

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

What we need to know for the past and the future?

일 시 | 2014년 12월 6일 토요일 8:30~17:30

장 소 | 순천향대학교 부천병원 별관 5층 향설대강당

주 최 | 대한뇌혈관내수술학회

주 관 | 대한신경외과학연구재단



모시는 글



존경하는 대한뇌혈관내수술학회 회원여러분, 안녕하셨는지요?

뇌혈관내수술은 뇌혈관질환의 병태생리학적 연구와 더불어 창의적인 수술수기의 도입과 새로운 기구의 개발로 인하여 끊임없이 변화와 발전을 해오는 역동적인 영역으로 자리매김하고 있습니다.

금년도 학회의 주제는 “What we need to know for the past and the future?”

입니다. 최근 많은 젊은 의사들이 어렵지 않은 환경에서 뇌혈관내수술을 배우고 있습니다. 그러나 이런 여건을 누릴 수 있기까지는 선배들의 노력이 있었다는 사실을 Presidential address를 통해 이해할 수 있는 시간이 될 것입니다. 반면 이제는 훌륭한 여건에서 근무하는 기성세대들은 후배들이 향후 어려운 의료환경의 변화에서 적응하여 일해야 하는 사실을 이해할 수 있는 시간이 될 것입니다. 일본의 Naoto Kimura 선생님을 초청해서 Iwate Prefectural Central Hospital 중소병원에서 근무하는 Endovascular neurosurgeons의 역할에 대하여 특강을 마련했습니다. 국내에서도 수련을 받고 중소병원에 자리를 잡고 일하는 젊은 의사들이 늘어나고 있는 바 일본과 우리를 비교해 볼 수 있는 기회가 될 것으로 봅니다. 결론적으로 초심자와 전문가가 미래의 주체로서 각기 입장을 바꿔서 생각해 보는 기회가 되었으면 합니다.

Symposium은 “Practical stroke intervention” 을 주제로 최근 보험인정기준의 변화로 인해 retrieval stent와 aspirator의 사용이 늘어나고 있는 바 국내 전문가로부터 각각 기술적인 관점에서 강의를 듣고 청중들과 사용경험을 공유할 수 있는 시간을 마련했습니다. 자유 연제 발표는 국제학회에 참석을 독려하는 차원에서 영어발표 세션도 마련했습니다. 다만 토론은 우리말 사용도 자유롭게 하도록 해서 자칫 영어사용으로 인한 깊이 있는 학문적 의견교환에 지장이 없도록 했습니다. 또한 금년 학술대회에서는 포스터 발표를 신설하였으며, 논문상수상 및 학술대회 우수발표자 시상을 마련하였으니 적극적인 논문 발표를 부탁드립니다.

한 해를 마무리하며 금번 학술대회에 참석하시어 열띤 발표, 토론과 함께 회원님들 간에 교류의 시간이 되길 바라겠습니다.

감사합니다.

2014년 12월

대한뇌혈관내수술학회 회장 김 범 태

2014~2015년 대한뇌혈관내수술학회 임원

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2014~2015년 대한뇌혈관내수술학회 임원

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학회 사무국	정효경	대한뇌혈관내수술학회

프로그램

08:30~08:45	Registration		
08:45~08:55	Opening remarks	대한뇌혈관내수술학회 회장 김범태	
	Congratulatory address	대한신경외과학회 이사장 임영진	
08:55~09:00	Introduction of scientific program	학술이사 윤석만	
09:00~10:30	Free paper I [Aneurysm session]	좌장 : 서울대 권오기, 을지대 강희인	
09:00~09:10	Factors Affecting Recanalization of Coiled Cerebral Aneurysms: Mid-term Follow-up Results	을지대 을지병원 김재훈	_11
09:10~09:20	Endovascular Treatment of Complex Cerebral Aneurysms with a Branch Incorporated into the Sac	원광대병원 김대원	_12
09:20~09:30	Short-term Angiographic Outcome of Intracranial Aneurysms with Minimal Neck Remnants After Coil Embolization	고려대 안산병원 최종일	_13
09:30~09:40	Standard vs Modified Antiplatelet Preparation for Preventing Thromboembolic Events in Patients with High on-Treatment Platelet Reactivity Undergoing Coil Embolization for an Unruptured Intracranial Aneurysm	분당서울대병원 황교준	_14
09:40~09:50	The Neck Remodeling Owing to Changes of Vessel-angle After the Placement of a Stent Applied to Small-sized Bifurcating Arteries for Coiling of Cerebral Aneurysms	인하대병원 장현준	_15
09:50~10:00	Outcomes of Retrievable Solitaire Stent-Assisted Coil Embolization of Wide-necked Intracranial Aneurysms	전남대병원 김태선	_16
10:00~10:10	Coil Embolization Using Multiple Catheters for Very Challenging Ruptured Cerebral Aneurysm Without Balloons or Stents in Patients Over 75 Years of Age	경상대병원 박 현	_17
10:10~10:20	Self-expanding Stent Placement for Anterior Circulation Intracranial Artery Dissection Presenting with Ischemic Symptoms	연세대 세브란스병원 영상의학과 김병문	_18
10:20~10:30	Outcomes of Vertebrobasilar Dissecting Aneurysms after Stent-Assisted Coil Embolization	서울대병원 영상의학과 전진평	_19
10:30~10:50	Coffee break & Poster view		
10:50~11:10	Presidential address	좌장 : 울산대 권도훈	
	"What we need to learn from the past?"	회장 김범태	
11:10~12:10	Symposium : Practical stroke intervention	좌장 : 충남대 고현승, 계명대 이창영	
	1. Technical aspects of using stent retrievers	연세대 정준호	_23
	2. Technical aspects of using aspiration	경북대 강동훈	_24
	3. Intervention for acute vertebro-basilar occlusion	계명대 김창현	_30

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

일 시 | 2014년 12월 6일 토요일 8:30~17:30

장 소 | 순천향대학교 부천병원 5층 향설대강당

12:10~13:20 **Lunch**

13:20~13:50 **General assembly**

Ceremony of 1st Annual Report publication

연보통계발간이사 김태곤

13:50~14:20 **Invited lecture**

좌장 : 가톨릭대 신용삼

"What we need to know for the future?"

Iwate Prefectural Central Hospital Dr. Naoto Kimura

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The role of young endovascular neurosurgeon in the medium sized hospital of Japan

14:20~15:50 **Free paper II (English session)**

좌장 : 전남대 김태선, 경희대 고준석

14:20~14:30 Progressive Thrombosis of Small Saccular Aneurysms Filled with Contrast Immediately After Coil Embolization: Analysis of Related Factors and Long-term Follow-up

서울대병원 조영대

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14:30~14:40 What's the Reliability and Significance of Pre-coiling CT Angiography in Ruptured Cerebral Aneurysms?

가톨릭대 성빈센트병원 성재훈

_50

14:40~14:50 Complex Techniques of Coil Embolization for Bifurcation Aneurysms

울산대 강릉아산병원 유승훈

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14:50~15:00 Rebleeding of Ruptured Intracranial Aneurysms at Immediate Postoperative Period After Coil Embolization

강동경희대병원 신희섭

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15:00~15:10 Relationship Between Two Types of Coil Packing Densities Relative to Aneurysm Size

연세대 세브란스병원 박근영

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15:10~15:20 Delayed Ischemic Stroke After Stent-assisted Coil Placement in Cerebral Aneurysm: Characteristics and Optimal Duration of Preventative Dual Antiplatelet Therapy

분당서울대병원 황교준

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15:20~15:30 Solitaire Stent-assisted Chemical Angioplasty for Resistant Vasospasm in SAH Patients

충남대병원 권현조

_55

15:30~15:40 Fate of MCA Perforators After Stent Assisted Angioplasty in Patients with Symptomatic MCA Stenosis: 10-year Experience in a Single Center

가톨릭대 부천성모병원 김성림

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15:40~15:50 Compare the Clinical Results of the Intra-arterial Thrombolytic Therapy, According to the Perfusion/diffusion-mismatching & Intravenous tPA Use or Not

가톨릭대 의정부성모병원 최선웅

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15:50~16:10 **Coffee break & Poster view**

16:10~17:30 **Free paper III [Ischemia and other session]**

좌장 : 가톨릭대 유도성, 한양대 이형중

16:10~16:20 IA Thrombolysis for Tandem Occlusive Lesion in Acute Ischemic Stroke

울산대병원 김동한

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16:20~16:30 Stent-Assisted Angioplasty for Severe Stenosis of the Intracranial Extradural Internal Carotid Artery Causing Transient Ischemic Attack or Minor Stroke

부산대병원 고준경

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프로그램

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

일 시 | 2014년 12월 6일 토요일 8:30~17:30

장 소 | 순천향대학교 부천병원 5층 향설대강당

16:30~16:40	Incidence and Risk Factors for Diffusion-Weighted Imaging (+) Lesions After Intracranial Stenting and Its Relationship With Symptomatic Ischemic Complications	연세대 세브란스병원 박근영	_63
16:40~16:50	Jostent Covered Stent Placement for Emergency Reconstruction of Ruptured Carotid Artery During or After Transsphenoidal Surgery	연세대 세브란스병원 영상의학과 김병문	_64
16:50~17:00	Balloon Angioplasty of Contralateral Transverse Sinus for Transvenous Embolization of Transverse-sigmoid Dural AV Fistula (DAVF) : A Case Report	동의료원 신병국	_65
17:00~17:10	Endovascular Treatment of Dural Arteriovenous Fistulas; Single Center Experience	순천향대 천안병원 오재상	_66
17:10~17:20	Ruptured Cerebral Proliferative Angiopathy	조선대병원 김도연	_67
17:20~17:30	The Utility and Technical Consideration of Spinal Angiography: Importance of Cooperation with Spine Surgeons	순천향대 부천병원 신동성	_68
17:30	Academic award ceremony / Closing remarks	총무이사 성재훈	
18:00	Official dinner		

Poster session

PS 1.	Knotting of coil During Endovascular Coil Embolization for Ruptured Basilar Artery Aneurysm: A Case Report	차의대 분당차병원 김태곤	_71
PS 2.	A Single Center Experience of Carotid Artery Stenting	순천향대 천안병원 오재상	_72
PS 3.	Intracranial Hemorrhage (ICH) Following Carotid Artery Stenting (CAS)	남양주 한양병원 강형래	_73
PS 4.	Rapidly Progressive Dissecting Aneurysm on Posterior Communicating Artery	인하대병원 이준기	_74

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

Free paper I (Aneurysm session)

좌장 : 서울대 권오기, 을지대 강희인

Factors Affecting Recanalization of Coiled Cerebral Aneurysms: Mid-term Follow-up Results

김재훈, 강희인, 김덕령, 문병관, 김주승

을지대학교 을지병원

Objective: To investigate recanalization rate and risk factors in consecutive patients treated with endovascular coil embolization.

Methods: A total of 91 patients with 94 saccular aneurysms were treated with endovascular coiling between 2010 and 2012 at our institution. Radiographic follow-up (angiography or plain skull x-rays) at least 12 months (mean; 25.7 months) were available in 60 patients with 63 aneurysms. Binary logistic regression analysis was performed to identify risk factors of recanalization.

Result: The patient's age ranged from 33 to 78 years (mean; 56.4 years $\pm$ 11.5) and 18 cases (28.6%) were treated with a stent. Thirty seven aneurysms (58.7%) were ruptured and the most prevalent location of aneurysms was the internal carotid artery (57.1%). The rate of recanalization (change of Raymond classification compared with initial studies) was 27% (17/63), and major recanalization (Raymond class III) occurred in 9 aneurysms (14.3%). Patient's age (5mm; $p=0.043$), and dome to neck ratio (>1.3 ; $p=0.026$) were statistically significant factor of recanalization. In binary logistic regression analysis, ruptured aneurysm status was the only independent predictor of recanalization (OR = 6.684; 95% CI, 1.198-37.282; $p=0.03$) after endovascular coiling.

Conclusion: Recanalization rate of cerebral aneurysms was associated with ruptured presentation. Long-term follow-up will be needed to confirm the durability of coiled aneurysms, especially in ruptured aneurysm.

Keyword: Aneurysm, Coiling, Recanalization

Endovascular Treatment of Complex Cerebral Aneurysms with a Branch Incorporated into the Sac

Dae-Won Kim, Sung-Don Kang

Department of Neurosurgery, School of Medicine, Wonkwang University, Iksan, Korea

Objective: The optimal management of geometrically complex aneurysms remains challenging. The aim of this retrospective study was to evaluate the safety and feasibility of endovascular treatment in complex aneurysms with a branch incorporated into the sac.

Methods: Forty-five consecutive patients harboring complex cerebral aneurysms with a branch incorporated into the aneurysm underwent coiling during 5 years.

Result: Sixteen (36%) aneurysms located at the terminus of basilar artery, 13 (29%) aneurysms located at the junction of internal carotid-posterior communicating artery. Five (11%) were posterior inferior cerebellar artery aneurysms, 4 (9%) were superior cerebellar artery aneurysms. Twelve two (49%) aneurysms were ruptured. Nineteen (42%) aneurysms underwent stent-assisted coiling, 16 (36%) underwent coiling by using multiple catheter technique. Balloon-assisted coiling was 5 (11%), and microcatheter-assisted coiling was 2 (4%). There was 1 (2%) case of occlusion of branch incorporated into the aneurysm which induced infarction. There was no procedure-related death.

Conclusion: Endovascular treatment seems safe and feasible for complex aneurysms with a branch incorporated into the sac. However, long-term following-up results are needed to evaluate the efficacy of this treatment modality.

Keyword: Complex aneurysm, Endovascular treatment

Short-term Angiographic Outcome of Intracranial Aneurysms with Minimal Neck Remnants After Coil Embolization

Jong-Il Choi, Bum-Joon kim, Sang-Dae Kim, Se-hoon Kim, Sung-Kon Ha, Dong-Jun Lim

Department of Neurosurgery, Ansan Hospital, Korea University Medical Center

Objective: The degree of aneurysm occlusion after coil embolization has an impact on aneurysm recanalization. The purpose of this study was to evaluate the short-term angiographic outcome of minimal neck remnants in aneurysms treated with coil embolization.

Methods: A single-center, retrospective study, aneurysms coiled from 2009 to 2012. 67 aneurysms (67%) had residual minimal necks at post-coil embolization. 16 of the aneurysms were small with small necks, 31 were small with wide necks, 9 were large with small necks, and 11 were large with wide necks. The angiographic outcomes at short-term follow-up, packing densities, procedure-related complications and degrees of recanalizations were investigated. The mean duration of angiographic follow up was 27.3 months.

Result: In small aneurysms with small necks, post-embolization angiography revealed 6 aneurysms (38%) with progressive thrombosis, 7(44%) unchanged, 3(18%) with minor recanalization, and no major recanalization. In small aneurysms with wide necks, 9 (29%) had progressive thrombosis, 11 (35%) remained unchanged, 10 (32%) had minor recanalization, and 1 (3%) major recanalization. In large aneurysms with small necks, 2 (22%) had progressive thrombosis, 2 (22%) remained unchanged, 3 (33%) had minor recanalization, and 2 (22%) major recanalization. In large aneurysms with wide necks, no progressive thrombosis, 4 (36%) remained unchanged, 5 (45%) had minor recanalization, and 2 (18%) major recanalization. Overall packing densities were 26.2%. There were no aneurysm ruptures after treatment.

Conclusion: The short-term angiographic outcome of aneurysms with minimal neck remnants after coil embolization is favorable, especially at small aneurysm. Understanding of natural history of minimal neck remnant aneurysms after coil embolization could potentially help the interventional neurosurgeon avoid complications such as coil herniation, vessel compromise, and stroke in selected cases. Further investigation with a larger patient population is warranted.

