

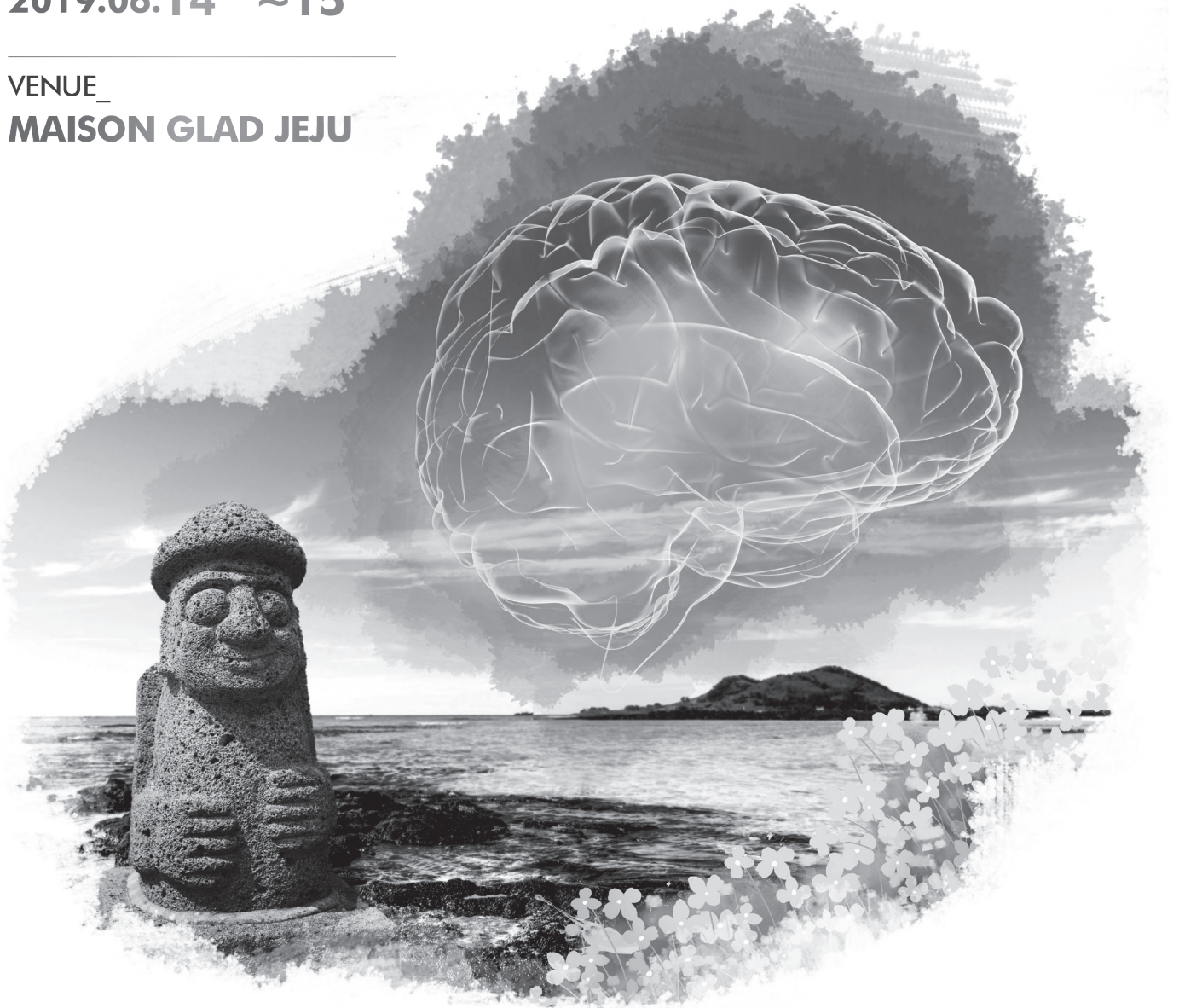
The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty

DATE_
2019.06.14^{FRI} ~ 15^{SAT}

VENUE_
MAISON GLAD JEJU





모시는 글

INVITATION



존경하는 대한뇌혈관내수술학회 회원 여러분!

작년 강릉에서 성황리에 진행했던 ASCENT가 올해는 아름다운 섬 제주에서 6월 14-15일 양일간 개최됩니다. 이번 제주에서 진행될 ASCENT 2019는 "for ascent beyond uncertainty"라는 테마로 진행됩니다. 그 동안 우리 회원들의 뇌혈관내수술 치료경험과 때로는 떠올리기도 싫었던 아픈 순간들을 공유함으로써 향후 치료에 있어서 든든한 길잡이로 삼고자 합니다. 학회 첫째날 일본 오키나와 토미시로병원의 손재현 선생님을 모시고 "Introducing a New Phase, Detail Finishing, to Cerebral Aneurysm Coil Embolization"이라는 주제로 세미나를 갖고 이어서 뇌동맥류치료의 새로운 컨셉으로 자리잡아가고 있는 flow diverter와 최근 대두되고 있는 flow disrupter에 대해 논의하는 심포지엄을 준비하였으며 양일간 뇌혈관내수술에 주로 사용되고 있는 코일, 스텐트, 카테터 등의 장단점을 공유하고 새롭게 런칭되거나 현재 개발중인 뇌혈관내수술 기구들에 대해 논의하는 세미나를 마련했습니다.

회원 여러분께서 아시다시피 ASCENT는 학술 활동뿐만 아니라 회원상호간의 친교를 도모하자는 목적에도 초점을 맞추고 있습니다. 개최지 제주의 지역적 특성을 고려하여 지역명사 양성철(제이누리 대표)과 함께하는 시간을 가질 예정이고 젊고 열정적인 SKEN 회원들의 적극적인 참여가 이루어질 수 있도록 ASCENT-Travel Grant를 대폭 제공할 계획이며 발표하실 연제의 초록을 준비중인 회원들에게 그 혜택을 드리겠습니다. 또한 자유연제 발표자 중에서 우수한 몇 분을 선정하여 ASCENT-학술상도 수여할 예정이오니 좋은 발표 및 지원을 부탁드립니다. 아울러 이번 ASCENT 2019는 첫째날 오전에 우리 회원들이 잠시 쉬면서 자연을 즐길 수 있는 프로그램을 준비하려고 합니다. 모든 회원들께서 진료와 연구를 위한 빠듯한 시간에서 잠시 벗어나 여유로운 순간을 만끽하시기를 기대합니다. 이번 ASCENT 2019를 제주에서 개최할 수 있도록 알뜰히 준비해주신 신승훈 총무이사님, 알찬 학술프로그램을 완성해주신 장철훈 학술이사님께 감사드립니다. 끝으로 이번 ASCENT 2019의 제주 개최를 위해 물심양면으로 지원해주신 여러 기업회원님들께도 심심한 감사의 말씀을 드립니다.

그럼 여름의 문턱 6월 14일, 제주에서 뵙기를 고대하겠습니다!

대한뇌혈관내수술학회 회장 고 준 석

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

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보험	박석규	순천향대학교 서울병원
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대구/경북지회	강연구	에스포항병원
대전/충청지회	조준성	단국대학교병원
부산/울산/경남지회	정진영	연세에스병원
감사	고준경	부산대학교병원
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2019 대한뇌혈관내수술학회 임원진

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제6대	안성기(작고)	(전) 한림대학교 성심병원
제7대	신용삼	가톨릭대학교 서울성모병원
제8대	권오기	분당서울대학교병원
제9대	김범태	순천향대학교 부천병원
제10대	성재훈	가톨릭대학교 성빈센트병원

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국제교류위원회	남택균	중앙대학교병원
	박정수	전북대학교병원
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	이동훈	가톨릭대학교 성빈센트병원
	정영진	영남대학교병원

6/14 Fri

11:00	Registration	
11:10-12:10	Symposium I: Education session for nurse & technician	좌장_ 유승훈(울산대) / 황교준(분당제생병원)
	1. Current status of EVT in Korea	오재상(순천향대) 10
	2. Neurovascular anatomy	정준호(연세대) 14
	3. Medication (pre, during & post)	김종훈(영남대) 16
12:20-12:30	Opening remark	고준석(대한뇌혈관내수술학회 회장)
	Welcome remark	오창완(대한신경외과학회 이사장)
12:30-13:30	Luncheon seminar	좌장_ 임용철(아주대) / 권현조(충남대)
	1. Endovascular treatments performed collaboratively by the Society of Korean Endovascular Neurosurgeons Members: A nationwide multicenter survey	김태곤(차의과학대) 28
	2. Introducing a new phase, detail finishing, to cerebral aneurysm coil embolization Dr. Jaehyun Son(Tomishiro Central Hospital, Okinawa, Japan)	31
13:30-13:40	Short break	
13:40-14:20	Symposium II	좌장_ 신용삼(가톨릭대)
	1. Flow Diverter, where are we now?	김성림(가톨릭대) 34
	2. Flow Disrupter, where are we going?	강현승(서울대) 36
14:20-15:00	명사초청강연	좌장_ 신승훈(차의과학대)
	제주, 그 또 다른 시선	양성철(제이누리 대표) 44
15:00-15:20	Photo time & Coffee break	
15:20-16:20	Free paper I : "complication case" for aneurysm	좌장_ 김태선(전남대) / 권오기(서울대)
	Case 1. Clinical and radiologic characteristics of ruptured vertebral artery dissecting aneurysms	오세영(인하대) 47
	Case 2. Delayed rupture of fusiform middle cerebral artery aneurysm treated with stent assisted coil embolization in adolescent with previously STA-MCA surgery	신희섭(경희대) 48
	Case 3. Proper management of premature rupture with thrombosed parent artery during coil embolization	김대원(원광대) 49
	Case 4. Missed wire perforation of tiny aneurysm arising from fenestrated A1 segment during the endovascular approach to ACOM aneurysm	고준경(부산대) 50
	Case 5. The fate of the parent vessel partially occluded by the coil	김종연(연세원주의대) 51
	Case 6. Aneurysm rupture after insertion of flow diverter stent	이선주(중앙보훈병원) 52
16:20-17:30	Free paper II: "complication case" for ischemia & others	좌장_ 김범태(순천향대) / 김영우(가톨릭대)
	Case 1. This is disaster after incomplete occlusion of AVF	박정현(한림대) 55
	Case 2. Trans-cranial embolization with direct dural sinus puncture at Hybrid operating room for failed or impossible trans-arterial approach in dural AVF	이호준(가톨릭대) 56
	Case 3. Challenging IA thrombectomy beyond DAWNs trials	엄태웅(울산대) 57
	Case 4. The modified stent retrieval technique for distal migrated embolus via controlling of unsheathing level	전홍준(한림대) 58
	Case 5. Intraprocedural in-stent plaque protrusion during carotid artery stenting	하상우(조선대) 59
	Case 6. Thrombectomy for superior sagittal sinus occlusion	배희진(고려대) 60
	Case 7. Double overlapping stent implantation using LVIS blue stents for a basilar artery aneurysm in a patient with vasculitis	반승필(서울대) 61
17:30-18:00	General assembly	신승훈(대한뇌혈관내수술학회 총무이사)
18:30-20:00	Welcome dinner & ASCENT award ceremony	



6/15 Sat

08:00-09:00	Breakfast seminar	좌장_ 윤석만(순천향대) / 김대원(원광대)
	1. Usefulness of metal coverage for treatment of intracranial aneurysm	박석규(순천향대) 64
	2. Flow diverter for treatment of intracranial aneurysm	진성철(인제대) 66
	3. Contact aspiration & stent delivery	권순찬(울산대) 76
09:00-10:00	Free paper III: "my first case from young gun" in EVT	좌장_ 성재훈(가톨릭대) / 김태곤(차의과학대)
	Case 1. First experience of transarterial Onyx embolization for Spinal AVM	박영기(인제대) 78
	Case 2. A report on the experience of endovascular treatment of a large aneurysm by a novice	김창현(부산대) 79
	Case 3. Treatment of blood blister-like aneurysms with overlapping stents assisted coiling	심재현(PMC박병원) 80
	Case 4. Early rebleeding after coil embolization of ruptured anterior communicating artery aneurysm	김정재(이화여대) 81
	Case 5. Vascular perforation during EVT of cerebral aneurysm	구본섭(울산대) 82
	Case 6. Treatment of vertebral dissecting aneurysm with the low-profile visualized intraluminal support (LVIS) device only	김영지(뉴고려병원) 83
10:00-10:20	<i>Coffee break</i>	
10:20-10:50	Introduction of new devices from company	장철훈(대한뇌혈관내수술학회 학술이사)
10:50-11:50	Free paper IV : "complicated case" in EVT	좌장_ 이창영(계명대) / 정진영(연세메스병원)
	Case 1. Reuse of Neuroform Atlas stent by Reloading technique	문종현(광주기독병원) 87
	Case 2. Ruptured Pcom artery aneurysm combined with large pseudo-sac in old lady	김소연(가톨릭관동대) 88
	Case 3. A2 dissecting rupture treated with stent	박상규(연세대) 89
	Case 4. Optimal microcatheter steam shaping for A3 frontal branch origin aneurysms	권현조(충남대) 90
	Case 5. Is giant AVM curable using maximum endovascular embolization and subsequent nidus removal? A case report and literature review	장동규(가톨릭대) 91
	Case 6. Surgical exposure of the vertebral artery for endovascular access in hybrid operating room	이종영(한림대) 92
11:50	<i>Closing remark</i>	고준석(대한뇌혈관내수술학회 회장)

Poster Session

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발표자 및 좌장 준수사항

발표자 준수사항

1. 한 연제당 발표시간은 아래와 같습니다. 활발한 토론을 위하여 시간을 엄수해 주시기 바랍니다.

Free Paper:

"Complication case" for aneurysm: **한 연제당 10분(5분 발표, 5분 토론)**

"Complication case" for ischemia & others: **한 연제당 10분(5분 발표, 5분 토론)**

"My first case from young gun" in EVT: **한 연제당 10분(5분 발표, 5분 토론)**

"Complicated case" in EVT: **한 연제당 10분(5분 발표, 5분 토론)**

Symposium I: **한 연제당 20분**

Symposium II: **한 연제당 20분**

Breakfast Seminar: **한 연제당 20분**

2. 사전에 (최소한 발표 30분 이전에 회의장으로) 발표하실 자료를 제출바랍니다.

좌장 준수사항

1. 시간을 엄격히 지켜 주십시오.
2. 한두 사람에 의해 토론이 독점되지 않도록 진행하여 주십시오
3. 토론이 없을 경우를 대비하여 좋은 토론 내용을 미리 준비하시기 바랍니다.
4. 주제를 벗어난 부적절한 발언이나 토론 내용은 즉시 제지하여 주시기 바랍니다.

The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty



Symposium I: Education session for nurse & technician

좌장 : 유승훈(울산대) / 황교준(분당제생병원)

1. Current status of EVT in Korea

오재상(순천향대)

2. Neurovascular anatomy

정준호(연세대)

3. Medication (pre, during & post)

김종훈(영남대)

오 재 상

순천향대학교 천안병원 신경외과



학력

1999-2005	순천향 의과대학 의과학 학사
2008-2015	순천향 의과대학 신경외과학 석사
2017-현재	순천향 의과대학 신경외과학 박사중

경력

2005-2006	순천향대 천안병원 인턴
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Current status of EVT in Korea

오재상

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국내 허혈성 뇌졸중 치료의 현황

뇌졸중은 크게 출혈성 뇌졸중과 허혈성 뇌졸중으로 나뉜다. 허혈성 뇌졸중은 전체 뇌졸중의 70%로 많은 비중을 차지하지만 인터벤션이나 수술분야에서 그 치료 방법이 오랫동안 큰 효과를 거두지 못했다. 하지만 전 세계적으로 2015년도 이후 MR CLEAN, ESCAPE, EXTEND-IA, SWIFT PRIME, REVASCAT 연구들이 나오면서 급성 허혈성 뇌경색의 인터벤션 치료는 두드러지게 발전하기 시작했다. 큰대뇌동맥혈관 폐색에 따른 급성 뇌경색 치료는 크게 두 가지가 있는데, 하나는 증상 발생 4.5 시간 이내에 응급실 내원한 환자를 대상으로 한 정맥내 혈전용해제 주입 (IVT; intra-venous t-PA) 이며, 다른 하나는 동맥내 기계적 색전 제거 기술(MT; mechanical thrombectomy)이다. 최근 DIFFUSE, DAWN 연구 이후로 16~24시간 까지 동맥내 기계적 혈전 제거 기술의 적응증이 측부순환이 좋은 환자들에게 연장 되면서 MT 는 더욱 중요한 역할을 하게 되었다.

한국의 뇌졸중 평가 지표 결과(2014~2015년도, 총9개월)에 따르면 중증 급성기 허혈성 뇌졸중 진단으로 이 기간 동안 총 216개의 전국 뇌졸중 센터 병원의 응급실로 내원한 환자는 총 6,612명이였다. 이 중 증상 발생 이후 4.5시간 내 응급실 내원하여 IVT 투여 받은 환자는 약 30%(1,995명)이며, 증상 발생 이후 4.5 시간이 초과되어 IVT 미투여된 환자는 총 70%(4,617명) 이였다. 증상 발생 이후 3시간 이내 병원에 도착한 환자들 중 IVT 와 MT 를 동시에 시행한 환자는 전체의 약 24% 였다. 반면 연구 대상자 중 3시간 이후에 IVT 와 MT 를 동시에 시행한 환자는 3.1%에 불과한 점을 볼 때, 증상발현 후 적어도 3시간 이내에 환자가 도착하여야 IVT 와 MT 를 동시에 시행해 치료효과를 높일 수 있다는 것을 알 수 있다.

한국의 현재 MT 방법으로는 크게 스텐트 보조하 방법과 큰 직경의 카테터 흡입 방법으로 나뉜다. 그 외 두 방법을 모두 사용하거나, 풍선 카테터를 근위부 두개강외 경동맥에 위치 후 주사기로 음압을 걸면서 색전 제거술을 동시에 시행하거나, 초음파 흡입기를 큰 직경의 카테터에 연결하여 사용하기도 한다. 각 시술자마다 선호하는 색전술의 방법은 다양하지만 MT를 시행하여 전체 환자 중 90% 이상의 환자가 막힌 혈관이 충분한 재개통이 가능하다는 점은 이제 일반적이다. 따라서 현재는 뇌졸중 센터 병원에 숙련된 뇌혈관 치료 인터벤션 전문의가 있는지에 따라 그 센터의 질이 결정된다고 볼 정도로 중요하다.

한국의 뇌졸중 치료는 전국민 의료보험제도와 4대 중증 질환의 보험혜택, 뇌졸중 평가 지표 사업의 나라 차원의 노력으로 좋은 의료 근접성과 함께 지속 발전해왔다. 나라 차원의 노력 뿐 아니라 빠른 시간 내에 움직여야 하는 치

료의 특성상, 각 센터에 일선에서 일하는 방사선사, 간호사들과 응급의학과, 신경과, 영상의학과, 신경외과, 재활의학과 전문의들의 희생과 노력으로 발전했다는 점을 잊지 말아야겠다.

국내 출혈성 뇌졸중 질환의 현황

앞서 이야기 했듯이 출혈성 뇌졸중 분야는 그 범위가 허혈성 보다는 적지만 그동안 인터벤션 분야에서 역사적으로 좀 더 일찍 적극적으로 치료가 시행되었던 분야이다. 특히 1990년 Guelielmi에 의하여 개발된 분리형 coil이 소개되면서 뇌동맥류 치료에 있어서 코일이 보편적으로 시행되는 발판이 되었다. 최초의 개발된 detachable coil (GDC; Target therapeutics, Fremont, CA)은 다양한 모양의 동맥류를 채울 수 있을 정도로 유연한 백금코일을 동맥류내 위치한 미세카테터를 통하여 동맥류 내로 전달하기 위하여 금속 와이어에 부착한 것으로 전기자극으로 일정 시간이 경과하면 코일이 분리되는 기구이다. 국내에서는 1995년 GDC의 MFDA 승인 이후 1996년 3월 당시 Lahey Clinic의 최인섭 교수의 지도로 첫 시술이 세브란스병원과 서울대학병원에서 이루어 지게 되었다. 이 후 동맥류의 코일 치료를 중심으로 신경중재시술이 점차 보편화되고, 신경계 영상의학뿐 아니라 신경외과 영역에서도 이 분야에 관심을 갖는 많은 의사들이 참여하게 되었다. 신경외과 전문의들이 모여 1995년 12월 뇌혈관내 수술연구회를 구성하여 활동을 시작하였고 이 연구모임이 점차 발전하여 2012년에 영문명칭을 Society of Korean Endovascular Neurosurgeons (SKEN)으로 변경하여 지금까지 발전하였다. SKEN은 2013년부터 뇌혈관내수술 인증제를 실시하여 처음으로 인증의 185명과 인증기관 69개를 배출하였다.

뇌동맥류의 기본 치료 방법은 미세도관의 성형(shaping) 이용하여 코일을 시행하는 것이다. 이상적인 미세도관의 성형이란, 미세도관의 말단부가 스스로의 모양 만으로 동맥류 입구 방향을 직각으로 통과하여 동맥류 벽을 닿지 않으면서 동맥류 내강의 한 가운데에 위치할 수 있어야 한다. 밀려 나왔던 미세도관은 시술자가 장력(tension)을 줄 때, 자연스럽게 동맥류 내강으로 다시 들어갈 수 있도록 말단부의 방향이 유지되어야 효과적인 시술이 가능하다. 미세도관 말단부는 동맥류의 상황에 맞게 증기(steam)를 이용하여 성형되어야 하는데, 미리 모양이 만들어져 제작되어진 (pre-shaped) 미세도관을 선택하여 사용할 수도 있다.

하지만 경부가 넓은 뇌동맥류(wide-necked aneurysm, neck size ≥ 4 mm or dome-to-neck ratio ≤ 1.5)의 코일색전술은 여전히 어려움이 있다. 이러한 문제로 코일색전술의 적응증이 되지 않았던 경부가 넓은 뇌동맥류의 치료에 1997년 Moret에 의해 처음 소개된 aneurysm neck remodeling technique이 balloon-assisted coiling (BAC)이다. BAC는 코일이 모동맥으로 빠져나오는 것을 방지할 뿐 아니라 동맥류 폐색률(packing density)을 높여 동맥류의 파열이나 재출혈을 방지하는 효과가 있다. Moret 등은 대규모 다기관 전향적 연구(large multicenter prospective studies) 결과 BAC의 합병증의 빈도가 더 높지 않다고 보고하였다. 또한 파열 동맥류에서 BAC은 고식적인 코일색전술에 비교하여 합병증의 빈도는 비슷하면서 동맥류의 폐색률이 높다는 다기관 전향적 연구 결과도 최근 발표되었다. 현재 다기관 전향적 연구들인 ATENA와 CLARITY에서는 BAC는 파열 동맥류(20.8%)보다는 비파열 동맥류(37.3%)에서 더 많이 사용한다고 보고하였다. 2002년 이후 스텐트와 flow diverter가 소개되면서 BAC 치료 빈도가 현저히 감소되는 추세라 볼 수 있지만 알고 있으면 때론 매우 유용한 술기라 할 수 있다.

그 다음으로 뇌동맥류의 대표적인 방법은 다미세도관코일색전술 (multiple microcatheter technique)이다 이는 두 개 이상의 미세도관을 뇌동맥류내에 삽입한 상태에서 여러 개의 코일을 동시에 혹은 순차적으로 삽입하여 코일 간 상호 작용으로 전체 코일 덩어리를 안정시켜 뇌동맥류를 치료하는 술기이다. 장점은 스텐트나 풍선과 같이 비교적 큰 기구를 사용하지 않고, 기술적으로 비교적 쉬우며, 미세도관의 위치나 모양, 코일의 크기, 모양, 길이 등 여러가지 조합으로 매우 다양한 모양의 코일 덩어리를 만들 수 있다.

