagnosis of dementia were excluded. Propensity score matching at a 1:1 ratio was employed to compare individuals with LDL-C levels below 70 mg/dL to those with levels above 130 mg/dL, resulting in a primary cohort of 108,980 matched patients. Secondary analyses further evaluated LDL-C thresholds below 55 mg/dL and the effect of statin therapy.

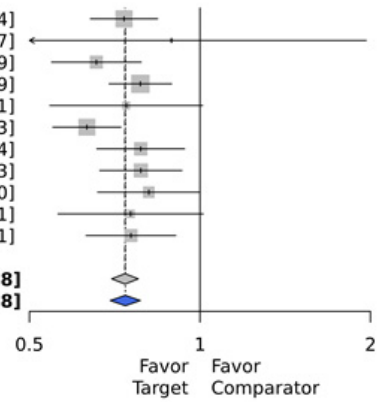
Results: Results: LDL-C levels below 70 mg/dL were linked to a 26% decrease in the risk of all-cause dementia and a 28% decrease in Alzheimer's disease-related dementia, compared to levels above 130 mg/dL. For LDL-C levels under 55 mg/dL, there was an 18% reduction in risk for both conditions. However, LDL-C levels <30 mg/dL (<0.8 mmol/L) did not exhibit reduced dementia risk compared with the LDL-C ≥130 mg/dL (≥3.4 mmol/L) group. Among those with LDL-C <70 mg/dL (<1.8 mmol/L), statin use was associated with a 13% reduction in all-cause dementia risk and a 12% decrease in ADRD risk compared with non-users.

Conclusions: Conclusion: Lower LDL-C levels (<70 mg/dL) are significantly associated with a decreased risk of dementia, including Alzheimer's disease-related dementia, with statin therapy offering additional protective benefits. These findings emphasize the importance of targeted lipid management as a preventive measure against dementia and highlight the need for personalized treatment strategies.

(A)

Source	Target Total	Target Event	Comparator Total	Comparator Event	HR	95% CI
AUMC	39,718	366	39,718	473	0.73	[0.64; 0.84]
GNUCH	1,317	11	1,317	15	0.89	[0.40; 1.97]
KDH	6,938	192	6,938	292	0.66	[0.55; 0.79]
KHMC	11,936	431	11,936	530	0.78	[0.69; 0.89]
KHNMC	3,314	69	3,314	95	0.74	[0.54; 1.01]
KWMC	7,204	330	7,204	514	0.63	[0.55; 0.73]
MJH	5,751	219	5,751	269	0.79	[0.66; 0.94]
SCHBC	9,015	251	9,015	305	0.79	[0.67; 0.93]
SCHCA	8,938	166	8,938	193	0.81	[0.66; 1.00]
SCHGM	4,601	76	4,601	107	0.75	[0.56; 1.01]
SCHSU	10,054	207	10,054	262	0.76	[0.63; 0.91]
Common effect model	**108,786**	**2,318**	**108,786**	**3,055**	**0.74**	**[0.70; 0.78]**
Overall					**0.74**	**[0.69; 0.78]**

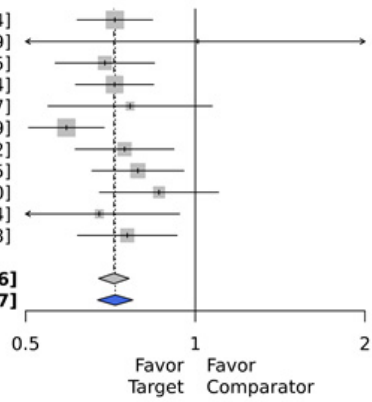
Heterogeneity: I^2 = 0.0%



(B)

Source	Target Total	Target Event	Comparator Total	Comparator Event	HR	95% CI
AUMC	39,750	287	39,750	377	0.72	[0.62; 0.84]
GNUCH	1,319	9	1,319	11	1.01	[0.41; 2.49]
KDH	6,949	158	6,949	229	0.69	[0.56; 0.85]
KHMC	11,984	264	11,984	356	0.72	[0.61; 0.84]
KHNMC	3,322	60	3,322	80	0.77	[0.55; 1.07]
KWMC	7,227	258	7,227	430	0.59	[0.51; 0.69]
MJH	5,768	168	5,768	217	0.75	[0.61; 0.92]
SCHBC	9,030	199	9,030	241	0.79	[0.66; 0.95]
SCHCA	8,954	125	8,954	137	0.86	[0.68; 1.10]
SCHGM	4,605	59	4,605	92	0.68	[0.49; 0.94]
SCHSU	10,072	167	10,072	211	0.76	[0.62; 0.93]
Common effect model	**108,980**	**1,754**	**108,980**	**2,381**	**0.72**	**[0.67; 0.76]**
Overall					**0.72**	**[0.67; 0.77]**

Heterogeneity: I^2 = 7.0%



Post-discharge exposure to ambient sulfur dioxide increases the risk of stroke recurrence

Keon-Joo Lee[1], Jeongeun Hwang[2], Seong-Eun Kim[3], Joon-Tae Kim[4], Dong-Ick Shin[5], Jae-Kwan Cha6, Dong-Eog Kim[7], Jong-Moo Park[8], Kyusik Kang[9], Soo Joo Lee[10], Kyung-Ho Yu[11], Keun-Sik Hong[12], Jay Chol Choi[13], Tai Hwan Park[14], Jee-Hyun Kwon[15], Jun Lee[16], Sung Il Sohn[17], Kyung Bok Lee[18], Juneyoung Lee[19], Hee-Joon Bae[3]

[1]Department of Neurology, Korea University Guro Hospital, Seoul, Korea [2]Department of Medical It Engineering, College of Software Convergence, Soonchunhyang University, Asan, Korea [3]Department of Neurology, Seoul National University Bundang Hospital, Seongnam, Korea [4]Department of Neurology, Chonnam National University Hospital, Gwangju, Korea [5]Department of Neurology, Chungbuk National University & Hospital, Cheongju, Korea [6]Department of Neurology, Dong-A University Hospital, Busan, Korea [7]Department of Neurology, Dongguk University Ilsan Hospital, Goyang, Korea [8]Department of Neurology, Uijeongbu Eulji Hospital, Eulji University, Uijeongbu, Korea [9]Department of Neurology, Nowon Eulji Hospital, Eulji University, Seoul, Korea [10]Department of Neurology, Eulji University Hospital, Daejeon, Korea [11]Department of Neurology, Hallym University Sacred Heart Hospital, Anyang, Korea [12]Department of Neurology, Inje University Ilsan Paik Hospital, Goyang, Korea [13]Department of Neurology, Jeju National University Hospital, Jeju, Korea [14]Department of Neurology, Seoul Medical Center, Seoul, Korea [15]Department of Neurology, Ulsan University Hospital, Ulsan, Korea [16]Department of Neurology, Yeungnam University Medical Center, Daegu, Korea [17]Department of Neurology, Keimyung University Dongsan Medical Center, Daegu, Korea [18]Department of Neurology, Soonchunhyang University Hospital, Seoul, Korea [19]Department of Biostatistics, Korea University, Seoul, Korea

Purpose: While ambient air pollution is a known risk factor for incident stroke, its influence on post-stroke outcomes remains less clearly defined. This study aimed to investigate whether post-discharge exposure to ambient air pollutants is associated with stroke recurrence in patients with acute ischemic stroke.

Methods: We analyzed data from 27,346 patients in the CRCS-K-NIH registry (2014–2021) with confirmed ischemic stroke, available residential information, and corresponding air quality data. The main exposure was the average concentration of ambient air pollutants (PM10, PM2.5, NO_2 , SO_2 , CO, and O_3) during the first 3 months following hospital discharge. The primary outcome was stroke recurrence in the subsequent 1-year period, with death events treated as competing risks. Cause-specific hazard models within a marginal Cox model were used, adjusting for a comprehensive set of clinical, demographic, meteorological, and regional socioeconomic factors.

Results: Among the air pollutants analyzed, only sulfur dioxide (SO_2) showed a statistically significant association with stroke recurrence. Patients in areas with higher 3-month average SO_2 exposure exhibited increased risk of recurrence during the following year (p;for overall effect = 0.024), with a potential threshold effect observed at 8.232 ppb. The dose-response relationship appeared with increasing exposure. Subgroup analyses suggested that the association was more pronounced among older individuals and women. Spatial analysis revealed that SO_2 levels were highest in harbor cities such as Incheon and Ulsan, which may reflect maritime

or shipping-related pollution sources. Other pollutants, including PM10, PM2.5, NO_2 , CO, and O_3 , showed no consistent or significant associations with stroke recurrence in this model.

Conclusions: Elevated SO_2 exposure following discharge from ischemic stroke is associated with a higher risk of stroke recurrence, particularly in regions with persistent harbor-related pollution. These findings underscore the importance of considering environmental exposures in secondary stroke prevention strategies and support the need for targeted public health interventions in high-risk areas.

Risk factors for cerebral infarction and cerebrovascular stenosis in antiphospholipid antibody-positive patients: A retrospective single-center study with propensity score matching analysis

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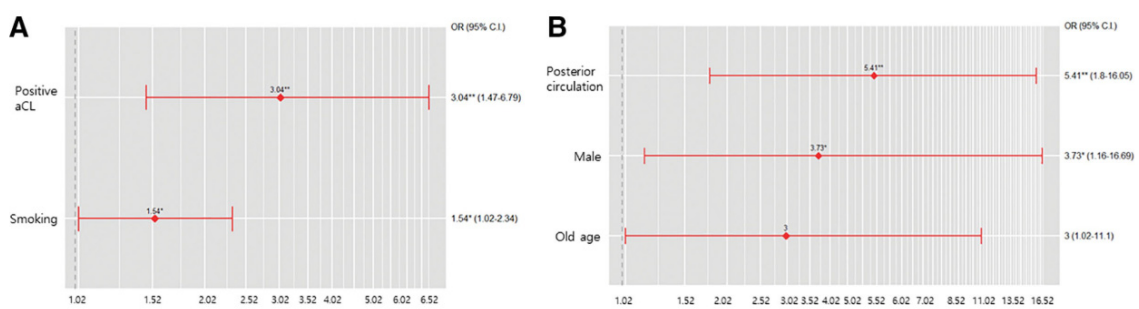
[1]Department of Neurosurgery, Myong-Ji St. Mary's Hospital, Seoul, Korea [2]Department of Neurology, Myong-Ji St. Mary's Hospital, Seoul, Korea

Purpose: Risk Factors for Cerebral Infarction and cerebrovascular Stenosis in Antiphospholipid Antibody-Positive Patients: A retrospective single-center study with propensity score matching analysis

Methods: In this retrospective single-center study, data from 9844 patients tested for aPLA between January 2017 and March 2023 were analyzed. A total of 647 aPLA-positive patients were included, with assessments of various factors including age, gender, hypertension, diabetes, dyslipidemia, smoking history, and cardiac disease. Propensity score matching was employed to create 2 matched groups of 202 patients each, comparing those with and without cerebral infarction. Logistic regression analyses were conducted to identify risk factors for cerebral infarction and progression of cerebrovascular stenosis.

Results: The mean age of the study cohort was 65.8 years, with 60% being male. LA was positive in 95.2% of the cases, aCL in 8.8%, and aβ2GPI in 5.3%. High-risk aPLA profiles were identified in 7.1% of the cases. In the cerebral infarction group, both smoking history and aCL positivity were significantly associated with an increased risk (OR = 1.543; 95% CI: 1.020–2.334; P = .040 and OR = 3.043; 95% CI: 1.426–6.491; P = .040, respectively). Male gender and posterior circulation involvement were significant risk factors for exacerbation of cerebrovascular stenosis (OR = 3.73; 95% CI: 1.16–16.69; P = .046 and OR = 5.41; 95% CI: 1.80–16.05; P = .002, respectively).

Conclusions: Smoking history and aCL positivity are prominent risk factors for cerebral infarction in aPLA-positive patients, while male gender and involvement of the posterior circulation emerge as significant risk factors for the progression of cerebrovascular stenosis. Further comprehensive prospective studies are necessary to deepen understanding of aPLA-related cerebrovascular diseases.



Logistic regression plot of odds ratios and 95% CIs. (A) multivariate logistic regression analysis of risk factors associated with infarction in aPLA- positive patients; (B) multivariate logistic regression analysis of risk factors associated with the aggravation of vessel stenosis in aPLA-positive patients with cerebral infarction.

2025 대한뇌졸중학회

춘계학술대회

| Room C |

Scientific Session 2

좌장: 안성환 (조선의대 신경과), **박경필** (부산의대 신경과)

대한뇌졸중학회
Korean Stroke Society

Infarct evolution despite complete recanalization after LVO

Nakhoon Kim[1], Wi-Sun Ryu[2], Joonnyung Heo[3], Jong-Won Chung[4], Chi Kyung Kim[5], Joon-Tae Kim[6], Leonard Sunwoo[7], Johanna Ospel[8], Longting Lin[9], Mark Parsons[9], Hee-Joon Bae[1], Beom Joon Kim[1]

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Purpose: Acute large vessel occlusion (LVO) stroke patients may continue to experience ischemic injury despite achieving complete recanalization (TICI 3). This study explored the dynamics of infarct evolution, as visualized on diffusion-weighted imaging (DWI), to elucidate factors driving lesion progression.

Methods: A total of 189 LVO patients who achieved complete recanalization were included. All of them had baseline CT perfusion, early DWI (within 24 hours post-endovascular therapy), and delayed DWI (24–168 hours) analyzed. Image analyses were performed using JLK-CTP and JLK-DWI, validated automated software for fast image processing.

