

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

- Complication avoidance in Neurovascular surgery

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

주최 _ 대한뇌혈관내치료의학회

주관 _ 대한신경외과학연구재단

머리말



존경하는 대한뇌혈관내치료의학회 회원 여러분 안녕하십니까?

대한뇌혈관내치료의학회 회장 장철훈입니다.

제가 2021년 12월 회장에 취임하면서 강조한 부분이 세가지였습니다.

첫번째는 회원들의 역량 강화를 통한 양질의 의료 환경 조성, 두번째는 학회 회원들의 연구 및 임상 경험의 정리 및 업적 관리, 세번째가 학회의 국제적 역량 강화입니다.

여러 전임 회장님들과 학회 임원들, 회원들의 도움으로 많은 업적을 이룩한 한해라고 자평합니다. 발전하는 의료 환경에 효율적으로 대응하고 임상에서의 오류를 최소화 하기 위한 연수 강좌, KoNES 인증 제도, CME program of KoNES 등이 정착되었고 연보 작업을 통해 우리의 업적을 정리하고 있으며, 신용삼 전임회장께서 주도하신 국제 학회로서의 Bi-Neurovascular symposium, 그리고 2026년 WFITN(World Federation of Interventional & Therapeutic Neuroradiology)의 부산 유치는 학회가 발전한 것을 반증하는 업적이며 동시에 학회가 또 한번 도약할 수 있는 동기 부여이기도 하다는 생각합니다.

하지만 과제도 안고 갑니다. KoNES Registry 사업은 아직도 회원들의 자발적 참여가 부족한 부분이며, 최근 변화하는 필수 의료에서의 대응 부분은 우리 회원들에게 부담으로 다가 오는 현실이며 이와 관련한 정책 부분에 있어 학회는 회원들의 권익 보호를 위해 노력할 것입니다.

이번 정기 학술대회의 주제는 “Complication Avoidance in Neurovascular Surgery”입니다. 임상에서 합병증을 최소화 하기 위한 경험 공유 및 토론을 준비하고 있으며 실제 합병증이 발생하였을 때 대처하는 법적 부분도 다루고 있어 의미 있는 학술 대회가 될 것으로 생각합니다.

Luncheon symposium 에서는 상대적으로 발생 빈도가 낮은 척추에서 발생한 혈관 질환에 대처하기 위한 해부학 및 혈관내 치료에 대하여 권오기 전임 회장님과 우리 나라 신경중재영상의학의 대부이신 최인섭 교수님의 강의를 준비 되어 있어 매우 유익한 시간이 될 것이라 판단합니다.

또한 이번 정기 총회에서는 김영준 전임회장께서 명예 회장으로 추대 되십니다. 먼저 축하 말씀 드리고 언제나 그러하셨 듯 항상 건강하시고 저희들 곁에서 많은 조언을 아끼시지 않는 학회의 큰 어른으로 남아 주시길 부탁드립니다.

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

2022년 11월 아름다운 자연 환경이 있는 부산에서 뵙겠습니다.

감사합니다.

2022년 10월

대한뇌혈관내치료의학회 회장 **장 철 훈**

2022~2023 13대 대한뇌혈관내치료의학회 임원진

직위	성명	소속
회장	장철훈	영남대학교병원
부회장	권순찬	울산대학교병원
총무	김영우	가톨릭대학교 의정부성모병원
학술	권현조	충남대학교병원
정책	신승훈	차의과대학교 분당차병원
	박석규	순천향대학교 서울병원
	권오기	분당서울대학교병원
재무	고준경	부산대학교병원
수련교육	김태근	차의과대학교 분당차병원
	박중철	울산대학교 서울아산병원
간행	하성곤	고려대학교 안산병원
보험	박석규	순천향대학교 서울병원
	정준호	연세대학교 세브란스병원
	이성호	서울대학교병원
대외협력	김성립	가톨릭대학교 부천성모병원
	강동훈	경북대학교병원
	김범태	순천향대학교 부천병원
국제교류	정진영	연세메스병원
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전산정보	신동성	순천향대학교 부천병원
	남택균	중앙대학교병원
회원관리	장인복	한림대학교 평촌성심병원
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전문병원	김문철	에스포항병원
	허준	명지성모병원
	전우열	대구굿모닝병원
	김희섭	청주효성병원
심뇌혈관정책	윤창환	분당서울대학교병원 순환기내과
	이찬희	영남대학교병원 순환기내과
	옥민수	울산대학교병원 예방의학과
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다학제연구	이학승	원광대학교병원 신경과
	정용안	가톨릭대학교 인천성모병원 핵의학과
	이아름	순천향대학교 부천병원 영상의학과
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별정직 이사 (학술지편집)	김대원	원광대학교병원
별정직 이사 (인증관리)	성재훈	가톨릭대학교 성빈센트병원
	오인호	중앙보훈병원
	김소연	가톨릭관동대 국제성모병원

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별정직 이사 (다기관임상)	황교준	분당제생병원
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특별이사 (신의료기술 / 장비 / 재료)	강현승	서울대학교병원
특별이사 (해외학회 유치)	신용삼	가톨릭대학교 서울성모병원
특별이사 (CME)	고준석	강동경희대학교병원
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대구/경북지회	이혁기	안동병원
대전/충청지회	정승영	을지대학교 대전병원
부산/울산/경남지회	고준경	부산대학교병원
인천지회	유찬종	가천대학교 길병원
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총무 간사	김훈	가톨릭대학교 부천성모병원
학술 간사	오재상	순천향대학교 천안병원

명예회장 (2명)

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	권도훈	울산대학교 서울아산병원

전임회장단 (9명)

직위	성명	소속
초대, 제2대	백민우	인봉의료재단 뉴고려병원
제3대	김영준	오산한국병원
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

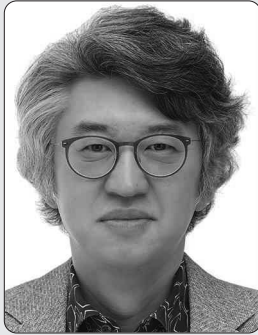
운영위원

직위	성명	소속
학술위원회 (8명)	김소연	가톨릭관동대학교 국제성모병원
	김유섭	전남대학교병원
	박정현	한림대학교 동탄성심병원
	반승필	분당서울대학교병원
	오재상	순천향대학교 천안병원
	이성호	유성선병원
	정은오	충남대학교병원
	조수희	울산대학교 강릉아산병원

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	김종훈	영남대학교병원
	김창현	계명대학교 동산병원
	김창현	양산부산대학교병원
	임상혁	가톨릭대학교 은평성모병원
	최대한	가천대학교 길병원
	김훈	가톨릭대학교 부천성모병원
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	신희섭	강동경희대학교병원
	안준형	강원대학교병원
	하상우	조선대학교병원
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정책위원회 (=급성뇌경색연구회 (ASTRO))	신승훈	차의과대학교 분당차병원
	권현조	충남대학교병원
	이종영	한림대학교 강동성심병원
	박근영	연세대학교 세브란스병원
	반승필	분당서울대학교병원
	오세양	인하대학교병원
	진성철	인제대학교 해운대백병원
	장철훈	영남대학교병원
	강동훈	경북대학교병원
	홍대영	에스포항병원
	문종현	광주기독병원
	박정수	전북대학교병원
	임종국	제주대학교병원
	이승진	강원대학교병원
	이동훈	가톨릭대학교 성빈센트병원
	김미경	명지성모병원
	김현곤	분당제생병원
	김성한	가톨릭대학교 부천성모병원
Registry 관리 운영위원회 (15명)	김명진	가천대학교 길병원
	김성태	인제대학교 부산백병원
	김창현	양산부산대학교병원
	김병준	경북대학교병원
	조재훈	포항세명기독병원
	문종현	광주기독병원
	박민	전주예수병원
	정재우	단국대학교병원
	조경일	청주하나병원
	임종국	제주대학교병원
	양구현	울산대학교 강릉아산병원

초청연자



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Present Title and Position

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Section Director, Section of Neuroimaging and Neurointervention, Busan Paik Hospital

Director, Intervention Center, Busan Paik Hospital

Education

Medical Doctor : School of Medicine, Busan National University, Busan, Korea (1988-1994)

Master : School of Medicine, Busan National Univeristy, Busan, Korea (1996-1998)

Ph.D : School of Medicine, Busan National Univeristy, Busan, Korea (2001-2005)

Postgraduate Training

Rotating Internship : Maryknoll Hospital, Busan, Korea (1994-1995)

Residency : Department of Radiology, Maryknoll Hospital, Busan, Korea (1996-2000)

Fellowship : Department of Radiology, Severance Hospital, Yonsei University, Seoul, Korea (2000-2001)

Clinical Fellow : Service de Neuroradiologie Interventionelle et Fonctionnelle, Fondation Adolphe de Rothschild Ophthalmologique, Paris, France (2007-2008)

Positions Held & Faculty Appointment

Faculty : Department of Radiology, Maryknoll Hospital, Busan, Korea (2001-2002)

Full-time Instructor : Department of Radiology, College of Medicine, Inje University, Busan, Korea (2002-2003)

Assistant Professor : Department of Radiology, College of Medicine, Inje University, Busan, Korea (2003-2009)

Associate Professor : Department of Radiology, College of Medicine, Inje University, Busan, Korea (2009-2016)

Professor : Department of Radiology, College of Medicine, Inje University, Busan, Korea (2016-present)

초청연자



최 인 섭

인천세종병원 뇌혈관센터

[학력사항]

- 1968 서울대학교 의예과 졸업
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 - 2022.9~ 국민의힘 원내대변인
 - 2022.8~ 제21대 국회 후반기 연금개혁특별위원회 위원
 - 2022.7~ 제21대 국회 예산결산특별위원회 위원
 - 2022.6~ 국민의힘 혁신위원회 위원
 - 2022.3 제20대 대통령직인수위원회 사회복지문화분과 상임자문위원
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심장대사증후군학회 학술위원 (21-22)

프로그램

11월25일(금)

08:30-09:40	상임이사회		
09:00-09:50	Registration		
09:50-10:00	Opening address	장철훈 (대한뇌혈관내치료의학회장)	
	Congratulatory address	김범태 (대한신경외과학회장)	
		임동준 (대한뇌혈관외과학회장)	
10:00-11:20	Symposium I (Tips for periprocedural complications avoidance)	좌장: 이창영 (계명대) 윤석만 (순천향대)	
10:00-10:20	Aneurysmal embolization with coil	정해웅 (인제대 영상의학과)	21
10:20-10:40	Aneurysmal embolization with WEB	박근영 (연세대)	23
10:40-11:00	Intra- and Extra-cranial stent angioplasty	김성림 (가톨릭대)	28
11:00-11:20	AVM & dural AVF embolization	최재호 (가톨릭대)	29
11:20-11:40	Coffee Break		
11:40-12:40	Free paper I (Aneurysm) & Committee session I		
11:40-12:40	Free paper I (Aneurysm) [Grand ballroom]	좌장: 성재훈 (가톨릭대) 정진영 (연세메스병원)	
	Difference in location and clinical characteristics between ruptured and unruptured very small intracranial aneurysm	구자호 (아주대병원)	33
	Comparison of modified dual-antiplatelet (aspirin and prasugrel) and triple-antiplatelet (aspirin, clopidogrel and cilostazol) therapy in patient with high on-treatment platelet reactivity undergoing stent-assisted coil embolization for an unruptured intracranial aneurysm: A Prospective Randomized Clinical Trial	반승필 (분당서울대병원)	34
	Quantitative analysis of hemodynamic changes induced by size discrepancy of flow diverter and parent artery in cerebral aneurysms	김성한 (가톨릭대 부천성모병원)	35
	New morphological parameter for intracranial aneurysms and rupture risk prediction based on artificial neural networks	조광천 (연세대 용인세브란스병원)	36
	Comparison of Neuroform Atlas stent assisted coiling and coiling alone in ruptured intracranial aneurysms: A propensity score matching analysis	이호준 (순천향대 부천병원)	37
	Stent-assisted Coiling vs. Flow Diverter for Treating Blood Blister-like Aneurysms : A Proportion Meta-analysis	이정준 (동국대 일산병원)	38
11:40-12:40	다기관임상위원회 [Ballroom 1]	좌장: 황교준 (한림대)	
	레지스트리 활성화 - 현 레지스트리 편의성 개선사항 - 참여 확대를 위한 방안 논의		
11:40-12:40	학술지편집위원회 [Ballroom 2]	좌장: 김대원 (원광대)	
	학회지 경과보고	박은석 (울산대)	43
	JCEN 리뷰어 경험 및 학술지 보완관련 제언	정재우 (단국대)	44
	기타 토의		
12:40-12:50	Photo time & short break		
12:50-13:50	Luncheon symposium	좌장: 권순찬 (울산대) 강현승 (서울대)	
12:50-13:20	Updates on Spinal angiography	권오기 (서울대)	47
13:20-13:50	Experiences of various endovascular spinal procedures	최인섭 (인천세종병원 뇌혈관센터)	48

13:50-14:50	Free paper II (Resident session) & General assembly	
13:50-14:50	General assembly [Grand ballroom]	사회: 김영우 (충무이사)
13:50-14:50	Free paper II (Resident session) [Ballroom 1]	좌장: 이동훈 (가톨릭대) 하상우 (조선대)
	Giant venous aneurysm misunderstood to posterior cerebral artery aneurysm	장삼찬 (원광대병원) 54
	Mechanical Thrombectomy for Anterior Cerebral Artery Occlusion: A Single-Center Experience	김경훈 (조선대병원) 55
	Transarterial embolization of dural arteriovenous fistula with multiple venous varix/ectasia	설정훈 (중앙보훈병원) 56
	Treatment strategies for mycotic aneurysms in patients with infective endocarditis: Report of 2 cases	이연후 (아주대병원) 57
	Mechanical thrombectomy of M2-3 occlusion: A single-center retrospective study	황인성 (서울대병원) 59
	Risk factors of contrast-induced encephalopathy after coil embolization for unruptured cerebral aneurysms	양기윤 (충남대병원) 60
13:50-14:50	Nurse & Technician [Ballroom 2]	좌장: 김명진 (가천대) 오재상 (순천향대)
	TFCA-related complications	정은오 (충남대) 63
	Contrast-related complications	조동영 (이화여대) 73
	Radiation-related complication	이종민 (울산대) 83
14:50-15:10	Coffee Break	
15:10-16:10	Free paper III (Ischemia), Plenary session & Committee session II	
15:10-16:10	Free paper III (Ischemia) [Grand ballroom]	좌장: 신승훈 (차의과대) 진성철 (인제대)
	Extended time window (>6 hour) mechanical thrombectomy; good clinical outcome in the young age population. Relationship between age and prognosis	조진모 (가톨릭관동대 국제성모병원) 91
	Neurological status should be considered when contemplating decompressive craniectomy after intraarterial thrombectomy	임상혁 (가톨릭대 은평성모병원) 92
	The practical application of mechanical thrombectomy without intravenous t-PA as a bridge therapy for acute large artery occlusion within 4.5 hours after symptom onset	진성철 (인제대 해운대백병원) 93
	Procedural factors for re-occlusion in acute large artery atherosclerotic occlusion after intra-arterial recanalization therapy plus balloon angioplasty or intracranial stenting	최윤혁 (인제대 해운대백병원) 94
	Endovascular Treatment of the Vertebral Artery Origin Stenosis by Using the Closed-cell, Self-expandable Carotid Wallstent	고준경 (부산대병원) 95
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프로그램

15:10-16:10	Plenary session 학술상 및 연구비지원 학술연구 발표 [Ballroom 1]	좌장: 김태곤 (차의과대) 심숙영 (인제대)
	에스포항병원 학술상 Clinical Significance of Prehospital Telecommunication Denied as the Critical Stroke Call Pathway in Acute Ischemic Stroke Requiring Intra-Arterial Recanalization Therapy	이현곤 (동남권원자력의학원) 101
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	Clinical outcome of coil embolization for unruptured intracranial aneurysms by region and hospital size: Nationwide cohort study in Korea	이시운 (서울대) 103
	대형뇌동맥류에 대한 혈류전환 스텐트 치료의 유효성 및 안정성평가	정준호 (연세대) 104
	뇌동맥류 혈관내 코일색전술의 총액 계약제 적용을 위한 연구	박석규 (순천향대) 105
	Discontinuation of antiplatelet therapy after stent-assisted coil embolization for cerebral aneurysms	김태곤 (차의과학대) 106
15:10-16:10	진료지침위원회 [Ballroom 2]	좌장: 최재형 (동아대)
	진료지침 개발원칙과 진행과정	김수영 (대한의학회 임상진료지침 전문위원, 한림의대 가정의학과) 109
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17:40-17:50	필수의료 문제 해결을 위한 심뇌혈관질환 정책 방향	김한숙 (보건복지부 보건의료정책실 질병정책과 과장) 134
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11월26일(토)

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	심뇌혈관질환 예방 및 관리에 관한 법률 개정에 따른 하위법령 제정에 대한 제언	권순찬 (울산대) 138
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	KONES 인증제의 과거, 현재 그리고 미래	신희섭 (경희대) 143
	뇌졸중센터 및 재관류치료 뇌졸중센터 인증제도와와의 비교	이현곤 (동남권원자력의학원) 144
08:00-09:00	학술위원회 [Ballroom 2]	좌장: 권현조 (충남대)
	역대 KONES 학술대회 REVIEW	정은오 (충남대) 151
	최근 미국 학회 동향	반승필 (서울대) 155
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09:00-10:00	Free paper IV (AVF, AVM & etc.) & Committee session IV	
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	The short-term follow up of P2Y12 reaction unit (PRU) for clopidogrel is necessary to predict the bleeding risk in patients underwent stent-assisted coil embolization for unruptured intracranial aneurysm	김영덕 (분당서울대병원) 164
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	Deep Learning for Detecting Intracranial Aneurysms in Computed Tomography Angiography	최대한 (가천대 길병원) 167
	Safety and efficacy of the novel Alpha stent™ for the treatment of intracranial wide-necked aneurysm: A single-arm, prospective study	정준호 (연세대 강남세브란스병원) 168
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	충북 스마트 시티 및 구급 효과	김상철 (충북대 응급의학과) 171
	BRAIN SAVER	이만우 (한림대 신경과) 173
	KONES의 병원전단계 시스템 제안	진성철 (인제대) 180
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10:00-10:20	Coffee Break	
10:20-11:40	Symposium III (Tips for device-related complications avoidance) & Committee session V	
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10:20-10:40	Detachable coils	김성태 (인제대) 185
10:40-11:00	Stents for coil embolization	반승필 (서울대) 186
11:00-11:20	Flow diverter	정준호 (연세대) 190
11:20-11:40	Suction catheter and stentriever	김창현 (계명대) 191
10:20-11:40	WFITN 2026 준비모임 [Ballroom 1]	좌장: 신용삼 (가톨릭대)
11:40-12:10	E-poster presentation	좌장: 김영우 (가톨릭대) 강동훈 (경북대)
12:10-12:20	Closing remark	장철훈 (대한뇌혈관내치료의학회 회장)

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Symposium I

(Tips for periprocedural complications avoidance)

11월 25일(금) 10:00-11:20

좌장: 이창영 (계명대),
윤석만 (순천향대)

Aneurysmal embolization with coil

정해웅

인제대 영상의학과



Aneurysm embolization with coil

Tips for periprocedural complications avoidance
Annual Meeting of KoNES, 2022-11-25



Hae Woong Jeong, M.D., Ph.D.
Intervention Center,
Inje University Busan Paik Hospital,
Busan, Republic of Korea

Presenter

Hae Woong Jeong, M.D., Ph.D.

- ❖ Professor, Department of Diagnostic Radiology, College of Medicine, Inje University
- ❖ Chief, Section of Neuroimaging and Neurointervention
- ❖ Director, Intervention Center, Busan Paik Hospital



Nothing to disclosure
A Proctor for Surpass Streamline and Surpass Evolve FD Cases
A Proctor for the use of Pipeline Embolization Device (PED)
A Proctor for Woven EndoBridge (WEB) Device Cases

Introduction

Complications

- Intra-procedural rupture
- Thromboembolism
- Coil migration
- Coil stretching
- Prolapsed coil mass or tail
- Unexpected stent migration
- Inappropriated stent deployment

Intra-procedural Rupture

Risk factors

- small, ruptured, A-com, lobulated, daughter sac

Diagnosis

- contrast leakage, device penetration, abruptly increased blood pressure

Mechanisms

- coil, microwire, microcatheter, contrast pressure

Management

- continuous packing

Thromboembolism

Introduction

ruptured, wide neck, MCA, balloon or stent assisted

Management principle

DSA evaluation

Treatment

heparinization, pharmacological thrombolysis,
mechanical thrombectomy

General considerations

nonocclusive thrombus, occlusive thrombus,
getting out of trouble

Coil Migration

Definition, cause, basic management

removal of migrated coil ASAP

Possible complications

ischemic stroke

Basic rescue technique

microsnare, microwire, monorail snare

Others

Enterprise stent, Solitaire stent

Prolapsed coil mass or tail

Definition and cause

prolapsed coil mass

Possible complications

ischemic stroke

Basic rescue technique

microcatheter, balloon, stent

Others

open surgery, microsnare

Unexpected Stent Migration

Stent migration

closed cell, vessel diameter discrepancy

Possible complications

ischemic stroke

Basic rescue technique

additional stent, stent deployment after coiling

Others

Enterprise stent, Solitaire stent

Summary

Complications

Intra-procedural rupture

Thromboembolism

Coil migration

Coil stretching

Prolapsed coil mass or tail

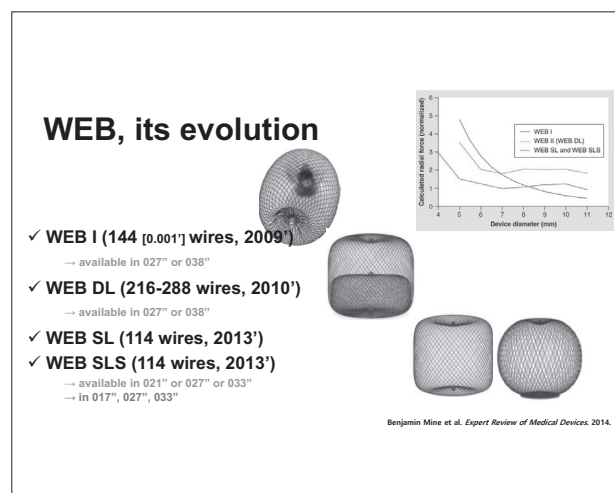
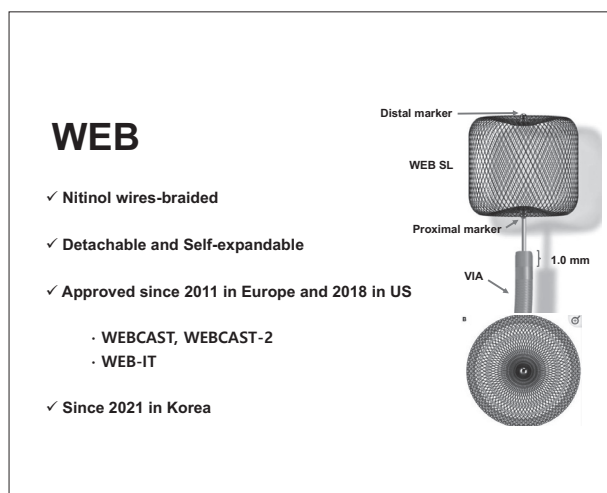
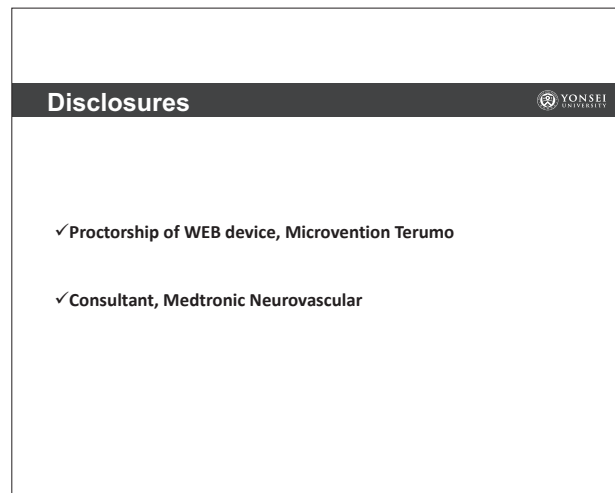
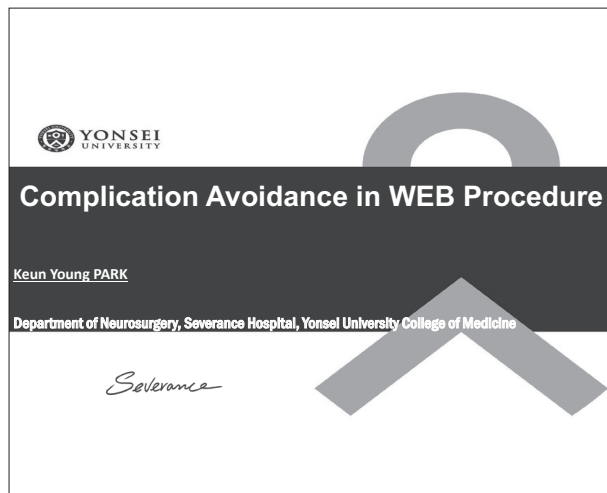
Unexpected stent migration

Inappropriated stent deployment

Aneurysmal embolization with WEB

박근영

연세대



Core Indications

1. Locations

- MCA bifurcation
- ICA terminus
- Acom complex and BA Apex

2. Saccular aneurysm

3. Aneurysm size (3~10mm)

Neck $\geq$ 4mm or Dome to neck ratio (1~2)

4. Easy micro-access to aneurysm

- "On" axis, angle parent vessel/aneurysm $< 45^\circ$
- "Less-twisted" parent vessel

Procedures

- Antiplatelet preparation
- Guiding support, Tri-axial system
- Working view
- Microselection
- Sizing
- Deployment and Detachment

Procedures

• Antiplatelet preparation

- ✓ Unruptured: ASA 100mg + Clopidogrel 75 mg
- ✓ Ruptured: No pre-medications

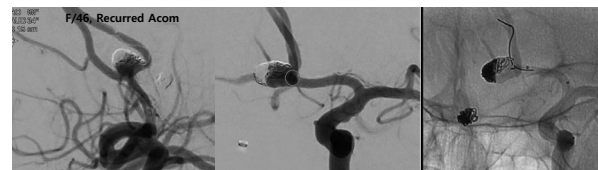
• Tri-axial system

- ✓ Guiding sheath
- ✓ Intermediate catheter (6F or 5F SOFIA)
- ✓ Microcatheter

Procedures

• Working view

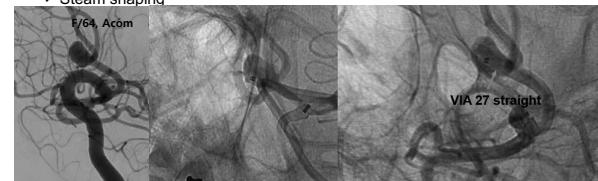
- ✓ Optimal Working or Barrel view using 3D reconstruction
- ✓ Before and After microselection



Procedures

• Microselection

- ✓ Microcatheter (VIA 17, 27, 33, and Headway 17 or 21)
- ✓ Steam shaping

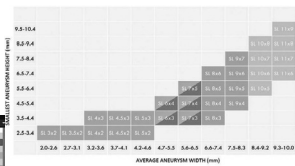
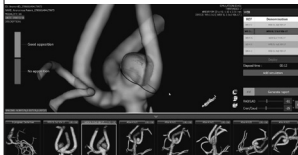




Procedures

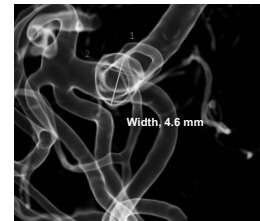
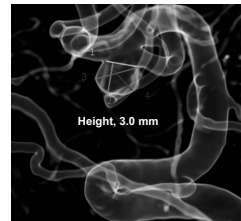
• Sizing

- ✓ Conventional sizing
- ✓ Virtual simulation



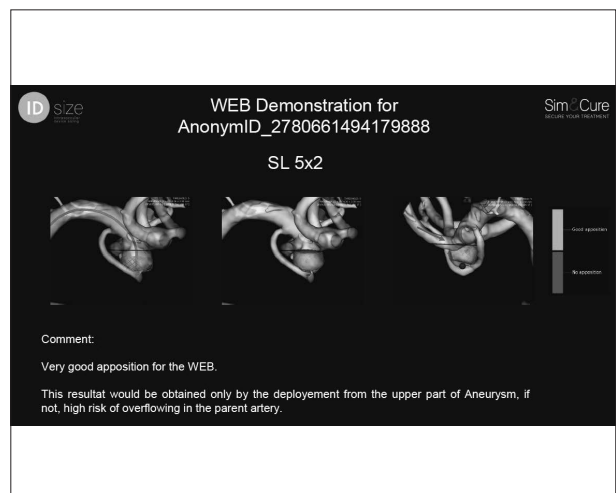
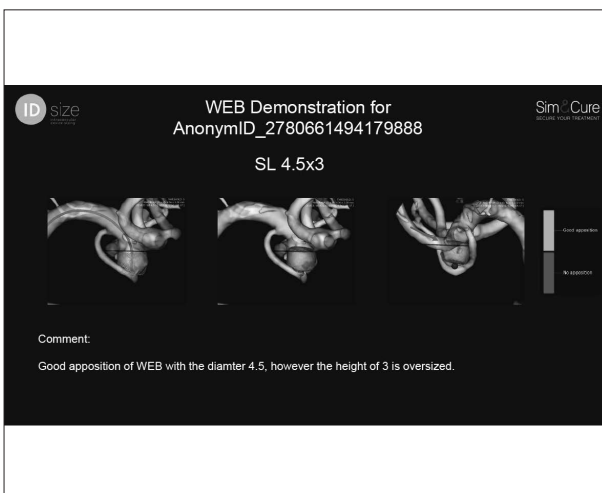
Device size change: 17/64, 26.6%
Mean number of WEB: 1.3

Size selection with “Sim & Size”



F/59, Incidental MCA bifurcation Aneurysm

WEB SL 4.5x3?, 5x2?

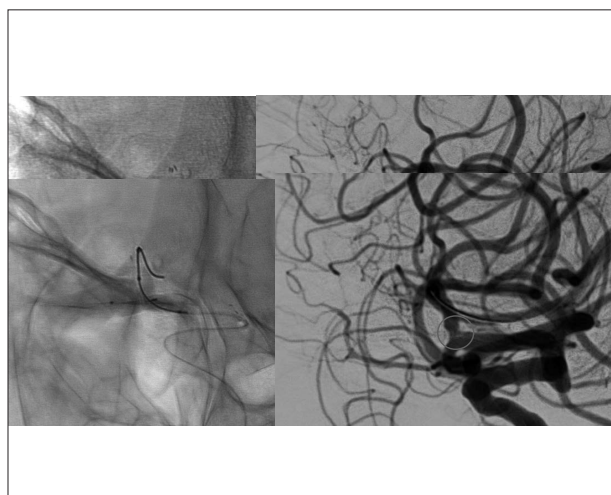
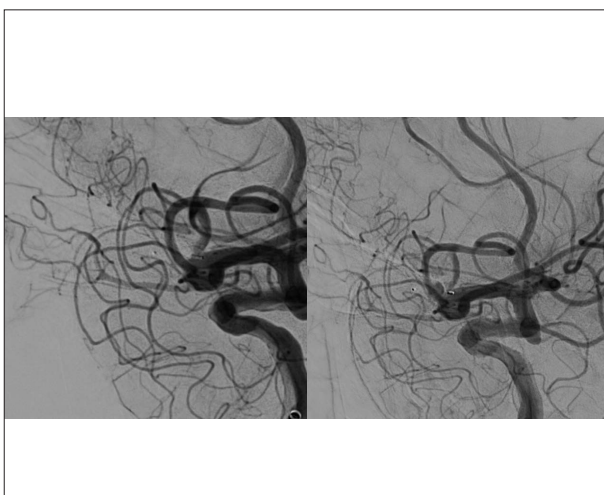
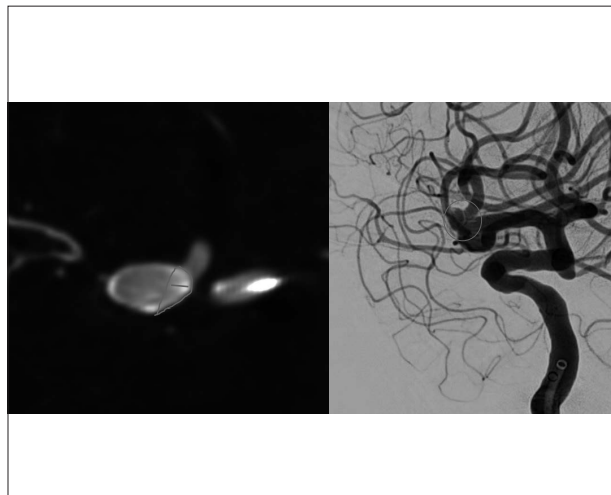
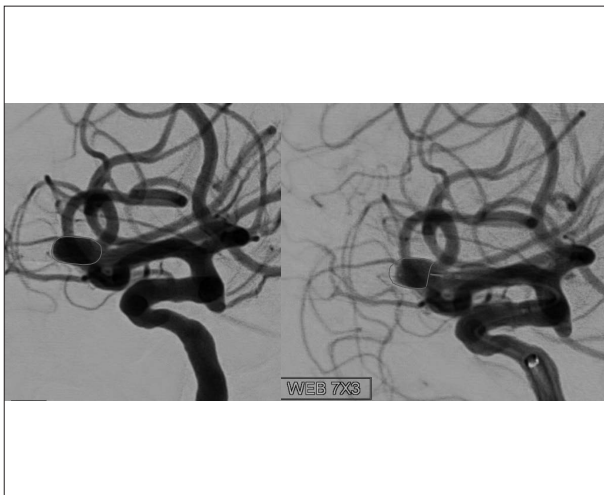
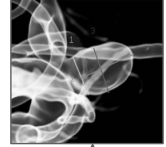




Procedures

• Deployment and Detachment

- ✓ Identifying full expansion of device using VasoCT
- ✓ Sticky detachment



Summary

- ✓ Feasible for WNBA
- ✓ But, might be effective and safe for “highly selective” WNBA
- ✓ Careful consideration for each step



Thank you for your attention!



Intra- and Extra-cranial stent angioplasty

김성립

가톨릭대

Complication avoidance during the treatment of intracranial arteriovenous malformations

Jai Ho Choi¹⁾, Bum-soo Kim²⁾, Yong Sam Shin¹⁾

Department of ¹⁾Neurosurgery and ²⁾Radiology, Seoul St Mary's Hospital, The Catholic University of Korea, Seoul, Korea

Abstract

The treatment of intracranial arteriovenous malformations including dural arteriovenous fistula and brain arteriovenous malformation would be challenging. For successful treatment, avoiding various perioperative complications is very important. In this study, the authors introduce our tips to reduce and manage complications during the treatment. First of all, precise evaluation of preoperative angiography is the most important thing. We should identify particularly venous drainage patterns as well as arterial feeders and fistulous points. In addition, normal venous drainage should be thoroughly evaluated, especially in cases treated with transvenous coil embolization. We could encounter devastating complications such as intracranial hemorrhage or severe venous congestion if draining vein is completely occluded with remaining arteriovenous shunting flow. For transarterial onyx embolization, dangerous anastomosis is always evaluated and considered not to penetrate the onyx to the normal vessels. If we use balloon catheter for onyx injection, we should be careful not to overinflate the balloon, which can lead to parent artery rupture. The pivotal factor for avoiding fetal complications is to decide an appropriate plan and treatment option after thorough assessment of detailed angioarchitectures. Pre- and intraprocedural image fusion technique to assess detailed angioarchitectures is very helpful. Moreover, firm supporting system using multiple coaxial catheters for delivering microcatheters as closer as possible to the lesion is also important. Finally, the operator should stay focused and keep eyes on the monitor during the whole procedure.

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Free paper I (Aneurysm) & Committee session I

11월 25일(금) 11:40-12:40

[Grand ballroom]

Free paper I (Aneurysm)

좌장: 성재훈 (가톨릭대),
정진영 (연세에스병원)

Difference in location and clinical characteristics between ruptured and unruptured very small intracranial aneurysm

Jaho Koo, Eui-hyun Hwang, Ji-Hye Song, Young-cheol Lim

Ajou university hospital

Objective: Unruptured intracranial aneurysms(UIA) are now being detected with increasing frequency in hospital. Results of the largest studies, including those of the International Study of Unruptured Intracranial Aneurysms, indicate that surgical and endovascular treatments was not recommended in very small aneurysm (≤ 3 mm). However, we have encountered several cases of rupture of very small aneurysms in our clinical practice. This retrospective study analyzed the incidence, location, and clinical characteristics of very small ruptured aneurysms.

Methods: This study was conducted retrospectively between January 2008 and July 2022. A total of 203 cases were treated with clip or coil for very small aneurysm. Various factors were analyzed, including the aneurysm location and size as well as the associated risk factors.

Result: Of the 203 patients, 90 cases were treated for ruptured aneurysm and 113 cases were treated for unruptured aneurysm. The locations of very small aneurysm ruptured cases (≤ 3 mm) are shown in order of Acom 27/90 (30.0%), MCA 17/90 (18.9%), Pcom 15/90 (16.7%), and AchA ICA 8/90 (8.9%). On the other hand, the locations of very small aneurysm unruptured cases (≤ 3 mm) differed in frequency, in order of MCA 44/113 (38.9%), cavernous ICA 17/113 (15.0%), A-com 16/113 (14.2%), AchA ICA 15/113 (13.3%) and A1 9/113 (8.0%). ($p < 0.001$). There was a significant difference in high blood pressure($p = 0.011$), irregular shaped aneurysm ($p < 0.001$) in risk factors.

Conclusion: The most common site of rupture of very small aneurysm was the Acom. Rupture of very small aneurysms is unpredictable, and treatment may be considered in selected high-risk patients according to AcomA location and irregular shape, and hypertension.

Comparison of modified dual-antiplatelet (aspirin and prasugrel) and triple-antiplatelet (aspirin, clopidogrel and cilostazol) therapy in patient with high on-treatment platelet reactivity undergoing stent-assisted coil embolization for an unruptured intracranial aneurysm: A Prospective Randomized Clinical Trial

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

Seoul National University Bundang Hospital

Objective: There is still a high risk of thromboembolic complications in patients with high on-treatment platelet reactivity (HTPR) undergoing stent-assisted coil embolization (SACE) of unruptured intracranial aneurysms (UIAs). In some previous studies, modified antiplatelet therapies are used to reduce the risk of thromboembolism but whether one treatment strategy is more effective than the other is unknown. We compared the efficacy between modified dual antiplatelet therapy (aspirin and prasugrel) and triple antiplatelet therapy (aspirin, clopidogrel, and cilostazol) in patients with HTPR undergoing SACE for an UIA.

Methods: We conducted a prospective, randomized, open-label trial. Patients with HTPR (220 or more P2Y12 reaction units) planned to undergo SACE for an UIA were assigned in a 1:1 ratio. The modified antiplatelet therapy was maintained after SACE for 3 months. The primary outcome was the composite frequency of major, minor, or minimal bleeding according to Thrombolysis in Myocardial Infarction bleeding criteria during 3 months after SACE in the intention-to-treat population. The secondary outcome was a thromboembolic event defined as thromboembolism during SACE and a transient ischemic attack or ischemic stroke within 90 days after SACE.

Result: We enrolled 198 patients (n=99 per group). The primary outcome occurred in 34 patients (34.3%) in the modified dual antiplatelet therapy group and 42 patients (42.4%) in the triple antiplatelet therapy group (hazard ratio, 0.77 [95% CI, 0.49-1.2]; p=0.26). There were no deaths, but two major bleeding (2.0%, intracranial bleeding) in the triple antiplatelet therapy group (hazard ratio, 0.20 [95% CI, 0.00-2.43]; p=0.22). Preplanned per-protocol analysis including patients who received the allocated antiplatelet therapy for the full duration of the 3-month follow-up showed all bleeding events in 34 (36.5%) of 93 patients in the modified dual antiplatelet group versus 35 (44.3%) of 79 patients in the triple antiplatelet therapy group (hazard ratio, 0.79 [95% CI, 0.50-1.30]; p=0.34). During the 90-day follow-up, the secondary outcomes occurred in 1 patient (1.0%) in the modified dual antiplatelet group and 3 (3.0%) in the triple antiplatelet group (hazard ratio 0.33, [95% CI, 0.04-3.20]; p=0.34)

Conclusion: We found no difference in all bleeding complications and thromboembolic complications between modified dual antiplatelet therapy and triple antiplatelet therapy in patients with HTPR undergoing SACE for an UIA.

Quantitative analysis of hemodynamic changes induced by size discrepancy of flow diverter and parent artery in cerebral aneurysms

Sunghan Kim, Hyeondong Yang, Je Hoon Oh, Yong Bae Kim

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

Objective: Flow diverter is a device that treats aneurysm by changing the direction of blood flow into the cerebral aneurysm and promoting thrombogenesis inside the cerebral aneurysm. The flow diversion effect of the flow diverter is closely related to metal coverage rate (MCR), which means the percentage of the aneurysmal neck covered by metal after the application of the flow diverting stent. Meanwhile, MCR within the aneurysmal neck changes in various ways as the stent wire is rearranged according to the size difference from the installed parent artery. The purpose of this study is to quantitatively compare and analyze the changes in the flow diversion effect caused by the difference in size between the flow diverter and the parent artery using computational fluid analysis (CFD).

Methods: Four silicone models of an ideal aneurysm with different sizes of the parent artery were fabricated, and the real flow diverting stents were deployed inside each silicone model in vitro to examine the configurations of the stents in the aneurysm neck. After installing each real stent inside the silicone model, the images of the stent shapes in the aneurysm neck were captured and virtual stents for subsequent CFD analyses were generated. CFD analyses were performed using an idealized aneurysm model with virtually created stents placed across the aneurysmal neck. Quantitative analysis was performed to evaluate the hemodynamic parameters of energy loss, average velocity, and inflow rate.

Result: Pipeline with a diameter of 4.0 mm was applied in four idealized aneurysm models with parent artery diameters of 3.0 mm, 3.5 mm, 4.0 mm, and 4.5 mm, respectively. The MCR of the flow diverter installed in each size of aneurysm model was 25 %, 29 %, 37 %, and 47 %, respectively. As the diameter of the flow diverter was smaller than the diameter of the parent artery, the MCR tended to be higher. In addition, the reduction rate of energy loss, average velocity, and inflow rate showed a tendency to increase as the MCR increased, indicating that the flow diversion effect was greater as the size of the flow diverter became undersized.

Conclusion: The flow diversion performance of flow diverter could be substantially increased by undersizing the devices compared to the diameter of the parent artery. As the level of device undersizing increases, reduction rate of hemodynamic parameters are significantly more increased, leading to more angiographic occlusion of the aneurysm.

New morphological parameter for intracranial aneurysms and rupture risk prediction based on artificial neural networks

Kwang-Chun Cho¹⁾, Hyeondong Yang²⁾, Jung-Jae Kim³⁾, Je Hoon Oh²⁾, Yong Bae Kim³⁾

¹Department of Neurosurgery, Yongin Severance Hospital, Yonsei University College of Medicine, ²Department of Mechanical Engineering and BK21 FOUR ERICA-ACE Center, Hanyang University, ³Department of Neurosurgery, Severance Hospital, Yonsei University College of Medicine

Objective: Numerous studies have evaluated the rupture risk of intracranial aneurysms using morphological parameters because of their good predictive capacity. However, the limitation of current morphological parameters is that they do not always allow evaluation of irregularities of intracranial aneurysms. The purpose of this study is to propose a new morphological parameter that can quantitatively describe irregularities of intracranial aneurysms and to evaluate its performance regarding rupture risk prediction.

Methods: In a retrospective study, conventional morphological parameters (aspect ratio, bottleneck ratio, height-to-width ratio, volume to ostium ratio, and size ratio) and a newly proposed morphological parameter (mass moment of inertia) were calculated for 125 intracranial aneurysms (80 unruptured and 45 ruptured aneurysms). Additionally, hemodynamic parameters (wall shear stress and strain) were calculated using computational fluid dynamics and fluid–structure interaction. Artificial neural networks trained with each parameter were used for rupture risk prediction.

Result: All components of the mass moment of inertia (I_{xx} , I_{yy} , and I_{zz}) were significantly higher in ruptured cases than in unruptured cases (p values for I_{xx} , I_{yy} , and I_{zz} were 0.032, 0.047, and 0.039, respectively). When the conventional morphological and hemodynamic parameters as well as the mass moment of inertia were considered together, the highest performance for rupture risk prediction was obtained (sensitivity 96.3%; specificity 85.7%; area under the receiver operating characteristic curve 0.921).

Conclusion: The mass moment of inertia would be a useful parameter for evaluating aneurysm irregularity and hence its risk of rupture. The new approach described here may help clinicians to predict the risk of aneurysm rupture more effectively.

Comparison of Neuroform Atlas stent assisted coiling and coiling alone in ruptured intracranial aneurysms: A propensity score matching analysis

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

¹⁾Department of Neurosurgery, Soonchunhyang University Bucheon Hospital, Bucheon, Republic of Korea.

²⁾Department of Neurosurgery, St. Vincent's Hospital, The Catholic University of Korea, Suwon, Republic of Korea

Objective: Although Neuroform Atlas stent is commonly used in stent assisted coiling (SAC) to treat ruptured intracranial aneurysms (RIA), its safety and efficacy remain controversial. The objective of this study was to assess the safety and efficacy of SAC using Neuroform Atlas for treating RIA compared with coiling alone by performing a propensity score matching analysis.

Methods: RIA treated with coiling alone and SAC between January 2017 to May 2021 were retrospectively reviewed. Demographics, peri-procedural complication rates, angiographic outcomes, and clinical outcomes of the SAC using Neuroform Atlas group and the coiling alone group were analyzed with 1:1 propensity score matching.

Result: A total of 375 aneurysms were enrolled, and 274 (63.1%) aneurysms were treated with coiling alone. Of 101 (26.9%) aneurysms were treated with SAC, and Neuroform Atlas stent was used in 71 aneurysms. In propensity score matching, the SAC using Neuroform Atlas group showed higher incidence of complete occlusion (69.0% vs. 56.3%, $P = 0.029$), lower rate of recanalization (11.3% vs. 25.4%, $P = 0.011$), and lesser need for retreatment (7.0% vs. 16.9%, $P = 0.016$) compared with the coiling alone group. However, there were no significant differences in peri-procedural complications such as intra-procedural thrombosis or post-procedural cerebral infarct between the two groups.

Conclusion: The use of Neuroform Atlas is safe and effective for SAC in RIA with comparable procedure-related complication rates but better angiographic outcome in comparison with coiling alone.

Stent-assisted Coiling vs. Flow Diverter for Treating Blood Blister-like Aneurysms: A Proportion Meta-analysis

Jeongjun Lee, Su Hwan Lee

Dongguk University Ilsan Hospital

Objective: Blood blister-like aneurysms (BBAs) are rare vascular lesions and a therapeutic challenge. Although endovascular treatment of BBA is a promising approach, the optimal treatment remains controversial. The purpose of this study was to compare the safety and efficacy of stent-assisted coiling (SAC) and flow diverter (FD) in the management of BBAs.