위와 같은 방법으로 코일 색전술을 하더라도 광경(wide neck) 동맥류, 동맥 분지가 동맥류에서 기시하는(branch-incorporated) 동맥류, 박리성(dissecting) 동맥류, 방추형(fusiform) 동맥류, 수포성(blister-like) 동맥류 등에서는 코일색전술을 시행하는 것이 기술적으로 매우 어려워 시술과 관련된 합병증의 위험이 높을 뿐 아니라, 치료 후 재발의 가능성도 매우 높다. 또한 하나의 중요한 한계는 코일색전술의 재발률이 클립결찰술에 비해 높다는 것이다. 지속 개발되는 스텐트는 코일색전술이 어려운 동맥류의 치료를 가능하게 할 뿐 아니라 어느 정도의 혈류전환 효과와 함께 스텐트를 따라 내피세포 형성을 촉진시킴으로써 동맥류의 재발을 방지하는 효과가 있다. 뇌혈관용 스텐트는 크게 첫째, 제조 방식 (laser-cutting versus wire-braiding), 둘째, 스텐트 cell의 디자인 (open-cell versus closed-cell), 그리고 셋째, 회수 가능성 (recapturable versus non-recapturable) 등에 따라 분류할 수 있게 된다. 하지만, 스텐트 보조 코일색전술(stent-assisted coil embolization)의 발전에도 불구하고 큰 동맥류의 경우 재발률이 높고 완치 가능성이 낮아 한계점이 나타나면서 이를 보완하기 위해서 혈류전환스텐트(flow diverter)가 개발되었다. Flow diverter는 일반적인 스텐트보다 더 높은 금속 피복율(metal coverage rate)과 적은 공극률(porosity)을 갖고 있기 때문에 동맥류로 유입되는 혈류를 모동맥으로 변환(redirection of blood flow)시키게 된다. 하지만 한국의 flow diverter에 대한 보험기준은 매우 까다롭기 때문에 그 사용이 현재는 매우 제한적이다. 또한 전방순환계 동맥류 (anterior circulation aneurysms)에 대한 flow diverter 치료는 안정성과 효과가 비교적 잘 정립되어 있지만 아직까지 후방순환계 동맥류에 대해서는 안정성이 확실히 입증되지 않은 상태이다. 뇌간으로 가는 수많은 perforating arteries가 존재하여 뇌간 경색을 포함한 다양한 합병증이 발생할 확률도 높아 후방순환계 동맥류 치료 시는 매우 신중하게 결정되어야 겠다.

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Neurovascular anatomy

정준호

연세대학교 세브란스병원 신경외과

Prior to treating patients with neurovascular diseases, normal neurovascular anatomy should be perfectly understood not only to maximize clinical outcomes but to minimize risks. Additionally, patterns of the normal anatomy need to be understood thoroughly before “missing” anatomy or pathologic states can be appreciated. This understanding includes the phenomenon of observing the negatives: identifying a missing branch, division, trunk, capillary blush, deep or superficial veins, or venous sinus. Furthermore, it is necessary to know about unique characteristics of intracranial vessels. Here, normal neurovascular anatomy and its unique characteristics will be reviewed and a practical guide to neurovascular anatomy will be introduced.

김 중 훈

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학력 및 경력

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뇌혈관내수술 인증의

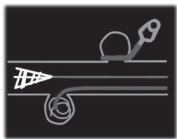
Medication (pre, during & post)

김종훈

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Endovascular Treatment Medication

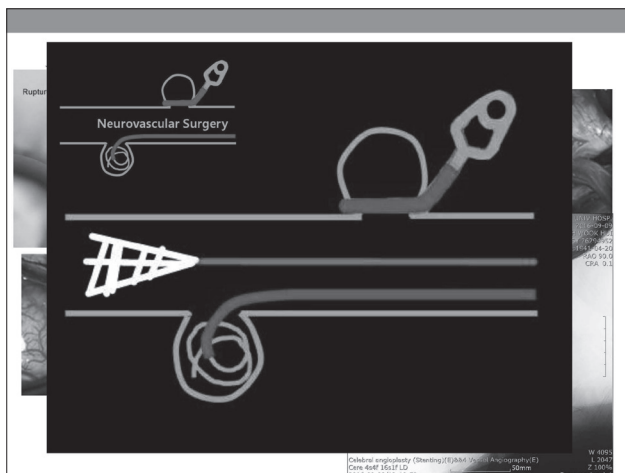
(pre, during & post)



NS

영남대병원 신경외과

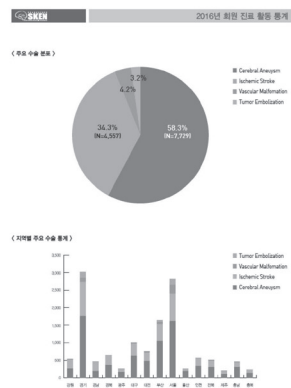
김종훈

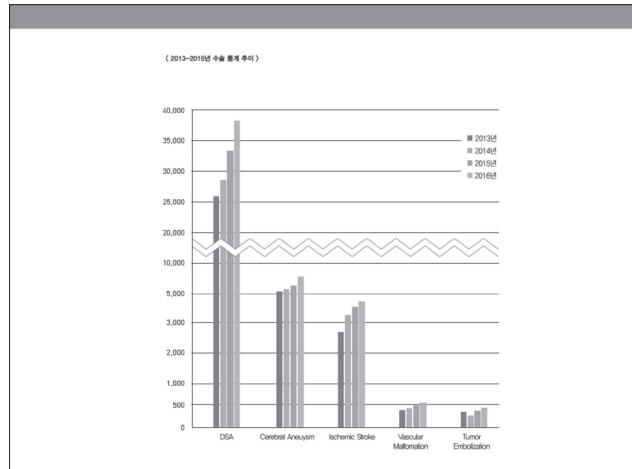


2014년 SKEN 통계

- Cerebral aneurysm (N=5,865)
- Coiling: 3,577(60.99%)
- Ischemic stroke (N=3,608)
- 그 중에 IA thrombolysis 가 1,570 (43.51%)

2016년 SKEN 통계





1. Pre-medication
2. Peri-medication
3. Post-medication

Effect of Antiplatelet Therapy on Thromboembolic Complications of Elective Coil Embolization of Cerebral Aneurysms

ORIGINAL RESEARCH

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C.J. Moran
C.P. Denney
R.G. Dooley, Jr

BACKGROUND AND PURPOSE: Thromboembolic events are the most common complications of elective coil embolization of cerebral aneurysms. Administration of oral clopidogrel and/or aspirin could lower the thromboembolic complication rate.

MATERIALS AND METHODS: Records over a 10-year period for 200 consecutive elective coil embolization procedures, 85 received antiplatelet drugs only after embolization and 115 received antiplatelet drugs only before and after embolization.

RESULTS: Symptomatic thromboembolic complications (stroke) occurred in 4 (16%) of 25 when no antiplatelet or antiplatelet drugs were administered only after embolization compared with 14 (12%) of 115 when antiplatelet drugs were administered before and after embolization. Closets were visible intraprocedurally in 5 (16%) administered before procedures and in 11 (9%) of 120 of the 9 was symptomatic postprocedurally, but 7 were by hemorrhagic complications occurred in 11 (9%) of 120 when they were (P value not significant).

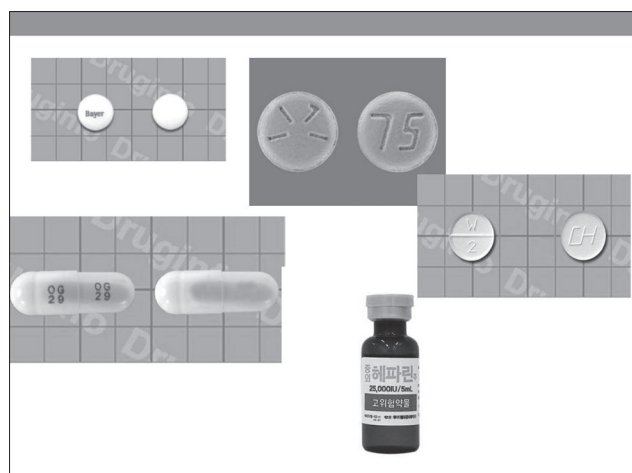
CONCLUSION: Oral clopidogrel and/or aspirin significantly combination rate of elective coil embolization of aneurysms toward a lower rate of intraprocedural clot formation; procedures and a higher hemorrhagic complication rate in antiplatelet therapy appear to outweigh risks.

Efficacy and Safety of Single versus Dual Antiplatelet Therapy for Coiling of Unruptured Aneurysms

Yusuke Nishikawa, MD,* Tetsu Satow, MD, PhD,* Toshinori Takagi, MD,* Kenichi Murao, MD, PhD, Susumu Miyamoto, MD, PhD, and Koji Iihara, MD, PhD*

Background: Although the efficacy of antiplatelet therapy for coiling of unruptured cerebral aneurysms has been reported, evidence for the therapy on net is not well established. The aim of this retrospective study was to analyze outcomes among the results of antiplatelet use on coiling configurations, coiling methods, and coiling outcomes to elucidate the optimal antiplatelet therapy for coiling. **Methods:** The study population comprised 104 patients with unruptured aneurysms who underwent coiling with antiplatelet therapy at our institution between 2005 and 2008. The patients were categorized by mode of antiplatelet therapy (single vs dual or dual vs dual). Each case (single vs dual or dual vs dual) was analyzed by logistic regression analysis and multivariate analysis on postprocedural diffusion-weighted magnetic resonance imaging (DWI) in each group were statistically assessed. **Results:** Hemorrhagic complications occurred in 1 case (1.7%) with single antiplatelet therapy and in 2 cases (2.2%) with dual antiplatelet therapy (hypotension-induced complications occurred in 1 case (1.7%) with single therapy and in 2 cases (2.2%) with dual therapy). Although there were no significant differences in the rates of antiplatelet therapy even when the technique used was taken into account. In cases of wide neck, however, there were significant differences in the rates of antiplatelet therapy (single, 12.7%; dual, 3.5%; $P = .048$) and DWI abnormalities (single, 27.8%; dual, 20.0%; $P = .005$). **Conclusion:** Our data suggest that dual antiplatelet therapy may better prevent ischemic complications than coiling for wide-necked aneurysms compared with single antiplatelet therapy. **Key Words:** Coil embolization—antiplatelet therapy—risk—thromboembolic complications.

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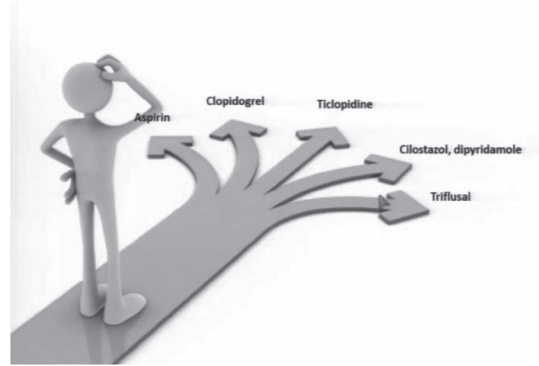
Platelet aggregation 을 유발하는 물질

- ADP (adenosine diphosphate)
- Thromboxane A₂
- Collagen
- Epinephrine
- Thrombin

특징

Variables	Aspirin	Clopidogrel	Ticlopidine	Cilostazol
t _{1/2}	• 15-20 min	• 11-13 hours	• 12 hours	• 8 hours
Onset time	• Fast action (within 30 min, < 1 hour of platelet aggregation ↓)	• Fast, and loading • Maintain after 5 days	• Maintain after 5 days	• Several days
S/E	• GI discomfort, bleeding	• Tolerated	• Neutropenia	• Headache, palpitation, irritable GI symptoms
Administration	• Qd	• Qd	• Bid	• Bid, and Qd
Characteristics	• Very old drug • Cheap • No one beat (except Aggrenox?)	• Safe and effective • Various indications	• Drug resistance ↓	• Only Asian trials • Reversible
Pitfalls	• Specificity for only platelets ↓	• Drug resistance • Expensive • Drug interaction	• Hematological S/E ↑	• Frequent S/E
Benefits	• Fast onset	• GI trouble: rare • Good compliance	• Drug resistance ↓	• Safe and efficacy in special conditions

Which one is better?



Hemostasis (지혈)

1. primary hemostasis

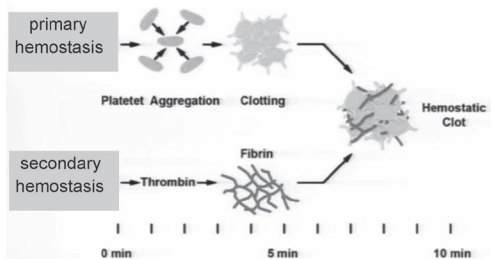
: platelet 이 주인공

2. secondary hemostasis (=coagulation)

: fibrin 이 주인공

• **primary hemostasis** 는 혈관의 상처가 난 곳에 platelet 이 모여 그 상처를 덮음으로써 일단 출혈을 막음.
우선 platelet 이 상처에 덮개를 하는 것임.

• **secondary hemostasis** 는 platelet에 의한 덮개를 견고하게 하여 완전히 지혈하는 것.
(응집된 platelet을 안정시켜 fibrin으로 clot을 형성함.)



Primary hemostasis

1. Adhesion (부착)

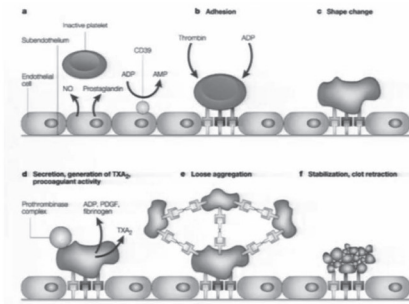
: 혈관이 파괴되면 혈액이 밖으로 흐르게 되는데, 이때 subendothelium(collagen)이 노출
→ platelet 과 collagen 이 결합.
→ 이 사이에 vWF(von Willebrand's factor)이 혈소판 표면의 glycoprotein 인 GP Ib/IX 복합체와 결합.

2. Activation (활성화)

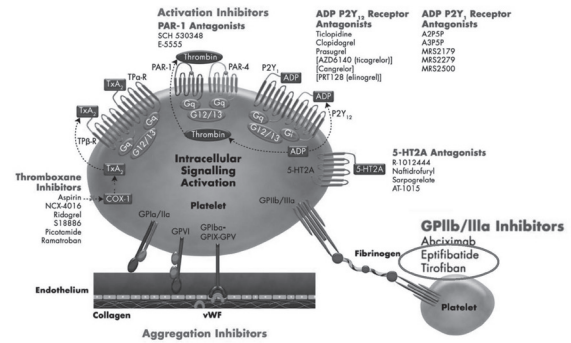
3. Aggregation (응집)

: subendothelium에 결합한 platelet 은 IP₃, G-protein 등 second messenger의 signal 로 platelet 이 활성화
→ 활성화된 platelet은 ADP (adenosine diphosphate) 방출
→ GPIIb/IIIa 복합체에 fibrinogen이 결합하면 혈소판이 차례로 응집.

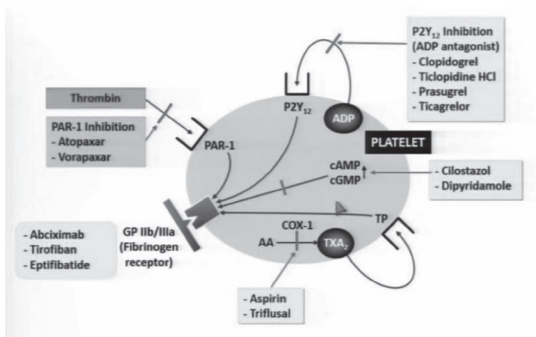
Platelets' 3As (Adhesion, Activation, Aggregation)



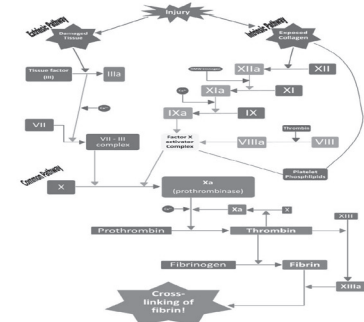
Tirofiban 작용기전



Site of action



Secondary hemostasis (=coagulation)



Antithrombin III

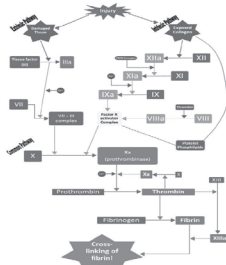
: -간에서 합성되는 glycoprotein
-thrombin의 응고활성을 중화시키면서
균형유지.

Heparin

: -antithrombin III와 결합하여 thrombin 및
factor Xa의 활성을 저하
-antithrombin III의 thrombin 제거 효과를
100~1000배 높이는 강한 항응고작용.

Coumarin(warfarin)

: -Vit K(factor II,VII,IX,X→Vit K 의존성 응고인자)의 대사 길항제
-Vit K와 경쟁적으로 작용하여 간에서 혈액응고인자 생산억제



Pradaxa[®] dabigatran etexilate



Plasmin

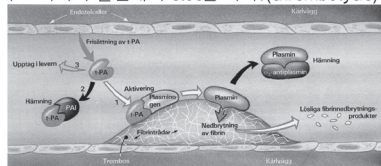
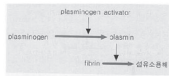
: plasmin이 clot의 fibrin을 분해시키고 clot 주위의 혈액응고인자를 억제시키면서 clot이 차츰 용해됨.

Plasminogen activator

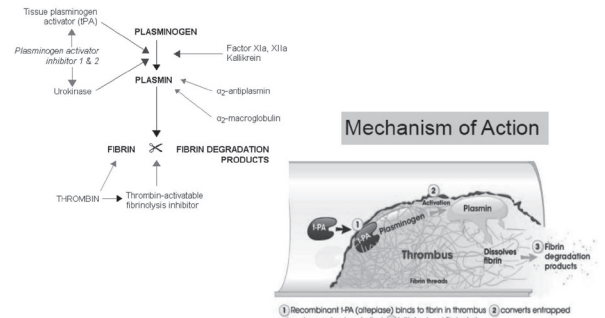
1. urokinase
2. t-PA

t-PA(tissue plasminogen activator)

: clot이 생성된 이후에 조직이나 혈관내의 clot을 제거.(thrombolytic)



IV t-PA



정맥내 혈전용해술

• 전체용량의 10%를 bolus injection한 후 나머지 90%를 1시간에 걸쳐 주입.

• 현재처럼 tPA를 0.9mg/Kg로 사용하게 된 것은 1990년대 초기에 이루어진 연구결과에 따른 것

IV-tPA 에 국내 권고사항.

표 38-1 정맥내혈전용해술에 대한 국내의 권고사항

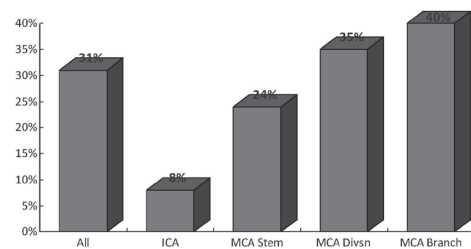
1. 허혈뇌졸중 환자에서 증상 발생(최종적으로 정상)이었던 시간 기준 3시간 이내에 투여가 가능한 경우, 정맥내tPA치료를 한다(근거수준la, 권고수준A). 단, 증상발생에서 뇌졸중이 배제되어야 하며 그 외 적응증은 표 38-2에 따른다.
2. 위의 치료는 81세 이상의 환자에서도 적용 가능하(근거수준b, 권고수준A).
3. 허혈뇌졸중 환자에서 증상 발생(최종적으로 정상)이었던 시간 기준 3~4.5시간 이내에 투여가 가능한 경우 정맥내tPA치료를 할 수 있다(근거수준la, 권고수준A).
* 단, 80세 이상, 심한 신경계장애(NIHSS점수 25점 초과), 과거 뇌졸중과 당뇨병의 병력이 함께 있는 환자, 경구항응고제를 복용하고 있는 환자에 대해서는 3~4.5시간에 투여할 근거가 부족하다.
4. 정맥내tPA치료를 치료하지 않은 군에 비하여 유의하게 높은 뇌출혈의 위험이 있으므로 그 위험성에 대하여 숙지하고 있어야 한다(근거수준la, 권고수준A).
5. 정맥내스트렙토키나아제(streptokinase)는 출혈의 위험이 유의하게 높으므로 사용하지 말아야 한다(근거수준la, 권고수준A).
6. 허혈뇌졸중에서 tPA 이외의 정맥내혈전용해제(urkinase, tenecteplase, desmoteplase)의 효과는 아직 입증되지 않았(근거수준IV, 권고수준C).
7. 정맥내tPA치료를 초기에 투여될수록 환자의 예후가 좋아지므로, 적응증과 금기증을 확인한 후 가능한 신속히 시작하도록 한다(근거수준la, 권고수준A).
8. 정맥내tPA치료방법은 표 38-2에 따른다(근거수준la, 권고수준A).

IV-tPA indication

표 38-2 정맥내혈전용해술 적응증

1. 신경계장애가 동반되고 경화되지 않은 허혈뇌졸중
2. 신경계장애가 자발적으로 신속히 호전되지 않아야 함
3. 신경계장애가 심한 환자는 치료 시 주의해야 함
4. 거머쥐어출혈(subarachnoid hemorrhage)로 인한 증상이 아니어야 함
5. 최근 3개월 이내 두부외상(head trauma) 및 뇌출혈이 없어야 함
6. 최근 3개월 이내에 심근경색이 없어야 함
7. 최근 21일 이내에 소화기 및 비뇨기계 출혈이 없어야 함
8. 최근 14일 이내에 주요수술(major surgery)을 시행하지 않았어야 함
9. 최근 7일 이내 압박 불가능한 동맥천자(arterial puncture)를 시행하지 않았어야 함
10. 두개내출혈(intracranial hemorrhage)의 과거력이 없어야 함
11. 혈압은 수축기혈압 185 mmHg 및 확장기혈압 110 mmHg 이내로 조절되어야 함
12. 신경장애 발생 후 의식(골루 포환)이 발견되지 않아야 함
13. 경구항응고제를 복용하고 있다면 INR 1.7 이하여야 함
14. 과거 48시간 이내 레티렌으로 투여받았다면, aPTT가 정상범위 이내로 조정되어야 함
15. 혈소판 수치는 100,000/mm³ 이상이어야 함
16. 혈당 수치는 50 mg/dL (2.7 mmol/L) 이상이어야 함
17. 경련(seizure) 후 발생한 신경계장애가 아니어야 함
18. CT에서 자발성혈액이 대변과 1/3 이상인 다엽성액(multilobar interhemispheric)이 아니어야 함
19. 환자 또는 보호자가 치료에 따르는 위험과 이득에 대해 이해하고 있어야 함

I.V. t-PA Recanalization at One Hour (angiographic data)



Del Zoppo et al., Ann Neurol 1993

- Aspirin, plavix, pletaal (antiplatelet agent)
- Heparin, Warfarin (anticoagulation agent)
→ 더 이상 disease가 진행 안되고 이차예방하는 drug
- t-PA, Urokinase (thrombolytic agent)
→ 현재 막혀있는 thrombus를 녹여서 뚫어주는 drug

1. Pre-medication

2. Peri-medication

3. Post-medication

시작일	종료일	처방전	처방량	처방시간	처방의
32 1)		get angio permission			
33 1)		금식			
34 1)		shaving and cleansing both inguinal			
2)		premedication			
3)		preparation			
4)		send patient to angio room c chart at c			
5)		24hours fluid keep			
6)		Foley catheterization			
34 7)		E-tube set, ventilator prep 하세요 (7N)			NS염재상
8)		Pendipine, Precedex, Norpin, Dope 달고			
35 1)		Saline 1000ml Inj(JW)	1 Bt 1* 1 Fluid 0		
36 1)		Cefin Inj 2g	1 Vii 1* 1 IV 0		
37 1)		Heparin 2.5만U Inj	1 Vii 1* 1 처치 재 0		
2)		Naibushine Inj 10mg	2 Am 1* 1 처치 재 0		
3)		Midacum Inj 5mg	2 Am 1* 1 처치 재 0		
4)		Ativan Inj 4mg/ml	2 Am 1* 1 처치 재 0		
5)		Pendipine Inj 10mg	3 Am 1* 1 처치 재 0		
6)		Protamine Sulfate 50mg Inj	3 Am 1* 1 처치 재 0		
38 1)		Saline 100ml Inj(JW)	1 Bt 2* 1 처치 재 0		
39 1)		Saline 1000ml Inj(JW)	2 Bt 1* 1 처치 재 0		

시작일	종료일	처방전	처방량	처방시간	처방의
2)		Precedex Inj 200mcg/2ml	1 Vii 1* 1 처치 재 1		
3)		Agastat Inj 12.5mg	1 Vii 1* 1 처치 재 1		
40 1)		<General prep medication>			
41 1)		Pofol Inj 120mg	2 Am 1* 1 처치 재 0		
2)		Pofol Inj 500mg	2 Vii 1* 1 처치 재 1		
3)		Vecaron Inj 10mg	3 Vii 1* 1 처치 재 0		
4)		Saline 100ml Inj(JW)	1 Bt 1* 1 처치 재 0		
5)		OW SX 100ml Inj	1 Bt 1* 1 처치 재 0		
41 6)		NorPin Inj 4mg/4ml	2 Am 1* 1 처치 재 0		NS염재상
7)		Doxamine 800mg/500ml Presix	500 ml 1* 1 처치 재 0		
42 1)		4 Vessel Angiography(E)	D/C M		
43 1)		Cerebral embolization (anurysm)(E) Other	P		
44 1)		Brain CT Noncontrast ▶post	D/C M		
45 1)		Skull A-P ▶post	D/C M		
2)		Skull Rt. Lat. ▶post	D/C M		
46 1)		Saline 1000ml Inj(JW) ▶post	1 Bt 1* 1 IV 0		
47 1)		Precedex Inj 200mcg/2ml	1 Vii 1* 1 MixFluid 1		
2)		Saline 100ml Inj(JW)	1 Bt 1* 1 MixFluid 0		
48 1)		ABO typing	1 EDTA(WB 0		
2)		RH typing	1 EDTA(WB 0		

Heparin

약물동태

- 반감기 평균: 60-90분(1-6시간)
- 높은 농도에서 반감기 더 길어짐.
- 발현시간 1. 정맥주사: 즉시
2. 피하주사: 20-30분

최대혈중농도 도달시간: 2-4시간

생체이용률 22-40%

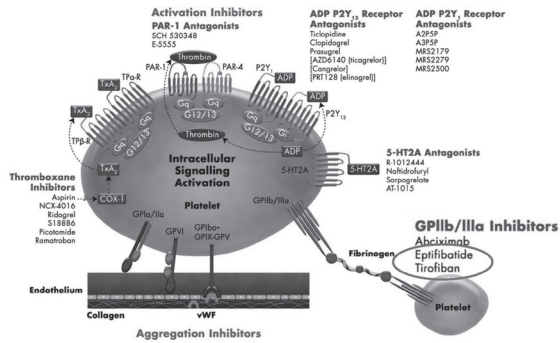
단백결합률 LDL, 글로불린, 피브리노겐 등에 광범위하게 결합

- 기타 1. 대사: 간에서 uroheparin (주로, N-desulfation)으로 대사됨.
2. 배설: 노배설(주로 대사체로 배설됨, 고용량에서는 50% 까지 미변화체로 배설됨.)

