

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



주최 _ 대한뇌혈관내치료의학회

주관 _ 대한신경외과학연구재단

인사말



존경하는 대한뇌혈관내치료의학회 회원 여러분

안녕하십니까?

지난 4년간 지겹게 기승을 부리던 COVID-19가 지나 가고 올해는 완전한 일상으로의 회복을 기대했지만, 다시 여러가지 복잡한 의료계의 현안들로 주변 상황이 여느 때와 달라 많은 혼란과 어려움으로 다소 위축되는 기분도 듭니다. 의료 현안 관련 미래가 예측이 되지 않는 현재, 특히 저희 회원 여러분의 몸과 마음이 지쳐 있을 것으로 생각합니다.

하지만 언제나 그랬듯이 여러분과 함께 힘을 모아 슬기롭게 이 위기 또한 극복해 나갈 거라는 조심스러운 확신과 간절한 바람입니다.

올해 제주도에서 개최되는 ASCENT 2024는 현재 이러한 저희의 모습과 가장 흡사한 단어라고 생각이 되어 “Patience and Passion”이라는 테마로 정하였습니다.

아직까지 힘든 시기인 만큼 이곳 제주에서 학술적 교류 뿐 아니라 잠시나마 고단함을 잊을 수 있는 편안하고 행복한 시간을 담아 가시길 바랍니다.

어려운 환경에서도 우리 학회를 지금의 자랑스러운 모습으로 성장시켜 주신 회원 여러분께 존경과 감사를 드립니다.

건강한 모습으로 2024년 6월 제주도에서 뵙기를 고대합니다.

대한뇌혈관내치료의학회 회장 권 순 찬

2023~2025 14대 대한뇌혈관내치료의학회 임원진

상임이사

직위	성명	소속
회장	권순찬	울산대학교병원
부회장	박석규	순천향대학교 서울병원
총무	하성곤	고려대학교 안산병원
학술	김태곤	차의과대학교 분당차병원
정책	신승훈	차의과대학교 분당차병원
	하상우	조선대학교병원
재무	김훈	가톨릭대학교 부천성모병원
수련교육	김영우	가톨릭대학교 의정부성모병원
	박중철	울산대학교 서울아산병원
간행	이종영	한림대학교 강동성심병원
보험	정준호	연세대학교 세브란스병원
	조동영	이화여자대학교 서울병원
	박근영	연세대학교 세브란스병원
	이성호	서울대학교병원
대외협력	장철훈	영남대학교병원
	임용철	아주대학교병원
국제교류	박근영	연세대학교 세브란스병원
법제윤리	김성림	가톨릭대학교 부천성모병원
	정영진	영남대학교병원
홍보	윤원기	고려대학교 구로병원
	양구현	울산대학교 강릉아산병원
전산정보	신동성	순천향대학교 부천병원
	신희섭	강동경희대학교병원
회원관리	고준경	부산대학교병원
진료지침	오재상	가톨릭대학교 의정부성모병원
연보·학회사편찬	심숙영	명지성모병원
진료심의	강현승	서울대학교병원
여의사회	김소연	가톨릭관동대학교 국제성모병원
	조수희	울산대학교 강릉아산병원
전문병원	김문철	에스포항병원
	허준	명지성모병원
	전우열	대구굿모닝병원
	김희섭	청주효성병원
별정직 이사 (학술지편집)	김대원	원광대학교병원
별정직 이사 (인증관리)	성재훈	가톨릭대학교 성빈센트병원
	오인호	중앙보훈병원
	김창현	계명대학교 동산의료원

2023~2025 14대 대한뇌혈관내치료의학회 임원진

직위	성명	소속
별정직 이사 (다기관임상)	황교준	분당제생병원
	김영수	에스포항병원
심뇌혈관정책	윤창환	분당서울대학교병원 순환기내과
	이찬희	영남대학교병원 순환기내과
	옥민수	울산대학교 예방의학과
뇌신경마취	박희평	서울대학교병원 마취통증의학과
의료기기 연구	양수근	인하대학교 의생명학과
뇌신경재활	김수아	순천향대학교 천안병원 재활의학과
	김여형	가톨릭대학교 의정부성모병원 재활의학과
	김기훈	고려대학교 안산병원 재활의학과
다학제연구	이학승	원광대학교병원 신경과
	정용안	가톨릭대학교 인천성모병원 핵의학과
	이아름	순천향대학교 부천병원 영상의학과
	김광준	연세대학교 세브란스병원 노년내과
특별이사 (대외협력)	김범태	순천향대학교 부천병원
특별이사 (WFITN)	신용삼	가톨릭대학교 서울성모병원
특별이사 (정책)	권오기	분당서울대학교병원
특별이사 (연보, 학회사편찬)	고준석	강동경희대학교병원
특별이사 (의학회)	윤석만	순천향대학교 천안병원
특별이사 (신의료기술/장비/재료)	강동훈	경북대학교병원
특별이사 (WFITN 준비이사)	최재호	가톨릭대학교 서울성모병원
	이중구	가톨릭대학교 서울성모병원
특별이사 (회칙관리)	이동훈	가톨릭대학교 성빈센트병원
특별이사 (KSCVS)	이재환	연세대학교 용인세브란스병원
특별이사 (CME)	반승필	분당서울대학교병원
특별이사 (ASTRO)	권현조(회장)	충남대학교병원
	진성철(부회장)	인제대학교 해운대백병원
특별이사	장인복	한림대학교 평촌성심병원
	장경술	진주한일병원
	정진영	참포도나무병원
	조준성	단국대학교병원
	남택균	중앙대학교병원
	장동규	가톨릭대학교 인천성모병원
	백진욱	제주한라병원
	김명진	가천대학교 길병원
광주/전라지회	김대원	원광대학교병원
대구/경북지회	홍대영	에스포항병원

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직위	성명	소속
대전/충청지회	임정욱	세종충남대학교병원
부산/울산/경남지회	최재형	동아대학교병원
인천지회	유찬중	가천대학교 길병원

감사 (2명)

직위	성명	소속
감사	김창현	양산부산대학교병원
	박정현	한림대학교 동탄성심병원

간사 (3명)

직위	성명	소속
회장 간사	김성태	인제대학교 부산백병원
총무 간사	김훈	가톨릭대학교 부천성모병원
학술 간사	김정재	연세대학교 세브란스병원

명예회장 (3명)

직위	성명	소속
명예회장	백민우	인봉의료재단 뉴고려병원
	권도훈	울산대학교 서울아산병원
	김영준	한림대학교 강남성심병원

전임회장단 (10명)

직위	성명	소속
초대, 제2대	백민우	인봉의료재단 뉴고려병원
제3대	김영준	한림대학교 강남성심병원
제4, 5대	권도훈	울산대학교 서울아산병원
제6대	안성기(작고)	(전) 한림대학교 성심병원
제7대	신용삼	가톨릭대학교 서울성모병원
제8대	권오기	분당서울대학교병원
제9대	김범태	순천향대학교 부천병원
제10대	성재훈	가톨릭대학교 성빈센트병원
제11대	고준석	강동경희대학교병원
제12대	윤석만	순천향대학교 천안병원
제13대	장철훈	영남대학교병원

초청연자



이 아 름

순천향대학교 부천병원 영상의학과 부교수

[학력 및 약력]

1999 ~ 2005	순천향대학교 의과대학 의학과 학사
2007 ~ 2009	순천향대학교 일반대학원 영상의학 석사학위
2013 ~ 2019	순천향대학교 일반대학원 영상의학 박사학위

[약력]

2006.10	호주 Edith Cowan University Australia Medical Board
2007.05 ~ 2011.02	순천향대학교 부천병원 영상의학과 전공의
2011.03 ~ 2012.02	순천향대학교 부천병원 영상의학과 전임의
2012.03 ~ 2013.02	서울대학교병원 영상의학과 임상조교수
2013.02 ~ 2020.02	순천향대학교 부천병원 영상의학과 조교수
2022.08 ~ 2023.09	University of Calgary, Canada, Stroke Center Visiting Professor
2020.02 ~ 현재	순천향대학교 부천병원 영상의학과 부교수

[학회활동]

대한신경영상의학회 수련이사
대한영상의학회 수련간사
한국의료방사선안전관리협회 학술교육이사
대한영상진단협회 학술이사
Korean Society of Magnetic Resonance of Medicine 학술지 심사위원

초청연자



박 희 평

서울대학교병원 마취통증의학과 교수

[학력 및 약력]

1987.3 ~ 1993.2	충북대학교 의학과 학사
1994.3 ~ 1996.8	충북대학교 의학과 석사
2003.3 ~ 2005.8	충북대학교 의학과 박사
1993.3 ~ 1994.2	충북대학교 병원 인턴
1994.3 ~ 1998.2	충북대학교 병원 전공의
1998.3 ~ 2001.4	국군 논산병원 마취과장
2001.5 ~ 2002.4	서울대학교 병원 전임의
2002.5 ~ 2004.2	청주 성모병원 마취과장
2004.3 ~ 2008.2	분당서울대학교병원 임상조교수
2008.3 ~ 2012.2	서울의대 조교수
2012.3 ~ 2017.2	서울의대 부교수
2017.3 ~ 현재	서울의대 교수

[학회활동]

2023년 ~ 현재	대한뇌신경마취학회 부회장
------------	---------------

초청연자



김 기 훈

고려대학교 안산병원 재활의학과 교수

[학력 및 약력]

2000	고려대학교 의학과 의학사
2012	고려대학교 의학과 재활의학 박사
2014 ~ 2019	고려대학교 안산병원 재활의학과 임상교수
2020 ~ 현재	고려대학교 안산병원 재활의학과 교수

초청연자



서명숙

사단법인 제주올레 이사장

[학력]	1980년	고려대학교 교육학과 학사
[약력]	1980 ~ 1983	기독교사회문제연구원 출판간사
	1985	월간 마당 기자
	1987 ~ 1989	월간 <한국인> 기자
	1989 ~ 2003	<시사저널> 정치부 기자, 정치부장, 취재 1부장, 편집장
	2003 ~ 2005	프리랜서 저술가
	2005 ~ 2006	인터넷신문 <오마이뉴스> 편집국장
	2007	산티아고 도보 순례 완주 / 환경재단 '세상을 밝게 만든 100인' 선정
	2010	재암문화재단 '재암문화상' 수상 제 1회 '2010 한국관광의 별' 수상 제 4회 그린시티 공모전 대통령상 수상
	2011	교보생명 환경대상 생태대안부문 대상 수상
	2012	제 1회 엄홍길 휴먼재단 '휴먼상' 수상
	2013	제34회 일가상 '사회공익부문' 수상, 한국 최초 아쇼카 펠로우 선정
	2014	제주올레 '제주관광대상' 수상
	2017	'국민훈장 동백장' 대통령 훈장 수상 제주올레 '대통령 표창장' 수상
	2019	'라이나 50+ 어워즈' 사회공헌 부문 대상 수상
	현재	사단법인 제주올레 이사장 한국관광공사 사외이사
[저서]	흡연여성잔혹사(2004) 꼬닥꼬닥 걷어가는 이 길처럼(2010) 놀명쉬명걸으멍-제주걷기여행(2011) 식탐(2012) 숨, 나와 마주 서는 순간(2015) 서귀포를 아시나요(2019)	

초청연자



Shinsuke Sato

St. Luke's International Hospital
Chief Physician

Education

Graduated from Kansai Medical University, Faculty of Medicine
Doctor of Medicine degree

Professional Experience

2002: Joined Tokyo Women's Medical University Hospital, Department of Neurosurgery
2004: Seconded to Atami Soga Memorial Hospital, Department of Neurosurgery
2005: Seconded to Saiseikai Kuribayashi Hospital, Department of Neurosurgery
2006: Seconded to Tokyo Women's Medical University Affiliated Hachioji Medical Center,
Department of Neurosurgery
2008: Seconded to Ushiku Aiwa General Hospital, Department of Neurosurgery
2011: Seconded to Ebina General Hospital, Department of Neurosurgery, promoted to Chief Physician
2012: Assistant Professor, Department of Neurosurgery, Tokyo Women's Medical University
2013: Vice Chief Physician, Department of Neurosurgery, Kobe City Medical Center General Hospital
2015: Vice Chief Physician, Neuroendovascular Therapy Division,
Department of Neurosurgery, St. Luke's International Hospital
2018: Chief Physician, Neuroendovascular Therapy Division,
Department of Neurosurgery, St. Luke's International Hospital

Certifications and Specializations

Certified Neurosurgeon by the Japan Neurosurgical Society
Certified Stroke Specialist by the Japan Stroke Society
Certified Neuroendovascular Therapy Specialist by the Japan Neurosurgical Society
Certified Neuroendovascular Therapy Instructor by the Japan Neurosurgical Society
Certified Surgical Technique Instructor for Cerebrovascular Diseases by the Japan Stroke Society

6월 21일 (금)

12:30-13:20	Registration		
	Opening remark	권순찬 (대한뇌혈관내치료의학회 회장)	
13:20-13:30	Welcome remark	권정택 (대한신경외과학회 이사장) 정신 (대한신경외과학회 회장) 안재성 (대한뇌혈관외과학회 회장)	
13:30-14:40	Free Paper I. How to Respond to Cuts in Insurance Payments - Case reports	좌장: 박석규 (순천향대), 정준호 (연세대)	
13:30-13:45	Insurance payment reduction for the flow diverter plus coiling procedure for the recurred large aneurysm	김영우 (가톨릭대 의정부성모병원)	18
13:45-14:00	Regrowing recurrence of the unruptured MCA treated by stent assisted coiling:retreated by Lvis assisted coiling	진성철 (인제대 해운대백병원)	19
14:00-14:15	Cuts in Insurance Payments in Dongtan Sacred Heart Hospital over the past 5 years.	박정현 (한림대 동탄성심병원)	21
14:15-14:30	뇌혈관조영술의 보험청구 및 삭감사례	조동영 (이화여대 서울병원)	22
14:30-14:40	질의응답		
14:40-15:40	Symposium I. Multidisciplinary approach for cerebrovascular disease	좌장: 김범태 (순천향대), 권순찬 (울산대)	
14:40-15:00	Ischemic stroke Imaging	이아름 (순천향대 영상의학과)	25
15:00-15:20	Anesthesia during treatment for cerebrovascular disease	박희평 (서울대 마취통증의학과)	26
15:20-15:40	Rehabilitation for cerebrovascular disease	김기훈 (고려대 재활의학과)	35
15:40-16:00	Coffee Break		
16:00-17:00	Free Paper II. 'My first case' from Young Gun	좌장: 백민우 (뉴고려병원), 이호국 (한림대)	
16:00-16:10	Review of Early Cases: Giant Aneurysms Treated with Coil-assisted Flow Diverting Stents	조현준 (고려대 구로병원)	43
16:10-16:20	Three cases of ruptured blood-blister like aneurysms treated with stent-assisted coil embolization using the LVIS EVO: a first-year experience	권민용 (계명대 동산병원)	44
16:20-16:30	Endovascular Treatment (EVT) for Wake-up Acute Ischemic Stroke (AIS) : My first, agonizing experience in my life	박광태 (영남대병원)	45
16:30-16:40	Facing the First Mountain: A Young cerebrovascular surgeon's Case report of Aneurysm treatment	황의현 (의정부을지대병원)	46
16:40-16:50	Flow Diverter as a Rescue Treatment for Ruptured Blood Blister-Like Aneurysm in a Patient with Multiple Medical Issues	이주환 (인제대 부산백병원)	47
16:50-17:00	Overcoming severe aortic tortuosity in endovascular treatment of intracranial aneurysm	김세윤 (울산대병원)	48
17:00-18:00	Free Paper III. Agony Session (Sharing painful memory for improvement)	좌장: 권오기 (서울대), 장철훈 (영남대)	
17:00-17:12	A WEB Embolization of a Large Anterior Communicating Artery Aneurysm with a Tortuous Anatomy: An Inadvertent Event and Technical Nuance	장동규 (가톨릭대 인천성모병원)	51

17:12-17:24	Flow diverter stent-assisted coil embolization of recurrent basilar artery aneurysm	성승연 (동래보생병원)	52
17:24-17:36	Delayed collapse of flow diverter after treatment of cervico-petrous ICA giant aneurysm: another concern for flow diversion in giant aneurysms	반승필 (분당서울대병원)	53
17:36-17:48	Should Patients With Acute Minor Ischemic Stroke With Isolated Internal Carotid Artery Occlusion Be Thrombolysed?	송승윤 (가톨릭대 성빈센트병원)	54
17:48-18:00	Fetal Bleeds after Flow Diversion for Large-Sized Aneurysms	정영진 (영남대병원)	55
18:00-18:30	General assembly and photo time	하성곤 (대한뇌혈관내치료의학회 총무이사)	
18:30	시상 및 만찬		

6월 22일 (토)

07:00-08:00	아침산책	진행: 권순찬 (대한뇌혈관내치료의학회 회장), 하성곤 (대한뇌혈관내치료의학회 총무이사)	
10:00-10:30	대한뇌혈관내치료의학회 연구비 지원사업 공모 발표	좌장: 김태곤 (차의과대학), 황교준 (분당제생병원)	
10:00-10:07	Clinical Effectiveness of Flow Diverting Stent with Surface Modification - Multicenter Retrospective Study	강현승 (서울대병원)	59
10:07-10:14	Korean Subarachnoid Aneurysm Trial, KSAT	권순찬 (울산대병원)	65
10:14-10:21	Development of a Novel Thrombus Model for Investigating Acute Ischemic Stroke Treatments	안홍석 (한림대 강동성심병원)	75
10:21-10:28	AI using Korean Stroke Registry	오재상 (가톨릭대 의정부성모병원)	81
10:30-11:30	Free Paper IV. Ecstasy session (Troubleshooting for difficult cases)	좌장: 권현조 (충남대), 윤석만 (순천향대)	
10:30-10:42	Arterial puncture of non-femoral site with difficult femoral access for thrombectomy or balloon angioplasty before carotid stenting	김창현 (계명대 동산병원)	89
10:42-10:54	Endovascular Removal of Freely Floating Retained Microcatheter at Aortic Arch with Snare during dural AVF embolization	신승훈 (차의과대학 분당차병원)	90
10:54-11:06	Life-threatening massive facial bleeding from pterygoid venous plexus with direct carotid cavernous fistula: A expedite embolization of cavernous sinus	안성열 (화정명지병원)	91
11:06-11:18	Combined Embolization Technique with WEB and Coil for Basilar Top Irregular-shaped Aneurysm	정연구 (성균관대 강북삼성병원)	92
11:18-11:30	Endovascular treatment for partially thrombosed aneurysm: agony and journey to summit	이종민 (울산대병원)	93

프로그램

11:30-12:00	Special Lecture	좌장: 신승훈 (차의과학대)	
	느림의 가치 - 제주올레	서명숙 (사단법인 제주올레 이사장)	97
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12:00-12:20	Initial Clinical Experience of Pipeline™ Vantage	김성림 (가톨릭대 부천성모병원)	109
12:20-12:40	The real clinical performance of the Avenir coil tailored for the first coil	Shinsuke Sato (St. Luke's International Hospital)	110
12:40-13:00	Next Neuroprotective agents?	이종민 (울산대병원)	111
13:00-14:00	Symposium II. 지멘스 3D 영상 기술을 통한 DFT Device (WEB/LVIS Evo) Visibility Improvement & Case Discussion	좌장: 신용삼 (가톨릭대), 강현승 (서울대)	
13:00-13:20	The Usefulness of Image Fusion Technique using ARTIS icono for the Evaluation of the WEB Device.	최재호 (가톨릭대 서울성모병원)	121
13:20-13:40	Imaging Protocol and Efforts for Optimal WEB Size Selection	조동영 (이화여대 서울병원)	126
13:40-14:00	PETRA-MRA as a follow-up imaging modality for intracranial aneurysms treated with WEB device	김정재 (연세대 세브란스병원)	139
14:00-14:10	시상 및 Closing remarks	권순찬 (대한뇌혈관내치료의학회 회장)	

» KoNES 방사선사/간호사 연수교육

6월 22일 (토)

제주 해비치호텔 & 리조트 지하1층 다이아몬드홀

08:20-08:25	Registration		
08:25-08:30	Opening remark	권순찬 (대한뇌혈관내치료의학회 회장)	
08:30-09:30	Session I. Basics of Anatomy & Devices		
08:30-08:55	Angiography: basic setting and anatomy	신동성 (순천향대 부천병원)	143
08:55-09:00	Q & A		
09:00-09:25	Basic devices for procedures	김소연 (가톨릭관동대 국제성모병원)	144
09:25-09:30	Q & A		
09:30-09:40	Coffee Break		
09:40-10:40	Session II. Imaging, Medication & Cases		
09:40-10:05	Imaging and medication for acute ischemic stroke	심유식 (인하대병원)	159
10:05-10:10	Q & A		
10:10-10:35	Stent retriever or Suction catheter for recanalization	박정현 (한림대 동탄성심병원)	166
10:35-10:40	Q & A		
10:40-12:40	방사선사 보수교육		

E-Poster

- | | | |
|---|---|--------------------|
| 1 | Popliteal artery occlusion during mechanical thrombectomy for acute ischemic stroke | 이영섭 (대구국모낭병원) |
| 2 | Aspiration boosted stent retrieval thrombectomy: personal experience 2 case | 강재성 (분당제생병원) |
| 3 | Case report: Treatment of Severe cerebral vasospasm | 김현곤 (분당제생병원) |
| 4 | Delayed Coil Migration from Anterior Communicating Aneurysm: A Rare Complication | 박민 (유성선병원) |
| 5 | 응급 뇌졸중 치료 가이드라인 제정 | 오재상 (가톨릭대 의정부성모병원) |
| 6 | Carotid artery stenting following CEA in acute stroke by complete ICA atherosclerotic occlusion | 박상규 (연세대 강남세브란스) |
| 7 | Transradial WEB Embolization of a Basilar Tip Aneurysm: A Technical Note and Literature Review | 김동섭 (가톨릭대 인천성모병원) |
| 8 | Histological Study of the Normal Vertebral Artery -Hypothetical Induction Site of Dissecting Aneurysms- | 김수빈 (순천향대 부천병원) |

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Free Paper I

(How to Respond to Cuts in Insurance Payments - Case reports)

6월 21일(금) 13:30-14:40

좌장: 박석규 (순천향대)

정준호 (연세대)

Insurance payment reduction for the flow diverter plus coiling procedure for the recurred large aneurysm

Young Woo Kim, Jae-sang Oh, Min-Jeong Kim

Department of Neurosurgery, College of Medicine, The Catholic University of Korea

Objective: A 38-year-old woman was admitted with a sudden headache followed by stuporous mentality. Initial CTA revealed localized ICH in the temporal lobe and diffuse SAH, caused by the rupture of an anterior choroidal artery aneurysm. She also had an unruptured intracranial artery (ICA) bifurcation aneurysm. Cerebral angiography showed a ruptured large aneurysm at the origin site of the anterior choroidal artery, measuring 12.48mm (long axis) x 11.30mm x 6.85mm (neck), and an unruptured aneurysm at the ICA bifurcation, measuring 3.93mm (long axis) x 3.60mm x 3.14mm (neck).

Methods: Considering the SAH and subsequent open craniotomy, coil embolization using double microcatheters without stent, followed by open craniectomy for hematoma removal and decompression was performed. A second treatment (stent deployment with additional coiling) was carried out simultaneously with treatment for the unruptured ICA bifurcation aneurysm 7 weeks after the initial treatment. A third treatment for major recurrence was performed 1 year later. The measured size of the recanalized portion with contrast filling was approximately 14.12mm x 7.07mm. Considering the previous two treatments, the stenting state, and the need to reduce jet flow, flow diverter deployment plus additional coiling was planned to further reduce recurrence.

Result: Insurance payment was denied for five coils, so we appealed this issue.

Conclusion: Sharing this issue, we can discuss the reasons behind the reduction, and strategies for addressing similar issues in the future.

FP1-2

Regrowing recurrence of the unruptured MCA treated by stent assisted coiling:retreated by Lvis assisted coiling

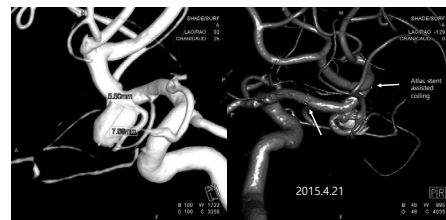
Sung-Chul Jin

Department of Neurosurgery, Inje University, Haeundae Paik Hospital

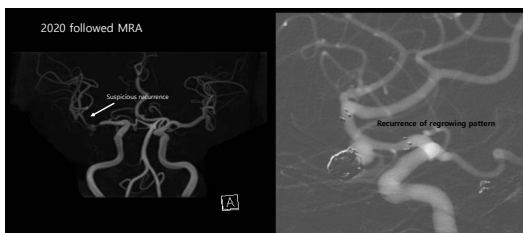
Regrowing recurrence of the unruptured MCA
treated by stent assisted coiling:
retreated by Lvis assisted coiling

Inje University, Haeundae Paik Hospital
Sung-Chul Jin

F/61, unruptured MCA aneurysm



단순히 추가적인 코일을 넣는 것만으로 재발된 동맥류 치료시 다시 재발 소견이 높아질 것이라 판단
하였고 이에 혈류 개선 효과를 기대할 수 있는 Lvis 스텐트 보조 코일 색전술을 계획하였음



multiple stent placement를 통한 neck remodeling 및 intra-aneurysmal flow
변화를 통한 thrombosis 유도를 위한 치료

Interv Neuroradiol. 2020 Oct; 26(5): 557-565.
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PMCID: PMC7645191
PMID: 32830566

Hemodynamic differences by increasing low profile visualized intraluminal support
(LVIS) stent local compaction across intracranial aneurysm orifice

Zhongbin Tian,¹ Mingqi Zhang,¹ Gaohui Li,² Rongbo Jin,² Xiaochang Leng,² Ying Zhang,¹ Kun Wang,¹ Yisen Zhang,¹
Xinjian Yang,¹ Jiansong Xiang,² and Jian Liu¹

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심판청구 기각의 이유

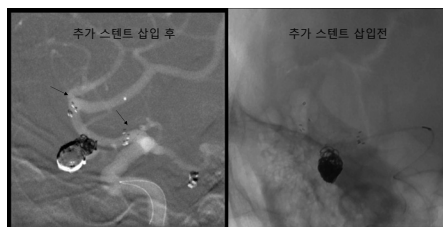
청구인이 제출한 전표기록부 등을 검토한 결과, 경외인은 UIA, Rt. MCAB에 대해 2015.4월 Stent assisted coil 시행, UIA Lt. MCAB로 2015.10월 Coil 시행, UIA, Lt. Ant. choroidal에 대해 2016.10월 Coil 시행한 자료, r/o Rt. MCAB An. recur에 대해 f/u TFCA 위해 2020.7.9부터 3일간 청구인 병원에 입원하여 UIA Rt. MCA s/p stent assisted coil recur로 7.10. "CDC packing with stent, aneurysm(AN)"을 시행하면서 TARGET DETACHABLE COILS 4x1, LVIS & LVIS JR 1x1 등을 사용한 사실이 확인된다. 청구인은 기존의 stent에 더해 multiple stent를 한다면 flow diversion의 effect를 낼 수 있다고 판단하여 close cell에 metal cover가 높은 stent를 사용하여 시술을 진행하였다고 주장하나, 경외인은 치료 후 재발된 경우로, 이번 시술을 통해 coil 삽입술이 충분해 이루어졌고, 기존 스텐트가 동맥류 경부를 리모델링하고 있으므로 추가로 LVIS stent를 사용할 근거가 미약하다고 판단된다.

행정 소송 진행

이 사건 수술이 neck(동맥류 입구)이 4mm 이상이거나, 동맥류 체부의 직경/경부의 직경이 2미만인 경우에 해당하지 않아서 이 사건 수술이 기준에 부합하지 않는다는 의미인지?

- 재발시에도 동맥류 목의 길이가 4mm를 넘었고 동맥류 체부의 직경/경부의 직경이 2미만이어서 스텐트 보조 코일 색전술의 인정기준으로 맞습니다. 단지 스텐트 하나가 들어가 있고 동맥류가 자라는 재발 형태가 아닌 코일 압축(coil compaction)으로 인한 재발 형태였다면 추가 코일 삽입으로 항 후 재발없이 치료 될 수 있을 가능성이 있지만 동맥류 자체가 자라는 경우는 혈류 개선을 시키는 것이 항 후 재발이 되지 않게 만드는데 있어 중요한 치료 방법으로 인정되어 지고 있다.

피청구인은 "기존에 스텐트 보호하 색전되어 있던 동맥류의 재발이 확인되어 추가 색전술 시행한 케이스로 기존 스텐트가 동맥류 경부를 리모델링 하고 있어 추가 스텐트 사용 인정할 근거가 없으며, 또한 영상자료에 추가 스텐트 확인되지 않는다"라고 주장한 것으로 보이는데, 위 주장의 의미가 이 사건 수술이 추가 스텐트를 시술한 것이 아니라 기존 스텐트를 리모델링한 것에 불과하기 때문에 추가 스텐트로 인정할 수 없다는 의미인지?



- 현 재발시에는 기존의 스텐트가 동맥류 목에 리모델링 효과가 있기 때문에 추가 스텐트 삽입술 자체를 인정할 수 없다는 취지이나 우리가 스텐트 추가 사용은 동맥류 목 리모델링 효과를 바라는 것이 아니라 혈류 개선하여 동맥류 재발을 낮추기 위하여 치료하였기 때문에 시술 불인정 받을 이유가 없습니다.

Cuts in Insurance Payments in Dongtan Sacred Heart Hospital over the past 5 years.

Park Jung Hyun

Department of Neurosurgery, Dongtan Sacred Heart Hospital, Hallym University

Cuts in insurance payments are bothering problems, especially in acute ischemic stroke treatment. Here we reviewed two cases of insurance problems in Dongtan Sacred Heart Hospital over past 5 years. One case was cuts in device – stent and aspiration catheter. The other was related with treatment prescription. There were no cuts insurance problems over past 3 years. It was possible through an avoidable black-label method. We recommend the elimination of limited quantity for thrombectomy devices.

뇌혈관조영술의 보험청구 및 삭감사례

조동영

이화여자대학교 서울병원

Introduction: 뇌혈관조영술의 수가는 현재 내경동맥, 외경동맥, 총경동맥, 추골동맥, 전뇌동맥의 5가지 분류로 청구되게 되어 있다. 청구 방법은 동시에 여러 개의 혈관조영술을 단일 장기에 시행하는 경우 200%까지 산정할 수 있으며, 산정 방법은 소정점수가 높은 혈관조영술을 100%, 두번째 혈관조영술씩은 50%를 산정한다. 3개의 혈관까지 밖에 청구할 수 없기 때문에 4개 이상의 혈관조영술을 시행하는 경우 전뇌동맥조영술 코드를 사용해야 하는데 전뇌동맥조영술의 수가는 현재 터무니없이 낮게 책정되어 있는 상황이다. 이번 사례에서는 뇌혈관조영술 이후 삭감된 사례를 중심으로 이에 대한 분석을 시행하고자 한다.

Method: 2019년 2월부터 2023년 12월까지 이대서울병원에서 시행한 뇌혈관조영술중 삭감 사례를 모아 분석하였다.

Result: 총 12례의 삭감 사례를 찾을 수 있었다. 단일 장기에 200%까지만 청구가 가능하지만 250%이상 청구하여 삭감된 사례가 있었고, 뇌혈관조영술 시행 후 같은날 코일색전술을 시행한 사례에서 코일색전술 후 시행한 뇌혈관조영술이 삭감되는 사례가 있었다. 또한 3혈관 촬영을 시행하고 4혈관을 처방하여 삭감된 사례가 있었다. 또한 최대 금액을 청구하기 위해서는 각각의 혈관을 청구하여 200% 최대 산정을 하여야 하지만 수가가 터무니없이 낮은 전뇌동맥조영술을 포함하여 청구가능 금액보다 낮은 금액을 청구한 사례들을 여럿 발견할 수 있었다.

Conclusion: 현재 전뇌동맥조영술의 수가가 터무니없이 낮게 책정되어 있어 전뇌동맥조영술을 포함한 처방은 되도록 삼가는 것이 좋으며, 청구시 200%범위를 초과하지 않게 계산이 필요하다. 혈관조영술과 코일색전술을 같은 날 시행한 경우 코일색전술에 따른 혈관조영술 수가를 받을 수 없는데 이에 대한 개선이 필요해 보인다.

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Symposium I

(Multidisciplinary approach for cerebrovascular disease)

6월 21일(금) 14:40-15:40

좌장: 김범태 (순천향대)

권순찬 (울산대)

Ischemic stroke Imaging

이아름

순천향대 영상학과

Anesthesia during treatment for cerebrovascular disease

박희평

서울대 마취통증의학과

ANESTHESIA DURING TREATMENT OF CEREBROVASCULAR DISEASE

HP Park
Department of Anesthesiology and Pain Medicine
Seoul National University Hospital

I have no COI related to this presentation



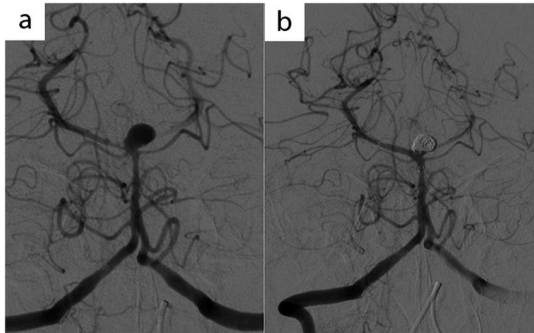
Contents

- Introduction
- General considerations
- Procedure-specific considerations
- Three cases
- Conclusions

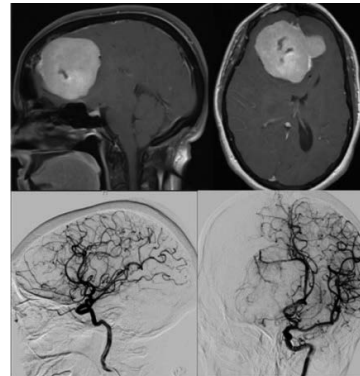
Cerebrovascular diseases

- Type
 - Aneurysms
 - AVM/AVF
 - Occlusive vascular ds (carotid artery stenosis)
- Treatment
 - Endovascular vs. Surgical





Ho MJ eNeurologicalSci. 2018



Ho MJ eNeurologicalSci. 2018

CLOSE COMMUNICATION BETWEEN ANESTHESIOLOGISTS AND NEUROSURGEONS

P-com An size 크네.
CN3 palsy는?

ICP는 대략 얼마 정도?
혈압은 이 정도면 좋겠죠?

체온이 낮아요
발관은 어떻게?
ICU로 갑시다



General Considerations for Anesthesia

• Awake vs General Anesthesia

• Awake

- Continuous neuro-monitoring
- Preservation of cerebral autoregulation

• General Anesthesia

- Minimized motion artifact
- Dynamic manipulation of blood pressure (BP) and ventilation parameters
- Facilitate the rapid management of complications and transfer to the neurosurgical operating room

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• Pre-operative Assessment

- Standard pre-operative assessment
- The underlying pathology and associated multi-system effects
- Baseline neurological deficits
- Baseline BP
- Patient positioning
- Risk of contrast-induced nephropathy

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• Monitoring

- ECG, non-invasive BP, pulse oximetry, and capnography
- Invasive BP monitoring
- Large bore IV access
- A urinary catheter
- Temperature monitoring and patient warming devices

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• Induction and Maintenance

- Maintenance of cerebral perfusion pressure (CPP) and cerebral oxygenation
- Extremes of BP should be avoided to attenuate the risk of bleeding and ischemia
- High-dose opioids (e.g., remifentanyl 2–4 mcg/kg) and hypnotics
- NMBA for facilitating endotracheal intubation
- Both inhalational anesthesia in combination with remifentanyl and total intravenous anesthesia (TIVA) may be used to maintain anesthesia

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• Induction and Maintenance

- Continuous NMBA infusion
- Nitrous oxide is avoided due to the risk of expansion of micro-emboli
- Peripheral infusion of an alpha-adrenergic receptor agonist (e.g., metaraminol or phenylephrine) to maintain hemodynamic stability and CPP
- Smooth emergence is essential to avoid spikes in ICP and to reduce risk of bleeding, particularly from groin vascular access sites
- A rapid wake up is also preferred to aid early neurological assessment.

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• Post-operative

- Appropriate BP control
- Close attention should be paid to the development of neurological deficit or severe headache, indicating potential bleeding or vessel occlusion
- Post-operative nausea and vomiting
- Euvolemia should be maintained as there can be a large osmotic diuresis due to the hyperosmolar contrast agents used
- Restrictions on the patient's mobility for some hours
- Strict monitoring of the vascular puncture site and distal perfusion

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

General Considerations for Anesthesia

• TIVA vs Inhalation anesthesia during interventional neuroradiology

• TIVA

- Deep anesthesia
- Prolonged extubation time
- More phenylephrine requirement
- Smoother recovery
- IICP

Kang E Anesth Pain Med 2019
Park HP Korean J Anesthesiol 2014

Procedure-Specific Considerations

• Endovascular Treatment of Cerebral Aneurysm

• Unruptured

- BP control during intubation
 - High concentration of remifentanyl
 - Esmolol
 - Lidocaine spray

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

Procedure-Specific Considerations

• Endovascular Treatment of Cerebral Aneurysm

• Ruptured

- Neurologic exam
 - GCS, neurological deficits, the amount of SAH
- Multi-system sequelae
 - Sympathetic hyperactivity leading to myocardial ischemia and left ventricular impairment
 - Neurogenic pulmonary edema
 - Sodium abnormalities
- BP control
 - Intubation
 - CPP

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Procedure-Specific Considerations

• Endovascular Treatment of Vasospasm

- Nimodipine
- Induced hypertension
- Normo-/hypervolemia
- Optimization of cerebral oxygen supply

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

Procedure-Specific Considerations

• Endovascular Thrombectomy

- Meticulous hemodynamic control
 - Initial invasive arterial monitoring
 - Guidelines recommend maintaining systolic blood pressure between 140 and 180 mmHg
- Secondary insults should be avoided
 - Maintaining normoxia and CO₂ control, normothermia, and euglycemia

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Procedure-Specific Considerations

• Endovascular Treatment of Arteriovenous Malformations

- Normal perfusion pressure breakthrough
 - The arterial pressure should be kept at 20% below baseline following embolization
- Steroids may be required to reduce post-procedure perinidal edema

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Procedure-Specific Considerations

• Carotid Re-vascularization: Stenting

- Stenting for symptomatic carotid stenosis is associated with a higher risk of peri-procedural stroke or death
- Bradycardia or asystole may occur due to carotid body stimulation.
 - Atropine and glycopyrrolate
 - External pacing
- Post-procedure hypertension should be avoided to prevent cerebral hyper-perfusion syndrome

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

Complications associated with endovascular neurosurgical procedures

• CNS complications

• Aneurysmal perforation

- Immediate management includes rapidly inducing hypotension, by either deepening anesthesia or using titrated doses of intravenous antihypertensives (e.g., labetalol), in order for endovascular control to be gained
- Heparin can be reversed with protamine
- Platelet transfusion remains the primary treatment for reversal of anti-platelet agents, occasionally in combination with DDAVP
- If the extravasated blood load is high, further interventions to control ICP may be required as a bridge to further CT imaging and definitive surgical intervention

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

Complications associated with endovascular neurosurgical procedures

• CNS complications

- Intracranial vessel injury, dissection, and perforation
- Thromboembolism
 - Increasing the arterial pressure to 30–40% above baseline
 - Anti-platelet agents
- Glue occlusion of distal vessels
- Displacement of coil into parent vessel
- Vasospasm
- Hyperemia and swelling post-AVM embolization

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

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Complications associated with endovascular neurosurgical procedures

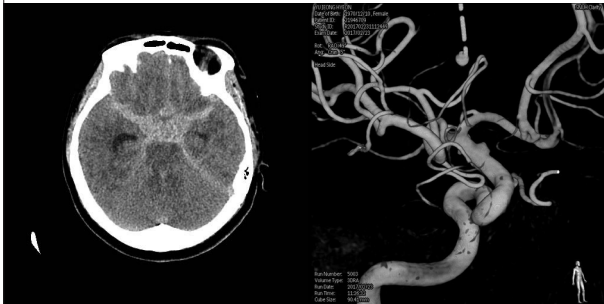
- Systemic complications
 - Contrast hypersensitivity reactions
 - Contrast-induced acute kidney injury
- Hemorrhage at the puncture site, groin hematoma, retroperitoneal hematoma, and arterial pseudoaneurysm

Lee CZ Curr Opin Anaesthesiol 2014, Earl M Current Anesthesiology Reports 2021

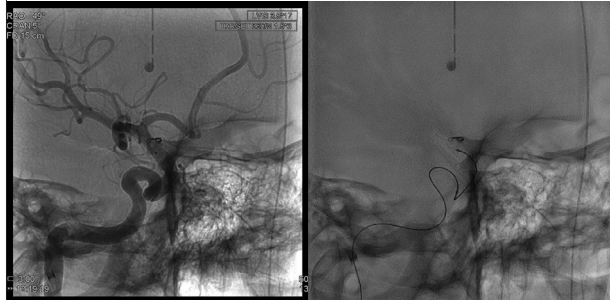
Case 1

- F/46
- Known Bechet ds
- Headache, nausea, Lt. weakness, dysarthria
- ER에서 검진중 obey-command 안되면서 호흡이 나빠지고 seizure
- Intubation

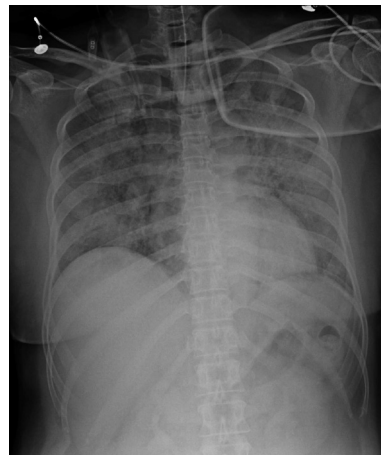
- SAH, Fisher 3, HH grade 5
- Ruptured dorsal ICA blister like aneurysm
- EVD insertion

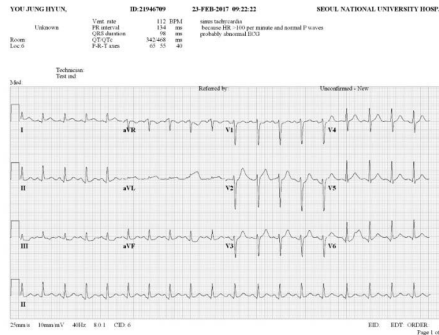


- Scheduled for endovascular coiling



- Preop VS
 - 120-150/56-64 – 80-96 – 15-23 – 36.5
- Preop lab findings
 - Lactate 6.1
 - ABGA (FiO₂ 1.0) 7.47-29-195-21.1



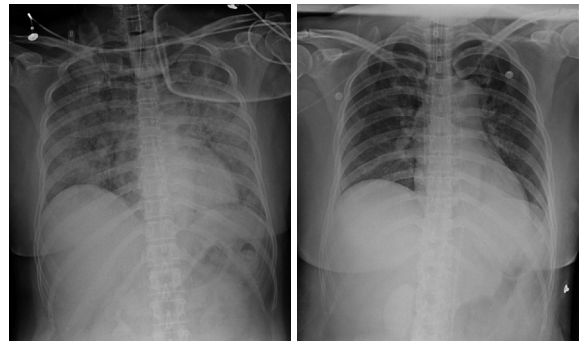


Intraoperative period

- Induction
 - TIVA, phenylephrine cont. infusion
 - FiO₂ 0.7에서 서서히 감소, PEEP 5 cmH₂O에서 서서히 증가
 - EVD setting 15 cmH₂O
- 20 min after induction
 - Desaturation (SpO₂ 91-95)
 - Hypotension (ISBP 72 mmHg)
 - Stress-induced cardiomyopathy and CPP
 - Epinephrine and NE cont. infusion
- 60 min after induction
 - ABGA (FiO₂ 0.45, PEEP 12 cmH₂O, SpO₂ 96) 7.33-43-71-22.7
- The end of procedure
 - VS 131/68- 94-20-36.1
 - FiO₂ 0.45, PEEP 12 cmH₂O, SpO₂ 99

Immediate postoperative period

- FiO₂ 0.7, PEEP 7 cmH₂O
- Precedex, remifentanyl continuous infusion
- Epinephrine, NE, dobutamine continuous infusion
- Echo finding
 - Compatible with stress-induced cardiomyopathy
- EVD setting 10 cmH₂O



Preoperative

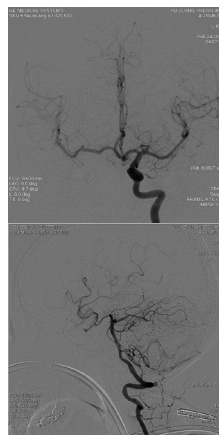
Postoperative 12 hr

POD 1

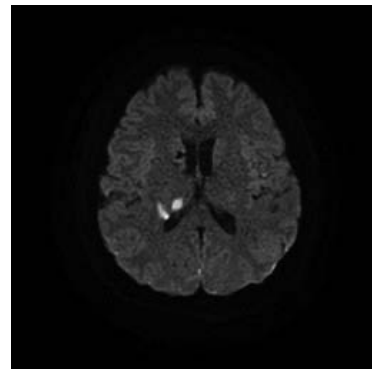
Lt. CN VI palsy, Lt. lat. gaze diplopia



- Rt proximal ICA occlusion
- Antiplatelet medication
- TCD f/u
- Caution to hypotension



POD 1



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POD 2

- Rt. retinal hemorrhage
- Lt. vitreous hemorrhage

POD 8-12

- #5 Vasospasm tx on both M1, M2, A2

POD 16

- Transfer to general ward

POD 36 and 43

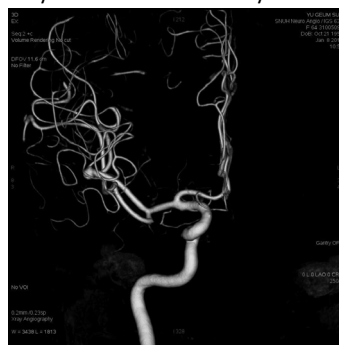
- Rt and Lt vitrectomies

POD 44

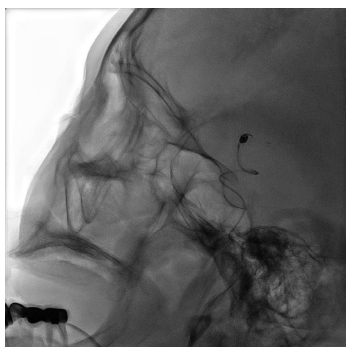
- Discharge without neurologic sequelae

Case 2

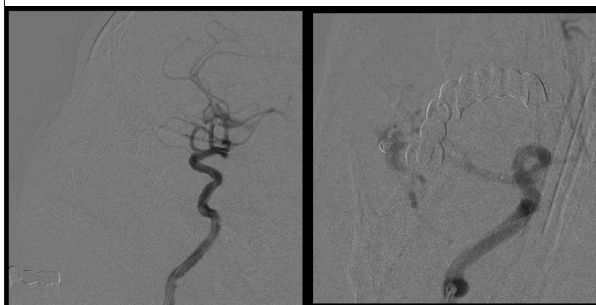
- F/64
- Incidentally found cerebral aneurysm



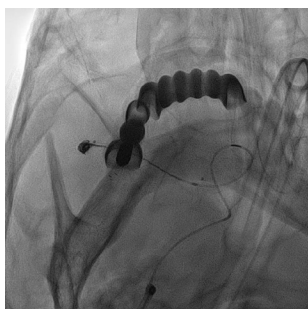
- Iatrogenic aneurysm rupture due to coil



- Contrast dye extravasation



- Rapid additional coiling
- Nicardipine for BP drop SBP: 124 → 164 → 118 mmHg
- Protamine, mannitol



- Rt. sylvian fissure와 Rt. hemispheric sulci에 소량의 SAH
- Transfer to NICU without extubation
- Extubation in NICU
- No neurologic deficit



Case 3

- F/52
- SAH ruptured BT aneurysm, coil embolization (17 days ago)
- Vasospasm tx.



