대한뇌혈관내수술학회
SKEN
Society of Korean Endovascular Neurosurgeons

2019 대한뇌혈관내수술학회
정기학술대회 및 총회

We are one, the SKEN

2019. 12. 7. (토) 여의도 콘래드호텔 3층 그랜드볼룸

주 최 | 대한뇌혈관내수술학회
주 관 | 대한신경외과학연구재단

인사말

대한뇌혈관내수술학회 회원 여러분 그 동안 안녕하셨습니까?

유난히도 태풍이 많았던 올 가을도 이제는 다가올 겨울에 자리를 내어줄 준비를 하고 있습니다. 아침 저녁으로 찬 공기가 느껴지고 나라 안팎으로 시끄러운 와중에도 진료, 교육, 연구에 힘쓰시는 대한뇌혈관내수술학회 회원 여러분께 경의를 표합니다.

다가오는 2019년 12월 7일에는 우리 학회의 일년을 마무리하고 새해를 준비하는 대한뇌혈관내수술학회 정기학술대회 및 총회가 여의도에서 개최됩니다. 먼저 이번 2019년 대한뇌혈관내수술학회 정기학술대회 및 총회를 꼼꼼히 준비해주신 학회 이사진 여러분의 노고에 깊이 감사드립니다. 이번 정기학회는 올해로 창립 23주년이 된 우리학회가 그 동안의 문제점을 극복하고 함께 뭉쳐서 도약하고자 "We are one, the SKEN" 이라는 주제로 진행됩니다. 뇌혈관질환을 전문적으로 다루는 대한뇌혈관내수술학회 회원들이 서로의 경험을 공유하고 새로운 술기와 지식을 습득하는 것 외에 우리 학회의 오늘과 내일을 공유하면서 토론하고 고민할 수 있는 시간이 되기를 희망합니다. 갈수록 척박해지고 경쟁으로 내몰리는 의료 환경 속에서 뇌혈관내수술을 전문적으로 다루는 신경외과의사로서의 역량을 다지고 회원간 친교를 다질 수 있는 뜻 깊은 학술대회가 될 수 있기를 고대합니다.

아무쪼록 2019년 한 해를 잘 마무리하시고 항상 건승 하십시오. 이번 2019 대한뇌혈관내수술학회 정기학술대회 및 총회를 위해 물심양면 지원해주신 기업회원 여러분과 참가해주신 대한뇌혈관내수술학회 회원 여러분, 수고해주신 모든 학회 이사분들께 다시 한번 감사드립니다.

대한뇌혈관내수술학회 회장 고준석

2018-2019 대한뇌혈관내수술학회 임원진

명예회장

직 위	성 명	소 속
명예회장	백민우	인봉의료재단 뉴고려병원

회장

직 위	성 명	소 속
회장	고준석	강동경희대학교병원

상임이사

직 위	성 명	소 속
총무	신승훈	차의과학대학교 분당차병원
학술	장철훈	영남대학교병원
정책	강현승	서울대학교병원
간행	김성림	가톨릭대학교 부천성모병원
보험	박석규	순천향대학교 서울병원
	권현조	충남대학교병원
수련교육	권순찬	울산대학교병원
재무	김영우	가톨릭대학교 의정부성모병원
인증위원장	이호국	한림대학교 강남성심병원
진료지침	임용철	아주대학교병원
대외협력	윤석만	순천향대학교 천안병원
국제교류	김대원	원광대학교병원
전산정보	조준성	단국대학교병원
회원관리	장인복	한림대학교 평촌성심병원
홍보	유승훈	울산대학교 강릉아산병원
연보 • 학회사편집	김태곤	차의과대학교 분당차병원
다기관연구	황교준	분당제생병원
회칙개정	이형중	한양대학교병원
법제윤리	전영일	건국대학교병원
광주/전라지회	김태선	전남대학교병원
대구/경북지회	강연구	에스포항병원
대전/충청지회	조준성	단국대학교병원
부산/울산/경남지회	정진영	연세에스병원
감사	고준경	부산대학교병원
간사	정준호	연세대학교 세브란스병원

2018-2019 대한뇌혈관내수술학회 임원진

전임회장단

직 위	성 명	소 속
초대, 제2대	백민우	인봉의료재단 뉴고려병원
제3대	김영준	단국대학교병원
제4, 5대	권도훈	울산대학교 서울아산병원
제6대	안성기(작고)	(전) 한림대학교 성심병원
제7대	신용삼	가톨릭대학교 서울성모병원
제8대	권오기	분당서울대학교병원
제9대	김범태	순천향대학교 부천병원
제10대	성재훈	가톨릭대학교 성빈센트병원

운영위원

직 위	성 명	소 속
학술위원회	정영진	영남대학교병원
	박중철	울산대학교 서울아산병원
	조수희	울산대학교 강릉아산병원
	신희섭	강동경희대학교병원
	박근영	연세대학교 세브란스병원
	이재일	부산대학교병원
	강동훈	경북대학교병원
	박상규	가톨릭대학교 인천성모병원
	최규선	한양대학교병원
수련교육위원회	오재상	순천향대학교 천안병원
인증위원회	신동성	순천향대학교 부천병원
	신희섭	강동경희대학교병원
	전홍준	한림대학교 강동성심병원
	김소연	가톨릭관동대학교 국제성모병원
	오인호	중앙보훈병원
	안준형	한림대학교 평촌성심병원
교과서편찬위원회	윤석만	순천향대학교 천안병원
	김영우	가톨릭대학교 의정부성모병원
	김태곤	분당제생병원
	황교준	한림대학교 한강성심병원
	오재상	순천향대학교 천안병원
	정준호	연세대학교 세브란스병원
국제교류위원회	남택균	중앙대학교병원
	박정수	전북대학교병원
	신희섭	강동경희대학교병원
	이동훈	가톨릭대학교 성빈센트병원
	정영진	영남대학교병원

Toshio Higashi, M.D., Ph.D.

Department of Neurosurgery, Fukuoka University Chikushi Hospital, Japan

▶ Education

1982–1984	Kyoto University, Pre-medicine
1984–1988	Kyoto University, Graduate School of Medicine
1988	M.D., Kyoto University, Graduate School of Medicine
1995	Ph.D., Kyoto University, Graduate School of Medicine

▶ Medical Training
Clinical

1988–1989	Residency in Neurosurgery
	Department of Neurosurgery, Kyoto University Hospital
1989–1991	Residency in Neurosurgery
	Department of Neurosurgery, Tenri Hospital, Nara, Japan
1994–1995	Staff Neurosurgeon
	Department of Neurosurgery Otsu Red Cross Hospital, Shiga,Japan
1998–2003	Staff Neurosurgeon
	Department of Neurosurgery, National Cardiovascular Center, Osaka, Japan
2002–2003	Chief, Gamma Knife Unit, National Cardiovascular Center, Osaka, Japan
2003–2009	Co-director, Department of Neurosurgery, Kokura Memorial Hospital, Fukuoka, Japan
2009–2010	Director, Endovascular Neurosurgery
	Instructor, Department of Neurosurgery, School of Medicine, Fukuoka University, Fukuoka, Japan
2010–2011	Assistant Professor
2011–2012	Co-director, Department of Neurosurgery
	Associate Professor
2013–2018	Clinical Professor
	Department of Neurosurgery, Fukuoka University Hospital
2018– present	Professor and Chairman
	Department of Neurosurgery, Fukuoka University, Chikushi Hospital
2019– present	Co-Director
	Fukuoka University, Chikushi Hospital

Research

1991–1995	Graduate Student, Department of Neurosurgery, Kyoto University, Graduate School of Medicine (Dr. Haruhiko Kikuchi) Department of Cell Biology (Dr. Kazuhiro Nagata) Chest Disease Research Institute, Kyoto University
1995–1998	Postdoctoral Research Fellowship Center for the Study of Nervous System Injury (CSNSI), Department of Neurology (Dr. Dennis W. Choi), Washington University, School of Medicine, St. Louis, Missouri, U.S.A.

Membership

Japanese Society of Neuroendovascular Therapy (Vice President, boad of directors, committee of board accreditation, chairman of judicial affairs and medical safety committee, secretary general, JSNET Kyushu branch).
Japan Neurosurgical Society (delegate),
Japan Stroke Society (delegate),
Japanese Congress of Neurological Surgeons,
Japanese Society on Surgery for Cerebral Stroke (delegate),
Niche Neuro–Angiology Conference,
World Federation of Neurointerventional Therapy (WFITN),
European Society of Neuroradiology (ESNR)

Clarençon Frédéric, MD, PhD.

Department of Neuroradiology, Head of the Interventional Neuroradiology unit., Sorbonne University. 47, Bd de l'Hôpital, Pitié-Salpêtrière Hospital

▶ University Course

1996-2003	Medicine school. Faculty of Medicine, Grenoble. Joseph Fourrier University.
2003-2009	Resident in Radiology, Paris (Paris V University) (Nov 2006-Oct 2007: Master 2 Medical Physique. Pr J. Bittoun. Paris XI medicine university)
2009-2012	Fellowship. Department of neuroradiology. Pr Jacques Chiras. Pitié-Salpêtrière Hospital.
Sep 2013	Assistant professor. Department of Interventional Neuroradiology. Pitié-Salpêtrière Hospital
Dec 2014	PhD., University of Limoges. France
May 2016	Ability to supervise research

▶ Diplomas

1996	Baccalaureat. Section S. Option biology
1998	First year medicine school concourse
2003	National concourse for residency
2004	Master 1. Study methods in cytopathology and histopathology; Methodology of clinical research and epidemiology.
2007	Master 2: « Medical Physique ». Paris XI. Pr J. Bittoun. Topic of the research: "Evaluation of deep gray structures lesions in severe traumatic brain injury by means of a tri-dimensional atlas". Research director: Pr D. Dormont. UPR 640 LENA
2009	Medical Degree. Specialty: Radiodiagnostic and medical imaging.
2014	PhD., University of Limoges. Research director: Pr C. Mounayer.
2015	CTN certification

프로그램

08:30-08:50	Registration	
08:50-09:00	Opening remark 대한뇌혈관내수술학회 회장 **고준석** 대한신경외과학회 이사장 **오창완**	
09:00-10:50	**Free paper I (Aneurysm)** 좌장 : 순천향대 **김범태,** 가톨릭대 **김성림**	
09:00-09:10	Inhibition rate should be also considered with P2Y12 Reaction Units (PRU) in antiplatelet preparation for coil embolization of unruptured aneurysm 분당서울대학교병원 **김영덕**	14
09:10-09:20	Advantages of coil embolization performed immediately after diagnostic cerebral digital subtraction angiography in unruptured intracranial aneurysms: Patients' perspective 영남대학교병원 **김종훈**	15
09:20-09:30	Pointwise encoding time reduction with radial acquisition with subtraction–based MRA during the follow–up of stent–assisted coil embolization of anterior circulation aneurysms 인제대학교 부산백병원 **김성태**	16
09:30-09:40	Role of high resolution vessel wall MRI in diffuse type angiographically occult spontaneous subarachnoid hemorrhage 고려대학교 구로병원 **윤원기**	17
09:40-09:50	Simultaneous neck coverage and branch preservation using the proximal portion of a self–expandable open–cell stent for embolization of distal internal carotid artery aneurysms: Multi–center, long–term results 충남대학교병원 **권현조**	18
09:50-10:00	Endovascular treatment for SAH with distal ACA aneurysm 한림대학교 동탄성심병원 **박정현**	19
10:00-10:10	Impact of fetal–type posterior cerebral artery on recanalization of posterior communicating artery aneurysms after coil embolization: Matched–pair case–control study 서울대학교병원 **조영대**	20
10:10-10:20	Influence of carotid siphon anatomy on difficulty during coiling of SHA aneurysm 분당서울대학교병원 **김성훈**	21
10:20-10:30	Endovascular treatment of spontaneous dissection carotid artery aneurysm causing complete ophthalmoplegia and cerebral infarction 가톨릭대학교 은평성모병원 **임상혁**	22
10:30-10:40	Immediate postprocedural angiographic stagnation of contrast media and T2–weighted MRI features within aneurysmal sac are associated with early regression of large or giant aneurysm after flow diversion only 이화여자대학교 서울병원 **조동영**	23
10:40-10:50	Literature review: Should flow diverting stent need an intra–saccular coil placement in the giant/large aneurysmal treatment to prevent later rupture? 순천향대학교 부천병원 **신동성**	24
10:50-11:10	Coffee break	
11:10-11:50	**Special lecture I** 좌장 : 서울대 **권오기**	
	Endovascular treatment of dural arteriovenous fistula Fukuoka University Chikushi Hospital, Japan **Dr. Toshio Higashi**	29
11:50-12:40	**Luncheon seminar** 좌장 : 순천향대 **윤석만**	
	First Pass Effect – how ADAPT change my practice in AIS treatment strategy Sorbone University Hospital, France **Dr. Clarençon Frédéric**	33

프로그램

12:40-12:50	Photo time & short break	
12:50-13:30	**Scientific seminar** 좌장 : 영남대 **장철훈,** 원광대 **김대원**	
	Brief presentation by SKEN academic awardee I–IV & Panel Discussion	
	I. 명지성모병원 남천 학술상 / Panel: 아주대학교병원 **임용철**	
	Frontline thrombectomy for acute large–vessel occlusion with underlying severe intracranial stenosis: stent retriever versus contact aspiration 경북대학교병원 **강동훈**	· 36
	II. 에스포항병원 학술상 (SCI(E) 부분) / Panel: 차의과학대학교 분당차병원 **김태곤**	
	In vitro and in vivo experiments of a novel intra–arterial neurovascular decompressor for treating neurovascular compression syndromes 연세대학교 세브란스병원 **정준호**	· 37
	III. 에스포항병원 학술상 (SCI(E) 부분) / Panel: 충남대학교병원 **권현조**	
	Predictive value of neurophysiologic monitoring during neurovascular intervention for postoperative new neurologic deficits 인제대학교 해운대백병원 **진성철**	· 38
	IV. 연세에스병원 학술상 (young endovascular neurosurgeon) / Panel: 연세에스병원 **정진영**	
	Selective compromise of hypoplastic posterior communicating artery variants with aneurysms treatable by coil embolization: clinical and radiologic outcomes 중앙대학교병원 **최현호**	· 41
13:30-14:30	**Free paper II (AVM, AVF etc)** 좌장 : 가톨릭대 **성재훈,** 울산대 **권순찬**	
13:30-13:40	Treatment outcomes according to various treatment modalities for intracranial dural arteriovenous fistulas in the Onyx era: A 10–year single center experience 가톨릭대학교 서울성모병원 **최재호**	· 46
13:40-13:50	Embolization with PHIL: Single–center 8–cases experience 울산대학교병원 **엄태웅**	· 47
13:50-14:00	Treatment outcome of type I spinal dural arteriovenous fistula under the policy of initial endovascular treatment trial 서울대학교병원 **이희승**	· 48
14:00-14:10	Case presentation: Treatment of traumatic CCF using intra–arterial approach 가톨릭대학교 의정부성모병원 **신재전**	· 49
14:10-14:20	Multimodal treatment for cranial dural arteriovenous fistula: Case reports 아주대학교병원 **김미경**	· 50
14:20-14:30	Endovascular trans–venous embolization (TVE) of paracondylar dural arteriovenous fistula 창원경상대학교병원 **박 현**	· 51
14:30-15:10	**Special lecture II** 좌장 : 가톨릭대 **신용삼**	
	Recent trend of EVT for large and giant cerebral aneurysm in JSNET Fukuoka University Chikushi Hospital, Japan **Dr. Toshio Higashi**	· 55
15:10-15:30	Coffee break	
15:30-17:00	**Free paper III (Ischemia)** 좌장 : 서울대 **강현승,** 차의과학대 **신승훈**	
15:30-15:40	The effectiveness of intra–arterial thrombectomy (IAT) protocol for decreasing door–to–recanalization time duration in acute stroke 계명대학교 동산병원 **김창현**	· 58
15:40-15:50	Is transradial mechanical thrombectomy alternative plan in impossible transfemoral access for mechanical thrombectomy? A single center's experience 강원대학교병원 **전효섭**	· 59
15:50-16:00	Clinical impact of ankle brachial index in patients undergoing simultaneous coronary and cerebral angiography due to atherosclerosis detected on brain imaging studies 가톨릭대학교 부천성모병원 **김성림**	· 60

