



2023

대한뇌혈관내치료의학회

정기학술대회 및 총회

Theme Better Policies for Better Stroke Care

일시 2023년 11월 25일 (토)

장소 가톨릭대학교 성의교정 옴니버스파크 L층

존경하는 대한뇌혈관내치료의학회 회원 여러분 안녕하십니까?



대한뇌혈관내치료의학회 회장 장철훈입니다.

유난히 무덥고, 비도 많은 여름이 지나가고 이제는 정말 가을임을 느낄 수 있는 계절입니다.

제가 2021년 12월 회장에 취임하고 현 집행부와 마지막으로 기획하는 “2023년 대한뇌혈관내치료의학회 정기학술대회 및 총회”를 위한 인사 말씀 드리게 되어 감회가 새롭습니다.

이번 정기학술대회의 주제는 “Better Policies for Better Stroke Care”입니다.

최근 사회문제로 대두된 중증/응급 뇌혈관질환치료를 위한 효율적 인적 네트워크 구성 관련 정책 개발을 위해 본 학회는 대한뇌혈관외과학회, 대한신경외과학회와 협력하며 많은 노력을 기울였고 이제는 그 가시적 결과물을 기대할 수 있는 시점에 도달하였다 생각하고 있으며, 이러한 정책이 중증/응급 뇌혈관질환을 가진 환자를 치료하기위한 이상적인 의료 환경 조성으로 연결 되기 위하여는 회원 여러분들의 자발적이고 적극적인 참여가 필수 요소라 판단됩니다. 이번 정기학술대회를 통해 우리는 회원들간의 임상적, 실험실적 연구 결과를 공유함과 동시에 효율적으로 중증/응급 뇌혈관질환을 가진 환자를 치료하기 위한 학회 및 회원들의 역할에 대하여 한번 더 고민할 수 있는 기회가 되기를 기대합니다.

또한 이전과 달리 이러한 국가 정책 수립 과정에 저희 학회가 적극적으로 참여 할 수 있었던 것은 여러 전임 회장님들과 학회 임원들, 회원들의 도움으로 우리 학회가 성숙한 역량을 가진 덕분이라 판단되어 이 자리를 빌어 모든 분들께 감사의 말씀 전합니다.

이번 정기 학술대회 및 총회를 준비하느라 수고하신 김영우 총무이사, 권현조 학술이사를 포함한 임원진들과 항상 학회 발전을 위해 노력해 주신 기업 회원분들께 다시 한번 감사 말씀 드립니다.

쉽 없이 달려온 2년이었습니다.

2023년 11월 현 집행부가 마지막으로 준비하는 정기학술대회 및 총회에서 뵙기를 희망합니다.

감사합니다.

2023. 11

대한뇌혈관내치료의학회 회장 장 철 훈

2022~2023 대한뇌혈관내치료의학회 임원진

상임 운영 위원회

직 위	성 명	소 속
회장	장 철 훈	영남대학교병원
부회장	권 순 찬	울산대학교병원
총무	김 영 우	가톨릭대학교 의정부성모병원
학술	권 현 조	충남대학교병원
정책	신 승 훈	차의과대학교 분당차병원
	박 석 규	순천향대학교 서울병원
	권 오 기	분당서울대학교병원
재무	고 준 경	부산대학교병원
수련교육	김 태 곤	차의과대학교 분당차병원
	박 중 철	울산대학교 서울아산병원
간행	하 성 곤	고려대학교 안산병원
보험	박 석 규	순천향대학교 서울병원
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	이 성 호	서울대학교병원
	박 근 영	연세대학교 세브란스병원
대외협력	김 성 림	가톨릭대학교 부천성모병원
	강 동 훈	경북대학교병원
	김 범 태	순천향대학교 부천병원
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법제윤리	이 종 영	한림대학교 강동성심병원
홍보	신 희 섭	강동경희대학교병원
전산정보	신 동 성	순천향대학교 부천병원
	남 택 균	중앙대학교병원
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진료지침	최 재 형	동아대학교병원
연보 · 학회사편찬	임 용 철	아주대학교병원
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	허 준	명지성모병원
	전 우 열	대구굿모닝병원
	김 희 섭	청주효성병원
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	이 찬 희	영남대학교병원 순환기내과
	옥 민 수	울산대학교병원 예방의학과
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	김 기 훈	고려대학교 안산병원 재활의학과
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	정 용 안	가톨릭대학교 인천성모병원 핵의학과
	이 아 름	순천향대학교 부천병원 영상의학과
	김 광 준	연세대학교 세브란스병원 노년내과

2022~2023 대한뇌혈관내치료의학회 임원진

직 위	성 명	소 속
별정직 이사 (학술지편집)	김 대 원	원광대학교병원
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	오 인 호	중앙보훈병원
	김 소 연	가톨릭관동대학교 국제성모병원
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대구/경북지회	이 혁 기	안동병원
대전/충청지회	정 승 영	을지대학교 대전병원
부산/울산/경남지회	고 준 경	부산대학교병원
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회장 간사	하 성 곤	고려대학교 안산병원
총무 간사	김 훈	가톨릭대학교 부천성모병원
학술 간사	오 재 상	가톨릭대학교 의정부성모병원

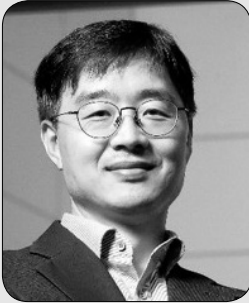
명예회장

직 위	성 명	소 속
명예회장	백 민 우	인보의료재단 뉴고려병원
	권 도 훈	울산대학교 서울아산병원
	김 영 준	오산한국병원

전임회장단

직 위	성 명	소 속
초대, 제2대	백 민 우	인보의료재단 뉴고려병원
제3대	김 영 준	오산한국병원
제4, 5대	권 도 훈	울산대학교 서울아산병원
제6대	안성기(작고)	(전) 한림대학교 성심병원
제7대	신 용 삼	가톨릭대학교 서울성모병원
제8대	권 오 기	분당서울대학교병원
제9대	김 범 태	순천향대학교 부천병원
제10대	성 재 훈	가톨릭대학교 성빈센트병원
제11대	고 준 석	강동경희대학교병원
제12대	윤 석 만	순천향대학교 천안병원

초청연자



최 홍 수

Professor, Department of Robotics and Mechatronics Engineering
Daegu-Gyeongbuk Institute of Science and Technology (DGIST)

[Education]

2002.02 B.S., Mechanical Engineering, Yeungnam University, Korea
2003.08 M.S., Mechanical Engineering, WSU, Pullman, WA, USA
2007.08 Ph.D., Mechanical Engineering, Washington State University (WSU), Pullman, WA, USA

[Professional Career]

2010.10–2014.02 Assistant Professor, DGIST, Daegu
2013.11–Present Co-Director, DGIST-ETH Microrobot Research Center, DGIST, Daegu
2014.03–2018.02 Associate Professor (Early tenured and promotion), DGIST, Daegu
2017.06–Present Director, Global Research Laboratory, DGIST, Daegu
2018.02–2019.02 Visiting Professor, Korea Brain Research Institute, Daegu
2018.03–Present Professor (Early promotion), Department of Robotics and Mechatronics Engineering, DGIST, Daegu
2019.07–2023.03 Chair, Department of Robotics and Mechatronics Engineering, DGIST, Daegu
2019.09–2020.12 Co-Founder and Co-CEO, ImSystem, Daegu
2021.01–Present Co-Founder and Technical Advisor, Im Systems, Daegu
2021.08–Present Director, Center for Targeted Neural Networks Reconstruction, National Science Challenge Initiatives
2022.01–Present Director, The First Center of Excellence (CoE) of DGIST
2023.02–Present Co-Founder and CTO, Miracure, Gyeonggi

초청연자



Naoto Kimura

Director of Department of Neurosurgery, Iwate Prefectural Central Hospital

[Education]

1994-2000	Medical Education in Akita University
2000-2003	Resident in Iwate prefecture Hospital
2003-	Belong to department of Neurosurgery, Tohoku university
2010	Graduate school of Tohoku University (Ph.D)
2013-	Belong to Department of Neurosurgery, Iwate Prefectural Central Hospital
2021-	Director of Neurology and Neurosurgery Center, Iwate Prefectural Central Hospital
2023-	Clinical Professor of Department of Neurosurgery, Tohoku University

[Certification]

2008	Japanese board of Neurosurgery
2009	Japanese board of Neuroendovascular
2009	Japanese board of Stroke
2018	Technology certified doctor of Stroke Neurosurgery

08:20-08:50	Registration	
08:50-09:00	Opening Remark	장철훈(대한뇌혈관내치료의학회 회장)
	Congratulatory Address	권정택(대한신경외과학회 이사장) 박익성(대한뇌혈관외과학회 회장)

09:00-10:00	Free Paper I(Aneurysm)	좌장: 김범태(순천향대) 성재훈(가톨릭대)
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09:00-09:10	Assessing Consensus and Variability in Treatment Decisions for Unruptured Intracranial Aneurysms: A Retrograde Multi-Center International Study Utilizing the Grade of Recommendation System	김영덕(분당서울대학교병원).....15
09:10-09:20	Elevated Blood Viscosity Is Associated with Delayed Cerebral Ischemia in Patients with Aneurysmal Subarachnoid Hemorrhage	이호준(순천향대학교 부천병원)16
09:20-09:30	Strategy of Stretched Coils: Insights from a Single Center Experience	박종현(순천향대학교 천안병원)17
09:30-09:40	Woven EndoBridge(WEB) Embolization in Small, Shallow Unruptured Bifurcation Cerebral Aneurysms	김대원(원광대학교병원).....19
09:40-09:50	New Methodology of Volume-based Woven EndoBridge(WEB) Selection and One-year Adequate Aneurysm Occlusion	한현진(연세대학교 세브란스병원).....20
09:50-10:00	Feasibility and Safety Values of Activated Clotting Time Guided Systemic Heparinization in Coil Embolization for Unruptured Intracranial Aneurysms	장동규(가톨릭대학교 인천성모병원).....22

10:00-10:50	학술상 및 연구비지원 학술연구발표	좌장: 김태곤(차의과학대) 황교준(분당제생병원)
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10:00-10:10	1. 에스포항병원 학술상 The inhibition rate estimated using VerifyNow can help to predict the thromboembolic risk of coil embolization for unruptured intracranial aneurysms (The Journal of Neurointerventional Surgery,2022;14:589-592)	김영덕(분당서울대학교병원).....27
10:10-10:20	2. 명지성모병원 남천학술상 Summary of personal research published between 2018 and 2022	최재호(가톨릭대학교 서울성모병원).....28
10:20-10:30	3. 薦宅(위택) 권도훈 명예회장 학술상 Retrospective 6 month-outcomes and prognostic factors following spontaneous angiogram-negative non-perimesencephalic subarachnoid hemorrhage (Journal of Clinical Neuroscience, 2022;96:12-18)	김명수(칠곡경북대학교병원).....31

10:30-10:40	4. Association between dynamic changes of blood biomarkers and prognosis of patients who underwent neuro-intervention for ischemic or hemorrhagic stroke	이호준(순천향대학교 부천병원).....32
10:40-10:50	5. Development of artificial intelligence model to predict the short and long-term prognosis after acute ischemic stroke	오재상(가톨릭대학교 의정부성모병원)~33
10:50-11:10	Photo Time & Coffee Break	

11:10-12:10 Free Paper II (Ischemia)

좌장: 윤석만(순천향대)
임용철(아주대)

11:10-11:20	Spontaneous Intracranial Artery Dissection as a Cause of Acute Ischemic Stroke in the Anterior Circulation: Analysis of Clinical and Morphological Characteristics and Outcomes	구자호(아주대학교병원).....37
11:20-11:30	Comparison of clinical and radiological outcomes between suction aspiration method and combination method of intra-arterial therapy (IAT) in large artery occlusion: prospective multicenter trials: interim results of COMPETE trials	진성철(인제대학교 해운대백병원).....39
11:30-11:40	The Influence of Retriever Stent Size On Mechanical Thrombectomy for Distal Middle Cerebral Artery Occlusion	송승윤(가톨릭대학교 성빈센트병원).....41
11:40-11:50	Association of Tirofiban and Intracranial Hemorrhage After Mechanical Thrombectomy for Acute Anterior Circulation Occlusion	서동욱(순천향대학교 서울병원).....42
11:50-12:00	Correlation between In-stent Restenosis Following Carotid Artery Stenting and Platelet Reactivity to Clopidogrel: Quantitative Assessment with P2Y12 Reaction Unit and Inhibition Rate	권민용(계명대학교 동산병원).....43
12:00-12:10	Distal Placement of Balloon Guide Catheter Facilitates Stent-retriever Mechanical Thrombectomy for Acute Ischemic Stroke in the Anterior Circulation	이인형(고려대학교 안산병원).....45

12:10-13:10 Luncheon Symposium

좌장: 정진영(참포도나무병원)
정준호(연세대)

12:10-12:30	1. Advancing Outcomes of Endovascular Treatment: The Role of Perclose ProStyle in Vascular Closure Techniques	김성현(가톨릭대학교 부천성모병원).....49
12:30-12:50	2. Our Current Strategy for MeVO Treatment - AXS Vecta46 Aspiration Catheter	Naoto Kimura(Iwate Prefectural Central Hospital, Japan).....50
12:50-13:10	3. Electromagnetically Controllable Microrobotic Interventional System for Active Guidewire Steering	최홍수(대구경북과학기술원).....51

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2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

09:00-10:00

Free paper I

Aneurysm

좌장: 김범태(순천향대)
성재훈(가톨릭대)

Assessing Consensus and Variability in Treatment Decisions for Unruptured Intracranial Aneurysms: A Retrograde Multi-Center International Study Utilizing the Grade of Recommendation System

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Objective: The management of unruptured intracranial aneurysms (UIAs) continues to be a subject of discussion within the field of neuroendovascular surgery, with various factors influencing clinical decisions, including clinician experience, institutional resources, and socioeconomic factors. This study aimed to evaluate the consensus and variability in treatment decisions for UIAs among international neurointerventionists using the Grade of Recommendation (GOR) system as a tool.

Methods: A total of 24 neurosurgeons from South Korea, the Philippines, Indonesia, and India participated in the study, which was conducted during an alumni meeting in May 2023. Participants reviewed imaging studies of 55 aneurysms, assigning a GOR based on their experience, knowledge, and philosophy. The concordance among the participants was analyzed using the kappa method.

Result: The overall agreement for 24 participants was fair ($\kappa = 0.369$). Delving into specific GORs, GOR1 and GOR2 showcased moderate agreement with kappa values of 0.456 (45.6%) and 0.098 (19.93%) respectively. GOR3 had a slight agreement ($\kappa = 0.077$, 10.33%), while GOR4 and GOR5 reflected slight agreement with kappa values of 0.188 (12.36%) and 0.324 (7.78%), respectively. A breakdown by GOR highlighted moderate agreement for Treat (GOR1-2) at 0.464 and Observation (GOR4-5) at 0.417, with a slight agreement for Moderate (GOR3) at 0.075.

Conclusion: Neurointerventionists showed varying levels of treatment decision for unruptured cerebral aneurysm. The overall consensus among the 24 neurointerventionists indicated a fair agreement, suggesting that while there are some commonalities in treatment approaches, significant variations still exist.

Elevated Blood Viscosity Is Associated with Delayed Cerebral Ischemia in Patients with Aneurysmal Subarachnoid Hemorrhage

Ho Jun Yi^{1,2}, Dong-Seong Shin¹, Bum-Tae Kim¹, Dong Hoon Lee², Jae Hoon Sung²

¹Department of Neurosurgery, Soonchunhyang University Bucheon Hospital, Bucheon; ²Department of Neurosurgery, St. Vincent's Hospital, The Catholic University of Korea, Suwon

Objective: Delayed cerebral ischemia (DCI) is a contributing factor for poor clinical outcome in aneurysmal subarachnoid hemorrhage (aSAH). Blood viscosity can reflect flow resistance and dehydration status. Our study aimed to analyze the association between blood viscosity and DCI in patients with aSAH.

Methods: In this retrospective cohort, systolic blood viscosity (SBV) and diastolic blood viscosity (DBV) were measured at admission in patients with aSAH. Receiver operating characteristic curve analysis was used to assess the predictive values of SBV and DBV for DCI after aSAH. Univariate and multivariate logistic regression was performed to analyze the association between blood viscosity and the development of DCI.

