대한뇌혈관내수술학회
SKEN
Society of Korean Endovascular Neurosurgeons

The 11th Annual Summer Conference on Endovascular Neurosurgical Therapy

ASCENT 2016

The 20th Anniversary of SKEN - We Lead, We Leap

일시: 2016년 6월 17일(금) ~ 18일(토)

장소: 경주 현대호텔

주최: 대한뇌혈관내수술학회 Society of Korean Endovascular Neurosurgeons

주관: 대한신경외과학연구재단 THE KOREAN NEUROSURGICAL SOCIETY

모시는 글

안녕하십니까?

존경하는 대한뇌혈관내수술학회 모든 회원 여러분들을 2016년 ASCENT가 개최되는 경주로 초대합니다.

신라 왕국이 그 누구도 넘볼 수 없는 찬란한 문화의 꽃을 피우고, 유구한 역사를 이어올 수 있었던 근본은 아마도 전통 속에서 혁신을 추구한 화랑도(花郎徒) 정신이라 생각합니다. 우리 학회도 창립 20주년을 맞으면서, 이 분야를 앞장서 이끌고, 도약시킬 준엄한 사명을 전통의 도시, 경주에서 새롭게 다짐해 보고자 합니다. 이에 금번 ASCENT 는 많은 부분에 청중 여러분이 실시간으로 참여하는 interactive system을 도입하였습니다. 연자 발표 도중, 스마트폰을 이용하여 실시간으로 본인의 의견을 전송, 발제하실 수 있고 voting을 통하여 회원 의견의 추세를 바로바로 파악하실 수 있습니다. 또한, 경험이 쌓인 회원과 새롭게 시작하시는 회원 모두가 만족할 만한 주제를 엄선하였습니다.

모쪼록 역사의 숨결과 소중한 여가를 귀한 가족분들과 함께 하시기를 바라오며 학술과 친교 모든 부분에서 기억에 남는 2016 ASCENT가 되도록 남은 시간 최선을 다해 준비할 것을 약속드립니다.

감사합니다.

2016년 6월

대한뇌혈관내수술학회 회장 **성 재 훈**

2016년 대한뇌혈관내수술학회 임원

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프로그램

6월 17일 금요일

13:30~13:50	등 록		
13:50~14:00	인사말	회장 **성재훈**	
14:00~15:30	**The "Difficult case" session**	좌장 : 순천향대 **김범태**	
	Voting with live interaction during case presentation		
	Case 1. ICA occlusion	동아대 **최재형**	_11
	Case 2. ICA stenosis	울산대 강릉아산 **양구현**	_16
	Case 3. Blister aneurysm	연세대 원주세브란스 **김종연**	_19
	Case 4. Blister aneurysm	동래봉생 **성승언**	_20
	Case 5. CCF	인제대 **김성태**	_22
	Case 6. CCF	부산대 **김영수**	_24
	Case 7. AVM	건양대 **이철영**	_26
	Case 8. Large basilar aneurysm	가천의대 **김명진**	_28
	Case 9. Symptomatic basilar dolichoectasia	계명대 **김성묵**	_32
15:30~15:50	***Coffee Break***		
15:50~16:50	**The "How to" session with live Q & A**	좌장 : 경희대 **고준석**	
	1) How to use flow diverter?	가톨릭대 **김성림**	_37
	2) How to use Onyx?	순천향대 **윤석만**	_43
16:50~17:30	**The "Unexpected case" session**	좌장 : 에스포항병원 **김문철**	
	Case 1. Hemorrhagic complication after Reopro use	고신대 **최재영**	_47
	Case 2. Ruptured proximal PICA aneurysm with ipsilateral hypoplastic VA	가톨릭대 성빈센트 **이호준**	_52
	Case 3. Retrieval of Onyx using Solitaire device	한림대 동탄성심 **박정현**	_56
	Case 4. EPD problems during CAS	원광대 **김대원**	_58
	Case 5. Embolic migration after ECA thrombectomy	가톨릭대 인천성모 **문병후**	_60
	Case 6. Intra-procedural rupture due to microcatheter	가천의대 **김명진**	_62
	Case 7. PCA infarction after coil embolization	동래봉생 **추연수**	_67
17:30~18:00	임시총회		
18:30~20:00	만 찬		

일시: 6월 17일(금)~18일(토), **장소**: 경주 현대호텔

6월 18일 토요일

08:00~09:00	**The "Debate" session: panel discussion with live audience interaction**	좌장 : 계명대 **이창영**	
	panel: 박석규, 김영우, 정진영		
	1) Balloon catheter guiding vs Non-balloon catheter guiding	계명대 **김창현** vs 부산대 **이재일**	_71
	2) Stent retriever vs Suction device	울산대 **권순찬** vs 충남대 **권현조**	_72
09:00~09:40	**"My first case" by the young guns**	좌장 : 가톨릭대 **성재훈**	
	1) Uruptured ICA aneurysm	영남대 **김종훈**	
	2) Uruptured paraclinoid aneurysm	고신대 **최재영**	
	3) Uruptured paraclinoid aneurysm	가톨릭 관동대 국제성모 **김소연**	
09:40~10:00	***Coffee Break***		
10:00~10:40	**Review of current stroke RCTs**	좌장 : 서울대 **강현승**	
	1) Acute ischemic stroke	순천향대 **신동성**	_77
	2) Flow diverter	연세대 **박근영**	_87
10:40~11:00	**Introduction of new devices (by company)**	좌장 : 울산대 **유승훈**	
11:00	맺음말	학술이사 **정진영**	

ASCENT 2016

The “Difficult case” session

좌장 : 순천향대 **김범태**

Voting with live interaction during case presentation

Case 1. ICA occlusion

최 재 형
동아대

Male 79 years old

■ Chief Complaint

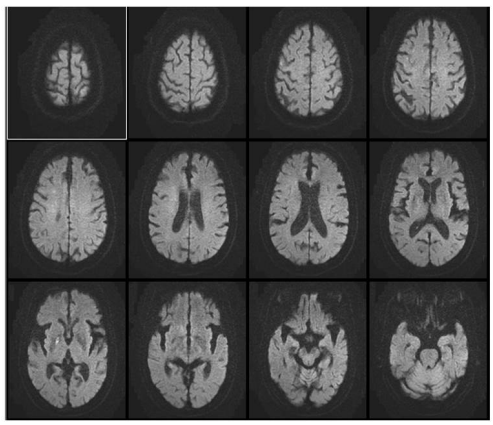
Aphasia, Lt. side weakness
Onset : 2016-01-21 08:00
ER arrival : 2016-01-21 17:06

■ Present Illness

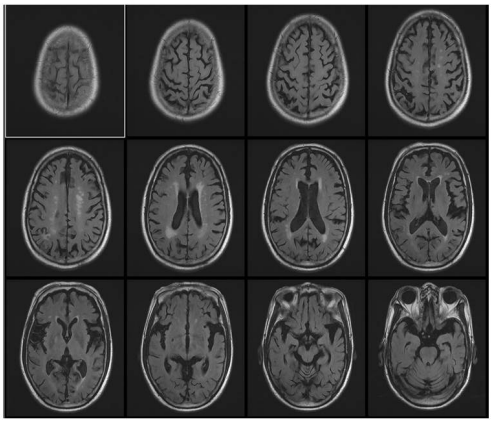
상기환자 특이 병력 없던 분으로 금일 오전 8시경부터 말을 잘 하지 못하고 자리에서 일어나지 못하는 증상 발생, local 내원하여 brain CT 촬영후 이상 소견 보이지 않아 further evaluation 위해 전원됨.

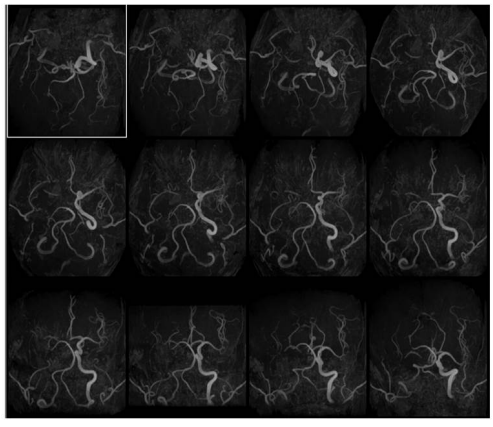
+ Neurologic exam
: Arousal alert mentality
LOC q/c obey defect 4
Lt. hemiparesis G4/G4 2
Lt. FP 2
Aphasia 3
Dysarthria 2
Sensory 1
: NIHSS 14점

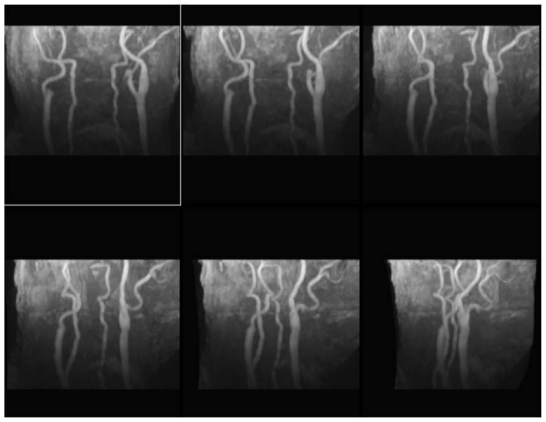
+ Risk factor : alcohol(daily 소주 1-2병)
+ Initial BP : 180/100 → f/u 140/90, EKG a.fib(-)



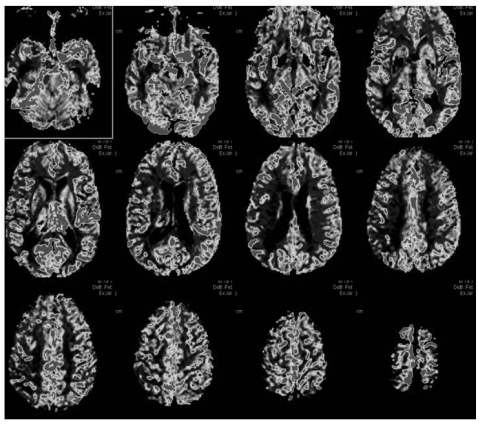
Ischemic core : 0.75 cc



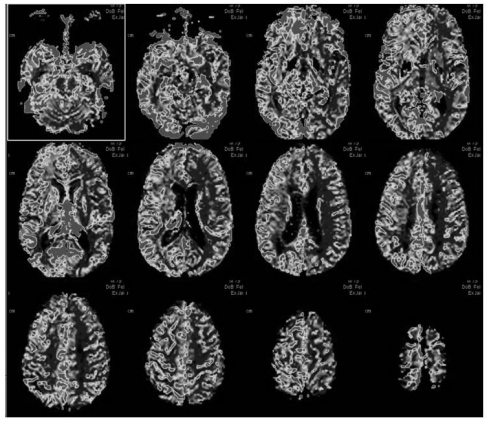




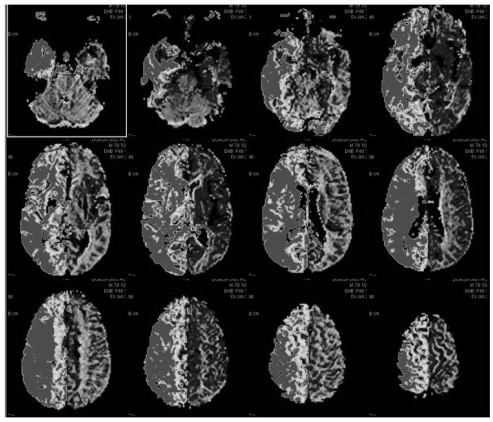
CBF



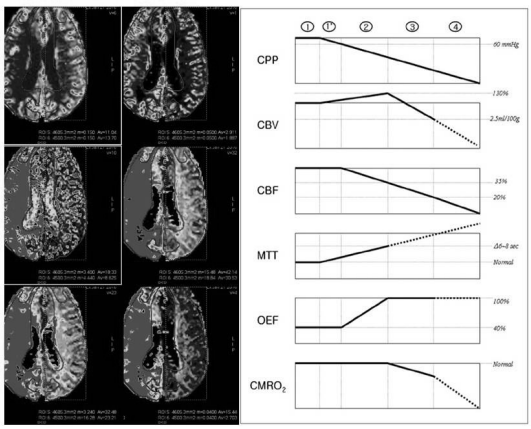
CBV

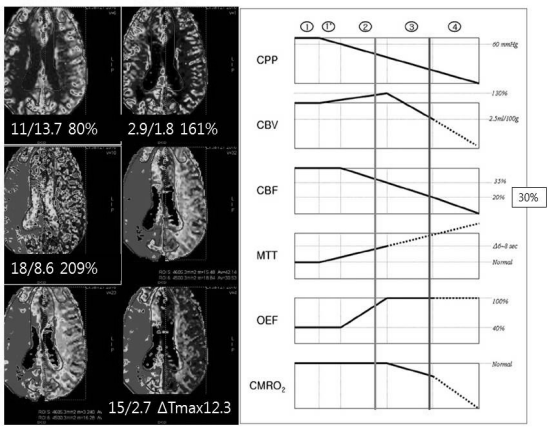


Tmax



perfusion defect : 283 cc





Ischemic core : 0.75 cc vs perfusion defect : 283 cc

RECOMMENDATIONS

4. When treatment is initiated beyond 6 hours from symptom onset, the effectiveness of endovascular therapy **is uncertain** for patients with AIS who have causative occlusion of the ICA or proximal M1 *(Class IIb; Level of Evidence C)*. Additional randomized trial data are needed. *(New recommendation)*

-ESCAPE: <12 hr from onset, REVASCAT: <8hr from onset

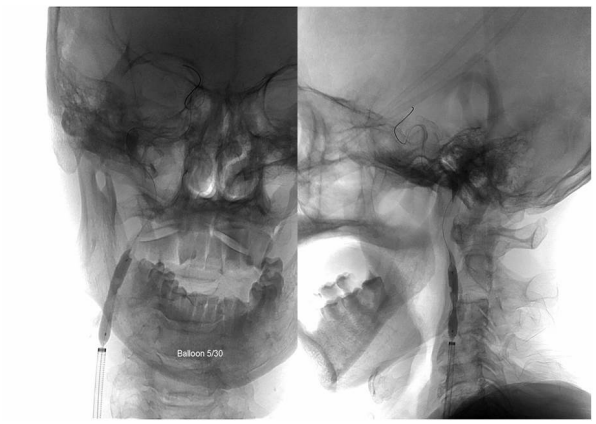
?

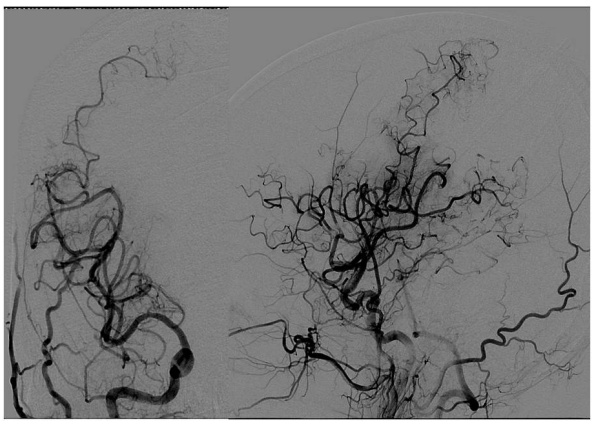
- Onset to puncture time : 12 hours 30 min
- Very small size acute infarction
- Large area of Tmax > 6 sec
- Good CBF ratio 80%
- Stenosis ?

?

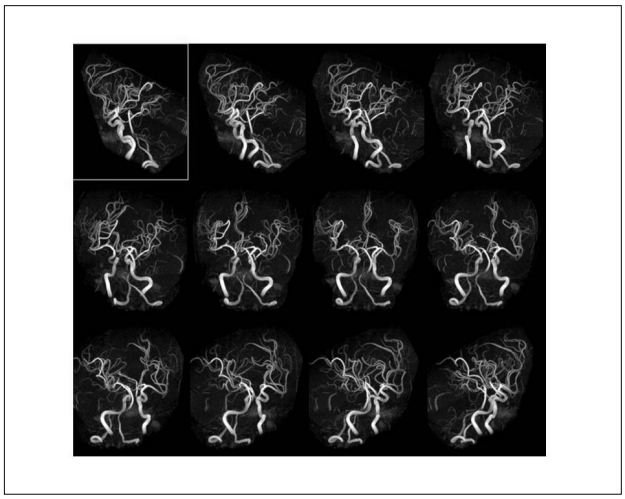
- STA-MCA anastomosis
- Balloon angioplasty at the risk of thrombus migration

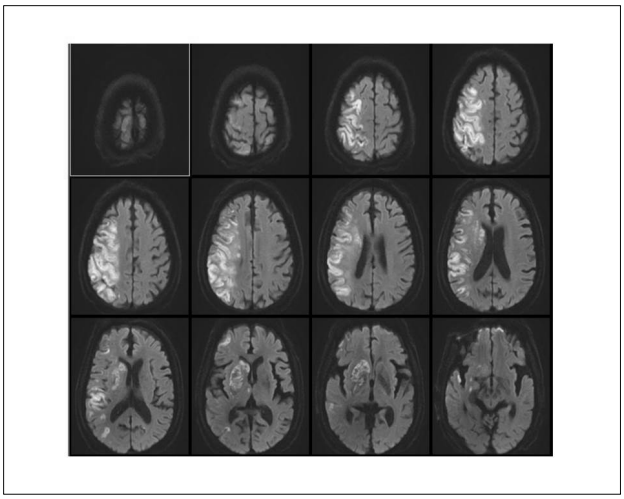
- Balloon type EPD?

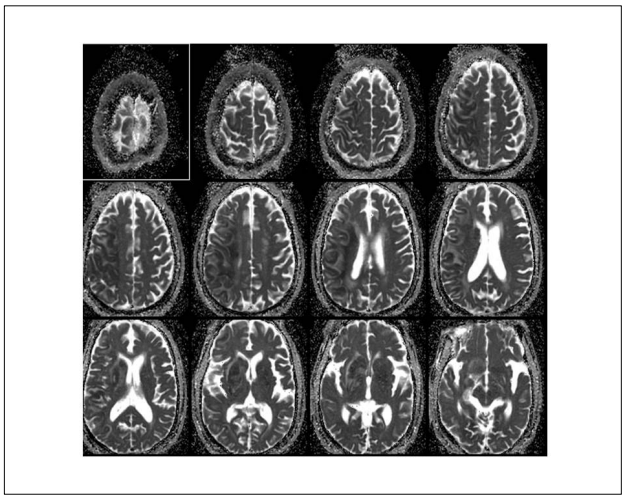




After 48 hours







Case 2. ICA stenosis

양 구 현
울산대 강릉아산

Difficult Case
Underlying HTN있는 current smoker인 76세 남자 환자.
내원 3일전 Rt. arm motor TIA 증상과 dysarthria 증상 있었음.
MRA 결과 Lt. proximal ICA bulb severe stenosis (90% 이상) 관찰되어 TFCA 시행 결과.
1. Rt. mid-CCA moderate to severe stenosis (60%)
2. Rt. proximal CCA severe stenosis (80%)
3. Lt. ICA bulb near occlusion (90%)
4. Lt. proximal CCA severe stenosis (80%)
5. Rt. VA OS moderate stenosis (50%)
6. Lt. VA OS complete occlusion with ascending cervical collateral
7. Both ILIAC artery severe stenosis (70% and 70%)
CT perfusion 결과 Lt. side hemisphere perfusion delay 소견 관찰됨.
1st session stent angioplasty for symptomatic Lt. proximal CCA and ICA bulb
Procedure : ICA bulb angioplasty에 쓸 예정인 먼저 6 Fr. shuttle을 Lt. CCA proximal 가장 심하게eccentric stenosis 보이는 부분 앞까지 올려 놓고 filterwire를 조심해서 Lt. ICA bulb lesion 지나 거치 시킴. 이후 aviator balloon 5 mm diameter balloon으로 Lt. proximal CCA balloon해서 6 Fr. shuttle catheter 통과 시킬 때 생길 수 있는 plaque rupture, dissection등의 위험을 줄이고 terumo 35" wire 이용 shuttle catheter를 CCA distal에 전진 위치 시킴. 이후 Lt. ICA bulb stent angioplasty후 filterwir로는 large profile의 ballon expandable stent 올리기가 어려워 filterwire 제거 후 terumo 35" stiff wire를 ECA로 거치 시킨 후 Lt. proximal CCA stent angioplasty함.