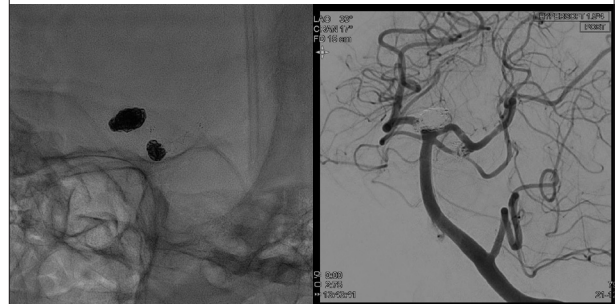
- Flow diversion and endovascular coiling for Lt. P2 pseudoaneurysm



- Nimodipine IA injection for vasospasm
- Communication about SBP elevation (110 → 130 mmHg) with phenylephrine continuous infusion



- Coiling and flow converter
- Thrombosis within flow converter
- Tirofiban IA injection



Anesthetic emergence

- Extubation
- Lt. CN 3rd palsy
 - Ptosis
 - Pupil dilatation
 - Medial gaze difficulty with nystagmus
- Observation
- Steroid therapy

Conclusions

- With respect to anesthetic aspects, immobilization should be necessary during neurointerventional procedures
- Both inhalational anesthesia in combination with remifentanyl and total intravenous anesthesia (TIVA) can be used for anesthesia in patients undergoing neurointerventional procedures
- Close communication about the patient's status between anesthesiologists and neurointerventionalists is very important to improve clinical outcomes, especially in critically ill patients with multi-system sequelae and patients with intraprocedural complications



Rehabilitation for cerebrovascular disease

김기훈

고려대 재활의학과

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Rehabilitation for Cerebrovascular Disease

Ki-Hoon Kim, M.D., Ph.D.
Korea University College of Medicine

Rehabilitation during acute phase

- ▶ **Early mobilization**
 - DVT
 - Deconditioning
 - Gastroesophageal regurgitation
 - Aspiration pneumonia
 - Contracture formation
 - Skin breakdown
 - Orthostatic intolerance
- Positive psychological benefits

Rehabilitation during acute phase

- ▶ Method of early mobilization
 - Turning from side to side in bed
 - Sitting up in bed
 - Transferring to a wheelchair
 - Standing and walking
 - Self-care activities (feeding, grooming, dressing..)
- ▶ Should begin as soon as possible
 - Within 24 to 48 hours of admission if medically stable

Stroke Impairments and rehabilitation

- ▶ **Motor impairment : Hemiplegia**
- ▶ **Spasticity**
- ▶ **Cognitive deficit**
- ▶ **Aphasia**
- ▶ **Dysphagia**

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Motor Impairment

- ▶ What's affected by cerebrovascular disease
 - Strength
 - Power (speed with which force can be generated)
 - Motor control and coordination
 - Muscle tone
 - Balance

Motor Impairment

- ▶ MRC (Medical Research Council's) 6-point scale
 - 0 to 5 (Zero to Normal)
 - 0: complete paralysis
 - 3: ability to fully move the limb against gravity
 - 5: normal strength
 - Clinical scale to assess strength
 - Useful in patients with lower motor neuronal lesion or myopathy
 - Problematic for assessing stroke patients
 - Failure to indicate the degree of motor control

Rehabilitation therapy for motor weakness

- ▶ Approach to facilitate and enhance motor recovery
 - Traditional approach: neurodevelopment technique by Bobath
 - Functionally oriented exercise training (e.g. transfer, early ambulation)
 - Recent approach: repetitive task-oriented practice
- ▶ Optimal timing and dosing of motor rehabilitation remain uncertain

Rehabilitation therapy for motor weakness

- ▶ Constraint-induced movement therapy (CIMT)
- ▶ Locomotor training
- ▶ Robot-aided rehabilitation
- ▶ Noninvasive brain stimulation
- ▶ Neuromuscular electrical stimulation

Constraint-induced movement therapy

- ▶ "Learned nonuse" of the weak limb

Use the intact upper limb to compensate



Enhance neurologic recovery

- ▶ Cortical reorganization of motor system
- ▶ Condition
 - At least, partial wrist and finger extension
 - Proximal limb control, sufficient balance



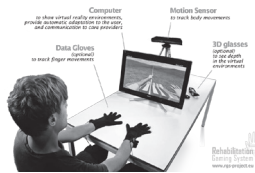
Robot-aided rehabilitation

- ▶ Suitable for highly repetitive exercises
- ▶ Require skilled assistance (from a therapist) in setting the patient up
- ▶ Not been proven superior to conventional therapy



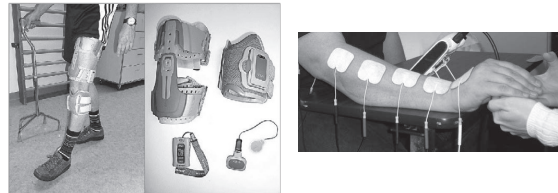
Virtual reality and gaming system

- › Encourage movement and provide feedback to users
- › Evidence of improved motor function
- › Failed to demonstrate benefit of a particular gaming intervention compared to conventional upper limb motor activities
- › Adjunct to conventional therapy



Neuromuscular electrical stimulation

- › = Functional electrical stimulation (FES)
- › Lower limb devices: alternative to ankle-foot orthosis



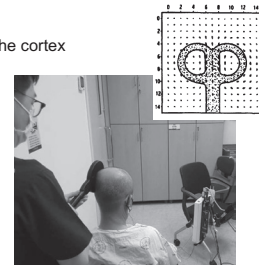
Biofeedback using EMG signal

- › Record surface EMG from muscle
- › Auditory or visual feedback
- › Result of trials: mixed



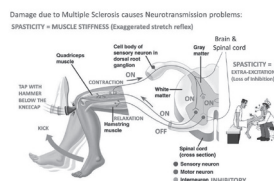
Transcranial magnetic stimulation (TMS)

- › Strong but brief magnetic field
- › Generate an electric current in the cortex
- › Induce cortical excitability
- › Possibility of inducing seizure
- › Transient headaches



Spasticity

- › Velocity-dependent increase in tonic stretch reflex
- › Motor impairment, pain, disability following stroke
- › Management
 - Daily stretching
 - Splint: hand, ankle
 - Botulinum toxin
 - Oral antispastic agent
- › Intrathecal baclofen therapy



Cognition deficits

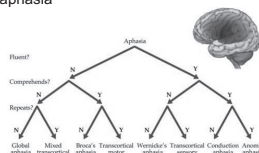
- › Retaining of specific component skills
- › Teaching compensation techniques
- › Adaptation of environment
 - Using visual aids, memory log, maps etc.



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Aphasia

- 1/4, acute phase -> 1/5, later phase
- Slower, more prolonged time than motor recovery
- Most recovery: first 3-6 mon.
- Amount and pattern of recovery: initial severity & type
- prognosis: fluent aphasia > non-fluent aphasia
- Broca's (motor) aphasia
- Wernicke's (sensory) aphasia



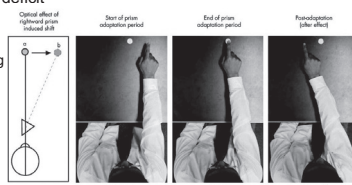
Treatment of Aphasia

- Melodic intonation Tx (MIT)
 - noninjured functioning neural pathway (carry musical information)
- Encouraging verbalization
- Conversational coaching
- Oral reading
- Dysarthria
 - exercise modalities
 - oromotor speech muscle strengthening
 - respiratory training
 - retraining of articulatory patterns and gestures



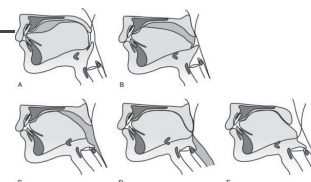
Perceptual function

- Neglect, denial of illness, loss of facial recognition
- Most of improvement: first 3 to 6 months after stroke
- Visual-spatial perceptual deficit
 - Prism glasses
 - Visuospatial cueing
 - Computer-assisted training (Augmented Reality)
 - Eye patch



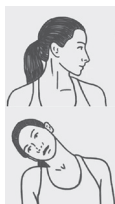
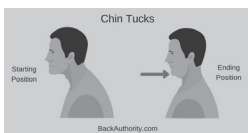
Dysphagia

- Oral phase
- Pharyngeal phase
- Esophageal phase
- Dysphagia: 1/3 – 1/2, all stroke survivors
- Aspiration, pneumonia, malnutrition, dehydration
- Malnutrition: 8-34% of patients



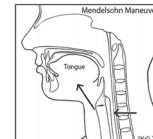
Rehabilitation of dysphagia

- Compensatory management
 - Changing posture and positioning for swallowing
 - Learning new swallowing maneuvers (supraglottic swallowing)
 - Changing food amount and texture



Rehabilitation for dysphagia

- Therapy strategies
 - Change swallow physiology
 - Sensory stimulation, exercise program, swallow maneuvers
 - Masako maneuver, Shaker exercise, Mendelsohn maneuver



Thanks for your attention!

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Free Paper II

('My first case' from Young Gun)

6월 21일(금) 16:00-17:00

좌장: 백민우 (뉴고려병원)

이호국 (한림대)

Review of Early Cases: Giant Aneurysms Treated with Coil-assisted Flow Diverting Stents

Hyunjun Jo, Won-ki Yoon

Department of Neurosurgery, Korea University Guro Hospital

Objective: Until last year, the healthcare insurance system of Korea did not permit the use of coils in conjunction with flow diverting stents (FDS) for the treatment of giant aneurysms. However, utilizing coils alongside FDS can potentially mitigate the risk of unpredictable ruptures and facilitate rapid obliteration of the aneurysm. Recently, there has been a limited approval for the combined use of FDS and coils in Korea. As a young practitioner, I aim to present several cases where I have attempted this treatment approach.

Methods: The first case involved a 52-year-old female presenting with severe headache and diagnosed with a ruptured thrombosed giant aneurysm measuring 25mm in the right distal internal carotid artery (ICA). Treatment comprised deploying an FDS with five coils. Although post-procedural stenosis occurred, the patient recovered well, showing significant aneurysm obliteration on follow-up angiogram. The second case concerned a 63-year-old female incidentally found to have a left distal ICA aneurysm. Similar treatment was administered, with a 3-month CT angiogram indicating potential decreased distal middle cerebral artery (MCA) flow. A follow-up digital subtraction angiography (DSA) was planned at the 6-month mark due to the patient's asymptomatic status.

Result: The common challenges encountered during these treatments included the difficulty in assessing whether the FDS was adequately deployed when using coils alongside, compared to using FDS alone. Additionally, it was noted that alternative methods of follow-up, apart from DSA, could hinder rather than facilitate obtaining information. Seeking advice from senior physicians who practiced stent-assisted coil embolization for giant aneurysms before the advent of FDS could offer valuable insights. I submit an abstract to discuss this matter further.

Conclusion: While coil-assisted FDS offer advantages such as mitigating the risk of unexpected rupture, they pose challenges in follow-up procedures. To effectively utilize this treatment approach, in-depth consideration is required regarding the appropriate follow-up modality and timing.

Three cases of ruptured blood-blister like aneurysms treated with stent-assisted coil embolization using the LVIS EVO: a first-year experience

Min-Yong Kwon, Jae Hyun Kim, Chang-Hyun Kim, Chang-Young Lee

Department of Neurosurgery, Keimyung University Dongsan Hospital, Keimyung University School of Medicine

Objective: I encountered three ruptured blood blister-like aneurysms (BBAs) of the supraclinoid internal carotid artery in my first-year as an independent neurosurgeon, two of which were the first and second endovascular experiences of my life.

Methods: Patient 1 was a 39-year-old male with Hunt and Hess Scale (HHS) 2 and modified Fisher Scale (mFS) 4, identifying a tiny aneurysm of 1.3 mm in height and 3.3 mm in neck. Patient 2 was a 34-year-old male with HHS 2 and mFS 1, with a lesion of 2.4 mm in height and 4.9 mm in neck. Patient 3 was a 59-year-old female with HHS 3 and mFS 4, and a wide-neck aneurysm measuring 2.6 mm in height and 5.6 mm in neck. I treated ruptured supraclinoid BBAs with stent-assisted coil embolization (SACE) using the LVIS EVO, a wire-braided stent with high metal coverage, while patients 2 and 3 were treated with the semi-jailing technique of double microcatheter.

Result: Patient 1 had no intraprocedural complications, and Raymond Roy occlusion classification (RROC) was 1 immediately after procedure and 1 year later. Patient 2 suffered a distal occlusion involving the middle cerebral artery due to acute in-stent thrombosis, which fortunately resolved almost completely with intraarterial tirofiban injection. The immediate postprocedural RROC was 2. However, cerebral angiography after 6 months revealed severe in-stent stenosis at distal flared markers and major aneurysmal regrowth. Therefore, intracranial artery stenting with Wingspan and additional SACE overlapping the LVIS EVO was performed, and cerebral angiography after 10 months confirmed that the improvement was well maintained. Patient 3 also had an immediate RROC of 1, however, cerebral angiography 11 days later identified recanalization of RROC 2 and overlapped stenting was performed. The lesion was completely obliterated on angiography after 4 months. Based on the modified Rankin scale, patients 1 and 2 are scored as 0 and patient 3 is scored as 1 due to mild cognitive impairment. All are currently being followed up on an outpatient clinic.

Conclusion: SACE with LVIS EVO for ruptured supraclinoid BBAs may be a beneficial treatment option. However, given the rapid morphological changes and frequent recurrence of BBAs, it is advisable to consider overlapped stenting in advance.

Endovascular Treatment (EVT) for Wake-up Acute Ischemic Stroke (AIS) : My first, agonizing experience in my life

Gwang-Tae Park, Young-Jin Jung

Department of Neurosurgery, Yeungnam University Medical Center

Objective: When acute ischemic stroke (AIS) with large artery occlusion (internal carotid artery (ICA) and middle cerebral artery (MCA)) occurs, endovascular treatment (EVT) should be performed after checking several points such as onset time for symptom development, National Institutes of Health Stroke Scale (NIHSS) score and Alberta Stroke Program Early CT score (ASPECTS). In the case of wake-up AIS with borderline ASPECTS, however, we need careful decision how to treat. I would like to report my first EVT case performed on a patient with wake-up stroke.

Methods: 63 year-old man was admitted at ER with mental deterioration and motor weakness. Time last known to be well (TLKW) was within 24 hours with unknown clear onset and initial NIHSS score was very high at 20. On brain CT angiogram, right ophthalmic ICA occlusion was checked but ASPECT score was very low at 3. Nevertheless, considering relatively young age, normal preoperative modified Rankin Score (mRS), we proceeded to do EVT immediately. After 4times trial of stent retriever thrombectomy (SRT), recanalization was checked completely. But severe brain swelling and midline shifting happened, so decompressive craniectomy was done. Unfortunately, patient died after POD#13.

Result: I concerned whether to do thrombectomy or not because of borderline ASPECT score, poor patient's neurology and unclear onset time. Someone told that we should not carry on procedure because of predictable reperfusion injury.

Conclusion: But, as long as it doesn't go against treatment indication, I think we should not give up even if poor prognosis is expected.

Facing the First Mountain: A Young cerebrovascular surgeon's Case report of Aneurysm treatment

황의현

의정부을지대병원

Objective: The first case of aneurysm is big mountain for all cerebrovascular neurosurgeon. The path may not be visible in the mountains, but it's a mountain that must be crossed. In this case, we described the course of overcoming tragedy of first case of young cerebrovascular neurosurgeon.

Methods: This report is case review.

Result: The sixty years old female patients was visited the emergency room for headache. Initial Hunt-Hess grade was 3 and Fisher grade was 4. After cerebral angiography, ellipsoid posterior communicating artery aneurysm was confirmed. The aneurysm was treated with coil embolization. After coil packing, right proximal M2 obstruction was identified in ICA angiography. Aspiration thrombectomy was attempted initially, but the aspiration catheter could not pass through the carotid siphon. After stent deployment, passage through the carotid siphon was facilitated via stent anchoring, enabling successful thrombus removal with a stent retriever thrombectomy.

Conclusion: The first case is always accompanied by fear for young cerebrovascular neurosurgeons. However, with perseverance, it's a mountain that can be climbed step by step.

Flow Diverter as a Rescue Treatment for Ruptured Blood Blister-Like Aneurysm in a Patient with Multiple Medical Issues

이주환, 김성태, 이진, 정해웅, 정영균

인제대학교 부산백병원

Objective: Treatment of ruptured blood blister-like aneurysms(BBA) is challenging. This study aims to present a case where a flow diverter was used as a rescue treatment following multiple stent-assisted coiling in a patient with multiple medical issues, including COVID-19 and colon cancer bleeding.

Methods: A 60-year-old male presented with stupor and left-side weakness. CT scan revealed a thick SAH (mFG 4), and the patient tested positive for COVID-19. Cerebral angiography detected a blood blister-like aneurysm (BBA) on the right ICA dorsal wall. Initial treatment involved stent-assisted coiling using two Neuroform ATLAS stents. Postoperatively, the patient was placed in isolation due to COVID-19. On POD 4, massive hematochezia occurred, and only transfusions were possible. Minor recurrence of the aneurysm was detected one week after isolation release, leading to a reduction in antiplatelet therapy. A ventriculoperitoneal shunt was performed at three weeks. Persistent hematochezia led to the diagnosis of colon cancer bleeding.

Result: Four-week angiography revealed a major aneurysm recurrence. Colon cancer surgery was prioritized, followed by a flow diverter (Surpass Evolve 3.25mmX20mm) deployment over the existing stents two weeks after laparoscopic resection. Three-month follow-up angiography showed aneurysm growth, prompting a reduction to single antiplatelet therapy. Serial HRMRI indicated stability of the BBA. At 18 months, angiography confirmed aneurysm resolution, though A1 flow was significantly reduced. After extensive chemotherapy and rehabilitation, the patient achieved independent living (mRS 2).

Conclusion: The flow diverter served as an effective rescue treatment for a ruptured blood blister-like aneurysm. In a patient with multiple medical issues, including COVID-19 and colon cancer, this case highlights the necessity of a multidisciplinary approach in managing such complex conditions.

Overcoming severe aortic tortuosity in endovascular treatment of intracranial aneurysm

Se Yun Kim, Jong Min Lee, Soon Chan Kwon

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

Objective: Effective access to supraaortic vessels and intracranial arteries is critical for neuroendovascular procedures. Navigating the aortic arch can be particularly challenging when anatomical complexity is present.

Methods: We share experiences from two cases – a ruptured aneurysm in a 77-year-old female and an unruptured aneurysm in a 76-year-old female – both complicated by severe aortic tortuosity. Various guide wires and catheters were used, and saline flushes were employed to gradually navigate the catheter. Specifically, 035 – buddy-wire assisted distal navigation technique was instrumental in overcoming severe aortic tortuosity.

Result: After persistent efforts, these attempts successfully opened the path to the desired target vessel.

Conclusion: These cases highlight unexpected challenges in the proximal vascular region and demonstrate effective strategies to manage these difficulties.

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장소: 제주해비치호텔



Free Paper III. Agony Session (Sharing painful memory for improvement)

6월 21일(금) 17:00-18:00

좌장: 권오기 (서울대)
장철훈 (영남대)

A WEB Embolization of a Large Anterior Communicating Artery Aneurysm with a Tortuous Anatomy: An Inadvertent Event and Technical Nuance

Dong-Sub Kim, Byung-Rae Cho, Young Hoon Choi, Dong-Kyu Jang^S

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

Objective: This study aimed to report an inadvertent event of a VIA27 microcatheter destruction stuck with a WEB device during retrieval of the deployed WEB device because of size mismatching in a larger anterior communicating artery aneurysm with a very tortuous anatomy.

Methods: A 76-year-old female patient presenting with a large anterior communicating (ACOM) aneurysm with multiple intracranial atherosclerotic changes and tortuous anatomy. A right-side dominance and aneurysm size were noted as 8.74x6.79x10.18mm (DNH). WEB embolization was planned due to a wide neck branch aneurysm.

Result: Under general anesthesia, a right femoral puncture was done and a 7F sheath was positioned up to the right CCA over the Headhunter catheter. A Sofia 5Fx115cm guiding catheter was positioned up to Rt C7 ICA, and 2D and 3D DSA were performed during left carotid compression. A working angle was set up. Aneurysm volume was calculated with AngioCalc software (www.angiocalc.com) as 416.94mm³. According to the WEB SL volume chart, the first choice was selected with a WEB SL 9x6mm (381.7 mm³), not a WEB SL 9x7mm (445.3mm³). A VIA27 microcatheter was positioned up to right A2 and the tension of triaxial system was released and the VIA27 catheter was inserted into the aneurysm sac. The selected WEB SL 9x6mm device was inserted into the microcatheter and tried to be inserted into the aneurysm with remarkable resistance due to tortuous anatomy. However, we identified the WEB SL 9x6mm device was proved to be under-fitted with the aneurysm. We tried to retrieve the WEB SL 9x6mm device but failed to recapture it due to being stuck with the VIA27 microcatheter. Therefore, we retrieved the VIA27 and WEB SL 9x6mm, altogether. During the retrieval procedure of the VIA27 and WEB SL 9x6mm, the Sofia 5F guiding catheter was advanced up to Rt A1 due to the principle of action and reaction. Another VIA27 microcatheter was inserted into the aneurysm sac and WEB SL 9x7mm was deployed into the aneurysm successfully. She was discharged two days later without any complications. At the 3-month follow-up, neither recurrence nor event were noted.

Conclusion: Microcatheter destruction might have been better considered as an inadvertent complication during the WEB device deployment for a large volume ACOM aneurysm with a very tortuous anatomy. In such a situation, a guiding catheter positioning up to A1 could be a technical tip for successful deployment.

Flow diverter stent-assisted coil embolization of recurrent basilar artery aneurysm

성승언

동래봉생병원 신경외과

Objective: A 55-year-old female patient who had undergone double stent-assisted ruptured basilar artery aneurysmal coil embolization 15 years ago presented to the our hospital with dizziness. She had underlying diseases such as autoimmune liver disease and hypertesion. Brain MRI/A and cerebral angiography showed recurrent mid-distal BA aneurysm. We performed Flow diverter stenting with coil embolization.(Semi-jailing)

Methods: Immediate post operative patient's neurologic status and radiologic findings were normal. However, despite appropriate antiplatelet agents and steroid treatments, brainstem infarction occurred four times over 10 weeks. The patient became unable to walk due to quadriplegia. After careful consideration of the patient's data, several tests performed showed significantly low serological cortisol levels.

Result: The above results were judged to be iatrogenic adrenal insufficiency caused by steroids administered over a long period of time to treat autoimmune liver disease. The inflammatory reaction that occurred around the stent and the occlusion of the perforators were determined to be caused by a lack of steroids.

Conclusion: After hydrocortisone administration, the patient was able to walk independently.

Delayed collapse of flow diverter after treatment of cervicopetrous ICA giant aneurysm: another concern for flow diversion in giant aneurysms

Seung Pil Ban, O-Ki Kwon, Young Deok Kim, Hwan Seok Shim

Department of Neurosurgery, Seoul National University Bundang Hospital

Objective: Delayed morphological change of flow diverter stents (FDS) can be seen in the form of deformation, fish-mouthing, foreshortening, migration and in-stent stenosis. These changes can be seen secondary to various device- and vasculature-related factors such as improper sizing of the device, twisting of the device in tortuous anatomy, insufficient proximal landing zone, and insufficient chronic resistive force of stent.

Methods: A 32-year-old-male presented with severe headache on the left side. The initial brain MRA and TFCA showed giant aneurysm in the left distal cervical and petrous ICA. We performed deployment of the flow diverter (Surpass Evolve, 5.0 X 40 mm). To prevent migration of the flow diverter and anchor the proximal end, a 5.5 X 30 mm LVIS Blue stent was deployed from the proximal one third section of the flow diverter to distal cervical ICA. There was no morphological change of the flow diverter and neurological change.

Result: On 1-year follow-up CT angiography, delayed collapse of the flow diverter was detected at the mid-section of the flow diverter. We performed follow-up TFCA and giant residual sac filling with collapsed mid-section was identified. We tried to dilated collapsed section using a Scepter balloon, but collapsed part was not dilated. We deployed additional flow diverter (Surpass Evolve, 5.0 x 40 mm) and performed post-balloon angioplasty using Scepter balloon. The 10-month follow angiogram revealed no change of collapsed flow diverter lumen with decreased aneurysmal sac filling.

Conclusion: Delayed collapse of flow diverter should be taken into consideration when planning flow diversion in giant aneurysms.

Should Patients with Acute Minor Ischemic Stroke With Isolated Internal Carotid Artery Occlusion Be Thrombolysed?

Seung Yoon Song, Sol Hooy Oh, Dong Hoon Lee, Jae Hoon Sung

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

Objective: The endovascular treatment (EVT) in patients with acute symptomatic isolated occlusion of the internal carotid artery (ICA-I occlusion) without involvement of the middle and anterior cerebral arteries is still controversial. We report a case of a patient with acute ICA-I occlusion who underwent EVT using multiple techniques but presented with neurologic deterioration after successful reperfusion.

Methods: An 80-year-old female patient presented to our institution's emergency department with a complaint of mental alteration. It had been approximately 30 hours since her last normal time and she was presenting with mild drowsiness, disorientation, and right arm weakness (NIHSS 3). Brain CT angiography & perfusion performed on admission revealed left ICA occlusion with MCA territory perfusion delay. Right ICA showed collateral flow to the left hemisphere through the anterior communicating artery and perfusion mismatching findings were also identified, so it was decided to try recanalization through EVT.

Result: Initial left ICA angiography confirmed a cavernous ICA occlusion and right ICA angiography showed a retrograde collateral through the anterior communicating artery. Recanalization through a combined technique using a retriever stent and an aspiration catheter was attempted, but delayed occlusion due to severe arteriosclerosis continued to occur, and ICA recanalization was successfully performed through balloon angioplasty and stent insertion. However, middle cerebral artery (MCA) occlusion due to distal emboli was newly observed on angiography after ICA recanalization. During thrombectomy for the MCA occlusion, the previously deployed stent was removed but finally, MCA was successfully recanalized using a combined technique. However, after the procedure, the patient neurologically worsened from before the procedure, with a stuporous mentality, global aphasia, and right hemiparesis (NIHSS 18). Since then, the patient has been bedridden with an mRS of 4 despite continued rehabilitation.

Conclusion: Although many recent studies have reported the benefit of intervention for acute ICA-I occlusion, the risk of embolization must nevertheless still be considered, so careful patient selection is therefore important.

Fetal Bleeds after Flow Diversion for Large-Sized Aneurysms

GT Park, JH Kim, CH Chang, YJ Jung

Department of Neurosurgery, Yeungnam University Medical Center

Objective: To review the authors' experience with fetal bleeds after flow diversion (FD) treatment of large-sized aneurysms.

Methods: The authors retrospectively reviewed their FD cases performed between 2016 and 2024. Among 40 FD cases, they identified 2 cases with hemorrhagic complications, including 2 instances of fetal bleeds shortly after FD treatment

Result: Case 1: A 51-year-old female patient with a large dICA aneurysm (N/H/W 3.95/16.20/18.95 mm) underwent coil embolization followed by a single Pipeline embolization device. The patient died on postoperative day 1 due to fetal bleeds. Case 2: An 81-year-old female patient with a large BA (BV junction) aneurysm (N/H/W 8.72/13.69/14.43 mm) underwent Surpass flow diverter placement from Lt VA to BA and Rt VA trapping. The patient died on postoperative day 5 due to hemorrhage. In both cases, there was persistent high-velocity jet flow within the aneurysm sac after FD, which likely led to the acute fetal bleeds.

Conclusion: To mitigate the risk of fetal bleeds after FD treatment of large/giant aneurysms, the authors suggest using adequate coil embolization within the aneurysm sac and/or deploying additional FD devices in the parent artery to reduce the jet flow.

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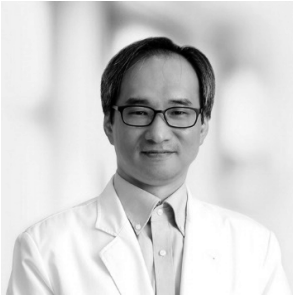
대한뇌혈관내치료의학회 연구비 지원사업 공모 발표

6월 22일(토) 10:00-10:30

좌장: 김태곤 (차의과학대)

황교준 (분당제생병원)

대한뇌혈관내치료의학회 연구비 신청서

연구 과제명	(국문) 표면 처리 혈류전환 스텐트의 임상적 유효성 - 다기관 후향 연구		
연구기간	(영문) Clinical Effectiveness of Flow Diverting Stent with Surface Modification - Multicenter Retrospective Study 연구과제 선정 후 1 년		
연구 책임자	(성명)	(국문) 강 현 승	(영문) Kang, Hyun-Seung
	(소속) 서울대학교 의과대학 신경외과학 교실		
	(직위) 교수	(전문과목) 신경외과	
	(E-mail) kanghs@snuh.org		
	(전화) 02-2072-2350	(휴대전화) 010-6229-9365	
연구비 종류	☐ 기초, ☒ 임상 ☐ 승 인, ☒ 제출 - 심의중, ☐ 해당 없음		(예산안) 총 2000 만원
IRB 심의			
본인 (등)은 대한뇌혈관내치료의학회 연구비를 소정의 서류를 갖추어 신청합니다. 2024 년 4 월 30 일 연구책임자 직위: <u>교 수</u> 성명: <u>강 현 승</u> ^{강현승} (인) 공동연구자 직위: <u>교 수</u> 성명: <u>김 강 민</u> (인) 직위: <u>교 수</u> 성명: <u>반 승 필</u> (인) 직위: <u>교 수</u> 성명: <u>이 덕 희</u> (인) 직위: <u>교 수</u> 성명: <u>백 승 국</u> (인) 직위: <u>교 수</u> 성명: <u>박 정 현</u> (인)			

대한뇌혈관내치료의학회 귀중

연구계획서

1. 연구의 배경 및 필요성

1-1) 연구개발의 배경

뇌동맥류(cerebral aneurysm)는 뇌혈관이 풍선처럼 부풀어 오르는 병으로 파열시 뇌지주막하출혈(subarachnoid hemorrhage)을 일으키는 치명적인 질환이다. 기존에는 개두술을 통한 클립 결찰외 다른 치료 방법이 없었으나 1990 년대에 분리형 코일(detachable coil)이 개발되고 안전성 및 유효성이 입증되면서 현재는 코일 색전술이 첫 번째 치료 방법으로서 많이 선택되고 있다. 또한 2002년 ISAT (International Subarachnoid Aneurysm Trial) 결과 발표 이후 [1] 현재 뇌동맥류의 치료의 중심에는 혈관내 치료가 자리잡고 있다. 지난 20년간 지속적인 코일 색전술과 연관된 뇌혈관내 시술 기구가 발전하면서 치료 성적이 좋아지고 많은 난치성 뇌동맥류를 안전하게 치료하게 되었다. [2]

현재 뇌동맥류의 혈관 내 치료의 가장 많은 부분을 차지하고 있는 것은 코일색 전술이다. 코일 색전술의 치료의 유효성과 안전성은 앞에서 언급한 것과 연구결과로서 확보되어 있으나 치료 후 시간이 지남에 따라 재발의 위험성이 있다는 단점이 있다. 특히 크기가 큰 뇌동맥류의 경우 코일 색전술 이후 재발의 위험성이 높은 것으로 알려져 있다. [3]

이러한 재발의 위험성을 비롯한 코일 색전술의 단점을 극복하고자 여러가지 치료 방법 및 기구들이 고안되어 왔는데 혈류전환 스텐트(Flow-diverting stent)가 그 대안 중 하나로 제시되고 있다. 2010년대에 소개된 혈류전환 스텐트(flow diverting stent)는 기존의 코일색전술로 치료가 어려웠던 난치성 동맥류를 모동맥(parent artery) 안에 스텐트를 설치함으로써 안전하게 치료할 수 있는 획기적인 방법이었다. [4] 혈류전환 스텐트의 사용은 다른 나라에서의 경우 뇌혈관 동맥류의 치료로서 현재 활발하게 사용되고 있으나 우리나라의 경우 보험기준에 따라 일부 환자에서 제한된 적응증으로 뇌동맥류 치료에 적용되고 있다. [5]

1-2) 연구개발의 필요성

혈류전환 스텐트를 사용한 치료의 장점은 위에 언급한 것과 같이 기존 코일 색전술로는 재발 가능성이 높은 환자에서 장기적으로 안정적인 동맥류 폐색을 이루어 낼 수 있다는 것이다. 하지만 혈류전환 스텐트는 뇌동맥류 치료에 사용함에 있어 단점들 또한 가지고 있다. 이 기구를 안정적으로 사용함에 있어 기술적인 경험이 필요하다는 점과 료 과정에 따르는 합병증의 발생이 기존의 코일 색전술보다 높다는 점, 항혈소판제의 장기적인 복용이 필요하다는 점 등이 그것이다. [5]

이러한 단점을 극복하기 위해 여러 노력이 이루어졌는데 그 중 하나가 혈류전환 스텐트를 구성하는 metal의 구성을 바꾸는 것과 스텐트 내면에 항혈소판 효과를 지닌 약제를 코팅하는 것이다.

이러한 노력들로 새롭게 개발된 혈류전환 스텐트가 기존의 혈류전환 스텐트들에 비해 실제 환자 치료에 적용됨에 있어 치료의 효과가 있는지에 대한 유효성과 합병증 발생의 위험성은 낮은지에 대한 즉 안전성에 대한 평가는 필요하다. 본 연구는 우리나라에서 혈류전환 스텐트를 많이 사용하는 다기관에서의 임상적 결과를 통해 기존의 단점을 개선한 혈류전환 스텐트의 치료의 유효성과 안정성을 검증하고 향후 난치성 동맥류 혈관 내 치료에 대한 대안을 제시하고자 한다.

2. 연구의 목표 및 내용

개선된 혈류전환 스텐트 중 국내에 가장 먼저 도입된 Pipeline Shield (Medtronic, Irvine, CA, USA) 로 다기관 후향적 연구를 진행하려고 한다. 이는 국내에서 가장 먼저 치료에 도입된 혈류전환 스텐트로서 단기간

(short-term), 장기간 (long-term) 치료의 유효성 및 안정성을 검증하는 것이 가능하며 증례의 수도 다른 혈류전환 스텐트에 비해 많아 높은 검증력을 기대할 수 있을 것으로 생각된다.

다기관 registry를 이용하여 안전성, 유효성을 평가하고자 하며 최종 목표는 다음과 같다.

- 혈류전환 스텐트의 안전성:

- A. 치료 후 30일 이내 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가
- B. 치료 후 30일 이후 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가
- C. 장기 추적 관찰에서 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가

- 혈류전환 스텐트의 유효성:

- A. 치료 후 6개월 및 그 이후 최근의 추적 검사: 동맥류 폐색의 정도 (영상학적 평가), 혈관협착 및 혈관폐색의 빈도

3. 연구의 추진전략 및 방법

A. 연구 대상 선정 기준 및 제외 기준

- **선정기준:** 2023년 7월까지 상기 기술된 참여기관에서 뇌동맥류에 대하여 Pipeline Shield (Medtronic, Irvine, CA, USA) 및 Pipeline Shield 도입 이전 제품군 (Pipeline 및 Pipeline Flex)으로 치료받은 환자
- **제외기준:** 해당사항 없음
- **참여기관 (공동연구자):** 서울대병원 (김강민, 조영대, 유동현), 분당서울대병원 (반승필), 서울아산병원 (이덕희, 박중철, 송윤선), 양산부산대병원 (백승국, 노지윤), 동탄성심병원 (박정현)
- **연구대상자수:** 301 case (서울대병원: 77, 분당서울대병원: 37, 서울아산병원: 101, 양산부산대병원: 46, 동탄성심병원: 40)

B. 구체적인 연구 방법

2023년 7월까지 상기 기술된 참여기관에서 뇌동맥류에 대하여 Pipeline Shield를 사용하여 치료받은 환자를 비교군으로 설정한다. 이에 대한 대조군으로 Pipeline Shield 도입 이전 제품군 (Pipeline 및 Pipeline Flex)으로 치료받은 환자군을 설정한다. 각각 군에서의 임상정보, 영상 소견 등을 후향적으로 분석하여 다음을 평가한다.

1) 안전성 평가

- a) 치료 후 30일 이내 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가
- b) 치료 후 30일 이후 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가
- c) 장기 추적 관찰에서 뇌출혈, 뇌경색, 기타 합병증 발생율, 사망률 평가

2) 유효성 평가

- a) 동맥류 폐색의 정도 (영상학적 평가)
방법: 시술 후 6개월 및 최근 MRA or conventional angiography
- b) 혈류전환 스텐트가 삽입된 모동맥의 협착 및 폐색의 빈도 (영상학적 평가)
방법: 시술 후 6개월 및 최근 MRA or conventional angiography
- Imaging data 수집 후 독립적인 평가자 (radiologist)에게 의뢰
- c) 추적관찰 기간 중 재치료를

C. 수집할 데이터 항목

- 환자의 기본 임상 정보: 나이, 성별, 시술 전 증상, 위험인자(고혈압, 당뇨, 고지 혈증, 흡연, 뇌졸중 병력, 뇌 동맥류 가족력), 기타 병력 (예를 들어 암, 심장 질환)
- 동맥류의 특성: 파열 여부, 위치, 크기
- 치료 관련 정보: 사용한 혈류전환 스텐트의 종류와 크기, 다른 사용 기구 (예를 들어 스텐트, 풍선카테터, 코일 등), 치료 중 합병증
- 환자의 임상 경과: 신경학적 증상, 뇌경색/뇌출혈 발생여부, 항혈소판제제 사용
- 혈류전환 스텐트치료 영상 (conventional angiography, fluoroscopic image)
- 시술 후 추적 영상 (MRA, conventional angiography or fluoroscopic image)

4. 연구 결과의 활용방안 및 기대성과

- 본 연구를 통해 현재 연구의 대상인 surface modified 혈류전환 스텐트의 안전성 및 실효성을 평가할 수 있음 혈류전환 스텐트를 이용해 치료를 받는 환자에게 정확한 정보를 제공할 수 있을 것으로 기대됨.
- 이후 도입되고 있는 다른 종류의 surface modified 혈류전환 스텐트의 연구에도 비교 데이터의 제공을 통해 큰 도움을 줄 수 있을 것으로 사료됨.

5. 기타사항

- 본 다기관연구에 총 5개 기관이 참여 의사를 밝힌 상태로 분석대상의 숫자는 대조군까지 합하여 301례 정도로 추정됨.
- 연구 과제 선정 후 다기관 IRB 진행 예정임.

6. 참고문헌

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- (3) Choi HH, Lee SH, Yeon EK, Yoo DH, Cho YD, Cho WS, Kim JE, Son YJ, Han MH, Kang HS. Determination of Aneurysm Volume Critical for Stability After Coil Embolization: A Retrospective Study of 3530 Aneurysms. *World Neurosurg*. 2019 Dec;132:e766-e774. doi: 10.1016/j.wneu.2019.08.020. Epub 2019 Aug 12. PMID: 31415892
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연구 책임자 서약서

연구과제명: 표면 처리 혈류전환 스텐트의 임상적 유효성 - 다기관 후향 연구

본인은 대한뇌혈관내치료의학회 연구비 지급 규정 제 7 조에서 정한 연구비 수혜자의 의무를 이행하지 못할 경우 제재 조치 (연구비 환수 조치)에 따를 것을 서약합니다.

2024 년 4 월 30 일

연구 책임자 강 현 승 (인)

강현승

대한뇌혈관내치료의학회 귀중

총괄 실행예산 내역서

비목 \ 구분	세 부 내 역	금액 (원)	비율
1. 연구원 인건비	책임 및 공동연구자 연구원 인건비	8,000,000	40
2. 여비	국내 출장 여비 1회 4인 평균 250,000*예상횟수1회	1,000,000	5
3. 기술정보활동비	참고문헌 구입비		
	회의 개최비용 1회 * 예상횟수 회		
	원고료, 번역료, 통역료	500,000	2.5
	전문가 자문료 1회 500,000 * 예상횟수 8회	4,000,000	20
4. 연구기자재구입비	연구기자재 구입비		
5. 시설비 및 기자재 임차료	회의장 임차료 1회 * 예상횟수 회 장비 사용료		
6. 재료 및 전산처리비	재료비 – 전산처리비	2,125,000	10.625
7. 수용비 및 수수료	인쇄, 복사, 인화, 슬라이드 제작비		
	사무용품비		
	간 접 비 (서울대)	4,375,000	21.875
총 액			100%

* 재료비 세부내역은 별도의 서식(첨부)을 사용하십시오.

* 연구의 성격에 따라 필요한 비목에 대해서만 계상하십시오.

대한뇌혈관내치료의학회 연구비 신청서

연구 과제명	(국문) 한국형 지주막하출혈 동맥류 치료 연구		
	(영문) Korean Subarachnoid Aneurysm Trial, KSAT		
연구기간	연구과제 선정 후 2 년		
연구 책임자 1	(성명)	(국문) 권순찬	(영문) KWON, Soon Chan
	(소속)	울산대학교병원	
	(직위)	교수	(전문과목) 신경외과
	(E-mail) nskwon.sc@gmail.com		
	(전화)	(휴대전화) 01032587312	
연구책임자 2	(성명)	오재상	(영문) Jae Sang Oh 
	(소속)	가톨릭대학교 의정부성모병원	
	(직위)	(전문과목) 신경외과	
	(E-mail) metatron1324@naver.com		
	(전화) 01029183903	(휴대전화) 01029183903	
연구비 종류	☐ 기초, ☒ 임상		(예산안) 2,000 만원
IRB 심의	☐ 승인, ☐ 제출 - 심의중, ☒ 해당 없음		

본인 (등)은 대한뇌혈관내치료의학회 연구비를 소정의 서류를 갖추어 신청합니다.

2024 년 03 월 14 일

연구책임자 1 직위 : 교수

성명 : 권순찬



연구책임자 2 직위 : 부교수

성명 : 오재상



공동 연구자 1 직위 :

성명 : 이종민

대한뇌혈관내치료의학회 귀중

연구계획서

연구의 배경 및 필요성

1. 연구 개발 배경

동맥류 파열에 의한 지주막하 출혈은 최근 고령화와 영상의학적 검진방법의 발달로 유병률이 상승하고 있는 질환으로, 결국은 파열되어 지주막하출혈로 이행됨으로써 높은 사회적, 경제적 비용을 야기하는 질환임. (표 1)

질병명		구분	2017	2018	2019	2020	2021
I60.1~I60.9	지주막하출혈	환자수(명)	34,702	37,177	38,071	38,248	38,577
		요양급여비용 총액(천원)	195,305,202	222,924,913	247,279,419	259,751,988	266,714,134

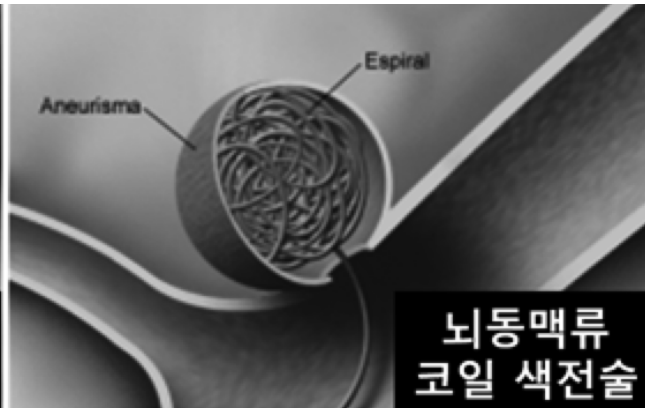
표1. 지주막하 출혈 환자 국민건강보험 청구현황 (2017 ~ 2021)

* 출처 : 건강보험심사평가원



ASCENT 2024

- 뇌동맥류 발생 원인은 현재까지 명확하게 밝혀지지 않았으나 파열에 의해 뇌출혈이 발생(지주막하 출혈)
- 출혈 순간 극심한 두통이 발생하고 3분의 1의 환자는 그 자리에서 즉사, 3분의 1은 병원 이송 중 또는 병원에서 사망, 나머지 환자만이 치료 가능함.
- 파열된 뇌동맥류를 치료하는 방법으로는 개두술을 통한 뇌동맥류 결찰술과 혈관내수술을 통한 뇌동맥류 코일 색전술 두가지 치료기술이 있음.



출처 : Bayhealth Medical Center

2. 국내 및 국외연구 현황

동맥류 파열에 의한 급성 뇌 지주막하 출혈의 치료에는 개두술을 통한 뇌동맥류 결찰술과 혈관내수술을 통한 코일색전술의 두가지 방법이 있다. 이 두가지 치료법 중 무엇을 선택하느냐는 각 센터의 상황마다, 치료자의 선호도마다 다를 수 있겠으나, 급성 뇌 지주막하출혈의 치료에 대한 국제 다기관, 전향적, 무작위 연구로 진행된 2002년의 연구 (International Subarachnoid Aneurysm Trial, 이하 ISAT) 에서 1년째 기능적 결과가 혈관 내치료를 통한 코일 색전술에서 통계적으로 유의미하게 우수하였으며, 재출혈의 빈도는 코일 색전술에서 더 높았던 것으로 결론 내렸다.

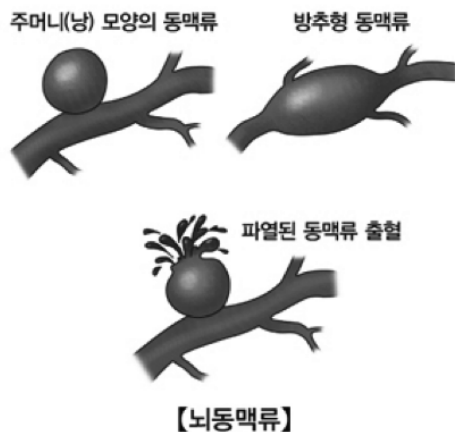
하지만 ISAT는 enroll되었던 환자중 대다수가 무작위 과정에서 제외되어 환자군 선택에 있어서 선택 비틀림이 개입했을 가능성을 염두에 두어야 한다. 이는 실제 의료환경에서 사실 큰 대안은 없는 부분이며, ISAT 시행 당시의 기술력으로는 경부가 넓은 동맥류나 낭포성 동맥류가 아닌 형태의 동맥류 등은 혈관내수술로 치료하기 힘들었다는 점을 고려해야한다. 또 한가지 ISAT가 받는 비판은 수술적 치료가 지연된 환자들이 많았다는 것이며 그것이 결과에 영향을 미쳤다는 것이다. 이외에도 ISAT의 한계점에 의해 추가적으로 입증되어야 할 부분들이 존재한다. 첫째로는 수술이 더 적합하여서 분석에서 제외되는 예를들면 중대뇌동맥 분지부 동맥류 같은 경우가 있으며, 혈관내치료가 더 위험할 수 있는 동맥류 예를 들면 크기가 매우 작은 동맥류이거나 스텐트의 사용이 강제되는 경부가 넓은 동맥류 등이 있다. 또한 다발성 동맥류를 가지거나 혈종을 동반한 환자에서의 비교역시 필요할 것이다.

동맥류 파열에 의한 급성 뇌지주막하 출혈의 치료에 대한 국내에서 시행된 다기관, 전향적 연구는 부족한 실정으로 진료지침의 대부분의 근거가 국내 데이터가 아닌 국외 데이터에 의존하고 있음. 또한 국내의 보건데이터를 이용한 연구에서 혈관내수술을 통한 코일색전술이 개두술에 비해 1년째 사망률이 낮았던 국외의 결과와는 다른 양상을 보였기 때문에, 국내의 전향적, 다기관 데이터 수집을 통한 국내 데이터 기반의 진료지침 개정이 필요하다 할 수 있겠음.

ISAT가 시행 되고나서 20년이 지난 현재, low profile의 스텐트, 더 부드럽고 다양한 코일, 혈류전환스텐트 등의 다양한 기구들의 개발 및 다양한 테크닉의 발전들로 인해 동맥류의 재발률은 점차 낮아지고 있으며, 파열된 동맥류 환자에서 그 안정성과 실효성은 입증되어 현재 널리 치료되고 있다. 기술, 기기 개발 뿐만 아니라, 약물 치료 또한 질적 향상이 이루어져왔다. 파열성 뇌동맥류의 치료에서 급성 뇌경색의 합병증을 막기위한 티로피반(tirofiban)의 안정성과 실효성 역시 입증되어 있다. 이런 시대적, 기술적 상황이 변했다는 점과 ISAT자체의 한계점에 대한 재평가가 필요할 것으로 생각된다.

1-2. 연구개발 대상의 국내외 현황

- 뇌동맥류(Cerebral aneurysm)란 뇌동맥의 일부에 결손이 생겨 그 부분이 도출된 것을 의미하는데, 구체적으로 뇌혈관 일부가 약한 경우 혈관벽이 늘어나 파리모양으로 불거져 나오는 것을 말함.
- (진단) 뇌동맥류가 파열된 경우 뇌컴퓨터단층촬영(CT촬영), 뇌혈관조영술로 알 수 있으며, 이외추가적으로 자기공명혈관조영술(MRA)로 추가적인 정보를 얻을 수 있음.
- (치료) 뇌동맥류의 재출혈을 예방하는 목적으로 수술적 치료를 진행함.



▶ 뇌동맥류 결찰술: 대표적인 수술법으로 개두술 방식으로 클립을 사용해 동맥류 경부직접결찰(direct neck clipping) 하는 방식으로 현미경하 미세수술 진행함.

▶ 코일색전술: 동맥류 경부직접결찰이 어려운 경우, 개두술을 시행하지 않고 혈관내 치료법(endovascular treatment)으로 백금코일, 스텐트 등을 동맥류내에 삽입하여 동맥류를 정상혈류로부터 차단함으로써 혈전형성을 유도하는 방법임.

연구의 목표 및 내용

최종 목표 : 파열성 뇌동맥에서 코일 색전술과 클립 결찰술의 유효성 안정성

1. 뇌동맥류 파열 환자에서 코일색전술과 클립결찰술의 결과 비교

- 단기 및 장기 사망률
- 기능적 예후
- 치료 시간/ 입원기간 비교
- 병원비용 비교

2. 코일색전술과 클립결찰술의 유효성 비교

- 재치료를

- B. 재발율
- C. 재출혈발생률
- D. 뇌혈관연축 발생률, 그리고 이로인한 후유장애 비교

3. 스텐트 보조하 코일 색전술의 단기 및 장기 결과 비교

- A. 연구 시작~WFTIN 까지의 결과 비교
- B. 시술중 합병증 발생 조사
- C. 시술후 추적 관찰중 동맥류 변화 비교

연구의 추진전략 및 방법

- 1) 다기관 레지스트리를 통한 뇌동맥류 파열 환자 수집
- 2) 권역 심뇌혈관센터, 권역 응급센터 지정 병원 중 KoNES 인증의 및 KSCVS 인증의의 수술과 시술 환자 데이터 수집
- 3) 환자 중증도별/ 동맥류 위치별 분류에 따른 결과 비교
- 4) 스텐트 사용 유무에 따른 비교

연구 결과의 활용방안 및 기대성과

뇌지주막하출혈 환자 치료에서 클립결찰술과 코일색전술을 비교한 연구는 의료 분야에서 중요한 정보를 제공하며, 이를 통해 다음과 같은 활용방안과 기대효과를 고려할 수 있습니다:

1. 환자 선택 및 개별화된 접근:

- 연구 결과를 기반으로 환자를 선택하고, 치료 방법을 개별적으로 결정할 수 있습니다.
- 동맥류의 위치, 크기, 환자의 상태, 그리고 기타 요인을 고려하여 클립결찰술 또는 코일색전술을 선택합니다.

2. 합병증 및 예후 개선:

- 코일색전술은 혈관경련의 발생률이 낮아 합병증의 위험이 줄어들고 또한, 입원 기간이 짧아지고 비용이 감소한다고 알려져 있습니다. 검증된 기관의 두 치료를 비교함으로써 환자 치료의 질향상에 도모할수 있습니다.

3. 비용 효율성:

- 코일색전술은 수술 시간이 짧고, 입원 기간이 단축되므로 비용 효율적이라고 알려져 있지만 정확한 대규모 연구가 없어서 이를 통해 이는 환자와 의료 기관 모두에게 경제성 비교 분석 데이터를 제공합니다.

4. 종합적인 치료 전략:

- 클립결찰술과 코일색전술은 서로 다른 장단점을 가지고 있습니다.
- 의료 전문가들은 환자의 상태와 동맥류 특성을 고려하여 종합적인 치료 전략을 수립할 수 있습니다.

5. 연구 지속 및 개선:

- 해당 연구를 기반으로 더 많은 연구를 진행하여 치료 방법을 지속적으로 개선할 수 있습니다.
- 새로운 기술과 접근법을 탐색하고, 환자의 예후를 더욱 향상시킬 수 있습니다.

기타사항

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연구 책임자 서약서

연구과제명:

본인은 대한뇌혈관내치료의학회 연구비 지급 규정 제 7 조에서 정한 연구비 수혜자의 의무를 이행하지 못할 경우 제재 조치 (연구비 환수 조치)에 따를 것을 서약합니다.

2024 년 04 월 16 일

연구 책임자 권 순 찬



연구 책임자 오 재 상



대한뇌혈관내치료의학회 귀중

총괄 실행예산 내역서

비목	구분	세 부 내 역	금액 (원)	비율
1. 연구원 인건비				
2. 여비		국내 출장 여비 1회 인 평균 * 예상횟수 회		
3. 기술정보활동비		참고문헌 구입비		
		회의 개최비용 1회 * 예상횟수 회	5,000,000	
		원고료, 번역료, 통역료	3,000,000	
		전문가 자문료 1회 * 예상횟수 회	2,000,000	
4. 연구기자재구입비		연구기자재 구입비		
5. 시설비 및 기자재 임차료		회의장 임차료 1회 * 예상횟수 회 장비 사용료		
6. 재료 및 전산처리비		재료비		
7. 수용비 및 수수료		인쇄, 복사, 인화, 슬라이드 제작비	5,000,000	
		사무용품비	5,000,000	
		제세공과금		
총 액			20,000,000	100%

* 재료비 세부내역은 별도의 서식(첨부)을 사용하십시오.

* 연구의 성격에 따라 필요한 비목에 대해서만 계상하십시오.