Result: A total of 235 patients with aSAH were included in this study, and 92 (39.1%) patients had DCI. Optimal cut-off values of DBV and SBV were presented as 12.05 (cP) and 3.75 (cP), respectively. In addition, DBV has higher predictable value of DCI than SBV (DBV: area under the curve [AUC] 0.793; standard error [SE] 0.026; 95% CI 0.722–0.864; $P < 0.001$, and SBV: AUC 0.702; SE 0.040; 95% CI 0.624–0.781; $P < 0.001$). In multivariate logistic regression analysis, elevated DBV was a predicting factor for development of DCI (odds ratio: 1.60; 95% confidence interval: 1.32–2.58; $P = 0.037$).

Conclusion: Blood viscosity is associated with development of DCI in patients with aSAH. Especially, DBV has a higher predictive value for the occurrence of DCI than SBV. Elevated DBV is a potential predicting factor for the occurrence of DCI.

Strategy of Stretched Coils: Insights from a Single Center Experience

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Objective: A stretched coil is an undesirable event that may occur during coil embolization procedures, involving the excessive elongation of coils within the parent artery. This can potentially lead to thrombus formation and result in an ischemic event. Therefore, this study aims to report on cases of stretched coils over a period of 15 years and discuss appropriate assessment methods and treatment strategies.

Methods: From January 2008 to November 2023, stretched coils were observed in 14 cases during coil embolization procedures. Clinical symptoms, location, embolization techniques, detection methods, complications, as well as radiological and clinical outcomes were analyzed through charts and PACS images.

Result: Among the 14 cases, 4 cases involved coil embolization for SAH due to ruptured aneurysms, while the remaining cases were for unruptured aneurysms. During the procedures, parent or major vessel occlusion occurred in 3 cases, with successful recanalization in 1 case using tirofiban. In 3 cases, stretched coils were either connected to other coils or packing was performed using a microwire within the aneurysm. In 2 cases, the stretched coils were removed without the need for additional devices. In 1 case, a rescue technique was successfully applied using stent retrieval to remove the stretched coil. In 7 cases, additional stent implantation was performed to secure the stretched coils against the vessel wall. In one of these cases, the stretched coil could not be retrieved using a snare, and it was subsequently secured to the wall with a stent after extending the proximal tip of the stretched coil to the cavernous ICA. In 1 case, the proximal end of the stretched coil showed no oscillation or instability in the patent artery, leading to the procedure being concluded without the need for a rescue technique. Unfortunately, in 1 case, procedural rebleeding occurred during microcatheter manipulation,

resulting in a fatality. The Modified Rankin Scale scores were as follows: 0 in 10 patients, 3 in 1 patient, 5 in 2 patients, and 6 in 1 patient, out of a total of 14 patients.

Conclusion: Numerous studies have been conducted on coil stretching, and various rescue methods have been introduced. However, relying solely on angiography for diagnosing stretched coils and applying an incorrect rescue method can potentially result in ischemic stroke. Therefore, this study emphasizes the utility of vaso-CT as a tool for accurately identifying the proximal end of a stretched coil. Additionally, we aim to enable the selection of an appropriate rescue technique based on this identification.

Woven EndoBridge (WEB) Embolization in Small, Shallow Unruptured Bifurcation Cerebral Aneurysms

Dae Won Kim

Department of Neurosurgery, Wonkwang University Hospital

Objective: The shallow aneurysm that has a short aneurysm height is difficult to treat with WEB device. The purpose of this study was to evaluate the feasibility and efficacy of the WEB device in small, shallow bifurcation aneurysms.

Methods: Patients with aneurysms treated with the WEB device were evaluated retrospectively. The technical feasibility, procedural complications, and clinical outcome were studied in small, shallow aneurysms.

Result: Thirty three aneurysms in 32 patients treated with the WEB device were included. The mean aneurysm size was 6 ± 2.9 mm. Aneurysm locations were the following: anterior communicating artery (17 case), MCA (9 cases), and basilar tip (7 cases). Seven cases were small, shallow aneurysms. The WEB devices were successfully delivered in all cases. Two patients changed WEB size. Two patients suffered embolic infarction within 1 month, but, there were no permanent deficits. Short-term angiographic complete occlusion was obtained in all cases.

Conclusion: Aneurysm embolization with the WEB device appears technically feasible and effective for the treatment of unruptured wide neck bifurcation aneurysms, even in small shallow aneurysms. However, beginners should be better to try easy cases considering the deviation of the aneurysm axis to the inlet flow line and aneurysm height

New Methodology of Volume-based Woven EndoBridge (WEB) Selection and One-year Adequate Aneurysm Occlusion

Hyun Jin Han, Jung-Jae Kim, Keun Young Park, Yong Bae Kim

Department of Neurosurgery, Severance Hospital, Yonsei University College of Medicine

Objective: Selection of appropriate fit Woven EndoBridge (WEB) device is crucial for the safe and successful treatment of bifurcation intracranial aneurysms. The aim of present study is suggesting the methodology of WEB device selection (the ratio of WEB device and aneurysm) for favorable radiologic outcome.

Methods: Present study identified the patients who underwent WEB procedure for bifurcation intracranial aneurysms between August 2021 and October 2023. Our investigators included the patients who had an appropriate data about one -year radiologic follow-up and initial result of volumetric analysis. Using TFCA, CTA, and MRA, radiologic outcome was assessed by WOS grading scale; WOS grades A and B was categorized as the favorable grade group. ROC curve and subsequent analysis was performed for demonstrating the effectiveness of volumetric WEB selection for aneurysm occlusion.

Result: Among a total of 170 patients, 52 patients were included in present study according to the inclusion/exclusion criteria. Semi-automated assessment was performed using 3D volumetric analysis software in Philips apparatus (Philips V3000, Philips Medical Systems, Eindhoven, Netherlands). The most frequent modality in one -year radiologic outcome was TFCA (61.5%), and favorable radiologic outcome was achieved in 38 patients (73.1%). In ROC curve analysis, when WEB occupied more than 86.5% of the intraaneurysmal space, it showed the highest Youman's index to predict aneurysm occlusion with a moderate accuracy. When more than 86.5% of the space was filled with WEB, 82.4% of cases showed a favorable occlusion grade at one -year follow-up (p-value = .038).

Conclusion: Beside conventional WEB selection (+1 and -1 rule), volume-based WEB selection

had a beneficial effect for not only for the initial device selection, but also one-year radiologic outcome. Selection or combination of an appropriate method according to aneurysm shape, size, and location might be helpful for intracranial aneurysm occlusion after WEB insertion.

Feasibility and Safety Values of Activated Clotting Time Guided Systemic Heparinization in Coil Embolization for Unruptured Intracranial Aneurysms

Hyuk Jang, Byung-Rae Cho, Dong-Kyu Jang, Dong-Sub Kim

Department of Neurosurgery, Incheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea

Objective: This study aimed to evaluate the feasibility and safety values of activated clotting time (ACT)-guided systemic heparinization in reducing periprocedural thrombosis and bleeding complications during coil embolization of unruptured intracranial aneurysms.

Methods: A total of 228 procedures performed on 213 patients between 2016 and 2021 were included in the retrospective analysis. The target ACT was set at 250 seconds. Logistic regression was performed to assess predictors for the occurrence of thrombosis and bleeding. Receiver Operating Characteristic (ROC) analyses were employed to determine the optimal cut-off values for ACT, heparinization, and procedure time.

Result: Most (85.1%) of procedures were stent-assisted embolization. The mean baseline ACT was 128.8 ± 45.7 seconds. The mean ACT at 20 minutes after the initial intravenous heparin loading of 78.2 ± 18.8 IU/kg was 185 ± 46.4 seconds. The mean peak ACT was 255.6 ± 63.8 seconds with 51.3% (117 cases) achieving the target ACT level. Peak ACT was associated with symptomatic thrombosis (OR per second, 1.008; 95% CI, 1.000-1.016; $P=0.035$) (cut-off value, 275 seconds; area under ROC (AUROC), 0.7624). Total administered heparin dose per body weight was negatively associated with symptomatic thrombosis (OR per IU/kg, 0.972; 95% CI, 0.949-0.995; $P=0.018$) (cut-off value, 294 IU/kg; AUROC, 0.7426) but positively associated with significant bleeding (OR, 1.008 per IU/kg; 95% CI, 1.005-1.012; $P<0.001$) (cut-off value, 242 IU/kg; AUROC, 0.7391). Procedure time was significantly associated with symptomatic thrombosis (OR per minute, 1.05; 95% CI, 1.017-1.084; P value =0.002) (cut-off value, 158 minutes; area under ROC, 0.8338).

Conclusion: This study demonstrated that ACT-guided systemic heparinization was feasible to

achieve the target ACT value and proposes probable safety thresholds to prevent periprocedural complications through reducing procedure time during coil embolization of unruptured intracranial aneurysms in the stent era.

2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

10:00-10:50

학술상 및 연구비지원 학술연구발표

좌장: 김태곤(차의과학대)
황교준(분당제생병원)

The inhibition rate estimated using VerifyNow can help to predict the thromboembolic risk of coil embolization for unruptured intracranial aneurysms

김영덕

분당서울대학교병원

(The Journal of Neurointerventional Surgery, 2022; 14: 589-592)

Background: The role of the inhibition rate of VerifyNow in assessing the thromboembolic risk of coil embolization for unruptured intracranial aneurysms is unclear.

Objective: To carry out a retrospective study to determine whether the inhibition rate could provide additional help in predicting thromboembolic events when it was used for patients with a P2Y12 reaction unit (PRU) level of 220 or lower.

Methods: Patients who underwent coil embolization for unruptured aneurysms with an appropriate PRU level (PRU 220 or lower) between January 1, 2015 and December 31, 2018 were analyzed. A total of 954 patients with 1020 aneurysms were included in this study. The primary outcome was the thromboembolic events occurring within 30 days after coil embolization. The receiver operating characteristic (ROC) curve and the area under the curve (AUC) were obtained to determine the quantitative predictive ability of the inhibition rate. The optimal cut-off value was derived using the Youden index.

Results: Thromboembolic events developed in 11 patients (1.08% of 1020 procedures). The AUC of the ROC curve was 0.83. The optimal cut-off value of the inhibition rate derived using the maximum Youden index was 22.0%. A sensitivity test using a multiple logistic regression analysis demonstrated that the inhibition rate was a significant variable for predicting thromboembolic events.

Conclusions: The inhibition rate can be used to determine high thromboembolic risks for patients with PRU levels of 220 or lower. The optimal cut-off value of the inhibition rate was 22.0% when the PRU level was 220 or less.

Cerebral aneurysm – Very large & giant

Original Article
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A Single Flow Re-direction Endoluminal Device for the Treatment of Large and Giant Anterior Circulation Intracranial Aneurysms

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Purpose: The purpose of this study was to report the authors' experience in treating large (10–25 mm) and giant (>25 mm) intracranial aneurysms (IA) using a single flow re-direction endoluminal device (FREDD) without balloon catheter, with a focus on procedure-related complications.

Materials and Methods: A total of 13 patients who were treated with FREDD between January 2019 and July 2020 were retrospectively reviewed. The timing of procedure-related complications was chronologically categorized as acute (within 7 days), sub-acute (8 to 21 days), and delayed (later than 21 days) periods. Follow-up angiography was performed at 3 to 27 months (mean 8.7 months), and clinical follow-up was performed at 3 to 33 months (mean 14.1 months) in all patients.

Results: Six (46.2%) patients experienced procedure-related complications, including 3 (23.1%) in acute period, 1 (7.7%) in sub-acute period, and 2 (15.4%) in delayed period. Procedure-related complications occurred in 10 (76.9%) patients on hemodynamic (hyperextension) (10/10), venous instability and occlusion were 100%. Two treated aneurysms (15.4%) located at the bifurcation of the internal carotid artery (ICA) and the middle cerebral artery (MCA) were the only independent risk factor for procedure-related complications on multivariate logistic regression analysis.

Conclusions: The present endoluminal complication rate was 46.2% in this study. Procedure-related complications might increase when treating large and giant IA located at the bifurcation of the internal carotid artery. Therefore, it may be suggested that neurointerventional and endovascular neurosurgeons should pay attention to the location of IA when treating large and giant IA with single FREDD.

Key Words: Endovascular treatment, flow diversion, intracranial aneurysm, acute

THE CATHOLIC UNIVERSITY OF KOREA
SEOUL ST. MARY'S HOSPITAL

Vertebral artery dissection

Clinical outcome

Original Article
Check for updates

Comparison of Parent Artery Occlusion and Stent-Assisted Treatments in Ruptured Vertebral Artery Dissecting Aneurysms
Hyung Jin Lee¹, Won Chul Choi¹, Jai Ho Choi¹, Bum Soo Kim¹, Yong Sam Shin¹

OBJECTIVE: To assess clinical outcomes of ruptured vertebral artery dissecting aneurysms, focusing on comparing parent artery occlusion (PAO) with stent-assisted treatment, and to identify risk factors for subarachnoid hemorrhage and neurological complications.

METHODS: This retrospective review included 30 ruptured vertebral artery dissecting aneurysms treated between February 2018 and April 2020. Treatment modalities included PAO without stent and stent-assisted treatment. Post-treatment outcomes were assessed using modified Rankin Scale (mRS), Barthel's index, and modified Glasgow Outcome Scale (mGOS).

RESULTS: Patients were treated with PAO only (n=16, 53.3%), PAO with stent (n=14, 46.7%), and PAO with stent and stent-assisted treatment (n=10, 33.3%). The mean age was 52.7 years. The mean aneurysm size was 12.5 mm. The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0. The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0.

CONCLUSIONS: Stent-assisted treatment in ruptured vertebral artery dissecting aneurysms was significantly related to the age and size of the aneurysm. There were no significant differences between treatment groups in clinical outcomes or ischemic complications. Stent-assisted treatment might be effective and safe in ruptured vertebral artery dissecting aneurysms.

THE CATHOLIC UNIVERSITY OF KOREA
SEOUL ST. MARY'S HOSPITAL

Vertebral artery dissection

Rupture risk factor – Stagnation sign

JNS

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Clinical and radiological risk factors for rupture of vertebral artery dissecting aneurysm: significance of the stagnation sign

Hyung Jin Lee, MD¹, Jai Ho Choi, MD, PhD¹, Kwan Sung Lee, MD, PhD¹, Bum Soo Kim, MD, PhD¹, and Yong Sam Shin, MD, PhD¹

Department of Neurology and Radiology, Seoul St. Mary's Hospital, The Catholic University of Korea College of Medicine, Seoul, Korea

OBJECTIVE: The aim of this study was to investigate the clinical and radiological features associated with the rupture of a vertebral artery dissecting aneurysm (VADA) and to evaluate whether the stagnation sign is a significant risk factor for rupture of VADA.

METHODS: Clinical and radiological features of 17 VADAs treated in a tertiary hospital from September 2018 to December 2020 were retrospectively reviewed. The stagnation sign was defined as the filling of the vertebral artery (VA) lumen with contrast medium on CT angiography (CTA) or magnetic resonance angiography (MRA) without evidence of a filling defect.

RESULTS: The mean age of VADA was 52.1 years (range 35–78 years). The mean size of VADA was 12.5 mm (range 5–25 mm). The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0.

CONCLUSIONS: The stagnation sign was significantly associated with the rupture of VADA. Therefore, it may be suggested that neurointerventional and endovascular neurosurgeons should pay attention to the stagnation sign when treating VADA.

Key Words: Intracranial aneurysm, vertebral artery dissection, subarachnoid hemorrhage, risk factor, rupture

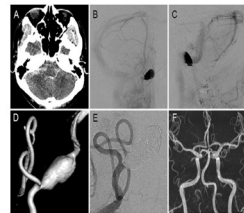


Fig. 1. Representative cases of a ruptured VADA with the stagnation sign. A 62-year-old male patient with a VADA rupture was treated with PAO. A, Axial CTA scan at the level of the VADA. B, Axial MRA scan at the level of the VADA. C, Sagittal CTA scan at the level of the VADA. D, Sagittal MRA scan at the level of the VADA. The stagnation sign is indicated by a white arrow in each panel.

THE CATHOLIC UNIVERSITY OF KOREA
SEOUL ST. MARY'S HOSPITAL

Vertebral artery dissection

Risk factor for ischemic complication

Check for updates

Symptomatic ischemic complications following endovascular treatment of vertebral artery dissecting aneurysms

Hyung Jin Lee¹, Jai Ho Choi¹, Bum Soo Kim¹, Yong Sam Shin¹

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Abstract The aim of this study was to investigate the clinical and radiological features related to the symptomatic ischemic complications of vertebral artery dissecting aneurysms (VADA) following endovascular treatment (EVT).