Results: The median infarct volume increased from 4.8 cc on early DWI (median 1.74 hours post–EVT) to 11.7 cc on delayed DWI (median 92.78 hours), with a median growth of 4.41 cc; 13.8% of patients demonstrated a reduction in lesion volume. Robust linear regression identified baseline ischemic core volume (rCBF <30%; estimate with standard error; 0.187 ± 0.025) and initial glucose level (0.049 ± 0.018) as significant predictors of lesion growth. Moreover, multivariable logistic regression showed that each decile increase in DWI lesion change independently decreased the odds of achieving mRS 0–2 (adjusted OR [95% CI], 0.81 [0.68 – 0.95]) and mRS 0–1 (0.80 [0.69 – 0.93]) at 3 months after stroke. Mediation analysis suggested that infarct growth partially mediated the effect of baseline core volume on three-month outcomes (P-value, 0.02). Models using delayed DWI infarct volume provided the best outcome discrimination.

Conclusions: Even after successful recanalization, DWI lesions may continue to expand, indicating ongoing tissue injury. These findings underscore the need for neuroprotective strategies and support the use of delayed DWI as a more accurate surrogate endpoint in acute stroke trials.

Effect of Standard versus Triple Lipid lowering therapy after Endovascular thrombectomy on functional outcomes in large vessel occlusion stroke (STYLE study): A multicenter experience

Ho Geol Woo[1], Tae-Jin Song[2], Mi-Yeon Eun[3], Min-Woo Koo[4], Hee-Kwon Park[5]

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Background: Evolocumab decreases level of low-density lipoprotein cholesterol (LDL-C) and mitigate vascular events. This study aimed to assess the efficacy and adverse events of intensive lipid-lowering treatment including evolocumab and ezetimibe (triple therapy) after endovascular thrombectomy (EVT) for acute ischemic stroke (AIS) secondary to large vessel occlusion (LVO).

Methods: This is retrospective analysis of the cohorts of the 5 comprehensive stroke centers between January 2021 and December 2024. The study included consecutive patients who had AIS secondary to LVO underwent successful EVT. Patients were dichotomized into 2 groups: triple therapy including evolocumab (140 mg every 2 weeks) and high intensity statin alone (standard therapy) during 12 weeks. The effect of triple therapy over high intensity statin alone was assessed.

Results: Of 197 patients (mean age 70.8 ± 12.1, men 63.5%), 55 received triple therapy. While baseline lipid profile was similar between the two groups, compared with standard therapy group, triple therapy group showed significantly lower mean cholesterol and TG level. Especially, the average LDL- C levels of the triple therapy and standard therapy groups were 41.4 ± 23.7 mg/dL and 87.5 ± 30.4 mg/dL at 4 weeks and 24.9 ± 12.5 mg/dL and 75.8 ± 25.4 mg/dL 12 weeks, respectively. Also, triple therapy improved neurological outcomes, with a lower 3-month mRS ≤2 (32.7% vs. 49.3%, p = 0.036) and percentage of patients with early neurologic deterioration (3.6% vs. 17.6%, p = 0.010). Multivariable analysis indicated that triple therapy had a potential impact on early neurologic deterioration (aOR: 0.114 [0.024−0.541]). In subgroup analysis, triple therapy was associated with favorable outcome in patients with AIS secondary to LVO due to large artery atherosclerosis at 3-month (aOR: 5.603 [1.787−17.565]).

Conclusion: Triple therapy in AIS patients undergoing EVT appeared to be safe and associated with better early neurological outcomes. Especially, the potential benefit of the triple therapy shown AIS secondary to LVO due to large artery atherosclerosis. Further prospective study was needed.

Alterations in basilar artery signal intensity gradient in patients with acute pontine infarction

Wookjin Yang[1], Seul-Ki Jeong[2], Chan-Hyuk Lee[3,4], Eung-Joon Lee[5,6], Hyemin Jang[5,6], Jeong-Min Kim[5,6], Seung-Hoon Lee[5,6], Keun-Hwa Jung[5,6]

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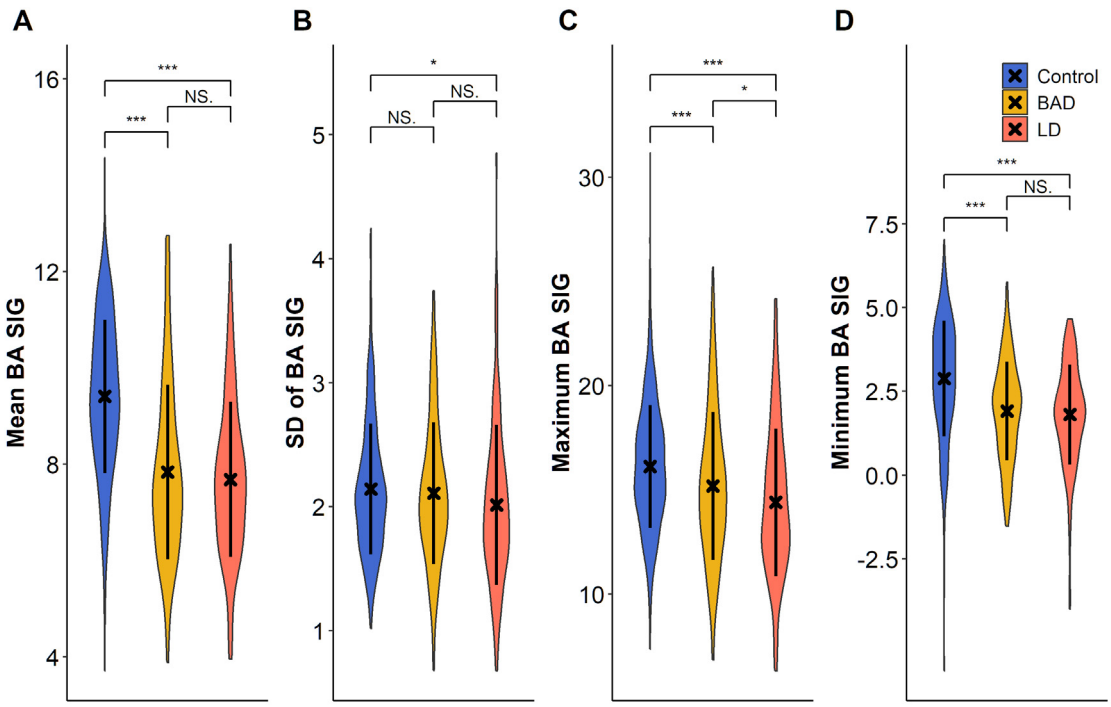
Purpose: Low wall shear stress (WSS) has been implicated in stroke pathogenesis, particularly in relation to atherosclerosis; however, most studies have focused on carotid artery WSS. This study assessed basilar artery (BA) signal intensity gradient (SIG), which reportedly correlates with WSS, in acute pontine infarction (API) patients compared to healthy controls. Additionally, the associations of BA SIG with stroke mechanisms and outcomes were analyzed in API patients.

Methods: We reviewed consecutive patients admitted for isolated API between January 2013 and May 2023. Healthy individuals who participated in a health check-up program served as controls. SIG was measured at the mid-to-distal BA using three-dimensional time-of-flight magnetic resonance angiography images, with semiautomated software. In API patients, stroke mechanisms were classified as branch atheromatous disease (BAD) if the lesions extended to the basal surface, and as lipohyalinotic degeneration (LD) otherwise. Propensity score matching was performed to address baseline differences. Logistic regression was performed to evaluate the association between BA SIG and API.

Results: In total, 334 API patients and 1,081 controls were analyzed, from which propensity score matching yielded 305 matched pairs. API was significantly associated with lower mean (Odds ratio [95% confidence intervals], 0.66 [0.59-0.73]; p<0.001) and minimum BA SIG (0.70 [0.63-0.78]; p<0.001). Among API patients, lower maximum BA SIG showed a non-significant trend toward association with LD compared to the BAD mechanism (0.94 [0.87-1.01]; p=0.12).

Conclusions: Reduced BA SIG was associated with API, particularly in LD cases. Establishing an SIG database in an ongoing prospective cohort may support future studies, and provide valuable insights.


A
B
C
D
Mean BA SIG
SD of BA SIG
Maximum BA SIG
Minimum BA SIG
Control
BAD
LD
***
NS.
*

Factors associated with inadequate anticoagulation in patients with cryptogenic stroke with active cancer

Hyung Jun Kim[1], Oh Young Bang[1]

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

Purpose: Patients with active cancer are at an elevated risk of ischemic stroke. It is hypothesized that cancer-associated hypercoagulability plays a crucial role in the pathogenesis of these strokes. Consequently, anticoagulation therapy is often considered for secondary stroke prevention in this population. However, the efficacy of anticoagulation can be variable, and understanding the factors associated with its failure in active cancer patients with cryptogenic stroke is essential for optimizing treatment strategies.

Methods: We enrolled 210 patients admitted to Samsung Medical Center and Ewha Women's University Medical Center from January 2017 to August 2024 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. Inadequate anticoagulation is defined if the D-dimer does not decrease by more than 50% (anticoagulation-resistance), increases by more than 2 times from the lowest value after decreasing by more than 50% (reduced effectiveness of anticoagulants), and recurs (recurrence) after anticoagulation therapy (LMWH, heparin, or DOAC).

Results: Of 210 patients with cryptogenic stroke with active cancer, 127 (60.5%) received anticoagulation therapy. Of the 127 patients, 5 (3.9%) received intravenous continuou;heparin, 98 (77.2%) received subcutaneous low molecular weighted heparin (LMWH), and 24 (18.9%) received a direct oral anticoagulant (DOAC). Of the 5 IV heparin patients, 1 (20%);had inadequate anticoagulation, of the 98 LMWH patients, 21 (21.4%) had inadequate anticoagulation, and;of the 24 DOAC patients, 9 (37.5%) had inadequate anticoagulation. In a multivariable logistic analysis, inadequate anticoagulation was associated with systemic metastasis (adjusted odd ratio, 3.222; 95% confidence interval, 1.023–5.150; p=0.004);, adenocarcinoma (adjusted OR, 2.172; 95% CI, 1.010–3.152; p=0.012), and NBTE (adjusted OR, 6.125; 95% CI, 1.987–14.121; p<0.001), and this inadequate anticoagulation was associated with more stroke recurrence and 3-month mortality compared with adequate anticoagulation.

Conclusions: Inadequate anticoagulation in active cancer patients with cryptogenic stroke is likely multifactorial. However, this inadequate anticoagulation is associated with the patient's neurological prognosis and requires appropriate treatment. Future research should focus on better understanding the specific pathophysiological mechanisms of stroke in individual cancer patients, optimizing antithrombotic strategies potentially involving anticoagulant agents

Factors associated with vertebral metabolic activity and its implications for cardiovascular disease

Jiyeon Ha[1], Jeong-Min Kim[1], Jin Chul Paeng[2], Wookjin Yang[3], Yong Seo Kim[4], Soo Jin Lee[5], Ji Young Kim[5], Yun Young Choi[5], Kang-Ho Choi[6], Jahae Kim[7], Kwang-Yeol Park[8], Juwon Seok[9]

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Purpose: Cardiovascular disease (CVD) remains a leading cause of morbidity and mortality, and vertebral metabolic activity measured by fluorodeoxyglucose positron emission tomography (FDG-PET) is increasingly recognized as an indicator of bone marrow activity representing inflammation, and hematopoiesis associated with CVD. However, its broader physiological determinants and precise relationship to cardiovascular risk are not fully understood.

Methods: This retrospective study analyzed data from 252 healthy Asian adults who underwent 18F-FDG PET/CT and dual-energy X-ray absorptiometry (DXA) between 2016 and 2022. Associations between vertebral metabolic activity, demographic characteristics, body composition and anthropometric indicators, laboratory data and cardiovascular risk scores (SCORE2 Asia-Pacific, WHO 10-year CVD risk, and Framingham Risk Score) were assessed using correlation, linear regression, and path analysis.

Results: In correlation analysis, higher vertebral metabolic activity was positively associated with skeletal muscle mass, spine bone mineral density (BMD), platelet count, neutrophil-to-lymphocyte ratio (NLR), and negatively associated with age and cardiovascular risk scores. These relationships werer distinct from those observed with other FDG-PET-derived markers such as spleen and amygdala activity. Multivariable linear regression analysis identified younger age, female sex, higher skeletal muscle mass, spine BMD, and elevated inflammatory profiles as independent predictors of increased vertebral metabolic activity. Path analysis revealed complex relationships, including direct positive effects of skeletal muscle mass, NLR, and spine BMD on vertebral metabolic activity, and direct and indirect negative effects of age, and direct positive and indirect negative effects of female sex.

Conclusions: Factors related to vertebral metabolic activity are diverse including aging, sex, hematopoiesis and musculoskeletal status. Further studies across diverse populations are warranted to confirm these findings and clarify its clinical applicability in cardiovascular risk evaluation.