Systemic heparinization

- IV bolus injection of 3,000 IU (or 100 IU/kg) of heparin after femoral puncture
- additional 1,000 IU of heparin was administered on an hourly basis to maintain the ACT(activated coagulation time) at two to three times the baseline.

Tirofiban 작용기전



크릴세전술 중 혈전 발생 시 구제요법

혈액내 주입 (중류과 외환하 주입, 50mcg/ml로 표시되어 있음)

비중	4mcg/kg	8mcg/kg	tirofiban 적대용량 (mg) 25mcg/kg
40	0.16	0.32	1
45	0.18	0.36	1.125
50	0.2	0.4	1.25
55	0.22	0.44	1.375
60	0.24	0.48	1.5
65	0.26	0.52	1.625
70	0.28	0.56	1.75
75	0.3	0.6	1.875
80	0.32	0.64	2
85	0.34	0.68	2.125
90	0.36	0.72	2.25
95	0.38	0.76	2.375
100	0.4	0.8	2.5

혈액내 주입 (중류과 주입 후에도 남아있는 경우 0.1mcg/kg/min으로 12시간까지 주입) N/S 200ml + Tirofiban 50ml

비중	주입속도 (ml/hr)
40	4.8
45	5.4
50	6
55	6.6
60	7.2
65	7.8
70	8.4
75	9
80	9.6
85	10.2
90	10.8
95	11.4
100	12

급성 뇌졸중의 일반적인 치료

• 혈압관리

Sys. 220mmHg 이상
 or Dia. 120mmHg 이상은 medication으로 조절

Suggested Target BP Goal for 1st 24 h following MT Until RTCs Can Verify

- TICI 3 with dramatic neurological recovery: <140/80 mm Hg
- TICI 3 but no neurological improvement: <160/90 mm Hg
- TICI 2 ± neurological improvement: <160/90 mm Hg
- No recanalization: <160/90 mm Hg
 or permissive hypertension <180/105 mm Hg

• 기도유지

• 산소공급

• 수액치료

• 체온조절

• 심장감시

• 혈당관리

180mg/dL 는 넘지않게

1. Pre-medication

2. Peri-medication

3. Post-medication

이차예방

(고혈압, 당뇨병, 고지혈증,
 항혈소판치료, 항응고치료)

1) 위험인자 조절

- Stroke(atheroma)의 위험인자
 - 고콜레스테롤혈증
 - 낮은 HDL
 - 높은 LDL
 - 높은 TG
 - HTN (140/90 이상)
 - 흡연
 - 당뇨병
 - 심혈관질환의 가족력
 - 연령 증가
 - 운동부족, 과체중 및 복부비만

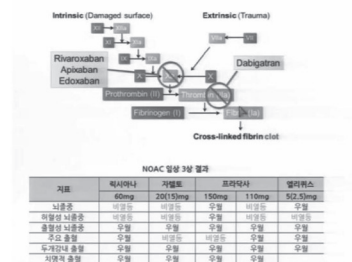
2) 항혈소판치료

항혈소판치료

- 급성 뇌경색 발생 후 예후에 대한 다기관 분석에서 발병 후 3주 이내에 15% 정도가 신경학적 악화를 보임.
- 뇌졸중 재발뿐 아니라 심혈관질환의 발생을 억제해 초기 사망률을 줄이고 신경학적결손을 최소화하는 데 중요
- Antiplt Tx.

3) 항응고치료

NOAC (Non-vitamin K antagonist Oral AntiCoagulant) or (New Oral AntiCoagulant)

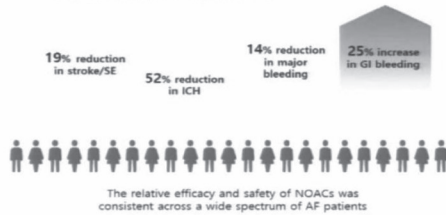


ASCENT 2019

NOACs Showed a Favourable Benefit–Risk Profile Versus Warfarin

• Meta-analysis of phase III trials for stroke/SE prevention in AF patients demonstrated:

Ruff *et al.* Lancet 2014



Profile of 4-NOACs

	Pradaxa	Xarelto	Eliquis	Lixiana
Administration	bid	QD With food	bid	QD
Formulation	Capsule	tablet	tablet	tablet
CYP metabolism	None	Extensive	extensive	<4%
Renal elimination	80%	35%	25%	50%
Protein binding	35%	92~95%	87%	40~59%
Pro-drug	Yes	No	No	No
Half life	14~17 hrs	9~13 hrs	8~15 hrs	10~14 hrs
T max	2~3 hrs	2.5~4 hrs	3~4 hrs	1~2 hrs
Bioavailability	6~7 %	60~100%	50~60%	62%
Transporter	P-gp	P-gp/BCRP	P-gp/BCRP	P-gp
GI tolerability	Dyspepsia 5~10%	No problem	No problem	No problem

NOAC (Non-vitamin K antagonist Oral AntiCoagulant) or (New Oral AntiCoagulant)

Different dose reduction regimen

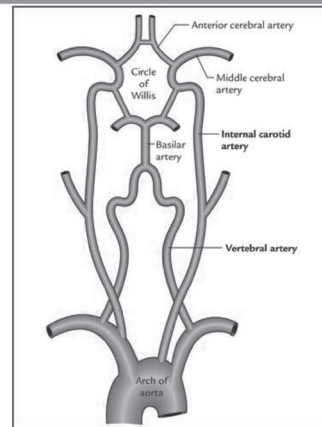
RE-LY ¹	ROCKET-AF ²	ARISTOTLE ³	ENGAGE-AF ⁴
• None	• 20→15 mg QD for: – Creatinine clearance <30–49 ml/min	• 5→2.5 mg BID for ANY TWO of: – Age ≥80 years – body weight ≤60 kg – Serum creatinine ≥1.5 mg/dL	• 60→30 mg QD or 30→15 mg QD for: – Creatinine clearance 30–50 ml/min – body weight ≤60 kg – Use of quinidine, verapamil or dronedarone

Recommendations on the initiation or resumption of NOACs after TIA or ischemic stroke ('1-3-6-12 day rule')

- TIA: NOACs can be initiated on day 1
- Mild stroke(NIHSS <8): NOACs can be initiated on 3 days
- Moderate stroke(NIHSS 8-16): NOACs can be initiated on 5~7 days
- Severe stroke(NIHSS >16): NOACs can be initiated after 12-14 days

참고 SDH이후에는 4주, ICH 이후에는 6~8주 후에 restart

To achieve ideal treatment for acute ischemic stroke



The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty



Luncheon seminar

좌장 : 임용철(아주대) / 권현조(충남대)

1. Endovascular treatments performed collaboratively by the Society of Korean Endovascular Neurosurgeons Members: A nationwide multicenter survey

김태곤(차의과학대)

2. Introducing a new phase, detail finishing, to cerebral aneurysm coil embolization

Dr. Jaehyun Son (Tomishiro Central Hospital, Okinawa, Japan)

김 태 곤

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2005-현재	분당차병원 신경외과 교수

Endovascular treatments performed collaboratively by the Society of Korean Endovascular Neurosurgeons Members: A nationwide multicenter survey

Tae Gon Kim¹, Oki Kwon², Yong Sam Shin³, Jae Hoon Sung⁴, Jun Seok Koh⁵, Bum-Tae Kim⁶

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²Department of Neurosurgery, Seoul National University Bundang Hospital,

³Department of Neurosurgery, Seoul St. Mary's Hospital, College of Medicine, The Catholic University of Korea,

⁴Department of Neurosurgery, St. Vincent's Hospital, College of Medicine, The Catholic University of Korea,

⁵Department of Neurosurgery, Kyung Hee University Hospital at Gangdong,

⁶Department of Neurosurgery, Soonchunhyang University Bucheon Hospital

Objective: Since less invasive endovascular treatment was introduced to South Korea in 1994, a considerable proportion of endovascular treatments have been performed by neuroradiology doctors, and endovascular treatments by vascular neurosurgeons have recently increased. However, few specific statistics are known regarding how many endovascular treatments are performed by neurosurgeons. Thus, authors compared endovascular treatments collaboratively performed by vascular neurosurgeons with all cases throughout South Korea from 2013 to 2017 to elucidate the role of neurosurgeons in the field of endovascular treatment in South Korea.

Methods: The Society of Korean Endovascular Neurosurgeons (SKEN) has issued annual reports every year since 2014. These reports cover statistics on endovascular treatments collaboratively or individually performed by SKEN members from 2013 to 2017. The data was requested and collected from vascular neurosurgeons in various hospitals. The study involved 77 hospitals in its first year, and 100 in its last. National statistics on endovascular treatment from all over South Korea were obtained from the Healthcare Bigdata Hub website of the Health Insurance Review & Assessment Service (HIRA) based on the Electronic Data Interchange (EDI) codes (in the case of intra-arterial (IA) thrombolysis, however, statistics were based on a combination of the EDI and I63 codes, a cerebral infarction disease code) from 2013 to 2017. These two data sets were directly compared and the ratios were obtained.

Results: Regionally, during the entire study period, endovascular treatments by SKEN members were most common in Gyeonggi-do, followed by Seoul and Busan. Among the endovascular treatments, conventional cerebral angiography was the most common, followed by cerebral aneurysmal coiling, endovascular treatments for ischemic stroke, and finally endovascular treatments for vascular malformation and tumor embolization. The number of endovascular treatments performed by SKEN members increased every year, and about 50%–60% of the endovascular treatments were performed with the participation of SKEN members

Conclusion: The SKEN members have been responsible for the major role of endovascular treatments in South Korea for the recent 5 years. This was achieved through the perseverance of senior members who started out in the midst of hardship, the establishment of standards for the training / certification of endovascular neurosurgery, and the enthusiasm of current SKEN members who followed. To provide better treatment to patients, we will have to make further progress in SKEN.

Keywords: Endovascular procedures · Big data · Data interpretation, Statistical.

Jae-Hyun Son, M.D., Ph.D

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Memberships:	Japanese Neurosurgery Association Japan Neuroendovascular Therapy Society Japanese Stroke Society Cardiovascular Stroke Society of Japan Japan Brain Dock Society World Federation of Interventional and Therapeutic Neuroradiology (WFTIN)

Introducing a new phase, detail finishing, to cerebral aneurysm coil embolization

Dr. Jaehyun Son

Tomishiro Central Hospital, Okinawa, Japan

The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty



Symposium II

좌장 : 신용삼(가톨릭대)

1. Flow Diverter, where are we now?

김성림(가톨릭대)

2. Flow Disrupter, where are we going?

강현승(서울대)

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Flow Diverter, where are we now?

김성림

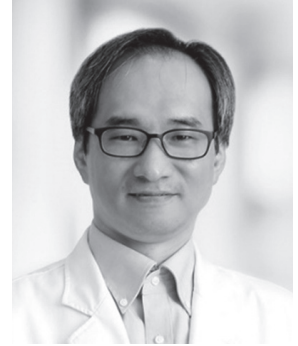
가톨릭대학교 부천성모병원 신경외과

The advent and evolution of the flow diverter has had a great deal of influence on every aspect of the endovascular treatment of large/giant aneurysm. It has both bright and seamy side of estimation. At this juncture, it is required to give a cold-headed assessment of the flow diverter.

In this lecture, the author would like to compare merits and demerits of the flow diverter and discuss ways to clinical application from the view point of purposefulness.

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2008-현재 서울대학교 의과대학 교수

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대한신경중재치료학회 회원
대한뇌혈관내수술학회 회원
World Federation of Interventional Neuroradiology 회원

Flow Disrupter, where are we going?

강현승

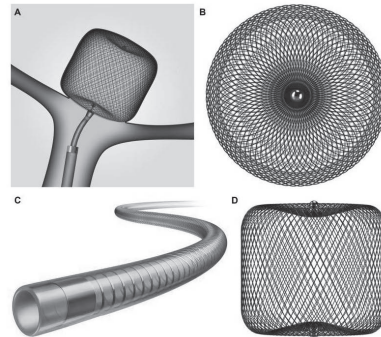
서울대학교병원 신경외과

Flow Disruption: Where are we going?

Hyun-Seung Kang, MD, PhD

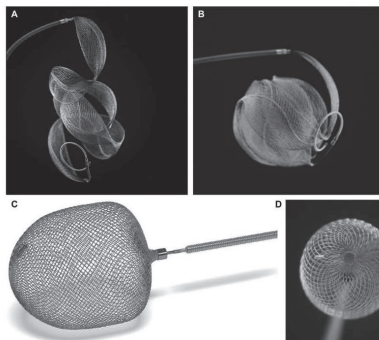
Professor, Department of Neurosurgery, Seoul National University Hospital, Seoul National University College of Medicine, Seoul, Korea

WEB



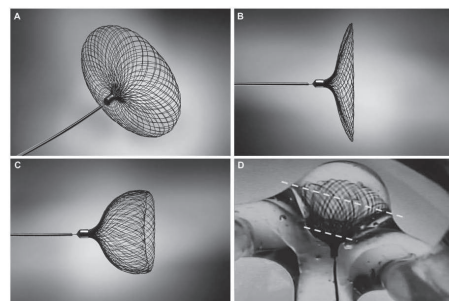
VIA

Medina

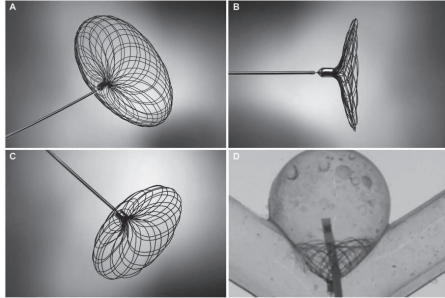


Artisse (LUNA)

Contour



Cerus



Device	Dimensions, mm	Structure	Coverage, %	Deployment	Resheathable	
WEB	Diameter, 3-11 Height, 2-9	SL, SLS	60	Electrothermal	Yes	Proximal and distal radiopaque markers
Medina		3D coil with petal filaments		Mechanical	Yes	Hybrid flow disruption device
Artisse (LUNA)				Mechanical		Oval shape
Contour		Dual-layer shape-memory mesh		Electrolytic	Yes	Flat disc, tulip-like configuration
Cerus		Dual-layer shape-memory mesh		Electrolytic	Yes	Coiled through

Device	Indication	Occlusion rate	Morbidity, %	Mortality, %
WEB [11]	Unruptured & ruptured bifurcation	52-96% @3-39mo	3-5.3 (ruptured) 0-6.2 (unruptured)	1-8.5 (ruptured) 0-1.1 (unruptured)
Medina [3]	Unruptured, wide neck; fundus ≥ 5mm	71-83% @1.7-5.2mo	0-23	0
Artisse (LUNA) [1]	Unruptured bifurcation, wide neck	78% @12mo, 79% @36mo	0 @12mo, 1.6 @36mo	1.6

Dmytriw AA et al. *Neurosurgery* 2019 Epub

Woven EndoBridge (WEB) Device: Systematic Review and Meta-Analysis

- 15 series, 565 patients with 588 aneurysms; 127 ruptured
- Adequate occlusion
 - Initial, 59% (95% CI, 39-78)
 - At 7 mo, 85% (78-91); ruptured vs. unruptured, 85% vs. 85%
- Perioperative morbidity, 4% (1-8)
- Perioperative mortality, 1% (0-2)

Asnafi S et al. *AJNR* 2016

Medina® Embolization Device

- 80 deployments in 10 aneurysms
- **Flow velocity reduction (%) = (1 – MAFA) x 100**
- mean aneurysm flow amplitude (**MAFA**) ratio
- **Aneurysm Flow**, Philips Healthcare

Frolich AM et al. *PLoS One* 2018

Neck coverage

- VasoCT & 3D RA overlay
- *en face* view of the aneurysm orifice
- **3 point Likert scale**
 - 1 = **insufficient** coverage, less than 50% of orifice covered
 - 2 = **partial** coverage, 50–90% of orifice covered
 - 3 = **complete or near complete** coverage, >90%

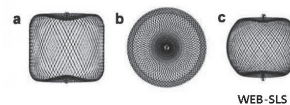
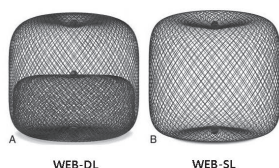
Medina® Embolization Device

- Intra-aneurysmal flow velocity reduction after MED implantation, **33.6%** (27.5–39.7%)

Aneurysm location along ICA	Aneurysm dimensions (mm)	Neck area (mm ²)	Dome-to-neck ratio	MED framer size (mm x cm)	Mean FVR (% 95% CI)	Median neck coverage rating
Paraophthalmic	7.6x6.4x5.9	9.5	2.1	6 x 8	52.8 (40.9–64.6)	2
Supracaloid	8.4x7.2x6.5	17.8	1.5	9 x 13	58.0 (46.3–69.7)	2
Supracaloid	10.0x8.9x8.0	23.2	1.8	9 x 13	13.1 (-11.2–13.7)	1.5
Posterior communicating	11.0x6.0x6.5	8.0	3.4	8 x 10	27.1 (9.4–44.8)	2.5
Paraclonid	7.7x8.1x8.1	14.4	1.8	8 x 10	43.1 (-10.9–19.4)	1.5
Infraophthalmic	7.4x8.4x6.7	14.2	2.5	8 x 10	58.5 (41.9–75.1)	2
Terminus	7.9x6.3x7.3	20.3	1.2	8 x 10	22.2 (-5.4–49.8)	1.5
Terminus	5.0x4.0x5.0	13.3	1.2	6 x 8	33.2 (13.4–52.9)	2.25
Posterior communicating	7.0x3.5x4.5	9.9	1.6	6 x 8	49.8 (39.5–60.0)	1.5
Supracaloid	10.8x8.5x7.5	21.9	1.6	8 x 10	31.7 (19.8–43.7)	2

- Degree of flow disruption, correlated with
 - **Neck coverage** ($p = 0.42$, 95% CI: 0.21~0.59, $p = 0.002$)
 - **Neck area** ($p = -0.35$, 95% CI: -0.54~-0.13, $p = 0.024$)

Woven EndoBridge (WEB)



Intrasaccular Flow Disruption in Acutely Ruptured Aneurysms: WEB

- 47 patients with 52 aneurysms, 10 centers
- Wide neck aneurysms at the bifurcation
- **Neck size ≥ 4 mm** in 49 of 52 (94%)
- **Aneurysms size < 10 mm** in 45 (87%)
- Adjunctive devices used in 8 of 52 (15%)

Liebig T et al. *A/WR* 2015

Intrasaccular Flow Disruption in Acutely Ruptured Aneurysms: WEB

- Thromboembolic events, 4 of 52 (**8%**)
- Adverse events, 15 patients with 16 aneurysms
 - No clinical impact
- 9, potentially related to the WEB procedure
 - 5 protrusions
 - **3 thromboembolic events**
 - **1 perforations**
 - 2 perforations, caused by the wire or catheter

Patient No.	AN Location	Complication	Device Related	Outcome (mRS Score)	Clinical Consequence
1	MCA	TE	Yes	0 at 8 mo	None
2	MCA	TE	Yes	3 [same as before SAH]	None
3	PcomA	TE	Yes	0 at 3 mo	None
4	BA	TE	No	4 at discharge ^a	None
5	MCA	TE	No	3 at 2 mo	Yes
6	AcomA	AN perforation	No	0 at 1 wk	Yes
7	Pericallosal artery	AN perforation	Yes	0 at 1 wk	None
8	MCA	AN perforation	No	6 from initial SAH	Unknown ^b
9	AcomA	Induced spasm	Unknown	6 from initial SAH	Unknown ^b
10	MCA	Induced spasm	Unknown	Unknown	Unknown
11	PcomA	Infarction	No	2 at 6 mo	Transient
12	AcomA	WEB protrusion	Yes	0 at 6 mo	None
13	BA	WEB protrusion	Yes	0 at 8 mo	None
14	MCA	WEB protrusion	Yes	0 at 3 mo	None
15	AcomA	WEB protrusion	Yes	0 at 25 mo	None
16	rMCA, IMCA, Dissect Vert	rMCA branch partial occlusion	Yes	0 at 3 wk	None

Intrasaccular Flow Disruption in Acutely Ruptured Aneurysms: WEB

- 4 patients, retreated
- Short-term follow-up in 25 of 39 patients
 - complete occlusion, 15 of 25 (60%)
 - residual neck, 5 of 25 (20%)
 - residual aneurysm filling, 5 of 25 (20%)
- Short- to midterm imaging in 9 of 25 patients
 - complete occlusion in 5 (55.6%)
 - residual neck in 2 (22%)
 - Residual aneurysm filling in 2 (22%)
- mRS score 0 to 2, 23 (49%)

WEB Treatment of Ruptured Intracranial Aneurysms: A Single-Center Cohort of 100 Patients

Van Rooij SBT et al. *AJNR* 2017

February 2015 – April 2017
242 ruptured aneurysms treated

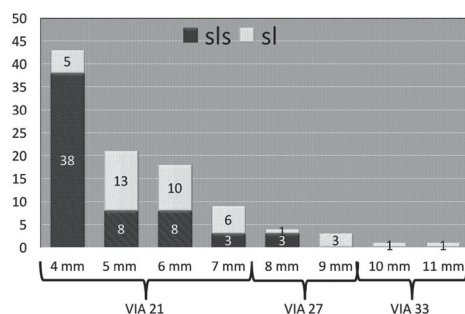
Surgery 53 (22%)