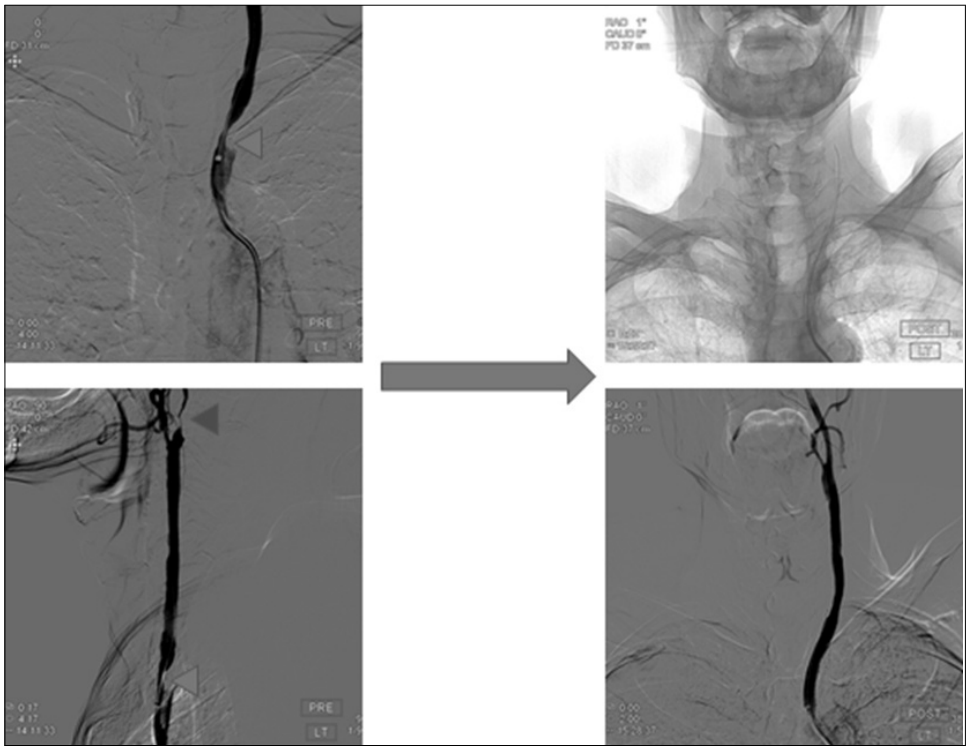


Fig. 1.

CT perfusion 결과 Lt. side hemisphere perfusion 개선 되면서 상대적으로 Rt. side hemisphere perfusion delay 소견 보임.

2nd session stent angioplasty for Rt. mid-CCA and proximal CCA

Procedure : Proximal CCA가 가장 심한 stenosis 상태로 꼭 stent angioplasty 필요한 상황이고 mid CCA에 대해서는 꼭 stent 해야하나 고민했지만 balloon 만을 하고 난뒤 recoiling / aggravation 되었을 경우 proximal CCA stent strut지나 시술을 해야하는 상황이 생길 것으로 판단. 되도록 그러한 상황을 피하기 위해 두 곳 모두 stent 하기로 결정. Rt. VA single vertebral artery에 OS에 50%의 stenosis 있지만 추후 이 곳에 시술이 필요하다면 Rt. radio-brachial artery route로 시술 하면 될 것이라 판단. Rt. brachiocephalic trunK와 aortic arch의 angle이 심해서 7 Fr. shuttle을 arch에 둘 수 밖에 없는 상황에서 co-axial method로 4 Fr. simmon angio-catheter를 ECA 까지 올리고 Boston scientific사의 Amplatz super stiff 35" steel wire를 ECA 거치시킴. 7 Fr. guiding shuttle이 aortic arch에 있었지만 안정적으로 mid-CCA에 balloon expandable stent를 이용 angioplasty 하고 그것을 내리면서 proximal CCA 살짝 balloon angioplasty해주고 다시 또 다른 balloon expandable stent를 이용 proximal ICA에 stent angioplasty 하고 시술 종료함.

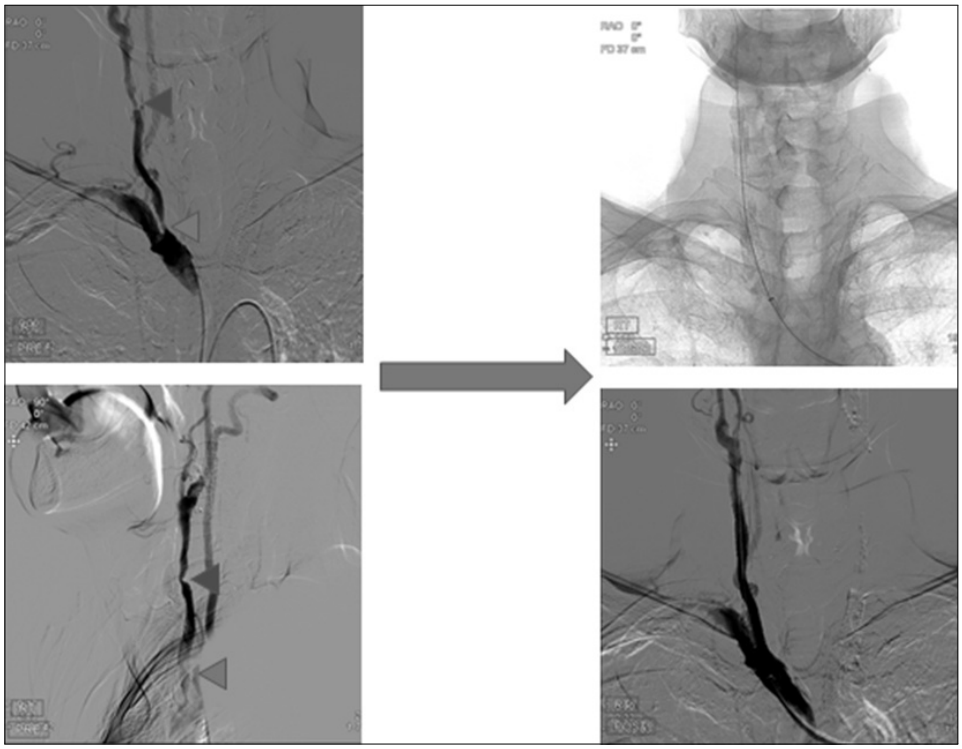


Fig. 2.

Rt. femoral route로 Lt. iliac lesion 그리고 Rt. iliac lesion 차례 데로 stent angioplasty 후 전체 시술 종료.

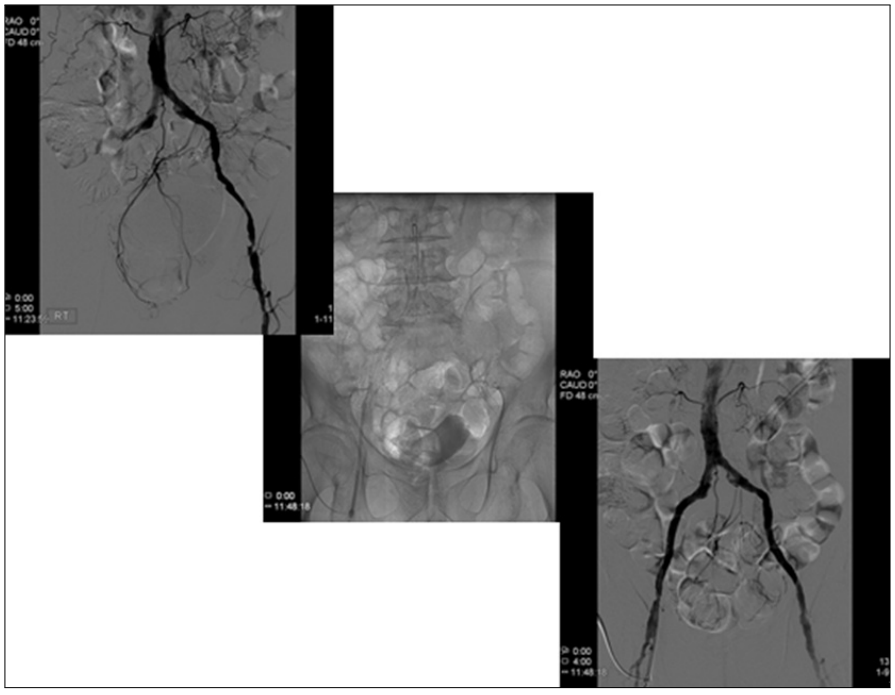


Fig. 3.

Case 3. Blister aneurysm

김 종 연

연세대학교 원주세브란스기독병원 신경외과

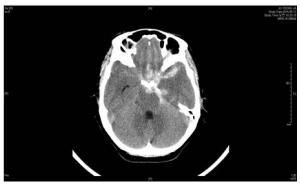
47/F

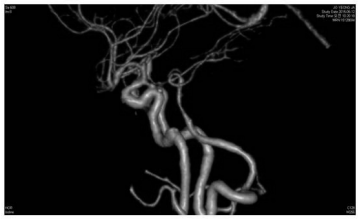
C.C: seizure & headache

P.I: 본 47세 여환은 당일 오전 7시 30분에 seizure 발생.
7시 33분에 119 신고후에 respiration 없는 것을 확인후
3분동안 CPR시행하심. 49분에 119도착후 본원 내원.

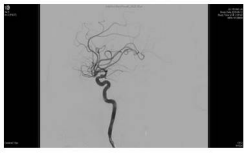
GCS: 13

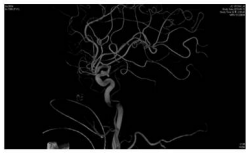
Lt. P-com aneurysm rupture로 보고, 전신마취후
TFCA 이후 바로 coiling 예정으로 들어감



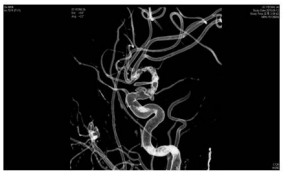


P-com 은 junctional 이었음. 대신에 dorsal wall에 blister like aneurysm의심되는 소견 보임.

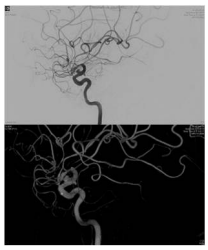




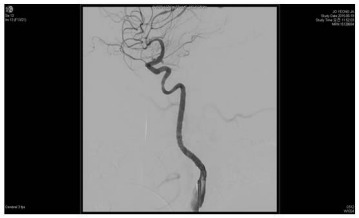
Stent assisted coil 시행함



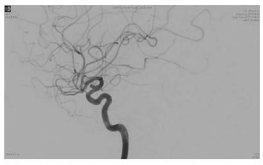
1주 f/u angio



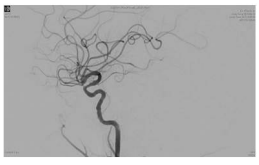
2nd coiling



3주뒤 f/u angio



3rd coiling



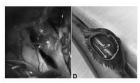
Case 4. Endovascular treatment of ruptured blood blister-like aneurysm with staged multiple stent-assisted aneurysmal coiling

Sung Seng Oun[1], Chae Kil Sung[2], Lee Sang Yoon[1], Choo Yeon Soo[1], Choi Yu Seok[1], Park Kang Hwa[1], Lee Sang Hoon[1]

Department of Neurosurgery, Dongrae Bongseng Hospital[1], Bongseng Memorial Hospital[2]

Introduction

Blood blister-like aneuryms (BBAs)



1. Incidence: 0.3-1% of intracranial anuerysms, 0.9-6% of the ICA

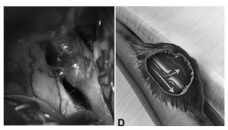
2. Characteristics: hemispheric bulge from non-branching sited of parent arteries
(m/c site: the dorsal wall of the supraclinoid portion of the ICA)
-small size, fragile wall, a poorly defined broad-based neck aneurysm

3. Pathogenesis: not well known
-hemodynamic stress, atherosclerosis
-the gradient of wall shear stress: m/i factor

4. Histology
-focal wall defect without internal elastic lamina and media
-the gap: covered with thin adventitia and fibrinous tissue
-pseudoaneurysm: presence of a subadventitial dissection
-the ruptured site: fragmented and lacerated adventitia (similar to vertebral dissection)
-progression of saccular lesion: organization and growth of the blood clot adjacent to the focal wall defect

Introduction

Blood blister-like aneuryms (BBAs)

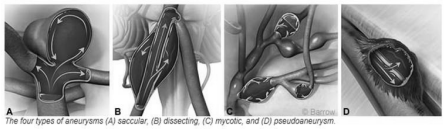


5. Diagnosis: Meticulous inspection is mandatory.
(DDx: atherosclerotic change and vascular dysplasia)

6. Treatment: challenging lesions to either surgery or endovascular treatment

We present two cases of ruptured BBAs of the internal carotid artery treated by staged multiple stent-assisted aneurysmal coil embolization.

48/F, Severe headache



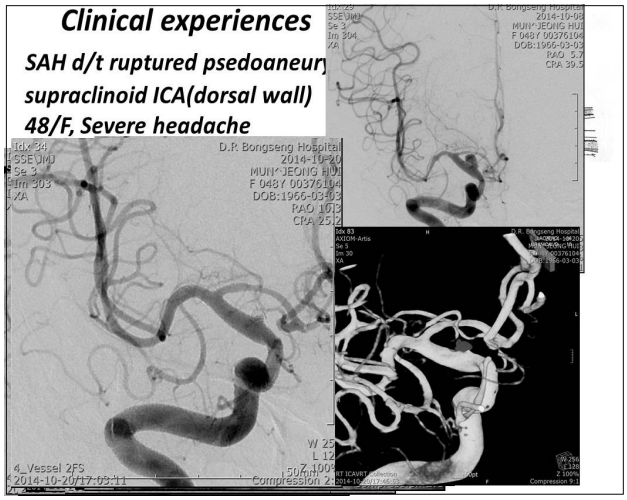
The four types of aneurysms (A) saccular, (B) dissecting, (C) mycotic, and (D) pseudoaneurysm.

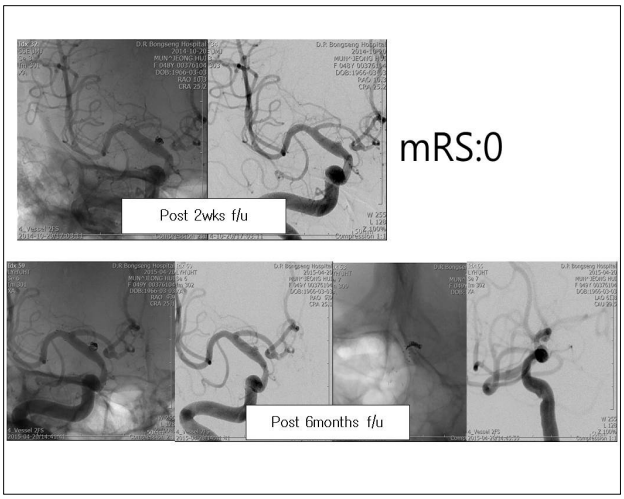
Clinical experiences

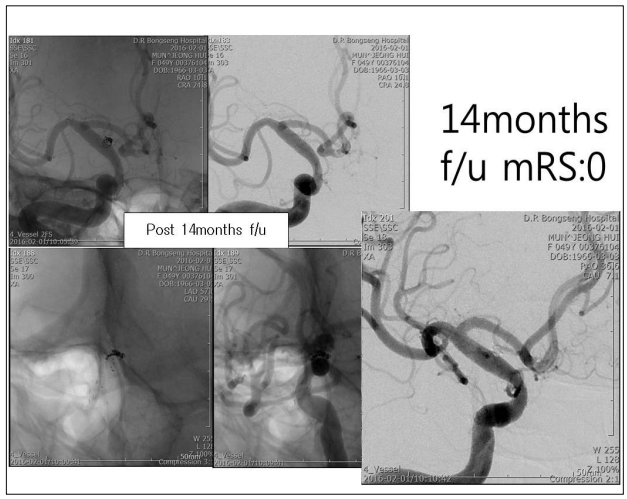
SAH d/t ruptured psedoaneurysm of Left supraclinoid ICA(dorsal wall)
48/F, Severe headache

Clinical experiences

SAH d/t ruptured psedoaneury
supraclinoid ICA(dorsal wall)
48/F, Severe headache







Discussion

1) *Preoperative recognition of a BBA is essential.*
2) *Short term f/u evaluation should be performed to validate either configurational change of aneurysms or ICA patency.*
3) *Treatment modality: Surgical treatment VS Endovascular treatment*

– ***Surgery:***

Direct clipping, wrapping, clipping with wrapping material, Trapping with/without EC-IC bypass

– ***Endovascular treatment:***

Simple coiling, stent-in-stent, stent-assisted coiling.

Multiple stent-assisted coiling: improve flow diversion
Staged treatment: if needed, to prevent thromboembolic event due to poor medications of antiplatelet agents

Conclusion

Staged multiple stent-assisted coiling of BBAs could be a effective alternative treatment for ruptured BBAs.

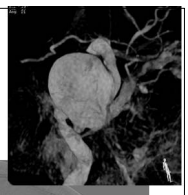
Case 5. Recurrent Giant Intracranial Aneurysm Accompanied by Carotid Cavernous Fistula after Placement of Covered Stent

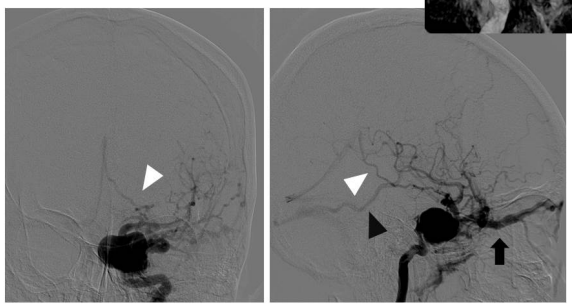
Kim Sung-Tae

Neurosurgery, Busan Paik Hospital, Inje University, Busan, Korea

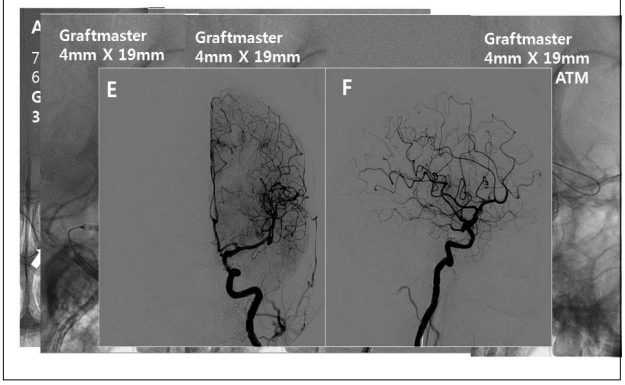
We report a case of a recurrent giant cerebral aneurysm (GCA) accompanied by a carotid cavernous fistula (CCF) after placement of a covered stent in an antiplatelet agent-resistant patient. A 47-year-old woman presented with sudden severe headache, exophthalmos, and left-side ptosis. Cerebral angiography revealed a CCF caused by rupture of a GCA. Two covered stents were placed in the neck of the aneurysm in the cavernous internal carotid artery. The neurological symptoms improved at first, but aggravated after 6 months. Endoleak of contrast agent was seen in the distal area of the stent. Even though additional treatments were attempted via an endovascular approach, the CCF could not be cured. After performing trapping and a bypass, the patient achieved a stable condition. In cases of recurrent CCF caused by rupture of a GCA after placement of a covered stent, it is possible to treat the CCF by endovascular trapping and surgical bypass. Covered stents may not achieve a good fit in the region of the carotid syphon.