Methods: A proportion meta-analysis including a published series of BBAs treated with endovascular approaches from 2009 to 2020 including SAC and FD was performed by searching English language studies via MEDLINE and EMBASE.

Result: The 32 studies included 16 based on SAC and 16 involving FD. The long-term complete occlusion rate was higher in FD (89.26%, 95% confidence interval, CI 82.93-94.26%, $I^2 = 14.42\%$) than in SAC (70.26%, 95% CI 56.79-82.13%, $I^2 = 70.60\%$). The rate of aneurysm recanalization was lower in FD (4.54%, 95% CI 1.72-8.16%, $I^2 = 0\%$) than in SAC (25.38%, 95% CI 14.44-38.19%, $I^2 = 67.31\%$). Rates of mortality, favorable functional outcome, procedural complications, and rebleeding showed no differences between the two procedures.

Conclusion: In a proportion meta-analysis comparing FD with SAC, the FD was associated with more favorable angiographic outcomes but similar complications and clinical outcomes.

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Free paper I (Aneurysm) & Committee session I

11월 25일(금) 11:40-12:40

[Ballroom 1]

다기관임상위원회

좌장: 황교준 (한림대)

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

**Free paper I (Aneurysm)
& Committee session I**

11월 25일(금) 11:40-12:40

[Ballroom 2]

학술지편집위원회

좌장: 김대원 (원광대)

JCEN 학술지 하반기 경과보고

박은석

울산대

1. 학술지 현황 보고
2. 제 15회 의학학술지편집인아카데미 관련 보고
3. 기타 토의

JCEN 리뷰어 경험 및 학술지 보완관련 제언

정재우

단국대

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Luncheon symposium

11월 25일(금) 12:50-13:50

좌장: 권순찬 (울산대),
강현승 (서울대)

Updates on Spinal angiography

권오기

서울대

Experiences of various endovascular spinal procedures

최인섭

인천세종병원 뇌혈관센터

Arterio-venous shunts of spine and spinal cord

In Sup Choi, MD, FACP
Chair, Neurovascular Center
Incheon Sejong Hospital
Professor of Radiology Emeritus
Tufts University, School of Medicine

Classification of Spine and Spinal Cord Vascular Lesions

- Spinal cord (SCAVM)
 - Intramedullary (AVM)
 - Perimedullary (AVF)
 - AVF OF Filum Terminale
- Metameric
- Spinal Dural AVF
 - Dural and Epidural
- Paraspinal AVF

Treatment of Spinal Cord AVM

- Clinical Presentation
- Neurological Status
- Location
- Arterial Feeders
- Angioarchitecture of Nidus
- Presence of a false aneurysm

Embolization of Spinal Cord AVM

- Complete Mapping of Malformation
- Timing of Treatment
- Goal of Treatment: Curative (+/- Surgery)
Palliative
- Select Route
- Choice of Embolic Material

Embolic Material

- Liquid: NBCA (n-butyl cyanoacrylate)
- Solid: Particles; PVA
 - Coils ; Fibered
 - GDC
 - Liquid

Perimedullary AVFs

Clinical Presentation

- Subarachnoid hemorrhage
- Spinal cord compression
- Progressive myelopathy

Perimedullary AVF's

- Macro-fistula ; more in children
one pheno type of HHT
- Micro-fistula ; more in adult
venous congestion or SAH

Metameric AVMs (SAMS)

(Cobb's syndrome)

- Involves more than 2 embryonic layers;
spinal cord, dura, bone, paraspinal muscles,
subcutaneous tissue and/or skin
- Clinical presentation is essentially from
spinal cord involvement

Spinal Arterio-venous Metameric Syndrome

Spinal Arteriovenous Metameric Syndrome: Clinical Manifestations and Endovascular Management

Y. Niimi, N. Uchiyama, L. Eljovich, and A. Berenstein

AJNR Am J Neuroradiol 34:457-63 Feb 2013

- 28 pts of 148 SCAVMs (19%)
- 24 Nidus type(86%), 4 Fistulas(14%)
- Female 71% (48% in non-SAMS)
- Initial presentation ; hemorrhage in 18 pts (64%)
4 more hemorrhage before Tx (total 79%)
92% of nidus type SAMS presented with hemorrhage

Spinal Arterio-venous Metameric Syndrome

Niimi et al

- Presence of associated Aneurysm ;
13 cases of 28 (non-SAMS 2/ 57)
7 incased in size or new development
- 26 pts embolized for the intradural lesions
- 23 followed for 3 to 309 mos (mean 94 mos)
5 pts hemorrhaged (22%)
- Long term in 5 yrs; 6 deteorated, 4 improved, 4 stable

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

**Free paper II (Resident session)
& General assembly**

11월 25일(금) 13:50-14:50

[Grand ballroom]

General assembly

사회: 김영우 (총무이사)

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Free paper II (Resident session) & General assembly

11월 25일(금) 13:50-14:50

[Ballroom 1]

Free paper II (Resident session)

좌장: 이동훈 (가톨릭대),
하상우 (조선대)

Giant venous aneurysm misunderstood to posterior cerebral artery aneurysm

Sam Chan Jang, M.D., Dae Won Kim, M.D.

Department of neurosurgery, Wonkwang University Hospital

Objective: Dural arteriovenous fistula (dAVF) is pathologic connection between the meningeal arteries to dural sinuses or veins. These lesion have direct feeding arteries connected with draining vein which associated venous varix or venous aneurysm. Herein, we report a case of dural arteriovenous fistula, a case of venous aneurysm at vein of Rosenthal that mimics posterior cerebral artery (PCA) aneurysm.

Methods: A 73-years-old man who presented with right hemiparesis G4 and dysarthria. Computed tomography (CT) showed cerebral peduncle compression by hyperdense mass. CT angiography revealed 2*2cm unruptured left PCA aneurysm. Three days after admission, right motor weakness was aggravated to G2. Brain CT showed enlargement of left PCA aneurysm and aggravation of mass effect.

Result: Emergency digital subtraction angiography was performed to coil embolization or parent artery trapping. However, PCA aneurysm was not found. External carotid angiogram showed dAVF that supplied from posterior meningeal artery and drained into vein of Rosenthal. Giant venous aneurysm was found at vein of Rosenthal. Transarterial onyx embolization was performed succesfully. Ten days after embolization, right motor weakness improved to G4+. Follow-up brain CT showed resolution of aneurysm and mass effect.

Conclusion: In case of rapidly growing aneurysm in short-term follow up, venous pathologic lesion should be considered. Further evaluations such as DSA should be performed to make accurate diagnosis and determine treatment plans.

Mechanical Thrombectomy for Anterior Cerebral Artery Occlusion: A Single-Center Experience

Kyoung Hoon Kim, Hak Sung Kim, Jae Ho Kim, Sang Woo Ha

Department of Neurosurgery, Chosun University Hospital, Gwangju, Korea

Objective: Mechanical thrombectomy (MT) is an effective treatment for acute ischemic stroke (AIS) with large-vessel occlusion (LVO). Occlusion of the anterior cerebral artery (ACA) may occur primarily or secondary to MT of other LVO. The efficacy and safety of MT for LVO were demonstrated with large randomized trials, however there are few studies associated with medium vessel occlusion including ACA. In this study, we reviewed retrospectively the patients who had underwent MT for ACA occlusions.

Methods: The patients with ACA occlusions were classified into primary and secondary occlusion groups as its etiology. The National Institutes of Health Stroke Scale (NIHSS) and the modified Rankin Scale (mRS) were measured for examining the neurologic and clinical status. The modified Treatment In Cerebral Ischemia (mTICI) scale was used for reperfusion grade, and the hemorrhagic complications were investigated.

Result: Among 520 patients who underwent MT for Anterior Circulation occlusion during 48 months, 41 patients (41/520, 7.88%) were ACA occlusion. The primary occlusions were 18 and the secondary occlusions were 23. The most common occlusion site was A3 segment of ACA with 14 patients (14/41, 34.15%). At 90 days, 13 patients (31.71%) had a good clinical outcome with mRS score of 0 to 2. The successful recanalization was achieved in 38 patients (38/41, 92.68%) as mTICI 2b and 16 patients (16/41, 39.02%) as mTICI 3. Hemorrhagic complications of ACA territory were noted on 6 patients. The good prognosis group was younger, had less time from puncture to recanalization, more frequent mTICI 3, and less any parenchymal hemorrhage.

Conclusion: In the presented study, less recanalization time and complete recanalization above mTICI 2b grade were important for better clinical outcomes in patients with acute ACA occlusion. The MT for ACA occlusion is feasible and safe compared to LVO.

Transarterial embolization of dural arteriovenous fistula with multiple venous varix/ectasia

설정훈, 홍창의, 한문희, 이지혜

중앙보훈병원

Objective: DAVF is classically defined as abnormal arteriovenous connections between an arterial feeder and a dural venous sinus or leptomeningeal vein with the channels located within the dural leaflets. The high turbulent flow of aggressive DAVF (with cortical venous reflux) can result in venous ectasia forming variceal pouch. Treatment for this type of DAVF is inevitable because of high risk for hemorrhage. However DAVF with venous outflow dilatation and varix have a significant challenge to various treatment modalities (surgery, radiosurgery, embolization) due to the fragility, long length of the vascular access, and its deep location. We describe a case of 78-year-old man diagnosed as DAVF with multiple venous varices.

Methods: A 78 years old man manifested by only headache. There was no associated relevant history and the clinical examination was normal. Magnetic resonance imaging (MRI) showed abnormal flow voids in the temporal lobe. There were multiple large focal venous ectasias (varix) and many dilated veins connecting these flow voids. There was no associated infarct/hemorrhage or edema in the brain parenchyma. Cerebral angiography revealed a Congard type IV DAVF at the left transverse sinus. It was supplied by ipsilateral middle meningeal artery (MMA) and occipital artery (OA). The cortical venous reflux was evident, from the isolated transverse sinus into the multiple pial veins, forming multiple dilated venous pouches (variceal change).

Result: The patient underwent one session of TAE with Onyx-18 for ipsilateral MMA. A detachable Apollo 3cm microcatheter was advanced just proximal to the fistulous connections, and Onyx-18 was injected. Control angiography revealed no more filling of the fistula from MMA, but there was some residual filling and pial venous reflux into sigmoid sinus, from ascending pharyngeal artery (APA) hypoglossal branch arising from ipsilateral OA. An Echelon-10 microcatheter was advanced to select fistulous supply from the hypoglossal branch, and subsequent Onyx-18 was injected. The final angiography showed complete occlusion of DAVF, and there was no residual shunt or venous ectasia.

Conclusion: DAVF with leptomeningeal venous ectasia (varix) is defined as high risk for cerebral venous hypertension, hemorrhage, or progressive neurological deficits. Their rupture may lead to subdural, subarachnoid or intracerebral hemorrhage. Transarterial embolization for these DAVF with large venous ectasia (varix) is a safe and considerable treatment option.

Treatment strategies for mycotic aneurysms in patients with infective endocarditis: Report of 2 cases

Yeonhu Lee, Jihye Song, Yongcheol Lim

Department of Neurosurgery, Ajou University School of Medicine

Introduction: Mycotic aneurysms are saccular or fusiform arterial dilatation that can occur anywhere. They develop when cardiac vegetation gives rise to septic emboli which induces acute inflammatory degradation of the arterial wall. The natural history and prognosis are unclear due to the rarity of the disease. However, untreated mycotic aneurysms may be associated with significant mortality when ruptured. Here, we present two cases of mycotic aneurysms in infective endocarditis patients and introduce treatment strategies.

Case report: Case1. A 59-year-old female was admitted due to the declined mental status and fever, diagnosed to have mitral regurgitation because of infective endocarditis. Empirical antibiotics with broad-spectrum coverage were injected immediately, and mitral valve replacement was done on day 4 of hospitalization. Initial Brain MR showed multiple scattered embolic infarctions. So, the follow up Brain MR was done after 25 days, and a mycotic aneurysm was suspected on left proximal ECA which was confirmed as a 14mm-sized mycotic aneurysm, with total proximal ECA occlusion on conventional angiography. We chose to maintain medical treatment with a total 6 weeks of antibiotics, with regular outpatient follow up with CT angiography. After a month, aneurysm size declined to 8mm. With another two months, aneurysm totally disappeared. Patient is doing well without any neurological complications. **Case2.** A 45-year-old female presented to the emergency department with left hemiparesis, dysarthria and fever. Brain MR showed multiple embolic infarcts on posterior circulation system, with severe stenosis throughout the vertebrobasilar artery, and aneurysmal dilatation was suspected at vertebrobasilar junction. In regards of the recent history of endodontic treatment due to dental caries, septic embolism and mycotic aneurysm was suspected, and the patient was diagnosed to have mitral regurgitation due to infective endocarditis. Antibiotic treatment started immediately, and mitral valve replacement was done on second day of hospitalization. Follow up CT angiography was done on day 7 of hospitalization, showed increased size of mycotic aneurysm. With conventional angiography for definite diagnosis, the morphology of the aneurysm showed subtle changes. So, we repeated CT angiography after two days, showed a definite morphologic change. So, stent assisted coil embolization was performed, achieving complete obliteration of the aneurysm without procedure-related complications. After the procedure, intravenous antibiotic treatment was continued for a total of 6 weeks.

Follow up imaging shows no demonstrable residual or recurred aneurysm. And the patient is doing well with mild degree of central vertigo.

Discussion: Neurologic complications of infective endocarditis can cause significant morbidity and mortality. Especially, unruptured mycotic aneurysms are tended to be underestimated because they do not show any neurologic problems until they are ruptured. Antibacterial treatment should be used for a total of 6 to 8 weeks and valvular replacement surgery should be done within appropriate time window when needed. Angiographic screening with CTA or MRA seems mandatory, with full coverage above aorta to vertex. Regular follow up imaging should be performed because there are cases with growing aneurysms. When enlargement or morphological change happens, endovascular or surgical treatment should be considered immediately. Even though the complete obliteration was achieved, closed observation and imaging follow up should not be missed in cases of recurrence or new lesion.

Conclusion: Our case series suggests that patient with infective endocarditis should be initially screened and followed up for mycotic aneurysms. Antibiotic treatment should be applied for enough duration recommended by guideline, to achieve cure and prevent relapse. To achieve coverage above aorta to vertex, CTA or MRA with contrast agents should be considered. Enlarging aneurysms should be treated immediately, stent assisted coil embolization can be a great option for mycotic aneurysm with stenotic parent artery.

Mechanical thrombectomy of M2-3 occlusion: A single-center retrospective study

In Sung Hwang, Hyuntaek Rim, Kang Min Kim, Dong Hyun Yoo, Young Dae Cho,
Hyun-Seung Kang

Seoul National University Hospital

Objective: Mechanical thrombectomy (MT) has become a safe and effective treatment for large vessel occlusion. But treatment and efficacy of mechanical thrombectomy for medium vessel occlusion (MeVO) is still controversial. The aim of this study is to evaluate the characteristics of M2-M3 segment of middle cerebral artery (MCA) occlusion and endovascular treatment outcome.

Methods: Single-center retrospective analysis of patients with M2-M3 segment occlusion was done. Patient characteristics, radiographic findings, and endovascular treatments were correlated with radiographic and clinical outcomes.

Result: A total of 49 patients (22 Women [44.9%]; mean [SD] age, 70.08 [12.75]; median [SD] baseline National Institutes of Health Stroke Scale [NIHSS] score, 11.43 [5.71]) were enrolled. Cardioembolism was the most common cause of M2-M3 occlusion (63.27%). The recanalization rate more than modified Treatment in Cerebral Infarction scale (mTICI) 2b/3 was achieved in 37 of 49 (75.5%). And good clinical outcome with modified Rankin Scale (mRS) ≤ 2 was achieved with 53%. A significant difference in 90 days mRS (modified Rankin Scale) was observed between mTICI 0-2a vs 2b-3 ($p = 0.013$). Patients were treated with stent retrieval with aspiration as first treatment in 36 patient (73.5%). A Direct aspiration as first treatment was performed in 7 patients (14.3%), but 3 patients had additional thrombectomy with stent-retriever. During stent-retriever technique, thrombus position in stent ($p = 0.287$) and aspiration catheter position ($p = 0.879$) did not significantly associated with good radiologic outcome (mTICI grade 2b/3). Poor clinical outcome (90 days mRS >2) was associated with Baseline and 24 hour NIHSS ($p = 0.01$ and 0.002), history of coronary artery disease or myocardial infarction ($p = 0.028$), infarct core and penumbra volume in perfusion CT ($p = 0.049$ and 0.019), use of IV tPA ($p = 0.006$).

Conclusion: Mechanical thrombectomy of MeVO in MCA is efficient and safe with stent-retriever techniques. Distal placement of stent or aspiration catheter may not be needed during stent-retriever technique. Baseline and 24-hour NIHSS, history of coronary artery disease or myocardial infarction infarct core and penumbra volume in perfusion CT, use of IV tPA clinical outcome was associated with poor clinical outcome.

Risk factors of contrast-induced encephalopathy after coil embolization for unruptured cerebral aneurysms

Kiyoong Yang, Eun-Oh Jeong, Hyeon-Song Koh, Hyon-Jo Kwon

Department of Neurosurgery, Chungnam National University Hospital, Chungnam National University School of Medicine

Objective: The contrast-induced encephalopathy (CIE) following cerebral interventions is a rare complication. This study aimed to analyze the risk factors of CIE in patients who underwent coil embolization for unruptured aneurysm.

Methods: Between January 2019 and January 2022, 466 patients with unruptured cerebral aneurysm who underwent coil embolization in a single tertiary institute were reviewed. Patient characteristics, features of aneurysm, and details of procedure, including procedure time and contrast dose were investigated. Contrast leakage was defined based on post-procedural radiological findings, and CIE was defined when neurological deterioration was accompanied.

Result: Of the 466 patients, 7 patients with infarction ($n = 3$), rupture ($n = 4$) were excluded. A total of 459 patients consisting of 135 male and 324 female, with the median age of 65 years were included in the analysis. Contrast leakage on post-procedural CT scan after coil embolization was evident in 35 patients (7.6%). Of these patient, 18 patients (3.9%) showed neurological deficits and defined as CIE. Severe headache was the most common symptom followed by motor weakness, mental deterioration, aphasia and visual loss. Multivariate analyses revealed that hypertension (odd ratio [OR] = 3.439, $P = 0.009$) large aneurysm (OR = 5.406, $P < 0.001$) and contrast dose (OR = 1.010, $P = 0.033$) were the risk factors of contrast leakage. Furthermore, the risk factors of CIE included large aneurysm (OR = 4.054, $P = 0.011$) and contrast dose (OR = 1.013, $P = 0.036$). All patients of CIE showed complete clinical and radiological recovery.

Conclusion: The development of CIE following coil embolization is associated with large aneurysm and amount of contrast during procedure.

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일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Nurse & Technician

11월 25일(금) 13:50-14:50

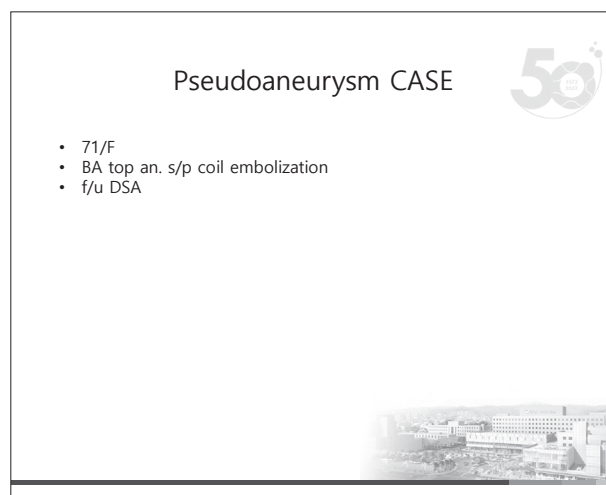
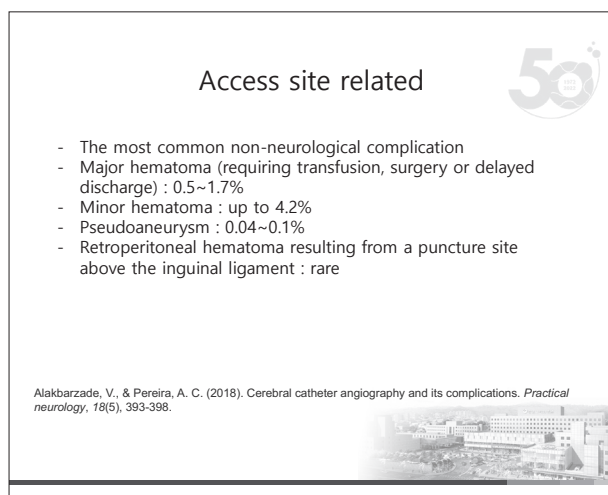
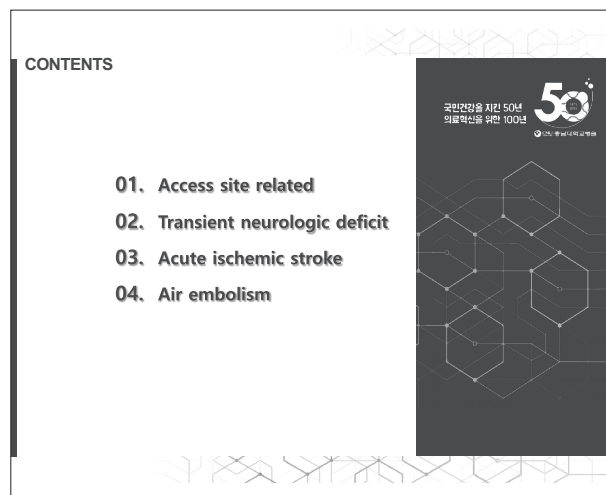
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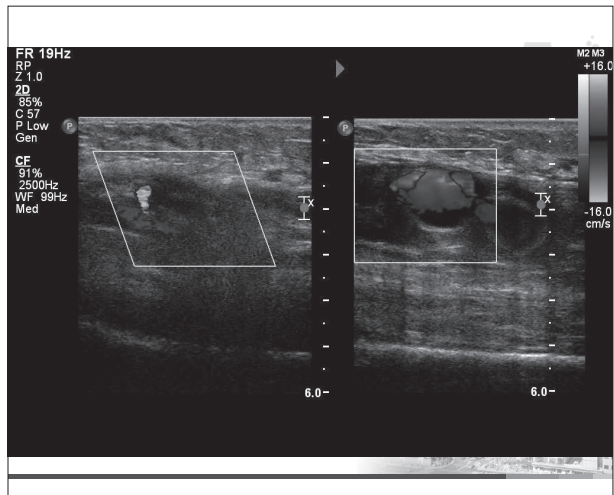
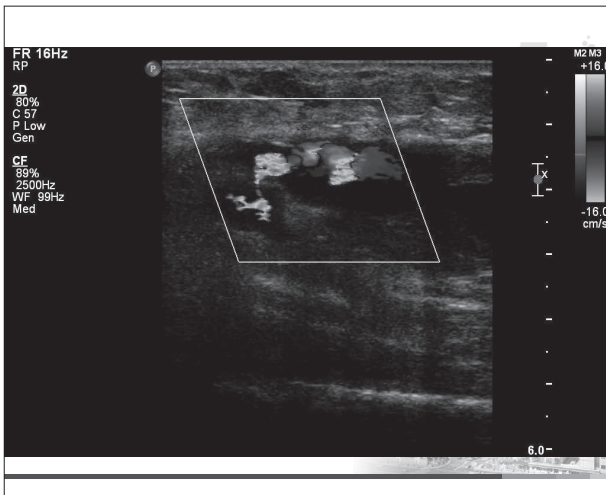
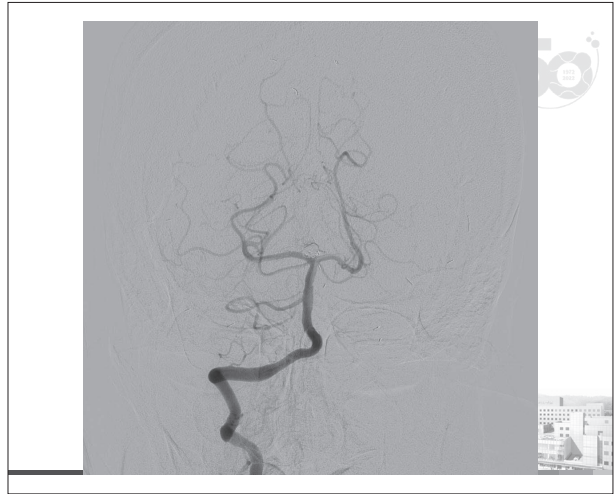
좌장: 김명진 (가천대),
오재상 (순천향대)

TFCA-related complications

정은오

충남대





Transient neurological deficit

- 1.2~2.5%
- Up to 24hr : 0.7%
 - Reversible : 0.2%, Permanent : 0.5%

Transient cortical blindness, global amnesia

- Less commonly reported neurological complications
- Excluding structural causes with non-invasive imaging
- Management : expectant

Reversible cerebral vasoconstriction syndrome

- Transient neurological deficits including a new thunderclap headache within an hour after angiography
- Presumably related to the underlying pathology

Acute ischemic stroke

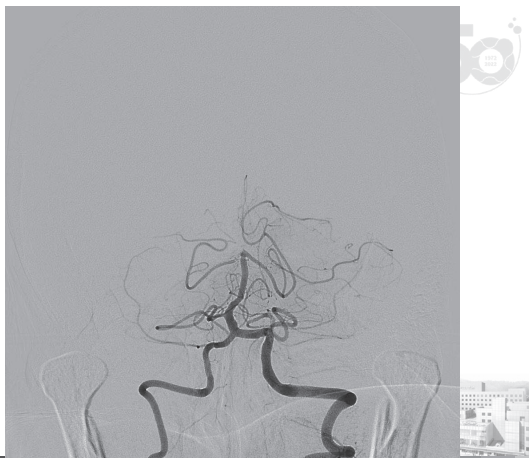
- 0.1-1%
- Thromboembolism
- Iatrogenic vessel dissection

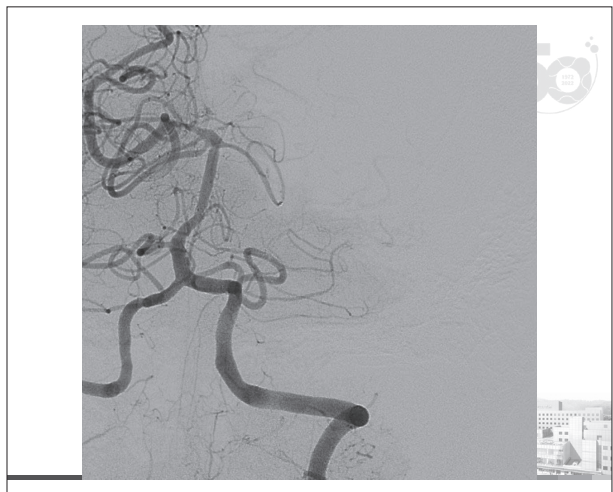
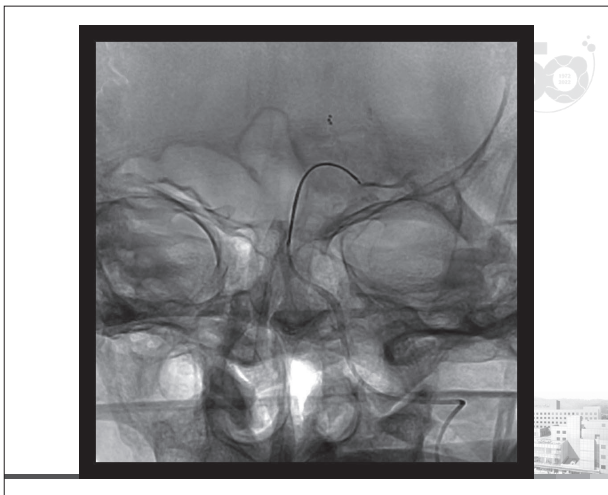
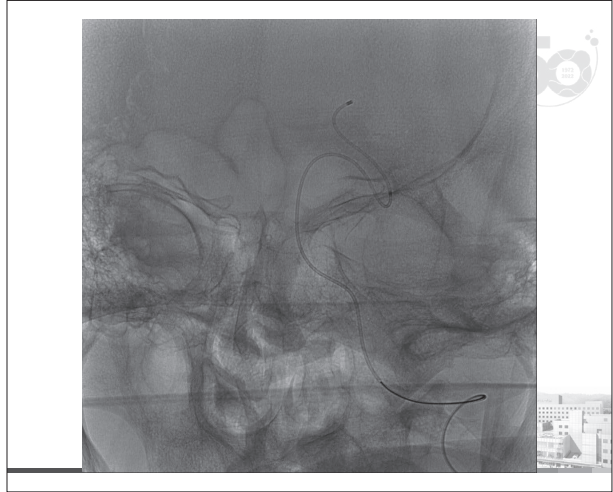
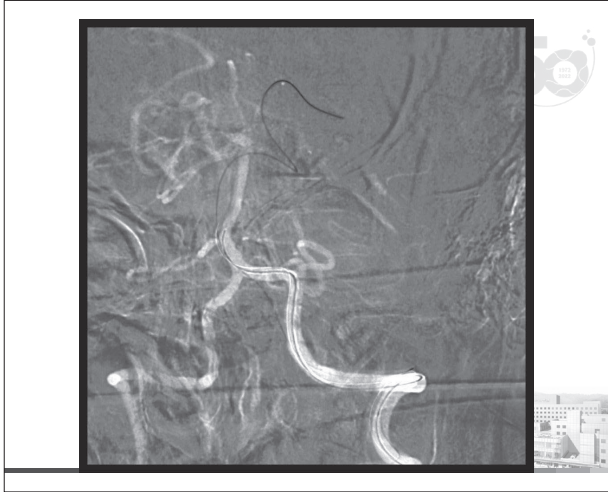
Thromboembolism

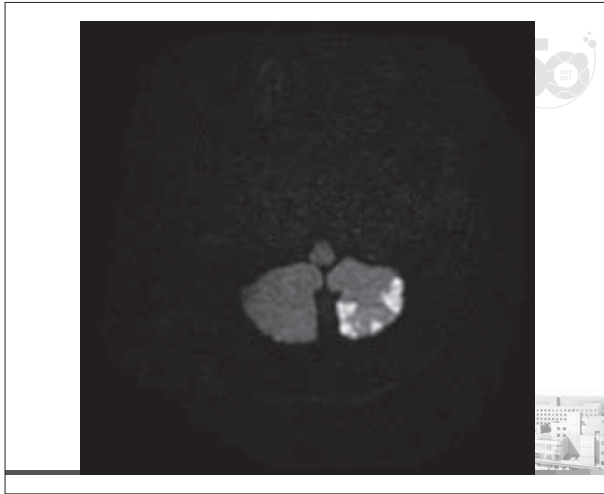
- Prolonged attempts
→ Imped blood flow or compromise hemodynamic conditions
→ Predispose to clot formation
- Emboli from atherosclerotic plaque disruption
- Emboli from vessel dissection

Thromboembolism CASE 1

- 74/M
- r/o A-com aneurysm

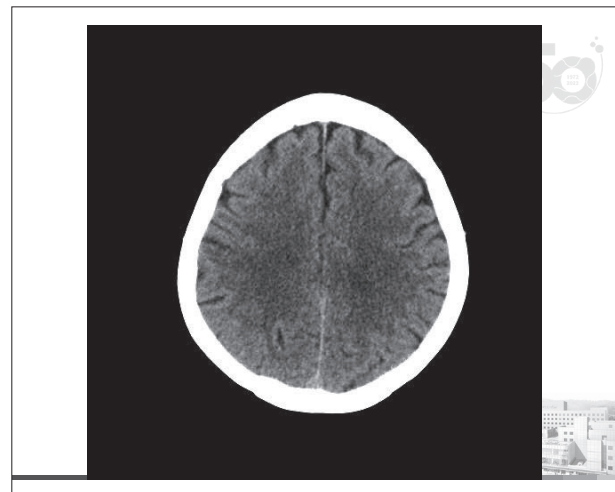
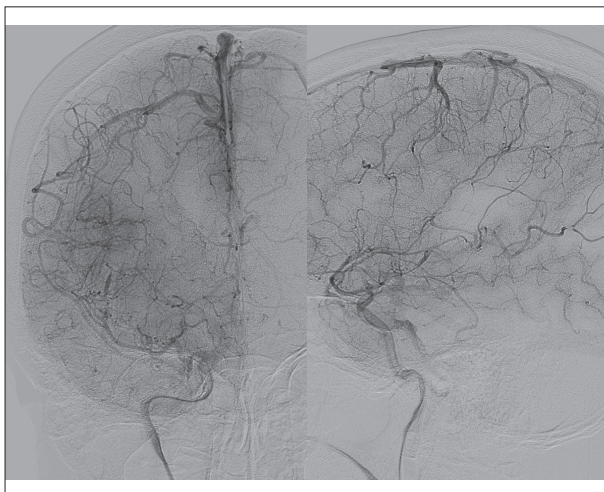
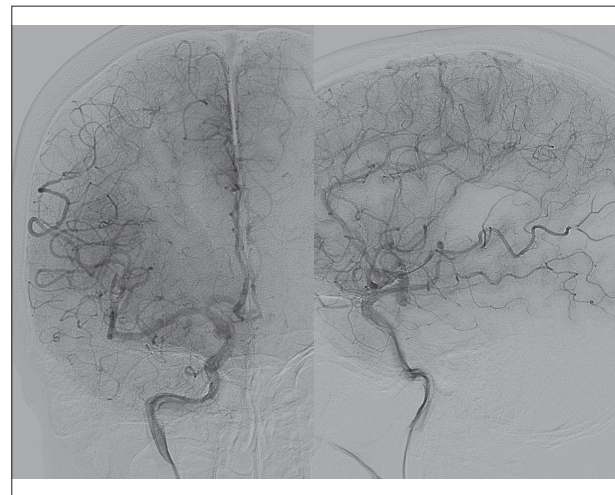
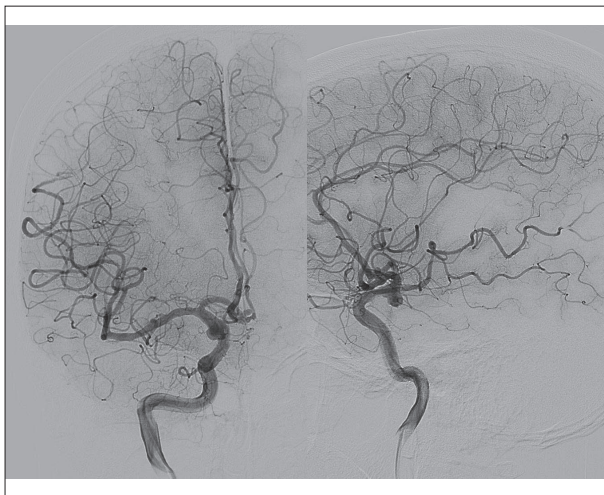


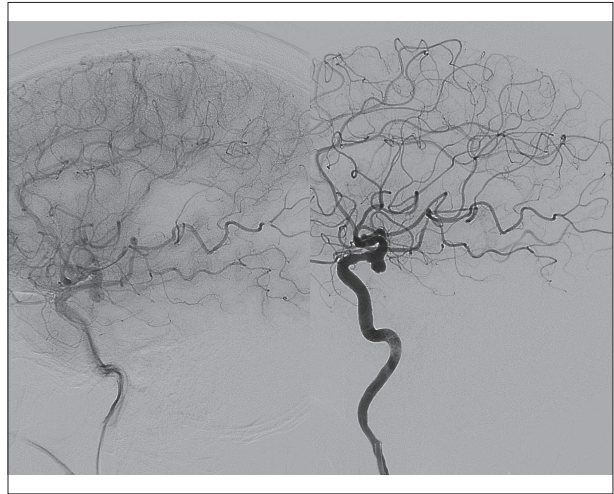
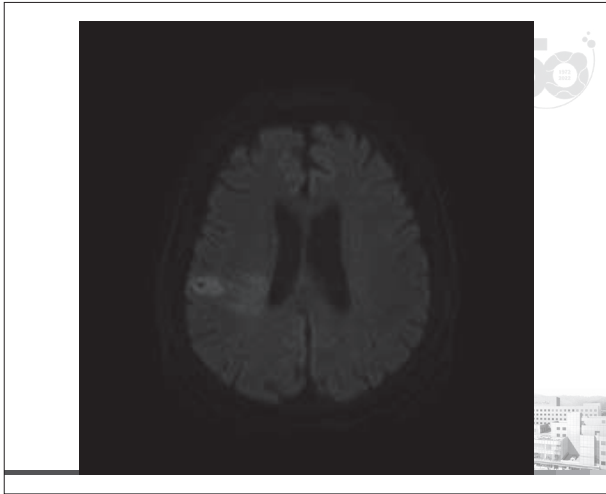




Thromboembolism CASE 2

- 74/M
- r/o A-com aneurysm





iatrogenic vessel dissection

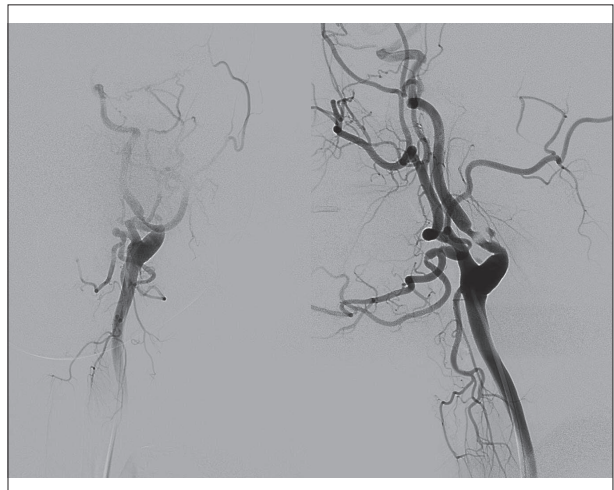
- 0.4%
- Vertebral arteries > Carotid arteries
 - Smaller vessel caliber
 - Surrounded by transverse foramen that limit flexibility of the catheter
 - Tortuous origin
- Collagen vascular disease

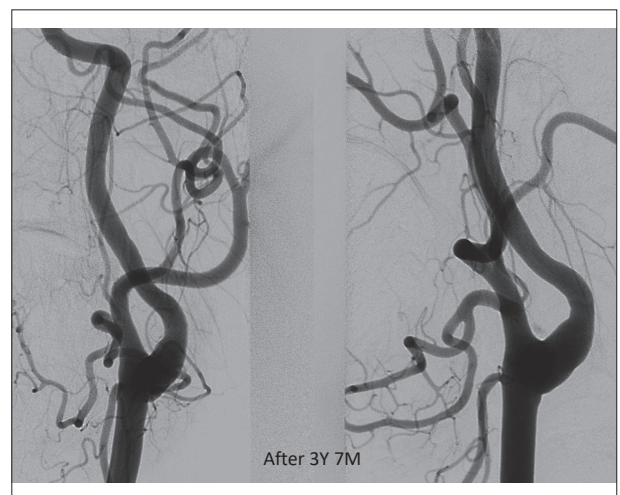
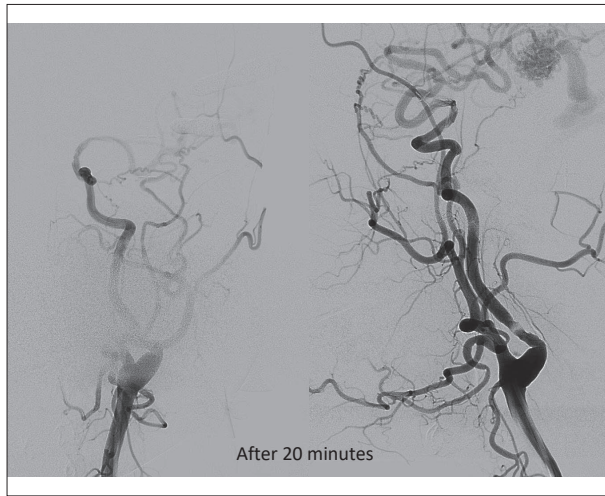
iatrogenic vessel dissection

- Ischemic symptom
 - Limiting flow secondary to severe stenosis/occlusion
 - Source of thromboembolism
- Treatment
 - Conservative management : antiplatelet agents
 - Angioplasty and/or stent placement

iatrogenic vessel dissection CASE 1

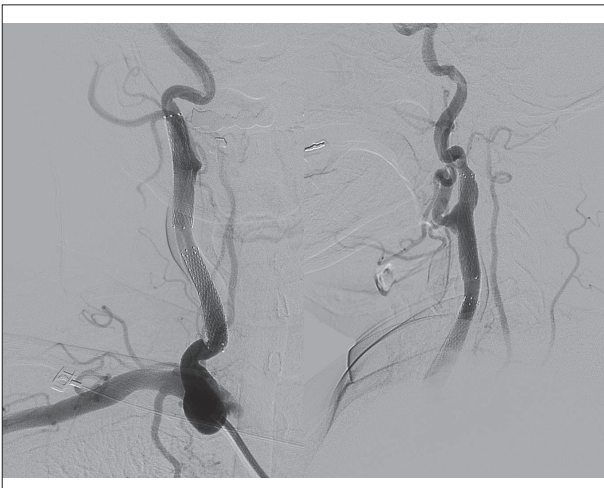
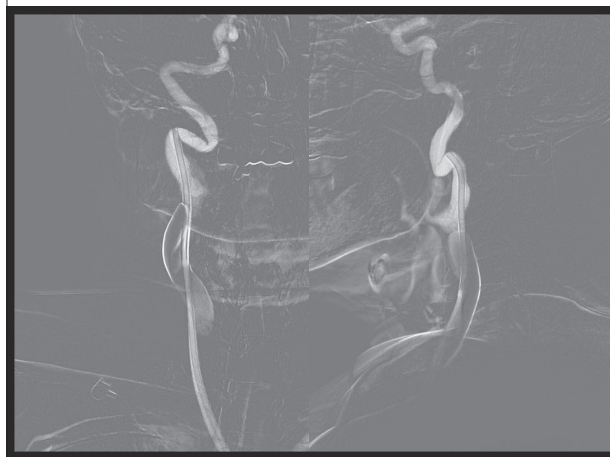
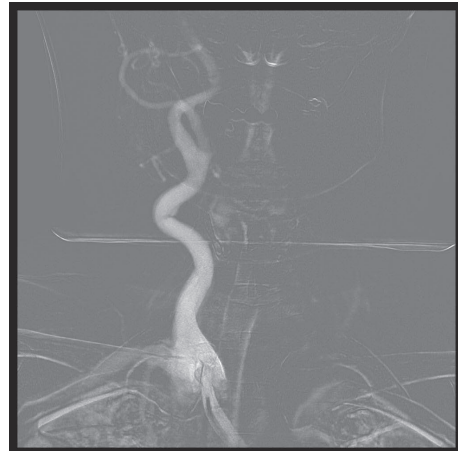
- 50/F
- AVM
- TFCA for GKS





iatrogenic vessel dissection CASE 2

- 60/F
- r/o Lt. MCA an.