- wide neck/vessels from sac 23
- too small (≤ 1.5 mm) 7
- hematoma evacuation 6
- dumbbell aneurysm 5
- rebleed after previous clipping 3
- no endovascular access 3
- failed endovascular treatment 3
- multiple aneurysms 2
- wrapping of dissection 1

Endovascular 189 (78%)

- Saccular aneurysms - coils 82
- **WEB** 100
- Dissections - flowdiverter 2
- stent only 1
- PVO V4 with WEB 4

WEB sizes in 100 ruptured aneurysms



3T MRA follow-up of aneurysms treated with WEB

- **Faraday shielding**
 - Flow within the braid of WEB will not be apparent on MRA.
- **WEB compression**
 - Water hammer hemodynamic effect
 - Thrombosis and organization – clot retraction

Patient No	Patient age	Aneurysm location	Aneurysm size	Rupture	MED	Other devices	Procedure time (min)	Adjuvantive tools	Periprocedural complications
1	Elderly	AcomA	8x6.1x5.5	No	B Raiser 6 Raiser	Cathmore 14 coil 6x9 4x6 Detrapush 3x4	41	None	0
2	Middle-aged	MCA	9.5x9x4.6	No	9 Raiser 8 Filter	Cathmore 14 coil 6x9 Cathmore 14 coil 5x12 Cathmore 14 coil 4x8 Cathmore 14 coil 3x6	25	None	0
3	Middle-aged	AcomA	5x3.9x2.7	Yes	Green Filter	Detrapush 10, 3mm x 6cm Detrapush 10, 3mm x 2cm Detrapush 10, 2x1cm	46	None	0
4	Elderly	AcomA	7.2x7x4.5	Yes	9mm Raiser Green Filter	Cathmore 4x4 Detrapush 1.5x10 Detrapush 2x4	49	Scepter XC 4/11	Partial dissection of the left ICA due to loop protrusion
5	Middle-aged	Pericallosal	8.3x5.1x5	No	8mm Raiser Green Filter	Axiom 3x8 Axiom 3x2	29	None	0
6	Elderly	Opticohalamic	9x6.5x3.5	No	9mm Raiser	None	12	None	0
6	Elderly	ICA-T	5.4x4.5x4	No	Green Filter	None	13	None	0
7	Middle-aged	MCA	5.5x4.8x5	No	Green Raiser	Scepter 4x10 balloon Detrapush 4x4 Detrapush 2x4 Detrapush 2x4	70	Scepter C 4/10	0

Haffaf I et al. JNIS 2018 Epub

Reference	Aneurysm Status	Morbidity*	Mortality*
Coiling			
ATENA (2008) ¹	UnR	1.7%	1.4%
HELPS (2008) ²³	UnR/R	—	0.8%
CLARITY (2011) ²	R	3.7%	1.7%
GREAT (2017) ²⁴	UnR/R	—	2.1% [†]
Stent-assisted coiling			
Piotin (2010) ²⁵	UnR/R	7.4%	4.6%
MAPS (2014) ²⁶	UnR/R	1.6%	2.3%
Phan (2016) ²⁷	UnR/R	—	1.4%
Intravascular flow diversion			
PUFS (2013) ²⁸	UnR	4.7%	0.9%
Brinjikji (2013) ²⁹	UnR/R	5.0%	4.0%
Kallmes (2016) ³⁰	UnR/R	5.7%	3.3%
SAFE (2017) ³¹	UnR	2.0%	1.0%
Intrasaccular flow disruption			
Pierot (2017) ³²	UnR/R	3.0%	0.0%
Fiorella (2017) ³³	UnR/R	0.7%	0.0%

Reference	Aneurysm Status	Complete Occlusion	Adequate Occlusion
Coiling			
HELPS (2008) ²³	UnR/R	47.6%	85.5%
CLARITY (2011) ²	R	34.4%	80.4%
MAPS (2014) ^{26,*}	UnR/R	27.1%	57.6%
GREAT (2017) ²⁴	UnR/R	52%	75%
Stent-assisted coiling			
MAPS (2014) ^{26,*}	UnR/R	45.7%	62.8%
Intravascular flow diversion			
PUFS (2013) ^{28,†}	UnR	86.8%	94.3%
Brinjikji (2013) ²⁹	UnR/R	76.0%	—
Kallmes (2016) ³⁰	UnR/R	85.5%	—
SAFE (2018) ³⁶	UnR	73.3%	81.1%
Intrasaccular flow disruption			
Pierot (2017) ³²	UnR/R	52.9%	79.1%

Flow Disruption - Conclusion

- **WEB & LUNA** in unruptured and ruptured aneurysms, not in partially thrombosed aneurysms
- **Medina**, to reduce number of coils
- **Contour & Cerus**, no publications yet; adjunctive to coils likely

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명사초청강연

좌장 : 신승훈(차의과학대)

제주, 그 또 다른 시선

양성철(제이누리 대표)

양 성 철

전 중앙일보 기자

현 제이앤앤(주) 대표이사, 인터넷뉴스 〈제이누리〉 발행 • 편집인



학력	1991	연세대학교 사회과학대학 정치외교학과 졸(정치학 학사)
	1993	연세대학교 대학원 정치학과 졸(정치학 석사)
	2009	제주대학교 대학원 관광개발학과 박사 수료
경력	1986-1988	연세대 부설 교육방송국(YBS) 보도부 기자
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	1993	중앙일보사 입사(공채 31기)
		사회부 경찰출입기자, 전국부 서울시청 출입기자
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	2004-2005	중앙일보사 편집국 사회부 기자
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	2006-2007	중앙일보사 섹션미디어팀 기자, 건강면 담당(부데스크), 교육파트장(교육면 부데스크)
	2007-2010	중앙일보사 편집국 사회부문 내셔널부(제주주재) 기자 (주출입처: 제주도청, 제주경찰청, 제주도교육청, 제주대학교, 제주도의회, JDC, 제주관광공사, 제주 • 서귀포시청 등)
	2011-현재	제이앤앤(주) 대표이사 / 인터넷뉴스 & TV 〈제이누리〉 발행 • 편집인

제주, 그 또 다른 시선

양성철

제이누리 대표



1. 변방의 역사, 고려말 서귀포 범섬에선 무슨 일이?

- 최영 장군과 범섬 앞 막숙 포구
- 목호의 난, 무얼 말하는가?



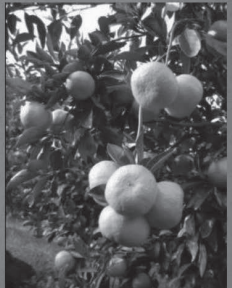
2. 4·3의 아픈 상처

- 한국현대사 그 상처는, 왜?
- 냉전과 2차 세계대전의 격랑속에 오키나와 참상과 대만2·28사건



3. 오렌지 드림을 싹 틔우다

- 감귤로 생명줄, '대학나무'로 속속 자라다
- 1990년대 초 감귤과 관광이 생명산업 (6000억~7000억)



4. 실패에서 기회를 찾다

- ▣ 1990년대 중반 아시아유럽 정상회의(ASEM)유치 실패
→도민주 공모 제주국제컨벤션센터로 미래 찾다



5. 제주, 화산섬 형성사에 눈을 뜨다

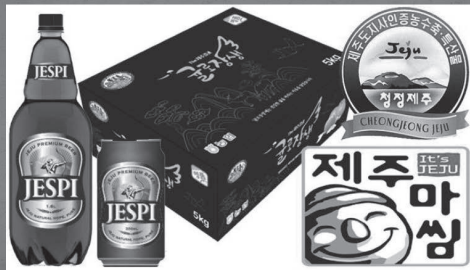
- ▣ 식생의 보고로만 불리던 한라산
한라산맥의 아들 딸 기생화산(오름) 주목!!



송악산/ 수월봉/ 성산일출봉 = 전란의 참상도 역사자원

6. 제주국제자유도시, 세계평화의 섬, 특별자치도

- = 제주의 브랜드는 어디에?



7. 제주의 물 삼다수 어떻게 등장?

- 한진그룹과의 공방전, 공기업으로 살 길 찾다



8. 넘치는 관광객, 비좁은 제주공항

- = 2017년 한해 제주행 관광객 1500만명(중국인 300만명)
- = 제주공항 연간 이용객 3000만명
(서울~제주 노선은 전세계 최고 밀집노선)



9. 다시 제주를 본다

- ▣ 1%의 제주, 그 가능성을 꿈꾼다
- ▣ 1990년대 초 51만명
→ 2018년 70만명
(13만명 37% 증가)
- ▣ 전국 관할해역 중 24% 제주도 관할
- ▣ 세계자연유산, 생물권보전지역, 세계지질공원 → 유네스코 3관왕 타이틀



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Free paper I : "complication case" for aneurysm

좌장 : 김태선(전남대) / 권오기(서울대)

- Case 1. Clinical and radiologic characteristics of ruptured vertebral artery dissecting aneurysms
오세양(인하대)
- Case 2. Delayed rupture of fusiform middle cerebral artery aneurysm treated with stent assisted coil embolization in adolescent with previously STA-MCA surgery
신희섭(경희대)
- Case 3. Proper management of premature rupture with thrombosed parent artery during coil embolization
김대원(원광대)
- Case 4. Missed wire perforation of tiny aneurysm arising from fenestrated A1 segment during the endovascular approach to ACOM aneurysm
고준경(부산대)
- Case 5. The fate of the parent vessel partially occluded by the coil
김종연(연세원주의대)
- Case 6. Aneurysm rupture after insertion of flow diverter stent
이선주(중앙보훈병원)

Case 1. Clinical and radiologic characteristics of ruptured vertebral artery dissecting aneurysms

Se-yang Oh, Yu Shik Shim, Dong Keun Hyun, Hyeonseon Park

Department of Neurosurgery, Inha University Hospital

Objective: Vertebral artery dissecting aneurysms (VADAs) are an uncommon etiology of nontraumatic subarachnoid hemorrhage. Treatment of ruptured VADAs is technically challenging with potentially high morbidity and mortality. The authors retrospectively evaluated the relationship between the clinical and angiographic characteristic and outcomes of the ruptured VADAs.

Methods: A retrospective chart review was conducted for ruptured VADAs between 2007 and 2018 at our hospital. Twenty patients (9 female; mean age, 51.8 years; Hunt-Hess grade: I-III in 6, IV-V in 14) were identified in this study. Treatment methods and outcomes were evaluated.

Result: All patients were treated by endovascular or surgical interventions; internal trapping using endovascular treatment (n=15, 75.0%), stent assisted coiling (n=2, 10.0%), stenting for flow diversion (n=2, 10.0%) and surgical clipping (n=1, 5.0%). Twelve patients (60.0%) had an external ventricular drainage. Eleven VADAs (55.0%) located distally at the origin of the posterior inferior cerebellar artery. Eleven involved vertebral artery (55.0%) were dominant supply to basilar artery. Mean aneurysm width was 5.9 mm. The modified Rankin scales (mRS) on discharge were 0-2 in 8 patents (40.0%), 3-5 in 2 patients (10.0%), 6 (death) in 10 patients (50.0%).

Conclusion: Endovascular treatment of ruptured VADAs appears to be safe and effective. Unfavorable Hunt-Hess grade was strong predictors of unfavorable outcomes.

Case 2. Delayed rupture of fusiform middle cerebral artery aneurysm treated with stent assisted coil embolization in adolescent with previously STA-MCA surgery

Hee Sup Shin, Jun Seok Koh, Hak Cheol Ko, Seung Hwan Lee

Department of Neurosurgery, Kyung Hee University Hospital at Gangdong, Kyung Hee University College of Medicine

Objective: A 16-year-old male patient visited hospital with a symptom of altered consciousness after seizure-like motion. Computed tomography (CT) showed acute subarachnoid hemorrhage, and CT angiogram (CTA) and digital subtraction angiogram (DSA) showed a fusiform aneurysm on M1 segment of right middle cerebral artery (MCA). He had been diagnosed with moyamoya disease and had an operation of STA-MCA bypass surgery on right side hemisphere 10 years ago.

Methods: We performed stent assisted coil embolization for right M1 fusiform aneurysm. We used two LVIS stents and three detachable coils. During procedure in-stent thrombosis was detected and MCA occlusion occurred. After 0.5mg of intra-arterial tirofiban infusion, the occluded MCA was revascularized. The final angiogram showed successful obliteration of aneurysm and patent MCA flow.

Result: The patient recovered to alert consciousness with left hemiparesis. The follow-up DSA after 40 days from hemorrhage showed small recanalization of aneurysm sac and patent MCA flow, and he was discharged from hospital after 2 months of hemorrhage.

Conclusion: At 10 days after discharge, he revisited the emergency room with huge intracerebral hemorrhage on right hemisphere, and was performed decompressive hemicraniectomy and hematoma removal. He had severe disability of mRS 5.

Case 3. Proper management of premature rupture with thrombosed parent artery during coil embolization

Dae Won Kim

Department of Neurosurgery, Wonkwang University Hospital

Objective: Premature rupture and parent artery thrombosis are serious complication during coil embolization. However, the treatments of these complications are opposite.

Methods: The author experiences the premature rupture with parent artery thrombotic occlusion simultaneously during coil embolization.

Result: Premature rupture was not seen due to the parent artery thrombotic occlusion. However, the author could not remove coil and microcatheter. The coil and microcatheter were removed by open craniotomy. Aneurysm was obliterated by clipping. Intraoperatively, coil was knotting.

Conclusion: The treatments of premature rupture and parent artery thrombosis are opposite and difficult when occur simultaneously. The neurosurgeon should be careful caution to prevent these complications. Interventionist should keep in mind that some complicated cases are solved by surgical approach, despite most of complicated cases can be solved by interventional method.

Case 4. Missed wire perforation of tiny aneurysm arising from fenestrated A1 segment during the endovascular approach to ACOM aneurysm

Jun Kyeong Ko

Department of Neurosurgery, Medical Research Institute, Pusan National University Hospital

Objective: Vascular anomaly and aneurysmal formation of an anterior communicating artery (ACOM) complex has often been reported. Because of such a complicated relationship between the vascular structure and aneurysms, ACOM aneurysm is one of the most difficult aneurysms to treat among other common anterior circulation aneurysms. We herein report a case of missed wire perforation of tiny aneurysm arising from fenestrated A1 segment during the endovascular approach to ACOM aneurysm.

Methods: This case was a 77-year-old woman incidentally diagnosed with an unruptured left ACOM aneurysm. Cerebral angiography revealed a 7mm-sized ACOM aneurysm with ACOM fenestration.

Result: During the endovascular treatment, contrast leakage from mid-A1 segment occurred as the microwire passed through the left A1 segment, suspecting A1 dissection by microwire. ACOM aneurysm and A1 dissection were treated simultaneously with a Solitaire AB stent and coils using the waffle-cone technique. No more bleeding has been observed since the stent was deployed through the entire A1 segment. Immediately after the procedure, the patient had recovered to a relatively good condition, but a rebleeding that occurred two hours after the procedure worsened her condition. Repeated cerebral angiography confirmed that the cause of the bleeding was a wire perforation of tiny aneurysm arising from fenestrated A1 segment, not A1 dissection. Despite immediate coil packing of fenestrated A1 segment and extraventricular drainage, she has not regained consciousness to date.

Conclusion: Endovascular treatment for ACOM aneurysm requires more detailed evaluations of the accompanying vascular anomaly and hemodynamics around ACOM to avoid complications.

Case 5. The fate of the parent vessel partially occluded by the coil

Jong Yeon Kim, Chul-Hu, Jhin-Soo Pyen, Kum Whang, Sung-Min Cho, Jong Wook Choi

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

Objective: Many undesirable results occur during coil embolization. If the parent vessel is partially clogged, insert stents or other rescue methods. However, if these methods are not possible, if the flow of blood flow is good, then it is impossible to leave it incomplete. However, if you do so, you will not be able to make an appointment for the remaining aneurysm and vessel. We report the 2-year follow-up results of partial-occlusion vessels.

Methods: A 59-year-old female patient underwent a coil embolization plan for unruptured DACA aneurysm. The waffle cone technique was used, but the stent was deployed too proximal and the frame coil was made first, but the parent vessel could not be completely covered. The second coil collapsed the frame and a portion of the distal parent vessel occlusion. I confirmed flow and finished the procedure.

Result: Follow-up TFCA was performed in 2 years. The vessel that had previously been partially occlusion became hypoplastic. In the meantime, the patient did not have any neurological symptoms. The patient will later receive additional treatment with a simple coil.

Conclusion: During the coil embolization, part of the parent vessel is occasionally occluded by a coil. If so, it would be a one way to wait and see if the flow is not bad.

Case 6. Aneurysm rupture after insertion of flow diverter stent

Sunjoo Lee, Oh Inho, Heeil Kang, JiHye Lee, Moonhee Han

Department of Neurosurgery, Veterans Health Service Medical Center

Objective: To report the experience of subarachnoid hemorrhage after flow-diverter stent implantation in the management of a giant aneurysm of proximal basilar artery

Methods: A 64 - year - old woman visited our clinic with a leg weakness and dizziness. As a result, a unruptured giant aneurysm was observed in the left side of the proximal basal artery, which is pushed to the right side of the pontine bridge. A flow-diverter stent insertion was performed for the treatment. The postoperative morbidity was the same as before the operation, and a very small cerebral infarction was observed in the left cerebellum in the postoperative MRI. On the fourth day after surgery, the patient suddenly complained of severe headache, and consciousness worsened to stupor. A large amount of subarachnoid hemorrhage was observed on the brain CT. It was confirmed that the distal portion of the stent was inserted into the aneurysm. It was speculated that the stent slipped and ruptured the wall of the aneurysm. Emergency coil embolization was performed, but the patient eventually died.

Result: The cause of the movement of the stent can't be clarified. First, the amount of blood flow into the aneurysm decreases after the flow-diverter stent is installed, but the pressure on the distal portion of the flow-diverter stent becomes stronger as the increasing amount of blood flow into the stent. Second, because of the calcification of the basilar artery, It is assumed that the position of the stent was changed by acting in a complex manner.

Conclusion: It is expected that this unforeseeable and unfortunate complication will be reduced if stent insertion and coiling of the aneurysm in the cerebral aneurysm is performed, rather than just stent insertion.

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Free paper II: "complication case" for ischemia & others

좌장 : 김범태(순천향대) / 김영우(가톨릭대)

Case 1. This is disaster after incomplete occlusion of AVF 박정현 (한림대)

Case 2. Trans-cranial embolization with direct dural sinus puncture at Hybrid operating room for failed or impossible trans-arterial approach in dural AVF 이호준 (가톨릭대)

Case 3. Challenging IA thrombectomy beyond DAWNs trials 엄태웅(울산대)

Case 4. The modified stent retrieval technique for distal migrated embolus via controlling of unsheathing level 전홍준(한림대)

Case 5. Intraprocedural in-stent plaque protrusion during carotid artery stenting 하상우(조선대)

Case 6. Thrombectomy for superior sagittal sinus occlusion 배희진(고려대)

Case 7. Double overlapping stent implantation using LVIS blue stents for a basilar artery aneurysm in a patient with vasculitis 반승필(서울대)

Case 1. This is disaster after incomplete occlusion of AVF

Jung Hyun Park

Department of Neurosurgery, Hallym University Dongtan Sacred Heart Hospital

Objective: To describe importance of complete occlusion of AVF. What kind of disaster would be happened after incomplete occlusion of AVF.

Methods: 59 years old male patient was visited ER with loss of consciousness (semi-comatose) by cerebellar ICH. After hematoma removal, AVF was found by DSA. Tried Onyx occlusion for AVF, and the procedure was finished by incomplete occlusion.

Result: The neurological symptom was aggravated after the procedure, and the patient was expired.

Conclusion: Incomplete occlusion of AVF is dangerous and should try to occlude them perfectly.

Case 2. Trans-cranial embolization with direct dural sinus puncture at Hybrid operating room for failed or impossible trans-arterial approach in Dural AVF

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: Dural arteriovenous fistulas (DAVF) are rare entities, constituting 10-15% of all intracranial vascular malformations. Trans-arterial or trans-venous embolization and surgical coagulation of draining vein are preferred treatment options for DAVF. Recently, a combination of surgical and endovascular techniques, including direct-puncture to feeder or large vein, has been described. So, we present two cases of DAVF treated with trans-cranial approach by direct dural sinus puncture, in which ONYX embolization failed or could not be attempted.

Methods:

Case 1 - A 67-year-old woman referred to our hospital due to symptoms like Gerstmann syndrome. Transverse-sigmoid sinus DAVF was diagnosed by various imaging studies and ONYX embolization was tried through the main occipital artery (OA) feeder, but failed due to its tortuosity of OA. And then, we tried trans-cranial coil embolization with direct dural sinus puncture at hybrid operating room (OR). Procedure was successful done and the patient was recovered well without complications.

Case 2 - A 48-year-old man transferred to our hospital for evaluation of seizure. Through the angiography, transverse-sigmoid sinus DAVF identified as in case 1. In this patient, primary trans-cranial embolization was performed through direct dural sinus puncture because the diameter of main feeder was too small and there was no appropriate vessel to perform a trans-venous approach. Postoperatively, he recovered well.

Result: Recently, there are many multimodality treatment modalities including compression, trans-venous, trans-arterial embolization, surgery, and radiosurgery. In our cases, trans-arterial ONYX embolization using main feeder was failed or could not be attempted due to poor accessibility of main feeder. And then, we tried combined coil embolization with trans-cranial approach using direct dural sinus puncture technique. This technique is sometimes very useful when a traditional trans-arterial or trans-venous approach was failed or impossible. Many neurosurgeons could successfully treated for DAVFs using trans-cranial approach, and it will be easier if hybrid OR is secured.

Conclusion: Trans-cranial approach using direct dural sinus puncture technique could be an alternative way to treat the DAVFs, when usual trans-femoral trans-arterial or trans-venous approach have failed, especially in hybrid OR.

Case 3. Challenging IA thrombectomy beyond DAWNs trials

Tae-oong Eom, Soon-Chan Kwon

Department of Neurosurgery, University of Ulsan College of Medicine

Objective: We performed a retrospective review to evaluate the efficacy and safety of IA thrombectomy in patients who underwent IA thrombectomy 24 hours after acute stroke.

Methods: We present two cases of delayed IA thrombectomy in a 61-year-old man with left-sided weakness and in 56-year-old man with motor aphasia. In the first patient, right ACA/MCA, MCA/PCA border zone infarction and ICA occlusion were observed. His symptoms worsened after 78 hours of stroke and clinical mismatch was suspected. In the second patient, a small amount of infarction in the left cerebral hemisphere and ICA occlusion were observed. Symptoms such as dysarthria and right hemiparesis deteriorated after 36 hours of stroke. Repeated MRI showed a slightly increased infarction core volume in both cases. IA thrombectomy was performed to complete reperfusion (TICI Gr3) and the symptoms of both patients improved.

Result: Our two cases are exclusion criteria for IA thrombectomy according to recent trial and recommendation. Patients received IA thrombectomy and showed clinical improvement.

Conclusion: The DEFUSE-3 and DAWN trials demonstrated the efficacy of delayed IA thrombectomy for 16 and 24 hours, respectively. But our two cases could be expected to extend time window for more than 24 hours for highly selected patients, if there are clinical or imaginary mismatch. Of course, further studies involving the control group will be needed.

Case 4. The modified stent retrieval technique for distal migrated embolus via controlling of unsheathing level

Hong Jun Jeon, Jong Young Lee

Department of Neurosurgery, Kangdong Sacred Heart Hospital, Hallym University College of Medicine

Objective: Although stent retrieval (STR) devices have demonstrated the promising benefit for patients with acute large vessel occlusion (LVO), the procedural migration of embolic particle to the distal branch may be a burden of vessel injury to achieve a successful recanalization. To resolve it with less risk, we described the modified STR technique via controlling for unsheathing level of the microcatheter.