Net water uptake and catastrophic functional outcome after endovascular thrombectomy in large infarcts

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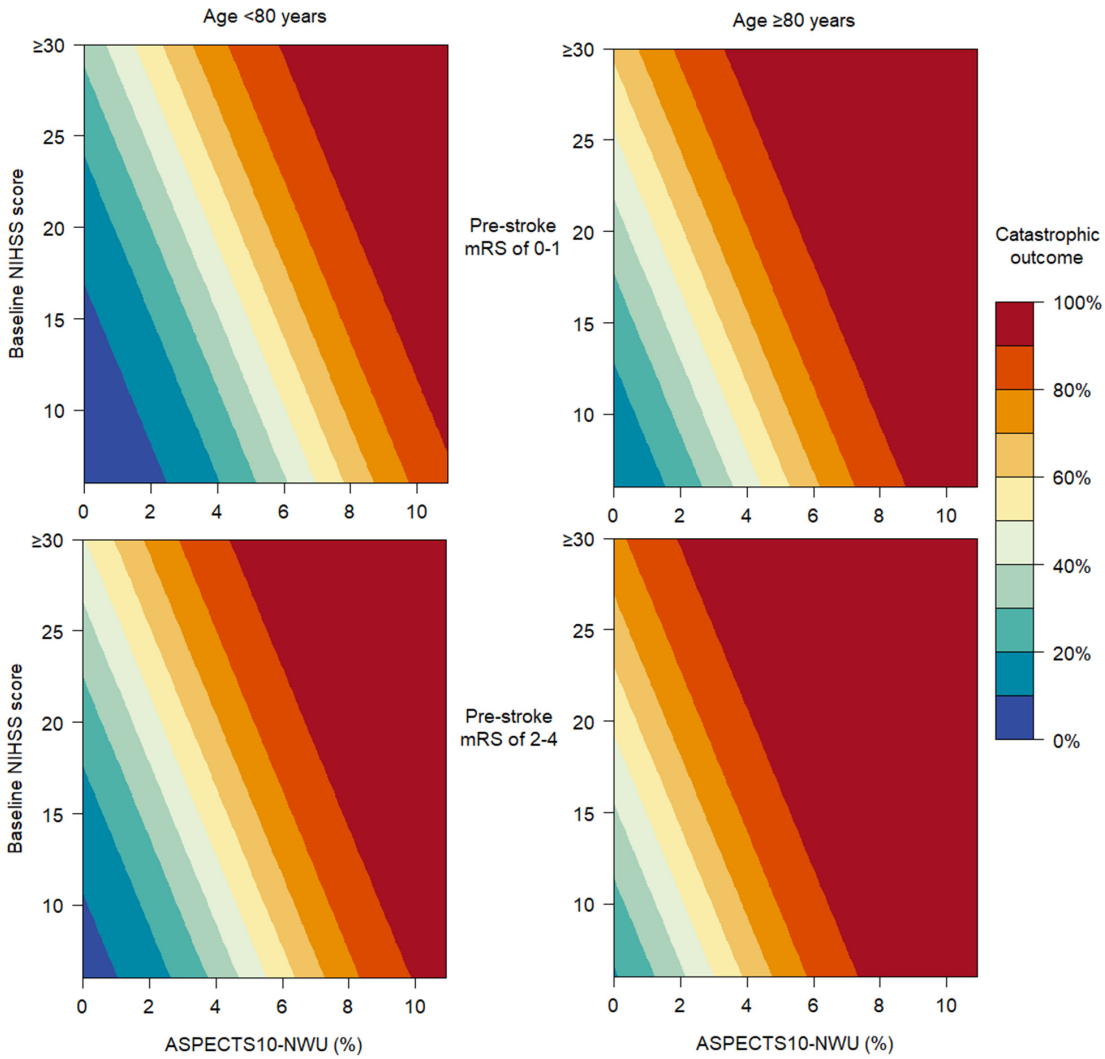
Purpose: To evaluate whether net water uptake (NWU) was associated with 3-month catastrophic functional outcome (defined as modified Rankin Scale [mRS] score of 5-6) after endovascular thrombectomy (EVT) in large infarcts.

Methods: This multicenter observational cohort study included 255 patients with anterior circulation stroke with Alberta Stroke Program Early Computed Tomography Score (ASPECTS) of ≤5 receiving EVT. NWU, a quantitative imaging biomarker reflecting the degree of hypoattenuation in non-contrast computed tomography, was measured across a whole ASPECTS region (ASPECTS10-NWU) using a validated software (JLK-ASPECTS) and its associations with stroke outcomes including catastrophic functional outcome were assessed with mixed-effects logistic regression model. Moreover, a predictive model with preprocedural factors including ASPECTS10-NWU were developed to support informed decision making for EVT in this population.

Results: The mean age of the included patients was 71.0 ± 12.6 years, and 54.9% were male. Median ASPECTS10-NWU was 3.0% (interquartile range 1.9–4.1%). Higher ASPECTS10-NWU was independently associated with catastrophic functional outcome (adjusted odds ratio [aOR] 1.73, 95% confidence interval [CI], 1.36–2.19, p <0.001). Higher ASPECTS10-NWU was also showed independent associations with symptomatic intracerebral hemorrhage (aOR 1.56, 95% CI, 1.12-2.18, p = 0.009) and moderate-to-severe cerebral edema (aOR 1.48, 95% CI, 1.19-1.84, p <0.001). The model integrating ASPECTS10-NWU with preprocedural variables suggested predicted probabilities; as ASPECTS-NWU and baseline National Institutes of Health Stroke Scale score increase, the marginal probability of catastrophic functional outcome increases in all age (age <80 and ≥80 years) and pre-stroke mRS (0-1 and 2-4) groups with the patient groups of age ≥80 years and of pre-stroke mRS of 2-4 had higher probability of the outcome (Figure).

Conclusions: Elevated ASPECTS10-NWU was strongly associated with catastrophic functional outcome in patients with large infarcts treated with EVT. Integrating ASPECTS10-NWU with clinical variables may provide patient-specific prognostication that may assist clinicians in decision-making for EVT in large infarcts.


Age <80 years
Age ≥80 years
Baseline NIHSS score
Pre-stroke mRS of 0-1
Pre-stroke mRS of 2-4
Catastrophic outcome
100%
80%
60%
40%
20%
0%
≥30
25
20
15
10
0
2
4
6
8
10
ASPECTS10-NWU (%)

Sex differences in the clinical and imaging characteristics of Korean CADASIL patients: A nationwide retrospective study

Joonggoo Kim[1], Jay Chol Choi[1], Jae-Sung Lim[2], Chong Hyun Seo[3], Sung Hyuk Heo[4], Hyo Suk Nam[5], Kyung-Ho Yu[6], Chi Kyung Kim[7], Young Seo Kim[8], Hee-Joon Bae[9], Keun-Hwa Jung[10], Sung-Il Sohn[11], Jee Hyun Kwon[12], Sang-Min Sung[14], Sang Won Seo[15], Jin-Man Jung[16], Kyung Bok Lee[17], Tai Hwan Park[18], Man-Seok Park[19],

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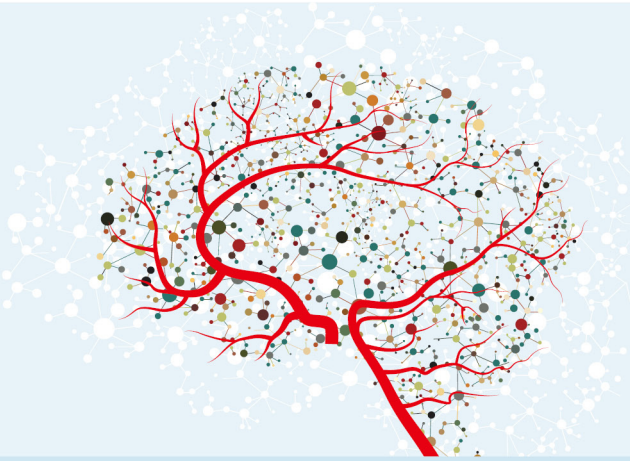
Purpose: Cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy (CADASIL) is a hereditary small vessel disease caused by;NOTCH3;mutations. While CADASIL affects both sexes, differences in clinical presentation and brain magnetic resonance imaging (MRI) findings remain unclear. This study aims to investigate sex-specific variations in vascular risk factors, clinical manifestations, and brain MRI features among Korean CADASIL patients.

Methods: A nationwide retrospective study analyzed 368 CADASIL patients (179 men, 189 women). Clinical characteristics, vascular risk factors, and;NOTCH3;variants were compared between sexes. Brain MRI findings, including white matter hyperintensity, lacunes, cerebral microbleeds, atrophy, and enlarged perivascular spaces, were evaluated. Kaplan-Meier analysis assessed sex differences in the onset of ischemic stroke, intracerebral hemorrhage (ICH), and dementia, and recurrent headaches.

Results: Men exhibited a higher prevalence of ischemic stroke (70.9% vs. 44.4%, p<0.001), whereas women were more likely to report recurrent headaches (35.4% vs. 16.9%, p<0.001). Survival analysis showed that men had a significantly earlier onset

of ischemic stroke (Hazard Ratio[HR]: 2.78, 95% CI: 1.92-4.03, p<0.001) while being male was associated with significantly later onset of recurrent headache (HR: 0.59, 95% CI: 0.38-0.90, p=0.016). No significant sex differences were observed for ICH (HR: 2.04, 95% CI: 0.80-5.18, p=0.136) or dementia (HR: 1.26, 95% CI: 0.56-2.84, p=0.579). On brain MRI, male sex was associated with significantly higher risk for lacune burden (Odds Ratio[OR] 3.03, 95% CI 1.70-5.38, p<0.001) along with age (OR 1.03, 95% CI 1.01-1.05, p=0.002) and hypertension (OR 1.86, 95% CI 1.15-3.03, p=0.002).

Conclusions: This study highlights significant sex-based differences in CADASIL, with men experiencing earlier and greater risk of cerebral infarction along with increased number of lacunes while women exhibited greater risk of earlier and greater risk recurrent headache. These findings underscore the importance of considering sex differences in CADASIL prognosis and treatment strategies.



2025 대한뇌졸중학회

춘계학술대회

| Room A |

Poster Presentation

대한뇌졸중학회
Korean Stroke Society

Development and validation of machine learning models for the identification of peripheral artery disease in patients with acute ischemic stroke

Eun-Tae Jeon[1], Sang-Hun Lee[1], Hyo Jung Lee[1], Jin-Man Jung[1]

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Purpose: Peripheral artery disease (PAD) is a common but frequently underrecognized vascular condition associated with increased morbidity and mortality. Although risk stratification tools such as CHADS2 and CHA2DS2-VASc scores are widely employed for cardiovascular risk prediction, their diagnostic utility for PAD remains limited due to suboptimal sensitivity and specificity. This study aimed to develop and validate machine learning-based models to screen for PAD using multidimensional clinical data and to compare their diagnostic performance against conventional scoring systems.

Methods: This retrospective study included 1,616 patients who were admitted for acute ischemic stroke to Korea University Ansan Hospital between March 2014 and March 2019 and underwent ankle-brachial index (ABI) measurement during hospitalization. PAD was defined as an ABI < 0.9 in either leg and/or a documented history of peripheral vascular disease. A comprehensive set of initial variables was collected, including demographic characteristics, comorbid conditions, pre-admission medications, laboratory findings, and neuroimaging evaluations. Two supervised learning algorithms, Light Gradient Boosting Machine (LightGBM) and multilayer perceptron (MLP), were trained to predict the presence of PAD. Model performance was evaluated using the area under the receiver operating characteristic curve (AUROC), sensitivity, and specificity, and was compared with that of traditional scoring systems, including CHADS2, CHA2DS2-VASc, and SCORE2. Feature importance was assessed using Shapley Additive Explanations.

Results: LightGBM exhibited the highest discriminative performance with an AUROC of 0.834 (95% CI, 0.788–0.880), sensitivity of 0.839, and specificity of 0.718, followed by MLP (AUROC, 0.811 [95% CI, 0.752–0.870]). Among the traditional scoring systems, the CHA2DS2-VASc score demonstrated the best performance (AUROC, 0.694 [95% CI, 0.620–0.768]), yet it was still significantly outperformed by both machine learning models (P < 0.001). The five most influential predictors of PAD identified by the models were age, body mass index, estimated glomerular filtration rate, serum homocysteine level, and glycated hemoglobin, highlighting the relevance of renal function and metabolic risk factors in PAD risk stratification.

Conclusions: Machine learning-based models leveraging routinely collected clinical data can significantly improve the accuracy of PAD detection compared to traditional risk scores. Age, renal function, metabolic markers, and vascular risk profiles emerged as key contributors. Implementation of such models in routine practice may enhance early identification and timely management of PAD in at-risk populations.

From a rare case to a broader pattern: A case-based review of 69 reports of ICA dissection presenting with hypoglossal palsy

Seung Yoon Song[1], Sunghoon Cho[1], Young Joo Kim[1], Jung Hwan Lee[1]

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Purpose: Isolated hypoglossal nerve palsy is a rare clinical presentation of internal carotid artery (ICA) dissection, often misdiagnosed due to its subtle and nonspecific symptoms. We encountered a 42-year-old male who presented with neck pain and dysarthria, and was diagnosed with ICA dissection and a pseudoaneurysm measuring 12.58 x 6.83 x 4.47 mm with a 9.27 mm neck. Antiplatelet therapy was initiated, and his symptoms began improving after six weeks, with near-complete recovery at eight months. This rare case prompted us to investigate whether similar patterns exist and to identify clinical features that may guide early diagnosis and treatment.

Methods: A comprehensive case-based review was conducted using 69 published cases of ICA dissection associated with hypoglossal nerve palsy, including our own. Demographic data, symptom profiles, diagnostic modalities, treatment strategies, recovery duration, and clinical outcomes were extracted and analyzed. Treatment approaches were categorized into medical (anticoagulation, antiplatelet therapy, or both) and surgical/interventional groups.