Keyword: Cerebral aneurysm, Coil embolization, Neck remnant, Angiographic outcome

Standard vs Modified Antiplatelet Preparation for Preventing Thromboembolic Events in Patients with High on-Treatment Platelet Reactivity Undergoing Coil Embolization for an Unruptured Intracranial Aneurysm

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Objective: Thromboembolism in coiling for an unruptured aneurysm is known to be frequent in patients with high on-treatment platelet reactivity (HTPR) to a standard antiplatelet preparation for its prevention. We evaluated the effect of a modified antiplatelet preparation, compared with a standard preparation, in patients with HTPR undergoing coiling.

Methods: We performed a prospective, randomized, open-labeled, active-control trial with blinded outcome assessment. Using a computer-generated sequence, patients with HTPR were randomly assigned (1:1) to the standard or modified preparation group. Patients without HTPR were assigned to the no-HTPR group. The modified preparation (HTPR to aspirin, 300mg aspirin and 75mg clopidogrel; HTPR to clopidogrel, adding 200mg cilostazol to the standard regimen) was performed before coiling in the modified preparation group. The standard preparation was maintained in the other groups. Primary outcome was an early (≤ 7 days) thromboembolic event. The principal secondary outcome was a bleeding complication. This trial is registered with Clinical Research Information Service, number KCT0000804.

Result: Between May 27, 2013, and April 7, 2014, we enrolled and allocated 228 patients with unruptured aneurysm: 63 to the standard preparation, 63 to the modified preparation, and 102 to the no-HTPR groups. The thromboembolic event rate was low in the modified preparation group (1/63 [1.6%]) compared with the standard preparation group (7/63 [11.1%]; adjusted risk difference [ARD], -11.7% [95% confidence interval -21.3, -2.0]; $p=0.018$), which had a higher thromboembolic risk than the no-HTPR group (1/102 [1.0%]; ARD, 8.6% [1.0, 16.3]; $p=0.027$). The bleeding rate was not different between the modified (6/63 [9.5%]) and standard preparation groups (4/63 [6.3%]; ARD 5.6% [-4.2, 15.4], $p=0.256$).

Conclusion: A modified antiplatelet preparation for patients with HTPR, compared with standard preparation, reduced the thromboembolic event rate in coiling for an unruptured aneurysm without increasing bleeding.

Keyword: Aneurysm, Antiplatelet, Coil

The Neck Remodeling Owing to Changes of Vessel-angle After the Placement of a Stent Applied to Small-sized Bifurcating Arteries for Coiling of Cerebral Aneurysms

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Department of Neurosurgery, Inha University School of Medicine and Hospital, Incheon, Republic of Korea

Objective: To assess the changes of vessel angles of aneurysms after the placement of a stent at small-sized bifurcating arteries.

Methods: Imaging data with seventeen aneurysms underwent stent-assisted coiling involving small-sized bifurcating arteries by using 17 self-expanding intracranial stents (8 women; mean age, 56.0 years) were retrospectively analyzed. The angles between the afferent vessels and the efferent vessels were calculated to investigate the changes after stent placement.

Result: In all 17 deployment of stents, 9 stents were placed between A1 and A2, 7 stents were placed between basilar artery and posterior cerebral artery (PCA), and 1 stent was placed between M1 and M2. Eight of 9 (88.9%) A1-A2 stentings, 5 of 7 (71.4%) BA-PCA stentings and one M1-M2 stenting were presented angular change over 5 degree. Two of 9 (22.2%) A1-A2 stentings and 2 of 7 (28.6%) BA-PCA stentings were presented decrease of neck-diameter over 1 mm owing to neck remodeling. In the mean comparison, stent deployment increased the angles from 93.9° to 117.9° ($p < 0.001$). The mean angle change of A1-A2 (24.0°) was greater than BA-PCA (16.3°); however, the statistical differences under the location of stents were not significant ($p = 0.381$).

Conclusion: Stent placement at the small-sized bifurcating artery changes the angle between efferent and afferent vessel of the aneurysms. The geometrical changes may play a role in the remodeling effects between the parent arteries and aneurysms.

Keyword: Neck remodeling, Vessel angle, Intracranial stent, Cerebral aneurysm

Outcomes of Retrievable Solitaire Stent-Assisted Coil Embolization of Wide-necked Intracranial Aneurysms

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Departments of Neurosurgery and Radiology, Chonnam National University Medical School

Objective: This study aimed to report clinical outcome and immediate and long-term angiographic results of stent-assisted coil embolization by using retrievable Solitaire AB stent for the treatment of wide-necked intracranial aneurysms.

Methods: From January 2011 to September 2014, a total of 156 patients harboring 162 aneurysms were treated with stent-assisted coiling by using Solitaire AB stent. Thirty-five patients (22.4%) presented with acute subarachnoid hemorrhage (SAH). Stent was removed after the procedure in 36 patients (23.1%); the reasons of stent removal were complete coiling in 23 patients, SAH in 8 patients and stent thrombosis in 5 patients. The stent thrombosis was disappeared after the removal of stent. Bailout stenting was performed in 27 patients (17.3%) and repositioned during and after the procedure in 8 patients (5.1%)

Result: Of 121 patients with an unruptured aneurysm, two thromboembolic complications and three periprocedural cerebral hemorrhages occurred; two (1.7%) of these patients had severe disability 3 months after coil embolization. The remaining 119 patients (98.3%) showed good recovery (mRS 0 or 1). There was no procedure-related mortality in patients with an unruptured aneurysm. Of 35 patients with ruptured aneurysms, two cerebral hemorrhages related with procedure and one thromboembolic complication were observed; 22 patients (62.9%) had a favorable outcome 3 months after coil embolization. Overall, the rate of procedure-related complications was 5.1% (8/156). Immediate angiographic results of 162 coiled aneurysms were complete occlusion in 106 aneurysms (65.4%), neck remnant in 52 (32.1%), and aneurysm remnant in 4 (2.5%). Follow-up angiography more than 1 year after the coil embolization was obtained in 42 patients with 43 aneurysms (34 with catheter angiography and 8 with MR angiography). Of these, recanalization was observed in 5 aneurysms (11.6%) and they didn't have re-coiling due to the small neck recanalization. 34 aneurysms (79.1%) unchanged, and 4 aneurysms (9.3%) had complete occlusion due to a progressive thrombosis.

Conclusion: Solitaire stent reposition and removal make it possible to prevent the stent thrombosis and make the procedure faster and easier in selected patients. Considering the good clinical outcome with the low procedural complication rates and angiographic results with low recurrence rates, I believe the Solitaire stent-assisted coil embolization is safe and effective in the treatment of wide-neck intracranial aneurysms.

Keyword: Solitaire, Stent, Coil embolization, Intracranial aneurysm

Coil Embolization Using Multiple Catheters for Very Challenging Ruptured Cerebral Aneurysm Without Balloons or Stents in Patients Over 75 Years of Age

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Objective: To present coiling cases using multiple catheters without balloons or stents for challenging ruptured cerebral aneurysm from a technical point of view in patients over 75 years of age.

Methods: From July 2012 to November 2014, we treated 26 patients with challenging ruptured cerebral aneurysm aged over 75 using multiple catheters (over two catheters) without balloons or stents. We retrospectively evaluated post operative angiographic outcome and intra-operative complication including with rebleeding of ruptured aneurysm, thromboembolic event.

Result: Total 26 patients with challenging ruptured aneurysms were treated by coiling using multiple catheters. Successful embolizations without intra-operative complication were performed in 25 cases. One patient had a non-symtomatic thrombus in parent artery around coiling aneurysm. Post-coiling angiograms showed 20 complete occlusions (77 %), 6 neck remnants (23 %).

Conclusion: Our study suggests that coiling of challenging ruptured cerebral aneurysm using multiple catheters is feasible, safe and rid limitation in coiling of cerebral aneurysm without balloons and stents.

Keyword: Ruptured aneurysm, Coiling, Embolization, Old age, Multiple catheters.

Self-expanding Stent Placement for Anterior Circulation Intracranial Artery Dissection Presenting with Ischemic Symptoms

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¹Departments of Radiology, Yonsei University College of Medicine, Severance Hospital, Seoul, South Korea ²Department of Radiology, Yonsei University College of Medicine, Gangnam Severance Hospital, Seoul, South Korea

Objective: To evaluate the safety and efficacy of a self-expanding stent for ischemic AC-ICD.

Methods: Eight patients (mean age, 36 years) underwent self-expanding stenting for ischemic AC-ICD. Imaging findings of ischemic AC-ICD, the reason for stenting, and the clinical and angiographic outcomes were retrospectively evaluated.

Result: AC-ICD involved intracranial internal carotid artery (ICA) to middle cerebral artery (MCA) in 2, intracranial ICA alone in 3 and MCA alone in 3 patients. Six AC-ICDs showed complete or near occlusions while 2 had a severe degree of stenosis. Six AC-ICDs showed an intimal flap and 3 had intramural hematomas. Six patients underwent emergent stenting for acute stroke within 6 hours (n=2) or crescendo-type stroke within 24 hours (n=4), while 2 patients had stenting for recurrent ischemia on dual antiplatelet and/or anticoagulation after the initial attack. The mean dissection-related stenosis improved from 93.1% to 20.3% after stenting ($p<0.05$). The mean NIHSS score improved from 7.5 to 1.4 ($p<0.05$). All patients had excellent or favorable outcomes at 3 months: mRS, 0 in 3, 1 in 3, and 2 in 1 patient(s). No patients had subarachnoid hemorrhage or ischemic symptom recurrence during the clinical follow-up (mean, 27 months). All stented arteries were patent without significant in-stent stenosis on angiographic follow-up (range, 3 to 12 months).

Conclusion: Self-expanding stents seem to be safe and effective for AC-ICD presenting with acute/crescendo-type stroke or recurrent ischemia despite adequate medication.

Keyword: Stroke, Intracranial dissection, Stenting.

Outcomes of Vertebrobasilar Dissecting Aneurysms after Stent-Assisted Coil Embolization

Jin Pyeong Jeon, M.D.¹, Jeong Jin Park, M.D.¹, Jong Kook Rhim, M.D.¹, Young Dae Cho, M.D.¹, Hyun-Seung Kang, M.D.², Moon Hee Han, M.D.¹

¹Department of Radiology, Seoul National University College of Medicine, Seoul, Korea ²Department of Neurosurgery, Seoul National University College of Medicine, Seoul, Korea

Objective: With the advance in the endovascular technologies, reconstructive treatments of vertebrobasilar dissecting aneurysms (VBDAs) have been increasingly reported. However, the data have been mainly derived from small samples and heterogeneous treatment modalities. This study was undertaken to assess the outcome of VBDAs after stent-assisted coil embolization (SACE).

Methods: Forty seven patients, diagnosed with 47 dissecting fusiform aneurysms between January 2008 and February 2014 at two institutions, were evaluated retrospectively. Medical records and radiologic data were analyzed. Angiographic features of VBDA were categorized as either circumferential or eccentric. Initial occlusion degree was classified as successful occlusion or incomplete occlusion (ie, subtotal and partial occlusion). Cox proportional hazards regression model was conducted to assess factors related to recanalization of VBDAs. Favorable outcomes were defined as modified Rankin scales (mRs) of 0-2.

Result: SACE was technically successful in all patients. There were no procedure-related complications except for one cerebral infarction on postoperative day 1. Successful occlusion was observed in 25 patients (53.2%), and incomplete occlusion, in 22 patients (46.8%). Ten cases of recanalization (major recanalization, n = 6; minor recanalization, n = 4) were observed during a mean follow-up of 20.2 months. Among them, five patients underwent additional endovascular procedures: one case of trapping and four cases of SACE. The overall recanalization rate of VBDAs after SACE was 12.64% per lesion-years. A multivariate analysis revealed that circumferential appearance (HR: 5.505, p=0.043) and incomplete occlusion (HR: 10.731, p=0.038) were significant predictive factors for VBDAs recanalization. VBDAs related to arterial branches marginally increased the risk of recanalization (HR: 4.876, p=0.055). Two cases of cerebral infarctions were noted at two weeks and twenty months after the procedures, respectively. All patients recovered well except for one patient due to middle cerebral artery infarction.

Conclusion: SACE may provide a feasible and safe treatment modality for VBDAs, given that 46.8% of the patients treated this way showed acceptable long-term results, despite of incomplete occlusion at post-operative angiography. And two factors, circumferential angiographic appearance and incomplete occlusion, could be related to VBDA recanalization after SACE.

Keyword: Dissection, Vertebral artery, Basilar artery, Stent.

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

Symposium : Practical stroke intervention

좌장 : 충남대 고현송, 계명대 이창영

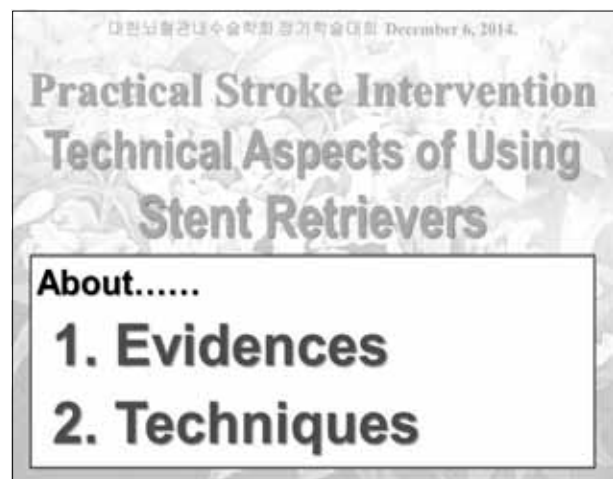
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| 1. Technical aspects of using stent retrievers | 연세대 정준호 |
| 2. Technical aspects of using aspiration | 경북대 강동훈 |
| 3. Intervention for acute vertebro-basilar occlusion | 계명대 김창현 |

Stent Retrievers

Joonho Chung, M.D., Ph.D.

Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University

To know about scientific evidences of using a stent retriever may be the best for us to use it practically. Thus, recent evidences are going to be introduced briefly, followed by giving out devices as well as techniques tailored for beginners in each step of mechanical thrombectomy.



Endovascular Recanalization with Penumbra MAX reperfusion catheter

“Lessons & Tips learned from the early case experiences”

Dong-Hun Kang MD

Department of Neurosurgery and Radiology Kyungpook National University Hospital Daegu, Korea

MT techniques at present

→ 2 main streams

• Clot aspiration

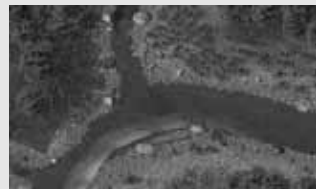
- **FAST (Forced Arterial Suction Thrombectomy)**

- **ADAPT (A Direct Aspiration first Pass Technique)**

Penumbra-Max [Ace]
DAC
Sofia

• Stent retriever

Solitaire FR
Trevo ProVue [XP]



1) Clot Aspiration: **FAST** and **ADAPT**

ORIGINAL RESEARCH

Direct Thrombus Retrieval Using the Reperfusion Catheter of the Penumbra System: Forced-Suction Thrombectomy in Acute Ischemic Stroke

Kang DH, Kim YH, et al. J Neurointerv Surg 2013; 5: 111-115

OBJECTIVE AND PURPOSE: Although the PT has been the main primary reperfusion catheter in acute stroke intervention, even the PT cannot retrieve all types of thrombus. Under such circumstances, we developed a new PT, the forced-suction catheter, and applied this catheter as a primary technique for thrombectomy. Here, we describe and discuss the clinical results and safety of this technique.