Methods: From January 2016 to February 2019, 11 (4.0%) of 273 with acute LVO stroke at the anterior circulation occurred secondary migration into M2, M3 or A2, A3 branch. All migrated clot was accessed by the modified retrieval technique. Radiopaque stent retrieval using Trevo XP 4/20 and Solitaire Platinum 4/20 was deployed within the clot by adjustment of covering range which delivery catheter was partially re-sheathed after fully unsheathing.

Result: After the recanalization of primary LVO with 8~9Fr balloon guiding catheter, the secondary distal vessel occlusion (DVO) has happened to M2/M3/A2/A3 in 4/3/2/2 patients (puncture to primary recanalization, 35 ± 4 min) and TICI (Thrombolysis in Cerebral Infarction) score was 2a in 7 patients and 2b in 4 patients. All migrated DVO was successfully recanalized into TICI 3 (mean duration, 8 ± 2 min) and has not occurred procedural complication. A favorable functional outcome (mRS, 0-2) was achieved in seven (63.3%) patients at 3 months.

Conclusion: Controlling of unsheathing level for retrieval stent is a simple modification of the STR. This technique serves safe and effective recanalization in distal occlusion by a migrated embolus.

Case 5. Intraprocedural in-stent plaque protrusion during carotid artery stenting

Sang-woo Ha, Hak-sung Kim

Department of Neurosurgery, Chosun University Hospital

Objective: To report our case with plaque protrusion through stent struts that were treated successfully by aspiration using guiding catheter.

Methods: A 67-years old female visited our emergency room with the right hemiplegia occurred 2hours ago. We confirmed the left ICA proximal occlusion due to severe stenosis. After emergency CAS, stenosis of ICA improved, but carotid angiogram after procedure demonstrated a movable plaque protrusion from the posterior wall of the carotid artery.

Result: We managed the plaque successfully by aspiration using guiding catheter. After the procedure, in-stent plaque protrusion disappeared.

Conclusion: Aspiration thrombectomy can be effective option for the management of in-stent plaque protrusion during the CAS.

Case 6. Thrombectomy for superior sagittal sinus occlusion

Heejin Bae, Wonki Yoon, Tackhyun Kwon, Jonghyun Kim, Kyuha Jung

Department of Neurosurgery, Korea University Medical Center, Guro Hospital

60-year-old female visited emergency room for headache, left hemiparesis. Through CT, she was diagnosed ICH at right parietal lobe. No arterial abnormality was observed by CT-A. As a further evaluation, DSA was performed. SSS thrombosis was diagnosed and treated by aspiration. ICP was controlled well, but 5~6 hours later, ICP became over 30. Recurrence of SSS occlusion was diagnosed by CT-perfusion. She was treated by aspiration again, and had taken surgery for evacuation of hematoma to decompression. She has been taking ICU care now.

Recurrence of SSS occlusion despite of use of anticoagulant.

Case 7. Double overlapping stent implantation using LVIS blue stents for a basilar artery aneurysm in a patient with vasculitis

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

Department of Neurosurgery, Seoul National University Bundang Hospital

Objective: Treatment of intracranial aneurysms associated with vasculitis is challenging.

Methods: A 20-year-old woman visited our out-patient clinic due to increasing the size of a basilar artery aneurysm. She was diagnosed with subarachnoid hemorrhage 7 months ago at other hospital. On digital subtraction angiography (DSA), irregular contour in right P1 branch was detected. During 5-month period of observation, the right P1 lesion did not change, but aneurysmal outpouching change at distal basilar artery (BA) was newly detected and the size slowly increased. In our hospital, vasculitis was confirmed on laboratory tests and corticosteroid medication was started. One month later, she came back to our department with complaint of severe headache. Brain MRA were performed and increased size of BA aneurysm was found. We planned to continue medical treatment for vasculitis and perform coil embolization for dangerous portion of the basilar artery aneurysm. Despite continued medical treatment for vasculitis, the size of the aneurysm increased on 6-month follow-up MRA. We performed double stenting for the BA aneurysm using LVIS blue stents.

Result: On 3-month follow-up brain MRA, the size of BA aneurysm decreased. She recovered well.

Conclusion: This case demonstrates the efficacy of flow diversion using double LVIS blue stents in select patients with basilar artery aneurysms associated with vasculitis.

The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty



Breakfast seminar

좌장 : 윤석만(순천향대) / 김대원(원광대)

1. Usefulness of metal coverage for treatment of intracranial aneurysm

박석규(순천향대)

2. Flow diverter for treatment of intracranial aneurysm

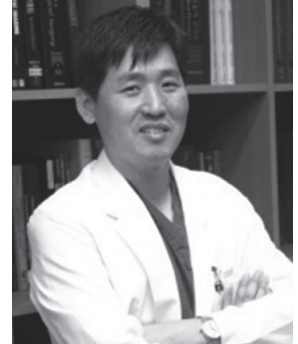
진성철(인제대)

3. Contact aspiration & stent delivery

권순찬(울산대)

박 석 규

순천향대학교 서울병원 신경외과,
순천향대학교 의과대학 신경외과학교실



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	1999	순천향대학교 대학원 석사
	2009	순천향대학교 대학원 박사
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	1996-2000	순천향대학교병원 신경외과 전공의
	2000-2003	공중보건과의
	2003-2005	순천향대학교 구미병원, 순천향대학교 의과대학 신경외과학교실 전임강사
	2005-2006	분당서울대학교병원 신경외과 임상강사 (뇌혈관분야)
	2006-2007	분당서울대학교병원 신경외과 촉탁조교수
	2008-2010	한국원자력의학원 원자력병원 신경외과 임상과장
	2010-2014	순천향대학교 서울병원, 순천향대학교 의과대학 신경외과학교실 부교수
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	2016-현재	순천향대학교 서울병원 중환자실장

Usefulness of metal coverage for treatment of intracranial aneurysm

박석규

순천향대학교 서울병원 신경외과

At present, cerebral aneurysm embolization is being developed into various treatment methods according to the development of new device. The coil is more subdivided, and the product is suitable for each step of coil insertion, and a coil for a higher packing density has been used. The stent used with Coil is softer than in the past, the profile becomes smaller, and it is possible to deploy it more easily in the small artery, and the variety of the stent becomes wider. The use of flow diverters (FD) is becoming increasingly widespread (although it is difficult to use of FD in Korea). And also intra-saccular flow disrupter has recently been reported in many clinical trials and recently passed the new medical technology evaluation of NECA, and it is likely to be available soon.

Endovascular flow diversion, with the ability to reconstruct the parent artery, has been suggested as an important addition to the endovascular treatment for the intracranial aneurysm and dissection.

Several articles have reported on the safety and efficacy of the FD which showed promising results. However, there has been considerable pessimism with respect to the use of FD for posterior circulation aneurysms because of its possible delayed complications, in particular perforator territory infarcts and delayed ruptures. Additionally, the Korea's Ministry of Health and Welfare sets the indication of PED to treat adults with large or giant wide-necked intracranial aneurysms and non-saccular lesions.

The low profile visualized intraluminal support (LVIS) stent (MicroVention Terumo, Tustin, California, USA), a new device offering an option between conventional neurovascular stents and flow diverters, was designed to improve the long term efficacy of endovascular treatment while avoiding impact on side branches. Its small cell structure and high metal coverage were found to provide great protection across the aneurysm neck and to improve flow diversion over other currently available coil assist stents.

It is well known that stent placement decreases wall shear stress in the aneurysm in proportion to the number of overlapping stents. Therefore, multiple overlapping stents may be more effective for obliteration of aneurysm than a single stent, and may also decrease the porosity of the stent construct and further promote immediate thrombosis in the aneurysm. As the metal surface area coverage of the stent increases, the risk of thrombosis from excessive neo-intimal growth increases. From another perspective, increasing the metal coverage promotes the obliteration of aneurysm and dissection.

In this presentation, we will discuss the use of LVIS stents for the treatment of aneurysm through flow diversion.

진 성 철

인제대학교 해운대백병원 신경외과



학력

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2006	이화여자대학교 목동병원 (레지던트)
2004-2006	고려대학교 의과대학 석사
2007-2012	고려대학교 의과대학 박사

경력

2006-2007	이화여자대학교 의과대학 목동병원 뇌혈관 직접 수술 신경외과 전임의
2007-2009	서울아산병원 신경외과 뇌혈관 직접 수술 및 뇌혈관 내 수술 전임의
2009-2010	분당 서울대학교 병원 허혈성 뇌질환 (모야모야병, 동맥 경화성 뇌질환) 및 뇌혈관 내 수술 전임의
2010-현재	인제대학교 의과대학 해운대 백병원 조교수 (뇌혈관 내 수술 및 허혈성 뇌질환 (모야모야병, 동맥경화성 뇌질환))

Flow diverter for treatment of intracranial aneurysm

진성철

인제대학교 해운대백병원 신경외과

Flow diverter for treatment of intracranial aneurysm

Sung-Chul Jin
Department of Neurosurgery, Inje university,
Haeundae Paik Hospital

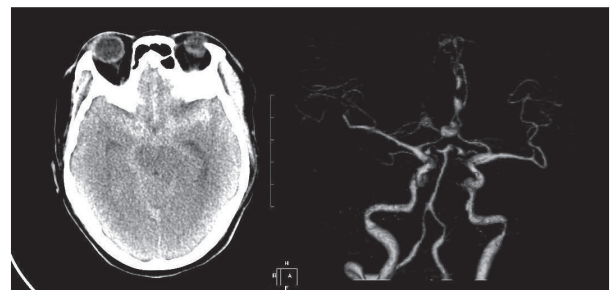
Recent trend of flow diverter

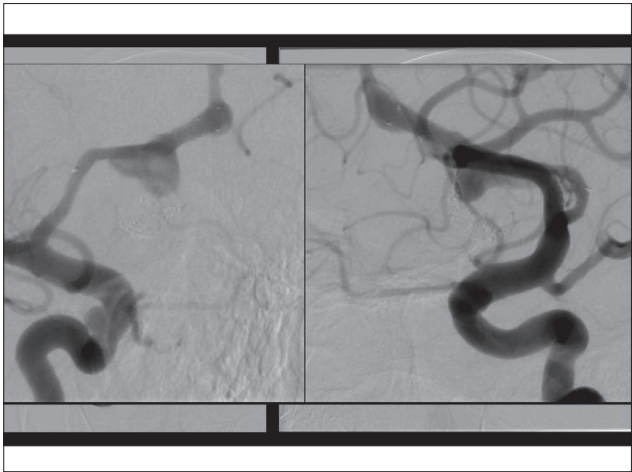
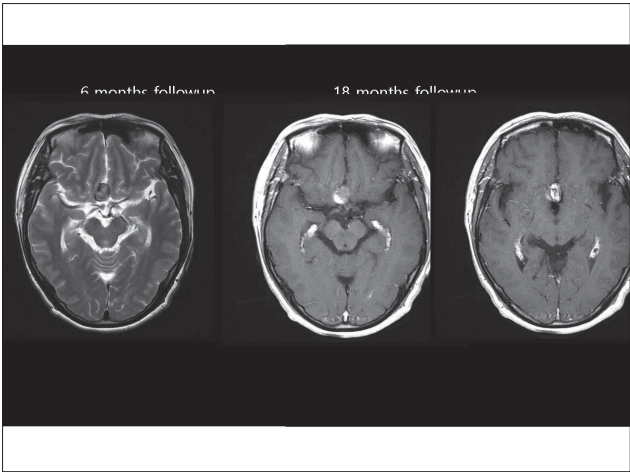
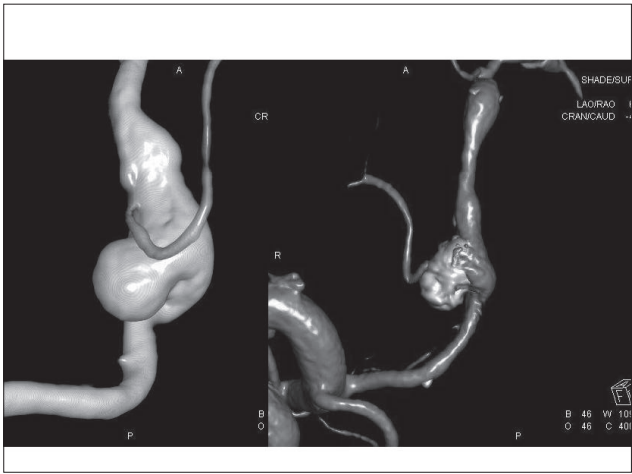
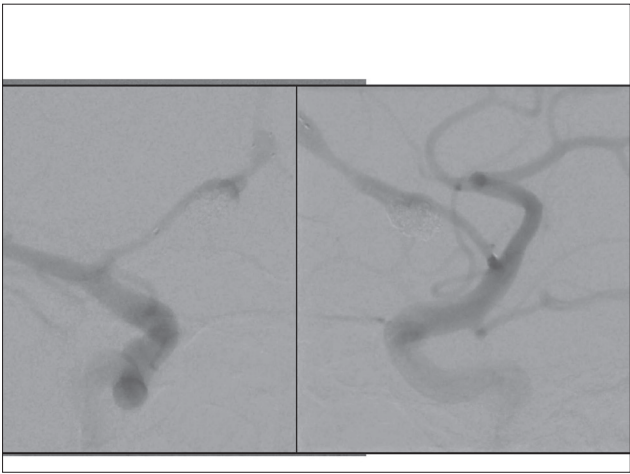
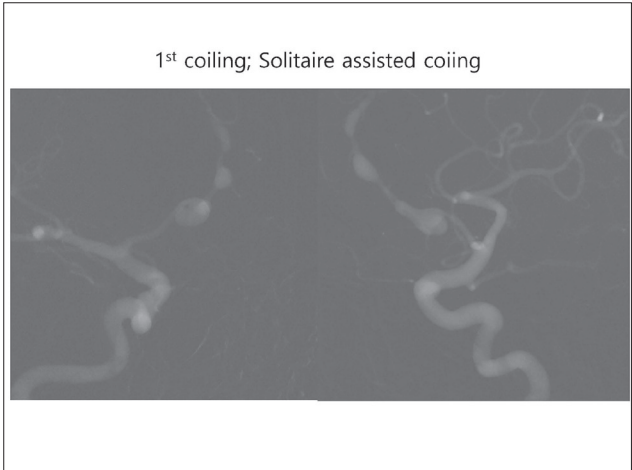
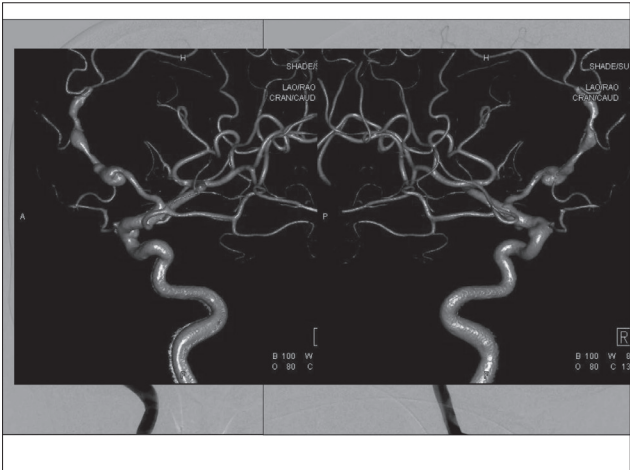
- Small cerebral aneurysms
- Ruptured cerebral aneurysms
- Blister or ruptured VA dissecting aneurysms

Practical use of flow diverter in Korea

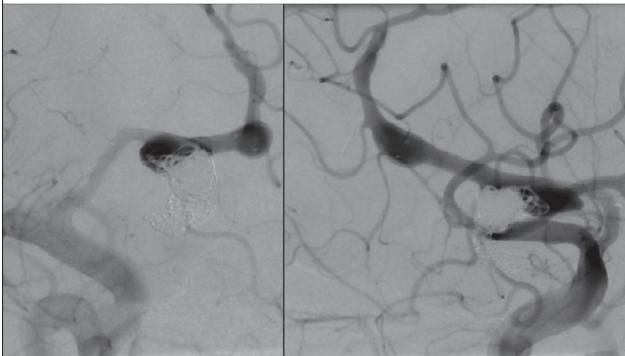
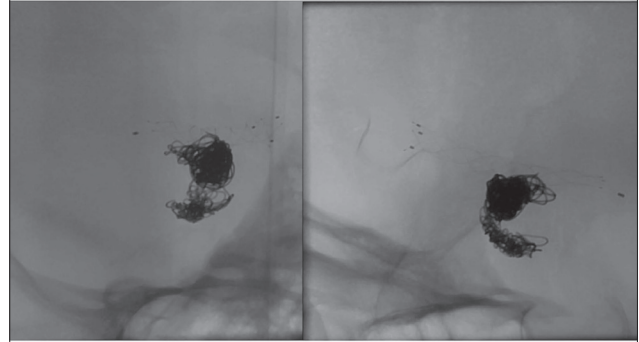
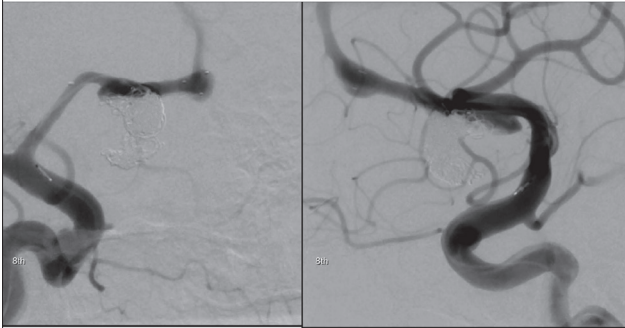
- Major re-growing aneurysms after coiling
- Large sized ICA aneurysms
- Vertebral dissecting aneurysms

F/48, headache

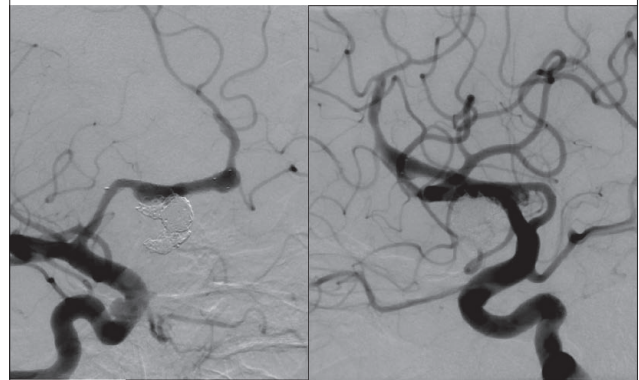




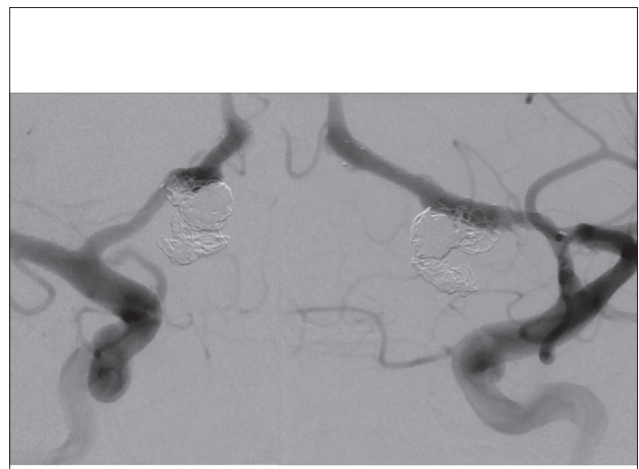
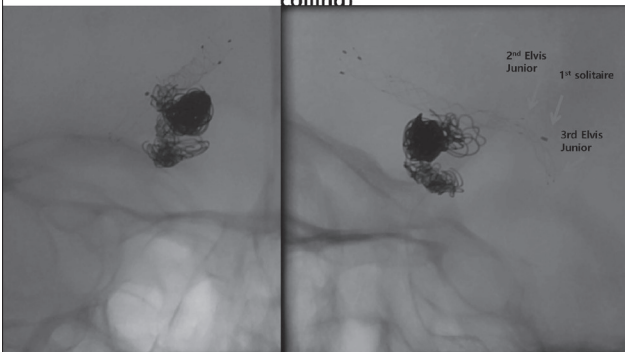
2nd coiling, Elvis junior stenting after coiling



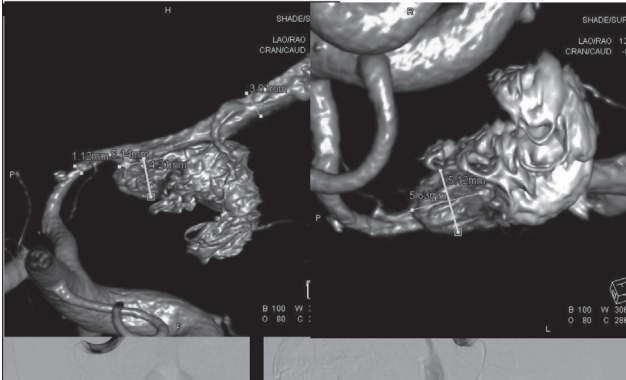
2 months after 2nd coiling



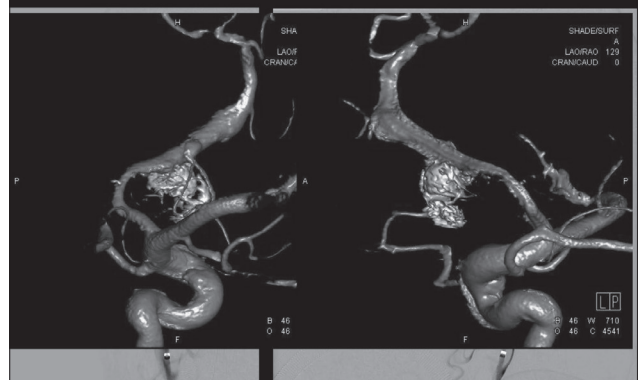
3rd coiling, Elvis junior stenting (3months after 2nd coiling)



5 months after 3rd coiling



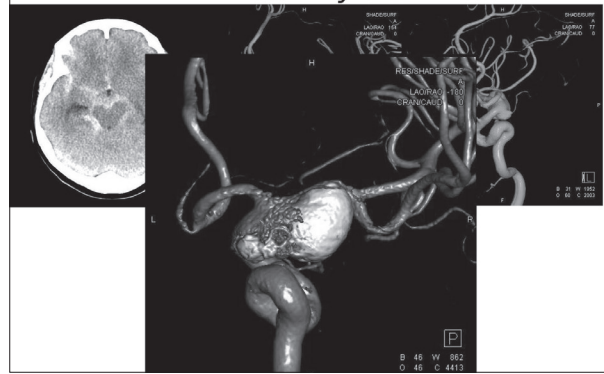
8 months after 3rd coiling



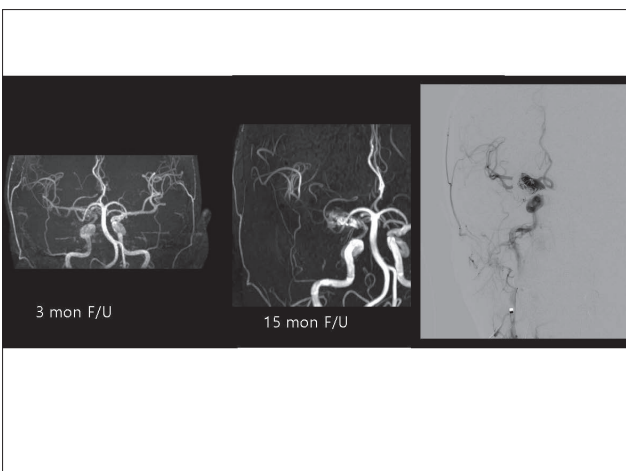
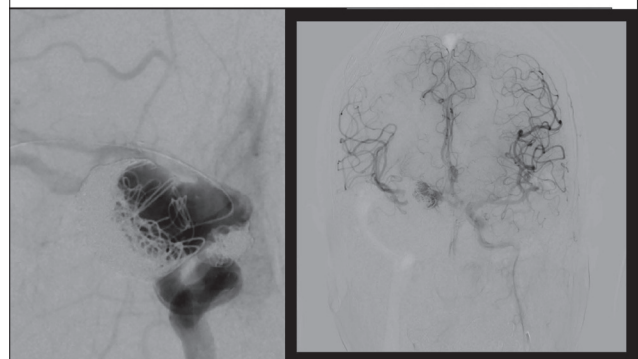
Take home message

- Stent assisted coiling is not durable option in the ruptured dissecting aneurysm
- Flow-diversion is inevitable in the treatment of re-growing aneurysms
- Cautious modulation of antiplatelet medication is cardinal.