Results: The median age of patients was 49 years, with a male predominance. The most frequent presenting symptoms included tongue deviation (84%), dysarthria (60%), dysphagia (52%), and tongue weakness or atrophy. Imaging modalities used for diagnosis varied, with MRI and DSA being the most common. Among the 69 cases, recovery time ranged from a few weeks to over two years. There was no statistically significant difference in favorable outcomes between medical and surgical treatment groups ($p > 0.05$). The combination of tongue deviation, dysarthria, and tongue weakness was observed in nearly half the cases, suggesting a potentially useful clinical triad for early suspicion of ICA dissection.

Conclusions: Hypoglossal nerve palsy, even when isolated or subtle, may be the first clinical clue of an underlying ICA dissection. Recognition of key symptom combinations can aid early diagnosis, especially in the absence of cerebrovascular symptoms. Although treatment outcomes were similar between medical and surgical groups, individualized decision-making remains essential. This study highlights the diagnostic importance of lower cranial nerve findings in vascular pathology and emphasizes the need for high clinical suspicion in atypical presentations.

Stroke heart syndrome: Prevalence and clinical implication

Surim Yoon[1], Hyun Kyung Kim[1], Hyung Jun Kim[1], Jong-Won Chung[1], Oh Young Bang[1], Gyeong-Moon Kim[1], Woo-Keun Seo[1]

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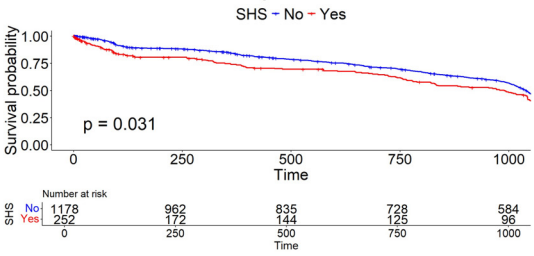
Purpose: The study aims to investigate the prevalence of Storke-Heart Syndrome (SHS), its subtypes, clinical characteristics and outcomes, based on the definition redefined in 2022.

Methods: The study was conducted on 1509 patients diagnosed with acute ischemic stroke and admitted to the Samsung Medical Center within 24 hours. The subtypes of SHS were;defined as aggravated;cardiac monitoring tests (troponin, electrocardiogram, echocardiogram), occurence of acute coronary syndrome (ACS) and sudden cardiac death within 30 days. Outcome measures were major adverse cardiovascular events (MACE), stroke recurrence, ACS, and mortality of all causes. Kaplan-Meier analysis and Cox regression were implemented to analyze the risk of adverse outcomes.

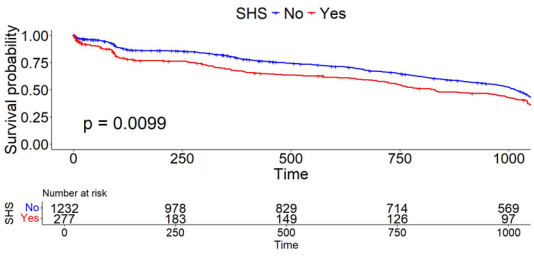
Results: SHS was identified in 277 patients (18.4%). According to the Kaplan-Meier analysis, patients with SHS exhibited a higher risk of MACE (p = 0.031), stroke recurrence (p = 0.0099), and ACS (p = 0.0017) compared to patients without SHS. In the univariate Cox regression, patients with SHS had a higher risk of MACE (HR 1.82, 95% CI 1.30 – 2.53) and stroke recurrence (HR 1.68, 95% CI 1.19 – 2.37). After adjusting for age, BMI, diastolic BP, initial NIHSS, history of hypertension, renal function, and lesion location, SHS was independently associated with elevated risks of both MACE (HR 1.73, 95% CI 1.23 – 2.44) and stroke recurrence (HR 1.65, 95% CI 1.15 – 2.36). Similar results were observed in patients without history of heart disease; the risk of MACE (univariate HR 2.09, 95% CI 1.32 – 3.32; multivariate HR 2.05, 95% CI 1.27 – 3.32) and stroke recurrence (univariate HR 1.92, 95% CI 1.18 – 3.10); multivariate HR 1.89, 95% CI 1.14 – 3.12) were greater in SHS patients.

Conclusions: Among acute stroke patients, those who developed SHS exhibited a greater risk of adverse outcomes. Notably, this was also observed in patients with no history of heart disease.

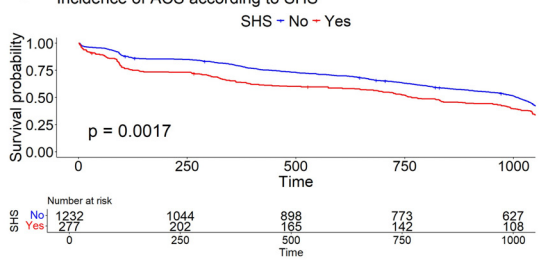
A Incidence of MACE according to SHS



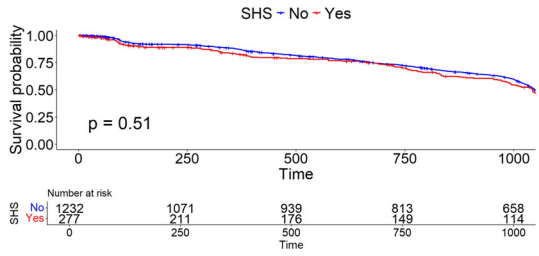
B Reccurence of stroke according to SHS



C Incidence of ACS according to SHS



D Death of all causes according to SHS



The association between nocturnal vital sign changes and prognosis in patients with acute cerebral infarction

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Purpose: Recent studies have suggested that vital signs, namely blood pressure (BP), heart rate (HR), and oxygen saturation (SpO_2) may influence risk and prognosis of cerebral infarction. While fluctuations in these parameters are known to affect cerebral hemodynamics, their role during nocturnal periods in the acute phase of ischemic stroke remains underexplored. This study aims to investigate whether nocturnal variations in vital signs, particularly oxygen desaturation and BP variability, are associated with early outcomes in patients with acute ischemic stroke (AIS). Given that early neurological deterioration (END) is a critical concern in AIS management, we focused on how day–night differences in vital signs may influence END occurrence.

Methods: We retrospectively reviewed patients with AIS admitted to Asan Medical Center between January 2022 and December 2023. Patients were included if they arrived within 24 hours of symptom onset and had continuous automated vital sign monitoring. After excluding those with missing data, severe consciousness impairment, or other confounders, 298 patients were analyzed. END was defined as a ≥2-point increase in NIHSS score within 7 days. Nocturnal time was defined as 10 PM–6 AM. NOD was defined as any SpO_2 ≤90% during that period. Daytime and nighttime BP and HR variability were calculated using the standard deviation of 4-hourly measurements.

Results: Among the 298 patients, 79 (26.5%) experienced END. Multivariate logistic regression showed that NOD was significantly associated with a higher risk of END (OR 3.73, p = 0.005), as was greater BP variability (OR 1.08, p = 0.018), whereas HR variability was not. Patients with NOD were more likely to experience END during nighttime hours (p = 0.03), although night-specific BPV did not significantly differ by END occurrence. Mediation analysis did not support a significant indirect effect of NOD on END through BPV (p = 0.062), while an indirect association between NOD and BPV through END was observed (p = 0.002). Among 26 patients with NOD, oxygen therapy reduced recurrent desaturation in some cases but did not significantly reduce END risk (p = 0.43).

Conclusions: During nighttime, vital sign changes, particularly NOD;were significantly associated with the risk of END. Although BPV was also associated with END, time-specific and mediation analyses suggested it may reflect secondary physiological changes following END rather than a direct cause. Managing NOD with oxygen therapy did not reduce the risk of END. Further studies are needed to clarify causal relationships.

A rare case of midbrain infarction with intracranial venous reflux in a hemodialysis patient: Venous congestion or arterial thromboembolism?

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Purpose: Background: Central venous stenosis (CVS) is a significant complication in hemodialysis patients and may, albeit rarely, lead to intracranial venous reflux. Previous reports have described central nervous system manifestations such as headache, seizure, or intracranial hemorrhage associated with intracranial venous reflux. However, ischemic stroke due to intracranial venous reflux is rare. Here, we report a case of midbrain infarction in a hemodialysis patient with arteriovenous fistula (AVF)-related CVS and intracranial venous reflux. Case: A 76-year-old man with end-stage renal disease on hemodialysis presented with swelling and bruising around his left brachiocephalic AVF. Neurological examination on arrival revealed dysarthria and mild right-sided hemiparesis, reportedly developed within the past week. Two months earlier, he had transitioned from a temporary catheter access to a left brachiocephalic AVF for dialysis. Brain magnetic resonance imaging (MRI) on admission showed focal area of high signal intensity on diffusion-weighted imaging with preserved apparent diffusion coefficient in the left cerebral peduncle. Susceptibility weighted imaging revealed prominently engorged basal veins. Time-of-flight magnetic resonance angiography showed steno-occlusion of the left vertebral artery and abnormal high-flow signal in the left internal jugular vein (IJV) and transverse sinus, raising suspicion for dural AVF. Duplex sonography of the left vertebral artery demonstrated a to-and-fro waveform, suggesting partial subclavian steal. Conventional angiography did not reveal dural AVF but demonstrated severe stenosis of the left brachiocephalic vein, with retrograde flow in the left IJV into the intracranial venous sinuses and drainage into the contralateral IJV. The left vertebral artery was patent but showed markedly sluggish antegrade flow in the V4 segment. The patient was diagnosed with intracranial venous reflux and vertebrobasilar hemodynamic impairment secondary to left brachiocephalic vein stenosis. Balloon angioplasty and stenting of the left brachiocephalic vein were performed, after which the IJV reflux resolved. Follow-up duplex ultrasonography confirmed restoration of antegrade flow in the left vertebral artery. The patient's neurological deficits, including dysarthria and right-sided weakness, improved markedly. Discussion: This case illustrates midbrain infarction in a dialysis patient with concurrent CVS and partial subclavian steal physiology. While stagnation of vertebral artery flow may predispose to arterial embolism, intracranial venous reflux and basal vein congestion may contribute to venous infarction. In dialysis patients with acute cerebral infarction and findings mimicking dural AVF, CVS with IJV reflux should be considered in the differential diagnosis.

A case of tuberculous meningoencephalitis initially presenting as transient ischemic attack

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Purpose: Tuberculous meningoencephalitis is a rare but serious manifestation of central nervous system tuberculosis. Early diagnosis is often challenging due to its nonspecific and varied clinical presentations. We report a case in which the disease initially presented as a transient ischemic attack (TIA), preceding the development of classic meningoencephalitic features.

Methods: A 73-year-old woman presented to the emergency department with transient motor aphasia lasting several tens of minutes. Initial brain imaging was unremarkable, aside from mild-to-moderate stenosis in both proximal internal carotid arteries. She was diagnosed with TIA and started on antiplatelet therapy with plans for outpatient follow-up. Shortly after discharge, she reported a progressive cough, and chest radiography revealed findings suspicious for miliary tuberculosis. Anti-tuberculosis medications were initiated by the pulmonology team, and her respiratory symptoms began to improve. Approximately one month after her initial TIA symptoms, the patient underwent total knee arthroplasty (TKA) for knee pain. Following surgery under general anesthesia, she developed acute disorientation and was referred to neurology department. Brain MRI demonstrated findings suggestive of; meningoencephalitis, and;CSF analysis confirmed the tuberculous meningoencephalitis. She was treated with dexamethasone and anti-tuberculosis agents, with gradual neurological improvement.

Conclusions: This case highlights an uncommon initial presentation of tuberculous meningoencephalitis as TIA-like symptoms, followed by rapid neurological deterioration after systemic stress. Although her pulmonary tuberculosis was considered clinically stable, central nervous system involvement emerged suddenly in the postoperative period. Clinicians should maintain a high index of suspicion for CNS tuberculosis in patients with systemic TB, especially when new neurological symptoms arise after surgical or physiological stress.

Impact of intravenous thrombolysis on early neurological deterioration and functional outcomes after mechanical thrombectomy in patients with pre-treatment MRI

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Purpose: Mechanical thrombectomy (MT) is the standard treatment for acute ischemic stroke (AIS) due to anterior circulation large vessel occlusion (LVO). However, early neurological deterioration (END) after successful recanalization remains a serious concern, often resulting in poor functional outcomes. The benefit of intravenous tissue plasminogen activator (IV t-PA) prior to MT remains debated, especially in the context of modern imaging selection strategies. This study investigated the impact of IV t-PA on END and functional outcomes in patients with anterior circulation LVO who underwent successful MT guided by multimodal MRI including perfusion imaging.

Methods: We retrospectively analyzed 242 patients with anterior circulation LVO who underwent successful MT following pre-treatment multimodal MRI including diffusion and perfusion sequences. According to Clinical Research Collaboration for Stroke in Korea (CRCS-K), END was defined as any neurological worsening within 3 weeks of stroke onset. Functional outcomes at 90 days were measured using the modified Rankin Scale (mRS), analyzed both dichotomously (0–2 vs. 3–6) and ordinally. Predictors of END and outcomes were identified using multivariable logistic regression. The effect of END on mRS shift was assessed with ordinal logistic regression.