Poster

2019 대한뇌혈관내수술학회
정기학술대회 및 총회

Free paper I (Aneurysm)

좌장 : 순천향대 **김범태**, 가톨릭대 **김성림**

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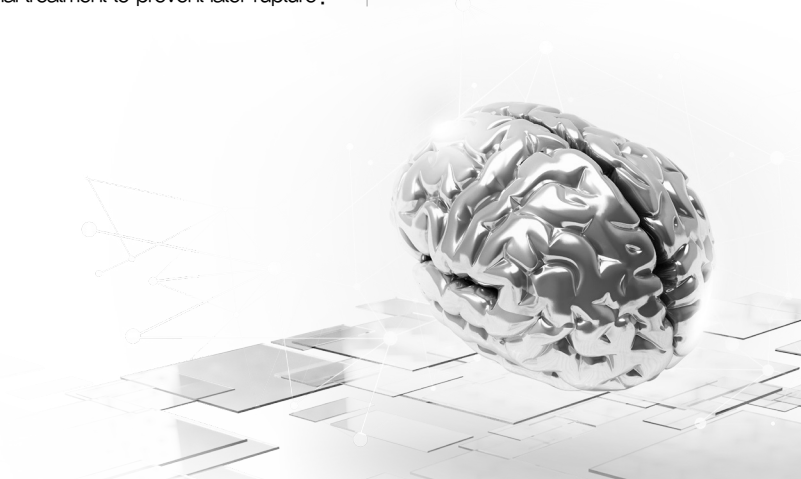
Endovascular treatment of spontaneous dissection carotid artery aneurysm causing complete ophthalmoplegia and cerebral infarction	가톨릭대학교 은평성모병원 **임상혁**
Immediate postprocedural angiographic stagnation of contrast media and T2–weighted MRI features within aneurysmal sac are associated with early regression of large or giant aneurysm after flow diversion only	이화여자대학교 서울병원 **조동영**
Literature review: Should flow diverting stent need an intra–saccular coil placement in the giant/large aneurysmal treatment to prevent later rupture?	순천향대학교 부천병원 **신동성**



FP1-1

Inhibition rate should be also considered with P2Y12 Reaction Units (PRU) in antiplatelet preparation for coil embolization of unruptured aneurysm

Young Deok Kim, O-Ki Kown, Seung Pil Ban

Department of Neurosurgery, Seoul National University Bundang Hospital

Objective : Thromboembolic event was notably reduced by premedication of antiplatelet before coil embolization of intracranial aneurysm. For measuring responsiveness of antiplatelet agent, especially clopidogrel, P2Y12 Reaction Units (PRU) was accepted as standard method. However, inhibition rate was not considered when measuring responsiveness of clopidogrel and it is unclear that impact on thromboembolic event.

Methods : We collected data of patients with unruptured intracranial aneurysm who underwent coil embolization with antiplatelet premedication from January 1, 2015 to December 31, 2018.
Our institution used standard antiplatelet premedication (aspirin 100mg, clopidogrel 75mg, 5days) if PRU was lower than 220 and used modified antiplatelet premedication (change clopidogrel to cilostazol or prasugrel) if PRU was higher than 220 before coil embolization.
We described distribution of PRU and inhibition rate. We used the receiver operating characteristic (ROC) curve analysis to estimate the effect of inhibition rate to thromboembolic event.

Result : A total of 1688 patients with 1837 aneurysms were identified. The patients whose threshold of PRU were lower than 220 were 940 and the patients whose threshold of PRU were higher than 220 were 748.
In patient whose threshold of PRU were lower than 220, mean PRU was 168 and mean inhibition rate was 32.6%.
Overall rate of thromboembolic event was 1.01%. the rate of thromboembolic event among the patient whose threshold of PRU were lower than 220 was 1.06% and the rate of thromboembolic event among the patient whose threshold of PRU were higher than 220 was 0.94%.
The receiver operating characteristic (ROC) curve analysis of inhibition rate demonstrated that inhibition rate allowed to distinguish between patients with and those without thromboembolic event (area under curve, AUR, 0.815) and optimal cutoff of inhibition rate was 32% (Youden index value, 0.53).

Conclusion : For measuring responsiveness of clopidogrel and reducing thromboembolic event in coil embolization, inhibition rate also should be considered with PRU.

FP1-2

Advantages of coil embolization performed immediately after diagnostic cerebral digital subtraction angiography in unruptured intracranial aneurysms: Patients' perspective

Jong-Hoon Kim, Young-Jin Jung, Chul-Hoon Chang

Department of Neurosurgery, Yeungnam University Hospital

Objective : We are inevitably faced with the need to perform coil embolization immediately after diagnostic cerebral digital subtraction angiography (DSA) for economic reasons, patient convenience, fear of rupture, and other reasons. Here we report the advantages of coil embolization performed immediately after diagnostic cerebral DSA for unruptured intracranial aneurysms (UIAs) from the patients' perspective.

Methods : Between January 2017 and October 2018, 145 patients were treated for UIAs with endovascular coil embolization at the Yeungnam University Medical Center. There were 87 patients in the group in which coil embolization was to be performed at least 1 week after diagnostic cerebral DSA (regular [R] group) and 58 patients in the group in which coil embolization was to be performed immediately after diagnostic cerebral DSA (immediate [I] group).

Result : There were no statistically significant between group differences in any factor analyzed expect for medical expenses (out-of-pocket costs), 2,218,416 KRW (1963 USD) for the R group and 1,128,906 KRW (999 USD) for the I group ($P < 0.001$). There were no statistically significant differences in the rate of complications between the 2 groups, with 4 minor complications and 1 morbidity in the R group and 3 minor complications and 1 morbidity in the I group.

Conclusion : Our findings indicate that coil embolization performed immediately after diagnostic cerebral DSA can be a relatively safe alternative approach to treating patients with UIAs.

FP1-3

Pointwise encoding time reduction with radial acquisition with subtraction-based MRA during the follow-up of stent-assisted coil embolization of anterior circulation aneurysms

Y.J. Heo, H.W. Jeong, J.W. Baek, **S.T. Kim,** Y.G. Jeong, J.Y. Lee and S.-C. Jin

Department of Neurosurgery, Busan Paik Hospital and Haeundae Paik Hospital, Inje University

Objective : Time-of-flight MR angiography, though widely used after coil embolization, is associated with limitations owing to magnetic susceptibility and radiofrequency shielding following stent-assisted coil embolization. We evaluated the pointwise encoding time reduction with radial acquisition (PRETRA) sequence in subtraction-based MRA (qMRA) using an ultrashort TE relative to TOF-MRA during the follow-up of stent-assisted coil embolization for anterior circulation aneurysms.

Methods : Twenty-five patients (3 men and 22 women; mean age, 59.1 ± 14.0 years) underwent stent-assisted coil embolization for anterior circulation aneurysms and were retrospectively evaluated using TOF-MRA and PETRA qMRA data from the same follow-up session. Two neuroradiologists independently reviewed both MRA findings and subjectively graded flow within the stents (relative to the latest DSA findings) and occlusion status (complete occlusion or neck/aneurysm remnant). Interobserver and intermodality agreement for TOF-MRA and PETRA qMRA were evaluated.

Result : The mean score for flow visualization within the stents was significantly higher in PETRA qMRA than in TOF-MRA ($P < .001$ for both observers), and good interobserver agreement was reported ($\kappa = 0.63$). The aneurysm occlusion status of PETRA qMRA (observer 1, 92.0%; observer 2, 88.0%) was more consistent with DSA than with TOF-MRA (observer 1, 76.0%; observer 2, 80.0%), and there was a better intermodality agreement between DSA and PETRA qMRA than between DSA and TOF-MRA.

Conclusion : These findings indicate that PETRA qMRA is a useful follow-up technique for patients who have undergone stent-assisted coil embolization for anterior circulation aneurysms.

FP1-4

Role of high resolution vessel wall MRI in diffuse type angiographically occult spontaneous subarachnoid hemorrhage

Wonki Yoon[1], Haewon Roh[1], Taekhyun Kwon[1], Sang-il Suh[2]

[1]Department of Neurosurgery, [2]Radiology, Korea University Guro Hospital

Objective : To verify the role of high resolution vessel wall MRI (HVM) in revealing possible cause of diffuse type angiographically occult spontaneous subarachnoid hemorrhage (SSAH).

Methods : From January 2017 to October2019, 203 patients were diagnosed as SSAH in our institute. 17 patients were diagnosed as angiographically occult SSAH by initial package of CT angiography and conventional angiography. 6 of them were focal or perimesencephalic type and 9 were diffuse type. 5 patients undertook one week second conventional angiography alone and the other 12 patients consisted of 9 diffuse type and 3 focal type undertook HVM followed by conventional angiography. HVM findings of the 12 patients were analyzed.

Result : Of the 12 patients with HVM, 3 focal type patients and 1 diffuse type patient showed no hemorrhage-related enhancement in the vessel wall. Their subsequent follow-up conventional angiography also showed normal findings. However, 8 diffuse type patients were revealed to have focal significant enhancement on various points of cerebral arteries. 5 patients demonstrated enhancement on the dorsal wall of basilar trunk, 1 patient on dorsal wall of supraclinoid ICA and 2 patients on M1 trunk. Except 3 patients with 2 focal basilar trunk and 1 ICA enhancement, there was no angiographically meaningful findings in subsequent second or even in third conventional angiography. One of the basilar trunk enhancements with angiographic micro-aneurysm and the ICA blister-like aneurysm undertook multiple stent placement without neurological sequel. Other patients showed excellent clinical course in their clinical and radiological follow-up.

Conclusion : By visualization of possible location of arteriopathy responsible for SSAH, HVM showed positive usefulness in evaluation on the cause of angiographically occult diffuse type SSAH. HVM can be considered as an additional evaluation tool in the protocol of diagnosis for such kind of disease.

FP1-5

Simultaneous neck coverage and branch preservation using the proximal portion of a self-expandable open-cell stent for embolization of distal internal carotid artery aneurysms: Multi-center, long-term results

Hyon-Jo Kwon[1], Seung-Hoon You[2], Jeong-Wook Lim[1], Hyoung Soo Byoun[1], Bon-Sub Gu[2], Su-Hee Cho[2], Hyeon-Song Koh[1]

[1]Department of Neurosurgery, Daejeon-Chungnam Regional Cerebrovascular Center, Chungnam National University Medical School and Hospital,
[2]Department of Neurosurgery, Gangneung Asan Hospital, University of Ulsan College of Medicine

Objective : We report the long-term results of a modified stent-assisted coil embolization technique using the far proximal part of a self-expanding open-cell stent. The technique was used to cover the neck of the aneurysm while simultaneously preserving the branches of the distal internal carotid artery in patients with aneurysms of the posterior communicating (Pcom) and anterior choroidal arteries (AchA).

Methods : We performed a retrospective review of the prospectively maintained databases at two tertiary neurosurgical centers to identify all patients who underwent embolization of Pcom or AchA aneurysms using this technique between January 2014 and July 2019. Postoperative and follow-up clinical and radiological results for initial (n=16) or re-do (n=4) embolizations were analyzed.

Result : We identified 19 patients with 20 (16 Pcom and 4 AchA) unruptured (n=19) or ruptured (n=1) aneurysms. Eighteen among 20 stents (90.0%) were deployed successfully, and complete occlusions were initially attained in 18 aneurysms (90.0%). At follow-up examinations 8 to 56 months later, 6 of 14 aneurysms (42.8%) showed neck remnants. All of the branches were saved and no thromboembolic event, rupture, or sequelae were noted during or after the procedures.

Conclusion : These results suggest that this modified stent-assisted technique is a feasible and reasonable alternative to conventional stent deployment for coil embolization of wide-necked sidewall aneurysms in the distal ICA.

FP1-6

Endovascular treatment for SAH with distal ACA aneurysm

Jung Hyun Park

Department of Neurosurgery, Hallym University Dongtan Sacred Heart Hospital

Objective : To review SAH with distal ACA aneurysms. Distal ACA aneurysms are relatively rare for other aneurysms. Because of distal location, vessel tortuously, and small diameters, endovascular treatment is challenging and show high recanalization rate.

Methods : Retrospectively reviewed SAH patient with distal ACA aneurysms. Analyzed complications and recanalization rate.

Result : Total 13 aneurysms were enrolled. Ischemic complication was 1 case. Aneurysmal recanalization was at 4 cases.

Conclusion : SAH with distal ACA aneurysms show high recanalization rate. Should consider about them and choose proper treatment option.

FP1-7

Impact of fetal-type posterior cerebral artery on recanalization of posterior communicating artery aneurysms after coil embolization: Matched-pair case-control study

Hyun Ho Choi, **Young Dae Cho**, Dong Hyun Yoo, Hyun-Seung Kang

Department of Neurosurgery, Seoul National University Hospital

Objective : It is well known that hemodynamic stress may impact the recanalization of coiled aneurysms. One of the commonest sites for aneurysms to develop is posterior communicating artery (PcoA), the variants of which are defined by diameter ratios (PcoA/P1 segment). This study was undertaken to investigate the impact of a fetal-type posterior cerebral artery (PCA) on recanalization of PcoA aneurysms after coil embolization, based on matched-pair (fetal vs non-fetal PCA) analysis.

Methods : A total of 480 consecutive PcoA aneurysms (PCA: fetal, n=156; non-fetal, n=324) subjected to coil embolization between January 2007 and June 2017 were selected for study. All lesions were followed for ≥6 months via radiologic imaging, grouped by adjacent PCAs as fetal (PcoA/P1>1) or non-fetal (PcoA/P1≤1) type. Paired subjects were matched (1:1) for several relevant variables.

Result : Of the 480 coiled aneurysms, 159 (33.1%) showed recanalization (minor, 76; major, 83) in the course of follow-up (mean, 33.8 ± 21.9 months), developing significantly more often in fetal (37.8%) vs non-fetal (26.9%; p=0.020) PCA types. Once matched, however, 6-month and cumulative recanalization rates did not differ significantly by group (p=0.531 and p=0.568, respectively). Complications (hemorrhage, p=0.97; thromboembolism, p=0.94) during endovascular coil embolization also showed similar rates in these groups.

Conclusion : Chances of recanalization after coil embolization proved greater in PcoA aneurysms than in intracranial aneurysms overall, thus calling for careful follow-up monitoring. Surprisingly, PcoA type appeared unrelated in this regard.

FP1-8

Influence of carotid siphon anatomy on difficulty during coiling of SHA aneurysm

Sung Hoon Kim, O-Ki Kwon, Seung Pil Ban, Young Deok Kim, and Hyunjun Jo

Department of Neurosurgery, Seoul National University Bundang Hospital

Objective : Tortuous carotid siphon have been recognized the major cause of difficult or failed access in endovascular treatment of superior hypophyseal artery (SHA) aneurysm. The purpose of this study was to assess the implications of carotid siphon anatomy (curvature & distance between siphon and aneurysm) for endovascular coiling of SHA aneurysm.

Methods : Between January 2017 and December 2018, lateral view digital subtraction angiographic images of 105 patients with SHA aneurysms treated in our department of interventional neuroradiology were reviewed and had their angles (siphon anterior bending angle) and distance measured. Procedural time and packing density were analyzed as factors related to the difficulty of treatment.

Result : In regard to the angle of total 105 aneurysms, two groups were divided based on the median of 43 degrees. In groups with less than 43 degrees, procedure time averaged 37.14 minutes, while packing density averaged 40.14%. In contrast, in groups with angles greater than 43 degrees, 36.72 minutes and 39.02%, respectively, were compared to the same results

Also, relate to the distance, two groups were divided based on the median of 4.65mm. In groups less than 4.65mm, procedure time averaged 35.96 minutes, while packing density averaged 40.34%. In contrast, in groups with distance greater than 4.65mm resulted 37.90 minutes and 39.43%, respectively

Conclusion : There was no significant relation of acute siphon angle and shorter distance with difficulty during SHA aneurysm coil procedure. These findings may be explained as overcoming difficulties through microcatheter shaping and additional devices (stent, balloon) for supporting stability.