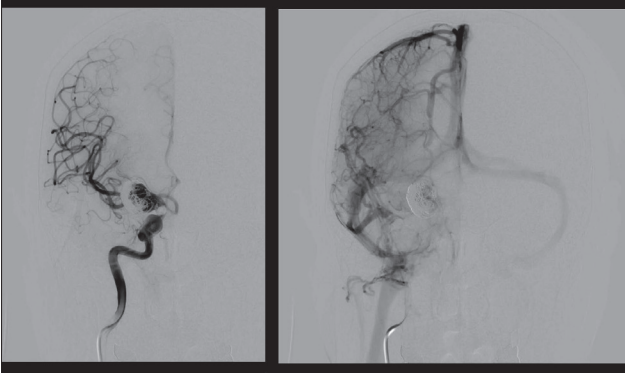
F/61, ruptured large pcoma aneurysm



Fred 4.5x28



1 week after Fred



Take home message

- Do not use overlength flow diverter in carotid siphon

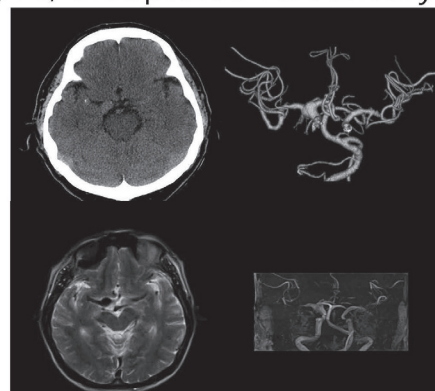
Lt side weakness with dysarthria

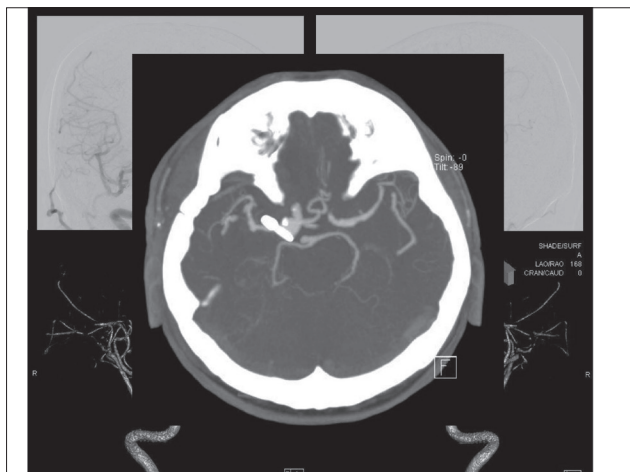


- Flow diverter; aspirin with pletaal
- 한달: aspirin mono
- Infarction후 처음 aspirin with effient 10mg
- 현재 aspirin with effient 5mg

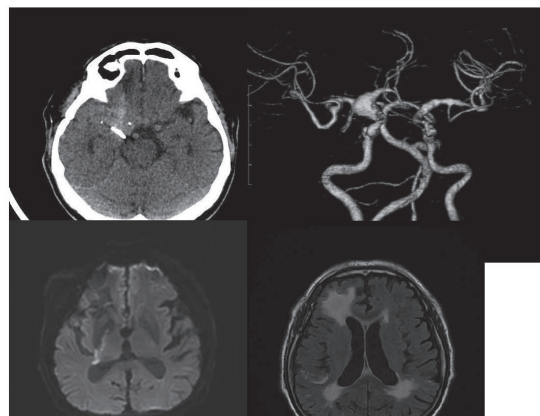
- 앞으로 어떻게?
- Medication trend?

M/78, unruptured ICA aneurysm



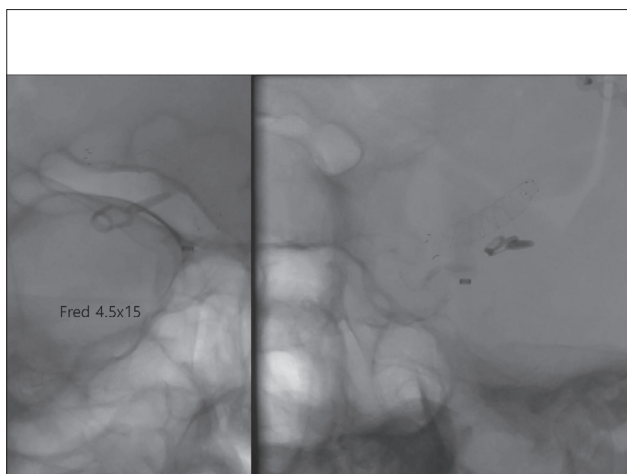
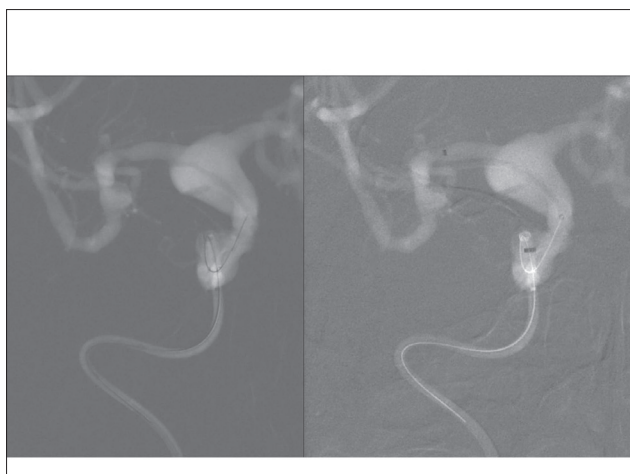
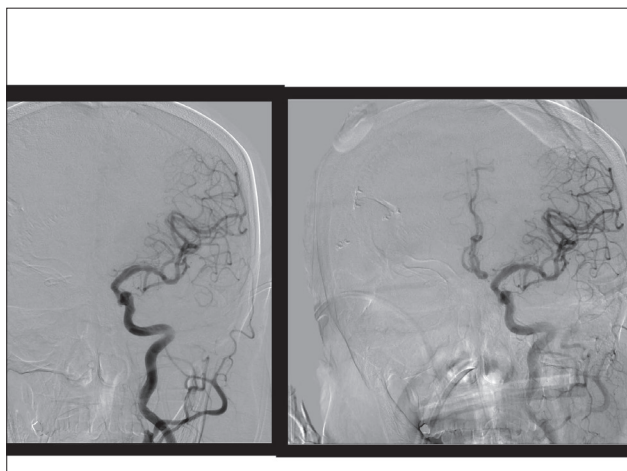


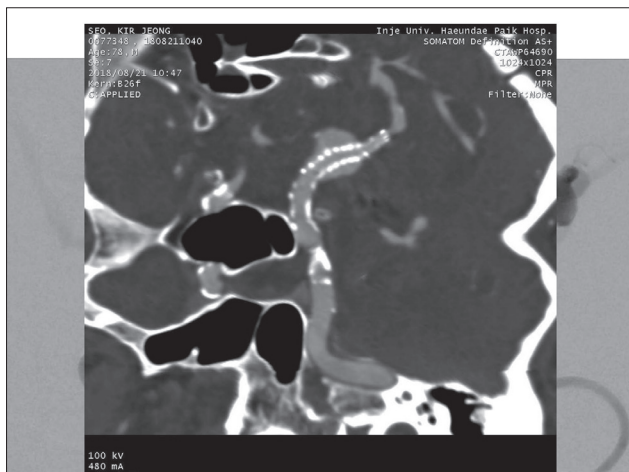
8yr later, drowsy mentality with Lt hemiparesis (grade II)



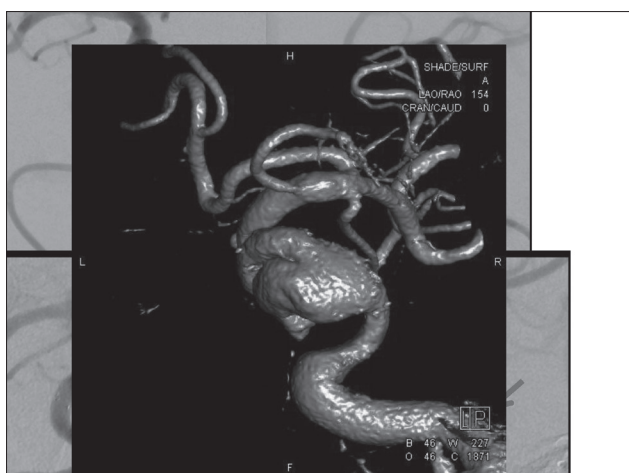
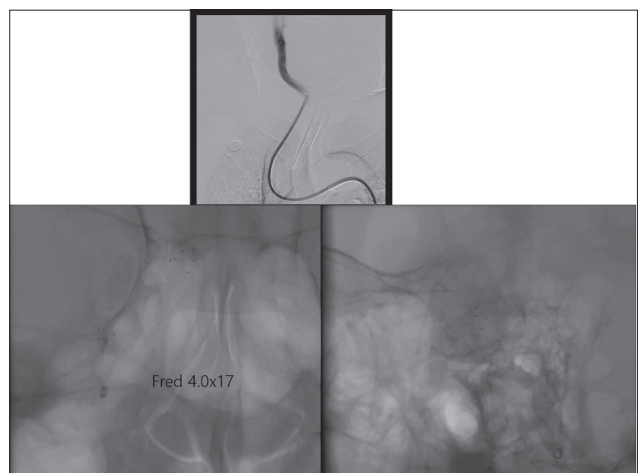
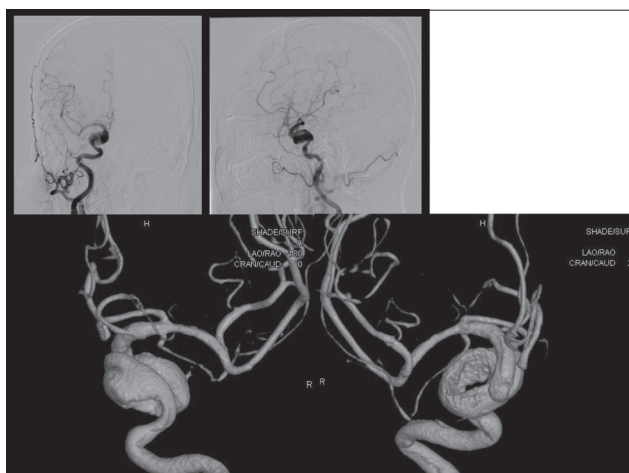
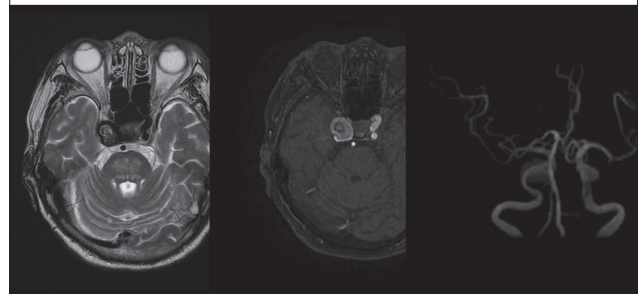
Option?

- Bypass with trapping
- Stent assisted coiling
- Flowdiverter





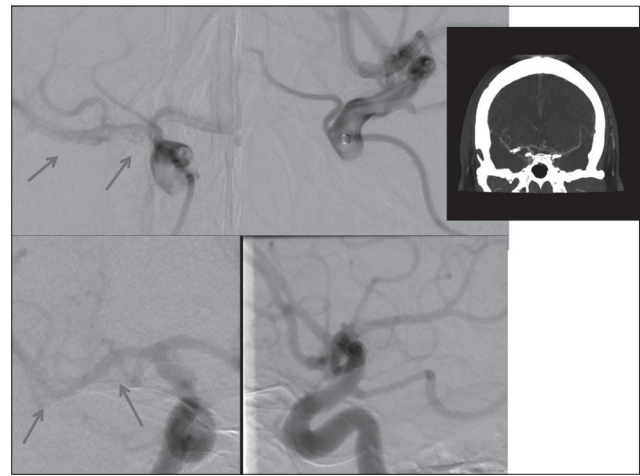
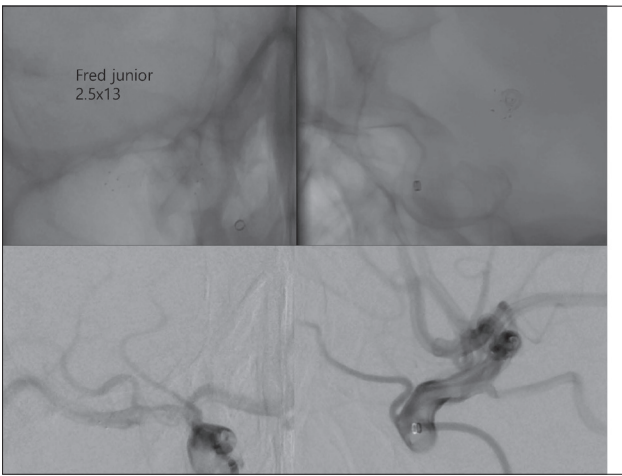
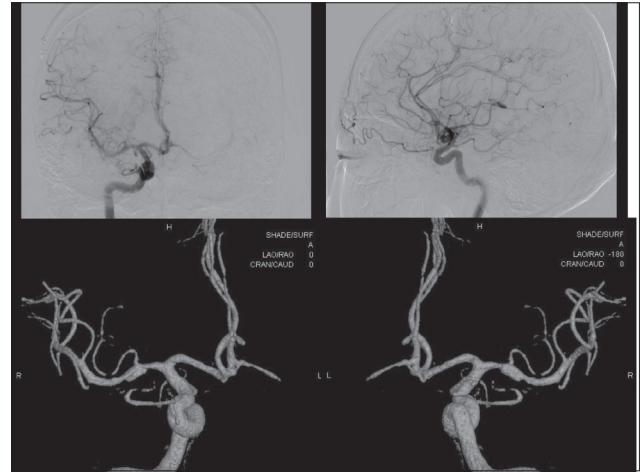
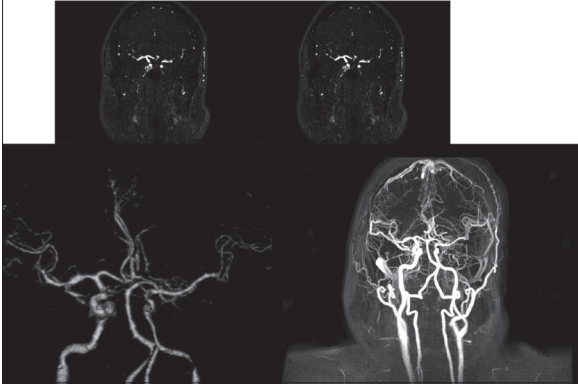
F/85, headache with ptosis



Take home message

- Cautious use for stent length due to shortage of stent

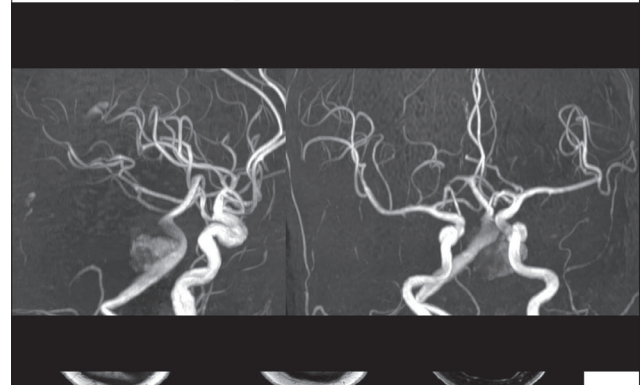
M/33, severe headache

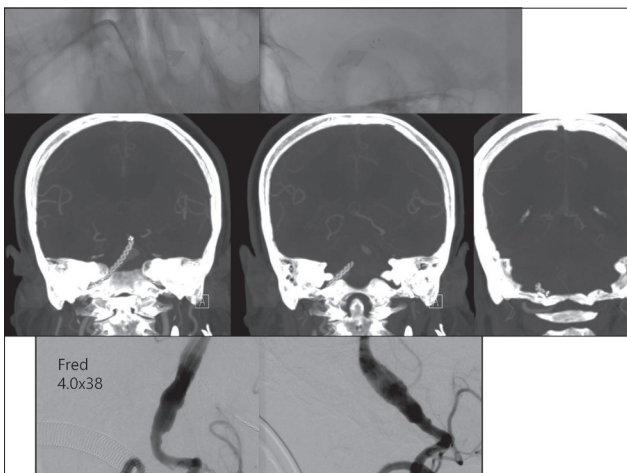
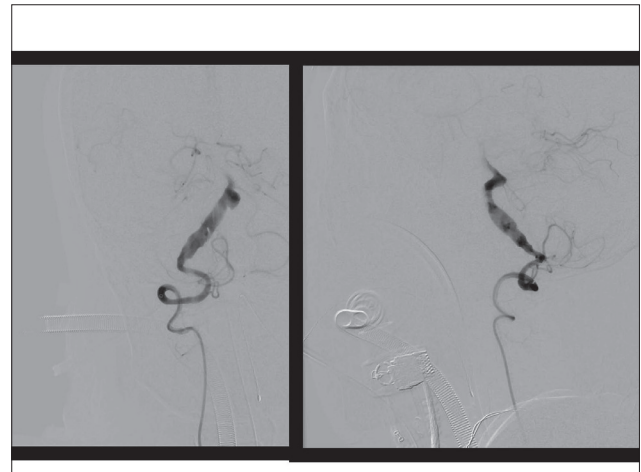
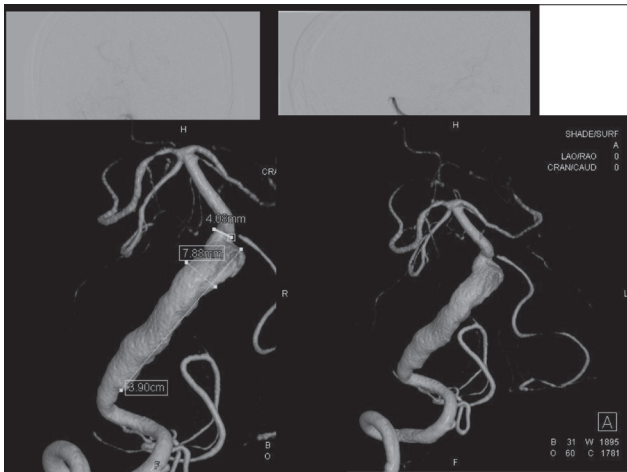


Take home message

- Undersizing stenting will may have a possibility of stent migration

F/67,gait disturbance





권 순 찬

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학력 및 경력

1994	인제대학교, 의학사
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2018-현재	권역심뇌혈관센터장 (울산대학교병원)
2009-2010	Research Fellow (Mayo Clinic, Rochester, MN, USA)

자격 및 면허

1999	Korean Board of Neurological Surgeons
2011	Korean Board of Traumatology
2013	Certification of Endovascular Neurosurgeon from Society of Korean Endovascular Neurosurgeons (SKEN)
2015	Certification from Korean Society of Interventional Neuroradiology (KSIN)

Contact aspiration & stent delivery

권순찬

울산대학교병원 신경외과

Modern evolution of endovascular mechanical thrombectomy can allow for faster and more effective reperfusion for acute ischemic stroke (AIS) with large artery occlusion less than 24 hours. And early successful reperfusion, which means fast and complete recanalization, and recently first pass effect (FPE) have been correlated with favorable outcomes for AIS.

Current mainstreams for technical aspects for IA thrombectomy are stent retriever, suction thrombectomy, and combined strategy. And there are many papers for comparison between stent-retriever and direct aspiration.

I want to review the recent details of mechanical thrombectomy technique in each with UUH experiences.

The 14th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2019

Theme: for ascent beyond uncertainty



Free paper III: "my first case from young gun" in EVT

좌장 : 성재훈(가톨릭대) / 김태곤(차의과학대)

Case 1. First experience of transarterial Onyx embolization for Spinal AVM

박영기(인제대)

Case 2. A report on the experience of endovascular treatment of a large aneurysm by a novice

김창현(부산대)

Case 3. Treatment of blood blister-like aneurysms with overlapping stents assisted coiling

심재현(PMC박병원)

Case 4. Early rebleeding after coil embolization of ruptured anterior communicating artery aneurysm

김정재(이화여대)

Case 5. Vascular perforation during EVT of cerebral aneurysm

구본섭(울산대)

Case 6. Treatment of vertebral dissecting aneurysm with the low-profile visualized intraluminal support (LVIS) device only

김영지(뉴고려병원)

Case 1. First experience of transarterial Onyx embolization for Spinal AVM

Yung Ki Park, Hae-Won Koo, Moon-Jun Sohn, Chae Heuck Lee

Department of Neurosurgery, Inje University, Ilsan Paik Hospital

Objective: I introduce the case of trans-arterial Onyx embolization for spinal arteriovenous malformation(AVM) patients, which is my first experience of Onyx.

Methods: Twenty-six years old male presented with left lower extremity motor weakness (Grade III), which was started 4 years ago. He suffered for left side foot drop and impaired tandem gait, and visited to our institution for second opinion. This patient had a history of surgical resection of intradural cavernous angioma at the level of T6-T7, 15 years before at different institution.

Result: Spinal angiography and MRI revealed a spinal AVM located at T6-T7 level, which is fed by left T8 segmental artery. Trans-arterial Onyx embolization was performed via the single feeder. Nidus was properly embolized by Onyx material and postop angiography and MRI revealed total obliteration of nidus and disappearance of dilated adjacent vein. Regurgitation of Onyx material was noted at the feeding artery, but fortunately procedural complication did not occur.

Conclusion: Spinal AVM with single large feeding artery was successfully treated with Onyx embolization. Proper flow management such as lowering blood pressure or balloon- or coil-assisted embolization could have been helpful to avoid Onyx regurgitation.

Case 2. A report on the experience of endovascular treatment of a large aneurysm by a novice

Chang Hyeun Kim, Young Ha Kim, Sang Weon Lee

Department of Neurosurgery, Pusan National University Yangsan Hospital

Objective: This study reports the difficulties experienced in the endovascular treatment of cerebral aneurysms more than 10mm.

Methods: We retrospectively analyzed data from all patients with ruptured or unruptured cerebral aneurysm who underwent coil embolization between January 2018 and April 2019. We analyzed 23 patients with 23 large aneurysms using electronic medical records (EMR) and picture archiving and communication system (PCAS) data

Result: Of eight unruptured patients, 1 patient was treated with Flow diverter (pipeline), 4 patients were treated with stent assisted coil embolization(SAC), and the rest were treated with double catheter technique(DCT). There was no specific clinical problem in unruptured aneurysms, and the 6 months angiographic result was good. In 15 patients who were ruptured aneurysm, seven patients were treated with SAC, seven were treated with DCT and one underwent simple coil embolization. Three patients died due to severe vasospasm, increased ICH and hypoxic brain damage, respectively. Five patients were fully recovery without neurologic deficit, and the remaining seven patients had neurological deficit. Case 1: A case of rebleeding after stent assisted coil embolization. Case 2: A case of ruptured thrombosed A1 aneurysm. Case 3: A case of MCAB aneurysm and M1 aneurysm treated with clip and coil.

Conclusion: In the treatment of large aneurysm, we need to establish a more sophisticated treatment plans and treat the aneurysm carefully.

Case 3. Treatment of blood blister-like aneurysms with overlapping stents assisted coiling

Jaehyun Shim

Department of Neurosurgery, PMC Park General Hospital

Objective: The treatment of Blood Blister-like Aneurysms (BBAs) of the supraclinoid internal carotid artery (ICA) is challenging because they are thin-walled and broad-based aneurysm.

Methods: In this report, we would like to share the experience of treating overlapping stents for 2 cases of BBA.