Results: END occurred in 9.9% of patients (n=24), with 87.5% experiencing poor 90-day outcomes (mRS 3–6) and a mortality rate of 26.2%. Absence of IV t-PA (OR=4.24; p=0.03), mild initial NIHSS score (OR=5.50; p=0.04), and proximal vessel occlusion (OR=3.79; p<0.1) were independent predictors of END. In the ordinal regression model, END was strongly associated with a shift toward worse 90-day outcomes (common OR=8.31; 95% CI, 1.98–34.92; p=0.004). Conversely, IV t-PA was associated with significantly better outcomes (OR=0.40; 95% CI, 0.20–0.78; p<0.01). Poor collateral flow visualized on perfusion MRI (e.g., elevated hypoperfusion intensity ratio) and elevated serum glucose were additional independent predictors of poor outcome.

Conclusions: END is a robust predictor of poor recovery after MT. In patients selected with comprehensive MRI including perfusion imaging, IV t-PA was associated with reduced risk of END and improved functional recovery. These findings support the use of IV thrombolysis in eligible patients even when MT is anticipated, especially when imaging confirms favorable diffusion-perfusion mismatch.

Machine learning-based prediction of in-hospital mortality in ischemic stroke using D-dimer dynamics and patient clustering

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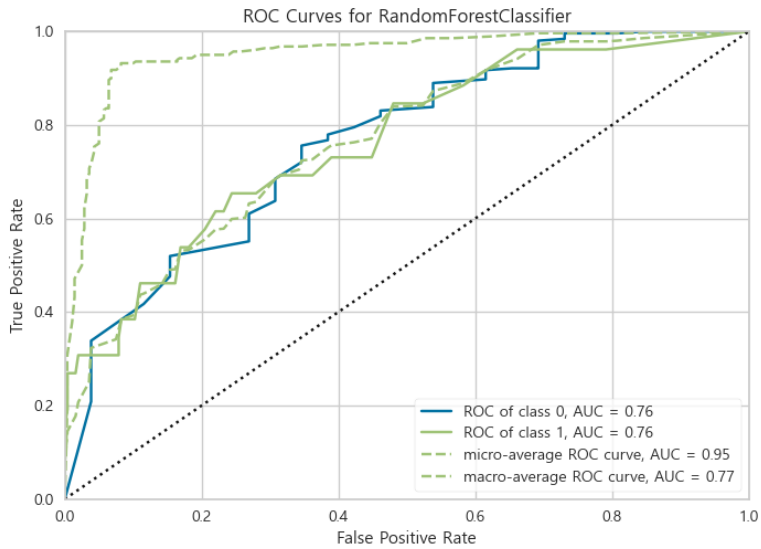
Purpose: Ischemic stroke is a leading cause of death and long-term disability in Korea, and its incidence is rising with the aging population. Although neuroimaging plays a key role in diagnosis, it often requires substantial time and resources. D-dimer, a substance released when blood clots break down, reflects thrombotic activity and may help assess treatment response and prognosis. In this study, we developed a machine learning model to predict in-hospital mortality in patients with ischemic stroke using patterns in D-dimer levels and patient subgroups identified through clustering.

Methods: We conducted a retrospective study of ischemic stroke patients admitted to Chuncheon Sacred Heart Hospital who received either thrombolytic therapy (tPA) or anticoagulants. Only patients who underwent at least two D-dimer tests during hospitalization were included. To train the model, we extracted features from D-dimer time-series data, including average values, variation over time, and overall fluctuations. These features, along with information from medication records, laboratory results, nursing assessment data, and vital signs, were used to group patients by similar response patterns using a clustering method (K-means).The final input variables for the Random Forest model included not only the D-dimer features, but also other clinical information and the cluster labels, all of which were used to predict in-hospital mortality. We also analyzed feature importance to identify which variables were most strongly associated with outcomes.

Results: Clustering analysis (K=4) identified four distinct patient subgroups with different D-dimer patterns and treatment profiles. In-hospital mortality varied significantly across these groups. The Random Forest model, trained on 66 clinical features including D-dimer dynamics, patient cluster labels, and various clinical data, achieved an accuracy of 92.1%, with a class-wise AUC of 0.76, a micro-average AUC of 0.95, and a macro-average AUC of 0.77, demonstrating strong performance despite class imbalance. The most important predictors included the mean D-dimer level, its standard deviation, and the delta (change over time) during hospitalization.

Conclusions: We proposed a data-driven approach that integrates D-dimer dynamics, patient subgrouping, and machine learning to predict in-hospital mortality in ischemic stroke patients. Our findings suggest that D-dimer is valuable not only for monitoring treatment response but also as a prognostic marker. Grouping patients based on similar patterns helped the model explain results better and improved predictions. This framework may provide clinical value in guiding stroke care, particularly in settings where

timely neuroimaging is limited.



Transient comatose event after acute medullar infarction

Jong-Hwan Choi[1], Seok-Kyung Kwon[1]

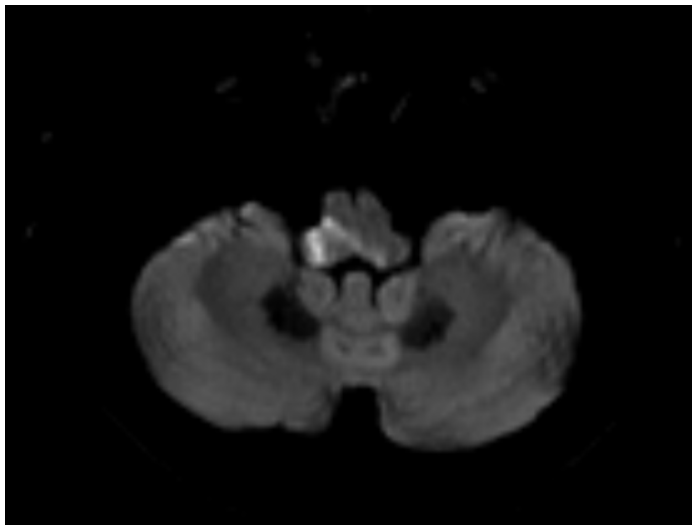
[1]Neurology, Daegu Fatima Hospital, Daegu, Korea

Purpose: Wallenberg syndrome, also known as lateral medullary syndrome, is a neurological condition caused by an infarction;in the lateral part of the medulla oblongata, typically due to occlusion of the posterior inferior cerebellar artery (PICA) or one of its branches. Respiratory arrest is rare but possible in Wallenberg syndrome, especially in severe or extensive cases. The authors report that patient;with complete coma without consciousness and spontaneous breathing at the time of admission to the emergency room were diagnosed with Wallenburg syndrome. I would like to share with you the experience of this rare case.

Methods: 2025-02-07 18:20,; A patient with 10 yr- diabetes mellitus ;suddenly became comatose and respiratory stop state. CPR was performed by a family member nearby.; Afterwards, 119 was called and contineous CPR was performed the entire time while the patient was in an ambulance. When the patient was admitted to the ER at our hospital, the patient was kept alive by a ventilator in the same condition.;In order to determine the cause of the symptoms, Rt. Wallenburg was confirmed through a brain MRI.

Results: While Wallenberg syndrome can be life-threatening in its acute stages, many patients recover with time, especially if respiratory failure is managed promptly. However, long-term rehabilitation may be needed to regain motor function and improve swallowing and speech, depending on the extent of the brainstem injury. This case teaches the importance of early recognition of the severity of neurological damage, particularly in cases that affect vital functions like respiration, and emphasizes the need for a coordinated, prompt response to prevent further complications.

Conclusions: The medulla oblongata, located at the brainstem, is essential for regulating vital functions, including breathing, heart rate, and reflexes like coughing and swallowing. Damage to this area, especially in conditions like Wallenberg syndrome, can disrupt these processes. Wallenberg syndrome can sometimes present with respiratory failure, a rare but serious complication. This underscores the critical role the medulla oblongata plays in controlling autonomic functions such as breathing, heart rate, and swallowing. When a stroke or infarction affects this region, it can interfere with these vital functions, leading to respiratory depression or failure.



Different long-term outcomes according to thrombus histology in patients with acute ischemic stroke

Hyungwoo Lee[1], Hyo Suk Nam[1,6], Ji Hoe Heo[1,6], Minyoul Baik[1,6], Joonsang Yoo[2], Jinkwon Kim[2], Tae-Jin Song[3], Gyu Sik Kim[4], Kwon-Duk Seo[4], Tae Dong Ok[4], Jin Kyo Choi[5], Il Kwon[6], Young Dae[1,6]

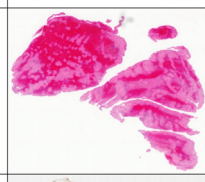
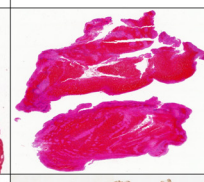
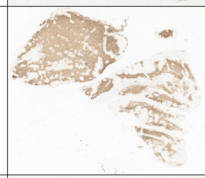
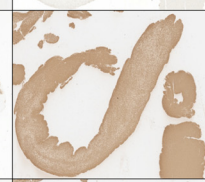
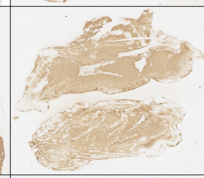
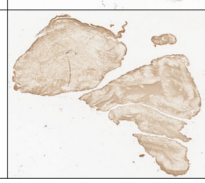
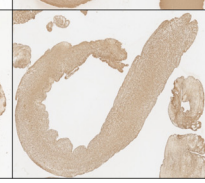
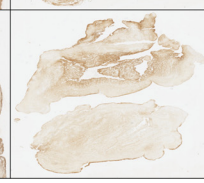
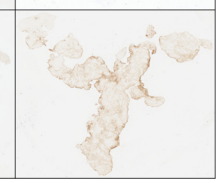
[1]Neurology, Yonsei University College of Medicine, Seoul, Korea [2]Neurology, Yongin Severance Hospital, Yonsei University College of Medicine, Yongin, Korea [3]Neurology, Seoul Hospital, Ewha Woman's University College of Medicine, Seoul, Korea [4]Neurology, National Health Insurance Service Ilsan Hospital, Goyang, Korea [5]Neurology, Seoul Medical Center, Seoul, Korea [6]Integrative Research Institute For Cerebrovascular And Cardiovascular Diseases, Yonsei University College of Medicine, Seoul, Korea

Purpose: Ischemic stroke is fundamentally a thrombotic disease in which thrombus characteristics reflect underlying vascular and systemic conditions. While previous studies have explored thrombus histology in relation to acute therapeutic outcomes such as thrombolysis efficacy or endovascular thrombectomy (EVT) success, little is known about its association with long-term patient prognosis.

Methods: This retrospective multicenter cohort study included 512 ischemic stroke patients treated with EVT between July 2017 and July 2023. Thrombus samples were analyzed by immunohistochemistry, measuring proportions of fibrin, red blood cells (RBCs), and platelets, and classified into four histological distribution patterns: layered, erythrocytic, diffuse platelet, and mixed. Associations between thrombus histology and long-term outcomes, including major adverse cardiovascular events (MACE), were assessed using Cox regression and Kaplan–Meier analyses.

Results: During a median follow-up of 38.1 months, 164 patients experienced MACE (incidence rate, 3.02 per 100 person-years). The diffuse platelet thrombus pattern was independently associated with increased risk of MACE (hazard ratio [HR], 2.66; 95% CI, 1.27–5.59; p = 0.010), including mortality (HR, 3.31; 95% CI, 1.36–8.07; p = 0.008) and stroke recurrence (HR, 5.20; 95% CI, 1.47–18.4; p = 0.011). These findings remained consistent across clinical subgroups defined by age, atrial fibrillation, cancer status, and discharge medications.

Conclusions: Histological characteristics of thrombi retrieved during EVT, particularly the diffuse platelet distribution pattern, could predict long-term prognosis in ischemic stroke patients. This highlights the importance of thrombus histology as a potential prognostic marker beyond acute stroke management.

	Layered	Erythrocytic	Mixed	Diffuse platelet
H&E				
Platelet				
Erythrocyte				
Fibrinogen				

Prognostic factors in patients with acute ischemic stroke and chronic kidney disease: How intraarterial thrombectomy affects outcomes

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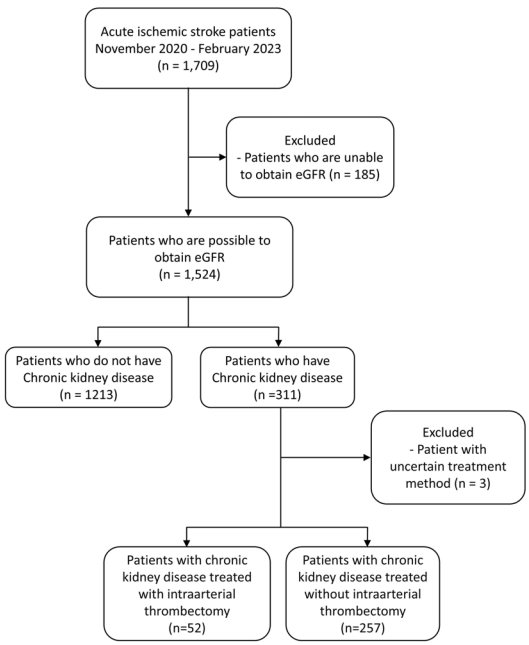
Purpose: Intraarterial thrombectomy (IAT), widely used for the treatment of acute ischemic stroke, sometimes results in adverse outcomes. IAT-associated risks in patients with chronic kidney disease (CKD) remain undefined. Therefore, this study aimed to investigate the effect of IAT on outcomes in patients with acute ischemic stroke and CKD, and to explore other prognosis-associated factors.