Impression: Giant cavernous ICA aneurysm rupture
Direct CCF, high flow

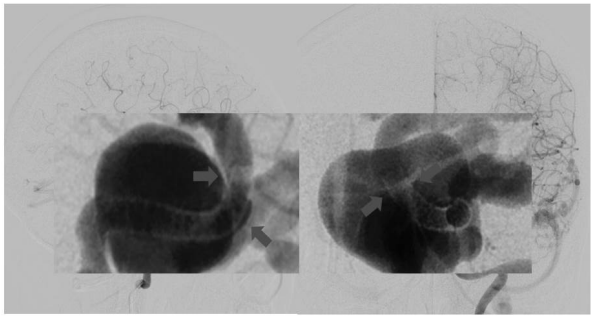


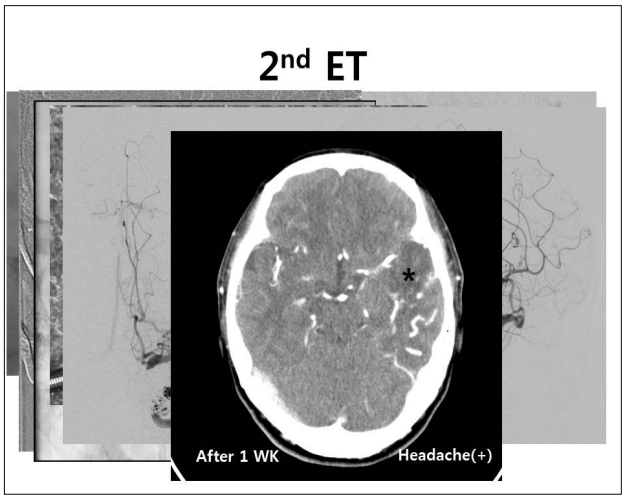


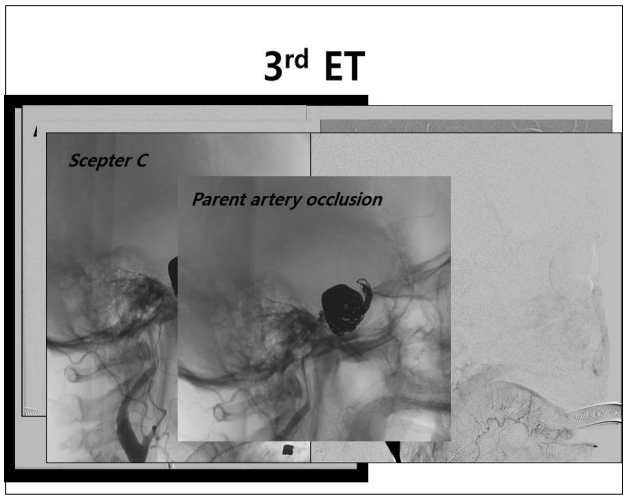
Endovascular treatment

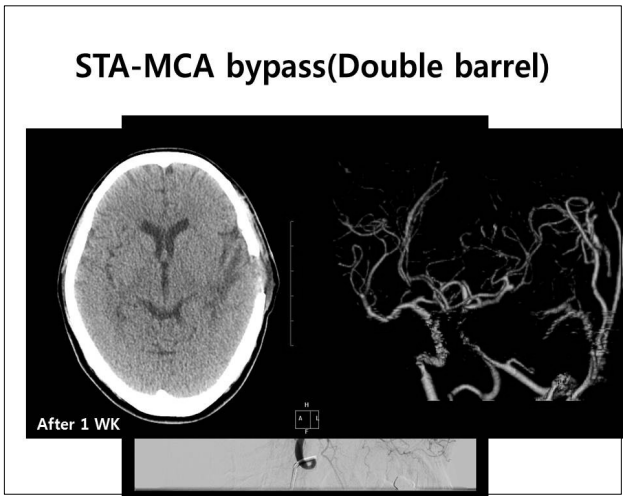


TFCA after 6mo



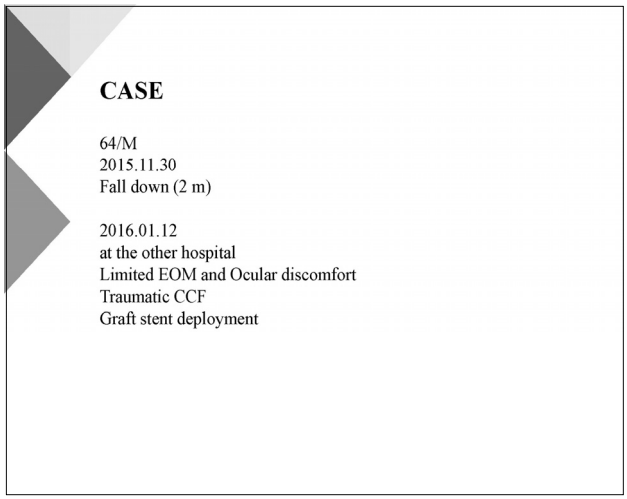

2nd ET
*
After 1 WK
Headache(+)

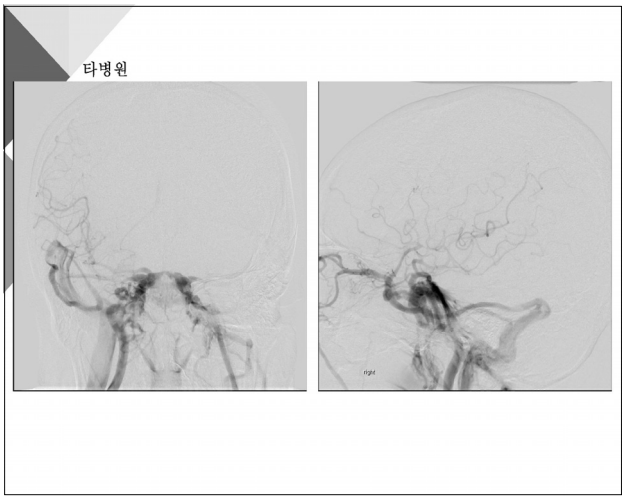

3rd ET
Scepter C
Parent artery occlusion

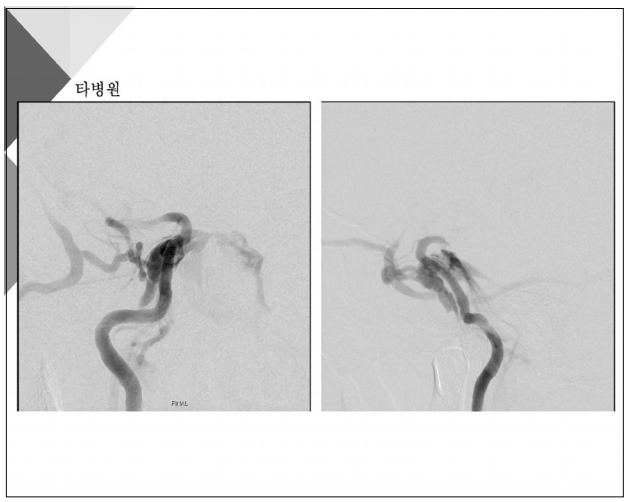

STA-MCA bypass(Double barrel)
After 1 WK

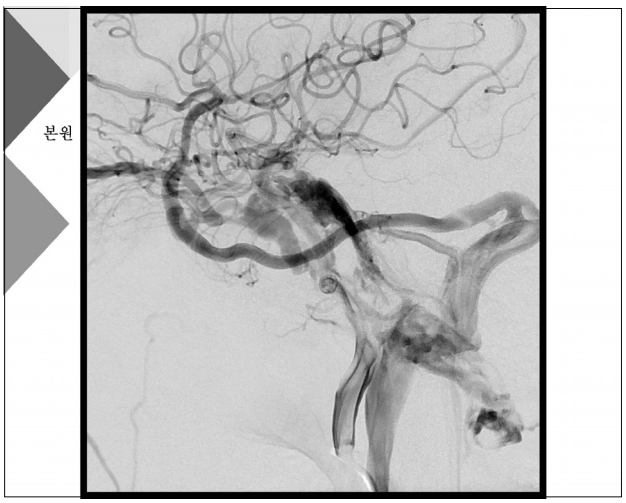
Case 6. Multimodal treatment for traumatic CCF

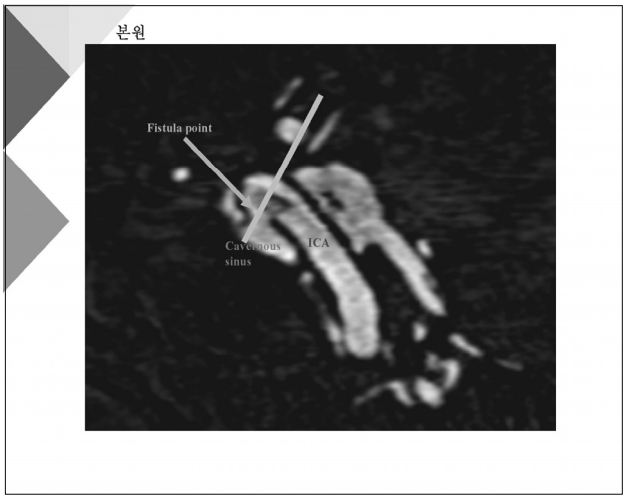
김 영 수, 백 승 국
Pusan National University Yangsan Hospital

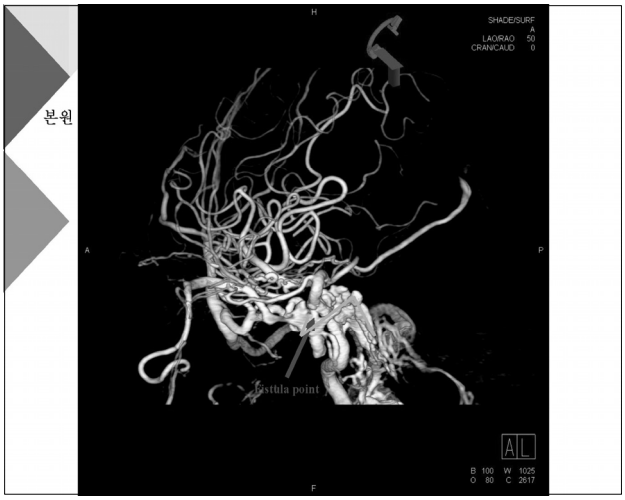


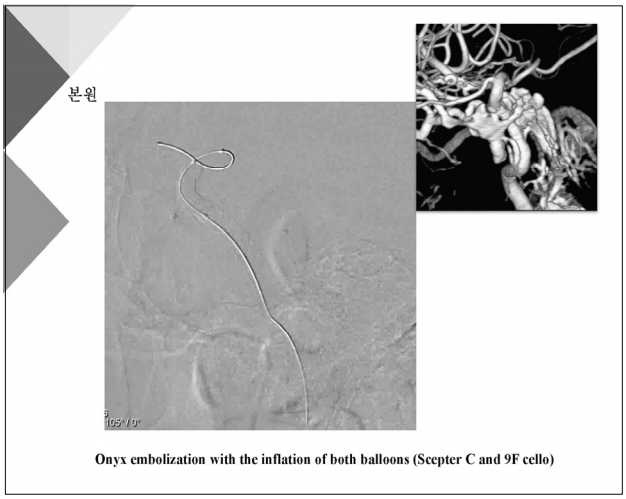












Onyx embolization with the inflation of both balloons (Scepter C and 9F cello)

Case 7. AVM

이 철 영
건양대

32/ M

-- 아주어릴때 대학병원에서 AVM 진단 받음

-- size가 작아서 observation하기로 함

-- size가 작아서 앞으로 살아가는데 문제가 없을것이라고 얘기들음

-- 그후 F/U은 하지 않음

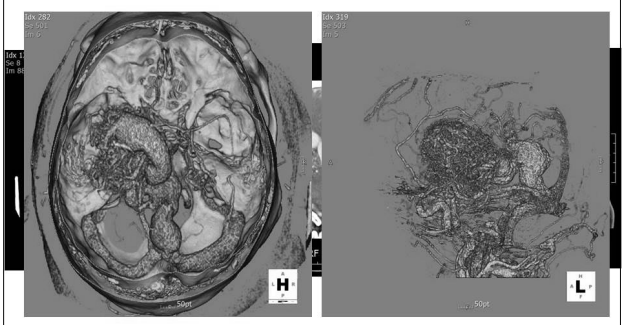
-- 경도의 인지기능 장애가 있으며

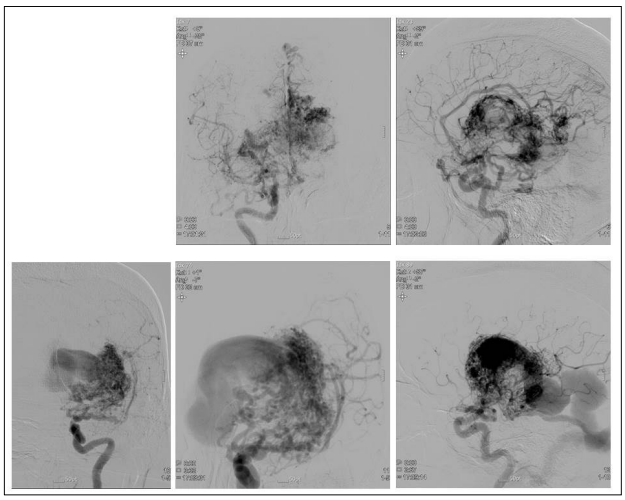
-- Neurologic deficit이 있는 상태임
(Rt side weakness : upper Gr III-IV, lower Gr IV+, self ambulation(+))

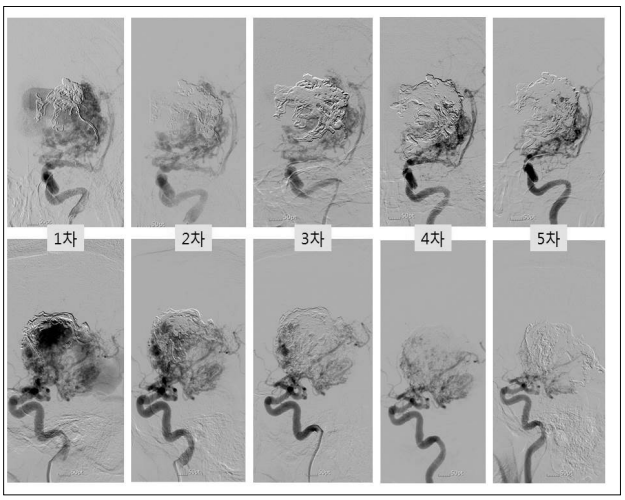
-- 이런 상태로 보호자와 같이 지금까지 생활함

-- 내원전에 TA로 인하여 brain CT check하여 전원

CASE X





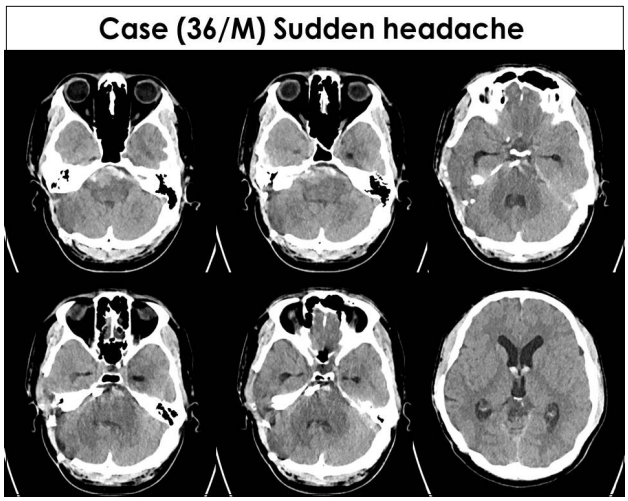


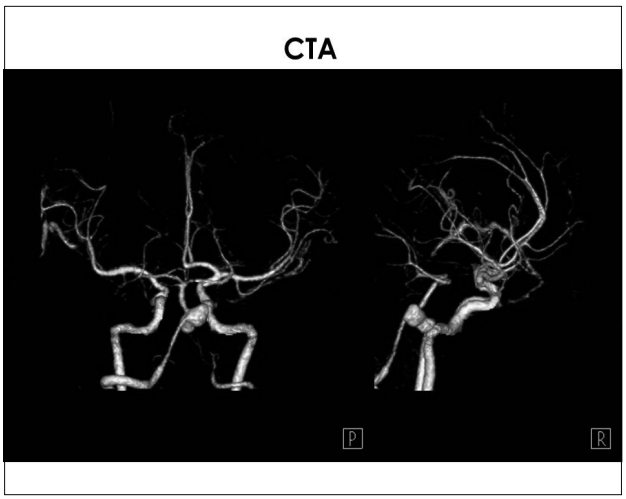
5차례 embolization
그후 frationated radiotherapy

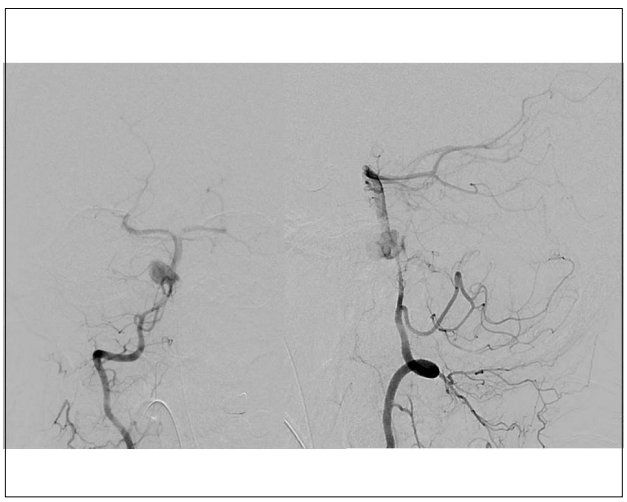
-- 현재 외래는 다니고 있으나, 경제적 및 further Tx 이루어지지 못함