MATERIALS AND METHODS: This study included 22 consecutive patients with acute ischemic stroke secondary to large artery atherosclerosis who underwent modified thrombectomy by using the PT to retrieve the thrombus.

RESULTS AND CONCLUSIONS: The forced-suction catheter was successfully inserted into the thrombus and aspirated with a negative pressure of 100 mmHg. The thrombus was completely removed in 100% of the cases. The clinical outcome was significantly better than that of the PT group.

CONCLUSIONS: The forced-suction catheter is a useful catheter for the treatment of acute ischemic stroke secondary to large artery atherosclerosis.

KEY WORDS: Penumbra, FAST, ADAPT, thrombectomy, acute ischemic stroke.

INTRODUCTION: The Penumbra System (Penumbra, Inc., Redwood City, CA) is a catheter-based system for the treatment of acute ischemic stroke. The system consists of a catheter with a distal filter and a proximal suction catheter. The catheter is inserted into the thrombus and aspirated with a negative pressure of 100 mmHg. The thrombus is completely removed in 100% of the cases. The clinical outcome was significantly better than that of the PT group.

CONCLUSIONS: The forced-suction catheter is a useful catheter for the treatment of acute ischemic stroke secondary to large artery atherosclerosis.

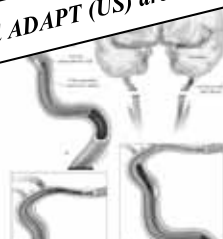
KEY WORDS: Penumbra, FAST, ADAPT, thrombectomy, acute ischemic stroke.

1) Clot Aspiration: **FAST** and **ADAPT**

Initial clinical experience with the ADAPT technique: A direct aspiration first pass technique for stroke thrombectomy

Alquist S, Turk T, Alvarado J, et al. J Neurointerv Surg 2013; 5: 116-120

FAST (Asia) and ADAPT (US) are technically same !!!



2) Stent Retriever: **Solitaire** and **Trevo**

Trevo versus Merci retrievers for thrombectomy revascularisation of large vessel occlusions in acute ischaemic stroke (TREVO 2): a randomised trial

Alquist S, Turk T, Alvarado J, et al. J Neurointerv Surg 2013; 5: 121-125

OBJECTIVE AND PURPOSE: The Trevo ProVue (Trevo, Medtronic, Minneapolis, MN) is a catheter-based system for the treatment of acute ischemic stroke. The system consists of a catheter with a distal filter and a proximal suction catheter. The catheter is inserted into the thrombus and aspirated with a negative pressure of 100 mmHg. The thrombus is completely removed in 100% of the cases. The clinical outcome was significantly better than that of the PT group.

CONCLUSIONS: The Trevo ProVue is a useful catheter for the treatment of acute ischemic stroke secondary to large artery atherosclerosis.

KEY WORDS: Trevo, Solitaire, thrombectomy, acute ischemic stroke.

INTRODUCTION: The Trevo ProVue (Trevo, Medtronic, Minneapolis, MN) is a catheter-based system for the treatment of acute ischemic stroke. The system consists of a catheter with a distal filter and a proximal suction catheter. The catheter is inserted into the thrombus and aspirated with a negative pressure of 100 mmHg. The thrombus is completely removed in 100% of the cases. The clinical outcome was significantly better than that of the PT group.

CONCLUSIONS: The Trevo ProVue is a useful catheter for the treatment of acute ischemic stroke secondary to large artery atherosclerosis.

KEY WORDS: Trevo, Solitaire, thrombectomy, acute ischemic stroke.



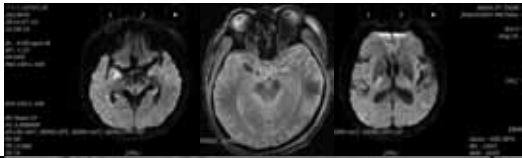


Case 1: 5 Max in M1

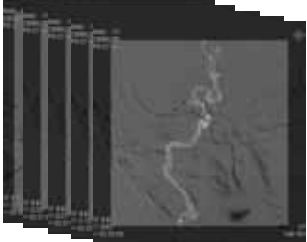




M/71 FAT 2.5hrs NIHSS 12 Rt M1 occlusion
TOAST: CE, AF (+)




M/65 FAT 2.5hrs NIHSS 12 Rt M1 occlusion
1st method used: FAST with 5 Max catheter under 9F Merci BGC 95cm



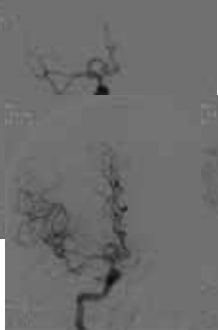
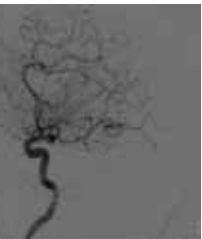

1. 5 Max advance with Prowler Selector
Plus pre-shaped 90: **생각보다 잘 들어라!**

M/65 FAT 2.5hrs NIHSS 12 Rt M1 occlusion
1st method used: FAST with 5-Max catheter under 9F Merci BGC 95cm

1. 4, 5Max의 proximal OD가
6F 이므로 9F BGC only
guiding에 의존해야 한다.
따라서 Max를 올릴 때
Guiding이 밀리고 있을 수 있
다는 점을 주의

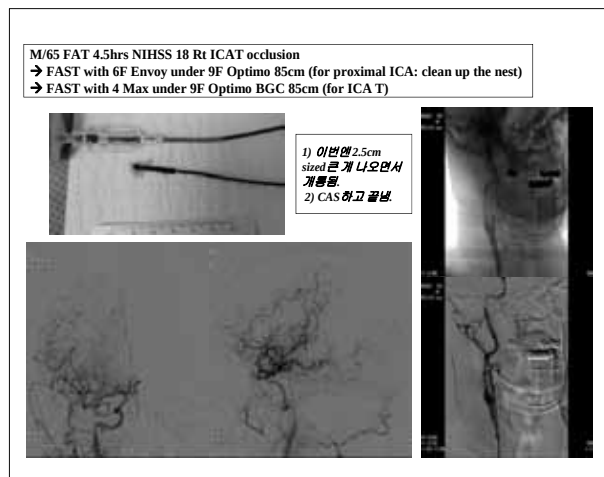
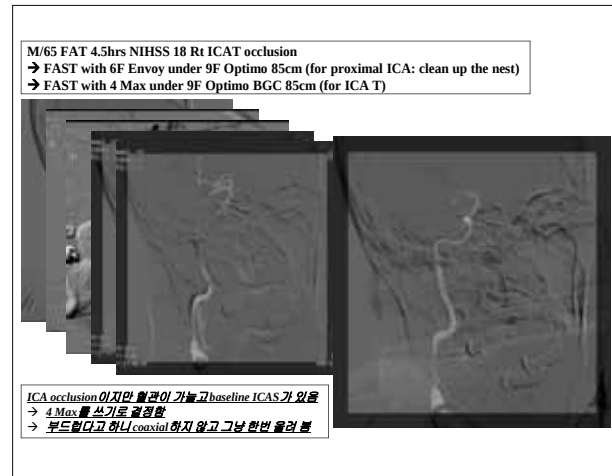
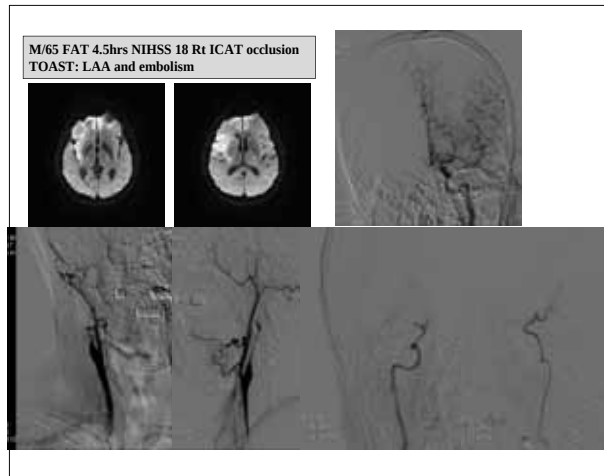


M/65 FAT 2.5hrs NIHSS 12 Rt M1 occlusion
1st method used: FAST with 5-Max catheter under 9F Merci BGC 95cm

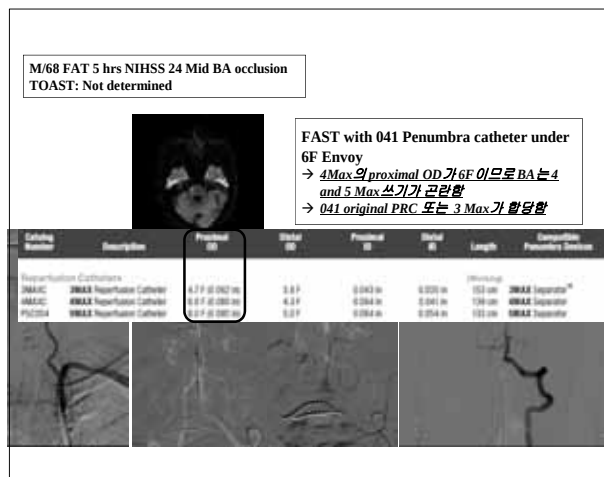




1. 5 Max retrieval under
balloon inflation
2. Single shot TICI of 3
recanalization achieved

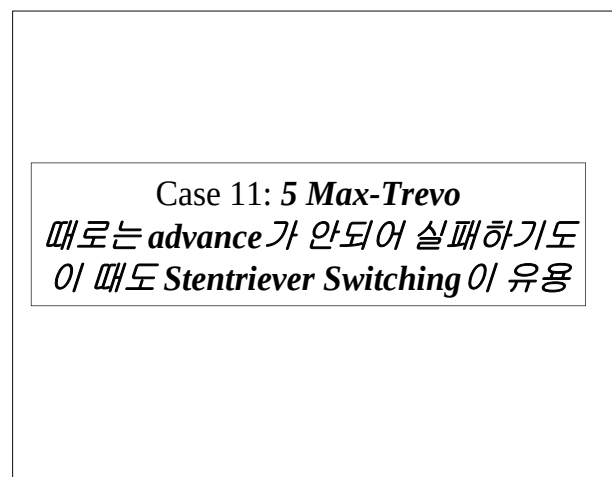
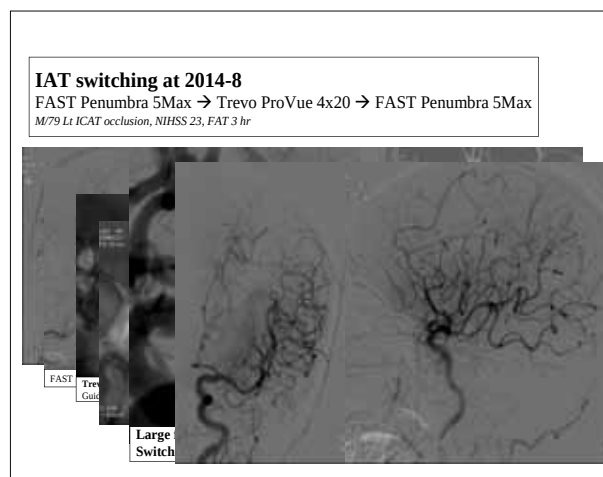
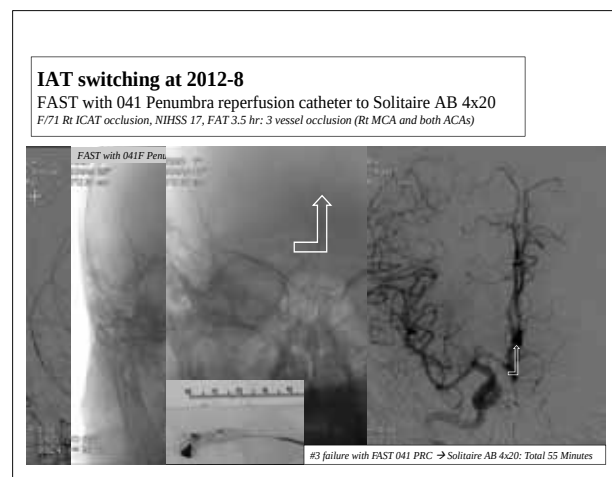
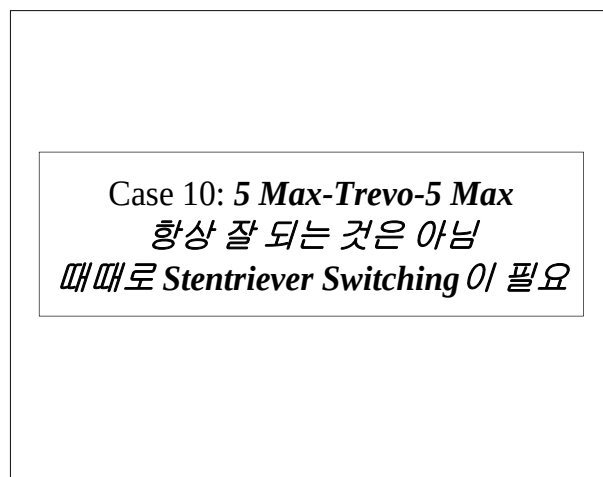
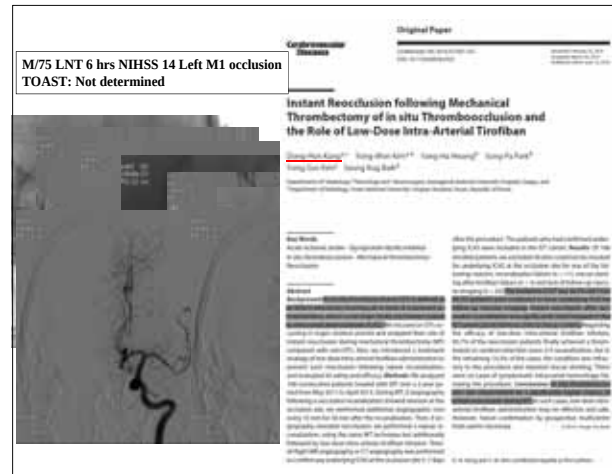
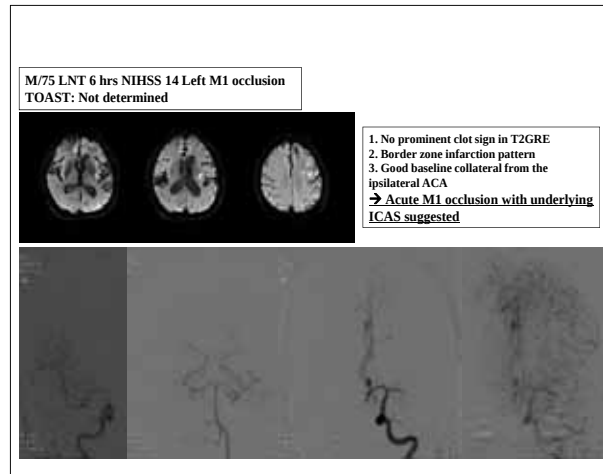
Case 2: 4 Max in ICA T