Methods: This study included 1,524 patients with stroke categorized into CKD and non-CKD groups to compare demographics, risk factors, and clinical outcomes. Factors affecting outcomes were investigated, and multivariate logistic regression analysis was conducted to identify important determinants.

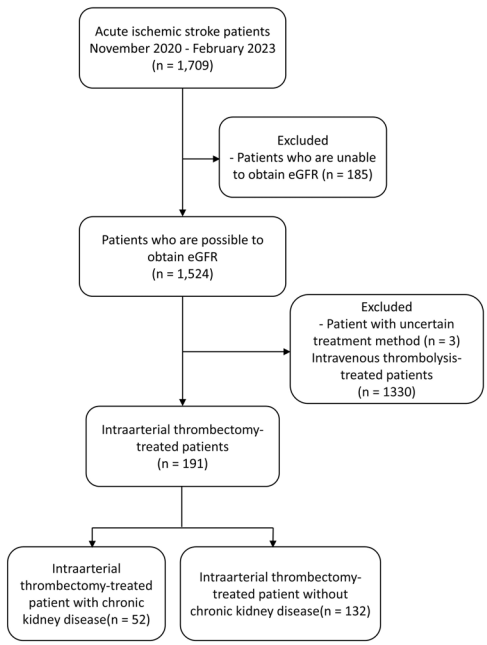
Results: In a cohort of 311 patients with acute ischemic stroke and CKD, factors associated with good outcomes, defined as a 3-month modified Rankin Scale 0–2, included younger age, absence of IAT, and higher estimated glomerular filtration rate (eGFR). Younger age and higher eGFR were associated with better outcomes, whereas IAT was associated with worse outcomes. White matter hyperintensity, early neurological deterioration, and C-reactive protein levels, which were significant in the univariate analysis, were not statistically significant in the multivariate model.

Conclusions: IAT-treated patients with ischemic stroke and CKD had worse 3-month functional outcomes than their non-IAT-treated counterparts. Older age and lower eGFR affected the prognosis. Although IAT is crucial for ischemic stroke treatment, it may lead to complications, making embolus removal difficult and potentially worsening outcomes. Moreover, renal function impairment can cause vascular damage, and older age may compromise the recovery ability of the brain both of these factors contribute to unfavorable outcomes following IAT.



A. Flowchart of the CKD population

eGFR = estimated glomerular filtration rate
mRS = modified Rankin scale
CKD = chronic kidney disease



B. Flowchart of the IAT population

eGFR = estimated glomerular filtration rate
mRS = modified Rankin scale
IAT = Intraarterial thrombectomy

Time-dependent relationship between blood pressure and functional outcome in acute ischemic stroke after endovascular thrombectomy

Kyubong Lee[1], Bum Joon Kim[2]

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Purpose: Current research on functional outcomes in acute ischemic stroke patients whose systolic blood pressure (SBP) spontaneously drops below 140 mmHg following endovascular thrombectomy (EVT) is limited. Additionally, the optimal time point at which SBP is most strongly associated with functional outcomes remains unclear. This study investigates the relationship between post-EVT SBP levels at different time points and their association with functional outcomes.

Methods: This retrospective analysis included patients who underwent EVT for acute ischemic stroke with emergent large vessel occlusion. We examined blood pressure data from the time of arrival at the emergency department through 24 hours post-EVT. Patients were categorized based on whether their SBP spontaneously dropped below 140 mmHg at different time points (immediately after EVT vs. within one hour after stabilization following EVT). We assessed factors associated with a good functional outcome, defined as a modified Rankin Scale (mRS) of 0-2, 3-months post-stroke

Results: Among the 349 patients (mean age: 71.4 ± 10.4 years; 56.2% male), 45.0% had a mean SBP < 140 mmHg immediately after EVT. Among the 237 patients who did not receive antihypertensive intervention immediately after EVT, 50.6% had a mean SBP < 140 mmHg within one hour after stabilization following EVT. Patients with a mean SBP < 140 mmHg after stabilization following EVT were significantly more likely to achieve good functional outcomes (Odds Ratio [95% Confidence Interval] = 4.62 [2.11 – 10.12], p < 0.001). In contrast, SBP < 140 mmHg immediately after EVT was not significantly associated with good outcomes in multivariable analysis (1.40 [0.78 – 2.54], p = 0.264).

Conclusions: Our findings suggest that an SBP <140 mmHg after stabilization following EVT, rather than immediately post-procedure, is significantly associated with good functional outcomes. Future prospective studies should consider using post-stabilization SBP following EVT as a more reliable indicator.

Vessel wall enhancement and high-sensitivity CRP as prognostic markers in intracranial atherosclerotic stroke: A prospective cohort study

Taewon Kim[1], Jaseong Koo[2], Seunghee Na[1]

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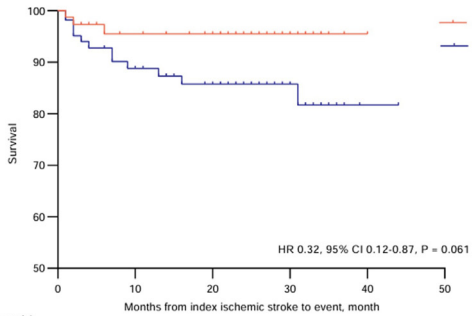
Purpose: Eccentric vessel wall enhancement (EVWE) and high-sensitivity C-reactive protein (hs-CRP) are inflammatory biomarkers associated with atherosclerotic disease. We investigated their prognostic value in patients with acute ischemic stroke receiving guideline-adherent medical treatment.

Methods: In this prospective observational cohort study, patients with acute ischemic stroke attributed to intracranial arterial disease (ICAD) underwent vessel wall MRI and hs-CRP testing. The study included intracranial cases of both large artery atherosclerosis (LAA) and small vessel occlusion (SVO). The primary outcome was subsequent ischemic stroke during the follow-up period. The median follow-up duration was 21 months. Kaplan-Meier survival and Cox regression analysis was used to determine the associations between EVWE, hs-CRP levels, and subsequent ischemic stroke.

Results: Among 191 patients, 81 (42.4%) had EVWE. EVWE positivity showed a trend towards a lower risk of subsequent ischemic stroke compared to EVWE negativity (HR 0.32, 95% CI 0.12-0.87; P=0.061). Hs-CRP levels were not associated with recurrent stroke risk. The combination of EVWE positivity and low hs-CRP levels (<1.25 mg/L) was associated with a favorable outcome, while EVWE negativity and high hs-CRP levels (≥ 1.25 mg/L) were associated with an unfavorable outcome (HR 0.143, 95% CI 0.04-0.50; P=0.031).

Conclusions: In patients with acute ischemic stroke receiving optimal medical therapy, EVWE positivity may paradoxically indicate a lower risk of recurrent stroke. The combination of EVWE and hs-CRP status provides prognostic information, with EVWE positivity and low hs-CRP levels associated with the most favorable outcome. These findings highlight the potential role of integrating imaging and serum inflammatory biomarkers in risk stratification and management of acute ischemic stroke patients.

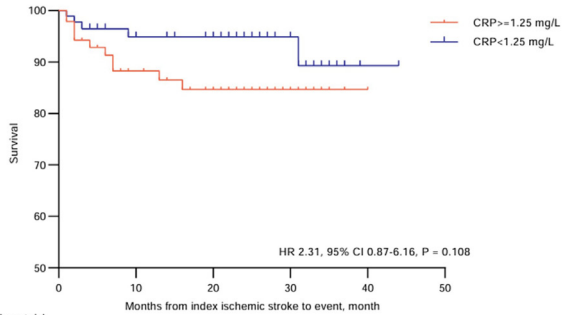
(A) Kaplan-Meier survival estimates of subsequent ischemic stroke



Number at risk

Eccentric VWE +	81	50	40	13	1
Eccentric VWE -	110	62	53	22	2

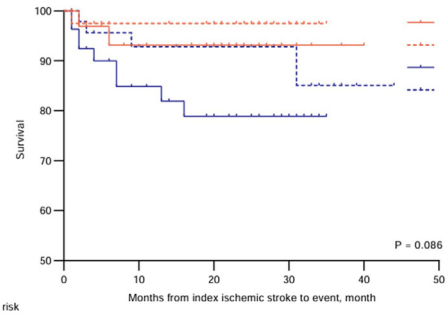
(B) Kaplan-Meier survival estimates of subsequent ischemic stroke



Number at risk

CRP>=1.25	96	55	42	16	1
CRP<1.25	95	58	51	19	2

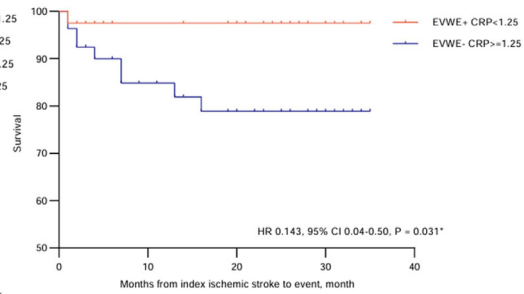
(C)



Number at risk

EVWE+ CRP>=1.25	41	24	17	7	1
EVWE+ CRP<1.25	40	28	23	7	1
EVWE- CRP>=1.25	55	32	25	10	2
EVWE- CRP<1.25	55	32	28	14	2

(D)



Number at risk

EVWE+ CRP<1.25	40	28	23	7	1
EVWE- CRP>=1.25	55	32	25	10	2

Ischemic stroke due to organizing thrombus in a post-carotid bypass pouch

Hee-Kwon Park[1], Heejung Mo[1]

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Purpose: We report an interesting case of recurrent stroke caused by organizing thrombus formation in a carotid pouch, occurring two years after carotid-carotid bypass and endarterectomy.

Methods: A 45-year-old male with a history of autosomal dominant polycystic kidney disease (ADPKD) presented with transient left monocular blindness and right arm weakness. Brain MRI and CT angiography revealed acute infarction in the left middle cerebral artery (MCA) territory, and severe stenosis of the left internal carotid artery (ICA) due to the aortic dissection involving the left common carotid and subclavian arteries. The patient transfered to departement of cardiothoracic surgery and;underwent carotid-carotid bypass and endarterectomy. Postoperatively, the patient developed surgical site bleeding, respiratory failure, and shock, requiring emergent tracheostomy and intensive care. Follow-up MRI demonstrated bilateral MCA infarctions and hypoxic brain injury. After prolonged hospitalization, the patient was transferred to a rehabilitation center. He recovered his alertness and verbal output, but remained bedridden state;due to severe spasticity and weakness in all extremities.

Results: Two years later, the patient was re-admitted with decraesed mentality;and severe dysarthria. CT angiography showed perfusion delay in the left MCA territory with decreased ICA-MCA flow. Digital subtraction angiography revealed tandem occlusion of the left ICA, and mechanical thrombectomy was performed. However, a large, cylindrical thrombotic structure remained in the left CCA. Further evaluation identified this as an organizing thrombus and plaque originating from a pouch at the anastomosis site of the carotid-carotid bypass;Redo endarterectomy was successfully performed.

Conclusions: This case highlights the rare and delayed embolic stroke caused by organizing thrombus formation in a carotid pouch, occurring two years after carotid-carotid bypass and endarterectomy.

Association between NCCT-based infarct core volume and risk of hemorrhagic transformation after recanalization therapy in acute ischemic stroke: A multicenter retrospective cohort study

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Purpose: The Alberta Stroke Program Early Computed Tomography Score (ASPECTS) on non-contrast CT scan (NCCT) is widely used to assess extent of ischemic lesion despite low to modest inter-rater agreement. In this study, we compared newly developed automated ASPECTS rating software (JLK ASPECTS) with another validated software (RAPID ASPECTS), human experts, and diffusion-weighted imaging (DWI) taken within 30 minutes of NCCT.

Methods: From 3 comprehensive stroke centers, we screened patients with acute ischemic stroke between June 2022 and December 2023. For agreement analysis, we included patients who acquired successful recanalization after endovascular thrombectomy for anterior circulation large vessel occlusion. For correlation analysis between automated ASPECT and DWI infarct volume, we included patients who underwent DWI within 30 minutes of NCCT scans. Intraclass correlation coefficients (ICC) were used to compare inter-rater agreements. Spearman correlation analysis (ρ) and receiver operating characteristics assessed the association between automated ASPECTS and DWI infarct volume at various cutoffs (30, 50, and 70 mL).

Results: The median age of population for agreement (n=74) and correlation (n=306) analysis were 75 years (interquartile range, 62–81) and 73 years (61–80) with 63.5% and 40.5% being male, respectively. JLK ASPECTS showed good agreement with RAPID ASPECTS and human experts (ICC range: 0.692–0.797). Agreement between the two software systems was higher than between human experts (0.797 vs. 0.631; p=0.039), particularly within 3 hours of onset (0.751 vs. 0.434; p=0.018). JLK ASPECTS correlated with DWI infarct volume (ρ= −0.532, p<0.001) and discriminated DWI infarct volume of 70 mL at the threshold of 5 with sensitivity of 88.2% and specificity of 95.5%.

Conclusions: Automated ASPECTS software systems exhibited higher agreement than human experts in early hours of stroke onset. Automated ASPECTS rating was correlated with DWI infarct volume and effectively identified patients with large ischemic core.

Validation of a novel automated ASPECTS software: Reliability, DWI correlation, and early ischemic core discrimination

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Purpose: Hemorrhagic transformation (HT) in acute ischemic stroke (AIS) is associated with unfavorable outcomes. Although infarct core volume is a risk factor for HT, estimating the infarct core using non-contrast CT (NCCT) remains challenging in clinical practice. This multicenter retrospective cohort study examined the association between HT, as assessed by advanced imaging, and functional outcomes and evaluated whether automated infarct core volume estimation on NCCT is associated with the risk of HT following recanalization therapy.