Methods: The clinical and radiological features of 127 VADAs, which were treated in a single tertiary institution between September 2018 and December 2020, were retrospectively reviewed. We defined a thrombotic aneurysm as being in which the thrombus was in the aneurysm in magnetic resonance imaging (MRI). Symptomatic ischemic complication was defined as a case in which acute infarction was confirmed on diffusion-weighted image after EVT with associated clinical symptoms.

Results: The rate of symptomatic ischemic complications was 14.5% (17/127). The thrombotic aneurysm was observed in 14.5% (17/127) of patients after EVT. The mean age of VADA was 52.1 years (range 35–78 years). The mean size of VADA was 12.5 mm (range 5–25 mm). The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0.

CONCLUSIONS: This study showed that the VADAs with thrombotic aneurysm and PICA involvement may be at high risk for symptomatic ischemic complications following EVT. Therefore, when the thrombotic VADAs with PICA involvement are observed, physicians may consider close postoperative monitoring for early detection of ischemic complications.

Keywords: Intracranial aneurysm, vertebral artery dissection, ischemic complication, posterior inferior cerebellar artery, risk factor, thrombus

THE CATHOLIC UNIVERSITY OF KOREA
SEOUL ST. MARY'S HOSPITAL

Aneurysm – General

Recurrence risk factors

Risk Factors for the Recurrence of Posterior Communicating Artery Aneurysm: The Significance of Fetal-Type Posterior Cerebral Artery

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OBJECTIVE: The purpose of this study was to investigate the risk factors associated with the recurrence of posterior communicating artery aneurysm after treatment and to evaluate the significance of fetal-type posterior communicating artery as an independent risk factor for recurrence of posterior communicating artery aneurysm. Materials and Methods: The clinical and radiological features of 127 posterior communicating artery aneurysms treated between January 2018 and December 2020 in a single tertiary institution were retrospectively reviewed. The fetal-type posterior communicating artery was defined as the presence of the fetal-type posterior communicating artery on CTA or MRA.

RESULTS: The mean age of PMA was 52.1 years (range 35–78 years). The mean size of PMA was 12.5 mm (range 5–25 mm). The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0.

CONCLUSIONS: The fetal-type posterior communicating artery was significantly associated with the recurrence of PMA. Therefore, it may be suggested that neurointerventional and endovascular neurosurgeons should pay attention to the fetal-type posterior communicating artery when treating PMA.

Key Words: Anterior communicating artery aneurysm, Aneurysm direction, Recurrence, Risk factor

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ORIGINAL ARTICLE · VASCULAR NEUROSURGERY · ANEURYSM

Clinical and morphological risk factors for the recurrence of anterior communicating artery aneurysms after clipping or coiling

Hee Jung Ki¹, Kwan Sung Lee¹, Bum Soo Kim¹, Jai Ho Choi¹, Yong Sam Shin¹

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Abstract Background The aim of this study was to evaluate clinical and morphological factors associated with recurrence in anterior communicating artery (ACA) aneurysms after clipping or coiling.

Methods: We retrospectively reviewed the clinical and morphological features of consecutive 214 patients with ACA aneurysms treated between January 2017 and December 2018 in a single tertiary institution. Statistical and multivariate analyses were performed to identify the relationship between clinical and morphological variables and recurrence.

Results: 152 (70.6%) patients with ACA aneurysms were treated with clipping. 62 (29.4%) patients with ACA aneurysms were treated with coiling. The mean age of ACA aneurysms was 52.1 years (range 35–78 years). The mean size of ACA aneurysms was 12.5 mm (range 5–25 mm). The mean follow-up period was 12.5 months. The mean mRS at follow-up was 2.0. The mean Barthel's index at follow-up was 18.0. The mean mGOS at follow-up was 3.0.

CONCLUSIONS: The fetal-type posterior communicating artery was significantly associated with the recurrence of ACA aneurysms after treatment. Therefore, it may be suggested that neurointerventional and endovascular neurosurgeons should pay attention to the fetal-type posterior communicating artery when treating ACA aneurysms.

Keywords: Anterior communicating artery aneurysm, Aneurysm direction, Recurrence, Risk factor

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Aneurysm – General

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REVIEW ARTICLE · VASCULAR NEUROSURGERY · ANEURYSM

Multiple anterior choroidal arteries and perioperative ischemic complications in unruptured anterior choroidal artery aneurysms treated with microsurgical clipping

Jung Kwon Lee¹, Jai Ho Choi¹, Yong Sam Shin¹

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Abstract Background This study aimed to identify the association between the number of anterior choroidal arteries (ACA) and perioperative ischemic complications in microsurgical clipping of unruptured ACA aneurysms.

Methods: We retrospectively reviewed the clinical, radiological, and intraoperative findings of 127 patients with unruptured ACA aneurysms treated with microsurgical clipping between January 2017 and November 2020 in a single tertiary institution. Intraoperative video-clips were reviewed, and the ACA type was categorized into two according to the number of ACA: (1) single type group with single origin and single branch and (2) multiple type group with duplicated origin or duplicated multiple branches. Clinical and radiological features were reviewed, and the ACA type was categorized into two according to the number of ACA and radiological features and perioperative ischemic complications.

Results: Of 127 patients, 52 (40.9%) were categorized as multiple type group. The frequency of perioperative ischemic complications, including transient neurological deficit, stroke, and death, was significantly higher in the multiple type group than in the single type group (p=0.001).

CONCLUSIONS: Multiple type ACA aneurysms and multibranched shape were significantly associated with perioperative ischemic complications. Perioperative ischemic complications can be minimized by recognizing these variations and using individual approach with MIP monitoring.

Keywords: Anterior choroidal artery, Clipping, Complications, Intraoperative aneurysm

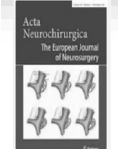


Fig. 1. Type of ACA aneurysm according to the number and origin of ACA.

Single Origin, Single Branch

Single Origin, Multiple Branch

Multiple Origin, Single Branch

Multiple Origin, Multiple Branch

Single Origin, Single Branch

Single Origin, Multiple Branch

Multiple Origin, Single Branch

Multiple Origin, Multiple Branch

Single Origin, Single Branch

Single Origin, Multiple Branch

Multiple Origin, Single Branch

Multiple Origin, Multiple Branch

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Ischemia

• Delayed filling sign - ICA pseudo-occlusion

Stroke

BRIEF REPORT

Multiphasic Computed Tomography Angiography Findings for Identifying Pseudo-Occlusion of the Internal Carotid Artery

Jin-Ho Choi, MD, Jihyeon Jang, MD, PhD, Jaesung Kim, MD, PhD, Kook-Jin Ahn, MD, PhD, Yong-San Shin, MD, PhD, Bumsoo Kim, MD, PhD

BACKGROUND AND PURPOSE: Differentiation between pseudo-occlusion and true occlusion of internal carotid artery (ICA) is important in treatment planning for acute ischemic stroke patients. We compared the findings of multiphasic computed tomography angiography between internal ICA pseudo-occlusion and true occlusion of the internal ICA in patients with anterior circulation stroke, middle cerebral artery stroke, and posterior circulation stroke.

RESULTS: Forty patients with non-occlusion of the proximal ICA were included. Diagnosis of pseudo- or true occlusion of the ICA was made based on digital subtraction angiography. Diagnostic performance of multiphasic computed tomography angiography (multiphase CT) in identifying internal ICA pseudo-occlusion and true occlusion of the internal ICA in patients with anterior circulation stroke, middle cerebral artery stroke, and posterior circulation stroke was evaluated. The Fisher exact test, χ^2 test, or McNemar test was used for data analysis.

CONCLUSIONS: We demonstrated that the delayed filling sign on multiphase computed tomography angiography could be a useful and easily available finding for identifying internal ICA pseudo-occlusion from true occlusion.

Key Words: brain ischemia, computed tomography angiography, multiphase imaging, pseudo-occlusion, stroke

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Ischemia

• Clinical outcome

ORIGINAL ARTICLE

Acute Ischemic Stroke Caused by Internal Carotid Artery Occlusion: Impact of Occlusion Type on the Prognosis

Jihyeon Jang, MD, Jaesung Kim, MD, PhD, Kook-Jin Ahn, MD, PhD, Yong-San Shin, MD, PhD, Jin-Ho Choi, MD, PhD

BACKGROUND: The extent of cerebral infarction caused by acute internal carotid artery (ICA) occlusion is related to the type of occlusion. However, the impact of occlusion type on the clinical outcome of acute ischemic stroke caused by ICA occlusion remains unclear.

OBJECTIVE: We investigated the impact of occlusion type on the clinical outcome of acute ischemic stroke caused by ICA occlusion.

DESIGN: Retrospective cohort study.

SETTING: Tertiary care hospital.

PARTICIPANTS: Patients with acute ischemic stroke caused by ICA occlusion.

MEASUREMENTS AND MAIN RESULTS: We analyzed the clinical outcome of acute ischemic stroke caused by ICA occlusion according to the type of occlusion. The types of occlusion were classified into three groups: total occlusion, subtotal occlusion, and non-occlusion. The clinical outcome was evaluated using the modified Rankin scale (mRS) at 90 days. The results showed that the clinical outcome was significantly worse in the total occlusion group compared to the subtotal occlusion and non-occlusion groups.

CONCLUSIONS: The type of ICA occlusion significantly impacts the clinical outcome of acute ischemic stroke. Total occlusion is associated with a worse clinical outcome compared to subtotal occlusion and non-occlusion.

Figure 1. ICA occlusion types. ICA, internal carotid artery; ICA occlusion, internal carotid artery occlusion; ICA occlusion type, internal carotid artery occlusion type.

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Ischemia

JNS

ORIGINAL ARTICLE

Relationship between ophthalmic artery flow direction and visual deterioration after carotid angioplasty and stenting

Hyeon G. Park, MD, Kyung Lee, MD, Byung-Ju Jung, MD, Jaesung Kim, MD, PhD, Bumsoo Kim, MD, PhD, Yong-San Shin, MD, PhD, and Jin-Ho Choi, MD, PhD

OBJECTIVE: Visual deterioration is one of the disabling complications that can occur after carotid angioplasty and stenting (CAS). The purpose of this study was to evaluate the risk factors for newly developed visual symptoms after CAS. We analyzed ophthalmic artery (OA) flow pattern and direction of visual symptoms.

DESIGN: Retrospective cohort study.

SETTING: Tertiary care hospital.

PARTICIPANTS: Patients with acute ischemic stroke and visual symptoms after CAS.

MEASUREMENTS AND MAIN RESULTS: We analyzed the relationship between OA flow direction and visual symptoms after CAS. The results showed that the visual symptoms were significantly worse in the group with OA flow direction towards the posterior compared to the group with OA flow direction towards the anterior.

CONCLUSIONS: The direction of OA flow is a risk factor for visual symptoms after CAS. Patients with OA flow direction towards the posterior should be monitored closely for visual symptoms after CAS.

Key Words: carotid stenosis, angioplasty, stenting, ophthalmic artery, visual symptoms, carotid artery occlusion, vascular disorders

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DAVFs

• Image fusion techniques

BRIEF/TECHNICAL REPORT

Intraprocedural Flat Panel Detector Rotational Angiography and an Image Fusion Technique for Delivery of a Microcatheter into the Targeted Shunt Pouch of a Dural Arteriovenous Fistula

JH Choi, MD, YS Cho, MD, YS Shin, MD, and JS Kim, MD, PhD

BACKGROUND: The accurate and safe delivery of a microcatheter to a targeted shunt pouch is essential for successful transvenous embolization of intracranial dural arteriovenous fistulas. However, complex anatomy and variations in head and neck veins and occluded sinuses can hinder intraprocedural microcatheter delivery. In this study, we introduce an intraprocedural flat panel detector rotational angiography and image fusion technique to aid precise navigation inside the vein and proper placement of the microcatheter in the targeted shunt pouch.

OBJECTIVE: We aimed to demonstrate the effectiveness of the intraprocedural flat panel detector rotational angiography and image fusion technique for the delivery of a microcatheter into the targeted shunt pouch of a dural arteriovenous fistula.

DESIGN: Case report.

SETTING: Tertiary care hospital.

PARTICIPANTS: A patient with a dural arteriovenous fistula.

MEASUREMENTS AND MAIN RESULTS: We successfully delivered a microcatheter into the targeted shunt pouch of a dural arteriovenous fistula using the intraprocedural flat panel detector rotational angiography and image fusion technique.

CONCLUSIONS: The intraprocedural flat panel detector rotational angiography and image fusion technique is a useful technique for the delivery of a microcatheter into the targeted shunt pouch of a dural arteriovenous fistula.

Key Words: dural arteriovenous fistula, microcatheter, image fusion, rotational angiography, shunt pouch

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가톨릭대학교

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Retrospective 6 month-outcomes and prognostic factors following spontaneous angiogram-negative non-perimesencephalic subarachnoid hemorrhage

김 명 수

칠곡경북대학교병원

(Journal of Clinical Neuroscience, 2022;96:12-18)

Our objective was to analyze functional outcomes and prognostic factors in patients suffering from angiogram-negative non-perimesencephalic subarachnoid hemorrhage (non-PMH). In total, 1601 patients presenting with spontaneous SAH between January 2009 to December 2019 admitted to our institution were reviewed. Among them, 51 patients with angiogram negative non-perimesencephalic subarachnoid hemorrhage were analyzed. We divided patients into groups according to hemorrhage pattern and duration. Prognostic factors were assessed according to initial neurologic grade, early hydrocephalus, fisher grade, and duration of hemorrhage. Outcomes were assessed according to the modified Rankin Scale after 6 months. Overall, 41 patients (80.3%) with angiogram-negative non-PMH achieved a favorable outcome. In univariate analysis, good initial neurologic grade, absence of early hydrocephalus, non-Fisher-type 3 bleeding pattern, and short term hemorrhage (blood wash out <7 days after onset) duration were significantly associated with a favorable outcome. In multivariate analysis, a non-Fisher-type 3 hemorrhagic pattern ($p < 0.05$) and good initial neurologic state ($p < 0.01$) were independent predictors of favorable outcomes in angiogram-negative non-PMH patients. Patients with angiogram-negative non-PMH generally had favorable outcomes. A non-Fisher-type 3 hemorrhagic pattern and good initial neurologic state were prognostic factors of a favorable outcome in non-PMH. Furthermore, patients with long-term SAH were more likely to develop hydrocephalus. Evaluating the pattern and duration of subarachnoid hemorrhage may allow better prediction of outcomes in patients with angiogram negative and non-PMH.

Dynamic changes of Systemic Inflammation Response Index and Systemic Immune-Inflammation Index are associated with Delayed Cerebral Ischemia after Aneurysmal Subarachnoid Hemorrhage

Ho Jun Yi

순천향대학교 부천병원

Objectives: Delayed cerebral ischemia (DCI) is a contributing factor for poor outcome in aneurysmal subarachnoid hemorrhage (aSAH). Serial inflammatory response is known to affect the occurrence of DCI. The aim of this study was to evaluate the association between dynamic changes of various inflammatory markers and occurrence of DCI after aSAH.

Methods: A total of 279 patients with interventional treatment for aSAH were enrolled, and dichotomized according to the occurrence of DCI. Various inflammatory markers, including systemic immune-inflammation index (SII) and systemic inflammation response index (SIRI) and their dynamic changes were analyzed at four different time points. Receiver operating characteristic (ROC) curve analysis with area under the curve (AUC), univariate and multivariate Cox regression analysis with hazard ratio (HR) and 95% confidence interval (CI) was performed to identify the predictors for DCI.

Results: Differences of SII and SIRI values between DCI (+) and DCI (-) group were significantly higher at 5-7 days than other time points ($P < 0.001$ and $P < 0.001$, respectively). SII and SIRI had higher predicting value for DCI occurrence than other inflammatory markers (AUC: 0.862, 95% CI: 0.786-0.928; $P < 0.001$ and AUC: 0.851, 95% CI: 0.769-0.913; $P < 0.001$, respectively). Dynamic changes of SII (HR: 1.74, 95% CI: 1.38-3.22, $P = 0.020$) and SIRI (HR: 1.62, 95% CI: 1.28-2.84, $P = 0.035$) were associated with occurrence of DCI.

Conclusions: Dynamic changes of SII and SIRI may be predictors of the occurrence of DCI in patients with aSAH.

A Machine Learning Approach to Mortality Prediction for Acute Ischemic Stroke Patients in South Korea

Jae Sang Oh

Department of Neurosurgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

Backgrounds: The purpose of this study was to predict short-term and long-term mortality rates in patients with Acute ischemic stroke (AIS) of acute stroke patients.