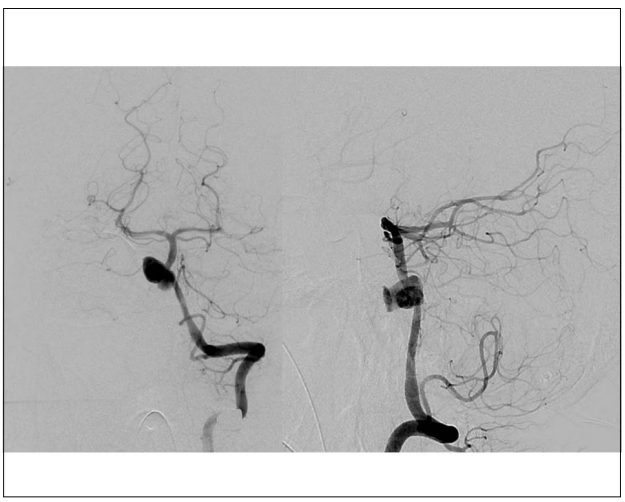
Case 8. Large basilar aneurysm

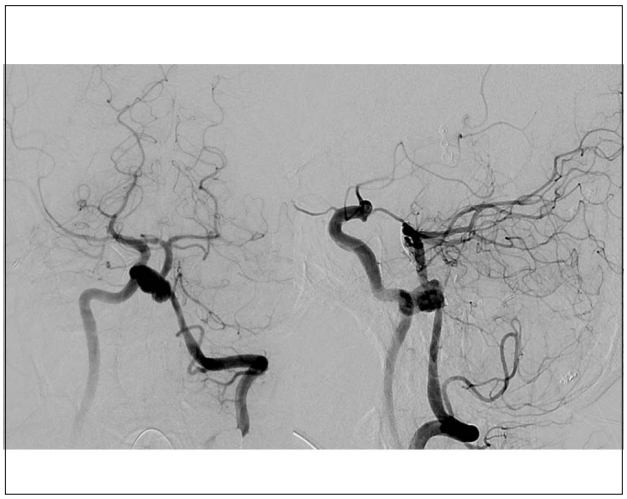
김 명 진
가천의대

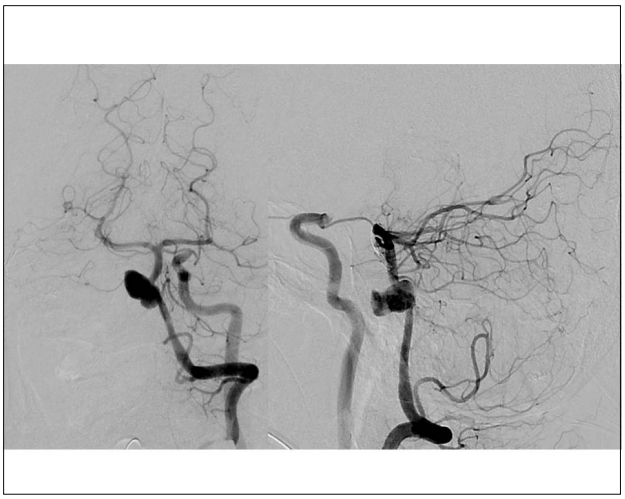




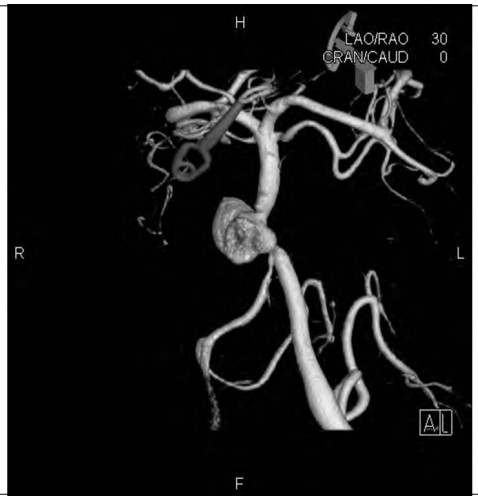




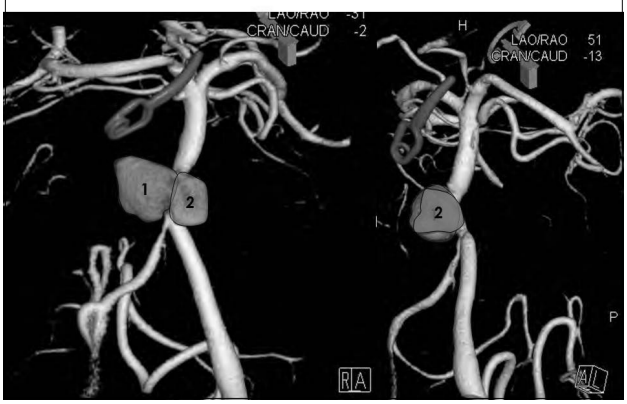




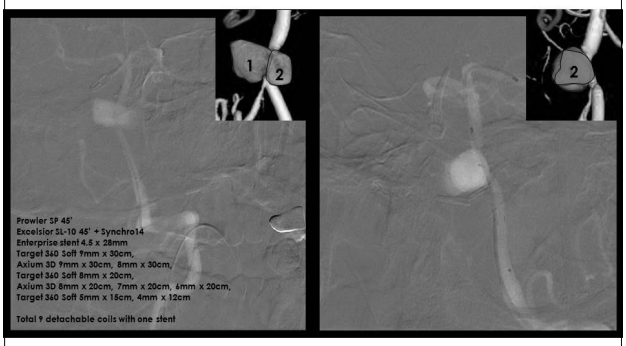
17.6 x 9.5 x 9.8 x 9.8(N)mm

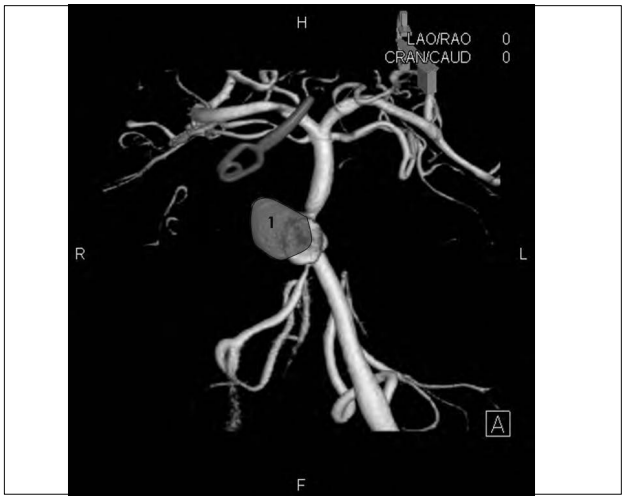


basilar artery 를 saving 하기 위해 2 session 에 걸친 roadmap 구상

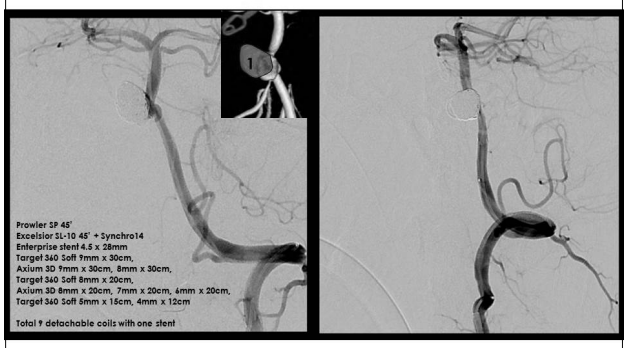


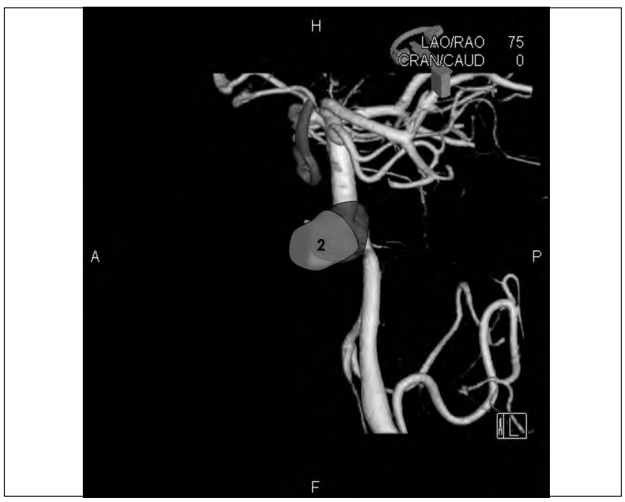
1st session



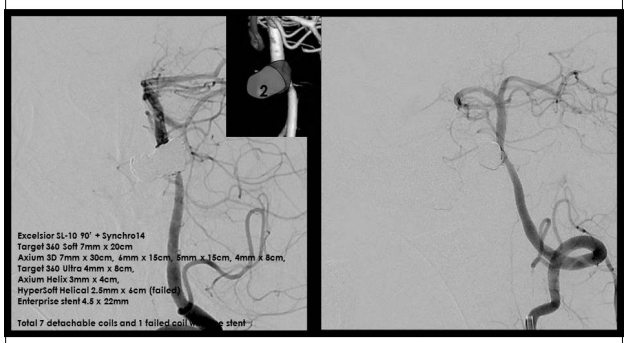


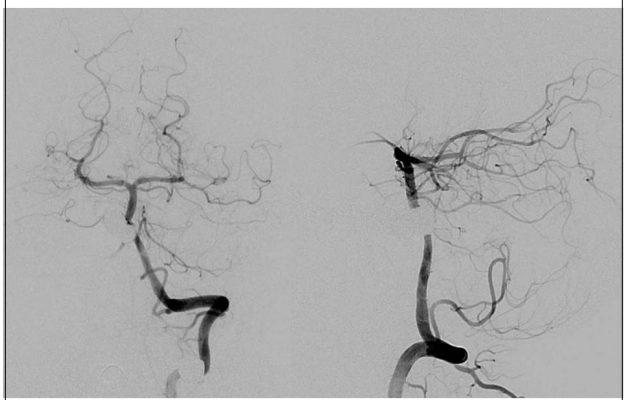
1st session

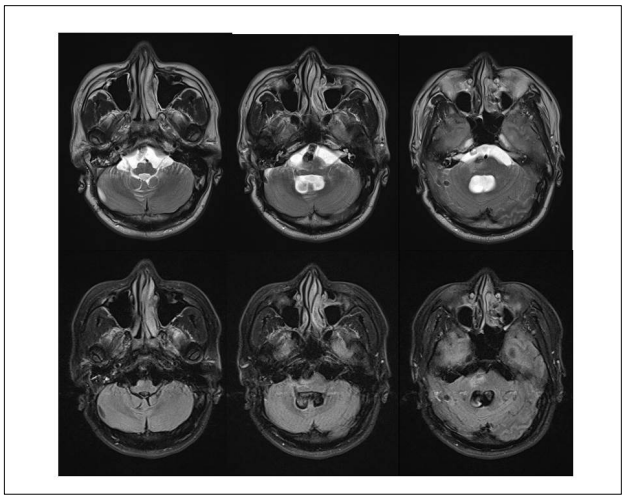


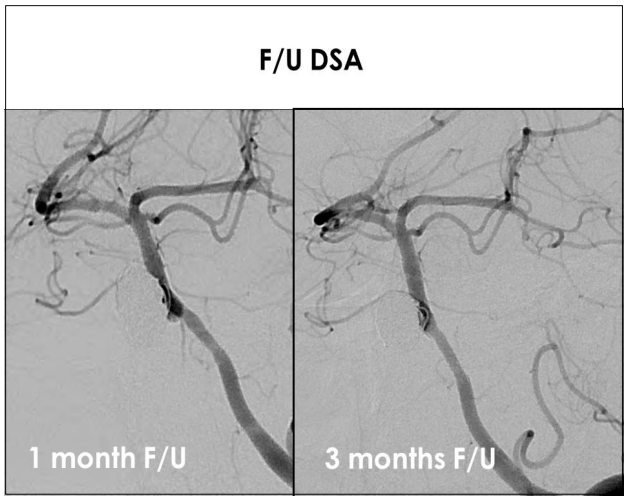


2nd session





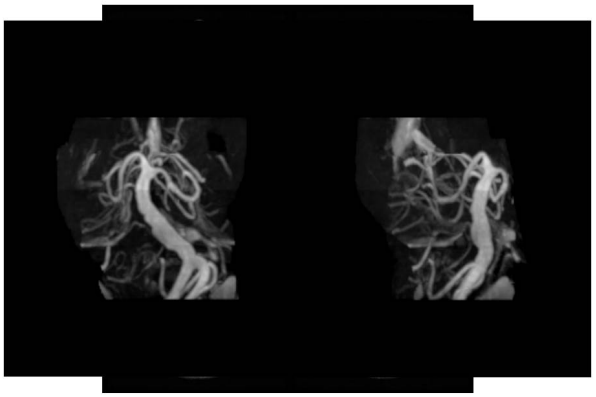



F/U DSA
1 month F/U
3 months F/U

Case 9. Symptomatic basilar dolichoectasia

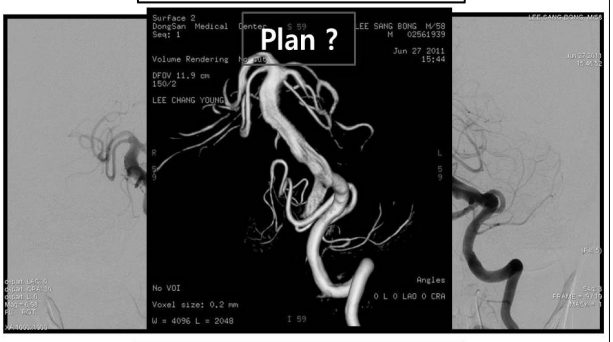
Seong-Mook Kim, MD, Chang-Hyun Kim, MD, Chang-Young Lee, MD.
Department of Neurosurgery Cerebro-vascular center, Dong-san Medical Center, Keimyung University School of Medicine

M/58(2011), Left hemiparesis, Gr III



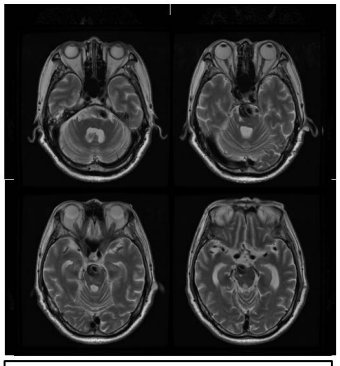
DSA

Basilar dolichoectasia



Anticoagulant therapy

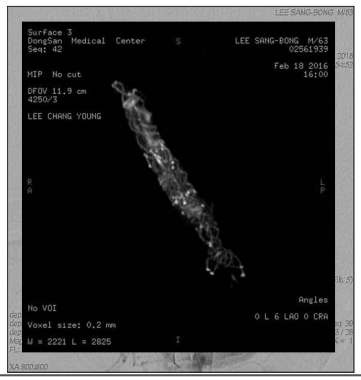
2014, seizure



Conservative manage

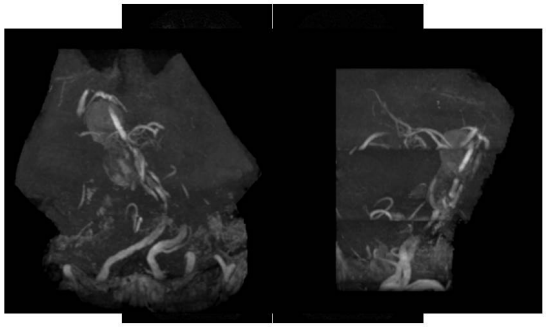
2016, drowsy consciousness

Stenting

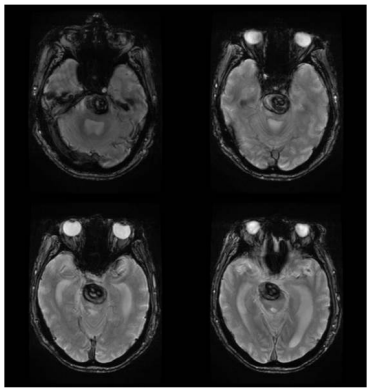


kissing-longitudinal telescopic stenting

Immediate post-operative



POD # follow-up



MEMO

ASCENT 2016

The “How to” session with live Q & A

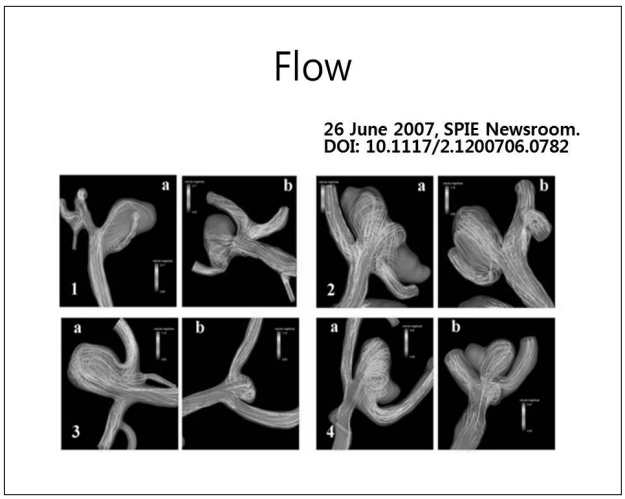
좌장 : 경희대 **고준석**

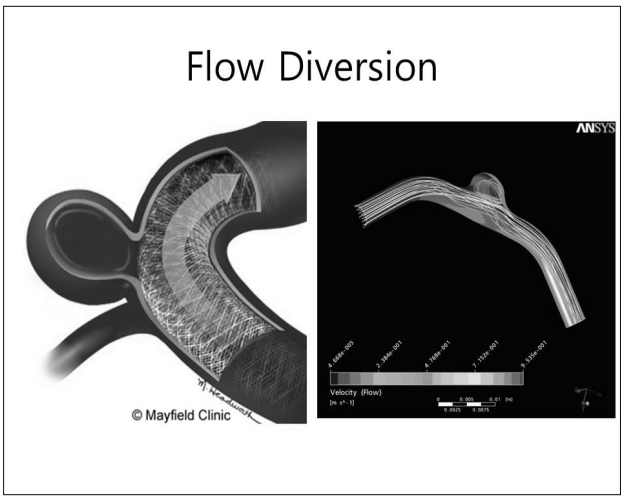
1) How to use flow diverter? 가톨릭대 **김성림**