Methods: We analyzed data from 18 comprehensive stroke centers, including AIS patients who received recanalization therapy—intravenous thrombolysis, endovascular thrombectomy, or both—between June 2022 and April 2024. Patients with baseline NCCT and follow-up imaging (NCCT, GRE, or SWI) after recanalization therapy;were included; those with isolated posterior circulation infarcts were excluded. HT was graded using European Cooperative Acute Stroke Study (ECASS)-II classification. Clinical variables included baseline and 3-month modified Rankin Scale (mRS), initial stroke severity (National Institute of Health Stroke Scale [NIHSS]), diabetes mellitus, atrial fibrillation, and type of recanalization therapy administered.

Results: A total of 1,652 patients were included. Median age, initial NIHSS, and NCCT-based infarct core volume were 73 years (IQR 62–81), 10 (IQR 5–16), and 0.8 mL (IQR 0.2–5.9), respectively. Any HT occurred in 708 patients (42.9%), of whom 212 (30.0%) had;parenchymal hemorrhage (PH). Follow-up imaging included SWI (49.8%), GRE (27.7%), and NCCT (22.5%). In multivariable ordinal logistic regression, both hemorrhagic infarct (HI, OR 1.96, 95% CI 1.59–2.43) and PH (OR 5.42, 95% CI 4.01–7.34) were associated with worse 3-month mRS outcomes. Moreover, when using ECASS-II classification as a categorical variable with no hemorrhage as reference, there was a significant gradual increase in the odds ratios with higher ECASS-II classifications (HI 1: OR 1.49; HI 2: OR 2.53; PH 1: OR 3.82; PH 2: OR 12.72). In mixed-effects logistic regression adjusted for institution, higher initial infarct core volume was significantly associated with increased risk of both any HT and PH (OR 1.02 per 1 mL increase). Compared to the reference group (infarct core of 0–5 mL), the odds of HT and PH progressively increased across volume categories, with markedly elevated risk in the ≥50 mL group (HT: OR 6.27, 95% CI 3.58–11.69; PH: OR 7.52, 95% CI 4.61–12.27).

Conclusions: HT including even HI following recanalization therapy in AIS is significantly associated with poor functional outcomes. Automated NCCT-based infarct core volume correlates with HT risk and may serve as a valuable decision-support tool in acute stroke management.

Patient-caregiver dyadic approach for post-stroke rehabilitation

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Purpose: Stroke has become one of the leading causes of chronic disability in adult population worldwide. Hemiplegia is one of the most common motor dysfunctions of stroke, which not only affects the quality of life (QoL) of patients but also brings a huge economic burden to families and society. Studies have shown that rehabilitation plays a crucial role for stroke survivors in promoting functional recovery, improving QoL, and gaining independence. In recent years, coaching has gradually been applied in home-based stroke occupational therapy, and published research results show that the combination of coaching and occupational therapy can mobilize the internal motivation and innovative thinking of home-based stroke patients, and improve occupational performance, self-management, and compliance. This study aimed to synthesize the method and utility of dyadic post-stroke rehabilitation programs, to evaluate the program outcomes, and to discuss implications for nurses and nursing practice in poststroke patient care as well as caregiver education.

Methods: The search process of the study was carried out adhering to the guidelines of PRISMA for conducting systematic reviews. After the study protocol was prospectively designed and registered, a systematic search was conducted using MEDLINE, Embase, CINAHL and Web of Science databases. A two-phase approach was performed to expedite the search process with an effort to remain rigorous search but prevent any potential bias. Reviewers independently assessed titles, abstracts and full-text articles. Any disagreements were resolved by consensus or consultation with a third reviewer. Data were extracted using a predefined, standardized form.

Results: A total of 23 studies satisfied our inclusion criteria. The majority of the identified studies were conducted in the north America, and the sample size ranged from 7 to 853 dyads. The outcomes of the health programs focused on cognitive, physical, psychological, social and family functions in the dyads, the caregiver burden and QoL in the dyads. The majority of the studies reported positive outcomes in both stroke survivors and caregivers, especially in terms of psychological, social and family functions and QoL.

Conclusions: Dyadic post-stroke rehabilitation programs are associated with improvements in survivor outcomes as well as caregiver outcomes. Standard use of dyadic interventions that combine skill-building strategies with psychosocial education will allow better stroke survivor and caregiver outcomes. Healthcare personnel should consider providing and supporting rehabilitation programs with dyadic approach as a replacement for traditional programs that separate survivors and caregivers. Future studies with larger, multi-center dyadic population is recommended.

Prediction of atrial fibrillation using only transthoracic echocardiography report: Development and external validation

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[1]Department of Neurology, Chung-Ang University Gwangmyeong Hospital, Gyeonggi-Do, Korea [2]Department of Neurology, Yonsei University College of Medicine, Seoul, Korea

Purpose: This study aimed to develop and externally validate an interpretable machine learning model to predict atrial fibrillation in patients with stroke using transthoracic echocardiography data.

Methods: This was a retrospective cohort study including consecutive patients admitted for stroke from two comprehensive stroke centers who had transthoracic echocardiography performed. For development, patients admitted between March 2022 to July 2024 were included, and patients admitted between January 2023 and January 2024 were included for external validation. A total of 37 variables consisting of basic demographic variables and variables included in the transthoracic echocardiography report were used. Temporal splitting was used to further split the development cohort into train/test dataset. Machine learning algorithms included extreme gradient boosting, support vector machine, light gradient boosting machine and multilayer perceptron. Shapley additive explanation was used to analyze feature attribution. For clinical usage, a simple rule-based model using the most important variables was constructed.

Results: A total of 1,035 patients (410 for development and 625 for external validation) were included and 20.4% (212 patients, 73 for development and 139 for external validation) had atrial fibrillation. The extreme gradient boosting model showed the highest area under the receiver operating characteristic curve of 0.894 (95% confidence interval, 0.766-0.990) on the test dataset. The model also performed well with an area under the receiver operating characteristic curve of 0.803 (95% confidence interval, 0.613-0.964) on external validation. Only transthoracic echocardiography variables were included in the top five most important features: E/A ratio, left atrial end-systolic volume index, global longitudinal strain, left atrium size, and lateral tricuspid annulus peak systolic velocity. On dependence analysis, the importance of large atrium size reduced when stroke volume was high. In addition, the simple rule-based model showed a positive predictive value of 75.6% and negative predictive value of 81.5% on external validation dataset.

Conclusions: Machine learning can be used to predict atrial fibrillation using mainly transthoracic echocardiography data in acute stroke patients.

Analysis of thrombus characteristics and immunothrombosis in ischemic stroke patients undergoing thrombectomy

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[1]Neurology, Ajou University School of Medicine, Suwon, Korea [2]Biomedical Sciences, Ajou University School of Medicine, Suwon, Korea

Purpose: Detailed histological analysis and understanding of ischemic stroke thrombi may improve our understanding of ischemic stroke pathophysiology and future targets of treatment.

Methods: We analyzed thrombus characteristics using Hematoxylin and Eosin (H&E) staining, Martius, Scarlet and Blue (MSB);staining, and immunohistochemistry for markers of immunothrombosis. The composition of thrombi was trichotomized to RBC (red blood cell) rich, mixed, and fibrin/platelet rich;based on percent RBC − percent Fibrin/Platelet components on MSB staining. Patient characteristics, stroke etiology, reperfusion outcomes, and clinical outcomes were evaluated, along with detailed thrombus characteristics.

Results: From September 2017 to May 2019, 98 patients were included in the analysis. Among them, 44.4% could be classified as RBC rich, 38.4% as mixed thrombi, and 16.2 as platelet rich thrombi. Percent RBC was inversely associated with fibrin (R=-0.51, p<0.001), von Willebrand factor;(vWF, R=-0.43. p<0.001), CD41 (R=-0.42, p<0.001), and CD142 (R=-0.23,p=0.022), while percent fibrin was associated with NE (R=0.27, p=0.008), vWF (R=0.508, p<0.001), CD41 (R=0.22, p=0.028). Stroke etiology was not associated with thrombus composition classification nor was it associated with individual parameters. Modified first pass effect was more commonly;observed in platelet rich and mixed thrombi, while lower in the RBC rich thrombi (75.0% vs. 71.1% vs. 40.9%, p=0.007). Trichomotized thrombus composition classification did not show association with early neurological deterioration (END) or good functional outcomes. Individually, thrombi in patients with END showed a lower rate of NE (3.5 ± 25% vs. 6.7 ± 3.8%, p<0.001) and CD41 (15.5 ± 6.2% vs. 26.8 ± 12.2%, p<0.001). No thrombus composition was associated with functional outcomes.

Conclusions: Higher fibrin/platelet content seems to be associated with immunothrombosis profiles. As it does not always seem to be associated or predictive of reperfusion outcomes and clinical outcomes,;further detailed studies are warranted.

A robust hybrid deep learning and machine learning model for affected brain volume prediction from computed tomography perfusion images

Gi-Youn Kim[1], Hyeon Sik Yang[1], Jundong Hwang[1], Kijeong Lee[1], Jin Wook Choi[2], Woo Sang Jung[2], Regina Eun Young Kim[1], Donghyeon Kim[1], Minho Lee[1]

[1]Research Institute, Neurophet Inc., Seoul, Korea [2]Department of Radiology, Ajou University School of Medicine, Suwon, Korea

Purpose: Volumetric estimation of affected brain volumes using computed tomography perfusion (CTP) is crucial in managing acute ischemic stroke (AIS) and often relies on commercial software, which often generates outputs as if the images are of normal quality, even when they are suboptimal. Our approach, however, assesses image quality using machine learning (ML) techniques and issues clear warnings when it is insufficient, ensuring clinicians are aware of potential inaccuracies.

Methods: We included 499 CTP images of patients with AIS with manually annotated vessel landmarks provided by expert radiologists, collected between 2021 and 2023. We developed a CNN-based approach for predicting eight vascular landmarks from CTP images, integrating ML components. The ML components serve as fail-safe in the proposed method by validating intensity curves from landmarks improving overall data assessment ability. It checks their peak Hounsfield units and correlation to the landmark, which may be affected by patient motion, poor contrast bolus, and more in CTP image making it inappropriate for analysis. We then used conventional methods to generate perfusion maps and compared the results with those of the RapidAI software (RapidAI, Menlo Park, California).

Results: The proposed CNN model achieved an average Euclidean distance error of 4.632.00 mm on the test set. Without the ML components, compared to RapidAI, our method yielded concordance correlation coefficient (CCC) scores of 0.898 for estimating volumes with cerebral blood flow (CBF) < 30% and 0.715 for Tmax > 6 s. Using the ML method, it achieved CCC scores of 0.905 for CBF < 30% and 0.879 for Tmax > 6 s, and the proposed method correctly identified 80% of the given inappropriate CTP images.

Conclusions: We developed a robust hybrid model combining deep learning and ML techniques for volumetric estimation of affected brain volumes using CTP in patients with AIS, ensuring potential inaccuracies are not missing out.

Table 1. Comparison of CTP image validation accuracy. Correct warnings means warnings were given on the inappropriate CTP image. Incorrect Warnings means warnings were given on the appropriate CTP image.

Method	Correct Warnings	Incorrect Warnings	Accuracy
Proposed method	**48**	**12**	**0.80**
RapidAI	37	23	0.62

Clinical outcomes and risk factors of restenosis after carotid artery stenting

So Yun Pyun[1], Hyun Kyung Kim[1], Hyung Jun Kim[1], Kyeong-Moon Kim[1], Oh Young Bang[1], Jong-Won Chung[1], Yang Jin Park[2], Wook Kim[3], Keon Ha Kim[3], Pyoung Jeon[3], Woo-Keon Seo[1]

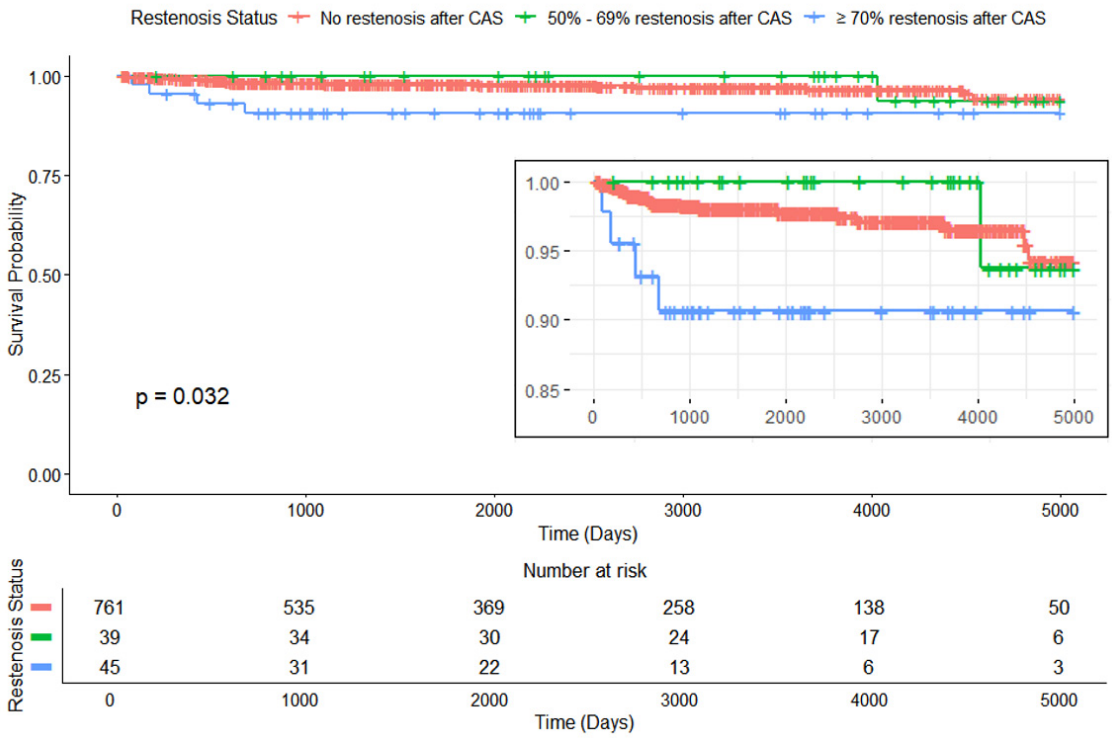
[1]Neurology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Gangnam-Gu, Korea [2]Surgery, Samsung Medical Center, Sungkyunkwan University School of Medicine, Gangnam-gu, Korea [3]Radiology, Samsung Medical Center, Sungkyunkwan University School of Medicine, Gangnam-gu, Korea

Purpose: Restenosis after carotid artery stenting (CAS) is one of the most common complications and is associated with an increased risk of stroke. However, few studies have independently evaluated restenosis and its clinical outcomes following CAS, and standardized treatment guidelines are lacking. This study aims to determine whether post-CAS restenosis increases the incidence of stroke in clinical practice and to identify its risk factors by analyzing patients who developed restenosis.