Methods: Random forest (RF) and support vector machine (SVM) were used as models to predict short- and long-term mortality in patients. Clinical information at admission of a total of 35,829 patients, excluding No record of NIHSS, Incomplete data of symptom onset time, and data lacking the features required for training, was taken as a training variable, and each death at discharge, 3-month, 1-year, 2-year, and 4-year timepoints was taken as target variable of models.

Results: For the RF method, the test AUC were 0.9778 in prediction of discharge mortality, 0.8409 in prediction of 4-year mortality. For the SVM method, the test AUC were 0.9700 in prediction of discharge mortality, 0.8258 in prediction of 4-year mortality.

Conclusions: Our study provides insight into the extent to which clinical information in AIS patients affects short-term and long-term mortality, and presents a predictive model with high performance.

2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

11:10-12:10

Free paper II

Ischemia

좌장: 윤석만(순천향대)
임용철(아주대)

Spontaneous Intracranial Artery Dissection as a Cause of Acute Ischemic Stroke in the Anterior Circulation: Analysis of Clinical and Morphological Characteristics and Outcomes

Ja-ho Koo¹, Eui-hyun Hwang¹, Young-Ju Lee¹, Woo-Sang Jung², Ji-Hye Song¹, Young-cheol Lim¹

¹Department of Neurosurgery, Ajou University Hospital; ²Department of Radiology, Ajou University Hospital

Objective: Spontaneous intracranial arterial dissection (IAD) in the anterior circulation is rare. This study aimed to investigate the clinical and morphological characteristics of the spontaneous intracranial artery dissection.

Methods: We retrospectively reviewed patients diagnosed with spontaneous intracranial artery dissection in the anterior circulation and treated between January 2015 and December 2022 in our institute. We excluded patients with extracranial cervical ICA artery dissection, those without follow-up imaging, and cases where the etiology of dissection was not acute ischemic stroke. Acute infarction and dissection lesions were identified by MRA with MRI or CTA. We performed digital subtraction angiography for all the patients.

Result: A total of 42 patients were included in the study. Patients' mean age was 49.40 (IQR, 41.5–57.0) years and 31 (73.8%) of the patients were men. The mean BMI was 24.8 (18.2–35.4) kg/m² and a multiple dissection was found in eight (13.6%) patients. 29 (69.0%) dissections were located on the middle cerebral artery, 7 (16.7%) on the anterior cerebral artery and 6 (14.3%) on the distal internal carotid artery. The morphology of dissection showed the following distribution: stenosis without dilatation (n=18, 42.9%), stenosis and irregular enlargement, or in other words, complex type (n=10, 23.8%), and occlusion (n=14, 33.3%). Nine patients underwent indirect revascularization surgery and five patients underwent direct bypass surgery and one patient underwent endovascular treatment. Nine (21.4%) patients had poor clinical outcome (modified Rankin Scale score 3–6) after discharge. All of them received anticoagulant or antiplatelet drug therapy, with 30 patients (71.4%) using antiplatelets, 7 patients (16.7%) using an-

ticoagulants, and 5 patients (11.9%) using both antiplatelets and anticoagulants as treatments.

During the follow-up period, change in the morphology of dissection in patients showed two patterns in the affected vessel: resolution (favorable) and no interval change or occlusion (unfavorable). For morphologically complex type IAD, a history of ischemia ($P = .023$), coronary heart disease ($P = .044$), diabetes mellitus ($P = .001$), hypertension ($P = .024$), and symptoms triggered by exercise ($P = .044$) were identified as related factors when compared to non-complex type IAD. High C-reactive protein ($P = .024$) and WBC count ($P = .012$) were identified as significant factors in the laboratory data related to a poor clinical outcome. We found that a favorable radiologic outcome was associated with the morphologically complex type ($P = .005$) and sex ($P = .019$).

Conclusion: Complex type IAD showed a higher rate of resolution on follow-up images compared to cases of stenosis without dilatation and obstructive type IAD following medication treatment. Factors associated with poor clinical outcomes include high CRP and WBC count, while factors related to favorable radiologic outcomes include morphologically complex type and sex.

Comparison of clinical and radiological outcomes between suction aspiration method and combination method of intra-arterial therapy (IAT) in large artery occlusion: prospective multicenter trials: interim results of COMPETE trials

Sung-Chul Jin¹, Yunhyeok Choi¹, Joonwon Lee², Hae-Won Koo³, Duck-Ho Goh⁴, Sang-Young Kim⁴, Won Deog Seo⁴, Yeon-Ju Choi⁵, YoungJin Lee⁶, YoungJin Jung⁷, Seung Hun Sheen⁸, Chang-Hyun Kim⁹, Eun-Oh Jeong¹⁰, Hyon-Jo Kwon¹⁰

¹Department of Neurosurgery, Inje university, Haeundae Paik Hospital; ²Department of Neurology, Inje university, Haeundae Paik Hospital; ³Department of Neurosurgery, Ilsan Paik Hospital; ⁴Department of Neurosurgery, Daegu Goodmorning Hospital; ⁵Department of Neurosurgery, Pohang Stroke and Spine Hospital; ⁶Department of Neurosurgery, Pohang SM christianity Hospital; ⁷Department of Neurosurgery, Yeungnam University Medical Center; ⁸Department of Neurosurgery, Bundang CHA Hospital; ⁹Department of Neurosurgery, Keimyung University Dongsan Hospital; ¹⁰Department of Neurosurgery, Chungnam National University Hospital

Objective: Comparison of clinical and radiological outcomes between suction aspiration method and combination method of intra-arterial Therapy (IAT) in large artery occlusion (COMPETE) is a prospective multi-centered randomization trial evaluating the non-inferiority of successful recanalization using suction aspiration as primary modality to that of combination method. This interim analysis reports outcomes for the first 103 patients enrolled in COMPETE trial.

Methods: Primary endpoint is a successful recanalization rate after thrombectomy including first pass recanalization rate. Secondary endpoints include failure rate, and procedural morbidity and mortality.

Result: First pass recanalization rate was not significant different between suction aspiration and combination modality (n=21 (40.4%) vs. n=28 (54.9%), p=0.201). total number of thrombectomy trials was not significant different between suction aspiration and combination modality (median [IQR]; n=2 [1-2.3] vs n=1 [1-2]). Multivariable logistic regression analysis showed that first pass recanalization was independently associated with stroke etiology of cardioembolism (adjusted OR, 3.04 [95% CI, 1-9.27]; p=0.05).

Conclusion: These interim results provide preliminary evidence of non-inferiority of suction aspiration to combination method in large artery occlusion feasible to both modalities including suction aspiration and combination method.

The Influence of Retriever Stent Size on Mechanical Thrombectomy for Distal Middle Cerebral Artery Occlusion

Seung Yoon Song, Shin Ho Park, Dong Hoon Lee, Jae Hoon Sung

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Objective: In the thrombectomy era, indications of endovascular procedure for acute ischemic stroke (AIS) patients have gradually expanded. Recently, it has been indicated for medium vessel occlusions(MVOs). However endovascular techniques and devices for MVOs have not been established yet. We evaluated the patients who received mechanical thrombectomy due to MVOs in the aspect of retriever stent size (3mm vs 4mm).

Methods: From Jan. 2015 to Jun. 2023, 665 endovascular procedures for AIS were performed in our institution. 127 cases were distal middle cerebral artery (M2 and M3 segment) occlusion. After excluding the proximal and mid M2 segment, 38 patients with distal M2 or M3 segment occlusions were included in the study. Baseline characteristics, revascularization rates, hemorrhage rates, outcomes, and mortality were analyzed.

Result: Except three of contact aspiration, 35 cases were divided into 3mm retriever stent group (n=17) and 4mm stent group (n=18). No statistically significant difference was found in the rate of successful recanalization (94.1% in 3mm vs 100% in 4mm, $p=0.49$), favorable clinical outcomes (76.5% vs 66.7%, $p=0.71$), and mortality (5.9% vs 11.1%, $p=1.0$) between the two groups. Although 2 cases of vessel ruptures occurred only in the 4mm group, the rates of subarachnoid Hemorrhage (58.8% vs 44.4%, $p=0.39$) and symptomatic hemorrhage (17.6% vs 5.6%, $p=0.39$) were comparable between the two groups.

Conclusion: Despite concerns about relatively small vessel diameters of the distal MCA, there is no significant difference in outcome and hemorrhagic complications depending on stent size.

Association of Tirofiban and Intracranial Hemorrhage After Mechanical Thrombectomy for Acute Anterior Circulation Occlusion

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Objective: The primary objective of this study is to investigate the extent of symptomatic hemorrhage that occurred after the use of tirofiban during mechanical thrombectomy. The ultimate aim is to find conditions under which tirofiban can be used safely and effectively.

Methods: We analyzed patients who underwent intra-arterial thrombectomy for acute ischemic stroke with anterior circulation vessel occlusion from 2010 to 2022. Tirofiban was used in cases that appeared to be re-occluded or in cases of intracranial artery stenosis where stenting was needed. We used 0.5~1.0 mg of Tirofiban and investigated the cases where hemorrhage occurred afterwards and the mortality rate.

Result: Out of a total of 70 cases, tirofiban was used in 9 cases. Among them, parenchymal hemorrhage (PH) occurred in 3 cases (33.3%), and symptomatic hemorrhage (SH) occurred in one case (11.1%). Out of the 9 cases where tirofiban was used, there were 2 deaths (22.2%). There was no statistical significance compared to the cases where tirofiban was not used (PH: 33.3 % vs 68.9%. $p = 0.06$; SH: 11.1% vs 16.4%, $p = 1.000$; mortality: 22.2% vs 18.0%. $p = 0.67$).

Conclusion: The use of tirofiban does not appear to increase the risk of hemorrhage or mortality. However, this is a small-scale single-center study. Further research is needed considering more detailed aspects of patients' ischemic stroke.

Correlation between In-stent Restenosis Following Carotid Artery Stenting and Platelet Reactivity to Clopidogrel: Quantitative Assessment with P2Y12 Reaction Unit and Inhibition Rate

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Objective: The association between in-stent restenosis (ISR) and platelet function in patients treated with carotid artery stenting (CAS) remains poorly documented. This study aimed to analyze the correlation between ISR following CAS and platelet reactivity to clopidogrel confirmed by P2Y12 reaction unit (PRU) and inhibition rate (IR).

Methods: We retrospectively analyzed 171 patients who underwent CAS with extracranial carotid stenosis from January 2016 to December 2019. Dual antiplatelet therapy of aspirin 100mg and clopidogrel 75mg started at least 5 days before CAS. Clopidogrel resistance was measured with the PRU and IR of VerifyNow. The degree of ISR was classified into R1 (mild luminal stenosis of <50% in the range of <50% of the total length of the stented carotid artery), R2 (mild luminal stenosis of <50% in the range of ≥50% of the total length of the stented carotid artery), and R3 (moderate to severe luminal stenosis of ≥50% or occlusion) through carotid computed tomographic angiography after 24-30 months. The receiver operating characteristic (ROC) curve method was adopted to determine the quantitative degree of the association between platelet reactivity and ISR R3. The optimal cut-off values of PRU and IR were derived using the maximum Youden index.

Result: There were 33 ISRs of R3 (19.3%) and 9 ipsilateral ischemic strokes (5.3%). The PRU and IR were different between R1 + R2 (176.4 ± 50.1 , $27.5 \pm 18.7\%$) and R3 (247.5 ± 55.0 , $10.3 \pm 13.4\%$) ($p < 0.001$). The area under the ROC curve of PRU and IR was 0.841 and 0.781, and the optimal cut-off value was 220.0 and 14.5%, respectively. Multivariate logistic regression

analysis showed that $PRU \geq 220$ and $IR \leq 14.5\%$ were the significant predictive factors for ISR R3 ($p < 0.001$, $p = 0.017$). ISR R3 was independently associated with ipsilateral ischemic stroke after CAS ($p = 0.012$).

Conclusion: High PRU (≥ 220) and low IR ($\leq 14.5\%$) are related to ISR R3 following CAS, which may cause ipsilateral ischemic stroke.

Distal Placement of Balloon Guide Catheter Facilitates Stent-retriever Mechanical Thrombectomy for Acute Ischemic Stroke in The Anterior Circulation

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Objective: Although balloon guide catheters (BGCs) have been demonstrated to improve recanalization and functional outcomes by enabling proximal flow control and forced aspiration during mechanical thrombectomy (MT), the significance of the BGC location has been overlooked. We evaluated the impact of BGC location during MT for anterior circulation acute ischemic stroke (AIS).

Methods: Patients were divided into the proximal and distal BGC groups according to the BGC tip location relative to the lower margin of the C1 vertebral body. Endovascular and clinical outcomes were compared between the two groups, including subgroup analyses of the two types of extracranial internal carotid artery (ICA) anatomy, categorized based on cerebral angiography.

Result: A total of 124 patients were analyzed, with 62 each in the proximal and distal BGC placement groups. The distal BGC group had higher rates of first-pass recanalization (FPR) (38.7% vs. 17.7%, $P=0.009$) and favorable outcomes (64.5% vs. 46.8%, $P=0.047$) with shorter procedure time (47.5 min vs. 65 min, $P=0.001$) and fewer distal embolization (3.2% vs. 12.9%, $P=0.048$) than the proximal BGC group. FPR was also more frequently achieved in the distal BGC group of patients with tortuous ICA (37.0% vs. 12.5%, $P=0.029$). Multivariate analysis showed that distal BGC placement was an independent predictor of FPR (odds ratio, 3.092; 95% confidence interval, 1.326–7.210; $P=0.009$).

Conclusion: Distal BGC placement facilitates MT for AIS in the anterior circulation. Therefore, we suggest distal BGC placement to maximize the effect of thrombectomy, even for tortuous extracranial ICA.

2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

12:10-13:10

Luncheon Symposium

좌장: 정진영(참포도나무병원)
정준호(연세대)

Advancing Outcomes of Endovascular Treatment: The Role of Perclose ProStyle in Vascular Closure Techniques

Sunghan Kim

Department of Neurosurgery, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea

Vascular access and closure are crucial aspects of endovascular procedures, with complications at the access site being a significant predictor of adverse outcomes. This presentation is dedicated to examining vascular access methodologies and the evolution of closure techniques, with a particular focus on the newly introduced Perclose ProStyle Vascular Closure Device (VCD). It will evaluate the design, application, and potential of Perclose ProStyle in enhancing procedural safety and facilitating patient recovery. Furthermore, the presentation will delve into the complications associated with the vascular access site, outlining strategies for prevention and management to improve overall procedural success. Through detailed analysis and discussion, this presentation will underscore the importance of advanced closure devices like Perclose ProStyle in the current landscape of endovascular interventions.

Our Current Strategy for MeVO Treatment - AXS Vecta46 Aspiration Catheter

Naoto Kimura

Iwate Prefectural Central Hospital, Japan

Many reports show the effectiveness of thrombus retrieval therapy for MeVO (medium vessel occlusion). We reviewed the changes in treatment strategies for MeVO at our hospital and the usefulness of Vecta46.

Our first strategy for MeVO was combined technique, from April 2020. 42 patient was treated with combined technique(Age 80.8).Average number of passes was 1.40. TICl IIB/III was 86.1% but intracranial bleeding was seen in 27.8.

After launch of VECTA46, we change our first line strategy for MeVO to aspiration technique. 17(Age 81.6) patient was treated with VECTA46. Average number of passes was 1.15. TICl IIb/III was 93.8% and no bleeding was seen.

Aspiration technique using Vecta46 may be safe and effective for MeVO treatment comparing combined technique.

Electromagnetically Controllable Microrobotic Interventional System for Active Guidewire Steering

Hongsoo Choi

Department of Robotics and Mechatronics Engineering, Daegu-Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Republic of Korea

Robotic magnetic systems offer potential advantages in interventional procedures, such as precise and fast control of magnetically steerable interventional tools (e.g., guidewires and catheters) in tortuous vessels. Recently, a robotic magnetic interventional system named 'Electromagnetically Controllable Microrobotic Interventional System (ECMIS)' that enables remote manipulation and active steering of guidewires for the treatment of cardiovascular diseases was developed. The ECMIS consists of a microrobotic guidewire in which a soft magnetically steerable robot (MSR) is attached to the tip of a guidewire, a human-scale electromagnetic control system, a biplane X-ray imaging unit, and a master-slave system. The flexible magnetic MSR at the tip of the guidewire exploits magnetic torques for active guidewire steering upon magnetic actuation. The microrobotic guidewire can be advanced and retracted by the master-slave system in a teleoperated manner. The ECMIS may open new avenues in multiple areas of vascular interventions.