Air embolism

- Rare
- Prevented by
 - Attaching air filters to both the catheter and contrast-medium syringe
 - Slowing the rate of contrast injection
 - Reducing the number of microcatheter runs
 - Ensuring appropriate catheter priming

**Thank you
for
your attention**



Contrast-related complications

조동영

이화여대

Contrast-related complications

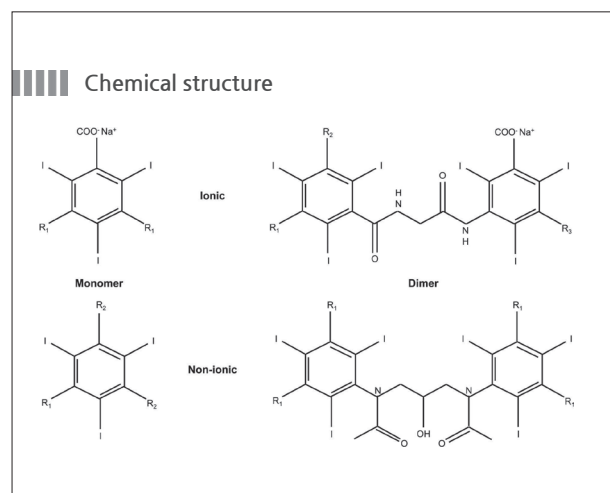
2022. 11. 25
대한뇌혈관내치료학회 2022년 정기학술대회

이대서울병원 신경외과
조동영

EUMC
이대서울병원

Contrast media

- Used to improve the visibility of internal organs and structures in X-ray based imaging techniques
- Based on chemical modification of a 2,4,6-tri-iodinated benzene ring
- Classified as ionic/non-ionic, monomeric/dimeric



Contrast osmolarity

- High-osmolarity contrast media (HOCM): 1300~2140 mOsm/kg
- Low-osmolarity contrast media (LOCM): 600-850 mOsm/kg
- Isoosmolar contrast media (IOCM): 290 mOsm/kg
- Contrast osmolarity higher than blood
 - Movement of water from interstitial space to vascular compartment
 - Increase blood viscosity
 - Endothelial damage
 - Hypervolemia
 - Vasodilatation
 - Edema
 - Neurotoxicity

Contrast viscosity

- Determined by flow friction, resistance, thickness
- Importance of IV injectability, flow rate, gauge of canular
- Reduced by injecting at body temperature (37°C)
- LOCM > HOCM
- High iodine concentration:
 - Better radiopacification, higher risk of adverse reaction
 - Increase viscosity
- High viscosity, high risk of nephrotoxicity

Type of radio-opaque contrast

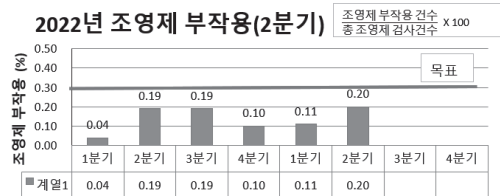
Table 6.1 Physical properties of ionic and nonionic contrast media

Contrast medium	Iodine content (mg/mL)	Viscosity (20°C) (mPa·s)	Viscosity (37°C) (mPa·s)	Osmolality (37°C) (mosm/kg H ₂ O)
Ionic (low osmolality)				
Ioxaglate (Hexagram)	320	15.7	7.5	580
Ionic (high osmolality)				
Amidotrizate (Urography)	370	18.9	8.4	2,100
Nonionic				
Iohexol (Omnipaque)	300	11.6	6.1	685
Iomeprol (Imeron 300)	300	8.1	4.5	521
Iopamidol (Isovue)	300	8.8	4.7	644
Iopromide (Ultravist)	300	8.7	4.7	607
Ioversol (Optiray)	300	11.6	5.8	661
Iodixanol (Visipaque)	320	26.6	12.7	290
Iohexol (Omnipaque)	350	23.3	10.6	823
Iopamidol (Isovue)	370	18.5	8.6	832
Iopromide (Ultravist)	370	20.1	9.5	774

EU/MC 이대서울병원

01

Contrast complication in our hospital



Contrast complication case (22.06~22.09)

CT	2022-06-15	65 / F	◆CT Kidney Dynamic	Hexosure 350	100ml	3.0ml/s	전신 쇠약감
CT	2022-07-14	73 / F	◆CT Abdomen & Pelvis	Bonorex 300	120ml	2.0cc/sec	nausea / drowsy, 가슴 redness 증상 / 지혈법
CT	2022-07-08	72 / F	◆CT Chest Routine	Ultravist 300	90ml	2.0cc/sec	urticaria / itching
CT	2022-06-27	78 / F	◆CT Kidney Dynamic	Hexosure 350	100ml	3.0ml/s	Urticaria / rash
CT	2022-07-08	75 / F	◆CT 3D Heart	Xenetix 350	60ml	4.5cc/sec	nausea / vomiting
CT	2022-07-22	69 / F	◆CT 3D Heart	Xenetix 350	60ml	4.5cc/sec	redness / 눈 앞이 안보인다고 호소
CT	2022-07-26	30 / F	◆CT Abdomen & Pelvis	Omnipaque 350	120ml	2.0cc/sec	urticaria / itching
CT	2022-07-27	69 / F	◆CT Abdomen & Pelvis	Bonorex 350	120ml	2.0cc/sec	urticaria / itching
CT	2022-08-08	77 / M	◆CT 3D Head + Neck Angio	Pamiray 370	55ml	4.5ml/s	Urticaria/rash
CT	2022-08-16	51 / M	◆CT 4D Head + Neck Angio	Pamiray 370	55ml	4.5ml/s	Urticaria/rash
CT	2022-08-18	59 / F	◆CT Kidney Dynamic	Hexosure 350	100ml	3ml/s	Urticaria/rash
CT	2022-08-19	53 / F	◆CT Kidney Dynamic	Hexosure 350	100ml	3ml/s	Urticaria/rash
CT	2022-08-29	64 / F	◆CT Heart	Xenetix 350	75ml	4.5ml/s	Urticaria/rash

Contrast complication in our hospital

영상의학과 조영제 부작용 보고서
2022년도 2분기

구분	등급	6월	7월	8월
CT	외래	상	4	
		중	2	5
		하		
	병동	상		
		중		
		하		
	응급실	상		
		중		
		하		
MRI	외래	상		
		중	2	4
		하		
	병동	상		
		중	4	1
		하		2
	응급실	상		
		중		
		하		
소계	상	2	6	5
	중			
	하			
소계	상	4	3	6
	중			
	하			

등급: 상, 중, 하
상: APREST, 의식저하
중: 전신 홍반, 전신 두드러기, 신속대응팀(호출관련), 부종
하: 국소적 홍반, 국소적 두드러기, 가려움, 오심, 구토

Adverse reaction

- Risk factor
 - History of asthma
 - History of allergies
 - Heart disease
 - Dehydration
 - Sickle cell disease
 - Polycythemia
 - Myeloma
 - Underlying renal disease
 - Infants and elderly
 - B-blocker, NSAID medication

Fatal adverse reaction

- Fatal adverse reaction: 1/170,000
 - Renal failure (58%)
 - Anaphylaxis or allergy (19%)
 - Cardiopulmonary arrest (10%)
 - Respiratory failure (8%)
 - Stroke or cerebral hypoxia (4%)

The mechanism of adverse effect

1. Anaphylactoid
2. Chemotoxic (Organ-specific)
3. Vasovagal

1. Anaphylactoid

- Anaphylactic reaction
 - Allergen, IgE-mediated release of chemical mediator - histamine from mast cell
- Anaphylactoid reaction:
 - Similar to anaphylactic reaction but not initiated by allergen/IgE complex
 - Reaction can occur with the first administration
 - not dose-related (test dose unhelpful)
 - Previous contrast reaction increase risk but not always

2. Chemotoxic (Organ specific)

- Nephrotoxicity
- Cardiovascular toxicity
- Neurotoxicity
- Associated with
 - Ionicity
 - Iodine concentration
 - Viscosity
 - Osmolarity
 - Injection rate
 - Dose on contrast agent

3. Vasovagal

- Bradycardia, Hypotension
- Not contrast itself but due to sympathetic response to fear and pain
- Parasympathetic reflex activation
- Rapid decrease in heartbeat, reduction of vascular tone
- Tx
 - Leg elevation, IV fluid, Oxygen by mask
 - Bradycardia persist-> IV atropine (0.6-1.0mg) every 3-5min, maxima dose 3mg

Contrast-related complications

- Mild inconvenience to life-threatening emergency
 1. Hypersensitivity reaction
 2. Contrast induced thyroid dysfunction
 3. Contrast induced nephropathy
 4. Contrast induced encephalopathy
 5. Extravasation

Hypersensitivity reaction

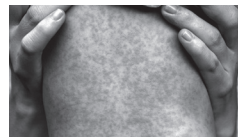
- Mild hypersensitivity reaction (incidence <3%)
 - Skin rashes, flushing, urticaria, pruritus
 - Rhinorrhea
 - Nausea/vomiting
 - Diaphoresis
 - Coughing
 - dizziness

Hypersensitivity reaction

- Flushing
- Urticaria
- Pruritus



- Skin rash



- Diaphoresis

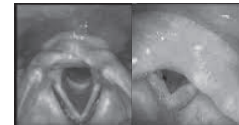


Hypersensitivity reaction

- Moderate to severe reaction (incidence <0.04%)
 - Persistent vomiting
 - Diffuse urticaria
 - Headache
 - Facial edema
 - Laryngeal edema
 - Bronchospasm
 - Angioedema
 - Dyspnea
 - Palpitation
 - Tachy/bradycardia
 - Life threatening cardiac arrhythmia

Hypersensitivity reaction

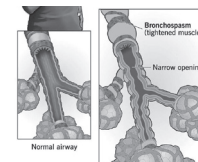
- Facial edema
- Laryngeal edema



- Angioedema



- Bronchospasm



Hypersensitivity reaction-Treatment

- Hypersensitivity reaction 발생시
 1. 주입하고 있던 조영제 즉시 중단
 2. Antihistamine 바로 투여
 3. 기관지연축, 후두부종, 호흡곤란, 저혈압발생시 adrenaline, IV fluid, 산소, antihistamine, hydrocortisone 즉시 투여

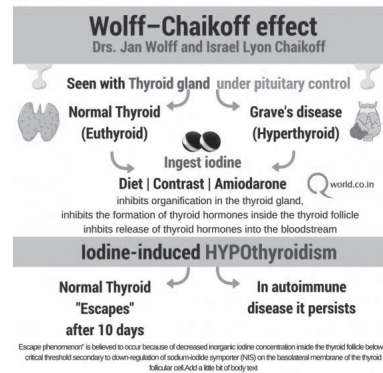
Delayed hypersensitivity reaction

- Delayed adverse reaction
 - 주로 rash, skin redness, swelling 등의 피부병변으로 발생
 - 주로 조영제 주입 후 6~12시간째에 발생 -> 귀가 후에 발생하는 경우가 많다.
 - 주로 mild, non-life threatening
 - 대부분 별 문제 없이 회복

Contrast induced thyroid dysfunction

- Both hypothyroidism and hyperthyroidism
- Due to effect of free, biological active iodide ions
- 하루 요오드 권장섭취량: 150ug
- 조영제 1회 사용당 투여되는 free iodide: 13500ug
- 요오드의 과잉 공급이 갑상선 호르몬의 생성에 교란을 일으켜 갑상선 항진증 또는 저하증을 일으킴.

Contrast induced thyroid dysfunction



Contrast induced thyroid dysfunction

- Hashimoto thyroiditis, autoimmune thyroid disease, 갑상선 절제술 과거력이 있는 경우에는 조영제 사용 후 갑상선 저하증이 발생할 수 있는 고위험군이다.
- Graves' disease, multinodular goitre 등 갑상선 항진증의 병력자는 조영제 사용 후 매우 드물게 hyperthyroidism에 의한 thyrotoxicosis의 위험성이 있다.

Contrast induced Nephropathy (CIN)

- 정의: 조영제 투입 후 24~72시간 내에 다른 위험인자의 개입 없이 발생하는 급성 신부전
- 24시간 꽤 발생, 3~5일째 peak, 10~14일째부터 신기능 회복
- Third leading cause of hospital acquired acute renal failure (12%)
- 기존에 신부전이 있던 환자군에서 발병 확률이 높음.

CIN-Pathogenesis

- Reduction in medullary blood flow leading to hypoxia
 - 신장으로 가는 혈관의 수축에 의한 GFR 감소
 - Increased renal tubular pressure
 - Increased urine viscosity
 - Tubular obstruction
 - Dehydration
- Direct tubular damage due to contrast toxicity
 - Reactive oxygen species(ROS)에 의한 독성
 - Apoptosis

CIN-Risk factor

Risk factors for the development of contrast-induced nephropathy (CIN).

Nonmodifiable risk factors	Modifiable risk factors
Advanced age (>65 years)	Large doses and multiple injections of contrast media
Preexisting impairment of renal function	Route of administration
Advanced congestive heart failure	Osmolality of contrast media
Diabetes mellitus	Severe dehydration
Multiple myeloma	Prolonged hypotension
Sepsis	Anemia
Compromised left ventricle systolic performance	Reduction of effective intravascular volume
Renal transplant	Concomitant use of nephrotoxic drugs
	Concomitant use of ACEi and/or ARBs

Abbreviations: ACEi: angiotensin-converting enzyme inhibitors; ARBs: angiotensin II receptor blockers.

■■■■ CIN-Prevention

- High risk patient
 - Careful monitoring
 - eGFR, serum creatinine check daily for 5 days

■■■■ CIN-Prevention

- Adequate hydration
 - Reducing renal vasocontraction and hypoperfusion
 - Increase diuresis -> limiting contrast material contact with renal tubule
 - 조영주 투여 전 경구 수분 섭취 권장
 - 검사 전 수분섭취 제한은 피하기.
 - High-risk patient: 조영제 투여 6~12시간 전, 검사 후 12~24시간까지 normal saline 1ml/kg/hr로 투여.

■■■■ CIN-Prevention

- Discontinuation of nephrotoxic drug
 - Aminoglycoside, vancomycin, amphotericin B, NSAID등...
- Metformin: 신장을 통해 배출 (>90% within 24hrs)
 - 혈당강하제로 장의 lactic acid 생성을 촉진
 - 조영제로 인한 신기능 저하 발생시 배출되지 않고 체내에 남아 lactic acidosis 유발. Mortality 50%
 - 조영제 투여 12시간 전 중단, 36시간 후 복용 시작

■■■■ CIN-Prevention

- Use of N-acetylcysteine
 - Reactive oxygen species (ROS): 신기능 손상의 주된 원인
 - Act as antioxidant: free-radical scavenger
 - Oral dose 600mg bid, 검사 전일, 검사 당일 2일간
 - 경구 복용 불가능한 경우 IV 150mg/kg over 30min before procedure

■■■■ CIN-Prevention

- Choice of low-osmolar contrast media
 - 정상 신기능환자에서는 차이 없으나 신부전 환자에서는 유의미한 차이
- 최소 용량의 조영제 사용
- Use of antioxidant vitamin C
- Use of antioxidant vitamin E
- Use of statin
- High dose steroid

■■■■ Contrast induced encephalopathy (CIE)

- Rare complication of the intravascular application of a contrast agent
- Manifested by
 - Headache
 - Cortical blindness
 - Consciousness disorder
 - Seizure
 - Focal neurological deficit

Contrast induced encephalopathy (CIE)

- Mechanism of injury: not well understood
 - Combination of chemotoxic effects related to contrast hyperosmolality and direct neurotoxicity of contrast itself
- Plasma hyperosmolality
 - Cerebral vasodilatation
 - Shrinking of intracellular space
 - Widening of gap junction
 - Increase permeability of BBB
 - Changes on oncotic pressure → brain edema

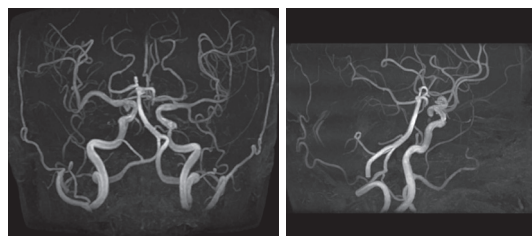
CIE- Our hospital case

- 2019.2~2022.2
 - 842 TFCA + 282 neurointervention: 1024 cases
 - 2 case of CIE after use of non-ionic, iso-osmolar agent
 - Incidence: $2/1024 = 0.19\%$

Case 1

- F/70
- DM/HBP/Dyslip (+/-/-)
- Asthma (+) - Nebulizer 치료중
- Digital subtraction angiography (DSA) for evaluation of Rt. PcomA aneurysm
- Lab
 - WBC 6790
 - Hb 10.8
 - BUN 14/ Cr. 0.57
 - HbA1c 6.4

MRA



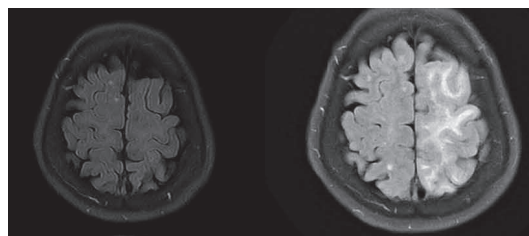
Post-DSA immediate Neurologic Examination

- GCS 2/3/5
- Pupil 3mm/3mm ppt.
- Motor Rt. upper I/ Lower III
- V/S: 146-74/76/20/36.9

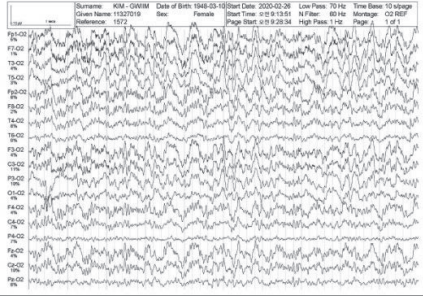
Post DSA MR FLAIR

Immediate MRI

POD#1 MRI



POD #1 EEG



This EEG study is suggestive of partial seizure disorder arising from left frontocentrottemporal area associated with left hemispherical cerebral dysfunction.

EUMC 이대서울병원 01

Prognosis

- Treatment
 - Keppra 500mg bid
 - Mannitol 150ml qid
 - Dexamethasone 5mg qid
- On POD #3
 - Rt. Upper motor recovered to Gr IV
 - GCS recovered to 4/4/6

EUMC 이대서울병원 01

Case 2

- F/62
- DM/HBP/Dyslip (+/+/-)
- 2021.04 SAH c Lt. Pcom An rupture, UIA A-com -> SAC (타병원)
- Post op Lt. thalamic infarction
- F/U MRA상 recur로 치료 위해 내원
- Lab
 - WBC 5410
 - Hb 13.6
 - BUN 18/ Cr. 0.71
 - HbA1c 6.3

EUMC 이대서울병원 01

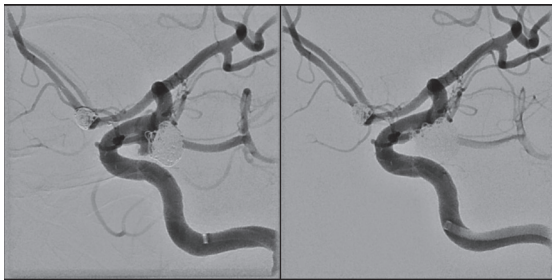
DSA



- Total contrast amount: Visipaque 50cc
- No neurologic deficit after DSA

EUMC 이대서울병원 01

Coil embo



- Complete occlusion
- Decreased fetal PcomA flow

EUMC 이대서울병원 01

Post Coil embo

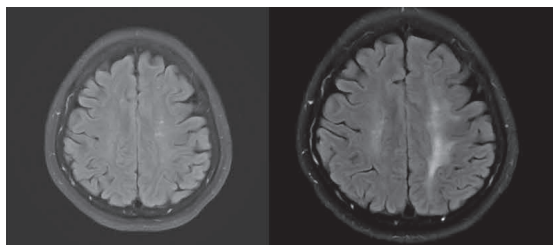
- Total contrast amount: Visipaque 250cc
- NEx
 - GCS 3/2/5
 - Global aphasia (+)
 - Pupil 3mm/3mm ppt.
 - No motor weakness
 - V/S: 182-104/70/17/36.5

EUMC 이대서울병원 01

Post OP MRI FLAIR

Immediate MRI

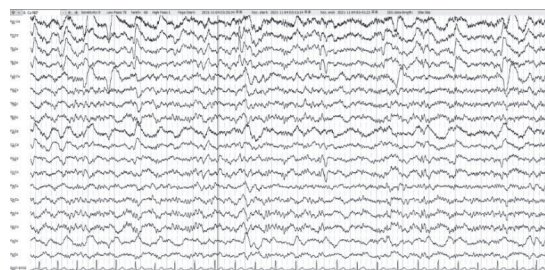
POD#1 MRI



EUMC 이대서울병원

01

POD #2 EEG



These feature suggest a focal seizure disorder with structural lesion in the left hemisphere.

EUMC 이대서울병원

01

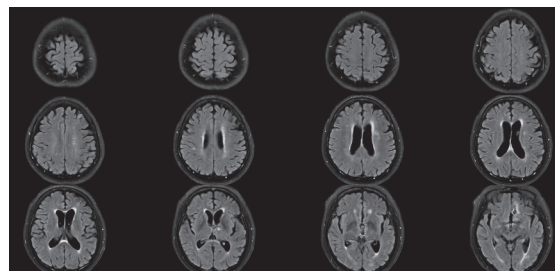
Prognosis

- Treatment
 - Kepra 500mg bid
 - Mannitol 150ml qid
 - Dexamethasone 5mg qid
- POD #6
 - Rt. motor recovered to Gr V
 - GCS recovered to 4/5/6

EUMC 이대서울병원

01

Brain MRI on POD 3 month



- Neurologically fully recovered

EUMC 이대서울병원

01

CIE Mechanism and prognosis

- Important mechanism of injury: Disruption of BBB
- Possible factors of BBB disruption
 - Osmolarity
 - Ionicity
 - Lipid solubility
 - Direct intraluminal pressure by injection
- CIE is typically reversible disease with support treatment for seizure and brain edema

EUMC 이대서울병원

01

Extravasation

- Extravasation of IV contrast during power injection: 0.1~0.9%
- Human error, canular dislodgement, leakage
- Peak reaction: 24~48hrs
- Risk factor
 - Altered circulation
 - Prior radiation therapy
 - Prior lymph node dissection
 - Severe debilitation
 - Certain access site: hand, foot, ankle..
- Usually, self-limiting
- Rare severe complications
 - Compartment syndrome, skin necrosis..

Extravasation



Extravasation

- Compartment syndrome



Extravasation- Prevention

- '예방'이 가장 중요한 치료!
- Test injection
- 주입속도 조절
 - Large vein: 3mL/s 이하
 - Small vein (hand, wrist..): 1.5mL/s 이하
- 주입 후 15초간 infusion site 관찰
- 환자와 소통하여 불편한데 없는지 물어보기. 이상강후 호소하면 바로 조영제 주입 중단

Extravasation- Treatment

- Extremity elevation
- Warm/cold compression
- Small volume, self limiting lesion: 2~4시간동안 관찰
- Large volume (30~100ml): blistering, ulceration, swelling...
- In case of severe extravasation injury: immediate surgical consultation
- Aware of skin discoloration, neurologic or vascular symptom

Take Home message

- Contrast adverse reaction: Anaphylactoid, organ-specific, vasovagal
- Hypersensitivity 발생시 주입중인 조영제를 즉시 중단하고 antihistamine을 바로 투여한다.
기관지연축, 후두부종, 호흡곤란, 저혈압이 동반될 경우 adrenaline, IV fluid, 산소, antihistamine, hydrocortisone을 즉시 투여한다.
- 갑상선 유결환자는 조영제 사용 후 갑상선 장애 발생 위험도가 높으니 유의한다.
- 신부전 질환자는 조영제 사용 후 신기능 손상 확률이 높으며 이를 예방하기 위해 충분한 수액공급, 신독성있는 약제 중단 및 최소한의 조영제 사용이 필요하다.
- Contrast-induced encephalopathy는 드물게 발생하며 신경학적 악화가 일어나지만 보존적인 치료를 잘 시행한다면 대부분 회복되는 질환이다.
- Extravasation은 예방이 제일 중요하다. IV line 관리, test injection, close observation!!

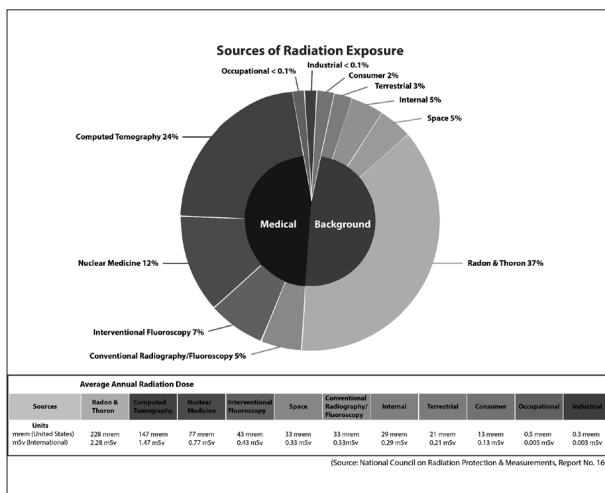
Thank You!



Radiation-related complication

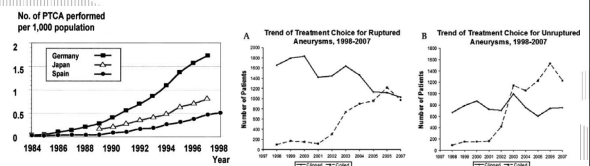
이종민

울산대



중재방사선 기술과 안전

- 모든 나라의 의료에서 더 많은 환자에게, 더 적은 비용으로, 더 넓은 영역에 대한 치료의 기회를 제공
- 비싼 수술실과 오랜 입원의 필요성을 감소시킴
- 일반 마취 요구의 감소



진단과 치료의 결정

많은 환자들이 생명을 위협하는 병을 치료
절차의 정당화는 상대적으로 단순
바람직한 수준의
방사선 유발 상해의 위험에 관한 지식?



UNSCEAR; 방사선원, 영향



ICRP; 방호 원칙 제시



IAEA; 구체적 이행 방법 제시

방사선의 정량화

- 흡수선량, Gy (Gray = 1J/kg)
 - 방사선이 물질과 상호작용하여 물질의 단위 질량당 흡수된 에너지
 - 방사선의 종류, 물질의 종류에 관계없음
- 등가선량, Sv
 - 방사선의 종류에 따라 영향이 다름 → 이를 고려
 - 등가선량 = 흡수선량 X 방사선가중치 (W_R)
 - X선의 방사선가중치 1, X선은 흡수선량 = 등가선량
- 유효선량, Sv
 - 장기와 조직의 등가선량을 조직가중치 (W_T)로 곱하여 합산
→ 방사선이 전체 인체에 미치는 영향을 실용화
 - 리프하게 등가선량 X 조직가중치(W_T)

Deterministic effect (결정론적 영향) = 조직반응

역치를 넘는 방사선 노출에 의해 인체 이상이 발생
많은 수의 세포가 사멸 또는 기능을 못하게 되어 발생
→ 문턱선량이 존재 (1%에게 조직반응을 유발할 것으로 추정되는 선량)
홍반, 백내장, 불임, 혈액상의 변화, 기형

Stochastic effect (확률론적 영향)

방사선량에 따라 건강이상 가능성이 확률적으로 증가하는 것
확률이 선량에 비례, 문턱선량이 없는 것으로 간주
피폭에 의한 암, 유전결함
일본 원폭 생존자에 대한 역학연구 결과에 기초

유효선량

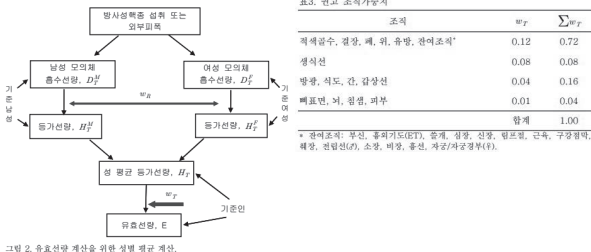


표3. 권고 조직가중치

조직	w_R	$\sum w_R$
적색골수, 결장, 폐, 위, 유방, 전이조직*	0.12	0.72
생식선	0.08	0.08
방광, 식도, 간, 갑상선	0.04	0.16
배뇨관, 자, 질, 피부	0.01	0.04
합계		1.00

* 전이조직: 부신, 흉골기대(RT), 중개, 심장, 신장, 림프관, 근육, 구강점막, 태장, 전립선(RT), 소장, 비장, 췌장, 자궁/자궁경부(RT).

• X-선을 일시에 전신에 받았을 경우 발생하는 유효선량에 따른 증상

피폭선량	증상
0.25Sv	임상적 증상이 거의 없음
0.5Sv	백혈구(림파구) 일시 감소
1Sv	구역질, 구토, 전신관통, 림파구 현저적 감소
2Sv	5%의 사망이 사망
4Sv	30일간 50%의 사망이 사망
6Sv	14일간 90%의 사망이 사망
7Sv	100%의 사망이 사망

방사선량의 감시

- Peak skin dose, Gy
 - 환자 피부 표면의 부위에 상관없는 최대조사량
 - Deterministic effect (결정적 효과)를 일으키는 실질적인 dose
 - 측정이 매우 어려움
- Fluoroscopic time, min
- Kerma-area product(KAP)
or Dose area product (DAP), Gy cm²
- Reference dose, mGy

"Monitoring"



시술자 및 환자의 방사선 피폭

- 단순 촬영과 비슷한 수준의 관전압 (80~100Kv), 매우낮은 관전류 (<10mA)
- But, 검사 및 시술부위에 대한 장시간의 피폭
 - 환자와 x선간의 거리
 - 각도
 - 시준기(collimator)의 크기와 모양
 - 확대여부

시술자 및 환자의 방사선 피폭

- 안전함의 목표
 - 결정적영향 방지; 손, 발, 수정체, 갑상선
 - 수정체 150 mGy/y → 20 mGy/y (ICRP 118, 2012)
 - 확률적영향 최소화(0인가 minimum인가)
 - 작업자 20 mSv/y, 일반인 1 mSv/y
- 방사선 선량 한도

구분	방사선 관계 종사자	일반인 (자연방사선, 직업성피폭, 의료성피폭을 계 위한 상황)
유효선량	5년간 100mSv (20mSv/년) (단 특정 1년에 한 하여 50mSv까지 허용)	연간 1mSv
특정 장기의 등가선량 -수정체 -피부 -눈, 발	연간 150mSv 연간 500mSv 연간 500mSv	연간 15mSv 연간 50mSv

시술자 및 환자의 방사선 피폭

- Martin et al. 2009
 - 연간 500건의 업무량을 지닌 중재시술의사에게 2 mSv/y를 줄
것으로 평가
 - Glasgow의 한 병원 심장학자의 납치마 아래에서 최대 1.2 mSv/y
측정됨
- Sanchez et al. 2012
 - 납치마 아래 0.11 mSv/month (심장학자), <0.01mSv/month (간호사)
 - 납치마 위 0.4mSv/월

시술자 및 환자의 방사선 피폭

- 갑상선 보호대 미착용시 절차당
 - 10 uSv → 10 mSv
- 납치페 미착용시[Hausler, 2009]
 - 절차당 몸통 16 uSv, 눈 2.8uSv, 갑상선 4.1uSv, 발 44 uSv, 손 75 uSv

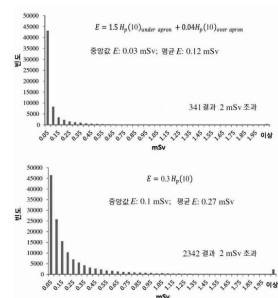
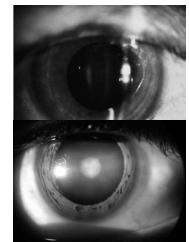


그림 2.1. 평가된 유효선량(1) 본포, (위) 두 선량계(납치마 아래와 위 하나씩)로 평가, (아래) 납치마 위 선량계 하나로 평가(Yoder와 Salaskey 2016).

수정체 등가선량

- 선량한도 하향조정 [ICRP 118, 2012]
 - 문턱선량 0.5 Gy
 - 선량한도; 20 mSv/y
- X-선관 위치가 [Kicken, 1999]
 - 허부에 있을때 16 uGy
 - 상부에 있을때 43 uGy
- 천정결이 미착용시 18.7배[Vano, 2016]
- 연간 눈 등가선량 50-100mSv에 이를 수 있음[Vano 2008]



손 등가선량

- Mayo 30건 [Felmlee, 1991]
 - 최대 5.5mGy, 중앙 1mGy
 - 신경증세; 0.01 mGy,
 - 말초혈관조형술; 0.4 mGy



정형외과 의사, 척주주사요법 100건 17년간 노출(2015년)

- 18편 review[Whitby, 2005]
 - 0.01 – 2 mGy
- 손은 천정결이의 보호를 받지 못함
- 천정결이 아래 남이나 고무커튼 부착
- Femoral approach시 이점



그림5.5. 대퇴동맥 접근으로 수행하는 절차에서 도관 조작용 위한 손 위치[Whitby와 Martin 2005(British J. Radiology 승인)을 받아 재현]



그림5.6. 경미접근과 안쪽 목정맥 접근에서 손 위치의 예[Whitby와 Martin 2005(British J. Radiology 승인)을 받아 재현]

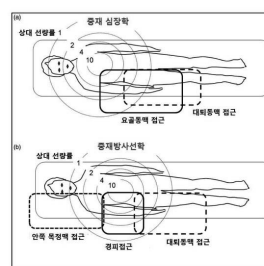


그림5.4. 도관을 조작하는 동안 시술자 손의 위치. (a) 요골동맥 및 대퇴동맥 접근을 통한 중대 조형술. (b) 안쪽 목정맥, 경미 및 대퇴동맥 접근을 통한 중대 조형술 [Martin과 Sutton(2014)]. (옥스퍼드대학 출판부 승인)을 받아 재현.

To reduce the radiation dose..

- Awareness of the practitioner to reduce the radiation
- 3 Principles
 - Time
 - Distance
 - Shielding
- Technical aspects

Technical strategies for DSA dose reduction

ORIGINAL RESEARCH

Practical techniques for reducing radiation exposure during cerebral angiography procedures

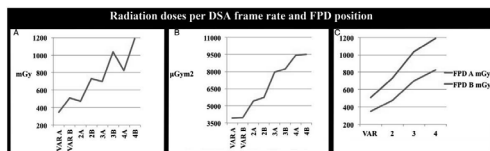
Monica S Pearl,^{1,2,3} Collin Torok,³ Jiangxia Wang,⁴ Emily Wyse,¹ Mahadevappa Mahesh,³ Philippe Gailloud^{1,3}

Protocol	Femoral marker (pts)	Fluoroscopic evaluation (pts)	DSA evaluation (pts)	Fluoroscopy time (min)
1A	3	3	—	0.2
1B	3	3	—	0.2
2A	4	4	—	0.2
2B	4	4	—	0.2
3A	3	—	2	0.1
3B	3	—	2	0.1
4A	4	—	2	0.1
4B	4	—	2	0.1
5A	3	—	3	0.1
5B	3	—	3	0.1
6A	4	—	3	0.1
6B	4	—	3	0.1

pts, frames per second; pts, points per second.

- FPD configuration A : collimation applied + source to image detector distance (SID) 110cm
- FPD configuration B : no collimation applied + SID 120cm

Technical strategies for DSA dose reduction



- Fluoroscopic Pulses per seconds (PPS)
 - 낮고 적절한 PPS를 사용 (3 or 4 p/s)
- DSA frames per seconds (FPS)
 - Variable frame rates (동맥기와 정맥기에 다른 FPS적용)
- Collimation & source to image detector distance
 - field of view 조절, 엑스선발생장치와 detector를 줄이려는 노력

Technical strategies for DSA dose reduction

Original Article

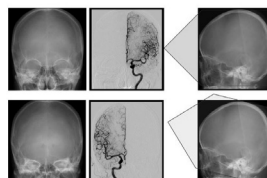
Estimated radiation dose according to the craniocaudal angle in cerebral digital subtraction angiography: Patient and phantom study

Yunsun Song¹, Youngeun Kim¹, Seongsik Han¹, Tae Il Kim¹, Joon Ho Choi¹, Jun Young Maeng², Youngrak Choi¹, Deok Hee Lee^{1,2}

¹ Department of Radiology, Research Institute of Radiology, University of Ulsan College of Medicine, Asan Medical Center, 88, Olympic-ro 43-gil, Songjeong, Seoul 05505, Korea

² Department of Radiologic Technology, University of Ulsan College of Medicine, Asan Medical Center, Seoul, Korea

³ Samsung Healthcare Ltd., Seoul, Korea

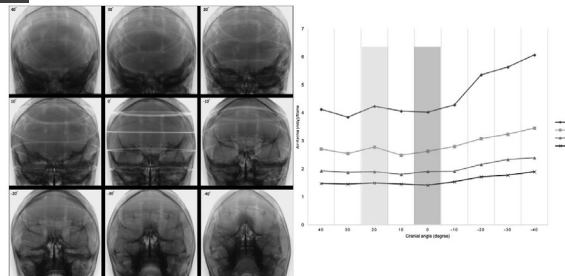


Parameters	PA view (n=31)	CC view (n=31)	P-value*
Cranial angle	1.7 ± 4.1	19.4 ± 4.4	<0.001
KVP	72.5 ± 2.2	73.1 ± 2.2	0.86
mAs	162.9 ± 20.7	162.8 ± 20.9	0.87
Copper filter (mm)	0.71 ± 0.69	0.58 ± 0.71	0.04
0 mm	12 (38.7%)	16 (51.6%)	
0.1 mm	17 (54.8%)	13 (41.9%)	
0.2 mm	1 (3.2%)	1 (3.2%)	
0.3 mm	1 (3.2%)	1 (3.2%)	
DAP (μGy·m ²)	508.6 ± 206.7	586.1 ± 222.5	0.03
AK (mGy)	33.2 ± 13.2	37 ± 14	0.02
Frames	23 ± 0.9	22.8 ± 0.8	0.11
DAP/IT	22.1 ± 8.9	26.9 ± 9.8	<0.001
AK/IT	1.44 ± 0.6	1.63 ± 0.6	<0.001

Data presented as mean ± SD or n (%). PA: postero-anterior; CC: craniocaudal angled; DAP, dose-area product (μGy·m²); AK, reference air-kerma (mGy); IT, frame.

* Wilcoxon signed rank test.

Technical strategies for DSA dose reduction



Technical strategies for DSA dose reduction

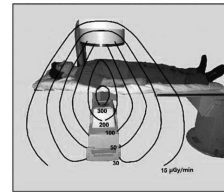


그림 5.1. 좌상 아래쪽 복선관으로부터 공기커버를 본보(Whitby et al. Martin 2003(British J. Radiology) 승인을 받아 재현함).

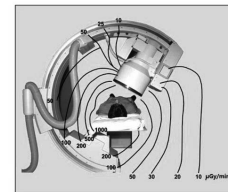


그림 5.2. 경시선 X선관상 대 중재용 X선관상 주변에 공기커버를 본보(Whitby et al. Martin 2003(British J. Radiology) 승인을 받아 재현함).

- 입사된 x선은 환자에 의해 대부분 감쇄, 약 1~5%정도만 영상 수용기측으로 방사
- x선관이 테이블하방에 있는 undercouch system이 유리

Technical strategies for DSA dose reduction

Original Article | Neurointervention
https://doi.org/10.3348/kjp.2017.18.4.722
pISSN 1229-4929 eISSN 2005-8130
Korean J Radiol 2017;18(4):722-728

Check for updates

KJR
Korean Journal of Radiology

Radiation Dose Reduction without Compromise to Image Quality by Alterations of Filtration and Focal Spot Size in Cerebral Angiography

Dong Joon Kim, MD, PhD, Min Keun Park, MD, Da Eun Jung, MD, Jung Han Kang, MD,
Byung Moon Kim, MD, PhD
All authors: Department of Radiology, Yonsei University College of Medicine, Seoul 03722, Korea

- Protocol 1 : inherent filtration + large focus
- Protocol 2 : inherent filtration + small focus
- Protocol 3 : copper filtration + large focus
- Protocol 4 : copper filtration + small focus

Technical strategies for DSA dose reduction

Table 4. Comparison of Total Mean Radiation Dose/Patient of Cohort Groups for Routine Cerebral Angiographic Study

	Total AK/Patient (mGy)	P < 0.05 from Protocol	Total DAP/Patient (mGy·cm ²)	P < 0.05 from Protocol
Protocol 1	1671.91 ± 380.99	3, 4	222759.76 ± 40524.46	3, 4
Protocol 3	987.89 ± 240.21	1	165783.88 ± 48924.18	1
Protocol 4	834.95 ± 181.04	1	139376.36 ± 30862.78	1

AK = air kerma, DAP = dose area product

Table 5. Comparison of Mean Image Quality Scores of Cohort Groups

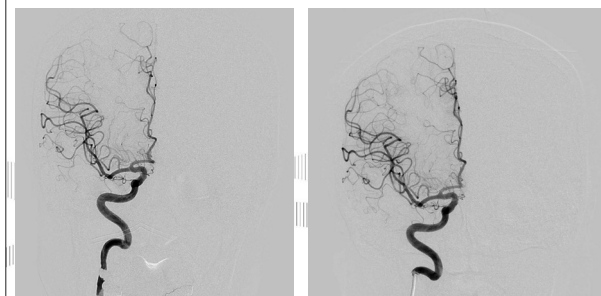
	Routine Projection				Magnified Working Projection			
	Protocol 1	Protocol 3	Protocol 4	P	Protocol 1	Protocol 3	Protocol 4	P
Overall	6.44 ± 0.81 (5.61 ± 0.81)	6.17 ± 1.41 (5.33 ± 1.41)	6.33 ± 1.58 (5.43 ± 1.68)	0.84 (0.87)	7.11 ± 1.13 (6.27 ± 1.13)	7.42 ± 0.96 (6.58 ± 0.96)	7.13 ± 1.23 (6.18 ± 1.23)	0.57 (0.43)
Contrast	6.98 ± 0.87 (7.15 ± 0.87)	6.68 ± 1.18 (6.85 ± 1.18)	7.01 ± 1.18 (7.08 ± 1.30)	0.70 (0.77)	7.41 ± 1.14 (7.58 ± 1.14)	7.61 ± 1.10 (7.78 ± 1.10)	7.30 ± 1.16 (7.35 ± 1.18)	0.63 (0.35)
Sharpness	6.33 ± 0.76 (6.00 ± 0.76)	6.18 ± 1.46 (5.85 ± 1.46)	6.25 ± 1.67 (5.85 ± 1.76)	0.91 (0.94)	7.12 ± 1.12 (6.94 ± 1.11)	7.36 ± 0.93 (7.24 ± 0.92)	7.17 ± 1.27 (7.00 ± 1.15)	0.74 (0.61)
Noise	6.24 ± 0.76 (5.91 ± 0.76)	5.94 ± 1.48 (5.61 ± 1.48)	5.94 ± 1.52 (5.51 ± 1.55)	0.65 (0.53)	6.97 ± 1.10 (6.64 ± 1.10)	7.29 ± 1.01 (6.96 ± 1.01)	6.99 ± 1.25 (6.54 ± 1.23)	0.55 (0.41)

Adjusted image quality scores in parentheses

Technical strategies for DSA dose reduction



Fig 1. Anteroposterior views of bilateral paired internal carotid artery (ICA) injections (Rt ICA, protocol 4; Lt ICA, protocol 1).



5 DSA VAR TIME TFCA UH 11s 48/s 19-May-20 10:02:16
A 67kV 327mA 60.1ms 0.0CL mHall 0.1Cu 42cm 445.94μGy/m 15.8mSv 0LAD 5CRA 17P

2 DSA VAR TIME TFCA UH 11s 48/s 29-Jun-21 10:32:28
A 68kV 242mA 90.5ms 0.0CL micro 0.2Cu 42cm 245.46μGy/m 11.8mSv 0LAD 5CRA 17P



2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

**Free paper III (Ischemia),
Plenary session & Committee session II**

11월 25일(금) 15:10-16:10

[Grand ballroom]

Free paper III (Ischemia)

좌장: 신승훈 (차의과대),
진성철 (인제대)

Extended time window (>6 hour) mechanical thrombectomy; good clinical outcome in the young age population. Relationship between age and prognosis.

Jin Mo Cho

Catholic kwandong university

Objective: Mechanical thrombectomy (MT) is the standard of care for acute ischemic stroke (AIS) caused by large vessel occlusion within 6 hours of symptoms onset. However, the outcome of MT in extended time window (6 hours up to 24 hours) MT effect is unknown. We evaluate the outcome of extended time window effect of MT in AIS.

Methods: We reviewed data from AIS patients treated with MT beyond 6 hours of stroke onset, from 2014 to 2021. Patients had an occlusion of the intracranial artery middle cerebral artery (MCA) or posterior circulation. We evaluated the modified Rankin scale (mRS) and mortality at 90 days and complications such as symptomatic intracranial hemorrhage (sICH).

Result: Thirty one patients were included, with a mean age of 65.6 ± 16.1 years, 52.3% were male, and the median NIHSS score at presentation was 17. Successful recanalization (TICI 2b to 3) was obtained in 95.6% of patients and sICH rate was 3.5%. and there is no difference between two groups. Young age group (Young age group (<80 years old) group clearly showed good clinical outcome (mRS 0-2; $p < 0.05$, Fisher's exact test) compared old age group Overall mortality rate was 0.3%.

Conclusion: Our study, the first series of MT for AIS treated with extended window shows that MT can be performed with effectively and safely lead to adequate functional outcomes especially young age group.

Neurological status should be considered when contemplating decompressive craniectomy after intraarterial thrombectomy

Sang hyuk Im, M.D., Ph. D, Do-Sung Yoo, M.D.,Ph.D., Hae-kwan Parkm M.D., Ph.D.

Eunpyeong St. Mary's Hospital, The Catholic University of Korea, College of Medicine

Objective: Many studies have reported that early decompressive craniectomy (DC) for patients with large hemispheric infarction can be life-saving and improves neurological outcomes. However, most of those studies were published before additional intraarterial thrombectomy (IA-Tx) became popular. We aimed to analyze risk factors associated with favorable outcome at 3 months after IA-Tx and DC.

Methods: Sixty-seven patients with major anterior circulation infarctions, who underwent DC after IA-Tx with or without intravenous recombinant tissue plasminogen activator (IV-tPA), were included in the analysis. We retrospectively reviewed the medical records, radiological findings, and clinical outcomes according to the “surgical time window” and neurological status at the time of the operation.

Result: For patients treated with DC after IA-Tx, a Glasgow Coma Scale (GCS) score of 7 was the lowest associated with a favorable outcome ($p = 0.013$). Favorable outcomes correlated significantly with successful recanalization after IA-Tx ($p = 0.001$) and perfusion/diffusion (P/D)-mismatch evident on magnetic resonance imaging performed immediately prior to IA-Tx ($p = 0.007$). However, the surgical time window (within 36 h, $p = 0.389$; within 48 h, $p = 0.283$) did not correlate with the neurological outcomes.

Conclusion: The indications for DC after IA-Tx should consider neurological status ($GCS \geq 7$). Recanalization of the occluded vessel and P/D-mismatch are important to improve the long-term neurological outcomes of patients treated with IA-Tx, with or without IV-rtPA.

The practical application of mechanical thrombectomy without intravenous t-PA as a bridge therapy for acute large artery occlusion within 4.5 hours after symptom onset

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³⁾Department of Neurosurgery, Inje University Haeundae Paik Hospital, Busan, Republic of Korea

Objective: Intravenous tissue plasminogen activator (IV t-PA) is limited because it has a short half-life and is a contraindication for adjuvant antiplatelet medication within 24 hours after IV t-PA injection. We could only evaluate the clinical outcome of IAT by comparing the IAT plus bridging therapy of IV t-PA within 4.5 hours after symptom onset.

Methods: From January 2018 to December 2020, 190 patients who had acute large cerebral artery occlusion within 4.5 hours after symptom onset were included in this study. The patients were divided into two groups: the IAT only (n = 135, 71.1%) and IAT plus bridging therapy of IV t-PA (n = 55, 28.9%) groups.

Result: The door-to-puncture time was significantly faster in the IAT only group (median, IQR 103 minutes, 76-136) than in the IAT plus IV t-PA group (median, IQR 132 minutes, 90-165) ($p = 0.010$). The successful recanalization rate was not different between IAT only and IAT plus IV t-PA (n = 120 (88.9%) vs. n = 49 (89.1%), $p = 0.968$). Good clinical outcome (3-month modified Rankin Scale [mRS], 0 to 2) was not significantly different between the IAT only and IAT plus IV t-PA (n = 73 (54.1%) vs. n = 34 (61.8%), $p = 0.329$) groups. On multivariable analysis, good clinical outcome was significantly independently associated with the National Institute of Health Stroke Scale score on arrival (adjusted OR, 0.863 [95% CI, 0.806-0.924]; $p < 0.001$), age (adjusted OR, 0.968 [95% CI, 0.942-0.995]; $p = 0.021$), and the door-to-puncture time (adjusted OR, 0.996 [95% CI, 0.993-1.000]; $p = 0.032$).

Conclusion: In our study, the clinical outcome of IAT is not inferior to that of IAT plus bridging therapy of IV t-PA in patients with large artery occlusion within 4.5 hours of stroke onset, with no statistical difference of successful recanalization.

Procedural factors for re-occlusion in acute large artery atherosclerotic occlusion after intra-arterial recanalization therapy plus balloon angioplasty or intracranial stenting

YunHyeok Choi, Joonwon Lee, Hyungon Lee, Seung Hwan Kim, Sung-Chul Jin

Inje University Haeundae Paik Hospital

Objective: Re-occlusion has been regarded as a fatal event influencing clinical outcome adversely after intra-arterial recanalization therapy (IAT) in acute intracranial atherosclerotic occlusion (ICAS). We evaluated demographic and procedural factors for re-occlusion after IAT in acute intracranial atherosclerotic occlusion (ICAS) retrospectively.

Methods: From January 2013 to December 2020, 46 patients with ICAS who underwent IAT plus rescue treatment of balloon angioplasty or intracranial stenting included our study. We classified into patency group (n=31, 67.4%) and re-occlusion group (n=15, 32.6%) based on CT angiography 1 day after IAT plus rescue treatment.

Result: Intravenous tissue plasminogen activator (IV t-PA) of patency group (n=18/31 (38.3%)) had statistical difference with that of re-occlusion group (n=1/15 (7.7%)) (p=0.045). The number of thrombectomy attempt of re-occlusion group was significantly more frequency than that of patency group (median(IQR), 2(1-3) vs 1(0-2), p=0.002). In multivariate logistic analysis, the independent predictor of re-occlusion was the number of thrombectomy attempts (odds ratio, 3.761 [95% CI, 1.416-9.990], p=0.008)

Conclusion: In our study, the number of thrombectomy attempts was an independent risk factor of re-occlusion in ICAS treated by IAT and rescue treatment. Accordingly, definite ICAS lesion should be cautious for additional attempt of IAT for reducing re-occlusion after IAT plus rescue treatment.