Methods: This retrospective study analyzed data from 845 patients who underwent CAS at Samsung Medical Center in South Korea between 1997 and 2023. Restenosis was assessed based on the presence of in-stent restenosis on carotid ultrasound.

Results: Among the 845 patients in the study group, 84 (9.94%) developed restenosis, including 45 (5.33%) with restenosis of 70% or more. The cumulative 1-year and 5-year post-CAS stroke incidence was 1.0% (n = 7), and 2.0% (n = 13) In the group without restenosis, 0% In the 50-70% group, and 4.4% (n=2) at 1 year and 9.4% (n=4) at 5 in the ≥70% restenosis group. Kaplan-Meier analysis demonstrated that these rates were significantly higher than those in patients without restenosis or with 50-69% restenosis (log-rank test, p = 0.032). Restenosis over 70% was associated with an increased risk of stroke (HR 3.166, 95% CI 1.059 − 9.462, p = 0.039) in the multivariate model.

Conclusions: Severe restenosis (≥70%) after CAS significantly increases the risk of stroke, highlighting the importance of rigorous monitoring and appropriate treatment strategies.


Restenosis Status
No restenosis after CAS
50% - 69% restenosis after CAS
≥ 70% restenosis after CAS
Survival Probability
1.00
0.75
0.50
0.25
0.00
p = 0.032
0
1000
2000
3000
4000
5000
Time (Days)
Number at risk
Restenosis Status
761 535 369 258 138 50
39 34 30 24 17 6
45 31 22 13 6 3
0
1000
2000
3000
4000
5000
Time (Days)

A nationwide analysis of physical inactivity and sedentary behavior among stroke survivors in Korea

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Purpose: Physical inactivity and prolonged sedentary behavior (SB) are common in stroke survivors (SSs) and are associated with poor health outcomes and functional decline. However, population-level data identifying the key sociodemographic and health-related predictors of low physical activity (PA) and long sedentary time (ST) among Korean SSs are limited.

Methods: This cross-sectional study analyzed data from the 2016–2020 Korea National Health and Nutrition Examination Survey (KNHANES), including 28,146 adults aged ≥19 years, of whom 633 were SSs without severe disability. Physical activity and ST were assessed through standardized self-reported questionnaires. Moderate-to-vigorous PA (MVPA), resistance exercise (RE), and ST were categorized according to WHO guidelines. Multivariate logistic regression analyses identified factors independently associated with aerobic physical inactivity (API), insufficient RE (≤1 day/week), and long ST (≥8 h/day).

Results: Among the 28,146 participants, 633 were stroke survivors (SSs). SSs were older and had more comorbidities, including hypertension, diabetes, and ischemic heart disease, compared to non-stroke participants. SSs engaged in significantly less moderate-to-vigorous physical activity (MVPA; 53.6% vs. 66.2%, $p < .001$) and less frequent resistance exercise (RE; 18.0% vs. 22.6%, $p = .022$). Particularly in the 70–79 age group, SSs spent significantly longer sedentary time (ST), averaging 9.7 hours per day versus 8.6 hours in controls ($p < .001$). Multivariate analyses revealed that aerobic physical inactivity (API) in SSs was independently associated with older age (≥80 years; aOR=5.45), lower education level (≤middle school; aOR=2.18), and rural residence (aOR=1.91). Insufficient RE (≤1 day/week) was more likely among women (aOR=2.36) and those with lower education (aOR=2.31). Long ST (≥8 h/day) was associated with being economically inactive (aOR=1.90), living without a spouse (aOR=1.68), and perceiving poor health (aOR=1.59). Sensitivity analyses using alternative thresholds (e.g., ST ≥6 h, RE <1 session/week) confirmed these associations.

Conclusions: This nationwide analysis highlights that Korean SSs are more vulnerable to physical inactivity and sedentary lifestyles, particularly among older, socioeconomically disadvantaged, and rural populations. Tailored interventions—including community-based exercise programs and policy-level strategies—are urgently needed to reduce SB and promote PA in SSs. Future rehabilitation efforts should consider educational, economic, and geographic disparities to ensure equitable support for post-stroke recovery.

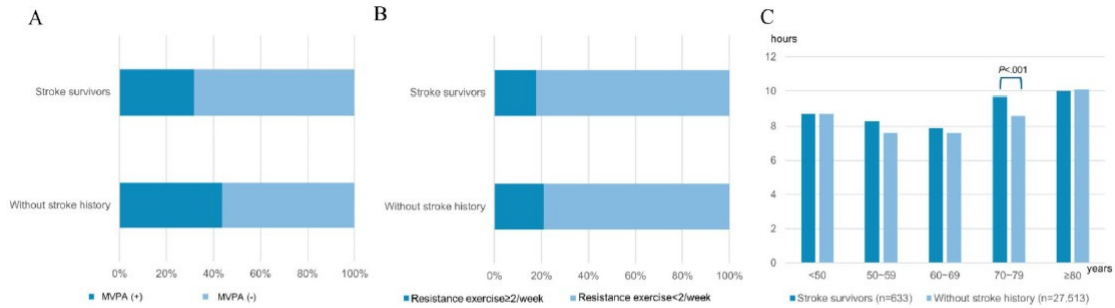

Fig. 1. Aerobic physical activity, resistance exercise frequency, and sedentary time by age in stroke survivors. (**A**) Aerobic physical activity practice was compared between stroke survivors and participants without a history of stroke. Moderate-to-vigorous aerobic physical activity was defined as ≥ 75 min of vigorous-intensity exercise weekly, ≥ 150 min of moderate-intensity exercise weekly, or a combination of vigorous- and moderate-intensity activity. (**B**) Comparison of resistance exercise frequency between stroke survivors and participants without a history of stroke. (**C**) Comparing sedentary time between stroke survivors and those without a history of stroke by age.

Effects of hearing difficulty on stroke: Retrospective cohort and mendelian randomization studies

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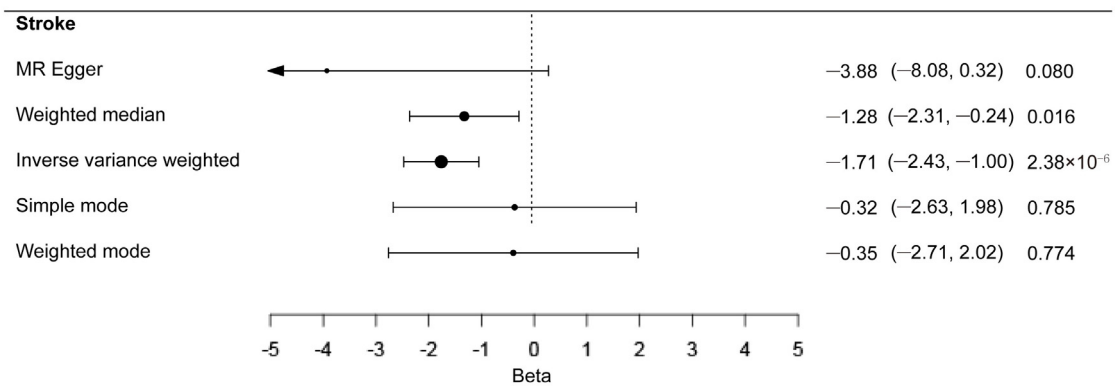
Purpose: Despite observational studies associating hearing difficulty (HD) with an increased risk of stroke, biases, such as confounding and reverse causation, remain. This study aimed to examine the causal association between HD and stroke more definitively using Mendelian randomization (MR).

Methods: A two-sample MR approach was employed using genetic variants identified from genome-wide association study data of European descent, sourced from the UK Biobank and FinnGen. This approach was complemented by retrospective cohort analyses of the Korean National Health Insurance Service Health Screening (NHIS-HEALS) and UK Biobank databases, applying propensity score matching and time-dependent Cox proportional hazards models to evaluate stroke risk associated with HD.

Results: MR analyses revealed a significant negative causal association between HD and stroke risk (β = −1.71; 95% confidence interval [CI], −2.43 to −1.00; p = 2.38 × 10−6). In contrast, observational studies revealed that HD significantly increased the risk of stroke in both the Korean NHIS-HEALS (adjusted hazard ratio [aHR] = 1.83; 95% CI, 1.69 to 1.98; p < 0.001) and UK Biobank (aHR = 1.60; 95% CI, 1.37 to 1.88; p < 0.001) databases.

Conclusions: MR analyses and observational cohort studies provided conflicting evidence on the effects of HD on stroke risk. This divergence underscores the complexity of the association between HD and stroke and highlights the need for further investigation of the underlying biological mechanisms.



Recurrent stroke risk and predictors in symptomatic vertebral artery steno-occlusion

Do Yeon Kim[1], Jeong-Yoon Lee[2], Nakhoon Kim[1], Jun Yup Kim[1], Beom Joon Kim[1], Moon-ku Han[1], Hee-Joon Bae[1]

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Introduction: Although current treatment guidelines for symptomatic vertebral artery (VA) stenosis recommend medical management with antiplatelet agents, lipid-lowering therapy, and antihypertensives, the efficacy of revascularization strategies including stenting or endarterectomy remains uncertain. However, the incidence of recurrent ischemic stroke (RIS) in patients with symptomatic VA steno-occlusion under standard medical therapy is now well known. This study aimed to evaluate the incidence of RIS and identify patients group at high risk of RIS to consider additional treatment strategies.

Methods: We conducted a retrospective analysis of patients diagnosed with acute ischemic stroke or transient ischemic attack (TIA) between 2011 and 2022 at a single tertiary stroke center. Individuals with symptomatic VA steno-occlusion, defined as ≥50% luminal narrowing or complete occlusion, were included. A multivariable Cox proportional hazards model was used to assess predictors of RIS, adjusting for demographic and vascular risk factors, baseline stroke severity, acute treatments, and discharge medications. Subgroup analysis were also performed within patients prescribed both antiplatelet and statin medications.

Results: Of 11,884 patients evaluated, 928 (7.8%) had symptomatic VA steno-occlusion. The cohort had a mean age of 62.7 years (±14.4), and 72.6% were male. At discharge, 92.5% received antiplatelets and 92.8% were prescribed statins and 815 patients (88%) were prescribed both. EVT and angioplasty were performed in 3.7% and 3.1% of cases, respectively. The 1-year cumulative incidence of RIS was 13.6% (95% CI, 11.5–16.0%), with similar rates in the stenosis group (12.6%, 95% CI, 10.1–15.7%) and the occlusion group (14.9%, 95% CI, 11.6–18.9%). In adjusted analysis, older age (HR 1.02, 95% CI 1.00–1.03; p=0.022) and EVT (HR 2.68, 95% CI 1.36–5.28; p=0.004) were significantly associated with RIS. Among patients discharged on both antiplatelet and statin therapy, older age (HR 1.02, 95% CI, 1.00–1.03; p = 0.022) and EVT (HR 3.17, 95% CI, 1.39–7.20; p = 0.006) remained independently associated with RIS.

Conclusion: In patients with symptomatic vertebral artery steno-occlusion, the risk of recurrent ischemic stroke remains considerable despite high adherence to antiplatelet and statin therapy. Older age and the use of endovascular treatment were consistently associated with increased risk of RIS, both in the overall patients and among those receiving dual medical therapy. These findings highlight the need for refined risk stratification and consideration of individualized treatment strategies beyond standard medical management in selected high-risk patients.

2025 대한뇌졸중학회 춘계학술대회

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† **Abbreviations: AAN**, American Academy of Neurology; **ADA**, American Diabetes Association; **CPS**, Canadian Pain Society; **EFNS**, European Federation of Neurological Societies; **ESMO**, European Society for Medical Oncology; **IASP**, International Association for the Study of Pain; **JSPC**, Japan Society of Pain Clinicians; **KSSS**, Korean Society of Spine Surgery; **NICE**, National Institute for Health and Care Excellence; **KDA**, Korean Diabetes Association.

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