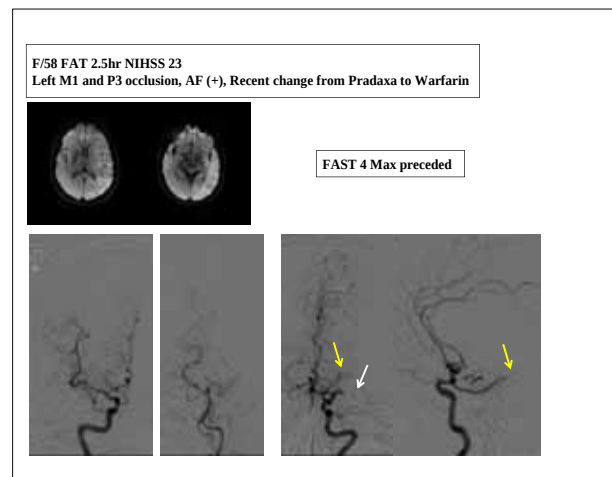
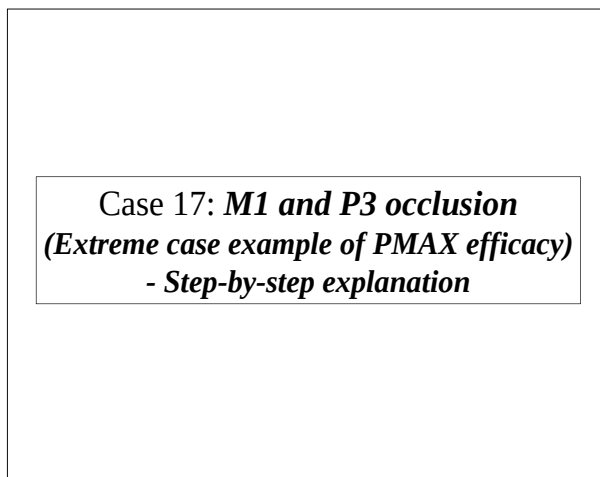
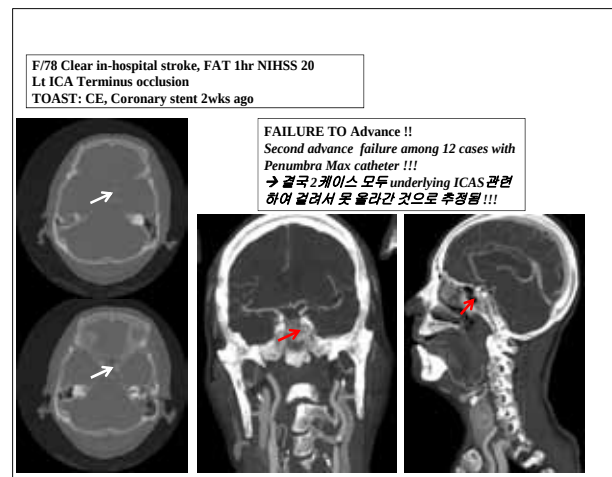
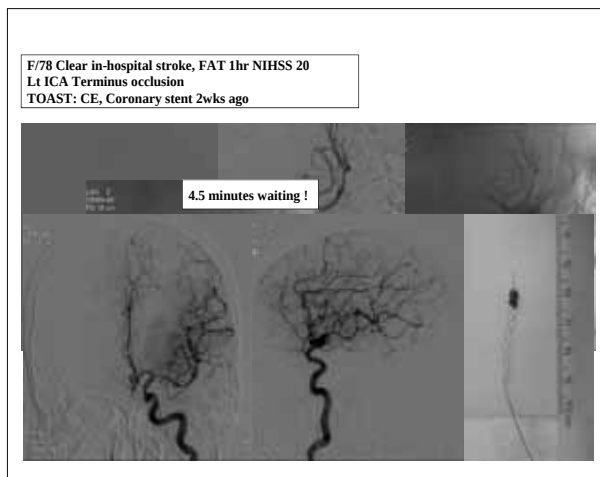
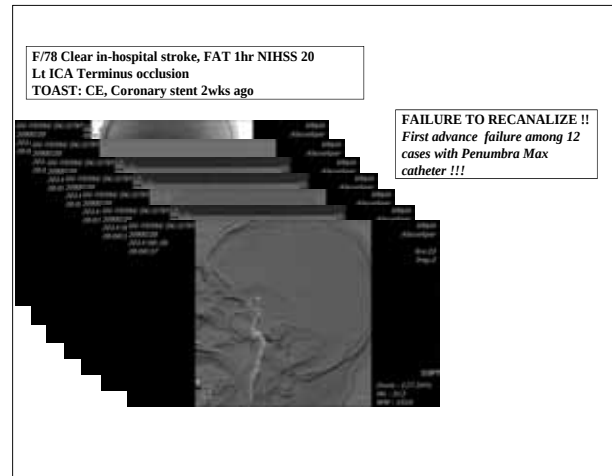
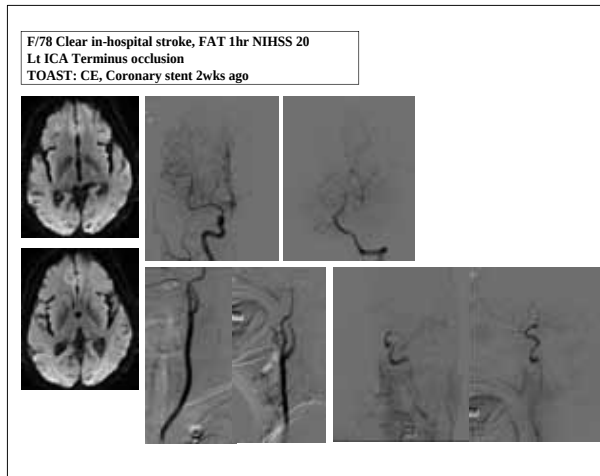


Case 4: 041 Penumbra in BAO



Case 5: 5 Max in M1 occlusion with underlying ICAS

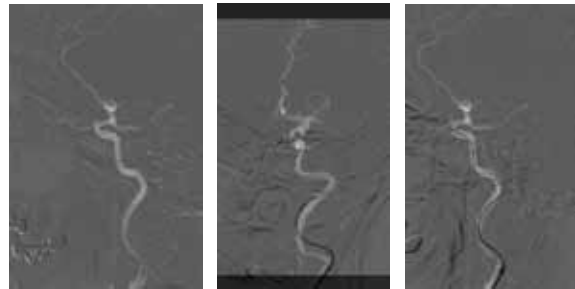




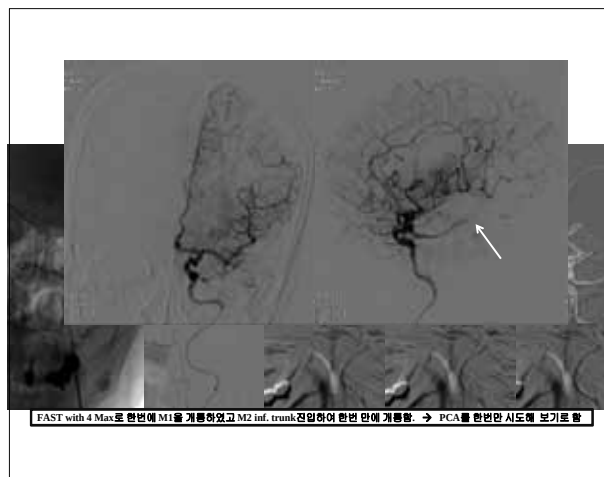
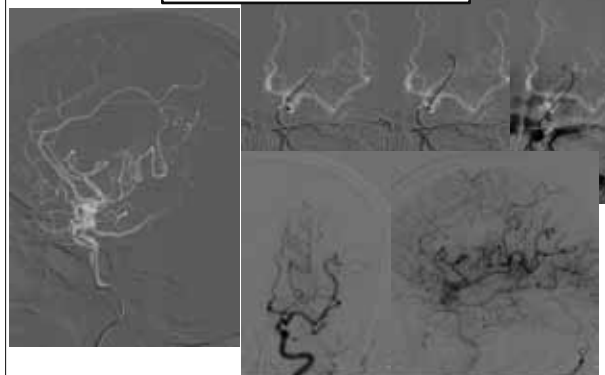
1. Guiding 올리기



2. 4 Max를 M1에 올리기



3. 4 Max를 P3에 올리기



Trend in Korea ???

Protocol in KNUH !

Switching Strategy for Mechanical Thrombectomy of Acute Large Vessel Occlusion in the Anterior Circulation

Seung-Hyun Kwon, MD, Young-Hoon Kim, MD, Sang-Ho Hwang, MD, Joon-Ho Park, MD, Sang-Hoon Hwang, MD, Young-Hoon Kim, MD

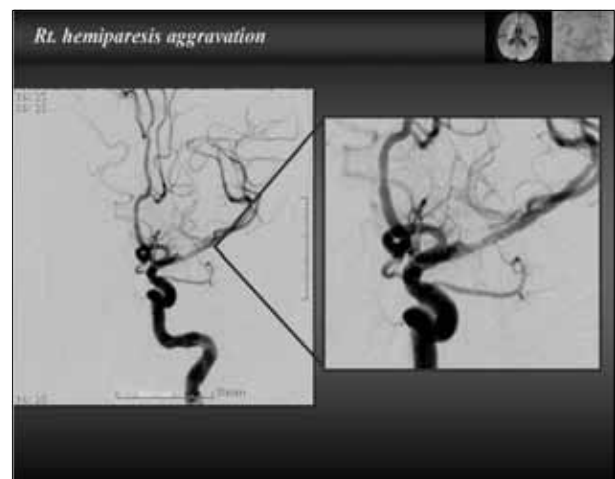
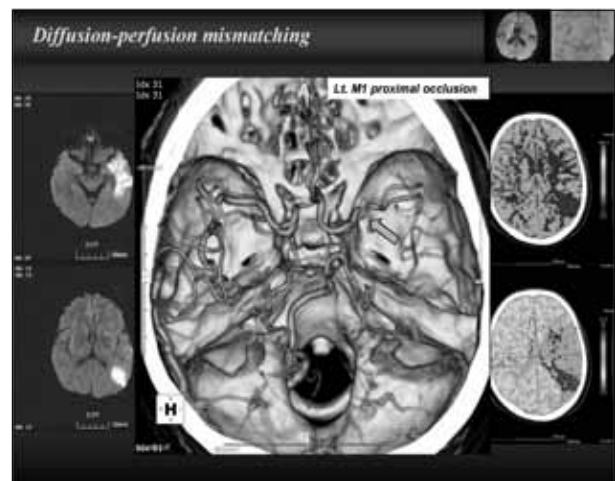
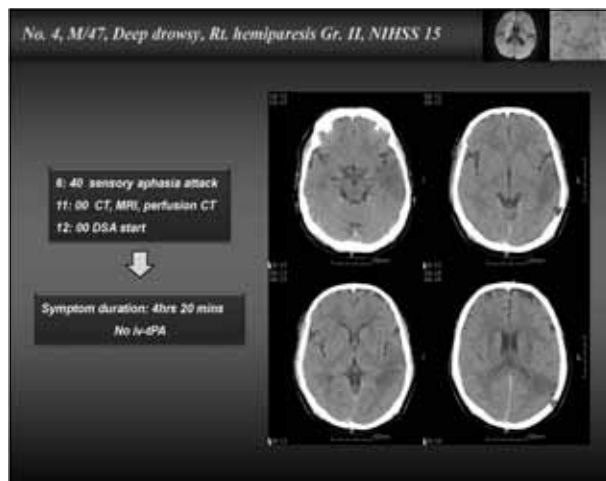


Under 9F BGC protection (Optimo / Merci)
FAST with PMax → Stent retriever (Trevor XP / Solitaire FR) → FAST again if required

Intervention for acute vertebro-basilar occlusion - Practical stroke intervention -

Kim Chang-Hyun¹, Sohn Sung-Il², Hong Jung-Ho², Chang Hyuk-Won³, and Lee Chang-Young¹

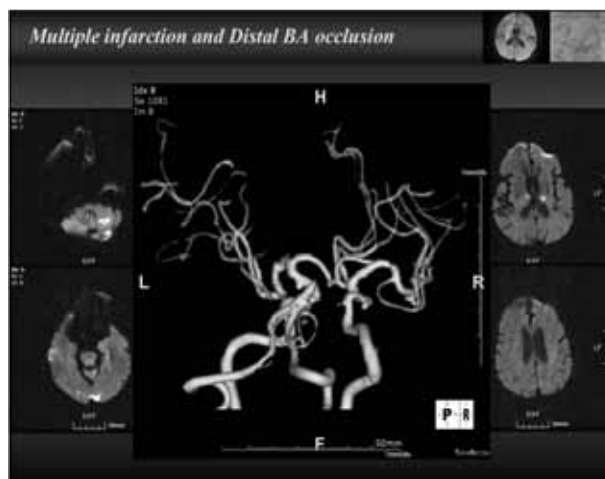
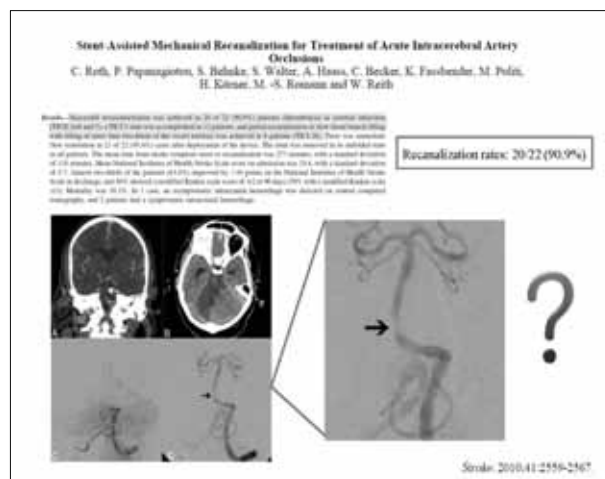
¹Department of Neurosurgery, ²Neurology, and ³Interventional Neuroradiology
Cerebro-vascular center, Dong-san Medical Center, Keimyung University School of Medicine