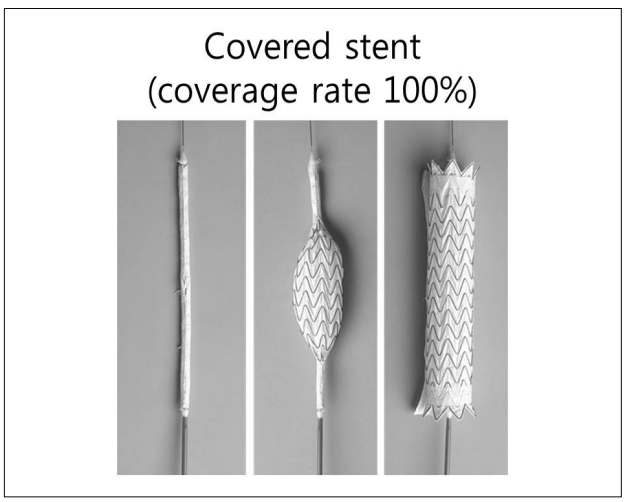
2) How to use Onyx? 순천향대 **윤석만**

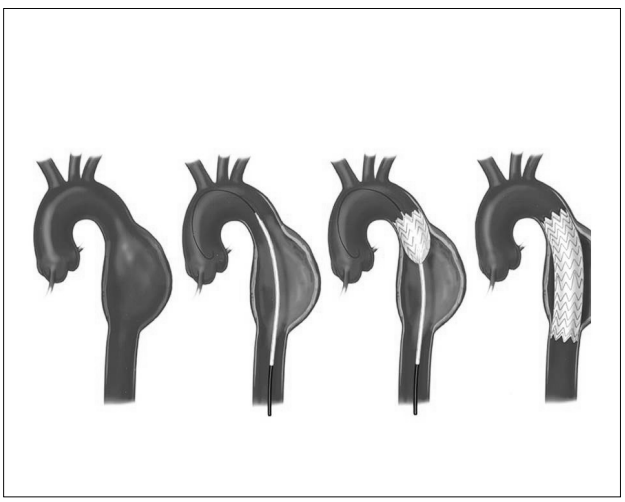
1) How to use pipeline stents

김 성 림
가톨릭대학교 부천성모병원 신경외과









Covered stent

Drawbacks

1. Bulky →
Trackability & conformability 떨어짐

2. cyllindrical figure, size가 다양하지 않다 →
endoleakage 위험성 증가

3. Coverage rate 100%
→**Side branch occlusion**

Application

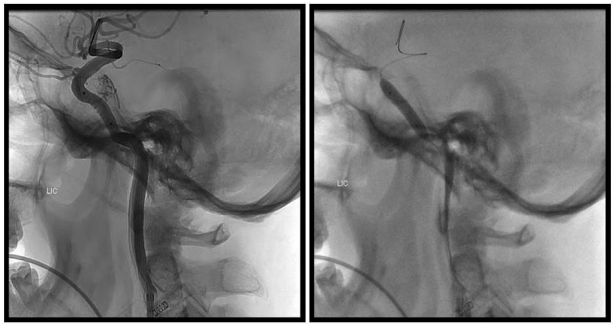
1. Cerebral aneurysm:
극히 제한적

2. CCF

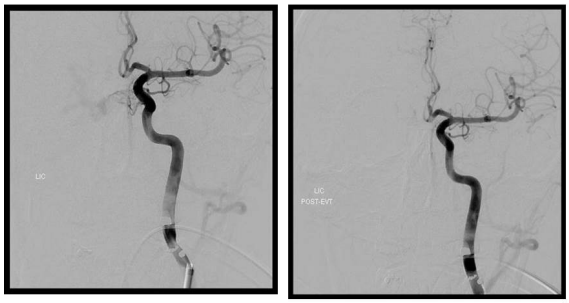
3. Traumatic ICA injury

Covered stent: CCF

Covered stent: CCF



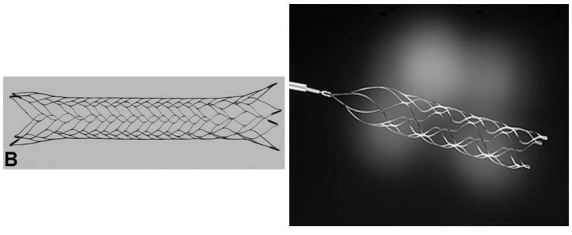
Covered stent: CCF



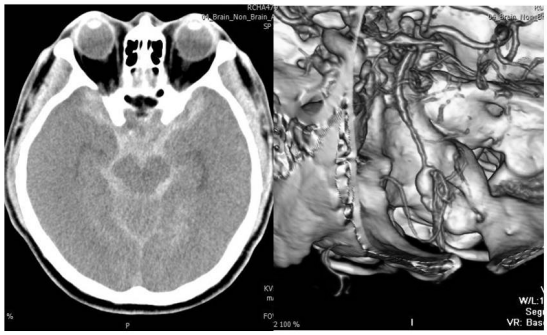
Covered stent: CCF

Multiple stents

Enterprise **Solitaire**

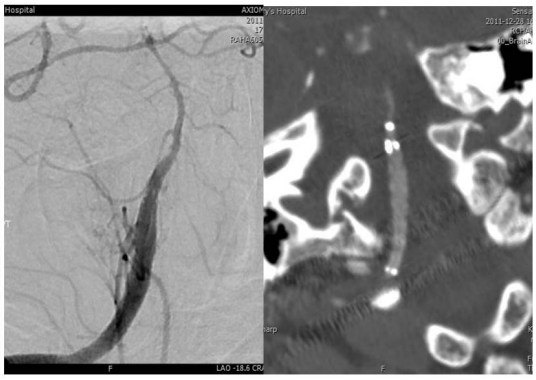


Multiple stents: Case I
56/M, Comatose mentality

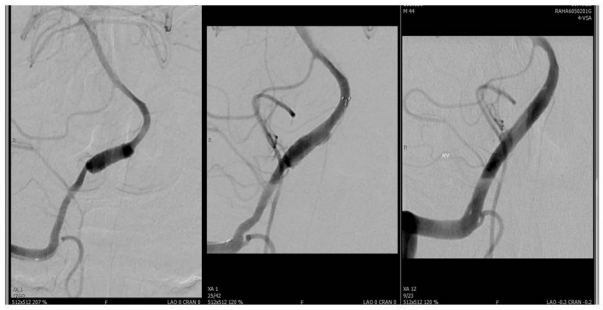


Enterprise 4.5/37, Solitaire 5/30

6일 & 2개월 후

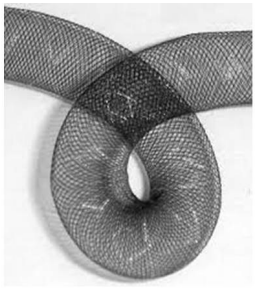


Multiple stents: Case II
Enterprise 4.5/37, Solitaire 6/30

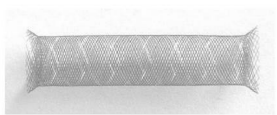


Flow Diverting Stents

Pipeline



Silk



Flow Diverting Stents

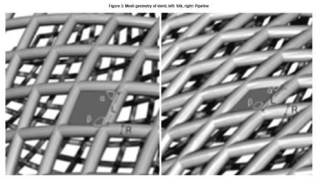
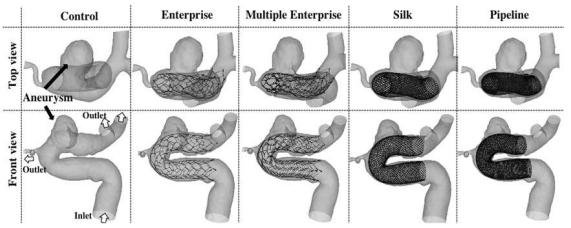


Table 1: Parameter of mesh

	Silk	Pipeline
Angle: α	90°	44°
Angle: β	90°	136°
Length	0.345 mm	0.317 mm
R	42 μm	45 μm
Mesh area	0.12 mm²	0.07 mm
Coverage rate	20.60%	31.06%

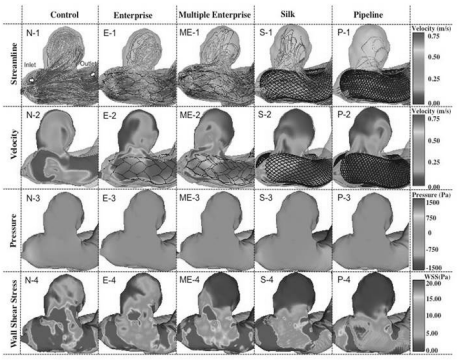
Kojima et al. Asian J Neurosurg 2012;7(4):159-65.

Flow Diverting Stents



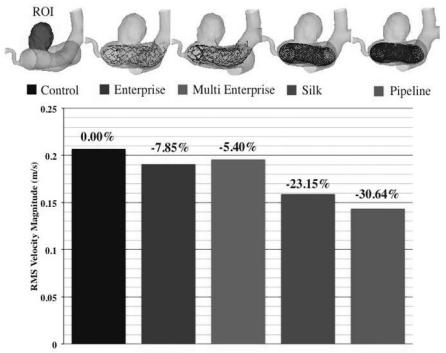
Kojima et al. Asian J Neurosurg 2012;7(4):159-65.

Flow Diverting Stents



Kojima et al. Asian J Neurosurg 2012;7(4):159-65.

Flow Diverting Stents



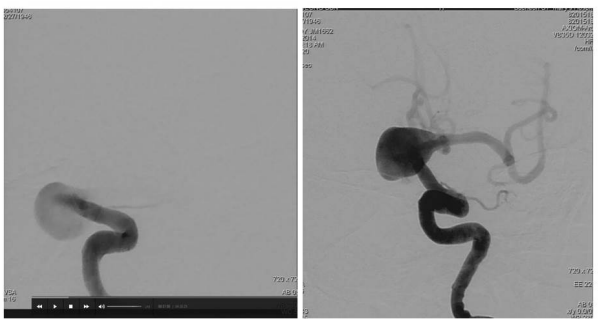
Kojima et al. Asian J Neurosurg 2012;7(4):159-65.

Pipeline stent: technical considerations

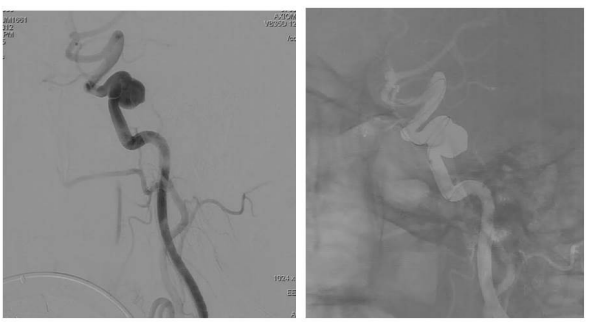
1. microwire & microcatheter navigation: how to overcome **internal jet flow**
2. Microcatheter position

   M1: cavernous, M2: paraclinoid
3. Deployment technique: **Pushing**
4. Foreshortening

Internal Jet Flow

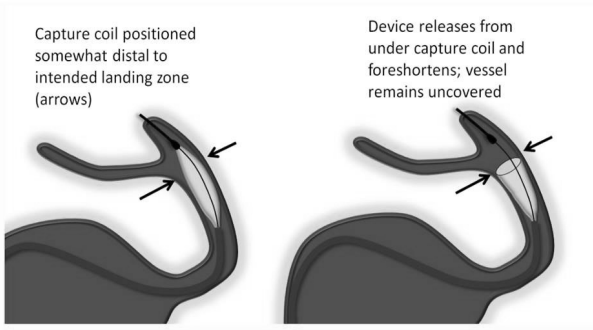


Easy navigation

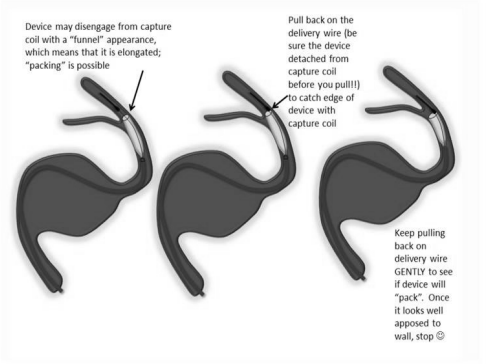


Difficult navigation

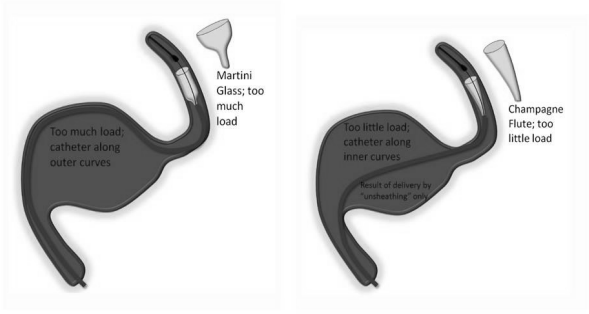
Detachment from Capture Coil



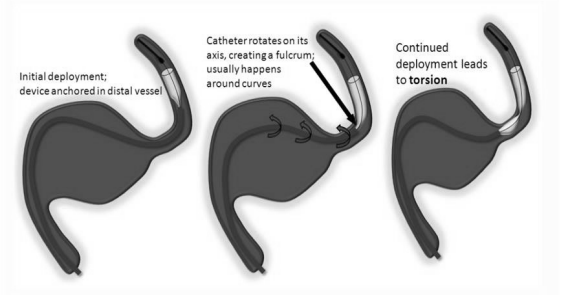
Detachment from Capture Coil

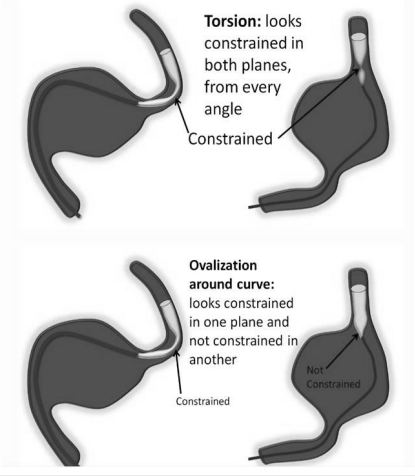


The Right Balance

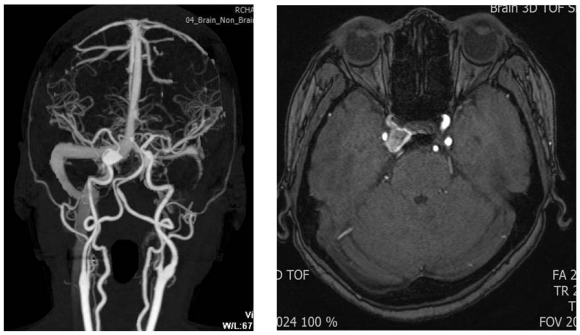


Torsion





Case 1
53/F, Headache



9개월 후 DSA.
Pipeline stent distal portion에 de novo aneurysm

Initial & F/up DSA

Pipeline Stent:
Take-Home Points

1. **PUSH** the stent

2. Keep the Right **BALANCE**

2) How to use Onyx?

윤 석 만
순천향대학교 천안병원

2005년 FDA 공인을 받은 Onyx가 임상에 도입된 지 10여년이 흘러 많은 경험이 축적되고 있으며, onyx delivery catheter 및 balloon catheter의 발전으로 말미암아 시술이 보다 더 효과적이고 안전해지고 있다. 또한 dual-lumen balloon microcatheter가 도입되면서 시술시간도 짧아지고 있어 장시간 시술로 인한 방사선 노출 위험도 점차 낮아지고 있다. 그러나 색전물질이 액체여서 코일과 비교해 다루기 어려우며 즉각적인 판단이 매우 중요하므로 내경동맥 및 외경동맥 분지와 이들간의 anastomotic channel에 대한 지식이 필수적이다.

적응증: 뇌동정맥기형, 경막동정맥루

Onyx 특성: EVOH (ethylene vinyl alcohol) copolymer dissolved in DMSO로 검은색을 띤다. 6%(Onyx 18), 8%(Onyx 34)두 종류가 상업용으로 개발되었으며, Non-adhesive하여 하나의 feeder를 통하여 장시간 injection이 가능하고 기형혈관이나 동정맥루를 하나의 feeder에서 완전히 폐색시킬 수 있다. 즉, 동맥쪽의 feeder에서 injection하여 기형, 혹은 fistula를 지나 정맥까지 도달하게 할 수 있으며, retrograde로 다른 feeder로 까지 나아가 여러 feeder 를 모두 막을 수 있는 장점이 있다. 혈관에 주입시 DMSO가 확산되어 제거되면 precipitation되면서 남아 혈관을 막는다. Catheter gluing incidence of 2-8.5%로 보고되며, 2분이상 주입을 멈추면 그 위험이 증가한다.

AVM 색전술 결과: 과거 NBCA를 이용한 색전술이 수술전 실혈과 수술시간을 줄이고 박리를 용이하게 할 목적으로 시행된 반면, Onyx 이후에는 완치를 목적으로 하는 시술이 주로 시행된다. 특히, 크기가 작거나 single superficial venous drainage를 보이는 경우 curative embolization의 가능성이 높으며, 그 빈도는 8.3-81.8%로 술자마다 차이가 크다. 시술 중 출혈은 4-12.2%에서, morbidity는 3.5-15.5%, mortality는 높게는 4.3%까지 보고되고 있다.

AVF색전술 결과: Onyx는 transarterial approach로 주로 사용하며, 흔히 MMA를 통해 주입하면 효과적이고 안전하다. 치료 성공률은 50-90%, 합병증은 2-10%로 보고되고 있다. ECA의 branch를 통한 시술시 cranial nerve palsy가능성을 고려하여 주의하여야 한다.

치료혈관 선택: AVM 이나, AVF 색전시 혈관조영상 가장 굵고 straight한 혈관을 target으로 선택하면 접근이 용이하고 카테터 제거시 어려움이 적다. 그러나 detachable Apollo microcatheter를 사용할 경우에는 feeder가 너무 굵으면 onyx plug를 만드는데 시간이 많이 걸리므로 적절한 굵기의 혈관을 선택하는 것이 더 용이 할 수 있다. dual lumen balloon catheter를 이용할 경우에는 가장 굵고 straight한 혈관을 target으로 선택하는 것이 좋으며, balloon inflation한 후 Onyx를 주입하면 onyx plug 만드는 과정을 생략할 수 있어 시술 시간이 상당히 단축되고 보다 안전하게 시술할 수 있다.

시술 과정:

1) Onyx시술은 전신마취하에서 시행해야 한다.
2) 시술 시작시 Onyx를 shaker에 올려 놓고 shaking을 시작한다. 최소 20분간 Onyx를 shaking한 후 사용하는 것을 권장한다.
3) 시술하고자 하는 target혈관을 결정하였으면 microcathter (Apollo혹은, Scepter C 4x10mm)를 target feeder에 병변에 최대한 가깝게 위치 시킨다.
4) Microcatheter를 통해 3cc주사기로 100%조영제를 사용해 angiogram을 시행한다. 이때 최소 초당 3 frame이상으로 하면 angioarchitecture를 이해하는데 도움이 될 수 있다.
5) 끼고 있는 glove를 모두 교체한다.
6) Microcathter에 연결된 Hub를 제거하고 5DW 5cc정도로 미세도관을 irrigation한다.
7) DMSO 0.4cc가량 서서히 주입하여 미세도관을 DMSO로 채우면 시술 준비가 완료된다.
8) Shaking 된 Onyx를 1cc 주사기에 받아 준비한다. 이때 Blood나 saline등에 닿으면 중화반응이 일어나므로 주의하고 주입을 하지 않을 때는 계속 흔들고 있어야 한다.
9) 1cc 주사기에 담긴 Onyx를 blank roadmap하에서 조명을 어둡게 한 후 서서히 주입한다. Balloon catheter를 사용하는 경우에는 balloon inflation을 하고 주입하나, 그렇지 않은 경우는 Onyx plug를 만들어야 하므로 reflux hold reinjection technique을 써서 reflux margin까지 plug를 만든다.
10) Onyx가 병변으로 들어가기 시작하면 일정한 속도로 계속 주입한다. 잘 들어간다고 좀 더빨리 주입하면 reflux가 바로 일어나게 되므로 인내심을 갖고 계속 천천히 주입해야 한다.
11) Reflux나 혹은 원치 않는 혈관으로 가기 시작하면 중지하고 1-2분 기다렸다가 다시 주입을 반복한다.
12) Onyx로 병변을 충분히 채웠거나 계속 reflux만 되는 경우는 시술을 종료해야 한다.
13) Onyx 주입 주사기로 microcathteter에 약간 음압을 걸어 서서히 부드럽게 당기면 detach tip이 떨어져 미세도관을 제거할 수 있다. Balloon catheter를 사용한 경우는 balloon deflation을 하고 완전히 deflation이 완전히 된 것이 확인되면 catheter를 제거한다.