Endovascular Treatment of the Vertebral Artery Origin Stenosis by Using the Closed-cell, Self-expandable Carotid Wallstent

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Hie-Bum Suh, M.D.²⁾, Tae-Hong Lee, M.D., Ph.D.²⁾, Han-Jin Cho, M.D.³⁾, Sang-Min Sung, M.D., Ph.D.³⁾

Department of ¹⁾Neurosurgery, ²⁾Diagnostic Radiology, ³⁾Neurology, Biomedical Research Institute, Pusan National University Hospital

Objective: Endovascular treatment has been considered a good alternative to surgery for symptomatic vertebral artery origin stenosis (VAOS) due to the high risk of morbidity associated with surgery. The purpose of this study was to evaluate the feasibility and efficacy of insertion of the closed-cell, self-expandable Carotid Wallstent for treatment of VAOS.

Methods: The records of 72 patients with VAOS refractory to adequate medication who were treated by endovascular treatment with the Carotid Wallstent from December 2006 and November 2018 were retrospectively evaluated.

Result: Of the 72 patients, 43 presented with transient ischemic attacks. Forty-seven patients (65.3%) manifested other brachiocephalic stenoses; of these, 40 patients had occlusion, hypoplasia, or stenosis of the contralateral vertebral artery. Overall technical success (defined as 20% or less residual stenosis) was 100%. Procedure-related complications (n = 8, 11.1%) included sudden asystole (n = 1), acute in-stent thrombosis (n = 3), minor stroke (n = 3), and stent shortening (n = 1). All complications were resolved without permanent neurological deficit. Angiographic follow-up (mean, 13.0 months) was achieved in 49 patients and revealed in-stent restenosis in 1 patient (2.0%) and stent malposition by shortening in 2 patients (4.1%). Follow-up records were available in 57 patients (mean 15.6 months). Three of the 57 patients (n = 3, 5.3%) had recurrent symptoms of vertebrobasilar ischemia and none was retreated.

Conclusion: Endovascular treatment of symptomatic VAOS using the closed-cell, self-expandable Carotid Wallstent is technically feasible and effective in alleviating patient symptoms and for improving vertebrobasilar blood flow.

Change of mortality of patients with acute ischemic stroke before and after 2015 using nationwide multicenter registry

Jae Sang Oh, Dong Sung Shin, Suk Que Park, Seok Mann Yoon, Bum Tae Kim

Soonchunhyang University Hospital

Objective: Advances in the diagnosis and management of acute ischemic stroke (AIS) and the increased use of mechanical thrombectomy (MT) have improved the quality of care and prognosis of patients with AIS since 2015. We investigated the changing trends in mortality of patients with AIS in Korea before and after 2015.

Methods: A retrospective cohort study was conducted using combined anonymized data from the Acute Stroke Assessment Registry of Korea and the Health Insurance Review & Assessment Service database. Patients with ischemic stroke with precise onset time and initial National Institute of Health Stroke Scale records were included. All patients admitted to stroke centers with a main diagnosis of first-ever AIS examined within 24 h of admission were selected from the ASAR from March to May 2013, June to August 2014, July to December 2016, and July to December 2018. Of these, 3,002 patients with no National Institute of Health Stroke Scale (NIHSS) scores and 17,134 patients with no precise onset time were excluded from this study to observe changes in treatment effectiveness. Overall, 36,124 patients were included, and data were collected on the duration of hospital stay, thrombectomy, medication, ICD-10 codes, and death from HIRA. All data were anonymized using encrypted personal identification numbers in partnership with HIRA under the Joint Project on Quality Assessment Research in Korea. The need for informed consent was waived because of the study's retrospective nature.

Result: Patients receiving MT treatment increased from 256 (2.7%) pre-2015 to 1,037 (3.9%) post-2015 ($p < 0.001$). Overall mortality significantly decreased from pre-2015 to post-2015. In pre-2015, intravenous thrombolysis (IVT) administered within 2 h significantly reduced 3-month mortality when compared with non-IVT. While, in post-2015, IVT administered within 2 h significantly reduced the 3-month, 1-year, 2-year, and 4-year mortality ($p < 0.05$). MT only reduced 1-year mortality pre-2015; however, MT significantly reduced the 3-month, 1-year, and 2-year mortality post-2015 ($p < 0.05$). Post-stroke antiplatelet and anticoagulant drugs significantly reduced the 3-month, 1-year, 2-year, and 4-year mortality post-2015. We shows the changing trends in hospitals treating patients with AIS in Korea. Between pre- and post-2015, the proportion of MT-capable hospitals increased from 33.3% (67) to 49.6% (123), and only IVT-capable hospitals decreased from

37.8% (76) to 23.4% (58). The proportion of tertiary hospitals decreased from 20.9% (42) to 18.1% (45), and general hospitals increased from 69.7% (140) to 85.9% (213). We shows the distribution of medical facilities by type. While the proportion of IVT-capable tertiary hospitals decreased from 40 (19.9%) to 44 (17.7%), IVT- capable general hospitals increased from 77 (38.3%) to 112 (45.2%). The proportion of MT-capable tertiary and general hospitals increased from 27 (13.4%) to 39 (15.7%) and from 26 (12.9%) to 69 (27.8%), respectively. The number of IVT+MT- capable general hospitals increased from 17 (8.5%) to 58 (23.4%).

Conclusion: In conclusion, changes in AIS management and the health insurance care system since 2015 have significantly impacted short- and long-term mortality of patients with AIS. Since 2015, IVT has significantly reduced short- and long-term mortality (3-month, 1-year, 2-year, and 4-year), and MT has significantly reduced the 3-month, 1-year, and 2-year mortality. With the increasing use of NOAC from 2013 to 2018, post-stroke antithrombotic medication has significantly lowered the 2-year and 4-year mortality since 2015.

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

**Free paper III (Ischemia),
Plenary session & Committee session II**

11월 25일(금) 15:10-16:10

[Ballroom 1]

Plenary session

좌장: 김태곤 (차의과대),
심숙영 (인제대)

에스포항병원 학술상

Clinical Significance of Prehospital Telecommunication Dened as the Critical Stroke Call Pathway in Acute Ischemic Stroke Requiring Intra-Arterial Recanalization Therapy

이현곤

동남권원자력의학원

명지성모병원 남천학술상

Flow diverter for the treatment of large (> 10 mm) vertebral artery dissecting aneurysms

정준호

연세대

Clinical outcome of coil embolization for unruptured intracranial aneurysms by region and hospital size: Nationwide cohort study in Korea

Si Un Lee, Hwan Seok Shim, Jeong-Mee Park, Yong Jae Lee, Young-Deok Kim, Tackeun Kim, Seung Pil Ban, Jae Seung Bang, O-ki Kwon, Chang Wan Oh

Seoul National University Bundang Hospital

Objective: We aimed to analyze outcomes of coiling in treating unruptured intracranial aneurysms (UIAs) according to region and hospital size based on national cohort data in South Korea.

Methods: The incidence of perioperative intracranial hemorrhage (ICRH), perioperative cerebral infarction (CI), mortality data of the patients who underwent coiling for UIAs or RIAs were retrieved. Hospitals are classified according to size as tertiary referral general hospitals (TRGH), general hospitals (GH), and semi-general hospitals (sGH). Regions were divided into 15 regions based on the administrative districts of the Republic of Korea, and hospitals in each region were analyzed by hospital size.

Result: Postoperative ICRH or CI complications occurred within 3 months at TRGH, GH, and sGH hospitals in 5.69%, 13.48%, and 20.45%, respectively. Comparing the size of hospitals nationwide, in TRGH, the complication rate was significantly lower than in GH ($p=0.039$) or sGH ($p=0.005$), and in GH, the complication rate was significantly lower than in sGH ($p=0.030$). On the other hand, among patients with complications, the mortality within 1 year was 0.81%, 2.16%, and 3.92% in TRGH, GH, and sGH, respectively, and there was no significant difference by hospital size. Complication rate significantly increases as the number of coiling cases is small ($p=0.001$; $\rho=-0.635$). However, there was no significant difference in the mortality rate within 1 year according to the number of coiling cases per hospital. There was no significant difference in complication rate and mortality according to the difference in the number of coiling cases per hospital between regions by hospital size.

Conclusion: Although there is no significant difference in mortality rate, the complication rate of coiling for UIA increases as the size of the hospital becomes smaller and the experience of coiling is lower. Therefore, quality control for coiling surgery is needed nationwide.

2020년 KoNES 연구비지원 학술연구입니다.

대형뇌동맥류에 대한 혈류전환 스텐트 치료의 유효성 및 안정성평가

정준호

연세대

뇌동맥류 혈관내 코일색전술의 총액 계약제 적용을 위한 연구

박석규

순천향대

Discontinuation of antiplatelet therapy after stent-assisted coil embolization for cerebral aneurysms

김태곤

차의과학대

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

**Free paper III (Ischemia),
Plenary session & Committee session II**

11월 25일(금) 15:10-16:10

[Ballroom 2]

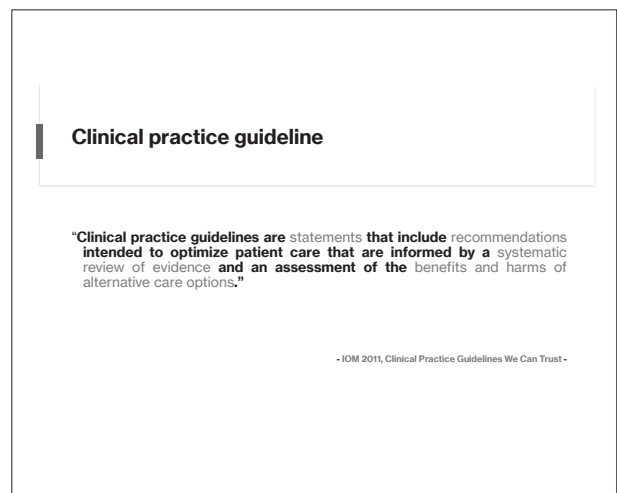
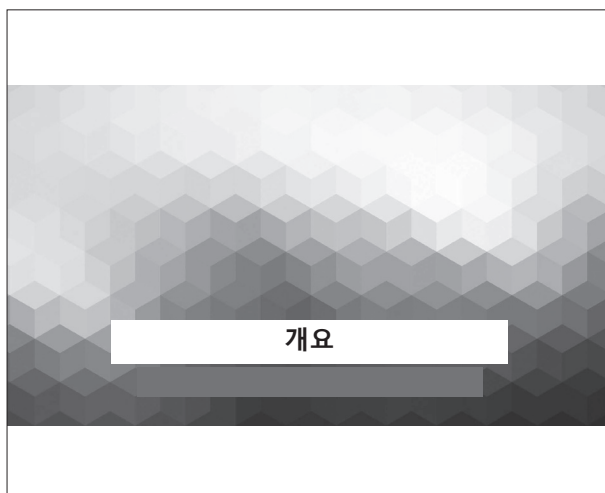
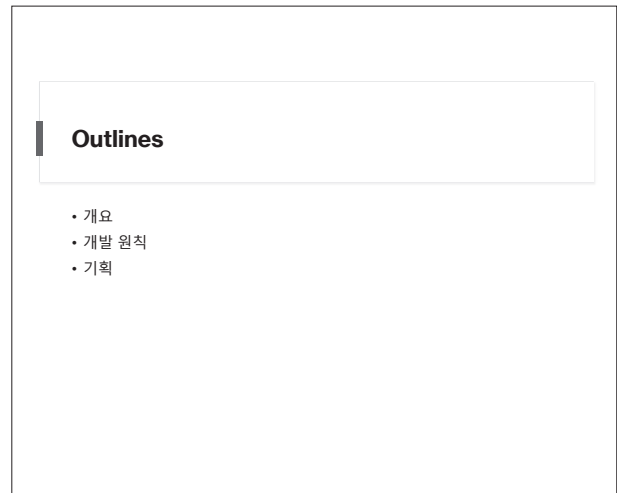
진료지침위원회

좌장: 최재형 (동아대)

진료지침 개발원칙과 진행과정

김수영

대한의학회 임상진료지침 전문위원, 한림의대 가정의학과

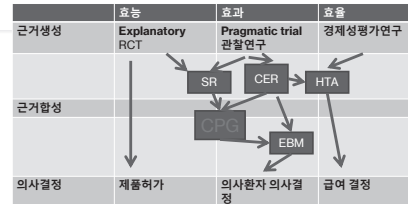


trustworthy, guidelines

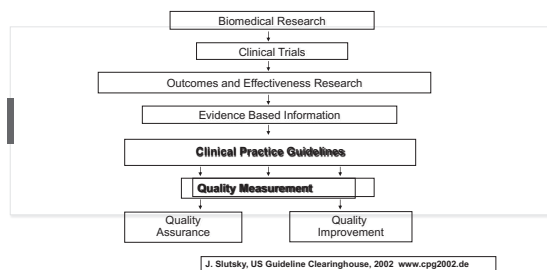
- be based on a systematic review of the existing evidence
- be developed by a knowledgeable, multidisciplinary panel of experts and representatives
- consider important patient subgroups and patient preferences, as appropriate
- be based on an explicit and transparent process
- provide ratings of both the quality of evidence, the strength of the recommendations
- be up to date

- IOM 2011, Clinical Practice Guidelines We Can Trust -

CPG 개념

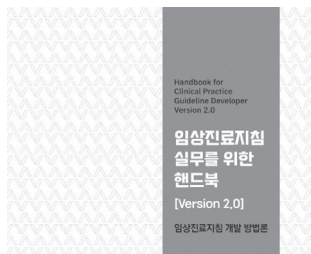


임상진료지침과 질 향상



진료지침은?

- 현존하는 근거에 대한 SR을 통해 근거 평가하고 권고를 도출하는 것
- SR은 세가지 형태
 - 개발을 위해 직접 SR 수행 (de novo SR)
 - 기존 SR의 이용 (Using SR)
 - 기존 CPG의 SR을 이용 (adaptation)



2022

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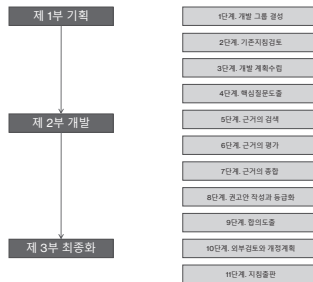
임상진료 지침 개발

- De novo development(직접 개발)
 - 개발을 위해 직접 SR 수행 (de novo SR)
 - 기존 SR의 이용 (Using SR)
- Adaptation(수용 개작)
 - 기존 CPG의 SR을 이용



De novo development

- 핵심 질문에 대해서
- 기존의 체계적 문헌 고찰, 일차 연구 등을 체계적으로 검색, 평가, 종합하여
- 해당 질문에 대한 권고를 도출하는 것



수용개작(adaptation)

- 하나의 문화적, 제도적 상황에 맞게 개발된 진료 지침을
- 다른 의료 상황에서 그대로 사용하거나
- 변경하여 사용하는
- 체계적인 접근법

목적

- 기존에 개발된 양질의 진료지침을 효율적으로 활용
 - 기존의 개발된 양질의 진료가치의 타당성을 훼손시키지 않는 범위에서
 - 의료 현실에 맞도록 변경 혹은 수용함으로써
 - 최종 권고안이 지침 사용 지역의 요구, 우선순위, 법적, 정책적 요구 사항, 자원함의 등을 만족하도록 하는 것

개발 원칙

근거에 기반한 개발 [개발방법] 임상진료 지침 개발

- De novo development(직접 개발)
 - 개발을 위해 직접 SR 수행 (de novo SR)
 - 기존 SR의 이용 (Using SR)
- Adaptation(수용 개작)
 - 기존 CPG의 SR을 이용



수용개작(adaptation) 주요 system

- ▶ ADAPTE framework
- ▶ CAN-implement
- ▶ GRADE-ADOLOPMENT framework

▶ ADAPTE framework

부	입력	만약사항
기초	수용개작 과정에 대한 준비	준비
수용개작	방법의 적절성 평가	방법의 적절성
	진료지침 단계의 선택	진료지침 단계의 선택
	진료지침 평가	진료지침 평가
	결과에 대한 선택	결과에 대한 선택
확인	진료지침의 조인 검토하기	진료지침 조인 확인
	결과 검토 및 공식적 승인	결과 검토 및 공식적 승인
	진료지침 개발 계획	개발 계획
	최종 진료지침 출판	최종 진료지침

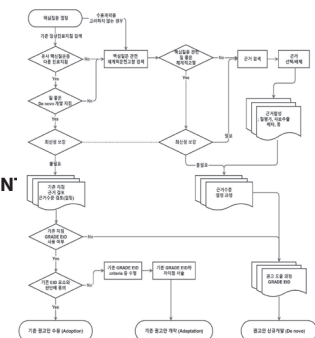
CAN-implement

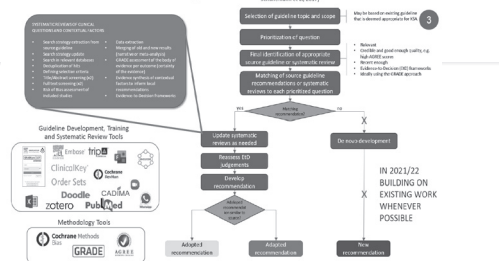
- ADAPTE framework을 기본으로 하되
- 개별 단계에 대한 자세한 예시와 설명
- 개별 단계에 적용 가능한 toolkit
- Knowledge translation이라는 캐나다 모델과 연계

GRADE-ADOLOPMENT framework

- 수용, 개작, 신규개발의 모든 권고안 개발에 사용 가능
- 사우디아라비아 국가 가이드라인 22개 진료지침 개발을 해 GRADE 그룹에 의해 개발
- 기존 진료지침에 각 권고안에 대한 GRADE EtD 테이블이 있어야함

▶ GRADE-ADOLOPMENT framework





다음과 같은 기준을 사용할 수 있다.

- [illegible]

- 동일한 CPG 존재?
- 해당 CPG는 근거중심의학 방법론?

- 동일한 KQ를 가진 CPG 존재?
- 최소한 질적 표준 : AGREE II 60점 이상?
- 해당 KQ가
 - SR에 의해서 개발
 - SR 결과물이 GRADE 평가 가능 : SOF table
 - Etd table이 있거나 생성 가능

- PICO별 가이드라인(SR) 검색
- 선택
- 평가 (AGREE2 OR AMSTAR2)
- 최신성에 대한 판단
- 추가 SR

- 개발그룹(실무위원회)
 - 근거평가 그룹
 - 운영위원회(steering group)
 - 이해상충 위원회
 - 자문위원회
 - 외부 자문 그룹
 - 이해상충위원회
- 대표성을 가진 다학제 전문가에 의해 개발 [개발자]

운영위원회

- 업무 : 기획관련 업무 주관, 핵심질문결정, 진료지침 개발 방법, 권고 결정 등 주요 정책 내용 논의 및 결정
- 구성 : 위원장, 간사, 방법론전문가, 주요 개발위원 2-3인 등 10인 이내로 구성

이해상충위원회

- 업무 : 개발인력이 보고한 이해상충 내용에 대한 의사결정을 수행
- 구성 : 운영위원회와 동일 할 수 있고, 의료윤리 전문가를 포함할 수 있다.

관련 위원회

개발그룹	이동	소속	재부진율	면할
실무위원회(필수)				
운영위원회(필수)				
자문위원회(선택)				
외부경로(필수)				
이해상충위원회(필수)				

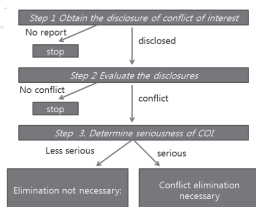
대표성을 가진 다학제 전문가에 의해 개발 [개발자]

진료지침에서 COI

- 검토 중인 진료지침의 개발/승인
- 관련학회 위원장, 이사(지적 이해상충)
- 관련성있는 기업, 조직
 - 고용
 - 자문
 - 소유지분
 - 연구비
 - 사례금

이해상충의 관리 [이해상충]

정책 흐름도



주요 정책

- 제시한 COI 양식의 사용
- 위원장, 간사 등은 주요 재정적 이해상충이 없어야
- 위원장, 간사 등은 COI 관리 위한 위원회 구성
- 공개된 COI는 부록에 수록
- 이해상충의 시한(2년), 역치(100만원) 등에 대한 내용을 운영약관에 기록

이해상충의 관리 [이해상충]

기획단계

공통 단계 : 기획

1. 개발 그룹 결성
2. 기존 지침 검토
3. 개발 계획 수립(범위 결정)
4. 핵심 질문(key question)을 도출한다.



지침관련 조직

- 개발그룹(실무위원회)
- 근거평가 그룹
- 운영위원회(steering group)
- 이해상충 위원회
- 자문위원회
- 외부 자문 그룹
- 이해상충위원회
- 행정조직

지침관련 조직

- 개발그룹(실무위원회)
- (근거평가 그룹)
- 운영위원회(steering group)
- 이해상충위원회
- 자문위원회
- 외부 자문 그룹
- 행정조직

개발 그룹

- 구성 원칙
 - 다학제성
 - 지침의 모든 이해 당사자 참여(stakeholder)
 - 지침의 범위, 유연성, 지침실행 고려
 - 대표성
 - 지속성
- 구성
 - 개발 그룹 리더
 - 임상 의사
 - 다른 보건의료인(간호사, 약사, 영양학자 등)
 - 방법론 전문가(체계적 고찰 전문가, 정보관리자, 역학자 등)

다학제 진료지침 개발에서 개발그룹

- 개발그룹은 전문성으로 선발
- 대체로 임상의학 전문성+방법론 전문성 : 가능하면 양쪽 다
- 체계모니터에 의한 결정(투표)이 아닌 근거에 대한 합의에 따른 결정
- 위원장의 역할의 매우 중요함

기획업무

- 이해관계 선언
- 개발의 주요 원칙 실현 : 환자의 선호도, 형평성, 실행가능성 등
- 합의 원칙의 결정
- 잠재적 승인 기구 선정
- 저자 원칙 결정

기획업무

- 이해관계 선언
- 개발의 주요 원칙 실현 : 환자의 선호도, 형평성, 실행가능성 등
- 합의 원칙의 결정
- 잠재적 승인 기구 선정
- 저자 원칙 결정

기획업무

- 이해관계 선언
- 개발의 주요 원칙 실현 : 환자의 선호도, 형평성, 실행가능성 등
- 합의 원칙의 결정
- 잠재적 승인 기구 선정
- 저자 원칙 결정

GuideLine Implementability Appraisal(GLIA)

- 집행가능성(Executability) (정확히 무엇을 해야 하는가)
- 결정가능성(Decidability) (정확히 어떤 상황(나이, 성별, 임상조건, 검사결과 등)에서 어떤 행동을 취해야 하는가)
- 타당도(Validity) (개발자의 의도 및 근거 강도가 권고 반영 정도)
- 유연성(Flexibility) (권고 실행에 있어서 해석과 대안을 허용하는 정도)
- 진료과정의 영향 (Effect on process of care) (권고가 일반적인 치료 세팅의 일상적인 치료 과정에 영향을 미치는 정도)
- 측정가능성(Measurability) (진료지침이 권고 실행의 영향력을 추적할 수 있는 적절한 결과지표들을 제시하고 있는 정도)
- 참신함/혁신성(Novelty/innovation) (임상의나 환자의 입장에서 권고가 제안하고 있는 행동이 기존과 다르다고 느껴지는 정도)
- 전자정보시스템 구현가능성(Computability) (전자정보시스템 상에서 권고의 수행이 용이한가) - 이 항목은 전자 정보시스템 실행이 계획된 경우에만 적용 가능함

GLIA

“핵심항목 4. 어떤 행동을 취해야 하는지, 어떤 행동을 취하지 말아야 하는지, 어떤 행동을 취할지 결정하는 데 도움이 되는 지침”

집행가능성(Executability)	임의, 의도된 용도
결정가능성(Decidability)	정확히 어떤 상황에서 어떤 행동을 취해야 하는지
타당도(Validity)	개발자의 의도 및 근거 강도가 권고 반영 정도
유연성(Flexibility)	권고 실행에 있어서 해석과 대안을 허용하는 정도
진료과정의 영향	권고가 일반적인 치료 세팅의 일상적인 치료 과정에 영향을 미치는 정도
측정가능성(Measurability)	권고 실행의 영향력을 추적할 수 있는 적절한 결과지표들을 제시하고 있는 정도
참신함/혁신성(Novelty/innovation)	임상의나 환자의 입장에서 권고가 제안하고 있는 행동이 기존과 다르다고 느껴지는 정도
전자정보시스템 구현가능성(Computability)	전자정보시스템 상에서 권고의 수행이 용이한가

- 집행가능성(Executability) Y
- 결정가능성(Decidability) N
- 타당도(Validity) N
- 유연성(Flexibility) N
- 진료과정의 영향 N
- 측정가능성(Measurability) Y
- 참신함/혁신성(Novelty/innovation) Y
- 전자정보시스템 구현가능성(Computability) N

실행 가능성 제고 방안 논의(Implementability). 셋 중 하나

- 권고안에 대해 GuideLine Implementability Appraisal(GLIA)로 평가한다
- 핵심권고안에 대한 실행계획을 수립한다
- 알고리즘, 요약문서 등 실제 진료에 이용할 수 있는 도구가 있고, 진료지침 실행에 대한 장애요인/촉진요인을 기술한다.

기획업무

- 이해관계 선언
- 개발의 주요 원칙 실현 : 환자의 선호도, 형평성, 실행가능성 등
- 합의 원칙의 결정
- 잠재적 승인 기구 선정
- 저자 원칙 결정

잠재적 승인기구 결정

- 진료지침을 공식적으로 승인(endorsement) 받을 기구 또는 단체를 선정
- 위원구성과 동시에 시행 가능
- 방법
 - 해당 진료지침과 관련성이 있는 전문학회, 중학 기구(NCA, 국립암센터, 질병관리본부 등)에 공문으로 승인 등의 여부를 문의
 - 수락하는 단체에 대해 선정할
- 참여수준
 - 실제 개발에 참여(운영위원회, 개발위원회 등)
 - 외부 검토에 참여(자문위원회 등)
 - 단순 승인기구

승인기구 요청 목적	수락여부	참여 방법(1. 개발에 참여, 2. 외부검토에 참여, 3. 단순 승인기구로 참여)

공통 단계 : 기획

1. 개발 그룹 결성
2. 기존 지침 검토
3. 개발 계획 수립(범위 결정)
4. 핵심 질문(key question)을 도출한다.



진료지침 검색관련

- 완전한 검색보다는 해당 질환의 주요 진료지침을 확인하는 수준
- 리뷰의 목적은
 - 1) 진료지침 범위 결정,
 - 2) 핵심질문의 결정
 - 3) 개발 방법론의 확인
 - 4) 수용개작의 가능성 탐색
- 위원들에게 진료지침 배분하고 리뷰

지침 검색 사이트

- 대개 Population과 intervention으로 검색
- 지침 포털 사이트 이용
 - GiN(guideline international network, www.g-i-n.net)
 - PubMed
 - Google search



기존 진료지침 검색

- 완전한 검색보다는 해당 질환의 주요 진료지침을 확인하는 수준
- 방법
 - 위문들에게 조사
 - CINA PubMed에서 검색
- 리뷰의 목적
 - 1) 진료지침 범위 결정
 - 2) 핵심질문의 결정
 - 3) 개발 방법론의 확인
 - 4) 유용제약의 가능성 탐색
- 위원들이 진료지침 개발, 리뷰하여 발표

공통 단계 : 기획

1. 개발 그룹 결성
2. 기존 지침 검토
3. 개발 계획 수립(범위 결정)
4. 핵심 질문(key question)을 도출한다.



범위의 결정

- 권고가 포괄하는 내용
- 가장 어렵고 핵심적인 부분
- 결정 방법
 - 기존 지침 검색 및 검토
 - 기존 지침의 범위 list
 - 능력, 시간, 비용 등 고려하여 결정
 - 해당 지역 상황에 대한 검토 필수

범위의 결정 - PIPoH

- 인구집단(Population) : 대상 인구집단의 특성, 나이, 성별, 임상적 특성, 동반 질환 등
- 중재(Intervention) : 논의할 중재
- 전문가/환자(Professionals/Patients) : 진료지침의 목표 사용자로서 전문가 혹은 환자
- 결과(Outcome) : 지침의 목적
- 의료환경(Healthcare setting) : 진료지침이 실제 쓰일 의료환경과 지역 상황

예 : 캐나다 자궁암 선별 진료지침

PIPOH를 이용해서 다음과 같이 범위를 결정하였다.

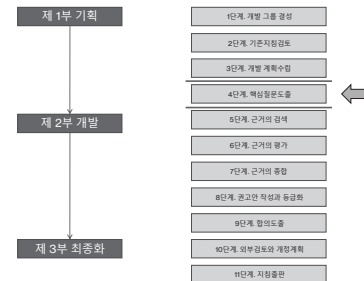
- Population: 중등도 위험 여성만 다뤄기로 하였다(즉 HIV 양성, 최근 5년 이내에 자궁도암 세포진 검사에서 중등도의 이상성(dysplasia)이 있었던 여성은 제외함). 선별의 시작 연령이나 종결 연령을 다루지 않기로 하였다.
- Intervention: 선별 중재만을 다루기로 하였다. 특정 장비(즉 통상적인 자궁경부 세포진검사 혹은 liquid based cytology)로 진료지침 검색 범위를 제한하지 않았다.
- Professionals: 자궁암 선별은 가정의, 일반의, 전문 간호사 (nurse practitioners)가 하기 때문에 이들을 목표로 사용자로 고려하였다.
- Outcomes : 일차의료인이 제시된 선별 주기와 선별검사 방법을 얼마나 잘 따르는지가 주된 결과이다. 의사에 따라 선별검사의 처방 빈도의 변화가 심하다.
- Health care setting and context: 일차의료

범위의 결정 - 암 관련

- 인구집단(Population): 암 부위, 조직형, 성, 나이, 임상적 상황(초치료, 난치성, 임상 등, 고위험군, 동반질환 등), 유전학
- 중재(Intervention) : 예방, 선별, 진단, 치료(약물, 방사선, 수술, 복합요법), 치료 단계, 지지요법, 호스피스 등
- 전문가/환자(Professionals/Patients) : 진료의사, 이해당사자, 환자
- 결과(Outcomes): 환자 결과(전체 사망률 감소, 암 사망률 감소, 삶의 질 상승),
- 의료환경(Healthcare setting) : 1차, 2차, 3차, 외래/입원, 응급, 재택, 장기요양병원 등

범위 결정 단계 (NICE)

- 단계 1: 주요 사안 선택 후 가안 작성 (기존 진료지침, SR 등 리뷰)
- 단계 2: 가안에 대한 이해당사자와 협의
- 단계 3: 범위 가안의 외부 자문
- 단계 4: 범위의 확정



PIPOH에서 PICO로

- PICO의 범위 결정 - PIPOH
- PICO
 - 연구집단(Population): 대상 연구집단의 특성, 나이, 성별, 임상적 특성, 동반 질환 등
 - 중재(Intervention): 논의할 중재
 - 전문가/환자(Professionals/Patients): 진료지침의 목표 사용자로서 전문가 혹은 환자
 - 결과(Outcome): 지침의 목적
 - 의료환경(Healthcare setting): 진료지침이 실제 쓰일 의료환경과 지역 상황



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PICO의 용도

- 필요한 근거 유형을 결정 (관찰연구 vs 실험연구, 정량적 vs 질적 연구 등)
- 근거 검색 전략 수립
- 근거합성, 근거 분석의 틀
- 권고안을 구성
- 기존 진료지침과 현 진료지침의 차이를 부각함

NHMRC 2021

PICO 결정 과정

1. 진료지침 범위내 가능한 핵심질문을 나열
2. 구조화된 질문으로 구성
3. 우선순위를 선정하여 최종 목록
4. 핵심질문 해답에 필수적인 건강결과(outcomes)를 선정
5. 핵심질문을 이용하여 진료지침 개발을 지속

PICO 개수는 몇 개

- 정해진 기간 동안 해당 지침 개발 그룹의 규모에서 감당 가능한 숫자
- 표준적인 지침의 경우, 15-20개의 질문
- 개발위원 1인이 1개 main, 1개 partial 정도
- 질문의 복잡성에 따라 변동가능성
- De NOVO vs adaptation

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PICO에 대한 오해

- 모든 권고에 PICO?
 - PICO는 실제로 평가할 것만
 - 모든 권고에 대해 근거 평가를 하지는 않는다
- 실제로 평가할 내용만..

잘못된 PICO

- ill-defined set of recommendations : "good practice recommendations"
- too vague to be implemented (e.g., "take a comprehensive history").
- sufficiently obvious that desirable effects outweigh undesirable effects : no one would be foolish enough to conduct a study addressing the implicit clinical question
- 이런 경우를 Key question으로 하거나 grading을 하는 것은 바람직하지 않음

<https://doi.org/10.1016/j.jclinepi.2010.04.028>

Any question?

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Symposium II

(Legal aspects of periprocedural complications)

11월 25일(금) 16:30-17:50

좌장: 백민우 (뉴고려병원),
김문철 (에스포항병원)

필수의료를 위한 국회의 노력

김미애

국회의원

비파열뇌동맥류 색전술 후 중증합병증 법원 판례 고찰

김범태

순천향대

비파열 뇌동맥류 색전술 후 중증합병증 법원 판례 고찰

김범태

순천향대학교 부천병원

연구 목표

- 비파열 뇌동맥류에 대한 법원의 시각
- 코일색전술 후 사망 혹은 중증장애 판례
- 설명 의무와 합병증 처치에 관한 견해
- 예방적 관점에서 고찰



법원 판례 고찰 관점

- 적응증
- 설명 및 동의서
- 합병증
- 시술 중 처치
- 술 후 합병증 발생 인지 및 처치

결 어

- 뇌동맥류 시술중 파열시 조작 시기 과실인정 (30~40%) 혹은 기각. 색전증 기각? 동맥류 크기?
- 판례에 시술 및 상황에 대한 상세한 기록이 되어있었고,판사는 이를 근거해서 논리적으로 판단하다. "미세철심 유도선과 미세 카테터를 동맥류가 파열되지 않도록 조작할. 동맥류 내에 길이 들 어가서 동맥류벽에 장력을 주지 않도록 노력했다"로 기록 필요
- 당시 의료수준에서 최적의 적응증과 시술시행. 시술중 합병증 조기 대처 또는 수술전환 결단이 필요해 보인다.
- 자기결정권: 본인에 대한 승락 의무가 요구된다.
- 합병증 빈도 만큼 발생 - 스트레스 받지않고 철저한 법적 대처

뇌혈관 수술 후 합병증에 관한 개인적 경험

권현조

충남대

임상의료현장에서의 의료분쟁 예방과 대응

조진석

변호사 (법무법인 세승)

임상의료현장에서의
의료분쟁 예방과 대응
(뇌혈관내 치료를 중심으로)

조 진 석 의료전문변호사 / 의사

 법무법인 세승

목차

1. 진료 관련 분쟁

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3. 의료분쟁의 사전예방 및 대응

1. 진료 관련 분쟁

1. 진료 관련 분쟁

가. 분쟁의 원인

[의료사고]
의료행위가 시작된 때로부터 종료될 때까지의 의료행위의 전 과정에서 예상 밖의 일이 발생한 경우
(진료상 과실, 부작용, 설명부족, 불가항력, 주관적 불만족 등)

[의료과오사건]
의료사고 중 의료상의 과실이 원인이 되어 나쁜 결과가 발생한 경우

1. 진료 관련 분쟁

나. 의료과오의 개념

[의료과오]
의료인의 업무 수행과정(의료행위)에서 필요한 주의의무를 다하지 않은 경우

[주의의무 위반]
해야 할 것을 하지 않거나, 하지 않아야 하는 것을 하는 경우

김우영진 교수

1. 진료 관련 분쟁

다. 진료과오로 인한 법적 책임

[법적 책임]
민사, 형사, 행정 상의 책임

[민사, 형사 책임 인정 요건]
의료과오 + 나쁜 결과 + 과오와 나쁜 결과 사이의 인과관계

김우영진 교수

1. 진료 관련 분쟁

나. 의료과오의 유형 예시

- 진단과정에서의 주의의무 위반
- 치료과정에서의 주의의무 위반
- 경과관찰과정에서의 주의의무 위반
- 전원의무 위반
- 설명의무 위반
- 요양지도의무 위반

김우영진 교수

2. 뇌혈관내 치료 관련 판례

2. 뇌혈관내 치료 관련 판례

가. 경과관찰과정에서의 과실이 인정된 사례



환자는 어지러움증으로 피고 병원 방문하여 비파열성 대뇌동맥류와 뇌동정맥 기형으로 진단

뇌동정맥 기형에 대하여 색전술 시행하는 과정에서 뇌혈관 파열되어 미세도관봉선으로 지혈한 후 색전술 시행함

환자 ICU에서 GCS score 9점에서 4점으로 저하되고 의식상태도 기면에서 혼미로 변화함

김우영진 교수

2. 뇌혈관내 치료 관련 판례

가. 경과관찰과정에서의 과실이 인정된 사례

환자 상태 변화에 대하여 간호사가 의사에게 알렸지만 의사는 직접 환자 상태 확인하지 않고 간호사에게 동공상태 변화 확인하면서 경과 관찰하라고 지시하였고 이후 뇌출혈로 응급개두술 시행하였으나 환자 사망함

→ 뇌동정맥 기형 색전술 도중 혈관파열이 발생했던 망인의 이러한 GCS 점수 및 의식상태의 변화에도 불구하고 즉시 환자를 방문하여 상태를 확인한 후 검사를 진행하지 않고, 심야에 야간 당직의만 근무 중이어서 결정을 내리기 어려운 경우라면 담당 전문의에게 연락해 상의하지도 않은 과실 인정

김우영진 교수

2. 뇌혈관내 치료 관련 판례

나. 색전술과정에서의 과실이 인정된 사례

환자는 눈의 불편감으로 피고병원을 방문하여 비파열성 뇌동맥류로 진단받음

이에 피고병원 의료진은 환자의 뇌동맥류에 대하여 스텐트 코일색전술을 시행하던 중 뇌동맥류 부위가 파열되어 출혈이 발생하고 있음을 확인하였지만 지혈 후 코일을 삽입하고 수술을 마침

수술 후 시행한 CT검사상에서 지주막하 출혈과 뇌부종이 발견되었고, 이어서 시행한 혈관조영검사상에서 뇌동맥류 부위에서 출혈이 일어나고 있음을 확인함

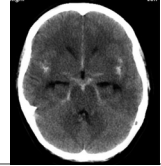
이후 코일색전술과 개두술 등을 시행하였으나 환자 사망함

법무법인 세우

2. 뇌혈관내 치료 관련 판례

나. 색전술과정에서의 과실이 인정된 사례

→ 1차 수술 후 시행한 CT검사상에서 이전에 없던 지주막하 출혈이 발견되었고, 의식상태가 혼수로 변화한 점 및 파열된 동맥류 부분이 완전히 막히지 않았을 가능성이 있다는 점을 고려할 때 지혈 조치가 미흡하였다고 과실을 추정함



법무법인 세우

2. 뇌혈관내 치료 관련 판례

다. 조영술과정에서의 과실이 인정된 사례

환자는 후교통동맥 뇌동맥류로 진단되어 피고병원에서 추가적 수술 등을 위해 뇌혈관조영술을 시행받기로 함

뇌혈관조영술 도중 조영제 투여를 위한 인젝터에 공기가 있는 것이 확인됨

이에 피고병원 의료진은 공기 제거를 위한 작업을 하던 중 환자에게 경련 및 의식 저하 발생함

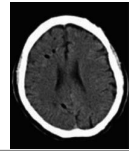
이후 뇌CT검사를 시행한 결과 혈관을 따라 다량의 공기색전증 소견이 확인되었고 환자는 공기색전증에 따른 저산소성 뇌손상으로 진단됨

법무법인 세우

2. 뇌혈관내 치료 관련 판례

다. 조영술과정에서의 과실이 인정된 사례

→ 환자에게 카테터를 연결할 당시에는 공기가 없었으나 이후 인젝터에 공기가 있었고 이를 제거하는 과정에서 경련 등이 발생하였던 것으로 보아 인젝터 및 카테터에 공기가 유입되지 않도록 하여야 함에도 이를 태만히 한 과실을 인정함



법무법인 세우

2. 뇌혈관내 치료 관련 판례

라. 설명의무 위반이 인정된 사례

환자는 갑자기 발생한 기억상실증으로 비파열성 뇌동맥류로 진단받고 피고병원에서 코일색전술을 시행받기로 함

이후 환자는 피고병원에서 코일색전술을 시도하던 중, 미세카테터 진입이 실패하고 코일을 삽입하였다가 크기가 맞지 않아 재삽입하는 과정을 거친 후 지주막하 출혈과 뇌내출혈이 발생하여 사망함

법무법인 세우

2. 뇌혈관내 치료 관련 판례

라. 설명의무 위반이 인정된 사례

피고병원 의료진은 환자에 대하여 코일색전술을 시행하기 전 환자의 자녀로부터 수술 동의를 받고 수술을 진행함

→ 수술과정에서의 과실은 인정되지 않았으나 환자의 자녀에게 설명한 것은 환자 본인의 자기결정권 침해라 하여 설명의무 위반이 인정됨

법무법인 세우

2. 뇌혈관내 치료 관련 판례

마. 과실과 설명의무 위반이 불인정된 사례

환자는 비파열성 뇌동맥류로 진단되어 피고병원에서 스텐트 보조 코일색전술을 시행받기로 함

피고병원 의료진은 시술의 위험성 등에 관하여 환자 본인과 그 배우자에게 설명하고 환자와 그 배우자의 서명을 받음

한편 피고병원 의료진은 시술 후반부에 혈류속도가 감소하는 소견을 확인하고 풍선확장술을 시행하였고 추가로 색전술을 시행함

이후 환자는 뇌압 상승 소견 보여 감압술 시행받았으나 사망함

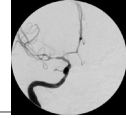
법무법인 세우

2. 뇌혈관내 치료 관련 판례

마. 과실과 설명의무 위반이 불인정된 사례

→ 스텐트 보조 코일색전술 시행 후 뇌동맥이 파열하였다는 사실 만으로 의료진의 과실을 추정할 수 없고, 뇌동맥 혈류 저하에 대하여도 선택가능한 범위에서 풍선확장술을 시행한 것으로 두고 과실이 인정될 수 없다고 함(과실 불인정)

→ 또한 환자 본인에게 시술에 관하여 설명이 되고 환자 본인의 동의를 받은 이상 환자의 자기결정권 침해가 있다고 볼 수도 없음(설명 의무 위반 불인정)



법무법인 세우

3. 의료분쟁의 사전예방 및 대응

3. 의료분쟁의 사전예방 및 대응

- ① 의무기록을 자세하게 작성하고 시술 영상도 남기자.
- ② 환자 본인에게 최대한 설명하고 동의를 받자.
- ③ 의료사고 후 의무기록을 임의적으로 수정하지 말자.
- ④ 항상 환자를 주의 깊게 살펴보자.
- ⑤ 검사 결과를 직접 확인하자.
- ⑥ 환자의 과거력, 현병력을 반드시 확인하자.
- ⑦ 환자의 상태를 직접 보고 판단하거나 지시하자.
- ⑧ 분쟁이 발생하면 대처방안에 대하여 충분한 시간을 두고 전문가의 조력을 받아 결정하자.

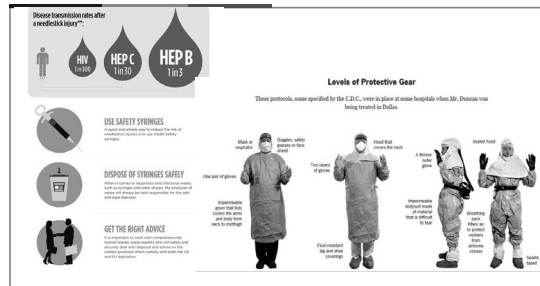
법무법인 세우

맺음말

- ① 의료분쟁은 언제든지 발생할 수 있다.
- ② 의료분쟁은 사전 예방이 가장 중요하다.
- ③ 의료분쟁이 발생하였다면 적절한 대응이 중요하다.

법무법인 세우

자신을 지키는 것은 여러분 자신입니다.



법무법인 세우

경청해 주셔서 감사합니다.

조 진 석 의료전문변호사/의사

Mobile: 010-4280-0410

E-mail: jscho@sslaw.kr

필수의료 문제 해결을 위한 심뇌혈관질환 정책 방향

김한숙

보건복지부 보건의료정책실 질병정책과 과장

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Committee session III

11월 26일(토) 08:00-09:00

[Grand ballroom]

정책위원회:

2022년도 정책 이슈 분석

좌장: 고준석 (경희대),

장철훈 (영남대)

급성기 뇌졸중 적정성 평가 - 이대로 좋은가?

박석규

순천향대

요양급여에 대한 적정성 평가는 건강보험으로 제공된 의료서비스 전반에 대해 의약학적·비용효과적 측면에서 적정한지 여부를 평가하는 것으로 2000년 7월 개정된 국민건강보험법에 요양급여 적정성 평가기능을 도입하고, 이를 건강보험심사평가원의 업무로 규정하면서 시작되어 현재에 이르고 있다.

급성기 뇌졸중 적정성평가는 2006년 예비조사를 거쳐, 관련 학회 및 전문가의 의견 수렴을 통해 검증된 임상 질 지표를 사용하여 2007년부터 급성기 뇌졸중 진료에 대한 구조, 과정, 결과 측면을 평가하고 있다. 또한, 재정적인 인센티브 (또는 디스인센티브)를 통해 의료서비스의 질 향상을 촉진시키고자 4차 평가부터는 가감지급사업을 수행하고 있다.

2006년 예비평가를 시작한 이후로 지표 결과는 지속적으로 향상되고 있으나 평가 시행과 관련하여 몇 가지 문제점이 제기되고 있고, 뇌졸중 적정성 평가 사업이 실제로 급성기 뇌졸중 환자에게 제공되는 진료의 질적 수준을 향상시켰는 지에 대한 평가가 필요하며, 지표값의 향상을 진료의 질적 수준향상으로 해석하는 것이 적절한지 살펴볼 필요가 있다.

최근 국내 최대의 병원에서 근무 중 직원에게 발생한 뇌지주막하출혈에 대한 응급 수술과 관련하여 많은 논란을 낳았고 필수의료 강화에 대한 사회적 요구가 증가하고 있다. 뇌졸중 적정성평가로 뇌혈관질환 환자에 대한 의료서비스의 질 향상을 전적으로 촉진시키기는 어렵지만 정부가 추진하고 있는 필수의료 강화 정책에 더불어 적정성평가의 문제점을 파악하고 개선을 이루고자 한다.

또한, 정부는 기존 진료량 중심에서 가치 중심으로의 보상체계 전환을 통해 의료의 효율성뿐만 아니라 의료의 질 향상을 추구하는 보건의료 패러다임의 변화를 추구하고 있다. 우리 학회에서는 이런 변화되는 의료환경에 대응하기 위해 각종 정책을 개발하고 정책 제안을 통해 제대로 된 뇌혈관질환 정책수립과 진료로 국민 보건향상에 노력할 때이다.

심뇌혈관질환 예방 및 관리에 관한 법률 개정에 따른 하위법령 제정에 대한 제언

권순찬

울산대

뇌혈관질환센터 구축의 방향

신승훈

차의과학대

최근 여러 사건 등을 계기로 뇌혈관질환센터에 대한 논의는 매우 활발해지고 있는 상황이다.