ASCENT 2024

MEMO

대한뇌혈관내치료의학회 연구비 신청서

연구 과제명	(국문) 급성 허혈성 뇌졸중 치료 연구를 위한 새로운 혈전 모델 개발		
연구기간	(영문) Development of a Novel Thrombus Model for Investigating Acute Ischemic Stroke Treatments 연구과제 선정 후 1 년		
연구 책임자	(성명)	(국문) 안 홍 석	(영문) Ahn Hong Suk
	(소속)	강동성심병원	
	(직위)	임상조교수	(전문과목) 신경외과
	(E-mail) academy.upfall2@gmail.com		
	(전화)	02-2224-2236	(휴대전화) 010-9198-4530
연구비 종류	☐ 기초, ☒ 임상		(예산안) 1000 만원
IRB 심의	☐ 승 인, ☒ 제출 - 심의중, ☐ 해당 없음		
본인 (등)은 대한뇌혈관내치료의학회 연구비를 소정의 서류를 갖추어 신청합니다. 2024 년 04 월 29 일 연구책임자 직위: <u>임상조교수</u> 성명: <u>안 홍 석</u> (인) 공동연구자 직위: <u>교수대우</u> 성명: <u>이 종 영</u> (인) 직위: _____ 성명: _____ (인) 직위: _____ 성명: _____ (인) 직위: _____ 성명: _____ (인) 직위: _____ 성명: _____ (인)			

대한뇌혈관내치료의학회 귀중

연구계획서

1. 연구의 배경 및 필요성

급성 허혈성 뇌졸중은 적절한 치료가 이루어지지 않을 경우 예후가 매우 불량한 질환입니다. 이를 개선하기 위해 혈전제거술이 널리 사용되고 있으며, 이 기술의 적용 범위는 계속해서 확대되고 있습니다. 기술 기술과 장비의 발전은 이러한 확대의 주된 이유 중 하나로 꼽힙니다. 따라서 혈전의 유형에 따라 가장 적합한 기술 방법 및 장비를 선정할 수 있다면, 치료 성공률을 높일 수 있을 것입니다.

이러한 배경을 바탕으로, 본 연구는 급성 허혈성 뇌졸중 치료에서 혈전의 종류를 고려한 맞춤형 혈전제거술의 효과성 및 안전성을 평가하는 것을 목표로 합니다. 혈전의 물리적 특성(예: 경도, 크기, 형태 등)에 기반하여 최적의 기술 방법과 장비를 선정함으로써, 치료의 예후를 개선하고자 하는 것이 본 연구의 목표입니다.

2. 연구의 목표 및 내용

1. 일차적인 목표는 재현 가능한 혈전 제작 프로토콜 확립입니다. Platelet과 RBC의 조성을 변경해가며, 흔히 fibrin-rich clot과 RBC-rich clot이라고 불리는 혈전을 원하는 대로 만들고자 합니다.
2. 만들어진 혈전을 이용하여 silicone model에서 적절한 혈전제거술 방법을 확인합니다. 조성에 따라 aspiration thrombectomy가 유리한 경우도 있을 것이고, mechanical thrombectomy, 혹은 combined treatment가 유리한 경우도 있을 것입니다.
3. 임상으로의 적용을 위해 실제 환자에서의 결과와 비교합니다. 만들어진 혈전을 stent 혹은 aspiration을 통해 제거해보고, 실제 환자에서 제거된 thrombus와 비교합니다. 이를 통해 시술을 시행한 환자의 thrombus 조성이 어떤 model과 가장 비슷하였는지 역추적할 수 있습니다.
4. 만들어진 혈전을 CT 등의 영상검사를 통해 환자의 시술 전 영상검사와 비교합니다. 이를 통해 추후 환자의 시술 전 검사를 보고 적절한 치료 방법을 결정할 수 있습니다.

3. 연구의 추진전략 및 방법

본 연구에서는 인공적으로 혈전을 생성하여 칼슘화된 뇌색전증(Calcified Cerebral Emboli, CCE)을 모사하는 뇌혈관 실리콘 모델 내에서 대혈관 폐쇄를 재현하고, 다양한 내혈관 치료 전략의 효율성을 평가할 예정입니다. 이를 위한 구체적인 방법은 다음과 같습니다.

1. 원심분리를 통한 혈액 성분 분리: 혈액을 특정 속도로 원심 분리하여 적혈구(RBC)와 혈소판(platelet)을 분리합니다.
2. 혈전 생성을 위한 혈액 성분 혼합: 분리된 적혈구와 혈소판을 특정 비율로 혼합합니다. 이 비율은 실제 혈전 생성 과정을 가능한 한 정확하게 모방하기 위해 선정됩니다. 혼합된 혈액 성분은 응고 반응을 일으키기 위해 특정 조건 하에서 응고시킵니다.
3. 인공 혈전의 사용: 생성된 혈전은 실리콘으로 제작된 뇌혈관 모델 내에 위치시켜 뇌혈관 폐쇄 상황을 재현합니다.
4. 혈관내 치료 전략의 평가: 이 모델을 사용하여, 현재 사용 가능한 다양한 내혈관 치료 기기와 기법들의 효과

를 평가합니다. 혈전의 종류에 따른 가장 효과적인 재개통 방법을 확인합니다.

4. 연구 결과의 활용방안 및 기대성과

본 연구의 접근 방법은 급성 허혈성 뇌졸중 치료에 있어서 재개통률을 개선할 수 있는 치료계획을 수립하는데 중요한 기초 자료를 제공할 것입니다. 또한 실제 인체 상황에 더 가까운 조건에서의 치료 전략 개발이 가능해질 것으로 기대됩니다.

5. 기타사항

혈전 생성을 위해 동맥혈에서 채취한 혈액 샘플이 필요하며, 이를 위해 환자로부터 동의를 받아야 합니다. 이에 따른 절차는 다음과 같습니다:

1. 환자 동의서 작성: 연구 참여를 위해 동맥혈 샘플을 제공하는 환자들로부터 명확한 동의를 얻기 위해 동의서를 작성합니다. 이 동의서에는 혈액 샘플 채취 목적, 절차, 잠재적 위험 및 이익 등에 대한 자세한 정보가 포함되어야 합니다.
2. 환자 선정과 동의: 연구에 적합한 환자를 선정한 후, 해당 환자들에게 연구 목적, 예상되는 위험 및 이점 등에 대해 충분히 설명하고, 자발적인 참여 동의를 얻습니다. 환자의 정보와 동의 과정은 철저히 기록되어야 합니다.
3. 위해 방지를 위한 조치: 연구 참여로 인해 환자들에게 중대한 위해가 가해지지 않도록 하며, 모든 절차는 환자의 안전과 복지를 최우선으로 고려하여 수행됩니다.
4. IRB 심의: 연구 계획서 및 환자 동의서를 포함한 모든 관련 문서를 IRB에 제출하여 심의를 받습니다. IRB는 연구의 윤리적 적절성, 환자의 권리 보호, 연구의 과학적 타당성 등을 평가하여 연구 수행 여부를 결정합니다.

이러한 절차를 통해 연구의 윤리적 기준을 준수하며, 동맥혈 샘플을 이용한 혈전 생성 연구를 안전하고 효율적으로 수행할 수 있습니다

6. 참고문헌

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연구 책임자 서약서

연구과제명: Development of a Novel Thrombus Model for Investigating Acute Ischemic Stroke Treatments (급성 허혈성 뇌졸중 치료 연구를 위한 새로운 혈전 모델 개발)

본인은 대한뇌혈관내치료의학회 연구비 지급 규정 제 7 조에서 정한 연구비 수혜자의 의무를 이행하지 못할 경우 제재 조치 (연구비 환수 조치)에 따를 것을 서약합니다.

2024 년 04 월 29 일

연구 책임자 안 홍 석 (인)

대한뇌혈관내치료의학회 귀중

총괄 실행예산 내역서

구분 비목	세 부 내 역	금액 (원)	비율
1. 연구원 인건비			
2. 여비	국내 출장 여비 1회 2인 평균 60만 * 예상횟수 3회	1,800,000	18%
3. 기술정보활동비	참고문헌 구입비		
	회의 개최비용 1회 200,000 * 예상횟수 2회	400,000	4%
	원고료, 번역료, 통역료	1,500,000	15%
	전문가 자문료 1회 200,000 * 예상횟수 3회	600,000	6%
4. 연구기자재구입비	연구기자재 구입비	1,800,000	18%
5. 시설비 및 기자재 임차료	장비 사용료	N/A	
6. 재료 및 전산처리비	재료비	2,500,000	25%
7. 수용비 및 수수료	인쇄, 복사, 인화, 슬라이드 제작비		
	사무용품비	400,000	4%
	제세공과금	1,000,000	10%
총 액		10,000,000	100%

* 재료비 세부내역은 별도의 서식(첨부)을 사용하십시오.

* 연구의 성격에 따라 필요한 비목에 대해서만 계상하십시오.

대한뇌혈관내치료의학회 연구비 신청서

연구 과제명	(국문) 뇌졸중 데이터를 이용한 환자 예후 인공지능 모델 개발 (영문) AI using Korean Stroke Registry		
연구기간	연구과제 선정 후 2 년		
연구 책임자	(성명)	(국문) 오재상	(영문) Jae Sang Oh
	(소속) 가톨릭대학교 의정부성모병원		
	(직위) 부교수		(전문과목) 신경외과
	(E-mail) metatron1324@naver.com		
	(전화) 01029183903		(휴대전화) 01029183903
연구비 종류	☐ 기초, ☒ 임상		(예산안) 2,000 만원
IRB 심의	☐ 승 인, ☐ 제출 - 심의중, ☒ 해당 없음		



본인 (등)은 대한뇌혈관내치료의학회 연구비를 소정의 서류를 갖추어 신청합니다.

2024 년 03 월 14 일

연구책임자 직위: 부교수 성명: 오 재 상

공동연구자

- 1) 가톨릭대학교 조교수 김민정
- 2) 순천향대학교 조교수 윤기용
- 3) 단국대학교 교수 고정호
- 4) 인제대학교 부교수 구혜원
- 5) 고려대학교 교수 김현정

대한뇌혈관내치료의학회 귀중

연구계획서

연구의 배경 및 필요성

- 뇌졸중 치료 및 예후 예측을 위한 임상 의사결정지원시스템의 필요성 - 급격히 변하는 뇌경색 패러다임 변화에 따른 환자-보호자 의사결정에 도움이 필요.
- 현재 기존 소규모 전향 연구와 후향적 연구만으로 현장에서의 의사결정에 한계
- 뇌졸중 같은 응급 질환이 초기 빠른 판단이 예후에 어떤 영향을 미치는지 보여주는 기존 연구들의 한계점이 많음. 다른 수집된 환자군과 다른 레지스트리로 인한 제한된 환자의 전향적 연구를 통해 정확한 데이터를 제공하여 의사결정에 도움을 주기 어려움.
- 임상 의사결정지원시스템의 분야로는 진단지원, 치료방법결정지원, 처방결정지원, 정보검색, 의료영상분석, 위험알림 등이 있음. 임상 의사결정지원모델은 실제 임상 환경에서 임상의의 결정 지원 뿐만 아니라, 환자에게 의사결정에서의 신뢰성을 주는 역할 또한 있음.
- 인공지능을 통한 임상 의사지원결정시스템 연구 현황
- 이스라엘 의료영상 솔루션 업체 MedyMatch 또는, IBM을 통해 인공지능 기반 응급실용 뇌출혈 검출 프로그램을 전 세계에 배포(2017년).
 - 1) 응급실을 방문한 환자의 뇌 CT영상을 이용해 잠재적으로 출혈이 발생할 수 있는 영역을 5 분 내에 의사에게 알림. 두부 외상이나 뇌졸중이 의심되는 환자들을 진단하고 뇌출혈 여부 확인.
 - 2) 기존 연구들은 대부분 이미지 중심의 데이터이며 결과값으로 예후나 사망과 같은 임상대 이터를 포함하지 않아 실제 임상 결과와 차이가 커서 임상 의사지원결정시스템이라고 보기 어려움.

연구의 목표 및 내용

최종 목표 : KONES REGISTRY 이용한 뇌졸중 환자 치료 의사결정 및 예후 예측 인공지능 모델 개발

1. 한국 뇌졸중 KONES REGISTRY 레지스트리를 이용한 환자 예후예측 인공지능 모델 개발 - 인공지능 모델을 통한 급성 뇌경색 환자의 예후 모델 제시
2. 인공지능 모델에서 위험인자 변화를 통한 뇌경색 환자 예후 변화 모델제시
3. Kones Registry를 통한 인공지능을 통한 뇌졸중 치료 의사결정 시스템 구축
4. 마이 데이터 기반 뇌졸중 환자 장기 예후 예측 모델 제시

연구의 추진전략 및 방법

- 급성기 뇌졸중 Kones registry 모델 생성 프로토콜
 - 1) 레지스트리에서 급성기 뇌경색 환자의 선별
 - 2) 정확한 증상 발현 시간, 정확한 임상 척도 데이터 있는 환자 선별
 - 3) 개인 비식별화 코드와 환자 내원 날짜를 기준으로 빅데이터 병합

- 4) 급성 뇌졸중 환자 시기와 초기 치료 등에 따른 단기 및 장기 예후 예측 모델
- 5) 뇌졸중 위험인자에 따른 장기 뇌졸중 발생 위험과 재발 검증 모델
- 6) 데이터 전처리 및 병합
- 7) 생성 모델 개발
- 8) 정확도 예측
- 9) 모델 개발을 통합 앱 또는 사이트 개발

연구 결과의 활용방안 및 기대성과

- 뇌혈관질환에서의 인공지능 방법론 적용에서의 프로토콜 정립 - 다른 질환의 환자에서의 머신러닝 및 딥러닝 적용 프로토콜을 제시 가능함.
- 응급 환자안전 관리 대응 의사결정 시스템 개발
- 한국형 뇌경색 환자의 인공지능 모델을 통한 예후 예측 애플리케이션 개발 - 응급실 환자 내원 후 뇌경색 환자 변수, 치료 병원, 치료 변수를 추가 시에 사망률 감소와 예후 호전률, 효율적인 의료비 감소 효과를 제시하여 환자 보호자의 치료 결정 참여도를 늘리고 치료의 의사결정에 참여하는 시스템 개발
- 급성기 촉박한 치료 시간 동안, 의사결정의 어려움을 환자, 보호자와 의료진 모두에 도움이 되는 적절한 환자-보호자-의사 동시 결정 패러다임 전환의 제공. 이를 통해 치료 의사결정 참여하는 환자와 보호자가 치료 만족도를 올릴수 있고 본인의 치료 선택에 책임을 질 수 있는 패러다임 변화 구축
- 한국형 뇌경색 환자의 인공지능 모델을 통한 예후 예측 애플리케이션 개발

기타사항

KONES REGISTRY 를 통한 인공지능 모델 개발을 통해 한국 레지스트리형 예후 예측 모델을 개발하겠습니다. 우선 뇌경색 위주로 진행하겠습니다만, 추후 뇌출혈 모델로 개발 후속도 추진 하겠습니다.

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3. Mehawej J, Saczynski J, Abu HO, Gagnier M, Bamgbade BA, Lessard D, et al. Factors Associated With Patient Engagement in Shared Decision-Making for Stroke Prevention Among Older Adults with Atrial Fibrillation. Can Geriatr J. 2021;24(3):174-83.

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6. Torres Roldan VD, Brand-McCarthy SR, Ponce OJ, Belluzzo T, Urtecho M, Espinoza Suarez NR, et al. Shared Decision Making Tools for People Facing Stroke Prevention Strategies in Atrial Fibrillation: A Systematic Review and Environmental Scan. *Med Decis Making*. 2021;41(5):540-9.

연구 책임자 서약서

연구과제명:

본인은 대한뇌혈관내치료의학회 연구비 지급 규정 제 7 조에서 정한 연구비 수혜자의 의무를 이행하지 못할 경우 제재 조치 (연구비 환수 조치)에 따를 것을 서약합니다.

2024 년 03 월 14 일

연구 책임자 오 재 상



대한뇌혈관내치료의학회 귀중

총괄 실행예산 내역서

구분 비목	세 부 내 역	금액 (원)	비율
1. 연구원 인건비			
2. 여비	국내 출장 여비 1회 인 평균 * 예상횟수 회		
3. 기술정보활동비	참고문헌 구입비		
	회의 개최비용 1회 * 예상횟수 회	5,000,000	
	원고료, 번역료, 통역료	3,000,000	
	전문가 자문료 1회 * 예상횟수 회	2,000,000	
4. 연구기자재구입비	연구기자재 구입비		
5. 시설비 및 기자재 임차료	회의장 임차료 1회 * 예상횟수 회 장비 사용료		
6. 재료 및 전산처리비	재료비		
7. 수용비 및 수수료	인쇄, 복사, 인화, 슬라이드 제작비	5,000,000	
	사무용품비	5,000,000	
	제세공과금		
총 액		20,000,000	100%

* 재료비 세부내역은 별도의 서식(첨부)을 사용하십시오.

* 연구의 성격에 따라 필요한 비목에 대해서만 계상하십시오.

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Free Paper IV. Ecstasy session (Troubleshooting for difficult cases)

6월 22일(토) 10:30-11:30

좌장: 권현조 (충남대)
윤석만 (순천향대)

Arterial puncture of non-femoral site with difficult femoral access for thrombectomy or balloon angioplasty before carotid stenting

Chang-Hyun Kim, Min-Yong Kwon, Chang-Young, Lee

Department of Neurosurgery, Keimyung University School of Medicine

Objective: In the difficult femoral access including difficult aortic arch, vessel tortuosity, bilateral femoral artery severe stenosis, and aortic dissection, endovascular treatment may be prolonged due to difficult femoral route in carotid artery stenosis or acute large artery occlusion.

Methods: And so, we report three cases of arterial puncture of non-femoral site with difficult femoral access for thrombectomy or balloon angioplasty before carotid stenting.

Result: Case presentation 1 A 95-year-old female presented global aphasia, Lt. hemiparesis, and altered mentality with 20 of NIHSS. She had a cardiac disease as left bundle branch block. Stroke CT Angiography showed the occlusion of proximal M1 segment with TICI 0 and tortuous aortic arch. Despite several trans-femoral approach, tortuous aortic arch prohibited the angiocatheter advance and cross tortuous vessel. This patient was planned to perform the procedure through direct carotid puncture. Successful recanalization was performed after direct puncture through common carotid artery. Case presentation 2 A 74-year-old female presented hemiparesis and altered mentality with 25 of NIHSS. She had no cardiac disease. Stroke CT Angiography showed the occlusion of distal basilar artery occlusion and tortuous subclavian – vertebral artery orifice. Despite several trans-femoral approach, we cannot cross tortuous vessel of vertebral artery with any devices. This patient was planned to perform the procedure through direct brachial puncture. Successful recanalization was performed after direct puncture through brachial artery. Case presentation 3 A 77-year-old male presented with severe degree of asymptomatic carotid artery stenosis over 70% in local clinics. This patient visited our OPD with recurrent TIA. We cannot approach CCA using transfemoral route. This patient was planned to perform direct carotid puncture. The procedure was performed without any complication. Manual compression over about 30mins was used to close the puncture site.

Conclusion: In the thrombectomy or balloon angioplasty before carotid stenting with the difficult femoral access, non-femoral site direct arterial puncture can be helpful for effective and safe procedure through carotid or brachial artery.

Endovascular Removal of Freely Floating Retained Microcatheter at Aortic Arch with Snare during dural AVF embolization

신승훈

차의과학대 분당차병원

Objective: Glued microcatheter is a rare complication during embolization of arteriovenous malformations (AVMs). Following the availability and popularization of Onyx, the incidence of retained catheters has become lesser. However there have been reports of retained microcatheter during embolization of AVM with Onyx. We report a case of endovascular removal of a freely floating of glued microcatheter during embolization of an arteriovenous malformation with Onyx.

Methods: A 56-year-old man suffers from a posterior occipital arteriovenous fistula with subarachnoid drainage supplied by several feeders (upside pharyngeal aa, right posterior inferior cerebellum aa, left posterior meninges aa, left posterior occipital aa, right relative cerebellum aa)

Result: In the first embolization session, we attempt embolization through the posterior meningeal artery pathway using Onyx 18 HD. However, we cannot completely embolize. Final control angiography shows the remaining right ascending pharyngeal artery and right posterior descending cerebellar artery feeder. And we attempt embolization through the newly recognized right ascending cerebellar artery pathway. After unsuccessful Onyx embolization, we attempt to remove the Apollo microcatheter. However, we cannot remove the microcatheter after a few attempts. So, we decide to maintain the microcatheter at the femoral artery perforation site. In the process of maintaining the microcatheter, the proximal part of the microcatheter was moved to the aortic arch. That's when a portion of the microcatheter enters the left ventricle of the heart. Arrhythmia has developed. We try to remove the microcatheter that freely floats in a 4 cm diameter snare, and finally recover the microcatheter successfully.

Conclusion: Therefore, we report a rare case of successful removal of a free-floating maintenance microcatheter using a large noose during Onyx embolization for posterior tibial sinus with subarachnoid drainage.

Life-threatening massive facial bleeding from pterygoid venous plexus with direct carotid cavernous fistula: A expedite embolization of cavernous sinus

Ahn Seong Yeol

Department of Neurosurgery, Myong ji Hospital

Objective: We will introduce a case that saved a life by neuro-intervention approach

Methods: TFCA showed the carotid cavernous fistula in cavernous sinus (CS) with bleeding in venous plexus in a patient with face injury in a shock

Result: After embolization of CS, vital sign of the patient was stabilized.

Conclusion: The expedite embolization of CS via neuro-intervention solved a shock.

Combined Embolization Technique with WEB and Coil for Basilar Top Irregular-shaped Aneurysm

Yeongu Chung

Department of Neurosurgery, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine

Objective: The Woven Endobridge (WEB) embolization device, a self-expanding mesh which achieves flow disruption allow intra-aneurysmal embolization for wide-neck bifurcation aneurysm without stent or antiplatelet medications. However, due to the shape of the device, it is impossible to cover the entire aneurysmal width if the aneurysmal neck is not centered on the axis. Herein, the author would like to introduce a case of an irregular-shaped basilar top unruptured aneurysm treated with a double microcatheter, using both WEB device and coil.

Methods: A 62 years-old male patient who had a past medical history of hypertension and dyslipidemia presented with headache for 2 weeks. During his admission for viral meningitis, MR angiography showed unruptured basilar top aneurysm. After medical treatment for meningitis, digital subtraction angiography was performed. The aneurysm was 10mm(width) x 5mm(height) sized irregular-shaped and divided into compartments, resembling a daughter sac, due to the atheroma located at posterior wall of aneurysm. And the neck was offset to one side rather than being located in the center of overall aneurysmal width.

Result: Due to the shape characteristics of a WEB device, placing it at the neck would not cover the entire width of the aneurysm. Furthermore, it was determined that if the WEB device does not fit enough within the aneurysm, there is a possibility that the axis of the WEB could rotate and shift position after detachment. Therefore, the daughter sac area was treated by jailing a microcatheter and performing coil embolization. First, WEB device (7/4mm sized) is deployed after jailing of microcatheter in the center of daughter sac and still noted inflow into daughter sac area. Additional 3 coils (3/6mm, 2/3mm and 1/3mm) was inserted into the daughter sac. Finally, completer embolization achieved and WEB device showed stable location.

Conclusion: The WEB device has been successfully used for the treatment of wide-neck bifurcation aneurysms by achieving intrasaccular flow diversion. Here, the author have shared combined embolization technique with both WEB and coil device. The size selection is the one of the most important consideration for the WEB device however, using an alternative technique can help achieve a more complete embolization.

Endovascular treatment for partially thrombosed aneurysm: agony and journey to summit

Jong Min Lee, Soon Chan Kwon

Department of Neurosurgery, Ulsan University Hospital

Objective: Giant partially thrombosed intracranial aneurysms pose significant challenges in management due to their unfavorable natural history and the absence of standardized treatment approaches. Conventional treatments often have difficulty to effectively manage these aneurysms without a high recurrence rates or significant morbidity.

Methods: we will discuss troubleshooting experiences in managing such aneurysms, exploring the strategies employed to navigate through the intricacies encountered during endovascular interventions. Drawing from clinical cases and procedural insights, we highlight the dilemmas faced by clinicians and share practical approaches to address them effectively.

Result: A two-stage endovascular treatment was performed, utilizing balloon occlusion test (BOT) and intraoperative monitoring (IOM) to ensure maximum patient safety, involving stent-assisted Woven EndoBridge (WEB) embolization and bilateral vertebral artery trapping. The procedure successfully isolated the aneurysm, with postoperative imaging confirming no recanalization and intact posterior circulation. The patient showed stable recovery and no neurological deficits during a 7-month follow-up.

Conclusion: This case demonstrates the feasibility and efficacy of the strategic integration of intrasaccular flow diversion using the WEB device and flow reversal by bilateral vertebral artery trapping for treating giant partially thrombosed aneurysms.

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

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대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Special Lecture

6월 22일(토) 11:30-12:00

좌장: 신승훈 (차의과학대)

느림의 가치 - 제주올레

서명숙

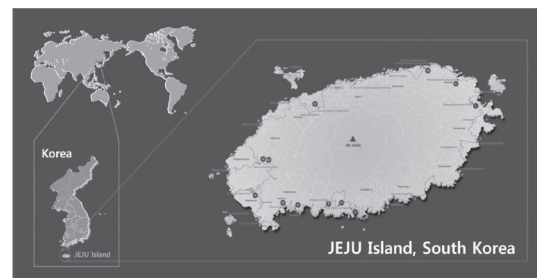
사단법인 제주올레 이사장



온전히 걷는 사람들만을 위한 길
놀멍 쉬멍 걸으멍 제주올레

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한국의 가장 남쪽에 있는 섬, 제주도



한국에서 가장 사랑 받는 여행지
UNESCO 세계 자연 유산, 세계지질공원, 세계생물권보전지역



성산일출봉



검은 돌담과 노란 유채꽃



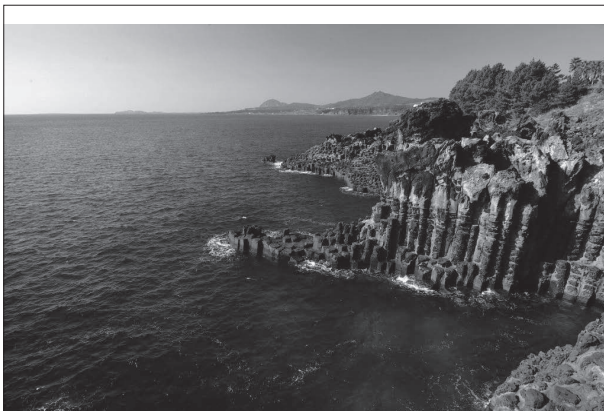
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제주의 오름들



서귀포 바다에서 바라본 한라산



주상절리



제주의 재래시장



나는 왜 걷기 시작했는가

Why I started walking



산티아고 순례길에서 행복을 찾다

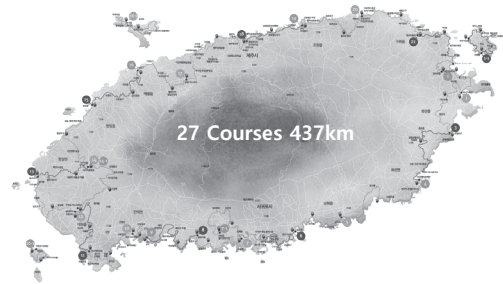


구간	소요시간	주요특징
- 프랑스 국경마을 '생 장 피드포르' 시작 - 스페인 '산티아고 데 콤포스텔라' 종점 - 총 800Km	2006년 09월 10일에 출발 2006년 10월 15일에 도착 - 총 36 일 소요	- 성 야곱의 전도길이자 중세 이후 천주교 신자들의 순례코스 - 전세계 도보여행자들이 가장 사랑하는 구간

산티아고 순례길을 걸으며



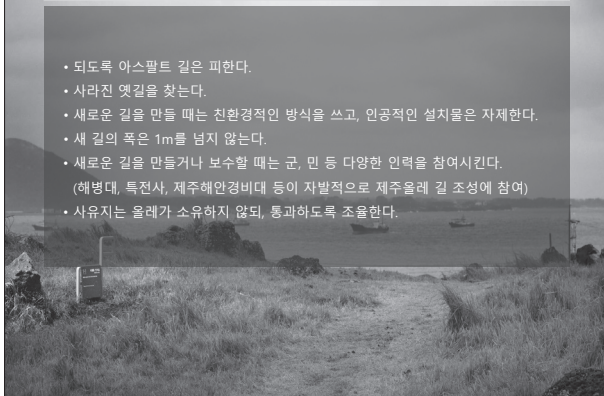
제주올레, 점을 선으로 연결하다



제주올레 조성 원칙



- 되도록 아스팔트 길은 피한다.
- 사라진 옛길을 찾는다.
- 새로운 길을 만들 때는 친환경적인 방식을 쓰고, 인공적인 설치물은 자제한다.
- 새 길의 폭은 1m를 넘지 않는다.
- 새로운 길을 만들거나 보수할 때는 군, 민 등 다양한 인력을 참여시킨다.
(해병대, 특전사, 제주해안경비대 등이 자발적으로 제주올레 길 조성에 참여)
- 사유지는 올레가 소유하지 않되, 통과하도록 조율한다.



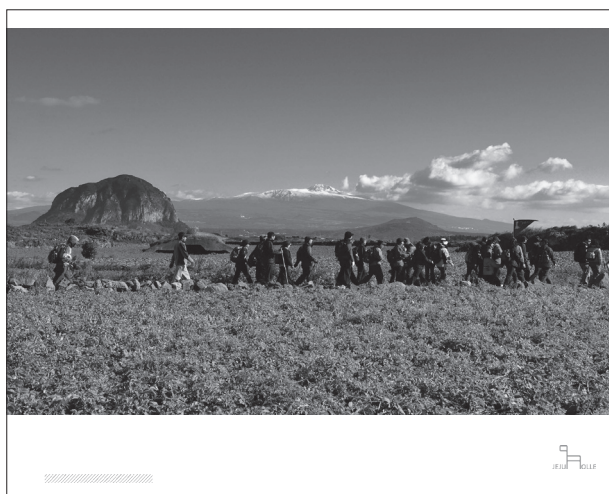
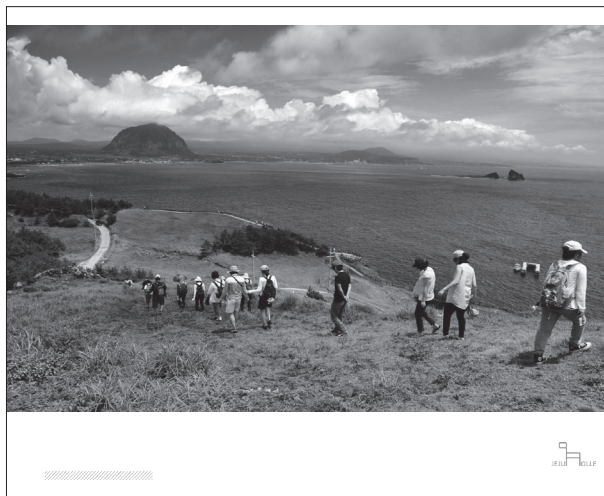
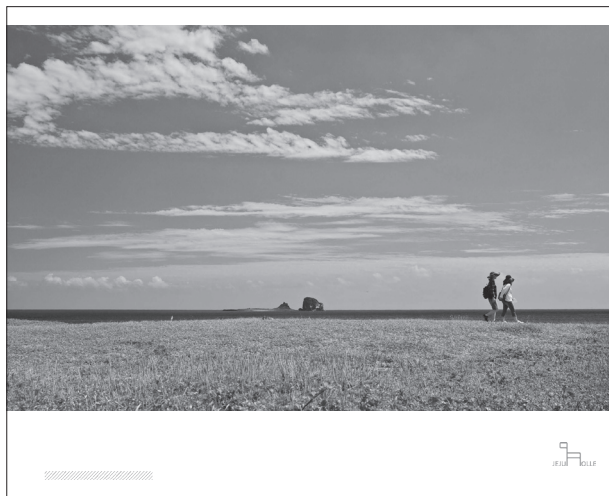
자연을 거스르지 않는 최소한의 디자인 - 제주올레 표식



올레길을 만들고 지키는 탐사팀



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지역경제 활성화



제주올레 길로 연결된 재래시장, 매년 30% 이상씩 매출 상승

2024 제주올레 걷기축제 '길을 맛 난다'



2024 제주올레 어린이 걷기축제
2024년 5월 11일(토) 16코스 일부구간

2024 제주올레 걷기축제
2024년 11월 7일(목)/8일(금)/9일(토) 3일간 (14/15/16코스 예정)

제주올레 걷기 축제 _ 일 년에 한 번 제주가 활짝 열린다!



길을 위해 _ 간세인형 공방조합



길을 위해 _ 간세인형 공방조합



- 제주올레 대표기념품인 '간세 인형'을 만드는 제주 여성들의 모임
- 지역에서 버려지는 헌 천을 이용해 바느질해서 완성되는 핸드메이드 인형
- 지역민과 환경을 위한 비즈니스 모델
- 제주 여성과 제주에 시집 온 다문화 가정 여성들로 간세인형 공방조합 구성
- 지역 여성 일자리 창출

클린올레



클린올레는 제주올레 길을 걸으면서 길 위에 버려진 쓰레기를 줍는 캠페인
내가 만든 쓰레기는 되가자고, 남이 버린 쓰레기까지 주워서 깨끗한 제주올레 길을 만드는 것이 목적

매월 둘째 주, 셋째 주 토요일은
제주올레를 사랑하는 사람들이 모여 클린올레를 함께 하는 클린올레의 날

클린올레의 날이 아니더라도 깨끗한 제주올레길을 만드는 데 동참하고 싶은 개인/단체 누구라도 클린올레 캠페인에 참가 가능

제주에서 시작한 클린올레는 한길연과 ATN이 함께 하는 클린워킹 캠페인으로 확대 운영

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길을 위해 _ 제주올레 아카데미



- 분야별 최고 전문가를 통해 제주의 역사와 문화, 언어, 자연, 음식 등을 배우는 교육 프로그램
- 2008년 12월 제1회를 시작으로 일반과정, 심화과정을 완료한 2000여 명의 수료생 배출
- 수료생으로 구성된 아카데미 동문회는 자원봉사자로 활약하며 아름다운 공원을 실천
- 사진, 식물, 지질, 신화, 요리, 어린이, 청소년 등 테마별 대상별 프로그램과 특별 아카데미

● 제주올레 아카데미 총동문회 '아카자봉 함께걷기' & 워킹 메이트



매일 초보 올레꾼과 함께 걷는 무료 프로그램/외국어 버전의 워킹메이트

아카데미 일반과정을 수료한 총동문회 회원이 인솔



지금, 올레?

지금, 올레? 제주올레걷기학교



길을 걷는 여행이 막연하고, 익숙한 공간을 벗어나 걷는 여행을 시작하는 방법이 궁금한 예비 올레꾼들을 위한 제주올레걷기학교. 서울숲을 함께 걸으며 제주올레 길 걷기 연습도 하고 제주올레 이야기도 들어보세요!

- 수강료 : 10,000원 / 커리큘럼 : 걷기 강연 + 함께 걷기
- 강연 장소 : 제주올레 서울센터(서울특별시 성동구 연동로1번지 1층)

제주올레 걷기여행 지원단

신노년세대 맞춤형 일자리 사업



제주올레, 제주중앙년내일센터, 느영나영복지공동체가 만 60세 이상 도내 거주자를 대상으로 함께 진행하는 시니어 일자리 및 지역사회 공헌 사업.

제주올레 걷기여행 지원단 참여자는 일정교육을 마친 후, 초보 올레꾼을 위한 함께 걷기 프로그램 '시작 올레'와 제주올레 환경정화 프로그램 '그린올레'에 참여하게 됩니다.

시작올레

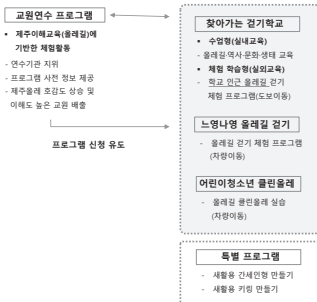


지역 주민들로 구성된 '제주올레 걷기여행 지원단'이 올레길을 처음 걷는 도보여행자들과 동행하며 6, 7, 7-1 코스를 함께 걷는 무료 프로그램

- 매일 오전 9시 제주올레여행자센터에서 출발(연요일 제외)
- 올레팩스 앱에서 '시작올레' 신청

어린이·청소년 걷기학교

제주의 아름다운 자연, 생태, 문화를 배우고, 걷기와 야외활동을 통해 균형 잡힌 심신의 건강을 도모하는 도내 초·중·고 학생대상 제주올레 길 걷기 프로그램.



모두가 즐길 수 있는 누구나 올레



손실영 올레&시각 장애인 함께 걷기 자원봉사자 양성

- 시각장애인 완주자 류정남님의 제안으로 시각장애인 걷기 지원 자원봉사자 양성과정을 열고, 자원봉사자(20명)와 시각장애인이 걷는 프로그램 주기적 운영. 2019년부터 (사)누구나와 함께 발달장애인들의 걷기를 지원하기 위해 맞춤형 길동무 자원봉사자(20명)를 양성하고, 연 10회 이상 걷기 지원 프로그램 운영
- (사)제주올레 서명숙 이사장이 2022년 초 이원석 제주지검장(현재 검찰총장)에게 제안, 검찰을 비롯한 관계기관들이 함께 기획 운영하기 시작한 프로그램. 관계기관과 시범운영을 마친 뒤 매월 2회씩 10여명의 대상 청소년들과 걷기 프로그램 운영중



제주올레 기념품 _ 제주여행의 추억과 의미를 간직하다



제주올레가 하는 일 _ 1사(社) 1올레



올레길이 지나는 마을과
하나의 기업을 연결하여
기업은 마을을 돕고
마을은 기업활동을 지원하는 프로젝트

지역민이 운영하는 숙소&식당 운영 홍보지원



2009년 서귀포시와 함께 시작한 올레길 할망숙소는
자식들을 육지로 떠나 보내고 적절하게 지내는 제주의 할머니, 할아버지의 집을 개조해
올레꾼들에게 방을 내주는 프로젝트

제주올레의 글로벌 프로젝트



월드 트레일즈 네트워크, 아시아 트레일즈 네트워크, 우정의길, 자매의 길



세계로 가는 제주올레 _ 아시아와 월드 트레일즈 네트워크



세계로 가는 제주올레 _ 우정의 길



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세계로 가는 제주올레 _ 우정의 길



- 제주올레 1코스 - 스페인 산티아고길 몬테 도 고소 구간 (2022.07)
- 제주올레 6코스 - 스위스 체르마트 57개 호수길 (2010.08)
- 제주올레 10코스 - 스위스 레만호 와인루트 (2010.08)
- 제주올레 3코스 - 영국 코츠월드웨이 (2011.4)
- 제주올레 2코스 - 캐나다 브루스트레일 (2011.09)
- 제주올레 13코스 - 일본 시코쿠 오텔로 (2012.10)
- 제주올레 9코스 - 레바논 마운틴 트레일 (2013.03)
- 제주올레 19코스 - 서호주 비블먼 트랙 (2015.01)
- 제주올레 7코스 - 이탈리아 친퀘테레 (2016. 05)
- 제주올레 18-1코스 - 그리스 시프노스 트레일 (2016.05)
- 제주올레 19코스 - 서호주 비블먼 트랙
- 제주올레 11코스 - 터키 리키아 올루
- 제주올레 15코스 - 대만 락크누스 셀루
- 제주올레 16코스 - 일본 돗토리 워킹리조트

세계로 가는 제주올레 _ 제주올레 & 산티아고 길 공동 완주 프로그램



- 제주올레와 카미노 데 산티아고가 우정의 길 협약을 맺고, 제주올레 길과 카미노 데 산티아고 길을 각각 100km 이상 걸은 이에게 별도의 공동 완주 인증서를 발급하는 Joint Completion 프로그램.
- 2022년 9월1일부터 발급
- 공동 완주증을 발급받은 이는 Joint Completion 명예의 전당 사이트에 완주기록과 사진이 게시



세계로 가는 제주올레 _ 자매의 길



세계로 가는 제주올레 _ 자매의 길



- 일본 규슈에 조성된 올레길, 규슈올레
 - 2012년 2월부터 규슈올레 20개 코스 개장
- 경기도 양평에 조성된 올레길, 양평 물소리길
 - 2013년 4월부터 6개 코스 개장
- 몽골에 조성된 올레길, 몽골올레
 - 2017년 6월부터 몽골올레 3개 코스 개장
- 일본 미야기에 조성된 올레길, 미야기올레
 - 2018년 10월부터 미야기올레 4개 코스 개장

제주올레 여행자 센터 _ 여행자를 위한 베이스 캠프



제주올레 여행자 센터 _ 여행자를 위한 베이스 캠프



제주올레여행자센터는 자신에 집중하고 스스로를 돌아보며, 지치고 상처받은 마음을 보듬고 위로하는 공간입니다.

다양한 프로그램을 통해 창작과 공연, 체험과 재능을 나누고 나와 세상을 이해하는 시간도 가질 수 있습니다. 올레꾼과 제주도민 모두가 이곳에서 먹고, 쉬고, 나누며 제주올레의 현재와 미래를 함께 만들어 가고 있습니다.

JEJU OLLE PUB

1F 청년올레식당 + 제주올레 Pub
 낯에는 청년들의 열정이 담긴 제주 밥상이
 밖에는 제주 보리로 만든 수제맥주와
 원상 게임을 자랑하는 제주 스타일 요리가



1F 삼다수출

각종 행사와 모임, 강연, 세미나 등을 위한 공간



1F 간세공방

제주올레 기념품인 간세인형을 직접 만들어 체험하는 공간



3F 올레스테이

비움과 차움을 테마로, 오직 '일'에 초점을 맞춘 숙소

제주올레 후원



제주올레 길을 지키는 아름다운 방법
매월 후원으로 제주올레와 함께 해주세요

• 제주올레 후원이 되면

- 제주올레에서 발행하는 뉴스레터와 후원회원 스타프 증정
- 후원회원을 상징하는 날개 달린 간세 맷지를 증정
- 연말정산 소득공제용 기부금 영수증 발급, 한정판 탁상달력을 함께 제공



• 후원금은 이렇게 쓰입니다

- 기존 코스의 유지 보수와 관리
 - 비영리 사단법인 제주올레 사무국 운영 등에 사용
 - 후원으로 길 안내 표식인 간세를 재정지하고 낡은 리본을 교체
- 매월 1만원을 1년 동안 후원하면, 길 안내 간세 하나가 세워집니다.
매월 2만원을 1년 동안 후원하면, 하나의 코스에 리본을 달 수 있습니다



• 후원계좌

제주올레 후원계좌: 농협 903035-51-073914
예금주: (사)제주올레

더 많은 올레길 공식 정보 얻기

내 손안의 올레길 '올레페이스'



437코트 기록하기
공식 인스타그램(jejuolletrail)
공식 블로그 구독!!!



'카카오톡 플러스 친구' 맺기



제주, 올레길 전문 여행 '제주올레트립'



'제주올레 홈페이지' 방문



하영 고맙습니다!
질문 잊수파?



The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Luncheon Symposium I

6월 22일(토) 12:00-13:00

좌장: 고준석 (경희대)

김영우 (가톨릭대)

Initial Clinical Experience of Pipeline™ Vantage

김성림

가톨릭대 부천성모병원

The real clinical performance of the Avenir coil tailored for the first coil

Shinsuke Sato

St. Luke's International Hospital

Extensive research has confirmed the safety and efficacy of flow diverters and W-EB for the treatment of intracranial aneurysms. Recently, the number of intracranial aneurysm coils performed by single operators has decreased in Japan. However, it may be beneficial to consider coiling as a first option for the treatment of small, irregularly shaped, ruptured and bifurcated aneurysms. With regard to the role of the framing coil in aneurysm treatment, the first coil will adhere to the wall of the aneurysm and it is necessary that the loop of the first framing coil does not collapse after the introduction of additional coils. The Avenir framing coil concept is unique.

The first segment of the coil becomes a loop structure, in addition the flexible wave designed loops of the coil continue from the second segment and finally the tail loop. I think that these designed loop as the framing coil indicate the useful to have the mechanical behaviour that automatically crawls on the wall of aneurysms easily by showing the movement of the coil that a practiced hand does not need the control of the microcatheter. We demonstrate some cases on these performance of the Avenir coil and a size choice in real clinical practice, showing the role of the framing coil as expected.

Next Neuroprotective agents?

이종민
울산대병원

Next Neuroprotective agents?

- Clinical evidence of Ginkgo biloba ext. in Cognitive impairment

Ginkgo biloba in PubMed (Since 2020)

Ginkgo & Cognitive
133건

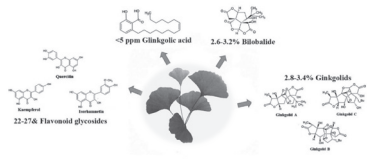
Ginkgo & Dementia
99건

Contents

- Ginkgo biloba ext.
- Ginkgo biloba on Dementia patients
- Ginkgo biloba on non-demented patinets

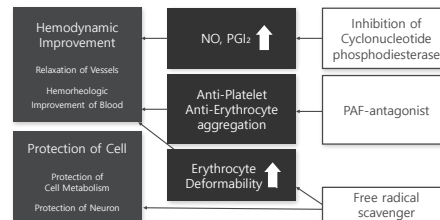
Ginkgo biloba ext.

Chemical Composition



Flavone, Ginkgolides (diterpenoid) Antioxidant
Bilobalides Neuroprotection GABA_A negative allosteric modulator

Proposed mechanism of action



Proposed mechanism of action

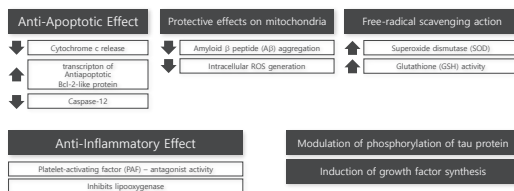


Figure 4. Mechanisms of action of Ginkgo biloba [41].

Proposed mechanism of action about β-amyloid

No.	1	2	3	4
제목	EGb761 improves cognitive function and regulates inflammatory responses in the APP/PS1 mouse	Effect of a short- and long-term treatment with Ginkgo biloba extract on Aβ1-42 precursor protein levels in a transgenic mouse model relevant to Alzheimer's disease	EGb 761 reduces Aβ1-42 precursor protein levels and Aβ1-42 levels in a transgenic mouse model of Alzheimer's disease	Ginkgo biloba extract (EGb 761) inhibits Aβ1-42 precursor production by lowering free radical levels
저자사항	Wenbin Wan, Chuan Zhang, Mark Danilov, Qian Li, Wenjing Chen, Yanyan CHAN, Yanning LI	Wang et al. J. Neurochem. 2010; 115: 1000-1010	Wang et al. J. Neurochem. 2010; 115: 1000-1010	Wang et al. J. Neurochem. 2010; 115: 1000-1010
연구유형	In vitro study	In vitro study	In vitro study	In vitro study
대상	EGb761 transgenic mice	Transgenic Tg2576 mice	double transgenic Tg2576 mice	EGb 761 transgenic mice
주요내용	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.
비고	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.	EGb761 (EGb 761) significantly improved cognitive function in Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice. The data show that EGb 761 has a protective effect on the cognitive function of Tg2576 mice.

EGb761 improves cognitive function and regulates inflammatory responses in the APP/PS1 mouse

Wenbin Wan¹, Chuan Zhang², Mark Danilov³, Qian Li⁴, Wenjing Chen⁵, Yanyan CHAN⁶, Yanning LI⁷

¹Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

²Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

³Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

⁴Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

⁵Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

⁶Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China

⁷Department of Neurobiology, Zhejiang University School of Medicine, Hangzhou, China



Fig. 2. EGb761 improves cognitive function and regulates inflammatory responses in the APP/PS1 mouse. The figure shows various graphs and images related to cognitive function and inflammation.

Demonstrate that chronic EGb761 treatment improves cognitive function in APP/PS1 mice and ameliorates amyloid pathology by increasing microglia around the amyloid plaque and regulating the inflammatory responses.

Effect of a short- and long-term treatment with Ginkgo biloba extract on Amyloid Precursor Protein Levels in a transgenic mouse model relevant to Alzheimer's disease

Sabine Argüelles¹, Gerald Rimbach², Kay Augustin³, Reinhard Schliebs⁴, Siegfried Woffram⁵

¹Department of Neurobiology, University of Würzburg, Würzburg, Germany

²Department of Neurobiology, University of Würzburg, Würzburg, Germany

³Department of Neurobiology, University of Würzburg, Würzburg, Germany

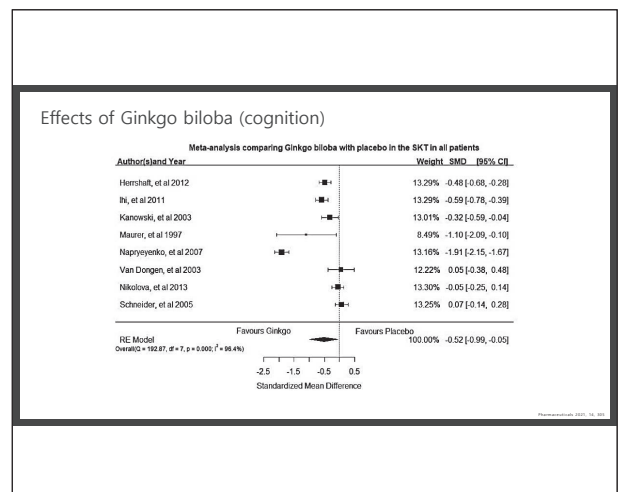
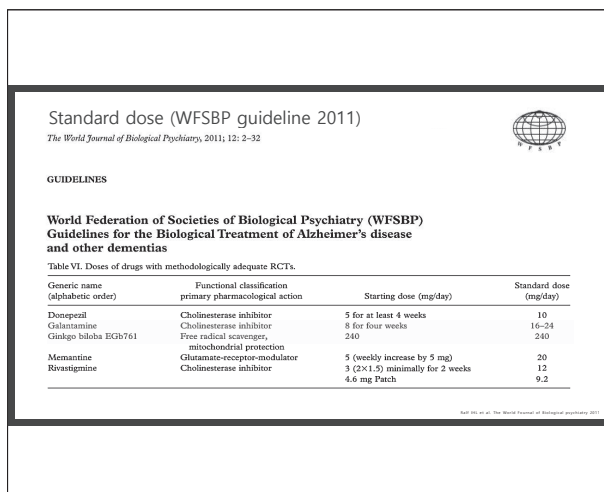
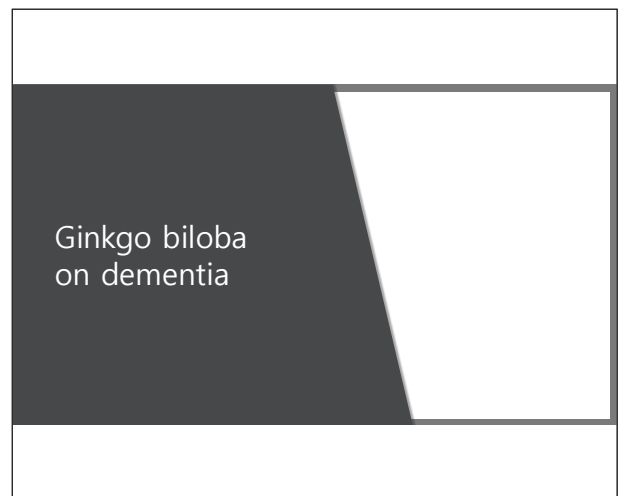
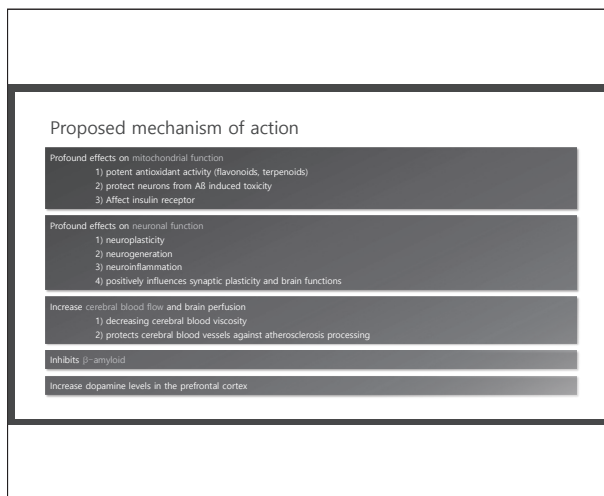
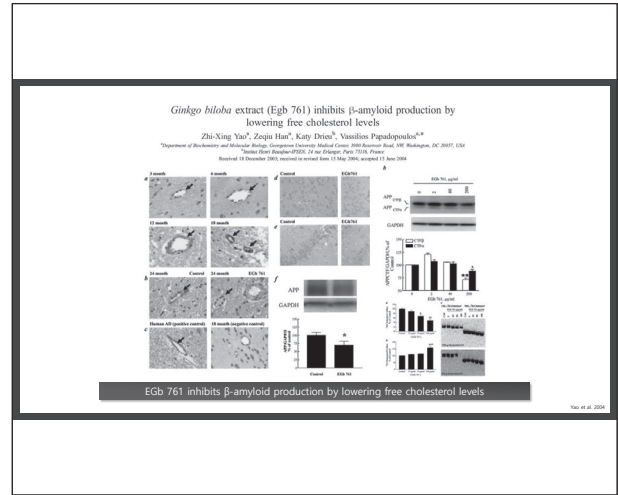
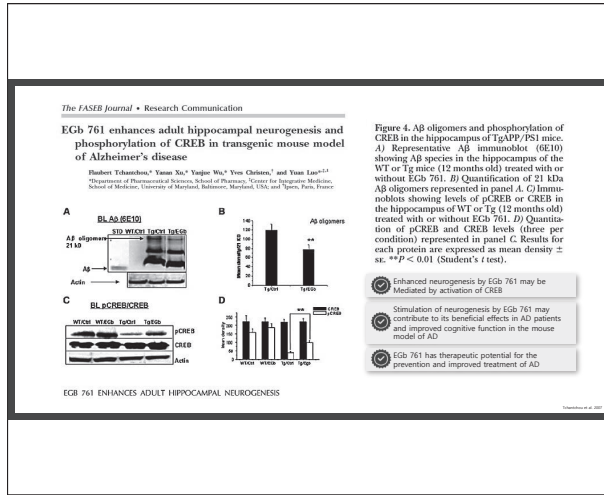
⁴Department of Neurobiology, University of Würzburg, Würzburg, Germany

⁵Department of Neurobiology, University of Würzburg, Würzburg, Germany



Fig. 3. Effect of a short- and long-term treatment with Ginkgo biloba extract on Amyloid Precursor Protein Levels in a transgenic mouse model relevant to Alzheimer's disease. The figure shows various graphs and images related to amyloid precursor protein levels.