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13:10-14:10

Free paper III

Shunt Disease & etc.

좌장: 권순찬(울산대)
김대원(원광대)

Traumatic Carotid Cavernous Fistula: Case Series and Consideration of Determining the Time of Endovascular Treatment

Young Ju Lee, Ja Ho Koo, Eui-Hyun Hwang, Ji Hye Song, Yong-cheol Lim

Department of Neurosurgery, Ajou university medical center

Objective: Traumatic carotid cavernous fistula (tCCF) is a rare condition that can happen after head trauma. It can cause eye problems and even severe bleeding or lack of blood flow in the brain. Furthermore, when it occurs with severe traumatic brain injury, poor prognosis is expected, and determining when to treat the CCF is difficult. In this retrospective study, we reviewed the medical records and imaging data of tCCF patients to consider the proper time to endovascular treatment of tCCF in the acute traumatic brain injury patients.

Methods: In this study, we conducted a retrospective review of patients admitted to our medical center from 2006 to 2023 and diagnosed with tCCF by diagnostic cerebral angiography. A total of 21 cases of tCCF were analyzed. We grouped patients by the length of time interval between trauma and treatment. The patients who treated within 24 hours were classified as "hyperacute" group, within 7days as "acute" group, within a 14days as "subacute" group and after 14days as "chronic" group.

Result: All 21 patients were treated by endovascular coil embolization. One patient had penetrating injury of head and the other 20 patients had blunt head trauma. There were 17 patients whose GOS is 4 or 5, two patients discharged with GOS 3, and one patient discharged with GOS 2. One patient died during hospitalization and was the only "hyperacute" group patient among the 21 patients. Three patients were "acute" group and other 17 patients were "chronic" group. The average time interval from injury to treatment was 63 days. The GOS of "hyperacute" group was 1 and "acute" groups were 2, 3 and 4 respectively. The GOS of "chronic" group patients were 4 or 5 except one case of GOS 3 who was treated by total occlusion of injured ICA. Among 21 patients 14 patients had collateral circulation through anterior communication

artery or posterior communicating artery to the circulation of injured side. The “hyperacute” group patient, two patients among 3 patients of “acute” group and 10 patients among 17 patients of “chronic” patient group had collateral circulation. The “hyperacute” group patient had faint collateral circulation and suffered infarction of injured side after total occlusion of injured ICA to die due to infarction swelling. One of the “acute” group patients had both ACA territory infarction which aggravated after endovascular treatment and was discharged with GOS 2.

Conclusion: Treatment of tCCF with acute traumatic brain injury is difficult and even determining when to conduct the endovascular treatment is not easy, but research on this issue is limited as far as we know. Based on this case series, when it comes to determine the time of endovascular treatment of tCCF, delayed endovascular treatment considering the collateral circulation rather than immediate ICA occlusion after trauma should be helpful to the patient’s prognosis.

Transvenous Embolization along with Intraprocedural Image Fusion Technique for Complex Intracranial Dural Arteriovenous Fistula

Oh Sol Hooy, Jai Ho Choi, Bum Soo Kim, Yong Sam Shin

Department of Neurosurgery, Seoul St.Mary's Hospital, The Catholic University

Objective: This study aimed to investigate the efficacy and safety of an intraprocedural image fusion technique using flat-panel detector computed tomography-based rotational angiography (FDCT-RA) and image fusion (IF) for the transvenous approach in treating intracranial dural arteriovenous fistulas (dAVFs).

Methods: A retrospective review was conducted on patients who underwent transvenous embolization for dural AVFs. The patients were classified into two groups according to the treatment technique used: the FDCT-RA and IF technique group and the conventional technique group. The primary outcomes assessed were the angiographic and clinical outcomes, complications, fluoroscopy time and radiation exposure. Univariate analyses were performed to compare the two treatment modalities.

Result: Eighty-six patients with intracranial dAVFs were treated with transvenous embolization (TVE), of which 37 patients underwent transvenous approach with flat-panel detector computed tomography-based rotational angiography (FDCT-RA) and image fusion (IF) technique used. The FDCT-RA and IF group showed difference in the location of dAVFs, occlusion state of the sinus, and access routes in comparison to the conventional treatment group. The FDCT-RA and IF technique was predominantly used for dAVFs involving the anterior condylar confluence and cavernous sinus with ipsilateral inferior petrosal sinus (IPS) occlusion. Patients treated with this technique demonstrated a higher rate of complete occlusion (91.9%, n=34) compared to those treated with the conventional technique (79.6%, n=39), but this difference was not statistically significant ($p=0.136$). Although the implementation of this technique during the treatment procedure showed a tendency to decrease both fluoroscopy duration and radiation dose, the observed results did not reach statistical significance ($p=0.315$, $p=0.130$).

Conclusion: The intraprocedural image fusion technique using FDCT-RA for transvenous treatment of intracranial AVFs could provide help in treatment of dAVFs of certain locations or access routes. It can provide aid in microcatheter navigation, without increasing the radiation exposure and fluoroscopy time.

Combined Approach of Symptomatic Inaccessible Dural Arteriovenous Fistulas

Yuseng Song, Jae Sang Oh, Min Jung Kim, Young Woo Kim

Department of Neurosurgery, Uijeongbu St. Mary's Hospital, College of Medicine, The Catholic University of Korea

Objective: Recently dAVFs has treated by transarterial approach and transvenous approach to cure it. But when dAVFs has high grade of type of Cognard, transarterial approach was failed in state of incomplete occlusion. We introduced a case of combined approach of dAVFs on superior sagittal sinus (SSS)

Methods: 67 years old male was admitted on ER with suddenly hemiparesis and mental change. His intermittent hemiparesis and drowsy consciousness after admission were aggravated. Angiograms showed the high grade type of dAVF with cortical venous reflux. So we planned the endovascular management..

Result: With transarterial approach and surgical approach, Onyx and coil embolization was performed. Transarterial approach Onyx embolization was done as followed by surgical approach. Final angiogram showed the complete obliteration of dAVFs. His symptom was recovered dramatically.

Conclusion: Intractable dAVF is sometimes hard to treat its location and configuration of arterial pathway or occlusion of venous system. So we introduced combined approach is useful as next options.

3D-printed Patient-specific Circles of Willis with An Intracranial Aneurysm and Their Application to Neurointerventional Endovascular Simulation

Jung-Jae Kim¹, Yeonwoo Kim², Hyeondong Yang², Kwang-Chun Cho¹, Yong Bae Kim¹, Je Hoon Oh²

¹Department of Neurosurgery, Yonsei University, ²Department of Mechanical Engineering, Hanyang University

Objective: The intracranial aneurysm (IA) is a common cerebrovascular disease, and the endovascular treatment (EVT) is typical treatment procedure for IA. However, EVT in the cerebral artery requires sophisticated techniques due to the tortuous and narrow structure of the artery, posing a challenge for less-experienced neurosurgeons. The difficulty of EVT in the cerebral artery led to requirements for neurointerventional endovascular simulator (NES) that enables to obtain endovascular interventional plans and techniques by performing endovascular procedure simulations.

Methods: A tubular, transparent, and patient-specific CoW replica is fabricated with realistic dimensions and elasticity using a combination of 3D printing and dip coating technique. First, a real-scale CoW core substrate is constructed using an extrusion-based 3D printing technology, then the thickness of the vascular wall is manipulated by coating the core substrate layer by layer, and finally the core substrate is dissolved to produce a tubular CoW structure. A liquid-assisted dip coating method is utilized and optimized for uniform and high-quality coating layers on the tortuous CoW core substrate. Moreover, the effectiveness of the CoW replica is demonstrated through an in-house NES. For the evaluation of efficacy, we performed an in-vitro simulation of coil embolization with the developed NES and CoW replica. After completing the coil embolization, a red fluid was injected through the guiding catheter to make the intraaneurysmal flow visible while circulating the pulsatile flow. We compare the flow near the IA before and after the in-vitro coil embolization simulation.

Result: Before coil embolization, the red fluid fully flowed into the IA. However, after coil embolization, the coils disrupted the red fluid flows into the IA and reduced the intra-aneurysmal

flow, indicating that the IA was assumed to be well treated. In a real situation, the coils inside the IA induce blood clotting and prevent the blood flow into the IA, and the IA will eventually be treated.

Conclusion: The proposed method paves a new way for practical and reliable endovascular simulations, which would help significantly improve the clinical outcomes of current IA treatments.

Endovascular Treatment of Intracranial Aneurysms Using the LVIS EVO stents: A Single-Center Experience

Kim Junyoung, Sukh Que Park

Department of Neurosurgery, Soonchunhyang Univ. Seoul Hospital

Objective: Low-profile, self-expandable stents have expanded therapeutic options for treating intracranial aneurysms, and the Low-Profile Visualized Intraluminal Support (LVIS) EVO stent has been now used as a novel tool for complex cases. In this single-center study, we report our early experience with the LVIS EVO stent, aiming to assess its safety and efficacy.

Methods: Between January 2022 and October 2023, we treated 24 cases involving 22 patients with both ruptured and un-ruptured intracranial aneurysms using LVIS EVO stent-assisted coil embolization. Comprehensive clinical data, including patient demographics, past medical history, aneurysm location, procedural outcomes, peri-procedural and post-procedural complications, and follow-up results were collected. The obliteration rates were estimated using a modified Raymond-Roy classification (mRRC), while patient outcomes were assessed with the modified Rankin scale (mRS).

Result: A total of 24 intracranial aneurysms (10 ruptured, 14 un-ruptured) in 22 patients were treated using LVIS EVO stents. There were 6 cases of incomplete stent deployment. In early follow-up assessments, 16 aneurysms (67%) achieved nearly complete occlusion (mRRC 1&2), while 8 aneurysms showed a residual aneurysm sac; 1 case was effectively managed with flow diversion. There were 3 cases (13%) of intra-procedural thromboembolic complications, but no post-procedural re-bleeding events. 6-month follow up MRA was available for the 13 patients (54%), and 11 patients (85%) achieved complete occlusion while 2 patients had residual neck. All patients experienced favorable post-procedural outcomes (mRS 0 & 1).

Conclusion: Currently, only a limited number of studies have explored the use of the LVIS EVO stent in clinical practice for intracranial aneurysm treatment. This single center study provides the experience of safety and efficacy, including management of complications. Additional prospective, comparative, larger-scale studies are necessary to confirm its long-term efficacy, safety, and potential superiority of the LVIS EVO stent relative to other devices in procedure.

Early Technical Experience with the Target Tetrahedral Coil(TARGET TETRATM); What Is Its Optimal Role for Aneurysm Coiling?

박신호, 송승윤, 이동훈, 성재훈

가톨릭대 성빈센트병원 신경외과

Objective: Recently, the Target tetrahedral coil (Stryker Corp., Kalamazoo, Michigan, USA) has been developed. It is specially designed for persistent maintenance of typical 4-directional entanglement, just like wave-dissipating concrete blocks on the coast. We'd like to share our early experience of this coil focusing on its unique characteristics and efficacies.

Methods: A retrospective study was conducted on all patients undergoing aneurysm coiling with Target tetrahedral coils to evaluate safety and efficacy. Between April 2023 and June 2023, 18 patients were treated for 19 cerebral aneurysms with Target tetrahedral coils at one center. Subsequent results were assessed using the Raymond-Roy scale.

Result: Mean aneurysm size was 5.0 ± 2 mm $\times$ 4.7 ± 2 mm (width x height). Mean neck size was 3.5 ± 1 mm. Mean dome-to-neck ratio was 1.44. Out of 19 cases, 13 were performed using either single or double catheter technique (68.4%), while 6 cases involved the use of stent-assisted technique (31.6%). Target tetrahedral coil was used as a framing coil in 9 aneurysms and as a filling coil in 10 aneurysms. With its strong shape memory characteristics, the Target tetrahedral coil showed early rotational behavior followed by stable occupation behavior. The successive and successful completion of these two steps without neck protrusion or catheter kick-back are key determinants of final detachment. The final Raymond-Roy I or II occlusion was achieved in 85.7%. Our cases will demonstrate its unique behavior intuitively.

Conclusion: Based on its unique characteristics and our experience, we recommend the Target tetrahedral coil as an initial framing coil, rather than a filling or finishing one.

2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

15:20-17:00

정책 심포지움:

중증·응급 뇌혈관질환에 대한 KoNES의 역할

좌장: 이건세(건국대 예방의학교실)
장철훈(영남대)

진료 현황 - 전국 155개 응급 중증 뇌혈관질환치료 병원

2021년 치료 현황조사

- 응답 병원 : 117/155 (75.5%)

iv TPA	IA Thrombectomy	SAH coiling	SAH clipping	ICH drain/ectom	AVM tx	decompression for infarction	
4144	4579	3586	1048	4169	633	587	18746

전국 치료 현황

- 대형병원 쓸림이 거의 없음

Big 5	iv TPA	혈전제거술	파열동맥류색전술	파열동맥류결찰술	자발성뇌출혈	감압개두술
서울아산병원	79	145	24	14	66	12
급	46	51	17	11	16	5
서울대병원	18	29	17	7	23	6
서울강남병원	90	61	18	14	16	21
병원	29	46	29	13	10	10
NA	NA	NA	23	17	25	5
서울대병원	27	46	25	6	26	10

2차 병원,	iv TPA	혈전제거술	파열동맥류색전술	파열동맥류결찰술	자발성 뇌출혈	두개감압술
비수련	30	56	44	19	33	9
종합병원,	30	71	57	1	24	2
비수련	90	26	39	0	29	5
대학병원	24	50	39	10	64	6
대학병원	22	53	51	23	106	5
대학병원	NA	25	35	2	36	3
대학병원	94	42	16	9	39	1

전국 치료 현황

- 대형병원에서 일반 질환과 달리 환자 쓸림이 없는 이유에 대한 파악 필요

Big 5	iv TPA	혈전제거술	파열동맥류색전술	파열동맥류결찰술	자발성뇌출혈	감압개두술
서울아산병원	79	145	24	14	66	12
급	46	51	17	11	16	5
서울대병원	18	29	17	7	23	6
서울강남병원	90	61	18	14	16	21
병원	29	46	29	13	10	10
NA	NA	NA	23	17	25	5
서울대병원	27	46	25	6	26	10

- 환자의 수용능력 문제 - 중환자실, 수술실 부족으로 수용거부
- 근접병원에서 수용되어 환자 방문 자체가 적음

전국 치료 현황

- 30 분 이내의 가까운 병원에서 대부분 치료가 이루어짐
- 비수도권지역은 권역 센터 비중 중요

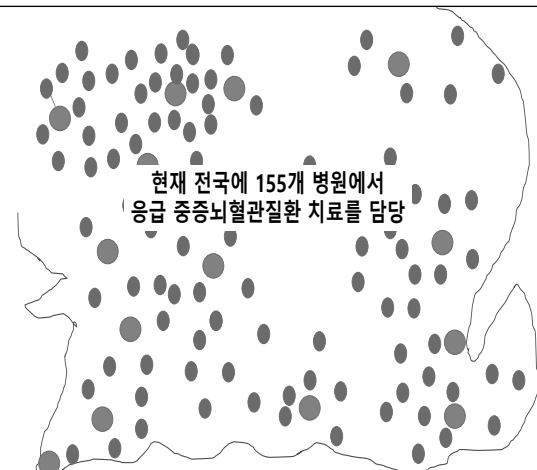
집계 병원	미집계 병원	iv TPA	IA Thrombectomy	SAH coiling	SAH clipping	ICH drain/ectom	AVM tx	decompression for infarction
권역 심뇌출혈	13/14	714	1022	432	165	576	136	102
권역 심뇌출혈		64.9	92.9	39.3	15.0	52.4	12.4	9.3

집계 병원	미집계 병원	iv TPA	IA Thrombectomy	SAH coiling	SAH clipping	ICH drain/ectom	AVM tx	decompression for infarction
권역/서권역		21%	29%	14%	19%	16%	27%	21%
권역외 종합	94/145	3430	3557	3154	883	3593	497	485
권역외 평균		36.5	37.8	33.6	9.4	38.2	5.3	5.2

집계 병원	미집계 병원	iv TPA	IA Thrombectomy	SAH coiling	SAH clipping	ICH drain/ectom	AVM tx	decompression for infarction
10개 이하병원		12	10	14	105	10	103	97
50개 이상 병원		27	8권역	104	19	3-1 권역	93	0
100개 이상		3 - 1 권역	6 - 3 권역	2	1	6-1 권역	0	0