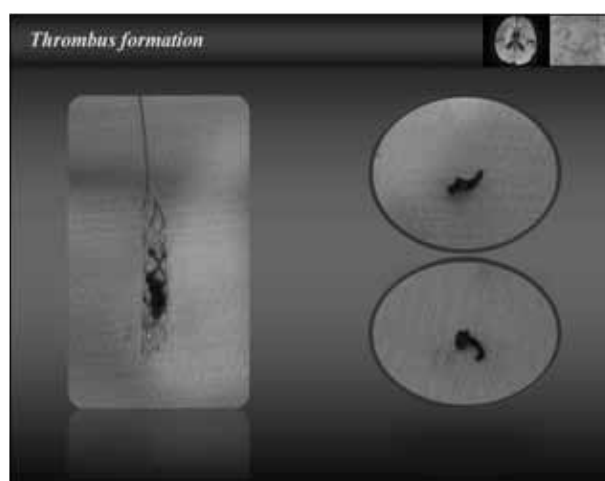
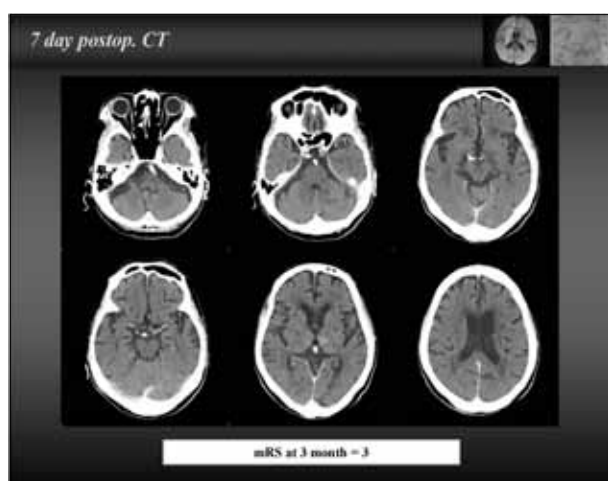
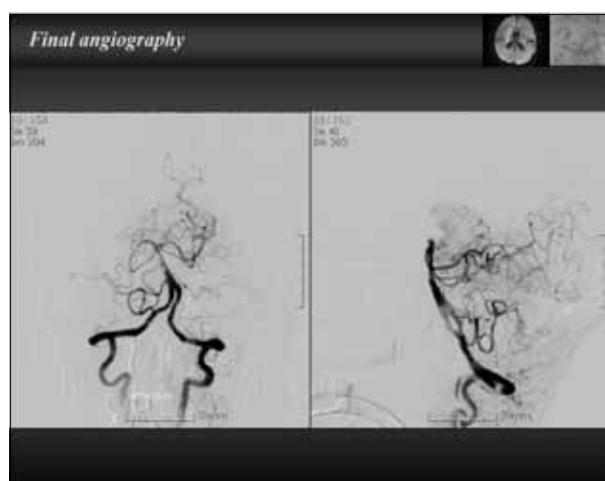
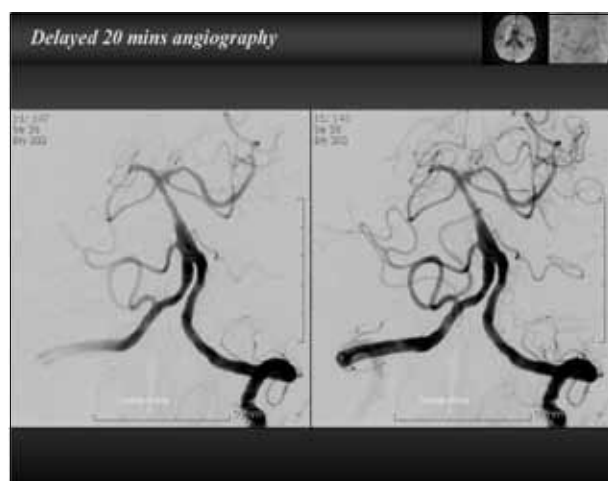


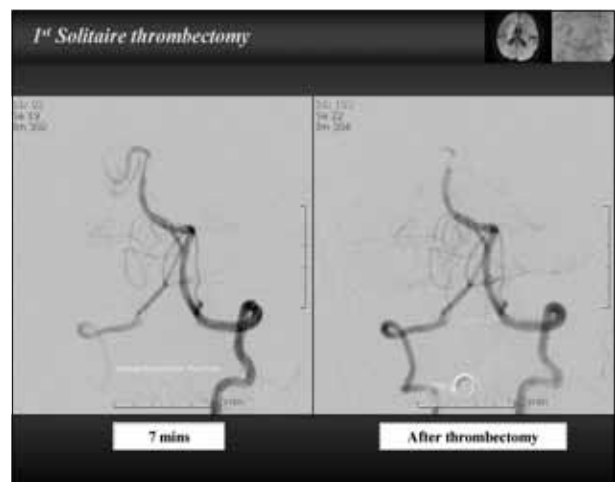
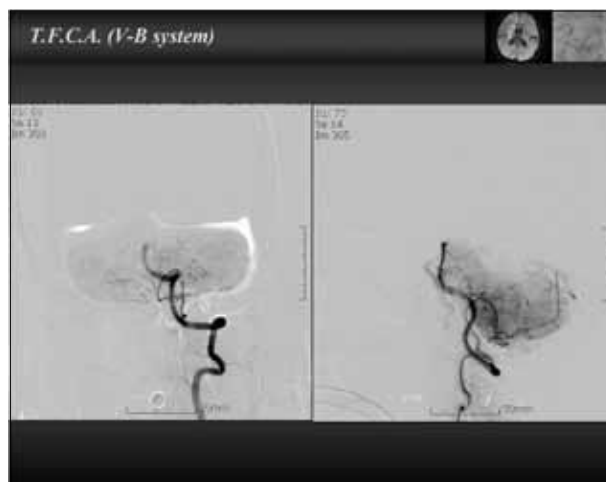
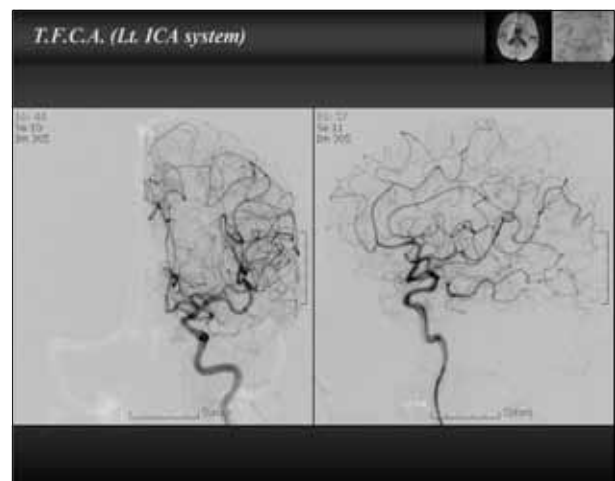
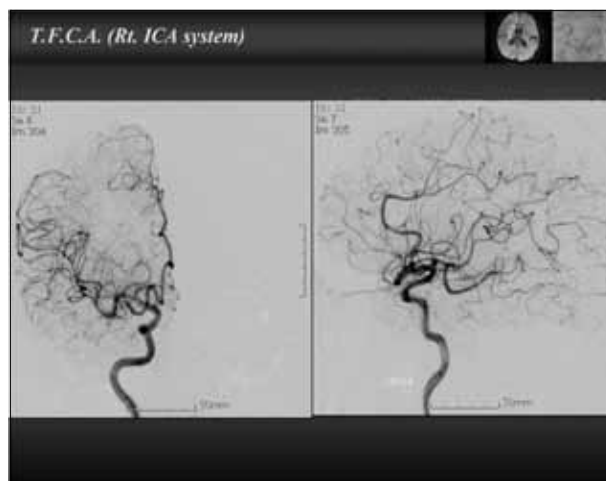
Several important points for successful recanalization ?

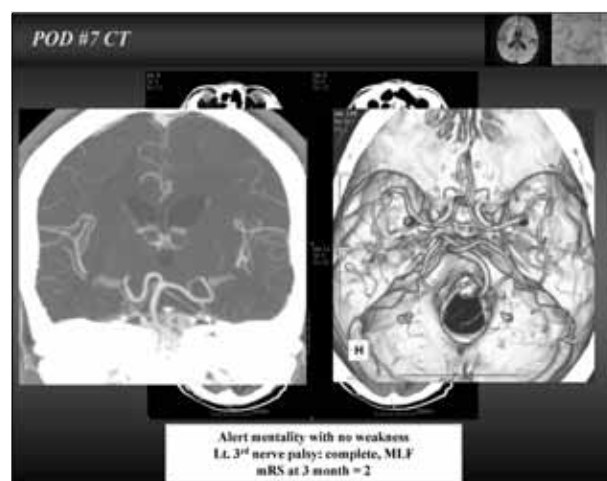
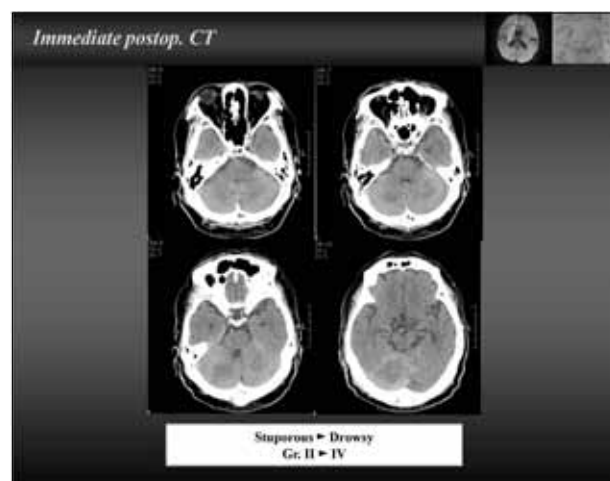
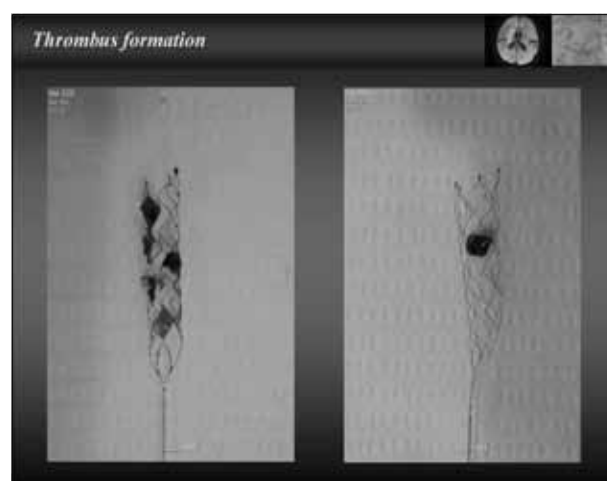
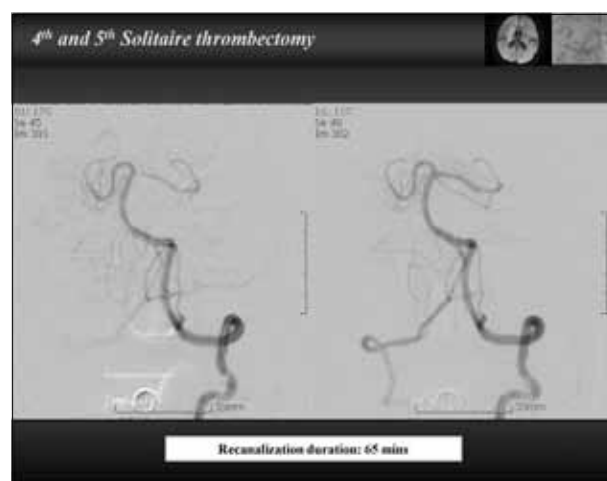
1. In-situ stenosis vs. cardio-embolic ?
2. Basilar bifurcation occlusion: bifurcation vs. non-bifurcation type
3. Balloon-guiding catheter vs. manual compression
4. Preoperative Collateral grade: Indication ?

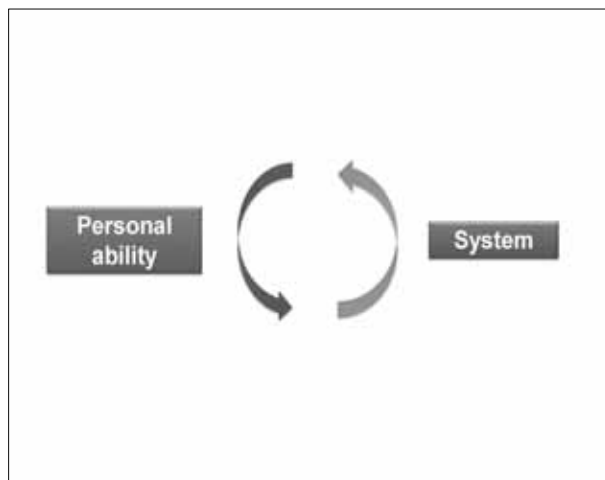
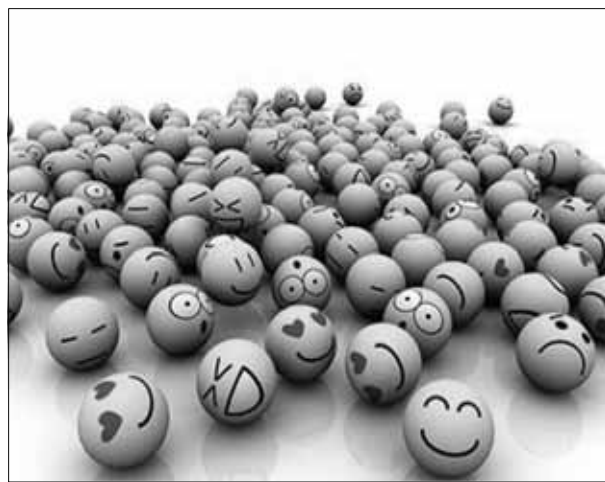












2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

General assembly

보험이사 보고사항

최근 몇 달 동안 선택진료비 축소, 의료 수가의 변동, 급여청구 문제, 새로운 제품의 소개 등 보험관련 분야의 많은 변화가 있었습니다. 우리 학회는 이런 변화에 적절히 대응하기 위해 노력해 왔으며, 그동안 많은 분들의 노력으로 보건복지부 및 건강보험심사평가원에서 대한뇌혈관내수술학회의 위상이 조금씩 높아지고 있습니다. 보험 관련 회의 등에 적극적으로 참여하여 우리 학회의 의견을 많이 개진하도록 노력하고 있습니다. 회원 여러분은 보험 관련 건의사항, 삭감이나 급여 청구에 관한 문제 등이 있으면 언제든지 학회 사무실 또는 홈페이지 보험 정보 게시판에 문의하여 주시기 바랍니다. 신속한 답변과 최대한 도움을 드리겠습니다. 앞으로 보험관련 소식뿐만 아니라 새로운 제품이나 업체의 소식도 지속적으로 알려드리고자합니다.

다음은 올해 진행된 보험관련 소식을 정리한 내용입니다.

1. 기계적혈전제거술용 치료재료 급여기준

변경 전	변경 후
Penumbra system Reperfusion Catheter의 인정기준 두개내 대형 혈관의 색전적출용카테터인 Penumbra system Reperfusion Catheter는 다음의 경우에 1개 인정함. - 다 음 - 1. 적응증 가. 두개내 대형 혈관의 폐색 질병으로 급성 허혈뇌졸중이 있으며, - 증상이 나타난 지 8시간 이내의 환자 - 증상발현 3시간 이내의 환자는 정맥내혈 전용해술이 실패하거나 이에 대한 금기증에 해당되는 환자 나. 두개내 대형 혈관 내경동맥(internal carotid artery), 중대뇌동맥(Middle cerebral artery)의 첫번째(MCA M1 segment)와 두 번째 부위(MCA M2 segment), 기저동맥(Basilar artery), 척추동맥(Vertebral artery) 2. 제외대상 가. Non-contrast CT상 중대뇌동맥 영역 1/3이상을 침범한 뇌경색 나. 심한 뇌부종 다. 뇌출혈 라. 뇌간경색(Stupor 이상의 심한 의식장애가 있는 경우 포함) 마. 다발성 뇌경색 바. 고령(80세 이상)	기계적 혈전제거술용 치료재료 급여기준 두개내 대형 혈관의 기계적 혈전제거술용 치료재료(흡인성 catheter, 회수성 stent)는 다음의 경우에 종류에 관계없이 1개 인정함. - 다 음 - 1. 적응증 두개내 대형 혈관의 폐색 질병으로 급성 허혈 뇌졸중이 있으며, 가. 증상이 나타난 지 8시간 이내의 환자 나. 증상발현 3시간 이내의 환자는 정맥내혈 전용해술이 실패하거나 이에 대한 금기증에 해당되는 환자 ※ 두개내 대형 혈관 인정범위 - 흡인성 catheter ① 내경동맥(internal carotid artery), ② 중대뇌동맥(Middle cerebral artery)의 첫번째(MCA M1 segment)와 두번째 부위(MCA M2 segment), ③ 기저동맥(Basilar artery), ④ 척추동맥(Vertebral artery) - 회수성 Stent ①~④ 흡인성 catheter의 범위와 동일, ⑤ 전대뇌동맥(Anterior cerebral artery), ⑥ 후대뇌동맥(Posterior cerebral artery) 2. 제외대상 가. 좌동 나. 좌동 다. 좌동 라. 다발성 뇌경색

2. Intracranial stenting의 급여기준 변경

현행		개정안	
제 목	세부인정사항	제 목	세부인정사항
두개강내 동맥 스텐트 삽입술 인정기준	두개강내 동맥(intracranial artery) 스텐트 삽입술은 다음과 같이 인정한다. - 다 음 - 가. 유증상의 70% 이상 두개강내대혈관 협착 (내경동맥, 추골동맥, 기저동맥) 나. 혈관내막박리가 있는 경우 등 다. 상기 '가,나'의 경우 이외에는 임상자료가 축적될때까지 사례별로 인정한다.	경피적두개강내 동맥 스텐트 삽입술의 급여 기준	두개강내 동맥(intracranial artery)스텐트 삽입술은 다음의 경우에 요양급여를 인정함. - 다 음 - 가. 유증상의 70% 이상 두개강내대혈관 협착 (내경동맥(<u>Internal carotid artery</u>), 중대뇌동맥(<u>Middle cerebral artery</u>), 척추동맥(<u>Vertebral artery</u>), 기저동맥(<u>Basilar artery</u>)) 나. 혈관내막박리가 있는 경우

3. Flow-diverter stent에 대한 급여기준

Flow-diverter에 대한 급여기준 제정에서 적응증 확대를 건의하였지만 이루어 지지 않았으나 사용량 제한에 대해서는 초과사용이 어느 정도는 가능하도록 근거를 만들었습니다. 앞으로 적응증 확대를 위해 지속적으로 건의하려고 합니다.