Current data indicate that long-term dietary treatment with EGb761 over 16 months significantly decreased hAβ protein levels in the cortex of Tg2576 mice.



International Journal of
Geriatric Psychiatry

Efficacy and safety of a once-daily formulation of Ginkgo biloba extract EGb 761 in dementia with neuropsychiatric features: a randomized controlled trial

Ralf Ihli^{1,1}, Natalia Bachinskaya², Amos D. Korczyn^{3†}, Veronika Vakhapova⁴, Michael Tribanek⁵, Robert Hoerr⁷ and Olexandr Naprsvenko^{6†} on behalf of the GOTADAY Study Group



- designed to assess the clinical efficacy and tolerability of a **once-daily formulation containing 240mg** of Ginkgo biloba extract Egb 761 in demented individuals.
- 20 outpatient clinics in Ukraine
- probable AD with/without CVD, probable VaD
- 410 patients (Egb: 206; placebo: 204)



Ralf Ihle^{1,2}, Natalia Buchinskaya², Annes D. Kozlowsky^{3C}, Veronika Vakhapova⁴, Michael Trifunak⁵, Robert Hoer⁵ and Oleksandr Nagryesenko^{6D} on behalf of the GOTADAY Study Group

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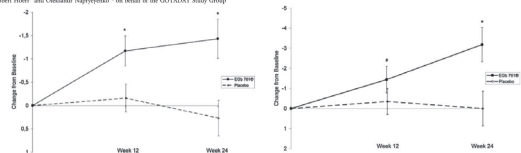


Figure 3 Change in NPI total score from baseline to week 24; full analysis set ($n = 410$); means and 95% confidence intervals. * $p < 0.05$, * $p < 0.001$ two-sided t -test.

baseline to week 24; full analysis intervals. * $p < 0.05$, ** $p < 0.001$

Ball JH, et al. *Int J Geriatric Psychiatry*. 2011 May 26(11):1166-90.

International Journal of
Geriatric Psychiatry

Erald Ilie^{1,2}, Natalia Bachinskaya², Amos D. Korczyn³¹, Veronika Vakhapova⁴, Michael Trifunak⁵, Robert Hoes⁶, and Gheorghe Naeumescu^{6*} on behalf of the GOTADAY Study Group

Rolf Illé^{1,2}, Natalia Bozhinskaya², Amos D. Kerczyn²¹, Veronika Vakhapova⁴, Michael Tribanek³, Robert Hozer⁵, and Chikaraide Nannucchi²⁰ on behalf of the GGTADAY Study Group

Table 2 Changes from baseline in primary and secondary outcome measures, change score for ADOS-CGIC, full analysis set; means (95% confidence interval) and *p*-values of *t*-test

	ESD 701 (n = 202)	Phonon (n = 202)	p-value	Active event	ESD 701 (n = 206)	Phonon (n = 204)
Primary outcome measures						
SRF total score	-14.1 (-1.9, -1.9)	-5.3 (-1.6, -1.6)	<.001	Hesitancy	43.09	38.16
Net total score	-14.1 (-1.9, -1.9)	5.0 (-1.8, -1.8)	<.001	Respiratory tract infection (cough, rhinorrhoea, bronchopneumonia)	27.13	20.49
Secondary outcome measures						
ADOC-CAT average score	3.0 (3.0, 3.0)	0.1 (0.9, 0.9)	<.001	Central pneumonia	22.73	21.75
Net status score	-12.1 (-1.7, -1.7)	-5.3 (-2.6, -2.6)	<.001	Obstructive, hypertensive		
Verbal fluency score	1.0 (1.0, 1.0)	1.0 (1.0, 1.0)	<.001	Diabetes	19.92	21.15
ADL-10 overall mean score	-6.7 (-6.2, -6.2)	5.0 (-6.1, -6.1)	<.001	Angina	9.44	10.46
ESDADL-10 mean total score	-14.1 (-1.9, -1.9)	5.0 (-1.8, -1.8)	<.001	Dermatophytosis	8.29	12.55
ESDADL-10 mean social skills	-6.7 (-6.2, -6.2)	5.0 (-6.1, -6.1)	<.001	Diagnosed	17.17	18.19
10-point total social distress	-6.7 (-6.2, -6.2)	5.0 (-6.1, -6.1)	<.001			

- a 240mg once-daily dosage form of EGB 761 significantly improved cognition, neuropsychiatric symptoms, overall assessment and quality of life in patients with dementia as well as behaviour-related distress of caregivers.
- EGB 761 was safe and well tolerated, there was no excess rate of adverse events compared to placebo.

Treatment effects of Ginkgo biloba extract EGb 761® on the spectrum of behavioral and psychological symptoms of dementia: meta-analysis of randomized controlled trials

Savaskan, Ferihsen : Mueller, Heiko : Hoerr, Robert : von Ganten, Armin : Gauthier, Serge

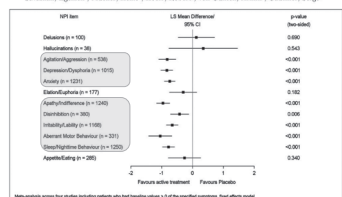


Figure 3. Improvement of symptom frequency/severity.

- Four trials (GIDEN-NP, GOTADAY, GOT-IT!, PLAGIN)
- Probable AD, VaD or AD with CVD, 1,628 patients (Egb 761®: 814; placebo: 814)
- treatment duration was 22 or 24 w
- the daily dose of Egb 761® was 240 mg in all trials
- NPI-t score at least 6

Twenty two- to twenty four-week treatment with Ginkgo biloba extract EGB 761® improved BPSD (except psychotic-like features) and caregiver distress caused by such symptoms.

Ginkgo biloba extract EGB 761®, donepezil or both combined in the treatment of Alzheimer's disease with neuropsychiatric features: A randomised, double-blind, exploratory trial
S. Yancheva*, R. Bihl*, G. Nikedova*, P. Panayotov*, S. Schlaefke* and R. Hoerr* for the GINDO Study Group

Ginkgo biloba extract EGB 761®, donepezil or both combined in the treatment of Alzheimer's disease with neuropsychiatric features: A randomised, double-blind, exploratory trial
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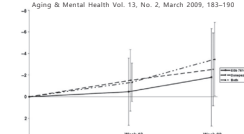
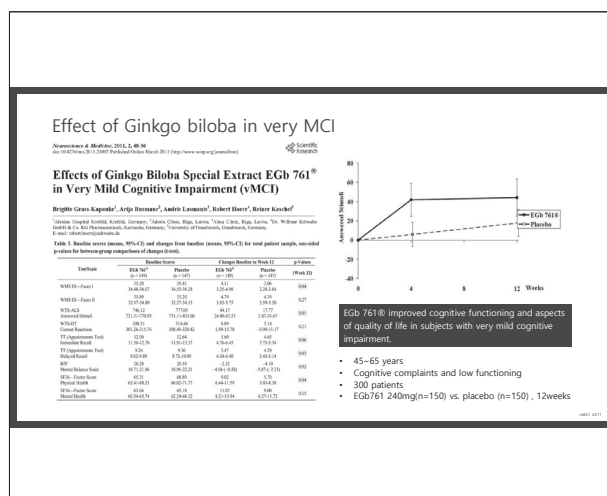
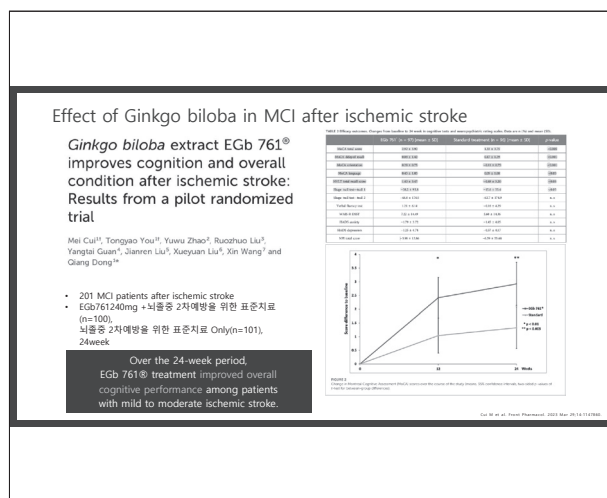
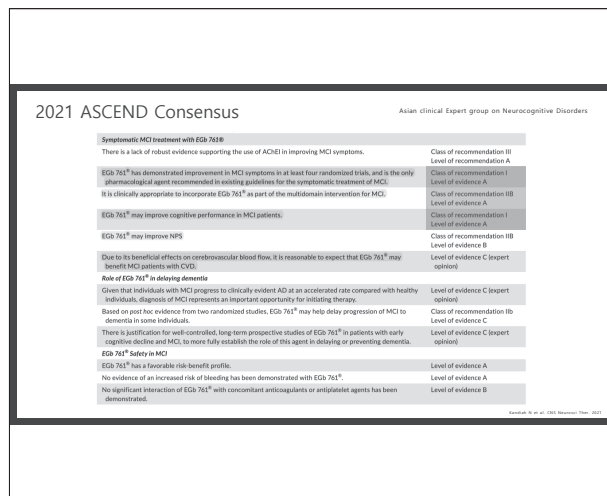


Figure 2. Changes from baseline in SKT total score (FAS; means $\pm$ SD, $p > 0.05$ for all comparisons between treatment groups).

	DGR 781 ^a (n=30)	Derepex ^b (n=32)	DGR 781 ^a +Derepex ^b (n=31)	<i>p</i> -value
SCT total score	-1.30±0.45	-2.73±0.34	-1.73±0.34	0.08
CVT	1.4±2.2	0.8±1.5	0.8±1.5	0.39
Verbal fluency test	1.4±2.7	0.9±2.9	1.8±3.1	0.47
NPI (32 items) total score	-0.6±0.74	-1.7±0.78	-1.2±0.89	0.75
NPI (12 items) distress score	-0.2±0.43	-0.4±0.41	-0.4±0.43	0.36
GDS Schvachkin's impairment of ADL	-0.0±0.24	-0.1±0.25	-0.0±0.24	0.61
GDS total score	-1.37±0.83	-4.7±0.83	-3.5±0.93	0.72
HAM-D	-1.9±0.28	-1.7±0.34	-2.2±0.26	0.26
CSS - Timidity	-0.0±0.14	-0.1±0.14	-0.0±0.14	0.98
CSS - Dominance	-0.0±0.14	-0.2±0.13	-0.0±0.14	0.78

- >50 years
- Probable AD with NPS
- 96 patients
- treatment duration was 22 weeks
- EGb761(n=30) vs. donepezil(n=32) vs. both(n=31)

Similar response rates between the three groups after 22 weeks. Compared to the donepezil group, the adverse event rate was lower in the EGB761 treatment and even under the combination group.



Prevention of dementia

ANALYSING TIME TO EVENT DATA IN DEMENTIA PREVENTION TRIALS:
THE EXAMPLE OF THE GUIDAGE STUDY OF EGB761®

B. SCHERRER¹, S. ANDRIEU^{2,3,4}, P.-J. OUSSET^{3,4}, G. BERRUT¹, J.-F. DARTIGUES¹, B. DUBOIS¹,
F. PASQUIER⁵, F. PIETTE⁶, P. ROBERT⁷, J. TOUCHON¹⁰, P. GARNIER¹³, H. MATHIEUX-FORTUNET¹³,
B. VELLAS^{3,4} AND THE GUIDAGE STUDY GROUP

GuidAge study 결과, 기억장애를 주관적으로 호소한 환자에서 **5년 이상** 은형알츠하이머를 복용한 군의 **알츠하이머병 발생률**은 위약군의 **절반 수준**이었습니다.²
그리고, GuidAge study의 post hoc analysis는 이러한 치매 발생 위험에 대한 위약과의 차이가 눈에 띄는 연구기간 중 후반부에 유의하게 나타나 late effect를 시사합니다.

온혈동물용 복원기(2주) 치료 위험도						
	Standardized gingiva disease extract		Placebo		Hazard ratio (95% CI)	p value*
	Cases (number exposed)	Incidence per 100 person-years	Cases (number exposed)	Incidence per 100 person-years		
1 year	10 (13486)	0.68	14 (1434)	1.02	0.72 (0.32-1.61)	0.416
2 years	20 (1287)	1.57	12 (1199)	1.07	1.46 (0.61-3.46)	0.139
3 years	13 (1017)	1.30	13 (1062)	1.16	1.13 (0.24-5.42)	0.794
4 years	5 (1061)	0.51	9 (1111)	0.84	0.57 (0.19-1.66)	0.332
23 years	13 (1011)	1.31	26 (1023)	2.41	0.49 (0.13-1.94)	0.002

Table 2: Incidence of probable Alzheimer's disease, by year of study

- ≥ 70 years
- Complaint subjective cognitive decline
- 2,854 patients
- EGb961 120mg bid vs. placebo
- 5 years follow-up

Egb 761 safety

- Some concerns have been raised regarding increased **bleeding risk** in patients treated with Egb 761®:
 - Meta-analyses: **no increased risk of adverse events** **no evidence of increased risk of bleeding with Egb 761** **no any important change in bleeding time, coagulation parameters, or platelet aggregation in dose up to 480mg/day**
- There also appears to be **no additive effect** of Egb 761® **with aspirin**.
- Egb 761® **does not** change the pharmacokinetic or pharmacodynamic properties of simultaneously administered **warfarin**.

Pharmacotherapy. 2017;1:37-4990-5022.
 Clin Lab Haematol. 2002;25:207-213.
 Blood Coagul Fibrinolysis. 2005;16:349-353.
 Blood Coagul Fibrinolysis. 2004;15:305-308.
 Drugs R D. 2006;7:143-172.
 Br J Clin Pharmacol. 2000;50:470-479.

보험 급여 기준

Ginkgo biloba extract 결구제(품명: 타나민정, 기넥신에프정 등)

분류 고시: 관원고거 고시 제2013-127호, 게시일: 2013-09-01, 조회수: 2355

허가사항 범위 내에서 아래와 같은 기준으로 루어시 요양급여를 인정하며, 통 인정기준 이외에는 약값 전 액을 원자가 부담으로 함.

-아래-

가. 인지기능 장애를 동반한 지체발달장애아(영, 유아)는 인지기능 개선목적으로 투여한 경우

○Ginkgo biloba extract 제제를 아세틸콜린분해효제제(아라벡트, 레미넌, 엑셀론 등)나 Memantine 제(에픽사 등)와 병용 시 1종은 본인 일부부담하고, 투약비용이 저렴한 약제의 약값 전액은 환자가 부담함.

나. 중추성 어지러움에 투여한 경우

다. 가형선상행진

* AITM: 2013.9.1

인지기능개선 목적 100대 100

초동맥순환 개선 목적 급여가능(I739)
저지혈증 개선 목적 급여가능(H814)

콜린알포세레이트 "선별급여 및 임상재평가" 이슈 요약

(2017) 건강사회를 위한 약사회에서 시약처에 콜린 제재 임상시험 자료요구
(2019.10) 국정감사에서 보형급여 적정성에 대한 문제가 다시 제기되면서 본격적 진행 될
관련 논란 본격화. 식약처 콜린 판매 제약사(130여개)에 유효성 자료 제출 요청

콜린알포세레이트 이슈

(2020.6) 콜리알포세레이트 임상재평가 실시 공고

(2020.8) 콜린알포세레이트 급여재평가 결과 고시
MCI 환자 선별급여 적용(환자 부담비율 80%)
→ 급여억소 취소소송 제기로 집행정지

(2021.6) **알츠하이머병**에 대한 임상시험 승인
알츠하이머 4년 6개월, 경도인지장애 3년 9개월
(2022.7, 2022.11) **급성 위소소송 제약사 1심 패소**

임상재평가

MCI/VCI DEMENTIA

Price, per cwt	CEMENT
25.03	25.12

감사합니다

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



Symposium II.

지멘스 3D 영상 기술을 통한 DFT Device (WEB/LVIS Evo)

Visibility Improvement & Case Discussion

6월 22일(토) 13:00-14:00

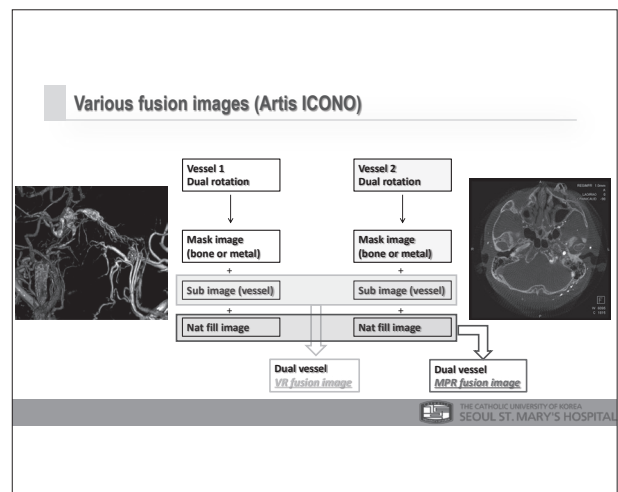
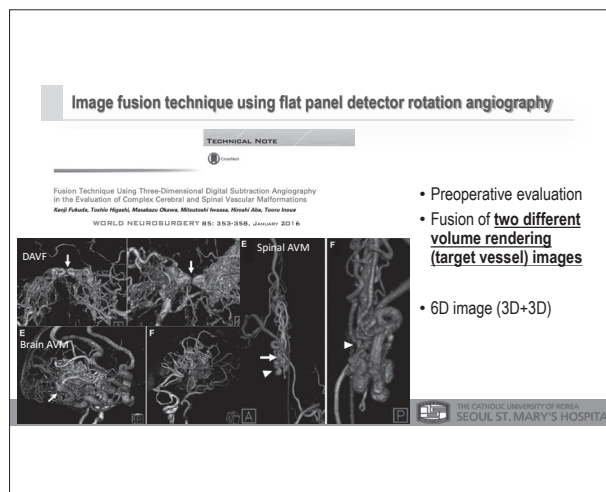
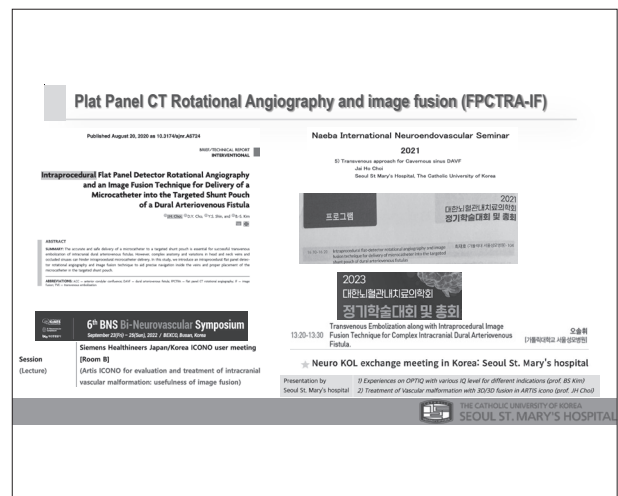
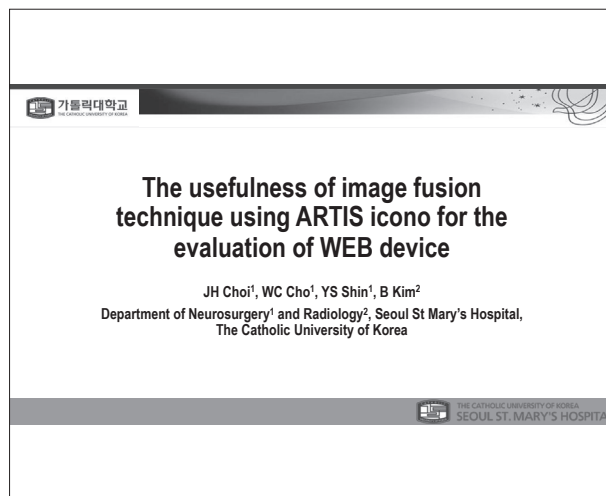
좌장: 신용삼 (가톨릭대)

강현승 (서울대)

The Usefulness of Image Fusion Technique using ARTIS icono for the Evaluation of the WEB Device.

JH Choi¹, WC Cho¹, YS Shin¹, B Kim²

Department of Neurosurgery¹ and Radiology², Seoul St Mary's Hospital, The Catholic University of Korea



Various fusion images (Artis ICONO)

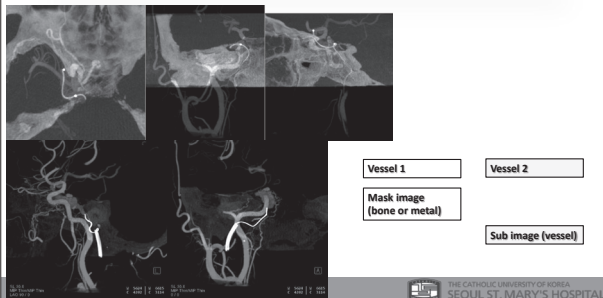


Image fusion technique for intracranial aneurysm ??

- Evaluation of AcomA

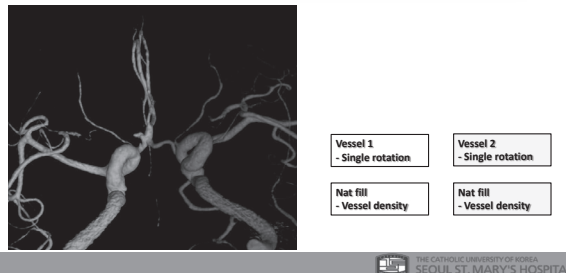
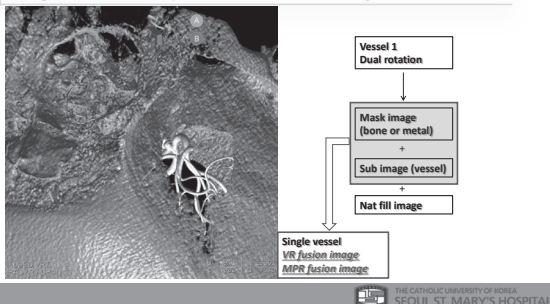


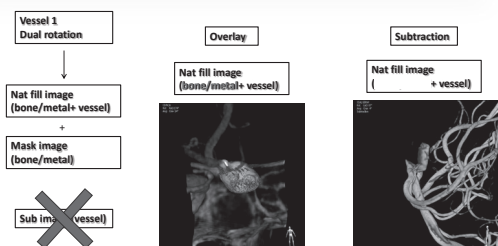
Image fusion technique for intracranial aneurysm ??



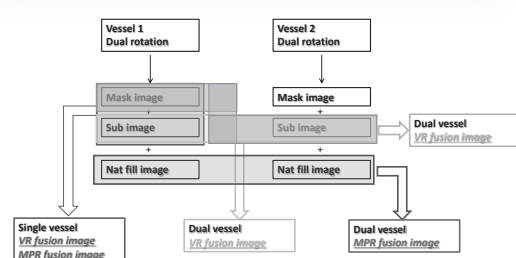
Philips angiomaachine

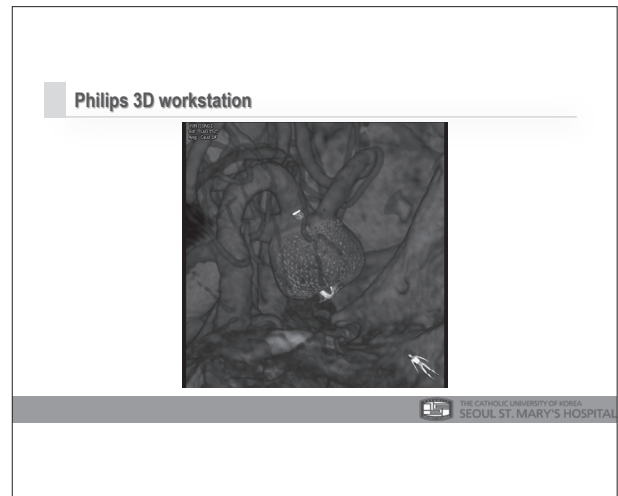
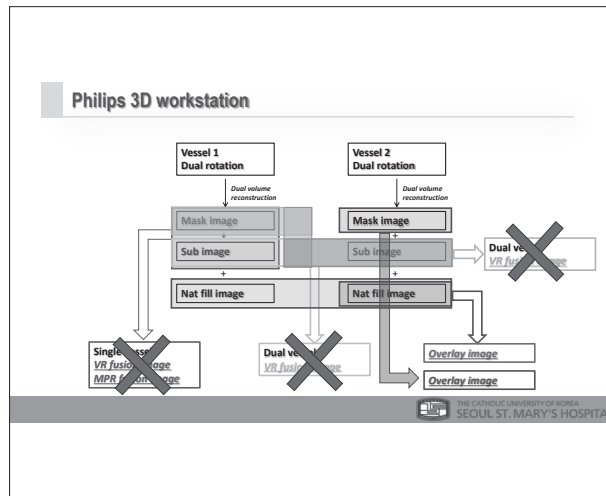


Philips angiomaachine



Siemens 3D workstation





- ### DSA for the evaluation of WEB device
- 2D angiography
 - Dual rotational angiography (4s)
 - DynaCT (14sDCT Head micro) w/wo diluted contrast media

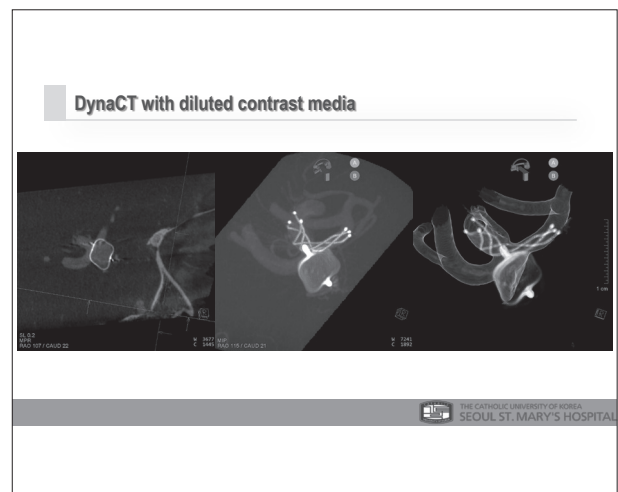
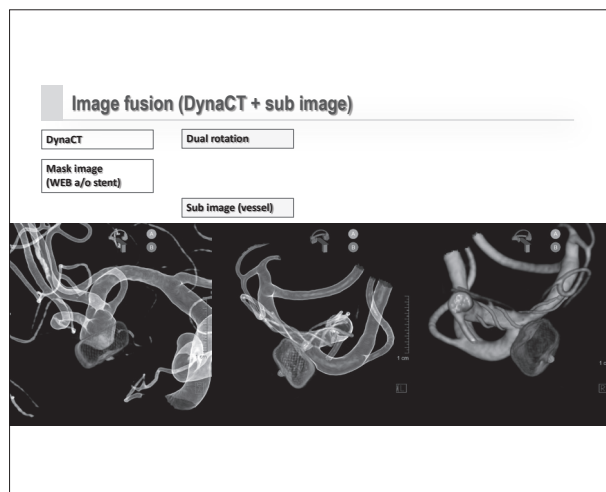
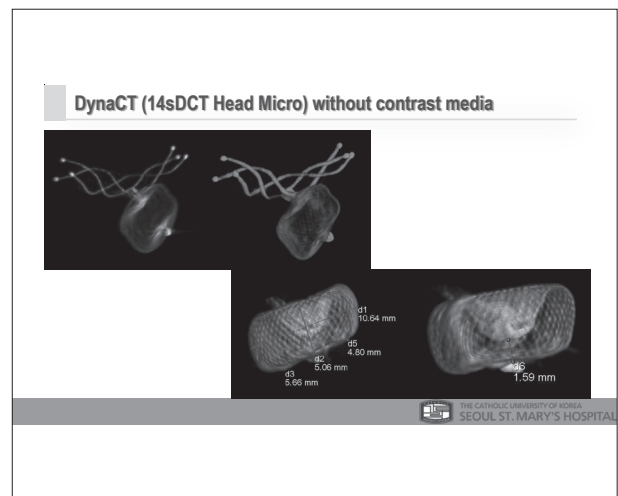
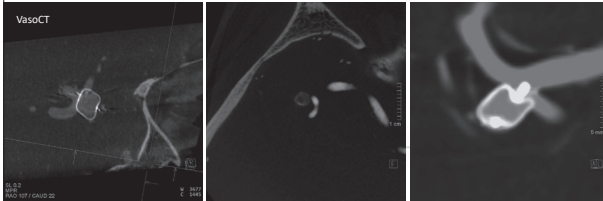
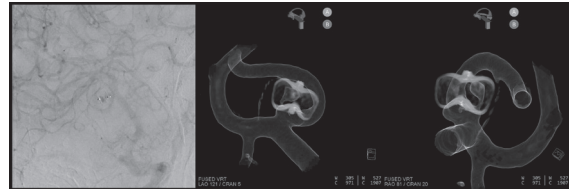


Image fusion (DynaCT + sub image)



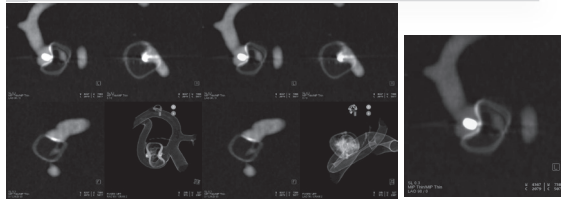
THE CATHOLIC UNIVERSITY OF KOREA
SEOUL ST. MARY'S HOSPITAL

Image fusion (DynaCT + sub image)



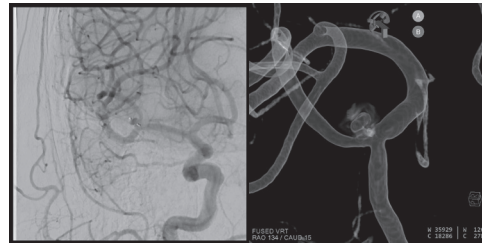
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SEOUL ST. MARY'S HOSPITAL

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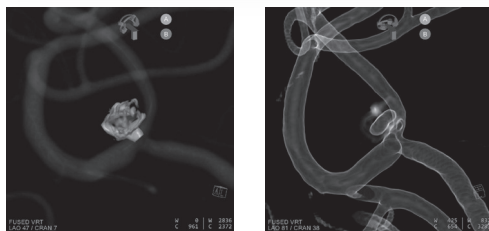
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Image fusion (DynaCT + sub image) – Adjust density gradient



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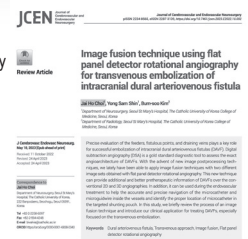
Image fusion (DynaCT + sub image) – Adjust density gradient



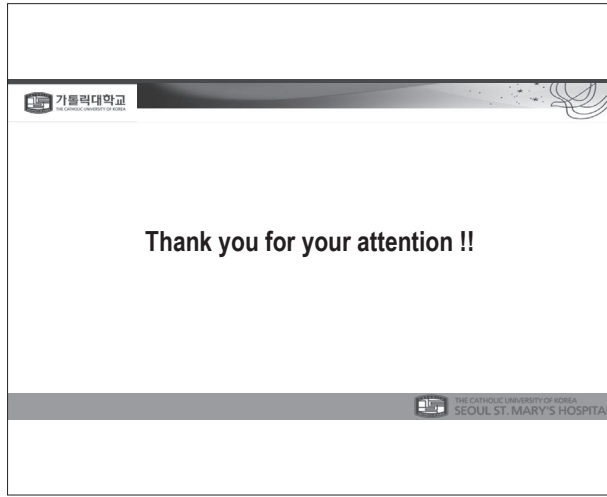
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SEOUL ST. MARY'S HOSPITAL

Conclusions

- AP/Lat 2D angiography
- Dual rotational angiography
- Working projection → Magnification angiography
- DynaCT
- Various fusion images



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



Imaging Protocol and Efforts for Optimal WEB Size Selection

Dong Young Cho, Ja Ho Koo, Eu Kyo Seo

Ewha Womans University Seoul Hospital, Department of Neurosurgery

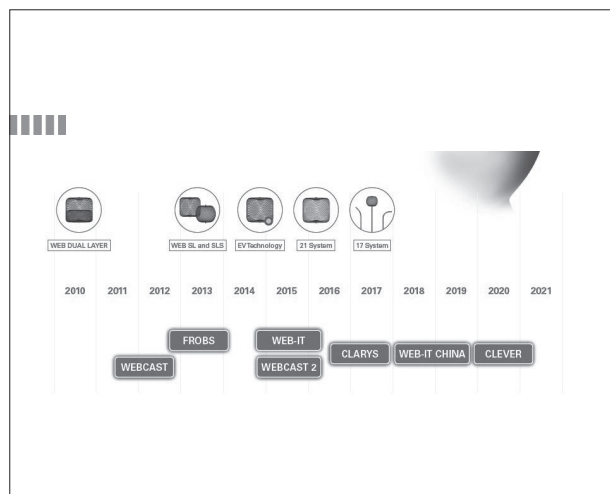
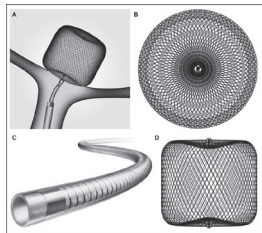
Imaging Protocol and Efforts for Optimal WEB Size Selection

2024. 06. 22
ASCENT 2024
Ewha Womans University Seoul Hospital, Department of Neurosurgery
Dong Young Cho, Ja Ho Koo, Eu Kyo Seo

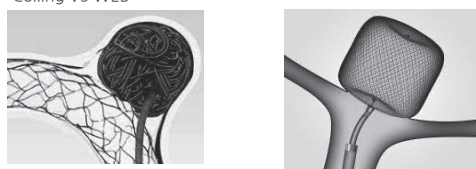


Introduction

- Woven Endobridge (WEB)
- Indicated to embolize intracranial wide neck bifurcation aneurysms, ranging in size from 3 mm to 10 mm in dome diameter, where the neck size is 4 mm or greater or the dome-to-neck ratio is less than 2.



Coiling VS WEB

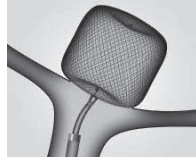


- Immediate occlusion of aneurysm
- Wide indication (less limitation to aneurysm size and shape)
- No need of long time antiplatelet
- Short procedure time
- Need of long-term antiplatelet in case of stent use
- Longer procedure time
- Risk of incomplete occlusion
- Risk of aneurysm occlusion failure
- Indicated to 3-10mm wide neck bifurcation aneurysm only

Coiling VS WEB



- Most important step:
 - Aneurysm selection with microcatheter
 - Various microcatheter and wire shaping
- Coil size selection: not delicate



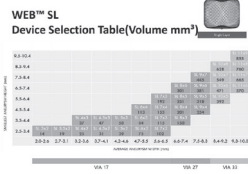
- Most important step
 - Appropriate size selection
 - Must be delicate and accurate
- Aneurysm selection
 - Not so complicated (wide neck bifurcation aneurysms)
 - Catheter shaping less meaningful

Size selection of device

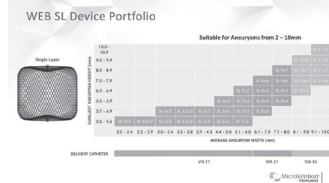
- Appropriate size selection is most important key point.
- +1/-1 rule
- Width of the device: Determined by adding 1-2mm (1mm for smaller and 2mm for larger aneurysms) to average of length and width of aneurysm on 3D image
- Height of device: subtracting 1mm from height

WEB size portfolio: old and new version

• Old version



• New version



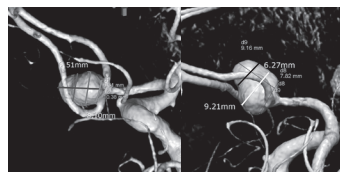
Considerations in optimal size selection

1. Size measurement on rotational 3D image
2. Comparison of size between 3D and 2D images
3. Measuring volume of aneurysm
4. Checking post-procedural distal vessel patency and wall apposition of device with Dyna CT

Size measurement on rotational 3D image

Size measurement on 3D image

- Aneurysm size measurement
 - Conventional method: $LL+LW/2$
 - Modified method: $((LL+SL)/2 + (LW+SW)/2)/2$
- Complex shape aneurysms:
 - Large difference between conventional method and modified method

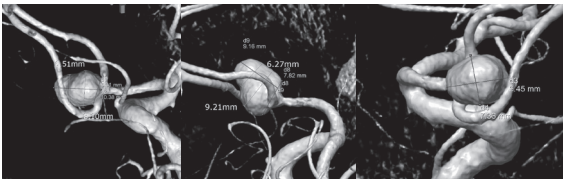


- Largest length (LL)
- Smallest length (SL)
- Largest width (LW)
- Smallest width (SW)
- Neck (N)
- Height (H)

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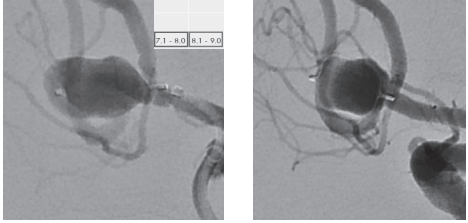
Comparison between successful and failed group			Student's T-test
	Successful selection group	Failed selection group	P value
Number (n=10)	7 (70%)	3 (30%) (1 st , 3 rd , 6 th cases)	
Age	65.14 ± 4.45	55.67 ± 17.9	0.006
Sex (M2, F8)	M=1, F=6	M=1, F=2	
Location	MCAB: 5 A-com: 4 ICAB: 1	MCAB: 1 (20%) A-Com: 2 (50%)	
Size on Conventional method	5.72 ± 1.69	6.61 ± 1.80	0.512
Size on Modified method	5.33 ± 1.54	5.84 ± 1.59	0.669
Height	5.51 ± 1.89	6.97 ± 3.02	0.503
Neck	4.50 ± 1.42	4.6 ± 1.70	0.934
Dome-to-Neck ratio	1.20 ± 0.20	1.30 ± 1.43	0.486
% of Size difference between Conventional and modified method	6.6 ± 2.7%	11.7 ± 4.9%	0.05

Case 3 F/76 A-com



- LL: 8.1 LW: 9.2 H: 10.4 N: 6.5
- SL: 6.5 SW 6.3
- (LL+LW)/2= 8.7, (mL+mW)/2=7.5

8.7 vs 7.5 / 10.4



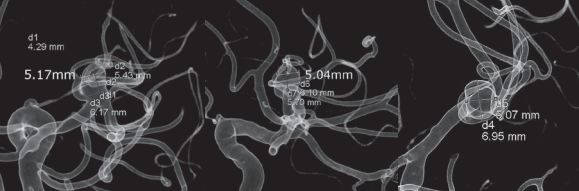
• SL 10-6: failed

• SL 9-5

6 month f/u DSA

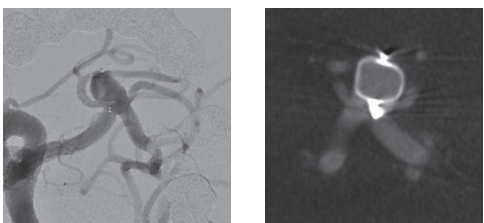


Case 8 F/69 A-com

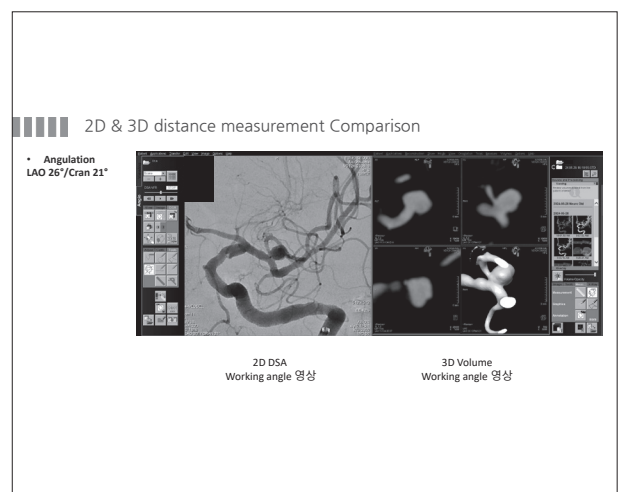
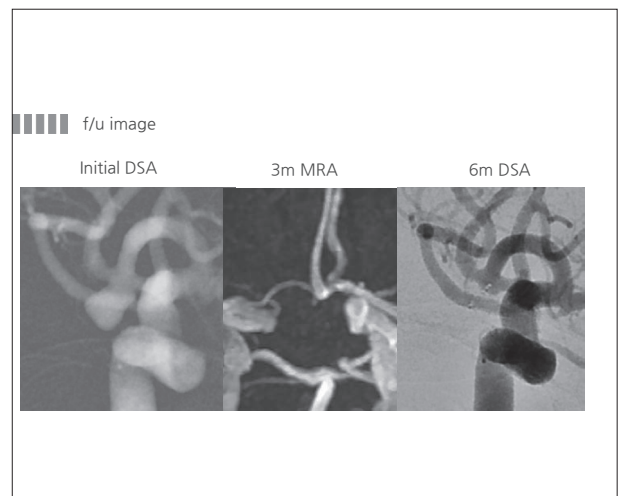
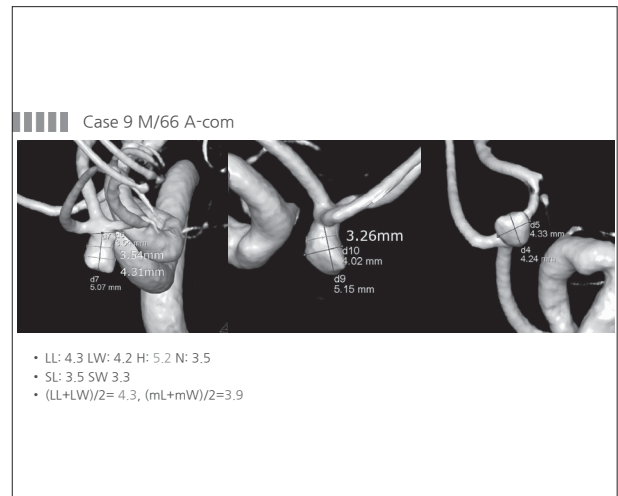
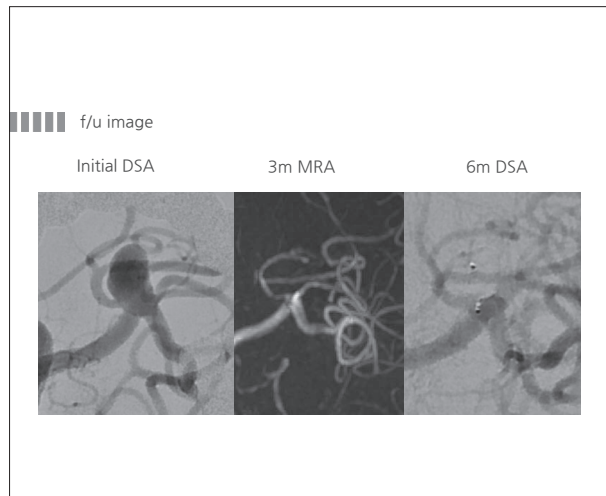


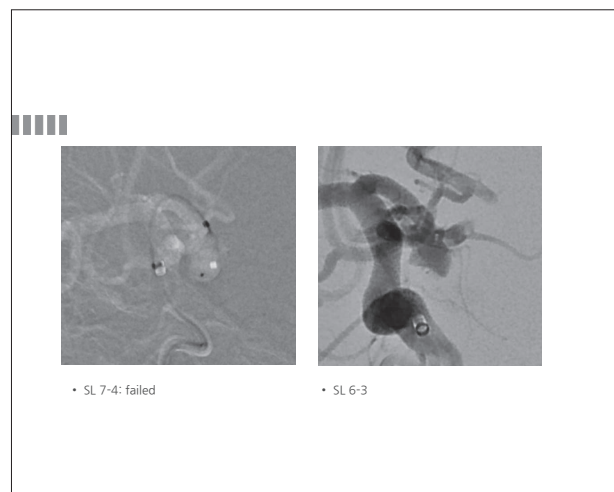
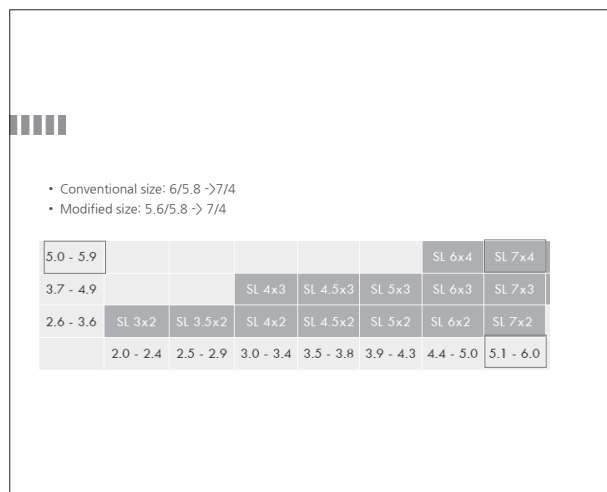
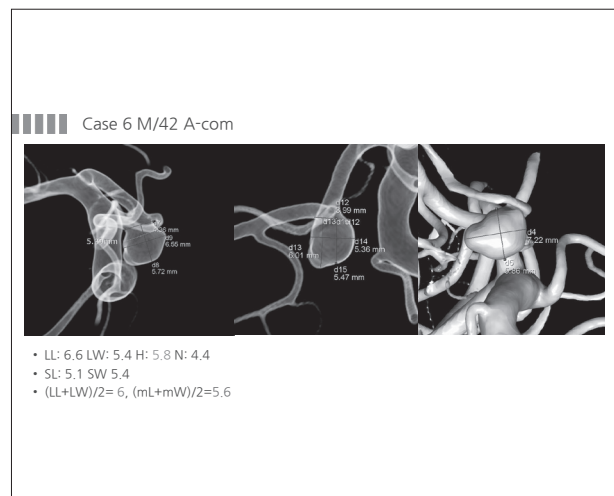
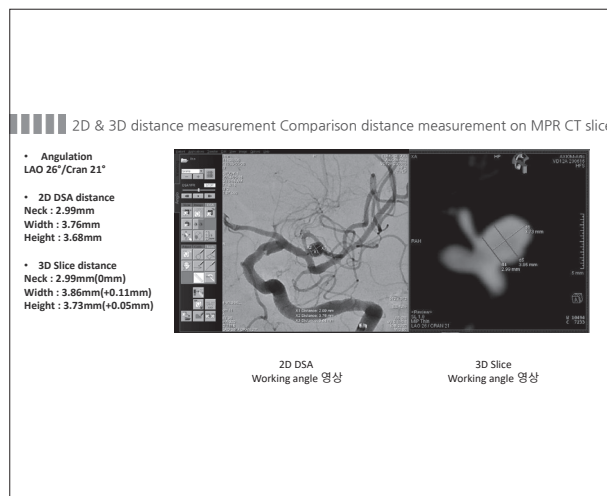
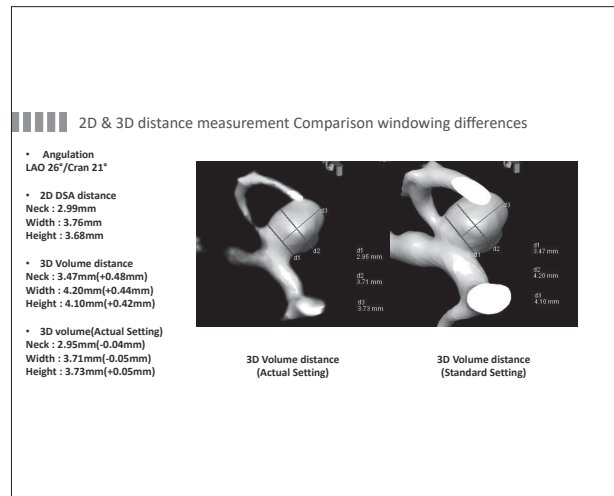
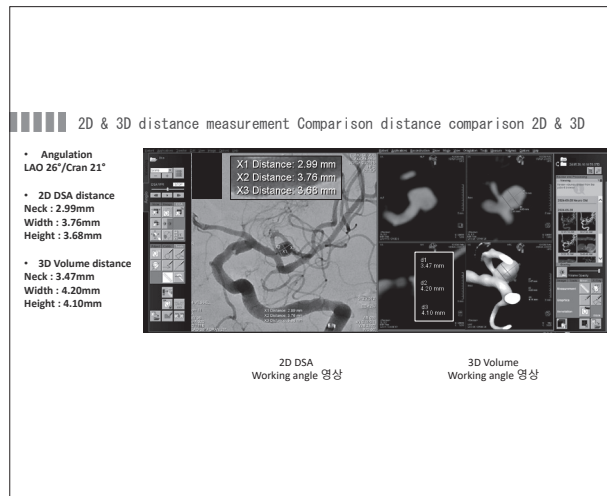
- LL: 5.4 LW: 7.0 H: 6.2 N: 4.3
- SL: 5.2 SW 5.0
- (LL+LW)/2= 6.2, (mL+mW)/2=5.7