FP1-9

Endovascular treatment of spontaneous dissection carotid artery aneurysm causing complete ophthalmoplegia and cerebral infarction

Sanghyuk Im[1], Youngwoo Kim[2]

[1]Department of Neurosurgery, Eunpyeoung St. Mary's Hospital, The Catholic University of Korea,
[2]Department of Neurosurgery, Uijeongbu St. Mary's Hospital, The Catholic University of Korea

Objective : Complete ophthalmoplegia with cerebral infarction secondary to a spontaneous dissecting aneurysm in the cavernous segment of internal carotid artery (ICA) is very rare. Antiplatelet therapy is the preferred treatment option for carotid dissections. However, endovascular treatment is considerable for selective cases, especially in cases of aggravating neurologic symptom.

Methods : We report of a 26-year-old female patient presenting with sudden onset, right-sided, spontaneous ophthalmoplegia with left side hemiparesis. Magnetic resonance imaging (MRI) and digital subtraction angiography (DSA) revealed a MCA territory infarction with multiple dissection of intracranial artery involving both vertebral artery and right internal carotid artery with dissecting aneurysm in the cavernous segment of internal carotid artery. On the 3rd day of treatment, partial ophthalmoplegia aggravated to complete ophthalmoplegia (CN 3,4,6 palsy) in spite of conservative treatment. Follow up DSA demonstrated increasing the aneurysm size.

Result : A dissecting aneurysm of the cavernous segment was successfully managed with a stent-assisted coil embolization. After the endovascular treatment of the aneurysm, a partial recovery of cranial nerve function was achieved.

Conclusion : Internal carotid artery dissecting aneurysm within the cavernous sinus can lead to third, fourth and sixth nerve palsy due to compression, stretching and ischemia from occlusion of the nutritional arteries. This case report illustrates that close observation and short term follow-up angiography should be considered for internal carotid dissecting aneurysm.

FP1-10

Immediate postprocedural angiographic stagnation of contrast media and T2-weighted MRI features within aneurysmal sac are associated with early regression of large or giant aneurysm after flow diversion only

Dong Young Cho[1,3], Jai Ho Choi[1], Hyun Seok Choi[2,4], Bum-soo Kim[2], Yong Sam Shin[1]

[1]Department of Neurosurgery and [2]Radiology, College of Medicine, Seoul St Mary's Hospital, The Catholic University of Korea, [3]Department of Neurosurgery, Ewha Womans University Seoul Hospital, Ewha Womans University College of Medicine, [4]Department of Radiology and Research Institute of Radiological Science, Severance Hospital, Yonsei University College of Medicine

Objective : We hypothesized immediate postprocedural image features were associated with early regression of flow-diverted aneurysm. To compare imaging features from digital subtraction angiography and spin echo T2-weighted MRI between early total regression and partial regression groups.

Methods : Thirty consecutive patients with large and giant aneurysms were treated with pipeline embolization devices and divided into two groups according to follow up angiographic result after three to six months; total or near total regression (n=20) and partial regression of aneurysmal sac (n=10). The baseline characteristics, percent area of stagnated iodine contrast agent on anterior-to-posterior and lateral view of angiography just after installation of pipeline device, and median, minimal, and 10-percentile signal intensity of aneurysmal sac on T2-weighted spin echo image after one day of procedure were compared between two groups.

Result : Demographic data comparison between two groups showed no significant difference. Volume of treated aneurysmal sac was not different (2559.28 mm3±3021.45, 2551.76 mm3±6550.58, p=0.455). Total or near total regression group showed larger area of percent iodine stagnation on lateral view of angiography than partial regression group (52.26%, 23.35%, p=0.002). Median, minimal and 10-percentile signal intensity of VOI were higher in total or near total regression group than partial regression group (1.29 vs 0.93, p=0.025; 0.07 vs 0.00, p=0.042; 0.57 vs 0.24, p=0.005).

Conclusion : Percentage area of contrast media stagnation on lateral angiography, and median, minimal and 10-percentile signal intensity of VOI of treated aneurysmal sac on T2 weighted image can be used to predict early regression of aneurysmal sac.

FP1-11

Literature review: Should flow diverting stent need an intra-saccular coil placement in the giant/large aneurysmal treatment to prevent later rupture?

Joo Seok Lee[1], **Dong Seong Shin[1]**, Brian Hoh[2], Bum-Tae Kim[1]

[1]Department of Neurosurgery, Soonchunhyang University Bucheon Hospital,
[2]Department of Neurosurgery at the University of Florida, Florida, USA

Objective : Flow diverting approaches had many early good results, recent apparently successful treatments have been complicated by later aneurysmal rupture. Many studies reported cause of later rupture after flow diverting and recommend alternative method for avoiding complication. However, Any Adjuvant treatment options (adjuvant coil embolization or stent) can't be allowed when treat large/giant aneurysm with flow diverting in Korea. Because, government control all medical supplement. Aim of this study is verification of flow diverter stent (FDS) approval of Korea health and welfare ministry and literature evidence of flow diverter stent assist coil embolization (FDS-CE).

Methods : Author (DS SHIN) visited department of neurosurgery in university of Florida (FL, USA) from Sep. 2018 to Aug. 2019 and prepared writing review article for flow diverter stent (FDS). 129 reference literatures selected for article writing. Among the literatures, 9 literatures correlated with later rupture complication and FDS-assisted coil embolization (FDS-CE). 9 literatures were analyzed more deeply.

Result : Chong et al. analyzed aneurysmal computational hemodynamics to determine the ones associated with successful and filed FDS treatment. In their 8 cases of study, factors for successful FDS treatment are obliteration of the inflow jet, reduction of energy loss, volume flow and wall share stress regions. If an optimal hemodynamics state cannot achieved by an initial FDS, authors recommend, a second FDS deploy within first one (double FDS). Cebral et al. analyzed their later aneurysmal rupture cases after treatment with FDS. In their 7 cases of series, placement of an FDS can increase in the intra-aneurysmal pressure, which can potentially cause the ruptured of the aneurysms, especially giant aneurysms that may have very weak walls. They recommend that placement of a coil or other prothrombotic devices in the aneurysm sac before the deployment of FDS, it can achieve rapid aneurysmal thrombosis or reduce the time period for post-treatment rupture risk in the post-treatment window. Lin et al. compared outcomes for FDS alone and flow FDS-CE for 104 aneurysms. The FDS-CE technique resulted in significantly higher complete occlusion rates (93.1% vs 74.4%, p=0.03) and lower retreatment rates (3.4% vs 16.0%, p=0.05) than stand-alone FDS. Five patients experienced periprocedural complications, 2 in the FDS group and 3 in the FDS-CE group. In a series of 28 patients, Nossek et al. evaluated a FDS-CE technique employing more traditional dense coiling supported by the FDS. With this technique, the authors reported a complete occlusion in all 28 patients on final angiographic follow-up. While the authors reported no radiographic evidence of ischemia, other studies have identified increased complications with FDS-CE techniques. Park et al. compared complications for FDS alone versus FDS-CE from the International Retrospective Study of Pipeline Embolization Device (IntrePED) dataset. Among 793 candidate cases, complication rates between those aneurysms treated by FDS and FDS-CE were not significantly different (7.8% FDS vs 12.5% FDS-CE, p=0.13).

Conclusion : Giant/large aneurysmal treatment using single FDS may lead to post-treatment aneurysmal rupture by intra-aneurysmal hemodynamic change. Placement of a coil in the aneurysmal sac before the FDS deployment may help for reducing post-treatment rupture risk and advancing intra-aneurysmal thrombosis. However, any Adjuvant treatment options can't be allowed when treat large/giant aneurysm with FDS in Korea. We hope that this regulation should be change for patient's safety as soon as possible.

2019 대한뇌혈관내수술학회

정기학술대회 및 총회

Special lecture I

좌장 : 서울대 **권오기**

Endovascular treatment of dural arteriovenous fistula

Fukuoka University Chikushi Hospital, Japan **Dr. Toshio Higashi**

Endovascular treatment of dural arteriovenous fistula

Toshio Higashi

Department of Neurosurgery, Fukuoka University Chikushi Hospital, Japan

Recently, various aspects of the pathophysiology of dural arteriovenous fistula (DAVF) has become apparent. Formerly, DAVF was categorized as a vascular malformation, and the clinical entity has established, which has arteriovenous shunt localized within dural layers. It was reported that the disease could be treated with the occlusion of the venous outlet. Several reports have presented the natural history of DAVF, which has also provided clear therapeutic indications. It is essential to recognize the shunt point (1), the feeding artery (2), and the draining vein (3) for the understanding of the pathophysiology. Understanding the anatomy of the feeding artery such as dangerous anastomosis lead to avoid complications with transarterial embolization (TAE), and understanding of the anatomy of the draining vein provides the cause of clinical symptoms and the treatment strategy of transvenous embolization (TVE). Historically, TAE for DAVF is initially indicated only to reduce the shunt flow, then the TVE with occlusion of the shunt point or the venous outlet brought the high cure rate. Recently, TAE is selected as the curable treatment with the advent of new liquid embolic materials. Recently, the development of imaging modalities such as 3D-rotational angiography provides an accurate diagnosis of the location of the shunt point; precise selective embolization is possible with the advent of catheter technology. The TAE with liquid embolic materials will be focused in the presentation.

2019 대한뇌혈관내수술학회

정기학술대회 및 총회

Luncheon seminar

좌장 : 순천향대 **윤석만**

First Pass Effect – how ADAPT change my practice in AIS treatment strategy

Sorbone University Hospital, France **Dr. Clarençon Frédéric**

First Pass Effect – how ADAPT change my practice in AIS treatment strategy

Dr. Clarençon Frédéric

Sorbone University Hospital, France

2019 대한뇌혈관내수술학회
정기학술대회 및 총회

Scientific seminar

좌장 : 영남대 **장철훈**, 원광대 **김대원**

Brief presentation by SKEN academic awardee I–IV & Panel Discussion

I. 명지성모병원 남천 학술상 / 패널 : 아주대학교병원 **임용철**

Frontline thrombectomy for acute large–vessel occlusion with underlying severe intracranial stenosis: stent retriever versus contact aspiration — 경북대학교병원 **강동훈**

II. 에스포항병원 학술상 (SCI(E) 부분) / 패널 : 차의과학대학교 분당차병원 **김태곤**

In vitro and in vivo experiments of a novel intra–arterial neurovascular decompressor for treating neurovascular compression syndromes — 연세대학교 세브란스병원 **정준호**

III. 에스포항병원 학술상 (SCI(E) 부분) / 패널 : 충남대학교병원 **권현조**

Predictive value of neurophysiologic monitoring during neurovascular intervention for postoperative new neurologic deficits — 인제대학교 해운대백병원 **진성철**

IV. 연세에스병원 학술상 (young endovascular neurosurgeon) / 패널 : 연세에스병원 **정진영**

Selective compromise of hypoplastic posterior communicating artery variants with aneurysms treatable by coil embolization: clinical and radiologic outcomes — 중앙대학교병원 **최현호**

I. 명지성모병원 남천 학술상

Frontline thrombectomy for acute large-vessel occlusion with underlying severe intracranial stenosis: stent retriever versus contact aspiration

강 동 훈

경북대

Objective : The optimal front-line thrombectomy choice for primary recanalization of a target artery remains unknown for patients with acute large-vessel occlusion (LVO) and an underlying intracranial atherosclerotic stenosis (ICAS). The authors aimed to compare procedural characteristics and outcomes between patients who received a stent-retriever thrombectomy (SRT) and patients who received a contact aspiration thrombectomy (CAT), as the front-line approach for treating LVO due to severe underlying ICAS.

Methods : One hundred thirty patients who presented with acute LVO and underlying severe ICAS at the occlusion site were included. Procedural characteristics and treatment outcomes were compared between patients treated with frontline SRT (n = 70) and those treated with front-line CAT (n = 60). The primary outcomes were the rate of switching to an alternative thrombectomy technique, time from groin puncture to initial reperfusion, and duration of the procedure. Initial reperfusion was defined as revealing the underlying culprit stenosis with an antegrade flow after thrombectomy.

Result : The rate of switching to an alternative thrombectomy after failure of the front-line technique was significantly higher in the CAT group than in the SRT group (40% vs 4.3%; OR 2.543, 95% CI 1.893-3.417, p < 0.001). The median time from puncture to initial reperfusion (17 vs 31 minutes, p < 0.001) and procedure duration (39 vs 75.5 minutes, p <0.001) were significantly shorter in the SRT group than in the CAT group. In the binary logistic regression analysis, a longer time from puncture to initial reperfusion was an independent predictor of a 90-day poor (modified Rankin Scale score 3-6) functional outcome (per 1-minute increase; OR 1.029, 95% CI 1.008-1.050, p = 0.006).

Conclusion : The authors' results suggest that SRT may be more effective than CAT for identifying underlying culprit stenosis and therefore considered the optimal front-line thrombectomy technique in acute stroke patients with LVO and severe underlying ICAS.

Keywords : atherosclerosis; intracranial; cerebral infarction; endovascular thrombectomy; large-vessel occlusion; vascular disorders; interventional neurosurgery

II. 에스포항병원 학술상 (SCI(E) 부분)

In vitro and in vivo experiments of a novel intra-arterial neurovascular decompressor for treating neurovascular compression syndromes

정 준 호

연세대

BACKGROUND and PURPOSE : Neurovascular compression syndromes (NVCS) could be cured with an intravascular device that releases compression of the root entry zone of cranial nerves by changing the course of offending vessels. The purpose of this study was to report our results of in vitro and in vivo experiments with a novel intra-arterial neurovascular decompressor (IA-NVD) for NVCS.

Methods : A nitinol-based IA-NVD was developed to release pressure applied to the root entry zone of cranial nerves by changing the course or angle of an offending vessel, which can possibly cure NVCS. We performed in vitro tests for safety and feasibility and preliminary in vivo tests up to 4 weeks for safety.

Result : The bending stiffness of the device was similar to but slightly stronger than that of current, closed-cell intracranial stents. Hemocompatibility tests showed no significant thrombogenesis in whole blood. After the 4-week follow-up, all animals (20-month-old female Gottingen mini-pigs weighing 15 - 18 kg, n = 4) had a normal upright position and gait. Scanning electron microscopy images and H&E staining of arteries containing the devices showed good neointima formation on the devices. Intima hyperplasia occurred over wires and connecting tubes, but it did not interrupt the patency of the arterial lumen.

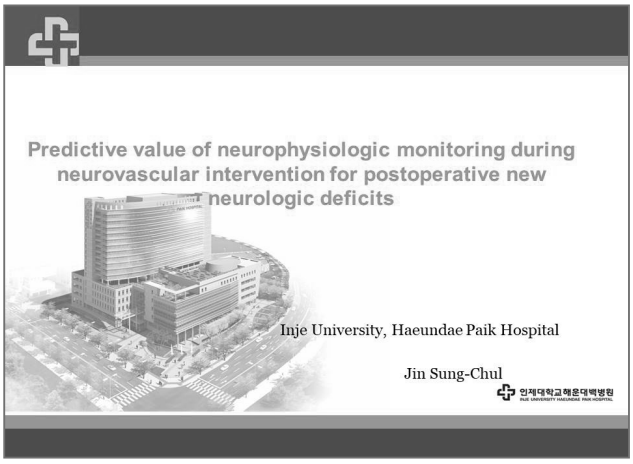
Conclusion : An IA-NVD was created and tested to demonstrate its functionality and biocompatibility in the present experiments. The device may be safely applied to intracranial arteries, providing us a chance to test the efficacy of an upgrade version of the device on changing the course of an artery that compresses a cranial nerve.