Result: Both cases were subarachnoid hemorrhage patients with BBA rupture at a relatively young age of 50 years. Two BBAs were treated with overlapping stents and only one coil was used. Because the size of both BBAs were so small that the entire length of coil could not enter the aneurysm. So, the remaining length of the coil was attached to the parent arterial wall using a second stent. Of the two patients, the first patient with initial Hunt-Hess grade 5 was expired. The other patient recovered with modified Rankin Score 0 and 6 months follow-up angiography revealed complete occlusion of the BBA.

Conclusion: Overlapping stents assisted coiling may be a good option for the treatment of BBAs.

Case 4. Early rebleeding after coil embolization of ruptured anterior communicating artery aneurysm

Jung-Jae Kim, Dong-Young Cho, Euikyo Seo

Department of Neurosurgery, Ewha Womans University Seoul Hospital

The 60-year old male patient visited the emergency room for mental change. The patient was diagnosed as subarachnoid hemorrhage due to the rupture of anterior communicating artery aneurysm, which was measured in 6 millimeters with an irregular shape and underwent coil embolization. The mentality of the patient was improved immediately as nearly alert but has been altered on postoperative day 2. The follow-up computed tomography (CT) revealed rebleeding mainly into cavum septum pellucidum, but serial cerebral angiographies and magnetic resonance angiography (MRA) could not identify any evidence of leakage from the coiled aneurysm or pseudoaneurysm. The patient recovered and returned to his daily life, but still complains about cognitive dysfunction. We plan a short-term follow-up angiography for the coiled aneurysm.

Case 5. Vascular perforation during EVT of cerebral aneurysm

Bon-Sub Gu

Department of Neurosurgery, Gangneung Asan Hospital, University of Ulsan College of Medicine

Objective: A 65-year-old woman with hypertension presented with a subarachnoid hemorrhage. Her condition was categorized as Hunt and Hess grade 2 and Fisher grade 3 based on CT scans. Angiography showed a 4.0mm AComA aneurysm with daughter sac.

Methods: We describe the management of perforation during endovascular treatment of a ruptured AComA aneurysm in a 65-year-old woman. The microcatheter and guidewire perforated the aneurysm after coil detachment. Its cause was excessive tension applied to microcatheter. Mild extravasation was resolved soon due to deposited coil mass. There were no adverse effects from the procedure.

Result: The patient was woken up, and her neurologic status was unchanged. Repeat CT showed no evidence of extravasation and no new subarachnoid blood. f/u angiography performed 14 days after treatment showed that the aneurysm remained closed, and the results of a neurologic examination were normal.

Conclusion: This report might be considered useful by some beginners. In a stable patient, use of a second microcatheter to occlude a perforated aneurysm allows the endovascular therapist to leave the original microcatheter in place.

Case 6. Treatment of vertebral dissecting aneurysm with the low-profile visualized intraluminal support (LVIS) device only

Young Ji Kim, Song Kyung Sun, Sung Yun Cho, Min Woo Baik

Department of Neurosurgery, Neurovascular Center, New Korea Hospital

Objective: Intracranial vertebral artery dissecting aneurysm (VADA) has been considered as a major cause of subarachnoid hemorrhage (SAH) and ischemic stroke of the posterior circulation. As endovascular devices have been developed, parent artery preservation has emerged as a reasonable technique. In our center, we prefer using LVIS stent to facilitate flow diversion in treatment of VADA. Because of a flow diverting effect which can promote thrombosis, we consider more potent antiplatelet agent such as prasugrel or ticagrelor. The aim is to report my first case using a LVIS stent for the treatment of intracranial VADA.

Methods: A 39-year-old male patient visited our clinic with severe headache. CT angiography showed a 9mm sized fusiform dilatation at right V4. Diagnostic angiography was performed to confirm dissecting aneurysm. Pretreatment with aspirin was initiated on admission day and a loading dose of prasugrel was administered 2 days before treatment. The case was treated using a triaxial system of a proximal Shuttle, an intermediate catheter, and a standard 0.021" microcatheter. LVIS stent was deployed to cover the entire lesion.

Result: LVIS stent deployment for VADA was successfully performed without any procedure-related complication. Immediately after procedure, symptom of the patient was totally improved. Follow-up CT angiography revealed obliteration of the dissecting aneurysm.

Conclusion: As the treatment of intracranial VADAs is considered high risk owing to the presence of perforating branches, most operators advocate the use of the smallest number of stents. A single LVIS stent can be a good option for treatment of VADA.

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Free paper IV : "complicated case" in EVT

좌장 : 이창영(계명대) / 정진영(연세에스병원)

Case 1. Reuse of Neuroform Atlas stent by Reloading technique

문종현(광주기독병원)

Case 2. Ruptured Pcom artery aneurysm combined with large pseudo-sac in old lady

김소연(가톨릭관동대)

Case 3. A2 dissecting rupture treated with stent

박상규(연세대)

Case 4. Optimal microcatheter steam shaping for A3 frontal branch origin aneurysms

권현조(충남대)

Case 5. Is giant AVM curable using maximum endovascular embolization and subsequent nidus removal? A case report and literature review

장동규(가톨릭대)

Case 6. Surgical exposure of the vertebral artery for endovascular access in hybrid operating room

이종영(한림대)

Case 1. Reuse of Neuroform Atlas stent by reloading technique

Young Min Park, **Jong Hyeon Mun**, Hyun-Jean Jeong, Jun Seob Lim

Department of Neurosurgery, Kwangju Christian Hospital

Objective: Neuroform Atlas stent is a combination of open cell and closed cell type stent that is self-expandable. The stent is useful when stent assisted coil embolization is practiced. However, it sometimes is hard to deploy at a desired site if the vessels are curved. Withdrawals can occur when the tension of microcatheter is being released or the Neuroform Atlas stent is being spread from distal tip of the microcatheter. It is hard to navigate the microcatheter, that is loaded with Neuroform Atlas stent, to the right site in the cases mentioned above. This paper will introduce the technique that reloads Neuroform Atlas stent to the microcatheter in such difficult situations.

Methods: The two cases that we successfully deployed stent by reloading Neuroform Atlas stent will be discussed in this report.

Result: The method enabled us to reuse Neuroform Atlas stent when the stent had to be disposed due to the withdrawal of the microcatheter.

Conclusion: The reloading technique of Neuroform Atlas stent is a useful way to reuse Neuroform Atlas stent.

Case 2. Ruptured Pcom artery aneurysm combined with large pseudo-sac in old lady

So Yeon Kim

Department of Neurosurgery, International St. Mary's Hospital

Objective: A seventy-five-year-old female patient visited an ER through ambulance. Her initial neurologic exam revealed semicomatous mental status with blown pupils. Emergent CT angiography showed Posterior communicating artery aneurysm with additional sac connected to Pcom aneurysm.

Methods: Her cerebral angiography revealed ruptured Pcom artery aneurysm with pseudo-sac in posterolateral direction, sized as 9.5 mm and 14mm, respectively. The aneurysm was planned to coil due to the patient's poor clinical condition.

Result: During the coil embolization, the contrast agent of the previous angiogram did not disappear even after a few minutes. The embolization was conducted with a double-catheter technique. During the embolization, some coil loops were protruded from true aneurysm toward pseudo-sac, but it did not seem to occur an intraoperative rupture.

Conclusion: The procedure ended without further events, but the patient underwent decompressive craniectomy due to subdural hematoma resulting midline shift. Despite all the measures with open surgery and ICU cares, the patient deteriorated further and further and passed out after four days.

Case 3. A2 dissecting rupture treated with stent

Sang Kyu Park

Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University

Objective: 85-year old female visit emergency room (ER) due to stuporous mental change. Computed tomography (CT) showed subarachnoid hemorrhage (SAH) of Fisher grade 3. However, there was no definite aneurysmal sac on computed tomographic angiography (CTA). We performed digital subtraction image (DSA) and there was irregular stenosis and dilatation at left anterior cerebral artery (ACA, A2-3). We diagnosed as ACA dissection rupture.

Methods: We considered several therapeutic option as dissecting segment occlusions, flow diversion, bypass including just observation. However, occlusion therapy We decide to stent deploy at dissecting segment for flow diversion effect and dissecting wall stabilization. Dissecting length was long and we deployed two stents (two LVIS Jr stent). After the stent-deploying, dual antiplatelets (aspirin, clopidogrel) were loaded and dispensed daily.

Result: At immediate post-procedure, there was no further SAH, in stent thrombosis or occlusion. The patient was stable until 10 days. However, 12th day post-operatively she suffered right leg weakness. CTA was done and left ACA territory infarct was seen.

Conclusion: In the case of dissecting aneurysm rupture, flow diversion with multi-stent can be a good treatment modality. However, we always have to be cautious about occlusion or rebleeding.

Case 4. Optimal microcatheter steam shaping for A3 frontal branch origin aneurysms

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

Department of Neurosurgery, Chungnam National University Hospital

A 56-year-old female patient presented with a headache that started two days ago. Brain CT showed subarachnoid hemorrhage mainly in the medial side of the left frontal lobe. In CTA, small aneurysms were found at the frontal branch origins of both ACA A3 segment and left MCAB. The right one of the ACA A3 aneurysms was relatively large and had basal outpouching on the dome. Coil embolizations were performed on two A3 aneurysms. While the coils were filled to a state where the dome contrast filling was not found including basal outpouching on the right one, the left side embolization was ended with delayed dome filling due to unstable microcatheter tip positioning. No dome filling was observed in the 2 coiled A3 aneurysms on TOF MRA performed two days later. In the skull X-ray which was performed again at 4 months after surgery, however, there was a change in the shape of the left A3 aneurysm coil mass. TOF MRA was performed again and recurrence of aneurysm findings were confirmed. Emergency coil embolization was performed. Several preshaped and steam shaped microcatheters were attempted including preshaped 'S' without success. Finally, stable microcatheter selection was achieved by tip shaping using '8' shaped mandrel. Thanks to stable microcatheter selection, four detachable coils with 8cm lengths in total were able to be filled to the dome.

Case 5. Is giant AVM curable using maximum endovascular embolization and subsequent nidus removal? A case report and literature review

Dong-Kyu Jang, Byung Hoo Moon, Kang Min Kim, Kyung-Sool Jang

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

Objective: Treatment of giant arteriovenous malformations (AVMs) still remain challenging. Recent progress of endovascular devices can make this lesion treatable through maximization of preoperative embolization. Here, we report a giant parietooccipital AVM case treated with staged Onyx embolization subsequent to nidus removal.

Methods: A 53-male patient presenting with headache, syncope, visual disturbance and declined cognition visited at our clinic. Left giant parietooccipital AVM (>6cm) was identified with multiple feeders of left middle cerebral artery (MCA), posterior cerebral artery (PCA), anterior cerebral artery (ACA), and middle meningeal artery (MMA), and superficial drains rendering Spetzler-Martin Grade 4. Two-staged Onyx embolizations using Sofia distal access intermediate catheter, Apollo detachable micro catheter, and Scepter C dual lumen balloon catheter were performed leading to subtotal occlusion of AVM nidus with small amount of subarachnoid hemorrhage.

Result: Surgical removal of remnant AVM nidus was conducted without complications. AVM total occlusion was confirmed on catheter angiography. He discharged without new neurologic deficits.

Conclusion: Giant AVMs are still very difficult to treat but may be safely cured with maximum endovascular embolization and subsequent nidus removal. A prospective multicenter study may be necessary to elucidate whether maximum endovascular embolization with or without nidus removal is effective and safe.

Case 6. Surgical exposure of the vertebral artery for endovascular access in hybrid operating room

Jong Young Lee, Hong Jun Jeon, Jong Hwa Park

Department of Neurosurgery, Gangdong Sacred Heart Hospital, Hallym University

Objective: Endovascular procedure is a desirable treatment options for neurovascular lesions of posterior circulation. However, endovascular access is occasionally prohibited by tortuosity of proximal vertebral artery (VA), aortic arch or stenosis of VA ostium. One strategy in such instances involves surgical exposure of VA for endovascular access.

Methods: We describe a creation of endovascular access via surgical exposure of VA to overcome anatomical difficulties hampering distal access to the VA through the transfemoral approach.

Result: Surgical exposure of VA was performed on 5 patients with cerebral aneurysm (n=4) and symptomatic stenosis of VA ostium (n=2). Four patients were female; one was male. Ages ranged from 73 to 82 years (mean: 76.4 years). Surgical exposure was usually done beyond the tortuous segment of VA. After endovascular access was provided, coil embolization was performed for cerebral aneurysms. Balloon angioplasty and stenting was done to treat the stenosis of VA ostium. Puncture site was closed by direct suture using 7-0 prolene. All procedures were completed without any adverse events.

Conclusion: Endovascular access via surgical exposure of VA can be valuable tool as an alternative for patients in whom the femoral route does not allow the navigation and stabilization of guiding catheter into the proximal segment of VA.

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Poster Session

1. Coil stretching during endovascular rescue therapy using snare device for intraprocedural protruded coil:
A case report 김태곤(차의과학대)
2. Complications during and after coil embolization with SAH patients 박정현(한림대)
3. A ruptured giant basilar tip aneurysm with mass effect treated with stent-assisted coil embolization:
A case report and literature review 장동규(가톨릭대)
4. Endovascular coil embolization of SAH d/t basilar top dual aneurysms ruptured during vertebroplasty:
A case report 오형석(부평세림병원)
5. Delayed rupture of middle cerebral artery aneurysm after flow diverter treatment 문종언(국립중앙의료원)
6. Diffuse alveolar hemorrhage after coil embolization of unruptured intracranial aneurysm 김성태(인제대)
7. Stent retriever thrombectomy for acute MCA occlusion 정현진(광주기독병원)
8. Endovascular trapping of direct carotid-cavernous fistula 임상혁(가톨릭대)
9. Extracranial internal carotid artery aneurysm:
My first case 정원주(오산한국병원)
10. Carotid artery stenting in Internal carotid artery severe stenosis; My first case in endovascular treatment 김학성(조선대)
11. Renal bleeding after use of Perclose 박재원(가톨릭대)
12. Treatment for recanalization distal ACA aneurysm after endovascular treatment 박정현(한림대)
13. Migration of radiopaque marker of the FlowGate2™ Balloon Guide Catheter during the mechanical thrombectomy 허원(한일병원)
14. Differential diagnosis report – Intracranial dural arteriovenous fistula mimicking pontine glioma 양세연(가톨릭대)
15. Unexpected pulled down stent migration while using the through stent technique (Neuroform Atlas Stent) 박광태(영남대)

1. Coil stretching during endovascular rescue therapy using snare device for intraprocedural protruded coil: A case report

Tae Gon Kim¹, Sang Heum Kim², Dong Ik Kim²

Department of ¹Neurosurgery, ²Neuroradiology, CHA Bundang Medical Center, CHA University School of Medicine

Objective: This report describes a case of coil stretching during endovascular rescue therapy using snare device for intraprocedural protruded coil while the endovascular coiling for unruptured left internal cerebral artery-supraclinoid aneurysm. The rescue therapy using snare device was eventually successfully done.

Methods: A 56-year-old man was admitted to our hospital complaining of headache for 2 months. Neurological examination showed no focal neurological deficits. A brain computed tomography and conventional cerebral angiography showed unruptured left internal cerebral artery-supraclinoid aneurysm with a size of about 5.5mm, which had a relatively small neck.

Result: We planned to perform a endovascular coil embolization. After three coiling was done, the fourth coil was tried to be packed into the aneurysm. During the procedure, the third coil was partially protruded into the lumen of the left distal ICA, so we stopped the fourth coiling. Prowler Select Plus microcatheter was inserted into the left internal cerebral artery-M1 division. We tried to capture and withdraw the protruded coil using Snare (2 mm) catheter. During the procedures, the stretching of the captured coil occurred. The partially protruded coil was successfully captured and removed because the stretching was partial one. Two more coils were packed into the aneurysm via new microcatheter. In conclusion, four coils packing was successfully done and short-time follow-up angiography revealed no abnormal findings. The patient showed no neurological deficits and was uneventfully discharged several days later.

Conclusion: Coil protrusion during endovascular coil embolization procedures can occur. This coil protrusion could result in from minor flow alterations to thromboembolic complications. Snares microcatheter is one of the good rescue methods. However, the coil stretching or breakdown can occur during the capturing because the snare was very sharp. Therefore, procedures should be gently performed.

2. Complications during and after coil embolization with SAH patients

Jung Hyun Park

Department of Neurosurgery, Dongtan Sacred Heart Hospital

Objective: To describe complications during and after coil embolization with SAH patients.

Methods: One case is for ischemic complication after coil embolization. SAH patient with left Pcom and right MCAb. Coil embolization was done for both sides. and right MCA infarction was detected after coil embolization. The other is SAH with Acom. Complication is related premature rupture with frame coil. Rapidly coil embolization was done with hematoma evacuation.

Result: Both patients were discharged without neurological deficit.

Conclusion: Rapid treatment is needed for hemorrhagic complication, and proper treatment is needed for ischemic complication.

3. A ruptured giant basilar tip aneurysm with mass effect treated with stent-assisted coil embolization: A case report and literature review

Dong-Kyu Jang, Byung Hoo Moon, Kang Min Kim, Kyung-Sool Jang

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

Objective: Ruptured giant basilar tip aneurysms with mass effect are still challenging to treat. We here report the patient who had a devastating ruptured giant basilar tip aneurysm treated with stent-assisted coil embolization.

Methods: A 68-female patient who had been diagnosed with a ruptured giant basilar tip aneurysm compressing both thalamus and midbrain involving both PCAs and SCAs at China was referred to our clinic presenting with severe headache and confused mentality. Endovascular occlusion was planned for prevention of rebleeding using single-stent or Y-stent assisted coil embolization or Waffle cone technique.

Result: Super-selection of left PCA was failed and Waffle cone technique was adopted. Aneurysm occlusion was achieved with Raymond-Roy class II without intraoperative complications. However, after procedure, her mentality did not gain recovery. Brain MRI showed bilateral thalamic and midbrain edema from aneurysm mass effect without acute infarction. Due to hydrocephalus, VP shunt was conducted at postoperative day 3. Her family did not want her to take further treatment. She was transferred to local rehabilitation center. At the 4-month follow-up, her outcome was modified Rankin scale 4.

Conclusion: Ruptured giant basilar tip aneurysms with mass effect are still challenging to treat with either endovascular or surgical modality. Endovascular occlusion with flow-diversion may be considered for this devastating lesion.

4. Endovascular coil embolization of SAH d/t basilar top dual aneurysms ruptured during vertebroplasty: A case report

Hyungsug Oh, Hyosang Lee, Munsul Yang

Department of Neurosurgery, Serim General Hospital

Objective: To report a case of SAH due to basilar top dual aneurysm ruptured during vertebroplasty. Percutaneous vertebroplasty is rapidly being incorporated into the portfolio of spine surgeons and interventionists for treatment of painful fractures in the spine column with benign and malignant pathologies. Although this percutaneous technique is a less invasive and maximally effective to the patients of spine compression, several procedure-related complications affecting the spine and its neuromusculatures, and extraspinal organs have been reported. There is very rare report that describes the case of intracranial hemorrhage as complication of the Percutaneous vertebroplasty.

Methods: A 79-year-old female suffer from back pain due to recent compression fracture T12. So, percutaneous vertebroplasty was planned as a routine for T12 level. During procedure, under electrocardiography monitoring, arterial blood pressure, respiratory rate, and oxygen saturation were also checked and recorded regularly. After local lidocaine injection, when the needle insertion and cement injection, she suffered from pain. And then patient SBP was checked over 200mmHg. After she complained severe headache, her mental status changed to drowsy. The brain computed tomography (CT) scans immediately taken after procedure revealed diffuse subarachnoid hemorrhage (SAH) at basal cystem and cerebellar tentorium. The head and neck CT angiography was checked. The dual aneurysm was noted at basilar top and left proximal PCA(proximal P1 segment). So, VA angiography and endovascular coil embolization was planned for dual aneurysms at basilar top and left proximal PCA under the general anesthesia. The endovascular coil embolization of dual aneurysms was successfully.

Result: Three days after endovascular coil embolization, the patient mental status changed from alert to drowsy. And right side motor weakness was noted. So, brain MR diffusion checked, and multiple acute infarction at cerebellar and cerebral hemisphere was reported. After a month of conservative treatment, the patient mental status and right side motor weakness was improved.

Conclusion: The Percutaneous vertebroplasty is generally a safe and effective procedure to control pain associated with fractures of the spinal column. With the increasing popularity of Percutaneous vertebroplasty, it is anticipated that more cases of intra- and extraspinal complications will be seen. Particularly for the cerebral unruptured aneurysm patients, we recommend that this procedure is only done under intensive cardiopulmonary monitoring, with blood pressure control and adequate sedation and analgesia.

5. Delayed rupture of middle cerebral artery aneurysm after flow diverter treatment

Jong Un Moon, Myoung Soo Kim

Department of Neurosurgery, National Medical Center

Objective: Flow diverter stent is a good treatment modality for complex aneurysms that are difficult to treat with conventional treatments. However, the flow diverter stent is time consuming to complete occlusion of the aneurysm, unlike conventional treatment, and consequently there is a risk of complications. We report a case of a patient with delayed aneurysm rupture after flow diverter stent treatment.

Methods: The patient was a 74-year-old woman who underwent flow diverter stent treatment with middle cerebral artery(MCA) aneurysm at another hospital 9 months ago. The consciousness at the time of admission was semicoma state, and large amount of subarachnoid hemorrhage(SAH), intraventricular hemorrhage(IVH) and intracerebral hemorrhage(ICH) of Fisher grade 4 were confirmed by computed tomography(CT). Cerebral angiography showed that the aneurysm was located at the M1 of the MCA, the neck was 8.60 mm, the dome was 9.89 mm, and the longest diameter was 12.17 mm. Because of the effect of flow diversion, partial thrombus was found inside the aneurysm and the contrast was stagnated. The flow diverter was located from the beginning of the ophthalmic artery to the end of M1 of MCA.

Result: Because of the difficulty of accessing the aneurysm due to the flow diverter, we decided to perform the operation. Because the proximal end of the flow diverter starts at the ophthalmic artery, bypass and trapping are not performed. Pterional approach with wide craniectomy was performed. Because of the flow diverter, proximal control using a temporary clip was not possible. The diameter of the aneurysm was so large that the clip did not open sufficiently. A clip was inserted only after the diameter of the aneurysm was reduced using a Bulldog vascular clamp. Sugita 18mm slightly curved clip and 12mm bayonet clip were used. After clipping, the flow into the aneurysm was completely blocked. There were no complications during the operation and the operation was completed successfully. However, because of large amount of hemorrhages and high intracranial pressure levels from the time of admission, active treatment was performed postoperatively, but the patient died after 4 days.

Conclusion: Unlike aneurysmal neck clipping or aneurysmal coil embolization, flow diverters require time to complete occlusion of the aneurysm. Because lethal complications like aneurysm rupture may occur before the complete occlusion of the aneurysm, careful observation is needed. The use of Flow diverter with coil is one of the best techniques to reduce the time required for aneurysm occlusion.

6. Diffuse alveolar hemorrhage after coil embolization of unruptured intracranial aneurysm

Sung Tae Kim¹, Young Gyun Jeong¹, Hae Woong Jeong²

Department of ¹Neurosurgery, ²Radiology, Inje University Busan Paik Hospital

Objective: When we treat an intracranial aneurysm, we should consider not only the aneurysm itself, but also possible complications. Here, we introduce the case that mortality occurred after coil embolization because of complications.

Methods: A 66-year-old male patient presented with unruptured A-com aneurysm. He had been recently diagnosed with Parkinson's disease. We performed coil embolization of the aneurysm using stent jailing technique.

Result: At the moment of final coil re-adjustment, intra-procedural rupture occurred, and then we found protrusion of the microcatheter into the subarachnoid space. We occluded the rupture point, and 1 week-follow-up angiography revealed stable occlusion of the aneurysm. At the moment of letting him discharge from the hospital, we realized the patient began to hemoptysis from the day before. Diffuse alveolar hemorrhage occurred. Next day, the bloody sputum increased, and it progressed to acute respiratory distress syndrome in just two days. He was dead, despite the 3-week intensive care unit treatment.