제 목	세부인정사항
Flow-diverter를 이용한 뇌동맥류 색전술용색전 기구(Embolization Device)의 급여기준	Flow-diverter를 이용한 뇌동맥류 색전술시 사용하는 색전 기구(Embolization Device)의 인정기준은 다음과 같음. - 다 음 - 가. 적응증 (1) 직경 15mm이상의 비파열성 뇌동맥류 (2) 직경 15mm미만의 비파열성 뇌동맥류 중 다음의 경우 사례별로 인정 - 내경동맥원위부의수포성 뇌동맥류 - 방추형 뇌동맥류 - 척추동맥의 박리형 뇌동맥류 나. 인정개수 : 1개 다만, 환자의 상태나 동맥류의 해부학적 특성 등으로 불가피하게 인정개수를 초과하여 사용하는 경우에는 의사소견서 및 진료기록부 등 관련 자료를 첨부하여야 하며 제출된 관련 자료를 참조하여 요양급여를 인정함. 다. 뇌동맥류 색전술용Micro Coil과의 병용사용은 인정하지 아니함.

항 목	제 목	세부인정사항
자-664 혈관색전술	Flow-diverter를 이용한 뇌동맥류 색전술 Intracranial Aneurysms Embolization with Flow-diverter	자-664가(1)(가) 혈관색전술-뇌혈관[척추포함]-동맥류-보조물지지 소정점수를 산정함. 다만, Flow-diverter를 이용한 뇌동맥류 색전술용색전 기구(Embolization Device)의 급여기준에 적합한 경우에만 산정함.

별지. 급여품목 및 상한금액							
코드	품명	규격	단위	제조회사	재질	수입(판매)업소	상한금액
FLOW-DIVERTER를 이용한 뇌동맥류색전술용							
J3207073	PIPELINE EMBOLIZATION DEVICE	전규격	1EA	MICRO THERAPEUTICS,INC. DBA EV3 NEUROVASCULAR	PLATINUM, TUNGSTEN	코비디엔코리아	10,369,450
J3207064	SURPASS FLOW DIVERTER	전규격	1EA	STRYKER NEUROVASCULAR	COBALT-CH ROMIUM ALLOY 등	한국스트라이커	10,369,450

4. 뇌혈관조영술의 수가 청구 안내문

건강보험 행위 급여·비급여 및 상대가치점수 제1편 제2부 제3장 제2절혈관조영촬영 항목 다260마 전뇌동맥조영촬영수가는 뇌혈관동맥 4Vessel(양측 내경 동맥 및 양측 추골 동맥)조영촬영을 실시한 경우에 전뇌동맥조영촬영술[다260마(HA605)] 산정할 수 있으나, - 실제 뇌혈관 동맥 3Vessel (양측 내경 동맥 및 편측추골동맥) 조영촬영을 실시하고 전뇌동맥 촬영 수가로 착오청구 등 사례가 있어 아래와 같이 수가산정방법에 대하여 안내하오니 혈관조영촬영술에 대한 요양급여비용 청구시 정확한 청구가 이루어질 수 있도록 협조하여 주시기 바랍니다.

<수가 산정 방법>

- ① 양측 내경동맥 및 편측추골동맥조영촬영
 - 다 260라 (내경동맥)*100% + 50%
 - 다 260가 (추골동맥)*50%
- ② 편측추골동맥 및 양측 총경동맥 조영촬영
 - 다 260가(추골동맥)*100%
 - 다 260나(총경동맥)*75%
- ③ 편측내경동맥 및 추골동맥 과 편측 총경동맥 조영촬영
 - 다 260라(내경동맥)*100%
 - 다 260가(추골동맥)*50%
 - 다 260나(총경동맥)*50%
- ④ 양측 추골동맥 및 편측 총경동맥 조영촬영
 - 다 260가(추골동맥)*100% + 50%
 - 다 260나(총경동맥)*50%

5. 뇌혈관의 중재적 시술시 사용하는 Distal Access Intermediate Catheter (원위 접근용 중간도관) 급여기준

뇌혈관의 중재적 시술시 사용하는 Distal Access Intermediate Catheter (원위 접근용 중간도관) 급여기준	뇌혈관의 중재적 시술시 가이드카테터와 마이크로카테터 사이에서 가교(Bridging)역할을 함으로써 원위부 혈관으로 좀 더 쉽고 안전하게 진입할 수 있도록 도와주는 Distal Access Intermediate Catheter (원위 접근용 중간도관)는 다음의 적응증에 한하여 뇌혈관의 꺾임과 굴곡이 심하거나 혈관 근위부의 지지가 약하고 불안정하여 카테터의 진입이 어려울 경우 1개를 요양급여로 인정함. - 다 음 - 가. 뇌동맥류 및 혈관박리의 혈관색전술 나. 뇌동정맥 기형의 혈관색전술 다. 뇌경색(뇌졸중)의 기계적 혈전제거술 라. 뇌혈관 협착증의 스텐트 삽입술, 풍선혈관성형술
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DISTAL ACCESS INTERMEDIATE CATHETER(원위 접근용 중간도관)									중분류 신설
J6091064	DAC	전규격	1EA	CONCENTRIC MEDICAL INC	PTFE등	한국스트라이커	480,000	2014-12-01	

2014년 12월 6일
대한뇌혈관내수술학회
회장 김범태
보험이사 박석규

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

Invited lecture

좌장 : 가톨릭대 신용삼

“What we need to know for the future?”

The role of young endovascular neurosurgeon in the medium sized hospital of Japan

Iwate Prefectural Central Hospital **Dr. Naoto Kimura**

Naoto Kimura M.D. Ph.D.



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E-mail: kmr@themis.ocn.ne.jp

» Education

- 1994-2000 Medical Education in Akita University
- 2000-2003 Regident in Iwate prefecture Hospital
- 2003- Belong to department of Neurosurgery, Tohoku university
- 2009-2013 Belong to Department of Neurosurgery, National Hospital Organization, Sendai Medical Center
- 2010 Graduate school of Tohoku University (Ph.D)
- 2013- Belong to Department of Neurosurgery, Iwate Prefectural Central Hospital

» Certification

- Japanese board of Neurosurgery, 2008
- Japanese board of Neuroendovascular, 2009
- Japanese board of Stroke, 2009

The role of young endovascular neurosurgeon in the medium sized hospital of Japan

Dr. Naoto Kimura

Iwate Prefectural Central Hospital

900 board certificated endovascular neurosurgeons working in Japan. Number of endovascular treatment is increasing year by year. Even though, Iwate prefecture has been face to a chronic shortage of doctors, and there were only 2 endovascular neurosurgeon till 2013. For this reason, number of endovascular therapy was very small in this area.

Our hospital increased board certificated endovascular surgeon from 1 to 2 from last year. To increase number of endovascular therapy, first we started out patient clinic and announced to all hospital in our prefecture. By this effect, about 100 operations were performed this year. But most cases were emergent case and constructing a system for acute endovascular treatment became important.

In subarachnoid hemorrhage cases, it is difficult to gather assistants. From my experience, intraoperative-ruptured ratio is 1.7% in ruptured aneurysm case. Judging by this low ratio of intraoperative rupture, balloon protection backup would not be necessary and we decided to treat aneurysms by simple catheter technique to prepare devices easily with small number of assistants.

In Acute cerebral infarction cases, we cooperate with young stroke neurologists. After evaluation for i.v. rt-PA, MRI (MRA, DWI, ASL) is performed. If patient was indicated for endovascular treatment, we perform stent-retriever thrombectomy with stroke neurologist.

To propagate endovascular in local area, existence of hard-working young endovascular neurosurgeon is important. However, There are limitation to do surgery by oneself. It is essential to construct a system for emergent endovascular treatment added to the situation.

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

Free paper II (English session)

좌장 : 전남대 김태선, 경희대 고준석

Progressive Thrombosis of Small Saccular Aneurysms Filled with Contrast Immediately After Coil Embolization: Analysis of Related Factors and Long-term Follow-up

Young Dae Cho, Hyun-Seung Kang, Jin Sue Jeon, Jong Kook Rhim, Jeong Jin Park, Moon Hee Han
Seoul National University Hospital

Objective: Although it is well-known that incomplete occlusion of aneurysms after coil embolization predisposes to later recanalization, not all aneurysms will be fully occluded by coiling. In follow-up, we evaluated outcomes of small aneurysms (<10 mm) that showed filling of the sac with contrast immediately after coil embolization and assessed factors implicated in subsequent progressive thrombosis.

Methods: Between January, 2008 and December, 2010, a total of 1035 aneurysms in 898 patients were treated by endovascular coiling. Of these, 210 small aneurysms displayed filling of the sac by contrast immediately after coil embolization. TOF-MRA (at 6, 12, 24 and 36 months) and digital subtraction angiography (as needed) were used for postoperative monitoring. Complete occlusion of these aneurysms at the 6-month follow-up point was attributed to progressive thrombosis.

Results: In 186 (88.5%) of the 210 aneurysms that showed filling of the sac with contrast, complete occlusion was observed on follow-up imaging studies at 6 months. Multiple logistic regression analysis indicated that progressive thrombosis was linked to aneurysmal neck diameter ≤ 4 mm ($p < 0.001$) and packing density > 30 % ($p = 0.016$). Aneurysms originating from non-branching vessel were of marginal statistical significance ($p = 0.056$). In 179 progressively thrombosed aneurysms with follow-up evaluations of ≥ 12 months (mean, 31.9 ± 7.6 months), 168 aneurysms (93.9%) exhibited stable occlusion, whereas minor recanalization was observed in six (3.3%) instances, and major recanalization occurred in five (2.8%).

Conclusion: In aneurysms where filling of the sac with contrast was demonstrable after coil embolization, aneurysms with small neck diameter, with high coil packing density, or non-branching aneurysm seem predisposed to progressive intra-aneurysmal thrombosis over the course of time.

What's the Reliability and Significance of Pre-coiling CT Angiography in Ruptured Cerebral Aneurysms?

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Objective: The endovascular coiling of cerebral aneurysm is fundamentally based on exact evaluation of aneurysm size, shape and so-called working angle of procedure. Nowadays, as initial surveillance procedures, CT angiography has been performed prior to endovascular coiling of ruptured aneurysms. We retrospectively compared the initial CT angiography and initial working angle angiography focusing to interval changes, chosen treatment modality and its results.

Methods: One hundred twenty two patients, each with ruptured cerebral aneurysm(s), underwent endovascular coiling procedure between 2012 Jan and 2014 Nov. Immediately after recognition of subarachnoid hemorrhage (SAH) symptom or mental change, CT angiography was checked as initial diagnostic procedure. After confirmation of SAH, catheter angiography was performed for decision making. We compared the CT angiography and catheter angiography and subgrouping was performed same as follows ; Group 1=no changes, group 2=smaller aneurysm at catheter angiography, group 3=larger aneurysm at catheter angiography.

Result: The mean age was 53.9 years and female patients were dominant (80 cases). The mean interval of getting first image between CT angiography and catheter angiography was 115 minutes. Group 1 was 107 cases (87.7%). Group 2 was 11 cases (9.0%). Group 3 was 4 cases (3.3%). In group 2, the specific aneurysm location did not exist. Rather, "narrow neck with saccular dome" pattern was dominant (6 cases ; 54.5% of group 2). The coiling procedures were successful in 9 cases (81.8%) in group 2, and one case of failed coiling showed typical discrepancy between CT angiography and catheter angiography. In group 3, specific aneurysm location could be found definitely ; the dorsal wall of internal carotid artery was dominant (3 cases ; 75% of group 3). In both groups, coiling procedures could be performed effectively based on working angle angiography as well as CT angiography.

Conclusion: The discordance between CT angiography and catheter angiography was infrequent, but in these cases, mutual supplement is critical for exact decision making and safe endovascular coiling procedure. The CT angiography should be performed with same importance of working angle angiography.

Keyword: Cerebral aneurysm, Computerized tomography angiography, Endovascular coiling

Complex Techniques of Coil Embolization for Bifurcation Aneurysms

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Objective: The purpose of this study is to investigate the clinical and angiographic results of complex techniques of coil embolization for bifurcation aneurysms.

Methods: From Jan. 2007 to Sep. 2014, 92 patients (32 males, 60 females, mean age: 60.3±10.9 years) with intracranial aneurysms were treated with detachable coil and/or stent. Thirty of 92 patients presented with subarachnoid hemorrhage (SAH) and the other 62 presented without SAH. Seventy aneurysms were located in the anterior circulation and the other 22 in the posterior circulation. Clinical and angiographic outcomes and procedure-related complications were analyzed retrospectively.

Result: The mean size and Aspect ratio (Dome/Neck) were 6.3±3.7mm and 1.3±0.4 respectively. Fifty-eight cases (63%) were treated with stent-assisted technique and 34 cases (58.6%) of these were with jail technique. Twenty-one cases (22.8%) were treated with multiple catheter technique. Complete or near complete occlusion was achieved in 87 (94.6%) aneurysms, incomplete occlusion in 4 (4.3%), and failed to coil embolization in one case (1.1%). Permanent complications were occurred in 6 (6.5%) cases including postoperative rebleeding during the perioperative period. Clinical follow-up achieved in 81 of 92 (88.0%) patients, and there has been no SAH during the follow-up period (32.8±25.1months). Angiographic follow-up in 53 of 92 (57.6%) patients, recanalization were found in only 2 cases (3.8%), and in the other 51 cases (96.2%), no change or even remodeling were found.

Conclusion: Though endovascular treatment of bifurcation aneurysms was technically complex and difficult, it appears to be a satisfactory treatment option with the aids of careful planning and multiple stent/catheter techniques.

Keyword: Cerebral aneurysm, Bifurcation aneurysm, Coil embolization, Stent-assisted technique, Multiple catheter technique

Rebleeding of Ruptured Intracranial Aneurysms at Immediate Postoperative Period After Coil Embolization

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Objective: Although early rebleeding after coil embolization of ruptured intracerebral aneurysms is rare, the results of rebleeding have been reported to be serious and fatal. The authors investigated the incidence, angiographical and clinical characteristics of early rebleeding of ruptured aneurysms that occurred at immediate postoperative period after coil embolization.