전국 치료 현황

- 병원 규모, 지역에 따른 치료 질의 차이가 있는가 ?
- 치료 방식의 변화
 - 뇌동맥류·속련된 전문가에 의한 개두술 -> 혈관내 색전술
 - 자발성 뇌출혈: 뇌장위적 미세침습적 배액술, 현미경적 제거술
 - 뇌혈관 폐쇄: 감압 개두술 → 혈전제거술
- 의료시설의 변화
 - MRI, CT, 혈관조영술
 - 수술현미경, IOM, Navigation
- 응급 중증 뇌혈관질환 환자에서 가장 먼저 고려 사항-응급조치





응급뇌혈관질환치료 전문센터 전국네트워크

- 정의
 - 응급뇌혈관질환: 긴급한 수술이나 중재가 필요한 뇌혈관질환 - 급성대뇌혈관 폐쇄, 뇌동맥류 파열, 수술이 필요한 자발성 뇌출혈
 - 치료 : IA thrombectomy, SAH coiling/Clipping, ICH surgery
- 배경
 - 중증뇌혈관치료를 대한 전국 단위의 안전망이 구축되어 있지 않음
 - 전국 14개 권역심뇌혈관센터 만으로는 중증응급뇌혈관치료를 전적으로 담당할 수 없음
 - 2021년, '제2차 공공보건의료기본계획'을 통해 심뇌혈관질환의 적절한 관리를 위한 지역심뇌혈관질환센터를 2025년까지 70개소 지정하겠다는 계획

응급뇌혈관질환치료 전문센터

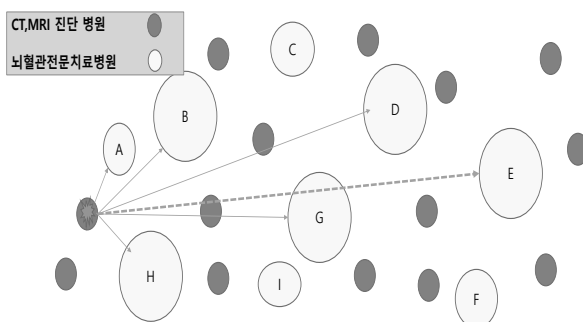
- 전문센터 인증제 마련
 - 최대한 많은 병원이 인증을 받도록 유도,
 - 즉 현재 이루어지고 있는 신경외과 중심의 중증뇌혈관치료활동을 규정에 의한 활동이 되도록 매뉴얼을 만들고 프로세스를 개선하는 것임
- 전문센터 인증은 중증뇌혈관질환 치료의 질적인 내용을 학회에서 보증한다는 의미이므로 세부기준을 마련해야 하며, 학회 인증이므로 인증을 못 받는다고 해서 뇌혈관질환치료를 못하는 병원은 아님
- 중증뇌혈관질환치료 이므로 구조, 인적구성, 치료건수 등에 대한 세부규정이 마련되어야 함
 - (신경계중환자실, 수술이나 중재술이 가능한 3인(당직고래), SAH 10건, ICH 10건, Thrombectomy 10 건 등)
- 인증센터별 장비, 전문의 구성, 치료 실적을 공개하고 전국 지도에 구체적인 기관의 위치를 기입하고 전문가용 어플과 뇌졸중 환자용 어플을 통해 공개
- 인증센터는 최소 매주 치료실적을 공개하고 공동의 리지스트리 등록의무 부여 - 비용관련 정부 연구비 획득이나 지원요구

응급뇌혈관질환치료 전문센터

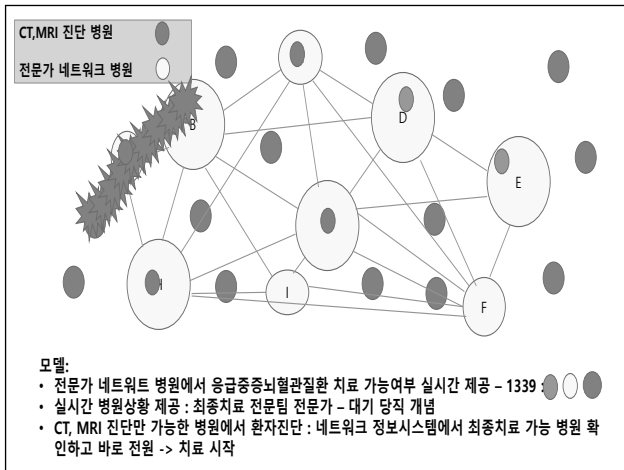
- 전문센터 구성 및 활동
 - 전문의 당직제로 운영하여 센터 병원에 방문하는 중증뇌혈관질환 환자를 신속하게 치료
 - 병원에서 수용하기 어려운 상황이거나 치료가 지연될 가능성이 있는 경우 네트워크로 연결된 지역 타센터로 신속하게 전원
 - 초기 환자 평가 및 치료 결정은 병원 상황에 따라 자율결정
 - 대부분의 병원이 응급실에서 Fast tract system을 운영함
 - 신경과에서 triage하고 중증뇌혈관질환으로 진단하여 신경외과에 의뢰되는 시스템으로 운영되는 병원은 뇌강액밀지라도 최종치료를 유지하는 능력이 필요 함
 - 신경과도 전공의 부족과 80시간제로 전공의 응급실당직근무 어려워하는 병원들이 있어 신경외과와 역할 분담하는 병원도 있음
 - 치료결과를 공동 리지스트리에 등록하고 중증뇌혈관치료 연구의 근거자료 마련
 - KSCVS, KONES에서 리지스트리 풀을 만들고 최소한의 시간 투여로 리지스트리 등록하도록 하고 정부지원을 받아 안전바가 해결되면 좀더 상세한 리지스트리로 발전

그러나 실재는

- 뇌졸중 적절성 평가 사업 : 255개 참여 기관중 90여개만 1등급
- 뇌졸중 학회 주관 뇌졸중센터인증, 재관류센터 인증 등등
- 의료 보험 재정을 바탕으로 민간의료 차원의 진료 - 센터 운영 수가 ?
- 기관 간 연계는 여러 장벽
- 응급수술 최종치료과 순환당직제 실효성 ?
- 응급의학과 - 최종치료과 간 연결



- 현 상황 :
- CT 나 MRI로 응급 중증 뇌혈관질환 진단 병원 -> 치료 가능한 인근 전문가가 있는 병원으로 전원
 - 프로세스 : 응급실 -> 전문가병원 응급실- 응급의학과 전공의/전문의 - 최종진료과 전공의/전문의의 확정 - 응급의학과 - 의뢰 병원 답변 : 여러 병원 문의 - 시간 소모 많음 - 적시치료 어려움



현재 중증 응급 뇌혈관질환 치료 현황

- 응급중증 뇌혈관질환 치료 - 의학적 권고와 진료 지침에 의한 치료
 - 치료의 질적 측면 : 인증제도 - 학회, 정부
- 필수의료 수행 관련 : 민간의료기관에서 수행하기 어려운 점
 - 치료 지연 (진료 공백) 해소
 - 치료 전문의 부재
 - 수용 가능한 병원 부재
 - 전원 과정의 지연 - 전문의간 연락체계
 - 의료취약지역 해소
 - 지역 전문가 회의를 통한 현황파악

SKT 613 ㅁ ㅂ ㅅ ㅈ ㅊ ㅋ ㆁ ㆃ ㆅ ㆇ ㆉ ㆋ ㆍ ㆏ ㆑ ㆓ ㆕ ㆗ ㆙ ㆛ ㆝ ㆟ ㆡ ㆣ ㆥ ㆧ ㆩ ㆫ ㆭ ㆮ ㆰ ㆲ ㆴ ㆶ ㆸ ㆺ ㆼ ㆾ ㆿ

< 응급중증뇌혈관질... 27 🔍 ≡

응급중증 뇌혈관질환

- 양 학회 회장, 총무,
- 매 2-3주 간격 중 회
- 복지부 진행 각종 필
- 복지부 질병 정책과
- 뇌혈관치료 전문가가
구성의 필요 확인

KCT 613 ㅁ ㅂ ㅅ ㅈ ㅊ ㅋ ㆁ ㆃ ㆅ ㆇ ㆉ ㆋ ㆍ ㆏ ㆑ ㆓ ㆕ ㆗ ㆙ ㆛ ㆝ ㆟ ㆡ ㆣ ㆥ ㆧ ㆩ ㆫ ㆭ ㆮ ㆰ ㆲ ㆴ ㆶ ㆸ ㆺ ㆼ ㆾ ㆿ

1) 광주 전남+ 전북지역
4/3일 5시 30분

2) 4월 3일 월요일 6시
대강TFT

3) 4월4일 오후 5시 중회의
경기서북

4) 4월5일 오후 4시
서울서북 중회의

5) 4월5일 오후 5:30
경기동남 중회의

6) 4월 5일 오후 6시반
대전 오보러민

7) 경남권역 4월 6일
5시30분

8) 서울 동남 4월 10 일
오후 5시 반

9)울산권역 4월11일 오후
5시30분

10) 경기남부 4월 12일
오후 5시 중

11) 충북권역 4월 12일
오후 5시 중회의

12) 부산권역 4월13일
오후 5시

주

책임자

전교한

로팀 전국망

사례 3

인천 00 병원 (수련병원, 3차병원)

- 뇌혈관전문의 3명 (전국 평균 3.3명)
- 신경외과 수술 병 2/혈관조영실 1
- 병 9시, 응급실로 내원하여 진단받은, Thrombectomy 필요 환자
- COVID 19 양성
- 치료는 가능 하나 치료 후 수용 가능한 격리실이 없는 상태
- 전문가 네트워크에 상황을 올리고
- 3분만에 응급, 9분만에 의사결정

SKT 6:34 일 · 음성 녹음 100% 종료
< 응중비네트워킹원천 36 >
Q ≡

2023년 6월 15일 목요일

ER [redacted] M/57
 C/C : motor aphasia

 LNT 23/06/15 05:00 AM
 FAT 23/06/15 08:00 AM
 추정

 NIHSS 2점

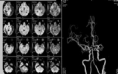
 COVID-19 positive

 본원에 격리실이 없는데
 혹시 받을수 있는곳 있나요?

 Thrombectomy
 case입니다

오후 9:09

SKT 6:35 일 · 음성 녹음 100% 종료
< 응중비네트워킹원천 36 >
Q ≡



저희 원례도 감사합니다.

[redacted]

네 감사합니다.
지금 보낼게요

오후 9:22

교 혼

- 아간에도 전문가 네트워킹을 활용하면 신속한 의사결정 가능
- 전문 받는 병의 전문의를 통한 신속한 상황 파악 가능

SKT 9:12 일 · 음성 녹음 100% 종료
< 응중비네트워킹원천 36 >
Q ≡

Motor aphasia만 이외요
 TPA CIX입니다

입야불요

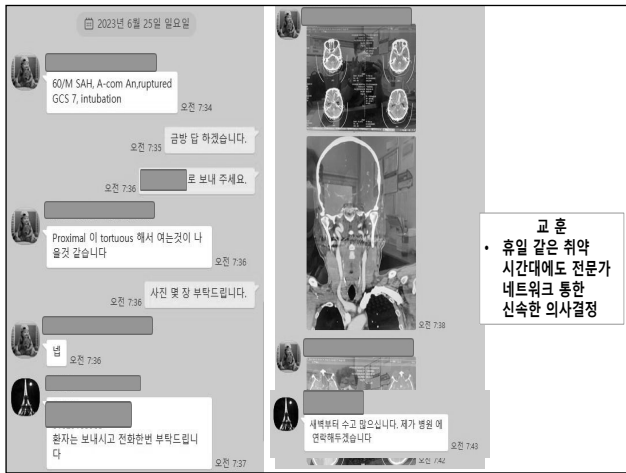
네 감사합니다.

오후 9:17

사례 5

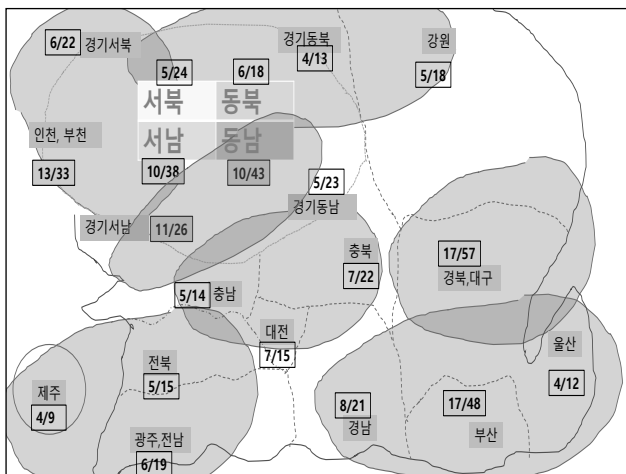
경기도 00 병원 (종합병원)

- 뇌혈관전문의 2명 (전국 평균 3.3명)
- 신경외과 수술 병 1/혈관조영실 1 - 혈관내 치료 위주, 결찰술은 안함
- **월요일 오전 6시** 응급실로 내원하여 진단받은 뇌동맥류 파열환자
- Poor grade이고 혈관내 접근 치료가 어렵다는 전문의 판단
- 전문의 판단에 의해 개두술 필요병일지 전일 결정
- 전문가 네트워크에 상황을 올리고
- 1분만에 응급, 2분만에 의사결정

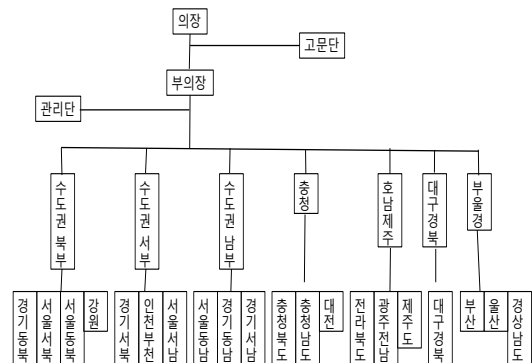


응급 중증 뇌혈관 치료 과정

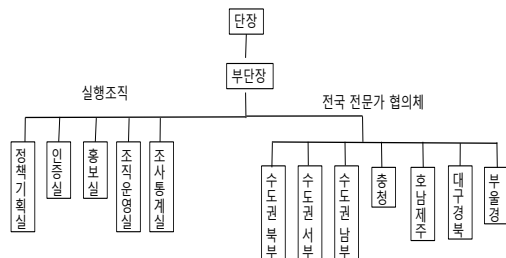
- 장비 : 혈액생화학검사, 영상 (CT, MRI, Angio), 수술장비
- 치료 프로토콜 : 의학적 권고사항, 병원 인증 - Fast tract
- 인력
 - EM 전공의, 전문의
 - 신경과 전공의, 전문의
 - 신경외과 전공의, 전문의
 - 영상의학과 전문의
 - 혈관조영실 기사, 간호사, 전담간호사, 수술방 간호사



전국 응급 중증 뇌혈관치료 전문가 네트워크 협의체

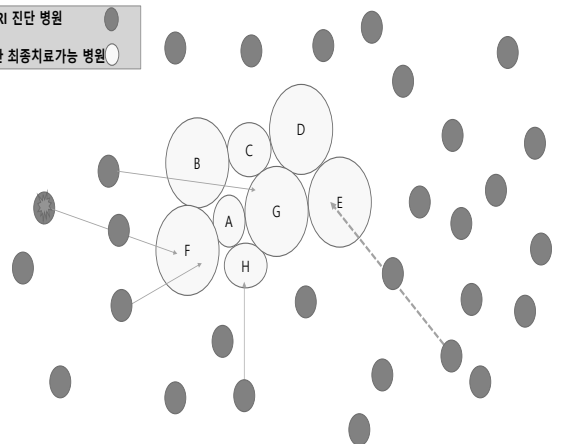


전국 응급 중증 뇌혈관치료 전문가 네트워크 관리단



CT, MRI 진단 병원

뇌혈관 최종치료가능 병원



최종 치료 전문가가 할 수 있는 일 ?