6.2 vs 5.7 / 6.2



• SL 7-3





Aneurysm Volume Measurement - syngo Aneurysm Guidance

-

Aneurysm Volume Measurement - syngo Aneurysm Guidance

-

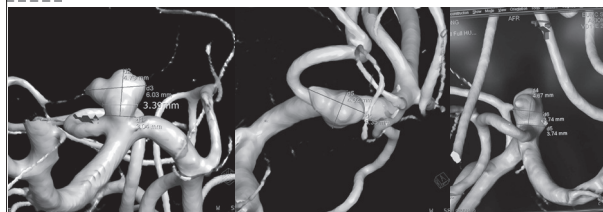
Aneurysm Volume Measurement - syngo Aneurysm Guidance

-

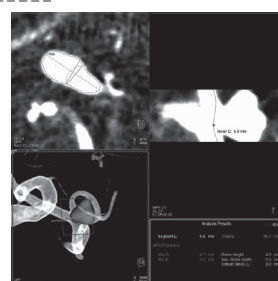
Aneurysm volume and WEB size selection - WEB volume chart

Delivery Catheter	Diameter (mm)	Height (mm)	Approximate Volume (cc)
WEB 11	1.5	2	15.72455
WEB 12	1.5	2.5	19.14188
WEB 13	1.5	3	22.55921
WEB 14	1.5	3.5	25.97654
WEB 15	1.5	4	29.39387
WEB 16	1.5	4.5	32.81120
WEB 17	1.5	5	36.22853
WEB 18	1.5	5.5	39.64586
WEB 19	1.5	6	43.06319
WEB 20	1.5	6.5	46.48052
WEB 21	1.5	7	49.89785
WEB 22	1.5	7.5	53.31518
WEB 23	1.5	8	56.73251
WEB 24	1.5	8.5	60.14984
WEB 25	1.5	9	63.56717
WEB 26	1.5	9.5	66.98450
WEB 27	1.5	10	70.40183
WEB 28	1.5	10.5	73.81916
WEB 29	1.5	11	77.23649
WEB 30	1.5	11.5	80.65382
WEB 31	1.5	12	84.07115
WEB 32	1.5	12.5	87.48848
WEB 33	1.5	13	90.90581
WEB 34	1.5	13.5	94.32314
WEB 35	1.5	14	97.74047
WEB 36	1.5	14.5	101.15780
WEB 37	1.5	15	104.57513
WEB 38	1.5	15.5	107.99246
WEB 39	1.5	16	111.40979
WEB 40	1.5	16.5	114.82712
WEB 41	1.5	17	118.24445
WEB 42	1.5	17.5	121.66178
WEB 43	1.5	18	125.07911
WEB 44	1.5	18.5	128.49644
WEB 45	1.5	19	131.91377
WEB 46	1.5	19.5	135.33110
WEB 47	1.5	20	138.74843
WEB 48	1.5	20.5	142.16576
WEB 49	1.5	21	145.58309
WEB 50	1.5	21.5	148.99942
WEB 51	1.5	22	152.41675
WEB 52	1.5	22.5	155.83408
WEB 53	1.5	23	159.25141
WEB 54	1.5	23.5	162.66874
WEB 55	1.5	24	166.08607
WEB 56	1.5	24.5	169.50340
WEB 57	1.5	25	172.92073
WEB 58	1.5	25.5	176.33806
WEB 59	1.5	26	179.75539
WEB 60	1.5	26.5	183.17272
WEB 61	1.5	27	186.59005
WEB 62	1.5	27.5	190.00738
WEB 63	1.5	28	193.42471
WEB 64	1.5	28.5	196.84204
WEB 65	1.5	29	200.25937
WEB 66	1.5	29.5	203.67670
WEB 67	1.5	30	207.09403
WEB 68	1.5	30.5	210.51136
WEB 69	1.5	31	213.92869
WEB 70	1.5	31.5	217.34602
WEB 71	1.5	32	220.76335
WEB 72	1.5	32.5	224.18068
WEB 73	1.5	33	227.59801
WEB 74	1.5	33.5	231.01534
WEB 75	1.5	34	234.43267
WEB 76	1.5	34.5	237.85000
WEB 77	1.5	35	241.26733
WEB 78	1.5	35.5	244.68466
WEB 79	1.5	36	248.10199
WEB 80	1.5	36.5	251.51932
WEB 81	1.5	37	254.93665
WEB 82	1.5	37.5	258.35398
WEB 83	1.5	38	261.77131
WEB 84	1.5	38.5	265.18864
WEB 85	1.5	39	268.60597
WEB 86	1.5	39.5	272.02330
WEB 87	1.5	40	275.44063
WEB 88	1.5	40.5	278.85796
WEB 89	1.5	41	282.27529
WEB 90	1.5	41.5	285.69262
WEB 91	1.5	42	289.10995
WEB 92	1.5	42.5	292.52728
WEB 93	1.5	43	295.94461
WEB 94	1.5	43.5	299.36194
WEB 95	1.5	44	302.77927
WEB 96	1.5	44.5	306.19660
WEB 97	1.5	45	309.61393
WEB 98	1.5	45.5	313.03126
WEB 99	1.5	46	316.44859
WEB 100	1.5	46.5	31

Case #1 F/49 Lt. MCAB



- LL: 6.4 LW: 4.0 H: 4.7 N:3
- SL: 3.4 SW 3.7
- $(LL+LW)/2 = 5.2, (mL+mW)/2 = 4.3$

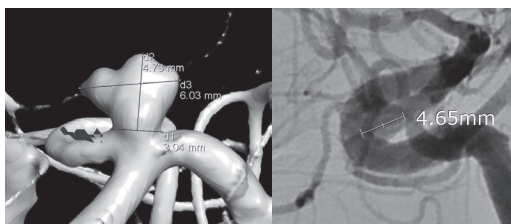


- Aneurysm volume: $56.1 \text{ mm}^3 \Rightarrow 5/3 \text{ or } 4.5/3$

VIA 17	4.5	3	47.7121845
VIA 17	5	3	55.8498877
VIA 17	5	3	55.80488275
VIA 17	6	3	73.75621249
VIA 17	6	3	84.82560165

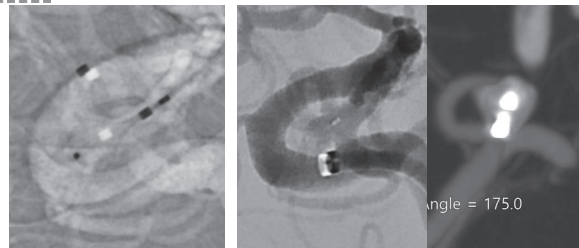
- Conventional size: 5.2/4.7 $\rightarrow$ 7/3
- Modified size: 4.3/4.7 $\rightarrow$ 5/3

5.0 - 5.9						SL 6x4	SL 7x4
3.7 - 4.9			SL 4x3	SL 4.5x3	SL 5x3	SL 6x3	SL 7x3
2.6 - 3.6	SL 3x2	SL 3.5x2	SL 4x2	SL 4.5x2	SL 5x2	SL 6x2	SL 7x2
2.0 - 2.4	2.5 - 2.9	3.0 - 3.4	3.5 - 3.8	3.9 - 4.3	4.4 - 5.0	5.1 - 6.0	



- 3D/2D difference: 0.08 mm

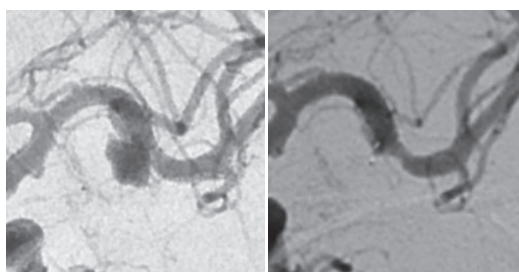
- 3D measure: 5/3, 2D/3D difference <10%, Volume: 5/3



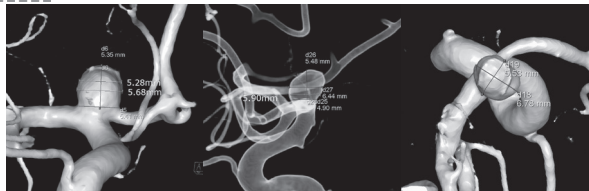
- SL 6-3: failed.

- SL 5-3

6 month DSA

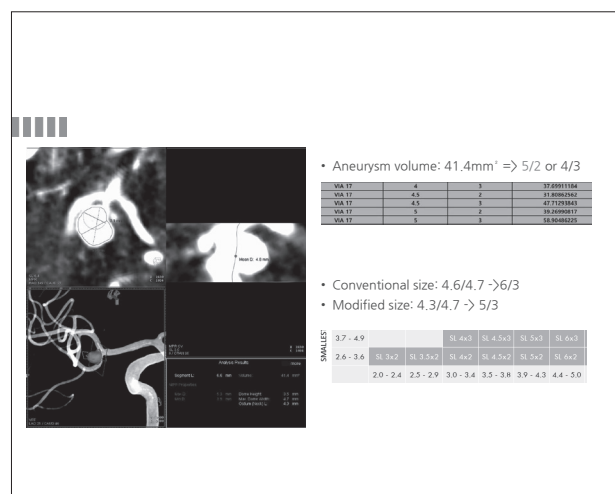
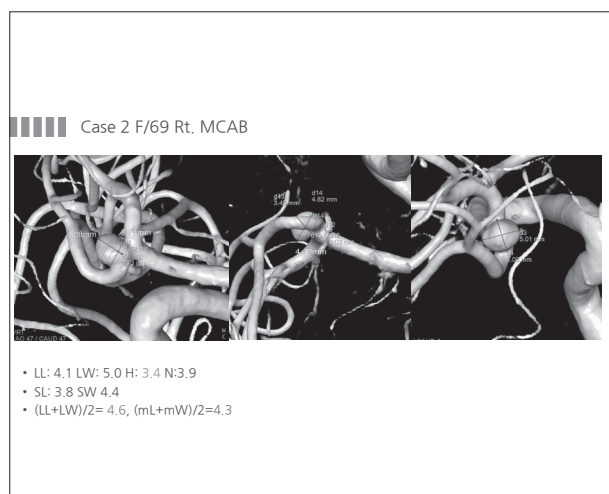
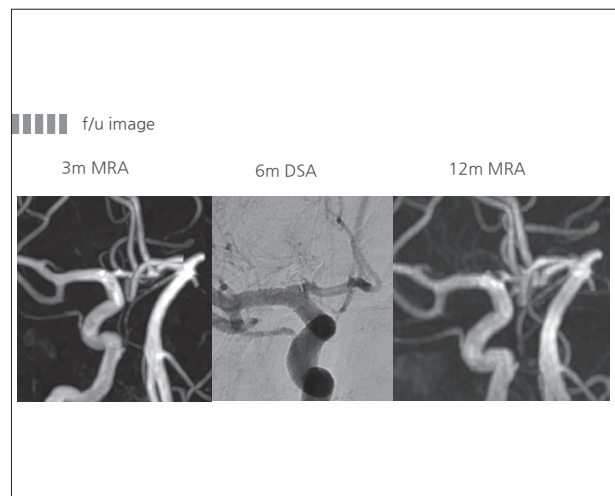
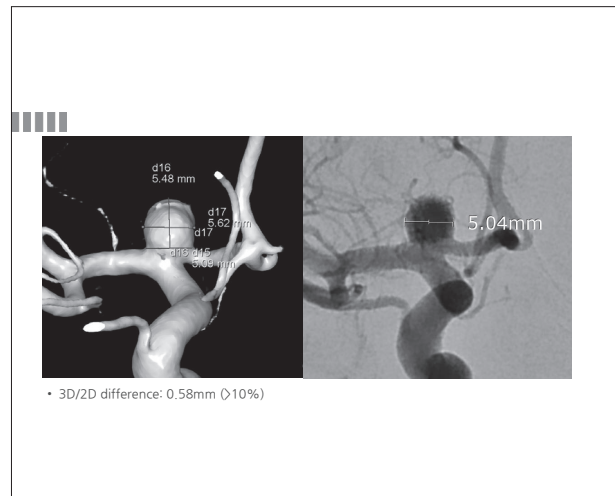
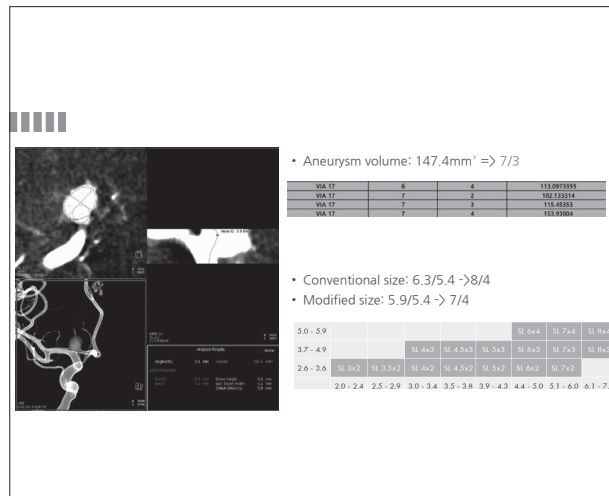


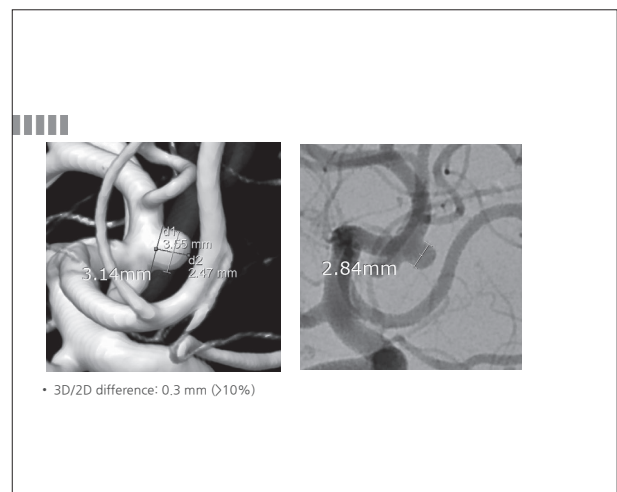
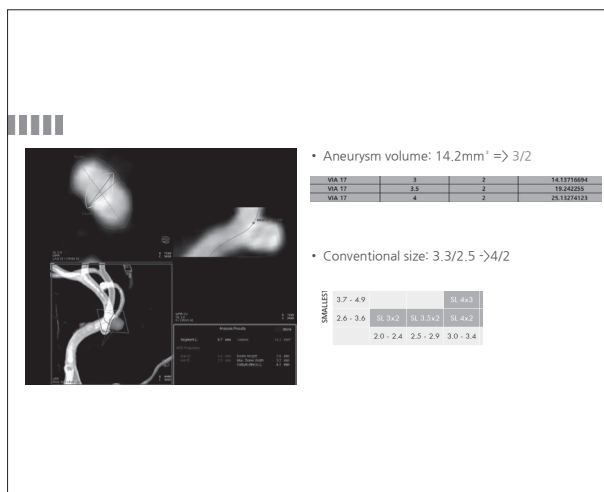
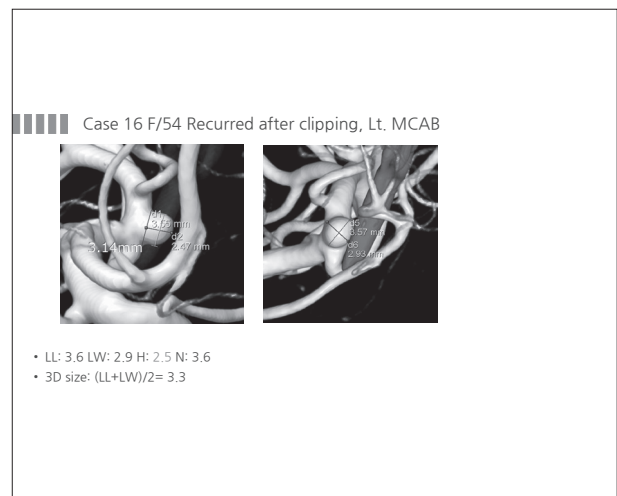
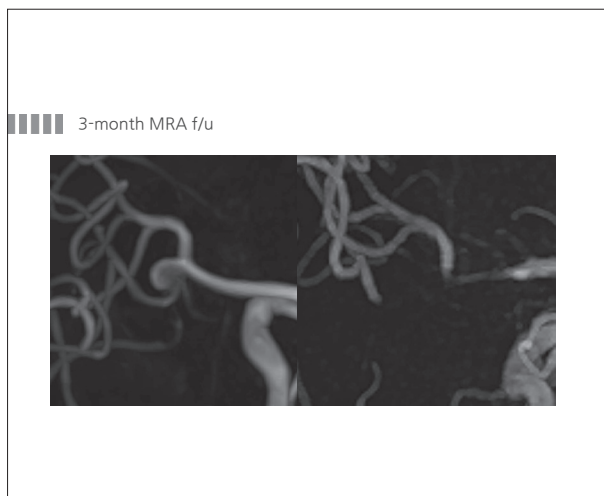
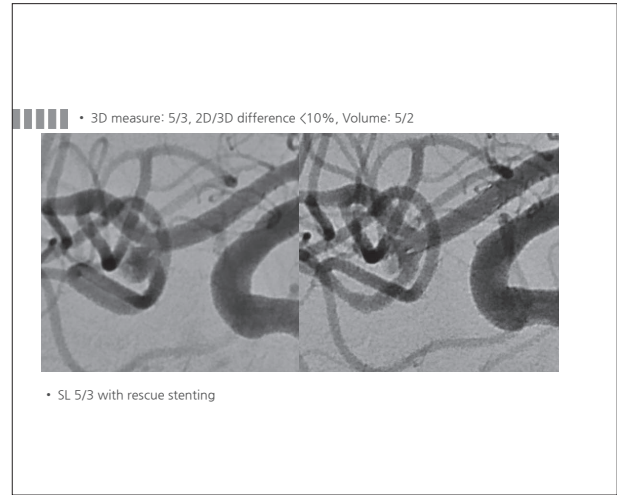
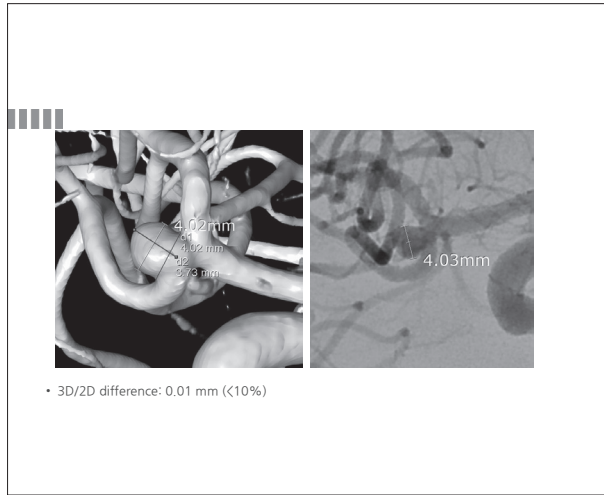
Case 4 F/60 Rt. ICAB

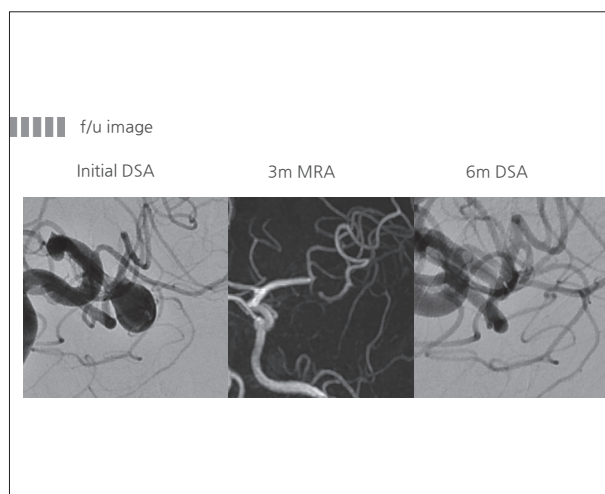
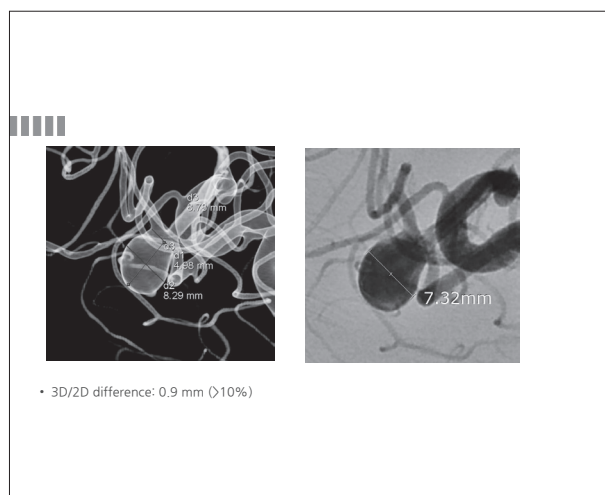
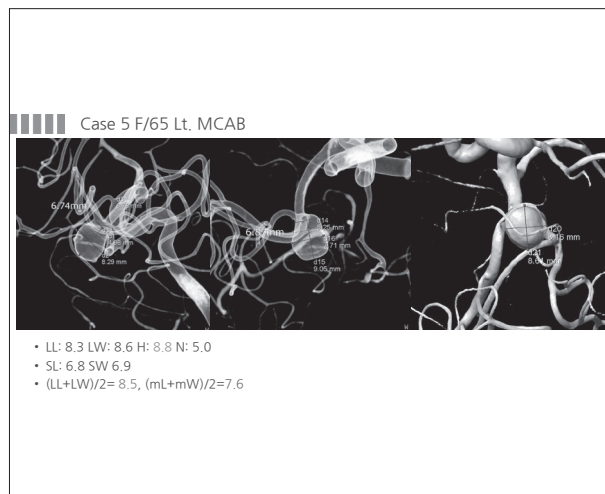


- LL: 5.7 LW: 6.8 H: 5.4 N: 5.4
- SL: 5.3 SW 5.9
- $(LL+LW)/2 = 6.3, (mL+mW)/2 = 5.9$

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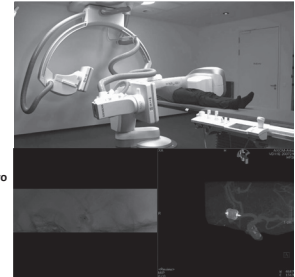
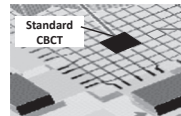




Checking post-procedural distal vessel patency and wall apposition of device

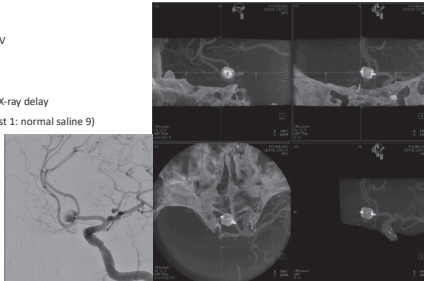
Cone-Beam CT(CBCT) imaging on WEB device- Syngo DynaCT micro

- Cone-Beam CT(CBCT) imaging
 - 16bit acquisition and reconstruction 3D imaging delivers to better spatial resolution and contrast.
- Syngo DynaCT micro
 - Using each detector pixel to increase spatial resolution

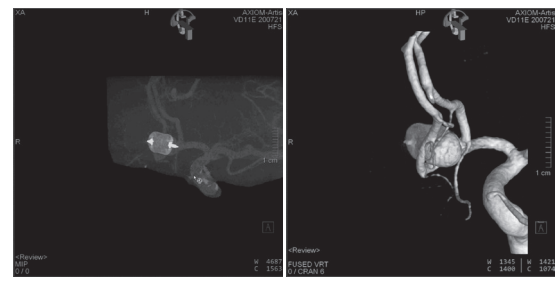


Cone-Beam CT(CBCT) imaging on WEB device- Syngo DynaCT micro

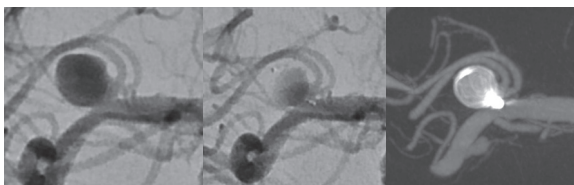
- Acquisition Setting
 - Protocol : 20sDCT Head 70kV
 - zoomed FOV : 22cm
 - Injection Flow rate : 2ml/s
 - Injection Delay time : 2sec, X-ray delay
 - Total Volume : 44ml (contrast 1: normal saline 9)



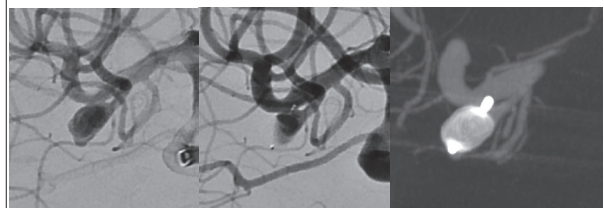
Cone-Beam CT(CBCT) imaging on WEB device- Syngo DynaCT micro



F/53, Rt. MCAB, SL 7/2

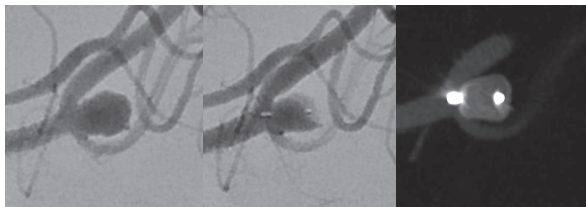


F/53, Rt. MCAB, SL 7/2

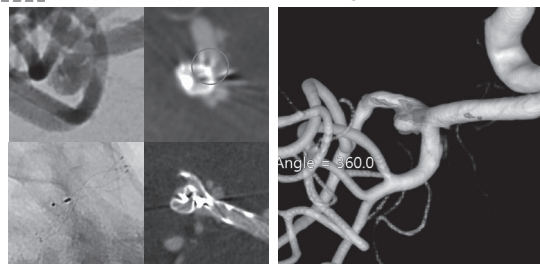


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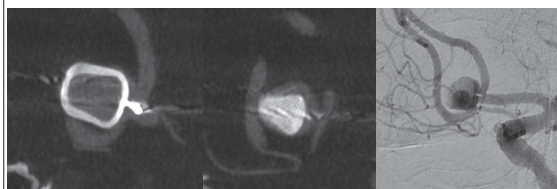
||||| M/53, Rt. MCAB, SL 4.5/3



||||| F/69, Rt. MCAB, SL 5/3, rescue stenting



||||| Inappropriate wall apposition



||||| Conclusion

- Use detailed size measuring method, esp. in case of complex shaped aneurysm
- Always consider blurring effect of 3D image. Compare 3D/2D size difference. One step size down when difference >10%
- Consider aneurysm volume in web size selection
- Use DynaCT post-operatively for evaluation of wall apposition and distal vessel patency

|||||

Thank
you

Contact:
nsdyc0501@gmail.com

PETRA-MRA as a follow-up imaging modality for intracranial aneurysms treated with WEB device

김정재

연세대 세브란스병원

Woven EndoBridge (WEB; Microvention, Aliso Viejo, California, USA) device has been introduced to treat wide-necked bifurcation aneurysms (WNBAs). In Korea, the device was approved by the Ministry of Food and Drug Safety and has been utilized since 2021. The previous study reported long-term adequate occlusion of intracranial aneurysms in 79.1~84.1% at 12 months.

The majority of outcome assessments in previous WEB studies to date have been performed with cerebral angiography. Some studies have suggested that MR TOF or CE-MRA may be useful for outcome assessment, but cerebral angiography remains mandatory to detect inadequate occlusion. Pointwise encoding time reduction with radial acquisition subtraction-based MRA (PETRA-MRA; Siemens Healthcare, Erlangen, Germany) was introduced to reduce metallic artifacts. With Ultra-short echo time (TE), PETRA-MRA has been reported to be useful to evaluate after microsurgical clipping or endovascular treatment of intracranial aneurysms.

In this presentation, the authors will discuss the potential usefulness of PETRA-MRA for evaluating intracranial aneurysms treated with WEB devices. Additionally, we will summarize single institutional experiences and mid- and long-term outcomes of WEB.

[Reference]

Arthur AS, Molyneux A, Coon AL, et al. The safety and effectiveness of the Woven EndoBridge (WEB) system for the treatment of wide-necked bifurcation aneurysms: final 12-month results of the pivotal WEB Intracranial Therapy (WEB-IT) Study. *J Neurointerv Surg* 2019;11:924–30.

Pierot L, Moret J, Barreau X, et al. Safety and efficacy of aneurysm treatment with web in the cumulative population of three prospective, multicenter series. *J Neurointerv Surg* 2018;10:553–9

Mine B, Tancredi I, Alijishi A et al. Follow-up intracranial aneurysms treated by a WEB flow disrupter: a comparative study of DSA and contrast-enhanced MR angiography. *J Neurointerv Surg* 2016;8:615–620.

Heo YJ, Kim D, Jeong HW et al. Usefulness of Pointwise Encoding Time Reduction with Radial Acquisition-Magnetic Resonance Angiography after Endovascular Treatment for Intracranial Aneurysms. *Interv Neuroradiol* 2023;29:20–29.

The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

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대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



KoNES 방사선사/간호사 연수교육

Session I. Basics of Anatomy & Devices

6월 22일(토) 08:30-09:30

Angiography: basic setting and anatomy

신동성

순천향대 부천병원

Basic devices for procedures

김소연

가톨릭관동대 국제성모병원

가톨릭관동대학교 국제성모병원
CATOLIC CHANGDONG UNIVERSITY INTERNATIONAL ST. MARY'S HOSPITAL

Angiographic devices

- Basic devices for procedures

국제성모병원
김소연



목차

1. Sheath
2. Guiding catheter
3. Angio catheter
4. Guidewire
5. Intermediate catheter
6. Aspiration catheter
7. Microcatheter
8. Microwire

1. Basic Concepts

Unit

- **Outer Diameter(OD): French system (Fr)**
 - **Inner Diameter(ID): Inches (inch/")**
 - 3 Fr = 1 mm
 - 1 Fr = 0.33 mm
- 1 mm = 3 Fr = 0.0394 inch = 19 G**
- **5 Fr diagnostic catheter (100cm length)**
 - 0.066 inch outer diameter (1.65 mm/5Fr)
 - 0.038 ~ 0.45 inch inner diameter (0.97 ~ 1.2 mm)
 - **Guidewire: 0.035 inch (0.89mm) angled tip wire, 150 cm length**

french	mm	in	french	mm	in
3	1	0.039	12	4	0.158
4	1.35	0.053	13	4.3	0.170
5	1.67	0.066	14	4.7	0.184
6	2	0.079	15	5	0.197
7	2.3	0.092	16	5.3	0.210
8	2.7	0.105	17	5.7	0.223
9	3	0.118	18	6	0.236
10	3.3	0.131	19	6.3	0.249
11	3.7	0.144	20	6.7	0.263

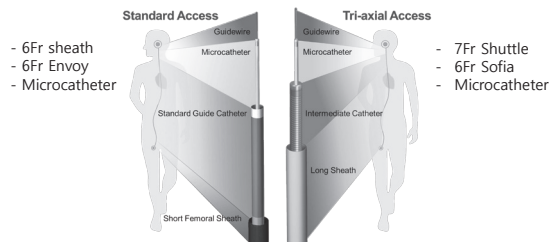
• Aneurysm coiling

	OD	ID
6Fr Guiding	8Fr	0.087"
6Fr Intermediate	084"	070"
10 microcatheter	1.7Fr	017"
014 microwire	014"	

- Guiding 은 ID 개념, 그 외는 OD 개념
- 5Fr Angio catheter

2. Guiding catheter

- Guiding catheter back up force가 제품마다 다르고 또 Fr 에 따라 달라진다
- Co-axial system으로 사용하면 장단점을 보완할 수 있다

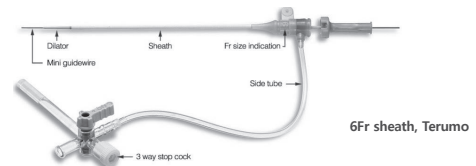


1. Sheath

2. Sheath

1. Regular sheath / Terumo

- Artery로의 접근 용로, flushing line 연결 가능
- Length 10~25cm
- Dilator 포함,
- 구불구불한 혈관부위를 지나 곧은 부위까지 도달할 수 있도록



2. Sheath

	Length (cm)	ID (Fr/mm)	Guidewire length (cm)	Guidewire (Inch)
4 Fr	10	1.45	45	0.035"
5 Fr	10	1.78	45	0.035"
6 Fr	10	2.10	45	0.035"
7 Fr	10	2.45	45	0.035"
8 Fr	10	2.78	45	0.035"
9 Fr	10	3.14	45	0.035"
11 Fr	10	3.82	45	0.035"
5 Fr long	25	1.78	80	0.038"
6 Fr long	25	2.10	80	0.038"
7 Fr long	25	2.45	80	0.038"
8 Fr long	25	2.78	80	0.038"
9 Fr long	25	3.14	80	0.038"

2. Sheath

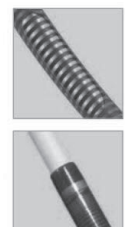
2. Flexor® Shuttle Guiding Sheath / Cook

- Sheath + Guiding catheter 동시 기능
- hydrophilic-coated braided sheath

→ excellent stability during the procedures

Flexor® Shuttle guiding sheath paired with a specially designed coaxial selective catheter.

	Length (cm)	ID	Dilator OD
6 Fr	90 / 80	2.21mm / 0.087"	0.038"
7 Fr	90 / 80	2.54mm / 0.100"	0.038"
8 Fr	90 / 80	2.87mm/0.113"	0.038"



Shuttle Guiding Sheath System

FLEXOR SHUTTLE

G30009	KSAW-5.0-18/38-90-RB-SHTL-HC
G13539	KSAW-6.0-38-80-RB-SHTL-HC
G13264	KSAW-6.0-38-90-RB-SHTL-HC
G13338	KSAW-7.0-38-80-RB-SHTL-HC
G12835	KSAW-7.0-38-90-RB-SHTL-HC
G12836	KSAW-8.0-38-90-RB-SHTL-HC

FLEXOR SHUTTLE SELECT

G31133	KSAW-5.0-38-90-RB-SHTL-FLEX-HC
G31138	KSAW-6.0-38-90-RB-SHTL-FLEX-HC

Flexor® Shuttle Select guiding sheath:

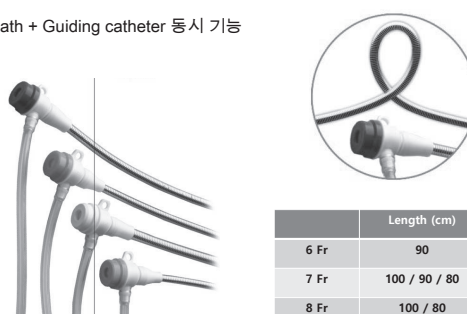
- Softer Distal Tip
- Stiffer Proximal Shaft



2. Sheath

3. Arrow-Flex® Sheath Introducer / Teleflex

- Sheath + Guiding catheter 동시 기능



	Length (cm)
6 Fr	90
7 Fr	100 / 90 / 80
8 Fr	100 / 80

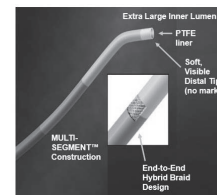


2. Guiding catheter

2. Guiding catheter

1. Envoy / Cerenovous

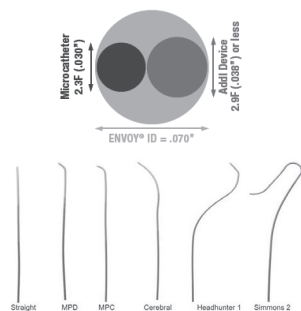
- **Soft atraumatic tip section**
 - Braid-free soft tip
- **Large ID**
 - Improved injections, ability to road map
 - Accommodates variety of interventional devices
- **Lubricious PTFE inner liner**
 - Enhances mobility of devices
- **Radiopaque shaft**
 - Provides visibility of body and tip
- **Four segment construction**
 - Varies firmness and flexibility from hub (stiffest) to tip (softest)



	OD	ID	Length
Envoy 5F	5F	0.056"	90/100 CM
Envoy 6F	6F	0.070"	90/100 CM
Envoy 7F	7F	0.078"	90/100 CM

2. Guiding catheter

1. Envoy / Cerenovous



- 5Fr Envoy : single microcatheter but difficult DSA
- 6Fr Envoy : double catheter
- 7Fr Envoy : balloon catheter

	OD	ID	Length
Envoy 5F	5F	0.056"	90/100 CM
Envoy 6F	6F	0.070"	90/100 CM
Envoy 7F	7F	0.078"	90/100 CM

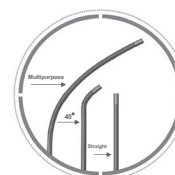
2. Guiding catheter

2. Guider Softip™ XF Guide Catheter / Stryker

- The Boston Scientific Guider Softip® XF Guide Catheters are intended to facilitate the placement of interventional devices into the neurovascular system.

Designed for support

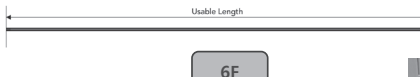
- Braided multi-durometer shaft for **proximal support** with **distal flexibility**
- **Atraumatic soft tip** available in three configurations



	Guider soft tip
Outer Diameter (F)	5,6,7,8
Inner Diameter (in)	.053/.064/.073/.086
Usable length (cm)	90,100
Tip shape	Straight 40° MP

2. Guiding catheter

3. Fubuki Guiding catheter / Asahi



ASAHI FUBUKI	Tip Shape	Hydrophilic Coating	Inner Diameter	Outer Diameter	Usable Length
6Fr GC	Straight	50mm	2.28mm (0.090")	2.70mm (6Fr)	80cm, 90cm

ASAHI FUBUKI	Tip Shape	Hydrophilic Coating	Inner Diameter	Outer Diameter	Usable Length
6Fr	Angle	150mm	1.80mm (0.071")	2.09mm (6Fr)	90cm, 100cm
7Fr	Angle	150mm	2.05mm (0.081")	2.40mm (7Fr)	90cm, 100cm

sheath 개념- guiding catheter 사용이 어려움



2. Guiding catheter

4. Chaperon Guiding catheter / Microvention



Guiding Catheter 5F (ID: 0.059") / 6F (ID: 0.071")

Length 95cm

Distal Flexible Length 7cm

Size	ID	Catheter Length	Distal Flexible Length	Distal Tip Shape
5F (1.73mm)	0.059" (1.50mm)	95cm	7cm	STR/MP1/MP2/BUR
6F (2.06mm)	0.071" (1.80mm)	95cm	7cm	STR/MP1/MP2/BUR

Key Feature	Supportive Function	Key Benefit
Soft Inner Catheter with Terumo Glide Technology	Soft atraumatic distal shaft contains no braiding Hydrophilic coating distal in 15 cm Thin PTFE inner layer	Improved vessel access safety and superior trackability
Largest ID of 0.071" for 6F, 0.059" for 5F		Enhanced work space for parallel use of Balloon and Microcatheter with less friction (6F)
Unique Shaft Materials	Polyester outer layer	Sustainable device supportability with lower water absorption rate
High Rigidity Stainless Flat Braid	Appropriately controlled metal composition to the plastic materials	Optimized torque control and high kink resistance

2. Guiding catheter

5. FLOWGATE Balloon Guiding Catheter / Stryker

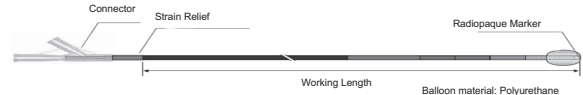


FlowGate2 8F	
OD	8Fr
ID	0.084"
Tip length	2.5 mm
Effective length	85, 95 cm
Balloon length	10 mm

DESIGN FEATURE	INTENDED DESIGN BENEFIT	INTENDED CLINICAL BENEFIT
Inner Shaft	Flexibility profile	Optimal distal flexibility affects deliverability and stability in the vessel
	Bonded to the inner shaft and hub to create the coaxial lumen; outer blend of materials provides optimal proximal stability	Coaxial lumen allows for reliable inflation and deflation Optimal proximal stability affects pushability and stability in the vessel
Outer Jacket		
Compliant Balloon	Conforms to the vessel when inflated	Proximal flow control = less distal emboli during clot retrieval

2. Guiding catheter

6. Optimo Balloon Guiding Catheter



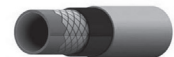
- Tip less Design in Balloon Dilatation
- Largest Inner Lumen in same category
- Balloon material made of Polyurethane
- Shaft transition design for good conformability
- Optimized balloon deflation time

O/D	I/D	CM
9Fr	0.093inch	90cm
8Fr	0.085inch	95cm
8Fr	0.085inch	90cm



3. Angio catheter

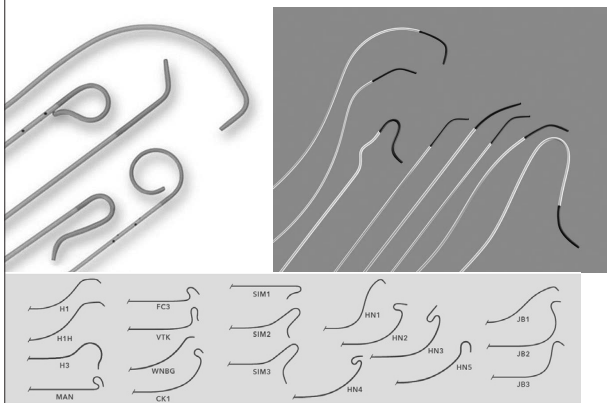
3. Angio catheter



- Diagnostic DSA; Headhunter 5Fr
- Polyamide surface: flow, smoothness and superior safety
- Internal metallic mesh braid → excellent torque control
- Tungsten layering in the distal catheter segment(no braid) → radiopaque
- Soft and non-traumatic catheter
- Optimal performance
 - Outer jacket: strength, support kink resistance, flexibility
 - Stainless steel: 1:1 Torque, kink resistance
 - Inner Liner/coating: large lumen, lubricious material device compatibility

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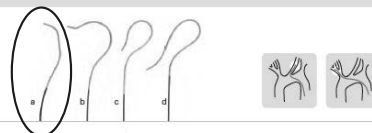
3. Angio catheter



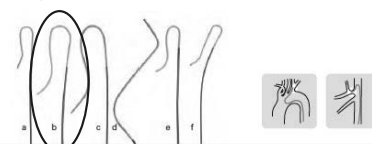
3. Angio catheter

Diagnostic Peripheral Catheter Shapes

- a. HEADHUNTER 1
- b. HEADHUNTER 3
- c. HEADHUNTER 5
- d. HEADHUNTER 6

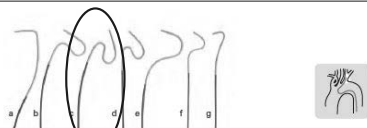


- a. SIMMONS 1
- b. SIMMONS 2
- c. SIMMONS 3
- d. SIMMONS 4
- e. MODIFIED SIMMONS 1.5
- f. MODIFIED SIMMONS

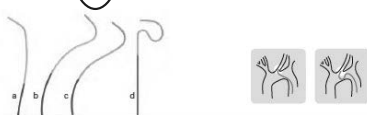


3. Angio catheter

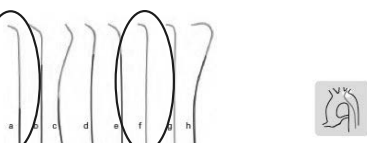
- a. NEWTON 1
- b. NEWTON 2
- c. NEWTON 3
- d. NEWTON 4
- e. NEWTON 5
- f. OSBORN 1
- g. OSBORN 2



- a. BENTSON 1
- b. BENTSON 2
- c. BENTSON 3
- d. MANI



- a. BERENSTEIN
- b. VERTEBRAL
- c. MODIFIED CEREBRAL
- d. MW2
- e. MODIFIED MW2
- f. DVS A1
- g. DVS A2
- h. HOCKEY STICK



3. Angio catheter

1. Head Hunter

- 일반적 diagnostic angio시 사용

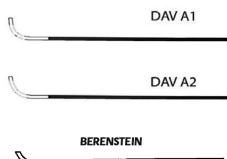
	Length(cm)	ID	Recommended Guide wire
4 Fr	100, 125	0.041"	0.035"
5 Fr	100, 125	0.046"	0.035"



3. Angio catheter

2. Davis/Berenstein

- 일반적 diagnostic angio시 사용
- 끝만 구부러져 있어 CCA, Lt VA가 심하게 angulation 된 경우 혈관 기시부에 걸쳐 놓고 사용



	Length(cm)	ID
4 Fr	100, 120	0.042"
5 Fr	100, 120	0.046"
6 Fr	100, 120	0.054"

3. Angio catheter

3. Simmons

- Acute angle의 brachiocephalic trunk, Lt CCA selection 시 유용함
- Lt subclavian artery selection 후 shaping 하여 사용
- Stiff wire 같이 사용



	Length(cm)	ID
4 Fr	100, 120	0.042"
5 Fr	100, 120	0.046"
6 Fr	100, 120	0.054"

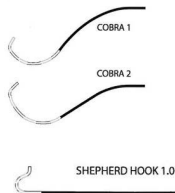
3. Angio catheter

4. HS1/Cobra/Shepherd hook

- Distal angulation으로 spinal angio시 유용
- Intercostal artery selection



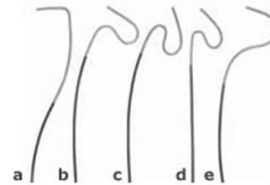
HS1



3. Angio catheter

5. Newton

- Old age 환자에서 Lt CCA angulation 이 심할 경득

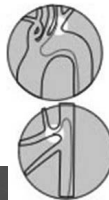


	Length(cm)	ID
4 Fr	100, 120	0.042"
5 Fr	100, 120	0.046"
6 Fr	100, 120	0.054"

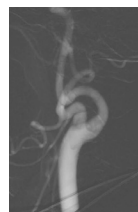
3. Angio catheter

6. VTK

- Cervical ICA 가 많이 tortuous 하여 catheter 유지가 어려운 경우
- Lt CCA selection 시도 유용



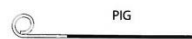
	Length(cm)	ID
4 Fr	100, 120	0.042"
5 Fr	100, 120	0.046"
6 Fr	100, 120	0.054"



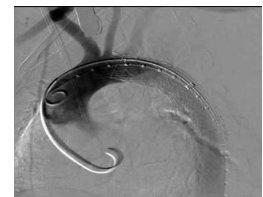
3. Angio catheter

7. Pigtail

- Great vessel anatomy를 보기 위한 aortogram 시 사용



	Length(cm)	ID
4 Fr	70~120	0.042"
5 Fr	70~125	0.046"
6 Fr	70~125	0.054"



4. Guidewire

- Hydrophilic coating: smooth, rapid movement
- Nitinol or stainless core: resists kinks
- Core: torquability and steerability

	Diameter	Length (cm)	Flexible tip length (cm)
Angled	0.035"/0.89mm	150	3
STIFF angled	0.035"/0.89mm	150	3
Shapeable	0.035"/0.89mm	150	3
Straight	0.035"/0.89mm	150	3
STIFF exchange	0.035"/0.89mm	260	3
Angled exchange	0.035"/0.89mm	260	3

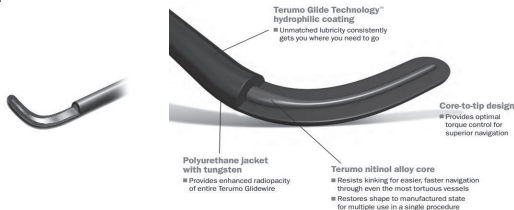
- Stiff
- Shapeable
- Exchange

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4. Guidewire

1. Radifocus® Guide Wire / Terumo

- Highly flexible, tapered tip for atraumatic and controlled navigation through vessels
- M Coat hydrophilic coating for low friction endovascular steerability and trackability
- Radiopaque polyurethane jacket for good fluoroscopic visibility and controlled navigation
- One-piece construction with one-to-one torque transmission for predictable navigation
- Rounded, atraumatic tip for the prevention of vessel trauma and low friction guidewire insertion



4. Guidewire

2. Roadrunner UniGlide / Cook

- Hydrophilic guide wire



Features	Benefits
Nitinol core	Kink resistance and elasticity
Hydrophilic coating	Lubricity, durability and quality
Radiopaque polymer jacket	Visibility
Construction	Torque control and trackability
Free torque device	Convenience and cost savings
Wire inserter	Ease of use



5. Intermediate catheter

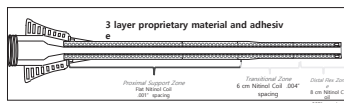
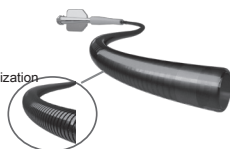
5. Intermediate catheter

- Guiding catheter와 microcatheter 사이의 유격을 줄여 주고 microcatheter를 좀 더 distal까지 delivery 하기 용이하도록 도움
- For further delivery & better control
- Guiding catheter와의 병용사용만 인정
 - Intermediate catheter 2개 사용 불가
- Intermediate guiding catheter는 intermediate catheter 추가 사용 불가

5. Intermediate catheter

1. Navien / Medtronic

- More kink resistance
- 5f-0.058 Lowest ovalization rates
- 6f-0.072 Increased flow rates for better visualization from better contrast injections
- Increased aspiration rates
- More device compatibility/flexibility

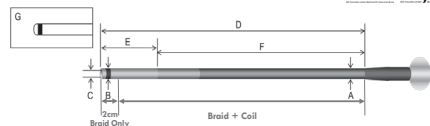


Product Catalog Number	Maximum Outer Diameter (F/in)	Inner Diameter (in)	Length (cm)	Tip Shape	Max Wire Compatibility (in)	Flexible Distal Length (cm)
RFK058-115-08	5 / 0.070	0.058	115	Straight	0.038	8
RFK058-125-08	5 / 0.070	0.058	125	Straight	0.038	8
RFK058-130-08	5 / 0.070	0.058	130	Straight	0.038	8
RFK072-105-08MP	6 / 0.084	0.072	105	Multi-Purpose 25°	0.038	8
RFK072-115-08MP	6 / 0.084	0.072	115	Multi-Purpose 25°	0.038	8