심뇌혈관질환 예방 및 관리에 관한 법률에 근거하여 지정된 “권역심뇌혈관질환센터”가 최초로 국가정책에 의해 시행된 최초의 뇌혈관질환센터라 할 수 있다. 현재 전국의 13개 의료기관이 지정되어 역할을 다하고 있다. 하지만, 위의 권역 센터들이 전국의 모든 뇌졸중 환자를 진료할 수 없고, 응급뇌혈관질환의 특성인, 매우 시간 민감성에 의해, 치료의 지역 완결성이 매우 중요하게 여겨지고 있다. 이에 따라, 촘촘한 의료를 시행하기 위해 “지역심뇌혈관질환센터” 지정에 관한 논의가 약 3년전부터 활발히 논의되었으나, COVID-19으로 인해 그 논의의 진행이 매우 부진하다.

최근 필수의료, 응급의료, 공공의료에 관한 논의가 여러 관련 단체에서 진행이 되고 있다. 필자 또한 이 논의에 대한 뇌혈관내치료의학회와 정책이사의 자격으로 다양한 위원회에서 위원으로 활동하고 있다.

뇌혈관질환센터의 가장 중요한 부분은 1) 센터 지정에 있어, 능력이 되고 하려는 의지가 있는 의료기관에 대한 인증이다. 2) 치료의 지역 완결성이라는 해결하기 위해 반드시 지역별 거버넌스 구축이 필요하다. 3) 기관의 개수를 정해 놓고 시작하지 말고, 능력위주로 인증을 시행하고, 특히 의료취약지인 경우 지원 대책을 마련하는 것이 중요하다. 4) 다른 나라의 의료시스템은 참고하지만, 대한민국의 현실에 맞는 시스템을 구축하여야 한다. 5) 가장 중요한 것은 어느 특정 학회의 주도가 아닌, 뇌혈관질환과 관련된 여러 전문학회 및 중앙정부, 지자체, 응급의료 체계 등과 잘 융합된 모형을 개발해야 한다는 것이다.

뇌혈관질환센터의 구축은 급성기 뇌졸중, 특히 대혈관이 막힌 급성 뇌경색(Large vessel occlusion-Acute ischemic stroke, LVO-AIS) 환자의 치료에 특히 중요하다. 치료의 결과가 시간에 가장 민감한 질환이기 때문이다. 환자가 적절한 병원에 방문하여 적절한 치료를 받기 위한 여러 경로 중, 지연이 발생할 수 있는 모든 요소에 대한 철저한 검토가 아마 훌륭한 뇌혈관질환센터 구축의 시작이 아닌가 생각해본다.

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Committee session III

11월 26일(토) 08:00-09:00

[Ballroom 1]

인증관리위원회

좌장: 성재훈 (가톨릭대)

KoNES 인증제의 과거, 현재 그리고 미래

신희섭

경희대

뇌혈관질환은 우리나라의 사망원인의 최상위권 질환이며, 의료비와 사회적 비용이 매우 높은 질환입니다. 대한뇌혈관내치료의학회(KoNES)는 뇌졸중(뇌출혈과 뇌경색)의 혈관내 치료를 선도하는 국내 최대 학회로 성장하였고, 우리 학회의 회원들은 뇌졸중치료의 최일선에서 묵묵히 진료에 매진하고 있습니다. 2010년 우리 학회는 안전한 뇌졸중치료를 위해 뇌혈관내수술을 시행하는 의료인의 질적 표준을 수립하기 위해 뇌혈관내수술에 대한 인증제를 시행하기로 결정하였습니다. 3년간의 준비기간을 거쳐 2013년 제1회 인증제를 시행하였는데, 이는 뇌혈관 질환 및 뇌졸중에 대한 최초의 인증 제도였습니다. 이후 10년간 매년 인증제를 시행하여, 2022년 현재 255명의 인증의 및 95개소의 인증기관을 인증하여 뇌혈관내치료 유관 학회 중 최대 규모로 성장하였습니다. 2015년 이후에는 기존 인증의와 인증기관에 대한 재인증을 시행하고, 대한뇌혈관내치료의학회가 시행하는 다양한 학술대회와 교육 프로그램과 연계하여 인증제도의 질관리에도 힘을 쓰고 있습니다. 인증제도 도입이후 10년이 지난 지금, 우리 학회의 “뇌졸중치료 인증제”는 대한뇌혈관내치료의학회 뿐만 아니라, 우리나라 의료계의 소중한 자산이 되었다고 생각합니다. 본 인증위원회는 인증제도의 정비, 인증의와 인증기관의 특화하고, 인증기관의 지역 균형, 국가 정책에 적극적인 참여, 세부전문의 제도로의 전환 등을 통하여 인증제의 양적, 질적 성장을 도모하고 있습니다. 인증제의 새로운 10년의 도약과 발전을 위하여, 금번 학술대회에서 회원 여러분의 다양한 의견을 경청하고, 적극적으로 수용하도록 하겠습니다.

뇌졸중센터 및 재관류치료 뇌졸중센터 인증제도와 비교

이현곤

동남권원자력의학원

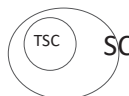


뇌졸중 센터 및 재관류 치료 뇌졸중 센터 인증제와 비교

2022년 대한뇌혈관내 치료의학회 정기 학술 대회 및 총회
26일 (토) Committee session III 인증관리위원회
동남권원자력의학원 이현곤

뇌졸중 센터 및 재관류 치료 뇌졸중 센터

- 대한 뇌졸중 학회 주관
- 2018년도 첫 뇌졸중 센터(Stroke Center, SC) 인증 사업 시작
- 2021년도는 SC 인증 기준 안에 재관류치료 뇌졸중 센터(Thrombectomy-capable Stroke Center, TSC)를 추가
- ☆ Kones에서는 2013년 뇌혈관내 수술 인증제를 시작



뇌졸중 센터 및 재관류 치료 뇌졸중 센터

- 대한 뇌졸중 학회
 - 1995년 5월 수도권 9개 병원 신경과 중심으로 뇌졸중 연구 월례 집담회 개최를 시작
 - 1998년도 10월 1일 창립
 - 1999년 6월 대한 뇌졸중 학회지 (Journal of Stroke, IF 8.632) 발간
 - 2002년 7월 Korean Stroke registry 실행
- 심평원 - 뇌졸중 적정성 평가 지표/ 국가 뇌졸중 정책 사업에 영향

뇌졸중 센터 및 재관류 치료 뇌졸중 센터

심평원 - 뇌졸중 적정성 평가 지표/ 국가 뇌졸중 보건 정책 영향

2023년 뇌졸중 적정성 평가 기준 (개정안) - 심평원	
항목	평가지표 (6개)
뇌졸중 센터 및 재관류 치료 뇌졸중 센터 인증 기준 그대로 반영, 더 특별한 노력 없이도 뇌졸중 적정성 평가 1등급 가능 가산 추가 1% (의료인 1명) 각종 정부 뇌졸중 정책에 참여 가능	☐ 국공립 의료기관 ☐ 중증환자 후 돌봄과 연계(4차) 돌봄망
	☐ 1등급 인증기관 (의료인 1명) ☐ 2등급 인증기관 (의료인 1명)
	☐ 3등급 인증기관 (의료인 1명) ☐ 4등급 인증기관 (의료인 1명)
	☐ 5등급 인증기관 (의료인 1명) ☐ 6등급 인증기관 (의료인 1명)
결과	평가결과
☐ 1등급 인증기관 (의료인 1명) ☐ 2등급 인증기관 (의료인 1명)	☐ 1등급 인증기관 (의료인 1명) ☐ 2등급 인증기관 (의료인 1명)

뇌졸중 센터 인증 기준

• 뇌졸중 학회에서 추구하는 뇌졸중 센터의 모습

1. **표준** 적 진료
 - 1) **표준 진료 지침 (CP)** 마련 여부 : 동일 진단명에는 동일한 검사와 시술이 이루어져야 함.
다학제 진료팀을 구성해야 되는 상황에서도 표준 진료 지침 구축하게 함. => **모략** 추가제?
 - 2) 간호/간병 요소 또한 표준적 관리 : 뇌졸중 집중 치료실 운영 지침 준수 => **통합 간호/간병?**
2. 최선의 치료가 **적합** 하게 적용 여부 => **심혈관 진료** 적정성 평가
적합 여부를 따지기 위해 **세세한 항목의 데이터** 구축, 필수 및 지표 설정/구축하고 관리하게 함.
3. 병원의 지속적인 **질.향상.** => **뇌졸중 학회로의 단합**
대한 뇌졸중 학회 참석, 다학제 팀 안에서 정기적인 회의 개최 여부 확인
뇌졸중팀 구성원들에게 직무 교육 실시

인증 기준

총 7개의 기준, 21개의 조사 항목

1. 응급/급성기 적정 진료
2. 뇌졸중 집중 치료실 (Stroke Unit)
3. (TSC) 중환자 진료
4. 뇌졸중팀
5. (TSC) 중재 시술 의뢰진
6. 뇌졸중 레지스트리 운영과 질 향상
7. 적정 진료 및 시설

인증 기준 - 1. 응급/급성기 적정 진료

1. 담당의료진의 적절한 연락 체계가 운영된다. => **담당표**
2. 급성 뇌졸중 환자를 위한 다학제 진료팀 구축되어 있다. => **aka 뇌졸중 진료의 자격?**
3. 급성 뇌졸중 환자에 대해서 적절한 평가가 이루어진다. => **NIHSS 평가, 출혈은 GCS**
4. 표준진료지침 (CP)에 따른 급성기 검사와 시술을 수행한다. => **검사 순서/방법**
5. 정맥내 혈전 용해술 시행 환자의 데이터를 구축하고 관리한다. => **Checklist, Time table**
(TSC) 정맥내 혈전 용해술 및 혈전 제거술 시행 환자의 데이터를 구축하고 관리한다.
6. 급성기 뇌졸중 환자를 위한 의료기관 또는 구급대원과의 네트워크를 운영한다. => **Hot line 구축**

인증 기준 - 1. 응급/급성기 적정 진료

1. 다학제 구성 -> (a.k.a) "뇌졸중 담당 진료 의사"의 능력을 평가
 - 1) 혈전 용해술 및 혈전 제거술의 적응증 및 금기증을 숙지
 - 2) **혈전 제거술이 필요한 경우 시술 담당 의사에게 시술을 결정할 근거를 설명할 수 있어야 한다.**
 - 3) 급성기 뇌졸중 환자 처치에 대한 내용을 정확히 숙지하고 이를 적용
 - 4) **혈관개거술, 두개절제술 등을 포함한 응급 수술이 필요한 경우** 수술 가능 연계 시스템 또는 연락 체계가 있거나 수술이 가능한 병원으로 이송을 유도
2. 최근 3개월 간의 혈전 용해술 및 혈전 제거술을 받은 환자 데이터 확인
 - 1) Door-to-needle time, 1시간 이내 뇌영상 검사 실시를 등을 포함한 데이터 유무, 환자의 검사와 치료 과정이 적절하였는지 확인한다.
 - 2) Door-to-puncture time, 뇌원시 mRS 등을 포함한 데이터 유무 및 환자의 검사와 치료 과정이 적절하였는지 확인한다.

인증 기준 - 1. 응급/급성기 적정 진료

조사 장소 : 응급실, 당직실, 의국/ 뇌졸중팀 의사 및 간호사 대상

준비 서류

- 최근 3개월 간의 의료진 명단 및 담당표
- 3개월 이내 응급실을 통해 입원한 급성기 뇌졸중 (onset 1주일 이내 내원) 환자 명단 및 의무 기록 문서화 된 CP 프로토콜
- 정맥내 혈전 용해술 및 혈전 제거술을 받은 환자 명단 및 관련 데이터 확인
- 응급 환자 네트워크 관련 문서**
 - 연계 병원 리스트 및 연락처 및 환자 이송 현황 또는 명단 등 근거 문서
 - 또는 다이렉트를 연락처 및 119 구급 대원 연계 관련 근거 문서

인증 기준 - 2. 뇌졸중 집중 치료실 (Unit)

1. 뇌졸중 집중 치료실 (unit)을 운영한다.
2. 뇌졸중 집중 치료실에 필요한 인력, 시설, 운영지침을 준수한다.
 - 1) Stroke Unit, SU 시설의 적절성 => 독립공간, 4명 이상 배치, 병상 1개당 최소 4평, 모니터링 필수(중앙 포함)
 - 2) SU 운영지침에 근거한 운영 및 관리 => 운영 지침 마련
 - 3) SU 관리 **신경과 의사** => 뇌졸중 학회 회원
 - 4) SU 전담 간호인력기준을 만족한다. => 간호사 1명당 1.2 병상 이하
 - 5) SU환자들의 신경학적 모니터링을 충실히 실시한다. => 3회 이상 NIHSS 확인 기록, 출혈은 GCS로

인증 기준 - 3. (TSC) 중환자 진료

1. (TSC) 중환자실(ICU)을 운영하고 뇌졸중 환자 진료에 활용한다.
2. (TSC) 중환자실은 적절한 시설과 인력을 갖추어야 한다.
⇒ 의료법 시행규칙에 달당.
⇒ 전담 의사 근무여부 확인 → 조사 대상자 : 신경과 의사/중환자실 전담 의사
⇒ 중환자실 형태에 대한 조사 : 신경외과계 중환자실/신경계 중환자실/내과계 중환자실
⇒ 적절한 중환자실 활용 : 애매한 기준

인증 기준 - 4. 뇌졸중 팀(Stroke Team)

1. 의료기관내 뇌졸중 환자 진료를 위한 뇌졸중 센터가 구성되어 있다. ⇒ 원내 조직도와 임명장, 신경과 전공의를 포함하여 구성 + 기타 의료진(응급의학과, 신경외과, 영상의학과)
2. 뇌졸중 팀의 의료진은 대한 뇌졸중 학회를 포함한 학회 활동에 참여 한다. ⇒ 대한뇌졸중학회의 학회 및 지회 활동, KSR 등록, 뇌졸중 교육 및 홍보
3. 뇌졸중 팀은 환자 진료 및 뇌졸중 센터 관리와 개선활동을 위해 정기적으로 회의를 개최한다. ⇒ 회의록
4. 뇌졸중팀 구성원들에게 직무수행에 필요한 교육을 시행한다. ⇒ 의사 : 원내/외 연수 교육, 학회 참석(연 1회, 8시간 이상 수료), 간호사 : 원내/외 연수 교육 또는 뇌졸중 학회 교육 4시간 이상

인증 기준 - 5. (TSC) 중재시술의료진

1. 신경중재시술의사가 뇌졸중환자에게 적합한 시술을 시행한다.
신경중재의사는 병원 소속이며 근무 중인 상태
최소 1명 이상 보유
2. 신경중재시술은 숙련된 의사가 시행한다.
신경과 또는 영상의학과 또는 신경외과 전문의여야 한다.
연간 신경중재시술의사 최소 1명 이상은 12명 이상의 Endovascular treatment를 시행해야 한다.
신경 중재 시술의로서 전문 학회(KSIN, KcNCS)의 인증을 받는 것을 권고한다.
3. 365일 24시간 신경중재시술 가능 여부
재관류 치료 뇌졸중 센터는 자동 병상 부족 등으로 인한 치료 불가 등 사유를 제외하고 365일 24시간 신경 중재시술이 가능하도록 증명되는 것을 권고한다. (포니터링)

인증 기준 - 6. 뇌졸중 레지스트리 운영과 질 향상 활동

1. 뇌졸중 환자의 체계적인 데이터 관리를 한다.
⇒ 병원 7일 이내 급성기 환자 대상, 3개월 이상을 운영해야 한다.
2. 뇌졸중 환자의 DB에 필수 항목이 포함되어 있다. (핵심지표)
⇒ 증상 발생시간, 내원 시간 ⇒ 뇌졸중 종류 (TOAST)
⇒ 입원 환자 초기 신경학적 검사 (NIHSS 또는 GCS) ⇒ 혈관내 시술 시행 유무 및 미시행 사유, 시작 시간
⇒ 혈전 용해제 (tPA) 사용 유무, 미사용 사유, 치료 시작 시간 ⇒ 치료 전후 혈관 폐색의 정도 (TICI)
⇒ 뇌졸중 종류 (TOAST) ⇒ 혈관내 시술 후 3일 이내 출혈 여부 확인
⇒ 퇴원시 기능적 예측 평가 (mRS) ⇒ 퇴원시 기능적 예측 평가 (mRS)
1. 데이터 항목에 필수 질지표를 설정하고, 지속적인 질 관리 활동을 한다.

인증 기준 - 6. 뇌졸중 레지스트리 운영과 질 향상 활동

3. 데이터 항목에 필수 질지표를 설정하고, 지속적인 질 관리 활동을 한다.
⇒ KSR 참여 병원
⇒ KSR 연계 등급 A : 참여 6개월 이상 + KSR 질관리 활동 참여
⇒ KSR 연계 등급 B : 참여 3개월 이상 + KSR 질관리 활동 미참여

인증 기준 - 7. 적정진료 및 시설

1. 표준진료지침에 따른 CP를 구축하고, 운영한다.
(TSC) 표준진료지침에 따른 EVT CT를 구축하고 운영한다.
⇒ 대한 뇌졸중 학회의 급성기 뇌졸중 표준 지침을 따르는 CP
2. CP에 따라 IVT 시행과 EVT 선별 및 이송을 적절히 하고 있다.
(TSC) CP에 따라 EVT를 시행하고 있다.

인증 기준 - 7. 적정진료 및 시설

3. 적정 수준의 장비가 운영된다.
- (TSC) EVT를 위한 적정 수준의 장비가 운영된다.
- ⇒ 뇌 영상 관련 : CT/MRI, CTA/MRA/ CT perfusion/DWI, Angiography suite
- ⇒ 심장 검사 관련 : ECG, Echocardiography, Holter
- ⇒ 뇌혈관 초음파 관련 : TCD, Carotid doppler sonography

	뇌졸중 센터 / 재관류 치료 뇌졸중 센터	Kones 뇌졸중 시술 인증의/뇌졸중 시술 인증기관
목적	뇌졸중 환자의 표준적 치료 확립	적정 수준 이상의 뇌혈관 내 치료 확립
기준	학회에서 정한 지표	시술 의사의 진료 능력 평가
시설	1) 뇌졸중 집중 치료실 2) 중환자실 3) 뇌혈관 조영 장비 + CT/MRI, TTE, Holter	1) 뇌혈관 조영기 + 마취 여부 2) 중환자실
인력	신경과 의사 (필수), 뇌졸중 팀 (응급/신경외과/영상의학과)	뇌졸중 시술을 위한 인력 (시술 전문의/방사선사/ 간호사)
평가 항목	KSR 등록 지표 1) 핵심 지표 2) 추가 지표	시술 의사의 연간 40례 경험
참여 병원	참여 병원 – big center 위지	참여 병원 – 의료 사각지대 중소병원까지 포함
결과	제한된 병원에서 제한된 지원	현재 뇌졸중 시술 상황을 반영

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 **11월 25일(금)-26일(토)**

장소_ 시그니엘 부산

Committee session III

11월 26일(토) 08:00-09:00

[Ballroom 2]

학술위원회

좌장: 권현조 (충남대)

역대 KONES 학술대회 REVIEW

정은오

충남대

역대 KONES 학술대회 REVIEW

충남대학교병원
정은오

2017년도 ASCENT

11:00-12:30	Symposium for nurses and technicians	좌장: 울산대 유승훈
	1) Anatomy of cerebrovascular structure	울산대 유승훈 · 10
	2) History of endovascular surgery	순천향대 윤석만 · 21
	3) Medication summary during endovascular treatment	연세대 박근영 · 27
16:10-16:50	Stryker symposium	좌장: 서울대 권요기
	Proximal control BGC and specially FlowGate 2 on the Stent retriever thrombectomy procedure	Dr. Jordi Blasco (Hospital Clinico Y Provincial De Barcelona) · 50
08:00-08:40	The "Debate" session: panel discussion with live audience interaction	좌장: 한림대 이호국
	패널: 윤석만, 박석규	
	Intraoperative neurophysiological monitoring during endovascular procedure	가톨릭대 인천성모 장동규 · 61
	1) Case presentation: IOM	순천향대 오재상 · 63
	2) Cerebral oximetry	순천향대 신동성 · 69
09:30-10:30	My technical tips and tricks: mechanical thrombectomy	좌장: 계명대 이창영
	1) Stent retriever thrombectomy for acute major arterial occlusion	계명대 김창현 · 82
	2) Combined IAT strategy based on manual clot aspiration	경희대 강동훈 · 91
10:30-11:00	Introduction of new devices (by company)	학술이사 정진영

2018년도 ASCENT

14:40-15:30	Special Lecture I	좌장: 가톨릭대 신용삼
	1. FRED for treatment in Aneurysm, Technology & Application Overview and Experience	20
	2. Sofia Intermediate Catheter for its Clinical Application and Experience	Dr. Duncan Mark Brooks (Interventional Radiology, St Vincent's Private Hospital, Austin Health, Melbourne, Australia)
15:50-16:40	Special Lecture II	좌장: 울산대 유승훈
	저 혈전제 담긴 카테터	(사립한국과학기술연구원) 부회장 정성환 24
16:50-17:50	Satellite Symposium for Nurses & Technicians	좌장: 울산대 권순환
8A Ballroom	Current Endovascular Treatment(EVT) for Intracranial aneurysm	울산대 권순환 38
	Medication (Pre, during & Post)	연세대 박근영 44
	Technique of EVT for intracranial aneurysm	경희대 신희섭 51
12:30-13:30	Luncheon Seminar	좌장: 경북대 고준석
	Experiences of Neuroform Atlas Stent for Intracranial Aneurysm Treatment	Prof. Hidenori Oishi (Neurosurgery, Juntendo University, Japan) 54
13:30-14:30	Scientific Symposium (Debate Session)	좌장: 서울대 권요기
	Coil vs Clip in treatment of intracranial aneurysm	부산대 이재일 58
	Optimal Tx. for ruptured fusiform ICA aneurysm in elderly patient	영남대 정영진 67
	Open vs Closed cell stent in peri-aneurysmal stenosis	계명대 김창현 74
	Streamline vs FRED for UJA	한양대 김대환 79
	Pipeline vs FRED for UJA	가톨릭대 최재호 83
14:30-15:10	Scientific Session (Review of aneurysm coils)	좌장: 순천향대 김경태
	Asium Prime Coil	가톨릭대 김성필 86
	Orbit Galaxy Coil	서울대 김한승 88
	Microvention Coil	순천향대 박석규 89
	Target Coil	이주대 임용철 99

2019년도 ASCENT

11:10-12:10	Symposium I: Education session for nurse & technician	좌장: 유승훈(울산대) / 황교준(분당재생병원)
	1. Current status of EVT in Korea	오재상(순천향대) 10
	2. Neurovascular anatomy	정준호(연세대) 14
	3. Medication [pre, during & post]	김동훈(영남대) 16
12:30-13:30	Luncheon seminar	좌장: 임용철(이주대) / 권현조(충남대)
	1. Endovascular treatments performed collaboratively by the Society of Korean Endovascular Neurosurgens	
	Members: A nationwide multicenter survey	김태권(차의과대학) 28
	2. Introducing a new phase, detail finishing, to cerebral aneurysm coil embolization	Dr. Jaehyun Son(Tomishiro Central Hospital, Okinawa, Japan) 31
13:40-14:20	Symposium II	좌장: 신용삼(가톨릭대)
	1. Flow Diverter, where are we now?	김성필(가톨릭대) 34
	2. Flow Disrupter, where are we going?	강현승(서울대) 36
14:20-15:00	명사초청강연	좌장: 신승훈(차의과대학)
	재주, 그 또 다른 시선	양상철(세이누리 대표) 44
08:00-09:00	Breakfast seminar	좌장: 윤석만(순천향대) / 김대원(영광대)
	1. Usefulness of metal coverage for treatment of intracranial aneurysm	박석규(순천향대) 64
	2. Flow diverter for treatment of intracranial aneurysm	신상철(연세대) 66
	3. Contact aspiration & stent delivery	권순환(울산대) 76

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

2021년도 ASCENT

09:00-12:00	Workshop for review board of HIRA service / 장소: 바부다울	좌장: 권오기(서울대) / 박석규(순천향대)
09:00-09:45	1. 심사체계 개편의 방향과 자율형 심사	박영희(강북삼성병원) 17
09:45-10:30	2. 뇌혈관내치료 심사의 기본	권오기(서울대) 18
10:30-11:15	3. 뇌혈관내치료 심사의 실제 및 제언 (I)	권현준(충남대) 19
11:15-12:00	4. 뇌혈관내치료 심사의 실제 및 제언 (II)	최재영(동아대) 20
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12:00-13:00	3. Direct carotid / vertebral approach	신동성(순천향대) 37
12:00-13:00	4. Guiding technique for endovascular surgery	김성배(연세대) 43
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14:00-15:40	1. Neurostimulation & clinical application	정용민(가톨릭대 핵의학대) 63
14:00-15:40	2. The Computer Aided Diagnostics Algorithm and Intracranial Applicable Catheter of Intravascular OCT	이종하(계명대 의용공학대) 69
14:00-15:40	3. Stroke rehabilitation at present, and in the future	김수아(순천향대 재활의학대) 76
16:00-16:40	인문학 특강	좌장: 윤석민(순천향대)
16:00-16:40	아름다운으로 재우는 일상	윤광준 (작가) 83

16:50-17:50	Satellite symposium for nurses and technicians / 장소: 바부다울	좌장: 김태관(치의료대) / 심숙영(연세대)
16:50-17:50	1. Natural history and treatment guidelines of cerebral aneurysm	오세영(연세대) 97
16:50-17:50	2. Endovascular treatment of cerebral aneurysm	김대현(한림대) 106
16:50-17:50	3. Perioperative care of cerebral aneurysm	고희화(단국대) 114
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09:00-12:00	2. Review of devices	윤환기(고려대) 140
09:00-12:00	3. Patent selection, technical tips and basic tactics	신병국(동의의료원) 157
09:00-12:00	4. Escape from complicated situation	김영우(가톨릭대) 161
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12:30-13:30	1. Role of direct thrombin inhibitor for acute ischemic stroke	장진영(연세메스병원) 173
12:30-13:30	2. Safety and feasibility of using Argatroban	이동훈(가톨릭대) 181
14:50-15:20	Introduction of new endovascular devices by company	좌장: 정준호(대한뇌혈관내치료의학회 보합이사)
15:20-15:40	Coffee break	
15:40-17:20	Symposium II : Bifurcation aneurysm from clipping/coiling to flow modulation	좌장: 신용성(가톨릭대) / 권순원(울산대)
15:40-16:00	1. Why clipping for bifurcation aneurysm	하성근(고려대) 197
16:00-16:20	2. Why coiling for bifurcation aneurysm	박정현(한림대) 204
16:20-16:40	3. Benefit of flow disruptor on bifurcation aneurysm	신용성(가톨릭대) 207
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13:50-14:50	Symposium I: Anatomy & Angiography of dural arteriovenous fistula	좌장: 김병태(순천향대) / 유승훈(울산대)
13:50-14:10	ECA Anatomy & Dangerous anastomosis	김현영(가톨릭대 영상의학과) 17
14:10-14:30	Magnetic resonance angiography & Transfemoral cerebral angiography	강명진(동아대 영상의학과) 21
14:30-14:50	Finding shunting point on angiogram	최재호(가톨릭대) 22
16:10-17:10	Symposium II: Multi-disciplinary management of dural arteriovenous fistula	좌장: 신용성(가톨릭대) / 윤석민(순천향대)
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16:25-16:40	Conventional radiation therapy	임용철(아주대) 41
16:40-16:55	Stereotactic radiosurgery	박성현(강북대) 42
16:55-17:10	Superior ophthalmic vein approach for cavernous dural arteriovenous fistula	박정현(부산대 안과) 43
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09:00-09:20	간단한 게임을 즐기는 Know-how	김학하(강원랜드 차장) 63
09:20-09:40	뇌혈관 분야에서의 AI의 적용	김재규(서울대) 64
09:40-10:40	Symposium III: Practical points for successful embolization of dural arteriovenous fistula	좌장: 고준석(강원대) / 권순원(울산대)
09:40-10:00	Finding inferior petrosal sinus orifice and route to cavernous sinus	변승필(서울대) 67
10:00-10:20	Embolization using dual lumen balloon	박근영(연세대) 72
10:20-10:40	Hybrid approaches	오재성(순천향대) 76

2017년도 정기학술대회

11:00-12:00	Special lecture	좌장: 가톨릭대 성재훈
11:00-11:30	의학논문의 각종 통계 - 나는 제대로 읽고 이해하고 있는가?	가톨릭대 피부과 박정민 · 22
11:30-12:00	Dangerous anastomosis: Clinical revelations	연세대 영상의학과 김동준 · 36
12:00-13:00	Lunch	
	의료사고 및 법적 문제발생 시 대응방법	법무법인 진영 강호형 · 38
13:00-14:00	Symposium: Review of endovascular devices	좌장: 순천향대 김병태, 서울대 권오기
13:00-13:20	Stroke devices	가톨릭대 박성규 · 42
13:20-13:40	Overview of detachable coils	한림대 전홍준 · 52
13:40-14:00	Stent for aneurysm coiling	연세대 정준호 · 68

2018년도 정기학술대회

11:00-12:00	Scientific Session I. 빅 데이터 활용 연구	좌장: 연암대 이항중, 울산대 권순환
11:00-12:00	건강보험자료를 활용한 의학연구의 접근방법	고려대학교 의과대학 근거중심의학연구소 김현정 33
12:00-13:00	Luncheon seminar	좌장: 경희대 고준석
12:00-13:00	Efficacy of Combined Technique with Stent Retriever for Acute Ischemic Stroke	Kyushu Medical Center, Japan Dr. Tomoyuki Tsunoto 45
13:00-13:10	Rest & Cleaning the room	
13:10-14:10	Scientific Session II. 임상 연구 종진 방향	좌장: 서울대 권오기, 순천향대 박석규
13:10-13:40	1. 공익적 임상연구 및 환자중심 의료기술 최적화 연구사업	한국보건과학연구원 국민건강증진연구 코디네이터(연구책임자) 김석현 49
13:40-14:10	2. 레지스트리 연구 경험 공유	고려대학교 구로병원 순환기내과 나승운 55

2019년도 정기학술대회

11:10-11:50	Special lecture I	좌장: 서울대 권오기
	Endovascular treatment of dural arteriovenous fistula	
	Fukuoka University Chikushi Hospital, Japan Dr. Toshio Higashi · 29	
11:50-12:40	Luncheon seminar	좌장: 순천향대 윤석민
	First Pass Effect - how ADAPT change my practice in AS treatment strategy	Sabotone University Hospital, France Dr. Clémentine Frédéric · 33
12:50-13:30	Scientific seminar	좌장: 연세대 장철호, 연세대 김대현
	Brief presentation by SHEN academic award I-IV & Panel Discussion	
	I. 영지성외발원 뇌전 학습상 / Panel: 아주대학교병원 임용철	
	Fluorine thombectomy for acute large-vessel occlusion with underlying severe intracranial	
	stenosis: stent retriever versus contact aspiration	경희대학교병원 강태훈 · 36
	II. 에스프랑병원 학습상 (SCIE) 부분 / Panel: 차의과학대학교 분당차병원 김태준	
	In vitro and in vivo experiments of a novel intra-arterial neurovascular decompressor for	
	treating neurovascular compression syndromes	연세대학교 세브란스병원 정준호 · 37
	III. 에스프랑병원 학습상 (SCIE) 부분 / Panel: 충남대학교병원 권태준	
	Predictive value of neurophysiologic monitoring during neurovascular intervention for	
	postoperative new neurologic deficits	연세대학교 세브란스병원 전홍준 · 38
	IV. 연세대학교 (young endovascular neurosurgeon) / Panel: 연세대학교병원 장철호	
	Selective compromise of hypoplastic posterior communicating artery variants with aneurysms	
	Irreversible by coil embolization: clinical and radiologic outcomes	충남대학교병원 최현호 · 41
14:30-15:10	Special lecture II	좌장: 가톨릭대 신용성
	Recent trend of EVT for large and giant cerebral aneurysm in JNET	
	Fukuoka University Chikushi Hospital, Japan Dr. Toshio Higashi · 55	

2020년도 정기학술대회

10:40-11:40	Symposium I. NeuroEndovascular Therapy in the Future	좌장: 신승철(가톨릭대), 박석규(순천향대)	27
10:40-11:00	1. Robotic-assisted Intervention	송교석(메디칼)	
11:00-11:20	2. Development of Magnetically Controlled Guidewire Microrobots for Vascular Interventions	최홍수(대구경북과학기술원)	28
11:20-11:40	3. Robotic-assisted Neuroendovascular Surgery	Daniel H. Kim (University of Texas at Houston, USA)	29
11:40-13:00	Luncheon Seminar	좌장: 윤석민(순천향대), 권순천(울산대)	
11:40-12:00	1. 심뇌혈관질환의 국가정책방향	이진세(건국대 의학전문대학원 예방의학교실)	33
12:00-12:20	2. 심뇌혈관센터 중앙지원단 및 권역 심뇌혈관센터의 역할	배희준(서울대 신경과)	39
12:20-12:40	3. 지역심뇌혈관센터	임준(서울대 도시보건대학원)	40
12:40-13:00	4. 심뇌혈관질환정책에 대한 대한뇌혈관내치료의학회와의 제안	신승훈(차의과대학)	49
15:20-16:10	Symposium II. Neuro Endovascular Therapy in era of COVID-19	좌장: 권오기(서울대), 장철호(영남대)	
15:20-15:35	1. Reviews of COVID-19 Focus on Neurovascular Presentation	오세영(연세대)	71
15:35-15:50	2. Sharing Experiences of Neuroendovascular Surgery in COVID-19 patient or suspected	김성범(가톨릭대)	72
15:50-16:10	3. Prevention and Control of COVID-19 in Neuroendovascular Surgery: KoNES' Guideline	남택균(충청대)	73

2021년도 정기학술대회

10:40-12:00	Symposium I (New Leap of KoNES as a member of KAMS)	좌장: 김범택 (순천향대), 윤석민 (순천향대)	
10:40-10:55	KoNES 대한학회의 가입과정 및 향후과제	장철호 (의학의 이사, 영남대) -----	27
10:55-11:10	대한학회의 사업 및 역할 (세부전문의 및 인증제도에 대한 고찰)	염호기 -----	35
11:10-11:25	KoNES 뇌졸중치료 인증제 9년의 역사	신희섭 (인증관리위원회, 경북대)-----	41
11:25-11:40	뇌혈관질환 관련 인증제도에 대한 고찰	김지훈 (대한뇌졸중학회, 서울대)-----	46
12:10-13:10	Luncheon Seminar	좌장: 권순천 (울산대), 권현조 (충남대)	
12:10-12:30	Challenges and perspectives in neurorecovery: Multi-modal drug	박근영 (연세대)-----	61
12:30-12:50	Updates in neurorecovery after stroke: EAN Guideline	신승훈 (차의과대학)-----	67
15:00-16:00	Symposium II (New trends in Neuroendovascular Surgery)	좌장: 신승철 (가톨릭대), 권오기 (서울대)	
15:00-15:20	KoNES WEB registry: Procedural characteristics	김현승 (서울대)-----	83
15:20-15:40	Safety and Efficacy of Shield technology: aneurysm size or location matters?	Mario Martinez-Galdamez ----- (Department of Interventional Neuroendovascular, Hospital Clinico Universitario de Valladolid, Spain)	86
15:40-16:00	The Future of Neuro Intervention - Robotics, Remote Assist & Evolve	Vincent Costalat ----- (Equipment of Neuro-Vascular Unit CHU Montpellier - Hospital Gui de Chauliac, France)	99

2017년도 뇌혈관 합동

09:00-10:20	Scientific Session I	좌장: 가톨릭대 신승철, 서울대 오창환	
	Posterior circulation aneurysms: VA dissection/complex PICA aneurysm		
	1. Pathogenesis and prognosis	황태대 황교준	14
	2. Recent trend and literature review	홍영대 남태균	15
	3. Endovascular treatment	홍익희(서울대) 장민영	17
	4. Surgical treatment	윤신대 안재성	29
10:20-10:40	Coffee Break		
10:40-11:45	Special Lecture I	좌장: 경상대 박인성, 가톨릭대 심재호	
	1. 뇌혈관질환의 미래	디지털 헬스케어 연구소 최문진	42
	2. 뇌혈관질환 보건의료 빅데이터활용	국립보건연구원 박동현	48
11:45-12:10	Special Lecture II	좌장: 뇌교대병원 박인우	
	Intracranial vessel wall imaging	김희대 경상대교 류성우	58
12:10-13:10	Lunch		
13:10-14:10	Scientific Session II AVM	좌장: 연세대 김태선, 고려대 임동준	
	1. Pathogenesis and natural history	연세대 박근영	68
	2. Current recommendation for treatment of AVM	한영대 정진환	75
	3. Endovascular treatment	서울대 강현승	76
	4. Surgical treatment	연세대 주성일	78

14:30-16:00	Workshop by Video for Beginner	좌장: 연세대 장영준, 경북대 고준석	
	1. CT workstation simulation for surgical clip	가톨릭대 박이성	80
	2. Practice makes perfect: bypass surgery	경북대 이상호	81
	3. Surgical management of complex aneurysms	서울대 황재승	86
	4. Step by step clipping of MCA aneurysm	연세대 김용재	94
	5. Endovascular management of complex aneurysms	아주대 임동철	101
	6. Special features of various thrombectomy devices	분당제생병원 신승훈	102
16:00-17:30	Scientific Session III	좌장: 순천향대 김범택, 숭실대 고현승	
	Update in the management of acute ischemic stroke		
	1. Current recommendation and literature review	가톨릭대 김 준	106
	2. Medical management	이화여대 서희고	111
	3. Endovascular treatment	동아대 최재형	119
	4. Surgical treatment	가톨릭대 장동규	121

2018년도 뇌혈관 합동

09:00-10:20	Scientific Session I: Cavernous Malformation	좌장: 성재훈 (가톨릭대), 강현승 (서울대)	
	1. Overview	연세대 (양곡연대)	17
	2. Microsurgery of supratentorial CM	김용재 (연세대)	21
	3. Microsurgery of infratentorial CM	연세대 (연세대)	22
	4. Radiosurgery	박정현 (충북대)	33
10:20-10:40	Coffee Break		
10:40-12:10	Special Lecture	좌장: 장영준 (연세대), 고준석 (경북대)	
	1. Functional Venous Anatomy of the Brain	Masaki Koniya (Osaka City General Hospital, Japan)	37
	2. Cerebral arterial anatomy	권오기 (서울대)	38
12:10-13:10	Lunch		
13:10-14:30	Scientific Session II: Dural AVF	좌장: 임동준 (고려대), 장철호 (연세대)	
	1. Overview	조현성 (서울대)	49
	2. Transarterial approach	장철호 (연세대)	54
	3. Transvenous approach	박동철 (연세대)	60
	4. Direct approach: SOV, burr hole	김동준 (연세대 영성의학대)	63
14:30-14:50	Coffee Break		
14:50-16:30	Workshop by Video for Beginner (Surgical Anatomy and Basic Technique)	좌장: 김태선 (연세대), 강현준 (서울대)	
	1. ACOM, Distal ACA aneurysm	장준호 (연세대)	79
	2. MCA aneurysm	방재승 (서울대)	80
	3. PCOM, Anterior choroidal artery aneurysm	이상원 (연세대)	88
	4. CEA	주성일 (연세대)	91
	5. STA-MCA bypass	박익성 (가톨릭대)	96
16:30-17:30	Scientific Session III: SAH, Vasospasm	좌장: 고현승 (충남대), 장철호 (가톨릭대)	
	1. VSP, Basic research update	박동철 (고려대)	103
	2. Intervention for VSP	신승훈 (분당제생병원)	104
	3. Medical complication & treatment	윤진홍 (가톨릭대)	105

2019년도 뇌혈관 합동

09:30-10:45	Session I. Moyamoya Disease: General	좌장 김명준 (서울대, 연세상 (홍산대))
	Epidemiology and clinical course of Moyamoya disease	김재현 (홍산대) 14
	Genes in Moyamoya disease: Updates information of the function of RNF213 and novel candidate genes for Moyamoya disease	신규원 (연세대) 23
	Diagnostic image of Moyamoya disease: Radiologic image & differential diagnosis of Moyamoya disease	김종배 (연세대) 33
10:45-11:00	Coffee Break	
11:00-12:15	Session II. Moyamoya Disease: Treatment	좌장 김재현 (기톨릭대, 고려대 (홍산대))
	Bypass strategies for Moyamoya disease: Risk and incidence of complication & avoidance of complication from revascularization surgery	안병영 (연세대) 34
	Surgical role in hemorrhagic Moyamoya disease	김종철 (서울대) 38
	Endovascular treatment for targeted embolization in Moyamoya disease with hemorrhagic manifestation	변승철 (서울대) 48
12:15-12:30	Lunch	
12:30-14:00	Special Lecture	좌장 고준석 (연세대, 김문수 (연세대))
	Clinical application of DTI for stroke in the viewpoint of neurosurgeon	장성호 (연세대 재발의학자) 42
14:00-15:15	Session III. Intracranial Dissection: General	좌장 윤성민 (충청대), 김지현 (연세대)
	Epidemiology and pathophysiology of intracranial dissection	원호기 (서울대) 70
	Diagnostic image of intracranial dissection	최창우 (연세대 영상의학자) 71
	Natural course and medical treatment for intracranial dissection	김태원 (연세대) 75
15:15-15:30	Coffee Break	
15:30-17:00	Session IV. Intracranial Dissection: Treatment	좌장 신동진 (기톨릭대, 연세상 (연세대))
	Surgical treatment for intracranial dissection	박지현 (연세대) 76
	Endovascular treatment for intracranial dissection	박종우 (연세대 영상의학자) 79
	Complicated cases and panel discussion	주성철 (연세대) 83
		김성원 (기톨릭대) 86
		이재원 (부산대) 87
		박동철 (홍산대) 88

2021년도 뇌혈관 합동

10:30-11:00	Session 1. Ischemic stroke etiology	좌장 : 고연승(홍산대), 고준석(연세대)
10:30-10:50	TOMT classification and its connection to LVO / IAT	곽동식 (경북대병원 신경과) 16
10:50-11:10	AF and Cardioembolic stroke	송아영 (세종대병원 순환기내과) 26
11:10-11:30	Cardioembolic stroke 1: Overview and intra-IAT / post-IAT care	장영영 (서울아산병원 신경과) 32
11:30-11:50	Cardioembolic stroke 2: IAT	신동성 (순천향대 부천병원) 45
11:50-12:00	Lunch break	
12:00-14:15	Session 2. Carotid revascularization strategy	좌장 : 김태진(연세대), 윤지현(연세대)
12:00-12:25	Carotid endarterectomy	김희재 (연세대 세바연구소병원) 50
12:25-12:50	EC-IC Bypass	윤창기 (고려대 구로병원) 59
12:50-14:15	Carotid stenting	이종훈 (기톨릭대 성모병원) 60
14:30-16:00	Session 3. Expert experience for special situations in LVO	좌장 : 임동진(고려대), 정철호(연세대)
	Medium Vessel Occlusions	
14:30-14:45	Medium vessel occlusions	정현진 (연세대병원) 80
14:45-15:00	Medium vessel occlusions	하영우 (조선대병원) 90
	LVO with underlying intracranial arterial stenosis	
15:00-15:15	LVO with underlying intracranial arterial stenosis	홍대영 (연세대병원) 95
15:15-15:30	LVO with underlying intracranial arterial stenosis	양구현 (홍산대 강릉아산병원) 114
	Acute tandem EC and IC occlusions	
15:30-15:45	Acute tandem EC and IC occlusions	박희현 (연세대 동탄성모병원) 115
15:45-16:00	Acute tandem EC and IC occlusions	조용환 (동아대병원) 118

2022년도 뇌혈관 합동

Scientific Session I: Keeping Patients Safe for Young Neurosurgeons		좌장 : 고현승 (충청대), 황세민 (순천향대)
09:00-09:25	Principles and application of intraoperative monitoring (IOM) in the treatment of cerebral aneurysm	최현호 (충청대)
09:25-09:50	Perioperative management in subarachnoid hemorrhage (SAH) patients	조진제 (연세대)
09:50-10:15	Painful memories as a young neurosurgeon in clipping surgery	박문석 (홍산대)
10:15-10:40	Painful memories as a young neurosurgeon in bypass surgery	오재상 (순천향대)
10:40-11:00 Coffee Break		
Scientific Session II: Functional Complications during Treatment of Cerebral Aneurysm		좌장 : 박재현 (연세대), 권순환 (홍산대)
11:00-11:25	Anterior communicating artery aneurysm surgery : About olfaction and cognitive function	김성태 (연세대)
11:25-11:50	Anterior choroidal artery aneurysm surgery : About "Triple H symptoms"	한재성 (홍산대)
11:50-12:15	Protection from radiation during endovascular procedure in cerebrovascular field	최재호 (기톨릭대)
12:15-12:30 Lunch & Photo		
Special Lecture		
13:15-13:40 From Bypass technique to Medical school Club		정영준 (연세대)

Learning with Experts: Key Note Lectures		좌장 : 김태진 (연세대), 장필준 (연세대)
13:50-14:15	Far lateral approach with harvest of occipital artery using layer-by-layer dissection technique	김용복 (연세대)
14:15-14:40	Bypass technique in intracranial-intracranial (IC-IC) bypass	박익성 (기톨릭대)
14:40-15:05	Deployment of Woven EndoBridge (WEB) device	신용성 (기톨릭대)
15:05-15:30	Deployment of flow-diverting stents	김현승 (서울대)
15:30-15:40	Coffee Break	
Scientific Session III: Atherosclerotic Large vessel occlusion (LVO)		좌장 : 고준석 (연세대), 김승원 (서울대)
15:40-16:05	Pathogenesis and natural course of LVO	전민형 (연세대)
16:05-16:30	Medical treatment for LVO: antiplatelet, direct oral anticoagulant (DOAC), and statin therapy	김소연 (기톨릭대 권영대)
16:30-16:55	Intracranial stenting for symptomatic LVO	박성규 (연세대)
16:55-17:20	Extracranial-intracranial (EC-IC) bypass for symptomatic LVO	이시훈 (서울대)

최근 미국 학회 동향

반승필

서울대

2022 정기학술대회 학술위원회

최근 미국 학회 동향

Seoul National University Bundang Hospital

Seung Pil Ban



2022 KoNES 정기학술대회

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✓ 뇌혈관시술 관련 미국 학회

ASNR, American Society of Neuroradiology

SVIN, Society of Vascular and Interventional Neurology

SNIS, Society of NeuroInterventional Surgery

CNS, Congress of Neurological Surgeons

AANS, American Association of Neurological Surgeons

2022 KoNES 정기학술대회

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✓ ASNR 2021

• Neurointervention 관련 Session

- SNIS Programming: Critical Gaps in Evidence for Neurointervention
=> Posterior Circulation Thrombectomy / Pediatric Stroke Thrombectomy
- SNIS Programming: Diagnostic Neuroradiologist Reporting in Neurointerventional Patients (SA-CME)
=> Reporting Aneurysms / Reporting Large Vessel Occlusion Stroke / Reporting AVM, dAVF, and CCF / Reporting Vessel Wall Imaging
- SNIS Programming: Frontiers in Neurointervention
=> Robotically Assisted Neurointervention / Novel Routes of Access / Brain-Computer Interface / Ultrasound for Minimally Invasive Neurointerventions / Interventional Treatment of Psychiatric Disease / Blood and Clot Research in Thrombectomy / Neuroprotection in Stroke

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✓ ASNR 2021

• Neurointervention 관련 Session

- EBM Committee Programming
=> Intro to Intracranial VWI Imaging Technique/How-to's/Basic Image Interpretation / Evidence for Intracranial VWI in Cryptogenic Stroke and Vasculopathy / Evidence for Intracranial VWI in Evaluation of Aneurysms
- SNIS programming: Evidence-based Review of Neurointervention
=> Evidence in Stroke Intervention / Evidence in Aneurysm Treatment / Evidence in Arteriovenous Malformation Treatment / Evidence Based Carotid Disease Treatment / Evidence in Spine Intervention

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✓ ASNR 2022

• **Neurointervention 관련 Session**- **Interventional**

=> Stroke Keynote Lectures

=> Stroke Treatment – Is there Evidence for

=> Arteriovenous Shunts 1 & 2

=> Aneurysm 1 & 2

=> Expanding Indications of Neurointervention

=> Expanding Techniques in Neurointervention

- **SNIS programming: Complex NIR Treatments**

=> What Am I Supposed to Do With This?