- 어떠한 치료가 필요한지 파악
- 치료를 위한 자원의 파악 - 영상, 중환자실, 수술실, 혈관조영실
- 치료를 위한 자원의 조정
- 신속한 의사결정
 - 자발성 기반 - 수용의사 표현
 - 취약 시간대를 위한 당직전문의 제도
 - 본인 병원에서 수용, 치료
 - 네트워크 내 다른 전문가 혹은 팀장에게 의뢰
 - 인근지역 네트워크 의뢰

뇌혈관 전문가 네트워크 활동이 가능한 배경

- 응급 중증 뇌혈관질환 치료의 질
 - 영상 장비 : CT, MRI, DSA
 - 전문 인력
 - 진료프로세스
- 인적네트워크 - 학회, 지역의사회 -카카오톡

② 팀 단위 적정 보상을 위한 인적 네트워크 시범사업

- 심뇌혈관질환 치료전달체계를 개선하고 전문의간 인적 네트워크를 활성화하기 위해 건강보험 시범사업 실시

- 인적 네트워크 단위의 사전 일괄보상과 적정 기능수행 성과에 따른 가차기반 지불보상

- 네트워크당 연 2억원 수준을 사전(100%), 성과기반 사후(40%) 추가 보상 검토

· (사전보상) 네트워크 구성 유지 관리비 지원

- 네트워크 운영 관리비: 운영에 필요한 통신비, 네트워크 팀과의 원활한 소통을 위한 연락망 체계 구축 및 유지 비용, 환자 사례관리 등 네트워크 유지비

· 활동비용:

- ① 의사 활동비: 의사가 수행한 당직, 인력간 소통과 의사결정에 대한 부가적 보상
* 의사의 치료 행위 자체는 기존 정규 수가로 보상
- ② 비의사 전문 인력 활동비: 비의사 전문 인력이 수행한 활동에 대한 보상

· (추가보상) 활동 효과 분석을 통해 차등 보상

- 환자수 대비 치료율: 해당 지역내 발생 환자 중 네트워크팀이 담당한 환자의 비율로 평가, 네트워크팀의 효율성과 활동 수준 반영
- 골든타임 내 최종치료 환자 비율: 네트워크팀이 담당한 환자 중 골든타임 내에 필요한 조치를 취한 환자의 비율로 평가, 네트워크팀의 응급상황 대응 능력과 협업에 대한 평가
- 과정평가 : ①의뢰건수 대비 응답 비율, ②평균 응답 소요시간, ③의사결정 소요 시간 등을 네트워크 특화 플랫폼과 연계하여 수집하여 평가

영역	지표명	점수	평가방법	자료원
네트워크팀 구성 (25점)	지표 1 해당 진료권의 네트워크팀 필요성	5	정성	운영계획서
	지표 2 협력체계 구성	10	정성	
	지표 3 네트워크 지역 구성	10	정량	
	지표 4 심뇌혈관질환 취약지 전문의 참여 여부	5 (가점)	정량	
네트워크팀 운영 (60점)	지표 5 PI 및 참여전문의 역할 설정	15	정성	
	지표 6 골든타임 내 신속치료 제공위한 서비스 모형 및 표준운영절차(SOP) 계획	25	정성	
	지표 7 관련 학회 인증의사 수	10	정량	
	지표 8 보상금액 내부 정산 기준	10	정성	
의료 질 개선 (15점)	지표 9 골든타임 내 최종치료 제공 개선 계획	15	정성	

전문가 네트워크 핵심역량

- 최종치료 전문가의 치료 능력 - 허혈, 출혈
- 최종치료 전문가의 조정능력
- 최종치료 전문가간 내부 협업
- 전문가 네트워크와 외부연결 : 지역완결형
- 전문가 네트워크 총괄

결론 및 제언

- 우리나라의 뇌혈관치료 시설, 역량은 선진대열에 있다
- 건강보험 재정을 기반으로 운영되는 민간의료기관에서 대부분의 치료를 담당한다
- 응급중증뇌혈관질환은 발생지역 주변에서 치료받는다
- 뇌혈관질환 치료 자원이 전국각지에 흩어져 있고 병원 별 당직 시스템으로 업무 피로도는 높고 진료공백의 위험이 있다
- 뇌혈관질환 관리 정책은 현실에 기반을 둔 실현가능하고 지속 가능한 방식으로 진행되어야 한다
- 뇌혈관전문가 네트워크는 최종치료 전문의의 열정과 정부의 지원을 통해 국민의 생명을 보호하는데 기여할 수 있다

보건복지부 심뇌혈관질환센터 지정/응급의료 전달체계 개선에 관한 KoNES의 제언

신 승 훈

차의과학대학교 분당차병원

중증, 응급뇌혈관질환은 치료의 시간, 민감성이 매우 중요시되어지는 질환이다, 특히 급성뇌경색 치료에 있어 동맥내 혈전제거술은 그 치료의 효용성이 24시간까지 확대되었고, 또한 이전에는 시도하지 않았던 뇌경색 범위가 넓은 경우, 작은 혈관 폐색, 등등 치료의 적응증이 나날이 늘어나고 있는 현실이다. 혈전제거술의 성공률 또한 약 90%를 선회할 정도로 높아지고 있는 상황이다. 뇌동맥류성 지주막하 출혈의 경우에도, 기술의 향상과 의료가기 등의 발전에 힘입어 치료 성적이 매우 향상되어지고 있다. 뇌내 출혈의 치료에서 최소 침습 수술의 발달로 이전의 개두술이 아닌 최소 침습 수술을 통해 많은 환자들의 치료가 성공적으로 이루어지고 있다.

현재 전국의 대학병원, 수련병원, 보건복지부 인증 뇌혈관전문병원 및 뇌혈관질환 치료 능력을 갖춘 종합병원 등 전국의 다양한 수준의 의료기관에서 골고루 중증,응급 뇌혈관질환을 진단, 치료하고 있다. 대한민국의 치료 수준이 매우 높다고 알려 졌음에도 불구하고, 국가에서 각 의료기관의 능력을 제대로 평가하고 인증하는 인증제 또는 그에 준하는 사업은 현재 없는 실정이다. 하지만, 개별 의학회의 수준에서 다양하게 진료역량에 관한 인증제를 도입하여 시행하고 있다. 그 중 대표적인 인증제가 대한뇌혈관내치료의학회에서 시행하는 뇌졸중 시술 인증의 및 시술 인증기관 제도이다. 물론 대한뇌졸중학회에서도 뇌졸중센터 및 혈전제거술 가능 뇌졸중센터 사업을 진행하고 있다. 뇌혈관질환 치료의 수준을 한층 더 높이기 위해서는 이러한 개별학회의 인증제를 국가수준의 사업으로 끌어 올리는 것이 필요하다고 보인다. 현재 대한민국은 약 2-300 병상의 병원에도 MRI, 혈관조영실, 중환자실 등의 시설을 잘 갖추고 있다. 하지만, 치료대응력의 관점에서는 상당히 편향된 면이 없지 않다. 치료대응력이라 함은 결국 어떤 질환에서 최종치료를 시행할 수 있는 능력을 말한다고 봐야 한다. 급성 뇌경색 분야에서는 동맥내 혈전제거술이 그 최종치료로 보아야 하며, 뇌내 출혈에서는 개두술을 통한 혈종 제거술 또는 최소 침습 수술이라 할 수 있다. 또한 뇌동맥류성 지주막하 출혈의 경우에는 재출혈을 방지하기 위한 개두술 및 클립결찰술 또는 혈관내 색전술이 그 최종치료라 할 수 있다. 중증,응급 뇌혈관질환 치료에서 가장 중요한 것이 지금 당장 최종 치료를 하지 않으면, 환자의 생명에 문제가 발생한다는 것이다. 결국 가장 중요한 것이 최종 치료이며, 더욱 더 중요한 것이 최종치료를 담당하는 각 분야의 전문의 들이다.

급성 뇌경색의 치료에서 가장 중요한 동맥내 혈전 제거술을 시행할 수 있는 전문의, 뇌내 출혈에서는 수술적 치료를 시행할 수 있는 전문의, 뇌동맥류성 지주막하 출혈에서 또한 수술적 치료를 시행할 수 있는 전문의 및 혈

관내 치료를 할 수 있는 전문의가 중요하다. 다른 분야, 즉 정맥내 혈전용해제의 투여 및 진단 등은 AI, Tele-medicine 등을 통해서 인력의 부족을 해결할 수 있지만, 동맥내 혈전 제거술, 개두술, 혈관내 치료 등은 사람이 직접 병원에 나와 현장에서 직접 시행을 하여야 하는 일이다. 그것도 24시간 365일을 말이다. 여기에서 현재 이슈가 되고 있는 필수의료에 대한 해답이 나온다. 최종치료를 할 수 있는 인력을 확보하고 육성하며, 지원하는 것이다. 수술적 치료는 현장에 나와 현장에서 해결을 해야 하는 일이다. 말로 하는 일이 아니다. 현 권역심 뇌혈관질환센터의 뇌혈관질환센터 지표 중 신경외과 전문의 1명 이상이라는 지표는 현재 정부의 중증응급뇌혈관질환에 대한 인식을 적나라하게 보여준다고 할 수 있다. 이 지표에 대해 지난 수년간 대한신경외과학회 및 관련 학회에서 수없이 이의를 제기하였음에도 현재까지도 바뀌어 지지 않은 지표이다. 핵심인 치료 대응력이 무엇인지를 전혀 이해하지 못하고 있는 것이다. 치료 대응력, 즉 필요한 분야에 인력을 갖추는 것이 문제해결의 핵심이다. 인력의 확충은 이런 분야에 대해 해야 하는 것이다.

중증, 응급뇌혈관질환의 문제점은 결국 응급의료 전달체계 내에서 그 해결점을 찾아야 한다. 최근 보건복지부에서는 현 3 단계의 응급의료 전달체계를 3 단계(중증, 일반, 24시간센터)의 응급의료전달체계로의 개편을 계획하고 있다. 상당히 올바른 방향으로 가고 있다고 판단된다. 현재 약 40개의 권역응급의료센터와 125개의 지역응급의료센터, 243개의 지역응급의료기관 등 전국의 409개기관에서 응급진료를 시행하고 있다. 특히 응급의료센터로 방문하는 중요 질환에서 응급 심.뇌, 중증외상, 소아.분만 등이라 할 수 있다. 응급의료에서 가장 중요한 것은 중증의 환자들이 119를 통해 병원을 방문하던 아니면 직접 병원을 방문하던 첫 방문한 병원에서 최종 치료가 가능해야 한다는 것이다. 치료의 시간을 다투는 질환에서 타 의료기관으로의 이송은 golden time을 놓치는 문제가 발생하기 때문에 결국 치료의 질적 저하 및 결과의 악화를 가져올 수밖에 없다.

결국 각 질환 별로 24시간/365일 치료가 가능한 병원임을 사전에 전국민에게 알리는 것이 필요하다는 것이다. 이 기관에서는 항상 일정한 인력과 시설, 장비 등을 응급상황을 대비하여 준비를 하여야 한다는 것이다. 응급상황은 전국에서 골고루 발생하며, 전국의 다양한 의료기관에서 치료를 시행하고 있다. 현재의 권역심뇌혈관질환센터 처럼 아주 일부의 병원만 인정 또는 지정을 하여서는 안된다는 것이다. 각 응급질환 별 치료가능 능력에 대한 인정을 받아 응급 치료의 두터운 층을 만들어야 한다는 것이다. 응급 질환은 몇 개의 병원만으로는 해결이 안된다. 24시간 365일 치료가 가능한 병원들에 대한 국가적인 인증 사업 및 지원을 하여 촘촘한 응급치료의 두터운 층을 만들어야 현재 벌어지고 있는 응급실 뱅뱅이 같은 일들이 사라질 것이다. 현재 진행되고 있는 권역심뇌혈관질환센터 사업은 재고되어야 한다.

향후 의료정책의 방향성을 제시하면서, 글을 마무리하려 한다.

1. 뇌졸중시술 인증의/인증기관 제도의 확장 => 국가인증제도로 편입
2. 중증·응급뇌혈관질환 치료 전문가 전국 네트워크 활용
3. 심평원 급성기뇌졸중 적정성평가 결과 활용: Registry & 결과
4. 시설, 시스템도 중요하지만, 결국 최종치료가 가능한 인력(치료대응력), 사람이 문제다.

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좌장

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[Education]

1982.03-1989.02	서울대학교 의학사
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2013-2015	건강보험심사평가원 중앙평가위원
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Panel Discussion

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보건복지부 보육정책과장

Panel Discussion

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① 2019.04~2020.03	보건복지부 건강정책국 구강정책과
② 2020.03~현재	보건복지부 건강보험정책국 보험급여과

Panel Discussion

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Panel Discussion

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2023 대한뇌혈관내치료의학회 정기학술대회 및 총회

Theme: Better Policies for Better Stroke Care



| 2023년 11월 25일(토) | 가톨릭대학교 성의교정 옴니버스파크 L층

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| P-02 | Ambiguous spontaneous Intracranial bilateral vertebral artery dissection Patient who had trauma and loss of consciousness: Case report | 석훈(순천향대학교 부천병원) |
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P-01

Strategic endovascular approach to uncoilable ruptured blood blister-like aneurysm using stent-only technique with the Accero stents

Yungbaeg Park, Yongjae Lee

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Objective: The endovascular treatment of ruptured blood blister-like aneurysms (BBAs) is a complex endeavor when stent-assisted coiling is not feasible due to the aneurysm's shallow shape or technical challenges in microcatheter superselection. Given the constraints of the Korean health insurance system, which does not approve the use of flow-diverting stents for ruptured aneurysms, we explore the viability of stent-only technique with the Accero stents (Acandis, Pforzheim, Germany), which exhibit flow-diverting effects with high metal coverage.

Methods: We present two cases of ruptured BBAs with uncoilable morphology. The first patient, a 40-year-old male who presenting SAH, was confirmed a ruptured BBA located in the lateral direction of the left supraclinoid ICA. The aneurysm measured 2.9x2.7 mm with an exceptionally shallow height of 0.7 mm, rendering microcatheter superselection unfeasible. The second case involved a 28-year-old male who presenting SAH, was confirmed a ruptured BBA in the lateral direction of the left supraclinoid ICA. The dimensions of this aneurysm were 2.7x2.4 mm with a height of 1.0 mm, also exhibiting a shallow morphology.

Result: In our two cases, only the Accero stent was deployed on the ruptured BBAs, and wall apposition of the stent was enhanced using a compliant type balloon. Post-procedure, both patients were managed in the intensive care unit with strict blood pressure control and there was no rebleeding of the ruptured BBAs. In the first male patient, a follow-up DSA performed two weeks post-stenting revealed an increase in the aneurysm size to 3.2x2.5 mm with a height of 1.4 mm, for which a small-sized coil was inserted and an additional flow-diverting stent (Pipeline Flex with Shield Technology, Medtronic) was deployed. A subsequent DSA after two weeks showed complete obliteration of the ruptured BBA. The second male patient was

turned out a healed lesion on a DSA performed one week after stenting. Further follow-up CTA at two week and one month showed no signs of regrowth, and the patient continued to be monitored on an outpatient clinic.

Conclusion: For uncoilable ruptured blood blister-like aneurysms (BBAs), the Accero stent with high metal coverage can provide the ability to stabilize ruptured BBAs, and it allows for a strategy where further treatment can be planned with short-term follow-up observations.

Ambiguous spontaneous Intracranial bilateral vertebral artery dissection Patient who had trauma and loss of consciousness: Case report

Hoon Seok, In chul Yang, Ho Jun Yi, Bum-Tae Kim, Dong seong Shin

Department of Neurosurgery, Soonchunhyang University Bucheon Hospital, Bucheon

Background: Intracranial vertebral artery dissection(VAD) is the most common intracranial arterial dissection. Some types of VAD can have good prognosis after reconstitution of the vessel lumen with excellent prognosis spontaneously, but others, sometimes can progress to severe stroke that needs other treatment. Recently, Endovascular treatment (EVT) is suggested as a treatment option for VADs due to perceived low rates of procedure-related morbidity with good efficacy.

Case presentation: Recently, We experienced ambiguous bilateral VADs presenting with scanty subarachnoid hemorrhage in interpeduncular cistern and tentorial subdural hemorrhage that was mild a lot on the left side. A-51-year-old women visited local hospital after Loss of consciousness and minor slip down trauma. After brain CT, MRI & head MRA, TFCA was evaluated. bilateral distal vertebral fusiform dissecting aneurysm was founded. Right dissecting aneurysm had dissecting flap. She had minor headache and other neurologic deficit was not presented. At the local hospital, She was transferred at our emergency center.

Concerned patient history and dissecting aneurysm's shape and location, It was possible not spontaneous ruptured bilateral dissecting aneurysm but also traumatic hemorrhage. or ruptured Rt distal VA dissection. But We could not be certain that the left distal dissecting VA had not ruptured because dissecting aneurysm was in bed shape and hematoma location. Few days later, although f/u TFCA and vessel wall image MRI was checked, bilateral VA dissecting aneurysm shape and intraluminal flap was no changed. We decided to operation at bilateral dissecting VAD. We planed to occlude the Rt distal VA(trapping) in non-dominant VA and Lt distal VA stent assist coiling using reconstructive treatment in dominant VA considered PICA orifice & ant. Spinal artery.