5. Intermediate catheter

2. Sofia / Microvention

Sofia = Sofia PLUS



Sofia
 Sofia PLUS

Name	Catheter Size (French)	A Proximal OD (inch/mm)	B Distal OD (inch/mm)	C ID (inch)	D Working Length (cm)	E Distal Length (cm)	F Proximal Length (cm)	G Distal Tip Shape
Sofia DAC	5	0.068/1.7	0.067/1.7	0.055	115	17	98	Straight
Sofia DAC	5	0.068/1.7	0.067/1.7	0.055	125	17	108	Straight
Sofia DAC	6	0.0835/2.1	0.0815/2.1	0.070	115	17	98	Straight
Sofia PLUS	6	0.0835/2.1	0.0815/2.1	0.070	125	19	106	Straight

5. Intermediate catheter

3. Catalyst 5 - Stryker - Catalyst 6

Designed for Distal Support and Smooth Navigation

	ACS Catalyst 5	ACS Catalyst 6
Outer diameter proximal/distal (F)	5.6/5.3	6.0/5.4
Outer diameter proximal (in)	0.073	0.079
Outer diameter distal (in)	0.058	0.060
Usable length (cm)	115	132
Tip Shape	Straight	Straight
Minimum guide catheter sheath clearance	0.078 in	0.084 in
Transition zones	13	16

Stroke Catheter - Optimized for Trevo

Proximal Support	Smooth Force Transmission	Distal Flexibility
The key to responsive pushability & control	Enables smooth force transmission	Access more distal tortuosity
Stainless steel tight pitch coil	12 transitions	16 transitions
Thick walled, high diameter shaft	Outer jacket diameter	Outer jacket diameter
	Catalytic	Catalytic

5. Intermediate catheter

4. Envoy DA, DAXB / Cerenovus(Intermediate Guiding)

- Distal Segment Flexibility
 - 8 cm의 Flexible distal segment
- Soft Distal Tip
 - Braid-free distal tip with excellent fluoroscopic visibility
- Large .071" Lumen Diameter
- End-to-End Braided Construction
 - support 증가

Distal Access G/C	OD	ID	Length	Distal soft segment	Shape
Envoy DA	6F	0.071"	95/105 CM	8CM	STR/M PD
Envoy DA XB	6F	0.071"	95/105 CM	8CM	STR/M PD

5. Intermediate catheter

5. Penumbra Neuron Max 088(Intermediate Guiding)

Neuron MAX 088 | 80 / 90 / 100 cm

Neuron MAX 088 vs. Cook® Shuttle®

Measuring Distal Flexibility

- 3x softer than Cook® Shuttle®
- 9x softer than Terumo® Destination®

Optimal Proximal Support

- 75% more proximal support than Cook® Shuttle®

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CKU

6. Aspiration catheter

6. Aspiration catheter

- 최근 large bore aspiration catheter가 많이 출시되고 있어 IA thrombectomy 시 Direct Aspiration(ADAPT)을 많이 하고 있음
- distal은 soft 하고 향상된 trackability를 보임

6. Aspiration catheter

1. Penumbra ACE 68(Reperfusion)

Ultimate Tracking: Advancements from Hub to Tip

Ultimate Tracking: Advancements from Hub to Tip

- Unique coil winding geometry
 - Advances pushability for navigation while maintaining kink resistance
- 16 transitions
 - Enables smooth force transmission and minimizes kinking
- Optimized PTFE liner
 - Increases shaft flexibility

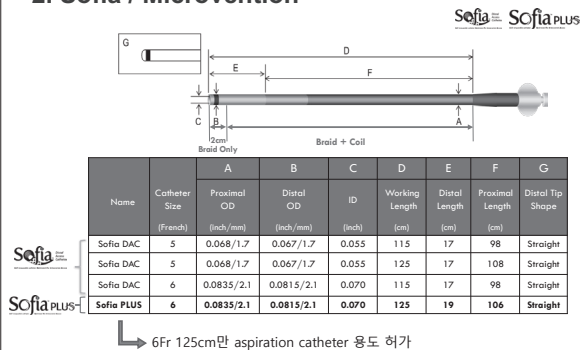
Ultimate Tracking: Advancements from Hub to Tip

- Extended flexible distal shaft
 - Allows improved tracking through tortuosity
- Construction resistant to compressive pressure
 - Maintains lumen integrity and reduces risk of collapse under aspiration
- Large .068" lumen
 - Optimizes clot engagement and maximizes aspiration
- Beveled tip
 - Improves navigation

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6. Aspiration catheter

2. Sofia / Microvention



6. Aspiration catheter

2. React 68, 71 / Medtronic

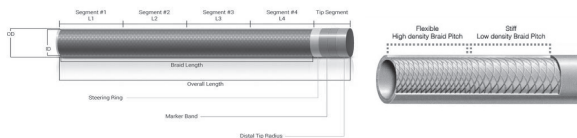
- React 68- 8F BGC compatibility (.084")**
 - Soft atraumatic beveled tip
 - End to End nitinol construction
 - Coil and braid reinforcement
 - Navigability of a coil, Pushability of a nitinol
- React 71- Larger ID, Increased suction efficacy, Improved distal flexibility**
 - Same features with React 68.
 - 9F Guiding compatibility (.087")
 - Distal TPE Material to increase the flexibility

Product	ID	OD	Working length
React 68	.068"	.083"	132cm
React 71	.071"	.085"	132cm



7. Microcatheter

- Hydrophilic coating
- Polyethylen, polyamide, polyurethane, polyester, silicone, teflon
- Braiding(stainless steel, nitinol, platinum) - kinking 과 굴곡이 심한 혈관을 지나갈 때 카테터의 내경이 좁아지는 문제를 방지, pushability 유지 역할



7. Microcatheter

1. Excelsior microcatheter family / Stryker

Feature	Intended Benefit
Steam-shapeable distal tip	Enhances vessel selectivity and helps maintain position in aneurysm during coil delivery
PTFE lined inner lumen	Enhances manipulation of devices within the Microcatheter
Kink resistant shaft construction	Designed to provide excellent kink resistance for challenging anatomy
Ultra-lubricious hydrophilic coating	Facilitates advancement and negotiation through challenging anatomy
Precisely placed radiopaque markerbands	Facilitates proper Target®, Matrix® and GDC® coil detachment
Transparent hub	Allows direct visualization of coil and guidewire introduction



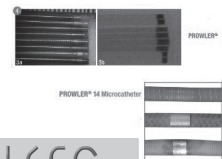
	Excelsior 1018	Excelsior SL-10	Excelsior XT-17
Outer diameter proximal/distal (F)	2.6/2.0	2.4/1.7	2.4/1.7
Inner diameter proximal/distal (F)	0.019	0.0165	0.017
Usable length (cm)	150	150	150
Distal Flexibility (cm)	6	6	7.5
Number of RO markers	1 or 2	1 or 2	2
Tip Shapes	45°, 90°, J.S.C., Straight	45°, 90°, J.S.C., Straight	45°, 90°, J., Straight

	Excelsior XT-27
Outer diameter proximal/distal (F)	2.9/2.7
Inner diameter (in)	0.027
Usable length (cm)	135, 150
Distal Flexibility (cm)	6
Number of RO markers	18
Number of RO markers	1

7. Microcatheter

2. Prowler / Cerenovus

- Braid+Coil construction
 - Proximal Support와 Distal Flexibility
- Accurate tip position
- Widest choice
 - 0.015", 0.0165", 0.021" & 4 pre-shaped tips
- Truelumen Technology
 - In-line Marker로 타사제품 대비 Marker 부분에서도 ID가 변형없이 동일



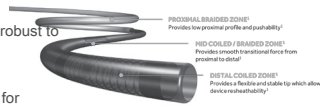
Microcatheter	OD (Proximal/Distal)	ID	Length	Distal Length
Prowler 10	2.3F/1.7F	0.015"	150cm	50cm
Prowler 14	2.3F/1.9F	0.0165"	150cm	50cm
Prowler Select LP-ES	2.3F/1.9F	0.0165"	150cm	5cm
Prowler Plus	2.8F/2.3F	0.021"	150cm	20cm
Prowler Select Plus	2.8F/2.3F	0.021"	150cm	5cm



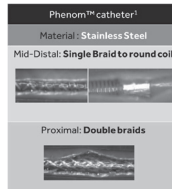
7. Microcatheter

3. Phenom / Medtronic

- 3 Performance zones with progressive flexibility
- A proximal microcatheter Stable and robust to a tip flexible and control.
- With a large ID & small proximal OD.
- Phenom27 engineered to be durable for device delivery & recapturing.



	CATHETER ID	PROXIMAL OD	DISTAL OD	TIP SHAPE	Length
Phenom™ 17	0.017"(0.43mm)	0.029"(2.2F)	0.024"(1.8F)	STRAIGHT	150cm
				J CURVE	150cm
				45° CURVE	150cm
Phenom™ 21	0.021"(0.69mm)	0.034"(2.6F)	0.030"(2.3F)	STRAIGHT	160cm
				90° CURVE	150cm
Phenom™ 27	0.027"(0.69mm)	0.040"(3.1F)	0.036"(2.8F)	STRAIGHT	150cm
				STRAIGHT	160cm



7. Microcatheter

4. Rebar / Medtronic

- The REBAR™ REINFORCED MICRO CATHETERS are designed to deliver a wide variety of pharmacologic, diagnostic and therapeutic agents, including detachable coils and the Onyx™ liquid embolic system.



REBAR™ 18 REINFORCED MICRO CATHETER				
Product Catalog Number	Outer Diameter (F)	Inner Diameter (F)	Usable Length (cm)	Max. Guidewire (F)
105-5083-153	2.7-2.4	.021	153	0.018

REBAR™ 27 REINFORCED MICRO CATHETER				
Product Catalog Number	Outer Diameter (F)	Inner Diameter (F)	Usable Length (cm)	Max. Guidewire (F)
105-5082-130	2.8-2.8	.027	130-145	0.021

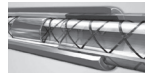
[MDT Confidential]

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7. Microcatheter

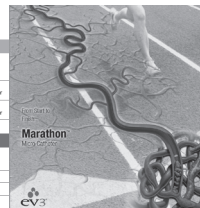
5. Marathon / Apollo / Medtronic

- MARATHON™ - for Onyx™ delivery
- APOLLO™ - Marathon™ 에 detachable tip version



APOLLO™ ONYX™ DELIVERY MICRO CATHETER									
Product Catalog Number	Proximal Outer Diameter (F)	Distal Outer Diameter (F)	Inner Diameter (F)	Total Length (cm)	Tip Length (cm)	Tip Shape	Wire Configuration (cm)	Maximum Guidewire (F)	
105-5095-000	2.7 / 0.056	1.5 / 0.020	0.015	165	1.5	Straight	0.028 & 0.010 Polyethylene	0.023	± 0.20 (20) adaptor
105-5096-000	2.7 / 0.056	1.5 / 0.020	0.015	165	3.0	Straight	0.028 & 0.010 Polyethylene	0.023	± 0.20 (20) adaptor

MARATHON™ FLOW DIRECTED MICRO CATHETER						
Product Catalog Number	Style	Outer Diameter (F)	Inner Diameter (F)	Usable Length (cm)	Distal Length (cm)	Max. Guidewire (F)
105-5095	With	2.7-1.5	.015-.013	165	25	0.020
105-5096	Without	2.7-1.5	.015-.013	165	25	0.020



7. Microcatheter

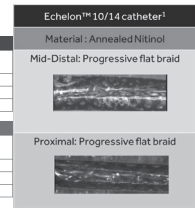
6. Echelon / Medtronic

- Better proximal pushability, stability and support
- Shape retention
- Kink resistance and less ovalization
- Fatigue resistance
- Softness via graduated zones and transition point



ECHELON™ 10 MICRO CATHETER					
Product Catalog Number	Outer Diameter (F)	Inner Diameter (F)	Usable Length (cm)	Max. Guidewire (F)	Tip Configuration
105-5091-150	2.3-1.7	.017	150	0.014	STRAIGHT
145-5091-150	2.3-1.7	.017	150	0.014	45°
190-5091-150	2.3-1.7	.017	150	0.014	90°

ECHELON™ 14 MICRO CATHETER					
Product Catalog Number	Outer Diameter (F)	Inner Diameter (F)	Usable Length (cm)	Max. Guidewire (F)	Tip Configuration
105-5092-150	2.4-1.9	.017	150	0.014	STRAIGHT
145-5092-150	2.4-1.9	.017	150	0.014	45°
190-5092-150	2.4-1.9	.017	150	0.014	90°

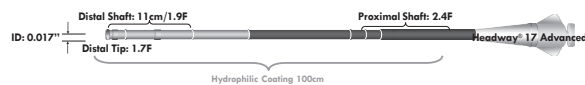


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7. Microcatheter

7. Headway family / Microvention



Product	Tip Markers	Strain Relief	Shape	Usable Length (cm)	OD Proximal / Distal (F)	ID (inch)
Headway17	2	Dark Green	STR	150	2.4 / 1.7	0.017
Headway27	2	Dark Green	STR	156	3.1 / 2.6	0.027

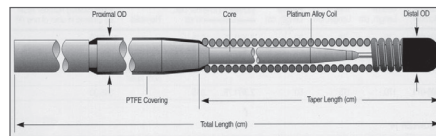
Product	ID (inch)	Distal Length	Total Length	Hydrophilic Coating Length	Entry OD	Distal OD	Proximal OD	Distal Tip Shape	Tip Markers
Headway21	0.021"	15cm	150cm	100cm	2.0F	2.2F	2.5F	STR	2



Headway DUO	1.6F / 156cm	1.3F / 167cm
Proximal / Distal OD	2.1F / 1.6F	2.1F / 1.3F
Proximal / Distal ID	0.0165" / 0.0165"	0.0165" / 0.013"
Guidewires Compatibility	0.014" and smaller	0.014" / 0.012" and smaller
Distal Tip End	No Taper	Tapered
Distal Progressively Soft Length	30cm	30cm
Total Length	Longest length of any coil compatible catheter 156cm	Longer liquid embolic delivery catheter length 167cm
Markers	2	1
Delivery Compatibility: Liquid Embolics / Coils		
DMSO Compatible	Yes	Yes
Dead Space	0.34cc	0.35cc
Burst Pressure	700psi	700psi

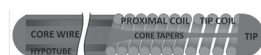


8. Microwire



Core: Platinum, Tungsten, stainless steel

Torque control
Tip shape and retention
Tapered core; length of transition
Length of distal floppy segment



8. Microwire

1. Transend & Synchro family

Transend® Guidewire:

- Features Sotanium™ Alloy
- Corewire construction designed for enhanced torque transmission and distal support

Synchro® Guidewire:

- Employs a microfabricated nitinol hypotube technology with a pattern of machined slots; Variations in the slot profiles determines the support and flexibility characteristics of the distal segment



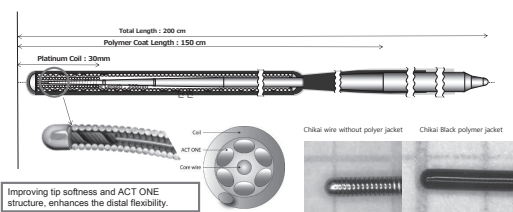
Synchro Access Transformed

- Designed for **Torque Control**
- Intended for reliable **Stability and Flexibility**

	Synchro 10	Synchro 14	Synchro ²	Synchro ² Support	Synchro SELECT
Wire diameter proximal/distal (F)	0.012/0.010	0.014/0.014	0.014/0.014	0.014/0.014	0.014/0.014
Length (cm)	200, 300	200, 300	200, 300	215, 300	215, 300
Core Material	Microfabricated nitinol hypotube, stainless steel core	Microfabricated nitinol hypotube, stainless steel core	Microfabricated nitinol hypotube, stainless steel core	Microfabricated nitinol hypotube, stainless steel core	Microfabricated nitinol hypotube, stainless steel core
Flexibility options		Standard	Standard Soft	Support	Standard
Shape options	Shapeable tip	Shapeable tip	Straight Pre-shaped	Straight Pre-shaped	Straight Pre-shaped

8. Microwire

2. Chikai black / Asahi



Improving tip softness and ACT ONE structure, enhances the distal flexibility.

	Usable length	Distal/Proximal OD	Polymer Jacket Length	특징
CHIKAI Black 14 soft tip	200cm	0.014" (0.36mm)	150cm	Polymer Jacket type
CHIKAI wire	200cm	0.014" (0.36mm)	None	Bare coil type

8. Microwire

3. Agility & Neuroscout / Cerenovus

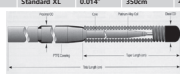
Agility

- Soft Tip : Safe navigation, min. risk rupture
- Shapeable Tip : Vessel access
- Flexible Lateral Profile : Vessel conformability
- MICROSPRING™ Ring : Torque response
- Platinum/Tungsten Coil : Radiopacity

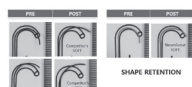
Neuroscout

- Good Shapeability : procedural flexibility
- Tip Re-shapeability : re-shaping without wire kinking
- Tip Shape Retention : minimize shape loss over time

Guidewire	Description	OD	Length	Tapered Length
Agility 10	Standard	0.010"	195cm	36cm
	Soft	0.010"	195cm	38cm
Agility 14	Standard	0.014"	205cm	42cm
	Soft	0.014"	205cm	45cm
Standard XL	Standard	0.014"	330cm	42cm
	Soft	0.014"	330cm	45cm

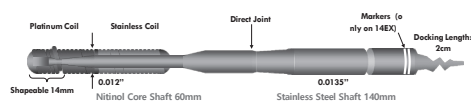


Guidewire	Description	OD	Length	Tapered Length
Neuroscout 14	Standard	0.014"	205cm	42cm
	Soft	0.014"	205cm	45cm



8. Microwire

4. Traxcess / Microvention



Product	Total Length	Nitinol Core Length	Stainless Core Length	Platinum Coil Length	Stainless Coil Length	Shapeable Length	Hydrophilic Coating Length	Proximal Diameter	Distal Diameter	PTFE Coating
Traxcess 14	200cm	60cm	140cm	3cm	37cm	1.4cm	40cm	0.014"	0.012"	133cm
Traxcess 14E X	200cm	60cm	140cm	6cm	34cm	1.4cm	40cm	0.014"	0.012"	133cm

감사합니다



The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



KoNES 방사선사/간호사 연수교육

Session II. Imaging, Medication & Cases

6월 22일(토) 09:40-10:40

Imaging and medication for acute ischemic stroke

심유식
인하대병원

Imaging and Medication for Acute Ischemic Stroke

Yushik Shim

Inha University Hospital

History of AHA/ASA guidelines in AIS

"American Heart Association (AHA)" & "American Stroke Association (ASA)"



Founded in Cleveland
At the city's Colonial Hotel in September 1899, eight hospital superintendents from Michigan, Ohio, and Pennsylvania met to launch a national association for exchanging ideas. Seven years later, it was renamed the American Hospital Association.



"8 times for 23 years"

1992 → 1994 → 1996 → 2003 → 2005 → 2007 → 2013 → 2015

"1992 Guidelines for cardiopulmonary resuscitation and emergency cardiac care, IV: special resuscitation situations Cardiac Care Committees, American Heart Association"

First recommendations

Emergent stroke care

Special resuscitation situations for BLS and ALS



History of AHA/ASA guidelines in AIS

"1994 Guidelines for the Management of Patients With Acute Ischemic Stroke A Statement for Healthcare Professionals From a Special Writing Group of the Stroke Council, American Heart Association"

- 1) Early Recognition (Public, Nonphysician, Physicians)
 - 2) Emergent Supportive Care and Treatment of Acute Complication
 - 3) Treatment of Acute Neurological Complications
 - 4) General Early Supportive Care
- Acute Treatment With Antithrombotic or Antiplatelet-Aggregating Drugs
Thrombolytic Therapy
Surgical Interventions

Modality	Recommendation	Evidence
Thrombolytics	Not recommended	Hemorrhage
Heparin	No recommendation	Preferences of Dr.
Angioplasty	No recommendation	Preferences of Dr.
Emergent CEA	No recommendation	Preferences of Dr.



History of AHA/ASA guidelines in AIS

"1993-1995 Period of Research for Thrombolytics"

plasminogen $\xrightarrow{\text{Thrombolytics}}$ plasmin
1st ~ 4th generation
tissue PA & Streptokinase



"1995 NINDS, ECASS, MAST-I, MAST-E, ASK"



"1996 Guidelines for Thrombolytic Therapy for Acute Stroke A Supplement to the Guidelines for the Management of Patients With Acute Ischemic Stroke A Statement for Healthcare Professionals From a Special Writing Group of the Stroke Council, American Heart Association"

IA thrombolysis in clinical settings

Iv tPA (0.9mg/kg, maximum 90mg) with 10% of bolus dose followed by and infusion lasting 60 min.
Persons given intravenous r-TPA should not receive aspirin, heparin, warfarin, ticlopidine, or other antithrombotic or antiplatelet aggregating drugs within 24 hours of treatment (Grade A recommendation).

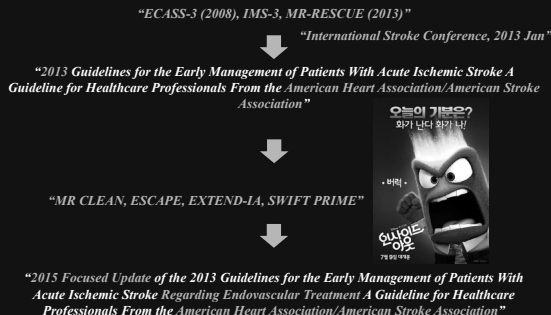


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History of AHA/ASA guidelines in AIS



History of AHA/ASA guidelines in AIS



CT & MR imaging in AIS

- * Patients eligible for intravenous rtPA should receive intravenous rtPA even if endovascular treatments are being considered (Class I; Level of Evidence A)
- * Patients should receive endovascular therapy with a stent retriever if they meet all the following criteria (Class I; Level of Evidence A) (New recommendation)

"A limited role of current stroke imaging for time based iv thrombolysis"

Limitations of CT scan in prediction of complication and outcomes
Expands to identification of candidates for endovascular treatment and extend the time window for treatment

To understand various imaging findings and imaging strategies in acute ischemic stroke

- 1) Infarct Core Assessment
- 2) Assessment of Fluid-Attenuated Inversion Recovery (FLAIR) Imaging
- 3) Thrombus Assessment
- 4) Assessment of Hemorrhagic Transformation
- 5) Imaging Assessment of Cerebral Vascular System
- 6) Imaging Assessment of Penumbra

"The 4 P's"

Goals of Acute Stroke Imaging (CT & MR)

Parenchyma	Pipes
Assess early signs of acute stroke, rule out hemorrhage	Assess extracranial circulation and intracranial circulation for evidence of intravascular thrombus
Perfusion	Penumbra
Assess cerebral blood volume, cerebral blood flow, and mean transit time	Assess tissue at risk of dying if ischemia continues without recanalization of intravascular thrombus

The four Ps of acute stroke imaging: parenchyma, pipes, perfusion, and penumbra. Rowley HA. AJNR Am J Neuroradiol. 2001

Parenchyma

Exclusion of hemorrhage

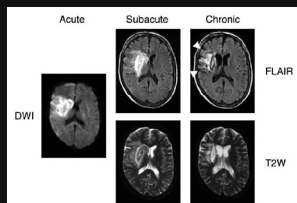
- 1) CT
- 2) MR (T2*-weighted and FLAIR)

Ischemic change

- 1) T2 / FLAIR MR (several hours)
 - 2) Diffusion weighted image (DWI)
- most sensitive (within minutes to hrs)
→ "light bulb" bright signal

Sodium MR (²³Na MR)

- a firmer prediction of absolutely dead tissue versus likely infarcted brain in future



Development of brain infarct volume as assessed by magnetic resonance imaging (MRI): follow-up of diffusion-weighted MRI lesions. J Magn Reson Imaging. 2004 Aug;20(2):201-7.

Pipe

Large arteries ultimately causing either hemorrhage or infarction

Identifying a lesion in "Pipes"

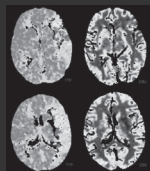
- 1) source of thrombi or emboli
- 2) sites for potential thrombolysis
- 3) assessing gross collateral flow patterns
 - hyperdense artery sign (thrombus on NECT)
 - vessel narrowing or occlusion (CT angiography)
 - loss or alteration of intravascular signal voids (MR)
 - stasis of gadolinium in slow-flowing territories (enhanced MR)
 - loss of flow-related enhancement (MR angiography)

Perfusion

"Definition"

Total cerebral blood flow arriving at a particular brain region at a given moment in time both via normal routes and recruited collaterals

- 1) Not sufficient to know what level the "pipes" are occluded on CT / MR
 - 2) Individual variation in collaterals & vascular autoregulation
- results net perfusion that means brain survival or infarction

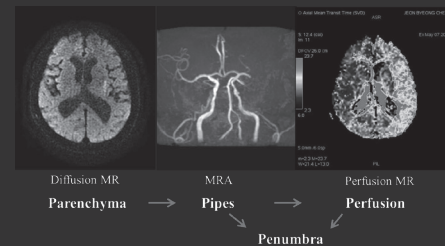


Penumbra

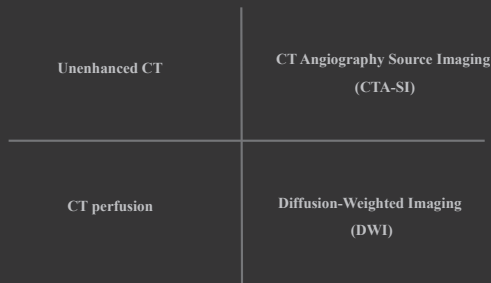
Brain tissue that is ischemic but not yet infarcted

→ at risk for further damage unless flow is rapidly restored

Detection of PWI-DWI mismatch → a realistic target for potential intervention



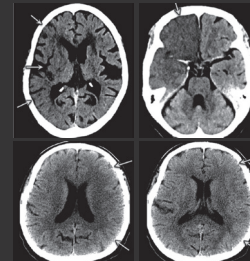
Infarction Core Assessment



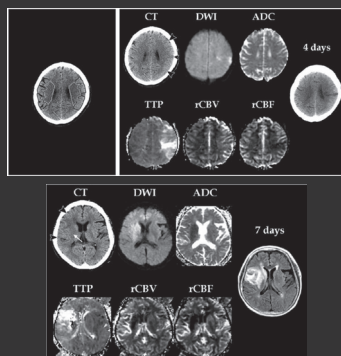
Unenhanced CT

"Early Ischemic Changes (EIC)"

- 1) focal or diffuse loss of gray/white matter differentiation
- 2) focal or diffuse hypodensity or hypoattenuation (gray matter > EIC > CSF)
- 3) focal or diffuse swelling with compression of CSF spaces (penumbra?)



EIC = Penumbra ?



CT sign of brain swelling without concomitant parenchymal hypoattenuation: comparison with diffusion- and perfusion-weighted MR imaging. Radiology. 2005 Jun;235(3):992-98.

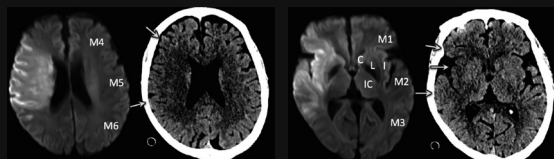
EIC → Frank Hypodensity (FH)

- 1) EIC in recent guidelines
 - 2) focal or diffuse hypodensity or hypoattenuation
- JAMA. 2001 Dec 12;286(22):2830-8
- Lack of clinical significance of early ischemic changes on computed tomography in acute stroke.**
- Patel SC¹, Levine SR, Tiller BC, Grotta JC, Lu M, Frankel M, Haley EC Jr, Broft TG, Broderick JP, Horowitz S, Luden PD, Lewandowski CA, Marler JR, Welch KM; National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group.
- 3) prevalence of 31%
 - 4) significantly associated with baseline NIHSS & time from stroke onset to CT scan
 - 5) unlikely to affect response to rtPA treatment
 - 6) not independently associated with increased risk of adverse outcome after rt-PA treatment
 - 7) Patients treated with rt-PA did better whether or not they had FHs, suggesting that FHs on CT scan are not critical to the decision to treat otherwise eligible patients with rt-PA within 3 hours of stroke onset.

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ASPECT

"The Alberta Stroke Program Early CT (ASPECT) score system"
whether EIC involves > 1/3 of MCA territory or not (One third rule)
designed to improve interrater reliability
not only to unenhanced CT but also MRI

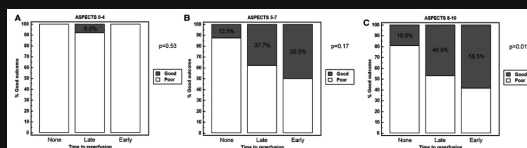


ASPECT

"Limitations of ASPECT score system"
no anatomic landmarks for distinction of each M region
low reliability of each region on CT

presumption	ASPECT score
1/3 involvement of MCA territory	4-6

"futility of endovascular treatment in ASPECT 0-4"



Impact of pretreatment noncontrast CT Alberta Stroke Program Early CT Score on clinical outcome after intra-arterial stroke therapy. Stroke. 2014 Mar;45(3):746-51

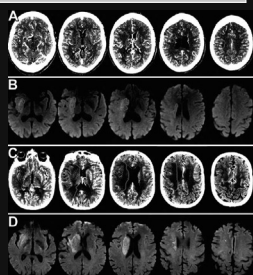
CT Angiography Source Imaging (CTA-SI)

Unenhanced CT	CTA-SI
Cytotoxic edema	Severe reduction in CBV / long delays in contrast arriving at the ischemic brain

- 1) a good alternative
- 2) higher sensitivity of detection of infarct core

"Limitations of CTA-SI"

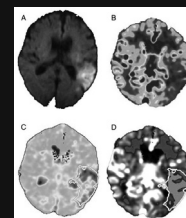
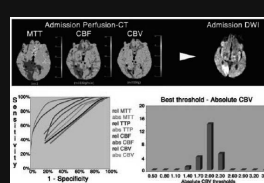
- 1) recent scanners with > 64 detector rows
→ obtain arterial phase images much faster
→ resulting in larger poor contrast-filling areas
→ overestimate infarct core
- 2) no longer a reliable tool to identify infarct core when it is obtained with faster scanners



Acute ischemic stroke: infarct core estimation on CT angiography source images depends on CT angiography protocol. Radiology. 2012 Feb;262(2):593-604

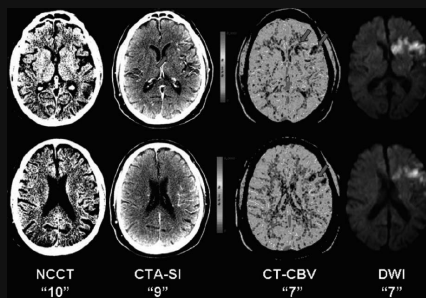
CT perfusion

CBV	rCBF
< 2.0mL/100g	< 31%



Perfusion-CT assessment of infarct core and penumbra: receiver operating characteristic curve analysis in 130 patients suspected of acute hemispheric stroke. Stroke. 2006 Apr;37(4):979-83
Comparison of computed tomography perfusion and magnetic resonance imaging perfusion-diffusion mismatch in ischemic stroke. Stroke. 2012 Oct;43(10):2648-53

Accuracy of ASPECT: CT vs. CTA-SI vs. CT perfusion



Accuracy of the Alberta Stroke Program Early CT Score during the first 3 hours of middle cerebral artery stroke: comparison of noncontrast CT, CT angiography source images, and CT perfusion. AJNR Am J Neuroradiol. 2008 May;29(5):931-6

Diffusion-Weighted Imaging (DWI)

- 1) most sensitive and reliable for acute infarction detection
- 2) extent of DWI lesion & benefit of endovascular treatment

(DIFFUSE 2) ~ 70 mL

(MR-RESCUE) ~ 90 mL

- 3) DWI should be obtained at a thickness ≤ 5mm

- 4) measure DWI volume if software is available

if not, estimate with the ASPECT score

- 5) DWI ASPECT < 4 → volume > 100 mL

DWI ASPECT ≥ 7 → volume < 70 mL

DWI-ASPECTS	Volume on DWI, mL			
	n	Median	IGR	Range
<4	34	164	125-214	93-287
≥4	296	19	9-47	0-197
<5	52	145	104-186	60-287
≥5	278	18	8-37	0-197
<6	91	114	94-171	29-207
≥6	240	16	7-30	0-166
<7	123	92	49-148	10-287
≥7	207	13	6-23	0-67
<8	187	50	24-109	3-287
≥8	143	9	5-18	0-67

MRI profile and response to endovascular reperfusion after stroke (DEFUSE 2): a prospective cohort study. Lancet Neurol. 2012 Oct;11(10):860-7
A trial of imaging selection and endovascular treatment for ischemic stroke. N Engl J Med. 2013 Mar 7;368(10):914-23.

Assessment of FLAIR imaging

"DWI-FLAIR mismatching"

symptom onset	specificity	Positive predictive value
4.5 hrs	78%	83%
3 hrs	93%	94%

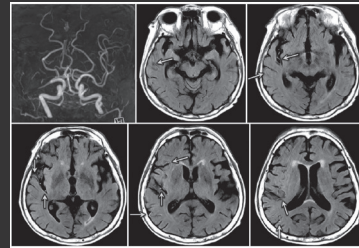
"Wake-up stroke"

- 1) about 20% of acute ischemic stroke during sleep
- 2) generally excluded from iv rtPA
- 3) randomized study to determine whether it can improve the outcome in patients of unknown onset with iv rtPA

WAKE-UP: 2014 Aug 16(16):1659-64. doi: 10.1161/STROKEAHA.114.11116. Epub 2013 Mar 12.
A multicenter, randomized, double-blind, placebo-controlled trial to test efficacy and safety of magnetic resonance imaging-based thrombolysis in wake-up stroke (WAKE-UP).
Thomalla G¹, Florschütz J², Ostergaard L, Pedraza S, Thies V, Nieuwenhuis N, Rou P, Muir KW, Ebner M, Chen B, Gollner J, Cho TH, Pász J, Bouillon F, Simonsen CJ, Endres M, Fiehler J, Gellert C. WAKE-UP investigators

Hyperintense vessels (HVs)

- 1) frequently visualized due to slow flow beyond the occlusion site
- 2) specificity of 86% and sensitivity of 76% for detection of proximal occlusion
- 3) may represent the presence of collaterals



Thrombus Assessment

"Clinical implication of acute thrombus location"

occlusion in the terminal ICA or BA barely responds to rt PA

"Extent of acute thrombus"

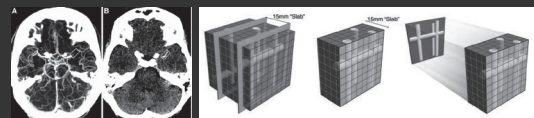
- 1) unenhanced CT
- 2) Dynamic CTA / Multiphase CTA
- 3) gradient-recalled echo (GRE) / susceptibility-weighted imaging (SWI)

Assessment of thrombus in acute middle cerebral artery occlusion using thin-slice nonenhanced Computed Tomography reconstructions. Stroke. 2010 Aug;41(8):1659-64.

Thrombus Assessment – Nonenhanced CT

"Hyperdense middle cerebral artery sign (HMCAS)"

- 1) a highly specific marker of thrombotic vascular occlusion
- 2) low sensitivity of 26–47%
 - ← different consistencies of clots or by the spatial resolution of standard NECT images reconstructed with slice width between 5 and 10 mm
 - thin-slice reconstruction & thick-slab MIP image

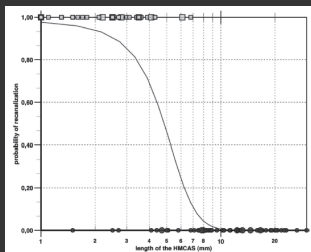


Thin-slice reconstructions of nonenhanced CT images allow for detection of thrombus in acute stroke. Stroke. 2012 Sep;43(9):2319-23.

Thrombus Assessment – Nonenhanced CT

"Thrombus size and Recanalization"

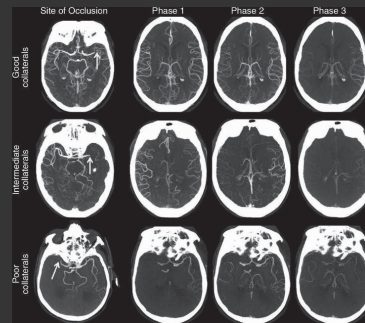
No thrombus > 8 mm in the MCA is recanalized after iv rtPA



The importance of size: successful recanalization by intravenous thrombolysis in acute anterior stroke depends on thrombus length. Stroke. 2011 Jun;42(6):1775-7.

Multiphase CTA

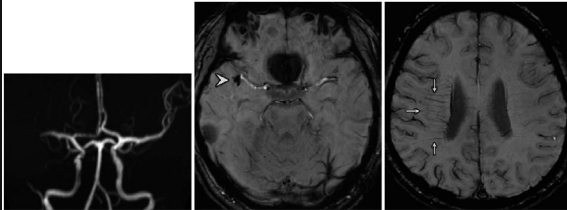
"the best imaging modality"



Assessment of Cerebral Vascular System

Susceptibility-weighted imaging

- : prominent asymmetrical cortical and transmedullary veins in the region of ischemia
- possibly represent the region of increased oxygen extraction fraction (blood oxygen level-dependent venographic imaging)



DWI-SWI mismatching

"prominent hypointense cerebral veins on SWI / relatively small DWI lesion"

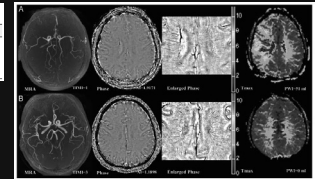
→ useful to identify patients who can benefit from reperfusion therapy

AlJMS, Am J Neuroradiol. 2014 Nov-Dec;35(11):2081-7. doi: 10.3174/ajnr.A4017. Epub 2014 Jul 10.

Susceptibility-diffusion mismatch predicts thrombolytic outcomes: a retrospective cohort study.
Lou M¹, Chen Z², Wang J², Hu H², Cai X², Shi Z², Sun J³

Table 3: The sensitivity, specificity, and accuracy between SWI-DWI and PWI-DWI mismatches*

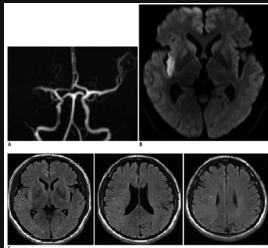
	Sensitivity	Specificity	Accuracy	AUC
SWI-DWI mismatch	46.7	55.6	63.0%	0.511
Standard PWI-DWI mismatch	63.3	8.3	37.0%	0.238
Optimal PWI-DWI mismatch	60.0	25.0	44.4%	0.425
Target PWI-DWI mismatch	63.3	38.9	48.1%	0.463



Imaging Assessment of Penumbra

Some issues on CT or MR perfusion

- : not standardized
- : not standardized postprocessing software tools



Summary

Imaging Modality	Interpretation	Reporting	Aims of Imaging
Unenhanced CT	Acute hemorrhage	Presence of absence / Location	Eligibility of further imaging and therapy
	Early ischemic change	ASPECT score	Prediction of outcome
	Frank hypodensity	≤ or > 1/3 of MCA territory	Eligibility of endovascular therapy
	Hypodense artery sign	Presence of absence / Location and extent (length)	Prediction of thrombolytic efficacy
CTA	Acute occlusion	Location	Prediction of thrombolytic efficacy
	Collaterals	Degree (good, intermediate, or poor)	Prediction of reperfusion and outcomes
	Stenosis	≤ or ≥ 50%	Assessment of stroke mechanism
	Thrombus (if dynamic CTA available)	Length	Prediction of thrombolytic efficacy
CT perfusion	Infarct core (absolute CBV or relative CBF)	Volume	Eligibility of endovascular therapy
	Penumbra (Tmax or MTT)	Volume, ratio of penumbra to infarct core	Prediction of outcomes
	Collaterals (if dynamic CTA available)	Degree (excellent, fair, or poor)	Eligibility of endovascular therapy

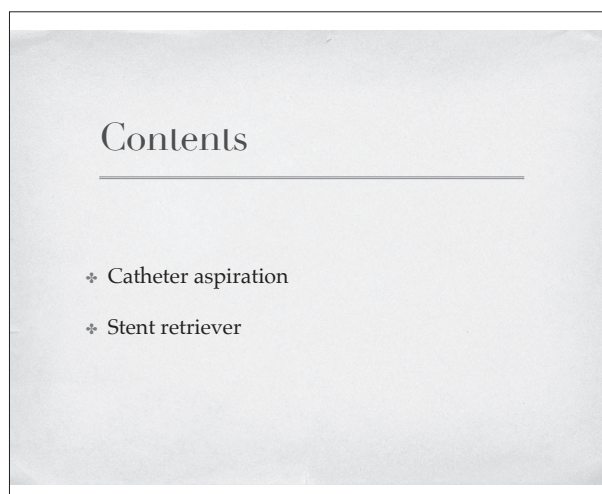
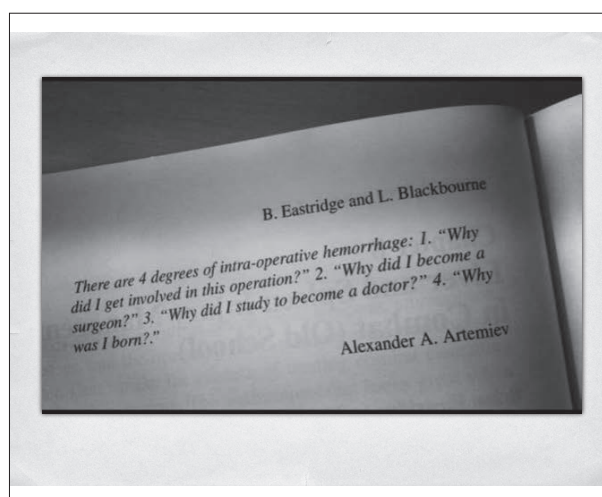
Summary

Imaging Modality	Interpretation	Reporting	Aims of Imaging
DWI	Infarct core	Volume or ASPECT score	Eligibility of endovascular therapy
	Infarct core	Location	Prediction of outcomes
T2* GRE or SWI	Acute hemorrhage	Presence or absence and location	Assessment of stroke mechanism
	Susceptibility vessel sign	Presence or absence	Eligibility of further imaging and therapy
	Old microbleeds	Location and length	Prediction of thrombolytic efficacy
	Old hemorrhage	Number and location	Assessment of stroke mechanism
FLAIR	DWI-FLAIR mismatch	Presence or absence and location	Assessment of stroke mechanism
	Hyperintense vessel sign	Presence or absence and location	Prediction of thrombolytic efficacy
		Determination of occlusion or severe stenosis	
MRA	Occlusion	Presence or absence and location	Eligibility of further therapy
	Stenosis	Presence or absence and location	Assessment of stroke mechanism
MR perfusion	Penumbra	Volume, ratio of penumbra to infarct core	Eligibility of endovascular therapy

Stent retriever or Suction catheter for recanalization

박정현

한림대 동탄성심병원



Devices settings

- ✦ Aspiration Catheter
- Balloon Guiding Catheter / Guiding Catheter + Aspiration Catheter (+microwire and microcatheter)
- ✦ Stent Retriever
- Balloon Guiding Catheter / Guiding Catheter + Intermediate catheter + microwire + microcatheter + Retrieval stent

Patient selection

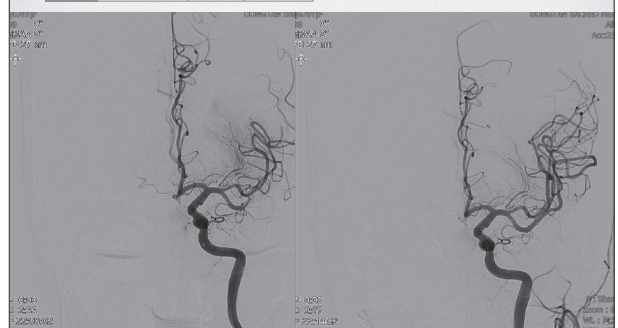
- ✦ Curvature of parent artery
- just proximal site of occlusion
- ✦ Characteristics of occlusion

No.1 210173799 KGJ 78/f

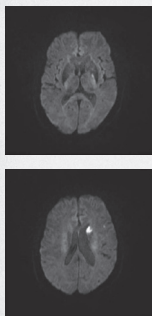
- ✦ Lt. MCA Occlusion
- ✦ Good indication to Aspiration



No.1 210173799 KGJ 78/f



No.1 210173799 KGJ 78/f

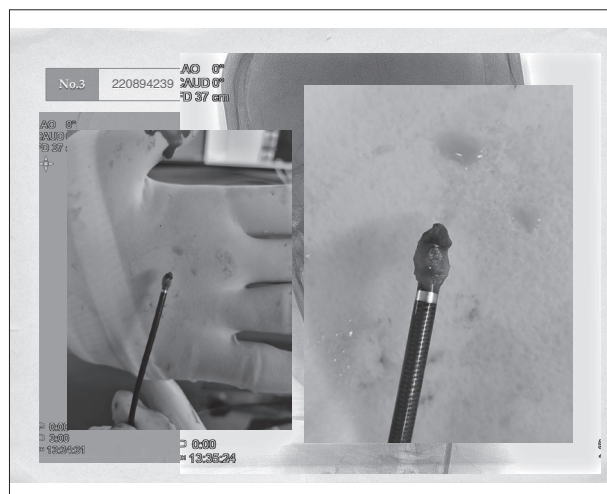
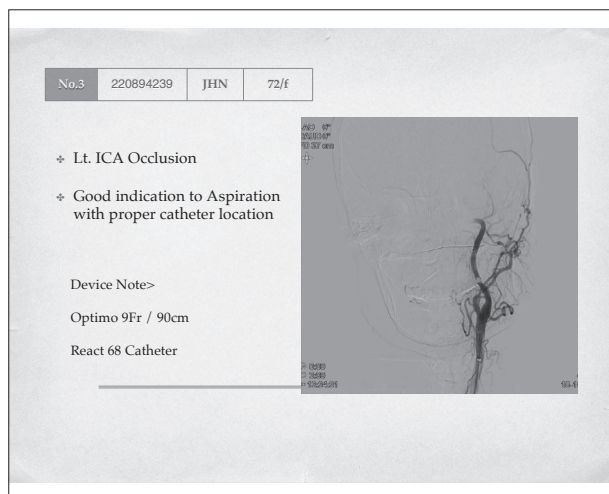


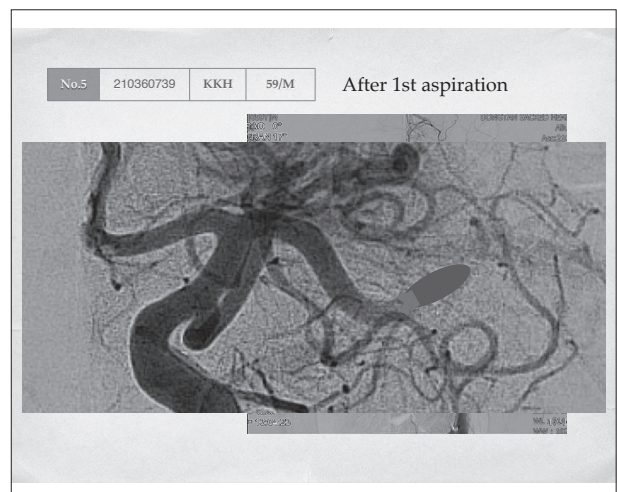
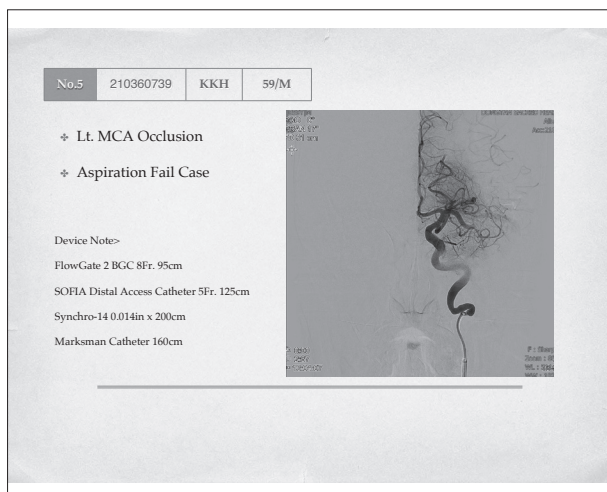
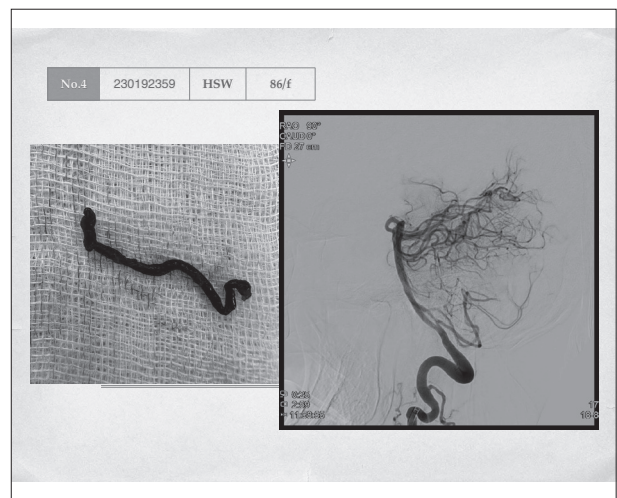
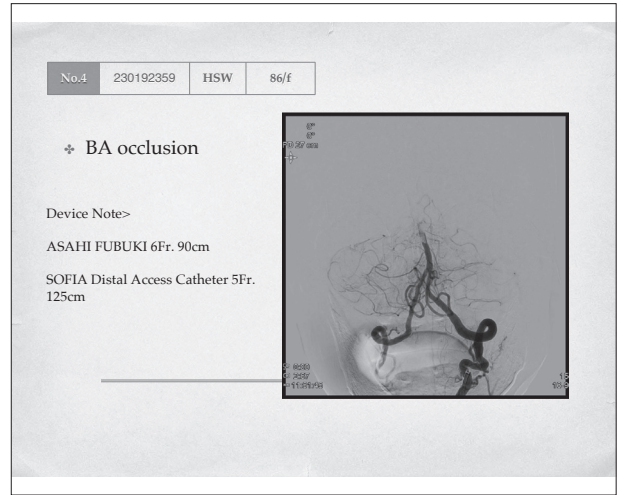
No.2 220110197 KGJ 78/f