- **SNIS programming: Veins**

=> Is this for Real?

- **SNIS Programming: Essentials of Neuroradiology**

=> Evidence for Challenging NIR Situations

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SVIN 2021

WEDNESDAY, NOVEMBER 17TH (Stroke Center Day)

7:00 am – 9:00 am	Breakfast	Akmet Foyer
7:00 am – 9:30 am	Morning Recreational Activities	Akmet Foyer
7:00 am – 9:00 pm	Registration/Help Desk	Akmet Foyer
7:00 am – 9:00 pm	Speaker Ready Room	Battensdale
9:00 am – 11:00 am	MT2020+ Annual Update Brunch	Akmet 3 & 4
10:00 am – 5:00 pm	Tech Sutter Medtronic – Roadrunner, Penumbra – Bird, Stryker – Jackrabbit, Cerenovus – Qual, MicroVention – Horse	
10:45 am – 11:00 am	Coffee Break	Akmet Foyer
11:00 am – 11:10 am	Welcome to the Desert	Akmet 3 & 4
11:10 am – 12:00 pm	Developing Systems of Care	Akmet 3 & 4
12:00 pm – 12:55 pm	Lunch	Mesquite Terrace
12:00 pm – 6:15 pm	Exhibits Open	Akmet 1 & 2/Kave Ballroom
1:00 pm – 2:45 pm	New Developments: Pros and Cons	Akmet 3 & 4
2:45 pm – 3:15 pm	Exhibit Hall and E-Poster Viewing	Akmet 1 & 2/Kave Ballroom
3:15 pm – 4:00 pm	Treatment Options for Hemorrhagic Stroke	Akmet 3 & 4
4:00 pm – 5:15 pm	Happy Hour	Akmet 3 & 4
4:15 pm – 5:15 pm	A Battle of Wits: Mobile Stroke Units	Akmet 3 & 4
5:15 pm – 6:15 pm	Welcome Reception – Sponsored by Penumbra	Akmet 1 & 2/Kave Ballroom
5:30 pm – 9:00 pm	SVIN Board of Directors Meeting (Invite Only)	Deer/Scorpion
6:30 pm – 8:00 pm	CLOTS Workshop (Invite Only) – Sponsored by Cerenovus	Coyote/Buzzard/Eagle

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SVIN 2021

THURSDAY, NOVEMBER 18TH

7:00 am – 7:45 am	Breakfast Symposium with Rapid Medical	Coyote/Buzzard/Eagle
7:00 am – 5:30 pm	Registration / Help Desk	Akmet Foyer
7:00 am – 7:00 pm	Speaker Ready Room	Battensdale
8:15 am – 9:45 am	Welcome/Stroke Debates	Akmet 3 & 4
8:00 am – 4:00 pm	Tech Sutter Medtronic – Roadrunner, Penumbra – Bird, Stryker – Jackrabbit, Cerenovus – Qual, MicroVention – Horse, Imperative Care – Thunder 1	
9:45 am – 10:15 am	Business Meeting & Presidential Address	Akmet 3 & 4
10:15 am – 11:00 am	Coffee Break with Exhibitors & E-Poster Presentations	Akmet 1 & 2/Kave Ballroom
10:00 am – 4:00 pm	Exhibits Open	Akmet 3 & 4
11:00 am – 12:00 pm	Platform Session I	Akmet 1 & 2/Kave Ballroom/Mesquite Terrace
12:00 pm – 2:10 pm	Lunch with Exhibitors, E-Poster Viewing	Akmet 3 & 4
12:00 pm – 2:10 pm	Lunch Symposium	Akmet 3 & 4
2:15 pm – 3:45 pm	APP Track	Deer/Scorpion
2:15 pm – 3:45 pm	NIR Track	Coyote, Buzzard, Eagle
2:15 pm – 3:45 pm	Vascular Neurology Track	Akmet 3 & 4
3:45 pm – 4:00 pm	Coffee Break with Exhibitors & E-Poster Presentations	Akmet 1 & 2/Kave Ballroom
4:00 pm – 5:30 pm	Endovascular + Vascular Neurology Joint Session 1	Akmet 3 & 4
5:30 pm – 6:30 pm	Mentors in Training Reception (All Welcome) – Sponsored by Cerenovus	Coyote/Buzzard/Eagle
6:30 pm – 7:30 pm	Women in Vascular and Interventional Neurology (WIN) Reception – Sponsored by Stryker	Coyote/Buzzard/Eagle
6:30 pm – 7:30 pm	MT2020+ Industry Advisory Meeting	Deer/Scorpion

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SVIN 2021

FRIDAY, NOVEMBER 19TH

9:45 am – 9:00 am	14th Annual SVIN Top Supporter Breakfast (Invitation Only)	Gila Monster
7:00 am – 8:00 am	Breakfast with the Exhibitors	Akmet 1 & 2 / Kave Ballroom
7:00 am – 9:00 am	How To Get Published Breakfast	Coyote/Buzzard
7:00 am – 5:30 pm	Registration / Help Desk	Akmet Foyer
7:00 am – 9:00 pm	Speaker Ready Room	Battensdale
8:00 am – 9:30 am	APP Track	Coyote/Buzzard/Eagle
8:00 am – 9:30 am	NIR Track	Akmet 3 & 4
8:00 am – 9:30 am	Vascular Neurology Track	
9:30 am – 10:15 am	Tech Sutter Medtronic – Roadrunner, Penumbra – Bird, Stryker – Jackrabbit	
9:30 am – 10:00 pm	Cerenovus – Qual, MicroVention – Horse, Imperative Care – Thunder 1	
9:30 am – 10:15 am	Coffee Break with Exhibitors & E-Poster Presentations	Akmet 1 & 2/Kave Ballroom
10:15 am – 11:15 pm	Exhibits Open	Akmet 1 & 2/Kave Ballroom
10:15 am – 11:15 pm	Platform Session II	Akmet 3 & 4
11:15 am – 12:00 pm	Keynote Address	Akmet 3 & 4
12:00 pm – 2:35 pm	Lunch with Exhibitors, E-Poster Viewing	Akmet 1 & 2/Kave Ballroom/Mesquite Terrace
12:00 pm – 2:35 pm	Lunch Symposium	Akmet 3 & 4
2:35 pm – 3:30 pm	Aneurysms	Akmet 3 & 4
3:30 pm – 3:45 pm	Coffee Break with Exhibitors & E-Poster Presentations	Akmet 1 & 2/Kave Ballroom
3:45 pm – 4:30 pm	ACS Joint Session	Akmet 3 & 4
4:00 pm – 6:00 pm	GAPS Committee Meeting	Gila Monster
4:30 pm – 5:40 pm	Complex Cases and Fall-Out Techniques	Akmet 3 & 4
5:40 pm – 6:40 pm	DEI Reception – Sponsored by Cerenovus	Coyote/Buzzard/Eagle/Deer/Scorpion
7:00 pm – 10:00 pm	SVIN Black and White Gala (in celebration of SVIN Journal Launch) – Sponsored by Viz.ai	Hempack Lawn

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SVIN 2021

SATURDAY, NOVEMBER 20TH

7:00 am – 8:00 am	Breakfast	Akmet 3 & 4
7:00 am – 12:00 pm	Registration / Help Desk	Akmet Foyer
7:00 am – 3:30 pm	Speaker Ready Room	Battensdale
8:00 am – 9:30 am	Clinical Trials Update – Stroke and Neurointerventional	Akmet 3 & 4
9:30 am – 10:45 am	Endovascular + Vascular Neurology Joint Session 2	Akmet 3 & 4
10:45 am – 11:00 am	Coffee Break	Akmet Foyer
11:00 am – 12:00 pm	Fellow Course – Didactic	Akmet 3 & 4
12:00 pm – 12:30 pm	Fellow Course Lunch	Coyote/Buzzard/Eagle
12:30 pm – 3:30 pm	Fellow Course – Hands On	Kave Ballroom

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Women in Neurointervention Leadership Program**• **Neuroanatomy master Class**

- Cavernous Sinus / Cerebral Venous Anatomy & Access

• **Didactic Session – Subdural Hematoma as an Interventional Disease**

- MMA embolization: First-line versus Adjunctive or Rescue Treatment for SDH /

Embolization Agents: Experience & Current Choices for MMA embolization

Angiographic Predictors for Successful MMA Embolization

Complications & Challenges during MMA Embolization Procedures

MMA Embolization as First-choice Treatment for the Poor Surgical Candidate

SDH Due to Waldenström Macroglobulinemia: International Experience of MMA

Embolization

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Didactic Session – Emerging Trends in Neurointerventional Stroke Treatment**

- New Aspiration and Stent Retriever Devices
- MEVOS and Beyond: Evidence and Technical Nuances
- Thrombolytics and Mechanical Thrombectomy
- Tandem Cervical Lesions
- CVST Endovascular Approach: Patient Selection and Approach
- Direct to Angiosuite: Are we Ready?
- Reducing Consumable Waste in the Neurointerventional Suite

• **International Reception**• **Pediatric Neurointervention Reception**

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Neuroanatomy master Class**

- Craniocervical Junction / Pial Dural Anastomosis

• **CV section Awards/Luessenhop Lecture**

- MMA embolization: First-line versus Adjunctive or Rescue Treatment for SDH

• **Didactic Session – Pediatric Neurointerventional Surgery: Complications and Lessons Learned**

- IA chemotherapy
- Intracranial AV Shunts
- Head and Neck Lesions
- Neonatal Vascular Malformations
- Pediatric Trauma

2022 KoNES 정기학술대회

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✓ SNIS 2022

• **Didactic Session – Learning the Trade: Neurointerventional Education**

- Graded Autonomy in Fellowship Training
- Training individual Learning Styles
- Incorporating Research into the Neurointerventional Fellowship: Translational, Clinical Trials, Registries and QI
- The New Era of Evaluation
- Interviewing in the Virtual Era

• **Didactic Session – Complication management**

- Stroke Complication & Discussion
- dAVF Complication & Discussion
- AVM Complication & Discussion
- Aneurysm Rupture Complication & Discussion
- Aneurysm Treatment Device Malfunction & Discussion

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Didactic Session – The Next Frontier of Neurointerventional Surgery – Image-Guided Drug Delivery to the CNS**

- AAV/ASO – Problem of Drug Delivery to the CNS
- BBB Disruption for the Therapeutic Drug Delivery in Neuro-oncology
- Endovascular Access to the Pontocerebellar Cistern for Repeated Drug Delivery
- Targeted Nanoparticle Delivery for Cerebrovascular Disease

• **Didactic Session – Aneurysm Treatment: Refining the Craft**

- A New Era of Flow Diversion: Clinical Experience from Surface Modified Stents
- When Flow diversion Fails: Why and How to Deal with it
- Intracranial Devices: Early Follow-up
- Surgery as an Endovascular Bail-out or Endovascular as a Surgical Bail-out
- Advances in Vasospasm from the NeuroICU to the Angiosuite

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Neuroanatomy master Class**

- Rethinking the Arch and Radial Approaches / Anterior Choroidal Artery

• **Didactic Session – Thinking Outside the Box: Novel Techniques and Treatments of Vascular Malformations of the Brain, Head, Neck and Spine**

- Endovascular and Nonvascular Spine
- Low Flow Head and Neck Vascular Malformations
- Dural AV Shunts
- Intracranial AV Shunts: Getting out of Trouble
- Microsurgical AVM Resection: Getting out of Trouble

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ SNIS 2022

• **Didactic Session – The Latest and Greatest in Clinical Trials**

- Update on MMA Embolization Trials
- Direct to Angio and other Stroke Triage Trials
- Recent and Upcoming Trials in Flow Diversion
- Clinical Data and Trials Regarding Venous Stenting
- Neuroprotection in Acute Ischemic Stroke Trials

• **Didactic Session – Future of AI in Neurointerventional Surgery**

- Introduction to AI in the Neurointerventional Space
- Beyond the Hype: How to Evaluate the Value of AI Applications
- Creating More Efficient Systems of Stroke Care with AI
- AI Applications in Cerebral Aneurysms

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ **CNS 2021**

● CEREBROVASCULAR

SATURDAY
8:00 am–4:15 pm

● SYM2: Vascular Symposia Bundle: Stenting and Bypass

SUNDAY
8:00 am–4:15 pm

● SYM14: Cerebrovascular Symposia Bundle: Stroke and Guidelines

MONDAY
7:00–8:30 am

● Sunrise Science Abstract Session I

12:15–1:45 pm

● M2: Minimally Invasive Surgical Evacuation of Intracerebral Hemorrhage

● M9: Artificial Intelligence in Cerebrovascular Neurosurgery

2:45–4:15 pm

● Section on Cerebrovascular Surgery: Neuroprotection in Cerebrovascular Disease—The Next Wave of Ischemic and Hemorrhagic Stroke Treatments

4:15–5:45 pm

● Multimodality AVM Treatment: Operative Techniques and Case-based Discussions

5:45–7:15 pm

● International Symposia

TUESDAY
7:00–8:30 am

● Cerebrovascular Guidelines: Aneurysms, Arteriovenous Malformations, and Acute Ischemic Stroke

12:15–1:45 pm

● T29: Robotic Approaches in Endovascular Neurosurgery

● T32: Virtual and Augmented Reality in Neurosurgery

● T24: Social Media Use in Neurosurgical Practice: Showboating or Real Value

2:45–4:15 pm

● Section on Cerebrovascular Surgery: Advanced Aneurysm Treatment Techniques

4:15–5:45 pm

● Aneurysm Treatment: Operative Techniques and Case-based Discussions

5:45–7:15 pm

● Interactive Multimedia Research Presentation Session

WEDNESDAY
12:15–1:45 pm

● W23: Middle Meningeal Artery Embolization in the Treatment of Chronic Subdural Hematomas

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ **CNS 2022**

● CEREBROVASCULAR

SATURDAY

● SPECIAL SYMPOSIUM: Frontiers in Skull Base Surgery
A CNS collaboration with the North American Skull Base Society (NABSS)

● SYM02A: Comprehensive Management of Acute Stroke

● SYM02B: Multimodal Management of Pediatric Cerebrovascular Disease

SUNDAY

● SYM12A: Cerebrovascular Bypass and Management of Complex Vascular Lesions

● SYM12B: A Comprehensive and Evidence-based Review of the Treatment of Intracranial Aneurysms

● SYM17A: Keyhole Approaches for Treatment of Intracranial Aneurysms

● SYM17B: Trigeminal Neuralgia - Latest Trends in Management

MONDAY

● Sunrise Session and Late Breaking Abstract Session - Cerebrovascular

● M05: Timing and Approaches to Brainstem Cavernous Malformations

● M07: Artificial Intelligence in Cerebrovascular Neurosurgery

● Section on Cerebrovascular Surgery 1: Evolving Treatment Paradigms for Cerebrovascular Disease

● Complex Case Discussion - Dural AV Fistula

TUESDAY

● Sunrise Session and Late Breaking Abstract Session - Cerebrovascular - Ischemic

● T15: Middle Meningeal Artery Embolization in the Treatment of Subdural Hematoma

● T17: Multimodal Treatment of Spinal Vascular Malformations

● Section on Cerebrovascular Surgery 2: The Future of Stroke Care

● Nuances in Multimodal Treatment of AVMs

● Interactive Multimedia Research Presentation Session

WEDNESDAY

● Sunrise Session and Late Breaking Abstract Session - Cerebrovascular

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ **AANS 2022**

International Symposium—Session IV:
Cerebrovascular
Location: 201 C
Moderators: A. Aljoudi, N. Khan, J. Morris

1:48–2:03 pm
The Effectiveness of Surgery in S.M Grade 3 and 4 Brain AVMs
S. Topor

2:04–2:19 pm
Vascular Neurosurgery in Senegal: An Overview
M. Thoub

2:20–2:35 pm
Contemporary Management Options for Intracranial Aneurysms of Distal Arterial Branches
K. Rabin

2:36–2:51 pm
Role of Developing and Implementing Microsurgical Techniques of Clipping in the Management of Cerebral Aneurysms in Africa
A. El-Dars

2:52–3:07 pm
Advances in the Endovascular Management of Brain AVMs
R. Manthandaram

3:08–3:23 pm
Timing of Carotid Endarterectomy After I.V.T. Thrombolysis and Mechanical Thrombectomy
M. Samra

3:24–3:39 pm
Beverage Break

3:40–3:55 pm
Cottonoid-guided Intraoperative Ultrasonography in Vascular Neurosurgery
U. Tule

3:56–4:11 pm
Hybrid Microsurgical and Endovascular Approach in the Treatment of Multiple Cerebral Aneurysms
T. Sapiro

4:12–4:30 pm
Cerebrovascular Panel / Case Discussions

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

Thank You !

최근 혈관내 시술 관련 해외학술지의 동향

김유섭

전남대

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

**Free paper IV (AVF, AVM & etc.)
& Committee session IV**

11월 26일(토) 09:00-10:00

[Grand ballroom]

Free paper IV (AVF, AVM & etc.)

좌장: 임용철 (아주대),
이종영 (한림대)

Dural arteriovenous fistulas: a presentation of a single institution's experience

Dae Won Kim, Sung Don Kang

Wonkwang University Hospital

Objective: Dural arteriovenous fistulas (DAVFs) are arteriovenous shunts from a dural arterial supply to a dural venous channel, typically supplied by pachymeningeal arteries and located near a major venous sinus. A retrospective review was conducted to present the results of treatment of DAVFs.

Methods: A review of the medical record was performed, and a presentation of the number of treatments, complications, and outcomes is included here. The number of arterial embolizations and need for transvenous embolization, and open surgery was assessed.

Result: Forty-one patients (23 men and 18 women) underwent endovascular or surgical treatment of DAVFs at our institution from 2007 to 2022. Ages ranged from 17 to 86 years (mean, 48 years). Seventy-nine percent of patients had retrograde cortical venous drainage. The average number of embolizations in all patients was 2.1. Twelve patients underwent 40 embolization treatments with Onyx, with an obliteration rate of 80% and cortical venous drainage obliteration rate of 87%. Eighty-five percent (35/41) of patients had complete treatment of the fistula: 30 by purely endovascular treatment and 5 with craniotomy.

Conclusion: Endovascular and surgical management of DAVFs is a safe and effective method of treating these complex lesions.

The short-term follow up of P2Y12 reaction unit (PRU) for clopidogrel is necessary to predict the bleeding risk in patients underwent stent-assisted coil embolization for unruptured intracranial aneurysm.

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

Seoul National University Bundang Hospital

Objective: The purpose of this study was to describe the short-term change of a clopidogrel effect after stent-assisted coil embolization and its impact to the patients using P2Y12 reaction unit (PRU).

Methods: Patients were eligible if they underwent stent-assisted coil embolization for unruptured intracranial aneurysms between December 1, 2021 and September 30, 2022 with an appropriate PRU (between 85 and 220). The short-term follow-up PRU was checked within 2 weeks and 1 month after coil embolization. The primary outcome was the follow-up PRU lower than 85. The secondary outcome was hemorrhagic complication defined with the thrombolysis in myocardial infarction (TIMI) bleeding criteria. The receiver operating characteristic (ROC) curve and the area under the curve (AUC) were obtained to determine the quantitative predictive ability of the inhibition rate. The optimal cut-off value was derived using the Youden index.

Result: A total of 102 patients with 112 aneurysms included in this study. Patients with PRU lower than 85 was 24 (23.5%). The AUC of the ROC curve for prediction of follow-up PRU lower than 85 using PRU before coil embolization was 0.79. The optimal cut-off of the PRU before coil embolization was 122. The one major bleeding by TIMI bleeding criteria (gastrointestinal bleeding with a drop in hemoglobin more than 5g/dL) was in the patient group with PRU lower than 85 (4.2%).

Conclusion: We found that the considerable patients' PRU was dropped to the high-risk level for bleeding after coil embolization. A short-term follow up of PRU is necessary for predicting the bleeding risk in patients underwent stent-assisted coil embolization for unruptured intracranial aneurysm.

Application of Middle meningeal artery embolization for hemorrhagic conditions of intracranial dura: How to avoid potential complications?

Heui Seung Lee MD, Jong Young Lee MD, PhD

Hallym University College of Medicine, Department of Neurosurgery

Objective: Effectiveness of middle meningeal artery (MMA) embolization for recurrent chronic subdural hematoma (SDH) has been reported. However, reports regarding complications associated with procedure and potential procedural risk from MMA-ophthalmic artery (OA) collaterals are limited. In this series we reported procedural complications with following treatment. Also, we reviewed experience of MMA embolization in special conditions of hemostasis disorders.

Methods: From January 2015 to March 2022, patients treated by MMA embolization for recurrent chronic or subacute SDH were reviewed. We also included patients who had MMA embolization as an initial treatment option for epidural hematoma (EDH) or SDH due to their hemostatic disorder.

Result: Twenty-one patients had recurrent chronic or subacute SDH, who had at least one surgery for SDH drainage. MMA embolization was initially considered for two patients with acute EDH and one with acute SDH, who had hemostatic disorders. MMA-OA collaterals was observed in 4 out of 24 patients (16.7%) including one case in which embolization was not feasible due to the predominance of ophthalmic-middle meningeal collaterals. There was no ophthalmic complication. MMA dissection occurred in 3 cases which were occluded using detachable coils.

Conclusion: The predominance of OA-MMA collaterals is important determinant in deciding the feasibility of MMA embolization. For the procedural safety, careful catheterization should be made to avoid MMA dissection and early detection followed by proper treatment of MMA dissection is important. Medical conditions with disorders in hemostasis and coagulation can be the special consideration of MMA embolization in adjunction with hematoma drainage.

Angioarchitectural analysis of the arteriovenous shunts in dural arteriovenous fistulas and its clinical implications

Junhyung Kim, Byung Moon Kim, Keun Young Park, Jae Whan Lee, Yong Bae Kim, Joonho Chung, Dong Joon Kim

Gangnam Severance Hospital, Severance Hospital, Yonjin Severance Hospital

Objective: The detailed understanding of the angioarchitecture of the arteriovenous shunts in dural arteriovenous fistulas (DAVFs) is essential for the planning of endovascular treatment (EVT). This study aimed to analyze the shunt patterns and their clinical implications in transverse-sigmoid sinus (TS-SS) and superior sagittal sinus (SSS) DAVFs.

Methods: A total of 48 DAVFs treated by endovascular embolization between January 2010 and June 2021 were investigated. The pre-procedural and intra-procedural digital subtraction angiographies were examined to characterize the shunt patterns of the DAVFs in terms of anatomic relations to the sinuses and the cortical veins. Treatment characteristics and outcomes were also evaluated.

Result: Thirty-eight DAVFs (79.2%) were aggressive lesions with cortical venous reflux (CVR). The shunt patterns were categorized into four types: direct sinus fistula ($n = 8/48$, 16.7%), compartmental sinus channel ($n = 14/48$, 29.1%), mural channel ($n = 13/48$, 27.1%), and bridging vein shunt ($n = 13/48$, 27.1%). Mural channel lesions showed both direct ($n = 4/13$, 30.8%) and indirect ($n = 6/13$, 46.2%) cortical venous connections. Overall, complete/near complete occlusion was achieved in 42 patients (87.5%) after final embolization. Patients with mural channels received most embolization sessions on average (1.4 sessions per patient). All bridging vein shunts were completely occluded via single trans-arterial embolization sessions.

Conclusion: The shunt patterns of DAVFs can be categorized into direct sinus fistula, compartmental sinus channel, mural channel, and bridging vein shunts. EVT may effectively treat the lesions with considerations of the shunt location and cortical vein connection.

Deep Learning for Detecting Intracranial Aneurysms in Computed Tomography Angiography

Dae Han Choi, Myeong Jin Kim

Department of Neurosurgery, Gil Medical Center, Gachon University College of Medicine

Objective: CT angiography (CTA) is recommended as a standard diagnostic tool for intracranial aneurysm (IA); however, the interpretation can be time consuming and challenging. We present a deep learning (DL)-based computer-aided diagnosis (CAD) system for automated intracranial aneurysm detection.

Methods: Head CTA images were retrospectively retrieved from a single tertiary hospital database between January 2013 and December 2017. A total of 486 IA and 325 non-IA angiographic scans were included in the dataset. The whole angiographic data were reconstructed into centrally aligned 0.5mm isotropic volume by extracting bone, brain, and vessels through preprocessing, and performing non-rigid registration to a Non-IA brain template. We constructed a 3D Efficient-Net-based DL algorithm to detect aneurysm regions within CTA volumes.

Result: The CTA dataset was divided into 684 (IA: 416, Non-IA: 268) for training-set, 33 (IA: 23, Non-IA: 10) for validation-set, and 94 (IA: 47, Non-IA: 47) for test-set. The proposed DL model showed the performance of 95.74% sensitivity and 100% specificity, analyzing the test-set for patient-level. The lesion-level performance is achieved precision 93.22% and recall 90.16% for a total of 55 aneurysm clusters. With this CAD system, the IA detection took less than 15 seconds, including the pre-processing and detection steps.

Conclusion: Although the external validation is required, we believe that the proposed DL model can improve clinical performance by providing automated aneurysm detection.

Safety and efficacy of the novel Alpha stent™ for the treatment of intracranial wide-necked aneurysm: A single-arm, prospective study

Junhyung Kim and Joonho Chung

Gangnam Severance Hospital, Yonsei University College of Medicine

Objective: The Alpha stent™ is a newly available intracranial stent with a modified closed-cell design to enhance wall apposition. It recently underwent structural modifications to facilitate easier stent deployment. This prospective, single-arm study aimed to evaluate the safety and efficacy of stent-assisted coil embolization for unruptured intracranial aneurysms in distal ICA using the Alpha stent™.

Methods: This prospective, single-center, open-label, single-arm study evaluated the safety and effectiveness of stent-assisted coil embolization of wide-necked aneurysms, approved by the Institutional Review Board. The study was registered with the Clinical Research Information Service (CRIS No. KCT0005841). Informed consent was obtained from each participant prior to enrollment. Between January 2021 and November 2021, 35 adult patients (median age, 60 years; 33 women [88.6%]) with 35 unruptured intracranial aneurysms were prospectively enrolled. For efficacy outcomes, magnetic resonance angiography at the 6-month follow-up was evaluated using the Raymond-Roy occlusion classification (RROC). The safety outcome evaluated the occurrence of symptomatic procedure-related neurological complications up to 6 months postoperatively.

Result: The median values for the maximum diameter and the dome-to-neck ratio were 5.52 mm and 1.17, respectively. Technical success was achieved in 34/35 (97.1%), as stent migration occurred during the retrieval of a delivery wire after stent deployment in one case. Six months postoperatively, aneurysm occlusion showed RROC I in 32/35 (91.4%) and RROC II in 3/35 (8.6%) patients. Procedure-related neurologic complications occurred in one patient (2.9%) who experienced hemiparesis due to acute lacunar infarction, which resulted in a 6-month mRS score of 1.

Conclusion: The Alpha stent demonstrated excellent efficacy and safety outcomes in stent-assisted coil embolization of unruptured distal ICA aneurysms. The stent may be particularly useful in tortuous ICA for its excellent conformability and the ability to be recaptured.

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일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Free paper IV (AVF, AVM & etc.) & Committee session IV

11월 26일(토) 09:00-10:00

[Ballroom 1]

ASTRO

응급뇌혈관질환 병원전단계
이송체계 시스템의 실제 적용 및 효과

좌장: 차재관 (동아대 신경과),
김양원 (인제대 응급의학과)

충북 스마트시티 챌린지 사업 소개

김상철

충북대 응급의학과

충청북도가 타 시도에 비해 건강관련 지표에서 열악한 것은 취약한 응급의료환경과 무관하지 않다. 보건복지부는 2차년도 응급의료기본계획에서 전국 어디서나 30분 이내에 응급의료 이용이 가능하고, 1시간 이내에 최종 치료가 가능하도록 응급의료서비스를 제공하는 것을 목표로 하였는데, 충청북도는 3개시, 8개 군 가운데 1개시와 7개 군이 응급의료 취약지에 해당하고, 4개 군에는 응급의료기관이 없다. 적절한 응급의료서비스가 제공되지 못해 발생하는 ‘치료 가능한 사망률(amenable mortality rate)’의 지역 격차가 심각하며(인구 10만 명 당 치료 가능한 사망 서울 40.4명 vs 충북 53.6명 [17]), 뇌졸중으로 인한 1개월 사망률도 충북 모든 진료권의 사망률이 전국 평균값 6.7%보다 높아 중증도를 보정한 뇌혈관질환 환자 사망비도 충북이 부산에 비해 1.5배 높다.

응급의료시스템(Emergency Medical Service System, EMS)은 병원의 응급의료서비스를 병원 전 단계까지 확장한 것으로 응급환자가 발생했을 때 병원전 단계의 응급의료서비스, 병원단계에서의 응급처치 및 재활을 통해 정상적인 사회생활을 하기 까지 제공되는 여러 요소가 관여한다. 구체적으로 응급환자 발생시 신고, 구급대원 도착시 까지 일반인의 현장 응급처치, 구급대원의 현장 전문처치 및 적절한 응급의료기관의 선정, 이송 중 처치와 전문의와의 소통을 통한 의뢰지도 등 적절한 병원이송 전까지만 해도 고려해야할 요소가 많다. 또한 중증응급환자인 경우 병원내에서는 즉각적인 응급처치와 전문과의 최종치료가 골든 타임 내에 제공되어야 환자의 합병증 및 사망위험을 감소시킬 수 있다. 이러한 응급의료제공 과정에는 응급처치를 교육받은 시민들의 참여, 지역사회 제도마련, 지방정부 및 응급의료 관련기관의 관심과 지원, 응급의료에 관한 연구 및 재정 등 여러 요소가 충분히 마련되어야 응급의료의 개선으로 이어질 수 있다.

2020년 코로나19 팬데믹으로 더욱 악화된 지역 응급의료 문제를 극복하기 위해 응급의료지역화 관점에서, 응급의료협의체내 기관들의 협력과 IT 기술로 위기상황을 극복하고자 하는 내용으로 충청북도와 함께 스마트시티 챌린지 사업에 지원하였다. 예비사업에서는 지역맞춤형 응급의료체계 확립을 위해 119 구급서비스 표준지침을 바탕으로 세부지침을 마련하여 충북 권역 내에서 발생하는 중증응급환자(심정지, 심근경색, 뇌졸중, 중증외상)의 골든타임 내 최종치료를 제공하고, 코로나(SARS-CoV-2) 의심환자의 적정병원 이송을 위해 정보통신기술(Information and Communications Technology, ICT) 기반의 응급의료서비스 구축을 내용으로 하는 “ICT-EMS”라는 이름의 예비사업을 수행하였다. 예비사업은 청주권 6개 의료기관(충북대병원, 청주의료원, 청주성모병원, 한국병원, 효성병원, 하나병원), 7개 소방서(청주서부, 청주동부, 음성, 진천, 괴산, 보은, 증평 소방서)가

참여하였고, 사업 수행을 위한 거버넌스 구축을 위해 충청북도, 응급의료기관, 주관기업(주) 시큐웨어)이 참여하는 충북권역응급의료협력체를 발족하였다(2021.6월). 참여기관 대상의 26회의 교육, 13건의 모니터링 결과보고서를 발간하였고, 이 시스템을 이용한 응급환자에서 119의 재이송률 감소 효과와 중증응급환자의 이송시간 단축효과를 확인할 수 있었다.

스마트 시티챌린지 본 사업은 충북의 응급의료체계를 개선하기 위한 그간 노력이 정부의 재정 마련으로 이어진 절호의 기회로 올해 7월부터 충북전역을 대상으로 확대하여, 충북소방본부 12개 소방서와 16개 의료기관을 대상으로 시행할 계획이다. 스마트 응급의료서비스 확산, 충북응급의료데이터 지원센터 운영, 시민참여형 스마트 응급의료리빙랩 서비스, 병원기반 영상 응급의료지도 서비스의 4가지를 시행 계획으로 담고 있다.

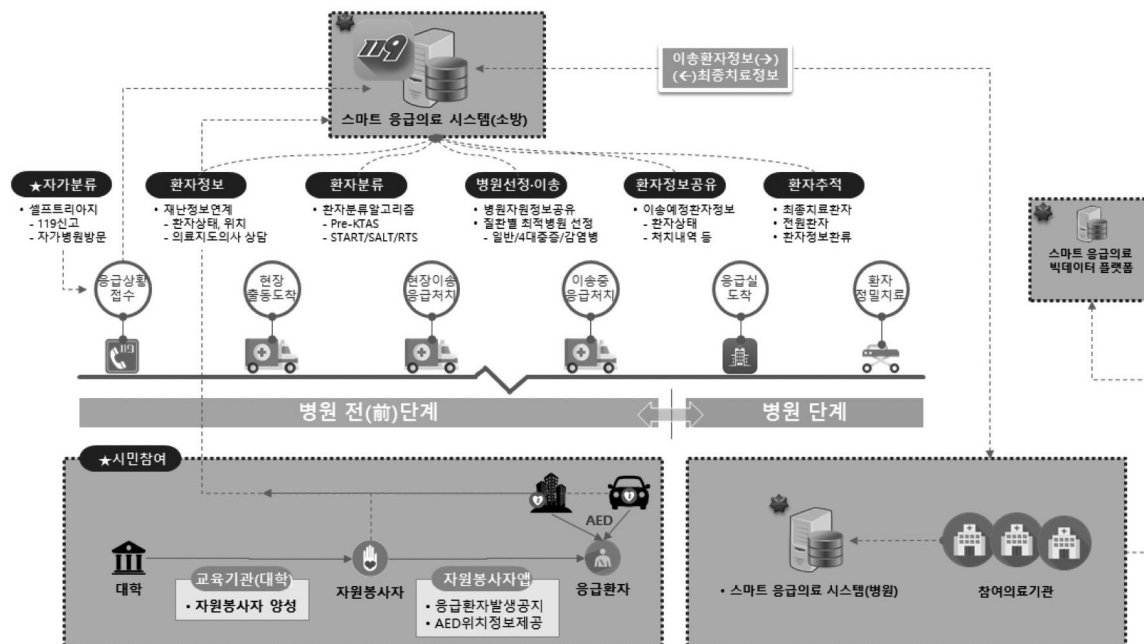


그림 1. 충북 스마트 응급의료서비스 모식도

- 스마트 시티챌린지 사업의 충북 스마트 응급의료서비스는 충북소방본부와 충북권역 응급의료기관이 상호협력하여 코로나19 팬데믹에서 지역응급의료체계 개선을 목적으로, 충북권역 내 중증응급환자 및 감염병 의심환자가 발생한 현장에서부터 중증도를 분류하고, 지역내 응급의료자원 정보를 공유하여 적절한 병원으로 이송하고, 병원내 신속한 최종치료를 제공하여 응급환자의 예후를 향상시키는 것을 목표로 하는 사업임.
- 스마트 시티챌린지 본사업은 2022년 7월부터 2023년 12월까지 충북전역 12개 소방서와 16개 응급의료기관을 대상으로, 충북 스마트 응급의료서비스 확산, 충북응급의료데이터지원센터 운영, 시민참여형 스마트 응급의료리빙랩 서비스, 병원기반 영상 응급의료지도 서비스를 내용으로 실행할 계획임.

BRAIN SAVER

이민우

한림대 신경과

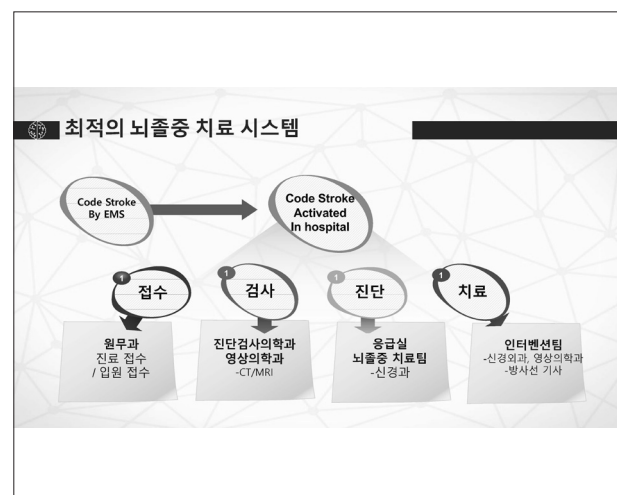
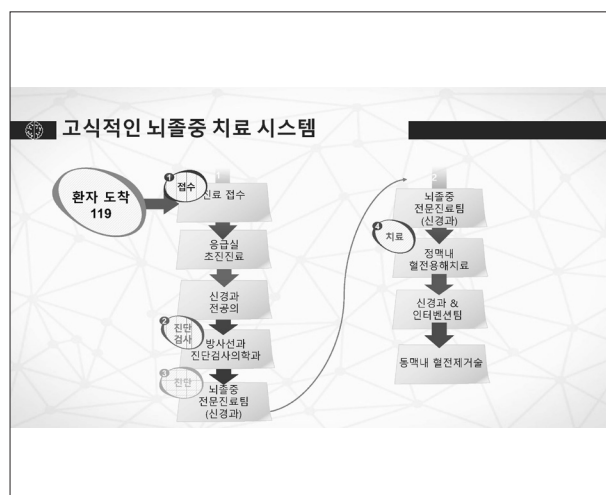
한림대학교성심병원 

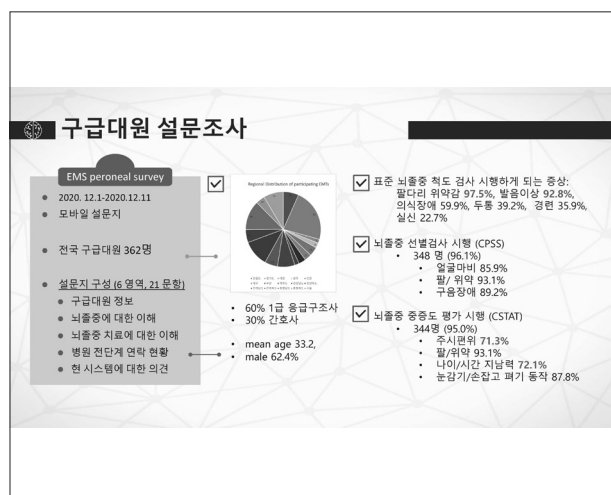
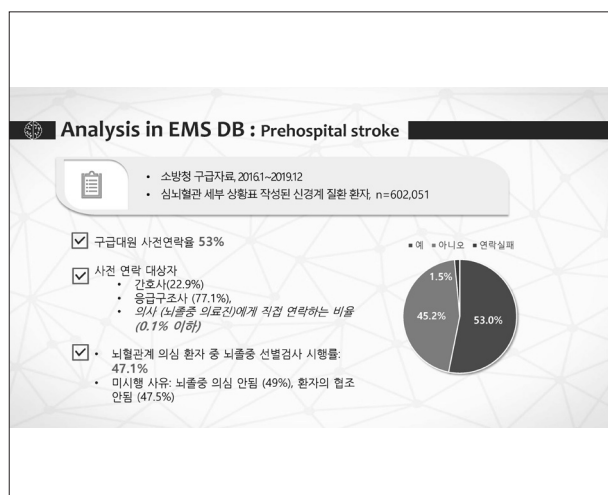
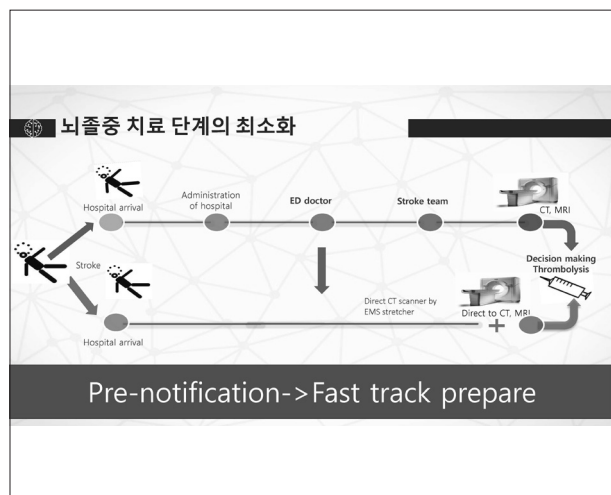
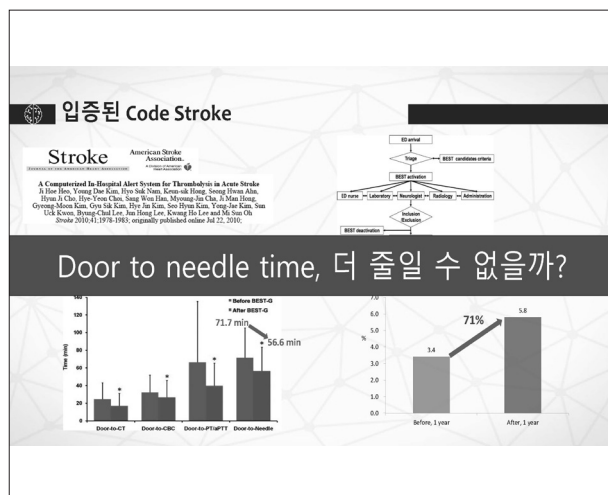
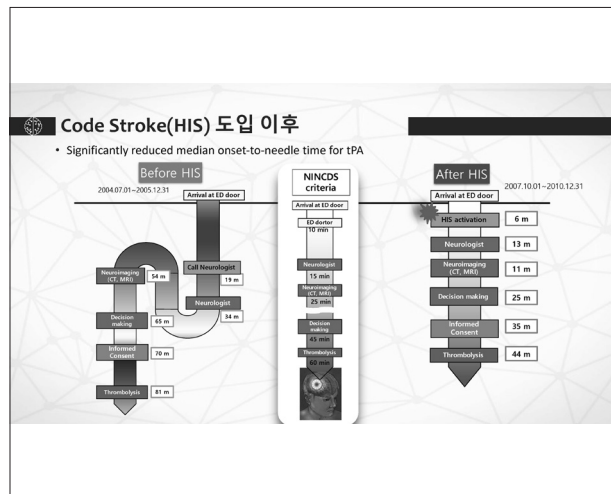
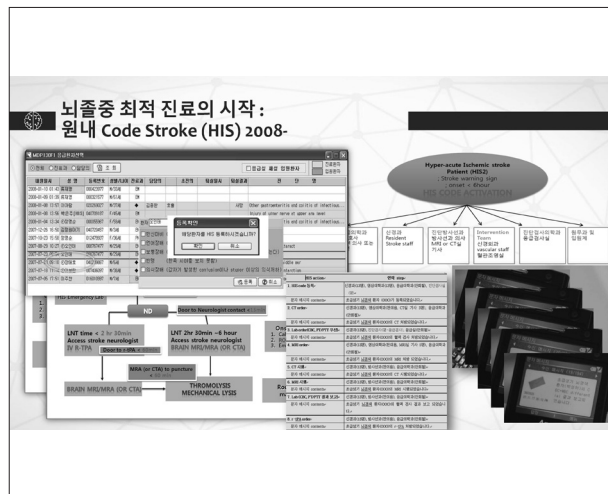
응급뇌혈관질환 병원전단계 이송체계 시스템의
실제 적용 및 효과
BRAIN SAVER

2022.11.26
이민우
한림대학교성심병원 신경과

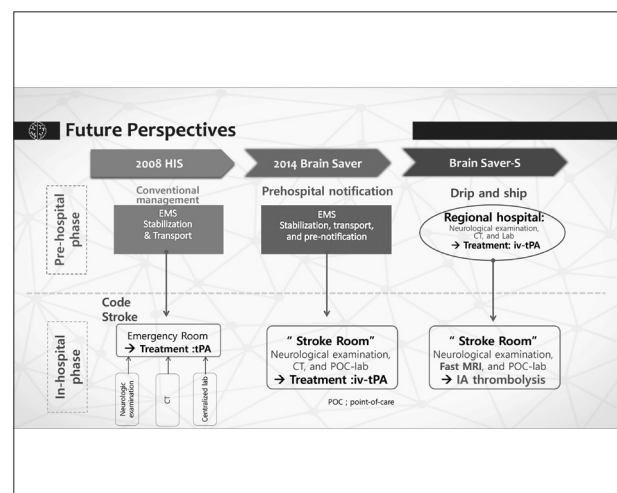
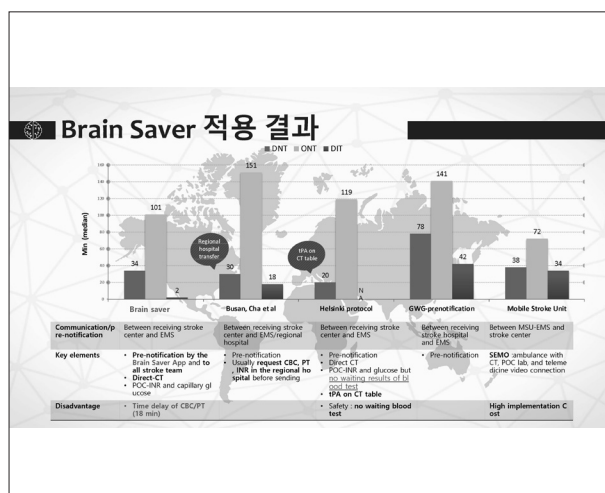
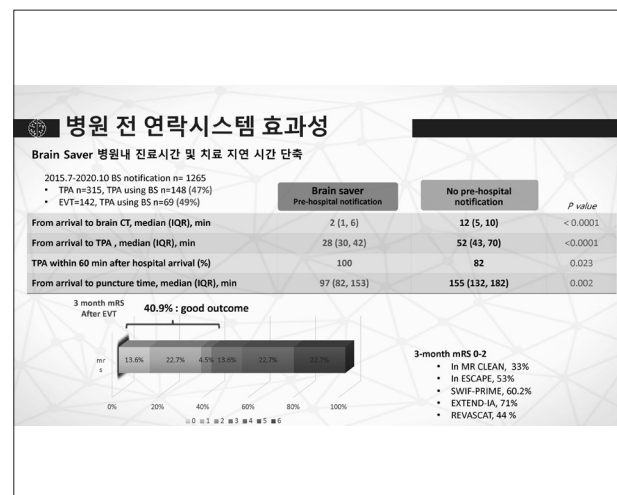
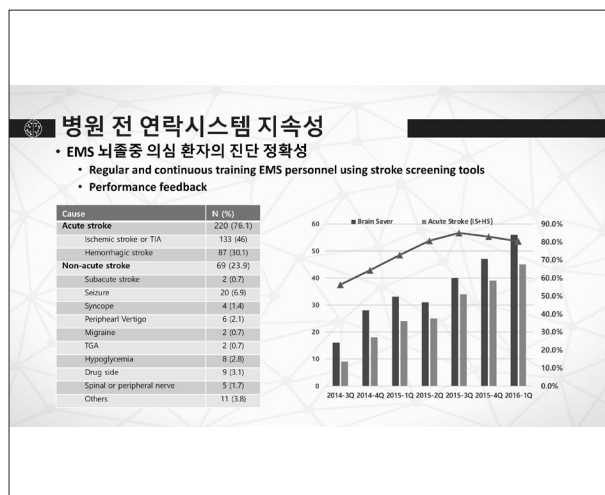
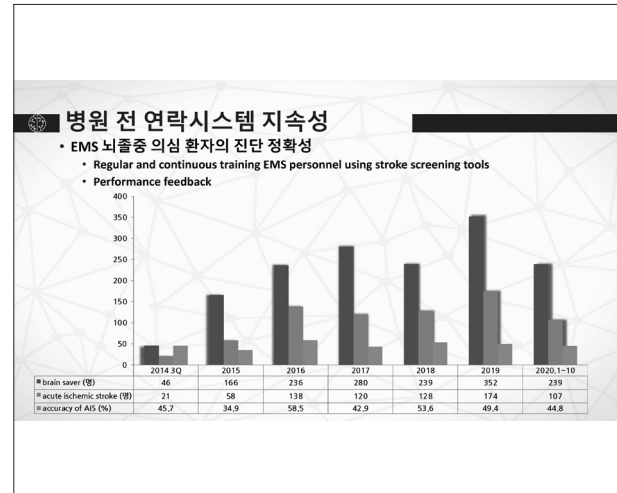
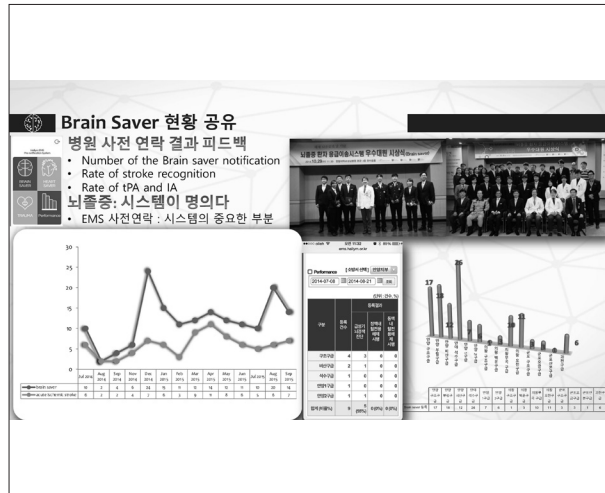
 **Agenda**