Conclusion: The physician who treats intracranial aneurysm should try to be prepared to any possible complication, even if it seems never happen to me.

7. Stent retriever thrombectomy for acute MCA occlusion

Hyun-Jean Jeong

Department of Neurosurgery, Kwangju Christian Hospital

Objective: To describe my first experience of Stent retriever thrombectomy for acute MCA occlusion using Solitaire stent.

Methods: A 77-year-old man visited the ER with decreased consciousness and NIHSS 17. Computerized tomography angiography(CTA) and magnetic resonance image(MRI) showed right basal ganglia infarction with right middle cerebral artery occlusion. The last normal time was one days ago. Digital subtraction angiogram(DSA) revealed right M2 inferior division occlusion. Thus, we planned to perform stent retriever thrombectomy using Solitaire stent(Solitaire Platinum 4*40).

Result: Recanalization (TICI grade 3) was achieved successfully at first trial and post-procedural intracerebral hemorrhage did not occur.

Conclusion: Even if the last normal time is not correct, successful recanalization was strongly associated with the good outcome.

8. Endovascular trapping of direct carotid-cavernous fistula

Sanghyuk Im¹, Youngwoo Kim²

¹Department of Neurosurgery, The Catholic University of Korea, Eunpyeong St. Mary's Hospital,

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

Objective: 45 years old patient presented with ophthalmosis after traffic accident. Digital subtraction angiography showed post-traumatic carotid-cavernous sinus fistulae (CCFs)

Methods: Most traumatic CCFs can be treated by transarterial balloon embolization or coil occlusion of the cavernous sinus with preservation of the parent artery, but in a few patients this approach is not possible. Some traumatic CCFs are occasionally incurable without parent vessel sacrifice. Authors used 2 microcatheter and occluded the ICA from just below of ophthalmic artery with coils.

Result: We treat a patient with a large high-flow shunt successfully by trapping the fistula using coil embolization. Ophthalmic artery was secured and filled by contrast at vertebral artery injection.

Conclusion: Endovascular trapping could be alternative treatment option for treatment of direct carotid-cavernous fistula for selective cases.

9. Extracranial internal carotid artery aneurysm: My first case

Won Joo Jeong, Rasun Kim, Hyoung Seok Kim

Department of Neurosurgery, Osan Hankook Hospital

Objective: Extracranial internal carotid artery aneurysms are uncommon lesion, and There is no treatment guideline or expert consensus for the management ill today. We report a case of dissecting aneurysm in cervical internal carotid artery with a pseudolumen.

Methods: A 57-year-old man was present with headache after head trauma. Brain computed tomography(CT) was performed and focal traumatic subdural hematoma, epidural hematoma, cerebral contusion were identified. Although follow up Brain CT showed improvement of hemorrhage, the patient complained of sustained headache without focal neurologic deficits. Brain CT angiography showed dissecting aneurysm in left cervical internal carotid artery with a pseudolumen.

Result: We decided to treat such aneurysm to relieve symptom and prevent thromboembolic complication. The patient was managed with stent assisted coil embolization after three months later from head trauma without serious complication.

Conclusion: Regard endovascular therapy there exists no significant experience in the treatment of this kind of aneurysms, but in selected patients, can be an excellent option, with satisfactory outcomes.

10. Carotid artery stenting in Internal carotid artery severe stenosis; My first case in endovascular treatment

Hak-sung Kim, Sang-woo Ha

Department of Neurosurgery, Chosun University Hospital

Objective: To report my first case of carotid artery stenting (CAS).

Methods: A 52-year old male visited our emergency room with the dysarthria occurred 1 hours ago. CT angiography demonstrated severe stenosis at the proximal internal carotid artery(ICA). He was immediately taken for angiography and underwent carotid artery stenting.

Result: Carotid angiography demonstrated 84% stenosis of left proximal ICA [North American Symptomatic Carotid Endarterectomy Trial (NASCET) criteria]. After balloon angioplasty, stent was deployed over the lesion successfully.

Conclusion: Carotid artery stenting(CAS) appears feasible and safe endovascular treatment, with few major complications.

11. Renal bleeding after use of Perclose

Jae Won Park

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

Objective: Femoral artery hemostasis is often performed perclose proglide after DSA with femoral approach. I would like to explore the risk of vessel suture using perclose proglide, which is sometimes thought to be a simple procedure. How to prevent it, by sharing the experience of renal artery bleeding due to perclose.

Methods: A 57-year-old woman, UIA paraclinoid Lt., underwent stent-assisted coil embolization in 2019-04-01. After embolization and transfer ICU, she complaint lt. flank pain. Neurosurgery resident found blood pressure decreased, under 80. Abdominal CT was performed as an emergency. CT finding was active bleeding in the lower pole of LK with a large amount of perirenal and pararenal hematoma. The patient underwent an emergency renal angiogram by radiologist. There is a rupture of the branch artery at the lower pole on the angiogram and contrast extravasation is observed. After entering the branch with microcatheter, embolization was performed using concerto 2mm * 4cm. 3 days after, follow up renal angiography was performed. Fortunately, there was no renal bleeding. Patient is discharged without any complication.

Result: I did not confirm the wire run using radiation when I inserted the guidewire through the sheath into the artery before using the perclose proglide. The wire entered the renal artery and damaged the renal pole. If it had not been found and treated early, it might have had to undergo renalectomy. Fortunately, the resident did not overlook it and was able to quickly find it and cope early.

Conclusion: In all endovascular procedures, wires should always be checked with radiation when inserted into the patient's body.

12. Treatment for recanalization distal ACA aneurysm after endovascular treatment

Jung Hyun Park

Department of Neurosurgery, Hallym University Dongtan Sacred Heart Hospital

Objective: To access endovascular treatment for recanalization of ACA aneurysm after coil embolization.

Methods: Two cases were reported. All case was for subarachnoid hemorrhage with distal ACA aneurysm. First case was SAH with distal ACA, and done by simple coil embolization. The aneurysm was recurred after 6 months, and treated by stent assisted coil embolization. Second case was also SAH with distal ACA, and treated by stent assisted coil embolization. After 5 days, the aneurysm was showed recanalization, and treated by additional stent assisted coil embolization.

Result: Distal ACA ruptured aneurysm is relatively considered with high recanalization.

Conclusion: Additional stent assisted coil embolization is effective method for recanalization ACA aneurysm.

13. Migration of radiopaque marker of the FlowGate2™ Balloon Guide Catheter during the mechanical thrombectomy

Won Huh

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Objective: During endovascular intervention we use many kinds of instruments and careful understanding of the structure of them is essential for the safe and successful result.

Methods: After utilization of an intermediate catheter as an aspiration catheter, combined stent-retriever plus aspiration thrombectomy approach has become one of the most popular techniques for the reperfusion of large artery occlusion. And also balloon guide catheter is one of the most preferred tools for the treatment of acute ischemic stroke.

Result: Herein we report migration of radiopaque marker of the FlowGate2™ Balloon Guide Catheter during combined stent-retriever plus aspiration thrombectomy approach. And we proposed the mechanism of that event.

Conclusion: During mechanical thrombectomy very rare complication, migration of radiopaque marker of the FlowGate2™ Balloon Guide Catheter, could take place.

14. Differential diagnosis report – Intracranial dural arteriovenous fistula mimicking pontine glioma

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Objective: Intracranial dural arteriovenous fistula(ICDAVF) is rare disease. There are 5 cases per 100,000 adults per year. ICDAVF increases the risk of intracranial bleeding and also causes non-hemorrhagic neurologic symptoms. And ICDAVF can be difficult to distinguish from tumors, inflammatory diseases, degenerative diseases and infectious lesions in their diagnosis.

Methods: As a method for diagnosing ICDAVF, CT-scan, MRI and Digital subtraction angiography can be used. The author obtained a clue from two CT-scan and two MRI trials. Ponto-cerebellar ICDAVF was diagnosed after DSA was performed.

Result: Case report: A 66-year-old woman with no underlying disease visited. The patient visited neurology and ENT with dizziness that started four months ago, and was treated with BPPV diagnosis, but the symptoms persisted, and MRI diffusion and C T angio scan were performed two months ago. No lesions were observed in the imaging findings, so preservation treatment was maintained afterwards. Then, tinnitus and Rt. side weakness occurred, and CT angio scan was followed up. Low density lesions of the left pons and cerebellum, and tortuous, elongated veins were observed. And left transverse sinus and sigmoid sinus were not observed. Additional MRI was performed, and high signal on T2 & FLAIR, enhancing T1 lesions were observed in Lt. pons and cerebellum. DSA was performed to distinguish between pontine glioma and ICDAVF. ICDAVF, which is mainly fed in Lt. occipital artery branch is diagnosed. ICDAVF was drained into Rt. transverse sinus. Feeder was also observed in post. auricular artery and MMA. The onyx embolization through Lt. occipital artery was planned. Using 6Fr. STR envoy, Apollo M. catheter, Chikai 10 wire, onyx embolization has done. Tinnitus and Lt. side weakness symptoms improved since then.

Conclusion: There are CT angio scan, MRI, DSA as a method for diagnosing ICDAVF. The ICDAVF of pons is similar to the pontine tumor in CT and MRI, requiring attention.

15. Unexpected pulled down stent migration while using the through stent technique (Neuroform Atlas Stent)

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Department of Neurosurgery, Yeungnam University Medical Center

Objective: When attempting through the stent technique in the stent assisted coiling, there is as risk of the distally stent migration due to the microwire or microcatheter. However, we had never seen a case in which a stent pulled down (proximally) in the literature review. We would like to report a stent migrated downward (proximally migrated stent).

Methods: A 79-year-old female patient was admitted with a wide neck aneurysm of the middle cerebral artery. The stent-assisted coil was designed to be saving the incorporated branch. With jailing technique, one microcatheter was placed in the sac, then the Neuroform Atlas stent was deployed, and another microcatheter was delivered with the through the stent technique for double microcatheter technique. During the re-cross the stent the distal migration was observed. We try removal of the microwire and microcatheter. At the moment of puling the microcatheter and microwire to remove, the existing stent was pulled downward. In a second attempt, the aneurysm coiling was finished moving the microcatheter into the aneurysm. The patient had a cerebral infarction result in left side motor weakness, can walking with cane.

Result: The patient was neurologically compromised by unexpected pulled down stent migration. Distal stent migration may occur occasionally, but proximal migration is the first experience reported.

Conclusion: Physician may remember that unexpected events may occur, and we think that more attention well be needed when doing something. Other reader may wish to remember that this can happen.

MEMO

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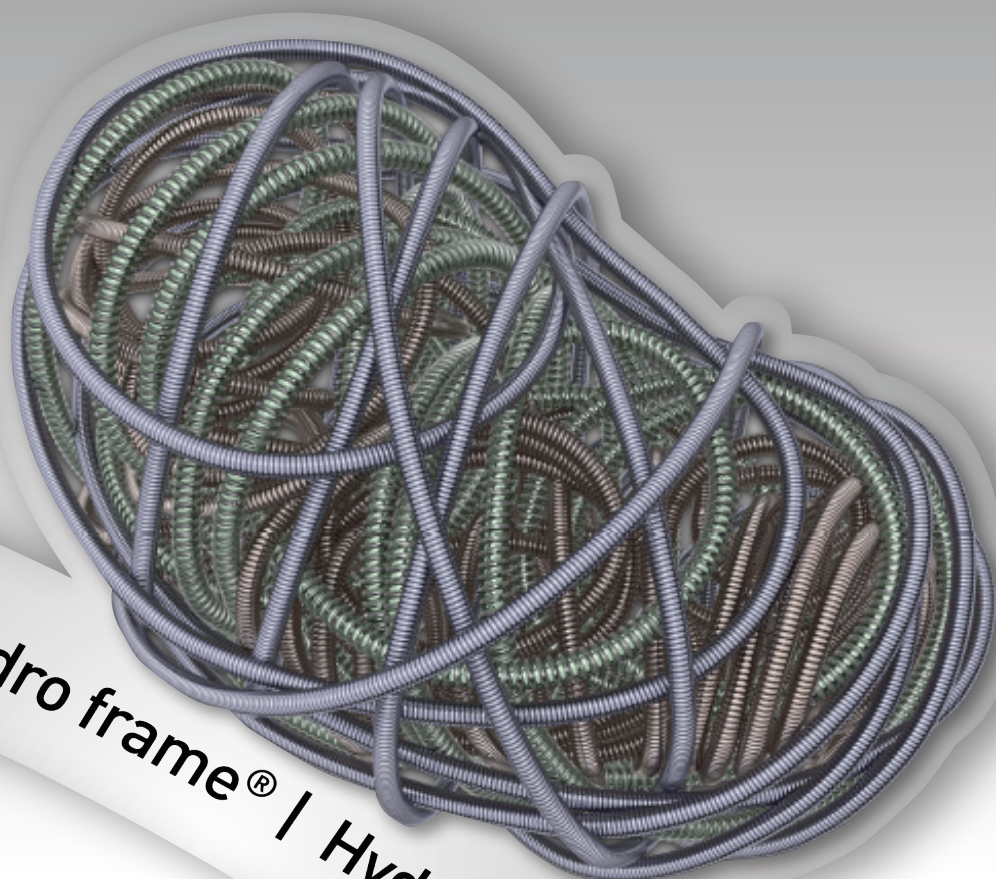
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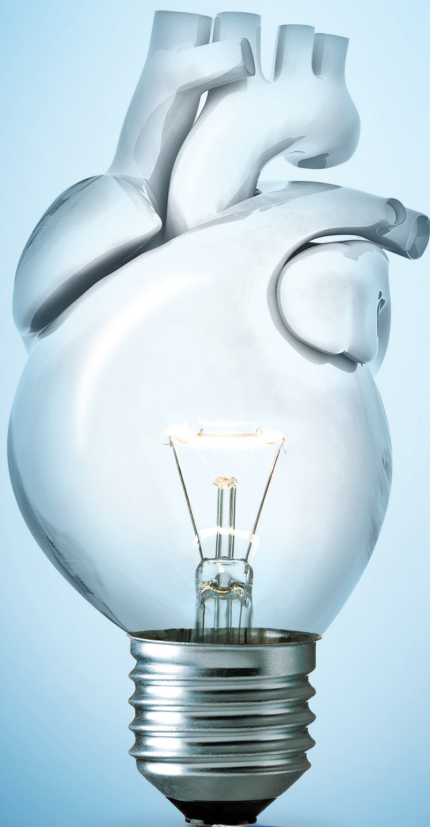
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100515HFRM-V	5	15	100833HFRM-V	8	33
100612HFRM-V	6	12	100931HFRM-V	9	31
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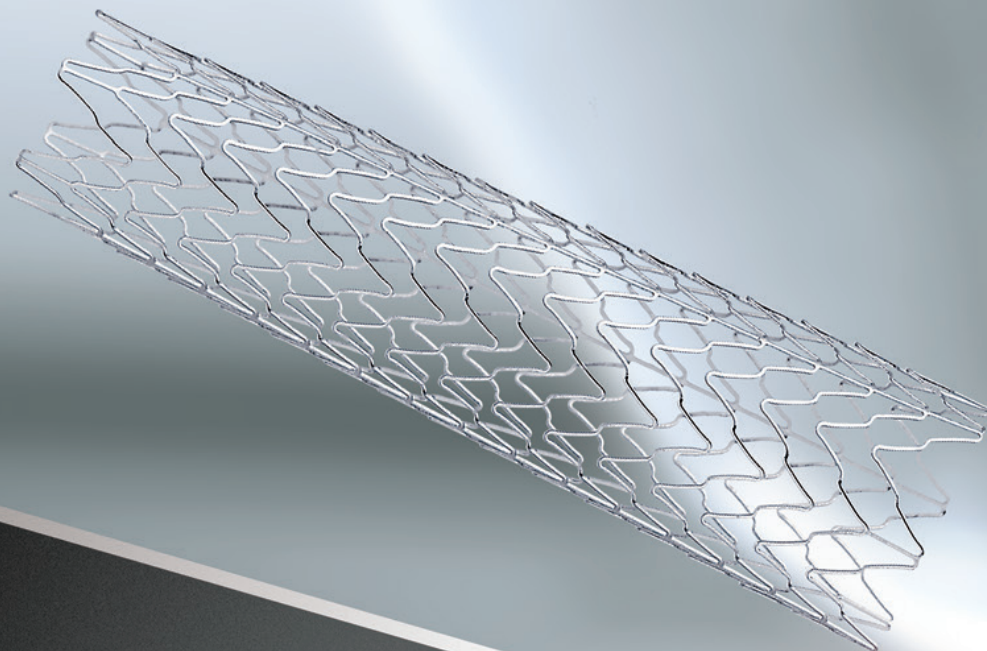
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References. 1. Parving H-H et al. N engl J Med 2001;345:870-878 2. Lewis EJ et al. N engl J Med 2001;345:851-860 3. Irbesartan제제 제품설명서 4. James Shepherd et al. Mayo Clin Proc. 2008;83(8):870-879 5. Atorvastatin 제제 제품설명서 6. KDOQI, Am J Kidney Dis. 2007 Feb;49:2 suppl 2):S12-154

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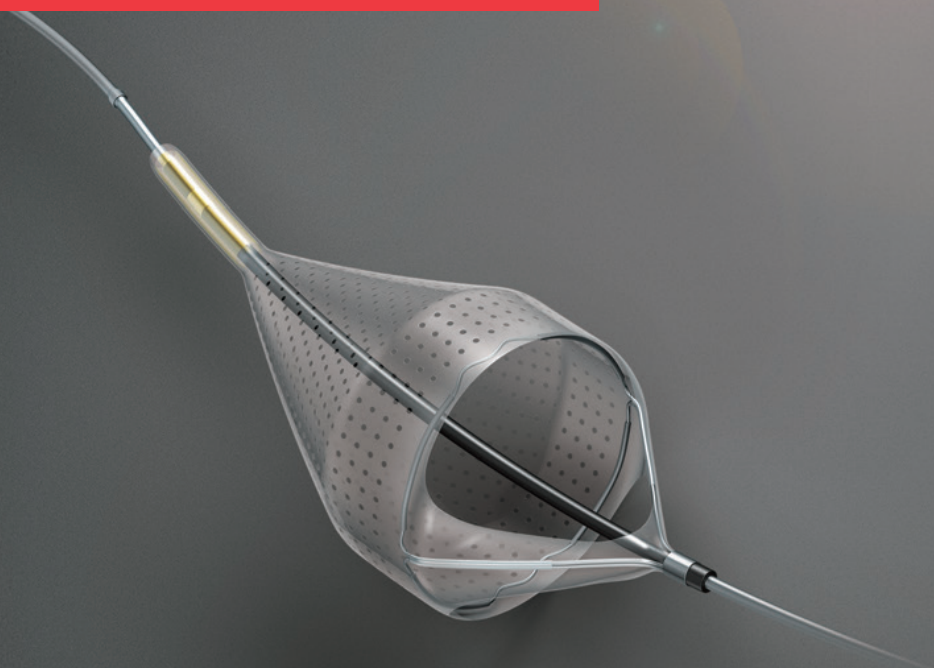
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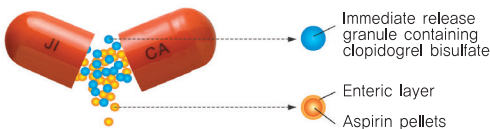
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릭시아나 정 [효능·효과] 1. 비판막성 심방세동 환자에서 뇌졸중 및 전신색전증의 위험 감소 2. 심재성 정맥혈전증 및 폐색전증의 치료 3. 심재성 정맥혈전증 및 폐색전증의 재발 위험 감소 [용법·용량] 이 약은 식사와 상관없이 물과 함께 투여한다. 1. 성인 1) 비판막성 심방세동 환자에서 뇌졸중 및 전신색전증의 위험 감소, 이 약의 권장용량은 1일 1회 60mg이다. 2) 심재성 정맥혈전증 및 폐색전증의 치료/심재성 정맥혈전증 및 폐색전증의 재발 위험 감소, 최소 5일간의 비경구 항응고제 사용 후 이 약의 권장용량은 1일 1회 60mg이다. 3) 위 세 가지 효능·효과에서 다음 중 한 가지 이상의 요인을 가진 환자의 경우, 이 약의 권장용량은 1일 1회 30mg이다. · 중등증 ~ 중증의 신장애 (15 CrCL 50mL/min) · 체중 60 kg · P-gp 저해제(사이클로스포린, 드로네다론, 에리트로마이신, 케토코나졸) 병용 2. 신장애 환자 경증의 신장애 (50 < CrCL 80mL/min)에서 이 약의 용량조절은 필요하지 않다. 중등증 ~ 중증의 신장애 환자(15 CrCL 50mL/min)에서 이 약의 권장용량은 1일 1회 30mg이다. 3. 이 약의 복용을 잊었을 경우 이 약의 복용을 잊었을 경우에는 당일 즉시 이 약을 복용해야 하며 그 다음날에는 권장되는 용법·용량에 따라 복용한다. 놓친 용량을 보충하기 위해 1일 권장용량의 두 배로 복용해서는 안된다. **[사용상의 주의사항]** 1. 경고 1) 이 약은 출혈의 위험을 증가시켜 잠재적으로 치명적인 심각한 출혈을 일으킬 수 있다. 따라서 다른 항응고제와 마찬가지로, 이 약은 출혈 위험이 증가된 상태에서는 주의하여 사용하여야 한다. 이 약으로 치료하는 동안 출혈은 어느 부위에서든 발생할 수 있다. 원인을 알 수 없는 헤모글로빈 및/또는 헤마토크릿의 감소 또는 혈압의 하강 시에는 출혈 부위에 대한 조사가 필요하다. 2) 중대한 출혈이 발생한 때에는 이 약의 투여를 중단하고 출혈부위를 신속하게 조사하여야 한다. 3) 출혈 위험성이 높은 환자들의 경우, 이 약 투여를 시작한 후에 출혈 및 빈혈의 징후 및 증상을 면밀하게 관찰해야 한다. 2. 다음 환자에는 투여하지 말 것 1) 이 약의 구성분 또는 구성성분에 과민반응이 있는 환자 2) 임상적으로 유의한 출혈 환자 3) 말기신질환 환자(CrCL < 15 mL/min) 및 신장 투석 환자 4) 혈액응고장애 및 임상적으로 의미있는 출혈 위험성과 관련된 간질환 환자 5) 중증 간장애 환자 6) 다음과 같은 질환으로 인하여 출혈 위험성이 증가된 환자 ① 최근의 위장관 궤양 병력 ② 출혈 위험이 높은 악성 종양(neoplasm) ③ 최근의 뇌 또는 척수 손상 ④ 최근의 뇌, 척수 또는 안과 수술 병력 ⑤ 최근의 두개내 또는 뇌내 출혈 병력 ⑥ 식도정맥류가 있거나 의심되는 경우 ⑦ 동정맥기형(arteriovenous malformations) ⑧ 혈관성 동맥류(vascular aneurysms) ⑨ 척수내 또는 뇌내 혈관 이상 기타 다른 항응고제와의 병용치료: 미분획 헤파린(Unfractionated Heparin, UFH), 저분자량 헤파린(에녹사파린, 달테파린 등), 헤파린 유도체(폰다파리녹스 등), 경구용 항응고제(와파린, 다비가트린, 리바록사반, 아픽사반 등) 등의 다른 항응고제와 병용치료 하는 경우. 단, 이 약과 서로 전환하는 경우나 미분획 헤파린(UFH)을 개발 중심 정맥 또는 동맥 카테터(open central venous or arterial catheter)를 유지하기 위해 투여하는 경우는 제외함 ⑩ 조절되지 않는 중증의 고혈압 환자 ⑪ 항응고제 투여가 필요한 인공 심장판막 치환술을 받은 환자 ⑫ 중등증 ~ 중증의 심도관협착증 환자 ⑬ 혈액역적으로 불안정하거나 혈전용해술 또는 폐동맥색전제거술을 받아야 하는 폐색전증 환자 ⑭ 임부 및 수유부 ※ 보다 자세한 정보는 당시 홈페이지(www.daiichisankyo.co.kr)를 참고하여 주시기 바랍니다.