Methods: We analyzed the patients who suffered from aneurysmal subarachnoid hemorrhage and were treated with coil embolization. We excluded the patients of dissecting aneurysm, blood blister like aneurysms, fusiform aneurysms, and pseudoaneurysms. Total 330 consecutive patients were included in this study. Among them, we reviewed the clinical and radiological data of 7 patients who showed acute rebleeding within 3 days of coil embolization.

Result: The incidence of acute rebleeding of ruptured intracranial aneurysms at immediate postoperative period after coil embolization was 2.1% (7/330). The radiological characteristics were as followings - location of anterior communicating artery (ACoA, 71.4%, 5/7); presence of intracerebral hemorrhage (ICH, 71.4%, 5/7); neck to dome ratio under 2 (42.9%, 3/7); presence of bleb (42.9%, 3/7); good treatment results of total or near total occlusion of aneurysms (85.7%, 6/7). And we also observed the discrepancy of aneurysm size between computed tomography angiography (CTA) and cerebral angiogram in 1 patient, and coil loop protrusion outside to the sac in 1 patient. We used the thrombolytic agent during procedure in 1 patient, and continued anticoagulant in 2 patients. The outcome of rebleeding patients was very poor (GOS 1, 85.7%, 6/7).

Conclusion: The prognosis of early rebleeding was very poor. The location of ACoA, presence if ICH and bleb, adverse events during procedure were probably related to early rebleeding of ruptured intracranial aneurysms at immediate postoperative period after coil embolization.

Keyword: Early rebleeding, Subarachnoid hemorrhage, Coil, Intracerebral aneurysm

Relationship Between Two Types of Coil Packing Densities Relative to Aneurysm Size

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Objective: Coil packing density (PD) can be calculated via a formula (PDF) or software (PDS). Two types of PD can be different each other for same aneurysm. This study aimed to evaluate the inter-observer agreement and relationships between the two types of PD relative to aneurysm size.

Methods: Consecutive 420 saccular aneurysms were treated with coiling. PD (PDF, [coil volume]/[volume calculated by formula] and PDS, [coil volume]/[volume measured by software]) was calculated and prospectively recorded. Inter-observer agreement was evaluated between PDF and PDS. Additionally, the relationships between PDF and PDS relative to aneurysm size were subsequently analyzed.

Result: Inter-observer agreement for PDF and PDS was excellent (Intraclass correlation coefficient, PDF; 0.967 and PDS; 0.998). The ratio of PDF and PDS was greater for smaller aneurysms and converged toward 1.0 as the maximum dimension (DM) of aneurysm increased. Compared with PDS, PDF was overestimated by a mean of 28% for $DM < 5\text{mm}$, by 17% for $5\text{mm} \leq DM < 10\text{mm}$, and by 9% for $DM \geq 10\text{mm}$ ($P < 0.01$).

Conclusion: Inter-observer agreement for PDF and PDS was excellent. However, PDF was overestimated in smaller aneurysms and converged to PDS as aneurysm size increased.

Keyword: Aneurysm, Coiling, Packing density.

Delayed Ischemic Stroke After Stent-assisted Coil Placement in Cerebral Aneurysm: Characteristics and Optimal Duration of Preventative Dual Antiplatelet Therapy

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Objective: To evaluate characteristics of delayed ischemic stroke after stent-assisted coil placement in cerebral aneurysms and to determine the optimal duration of dual antiplatelet therapy for its prevention.

Methods: This retrospective study was approved by the institutional review board, and the requirement to obtain written informed consent was waived. Of 1579 patients with 1661 aneurysms, 395 patients (25.0%) with 403 aneurysms (24.3%) treated with stent-assisted coil placement were included and assigned to groups stratified as early (126 patients [31.9%]; 3 months of coil placement), midterm (160 patients [40.5%]; 6 months), or late (109 patients [27.6%]; 9 months), according to the time points of switching dual antiplatelet therapy to monotherapy from coil placement. Cumulative rates of delayed ischemic stroke in each group were calculated by using Kaplan-Meier estimates that were compared with log-rank tests. Risk factors of delayed ischemic stroke were identified by using Cox proportional hazard analysis.

Result: Delayed ischemic stroke occurred in 3.5% of all cases (embolism, 3.0%; thrombotic occlusion, 0.5%) within 2 months following the switch. Late switch yielded no delayed ischemic stroke, unlike early (seven of 126 patients [5.6%]; $P = .013$) or midterm (seven of 160 patients [4.4%]; $P = .028$) switch. Incomplete occlusion (hazard ratio, 6.68 [95% confidence interval: 1.490, 29.900]) was identified as a risk factor.

Conclusion: Delayed ischemic stroke after stent-assisted coil placement is caused by embolism from or thrombotic occlusion of stent-containing vessels after switching from dual antiplatelet therapy to monotherapy. The stent-containing vessel with incomplete aneurysm occlusion presents as a long-term thromboembolic source. Therefore, dual antiplatelet therapy for more than 9 months and late switch to monotherapy are recommended for its prevention.

Keyword: Stroke, Stent, Coil.

Solitaire Stent-assisted Chemical Angioplasty for Resistant Vasospasm in SAH Patients

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Objective: To report our experience with Solitaire-assisted chemical angioplasty for medically refractory vasospasm in patients with subarachnoid hemorrhage.

Methods: We evaluated the retrospective series of initial 11 patients with subarachnoid hemorrhage and symptomatic vasospasm refractory to chemical only angioplasty who were treated with Solitaire-assisted chemical angioplasty. Immediate and follow-up angiographic results, procedure-related complications, and clinical outcomes were assessed.

Result: From April 2011 to August 2014, 11 patients with refractory vasospasm underwent chemical angioplasty assisted with Solitaire stent. There were 8 women (72%); patients were 40 to 85 years of age. A total of 25 vessels were angioplastied (18 proximal and 7 distal). Low dose of vasodilator (Nicardipine) was infused before (18 proximal vessels, 72%) or after (7 distal vessels) temporary deployment of Solitaire stent. Two cases of procedure-related thrombosis and one case of vessel injury occurred. Repeated treatment was needed for 7 patients. Good outcomes or no vasospasm-related aggravation was observed in 9 (82%) patients.

Conclusion: Solitaire stent-assisted chemical angioplasty for SAH-induced vasospasm can be considered as another option for medically resistant vasospasm, especially for distal vessels.

Keyword: Vasospasm Subarachnoid Hemorrhage Solitaire Angioplasty.

Fate of MCA Perforators After Stent Assisted Angioplasty in Patients with Symptomatic MCA Stenosis: 10-year Experience in a Single Center

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Purpose: The purpose of this study is to investigate the clinical features of MCA perforator infarction after stent-assisted angioplasty using balloon-mounted stents in patients with symptomatic MCA stenoses.

Methods: From July 2004 to June 2014, 107 patients underwent primary stent-assisted angioplasty using balloon-mounted stents for the treatment of symptomatic MCA stenoses. Technical success was defined as residual stenosis rate <50%. Postoperative diffusion-weighted MRI was done between 2 and 6 hours after stent deployment in patients with technical success. Procedure-related perforator infarction was defined as below: 1. New-developed lesion in the MCA perforator territories, 2. hypersignal intensity on DWI, 3. hyposignal intensity on ADC mapping image, 4. Isosignal intensity on FLAIR. Medical records and radiologic images were reviewed by two independent investigators who were not involved in the procedures.

Results: In all of 107 patients, stent deployment was successful in 102 patients and technical success rate was 95.3%. In 102 patients with technical success, perforator infarction was found in three patients and the perforator infarction rate was 2.9%. In three patients with perforator infarction, two had putamen infarction and all of them were asymptomatic. The other patient was symptomatic, which was due to the infarction of the posterior limb of the internal capsule. In that case, a microwire induced arterial perforation, which resulted in vasospasm and in-stent thrombosis subsequently.

Conclusions: In this series of perforator infarction after symptomatic MCA stent-assisted angioplasty using balloon mounted stents, the MCA perforator infarction rate was 2.9% (3/102) and the symptomatic MCA perforator infarction rate was 1% (1/102). Meticulous device manipulation is essential to avoid this complication and more clinical experience is mandatory.

Keywords: MCA stenosis. Stent assisted angioplasty. Perforator infarction.

Compare the Clinical Results of the Intra-arterial Thrombolytic Therapy, According to the Perfusion/diffusion-mismatching & Intravenous tPA Use or Not

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Objectives: Intra-arterial thrombolysis (IA-Tx) and advanced dynamic imaging studies, have been adopted for the ischemic stroke patient treatment. Many patients are treated with intravenous tissue plasminogen (IV-tPA) but this treatment is not always feasible. In this study, IA-Tx was used for patients for whom IV-tPA was not indicated or when IV-tPA didn't result in recanalization.

Methods: A total of 156 patients treated with IA-Tx were retrospectively reviewed. Of these, 72 patients were treated with a full dose of IV-tPA before receiving the IA-Tx, the remaining 84 patients received IA-Tx only. An initial imaging study using CT-angiography and acute stroke MRI followed. Patients' demographics and clinical results were recorded and compared according to the P/D-mismatching and IV-tPA.

Results: Among P/D-mismatched patients, the recanalization rate was 80% and the symptomatic intracranial hemorrhage (sICH) rate was 14.5%, while among P/D-matched patients, the rate were 63% and 41.3% respectively ($p < 0.05$). A favorable clinical outcome occurred in 49.1% of P/D-mismatched, but only in 21.7% of P/D-matched patients ($p < 0.05$). Among patients who were treated with IV-tPA before undergoing IA-Tx, the recanalization rate was 79.2% and the sICH rate was 27.8%, while it was 71.4% and 17.9% in patients who didn't receive IV-tPA ($p < 0.05$).

Conclusions: Patients who have P/D-mismatching and treated with IA-Tx have higher recanalization rates, greater probability of a favorable outcome than patients who have P/D-matching and didn't receive IA-Tx. For patients who don't successfully recanalization after IV-tPA or who are not indicated for IV-tPA, authors recommend IA-Tx after undergoing appropriate imaging evaluation.

Keywords: Thrombolysis. Perfusion/Diffusion mismatching. Recanalization.

2014년도 대한뇌혈관내수술학회 정기학술대회 및 총회

Free paper III (Ischemia and other session)

좌장 : 가톨릭대 유도성, 한양대 이형중

IA Thrombolysis for Tandem Occlusive Lesion in Acute Ischemic Stroke

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Objective: Tandem vascular occlusion is rarely present in acute ischemic stroke. But it has clinical importance because of its high morbidity and mortality. We present 7 cases of tandem occlusive cerebrovascular lesion that treated with endovascular approach in our hospital between 2012 and 2014.

Methods: We gathered pre- and post-procedural information of patients. Pre-procedural NIHSS, whether to use of IV tPA were evaluated. Post-procedural TICI grade after endovascular treatment, whether to use of post-procedural antiplatelet agent, presence of procedure-related hemorrhage, mRS score at discharge were retrospectively collected. Classically, there was two approaches in endovascular treatment of tandem occlusive lesion, including antegrade and retrograde approach. We tried combined approach (balloon angioplasty for proximal stenosis first, distal thrombectomy, and then stenting for proximal stenosis) in 6 patients, and tried antegrade approach in 1 patient.

Result: Among the 7 patients, 5 patients had proximal ICA stenosis and distal occlusion, 2 patients had vertebral artery stenosis and basilar artery occlusion. Mean NIHSS score at visit was 13(5~19). 4 patients (57.1%) was treated with IV tPA prior to endovascular treatment, other patients was not treated because time limitation. Complete revascularization (TICI grade 3) achieved in 5 patients (71.4%). And partial recanalization (TICI grade 2A) achieved in 2 patients. Post-procedural dual antiplatelet agent (Aspirin + Plavix) was used in 4 patients. One patient was treated with aspirin only because the patient had scanty post procedural hemorrhage. 2 patients was not treated with antiplatelet agent because their poor general conditions. Mean mRS score at discharge was 3.7. Procedure-related hemorrhage occurs in 2 patients (28.6%).

Conclusion: Still there are no consensus for IA thrombolysis and post-procedural medication. We think endovascular combined approach and use of post-procedural dual antiplatelet agent has possibility of good procedural options.

Keyword: Stroke, Tandem, Endovascular, Thrombolysis.

Stent-Assisted Angioplasty for Severe Stenosis of the Intracranial Extradural Internal Carotid Artery Causing Transient Ischemic Attack or Minor Stroke

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Objective: The purpose of this study is to assess the technical feasibility and clinical efficacy of stent-assisted angioplasty (SAA) for symptomatic stenosis of the intracranial extradural (petrous and cavernous) internal carotid artery (ICA).

Methods: Review of medical records identified 26 consecutive patients who underwent SAA using a balloon-expandable coronary stent (n=15, 57.7%) or a Wingspan self-expandable stent (n=11, 42.3%) for treatment of severe stenosis (>70%) involving the intracranial extradural ICA. The inclusion criteria were transient ischemic attack with an ABCD2 score of ≥ 3 (n=12, 46.2%) or minor stroke with a NIHSS score of ≤ 4 (n=14, 53.8%). Technical success rates, complications, and angiographic and clinical outcomes were analyzed retrospectively.

Result: SAA was technically successful in all patients. The mean stenosis ratio decreased from 77.1% to 10.0 % immediately after SAA. The overall incidence of procedural complications was 23.1%, and the postoperative permanent morbidity/mortality rate was 7.7%. A total of 22 patients were tracked over an average period of 29.9 months. During the observation period, 20 patients (90.9%) had no further cerebrovascular events and stroke recurrence occurred in two patients (9.1%), resulting in an annual stroke risk of 3.7%. Two cases (11.1%) of significant in-stent restenosis (>50%) were found on follow-up angiography (n=18).

Conclusion: SAA for severe stenosis(>70%) involving the intracranial extradural ICA showed a good technical feasibility and favorable clinical outcome in patients with transient ischemic attack or minor stroke.

Keyword: Stents, Angioplasty, Carotid stenosis, Transient ischemic attack, Stroke.

Incidence and Risk Factors for Diffusion-Weighted Imaging (+) Lesions After Intracranial Stenting and Its Relationship With Symptomatic Ischemic Complications

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Objective: Little is known about high-signal lesions in magnetic resonance diffusion-weighted imaging (DWI [+]) after stenting for intracranial atherosclerotic stenosis. This study aimed to evaluate the incidence, distribution, risk factors, and clinical implications of DWI (+) after intracranial stenting.

Methods: A total of 123 patients (male:female = 88:35, mean age, 64.1 years) with symptomatic intracranial atherosclerotic stenosis (mean stenosis, 76.1% $\pm$ 7.7%) underwent both stenting and poststenting DWI. The incidence, distribution (embolic-alone versus stenosis-associated perforator/mixed), and risk factors of DWI (+) and its relationship with symptomatic ischemic complications (SIC, including stroke or transient ischemic attack) were retrospectively evaluated.

Result: Forty-three patients (35.0%) had DWI (+). Middle cerebral artery, smaller distal parent artery, and treatment-related dissection were independent risk factors for DWI (+) ($P < 0.05$). SIC occurred in 4 patients (3.3%), all of whom had DWI (+). Of the patients with DWI (+), neither the number nor the volume of DWI (+) differed significantly between SIC and asymptomatic patients: median number/patient, 3.5 (range, 2 - 11) versus 2.0 (range, 1 - 11) and median volume/patient, 329.8 mm³ (range, 76 - 883.5mm³) versus 119.5mm³ (range, 32.5 - 873.0mm³). However, SIC occurred more frequently in the stenosis-associated perforator/mixed type (3/11, 27.3%) than in the embolic-alone type (1/32, 3.1%; $P < 0.05$).