- Pre-hospital notification Era
- EMS and Patients barrier in Stroke management
- Prehospital Notification System in Anyang : Brain Saver
- Brain Saver ED
- Future Perspectives









Drip and Ship concept : Telestroke

- Remotely-directed thrombolysis (IV tPA) followed by transfer to a stroke centre (available IA thrombolysis) is an option
- Allows endovascular therapy to follow IV thrombolysis within recognised time guidelines
- Feasible even over great distances

Drip, Ship, and On-Demand Endovascular Therapy for Acute Ischemic Stroke : 전남대

Impact of Mechanical Thrombectomy on the Organization of the Management of Acute Ischemic Stroke : 프랑스

After analyzing the reliability of data in the literature, an algorithm is suggested for a pre-hospital and in-hospital alert system to improve the timeliness of subsequent treatment: a drip-and-ship approach (2015)

PLOS one 2016

Brain Saver-s mobile application platform

Brain Saver-S for Drip & Ship

- 출발 지점 (전환병원)의 위치에서 출발 예정시각 기준 합월대 이후 도착 예정시각 입력
- 병원 도착전 병원 급선뇌중환자를 활성화
- 환자 내원전, 환자 접수, Brain CTA or MRA 준비

Brain Saver-ED : EMS

Stroke algorithm and optimal transport triage

- 모바일 기반 응급이송체계 앱 (Join App for communication system) prototype 개발

The algorithm calculates the best options for Stroke Centers (TSC vs. PSC or closest center) in order of arrival time/traffic/distance

Prediction of ELVO-stroke Stroke Transport Triage

Brain Saver-ED : MD

Prehospital notification

EMS-Hospital communication

Intra-hospital communication

Interhospital communication

- CIVIL-GFAST 점수를 포함한 사전 연락
- 알고리즘을 통한 최적의 뇌졸중 센터 추천 (TSC vs PSC, 소요시간)
- 응급구조사, 의사, 의사, 의사 가 화상 및 채팅을 통한 원격 의료(지리)의료데이터 공유

Shortening ictus to Door Times

- Rapid stroke recognition : stroke, ELVO
- Rapid transport to Treatable Stroke facility (SC, TSC)
- Pre-arrival notification of Stroke facility

In the future Brain Saver-IoMT

특수장비 추가 없이 Wireless monitoring, IoT

실시간 심전도, 심박수, 호흡수

실시간 제온

실시간 산소포화도

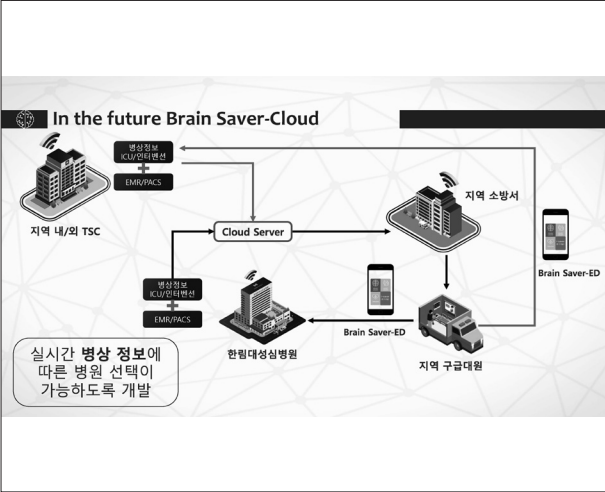
119 구급대

2차 의료기관

Prehospital Notification 뿐 아니라 Interhospital Medical Data & Image share 기능 개발 중

Halym EMS Pre-notification System

다학제 의료진



KONES의 병원전단계 시스템 제안

진성철

인제대

KoNES의 병원전단계 시스템 제안

진성철

인제대학교 해운대백병원 신경외과

병원 전 단계 이송 체계 필요성

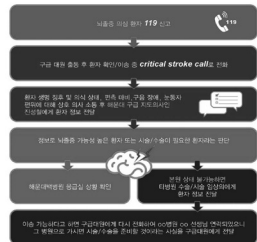
- 뇌졸중 의심 환자 발생시 소방 상황실에 각 병원 현황이 있으나 실시간 병원 별 상황을 반영하지 못함
- 각 병원 응급실 실제 상황 및 시술/수술 가능 여부를 동시에 확인하여 수술/시술이 필요하다고 의심되는 뇌졸중 환자의 병원 전 단계에서 이송 시간 단축

- 병원단계에서 수술/시술이 빨라지고 환자 임상 예후를 개선
- 응급 의료진, 시술/수술하는 의료진, 구급 대원의 상호 소통을 통해 상호 존중의 문화 형성

현 부산 소방 뇌졸중 의심 환자 병원 전 이송 체계

- “뇌졸중 의심 환자들을 병원 전 단계에서 직접 시술/수술 하는 의료진이 먼저 연락을 받아 준비하면 보다 신속하게 대처 할 수 있을 것이다”라는 자발적 동기에서 시작
- 이송이 안되는 경우에 critical stroke call (hot-line)연락

현행 부산 병원 전 단계 이송 시스템



뇌졸중 의심 환자 병원 전 이송 체계의 장점

- 핫라인을 통해 연락을 받은 환자가 시술 후 임상 결과나 예후가 더 좋았음.
- 응급실 도착 후 시술까지의 시간을 통계학적으로 유의미하게 줄일 수 있었음.

Table 1. Comparison of baseline characteristics, time of treatment stage, and clinical and radiologic outcomes between CSCP and RSP

Characteristic	CSCP (n=75)	RSP (n=96)	P Value
Initial NIHSS score (median) [IQR]	14 (8-18)	12 (8-15)	.049*
Door to puncture (median) [IQR] (min)	87 (63-107)	142 (106-177)	<.001*
Radiologic and clinical outcome [No.] (%)			
Successful recanalization (TICI ≥2)	64 (85.3)	79 (82.3)	.594*
Good clinical outcome (3-m mRS 0-2)	44 (58.7)	59 (61.5)	.711*
Excellent clinical outcome (3-m mRS 0-1)	32 (42.7)	35 (36.5)	.409*

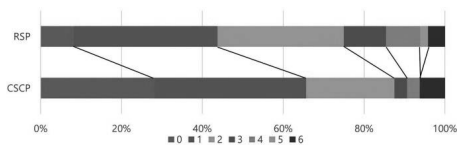
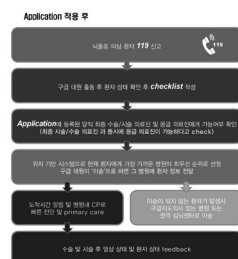


FIG 3. Graph comparing the 90-day mRS scores of the CSCP group and RSP group in the low NIHSS score (≤11 points) group.

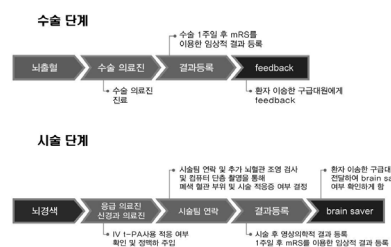
뇌졸중 의심 환자 병원 전 이송 체계의 문제점

- 일인 시스템으로 전화를 못 받으면 병원 전 이송 체계 시스템이 중단
- 당병원 진료 가능을 인적 network를 통해 알아보기 때문에 연락이 무전적으로 되는 병원으로 이송됨.
- 현재 환자에서 가장 가까운 거리에 시술할 수 있는 병원으로 이송하는 최적의 시스템이 아님
- 응급 의료진은 병원 전 환자 이송 체계에서 차순위로 밀린다는 소외감을 느낄 수 있음.

개선안



뇌졸중 의심 환자 이송 후 병원 단계 (CP적용)



병원 전 단계 시스템의 지향점

- 구급 대원/시술,수술 의료진/ 응급 의료진의 유대감 강화
- 시술/수술이 필요한 환자에게 최적의 의료 제공하여 지역 사회 의료 시스템 안정화 및 효율화에 공헌
- 지역 사회 병원의 급성 뇌혈관 치료 균형적 발전
- 향후 deep learning을 통한 예측 시스템을 추가하는 개발의 발판을 마련

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Symposium III

(Tips for device-related complications avoidance)

& Committee session V

11월 26일(토) 09:00-10:00

[Grand ballroom]

Symposium III

(Tips for device-related complications avoidance)

좌장: 고준경 (부산대),
최재형 (동아대)

Detachable coils

김성태

인제대

혈관조영기술의 개발 이후 뇌혈관질환에서 혈관내 접근을 통한 치료가 꾸준히 시도되었으며, 뇌동맥류 치료를 주 목적으로 한 Detachable coil의 개발 및 사용 이후 뇌혈관내치료의 폭발적인 보급이 이루어졌고, 이제는 뇌혈관질환의 치료에서 핵심적인 역할을 하고 있습니다.

다양한 뇌혈관내치료 관련 device가 개발되고, 사용되고 있으나, Detachable coil은 여전히 가장 많이 사용되는 device입니다. 기술이 점점 좋아지면서, Detachable coil의 성능이 많이 개선되었으며, 또한 그 종류도 점점 늘어나고 있습니다. 하지만 복잡한 구조를 가지고 있고, 아직까지 생산에 수작업이 필요하며, 시술 중 문제가 발생시 device를 직접 볼 수 없어 방사선사진과 시술자의 경험으로 판단해야 하는 점은 막상 뇌혈관내치료 중 예상하지 못한 일이 생겼을 때 complication 없이 치료를 마치기 어렵게 할 수 있습니다. 따라서 Detachable coil 를 사용할 때 발생할 수 있는 다양한 상황에 대해 미리 고민을 충분히 보고, 이에 대한 경험을 나누어 본다면 Detachable coil -related complications avoidance 할 수 있을 가능성을 높일 수 있을 것입니다.

이번 강의에서는 많이 쓰이는 Detachable coil들의 구조적인 특징에 대해서 정리해 보고, 발표자가 Detachable coil을 사용하면서 겪었던 관련된 경험을 공유해 보는 시간을 가져 보도록 하겠습니다.

Stents for coil embolization

반승필

서울대

2022 정기학술대회

Stents for coil embolization

Seoul National University Bundang Hospital

Seung Pil Ban



2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

Type of stent

Features of each stent

Considerations

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Type of stent_open cell vs. closed cell

Open cell type

Neuroform Atlas

Closed cell type

Enterprise 2 stent
LVIS Blue/EVO/Jr stent
Solitaire AB
Acclino/Accero stent
Alpha stent (modified closed cell)

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Type of stent_Laser-cut vs. Braided

Laser-cut type

Neuroform Atlas
Enterprise 2 stent
Solitaire AB
Alpha stent

Braided type

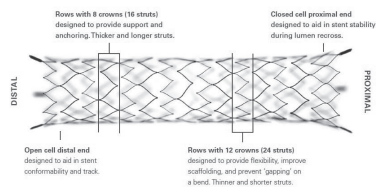
LVIS Blue/EVO/Jr stent
Acclino/Accero stent

2022 KoNES 정기학술대회

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✓ Features of each stent

- **Neuroform Atlas (Stryker Neurovascular)**
- Open cell & Laser-cut stent



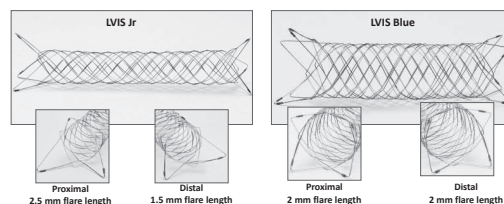
By Stryker Neurovascular

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✓ Features of each stent

- **LVIS Jr. & Blue & EVO (MicroVention)**
- Closed cell & Braided stent



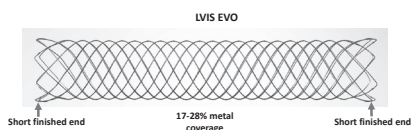
By MicroVention

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Features of each stent

- **LVIS Jr. & Blue & EVO (MicroVention)**
- Closed cell & Braided stent



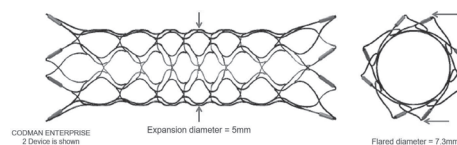
By MicroVention

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Features of each stent

- **Enterprise 2 stent (Cerenovus)**
- Closed cell & Laser-cut stent



By Cerenovus

2022 KoNES 정기학술대회

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✓ Features of each stent

- **Solitaire AB stent (Medtronic)**
- Closed cell & Laser-cut stent

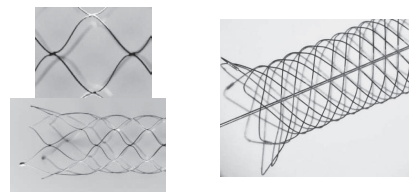


2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Features of each stent

- **Acclino & Accero stent (Acandis)**
- Closed cell & Braided stent



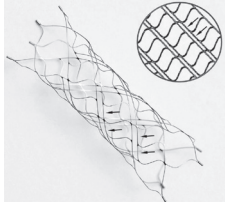
By Acandis

2022 KoNES 정기학술대회

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✓ Features of each stent

- **Alpha stent (CGBio)**
- Modified closed cell & Laser-cut stent
- : fish-scale-like closed cell



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✓ Comparison

- **Microcatheter profile**
- 0.0165"-0.017": Neuroform Atlas, LVIS Jr & EVO, Acclino (3.0-5.5 diameter), Accero
- 0.021": LVIS Blue, Enterprise 2, Alpha stent, Acclino (6.5 diameter), Solitaire AB

2022 KoNES 정기학술대회

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✓ Comparison

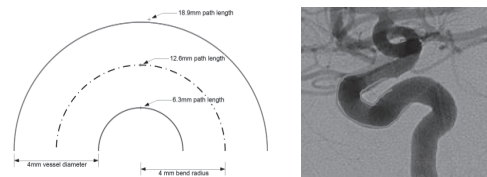
- **Diameter**
- < 5 mm: Neuroform Atlas (~ 4.5 diameter), LVIS Jr (~3.5), EVO (~ 4.0) & Blue (~ 4.5, 실재는 5.5), Accero (~ 4.5), Enterprise 2 (~ 4.0)
- ≥5 mm: Acclino (~ 6.5 diameter), Solitaire AB (~ 6.0 diameter), Alpha stent (5.0)
- **Length**
- longer length: Solitaire AB (~ 40 mm), Enterprise 2 (~ 39 mm)
- Neuroform Atlas (~ 30 mm), Accero (~ 25 mm), Acclino (~ 35 mm), LVIS Blue (~ 33mm), LVIS Jr (~ 33 mm), LVIS EVO (~ 31 mm), Alpha stent (~ 22 mm)

2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Vessel Wall Apposition

- **On tortuous anatomy**
- Distance traveled on outside of curve is longer versus the inside

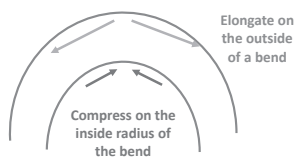


2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Vessel Wall Apposition

- **On tortuous anatomy**
- Distance traveled on outside of curve is longer versus the inside



2022 KoNES 정기학술대회

SNUH 분당서울대학교병원

✓ Permanent structural modification

- **Response to temporary clip application**
- No sign of permanent structural modification
- **Flow-diverting stent**
- Irreversibly deformed by clip application

Neurosurgery, 2011

2022 KoNES 정기학술대회

SNUH  분당서울대학교병원

Thank You !

Tips to avoid device-related complications: Flow diverter

정준호

연세대

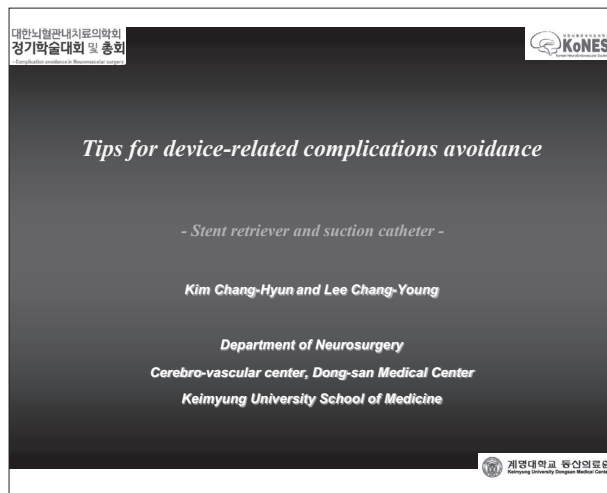
ABSTRACT

Flow diverters have become a well-accepted option for the treatment of unruptured intracranial aneurysms in clinical practice for more than a decade. However, uptake of flow-diverting technology is rapidly outpacing the availability of clinical evidence. Flow diverters are being more broadly applied to small aneurysms, anterior cerebral artery aneurysms, middle cerebral artery aneurysms, recurrent aneurysms, dissecting aneurysms, ruptured aneurysms, and posterior circulation aneurysms. According to the safety issues of using flow diverters, it is very important to know about tips to avoid procedure-related complications. Moreover, we need to get used to the tips in real world practice. The appropriateness of flow-diverting treatment must be decided on a case-by-case basis, considering experience and the relative risks against standard approaches or observation. Therefore, a comprehensive overview of technical specifications alongside key outcome data is essential for proper decision-making and to avoid procedure-related complications. We are very familiar with sharing and discussing about what we have experienced in our clinical practice to reduce the rate of complications and to minimize procedure-related adverse events. Not only to cope with, but to prevent those events is very important practically. Here, the author reviews some tips to avoid device-related complications and speculates possible future directions of using flow diverters.

Suction catheter and stentriever

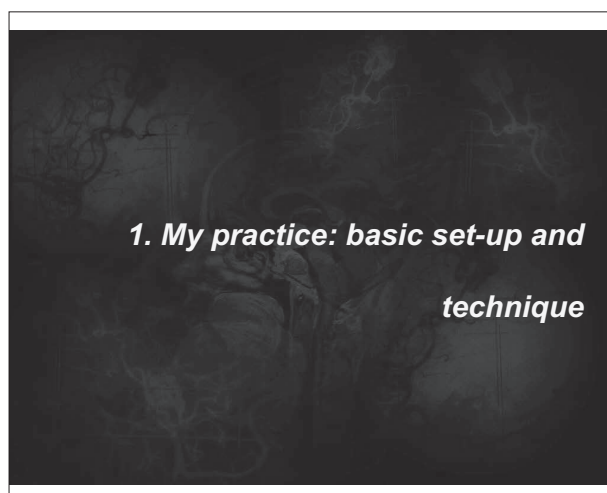
김창현

계명대



- Possible complications for thrombectomy -

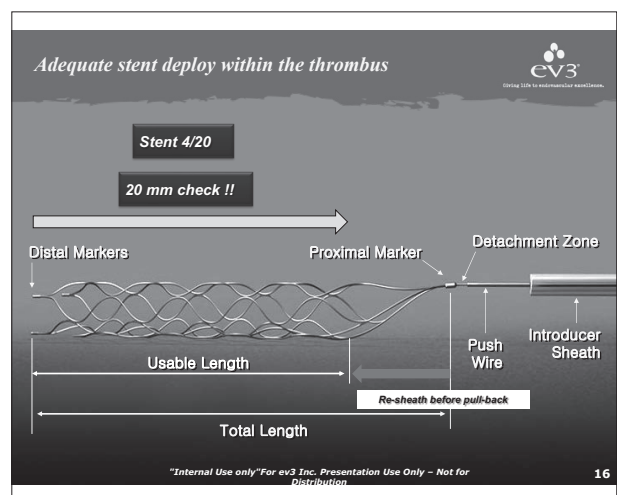
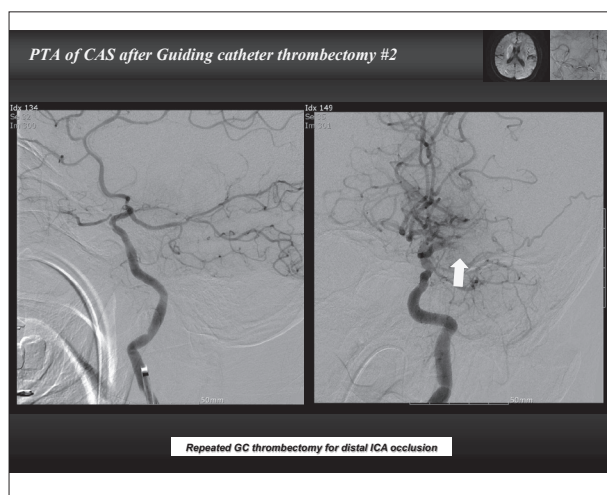
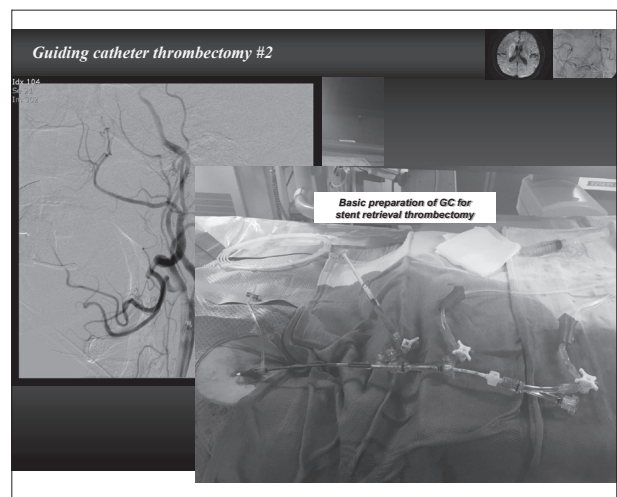
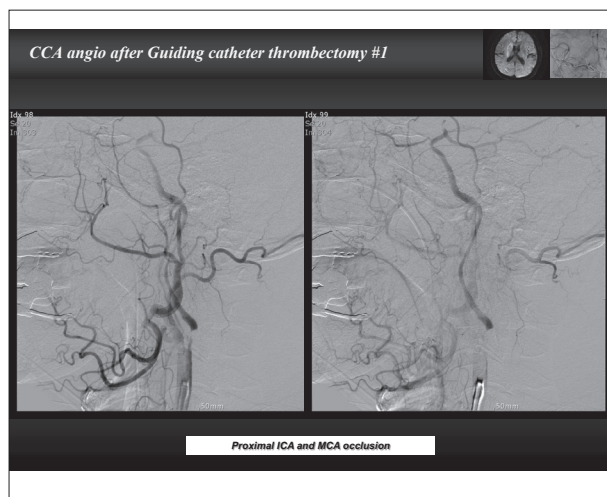
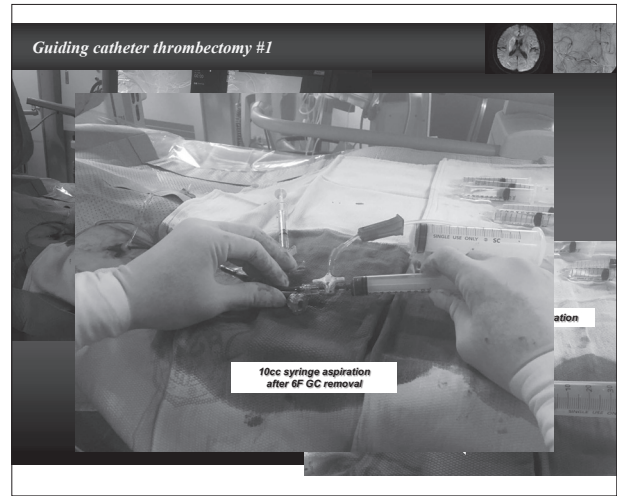
1. Preoperative, perioperative (intra-procedural), postoperative complication – influence morbidity and mortality!
2. Preoperative: patient selection and efficacy of EVT
3. Device- or procedure-related complication: 4 – 29%, extra- vs. intra-cranial
 1. Extra-cranial: access difficulties, iatrogenic dissection, vasospasm
 2. Intracranial: hemorrhagic (vessel perforation, SAH etc.) and ischemic (embolization within the same or new vascular territory)
4. Post-operative complication: hemorrhagic transformation, re-occlusion

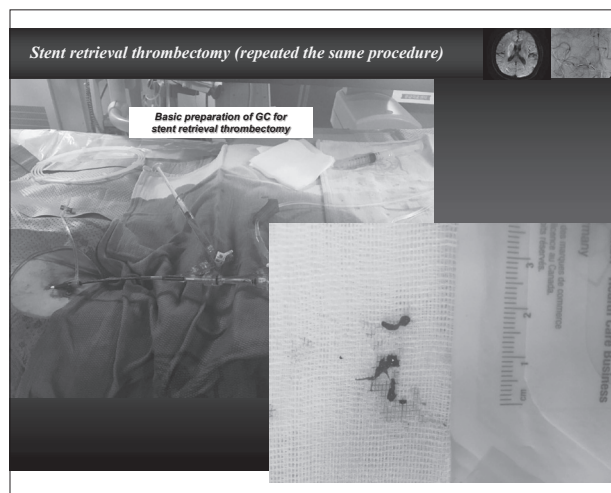
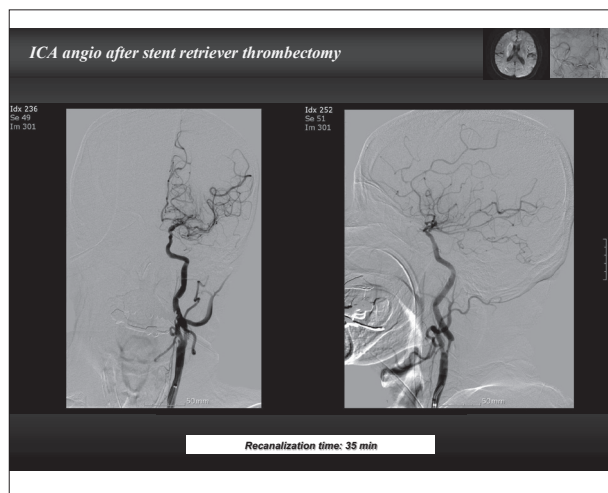
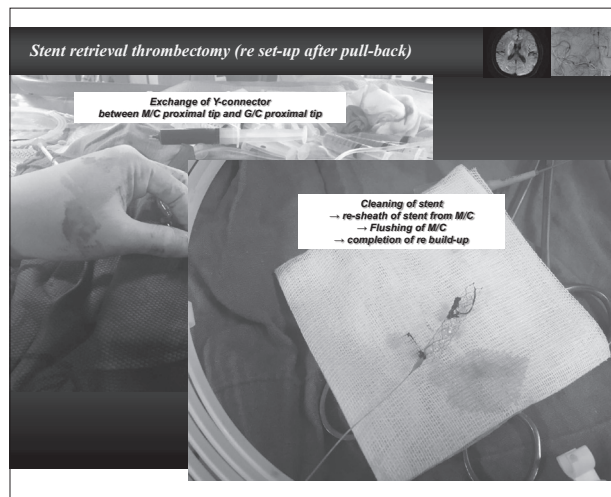
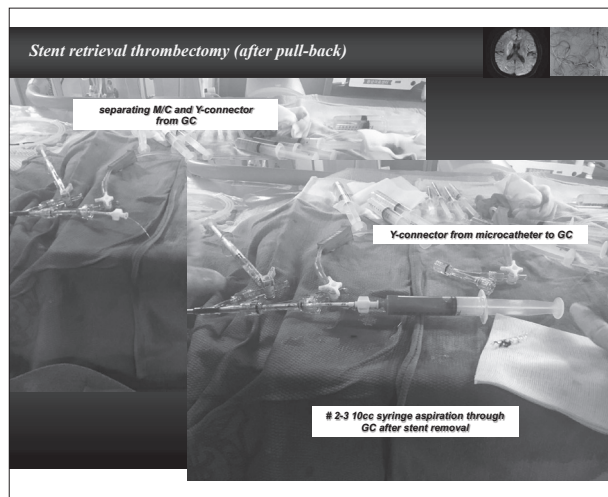
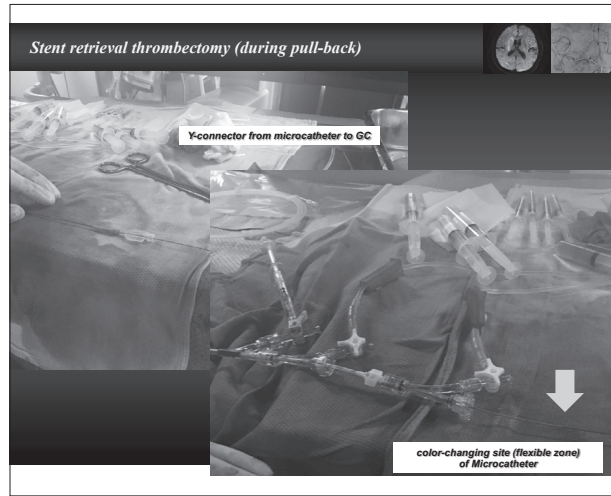
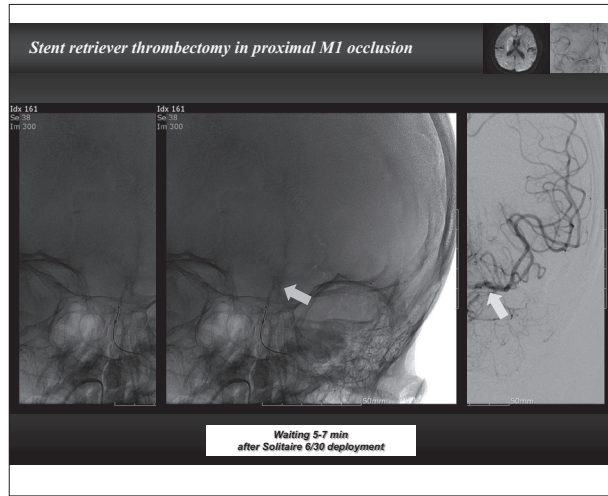


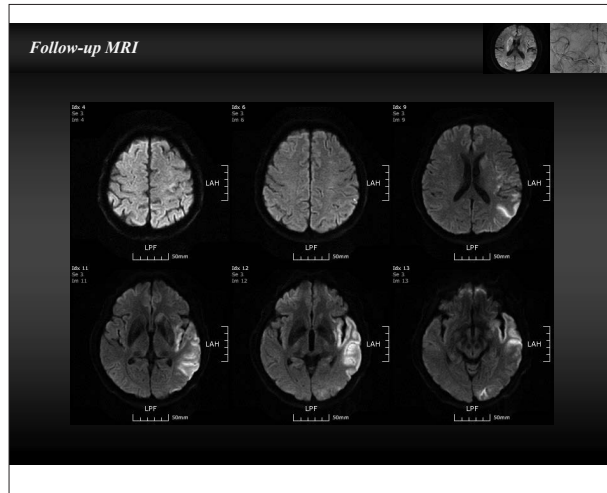
ER Order just before transferring to AR

- Prepare Intravenous anesthesia, **Precedex** (dexmedetomidine) – no respiratory depression
- Prepare **Tirofiban** for intra – arterial or – venous injection
- L-tube: 5분이 넘으면 stop !! 필요하면 angio-room 에서 시행.
- **IV-line**: 잘 안 들어가서 못 채우면 procedure 에 많은 어려움. 확실한 line 을 잡는 것이 중요!! 움직이면 엄청 짜증나죠!!
- Foley catheterization: 5분이 넘으면 stop !!
- Transfer to Angiography room

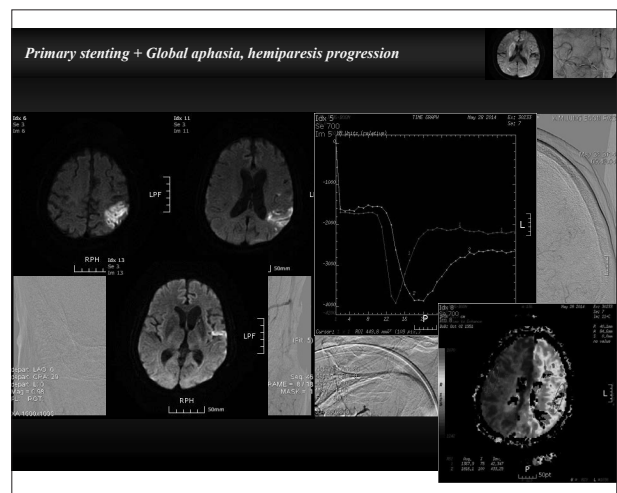
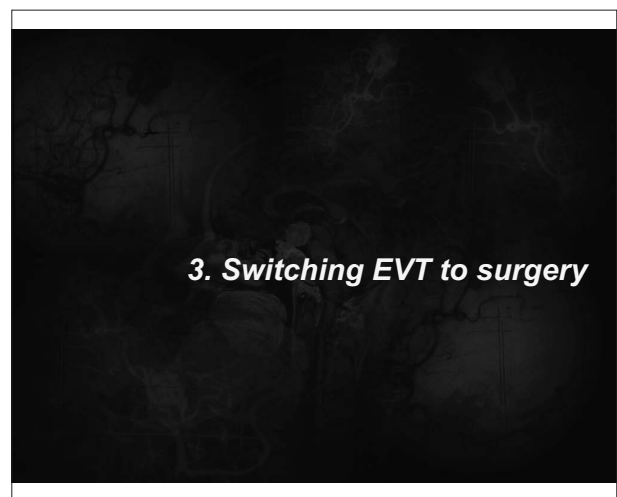


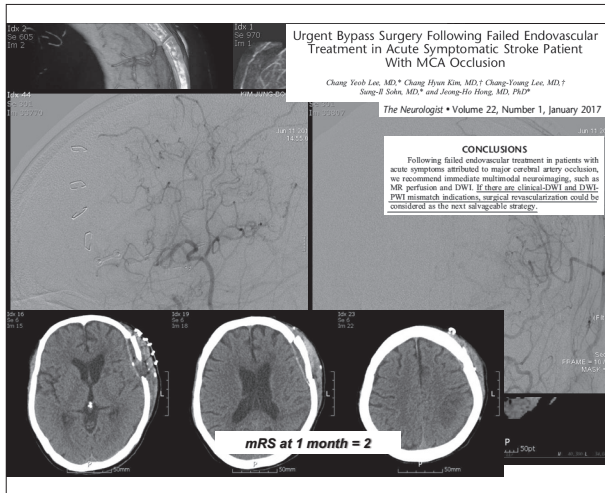






- Case presentations -**
1. Access difficulties for vessel tortuosity
 2. Exchange angiocatheter to BGC and intermediate catheter through stiff exchange wire
 3. Very tortuous intracranial vessel
 4. Too much movement of the patient related with accurate visualization of vessel
 5. Trying to force open a occluded vessel
 6. Early determination of rescue stenting without repetitive conventional thrombectomy: the timing for use of rescue stenting or balloon angioplasty
 7. ICAS: use of statin, anti-plt before iv- tirofiban after thrombectomy





4. How to lower procedure-related complication: summary!

- Avoidance of complications for thrombectomy -

1. Protocol of routine procedure needs to be set for safety and efficacy of EVT!!
2. For avoidance of complications, awareness of potential complication of EVT, immediate recognition, appropriate management, and implementation of prevention strategies is necessary. (하기 전에 어떤 게 생길 수 있는 지 알아야 하고, 발생하면 즉시 알아야 하고, 적절히 치료해야 되고, 예방적 전략을 해야 됨!)
3. Reperfusion catheter vs. stent retriever: difference?
4. For avoiding complication, it needs to use stent retriever and reperfusion catheter adequately!

- Avoidance of complications for thrombectomy -

1. You should set the anesthesia method earlier. (intra-venous or general?, in accordance with hospital condition)
2. You should not repeat the same procedure over 2-3 times during MT, without the thrombus retrieved and the vessel opened.
3. First-pass recanalization can decrease the complication rate.
4. Rapid recanalization is important to lower the complication.
5. It does not mean the rush or haste of the procedure.
6. Be careful to manipulate the microcatheter, microwire and delivery wire of stent retriever for vessel perforation or dissection.
7. You should control the friction between intermediate catheter and microcatheter, to loosen the friction.

Thank you for your attention !!!



2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토)

장소_ 시그니엘 부산

Symposium III

(Tips for device-related complications avoidance)

& Committee session V

11월 26일(토) 09:00-10:00

[Ballroom 1]

Committee session V

(WFITN 2026 준비모임)

좌장: 신용삼 (가톨릭대)

2022

대한뇌혈관내치료의학회 정기학술대회 및 총회

일시_ 2022년 11월 25일(금)-26일(토) 장소_ 시그니엘 부산

E-poster presentation

11월 26일(토) 11:40-12:10

좌장: 김영우 (가톨릭대), 강동훈 (경북대)

- | | | |
|------|---|-------------------|
| P-01 | Contrast-induced encephalopathy after stent-assisted coil embolization; A case report | 조병래(가톨릭대 인천성모병원) |
| P-02 | Predictors for intracerebral hemorrhage after intravenous or intraarterial recanalization in acute major cerebral artery occlusion in Korean patients | 조병래(가톨릭대 인천성모병원) |
| P-03 | Predictors of intracranial hemorrhage after mechanical thrombectomy using a stent-retriever for anterior circulation ischemic stroke | 이인형(고려대 안산병원) |
| P-04 | Case report: Cerebral hyperperfusion syndrome presented as intracranial hemorrhage after carotid angioplasty | 김우진(서울대병원) |
| P-05 | Endovascular treatment for ruptured bifurcation aneurysm with Woven EndoBrige device; a case series in single institution | 이상윤(연세대 강남세브란스병원) |
| P-06 | Source Image Based New 3D Rotational Angiography for Differential Diagnosis between the Infundibulum and an Internal Carotid Artery Aneurysm: Pilot Study | 박준형(연세대 세브란스병원) |
| P-07 | Delays in Intracerebral Hemorrhage Management Is Associated with Hematoma Expansion and Worse Outcomes: Changes in COVID-19 Era | 이서윤(연세대 세브란스병원) |
| P-08 | A retrospective study of recurrent Aneurysmal subarachnoid hemorrhage, more than once in life-time | 황의현(아주대병원) |
| P-09 | A comparison of endovascular strategies in the reconstructive endovascular treatment for VBA dissecting aneurysm: a retrospective study | 서동욱(순천향대 서울병원) |
| P-10 | Consideration in the endovascular treatment of my two blood blister like aneurysms | 윤별희(의정부 을지대병원) |
| P-11 | Risk factors for recanalization of basilar tip aneurysm after endovascular treatment: a retrospective cohort study | 김민정(연세대 세브란스병원) |

2022 대한뇌혈관내치료의학회 정기학술대회 및 총회

- | | | |
|-------------|--|-------------------|
| P-12 | Is a small coil more effective as a finishing coil for the embolization of intracranial aneurysms? : Outcomes using GALAXY G3TM MINI micro-coils as finishing coils in a single center | 김상욱(명지성모병원) |
| P-13 | Predictive Factors of Recurrence after Endovascular Treatment of Unruptured Vertebrobasilar Fusiform Aneurysms | 김재현(계명대 동산병원) |
| P-14 | Autoimmune rheumatic disease associated with intracranial aneurysm or dissection | 이한결(순천향대 서울병원) |
| P-15 | A case of Y-stent assisted coil embolization for ruptured large basilar top aneurysm and review of single center experiences | 이승언(울산대병원) |
| P-16 | Y-stent-assisted coiling with Neuroform Atlas stents for wide-necked intracranial bifurcation aneurysms: A preliminary report | 오명석(연세대 강남세브란스병원) |
| P-17 | Direct Cannulation of a calvarial Diploic Vein for Embolization of a Symptomatic Intraosseous Arteriovenous Fistula | 도성호(강동경희대병원) |
| P-18 | Efficacy and safety of new torque-controlled angiographic catheter in cerebral angiography: A pilot study | 신승민(순천향대 천안병원) |
| P-19 | Ruptured Infundibular dilatation of the posterior communicating artery | 윤수지(연세대 세브란스병원) |
| P-20 | One-year Clinical, Radiologic, and Safety Outcome of Surpass Evolve Flow Diverter: Tertiary single center, consecutive series of 40 patients study | 김강우(연세대 강남세브란스병원) |
| P-21 | Experience of Subacute Re-occlusion after Successful Recanalization by Mechanical Thrombectomy in Patients with Large Vessel Occlusion | 오신우(가톨릭대 성빈센트병원) |
| P-22 | Successful Recovery of Lateral Medullary Syndrome after Giant Vertebral Artery Dissecting Aneurysm: case study | 정창현(노원 을지대병원) |
| P-23 | The risk of unusual intracranial hemorrhage caused by dural AVF | 최우석(차의과학대 분당차병원) |
| P-24 | The optimal thresholds of P2Y12 reaction unit and inhibition rate for predicting in-stent restenosis following carotid artery stenting | 권민용(분당서울대병원) |
| P-25 | Early experience of mechanical thrombectomy for Large Vessel Occlusion | 윤기용(순천향대 천안병원) |
| P-26 | Isolated Hippocampal Infarction after Mechanical Thrombectomy for Anterior Circulation Acute Ischemic Stroke: A Case Report | 김미경(명지성모병원) |
| P-27 | Treatment of growing giant thrombosed basilar artery tip aneurysm after multi-times stent-assisted coiling | 성승빈(분당서울대병원) |
| P-28 | Clinical outcome of coil embolization for ruptured intracranial aneurysms by region and hospital size: Nationwide cohort study in Korea | 류봉규(분당서울대병원) |
| P-29 | Delayed stent stenosis due to stretch of a flow diverter used to treat giant cervico-petrous internal carotid artery aneurysm | 임정현(분당서울대병원) |

Contrast-induced encephalopathy after stent-assisted coil embolization; A case report

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

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

Objective: Contrast-Induced encephalopathy (CIE) has been defined as a new onset of neurological deficits after contrast exposure that can be observed following endovascular treatment for intracranial aneurysms. It is known to be a very rare complication. Here, we would like to present a case of CIE after stent-assisted coil embolization for unruptured A-com aneurysms.

Methods: A 74-year-old male patient visited our department with an incidentally found A-com aneurysms. He has a history of undergoing chemotherapy and radiotherapy for colon cancer and non-small cell lung ca. As a result of digital subtraction angiography, three aneurysms were found at an ant. communicating artery, each with sizes of 8 mm, 5 mm, and 2.5 mm. We planned stent-assisted coil embolization for two large aneurysms under general anesthesia.

Result: The procedure was completed without any major problems, and the patient recovered well from anesthesia after the procedure. Four hours after the procedure, the patient showed a confused mentality and left-side weakness of grade 2. A nonenhanced brain CT scan shows gyriform enhancement and effacement of the sulci in the right cerebral hemisphere. There is no mass effect or hemorrhage. Diffusion-weighted MR scan showed no acute infarction. The patient was transferred to the NICU, 25% mannitol, anticonvulsant, and dexamethasone were administered, and massive hydration was performed. Three days after the procedure, the patient recovered spontaneously without any sequelae.

Conclusion: In most patients who develop CIE, symptoms fully recover within a few days. But in a small percentage of patients, neurological deficits may be permanent, and in an even smaller number, the degree of cerebral swelling can be fatal. Therefore, the possible symptoms and treatment of CIE should always be considered.

Predictors for intracerebral hemorrhage after intravenous or intraarterial recanalization in acute major cerebral artery occlusion in Korean patients

Byung-rae Cho, Dong-Kyu Jang, Kyung-sool Jang, Byung-Hoo Moon

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

Objective: To evaluate predictors for intracerebral hemorrhage (ICH) and 1-month mortality after intravenous (IV) or intraarterial (IA) recanalization therapy for major cerebral artery occlusion in Korean patients.

Methods: From 2011 to 2015, we prospectively gathered data from consecutive patients treated with IV/IA recanalization within 8 h of symptoms in a single center. The effects of demographic, clinical, laboratory, and radiological factors on ICH within 2 weeks were assessed, as well as 1-month mortality.

Result: From a total of 183 patients, symptomatic intracerebral hemorrhage (SICH) occurred in 32 patients (17.5%), and asymptomatic ICH occurred in 37 patients (20.2%). The mortality rate at 1 month in ICH patients was 37.7%. The international normalized ratio (INR) (OR, 4.9; 95% CI, 1.03-23.4; $p = 0.046$), glucose (OR, 1.119 per mmol/L; 95% CI, 1.015-1.233; $p = 0.023$), medium-volume infarct (15-69.9 mL) (OR, 2.62; 95% CI, 1.1-6.26; $p = 0.03$), large-volume infarct (≥ 70 mL) (OR, 5.54; 95% CI, 2.1-14.6; $p = 0.001$), and angioplasty or stenting (OR, 6.29; 95% CI, 1.71-23.22; $p = 0.006$) were predictors of any ICH. Hyperlipidemia or statin medication (OR, 4.17; 95% CI, 1.38-12.59; $p = 0.011$), INR (OR, 7.13; 95% CI, 0.94-54.22 $p = 0.058$), and large-volume infarct (≥ 70 mL) (OR, 7.96; 95% CI, 2.31-27.39; $p = 0.001$) were predictors of SICH. Hypertension (OR, 5.77; 95% CI, 1.43-23.3; $p = 0.014$), initial NIHSS score (OR, 1.09; 95% CI, 1.01-1.18; $p = 0.27$), and SICH (OR, 15.7; 95% CI, 4.04-61.08; $p < 0.001$) were predictors of 1-month mortality.