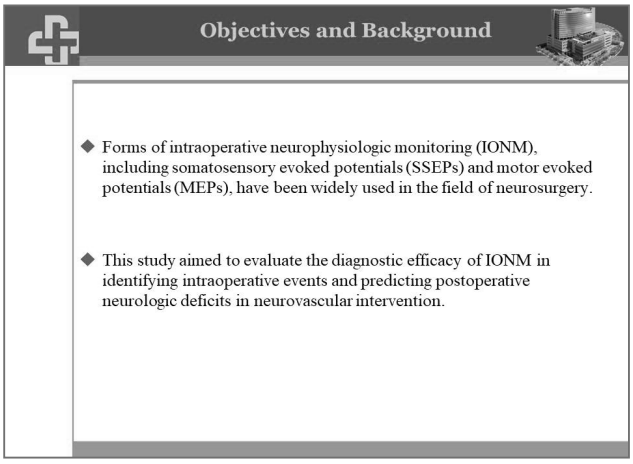
III. 에스포항병원 학술상 (SCI(E) 부분)

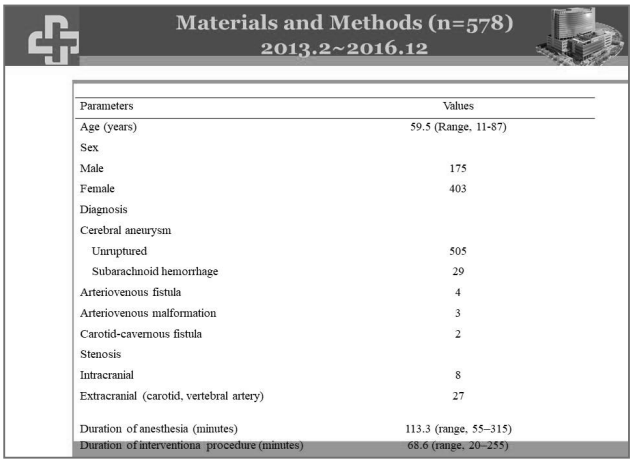
Predictive value of neurophysiologic monitoring during neurovascular intervention for postoperative new neurologic deficits

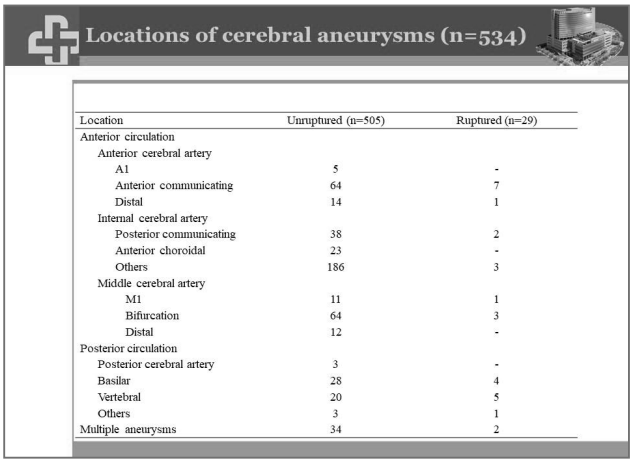
진 성 철

인제대









Summary of patients with intraoperative changes in MEPs or SSEPs and postoperative new neurologic deficits

Case No.	Age (yrs)	Sex	Diagnosis	Location	Preop neurologic status	SSEP changes	MEP changes	Duration	Postop new neurologic deficit	Causative event	Postop radiographic image findings
1	70	M	UIA	A-com	Lt hemiparesis (3-4/5)	None	None	-	4 hrs after operation, decreased mentality, Rt hemiparesis (1/5)	Thromboembolism	Lt ACA territory acute infarction
2	66	M	UIA	Rt P-com	Rt leg monoparesis (2/5)	None	Decrement>50%	Permanent	Same as preop	None	Not performed
3	60	M	UIA	Lt distal ACA	Normal	None	Decrement>50%	Temporary	None	None	Not performed
4	51	F	UIA	A-com	Decreased mentality, normal motor function	Decremen t>50%	Loss	Permanent	Semicomatous mentality, decreased motor response in all limbs (2/5)	Vasospasm	Lt parietal & frontal lobe multiple infarction
5	57	F	UIA	Lt ICA	Normal	None	Decrement>50%	Temporary	None	None	Not performed
6	49	F	UIA	Lt ICA	Normal	Loss	Decrement>50%	Temporary	None	An rupture	Diffuse SAH
7	48	F	SAH	Lt ICA	Decreased mentality, decreased motor function (3/5) without lateralizing	Decremen t>50%	None	Permanent	Rt side hemiparesis (2/5)	Thromboembolism	Lt precentral gyrus acute infarction Enlarged ventricle suggesting IICP
8	42	F	SAH	Rt VA	Decreased mentality, normal motor function	Decremen t>50%	None	Temporary	Same as preop	An rupture	Increased SAH, IVH Ventriculomegaly
9	53	F	UIA	Rt AchA	Normal	None	Decrement>50%	Temporary	None	None	Not performed
10	81	M	Stenosis	Lt carotid	Rt arm monoparesis (1/5)	Decremen t>50%	Decrement>50%	Temporary	Same as preop	Flow arrest	Increased number of tiny multiple embolic infarction
11	76	F	SAH	A-com	Normal	Decremen t>50%	None	Permanent	Rt hemiparesis (1/5), Aphasia	Thromboembolism	Lt ACA territory acute infarction

Contingency table describing the association between IOM SSEP alerts at any time during the operation and identifiable causative events*

Variable	SSEP alert	No alert
Identifiable causative event (+)	6 (100%)	0 (0%)
Identifiable causative event (-)	0 (0%)	571 (100%)
Total	6	571

Sensitivity = 6/6 (100%)

Specificity = 571/571 (100%)

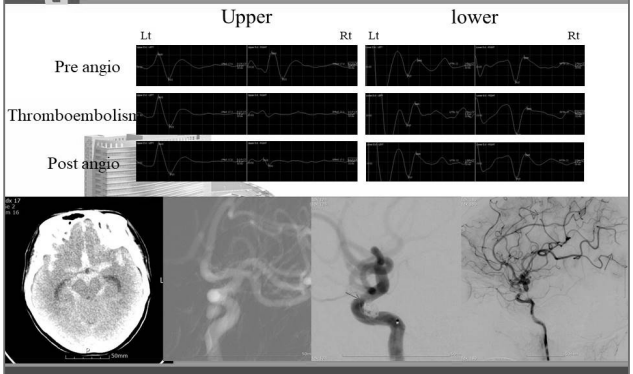
Contingency table describing the association between IOM MEP alerts at any time during the operation and identifiable causative events*

Variable	MEP alert	No alert
Identifiable causative event (+)	3 (50%)	3 (0.5%)
Identifiable causative event (-)	3 (50%)	551 (99.5%)
Total	6	554

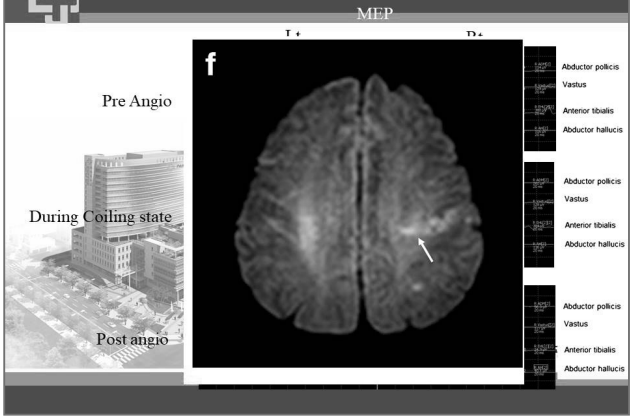
Sensitivity = 3/6 (50%)

Specificity = 551/554 (99.5%)

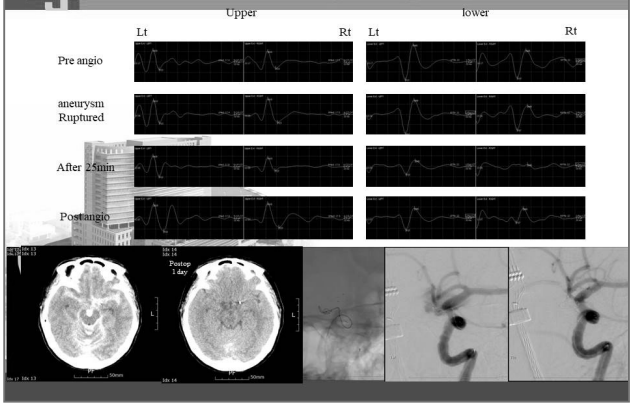
Procedural thromboembolism

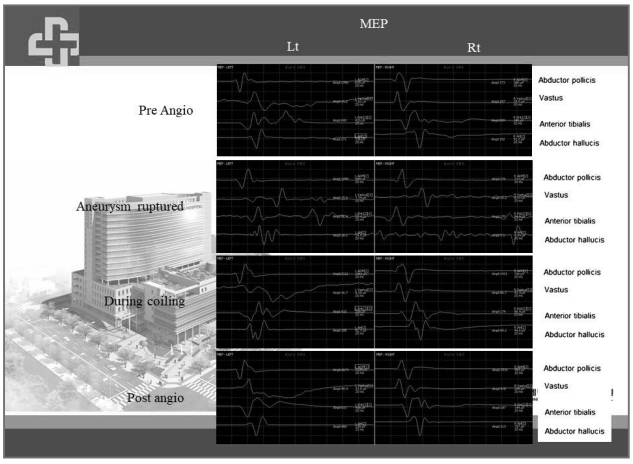


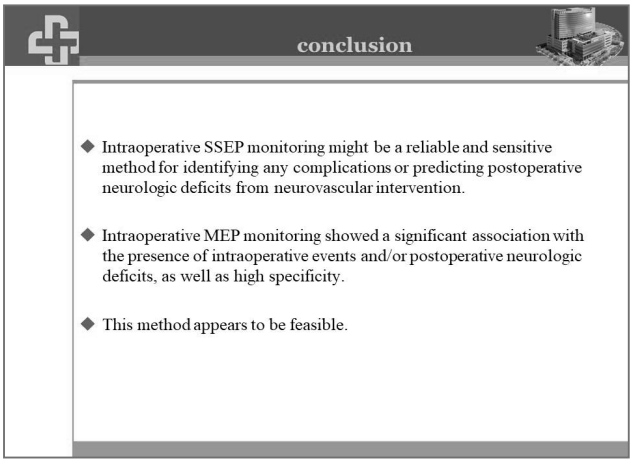
MEP



Procedural aneurysm rupture




MEP
Lt
Rt
Pre Angio
Aneurysm ruptured
During coiling
Post angio
Abductor pollicis
Vastus
Anterior tibialis
Abductor hallucis

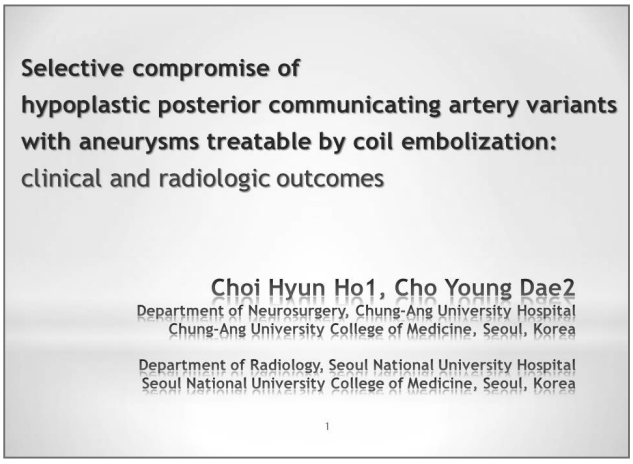

conclusion
◆ Intraoperative SSEP monitoring might be a reliable and sensitive method for identifying any complications or predicting postoperative neurologic deficits from neurovascular intervention.
◆ Intraoperative MEP monitoring showed a significant association with the presence of intraoperative events and/or postoperative neurologic deficits, as well as high specificity.
◆ This method appears to be feasible.

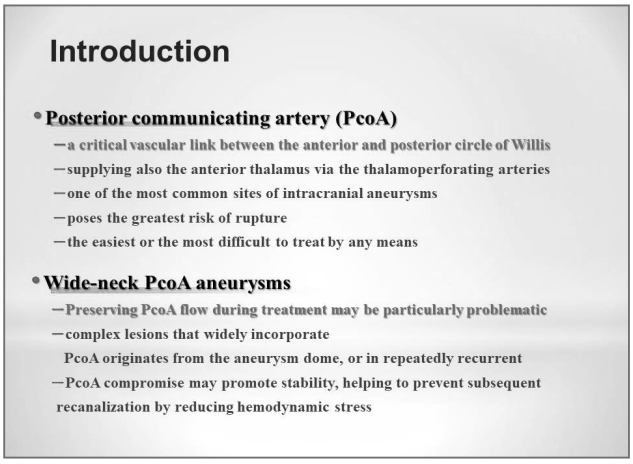
IV. 연세에스병원 학술상 (young endovascular neurosurgeon)

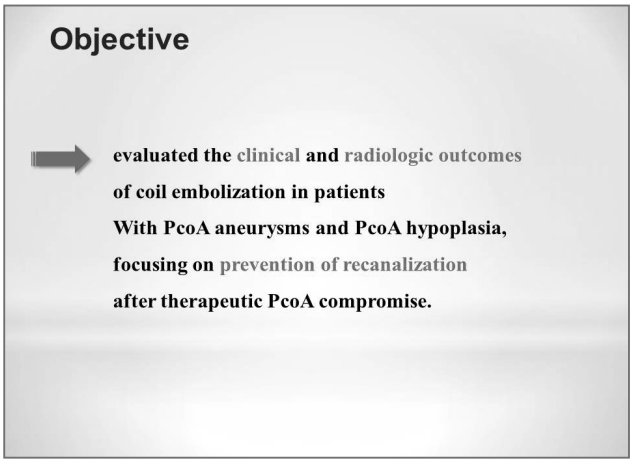
Selective compromise of hypoplastic posterior communicating artery variants with aneurysms treatable by coil embolization: clinical and radiologic outcomes

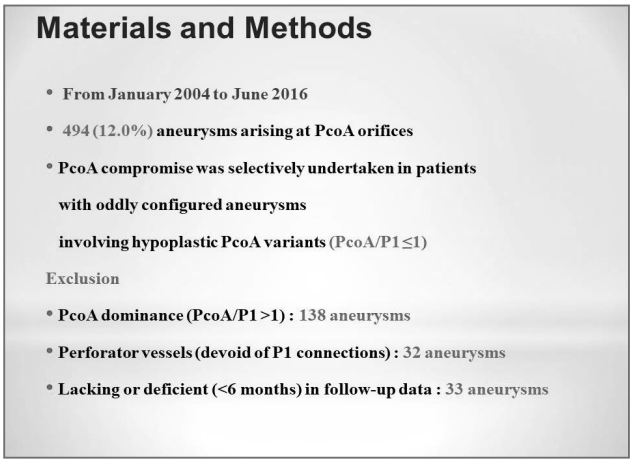
최 현 호

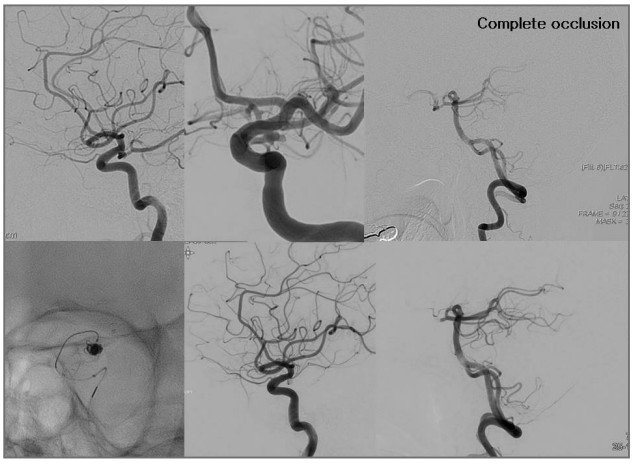
중앙대

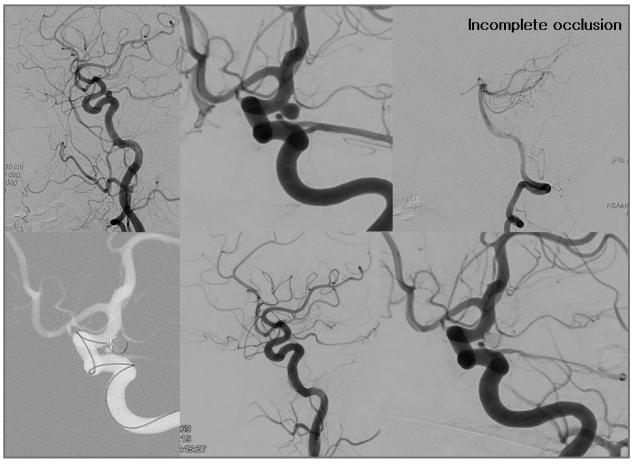












Results

Baseline characteristics of patients with posterior communicating artery (PcoA) aneurysms in hypoplastic variants