- ✦ Lt. IC

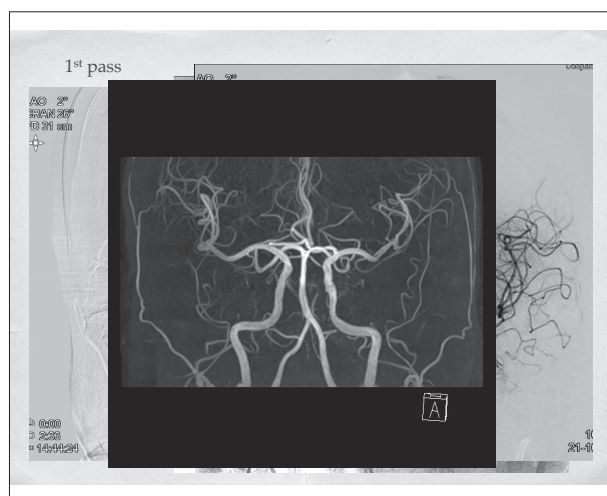
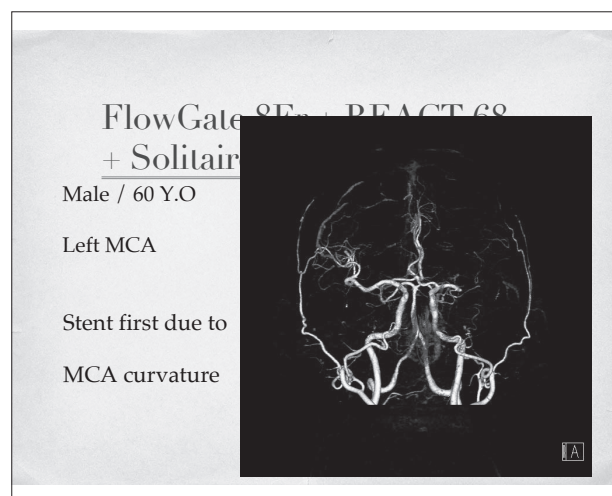
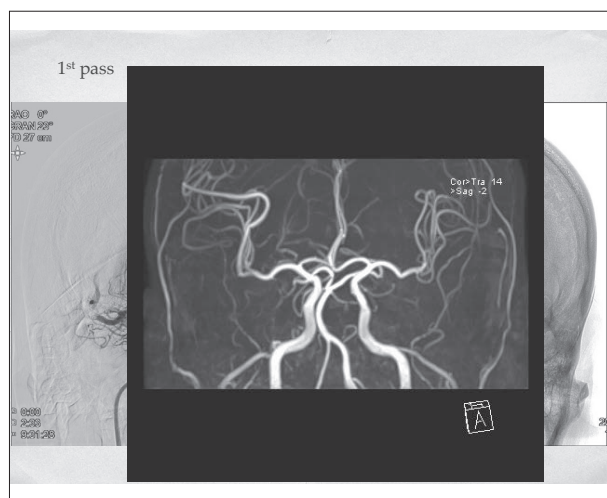
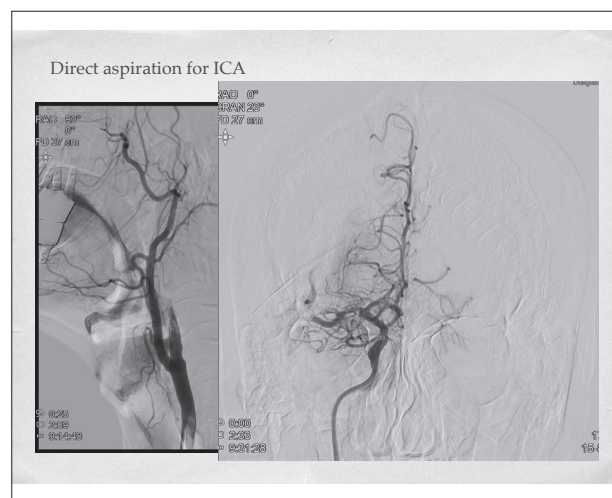
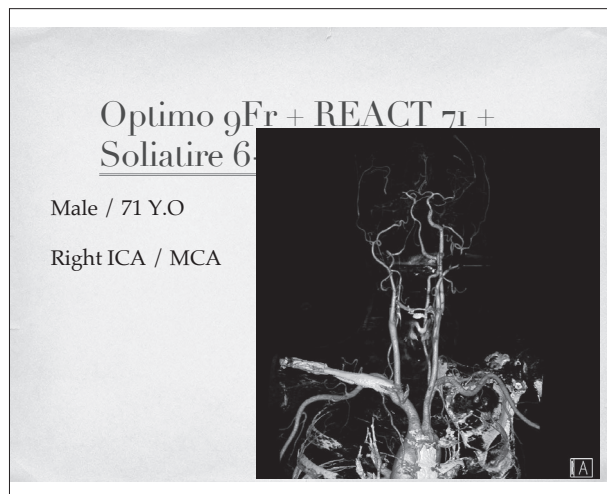
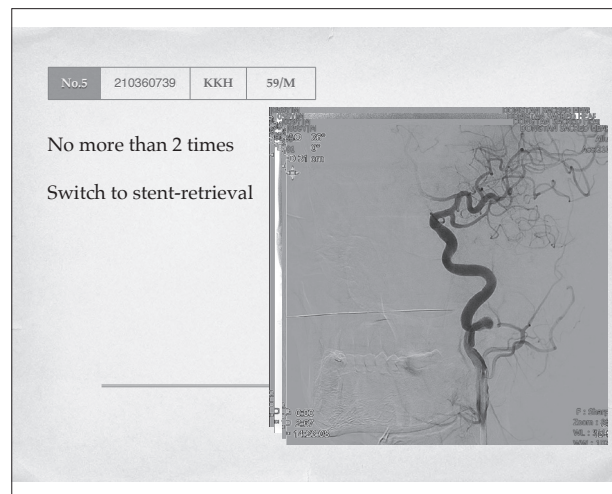


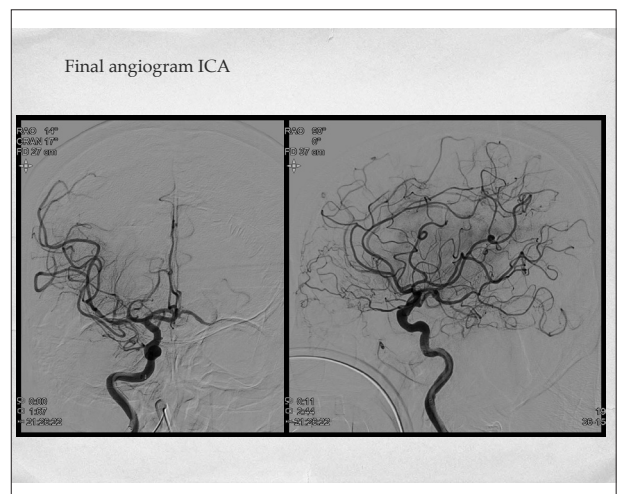
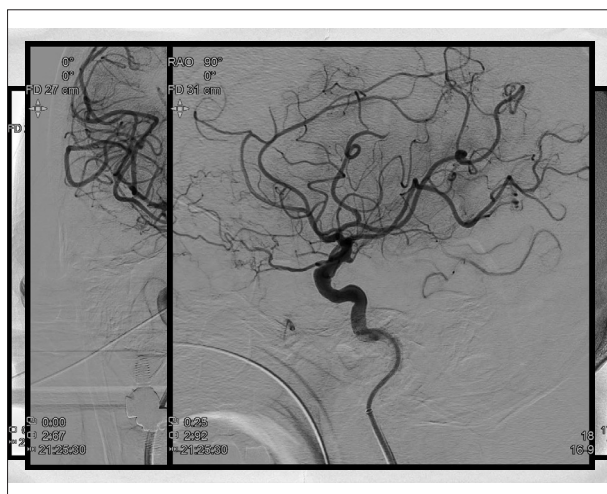
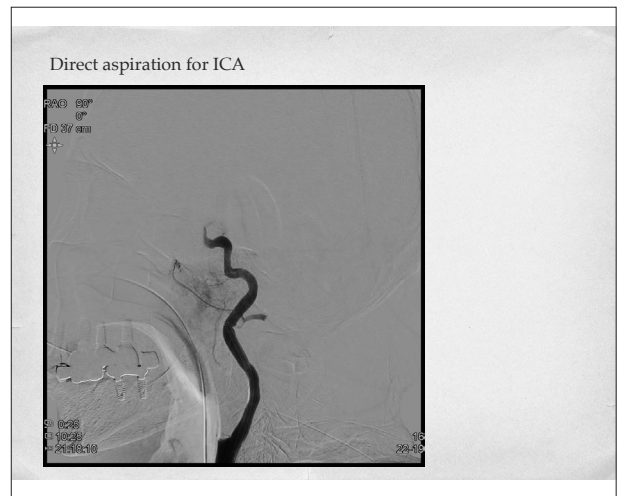
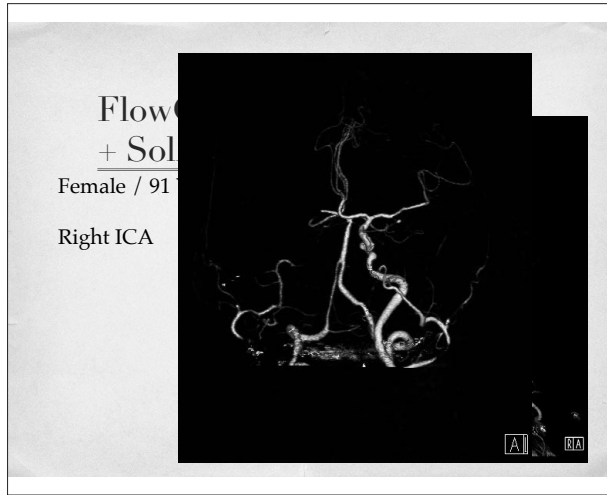
ASCENT 2024

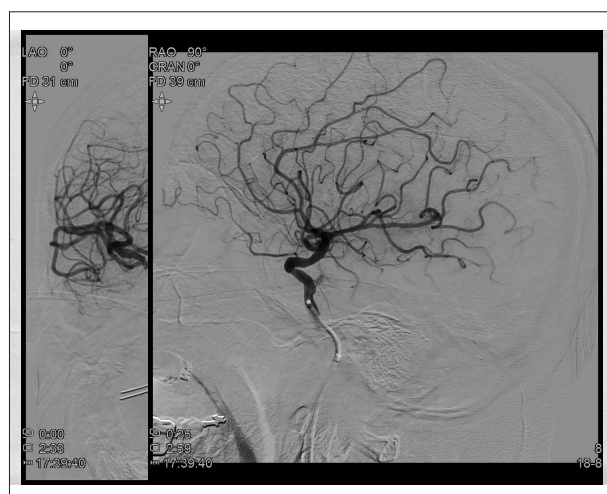
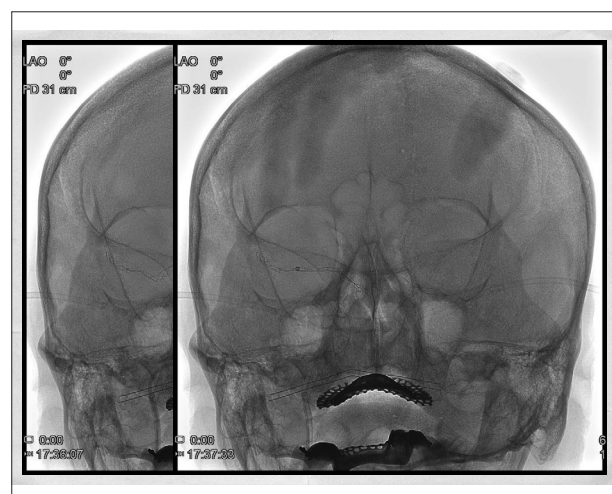
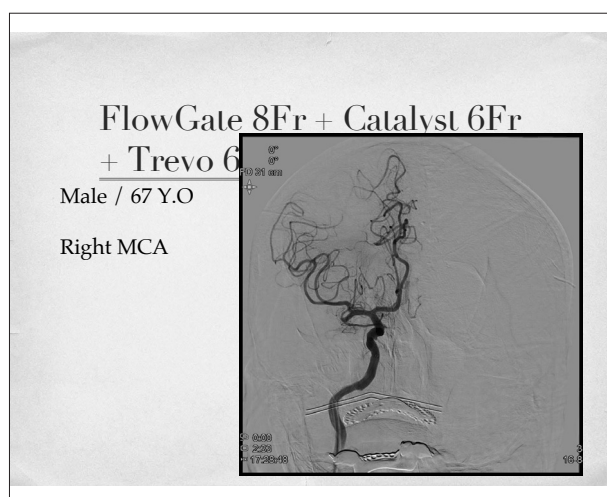
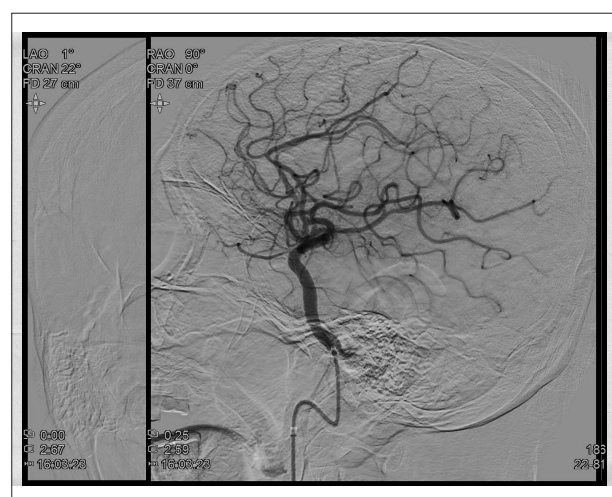
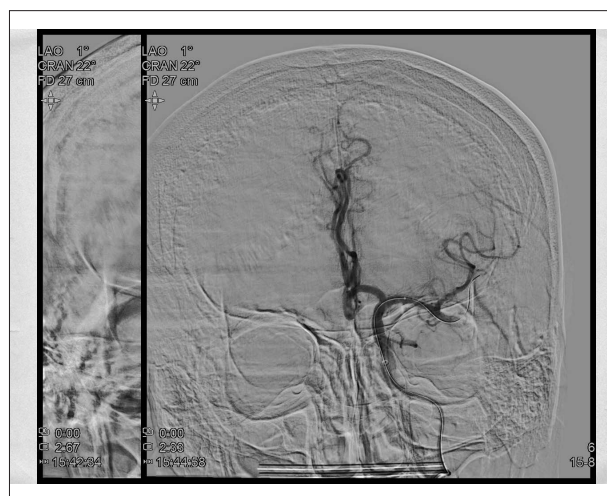
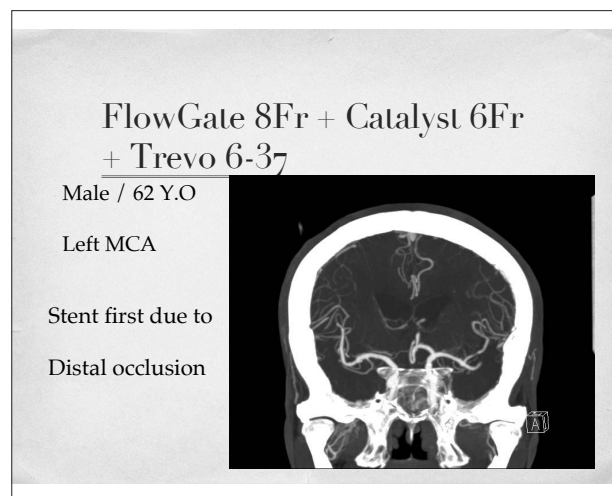


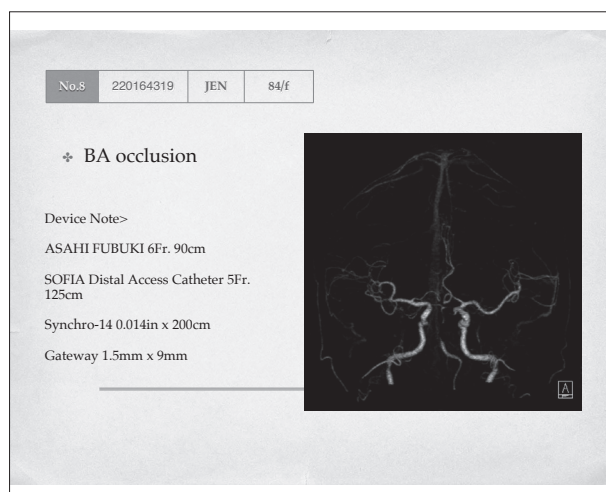
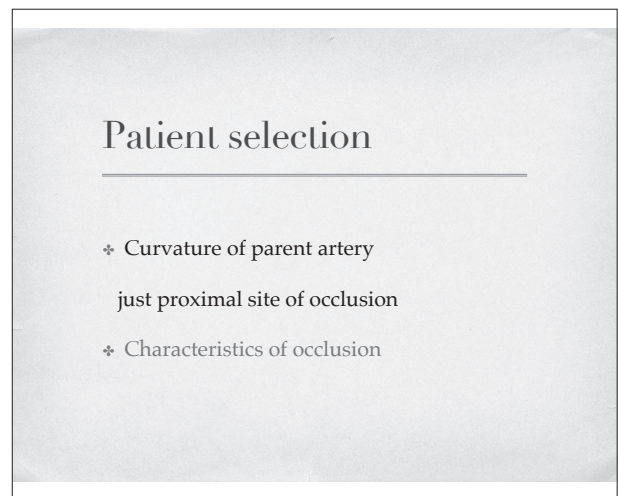
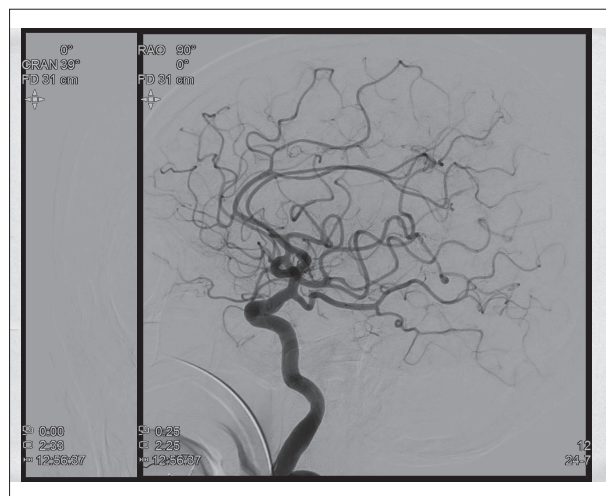
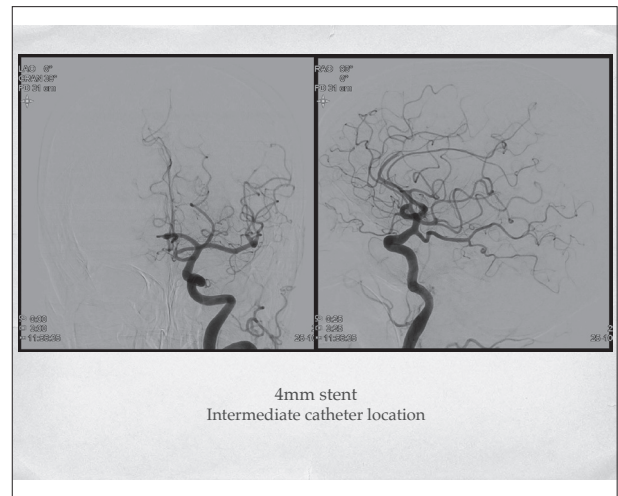
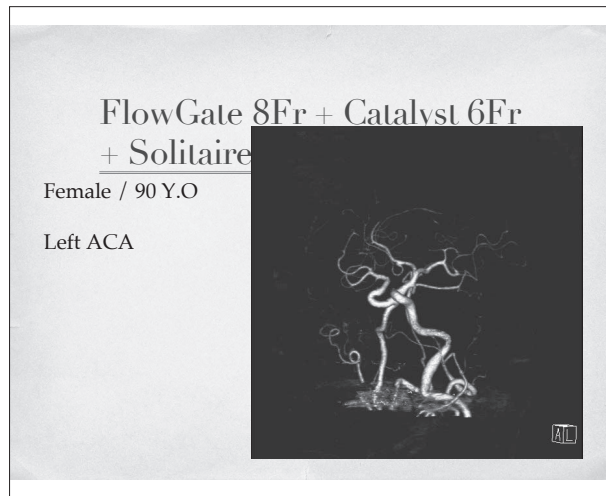


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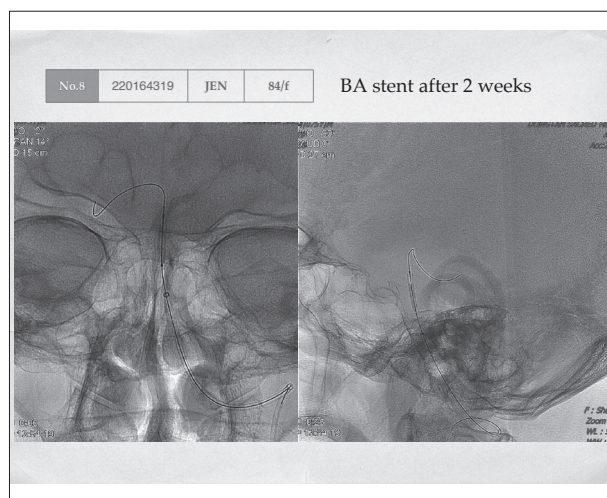
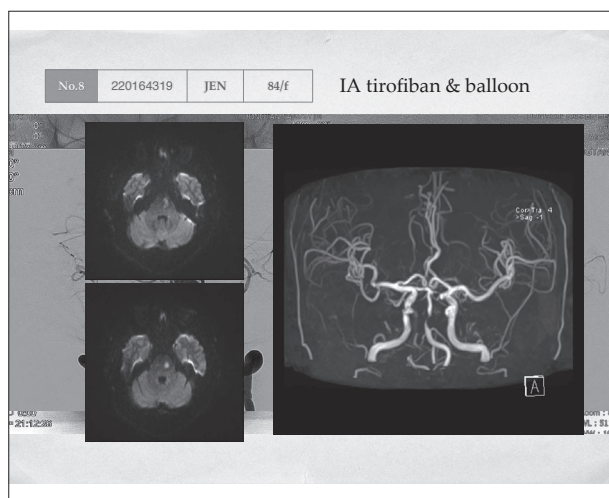
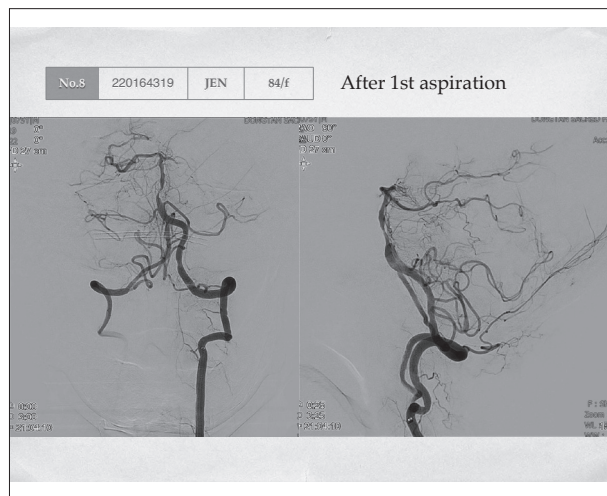








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Device Compatibility

- ✦ ACE68
- ✦ Catalyst 7
- ✦ SOFIA Plus
- ✦ Vecta 71 / 74
- ✦ React 68 / 71
- ✦ Embovac
- ✦ Esperance 6

- ✦ FlowGate 8Fr (084)
- ✦ Optimo 8Fr (085->087)
9Fr (093)
- ✦ Cello II 8Fr (085)
9Fr (091)
- ✦ CEREBASE DA
- ✦ NEUROMAX
- ✦ INFINITY Plus

Devices to use

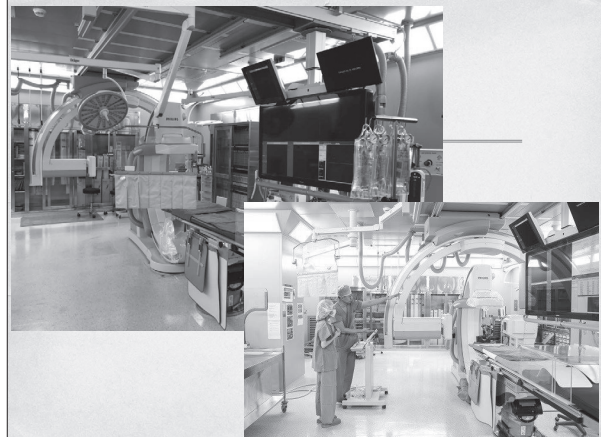
- | | | |
|-------------------------|---------------|----------------|
| ✧ FlowGate 8Fr (084) | | |
| ✧ Optimo 8Fr (085->087) | | |
| 9Fr (093) | | |
| ✧ Cello II 8Fr (085) | ✧ Navien | ✧ Soliotaire |
| 9Fr (091) | ✧ SOFIA 5Fr. | ✧ Trevo |
| ✧ CEREBASE DA | ✧ CAT 5, 6Fr. | ✧ Embotrap III |
| ✧ NEUROMAX | | ✧ pRESET |
| ✧ INFINITY Plus | | |

Insurance is problem..

- ✦ We can use only one Intermediate Catheter
- ✦ Can use 2 devices – stent or /and aspiration catheter

[illegible]

Data from Medtronic



The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2024

대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



KoNES 방사선사/간호사 연수교육

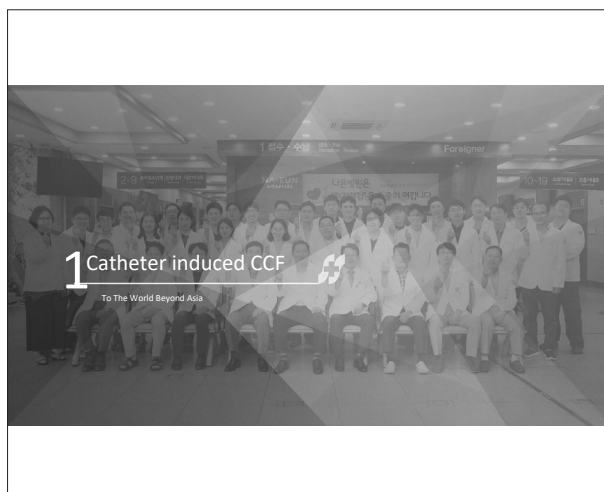
방사선사 보수교육

6월 22일(토) 10:40-12:40

Neuro-intervention case review

홍준희

인천나은병원 심뇌혈관센터



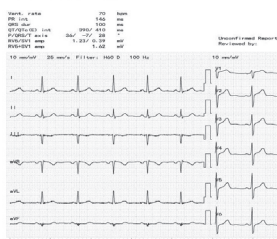
• Case Briefing

- 나이
- 성별
- C.C
- Risk factor

- 53
- Female
- Dysarthria
- HTN, Dyslipidemia

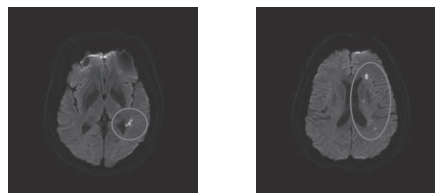
내원 3일전 갑자기 증상 발생

EKG



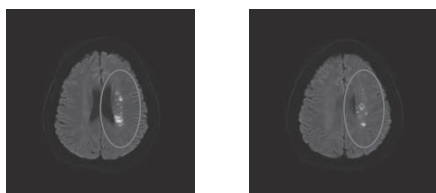
나은병원

MRI



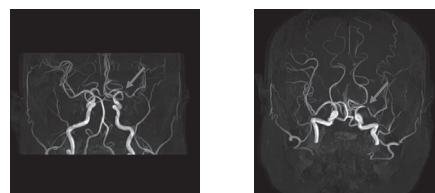
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MRI



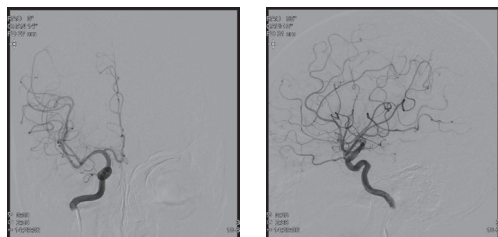
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MRA



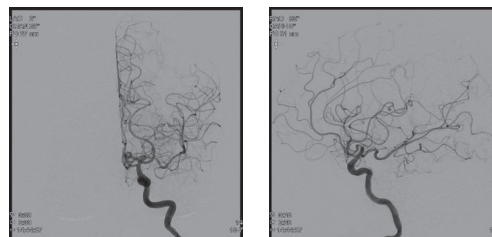
나은병원

Intervention



나은병원

Intervention



나은병원



ASCENT 2024

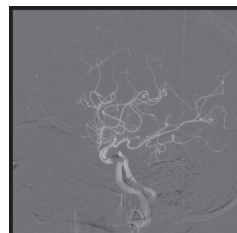
Intervention

Q. 시술중 Guiding cath 로 인한 CCF 발생, 대처는?

1. 경과관찰
2. Transarterial approach intervention
3. Transvenous approach intervention



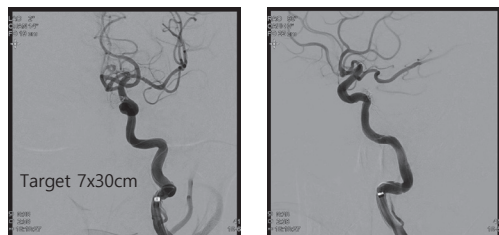
Intervention



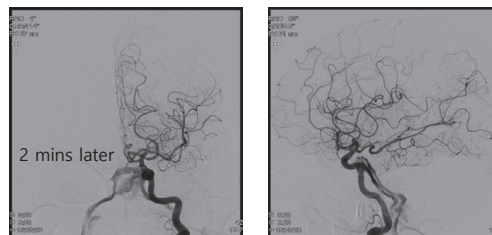
Balloon tamponade
- Scepter XC 4x11mm



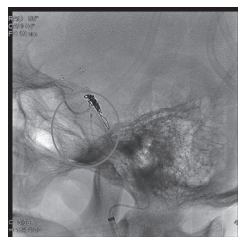
Intervention



Intervention



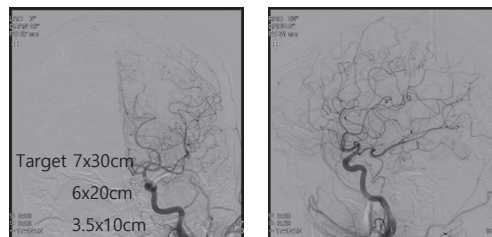
Intervention



LVIS 4.5x23mm



Intervention



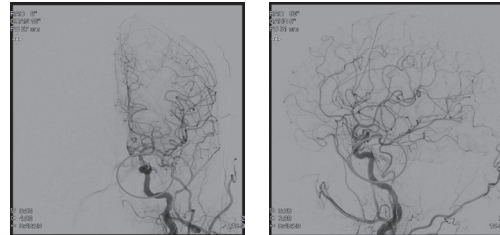
• Intervention

3 days later

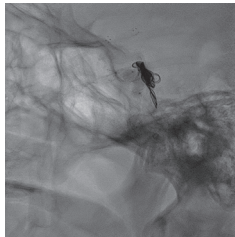
- Aphasia 양상
- Diffusion MRI 이상 없음
- F/U angio



• Intervention



• Intervention



LVIS 4.5x23mm
Sceptor XC 4.0x11



• Intervention



Transvenous approach
Lt 진입 실패
Rt. Inferior petrosal vein 통해
Cavernous sinus 진입



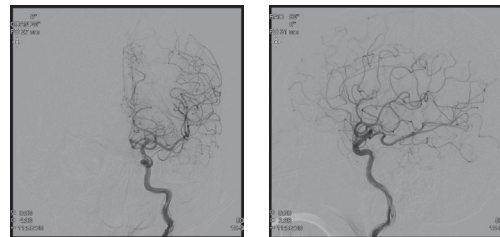
• Intervention



Target 5x20cm
6x30cm
6x30cm
5x15cm

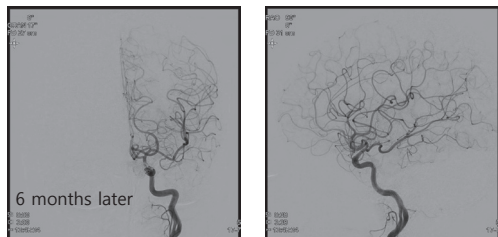


• Intervention



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Intervention



나은병원

Discussion

Discussion point

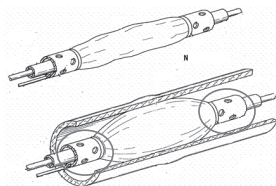
1. Aortic arch 에서의 acute angle, Tortuous ICA
환경에서 안전한 guiding cath 세팅

나은병원

Discussion

Discussion point

2. Balloon tamponade time



Perfusion balloon

나은병원

Subclavian steal syndrome

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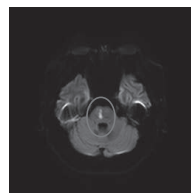


Case Briefing

- 나이 • 64
- 성별 • Male
- C.C. • Dizziness
4개월 전 Rt. Pons infarction
양팔 혈압 다름
- Risk factor • Dyslipidemia

나은병원

MRI



4개월 전 MRI

- Lt. side weakness
- antiplatelet medication

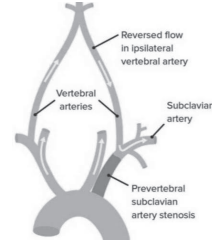
나은병원

• MRI



노르병원

• Steal syndrome

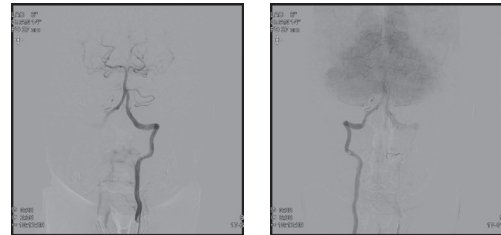


노르병원

Subclavian a. stenosis

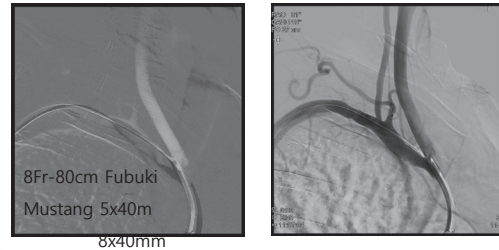
- Vertebro-Basilar junction
통해 반대팔 혈류 공급
- 뇌경색 유발

• Intervention



노르병원

• Intervention



노르병원

• Intervention



노르병원

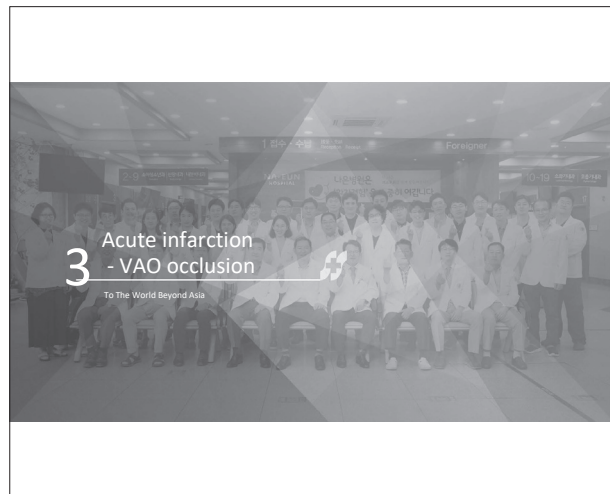
• Discussion

Discussion point

1. Subclavian a. PTA 시 Vertebral artery protection ?
2. Takayasu arteritis 여부

노르병원

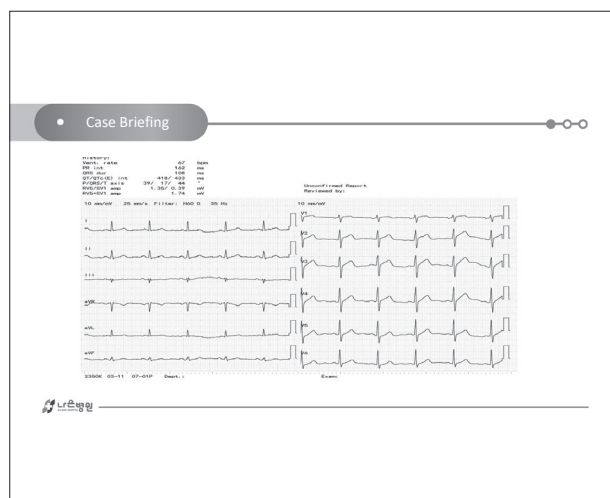
ASCENT 2024



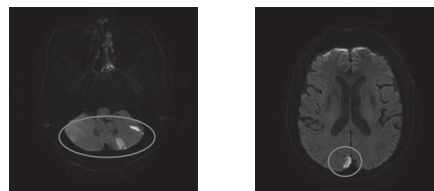
Case Briefing

- 나이 • 66
- 성별 • Male
- C.C • Lt. side weakness
- Risk factor • None

나인병원

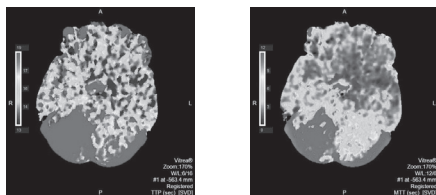


MRI



나인병원

CT

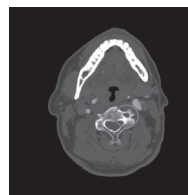


TTP

MTT

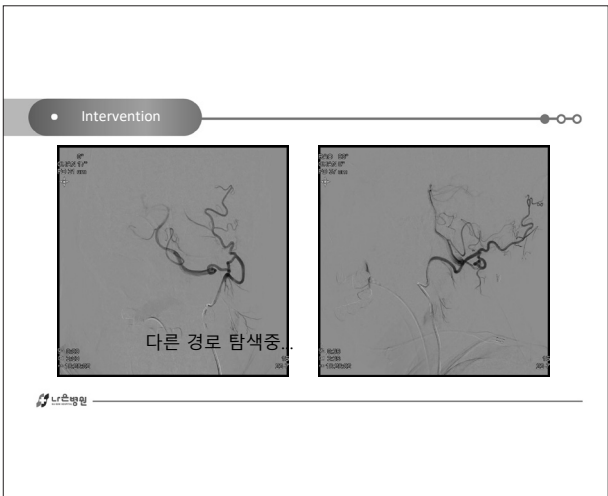
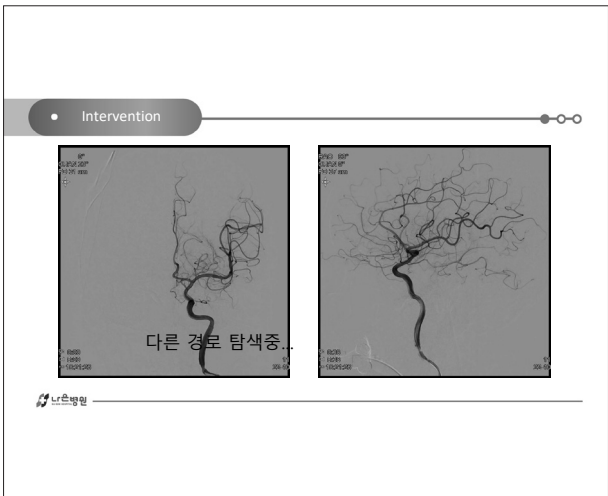
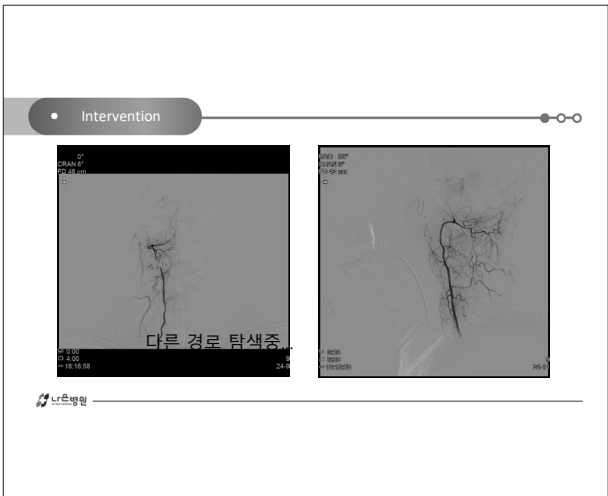
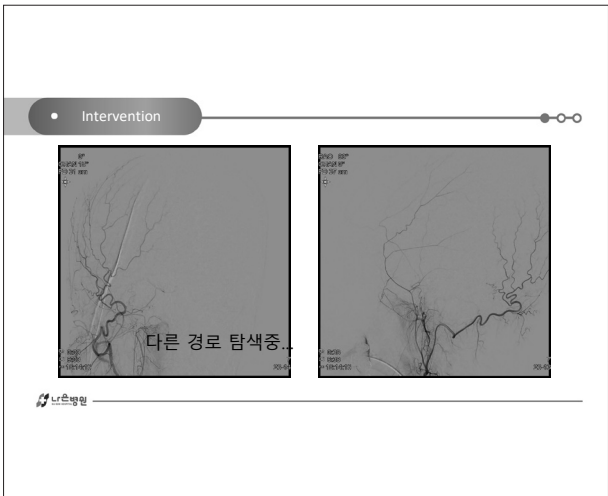
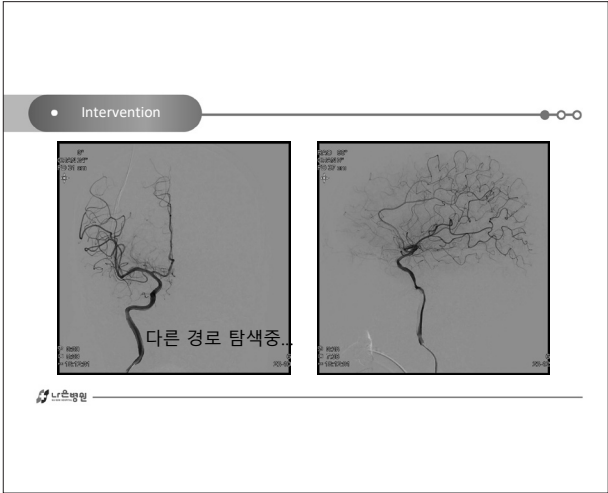
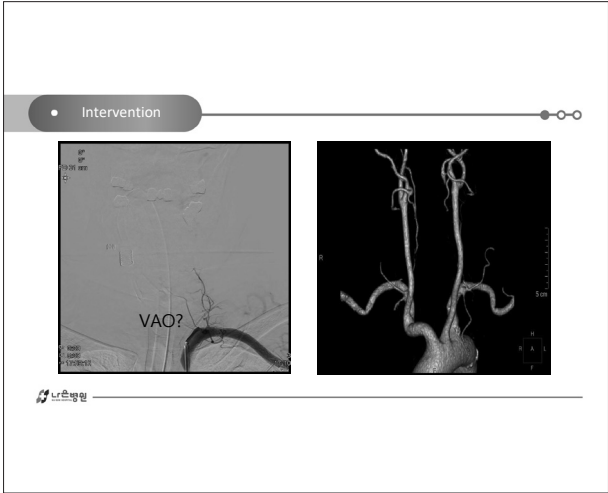
나인병원

CT



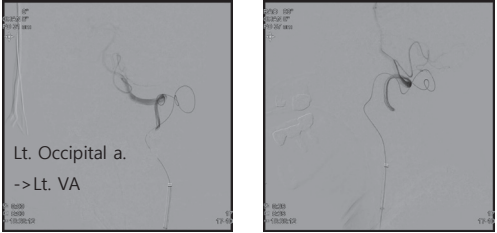
Lt. Vertebral artery occlusion
-Thrombectomy
under general anesthesia

나인병원



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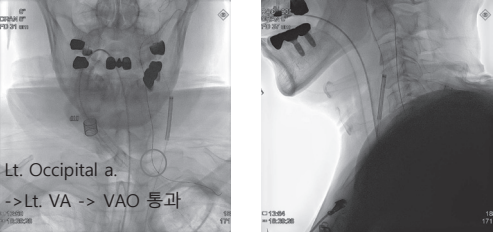
• Intervention



Lt. Occipital a.
-> Lt. VA

나은병원

• Intervention



Lt. Occipital a.
-> Lt. VA -> VAO 통과

나은병원

• Intervention

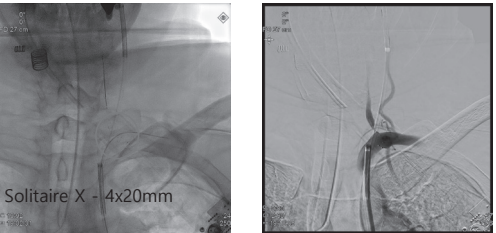


Lt. Occipital a.
-> Lt. VA -> VAO 통과

Q. Retrograde wiring 으로
Lt. VAO 통과
다음 step?

나은병원

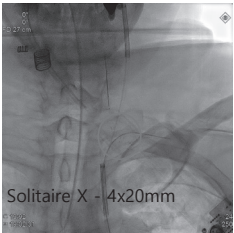
• Intervention



Solitaire X - 4x20mm

나은병원

• Intervention

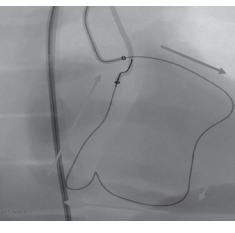


Solitaire X - 4x20mm

Q. 약 20분간 antegrade
wiring fail.
다음 step?

나은병원

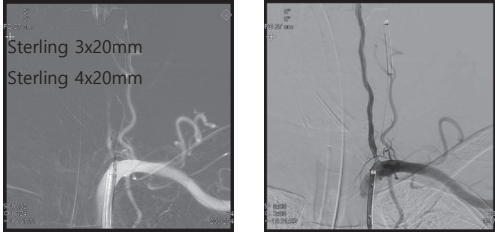
• Intervention



Wire Externalization
- fail
- wire tip 상할 우려로
snare 사용 X

나은병원

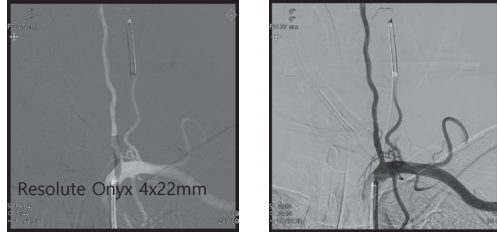
• Intervention



Sterling 3x20mm
Sterling 4x20mm

나온병원

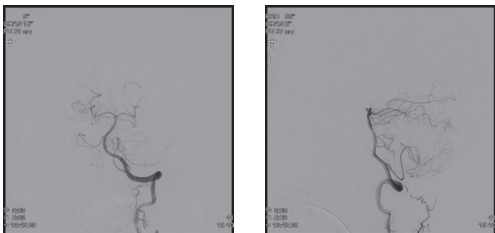
• Intervention



Resolute Onyx 4x22mm

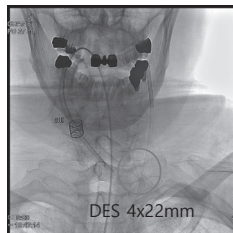
나온병원

• Intervention



나온병원

• Discussion



DES 4x22mm

Discussion point

1. VAO stenting 시 DES 유용성?
stage로 BMS 준비 후 시술?

나온병원

4 How to remove the coil pre-detached

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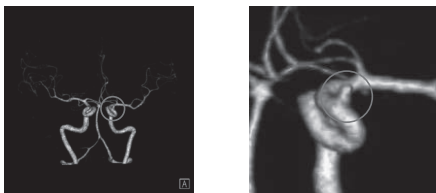
• Case Briefing

- 나이 • 34
- 성별 • Male
- C.C • Headache
- Risk factor • HTN, 아버지 뇌동맥류 수술

나온병원

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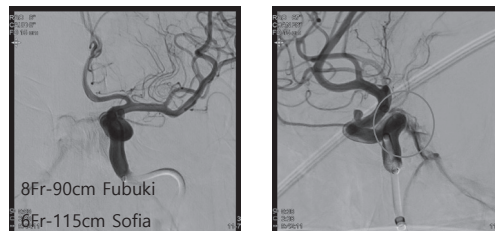
CT



Lt. dICA dorsal wall aneurysm

노은병원

Intervention



8Fr-90cm Fubuki

6Fr-115cm Sofia

노은병원

Intervention

Q. UIA 치료 과정에서 우연히 CCF 발견, 대처는?

1. 마취를 깨우고 사과한다
2. UIA 먼저 치료
3. CCF 먼저 치료

노은병원

Intervention

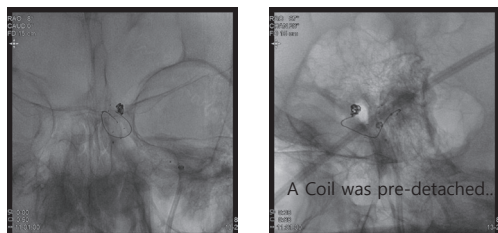


Atlas 4.5x21mm

Optima 3.5x8cm

노은병원

Intervention



A Coil was pre-detached..

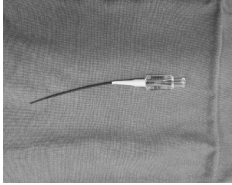
노은병원

Intervention

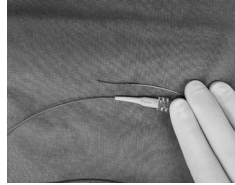
Q. Coils가 Micro-catheter 안에서 pre-detach 되었다.
현재 MC는 Atlas stent에 jail 되어있는 상태
어떻게 꺼낼 것인가?

노은병원

• Monorail snare

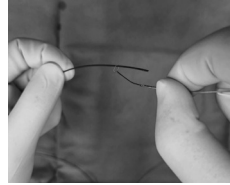


코일이 들어있는 MC
hub cutting

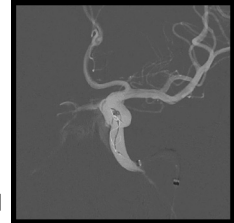


0.021 MC에 Goose neck
snare 2mm or 4mm 삽입

• Monorail snare



Snare를 cutting한 Coil 카테터에
monorail guide 삽입 진행시킴



• Intervention



3개월 뒤 CCF 치료계획



• Discussion

Discussion point

1. UIA 시술시 initial diagnostic angio 검사의 필요성
2. Coil 의 pre-detachment 예방법?



감사합니다.