Conclusion: INR and glucose may be strong modifiable predictors of critical ICH leading to death after IV/IA recanalization therapy in acute cerebral artery occlusion.

P-03

Predictors of intracranial hemorrhage after mechanical thrombectomy using a stent-retriever for anterior circulation ischemic stroke

In-Hyoung Lee, Sung-Kon Ha, Dong-Jun Lim, and Jong-Il Choi

Department of Neurosurgery, Korea University Ansan Hospital, Korea University College of Medicine

Objective: Intracranial hemorrhage (ICH) after mechanical thrombectomy (MT) is a potentially catastrophic complication. We aimed to identify predictors of hemorrhagic complications following MT using a stent-retriever (SR) for acute ischemic stroke (AIS) patients due to large vessel occlusion (LVO) of anterior circulation.

Methods: In consecutive AIS patients, the clinical and procedural variables were retrospectively analyzed. ICH was evaluated on computed tomography performed 24 hours following MT and dichotomized into asymptomatic ICH and symptomatic ICH (SICH) depending on the presence of neurological deterioration. Using univariate and multivariate analyses, the predictors of ICH and SICH were identified. The optimal cut-off value for predicting SICH was determined by receiver operating characteristic (ROC) analysis.

Result: Among 135 patients, ICH was detected in 52 (38.5%), and 17 (12.6%) were classified as having SICH. We found that serum glucose level (OR 1.016, $p=0.011$) and number of SR passes (OR 2.607, $p=0.028$) were the optimal cut-off values for predicting SICH.

Conclusion: In conclusion, serum glucose level and SR pass serve as predictors for any form of ICH in LVO-induced AIS patients undergoing MT. Moreover, patients with lower ASPECTS, prolonged OTP, and multiple SR passes are more vulnerable to SICH.

Case report: Cerebral hyperperfusion syndrome presented as intracranial hemorrhage after carotid angioplasty

WOOJIN KIM

Seoul National University Hospital (SNUH)

Objective: Carotid angioplasty of the cervical segment is an effective procedure for the treatment of carotid artery disease. In rare cases, more often in patients with severe stenosis, intracranial hemorrhage can happen, which is a presentation of cerebral hyperperfusion syndrome.

Methods: This is a case report.

Result: We report a case of 78-year-old man who underwent carotid angioplasty for unilateral severe occlusion of proximal ICA and ipsilateral basal hypoperfusion on SPECT. The patient presented disorientation, irritability 2 hours after carotid angioplasty. Brain CT was performed and Lt P-O ICH & bilateral IVH, and hydrocephalus was found. Bilateral EVD insertion was performed immediately. The patient maintained aspirin monotherapy after the event. After acute treatment of intracranial hemorrhage, both EVD was removed, but GCS score of the patient remains E4V4M2.

Conclusion: Cerebral hyperperfusion syndrome is a rare but severe complication of carotid revascularization. Neurosurgeons should be aware of CHS, so treatment can be established at an early stage.

P-05

Endovascular treatment for ruptured bifurcation aneurysm with Woven EndoBridge device; a case series in single institution

Sang Yoon Lee, M.D.¹⁾, Jun Hyeong Park, M.D.²⁾, Hyun Jin Han, M.D.²⁾,
Keun Young Park, M.D., Ph.D.²⁾

Department of Neurosurgery, ¹⁾Gangnam Severance Hospital and ²⁾Severance Hospital, Yonsei University College of Medicine, Seoul, Korea

Objective: Ruptured aneurysm is one of the fatal hemorrhagic stroke and early aneurysm secure was essential to prevent catastrophic rehemorrhage. Endovascular coiling is the standard treatment for ruptured aneurysm. However, its durability and antiplatelet medication are still limitations of coiling. Woven EndoBridge (WEB; MicroVention) is new device for bifurcation aneurysm. Here, we aimed to report the early safety and efficacy of WEB device for the treatment of ruptured aneurysm.

Methods: A total of 85 aneurysms in 83 patients were treated in single institution. Among them, five patients (M:F=3:2, mean 61 years old) were treated with WEB device between December 2021 and April 2022. Clinical and radiographic characteristics and clinical and angiographic outcomes were retrospectively evaluated.

Result: Three aneurysm were anterior communicating artery (Acom) and two were middle cerebral artery bifurcation (MCbif). Mean width of aneurysm was 4.4mm with a 3.6mm of height and 3.1mm of neck. All procedures were successfully conducted. Except one case (#4), SOFIA intermediate catheter (MicroVention) was routinely used. In 4 cases (#1,2,3,4) Headway 017 or 021 microcatheter (MicroVention) were used, while VIA 017 microcatheter (MicroVention) in one case (#5). During the procedure, neck thrombosis was identified and successfully resolved using intraarterial Tirofiban infusion without any morbidity (#1 and 3). During the follow up (mean 5.6 months), there was no re-hemorrhage. The latest clinical outcomes were mRS 0 (#1; 6 months), 5 (#2; 1 month), 4 (#3; 6 months), 0 (#4; 6 months), and 0 (#5; 6 months), respectively. At the latest follow up, WEB occlusion grade A was achieved in 2 cases and B was achieved in 3 cases, even though WEB morphologic change was noted in 2 cases.

Conclusion: Woven EndoBridge device seemed to be a safe and technically feasible treatment modality for ruptured bifurcation aneurysms. However, further study is needed to evaluate long term results.

Source Image Based New 3D Rotational Angiography for Differential Diagnosis between the Infundibulum and an Internal Carotid Artery Aneurysm: Pilot Study

Jun Hyeong Park¹⁾, Hyeongyu Jang²⁾, Woo Sang Jung^{3,4)}, Seong Uk Myoung⁵⁾, Jung-Jae Kim¹⁾, Chang Ki Jang⁶⁾, Kwang-Chun Cho⁶⁾

¹⁾Department of Neurosurgery, Severance Hospital, College of Medicine, Yonsei University, ²⁾Department of Neurosurgery, International St. Mary's Hospital, College of Medicine, Catholic Kwandong University, ³⁾Department of Radiology, Ajou University Hospital, College of Medicine, Ajou University, ⁴⁾Department of Radiology, College of Medicine, Kangwon National University, ⁵⁾Department of Radiology, Bundang Jesaeng General Hospital, ⁶⁾Department of Neurosurgery, Yongin Severance Hospital, College of Medicine, Yonsei University

Objective: Distinguishing between an infundibulum and a true aneurysm is clinically important. This study aimed to evaluate whether using source image based new three-dimensional rotational angiography (S-n3DRA) can increase the rate of aneurysm detection and improve distinction between a true aneurysm and an infundibulum.

Methods: Twenty-two consecutive patients with 23 lesions, were evaluated by time-of-flight (TOF) magnetic resonance angiography (MRA), S-n3DRA, and digital subtraction angiography (DSA). The data were retrospectively and independently reviewed by two neurointerventionists, and the diagnoses based on TOF MRA, S-n3DRA, and DSA were compared. The diagnostic efficacy (interobserver agreement and diagnostic performance) of S-n3DRA was compared with that of TOF MRA.

Result: S-n3DRA showed higher interobserver agreement ($\kappa=0.923$) than TOF MRA ($\kappa=0.465$) and significantly higher accuracy than MRA in distinguishing an aneurysm from an infundibulum ($p=0.0039$).

Conclusion: Compared to MRA, S-n3DRA could provide better screening accuracy and information for distinguishing an aneurysm from an infundibulum. Therefore, S-n3DRA has the potential to reduce the need for DSA.

P-07

Delays in Intracerebral Hemorrhage Management Is Associated with Hematoma Expansion and Worse Outcomes: Changes in COVID-19 Era

Seoyun Lee, Hyun Jin Han, Keun Young Park, Junhyung Kim, Woosung Lee, Yun Ho Lee, Chang Ki Jang, Kwang-Chun Cho, Sang Kyu Park, Joonho Chung, Young Sub Kwon, Yong Bae Kim, Jae Whan Lee, and So Yeon Kim

Severance Hospital, Yonsei University College of Medicine

Objective: The coronavirus disease 2019 (COVID-19) pandemic disrupted the emergency medical care system worldwide. We analyzed the changes in the management of intracerebral hemorrhage (ICH) and compared the pre-COVID-19 and COVID-19 eras.

Methods: From March to October of the COVID-19 era (2020), 83 consecutive patients with ICH were admitted to four comprehensive stroke centers. We retrospectively reviewed the data of patients and compared the treatment workflow metrics, treatment modalities, and clinical outcomes with the patients admitted during the same period of pre-COVID-19 era (2017–2019).

Result: Three hundred thirty-eight patients (83 in COVID-19 era and 255 in pre-COVID-19 era) were included in this study. Symptom onset/detection-to-door time [COVID-19; 56.0 min (34.0–106.0), pre-COVID-19; 40.0 min (27.0–98.0), $p=0.016$] and median door to-intensive treatment time differed between the two groups [COVID-19; 349.0 min (177.0–560.0), pre-COVID-19; 184.0 min (134.0–271.0), $p<0.001$]. Hematoma expansion was detected more significantly in the COVID-19 era (39.8% vs. 22.1%, $p=0.002$). At 3-month follow-up, clinical outcomes of patients were worse in the COVID-19 era (Good modified Rankin Scale; 33.7% in COVID19, 46.7% in pre-COVID-19, $p=0.039$).

Conclusion: During the COVID-19 era, delays in management of ICH was associated with hematoma expansion and worse outcomes.

A retrospective study of recurrent Aneurysmal subarachnoid hemorrhage, more than once in life-time

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Objective: Although subarachnoid hemorrhage(SAH) accounts for 5% of overall stroke, it is devastating stroke with high mortality and morbidity. Furthermore, reexperience of SAH is rare. This study investigated the clinical outcome of aneurysmal subarachnoid hemorrhage(aSAH) patients whom experienced more than once in lifetime.

Methods: Patients who were treated for ruptured intracranial aneurysm from September 2008 to October 2022 in our hospital were included. We analyzed these patients about new or previous episode of SAH. Depending on the cause, the patients were divided into two groups, recurrent aneurysmal rupture, and de novo aneurysmal rupture. Clinical and radiological data was collected, and categorized into aneurysm location, treatment type, aneurysm size and ruptured aneurysm status.

Result: In the 14 past years, 73 patients with 79 intracranial aneurysms were treated by clipping or coiling of recurrent SAH in our hospital. Nineteen patients were experienced aSAH more than once in lifetime. There were 14 recurrent aneurysmal ruptured patients and four de novo aneurysmal ruptured patients. Most patients were experienced the second time aSAH except one patient was three times. Mean durations between the first attack and the next attack were 9.6 years. De novo aneurysm ruptured was more than high modified Rankin Score(mRS) than recurrent aneurysmal aneurysm ruptured.(3.73 vs 4.75) Both Anterior and posterior communicating artery were frequent locations of ruptured points. There was no clear difference in the treatment method at the first episode of aSAH.(47.4% vs 52.6%) Second treatment methods were more prevalent in endovascular treatment.(26.3% vs 73.7%)

Conclusion: Recurrent SAH is unique finding in aSAH patients accompanied by a poor clinical outcome. Because of relatively higher recurrence rate, Multiple aneurysm including anterior and posterior communicating artery needs to closed and life-long follow up.

A comparison of endovascular strategies in the reconstructive endovascular treatment for VBA dissecting aneurysm: a retrospective study.

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Objective: This study is to report the treatment results of patients who performed stent-only therapy for vertebrobasilar artery (VBA) dissecting aneurysm and to analyze the differences according to treatment strategies.

Methods: A retrospective analysis of medical records of patients treated with stent-only therapy for VBA dissecting aneurysm at a single institution from 2010 to 2020.

Result: 52 cases were collected, and there was no statistical difference between groups in most factors. However, a significant difference in dissection length was confirmed between the single stenting group and the double stenting group. Nine (17.3%) cases were treated with single stenting, and 43 (82.7%) cases were treated with double stenting. The stents used were classified and compared into Enterprise family (1 & 2), LVIS (C & D), and LVIS junior. In the case of double stenting, the difference in treatment results according to the type of stent used and the order of deployment was compared. The combination of enterprise & LVIS family was 21 cases (48.8%), the combination of enterprise double was 12 cases (27.9%), and the combination of LVIS → LVIS family was 5 cases (11.6%). Among the single stenting group, recurrence occurred in one case operated using LVIS stent. Upon double stenting, recurrence occurred in 2 cases of the enterprise & LVIS family group (2.3% of double stenting) and 1 case of the enterprise double group (4.7% of double stenting). There was no statistically significant difference in the recurrence rate according to the treatment strategy.

Conclusion: There is no statistically significant difference according to the number of stents used in the treatment of stent-only therapy for VBA dissecting aneurysm, but attention should be paid to its interpretation. In the case of double stenting, there is no significant difference in treatment results depending on the stent combination used.

Consideration in the endovascular treatment of my two blood blister like aneurysms

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Objective: Treatment strategy of blood blister-like aneurysms (BBAs) has been obscure. The extremely fragile wall of BBAs makes the management complicated and risky. Herein, we would introduce two cases that were successfully treated after endovascular treatment.

Methods: First case was 47-year-old female presenting SAH with blood blister like aneurysm in Rt. Dorsal wall of supraclinoid ICA. Double-overlaying stent assisted coil embolization was performed using neuroform atlas and solitaire stent. In stent thrombosis was observed at the end of treatment, and aneurysm was successfully obliteration. Postoperative dual antiplatelet medication was performed, and the patient was shown good outcome. Second case was 60-year-old female presenting SAH with small bulging at Rt. dorsal wall of ICA. However, there was more smaller bulging at contralateral dorsal wall of ICA. Follow-up angiography, underwent a two days after, revealed further aggravation of bulging at Rt. Dorsal wall of ICA. Two neuroform-overlaying stent assisted coil embolization was performed, aneurysm was recurred after 12 days. Additional LVIS stenting was performed, in stent thrombosis was observed 5 days after, and aneurysm was successfully obliteration, and the patient was shown good outcome.

Result: In the our treatment of BBA, two stents were overlayed, but there was a recur on the higher postoperative Raymond scale and more loose in stent strut. In the end, there was additional stenting to increase the neck coverage rate, and healing was achieved with thrombosis.

Conclusion: Treatment of BBA should be particularly achieved flow diversion and induce thrombosis of intracranial aneurysms. In our experience, we consider that the more the flow diversion will be achieved, the more coil packing of aneurysms, the more intrasaccular thrombosis progresses without parent artery thrombosis, the better the healing process of BBA is.

Risk factors for recanalization of basilar tip aneurysm after endovascular treatment: a retrospective cohort study

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Objective: Endovascular treatment (EVT) of basilar tip aneurysms (BTAs) is arduous because of the lesions' angioarchitecture and the relatively high recanalization rate after EVT. In this study, we aimed to report the clinical characteristics of BTAs and evaluate the incidence and risk factors for recanalization and the long-term clinical and angiographic outcomes of the endovascular treatment of large/giant basilar tip aneurysms (BTAs) in our institutions.

Methods: One hundred twenty-five patients with BTAs (11 ruptured, 114 unruptured) treated with EVT between 2009 and 2019 at one institution were retrospectively reviewed. Among them, 113 patients were included in statistical analyses. The anatomical parameters of the aneurysms and clinical data were analyzed. Magnetic resonance angiography (MRA) was performed 6 to 12 months after the procedure, followed by once every 1 to 2 years as needed. Univariate (chi-square test and t-test) and multivariate (multiple logistic regression) analyses were performed to identify risk factors for recanalization.

Result: Recanalization of the BTA occurred in 15 patients (13.3%). One patient (0.9%) was retreated endovascularly. The mean follow-up duration was 49.8 months. Neck size, posterior cerebral artery (PCA) angle, maximum diameter, and the rupture rate differed significantly between the recanalization and non-recanalization groups ($P=.007$, $P<.001$, $P=.006$, and $P=.048$, respectively). The maximum diameter (odds ratio, 1.483 per mm; 95% confidence interval, 1.145–1.919; $P=.003$) and PCA angle (odds ratio, 1.020 per degree; 95% confidence interval, 1.001–1.039; $P=.036$) were independently associated with recanalization. A total of 12 patients with BTA that maximum diameter was over 10mm were included in this study. The median age was 60.08 years (27–80 years), and the mean clinical follow-up was 66.78 months (19.00–142.87 months). Almost half of the patients presented with unruptured BTAs (58.33%, $n = 7$). The median maximum aneurysm diameter was 13.00 mm (10.46–20.90 mm) and the mean neck size was 8.34 mm (4.82–13.04 mm). A Modified Raymond Roy Classification (MRRC1) of 1 or 2 was observed in 66.67% of the patients ($n = 8$) immediately after the first procedure. Procedural morbidity and mortality were 33.33% and 8.33%, respectively. Major recanalization occurred in two patients, one of whom underwent additional coiling with the other being merely observed due to older age.

Conclusion: Of all investigated BTAs, 96.8% were wide-neck aneurysms. The recanalization rate of BTAs after EVT was 13.3%. The PCA angle and maximal aneurysmal diameter were independently associated with recanalization; no associations were observed regarding vertebral artery dominance or modality of treatment. As such, BTA patients with wide PCA angles should be carefully monitored over time. It is very difficult to cure a large BTA completely at once and recanalization occurred often after endovascular treatment. Conducting long-term follow-up studies at short intervals is warranted, as well as improving existing treatment methods and developing new approaches.

Is a small coil more effective as a finishing coil for the embolization of intracranial aneurysms? : Outcomes using GALAXY G3TM MINI micro-coils as finishing coils in a single center

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Objective: The purpose of this study was to compare the outcomes of coil embolization using a 0.009 inches primary outer diameter coil as finishing coil (FC) to that of 0.01 inches.

Methods: From February and August 2020, 131 aneurysms that performed coil embolization using FC with a second loop diameter of 1mm, were reviewed retrospectively, conducting propensity score matching and logistic regression analysis. Angiographic results such as, occlusion grade, packing density, failure and event were compared between 0.009 inches coil of GALAXY G3TM MINI microcoil (n=54) and 0.01 inches coils (n=77).

Result: There were no statistically significant differences between two groups, but more events occurred in the 0.009 group. (Odds ratio, 3.65; 95% CI, 1.06-12.55; P=0.031) In the results of coil embolization, successful occlusion (complete occlusion and residual neck) was identified more in the 0.01 group. After propensity score matching, the variables in each group were similar, but the successful occlusion was higher in the 0.01 group as in the total population. Events tended to occur more frequently in the 0.009 inch group, and logistic regression analysis showed slightly higher events in the angled microcatheter. (48.3% versus 76.9%, P=0.075), Also, the 0.009 inch FC is an independent risk factor. (Odds ratio, 3.84; 95% CI, 1.07-13.80; P=0.039)

Conclusion: Using 0.01 inches coils as FC increased the packing density after the procedure, and showed more successful occlusion than using a 0.009 inches coil. The probability of unexpected events was observed more than three times in the 0.009 inch group.

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Predictive Factors of Recurrence after Endovascular Treatment of Unruptured Vertebrobasilar Fusiform Aneurysms

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Objective: This study aimed to investigate the predictive factors of recurrence after endovascular treatment (EVT) for unruptured vertebrobasilar fusiform aneurysms (VBFA).

Methods: This single-center retrospective study evaluated 36 patients who underwent EVT of unruptured VBFA between 2008 and 2020. Variables influencing recurrences, such as size, type, thrombus, preoperative symptoms, and treatment methods, were analyzed. All patients were followed up using vessel imaging.

Result: In total, 7 of 36 patients (19.4%) developed recurrence. The mean time from EVT to recurrence was 9.2 months (range 2–26.9 months). Maximum aneurysmal diameter on magnetic resonance imaging was decreased, increased, and remained unchanged in 1, 7, and 28 patients, respectively. Transitional type VBFA, brain compression symptoms, large aneurysmal diameter and length, preoperative modified Rankin Scale (mRS) score ≥ 2 , sole stenting technique, and intra-aneurysmal thrombus significantly influenced the risk of recurrence. Post-EVT, 7 (19.4%) patients showed complete occlusion of the aneurysm on the immediate postoperative angiogram, and 22 (61.1%) patients showed complete occlusion on the 1-year follow-up imaging. Good outcomes were observed in 32 patients (88.9%) at the last follow-up, with a mRS score of 0–1 after EVT.

Conclusion: EVT achieves good outcomes in unruptured VBFA. Transitional type VBFA, brain compression symptoms, large aneurysmal diameter and length, preoperative mRS score ≥ 2 , sole stenting technique, and intra-aneurysmal thrombus are risk factors for aneurysm recurrence after EVT.

Autoimmune rheumatic disease associated with intracranial aneurysm or dissection

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Objective: There are many rheumatic diseases that cause vasculitis. Vascular lesions contain aneurysm formation, occlusive disease. Intracranial aneurysm or dissection can occur in these diseases, but only few cases are reported. There are cases of subarachnoid hemorrhage(SAH) or cerebral aneurysm in patients with rheumatic diseases.

Methods: We retrospectively reviewed the patients hospitalized for SAH or intracranial aneurysm for recent 5 years. Among these patients, we choose the patients who have underlying rheumatic disease. There are three cases who met above criteria.

Result: There are three cases; A 47-year-old female patient with rheumatic arthritis and Behçet's disease who showed SAH due to vertebral artery dissection; A 61-year-old female patient with microscopic polyangiitis(MPA) who showed rapid progression of VA dissection and SAH; A 52-year-old female patient with IgA nephropathy who showed recurrence of posterior inferior cerebellar artery(PICA) aneurysm.

Conclusion: There are rare but several cases of SAH or intracranial aneurysm in patients with rheumatic diseases. We should consider a possibility of SAH or vascular abnormality in patients with rheumatic diseases and proper management is necessary for patients outcome.

A case of Y-stent assisted coil embolization for ruptured large basilar top aneurysm and review of single center experiences

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Objective: Stent-assisted coil embolization has been widely used in the treatment of intracranial aneurysm. Almost every kind of aneurysms, ruptured or unruptured, can be treated with the endovascular technique, mainly with the help of stent technology. The use of double stent in a "Y" configuration(Y-stenting) to assist with coil embolization of complex bifurcation aneurysm was first described in 2004. Since that time many reports have been published about Y stenting as a safe and effective option for treating challenging wide necked aneurysm. We would like to share an experience about treating a wide-necked basilar top aneurysm using a Y-stent assisted technique.

Methods: A 61-year-old woman with subarachnoid hemorrhage in hunt and Hess grade II and Fisher grade IV was admitted. The initial brain computed tomography(CT) scan revealed thick subarachnoid blood around basal and sylvian cistern. 3D-CT angiography and digital subtraction angiography(DSA) showed a large wide necked aneurysm on top of the basilar artery. A 6Fr and 5Fr guide catheter was placed within each of the left and right vertebral artery. First, we selected Both PCA and aneurysm sac carefully. We placed 4.0mm x 24mm Neuroform Atlas stent on Lt. PCA and 4.0mm x 30mm Neuroform Atlas stent on Rt. PCA subsequently. After stent deployment, further coiling was performed safely with a microcatheter placed in the aneurysm.

Result: We successfully accomplished complete occlusion of the wide necked large basilar top aneurysm. On follow up angiogram both PCA and SCA flow was intact.

Conclusion: Endovascular treatment of a large wide-necked basilar top aneurysm is technically feasible with Y-stent assisted coil embolization, even though ruptured case. More clinical data with longer follow-up are needed to help establish the role of this technique in ruptured large basilar top aneurysm.

Y-stent-assisted coiling with Neuroform Atlas stents for wide-necked intracranial bifurcation aneurysms: A preliminary report

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Objective: To report our experience on Neuroform Atlas Y-stenting for coiling of unruptured wide-neck bifurcation aneurysms.

Methods: From March 2018 to January 2021, we treated 473 aneurysms in 436 patients with coil embolization, of which 15 cases with wide-necked bifurcation aneurysms were treated by Y-stent-assisted coiling with two Neuroform Atlas stents. We retrospectively reviewed the characteristics of patients and aneurysms, procedure-related complications, radiographic results, and clinical outcomes.

Result: All 15 cases using Neuroform Atlas Y-stenting were successful. Patients included 6 men and 9 women with a mean age $\pm$ standard deviation of 56.4 ± 6.6 years. The mean dome and neck sizes were 6.4 ± 3.1 mm and 4.7 ± 1.8 mm, respectively. Immediate post-procedural angiograms showed complete occlusion in 46.7%, neck remnant in 13.3%, and incomplete occlusion in 40% of cases. No treatment-related morbidity or mortality occurred in any patients. All patients had good clinical outcomes (Glasgow Outcome Score 5) at both discharge and during a mean 12.3-month (range 1-28 months) follow-up. All aneurysms showed improved or stable occlusion on follow-up imaging. Further, the latest follow-up angiography showed complete occlusion in 73.3%, neck remnant in 6.7%, and incomplete occlusion in 20%.

Conclusion: Y-stent-assisted coiling with Neuroform Atlas stents might be a feasible and safe option for wide-necked bifurcation aneurysms.

P-17

Direct Cannulation of a calvarial Diploic Vein for Embolization of a Symptomatic Intraosseous Arteriovenous Fistula

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Objective: Describe the direct access of the calvarial DV for the treatment of a diploic AVF located along the left frontal bone.

Methods: Under the CT-based navigation system, the left frontal craniotomy was performed to access the dilated DV in the frontal bone. We performed direct cannulation of the diploic vein using a mobile C-arm.

Result: Immediately after embolization, angiography showed obliteration of the cortical venous reflux and stagnation of contrast media at the proximal segment of the anterior temporal DV. Six months after embolization, the patient was symptom-free with no reported neurologic deficits.

Conclusion: direct cannulation of the diploic AVF for embolization can be a safe and useful adjunct in diploic AVF therapy when percutaneous transarterial or transvenous approaches are not possible.

Efficacy and safety of new torque-controlled angiographic catheter in cerebral angiography: A pilot study

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Objective: The purpose of this study was to examine the effectiveness and safety of new torque-controlled angiography catheter in cerebral angiography by comparing it with control group catheters.

Methods: Patients who underwent routine transfemoral cerebral angiography was enrolled. Prospective cohort study was done by comparing new torque-controlled catheter group and control group. Femoral artery entry status, aortic arch entry status, common carotid artery access status, Device rotation force, Technical success rate, Result of failed procedure done by opposite group procedure related complication, the degree of satisfaction were reviewed

Result: New torque-controlled catheter shows better result in common carotid artery entry status(98.56% vs 92.79 P% = 0.004), device rotation force (100% vs 75.48% P<0.001), technical success rates (98.09% vs 93.75% P = 0.001) compared with control group catheter. 11 of 13 attempts that failed using the control catheter succeeded when using the new torque-controlled catheter and in all 4 cases where the new torque-controlled catheter failed, the control group failed. No catheter induced cerebrovascular diseases occurred during the procedure and no vessel damage, patient death was occurred. new torque-controlled catheter shows 1.836 (1.765 - 1.907) difference with statistical significance (P<0.001) on Mean device rotational force satisfaction, 2.092 (2.000 - 2.183) difference with statistical significance (P<0.001) on Mean operator satisfaction, have 2.072 (1.982 - 2.163) difference with statistical significance (P<0.001) on Mean manufacturer satisfaction by using 5 pont scale.

Conclusion: The new torque-controlled catheter was effective, safe and convenient compared with control group catheters in diagnostic cerebrovascular angiography.

Ruptured Infundibular dilatation of the posterior communicating artery

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Objective: An infundibulum of the posterior communicating artery (PcomA) or infundibular dilatation (ID) is considered to be a benign anatomical variant. However, some evidence suggests that ID is a pre-aneurysmal state. This case series presents cases of ruptured IDs and aneurysms originating from the IDs.

Methods: Between April 2002 and June 2020, 1337 patients were treated for aneurysmal subarachnoid hemorrhage (SAH). Among them, 7 patients with ruptured PcomA IDs were identified. Rupture IDs of the PcomA were categorized into 1) direct rupture of IDs, and 2) rupture of aneurysms originating from IDs. The clinical and radiographic factors were retrospectively reviewed.

Result: Two patients experienced direct rupture of IDs, while the other 5 patients presented with ruptured aneurysms originating from IDs. The 2 patients with direct rupture of IDs at presentation were relatively younger (< 50 years), while the other 5 patients with ruptured aneurysms originating from IDs were over 70 and had a history of aneurysmal SAH due to other intracranial aneurysms. Ruptured IDs were treated with microsurgery or endovascular treatment. There were no complications related to the procedure for securing ruptured IDs. Five (71.4%) patients showed favorable outcomes. One patient with initial Hunt and Hess grade 4 died due to initial brain damage with cerebral vasospasm and medical complications.

Conclusion: ID of the PcomA rarely causes SAH with or without aneurysm formation. Thus, patients with IDs of the PcomA should be carefully followed up for a long period, especially those with a history of aneurysmal SAH.

One-year Clinical, Radiologic, and Safety Outcome of Surpass Evolve Flow Diverter: Tertiary single center, consecutive series of 40 patients study

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Objective: Surpass Evolve Flow Diverter (SE-FD) was launched in 2019 as a second generation FD of Surpass Streamline. We aimed to report the efficacy and safety of SE-FD insertion for unruptured intracranial aneurysm at 1-year follow-up.

Methods: Between November 2019 and October 2021, a total of 40 patients with 41 aneurysms were treated with SE-FD in single institution. At one-year follow up, clinical and angiographic outcomes were retrospectively evaluated from electronic medical record and aneurysm database.

Result: There were 12 male patients and 28 female patients (mean age 59.1 years, 95% CI: 55.3-62.9). Dissecting of fusiform aneurysm was 46.3% (19/41). Maximal aneurysm diameter was 13.18 mm (SD 5.53) and 15mm or larger aneurysm was accounted for 34.1% (14/41). All procedures were successfully conducted with 7.3% (3/41) of procedure-related complications. At one-year follow up (n=40), neurologic morbidity was noted in 2 cases (5.0%; both MRS 1) without any mortality. At one-year follow up (n=41), radiologic outcomes were adequate occlusion in 33 (80.5%) and complete occlusion in 29 (70.7%). Among 41 aneurysms, complex aneurysm (recurred, thrombosed, or branch artery-incorporated) was accounted for 41.5% (17/41). Of these, adequate occlusion rate was 82.4% (14/17) at 1-year follow-up. There was no retreatment in our cohort.

Conclusion: Surpass evolve flow diverter seemed to be safe and effective for the treatment of large/giant or complex aneurysms at one-year follow up. However, further study is needed to evaluate long term results.

P-21

Experience of Subacute Re-occlusion after Successful Recanalization by Mechanical Thrombectomy in Patients with Large Vessel Occlusion

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Objective: Data on the frequency and outcome of acute large vessel occlusion patients with short-term re-occlusion despite successful recanalization by mechanical thrombectomy is limited. We report our institution's experience of re-occlusion.

Methods: A retrospective study was conducted of patients with re-occlusion after successful mechanical thrombectomy at a single center between January 2016 and December 2021. We named short-term recurrence of large vessel occlusion as subacute re-occlusion. It was defined as occlusion of a previous recanalized vessel within 7 days after the endovascular procedure. According to our protocol, patients treated by thrombectomy should perform follow-up vessel study with CT or MRI on the day after the procedure and around one week. We collected data about baseline demographics, angiographic outcomes, and clinical outcomes and analyzed that data.

Result: During the study period, a total of 508 patients received mechanical thrombectomy due to large vessel occlusion, and successful recanalization was done in 455 patients (success rate 89.5%). Among them, 42 patients revealed subacute re-occlusion (9.2%). Twenty-eight patients were treated with conservative care, and fourteen patients received repeated endovascular thrombectomy. In the analysis of baseline demographics, 24 patients were male, and the mean age was 66.71(37-86). Twenty-eight patients had a hypertension history (66.7%) and twelve patients noted atrial fibrillation at the initial electrocardiogram (28.6%). The mean initial NIHSS was 7.38 (0-22). Seventeen patients received intracranial stenting and 10 patients' occluded sites were posterior circulations. Ten patients showed functional independence at 3 months (3 months mRS <3, 23.8%), and the mortality rate was 16.7% (7/42). There was no significant statistical difference between the conservative group and the re-thrombectomy group.

Conclusion: Delayed re-occlusion after recanalization of an occluded vessel is an obviously undesirable situation for interventionists. Cases of re-occlusion showed poor outcomes and high mortality. Of our studies, regrettably, re-thrombectomy could not show a clear difference. Further research on patients with re-occlusion should be conducted.

Successful Recovery of Lateral Medullary Syndrome after Giant Vertebral Artery Dissecting Aneurysm: case study

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Objective: Vertebral artery Dissecting Aneurysm (VADA) is a leading cause of stroke in people under 50 years of age. However, unruptured vertebral artery dissecting aneurysm causing lateral medullary syndrome is rare case, and report about long term recovery after intravascular stent treatment and rehabilitation outcome is lacking. In this case, we report about the recovery of the patient who complicated with lateral medullary syndrome of giant VADA after intravascular stent insertion and rehabilitation treatment.

Methods: A 48-year-old woman was admitted with gait disturbance, swallowing difficulty and neuropathic pain in all extremities. At the time of admission, about 2.7-cm sized giant dissecting aneurysm from left vertebral artery, compressing brain stem and causing rightward deviation of medulla was found on MRI and cerebral angiography. She was started taking antiplatelet medication and nasogastric tube feeding. At that time, she underwent intravascular stent insertion of the VADA, but swallowing difficulty and gait disturbance were persisted for several months after intravascular stent treatment. On VFSS test, pharyngeal motility was severely reduced and aspiration to trachea was observed. Therefore, gait training and dysphagia therapy were started 3 months after stent treatment.

Result: After 8 months of stent treatment, muscle strength started to improve and she can walk independently, also, her symptom of neuropathic pain was improved. Eventually, 9 months after stent treatment and 6 months after starting rehabilitation treatment, pharyngeal motility was improved and semi-solid diet at reclining position was possible. On MRI taken follow-up 12 months after intravascular stent treatment, there was a significant reduction in the size (2.7x1.3cm → 1.9x1.5cm) of VADA.

Conclusion: Previous studies have reported lateral medullary infarction or TIA after VADA, but we report a mass effect of giant unruptured VADA causing lateral medullary syndrome. Her persistent swallowing difficulty and gait disturbance was successfully improved as the size decreases through intravascular stent treatment and rehabilitation for one year.

P-23

The risk of unusual intracranial hemorrhage caused by dural AVF

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Objective: This article is for reporting the risk of intracranial hemorrhage due to dural AVF that was missed at first. A 70-year-old male with no medical history was admitted to the emergency room with a stupor mentality. The contact was cut off from 11 am on the day of admission. At the time of admission to the emergency room, He was stupor, motor grade 2/3, and both pupil size and reflex were two prompt. In the brain CT, there was acute intracranial hemorrhage in Lt frontal lobe with intraventricular hemorrhage, which was about 60ml. On CT angiography, there was no spot sign and cerebral aneurysm.

Methods: After checking the covid-19 test, navigation guided ICH catheter insertion operation was performed under local anesthesia. Immediately after surgery, there was no change on a neurological examination and post op care was done in the ICU. Medical treatments such as mannitolization and BP control had also been done. Five days after the operation, the patient's pupil changed to 2F/2F with all motor grade 1 so that we took a brain CT immediately. After reviewing the CT angiography again, it was decided to undergo digital subtraction angiography and ICH catheter insertion operation.

Result: On DSA, there was left frontal pole dural AVF with cortical drainages and venous pseudoaneurysm which was fed by left ophthalmic artery and minimally by right ophthalmic artery. Therefore glue embolization was performed through the left anterior ethmoid artery of left ophthalmic artery, and no residual AVF was observed. After embolization, two ICH catheter were inserted on navigation guided.

Conclusion: Finally, intracranial hemorrhage was resolving without rebleeding, and the patient recovered well. He is currently undergoing rehabilitation treatment and in good condition for outpatient follow-up.

The optimal thresholds of P2Y12 reaction unit and inhibition rate for predicting in-stent restenosis following carotid artery stenting

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Objective: To evaluate the degree of in-stent restenosis (ISR) following carotid artery stenting (CAS) using computed tomographic angiography (CTA), examine its correlation with platelet reactivity to clopidogrel, and determine the optimal thresholds of P2Y12 reaction unit (PRU) and inhibition rate (INH) for predicting ISR.

Methods: We retrospectively analyzed 177 patients who underwent CAS with carotid artery stenosis from January 2016 to December 2019. Dual antiplatelet therapy of aspirin 100mg and clopidogrel 75mg started at least 7 days before CAS, and a loading dose of clopidogrel 300mg was given in the case of emergency CAS (n=6). Clopidogrel resistance was measured with the PRU and INH of VerifyNow. The degree of ISR was classified into Class 1, 2, and 3 (Moderate to severe ISR with more than 50% focal stenosis) through carotid CTA after 24-30 months. The receiver operating characteristic (ROC) curve method was adopted to determine the quantitative degree of the association between clopidogrel resistance and ISR Class 3.

Result: There were 34 ISRs of Class 3 (19.2%) and 9 ipsilateral ischemic strokes (5.1%). The PRU and INH were different between Class 1+2 (176.5 ± 49.3 , $27.4 \pm 18.5\%$) and Class 3 (248.5 ± 54.5 , $10.0 \pm 13.3\%$) ($p < 0.001$). The area under the ROC curve of PRU and INH was 0.848 and 0.788, and the optimal cut-off value derived using the maximum Youden index was 221.0 and 14.5%, respectively. The multivariate logistic regression analysis showed that high PRU (≥ 221) and low INH ($< 15\%$) were the significant predictive factors for ISR class 3 ($p < 0.001$, $p = 0.012$), and the ISR Class 3 was independently associated with ipsilateral ischemic stroke after CAS ($p = 0.012$).

Conclusion: High PRU (≥ 221) and low INH ($< 15\%$) may cause ISR following CAS, and a research on modified antiplatelet preparation to prevent ISR seems to be needed in patients with high clopidogrel resistance.

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Early experience of mechanical thrombectomy for Large Vessel Occlusion

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Objective: In patients with large vessel occlusion, mechanical thrombectomy is essential treatment modality for recanalization and better functional outcome. Thus, the proper understanding for pathophysiology and technical issue of mechanical thrombectomy is important for young neurosurgeon in interventional field. I want to share my early experience of mechanical thrombectomy during first 6 months.

Methods: Twenty-five patients had acute ischemic stroke caused by large vessel occlusion and were treated with mechanical thrombectomy with or without intravenous thrombolysis from May 2022 to October 2022. Baseline data and neurologic status were included. The factors to achieve successful recanalization (Thrombolysis in Cerebral Infarction scale score $\geq 2b$) were evaluated. And the neurological status (modified rankin scale [mRS] at hospital discharge) was also investigated.

Result: Among 25 patients, 76% was achieved successful recanalization (Thrombolysis in Cerebral Infarction scale score $\geq 2b$). In three cases, the procedure was failed due to severe acute angle of aortic arch. In one case, the extracranial internal carotid artery (ICA) was occluded and was not recanalized despite of balloon angioplasty. Except these 4 cases, the successful recanalization rate was 92%. The most frequent location of occlusion was middle cerebral artery (68%), followed by distal ICA (16%). In two cases, there was tandem occlusion and it was not related with poor outcomes. In 44% of cases, the pathophysiologic cause of ischemic stroke was cardiogenic embolus. Most of them had atrial fibrillation (72%). The 36% patients had intracranial atherosclerotic stenosis (ICAS). Median time from first abnormal time to puncture was 290 minutes. Median time from puncture to recanalization was 50 minutes. The 60% patients showed improvement of neurologic status or no more deterioration. The 24% patients were expired due to pulmonary or cardiologic complication. The 12% patients were expired due to both ICA occlusion or failure of mechanical thrombectomy. Except that, the procedure-related major complication (e.g. arterial rupture, dissection) rate was 0%. In 80% of cases, we used SOLUMBRA technique for retrieval. In three cases, we used direct suction thrombectomy alone and it was effective also. Captured clots were investigated, and the red, soft thrombus was 75%.

Conclusion: In acute large vessel occlusion patients, the proper understanding of pathophysiology is so important. And we should know that the intracranial atherosclerotic stenosis is more common in Asia than Western. In spite of multiple trials of thrombectomy, if there was no interval change from baseline, we should consider switching to other technique. And balloon angioplasty or intra-cranial stenting is also considered.

Isolated Hippocampal Infarction after Mechanical Thrombectomy for Anterior Circulation Acute Ischemic Stroke: A Case Report

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Objective: Embolic infarction to a new territory is most prevalent complication of thrombectomy for anterior circulation acute ischemic stroke, however, hippocampal infarction is rare. We present a case of hippocampal infarction after mechanical thrombectomy for acute middle cerebral territory infarction.

Methods: A 51-year-old woman presented with left-sided weakness, dysarthria and facial palsy over several hours with a National Institutes of Health Stroke Scale (NIHSS) of 4. Magnetic resonance imaging (MRI) revealed acute infarction in the right putamen-corona radiata and severe focal stenosis at right middle cerebral artery mid M1 segment. Intravenous thrombolysis was not performed because the neurologic symptoms improved very quickly with a NIHSS of 1 on admission. However, digital subtraction angiography revealed short segmental severe stenosis by thrombus in right mid M1 segment and delayed cerebral blood flow. Immediate endovascular thrombectomy was performed and complete recanalization was achieved with the aspiration and Solitaire stent retriever. Angiography after thrombectomy showed luminal irregularity of M1 segment, suggesting dissection treated with Enterprise stent deployment.

Result: Immediately after the intervention, the patient presented with altered consciousness and a NIHSS was aggravated to 5. Computed tomography and MRI showed newly developed isolated hippocampus infarction without involving the neighboring structure addition to previous infarction with focal hemorrhagic transformation. The drowsy mentality has improved over several days and the patient was transferred to rehabilitation hospital after 2 weeks with modified Rankin Score of 3 and mild verbal memory deficits.

Conclusion: In acute ischemic infarction in the posterior cerebral artery territory, involvement of the hippocampus is also a frequent finding. However, in this case, posterior communicating artery was absent in the right internal carotid artery and hippocampal infarction probably can be attributed to artery-to-artery thrombus embolism of the anterior choroidal artery during the intervention.

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Treatment of growing giant thrombosed basilar artery tip aneurysm after multi-times stent-assisted coiling

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Case: A 61-year-old female patient was incidentally discovered with a 20 mm thrombosed basilar artery (BA) tip aneurysm. Initially, stent-assisted coiling (SAC) was performed, but after 6 months it grew to a size of 26mm, and additional SAC was performed. At the same time, hydrocephalus was also found and VP shunt operation was performed. One year later, the patient was admitted to the emergency room due to altered consciousness. On imaging examination, the cerebral aneurysm was enlarged to 45 mm and was accompanied by intraventricular hemorrhage. SAC was additionally performed for recanalized sac, and the patient was transferred to our hospital for further treatment. We performed Hunterian ligation on the BA to reduce the direct flow to aneurysm. To compensate for blood flow in the posterior circulation, M2-Radial artery-SCA bypass was additionally performed. Fortunately, the patient's consciousness has gradually improved and she is undergoing rehabilitation treatment.

Conclusion: Giant thrombosed aneurysm has been reported to grow even after coiling, and the prognosis can be further worsened by mass effect. Therefore, it may be beneficial to consider surgery from the beginning of the treatment.

Clinical outcome of coil embolization for ruptured intracranial aneurysms by region and hospital size: Nationwide cohort study in Korea

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Objective: We aimed to analyze outcomes of coiling in treating ruptured intracranial aneurysms (RIAs) according to region and hospital size based on national cohort data in South Korea.

Methods: The incidence of perioperative cerebral infarction (CI), mortality data of the patients who underwent coiling for RIAs were retrieved. Hospitals are classified according to size as tertiary referral general hospitals (TRGH), general hospitals (GH), and semi-general hospitals (sGH). Regions were divided into 15 regions based on the administrative districts of the Republic of Korea, and hospitals in each region were analyzed by hospital size.

Result: Postoperative CI occurred within 3 months at TRGH, GH, and sGH hospitals in 5.79%, 7.20%, and 10.49%, respectively. In TRGH, the incidence of postoperative CI was significantly lower than in GH ($p=0.013$) or sGH ($p=0.041$). There was no significant difference between GH and sGH ($p=0.605$). On the other hand, the mortality within 1 year was 16.80%, 17.79%, and 19.97% in TRGH, GH, and sGH, respectively, and there was no significant difference by hospital size. There was no significant difference in CI rate or mortality rate according to the number of coiling cases per hospital in TRGH and GH. However, in sGH, the mortality rate increased significantly as the number of coilings per hospital decreased. ($p=0.025$; $\rho=-0.574$) The mortality rates after non-stent assisted coiling (NSAC) and stent assisted coiling (SAC) in TRGH were 15.03% and 21.71%, respectively, which were significantly higher in the SAC group. ($p=0.008$) In GH, the mortality rate of the SAC group (23.23%) was significantly higher than that of the NSAC group (15.98%). ($p=0.001$) There was no significant difference in mortality in both groups in sGH.

Conclusion: Although TRGH had a significantly lower incidence of CI than GH or sGH, there was no significant difference in mortality. However, since the SAC group has a significantly higher mortality rate than the NSAC group, caution should be required when determining SAC for RIAs.

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Delayed stent stenosis due to stretch of a flow diverter used to treat giant cervico-petrous internal carotid artery aneurysm

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Case: Flow diverters has been used to treat giant internal carotid artery (ICA) aneurysm. Delayed in-stent stenosis of deployed flow diverters can occur. However, delayed stent stenosis due to stretch of deployed flow diverter is not yet known. We present a case of delayed stent stenosis due to stretch of deployed flow diverter used to treat giant cervico-petrous ICA aneurysm. A 34-year-old male complained of left inner ear pain and headache. The patient was diagnosed with the left giant cervico-petrous ICA aneurysm. We performed deployment of single Surpass evolve and additional low-profiled visualized intraluminal support device (LVIS) blue was deployed at the proximal end of flow diverter to reduce the foreshortening of the proximal end of flow diverter. On 6-month follow-up transfemoral cerebral angiography (TFCA), the size of aneurysm decreased and no stent stenosis was observed. On 1-year computed tomography angiography (CTA). The severe luminal narrowing of deployed flow diverter was detected and large aneurysmal sac was also observed. On follow-up TFCA, there was severe stenosis in the middle of deployed flow diverter due to stretch of the flow diverter and giant aneurysm was still visualized. We planned to deploy additional flow diverter with balloon angioplasty to the stenotic lesion. During procedure, additional flow diverter was deployed easily, however, stenotic lesion due to stent stretch did not respond much to balloon angioplasty using Scepter C balloon. On 3-month follow-up CTA, the size of ICA aneurysm decreased and the stenosis remained unchanged.

Conclusion: This case demonstrates that the delayed stenosis due to stretch of a flow diverter can occur. Although the risk of stenosis due to stretch is rare, the endovascular neurosurgeons should be mindful of this risk.