주의사항:

1) 국소마취로 onyx시술시 심한 통증을 호소하므로 반드시 전신마취를 해야 한다.
2) scalp avm과 facial avm과 같은 superficial lesion에 Onyx를 사용하면 skin discoloration 이 발생하므로 사용해서는 안 된다.
3) Catheter gluing으로 제거가 안 되는 경우는 microcatheter를 잘라 femoral artery속으로 밀어 넣고 추후 수술로 제거하거나 그대로 둔다.

ASCENT 2016

The “Unexpected case” session

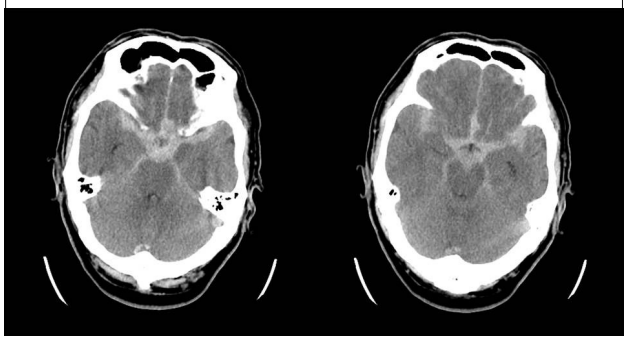
좌장 : 에스포항병원 **김문철**

Case 1. Intraarterial abciximab for treatment of thromboembolismduring coil embolization of intracranial aneurysms

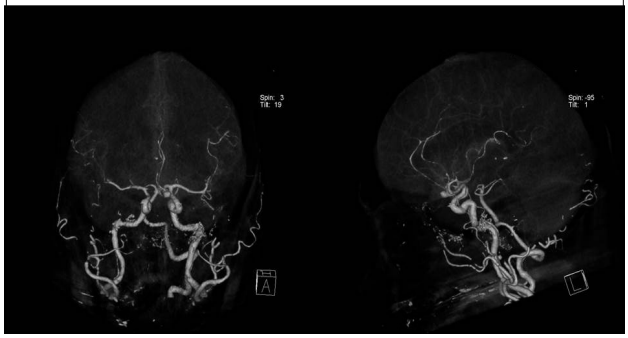
최 재 영
고신대학교 복음병원 신경외과

- M/63
- C.C: decreased mentality
- LOC: Stupor

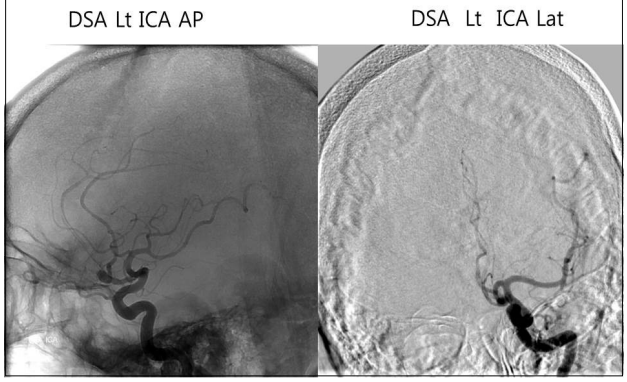
CT brain NCE (2016.05.20)



CT brain angiography (2016.05.20)

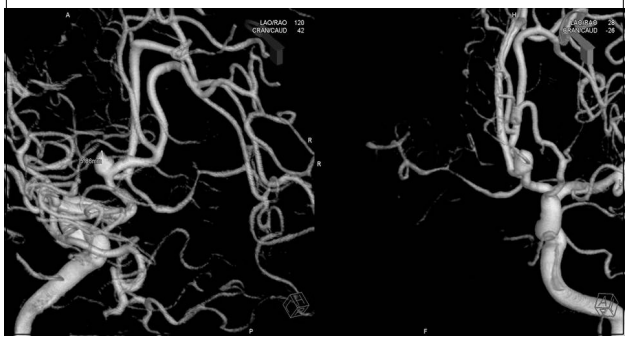


DSA(2016.05.20)



DSA 3D

6.7mmX5mm Lt Acom aneurysm



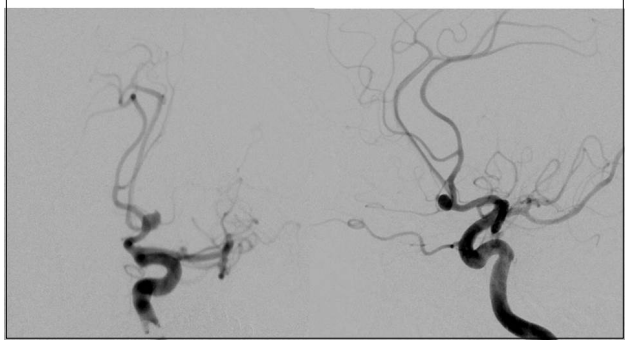
Method

- Two catheter method?
- Stent-assisted coil embolization?

Coil embolization working angle

DSA Lt ICA AP

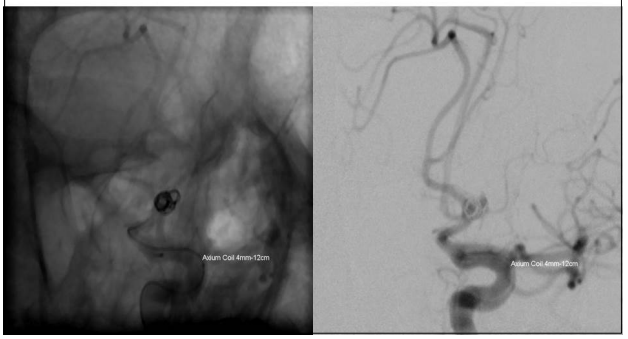
DSA Lt ICA Lat



Coil embolization(2016.05.20)

DSA Lt ICA AP

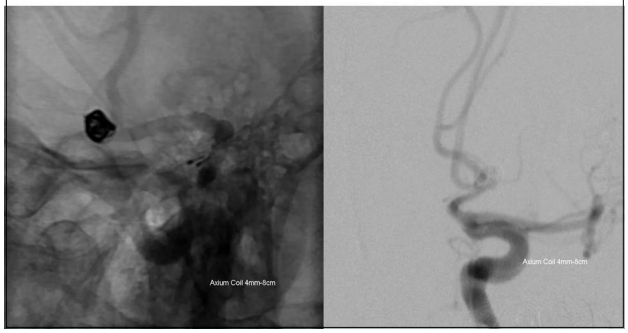
DSA Lt ICA Lat



Coil embolization(2016.05.20)

DSA Lt ICA AP

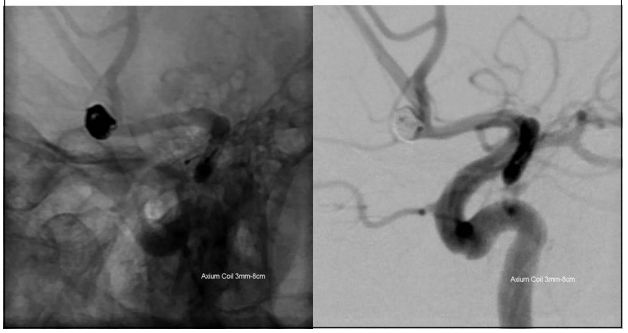
DSA Lt ICA Lat



Coil embolization(2016.05.20)

DSA Lt ICA AP

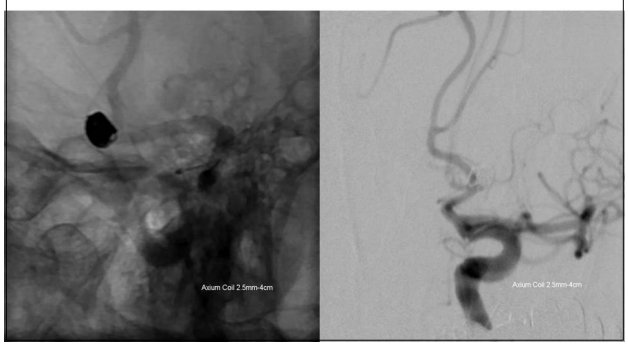
DSA Lt ICA Lat



Coil embolization(2016.05.20)

Heparin 3000 unit IV

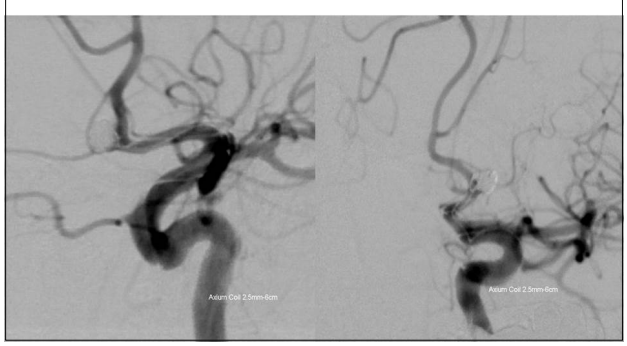
DSA Lt ICA AP DSA Lt ICA Lat



Coil embolization(2016.05.20)

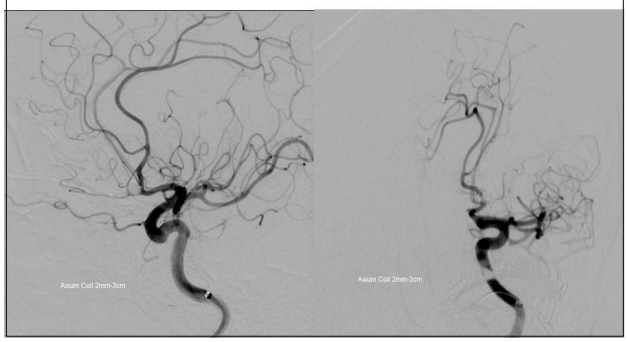
Reopro 6mg I.A

DSA Lt ICA AP DSA Lt ICA Lat



Post Reopro 6mg I.A after 10 min

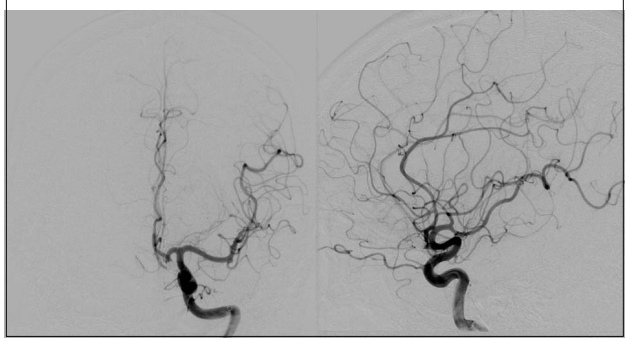
DSA Lt ICA AP DSA Lt ICA Lat



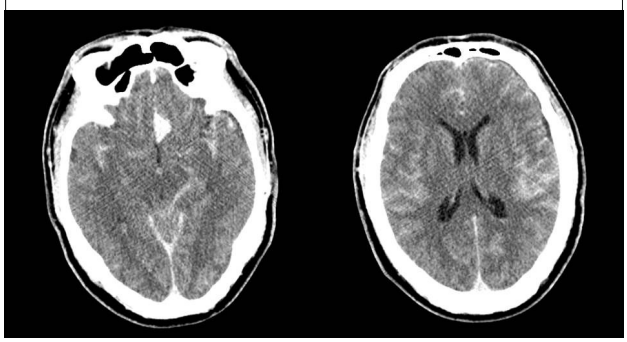
Rt neck compression angiography

Final angiography

DSA Lt ICA AP DSA Lt ICA Lat



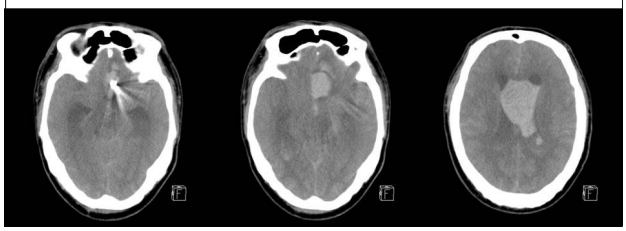
Post OP CT brain NCE (2016.05.20)



POD 1 day

- Stupor mentality
  → Drowsy mentality
- heparinization continue
- Post embolization 22 hour
  →Sudden decreased mentality

CT brain NCE (2016.05.21)

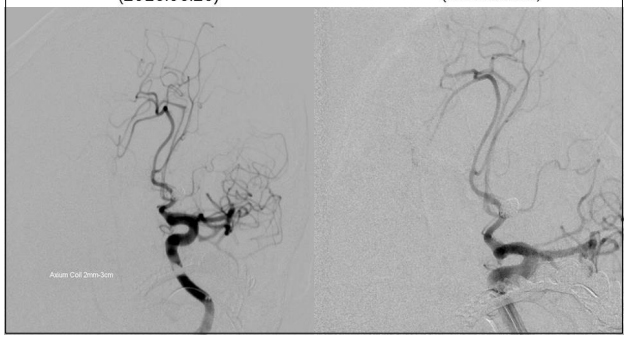


- Rebleeding induced Reopro?
- ICH expansion induced Reopro?

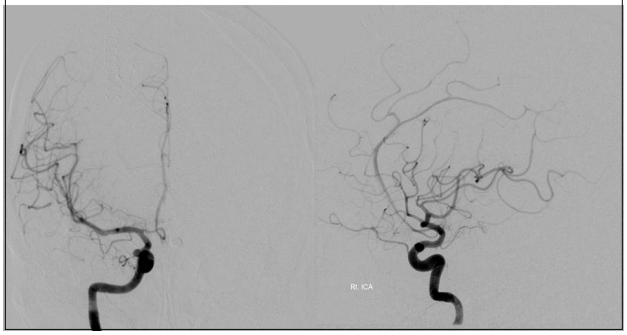
DSA F/U after rebleeding

Post embolization final angiography (2016.06.20)

Post rebleeding (2016.06.21)



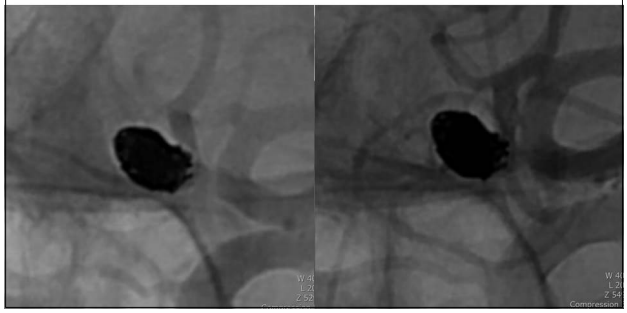
Post rebleeding Rt ICA angiography(2016.06.21)



Coil configuration

Post embolization final angiography (2016.06.20)

Post rebleeding (2016.06.21)



J Neurosurg 108:450–457, 2008

Intraarterial abciximab for treatment of thromboembolism during coil embolization of intracranial aneurysms: outcome and fatal hemorrhagic complications

JAE HYO PARK, M.D.,[1] JEONG EUN KIM, M.D.,[1] SEUNG HUN SHEEN, M.D.,[2] CHEOL KYU JUNG, M.D.,[2] BAE JU KWON, M.D.,[2] O-KI KWON, M.D.,[1] CHANG WAN OH, M.D.,[1] MOON HEE HAN, M.D.,[2] AND DAE HEE HAN, M.D.[1]

Departments of [1]Neurosurgery and [2]Radiology, Seoul National University College of Medicine, Seoul, Korea

Object. Experience with intraarterial abciximab for the treatment of thromboembolism during endovascular coil embolization is limited. The authors report the outcome of intraarterial abciximab use, with an emphasis on fatal hemorrhagic complications.

Methods. Between March 2003 and May 2006, the authors treated 606 aneurysms by using endovascular coil embolization, and in 32 (5.3%) of these aneurysms (31 patients) an intraarterial thrombus developed. Sixteen of these aneurysms were ruptured and the other 16 were unruptured. Arterial thrombi were totally occlusive in 3 and partially occlusive in the remaining 29 cases. Intraarterial abciximab was administered at a concentration of 0.2 mg/ml as a bolus of 4–15 mg over a period of 15–30 minutes.

Results. Complete thrombolysis was achieved in 17 (53%) and partial thrombolysis in 15 (47%) of 32 lesions. Twenty-eight patients (90.3%) were asymptomatic after abciximab thrombolysis, but 3 had postprocedural rebleeding that occurred after abciximab treatment; all of these patients had recently experienced an aneurysm rupture. Of these patients, 1 displayed severe thrombocytopenia and the other 2 showed a > 25% reduction in platelet count after abciximab treatment.

Conclusions. Intraarterial abciximab is effective for the treatment of thromboembolic complications that occur during intracranial aneurysm coil insertion. Nevertheless, attention should be paid to prevent potentially fatal complications such as thrombocytopenia and hemorrhage, especially in patients with a ruptured aneurysm.
(DOI: 10.3171/JNS/2008/108/3/0450)

KEY WORDS • abciximab • complication • embolization • thromboembolism • thromboembolism

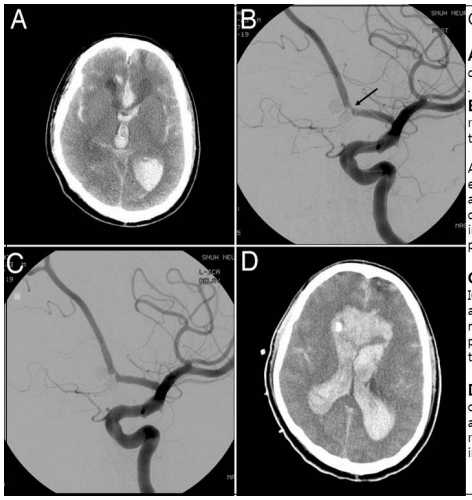
Compare of patients with aneurysm rebleeding

TABLE 2

*Characteristics of 3 patients with aneurysm rebleeding**

Characteristic	Case 1	Case 2	Case 3	Our patient
age (yrs), sex	57, M	50, M	85, F	63,M
lesion location	ACoA	ACoA (kissing)	PCoA	ACoA
lesion size (mm)	5 × 6 × 5	4 × 3 × 2, 3 × 3 × 2	7 × 5 × 4	6x5x4
hemorrhagic status	ruptured	ruptured	ruptured	ruptured
aneurysm occlusion rate (%)	100	100	90	100
coil packing density (%)	28	42	27	43
abciximab dose (mg)	10	5	5	6
angiographic response	partial	partial	partial	partial
intraembolization heparinization	yes	yes	yes	yes
postembolization heparinization	no	no	yes	yes
pre/postembolization platelet count (× 10^9/L)	250/14	295/135	281/199	220/120
% of platelet reduction	95	61	29.2	45
pre/postembolization aPTT (sec)	39/56	29/114	32/92	32/92
% of aPTT delay	143	393	287	287
interval btwn intraarterial abciximab & rebleeding (hrs)	2	12	22	22

* aPTT = activated partial thromboplastin time.



Case 2

A: Axial CT scan demonstrating SAH and IVH.

B: Left ICA angiography revealing kissinganeurysms that are 4 3 3 3 2 mm and 3 3 3 3 2 mm on the ACoA. At the end of the coil embolization, there appeared to be a filling defect *(arrow)* at the interface of the coil and the parent vessel.

C: Angiogram of the left ICA obtained 15 minutes after the local delivery of 5 mg of abciximab, showing partial thrombolysis and no thrombus progression.