Conclusion: The incidence of DWI (+) after intracranial stenting for intracranial atherosclerotic stenosis was 35.0%. Middle cerebral artery, smaller distal parent artery, and treatment-related dissection were independent risk factors for DWI (+). SIC occurred more frequently in the stenosis-associated perforator/mixed type than in the embolic-alone type.

Keyword: Diffusion magnetic resonance imaging, Intracranial atherosclerosis, Stents, Stroke.

Jostent Covered Stent Placement for Emergency Reconstruction of Ruptured Carotid Artery During or After Transsphenoidal Surgery

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Objective: Internal carotid artery (ICA) rupture during transsphenoidal surgery (TSS) is an extremely difficult complication to treat. This study aimed to evaluate the immediate and long-term outcomes of covered stent placement for emergency reconstruction of ruptured ICAs during or after TSS.

Methods: Seven patients underwent covered stent placement for emergency reconstruction of a ruptured ICA during or after TSS. The safety and effectiveness of covered stent placement for emergency reconstruction of ruptured ICAs were retrospectively analyzed.

Result: Pretreatment angiogram showed active bleeding in 6 patients (5 intraoperative and 1 postoperative) and a pseudoaneurysm in 1 patient. Of the 6 patients with active bleeding, 5 were treated with a successive operation to control active bleeding. The other patient was treated just after cardiopulmonary resuscitation due to massive nasal bleeding 20 days after revision of TSS. All active bleeding was controlled immediately after covered stent insertion in these 6 patients. One patient showed a gap between the covered stent and ICA wall without active bleeding 30 minutes after glycoprotein IIb/IIIa inhibitor administration due to in-stent thrombosis. The gap was occluded with coiling after completion of the temporarily held TSS. The 7th patient, whose ICA tear was treated with surgical suture, underwent covered stent placement for a pseudoaneurysm detected on postoperative day 2. During a mean follow-up period of 46 months (range, 12 - 85 months), all patients had excellent outcomes (modified Rankin scale, 0 or 1). All the stented ICAs were patent on vascular imaging follow-up at a mean of 34 months (range, 12 - 85 months).

Conclusion: Covered stents appear to be a safe and effective option for emergency reconstruction of ruptured ICAs during or after TSS.

Keyword : Covered stent, Transsphenoidal surgery, Internal carotid artery rupture.

Balloon Angioplasty of Contralateral Transverse Sinus for Transvenous Embolization of Transverse-sigmoid Dural AV Fistula (DAVF) : A Case Report

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Objective: We report a case of transverse-sigmoid DAVF with occlusion of ipsilateral sigmoid sinus and contralateral transverse sinus which was treated with transvenous embolization after balloon angioplasty of contralateral transverse sinus. So we would like to discuss endovascular decision-making in this subset.

Methods: A 57-years-old woman was admitted to our hospital with a seizure, right hemiparesis and visual disturbance. On initial MRI, cerebral infarction was found as well as marked dilatation of cortical vein. Angiography showed DAVF on the left transverse-sigmoid sinus with prominent cortical venous reflux and occlusion of ipsilateral sigmoid sinus and contralateral transverse sinus. Immediately after angiography, she had a GTC type seizure and showed a decrease of mentality. We performed a mechanical recanalization of the occluded right transverse sinus by balloon angioplasty. Subsequently, the microcatheter was advanced into the fistulous point at the left transverse-sigmoid region through the recanalized right transverse sinus. Embolization of the fistula was then accomplished by filling with detachable coils and multiple pushable coils.

Result: After this procedure, we could find a restoration of antegrade venous drainage as well as complete occlusion of the fistula. The patient was managed conservatively and discharged uneventfully. We followed up the patient for approximately 3 months, and the patient had complete resolution of symptoms and signs. Follow-up MR imaging study showed a marked diminution of the cortical reflux and we found no evidence of a recruitment of fistulous connections.

Conclusion: Recent studies have shown very good outcome for occluding DAVF via a transarterial route by using liquid embolic agents. However, this route may not always be feasible. Especially, the patients with intracranial hypertension should be considered not only to obliterate the fistula but also to restore a normal cerebral venous drainage. For properly selected patients, cure of the lesions can be achieved with this method with low risk of morbidity.

Keyword: Balloon angioplasty, Transvenous embolization, Transverse-sigmoid dural AV fistula, Cerebral venous sinus occlusion,

Endovascular Treatment of Dural Arteriovenous Fistulas; Single Center Experience

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Objective: Treatment of intracranial dural arteriovenous fistulas (dAVFs) is still challenging. However, after introduction of Onyx for the treatment of dAVFs, transarterial approach is preferred treatment option in many centers. The authors report their experience of dAVFs embolization with special emphasis on transarterial approach.

Methods: Seventeen embolization procedures were performed in 13 patients with dAVFs between Jan 2009 and Oct 2014. Clinical symptoms, location and type of fistulas, embolization methods, complications, and radiological outcomes were evaluated using clinical chart and PACS images.

Result: All 13 patients had symptomatic lesions. Pulsatile tinnitus was most common followed by seizure, intracerebral hemorrhage, exophthalmos, motor weakness. The locations of fistulas were transverse-sigmoid sinus in 6, cavernous sinus in 3, middle fossa dura in 3, and superior sagittal sinus in 1 patient. Cognard types were as follows; I in 4, IIa in 3, IIa+IIb in 4, III in 1, and IV in 1. Embolization procedures were performed twice or more in 3 patients. Transvenous approach was tried in 5 patients with or without transarterial approach (one surgical sinus puncture, two transvenous followed by transarterial, one transarterial followed by transvenous, one transvenous only). Nine patients were treated with transarterial Onyx embolization only. One of these required direct surgical exposure and puncture of middle meningeal artery. Complete obliteration of fistulas was achieved in 10/13 (80%) patients after multimodality treatment. Onyx migration into cerebral artery was developed in one patient with cavernous sinus dAVF, who was treated with transarterial Onyx injection after failed transvenous approach. Open surgical removal of migrated Onyx cast after unsuccessful endovascular retrieval resulted in good clinical outcome.

Conclusion: Transarterial Onyx embolization can be a first line therapeutic option in patient with dAVFs. However, transvenous approach should be tried first in cavernous sinus dAVF because of the risk of intracranial migration of liquid embolic materials. Furthermore, combine surgical endovascular approach can be considered as a useful option in case of inaccessible endovascular route.

Keyword: Dural arteriovenous fistula, Endovascular embolization, Onyx.

Ruptured Cerebral Proliferative Angiopathy

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Objective: Cerebral proliferative angiopathy is a rare and peculiar type of cerebral vascular malformation characterized by diffuse network with normal brain tissue intermingled, multiple nondominant arterial feeders, relatively small draining veins, angiographic capillary angioectasia and vascular proliferation. It should be separated from cerebral AVMs in angioarchitecture, nature history, clinical presentation.

Methods:

Result: In our case, we present a 61-year-old male patient who suffered headache with left side weakness and his brain radiographic images showed characteristics of ruptured cerebral proliferative angiopathy. We treated him through endovascular method. We also present a literature review of cerebral proliferative angiopathy.

Conclusion:

Keyword: Cerebral proliferative angiopathy.

The Utility and Technical Consideration of Spinal Angiography: Importance of Cooperation with Spine Surgeons

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Objective: Although endovascular approach is a useful option for treatment of spinal diseases, endovascular neurosurgeons haven't had many opportunities to use this approach in spinal lesions. We investigated our institutional experience with spinal endovascular procedures before surgical operation.

Methods: From Mar. 2013 to Sep. 2014, seventeen patients underwent twenty-four spinal endovascular procedures before surgical operation. Nine patients were males and mean age was 56.7(from 28 to 84). There were fourteen cases of catheter angiography and ten cases of embolization. We investigated location, diagnosis, and described case presentation.

Result: Out of total twenty-four cases, there were four cases with cervical, eighteen cases with thoracic, and two cases with lumbar spine lesion. Six cases were spinal cord tumor and ten cases were spinal arteriovenous fistula (AVF). Eight cases were spinal metastasis, which originated from lung, prostate, breast, gastric, hepatic and renal cancer. Polyvinyl alcohol (PVA) particle was used for all embolization in metastatic spinal tumors. Coil and N-butyl cyanoacrylate (NBCA) were used for embolization of spinal AVF. No patients had procedure-induced complications. However, in patients with spinal AVF, the paraesthesia (chief complaint) did not improve after embolization.

Conclusion: When we treat spinal lesions, cooperative approach with endovascular and surgical specialists working closely together is paramount to achieve the best results.

Keyword: Spinal angiography.

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Poster

Knotting of coil During Endovascular Coil Embolization for Ruptured Basilar Artery Aneurysm: A Case Report

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Objective: This report describes a case of knotting of coil during endovascular coil embolization for ruptured basilar artery aneurysm.

Methods: A 61-year-old woman was admitted to our hospital with an acute severe headache and vomiting. Neurological examination showed an alert mental state and absence of focal neurological deficits. A computed tomography head scan showed about 2 cm sized high density lesion in prepontine area. Three-dimensional computed tomographic angiography and conventional cerebral angiography showed about 14mm large aneurysm with wide neck and about 4.5 mm small aneurysm at basilar artery proximal portion.

Result: We performed endovascular coil embolization for those aneurysms. The small aneurysm was first coiled successfully. When we performed the coil embolization for large aneurysm, knotting and stretching of first coil occurred. We left stretched coils in the vessel from basilar artery to femoral artery and stretched coil was cut and buried in the femoral subcutaneous portion. And we retried and successfully finished the endovascular coiling. The patient did not show any neurological deficits after the procedure. The patient was managed conservatively and discharged uneventfully.

Conclusion: Knotting of coils during endovascular coil embolization for cerebral aneurysm can happen although it is very rare. The mechanism is not unknown. However, it may be important to select proper coils for aneurysms and to have a good shape and position of the microcatheter tip.

Keyword: Coil knotting, Coil stretching, Cerebral aneurysm.

A Single Center Experience of Carotid Artery Stenting

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Objective: Carotid artery stenting (CAS) has gained popularity as an alternative to carotid endarterectomy in patient with carotid artery stenosis. The authors evaluate the safety and efficacy of CAS to prevent recurrent stroke in a single center.

Methods: One-hundred and seventy-three CAS procedures in 145 patients were performed from Jan 2007 to Nov 2013. Patient clinical and radiological variables including presenting symptoms, stenosis degree, procedure related complications, remaining stenosis, in-stent restenosis were examined.

Result: Of 173 CAS procedures, 71.4% was performed for symptomatic stenosis. Bilateral lesions were treated in 24 patients. All procedures except 1 were performed under the distal protection. In 96% of procedures stent implantation was successful. Debris was captured in 27.3% of the procedures. The incidence of newly developed high signal intensity lesion on postoperative diffusion MRI was 11.5% (20 patients). The periprocedural major and minor stroke rates were 4% (7 patients). The hyperperfusion syndrome occurred in 5 patients (2.8%) including two hyperperfusional ICH, which were evacuated surgically. The periprocedural major stroke or death rate was 1.7% (3 patients). Median clinical follow-up was 24 ± 12 months. Median angiographic follow-up was 19 ± 12 months. Restenosis rates for symptomatic and asymptomatic stenoses were 1% and 2.8% (5 patients), respectively. Three patients (1.7%) required restenting due to the in stent restenosis or stent shortening. Complication rate decreased markedly with increasing experiences (for recent 3 years the major or minor stroke rate was 1.8% (1/94). Excluding perioperative (<30 days) events, the average annual major and minor stroke rate for 7 years was 0.5% (1 patient).

Conclusion: The CAS under the distal protection seems to be safe and effective carotid revascularization procedure to prevent recurrent stroke.

Keyword: Carotid stenting, Hyperperfusion syndrome, Complications.

Intracranial Hemorrhage (ICH) Following Carotid Artery Stenting (CAS)

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Objective: Intracranial hemorrhage seldom occurs after revascularization via endovascular approach. Authors reports two cases of these intracranial hemorrhages. Although ICH and hyperperfusion syndrome can complicate carotid revascularization, these complications occurs infrequently following CAS. We present two cases of ICH following CAS.

Methods: CASE 1. Left upper extremity mono-paresis occurred to 71-years-old female patient who had been treated with arterial hypertension and DM (Diabetes Mellitus). Multi-focal cerebral infarctions and right ICA stenosis on cavernous portion were revealed on brain MRI images. Authors performed cerebral angiography and balloon angioplasty to ICA stenosis. Mono-paresis progressed from G IV to G I after 6 hours . SAH on basal cistern and ICH on central sulcus were founded on brain CT scan. There was not any vascular lesion on follow up cerebral angiography. CASE 2. A 79-years-old female patient with left hemi-paresis had occurred 10 hours ago has visited to our institute. The brain MRI with diffusion image showed acute cerebral infarction on right cerebral hemisphere. The multiple infarction areas were showed on water-shade zone. An anti-platelet agent and hydration made improvement to patient's neurological sign. After that, a cerebral angiography revealed very severe stenosis on right bifurcation of ICA. The carotid artery stent insertion was done after balloon angioplasty. A successful CAS (Carotid Artery Stenting) was confirmed. There was not any neurological change to patient. After 3 hours, mental deterioration to patient occurred; a massive cerebral hemorrhage was showed on following brain CT.

Result: Intracranial hemorrhage from revascularized cerebral infarction area is rare complication. Average rate of hyper-perfusion syndrome is 0.67% of carotid artery stent insertion cases.

Conclusion: Hyper-perfusion syndrome can occur to any patient with carotid artery stent insertion. Its incidence is 0.67%. Especially, the risk factors of hyper-perfusion syndrome are a severe carotid stenosis, severe contra-lateral ICA stenosis or occlusion, poor intracerebral collaterals, elevated MCA velocities following the procedure, and concurrent arterial hypertension. Patients with these risk factors might require more intensive monitoring and aggressive blood pressure control after procedure.

Keyword: Hyperperfusion syndrome, Reperfusion injury, ICA stenosis, Revascularization.

Rapidly Progressive Dissecting Aneurysm on Posterior Communicating Artery

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Objective: Dissecting aneurysm of the posterior communicating artery is a rare, but dangerous lesion that carries a high morbidity and mortality rate. The progressive lesion in short period is an extremely rare, and there has been no case report as far the authors know. We present diagnosis and treatment experience of 49-year-old woman with rapidly progressive dissecting aneurysm on posterior communicating artery that was not found on initial angiography.

Methods: The patient presented with sudden bursting headache, and visited the emergency room. The neurological deficit was not noticed except meningeal irritation sign, and computed tomography revealed thin subarachnoid on basal cisterns. The conventional angiography did not show any intracranial aneurysm or dissection at all. The headache was aggravated although conservative management was done, and follow up angiography was performed nine days later. The fusiform dilatation which was not shown on previous angiography was found on posterior communicating artery. It was diagnosed as a rapidly progressive dissecting aneurysm.

Result: The posterior communicating artery was well developed, but posterior cerebral artery was mainly supplied from vertebrobasilar system. The occlusion and damage to the thalamoperforating arteries from posterior communicating artery was the most concerned complication, but the authors the occlusion might be safe because the segment was already injured from dissection. The coil embolization to occlude the dissecting segment was successful without any complication. And the patient discharged without any problem.

Conclusion: Subarachnoid hemorrhage with rapidly progressive dissecting aneurysm on posterior communicating artery can be treated with coil embolization without complication.

Keyword: Dissecting aneurysm, Subarachnoid hemorrhage, Endovascular procedures.





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