Number of aneurysms	291
Mean age (years)	58.3±10.1
Female	241 (82.8%)
Maximum diameter (mm)	5.5±2.4
Maximum neck (mm)	3.7±1.5
Depth to neck ratio	1.3±0.6
Angles of PcoA origin	53.0±32.7
PcoA/P1 ratio	0.60±0.20
Hypertension	153 (52.6%)
Diabetes mellitus	32 (11.0%)
Hyperlipidemia	101 (34.7%)
Smoking	33 (11.3%)
Presentation	
UIA	223 (76.6%)
SAH	68 (23.4%)
Retreatment	42 (14.4%)
PcoA flow compromise	
Complete compromise	28 (9.6%)
Incomplete compromise	53 (18.2%)
Preservation	210 (72.2%)
Stent	63 (21.6%)
Balloon	29 (10.0%)
Initial aneurysm occlusion	
Complete occlusion	99 (34.0%)
Residual neck	118 (40.6%)
Residual sac	74 (25.4%)

Results

- **Procedural complications**
  - −28 patients (thromboembolism 22; procedural leakage 6)
  - −Six months later, 26 of these patients had recovered well
  - −Only two patients with severe SAH at presentation did poorly
- **Patients subjected to PcoA compromise**
  - −10 (thromboembolism 7; hemorrhage 3)
  - −Incomplete compromise: 9/53
  - −Complete compromise: 1/28
  - −all having recovered well at 6 months

➡ **Cerebral ischemia (ie, thalamic or posterior cerebral artery (PCA) infarction) due to PcoA compromise was not encountered in any patient**

Results

- **Follow-up outcomes**
  - −Mean follow-up period
    33.9±24.6 months (median 36 months; range 6–140 months)
  - −Recanalization occurred in 107
    (36.8%, minor recanalization 50; major recanalization 57)
    mean period of 15.2±17.2 months (median 6 months; range 6–96 months)
  - −recanalization 35.0±25.4 months; complete occlusion 33.3±24.1 months; P=0.58)

Table 2 Recanalization rates by degree of posterior communicating artery (PcoA) compromise

PcoA flow compromise	Preservation (%)	Incomplete compromise (%)	Complete compromise (%)	Total (%)
Complete occlusion	125 (59.5)	35 (66.0)	24 (85.7)	184 (63.2)
Minor recanalization	39 (18.6)	7 (13.2)	4 (14.3)	50 (17.2)
Major recanalization	46 (21.9)	11 (20.8)	0 (0)	57 (19.6)
Total	210 (100)	53 (100)	28 (100)	291 (100)

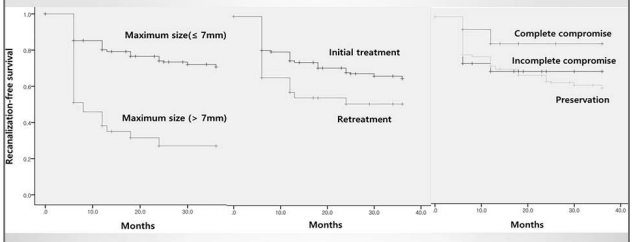
Table 3 Risk factor analysis for recanalization after coil embolization of posterior communicating artery (PcoA) aneurysms in hypoplastic variants

	Recanalization (%)		Univariate analysis	Multivariate analysis	
Variable	No (n=184)	Yes (n=107)	P values	P values	OR (95% CI)
Sex			0.901		
Female	152 (82.6)	89 (83.2)			
Male	32 (17.4)	18 (16.8)			
Age (years)			0.176		
≤65	133 (72.3)	85 (79.4)			
>65	51 (27.7)	22 (20.6)			
Hypertension	100 (54.3)	53 (49.5)	0.428		
Diabetes mellitus	25 (13.6)	7 (6.5)	0.070	0.183	0.519 (0.198 to 1.361)
Hyperlipidemia	71 (38.6)	30 (28.0)	0.069	0.250	0.715 (0.403 to 1.267)
Smoking	25 (13.6)	8 (7.5)	0.118		
Presentation			**0.046**	0.357	1.338 (0.720 to 2.489)
UIA	148 (80.4)	75 (70.1)			
SAH	36 (19.6)	32 (29.9)			
PcoA/P1 ratio >0.5	126 (68.5)	83 (77.6)	0.098	0.411	1.286 (0.706 to 2.342)
PcoA angulation >90°	30 (16.3)	11 (10.3)	0.158		
Maximum size (mm)			**<0.01**	**<0.01**	3.401 (1.605 to 7.206)
≤7 mm	165 (89.7)	73 (68.2)			
>7 mm	19 (10.3)	34 (31.8)			
Neck size (mm)			**<0.01**	0.122	1.670 (0.872 to 3.197)
≤4 mm	141 (76.6)	63 (58.9)			
>4 mm	43 (23.4)	44 (41.1)			
Depth to neck ratio (>1.5)	49 (26.6)	34 (31.8)	0.349		
Retreatment with recanalization	19 (10.3)	23 (21.5)	0.010	**<0.01**	3.234 (1.511 to 6.923)
Residual sac	43 (23.4)	31 (29.0)	0.291		
Use of stent	43 (23.4)	20 (18.7)	0.351		
PcoA flow compromise			**0.035**	**<0.01**	
Incomplete compromise	35 (19.0)	18 (16.8)	0.385*	0.170*	0.607 (0.298 to 1.238)
Complete compromise	24 (13.0)	4 (3.7)	**0.012***	**<0.01***	0.160 (0.047 to 0.545)
Preservation	125 (68.0)	85 (79.5)			Reference

*Reference variable; preservation of PcoA flow.
SAH, subarachnoid hemorrhage; UIA, unruptured intracranial aneurysm.

Results

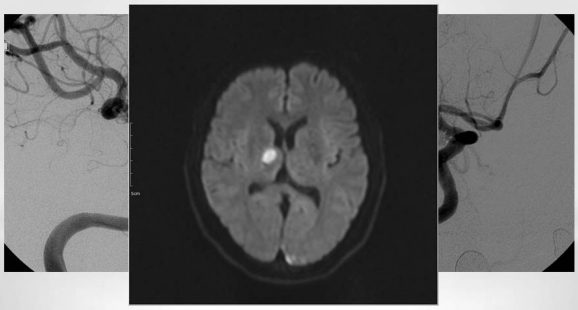
Kaplan-Meier estimates of cumulative survival without recanalization



P<0.01 P<0.01 P=0.03

Caution!!!

Perforator vessels (devoid of P1 connections)

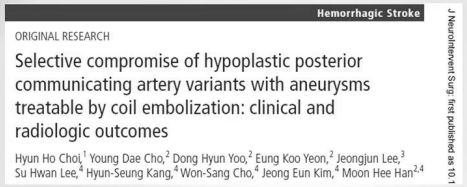


Conclusion

Hypoplastic PcoA compromise

- Favorable clinical outcomes
- Preventive effect for recanalization of PcoA aneurysm
- if complete compromise was achieved

➡ **Aneurysm size (> 7 mm) and retreatment with recanalization were also significantly associated with recanalization of PcoA aneurysm with hypoplastic PcoA .**



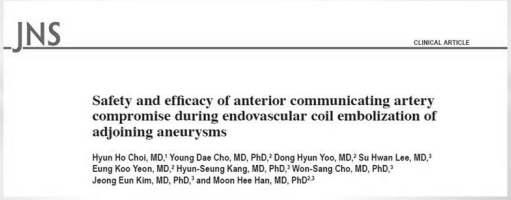
Hemorrhagic Stroke

ORIGINAL RESEARCH

Selective compromise of hypoplastic posterior communicating artery variants with aneurysms treatable by coil embolization: clinical and radiologic outcomes

Hyun Ho Choi,[1] Young Dae Cho,[2] Dong Hyun Yoo,[2] Eung Koo Yeon,[2] Jeongjun Lee,[3] Su Hwan Lee,[4] Hyun-Seung Kang,[4] Won-Sang Cho,[4] Jeong Eun Kim,[4] Moon Hee Han[2,4]

J Neurointervent Surg first published as 10.1



JNS CLINICAL ARTICLE

Safety and efficacy of anterior communicating artery compromise during endovascular coil embolization of adjoining aneurysms

Hyun Ho Choi, MD,[1] Young Dae Cho, MD, PhD,[2] Dong Hyun Yoo, MD,[2] Su Hwan Lee, MD,[3] Eung Koo Yeon, MD,[2] Hyun-Seung Kang, MD, PhD,[3] Won-Sang Cho, MD, PhD,[3] Jeong Eun Kim, MD, PhD,[3] and Moon Hee Han, MD, PhD[2,3]

Thank you for your attention

15

Free paper II (AVM, AVF etc)

좌장 : 가톨릭대 **성재훈**, 울산대 **권순찬**

Treatment outcomes according to various treatment modalities for intracranial dural arteriovenous fistulas in the Onyx era: A 10-year single center experience	가톨릭대학교 서울성모병원 **최재호**
Embolization with PHIL: Single-center 8-cases experience	울산대학교병원 **엄태웅**
Treatment outcome of type I spinal dural arteriovenous fistula under the policy of initial endovascular treatment trial	서울대학교병원 **이희승**
Case presentation: Treatment of traumatic CCF using intra-arterial approach	가톨릭대학교 의정부성모병원 **신재전**
Multimodal treatment for cranial dural arteriovenous fistula: Case reports	아주대학교병원 **김미경**
Endovascular trans-venous embolization (TVE) of paracondylar dural arteriovenous fistula	창원경상대학교병원 **박 현**

FP2-1

Treatment outcomes according to various treatment modalities for intracranial dural arteriovenous fistulas in the Onyx era: A 10-year single center experience

Jai Ho Choi, Yong Sam Shin

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

Objective : Even though transarterial embolization (TAE) with Onyx has become popular for the treatment of dural arteriovenous fistulas (DAVF), roles of transvenous embolization (TVE), surgery, and radiosurgery remain. The aim of this study was to compare the treatment outcomes, according to different treatment modalities.

Methods : Ninety-two patients with DAVFs treated between January 2009 and June 2018 were retrospectively reviewed. Treatment strategies were decided by a multidisciplinary team, based on the patient's clinical status and angiographic findings. Clinical and radiologic data were analyzed and correlated with the treatment modality.

Result : A total of 101 procedures were performed in 92 patients. TAE, TVE, surgery, and radiosurgery were performed in 31, 49, 12, and 9 procedures, respectively. Complete and near complete occlusion was achieved in 13 cases treated with TAE (41.9%), 41 cases with TVE (83.7%), and 10 cases with surgery (83.3%), as evidenced on immediate postprocedural angiography ($p<0.001$). Retreatment was needed in 9 cases in the TAE group, and none in the TVE or surgery groups ($p<0.001$). Surgery (n=1), TVE (n=3), TAE (n=1) and radiosurgery (n=4) were performed on patients needing retreatment. At last follow-up (mean 26.5±23.9 months), 66 out of 72 DAVFs (91.6%) showed angiographic complete occlusion. Clinically, initial symptoms had disappeared or improved in 87 of 90 patients (96.7%) at last follow-up (mean 26.4±26.8 months).

Conclusion : Even in the Onyx era, other treatment modalities still play important roles in this study. Therefore, the selection of an appropriate treatment modality should be individualized based on the angiographic findings and clinical symptoms.

FP2-2

Embolization with PHIL: Single-center 8-cases experience

Tae-Oong Eom, Soon-Chan Kwon

Department of Neurosurgery, Ulsan University Hospital

Objective : Novel embolic agents such as PHIL are clinically known to make fewer artifacts in image studies, but there is a drawback that visibility is blurred during embolization. We present 8-cases experiences with PHIL(AVM : 7, AVF : 1).

Methods : PHIL uses covalently bound iodine for radiopacity instead of tantalum. Because the radiopacity of the iodine is less visible than the tantalum, we have changed the setting of the Artis Zee biplane from SEIMENS(the set value of PHIL; edge enhancement Native : 80%, edge enhancement Subtraction : 10%, window brightness : 1800, window contrast : 90 and the value of Onyx; edge enhancement Native : 20%, edge enhancement Subtraction : 30%, window brightness : 2500, window contrast : 50). Embolization was performed using PHIL as the changed setting value and compared with the visibility when using Onyx.

Result : We did successful embolization with PHIL in all cases. There are some problems related to visibility in early PHIL groups, but we were able to get not only the same visibility as Onyx with the changed settings but also a low degree of artifacts in CT imaging.

Conclusion : We can overcome the visibility of PHIL. On conventional CT, PHIL produced significantly fewer artifacts.

FP2-3

Treatment outcome of type I spinal dural arteriovenous fistula under the policy of initial endovascular treatment trial

Heui Seung Lee, Hyun-Seung Kang, Chun Kee Chung

Department of Neurosurgery, Seoul National University College of Medicine, Seoul National University Hospital

Objective : We aimed to evaluate factors for incomplete occlusion, recanalization and worsening of neurological function by analyzing treatment results of type I spinal dAVF according to different treatments courses.

Methods : Medical records and radiographic studies of patients with type I spinal dAVF who underwent treatment by initial trial of EVT between January 2004 and March 2019 were retrospectively reviewed. Patient demographics, radiological findings including spinal cord myelopathy, number of arterial feeders and location of spinal dAVF were compared between groups categorized by different treatment courses, accomplishment of complete occlusion, outcomes by radiological and neurological function and recanalization.

Result : In total, 71 patients with type I spinal dAVF were retrospectively evaluated. Twenty-one patients underwent initial surgical treatment and 50 patients had initial EVT. Complete occlusion by initial treatment was achieved in 38 out of 50 patients of initial EVT group (76%) whereas all of 21 patients had complete occlusion. Multiple feeder was associated with incomplete occlusion by initial EVT (7 /38 patients of complete occlusion vs. 9/12 patients of incomplete occlusion, P 〈0.001). Worsened functional outcome was observed in 15.5% of all patients (1/21 patients in initial surgical treatment group; 10/50 patients in initial EVT group) and 8 patients had worsened functional outcome despite complete occlusion by initial EVT. Six out of 38 patients who had complete occlusion by initial EVT had recanalization on either follow-up MRI or follow-up spinal angiogram. Two patients with coexisting spinal perimedullary arteriovenous fistula (AVF) had dAVF showed simultaneous recanalization with worsening of neurological function.

Conclusion : Though complete occlusion of dural AVF by initial EVT was achieved, long term follow-up is necessary considering 15.8% of radiological recanalization which may cause worsened functional outcome. For cases in which perimedullary AVF is coexisting, patients need to have longer follow-up to detect simultaneous recanalization of both lesions and worsening of neurological function. To achieve better functional outcome in the group of incomplete occlusions by EVT, early surgical obliteration of dAVF should be considered for complete occlusion.

FP2-4

Case presentation: Treatment of traumatic CCF using intra-arterial approach

Jae Jon Sheen, Young Woo Kim

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

Objective : A 45 years old male presented with exophthalmos and ecchymosis of left eye after traffic accident. We describe the treatment for the occlusion of traumatic CCF using arterial approach.

Methods : Brain MRI showed engorged bilateral ophthalmic veins. A fistula lesion on the posterior genu of cavernous ICA segment was shown on cerebral angiography. We performed balloon occlusion test for occlusion of parent vessel which had a fistula lesion. Brain SPECT during test revealed a moderate perfusion defect. We performed an intra-arterial approach for occlusion of CCF.