Keyword : Endovascular treatment, Dissection, Dissecting aneurysm, Vertebral artery

New development of dissection in intracranial vertebral artery in the patient on follow-up after coil embolization of unruptured paraclinoid aneurysm

Ahn Seong Yeol

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We report a case of a 51 year old woman with history of coil embolization of unruptured paraclinoid aneurysm (UPA) has develop a new headache after two years on follow up. The patient had no symptoms after coil embolization for UPA. After two years on follow up, the patient has complained of severe headache in occipital. On unscheduled magnetic resonance angiography, new dissection with bleb in right intracranial vertebral artery (V4 segment) developed. Trapping of dissection was performed. The patient's symptom has improved after trapping of dissection in V4 segment. Clinician is apt to ignore nonspecific symptoms like headache or dizziness of the patients on follow up after treatment. But, sometimes, critical problem can come up like this case.

Incomplete Oculomotor Nerve Palsy Following Carotid Cavernous Fistula via Transvenous embolization; Lessons Learned

Giyong Yun

Department of Neurovascular, Soonchunhyang University College of Medicine, Cheonan

Objective: Transvenous embolization (TVE) is the primary option for endovascular treatment of carotid cavernous fistula (CCF) due to its safety and efficacy of obliteration of the fistula. But, it can sometimes give rise to several complications including venous congestion, sinus perforation, and cranial nerve palsy. The oculomotor nerve palsy mostly occurred immediately after TVE procedure, while delayed onset of oculomotor nerve palsy has been rarely reported. We want to share our experience of incomplete oculomotor nerve palsy after successful coil embolization of CCF.

Methods: A 57-year-old woman presented with persistent headache, dizziness, pulsatile tinnitus lasting for over a year. But she had no limitations in extraocular muscles, and there were no signs of exophthalmos or ecchymosis. The magnetic resonance imaging (MRI) showed signal voids in the both cavernous sinus and digital subtraction angiography (DSA) revealed the spontaneously arised bilateral dural arteriovenous fistula (AVF) on cavernous sinus. She underwent treatment for the left CCF (Barrow type C) through TVE initially, and one week later, she also received TVE for the right CCF (Barrow type D). After second treatment, the symptoms were completely resolved, however, two weeks later, she developed incomplete oculomotor nerve palsy. The oral corticosteroid was administrated and the close follow-up evaluation would be needed.

Result: After initial TVE treatment, the symptom was not relieved and the DSA showed more aggravated fistula flow on the other side CCF. The subsequent was needed for the potential for worsening of the remained and aggravated fistula flow and for the improvement of symptoms. Finally, we achieved complete obliteration of bilateral dural AVF on cavernous sinus with total 465cm of coil mass, and it induced the pupil sparing incomplete oculomotor nerve palsy

on right side.

Conclusion: A possible mechanism for oculomotor nerve palsy after TVE is direct compression by the coil mass. We had concerned about the risk of cranial nerve palsy, so we did not densely pack the lateral side of internal carotid artery. Instead, we focused on the reflux of the superior ophthalmic vein and densely pack the anterior portion of cavernous sinus. Unfortunately, it would be the cause of oculomotor nerve palsy. In such cases like bilateral dural AVF on cavernous sinus, the radiosurgery might have been a slightly better treatment option, if considering the patient.

P-05

Vertebral arteriovenous fistula secondary to ruptured vertebral artery aneurysm

Chang-Young Lee

Department of Neurosurgery, Dongsan Medical Center, Keimyung University School of Medicine

The author presents the case of a patient who developed sudden onset of dizziness and pulsatile tinnitus that was found to be associated with a vertebral arteriovenous fistula due to V3 aneurysm rupture. The aneurysm was successfully obliterated with transarterial stent -assisted coiling, after which the patient was symptom-free. Although vertebral arteriovenous fistula caused by V3 aneurysm is rare, this pathology should be considered in the differential diagnosis of dizziness and pulsatile tinnitus. Endovascular treatment appears to have been successful in resolving the symptoms associated with this pathology.

Occlusion of branch vessel after flow diversion in vertebral artery dissecting aneurysm: A case report

Tae-Kyu Lee, Hyeong Jin Lee, Seon Woong Choi, Sung han Kim, Hoon Kim, Ik Seong Park, Seong-Rim Kim

Department of Neurosurgery, Bucheon St. Mary's Hospital, College of Medicine, The Catholic University of Korea

The DERIVO embolization device (DED), a type of flow diverter (FD), has become an accepted treatment option with good clinical outcomes for vertebral artery dissecting aneurysm (VADA). We describe a case of major branch vessel occlusion following DED deployment.

A 67-year-old male patient complained of persistent headaches. We confirmed a VADA measuring 13.85 x 7.42 x 9.87mm on magnetic resonance angiography (MRA) and digital subtraction angiography (DSA). Because of his family history, he wanted interventional treatment rather than the option of follow-up with drug treatment, and we planned FD treatment.

We deployed the DED with complete coverage of the dissection flap, including the posterior inferior cerebellar artery (PICA) ostium. A twisting in the FD occurred in the latter half of the deployment. When we tried to pass a microwire to expand the balloon, the twist was released. However, a slowdown in PICA blood flow was noted. PICA territory infarction and lateral medullary infarction occurred sequentially several days after treatment.

Several studies to date have demonstrated that FD treatment alters blood flow in branch vessels or increases blood flow in collateral vessels without causing occlusion of major branch vessels. Rather, there are studies showing that the blood flow velocity in branch vessels increases. There are also studies showing that twisting during the procedure, as in our case, is not a risk factor for branch vessel occlusion.

We expected changes in PICA flow due to flow diversion or collateral blood supply, but the results were different. We focused on twists and releases that occurred within a few minutes of the procedure and discussed the impact of these events on outcomes. We concluded that the rotational force generated by release of twisting was transmitted to the VA and consequently caused occlusion due to bending or kinking of the PICA ostium.



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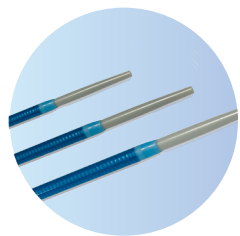
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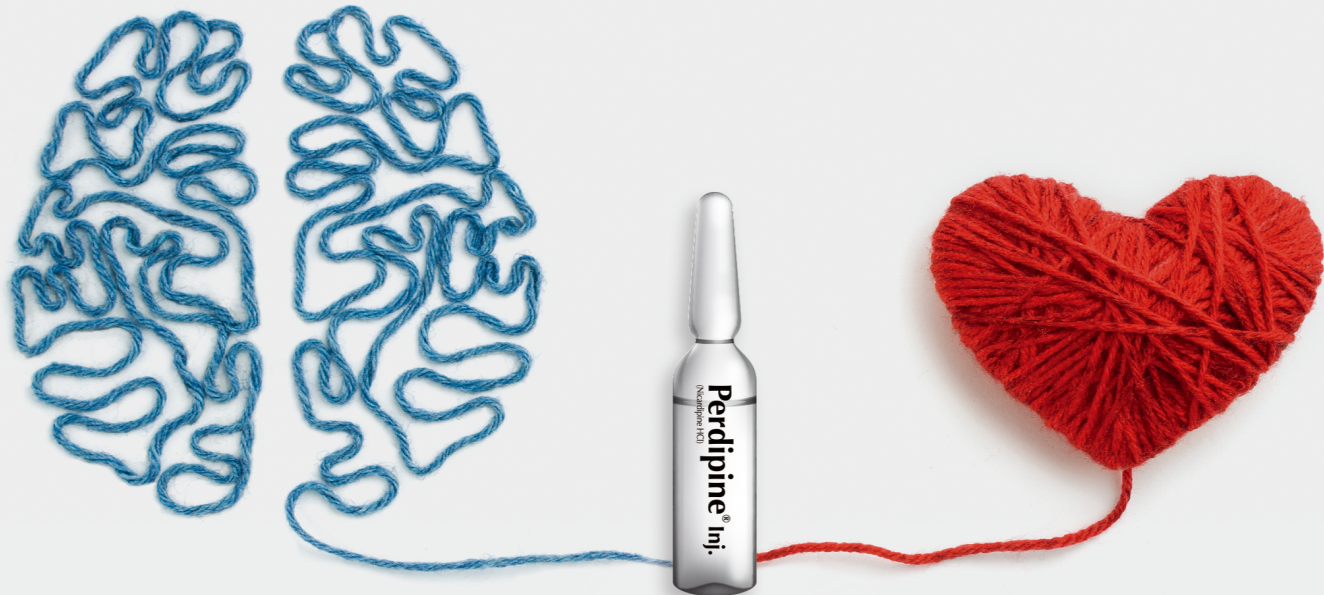
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* 100% 정제대두유 지질 성분의 종합영양수액제 제외

References 1. Choi H.J. J Clin Nutr 2017;9(1):7-15 2. Weijs PJ, et al. Crit Care 2014;18:701

올리멜 엔9이 주사 (OLIMEL N9E) • 성분 : 2개의격막에의해3개의공간으로분리된하나의투명한수액용플라스틱백이며,아미노산용액과당용액은투명한무색내지연한노란색의액제이고,지방용액은균질한백색의액제이다. • **효능·효과 :** 경구또는위장관영양보급이불가능또는불충분하거나또는제한되어경정맥영양공급을실시해야하는만2세이상소아및성인환자들에게수분,전해질,아미노산및칼로리보급. • **용법·용량 :** 환자의상태,열량소비,대사능력및경구/위장관으로공급되는추가적인영양또는단백질의공급에따라용량을결정하며,환자의체중에따라백의크기를결정한다. 환자의상태에따라미량원소,비타민,전해질등이첨가될수있다. • **사용상의주의사항 :** 1. 경고 1) 반드시 의사의 지시에 의하여 사용할 것 2) 아나필락시스성 반응의 징후나 증상 (열, 오한, 발진, 호흡곤란 등)이 나타내면 투여를 즉각 중단할 것 3) 정맥 환류 방지제와 세프트리악손을 혼합하여 사용할 때, 세프트리악손-칼슘 침전을 일으킬 수 있다. 따라서, 세프트리악손과 이 약을 포함한 정맥 환류 방지제를 동일한 주입용 기구를 사용하여 동시에 투여해서는 안된다. 연속주입을 위해 동일한 주입선을 사용해야하는 경우, 주입선을 주입 전/후 적절한 용액으로 철저히 씻어낸다. 2. 다음 환자에는 투여하지 말 것 1) 조산아, 신생아 및 만 2 세 미만의 소아 2) 탈갈, 대두, 땅콩, 이 약의 주성분 또는 부형제에 과민반응을 나타내는 환자 3) 혈액투석이나 혈액여과를 하지 못하는 중증의 신장에 환자 4) 중증 간질환 환자 5) 선천성 아미노산 대사 이상 환자 6) 중증 혈액응고 장애 환자 7) 중증의 고지혈 증환자또는중증의지질대사장애환자8)시간당인슐린6단위이상필요한고혈당증환자9)이약에함유된전해질의일정함량수치가병적으로높은환자10)정맥수액요법의일반적급기:급성폐부종,수분과다증,대사성산성증,저장성지방증11)다음과같은불안정상태:중증외상후상태,비대상성당뇨,순환기계속,발작,급성심근경색,중증대사성산증,고칼슘혈증,중증패혈증,고장성분수등12)간성분수또는간성분수의증가있는환자13)혈구포식세포증후군 환자 14) 부신기능부전증 환자

※ 세부 내용은 제품 설명서를 참조해주시기 바랍니다.

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Dual mechanism

- Platelet COX 1 inhibition
- Increase of cAMP

Additional effect

- Lower hemorrhagic complication
- NO increase / Neuroprotection



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Consistent 24h BP control*

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Reference 1, William B. White, et al. Effects of the Angiotensin Receptor Blocker Azilsartan Medoxomil Versus Olmesartan and Valsartan on Ambulatory and Clinic Blood Pressure in Patients With Stages 1 and 2 Hypertension, Hypertension 2011;57:413-420.

Prescribing Information [제품명] 아질사르탄 메독소밀 (아질사르탄 메독소밀정 / 아질사르탄 메독소밀정 40mg, 아질사르탄 메독소밀정 80mg) **[유효성분]** 아질사르탄 메독소밀 42.68mg (아질사르탄 메독소밀 40mg) 아질사르탄 메독소밀 85.36mg (아질사르탄 메독소밀 80mg) **[작용·효과]** 본제형 과립은 **[일반 용량]** 성인 : 이 약의 평균 초창효과로 인해 40mg의 과립에 서서히 관계없이 투여한다. 이 용량에서 약이 적절히 조절되어 있는 경우 일 최대 80mg까지 증량할 수 있다. 혈압강화 효과는 치료 시작 후 2주 이내에 나타날 수 있다. **[사용상의 주의사항]** 1. 경고 1) 임신 2, 3차 임신 임박에 레닌-안지오텐신 계(Renin-Angiotensin System, RAS)에 직접적으로 작용하는 약을 투여 시 태아 및 신생아에게 손상 및 사망까지 유발할 수 있다. 따라서 만일 임신으로 확인될 경우 즉시 이 약의 투여를 중단해야 한다. 2. 다음 환자에는 투여하지 말 것 1) 이 약 또는 이 약에 함유된 성분에 대하여 과민증이 있는 환자 2) 임부 3) 다음의 환자(예에 이 약과 알리스카렌 제제의 병용투여 : 당뇨병 환자 또는 중등증-중증의 신장(예사구제)마음<60mL/min/1.73m²) 환자 **[저장방법]** 차광기밀용기, 실온(15~30°C) 보관, 습기를 피하여 보관 **[수입판매자]** 셀트리온제약 중장복도 정주시 정관구 오창읍 22번로 82 [제조자] Takeda Ireland Limited

* 이 내용은 허가사항을 요약한 것으로 자세한 정보는 제품의 첨부문서 또는 <http://nedrug.mfds.go.kr>를 확인하십시오.



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전문약품

케이캡정 50밀리그램 **[원료약품 및 그 분량]** 이 약 1 정(206mg) 중 유효성분 : 테고프라잔 (별규) ... 50.0mg 기타첨가제 : D-만니톨, 미결정셀룰로오스, 크로스카르멜로스나트륨, 하이드록시프로필셀룰로오스, 폴리비드산하이드로콜로이드, 스테아르산마그네슘, 오파드라이 II 분홍색 (85F240134) 색상 연한 분홍색의 장방형 필름코팅정 **[효능·효과]** 1. 미란성 위식도역류질환의 치료 2. 위궤양의 치료 3. 소화성 궤양 및 또는 만성 위축성 위염 환자에서의 헬리코박테리아균의 제거를 위한 항생제 병용요법 **[용법·용량]** 이 약은 성인에게 다음과 같이 투여한다. 1. 미란성 위식도역류질환의 치료 1일 1회 1회 50mg을 4주간 경구투여한다. 심도열이 치료되지 않거나 증상이 계속되는 환자의 경우 4주 더 투여한다. 2. 비미란성 위식도역류질환의 치료 1일 1회 1회 50mg을 4주간 경구투여한다. 3. 위궤양의 치료 1일 1회 1회 50mg을 8주간 경구투여한다. 4. 소화성 궤양 및 또는 만성 위축성 위염 환자에서의 헬리코박테리아균의 제거를 위한 항생제 병용요법 헬리코박테리아균의 감염 환자들은 재균요법으로 치료받아야 한다. 이 약 50mg과 아목시실린 1g, 클라리트로마이신 500mg을 1일 2회 7일간 경구투여한다. 이 약은 식사와 관계없이 투여할 수 있다. **[사용상의 주의사항]** 1. 다음 환자에는 투여하지 말 것. 1) 이 약, 이 약의 구성성분 또는 보조제(미다졸람)에 과민반응 및 그 병력이 있는 환자 2) 아티자나비어, 탈파나비어, 또는 밀피라비린 함유제제를 투여 중인 환자 3. 상호작용 항 참조) 3) 임부 및 수유부 (6. 임부 및 수유부에 대한 투여 항 참조) 2. 다음 환자에는 신중히 투여할 것. 1) 간장애 환자: 간장애 환자에 대한 사용경험이 없다. 2) 신장애 환자(사용경험이 없다) 3. 고령자(8. 고령자에 대한 투여 항 참조) *기타 자세한 사항은 제품설명서를 참고하십시오.

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