D: Followup CT scan obtained 12 hours after abciximab administration revealing a significant increase in SAH and IVH.

Platelete and aPTT f/u

Platelete f/u

단위	%	참고치	0.13 - 0.28	
	외래일	NO	결과	F
4	16/06/07	449	0.21	
5	16/06/06	390	0.24	
6	16/06/05	389	0.28	
7	16/06/04	388	0.27	
8	16/06/03	371	0.28	
9	16/06/02	308	0.28	
10	16/06/01	307	0.26	
11	16/05/31	306	0.25	
12	16/05/30	240	0.23	
13	16/05/29	239	0.24	
14	16/05/28	238	0.22	
15	16/05/27	237	0.20	
16	16/05/26	165	0.16	
17	16/05/25	164	0.14	
18	16/05/24	163	0.15	
19	16/05/23	49	0.12	L
20	16/05/22	48	0.13	
21	16/05/21	103	0.12	L
22	16/05/21	47	0.15	
23	16/05/20	42	0.22	

aPTT f/u

PTT

단위	sec	참고치	27.0 - 45.0	
	외래일	NO	결과	F
1	16/05/21	103	32.2	
2	16/05/21	67	87.6	H
3	16/05/21	66	69.1	H
4	16/05/21	65	92.4	H
5	16/05/20	42	45.2	H
6	16/05/20	1	32.7	

Question

- Two catheter method
  VS Stent assisted method ?
- Antiplatelete agent or heparinaztion ?
- Rebleeding ***VS*** ICH expansion?
- Tirofibane ?
- Platelete transfusion?

Case 2. Ruptured proximal PICA aneurysm with ipsilateral hypoplastic VA - contralateral stent (LVIS Jr) assist coiling

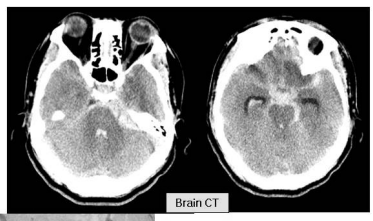
Ho Jun Yi, Jae Hoon Sung, Dong Hoon Lee, Sang Wook Kim, Sang Won Lee
Cerebrovascular Center, Department of Neurosurgery, St Vincent's Hospital, The Catholic University of Korea

Introduction

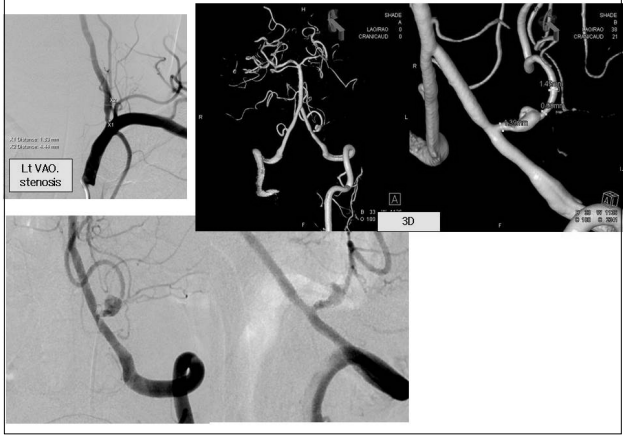
- The benefits of EVT of PICA are well documented
- Surgical Tx of PICA aneurysms : deep location, close to brainstem and lower CN.
- Therapeutic challenge : wide-necked, complex aneurysms of the PICA
- Navigation of the stent through the ipsilateral vertebral artery (VA) : difficult or impossible
  → the unfavorable geometry of the aneurysm, parent vessel angulation.
- Balloon- or stent-assisted coiling, selective occlusion of such wide-necked PICA aneurysms.
- Deconstructive techniques with PICA and/or VA occlusion : the only possible EVT option

Case report

SAH, M/64, Stupor



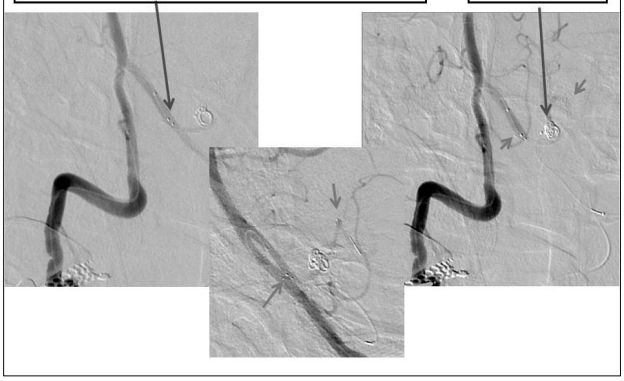
Case report



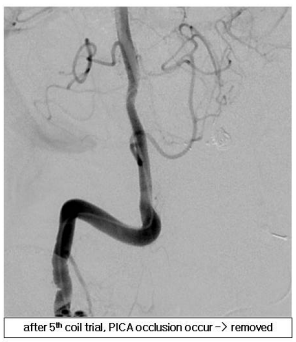
Stent (LVIS Jr) assist coiling

stent route : Rt VA to Lt PICA (via 6F Shuttle + 6F Envoy)
coil route : Lt VA to Lt PICA (via 5F Davis)

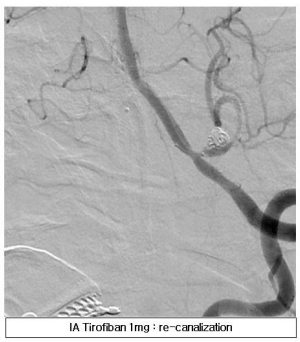
stent tips : arrows
inserted coil : 4



Final coil disintegrate LVIS Jr !

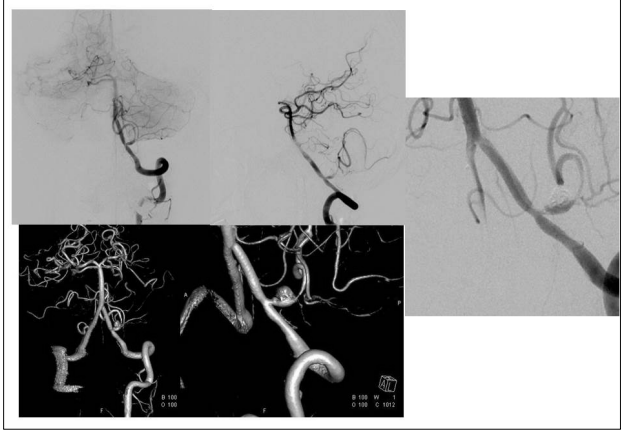


after 5th coil trial, PICA occlusion occur -> removed



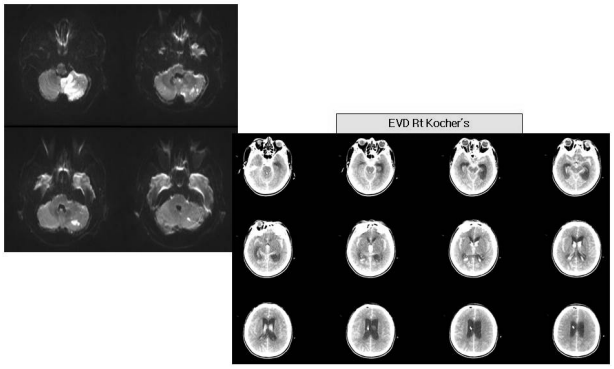
IA Tirofiban 1mg : re-canalization

After thrombolysis : Final angio

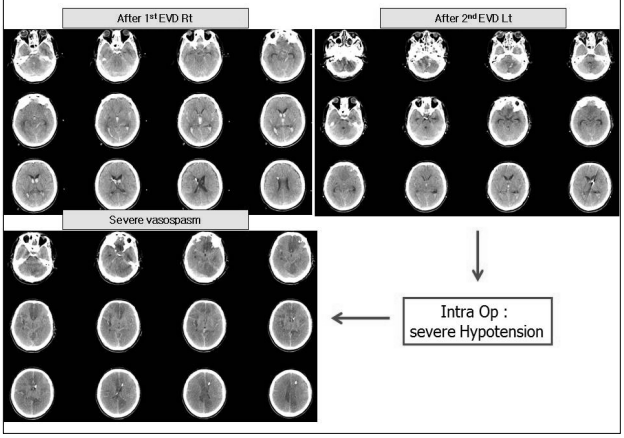


Procedure

Pateint Outcome



Pateint Outcome



Discussion

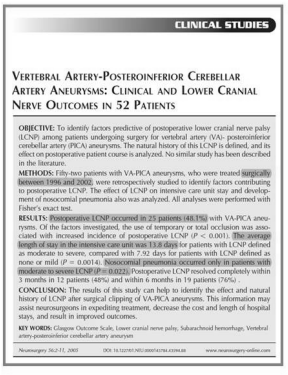
- PICA aneurysm remain a challenge for neurosurgeons

: deep and related close lower CN.

: bony structures in the lateral foramen magnum region can be obstacles during surgery

: Postop temporary or permanent cranial nerve palsies (about half)

: Need for ICU care and pneumonia



CLINICAL STUDIES

VERTEBRAL ARTERY-POSTEROINFERIOR CEREBELLAR ARTERY ANEURYSMS: CLINICAL AND LOWER CRANIAL NERVE OUTCOMES IN 52 PATIENTS

OBJECTIVE: To identify factors predictive of postoperative lower cranial nerve palsy (LCNP) among patients undergoing surgery for vertebral artery (VA)- posteroinferior cerebellar artery (PICA) aneurysms. The natural history of this LCNP is defined, and its effect on postoperative patient course is analyzed. No similar study has been described in the literature.

METHODS: Fifty-two patients with VA-PICA aneurysms, who were treated surgically between 1996 and 2002, were retrospectively studied to identify factors contributing to postoperative LCNP. The effect of LCNP on intensive care unit stay and development of nosocomial pneumonia also was analyzed. All analyses were performed with Fisher's exact test.

RESULTS: Postoperative LCNP occurred in 25 patients (48.1%) with VA-PICA aneurysms. Of the factors investigated, the use of temporary or total occlusion was associated with increased incidence of postoperative LCNP ($P < 0.001$). The average length of stay in the intensive care unit was 13.8 days for patients with LCNP defined as moderate to severe, compared with 7.92 days for patients with LCNP defined as none or mild ($P = 0.0014$). Nosocomial pneumonia occurred only in patients with moderate to severe LCNP ($P = 0.022$). Postoperative LCNP resolved completely within 3 months in 12 patients (48%) and within 6 months in 19 patients (76%) .

CONCLUSION: The results of this study can help to identify the effect and natural history of LCNP after surgical clipping of VA-PICA aneurysms. This information may assist neurosurgeons in expediting treatment, decrease the cost and length of hospital stays, and result in improved outcomes.

KEY WORDS: Glasgow Outcome Scale, Lower cranial nerve palsy, Subarachnoid hemorrhage, Vertebral artery-posteroinferior cerebellar artery aneurysm

EVT : PICA aneurysm

- PICA : most complex, tortous, vaiable course
  : procedural rupture or occlusion
- Wide-necked PICA aneurysm :

Balloon or stent-assisted coiling
: self expanding stent technology"
: supercompliant balloon technology"
: cross-over technique"

Navigation to the ipsilateral VA
(difficult, impossible)
: unfavorable geometry of the aneurysm,
: parent vessel angle and character

Deconstructive techniques with PICA and/or VA occlusion :option

Peluso | AJNR 29 | Jan 2008 | www.ajnr.org

Posterior Inferior Cerebellar Artery Aneurysms: Incidence, Clinical Presentation, and Outcome of Endovascular Treatment

The Endovascular Management of Saccular Posterior Inferior Cerebellar Artery Aneurysms

EVT : PICA aneurysm

AJNR 31 | Aug 2010 | www.ajnr.org

Clinical Outcomes of Ruptured and Unruptured Vertebral Artery-Posterior Inferior Cerebellar Artery Complex Dissecting Aneurysms after Endovascular Embolization

Summary of characteristics of 22 patients with VA-PICA dissecting aneurysms

Patient No.	Age (yr)/Sex	Presentation	Aneurysm Size (mm)	Treatment	Angiographic Results	Follow-Up (Mo)	Clinical Outcome (GOS)
1	53/F	CN VI palsy, headaches	10 × 8	VA occlusion	In	36	5
2	58/M	Brain stem, ischemia	6 × 4	VA occlusion	In	72	5
3	12/M	Headaches	15 × 6	Stent	In	72	5
4	40/M	Brain stem, ischemia	12 × 7	Stent	In	84	5
5	42/M	Brain stem, ischemia	7 × 6	Stent coil	In	48	5
6	41/M	Brain stem, ischemia	13 × 6	Stent coil	Co	12	5
7	39/F	SAH	30 × 30	VA occlusion	In	84	5
8	45/M	SAH	12 × 6	VA occlusion	In	36	5
9	40/M	SAH	8 × 8	VA occlusion	In	12	5
10	34/F	SAH	10 × 7	VA occlusion	In	60	5
11	42/F	SAH	11 × 6	VA occlusion	Su	5	5
12	59/F	SAH	12 × 7	VA occlusion	In	12	5
13	47/M	SAH	5 × 4	Stent	In	72	5
14	36/M	SAH	12 × 10	Stent	In	36	5
15	51/M	SAH	14 × 7	Stent	In	10	5
16	41/M	SAH	15 × 6	Stent	In	60	5
17	46/M	SAH	10 × 10	Stent coil	Co	11	5
18	44/F	SAH	12 × 8	Stent coil	Co	12	5
19	44/F	SAH	12 × 8	Stent coil	In	6	5
20	57/M	SAH	7 × 7	Stent	Co	9	5
21	45/M	SAH	8 × 11	Stent coil	Co	6	5
22	53/M	SAH	23 × 10	Stent coil	Co	36	5

Kim | AJNR 33 | Feb 2012 | www.ajnr.org

Stenting from the Vertebral Artery to the Posterior Inferior Cerebellar Artery

Summary of characteristics of 6 patients who underwent stenting of vertebral artery–PICA

Patient No.	Age (yr)/ Sex	Presentation	Diagnosis	Treatment	Stent (mm)	Imaging/Clinical F/U (mo)	GOS
1*	58/F	Coexisting	PICA aneurysm	Stent coil	Enterprise 4.5 × 22	11/24	5
2	49/M	SAH	Vertebral artery dissection	Vertebral artery occlusion with stenting	Enterprise 4.5 × 37	12/23	5
3	50/M	Headache	Vertebral artery dissection	Vertebral artery occlusion with stenting	Enterprise 4.5 × 22	6/6	5
4	55/M	Dizziness	Vertebral artery–PICA stenosis	Stent	Enterprise 4.5 × 26	6/6	5
5	49/M	SAH	PICA aneurysm	Stent coil	Solitaire 4 × 15	6/6	5
6*	68/F	Coexisting	PICA aneurysm	Stent coil	Enterprise 4.5 × 22	1/3	5

Retrograde, Contralateral approach

The Retrograde Approach: A Consideration for the Endovascular Treatment of Aneurysms

Data in 12 patient with cerebral aneurysm treated via nonanterograde approach

Case	Subarachnoid Hemorrhage	Aneurysm Location	Route of Assess for Embolization Catheter	Route of Assess for Balloon Catheter	Percentage of Occlusion	Outcome
1	Yes (H & H grade I)	R. PICA	R. vert.	L. vert.	100	Good
2	No	R. ICA bif.	R. ICA	L. ICA	100	Good
3	No	L. SCA	R. vert.	L. ICA	100	Good
4	No	R. ICA PComm	R. vert.	R. ICA	100	Good
5	No	L. ICA PComm	L. ICA	R. ICA	90	Moderate
6	No	Basilar bif.	R. vert.	R. ICA	100	Good
7	No	Basilar bif.	L. vert.	L. ICA	100	Good
8	Yes (H & H grade IV)	Basilar bif.	L. vert.	R. ICA	100	Poor
9	No	Basilar bif.	R. ICA	N/A	Failure	Good
10	Yes (H & H grade III)	L. SCA	R. ICA	N/A	80	Moderate
11	No	R. ICA bif.	R. ICA	L. ICA	Failure, but 100% via conventional approach	Good
12	No	Basilar bif.	L. vert.	R. ICA	100	Good

Note.—H & H indicates Hunt and Hess score; PICA, posterior inferior cerebellar artery; vert, vertebral artery; ICA, internal carotid artery; bif, bifurcation; SCA, superior cerebellar artery; PComm, posterior communicating artery; N/A, not assessed.

J Neurosurg 107:1214–1219, 2007

Contralateral vertebral approach for stenting and coil embolization of a large, thrombosed vertebral–posterior inferior cerebellar artery aneurysm

Case report

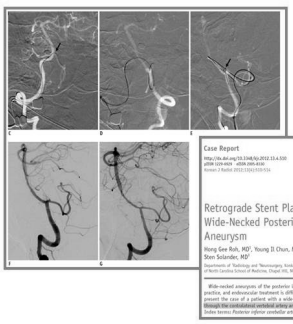
Other cases

Bilateral Approach for Stent-assisted Coiling of Posterior Inferior Cerebellar Artery Aneurysms - Two Cases

Lt PICA aneurysm : 7mm. D/N ratio : 0.7, PICA incorporation into the sac

Rt VA : 6Fr guiding : Solitaire (4 x 20) / Lt VA : 6Fr guiding : Coil

Other cases



Case Report

KJR

Retrograde Stent Placement for Coil Embolization of a Wide-Necked Posterior Inferior Cerebellar Artery Aneurysm

Lt PICA aneurysm : 6.1mm x 2.7mm x height 3.3mm, Lt PICA acute angle

Rt VA : 5Fr Envoy : Enterprise (4.5 x 22) / Lt VA : Envoy : Coil

Conclusion

- EVT is considered the primary treatment for PICA aneurysm
- Complex PICA aneurysm
  (wide neck, narrow PICA, acute angle with VA, VAO stenosis)
  : challenge for both surgical and endovascular treatments.
- Bilateral, contralateral approach for stent-assisted coiling : good option
  (retrograde stenting through the VBJ/ antegrade coiling of the aneurysm)

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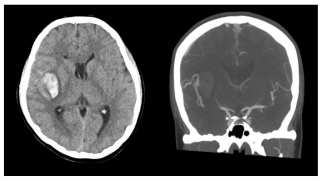
Case 3. Retrieval of Onyx using Solitaire device

박 정 현
한림대 동탄성심

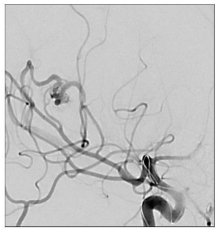
Retrieval of Onyx reflux particle of MCA using SolitaireDevice – Complication Case

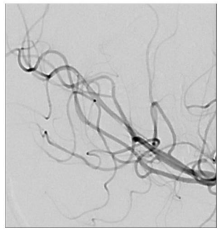
- 24 Y.O / Female
- Headache, Lt. hemiparesis Gd 2

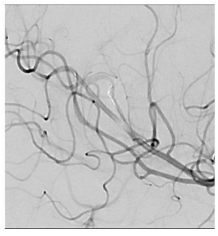


Onyx Embolization

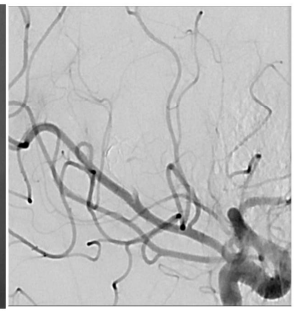
- Onyx embolization was done
- Reflux to parent artery, MCA