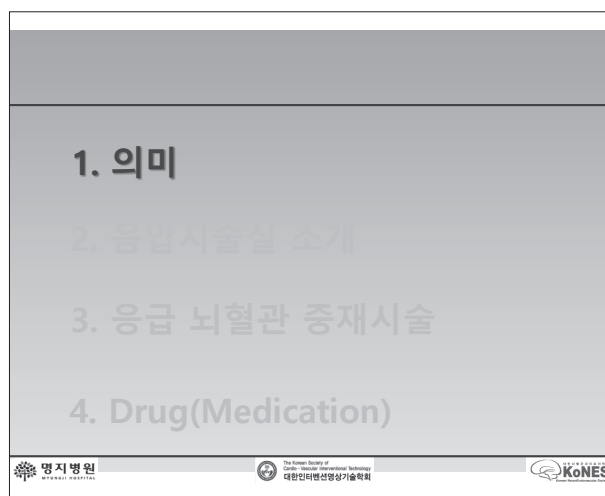
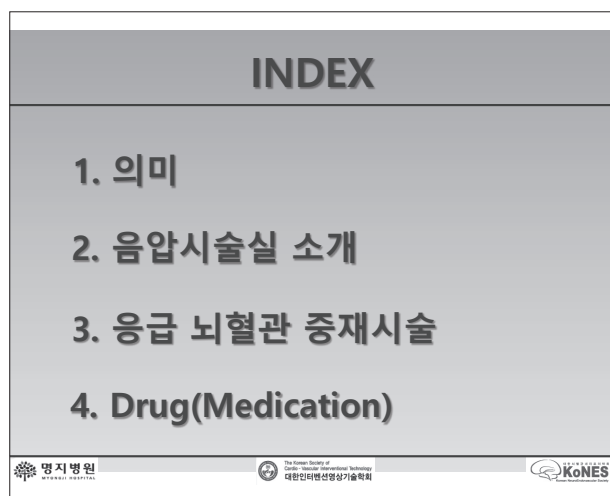
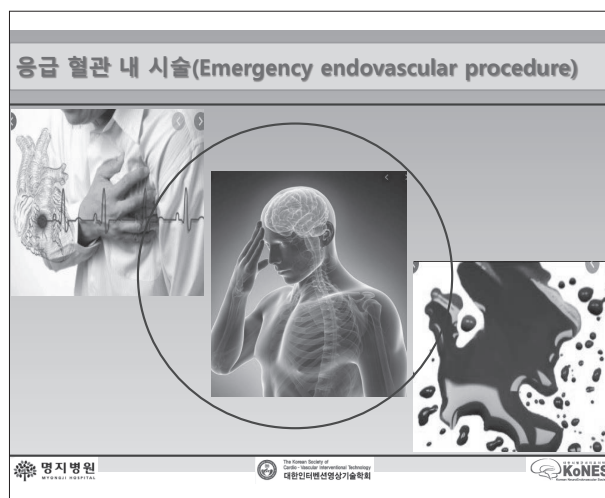
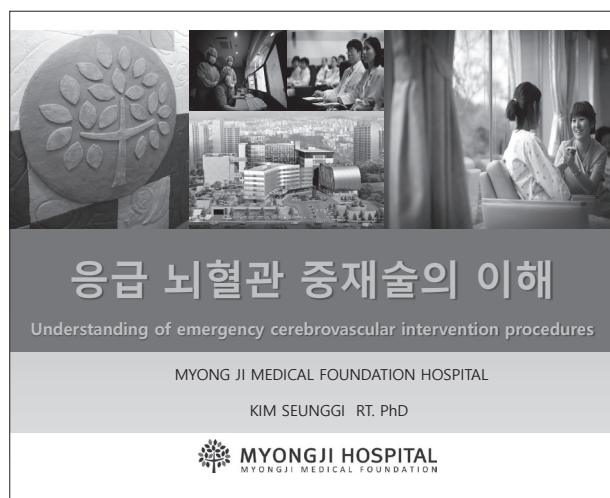
To The World Beyond Asia

응급 뇌혈관 중재술의 이해

Understanding of emergency cerebrovascular intervention procedures

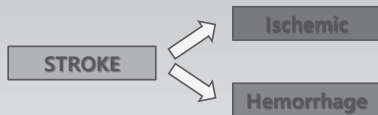
KIM SEUNGGI RT. PhD

MYONG JI MEDICAL FOUNDATION HOSPITAL



응급 뇌혈관 중재 시술이란?

정상 생활 중 갑자기 발생된 여러 원인 중 뇌졸중(출혈성, 허혈성)으로 인해 뇌신경학적 손상이 가해진 상태로 가능한 빠르게 치료하여 환자의 합병증과 사망률을 최소화 하여 신속하고 정확한 혈관 내 중재적 시술.



명지병원

The Korean Society of
Cerebral Vascular Interventional Technology
대한뇌혈관중재기술학회

KoNES

1. 의미

2. 음압시술실 소개

3. 응급 뇌혈관 중재시술

4. Drug(Medication)

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음압시술실

내부의 압력을 외부보다 낮게 만들어 시술실 내 음압을 형성하여 공기 중 오염된 세균이나 바이러스를 프리필터, 헤파필터로 여과하여 배기하는 시스템.

주로 결핵이나, 신종플루, 메르스, COVID-19처럼 공기매개 감염병이나 비말에 의한 감염을 최소화하는 장치.

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ASCENT 2024

응급 뇌혈관 중재시술

장점

첫째, 외과적인 수술보다 덜 침습적.

둘째, 부분마취로도 가능한 경우가 많다.

셋째, 시술 후 회복기간, 입원기간이 짧다.

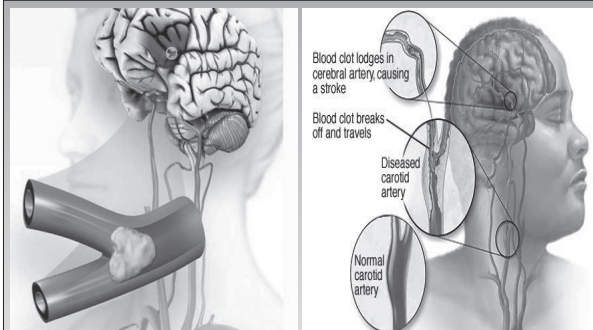
넷째, 시술을 반복하여 시행

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Ischemic stroke IA mechanical Thrombectomy



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KoNES

a. Cause

고지혈증, 당뇨, 동맥경화 등에 의해 발생한 혈전이 뇌혈관을 막거나 덩어리로 떨어져 나가 다른 혈관을 막는 색전증을 유발.

혈전증(Thrombosis)

손상된 혈관 속에서 혈전이 발생하여 혈액의 흐름을 막는 것

- stenosis, dissection

색전증(Embolism)

다른 혈관부위에 혈전 등의 물질이 생겨 혈류를 따라 이동하다 막히는 것

- A-fib, DVT

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b. Indication

* IV t-PA(tissue plasminogen activator; Actilyse)

: Last normal time 4.5h(0.9mg/kg)《

* 증상발생 8~24시간(19.8.1 확대 적용)

: IV t-PA recanalization failed

IV t-TPA – recanalization rate 40%
Mechanical thrombectomy 60~90%

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c. Mechanical Thrombectomy

* Suction aspiration thrombectomy

: Using suction reperfusion catheter (Penumbra, RED, VECTA..)

* Stent Retriever thrombectomy

: Using retrievable stent (Solitaire, Trevo....)

* Solumbra technique

: Using retrievable stent + Penumbra (Solitaire, Trevo....)

* Others technique

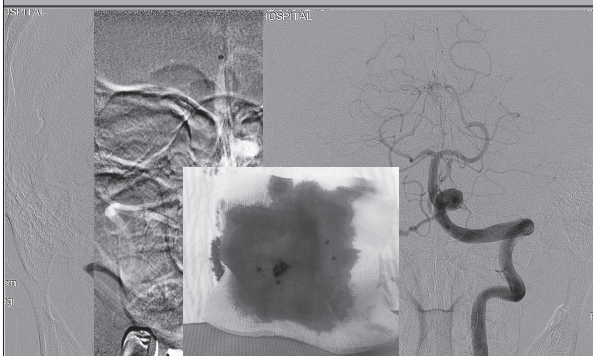
: Suction aspiration + Retrievable stent + Solumbra+ Balloon..

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KoNES

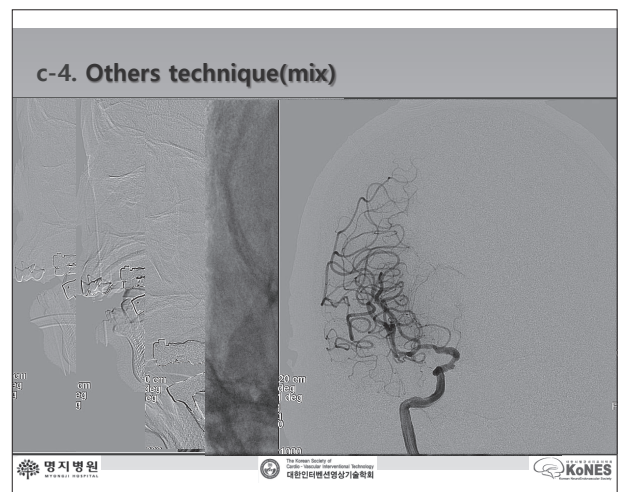
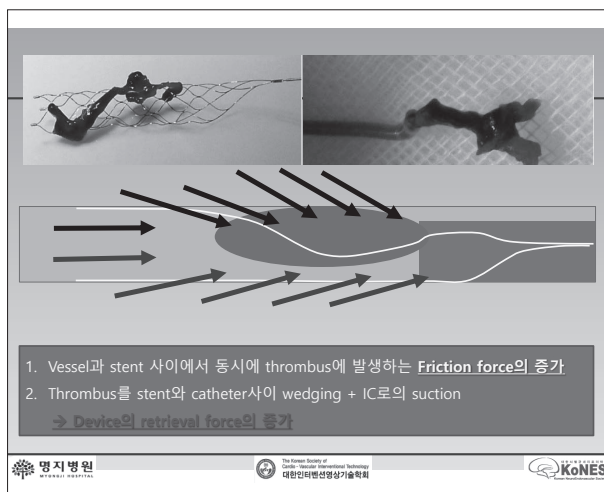
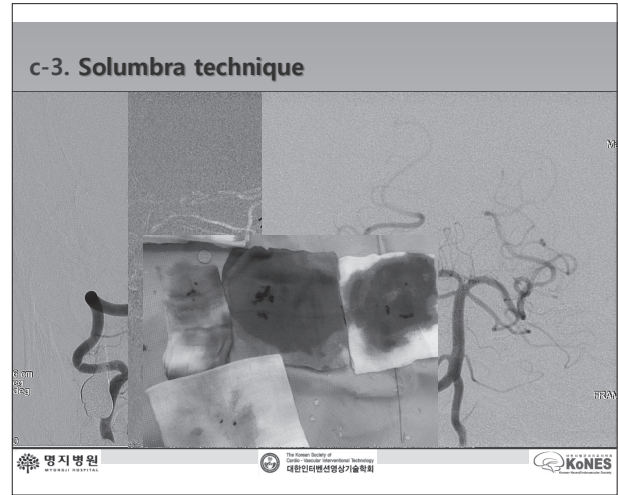
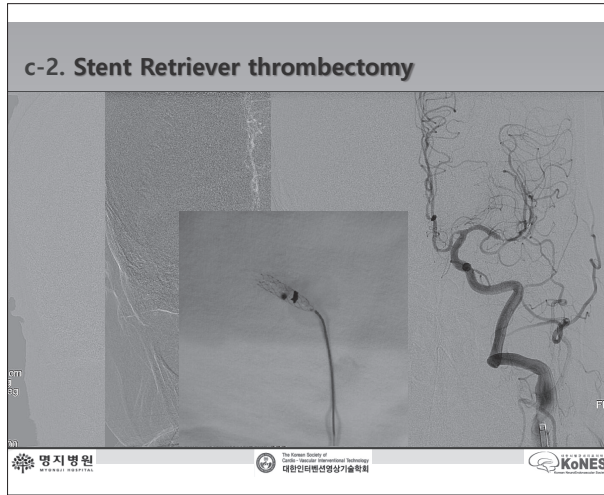
c-1. Suction aspiration thrombectomy



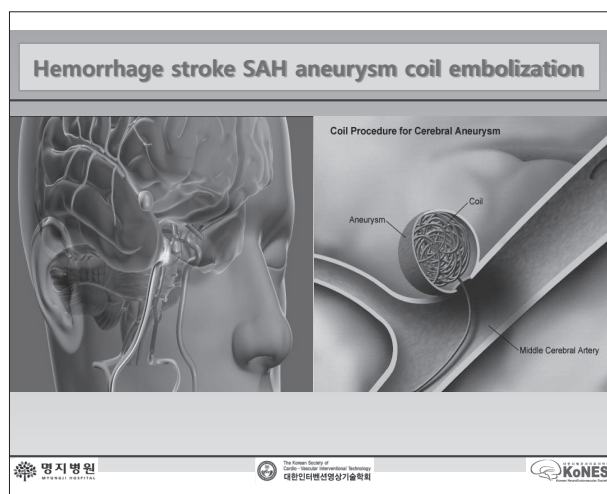
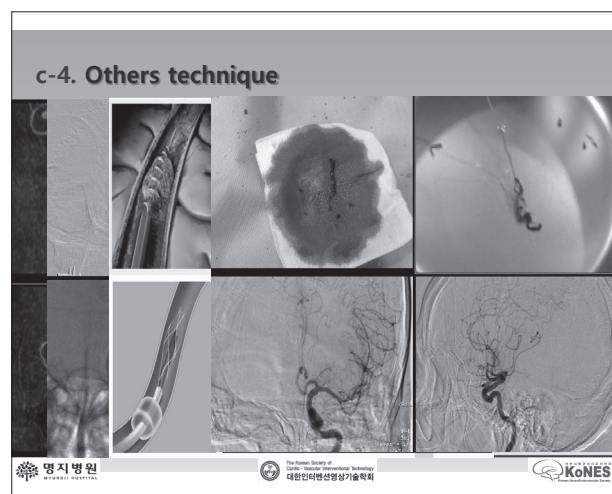
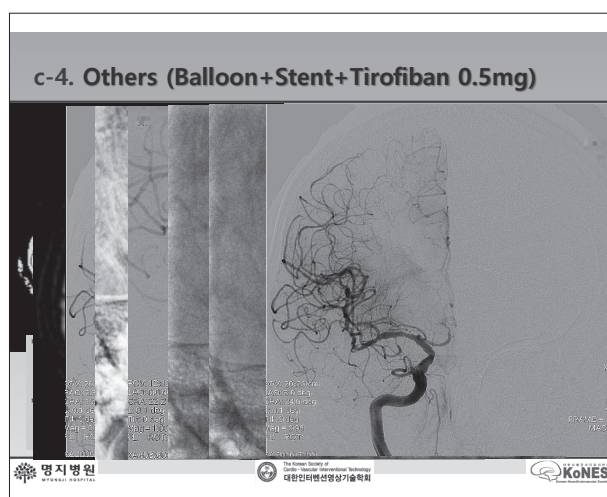
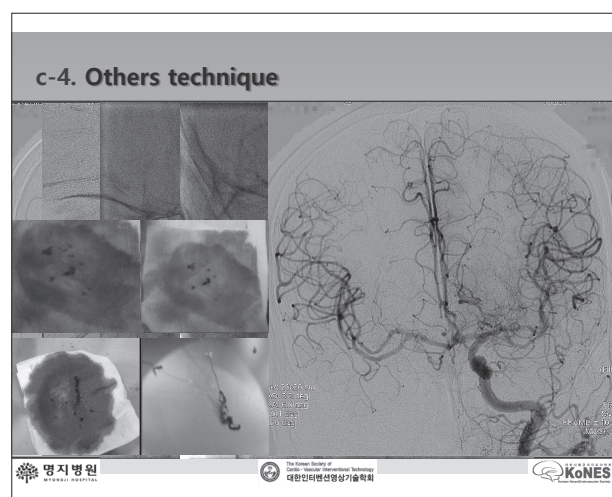
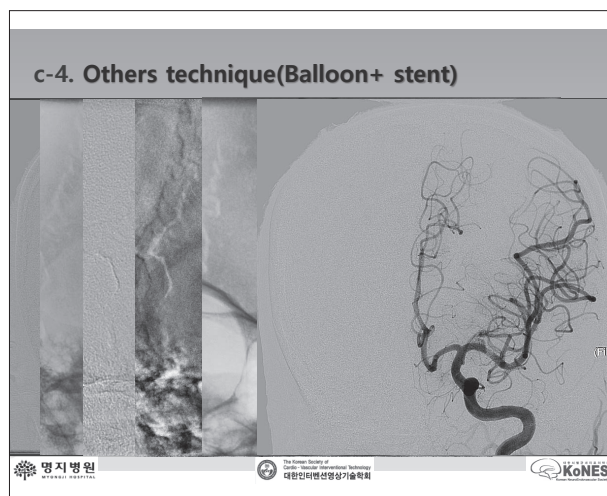
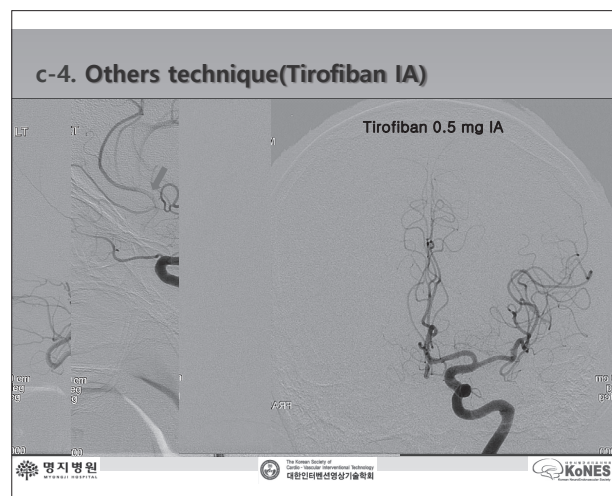
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a. Cause

원인 및 병리 생태에 대해 정확히 알려지진 않았지만 주로 선천적 혈관벽의 이상, 동맥경화, 고혈압, 군사체에 의한 혈관염, 외상 등에 의해 발생.

b. Indication

모든 동맥류 파열에 의한 지주막하출혈.
혈관박리.
동정맥기형 파열.

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c. Aneurysm rupture factors

- ✓ Size: large size ▲
- ✓ Location: high rupture risk - BT, P-com ICA, A-com ICA
low rupture risk - cavernous sinus
- ✓ Multiplicity » solitary aneurysm
- ✓ Symptomatic: most common in P-com ICA
- ✓ Age, HTN, smoking, genetic factors
- ✓ Female: increased likelihood for rupture, but data are inconclusive
- ✓ Controversial: alcohol, DM, metabolic factors

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d. Thromboembolism drug

1. Unruptured Intracranial Aneurysm

- ✓ Before coiling: Antiplatelet agent – aspirin, clopidogrel, plavix. . .
- ✓ During coiling: Anticoagulation – IV heparin(3000~5000 IU(50~100 IU/kg) then 1000 IU/hour
- ✓ After coiling: monitoring/ maintenance – TCD check, DWI MRI, neurologic symptom

2. Ruptured Intracranial Aneurysm

- ✓ Before coiling: PRN PO aspirin
- ✓ During coiling: After protection PRN IV heparin 1000 IU
- ✓ After coiling: monitoring – TCD, neurologic symptom

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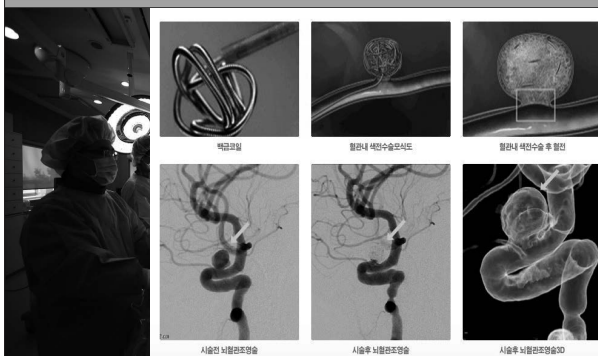
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**Antiplatelet regimen
most important!!**

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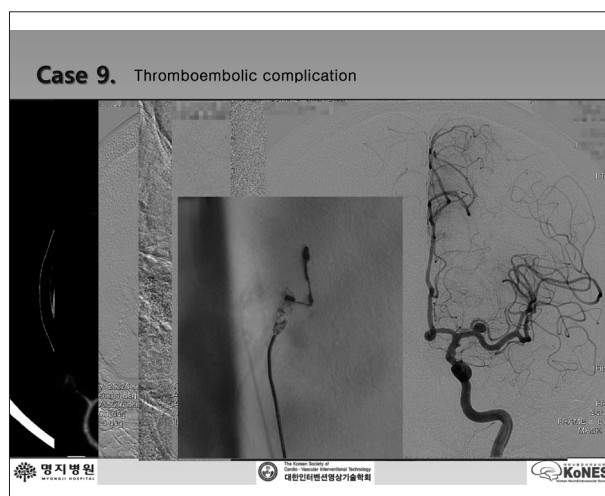
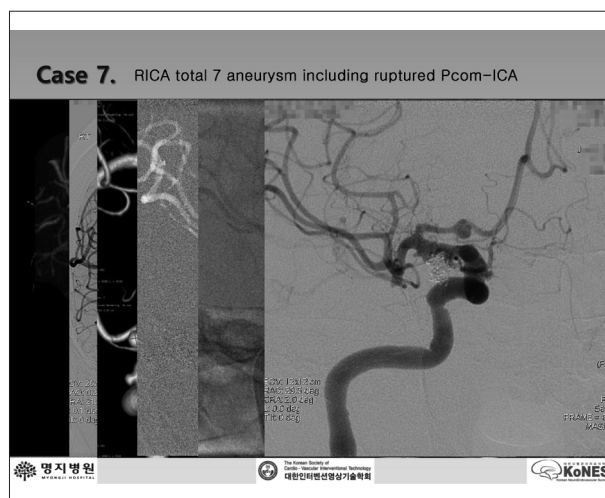
Case 1. RICA: a ruptured blood-blister aneurysm (1.3mm)

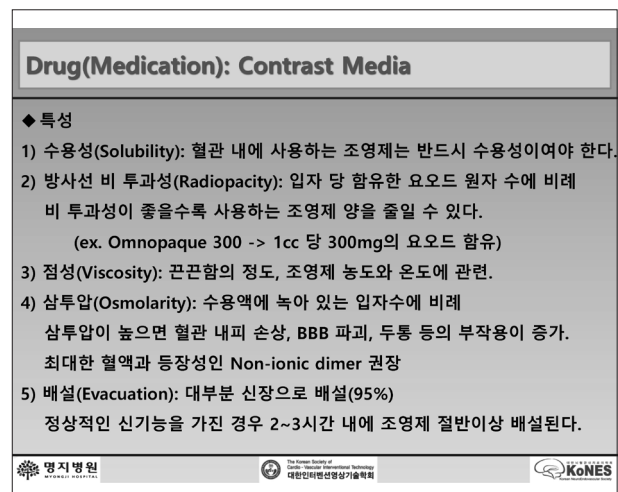
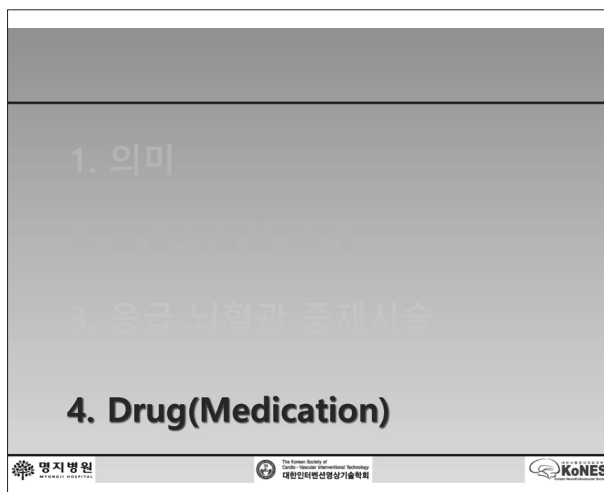
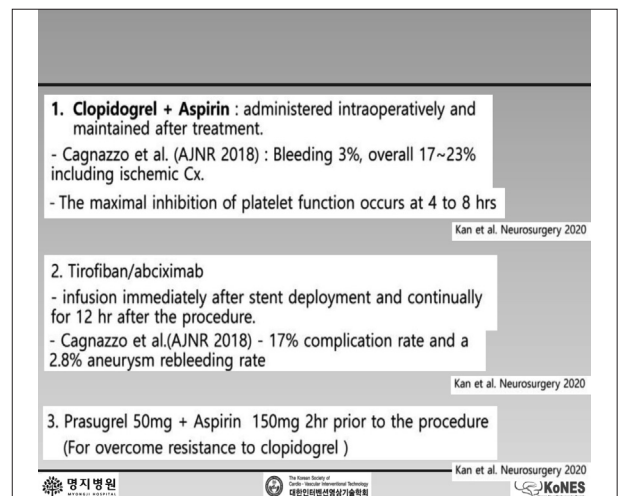
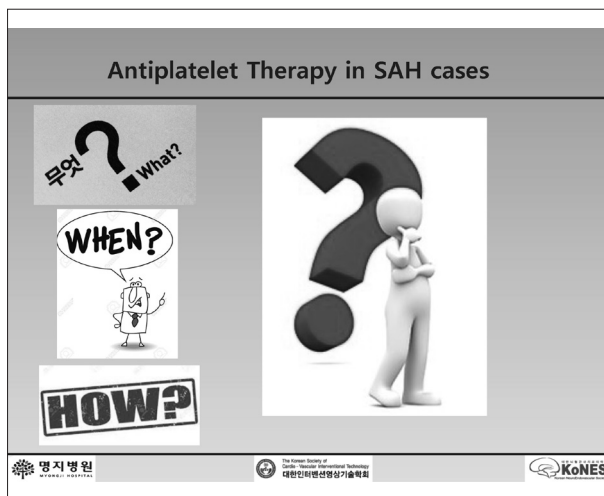
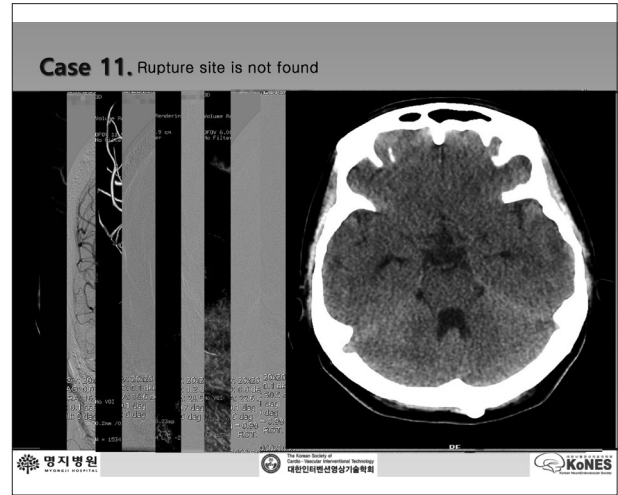
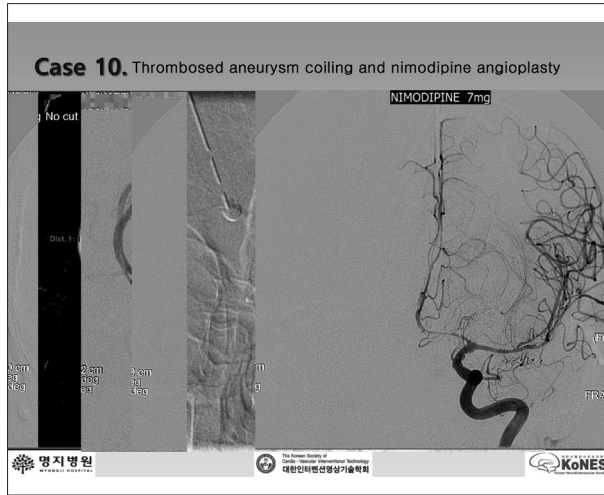


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Drug(Medication): Contrast Media

◆ 부작용(side effect)

1) Allergy: 2~5%

Urticaria

Skin rash

Mucosal edema

Bronchospasm

Anaphylaxis . . .

→ 예방이 최우선 - 이전 조영제 과민반응 유무

- 해조류, 어패류와의 연관성은 명확한 근거가 없음

→ 경미한 증상일 경우 항히스타민제가 도움(Avil, Dexa)

Hypersensitivity ≠ Allergy

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Drug(Medication): Contrast Media

◆ 부작용(side effect)

2) Contrast-induced nephropathy: 2~7%

: 조영제 주입 후 48~72시간 사이에 기저치와 비교하여 Cr이 0.5 mg/dL

or 25% 이상 상승하는 경우

→ DM, CKD, anemia, old age => 고위험환자! 20~30%까지 보고 됨...
0.3~0.7% 환자는 투석이 필요할 수도...

→ 예방이 최우선 - 이전 조영제 과민반응 유무

- 해조류, 어패류와의 연관성은 명확한 근거가 없음

→ 경미한 증상일 경우 항히스타민제가 도움(Avil, Dexa)

→ 조영제 사용 최소화, metformin 혼합사용 금지

→ IV hydration

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Drug(Medication): Antithrombotic agents

항혈소판제(Antiplatelets)

혈류 속도가 빠른 동맥에서는 혈관벽 손상에 의해 혈소판이 활성화되어 빠른 속도로 혈전이 형성되는데 이러한 혈전에 의해 발생할 수 있는 심근경색, 관상동맥증후군, 뇌졸중 치료/예방을 위해 항혈소판제가 사용된다. 항혈소판제에는 아스피린, P2Y12수용체 차단제(Ticlopidine, Clopidogrel, Prasugrel, Ticagrelor), PDE3 억제제(Cilostazole) 등이 있다.

- ✓ Aspirin: PO 100mg/T, GI irritation/bleeding, bronchospasm, Reye's syndrome(children)
- ✓ Clopidogrel: PO 75mg/T(식사 관계 없음)

→ Intracranial hemorrhage: clopidogrel 0.4%, aspirin 0.5%

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Drug(Medication): Antithrombotic agents

Tirofiban

- ✓ Small molecule.
 - ✓ Half-life 2hours. However, it's effect on platelet for 4~8hours
 - 0.9% 염화나트륨 수용액 또는 5% 포도당 수용액 250ml에서 50ml를 제거하고 이약 50ml(12.5mg)를 채워 mix한다.
 - ✓ Bolus(IA): 25µg/kg, 보통 100kg일 경우 최대 2.5mg까지
 - ✓ Maintenance(IV): 0.15 µg/kg/min(12~24hours)
 - ✓ 시술 중 생긴 급성 혈전 제거 - Tirofiban(aggrastat) → IA, IV
- 심장 혈관에 허가 받은 약제로 허가약품초과사용 승인 후 사용 가능한 유일한 약제

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Tirofiban



Tirofiban(Aggrastat) 12.5mg/50cc

: N/S 40cc + Tirofiban 10cc/2.5mg = 0.5mg/10cc

loading dose 0.4mcg/kg/min(30분간 IV or IA)	
50kg	target volume 12cc → 24cc/hr
60kg	target volume 14.4cc → 28.8cc/hr
70kg	target volume 16.8cc → 33.6cc/hr로 setting 함.

남아있는 Tirofiban 40cc(10mg)에 N/S 160cc mix 하라고 병동에 인계한다.

continue dose 0.1mcg/kg/min	
50kg	6cc/hr
60kg	7.2cc/hr
70kg	8.4cc/hr

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Drug(Medication): Antithrombotic agents

항응고제(Anticoagulants)

혈류 속도가 느린 정맥이나 심방에서의 혈전 발생(ex. 심방세동)은 혈류가 제대로 흐르지 못하는 울혈이 주된 원인인데 이때는 응고경로가 활성화 되어 혈전이 형성된다. 이러한 혈전/색전증 예방 및 치료에 항응고제가 사용된다. 항응고제에는 와파린, 헤파린, 저분자량 헤파린(LMWH), 직접/간접 Xa인자억제제, 직접 트롬빈 억제제(DTI) 등이 있다.

특히 NOAC(New oral anticoagulants)이라는 경구용 항응고제가 개발되어 와파린의 많은 단점(INR 조절, 음식/약물 상호작용 등)을 해결할 수 있게 되었다.

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Drug(Medication): Antithrombotic agents

Heparin

AT-III dependent anticoagulants, IV

- ✓ During endovascular treatment: IV bolus 3000 IU, then 1000 IU on every hour
- ✓ Monitoring: aPTT/ACT (Therapeutic range: aPTT 60~80 sec)
- ✓ Antidote: Protamine sulfate 1~1.5mg/1000 IU
 - 20mg/min < , 50mg/10min < , usually when ruptured 3mg IV injection
- ✓ Maintenance (IV): 0.15 µg/kg/min (12~24 hours)



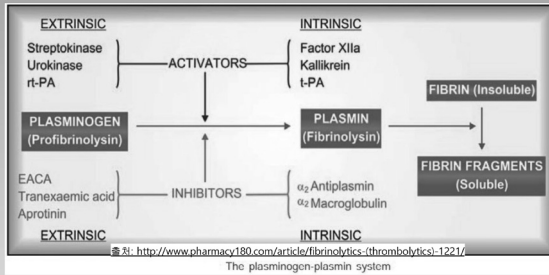
Warfarin

- ✓ Monitoring: PT INR (Therapeutic range: INR 2.0~3.0)
 - ✓ Warfarin-toxicity and Intracranial hemorrhage(약 8~11배 ICH발생률이 높다)
- Reversal: PCC(prothrombin complex concentrates).FFP > vitamin K



Drug(Medication): Thrombolytics agents

인체내에서 혈전이 축적되면 혈전용해를 유도하는 plasminogen activator가 분비되는데 이를 촉진시키는 것이 혈전용해제이다. 종류로는 streptokinase, urokinase, alteplase(rt-PA), tenecteplase 등이 있다



Drug(Medication): Thrombolytics agents

Alteplase(엑티라제, rt-PA)

- ✓ FDA approved for acute ischemic stroke
- ✓ IV, 0.9mg/kg. maximum dose 90mg)
- ✓ Within 3~4.5 hour of symptom onset



Drug(Medication): Thrombolytics agents

Alteplase(액티라제, rt-PA) 허가사항

- [illegible]



Drug(Medication): Thrombolytics agents

Nimodipine(Perdipine - Vasodilators)

- ✓ CA 2+-channel blocker(PO, IV)
- 처음에는 고혈압 치료제로 개발
- 현재는 유일하게 효과가 입증된 post SAH vasospasm 치료제
- ✓ SAH 후 96 hour 이내 사용, 최대 21일 사용
- ✓ IA therapy for vasospasm.....



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Drug(Medication): Thrombolytics agents

Nimodipine(Perdipine - Vasodilators)

<Vasospasm>

Nimotop(Nimodipine) 10mg/50cc

: N/S 75cc + Nimotop 25cc/5mg = 1mg/20cc

	1mg/20cc
1mg	target volume 20cc → 120cc/hr
2mg	target volume 40cc → 120cc/hr
3mg	target volume 60cc → 120cc/hr
4mg	target volume 80cc → 120cc/hr
5mg	target volume 100cc → 120cc/hr



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Drug(Medication) 혈전의 형태에 따른 항혈소판제 특징

동맥/정맥에서 혈전이 생성되는 기전에는 차이가 있다. 동맥벽에 죽상경화반(anthro-sclerotic plaque)이 생성되면 해당 부분을 지나는 혈류(high shear flow)는 빨라지게 된다. Plaque 주위 내피세포가 손상되면 혈소판이 달라붙어 혈전을 생성하게 되며, 높은 전단 흐름(high shear flow)에 의해 혈소판에 풍부한 혈전이 떨어져 나오면서 생성되는 것이 동맥 혈전이다. 혈소판의 응집 & 활성화가 동맥혈전 생성에 중요한 역할을 하며, 이를 white clot 이라고도 한다.

- 정맥혈전은 동맥혈전의 생성기전과 달리 전단 흐름이 낮으며(low shear flow)

	동맥혈전 (White clot)	정맥혈전 (Red clot)
주요 생성기전	혈소판 응집 및 활성화	Fibrin 생성
주요 항혈전제	항혈소판제	항응고제
유발 가능 계통	심근경색, 비심인성 뇌경색	심인성 뇌졸중, 경맥혈전색전증, 폐색전증



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Drug(Medication) 급성기 치료에서 항혈소판제 사용

- ✓ 뇌출혈의 가능성이 배제된 급성기 허혈성 뇌졸중 환자에서는 Aspirin을 뇌경색 발생 24~48시간 이내 경구투여(초기용량 160-300mg)해야 한다.
- ✓ 아스피린이 정맥 내 혈전용해술을 포함한 급성 중재치료를 대체하지는 못한다.
- ✓ 혈전용해술을 시행한 경우 24시간 이내 아스피린을 투여하면 안된다.
- ✓ 심인성 뇌색전증을 제외한 뇌경색과 일과성 허혈발작 환자들은 허혈 증상 재발방지를 위해 하루 50-300mg의 아스피린을 사용할 수 있다.



출처: https://en.wikipedia.org/wiki/Antiplatelet_drug



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Summary

RESISTANCE 인자

- * 약물의 종류
- * 투여 기간
- * 약물 상호 작용
- * 환자의 유전적 요인

What drugs

How modification

Dose control



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The 18th Annual Summer Conference on Endovascular Neurosurgical Therapy

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대한뇌혈관내치료의학회

Patience and passion

일시: 2024년 6월 21일(금) ~ 22일(토)

장소: 제주해비치호텔



E-Poster

1	Popliteal artery occlusion during mechanical thrombectomy for acute ischemic stroke	이영섭 (대구굿모닝병원)
2	Aspiration boosted stent retrieval thrombectomy: personal experience 2 case	강재성 (분당제생병원)
3	Case report: Treatment of Severe cerebral vasospasm	김현곤 (분당제생병원)
4	Delayed Coil Migration from Anterior Communicating Aneurysm: A Rare Complication	박민 (유성선병원)
5	응급 뇌졸중 치료 가이드라인 제정	오재상 (가톨릭대 의정부성모병원)
6	Carotid artery stenting following CEA in acute stroke by complete ICA atherosclerotic occlusion	박상규 (연세대 강남세브란스)
7	Transradial WEB Embolization of a Basilar Tip Aneurysm: A Technical Note and Literature Review	김동섭 (가톨릭대 인천성모병원)
8	Histological Study of the Normal Vertebral Artery -Hypothetical Induction Site of Dissecting Aneurysms-	김수빈 (순천향대 부천병원)

Popliteal artery occlusion during mechanical thrombectomy for acute ischemic stroke

Young sub Lee, Duk-Ho Goh

Department of Neurosurgery, Daegu Goodmorning Hospital

Objective: There is a case that I experienced for the first time as a neurosurgeon, and it had an occlusion of the ipsilateral popliteal artery during endovascular treatment and subsequently performed peripheral thrombectomy

Methods: The patient was a 87-year-old female patient who visited the hospital on 119 because stuporous mentality and left hemiparesis. Brain MRI/MRA performed in our hospital showed right MCA M1 occlusion and a.fib was observed on EKG. Since it was 1 hour after symptom onset, tPA was used immediately, and the patient was transferred to the angio room for endovascular treatment. After general anesthesia and femoral puncture with 9Fr, the balloon guiding catheter was placed in the right proximal ICA, and the angiogram showed that the thrombus of MCA M1 was distally migrated and located in MCA M3-4. It was not a thrombectomy case, so I removed the femoral sheath, but a clot appeared at the end of the femoral sheath. The right femoral angiography was performed by puncturing again for the left femoral angiography . Angiography was performed, and occlusion of the popliteal artery was observed. We are not equipped with device capable of performing peripheral thrombectomy. But, aspiration thrombectomy was performed three times using the React 068 aspiration catheter. Finally angiogram showed that popliteal artery became a recanalization.

Result: During endovascular treatment for acute ischemic stroke, popliteal artery occlusion occurred, but thrombectomy was performed and fortunately, it became a recanalization.

Conclusion: Always perform femoral angiography after a endovascular treatment through the femoral artery

Aspiration boosted stent retrieval thrombectomy : personal experience 2 case

Jae Seong Kang

Department of Neurosurgery, Bundang Jesaeng General Hospital, Daejin Medical Center

Objective: I would like to share an impressive thrombectomy case that I performed for a distal ICA occlusion during the period of April 1, 2024 to May 10, 2024. The first case was a 79-year-old man who was diagnosed with Lt. MCA territory infarction due to left distal ICA occlusion and underwent thrombectomy. The second case was a 90-year-old woman who was diagnosed with left MCA territory infarction due to left distal ICA, M1 occlusion and underwent thrombectomy.

Methods: An 8Fr Flowgate balloon guiding catheter, RED 62 aspiration catheter, Trevo trak 21 microcatheter, and synchro 14 microwire were used. Stent deployment was performed using a Trevo stent 4x28mm to fully cover the occlusion site, followed by an attempt to advance the aspiration catheter to the occlusion site for combined thrombectomy, but the aspiration catheter was unable to advance due to an athero-stenotic cavernous ICA segment, carotid siphon. However, before thrombectomy, an aspiration catheter was placed at the stent proximal marker and stent retrieval thrombectomy was performed with aspiration, and the first pass was successful. A large volume of thrombus was identified. The second case was exactly the same as the first, using an 8Fr Flowgate balloon guiding catheter with a RED 62 aspiration catheter, Trevotrak 21 microcatheter, synchro 14 microwire, and Trevo stent 4x28mm. Before stent retrieval, the aspiration catheter was stuck in the athero-stenotic cavernous ICA segment, carotid siphon, and the aspiration catheter could not be advanced, but the difference from the previous time was that the stent retrieval thrombectomy was performed alone without performing aspiration together due to a technical error, and recanalization was not performed. So next time, I performed a stent retrieval thrombectomy with aspiration with the aspiration catheter positioned at the stent proximal marker near the carotid siphon, and succeeded in passing. A moderate volume of thrombus was identified.

Result: In distal ICA occlusions with severe atherosclerosis in patients over 70 years of age, the aspiration catheter may not advance far enough to effectively perform combined thrombectomy. However, even in this case, if the aspiration catheter is placed only at the stent proximal marker site and aspiration is performed while stent retrieval is performed, it is thought that aspiration can help remove the thrombus by compressing the surrounding parent artery where the thrombus exists by temporarily eliminating the gap between the stent and the artery wall. Even if the distal tip of the aspiration catheter does not contact the thrombus, we experienced a significantly higher recanalization rate when aspirating near the stent proximal marker with performing stent retrieval.

Conclusion: Therefore, the combination of the Aspiration catheter and stent is thought to contribute to better outcomes in thrombus removal than the stent alone.

Case report: Treatment of Severe cerebral vasospasm

Kim hyungon

Department of Neurosurgery, Bundang Jaesang Hospital

Objective: A cerebral vasospasm is a complication that occurs after subarachnoid hemorrhage, and is an important complication that causes death and neurological deficits in patients. The treatment of vasospasm is an important factor in determining the patient's prognosis

Methods: 45-year-old man who is occurred severe headache suddenly is diagnosed with subarachnoid hemorrhage, right vertebral artery dissecting aneurysm is ruptured, in emergency room with headache. Emergency coil embolization is proceeded, Lt vertebral artery was trapped. Daily transcranial Doppler (TCD) was performed, both HI index (Vmca/Vica) is below 3, but patient was drowsy, motor of low extremity was grade II.

Result: So, TFCA was performed and diagnosed that Lt VA was occluded, Rt VA and BA were severely constricted. Drug angioplasty was treated using Nimodipin 3mg at POD7, 8.. Severe vasospasm was observed at POD 8 still, so firstly stent retriever angioplasty was performed, but vasospasm was slightly improved and still severe. Secondly balloon angioplasty using gateway 2.0mm x 9mm was performed and vasospasm was mostly improved. Another 6 drug angioplasty were treated, vasospasm was not seen in TFCA at POD16.

Conclusion: TCD is a non-invasive and useful examination for diagnosing vasospasm, but even if it is in a normal level, cerebral angiography should be performed to confirm the vascular constriction considering clinical symptoms. Drug angioplasty, stent retriever angioplasty, and balloon angioplasty were a very useful treatment for vasospasm, which should be performed until being improved.

Delayed Coil Migration from Anterior Communicating Aneurysm: A Rare Complication

Min Park

Department of Neurosurgery, Yuseong Sun Medical Center

Objective: Coil migration is an infrequent but potentially grave complication following cerebral aneurysm embolization, which can transpire early or late in the postoperative period. This study aims to discuss a rare case of delayed coil migration from an anterior communicating artery aneurysm and review the potential factors contributing to this complication.

Methods: We report the case of a 51-year-old male with a ruptured anterior communicating artery aneurysm who underwent coil embolization using the double microcatheter technique without stent insertion. The patient presented with left leg weakness and gait disturbance twelve days post-procedure, and brain magnetic resonance angiography (MRA) showed coil migration to the right A2 segment. On postoperative day 20, an endovascular procedure was performed to fix the migrated coil.

Result: This study highlights the rarity of delayed coil migration, emphasizes the importance of considering this complication, and discusses the possible contributing factors, including aneurysm shape, site, broad neck, low dome-to-neck ratio, coil size and design, use of soft coils, microcatheter kickback, and cerebral vasospasm.

Conclusion: Although delayed coil migration after endovascular treatment for an aneurysm is exceedingly rare, it poses a risk of severe ischemic complications. Therefore, it is crucial to acknowledge the possibility of this infrequent complication and implement strategies to minimize its occurrence.

응급 뇌졸중 치료 가이드라인 제정

오재상¹, 이종민³, 박석규², 권순찬³

¹가톨릭대학교, ²순천향대학교, ³울산대학교

Objective: 필수의료이 부족한 한국의 실정과 초기 환자 이송과 치료결정 가이드라인의 부족 • 필수의료인 뇌혈관 질환의 대표적인 직업군은 신경외과 의사가 노쇠화되고 점차 개두술등 어려운 고난이도 수술이나 시술을 담당하는 의사들이 감소하는 실정으로 충분한 시스템 구축과 지원이 없이 이루지는 현실임. • 아산병원 간호사와 같은 이슈가 발생해서 대대적인 국가적인 책임의식과 필수의료 전체적인 환자 시스템에 대한 가이드리안이 필요한 실정임. • 보건복지부는 24년 1월부터 인적네트워크 사업을 바탕으로 급성뇌졸중 치료 지역 네트워크체를 구성하기 시작함. 직접 최종치료 전문가가 해당지역의 이송을 필요로 하는 급성 뇌졸중 환자 (뇌경색/뇌출혈 모두 포함)의 이송 가능병원과 최종치료를 모두 어렌지하고 담당하는 당직 시스템 구축했으나 현장에서는 이송에 대한 적절한 조치와 가이드라인이 명확치 않아서 매우 혼란스런 상황임.

Methods: 뇌졸중 초기 발생 치료 전단계 및 이송 가이드라인 1. 급성 뇌경색 환자 치료 전단계 및 이송 가이드라인 개발 2. 급성 뇌출혈 환자 치료 전단계 및 이송 가이드라인 개발 3. 급성 뇌지주막하출혈 치료 전단계 및 이송 가이드라인 개발

Result: 1. 뇌졸중센터 네트워크 구축: 권역심뇌혈관센터와 권역심뇌혈관센터를 중심으로 전국 뇌졸중센터 협력 네트워크를 구축한다. 이 네트워크는 지식 공유, 협업 및 지침 개발을 위한 플랫폼 역할을 할 것입니다. 2. 다학제 태스크포스 구성: 신경외과 의사, 신경과 전문의, 중재적 신경방사선 전문의, 응급의사, 간호사 및 재활 전문가로 구성된 다학제 태스크포스를 구성합니다. 이 태스크 포스는 포괄적인 뇌졸중 치료 지침 개발에 대한 전문 지식과 다양한 관점을 제공할 것입니다. 3. 문헌 검토 및 근거 종합: 뇌졸중 치료와 관련된 관련 연구, 임상 시험 및 기존 지침을 식별하기 위해 체계적인 문헌 검토를 수행합니다. 뇌졸중 치료에 대한 신경외과적 중재에 대한 증거 기반 권장 사항 개발을 알리기 위해 증거를 종합합니다. 4. 전문가 합의 및 이해관계자 참여: 지침 개발과 관련하여 신경외과 의사 및 기타 이해관계자 간의 합의 구축을 촉진합니다. 설문 조사, 포커스 그룹, 이해 관계자 회의를 통해 신경외과 의사를 참여시켜 뇌졸중 치료에 대한 주요 우선 순위, 과제 및 선호 사항에 대한 의견을 수집합니다. 5. 지침 작성 및 개선: 종합된 증거와 전문가 합의를 바탕으로 뇌졸중 치료 지침 초안을 개발합니다. 명확성, 관련성 및 실용성을 보장하기 위해 신경외과 의사 및 기타 이해관계자의 피드백을 통해 지침을 반복적으로 개선합니다.

Conclusion: KoNES 진료지침부에서는 진료지침이사(오재상)와 연구개발위원 9인(김영덕, 김정재, 김장훈, 서동욱, 안홍석, 윤기용, 이종민, 이형진, 장경민) 의 젊은 연구자들과 함께 향후 1년간 1단계, 그 뒤 2년간 2단계 응급 뇌졸중 치료 가이드라인을 개발한다. 이를 통해 국내 뇌졸중 치료의 가이드라인을 전문가 집단에게 공유하고자 한다.

가이드라인 설문조사 실시

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KoNES

대한뇌혈관내치료의학회

회장 권순찬, 부회장 박석규, 진료지침 오재상 배상

Carotid artery stenting following CEA in acute stroke by complete ICA atherosclerotic occlusion

Sang Kyu Park

Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University

Objective: A 69-year-old male patient developed left-sided hemiparesis after undergoing TKR surgery. MR imaging revealed findings consistent with right ICA occlusion-induced cerebral ischemia.

Methods: Thrombectomy and CAS were attempted, but due to complete occlusion of the ICA, the wire could not pass through, resulting in procedural failure, and neurosurgical consultation was sought.

Result: CEA was performed for carotid bulb occlusion; however, even after CEA, persistent ICA occlusion was observed, prompting intraoperative DSA. Stenosis was confirmed at the site of CEA, with multiple stenoses and thrombus observed in the distal ICA, leading to thrombectomy and ICA stent placement.

Conclusion: Finally, CAS was additionally performed at the carotid bulb site, successfully achieving ICA recanalization. The patient was immediately started on dual antiplatelet therapy, and the ICA remained patent with no progression of cerebral ischemia.

Transradial WEB Embolization of a Basilar Tip Aneurysm: A Technical Note and Literature Review

Dong-Sub Kim, Byung-Rae Cho, Young Hoon Choi, Dong-Kyu Jang

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

Objective: The purpose of this report is that access to the vertebral artery through the Rt. radial artery is easier than access through the femoral artery when the origin of the right vertebral artery (VAO) is sharply curved.

Methods: A 61-year-old female patient presenting with 5.00 x 2.59 x 5.05mm (DNH) sized basilar tip aneurysm with multilobulated daughter sac. It was decided that the use of WEB device would be better than simple coil embolization in preventing recurrence of aneurysm.

Result: Under general anesthesia, a right radial puncture was done and a Sofia 5Fx115cm guiding catheter was positioned up to Rt. V4, and 2D and 3D DSA were performed. A working angle was set up. Aneurysm volume was calculated with AngioCalc software (www.angiocalc.com) as 44.3mm³. According to the WEB SL volume chart, the first choice was selected with a WEB SL 5x3mm (59 mm³), not a WEB SL 5x4mm (79mm³). A VIA17 microcatheter was positioned up to neck of basilar tip aneurysm. The selected WEB SL 5x3mm device was inserted into the microcatheter and deployed into the aneurysm successfully. The total procedure time was 51 minutes, which was shorter than the time required for coil embolization of an average basilar tip aneurysm. She was discharged two days later without any complications.

Conclusion: In the treatment of basilar tip aneurysms with a sharp entrance to the vertebral artery, the WEB procedure through the radial artery is thought to have advantages over the common coil embolization through the femoral artery in terms of ease of access to the aneurysm, faster procedure time, and less hemostasis time.

Histological Study of the Normal Vertebral Artery -Hypothetical Induction Site of Dissecting Aneurysms-

Su-Bin Kim¹, Dong Seong Shin², Ho Jun Yi², Bum-Tae Kim^{1,2}

¹Department of Neurosurgery, ²School of Medicine, Soonchunhyang University Bucheon Hospital

Objective: Histological evaluation of dissecting aneurysms of the cerebral arteries has suggested that defects in the internal elastic lamina (IEL) induce dissection of the arterial wall. Dissecting aneurysms occur most frequently in the vertebral artery (VA).

Methods: The present study examined sections of the normal VA to elucidate the mechanisms of arterial dissection. Bilateral VAs (24 vessels) were obtained from 12 formalin fixed cadavers who died of causes other than intracranial lesions. The VAs were detached from the VA union to the point penetrating the dura mater. The VAs were cut at 5-mm intervals from the VA union, and each segment was observed using Masson's trichrome staining for elastic fibers and its thickness was measured by NIH ImageJ (Wayne Rasband@R).

Result: There was a high incidence of IEL thinning areas at the medial wall of both VAs. The thinning of tunica media was observed/measured at the same IEL thinning wall.

Conclusion: -

MEMO