Result : The ocular symptom was improved after the procedure.

Conclusion : Intra-arterial approach can be considered as a viable option for treatment of CCF.

FP2-5

Multimodal treatment for cranial dural arteriovenous fistula: Case reports

Mi Kyung Kim, Yong Cheol Lim

Department of Neurosurgery, Ajou University Hospital

Objective : Dural arteriovenous fistula (DAVF) is an uncommon subtype among the intracranial arteriovenous malformations, which is treated with a variety of approaches, including surgical resection, venous clipping, transcatheter embolization, radiation therapy, or a combination of these treatments.

Methods : We present two cases of DAVF following a prior endovascular treatment which is treated using fractional dose radiation therapy.

Result : A 56-year-old woman was admitted for a progressively left tinnitus and facial palsy over 1 month. Computed tomography angiograph, magnetic resonance imaging angiography, and digital subtraction angiography (DSA) revealed a DAVF which was supplied from left internal maxillary artery branches and middle meningeal arteries with retrograde flow of the cortical vein. Transarterial embolization of the fistula was successfully performed with remnant fine feeding arterial shunting. Two months later, a follow-up DSA showed recurred DVAF supplied from innumerable branches from internal maxillary artery and ethmoidal branches. The recurred DVAF was treated using fractional dose radiation therapy, and follow-up images in 6 months showed a complete disappearance of DVAF.
A 53-year-old man was admitted for right tinnitus and headache. Magnetic resonance imaging angiography, and DSA revealed a DVAF of right transverse and sigmoid sinus with cortical venous reflux. Transarterial and transvenous embolization of the fistula by coils and onyx was successfully performed and residual DVAF around condylar area was treated using fractional dose radiation therapy. A follow-up image in 7 months showed a complete disappearance of residual DVAF.

Conclusion : A combination of approaches including endovascular treatment and fractional dose radiation therapy could be a good treatment option for recurred or residual DVAF which is difficult to treat anatomically with stereotactic radiosurgery.

FP2-6

Endovascular trans-venous embolization (TVE) of paracondylar dural arteriovenous fistula

Hyun Park, O-Ki Kwon

Department of Neurosurgery, Gyeongsang National University Changwon Hospital

Objective : Condylar dural arteriovenous fistular(DAVF) is an uncommon disease that accounts for 3.6% of total DAVF. There are some methods for treatment of DAVF. Transarterial embolization (TAE) and transvenous embolization (TVE) are recently considered effective methods. We report four cases of paracondylar DAVF treated by TVE recently.

Methods : One case is a 56-year-old woman with tinnitus, and TVE was performed for right condylar DAVF and complete occlusion was achieved. The other case is a 53-year-old woman with dysphagia, and TVE was performed for right condylar DAVF and complete occlusion was achieved. Another case is 57-year-old man with tinnitus, severe depressed mood. TVE was done for paracodylar DAVF.

Result : Four cases were treated with trans-venous embolization and all were complete occlusion.

Conclusion : Transvenous embolization is considered to be effective among the various methods of treating para-condylar DAVF.

2019 대한뇌혈관내수술학회

정기학술대회 및 총회

Special lecture II

좌장 : 가톨릭대 **신용삼**

Recent trend of EVT for large and giant cerebral aneurysm in JSNET

Fukuoka University Chikushi Hospital, Japan **Dr. Toshio Higashi**

Recent trend of EVT for large and giant cerebral aneurysm in JSNET

Toshio Higashi

Department of Neurosurgery, Fukuoka University Chikushi Hospital, Japan

According to the annual report of Japan Neurosurgical Society, the penetration of coiling for the treatment of intracranial aneurysm almost leached fifty percent in 2018, and sixteen thousand cases of coiling for ruptured and unruptured aneurysms were performed annually. As for the flow diverter system, only the Pipeline is clinically approved in 2015 through the priority approving system of the Ministry of Health, Labor and Welfare in Japan. Initially, the Pipeline Flex is introduced, and the Pipeline Shield is available since this year. The clinical trial was only finished with the other two flow diverters, Surpass and FRED. Indication of Pipeline in Japan is determined that ≥10mm in size, unruptured and ruptured (>day 14) aneurysm, and aneurysm located at proximal ICA except for the Pcom segment. It is introduced with a strict physician training system including lecture and model training, case observation at the certified hospital, pre-consultation, proctoring (5 cases), and industry observation (additional 5 cases). In October 2019, a total of 1,796 cases were performed, and the Pipeline is introduced in forty-four institutions with forty-nine physicians. Japan Neurosurgical Society operates the post-market surveillance (120 cases), and industry supported registry (1,000 cases) is planned. Several clinical questions, such as peri-procedural complications, optimal antiplatelet therapy, will be discussed.

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정기학술대회 및 총회

Free paper III (Ischemia)

좌장 : 서울대 **강현승**, 차의과학대 **신승훈**

The effectiveness of intra-arterial thrombectomy (IAT) protocol for decreasing door-to-recanalization time duration in acute stroke	계명대학교 동산병원 **김창현**
Is transradial mechanical thrombectomy alternative plan in impossible transfemoral access for mechanical thrombectomy? A single center's experience	강원대학교병원 **전효섭**
Clinical impact of ankle brachial index in patients undergoing simultaneous coronary and cerebral angiography due to atherosclerosis detected on brain imaging studies Case presentation: Treatment of traumatic CCF using intra-arterial approach	가톨릭대학교 부천성모병원 **김성림**
Safety and efficacy of intra-arterial tirofiban injection during mechanical thrombectomy for large artery occlusion	가톨릭대학교 성빈센트병원 **이호준**
Are there differences in the clinical and radiological outcomes between M1 occlusions proximal and distal to the lenticulostriate perforators after mechanical thrombectomy?	인제대학교 해운대백병원 **김성원**
Is there a difference of clinical and radiological outcomes between cardioembolic occlusion and in-situ stenotic occlusion after mechanical thrombectomy in acute ischemic stroke?	인제대학교 해운대백병원 **이현곤**
Thrombolysis in cerebral infarction grade 2C or 3 should be redefined as the aim of successful endovascular thrombectomy in acute ischemic stroke: A network meta-analysis	중앙대학교병원 **장경민**
Surgical treatment of extracranial-intracranial bypass anastomosis-associated aneurysm	에스포항병원 **진선탁**
Review of the association between bradycardia and cardioembolism through case report	가톨릭대학교 은평성모병원 **은 진**

FP3-1

The effectiveness of intra-arterial thrombectomy (IAT) protocol for decreasing door-to-recanalization time duration in acute stroke

Su-Chel Kim, Jung Sik Park, **Chang-Hyun Kim**, and Chang-Young Lee

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

Objective : Intra-arterial thrombectomy (IAT) is safe and effective treatment modality in acute stroke with major arterial occlusion. Early and successful recanalization are the important factors associated with good prognosis in acute stroke. However, because of several cause, it was not well-determined to set IAT protocol to decrease time duration during door-to-recanalization in each institute. The aim of this study is to investigate the effectiveness of IAT protocol for decreasing door-to-recanalization time duration.

Methods : We examined and reported time duration (min) of each step: 1) door-to-image, 2) image-to-puncture, and 3) puncture-to-recanalization.

As first step to decrease time duration (TD) in door-to-image, we made a protocol from the selection of imaging modalities to call system of endovascular neurosurgeon.

As second step to decrease TD in image-to-puncture, we made a protocol, which included preparation of iv-line, L-tube, Foley catheterization, and early preparation of dexmedetomidine (Precedex) for intra-venous anesthesia and intra-arterial tirofiban, oral anti-platelet such as aspirin and clopidogrel for immediate use which is suggestive of intracranial stenosis (ICAS) in ER. We made an IAT device set per each procedure and we let first anyone who visit angio-suite do the same thing. Also, to use IAT-related devices easily, we made protocol file in angio-suite. And we usually select the same devices from femoral sheath to micro-catheter.

Finally, for third step to decrease TD in puncture-to-recanalization, we made ICA and MCA protocol for faster recanalization.

According to each step, we compared time duration between patients not applied to IAT protocol (Sep 2012 – Feb 2014) and patients applied to IAT protocol (Mar 2014 – Jul 2018).

Result : 267 patients who underwent IAT in anterior circulation were included in this study. There are 50 patients who were not applied to IAT protocol and 217 patients who were applied to IAT protocol. There was statistical significance in successful recanalization rate between pre- and post-IAT period ($p<0.05$). In all three steps such as, 1) door-to-image, 2) image-to-puncture, and 3) puncture-to-recanalization, there were statistically significant time decrease, compared with pre- and post- IAT protocol group ($p<0.05$).

Conclusion : Application of an IAT protocol showed a significant time reduction for faster recanalization in patients with acute major arterial occlusion. We suggest that better IAT protocol according to each step on door-to-image, image-to-puncture, and puncture-to-recanalization can be needed to decrease time duration in recanalization therapy.

FP3-2

Is transradial mechanical thrombectomy alternative plan in impossible transfemoral access for mechanical thrombectomy? A single center's experience

Hyo Sub Jun

Department of Neurosurgery, Kangwon National University Hospital

Objective : Despite advancements in technology, complex vascular anatomy may occasionally generate substantial delays in clot engagement in cases performed via transfemoral access (TFA). These challenging characteristics have been extensively described, and typically relate to aortic arch elongation and/or tortuosity, femoral/iliac and aortic atherosclerotic, or dissecting disease. Some recent studies found that the transradial approach (TRA) for MT has a more favorable trajectory in patients with complex arches and significant tortuosity.

Methods : We retrospective analyzed the local institutional interventional databases that included consecutive patients undergoing attempted MT for Acute ischemic stroke (AIS) in single center (Kangwon university from 2017 to 2019). AIS patients in TRA was used secondary to TFA failure. Demographic, radiologic and procedural features were recorded.

Result : The decision to switch from the femoral to the radial approach is diificult. Moreover, the time to recanalization by TRA after failure of TFA was high. (54 ± 19.5 min) The vertebral arteries could be approached through an ipsilateral TRA approach. Considering the typical degree of tortuosity of the arterial system of patients with AIS, the right and left carotid arteries can be accessed via right TRA (especially in individuals with type Ⅱ-Ⅲ aortic arch configuration).

Conclusion : The TRA to mechanical embolectomy is a valid approach for the endovascular treatment of AIS. Failure of TFA in the endovascular treatment of AIS is uncommon but leads to unacceptable delays in reperfusion and poor outcomes. Standardization of access switch or guideline might be needed.

FP3-3

Clinical impact of ankle brachial index in patients undergoing simultaneous coronary and cerebral angiography due to atherosclerosis detected on brain imaging studies

Seong-Rim Kim[1], Hoon Kim[1], Seong-Han Kim[1], Jae-Won Park[2], Ji-Woong Roh[2], Hee-Yeol Kim[2], Ik-Seong Park[1]

Department of [1]Neurosurgery, [2]Cardiology, Bucheon St. Mary's Hospital, The Catholic University of Korea

Objective : To evaluate the association between low ankle brachial index (ABI) and clinical outcomes in patients undergoing simultaneous coronary and cerebral artery angiography due to atherosclerosis detected on brain imaging studies.

Methods : Between January 2009 and April 2019, 11047 patients underwent cerebral angiography for atherosclerotic change seen in brain magnetic resonance angiography or computed tomography angiography at a single center. Of these, 542 patients who underwent simultaneous coronary and cerebral angiography with ABI checked were enrolled. The primary outcome was major adverse cardiac and cerebrovascular event (MACCE), defined as a composite of all-cause death, myocardial infarction, stroke over 3 years.

Result : Of the 542 patients, 480 (88.6%) had normal ABI (>0.9) and 62 (11.4%) had low ABI (<0.9). Low ABI (odds ratio [OR], 2.58; 95% confidence index [CI], 1.05-6.36; p=0.039) was the most important predictor for significant coronary artery disease (CAD). The incidence of MACCE (hazard ratio [HR], 2.85; 95% CI, 1.61-5.03; p<0.001) and all-cause death (HR, 3.41; 95% CI, 1.83-6.38; p<0.001) were significantly higher in the low ABI group. MACCE on our cohort was independently associated with acute ischemic stroke (HR, 2.49; 95% CI, 1.42-4.37; p=0.002), significant CAD (HR, 2.43; 95% CI, 1.13-5.24; p=0.024), hypertension (HR, 2.39; 95% CI, 1.02-5.66; p=0.046), and diabetes mellitus (HR, 1.91; 95% CI, 1.11-3.28; p=0.019).

Conclusion : The presence of low ABI (<0.9) was associated with significant CAD and worse clinical outcomes during follow-up. ABI measurement should be considered in patients with cerebral artery atherosclerosis detected on brain imaging studies. Especially, patients with low ABI need accurate CAD assessment with coronary angiography.

FP3-4

Safety and Efficacy of Intra-arterial Tirofiban Injection During Mechanical Thrombectomy for Large Artery Occlusion

Ho Jun Yi, Jae Hoon Sung, Dong Hoon Lee, Seung Yoon Song

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

Objective : We investigated the safety and effect of intra-arterial (IA) tirofiban, a glycoprotein IIb/IIIa inhibitor, during the stent retriever mechanical thrombectomy (MT).

Methods: From January 2015 to May 2019, a total of 327 patients underwent mechanical thrombectomy of large artery occlusions (LAO). Patients were classified into two groups: MT with IA tirofiban (MTT) group and MT only (MTO, without IA tirofiban) group. Clinical outcomes, radiological results, and various complications, such as post thrombectomy hemorrhage, symptomatic hemorrhage, other systemic bleeding, and hemorrhagic transformation of infarct were evaluated by comparing the MTT group and MTO group. In addition, subgroup analysis was performed for patients who underwent MT with prior intravenous (IV) tissue plasminogen activator (t-PA).

Result : The MTT group needed a lower mean number stent passes and showed a re-occlusion rate compared with the MTO group (P=0.038 and 0.022, respectively). Between the two groups, there were no statistically significant differences in post thrombectomy hemorrhage, symptomatic hemorrhage, other systemic bleeding complications, or hemorrhagic transformation of infarct (P = 0.511, 0.397, 0.429, and 0.355, respectively). In the subgroup analysis, similar findings were observed.

Conclusion : The use of IA tirofiban during MT seems to be safe and potentially more effective than only MT without IA tirofiban, even in patients who used IV t-PA before MT.

FP3-5

Are there differences in the clinical and radiological outcomes between M1 occlusions proximal and distal to the lenticulostriate perforators after mechanical thrombectomy?

Seong Won Kim, Seung Hwan Kim, Hyungon Lee, Sung-Chul Jin

Department of Neurosurgery, Inje University Haeundae Paik Hospital

Objective : Whether M1 occlusions proximal (pM1) and distal (dM1) to the lenticulostriate perforators have different clinical outcomes after mechanical thrombectomy (MT) is not well known. We retrospectively compared the baseline characteristics and clinical and radiological outcomes between patients with these two types of occlusions.

Methods : From March 2010 to May 2019, we performed MT for 141 M1 occlusions, including pM1 occlusions (n=58) and dM1 occlusions (n=83).

Result : Good clinical outcomes (modified Rankin Scale score 0 to 2) were achieved in 28 out of 58 (48.3%) patients with pM1 occlusions and 46 out of 83 (55.4%) patients with dM1 occlusion, which was not significantly different (p=0.493). Successful recanalization (Thrombolysis In Cerebral Infarction grade 2b or 3) was achieved in 48 out of 58 (82.8%) patients with pM1 occlusions and 63 out of 83 (75.9%) patients with dM1 occlusions, which was not significantly different (p=0.405). Cardioembolic occlusions represented 19 out of 58 (32.6%) pM1 occlusions and 53 out of 83 (63.9%) dM1 occlusions, and atherosclerotic occlusions represented 37 out of 58 (63.8%) pM1 occlusions and 27 out of 83 (32.5%) dM1 occlusions, which were significantly different (p=0.001). Rescue treatments such as balloon angioplasty or stenting were needed more for pM1 occlusions than fore dM1 occlusions (21 out of 58 (36.2%) vs. 8 out of 83 (9.8%), p=0.000). The multivariable logistic regression analysis demonstrated that the need for rescue treatment was related to pM1 occlusions (adjusted odds ratio; 3.804, confidence interval; 1.306-11.082, p=0.014).

Conclusion : In our series, pM1 occlusions were associated more with atherosclerotic occlusions, and dM1 occlusions were associated more with cardioembolic occlusions. Rescue treatments were needed more for pM1 occlusions than for dM1 occlusions.

FP3-6

Is there a difference of clinical and radiological outcomes between cardioembolic occlusion and in-situ stenotic occlusion after mechanical thrombectomy in acute ischemic stroke?

Hyungon Lee[1], Seung Hwan Kim[1], Seong Won Kim[1], Soonyoung Kwon[1], Young Jin Heo[3], Sung Tae Kim[2], Jin Wook Baek[3], Hae Woong Jeong[3], Sung-Chul Jin[1]

[1]Department of Neurosurgery, Inje University Haeundae Paik Hospital, [2]Department of Neurosurgery, [3]Radiology, Inje University Busan Paik Hospital

Objective : The studies were few about the clinical and radiological different in the stroke etiology. We retrospectively compared the clinical and radiological outcome of the cardioembolic occlusion and in-situ stenotic occlusion.

Methods : From January 2017 to December 2018, 148 cases of 144 patients of the mechanical thrombectomy was done in our hospital. 51 cases (34.5%) were in-situ stenotic occlusion. And 71 cases (48.0%) were cardioembolic occlusion).

Result : The in-situ stenotic occlusion (68.00±10.99 years old) was younger than cardioembolic occlusion (72.83±10.13 years old) with statistical significance. The procedure time was short in the cardioembolic occlusion (63.75±35.57 minutes) than in-situ stenotic occlusion (82.18±40.54 minutes) with statistical significance. And the good recanalization (TICI score≥ 2b) was higher in the cardioembolic occlusion (64/71, 59.4%)) than in-situ stenotic occlusion (38/51, 42.6%) with statistical significance. But the good clinical outcome (mRS≤2) was not significantly different between cardioembolic occlusion and in-situ stenotic occlusion(p=0.954)

Conclusion : Our result showed cardioembolic occlusion was short procedure time and good recanalization rate than in-situ stenotic occlusion. However clinical outcome was not different in cardioembolic occlusion between in-situ occlusion.

FP3-7

Thrombolysis in cerebral infarction grade 2C or 3 should be redefined as the aim of successful endovascular thrombectomy in acute ischemic stroke: A network meta-analysis

Kyoung Min Jang, Taek Kyun Nam, Hyun Ho Choi, Jun Soo Byun

Department of Neurosurgery, Chung-Ang University Hospital, Chung-Ang University College of Medicine

Objective : Although Thrombolysis in Cerebral Infarction (TICI) grade 2B or 3 is considered 'successful' after endovascular thrombectomy (EVT) for acute ischemic stroke (AIS), TICI 2B was found to be associated with poorer outcomes than 3. Furthermore, the newly proposed TICI 2C grade seems to be clinically equivalent to TICI 3 rather than to 2B. This network meta-analysis aimed to assess the differences in clinical outcomes between TICI grades and redefine 'successful' reperfusion.

Methods : PubMed, Embase, and Cochrane Central Register were queried. A random effect model with frequentist framework was applied to evaluate outcomes using odds ratios (ORs) and 95% confidence intervals (CIs). Using surface under the cumulative ranking curve (SUCRA), the hierarchy of TICI grades was indicated.

Result : Analysis of 12 studies, with 2084 patients, indicated that TICI 2C (OR: 2.28, 95% CI: 1.65-3.13) and 3 (OR: 2.40, 95% CI: 1.74-3.30) were more significantly associated with favorable 90-day clinical outcomes than 2B; there was no significant difference between TICI 2C and 3 (OR: 1.05, 95% CI: 0.76-1.46). Based on the SUCRA, TICI 2C and 3 were considered as more effective reperfusion endpoints than 2B (TICI 3, 80.8%; 2C, 69.2%; 2B, 0.0%) and showed significant association with lower rates of mortality and symptomatic intracranial hemorrhage.

Conclusion : Patients with TICI 2C grade should be distinguished from those with 2B, as 2C is clinically equivalent to 3 and has better outcomes than 2B. Furthermore, achieving TICI 2C or 3 should be redefined as the successful aim for EVT in AIS.

FP3-8

Surgical treatment of Extracranial-Intracranial Bypass Anastomosis-Associated Aneurysm

ST Jin, HW Park, DY Hong, YG Kang, MC Kim

Department of Neurosurgery, Pohang Stroke & Spine Hospital

Objective : We report the successful surgical treatment of an EC-IC bypass anastomosis-Associated Aneurysm using a ligation of STA.

Methods : A patient who had an acute cerebral infarction 1 month ago was having decreased cerebral perfusion. We did a STA-MCA bypass. When we checked 6month follow-up image, we found an EC-IC bypass anastomosis-associated aneurysm.

Result : We did a surgical ligation of STA. The anastomosis-associated aneurysm was disappeared and the patient had no complication.

Conclusion : The ligation of STA is a technically viable alternative with positive outcomes without the need for a revision operation.

FP3-9

Review of the association between bradycardia and cardioembolism through case report

Jin Eun, Min-hyung Lee, Sang-hyuk Im, Byung-rae Cho, Do-Sung Yoo, Jae-kun Ahn, Won-il Joo, Hae-kwan Park

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

Objective : It is well known that atrial fibrillation is the source of cardioembolism. However, for bradycardia, there is still insufficient research, and I would like to review previous reports through related cases.

Methods : A 79-year-old male who had bradycardia diagnosed at another hospital got conservative care without any medication. He visited the emergency room with right arm clumsiness and dysarthria. However, no specific findings were found on Brain CT angiography and diffusion MRI. At the time, he returned home after prophylactic administration of aspirin 100mg and pregrel 75mg daily under impression of transient ischemic attack.

Result : Next afternoon right side weakness recurred and the patient was returned to the emergency room with aphasia. CT angiography showed occlusion of the left ICA. After mechanical thrombectomy, TICI 2b recanalization was secured. But, with the MCA whole territory infarction, the sequelae of the GCS 426 with left side motor weakness grade I remained. We applied a temporary pacemaker through cardiology consultation immediately after mechanical thrombectomy. The patient's progression was not found to be suspected of embolic source other than cardioembolism, but there was no evidence of fibrillation at all.

Conclusion : Several case reports associated with bradycardia have been identified, but the evidence for making thrombus has not yet been established. Retrospective papers have shown that junctional bradycardia may be a risk factor for stroke. The patient was discharged with prophylactic administration of NOAC, but the evidence for anticoagulation is lacking. Arterial fibrillation is an important cause of stroke, and it is agreed that stroke prevention is necessary for patients with underlying arterial fibrillation through CHA2DS2-VASC score, but the mechanism of arterial fibrillation and thromboembolism is still not clear. A possible hypothesis is that disproportionate movement of myocytes does not provide sufficient atrial contraction and that the stasis of blood increases thromboembolic risk. If cardiac stasis is the source of embolus, it is recommended that bradycardia, which, although regularly, have the potential to develop stasis, also weigh the potential for thromboembolism, and consider performing related tests and preventive managements if necessary.

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Poster Session

Are there differences in the thromboembolic events after stent assisted coiling for unruptured aneurysm between aspirin plus clopidogrel group and ticagrelor group?	인제대학교 해운대백병원 **김승환**
Efficacy of dual antiplatelet therapy as premedication before diagnostic cerebral digital subtraction angiography	영남대학교병원 **이현호**
Mechanical thrombectomy in acute vertebrobasilar occlusion: a single-centre experience	인제대학교 해운대백병원 **권순영**
Follow-up modality after aneurysm coiling: Comparing 'special method of taking skull plain films' to normal skull plain films and MRA	분당서울대학교병원 **조현준**
Practical limitation of hybrid mechanical thrombectom	인제대학교 해운대백병원 **진성철**
Noncrossing Y-stent technique with Solitaire AB stent for coil embolization of wide-neck bifurcation aneurysms	충남대학교병원 **권현조**
Three retroperitoneal hematomas after transfemoral endovascular therapy: Clinical manifestations & optimal management based on bleeding site	순천향대학교 부천병원 **이주석**

P-1

Are there differences in the thromboembolic events after stent assisted coiling for unruptured aneurysm between aspirin plus clopidogrel group and ticagrelor group?

Seung Hwan Kim, Hyungon Lee, Sung-Chul Jin

Inje University Haeundae Paik Hospital

Objective : To reduce procedural thromboembolism, tailored antiplatelet drug preparation has been increasingly used according to antiplatelet resistance for endovascular coiling of unruptured aneurysm. We compared aspirin plus clopidogrel group with ticagrelor group using diffusion-weighted image (DWI) after stent assisted coiling for unruptured aneurysm with prospective design.

Methods : From October 2018 to April 2019, 72 patients with 78 aneurysms underwent stent assisted coiling, using aspirin plus clopidogrel (n=20 patients with 22 aneurysms) and ticagrelor (n=52 patients with 56 aneurysms) as a antiplatelet preparation, and all of them were evaluated using DWI at 2 hours after coiling to detect thromboembolic events.

Result : Post-procedure cerebral infarction on DWI was observed in 37 procedures and symptomatic cerebral infarction occurred in 1 procedure. Aspirin plus clopidogrel group and ticagrelor group had significantly different incidence of post-procedure cerebral infarction (6 out of 22 (27.3%) vs. 31 out of 56 (55.4%), p=0.043). Post-procedure cerebral infarction was associated with aneurysm type (side wall aneurysm (30.8%) vs. bifurcation aneurysm (64.1%), p=0.006) and guiding catheter type (single (23.8%) vs. double (56.1%), p=0.020). Multivariable logistic regression analysis demonstrated that post-procedure cerebral infarction was related to aneurysm type (adjusted odds ratio (OR); 3.317, confidence interval (CI); 1.223-8.991, p=0.018), guiding catheter type (adjusted OR; 2.783, CI; 0.828-9.353, p=0.098), and antiplatelet medication (adjusted OR; 1.295, CI; 0.969-1.730, p=0.080).

Conclusion : In our series, post-procedure cerebral infarction on DWI after stent assisted coiling for unruptured aneurysm occurred more frequently in ticagrelor group than aspirin plus clopidogrel group. However, our study suggests that post-procedure cerebral infarction is more associated with aneurysm type than antiplatelet medication.

P-2

Efficacy of dual antiplatelet therapy as premedication before diagnostic cerebral digital subtraction angiography

Hyounho Lee, Yoon-Hee Choo, Young-Jin Jung, Chul-Hoon Chang, Jong-Hoon Kim

Department of Neurosurgery, Yeungnam University Hospital

Objective : Cerebral digital subtraction angiography (DSA) is commonly used clinically to diagnose cerebrovascular abnormalities Thromboembolism is the most significant complication of cerebral DSA, which occurs secondary to thrombus formation within catheters, within pre-existing friable intravascular thrombotic plaques, or device-induced microdissections. Antiplatelet and anticoagulant therapy effectively reduces the risk of thromboembolism. We hypothesized that preprocedural administration of dual antiplatelet agents (aspirin and cilostazol) for 7 days may reduce the risk of complications associated with diagnostic cerebral DSA.

Methods: Patients – We retrospectively reviewed the records of 419 patients Diagnostic cerebral DSA between September 2015 and April 2018. Among these 419 patients 221 patients who underwent diagnostic cerebral DSA from September 2015 to June 2016 did not received dual antiplatelet therapy as premedication 198 patients who underwent diagnostic cerebral DSA between July 2016 and April 2018 received dual antiplatelet therapy as premedication. Inclusion criteria for this study were non-ruptured aneurysms, arteriovenous malformations, and arteriovenous fistulas, stenosis or occlusion of cerebral artery, as well as postoperative evaluation 1–2 years after coiling or clipping. We defined cerebral DSA-related TEC as the occurrence of acute ischemic stroke that was confirmed on MRI within 48 hours of testing among patients presenting with neurological symptoms.
Drug protocols – Patients who underwent DSA between July 2016 and April 2018 received aspirin and cilostazol (both 100 mg/day) for 7 days. All antiplatelet therapy was discontinued post-procedure in premedicated patients who underwent cerebral DSA but did not develop TEC.
Statistical Analysis – Comparison between two groups was performed using Fisher's exact test, chi-square test and independent t tests (significant level 0.05). Statistical analysis was performed using the SPSS software, version 19 (IBM SPSS Statistics, IBM Corp., Armonk, NY). A p-value<0.05 was considered statistically significant.

Result : The risk factors for ischemic stroke after cerebral DSA include hypertension, diabetes mellitus, dyslipidemia, cardiac disorders like heart failure or arrhythmia, a history of smoking, chronic kidney disease, the number of catheters used, types of catheters used, and the volume of contrast agent used. We analyzed the effect of each risk factor on the incidence of cerebral DSA-induced complications. The association between the incidence of TEC and each risk factor was non-significant. There was a significant difference in the incidence of TEC between patients who took dual antiplatelet therapy and those who did not, which is consistent with our hypothesis. Of the 221 patients who did not receive antiplatelet therapy, 210 patients (95.0%) did not report neurological symptoms; however, 11 patients (5.0%) reported various neurological symptoms including motor weakness and showed MRI-proven ischemic stroke, which represents a TEC. Of the 198 patients who received dual antiplatelet therapy, 196 (99.0%) showed no evidence of TEC. However, 2 (1.0%) developed diplopia and motor weakness respectively, and acute ischemic stroke was confirmed on MRI (p=0.019). Of the 13 patients diagnosed with DSA-induced TEC, 7 presented motor weakness, 4 reported visual disturbance, and 1 reported dysarthria and paresis.

Conclusion : In this study, a single neurosurgeon performed all cerebral DSA procedures □ minimizing the complication rate related to variations in operator's skill. We concluded that this pathomechanism of thrombus formation is a major contributor to cerebral DSA–induced ischemic stroke. We hypothesized that preprocedural antiplatelet therapy could effectively reduce cerebral DSA–induced TEC and dual antiplatelet therapy could be more effective than the use of a single antiplatelet agent. Platelet aggregation, an important step in the process of thrombus formation, occurs through a chain of mechanisms. Antiplatelet agents are classified according to which mechanisms are inhibited. It can be divided into cyclooxygenase inhibitor, phosphodiesterase inhibitor, Adenosine diphosphonate receptor antagonist, glycopeptide IIb / IIIa antagonist and serotonin receptor antagonist. Aspirin, an irreversible inhibitor of cyclooxygenase, inhibits the conversion of arachidonic acid to thromboxane A2 and prevents vasospasm and platelet aggregation. The effect of aspirin lasts approximately 7 to 10 days corresponding to the lifespan of platelet. The premedication period was determined for 7 days in this study based on this fact. Cilostazol inhibits phosphodiesterase 3, which is strongly expressed in platelets and vascular smooth muscle cells. Thus, cilostazol inhibits platelet aggregation and vascular smooth muscle proliferation and causes vascular dilatation. Furthermore, several reports have demonstrated the synergistic effect of cilostazol and endogenous mediators to lower the risk of hemorrhage compared with the use of clopidogrel and endogenous mediators, Therefore, we preferred cilostazol over clopidogrel as premedication to lower the risk of TEC. Patients who were pretreated with dual antiplatelet therapy did not report hemorrhagic related complications. This study suggests that preprocedural dual antiplatelet therapy can significantly reduce the cerebral DSA–induced TEC rate.

P-3

Mechanical thrombectomy in acute vertebrobasilar occlusion: A single-centre experience

Soon Young Kwon, Dong Hyuk Lee, Seung Hwan Kim, Hyungon Lee, Hae Yu Kim, Sung-Chul Jin

Department of Neurosurgery, Inje University Haeundae Paik Hospital

Objective : Acute vertebrobasilar occlusion (VBO) has a grave clinical course; however, mechanical thrombectomy (MT) in VBO has rarely been reported. We retrospectively evaluated the clinical and radiological outcomes of MT in VBO.

Methods: From March 2010 to December 2017, 38 patients with 40 acute VBOs underwent MT at our hospital. MT was performed using catheter aspiration (n=11, 26.8%) or a stent retriever (n=29, 70.7%).

Result : Good clinical outcomes (3-month modified Rankin scale (mRS), 2 or lower) were achieved in 9 cases (22.5%), and successful recanalization (thrombolysis in cerebral infarction (TICI) grade, 2b or 3) was achieved in 35 cases (87.5%). Good clinical outcomes were significantly related with etiologies other than atherosclerosis (p=0.020) and lower National Institutes of Health Stroke Scale (NIHSS) score on admission (p=0.025). The clinical and radiological outcomes did not differ significantly between catheter aspiration and stent retriever (p=1.000 and p=0.603, respectively), however, stent retriever had shorter procedure time than catheter aspiration (59.7 ± 31.2 vs. 84.5 ± 35.1 minutes, p=0.037).

Conclusion : In our series, a good clinical outcome was associated with a lower NIHSS score on admission and stroke etiologies other than atherosclerosis. The two MT modalities showed similar clinical and radiological outcomes. However, stent retrievers seemed to allow more rapid recanalization than catheter aspiration in VBO.

P-4

Follow-up modality after aneurysm coiling: Comparing 'special method of taking skull plain films' to normal skull plain films and MRA

Hyunjun Jo, O-Ki Kwon, Seung Pil Ban, Young Deok Kim, Sung Hoon Kim

Department of Neurosurgery, Seoul National University Bundang Hospital

Objective : Endovascular treatment with detachable coils has been a common and widespread method of treating cerebral aneurysm. However, one of the major demerits of endovascular treatment is a high rate of recurrence. Therefore, close follow-up after coiling is necessary and important point. Even though skull plain films are known to be used only in limited roles, we tried to improve the accuracy of skull plain films by taking them as a 'working angle view.'

Methods : We took the skull plain film with normal Town's view and lateral view at cerebrovascular imaging room. Then we turned the AP and lateral tube as a pre-checked working angle, which can show the neck of the aneurysm better than the normal skull plain films. We compared the sensitivity, specificity and the accuracy of 1. skull plain film working angle view group, 2. skull plain film Town's and lateral view group, and 3. MRA group. 56 aneurysms of 54 patients who took TFCA between August 2019 and October 2019 were enrolled.

Result : The sensitivity and specificity of skull plain film working angle view group was 87.5% and 87.5% respectively. This result showed higher sensitivity and lower specificity than skull plain film Town's and lateral view group (68.8% and 92.5% respectively). The accuracy of skull plain film working angle view group was higher (87.5%) than the skull plain film Town's and lateral view group (85.7%). The MRA group showed lower sensitivity (81.8%), higher specificity (96.6%) and higher accuracy (92.5%) compared with skull plain film working angle view group.

Conclusion : In our study, we can find that when we take skull plain film with working angle view, it can help improve the accuracy of skull plain film taken only with Town's and lateral view. Although this method cannot overtake the accuracy of the MRA, taking skull plain film of working angle view may be a helpful tool which can check the aneurysmal neck portion. It can especially be helpful when there is a stent noise at the MRA image, or when the patient has a claustrophobia. This special method of taking skull plain film may not be a substitute of MRA, but can be a good additional option of following-up post-embolization patients.

P-5

Practical limitation of hybrid mechanical thrombectomy

Seung Hwan Kim[1], Hyungon Lee[1], Su Bin Kim[1], Sung Tae Kim[2], Jin Wook Baek[3], Hye Jin Kim[4], Jung-Soo Kim[5], Hae Woong Jeong[3], **Sung-Chul Jin[1]**

[1]Department of Neurosurgery, Inje University Haeundae Paik Hospital, [2]Department of Neurosurgery, [3]Radiology, Inje University Busan Paik Hospital, [4]Department of Neurology, Hanseo Hospital, [5]Department of Neurosurgery, Gyeongsang National University Changwon Hospital

Objective : To prevent thrombus fragmentation or migration, we designed a hybrid mechanical thrombectomy (MT) using simultaneous suction aspiration and stent retrieval. We evaluated the clinical and radiological outcomes and limitations of the hybrid MT.

Methods: From November 2017 to June 2019, we performed hybrid MT as primary modality in 89 patients with 90 large artery occlusions. Occlusion performed by hybrid MT included anterior (n=78, 86.3%) and posterior circulation (n=12, 13.7%).

Result : 15 lesions (16.6%) that included ICA (n=4), ICA bifurcation (n=2), M1 (n=2), M2 (n=4), and vertebrobasilar (n=3) were switched from hybrid MT to traditional MT. Good clinical outcomes (mRS 2 or less) were achieved in 52 patients (57.8%), and successful recanalization (TICI grade 2b or 3) was achieved in 84 lesions (93.3%).

Conclusion : Our study suggests that hybrid MT is beneficial as a primary modality but is not applicable in all large artery occlusion.

P-6

Noncrossing Y-stent technique with Solitaire AB stent for coil embolization of wide-neck bifurcation aneurysms

Hyon-Jo Kwon, Jeong-Wook Lim, Hyoung Soo Byoun, Hyeon-Song Koh

Department of Neurosurgery, Daejeon-Chungnam Regional Cerebrovascular Center, Chungnam National University Medical School and Hospital

Summary : The crossing Y-stent method is one of the indispensable techniques to achieve sufficient neck coverage during coil embolization of bifurcation aneurysms with a wide neck and/or branch incorporation. However, the inevitable hourglass-like expansion of the 2nd stent at the crossing point can result in insufficient vessel wall apposition, reduced aneurysm neck coverage, delayed endothelialization, and subsequent higher risks of acute or delayed thrombosis. It also interferes with engagement of the microcatheter into the aneurysm after stent installation. We expected to be able to reduce these disadvantages by installing a noncrossing type Y-stent using the Solitaire AB stent, which is fully retrievable with a tapered proximal end. Here we report two successful cases.

Case 1

A woman was admitted to our hospital for coil embolization of multiple unruptured small aneurysms. Under general anesthesia and heparinization, two small middle cerebral artery aneurysms were embolized first using stent assistance. For the bifurcating type anterior communicating artery aneurysm with a depth-to-neck ratio of 0.41, the Prowler Select plus microcatheter (Cordis Corporation, Bridgewater, NJ, USA) was delivered to the ipsilateral distal anterior cerebral artery (ACA). After delivery through the microcatheter, the Solitaire AB stent (4×20 mm) was deployed as planned previously. Using rotational angiogram, we confirmed that the proximal end of the stent working zone was aligned with the neck of the aneurysm and the proximal tapered end was not hindering the passage of the microcatheter for the second stent. During the delivery of the 2nd Prowler Select plus microcatheter to the other ACA branch, no significant interruption was noticed and an Enterprise2 stent (4×30 mm, Codman Neurovascular, Raynham, MA, USA) was deployed successfully from contralateral A2 to A1 in front of the aneurysm neck. After selection of the aneurysm dome with an Excelsior10 microcatheter (Stryker, Fremont, CA, USA), framing and filling coils were packed until the aneurysm was completely obliterated (Fig. 2). No acute or delayed ischemic or other complications were identified during 8 months' outpatient clinic follow-up with dual anti-platelet medication, and no evidence of remnant aneurysm was found on MRA 6 months after the procedure.

Case 2

A woman was admitted to our department for coil embolization of an incidental distal ACA aneurysm arising at the origin of trifurcating branches. The depth was 3.7 mm and the neck was 7.0 mm. The procedure was carried out according to the usual protocol under general anesthesia. The Prowler Select plus microcatheter was delivered to the distal segment of one of the three branches and a Solitaire AB stent (4×15 mm) was delivered in it. After the Solitaire stent was deployed as planned, we performed vasoCT to confirm the positioning of the stent, particularly at the aneurysm neck and the proximal tapered segment. During passage of the Excelsior 10 microcatheter for the 2nd stent, no obstacle was identified around the aneurysm neck segment of the distal ACA. After deployment of a Neuroform Atlas stent (4.5×30 mm, Stryker, Kalamazoo, MI, USA) from the distal to proximal part of the parent vessel via the aneurysm neck, we again performed vasoCT to confirm the deployment status of the stents. Coil packing through the previously jailed Excelsior10 microcatheter was carried out uneventfully and successfully,

and final angiogram showed a neck remnant only (Fig. 3). The patient showed no evidence of complications during and after the procedures during 5 months' follow-up with dual anti-platelet medications.

Conclusion : The noncrossing Y-stent technique using the Solitaire AB stent can be considered an alternative to the crossing Y-stent technique with fewer shortcomings and similar neck coverage and branch preservation during coil embolization of broad neck bifurcation aneurysms.

P-7

Three retroperitoneal hematomas after transfemoral endovascular therapy: Clinical manifestations & optimal management based on bleeding sites

Joo Seok Lee, Dong Seong Shin, Bum-Tae Kim

Department of Neurosurgery, Soonchunhyang University Bucheon hospital

Introduction : Retroperitoneal hematoma(RPH) is an infrequent but serious complication of transfemoral endovascular therapy. We have presented the clinical manifestations and rescue managements of 3 RPHs after coil embolization (CE) for unruptured aneurysms (UIA) based on bleeding sites: (case 1) a pelvic hematoma caused by common femoral artery, (case 2) a huge retroperitoneal hematoma caused by external iliac artery and (case 3) a renal subcapsular hematoma caused by accessory renal artery injuries.

Case 1

A 82-year-old male was admitted to hospital presented with UIA on let ICA. CE was performed via right common femoral artery(CFA). CFA was very tortuous on femoral angiogram and 8Fr Arrow femoral sheath has been introduced and completed CE successfully. Puncture site was closed with vascular closure device(VCD). Post procedure femoral angiogram was unremarkable. 3 hours after CE, blood pressure was dropped to 52/40 mmHg. Puncture site oozing has been noted and patient consciousness was aggravated with stupor mentality. Abdomen-Pelvic CT (APCT) was performed and pelvic hematomas have been identified on the extra-pelvic and retroperitoneal areas. Puncture site compression and hydration were performed immediately. The vital signs have been improved and mentality was stabilized.

Case 2

This 50-year-old male with UIA on basilar top was admitted for elective CE. The patient has been received DAPT prior to CE. 6Fr 25cm length femoral sheath has been introduced via right CFA and completed stent assisted CE successfully. No markedly hemodynamic fluctuation or angiographic evidence of hemorrhage was noted during procedures. Puncture site was closed with VCD. The patient has been awaked from anesthesia without any abnormal finding and sent back to recovery room. Ten minutes later, a blood pressure has been sudden dropped. APCT has been revealed the huge hematomas on the right retroperitoneal areas with active contrast leakage from right external iliac artery. Emergency femoral angiogram revealed contrast extravasation from right external iliac artery. Stent-graft has been deployed in right external iliac artery including contrast leakage site. Complete hemostasis was made on angiogram.

Case 3

A 66-year-old male was admitted to hospital presented with UIA on Acom. 3 antiplatelet agents have been administered due to clopidogrel resistance before CE. Under the general anesthesia, right CFA has been punctured and 6Fr long femoral sheath has been introduced. Stent assisted CE has been performed. The initial activated clotting time was checked on 126 seconds and heparin 4500 unit has been administered. CE has been performed well. There was no vital abnormality during surgery. Puncture site was closed with VCD. 3hours and 30 minutes after CE, blood pressure began to drop. Right flank pain has been complained on 4 hours after CE. Hemoglobin has been checked on 8.5. APCT showed right renal subcapsular hematoma with contrast extravasation has been noted. Embolization on the accessory renal arteries has performed with NBCA / lipiodol mixture.

P-7

The patient was improved and discharged three weeks later.

Conclusion : The early detection of RPH according to the clinical manifestations, diagnosis with APCT and optimal management based on bleeding sites are mandatory. Careful closure of puncture site, guide-wire and sheath passage under full visual inspection are important to avoid inadvertent vascular injury during transfemoral endovascular therapy.

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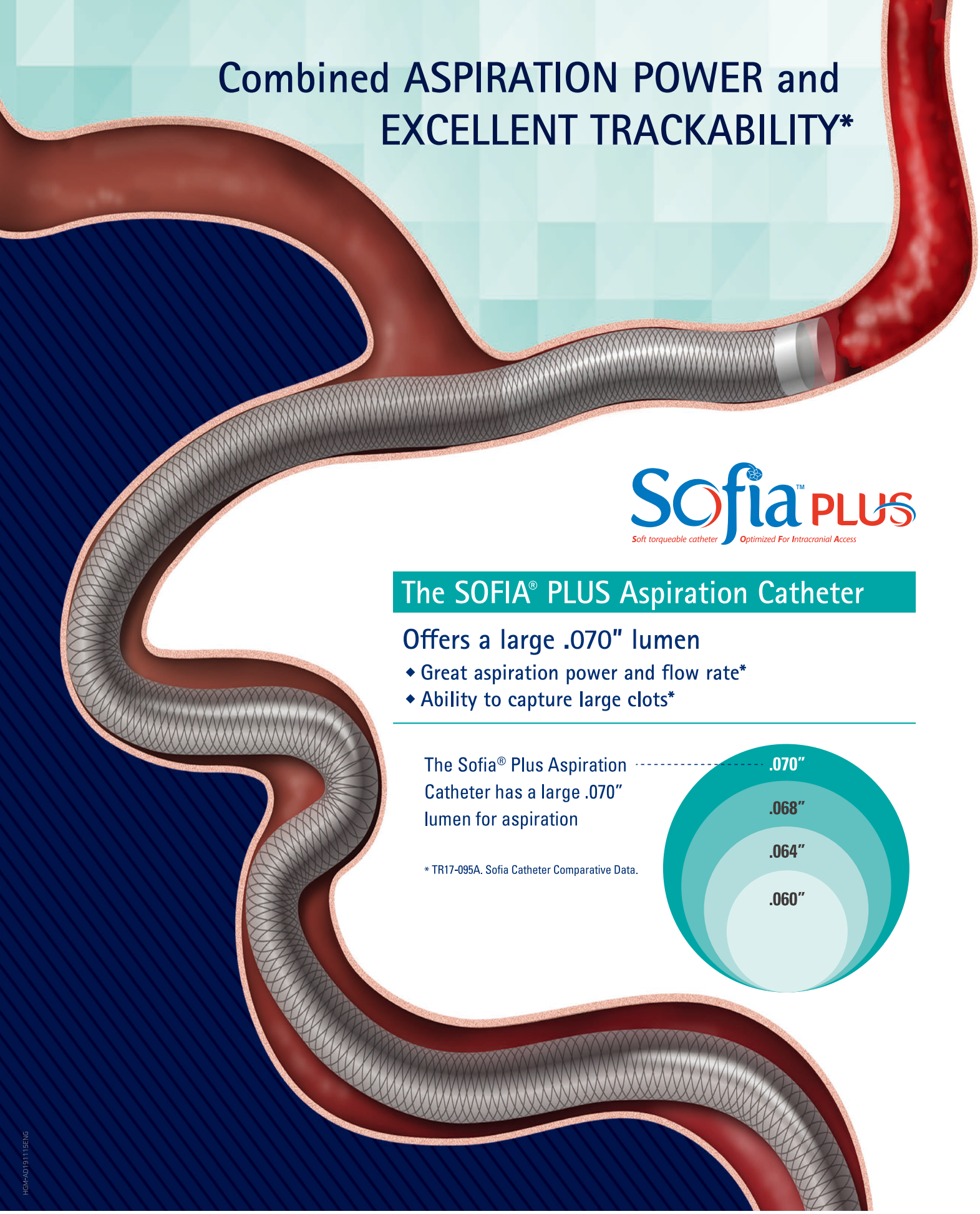

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Ref)1. Giugliano RP., et al. *N Engl J Med,* 2013:369(22):2093-2104

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Reference
1. González-Contreras J. et al. NutrHosp . 2012;27(6):1900-7 **2.** Braga M et al., Clinical Nutrition 2009;28:378-386

프레지니우스 카비 코리아 [주]
서울특별시 송파구 백제고분로 69, 애플타워 8,9층 (05556) / TEL.02-3484-0900 / FAX.02-3484-0909 / www.fresenius-kabi.co.kr

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