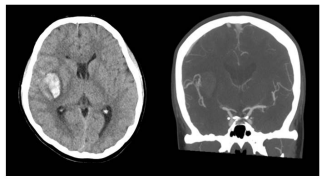


- Retrieval of Onyx particle using Solitaire Device



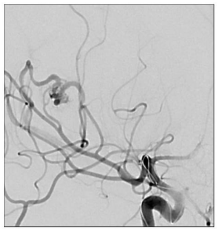
Retrieval of Onyx reflux particle of MCA using SolitaireDevice – Complication Case

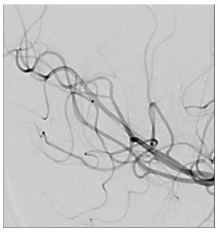
- 24 Y.O / Female
- Headache, Lt. hemiparesis Gd 2

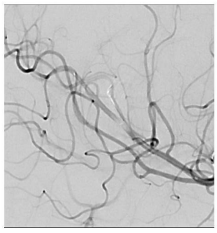


Onyx Embolization

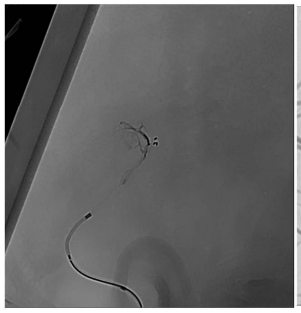
- Onyx embolization was done
- Reflux to parent artery, MCA

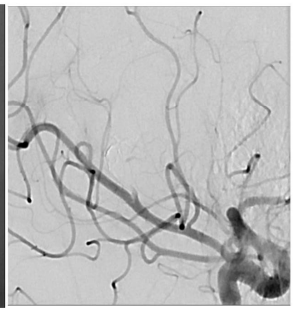






- Retrieval of Onyx particle using Solitaire Device





Case 4. EPD problems during CAS

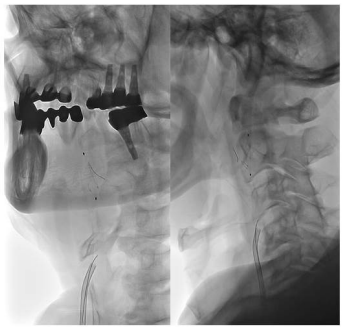
김 대 원
원광대

CAS in tortuous distal ICA

김 대 원 (원광대)

M/75

Rt. ICA AP Lat 3D



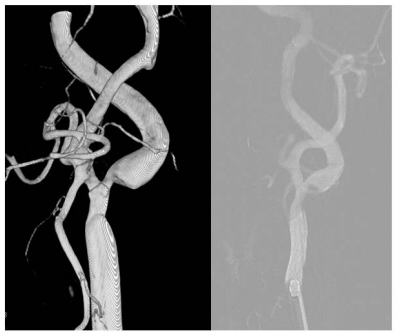
. ICA 꺾이는 부분에서 filter 더 이상 안 올라감.
. 다른 wire 이용하여 혈관을 좀 펴보려 했으나 안됨.
. 필터 capture 하려고 하였으나 capture cath. 안들어감.
. Filter wire 따라 들어가면 잘 못하면 filter와 balloon & stent 끼일 수 있어 다른 wire를 통과시켜 그 와이어 따라서 balloon 및 stent 하려 하였으나 lesion 부위 통과 못함.

. Filter 유지한 채 PTA 시행.
. PTA후 filter capture한 후 stent deploy

Complicated CAS

김 대 원 (원광대)

F/65



. Filter 거치 시킨 후 filter 움직임을 없애기 위해 다른 wire를 이용하여 stent와 PTA 시행함.
. 시술 후 filter recapture 못함.

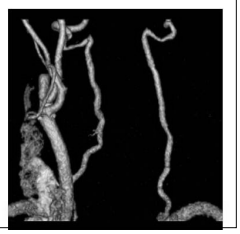
. Filter recapture 불가능하여 다른 stent로 혈관벽에 눌러 놓음.
. 시술 후 filter wire는 femoral artery 밖으로 나와 있는 상태임.
. 수술실에서 경동맥 small arteriotomy 하여 filter wire 절단하고 puncture site에서 잡아 당겨 remove.
. 1년 후 DSA, 4년 후 CTA에서 문제 없음.

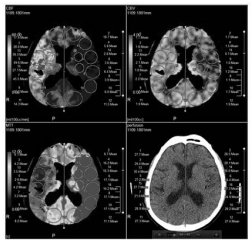
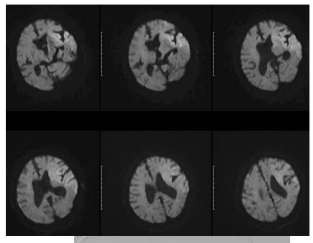
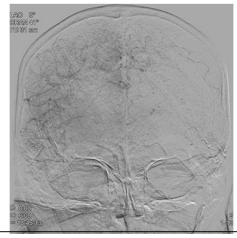
Case 5. Embolic migration after ECA thrombectomy

Byung Hoo Moon, Kyung Sool Jang, Sang Kyu Park
Incheon St. Mary's Hospital Catholic University of Korea

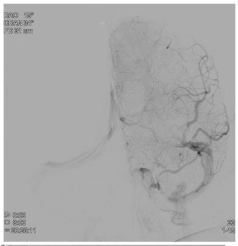
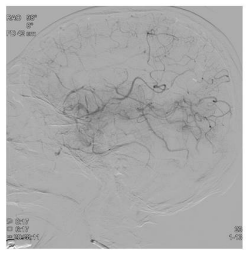
Case

- 82/M
- C/C : Stuporus mentality, Rt. Side weakness G II
- Last normal time : pm 4:40
- First abnormal time pm 5:00
- ER visit time : pm 5:20
- Past Hx. : PTE (2015 rivaroxaban -> F/U loss)

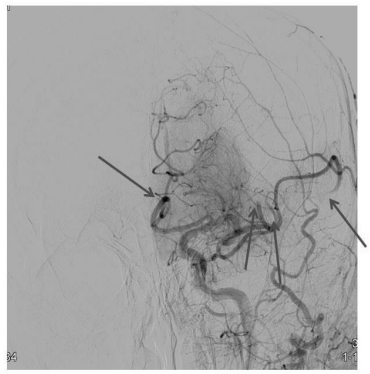



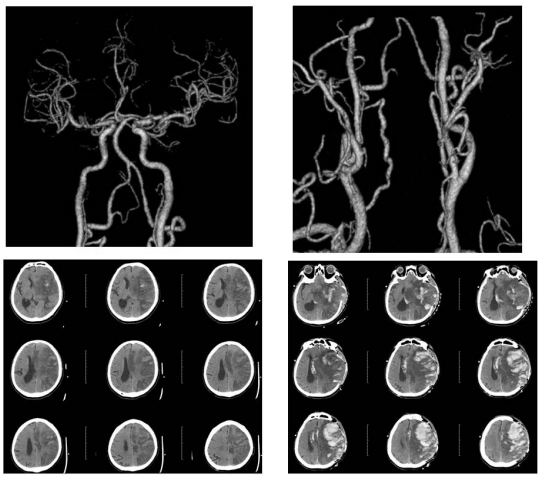
- Arrow 7Fr
- Optimo 7Fr
- Rebar 18
- Solitaire 5-30


- MCA sup' trunk partial recannalization
- Recannalization time : 3h30min after Sx. onset
- ECA thrombectomy



- ACA & MCA mutiple embolic migration & occlusion after ECA thrombectomy
- Urokinase 20k IU use

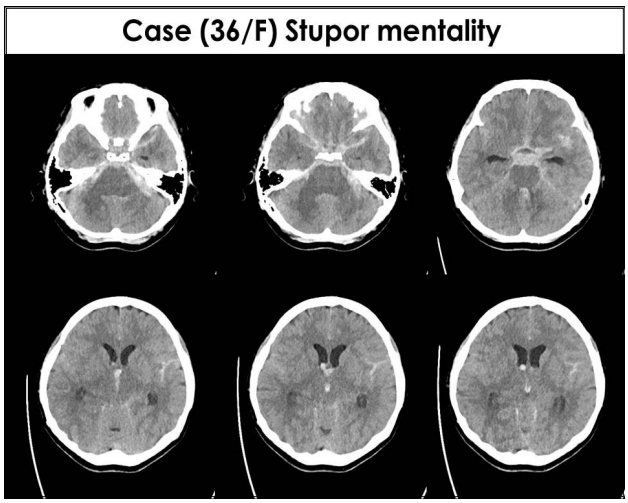


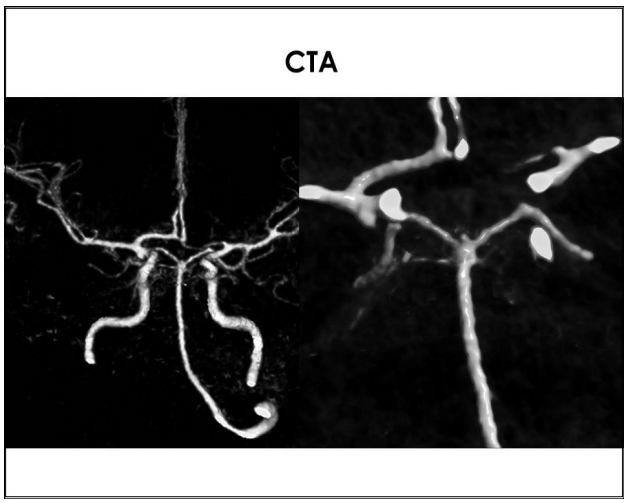
Case 요약

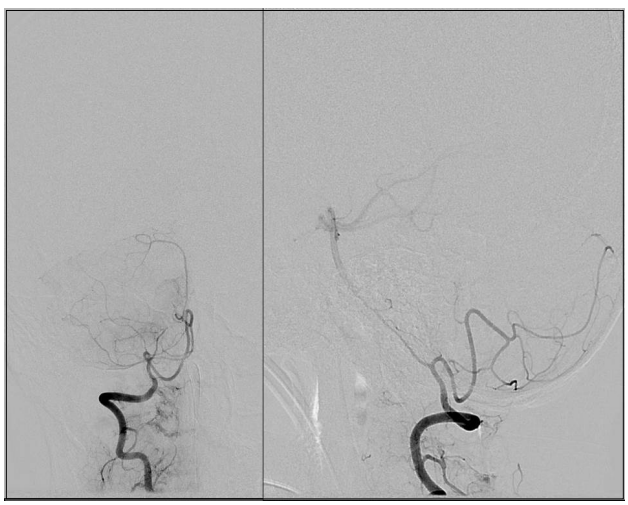
- Distal ICA 및 ECA occlusion 환자에 대해 d-ICA ~ MCA occlusion 에대해 solitaire를 이용하여 4차례 thrombectomy 후 MCA superior trunk 가 partial recannalization 되어 UK 2만 unit 사용하였으며 시술 종료후 ECA occlusion 도 동반된 상태로 ECA도 solitaire를 이용하여 thrombectomy 시행하였음. ECA thrombectomy 후 embolic migration 되면서 ACA 및 MCA에 multiple하게 distal occlusion 되어 UK 2만 unit 사용후 시술 종료함.
- 그후 환자는 hemorrhagic transformation 및 infarction 부위에 edema 증가하여 decompressive craniectomy 시행함.

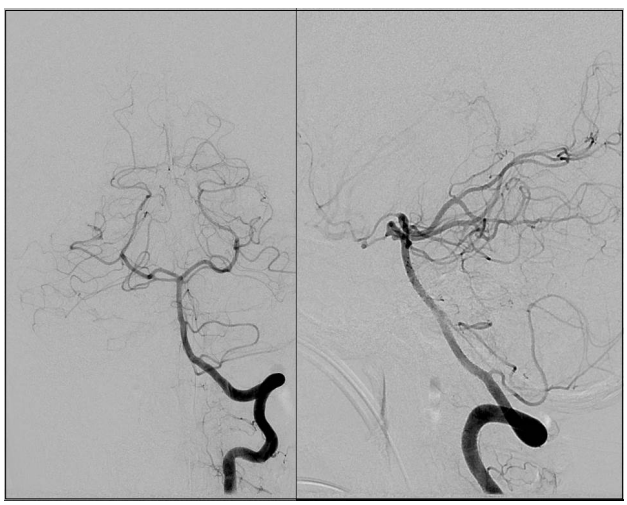
Case 6. Intra-procedural rupture due to microcatheter

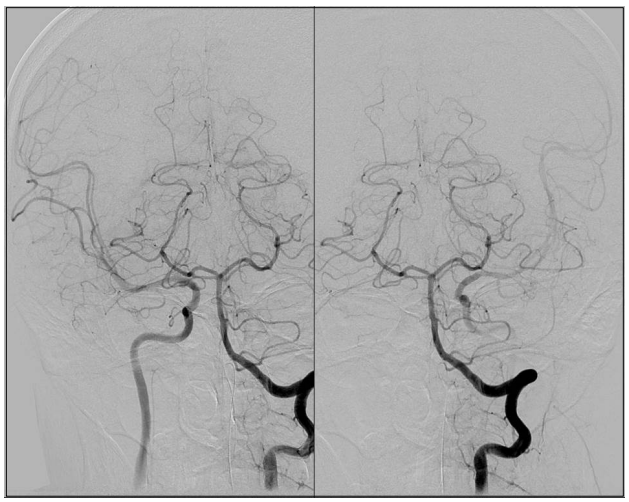
김 명 진
가천의대

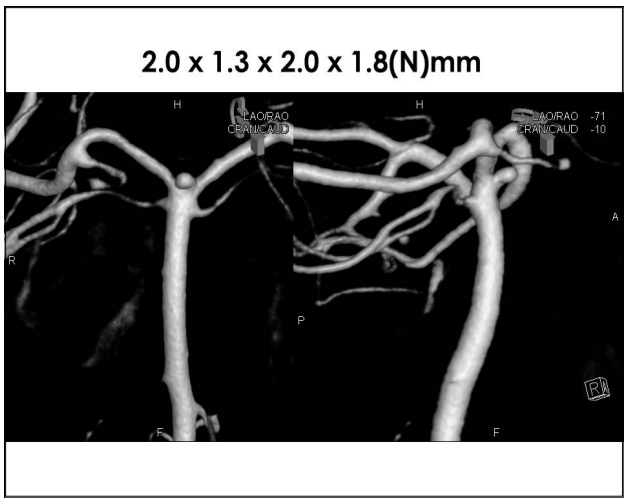


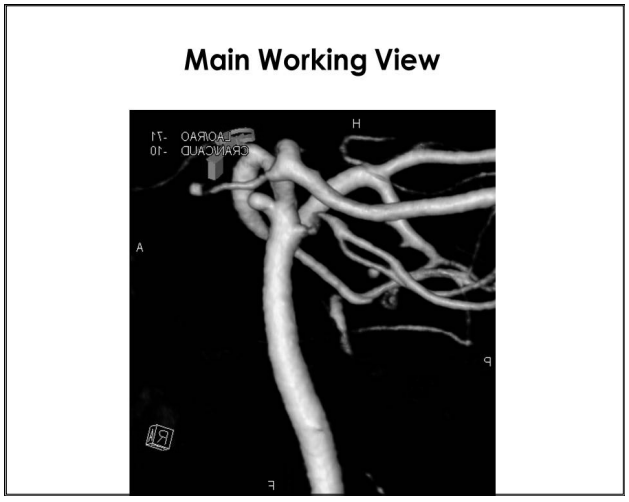


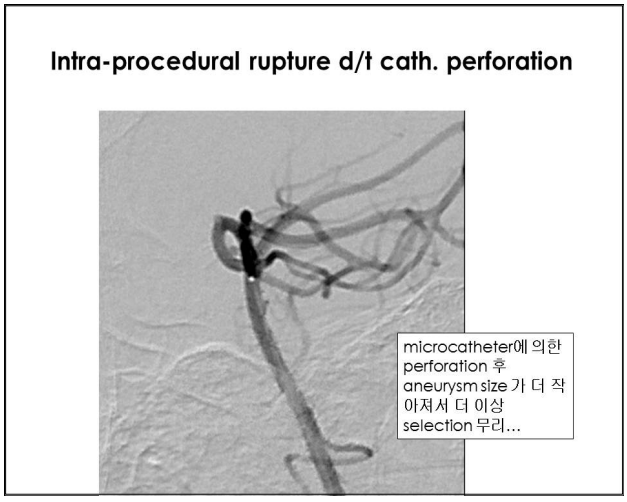


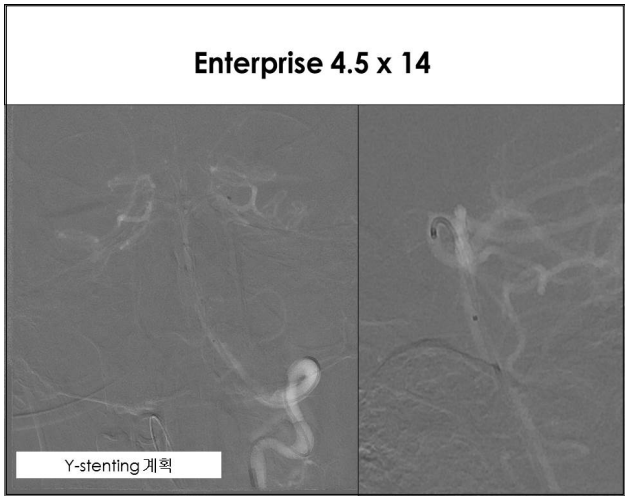


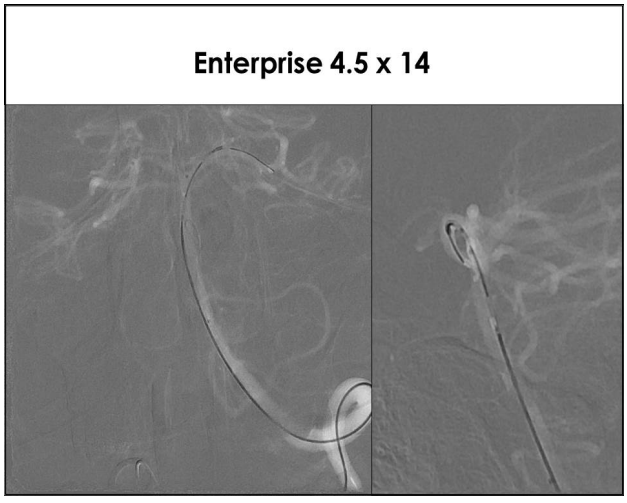



2.0 x 1.3 x 2.0 x 1.8(N)mm

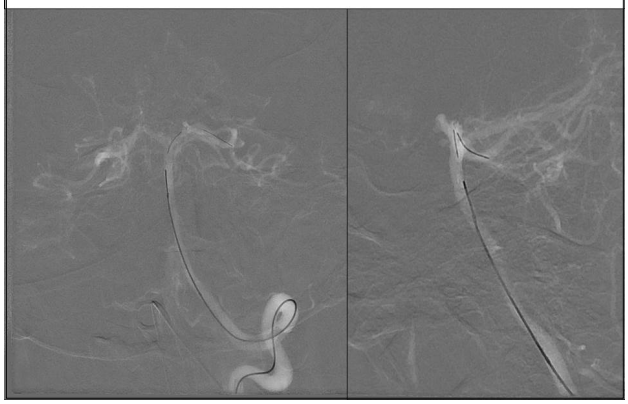

Main Working View

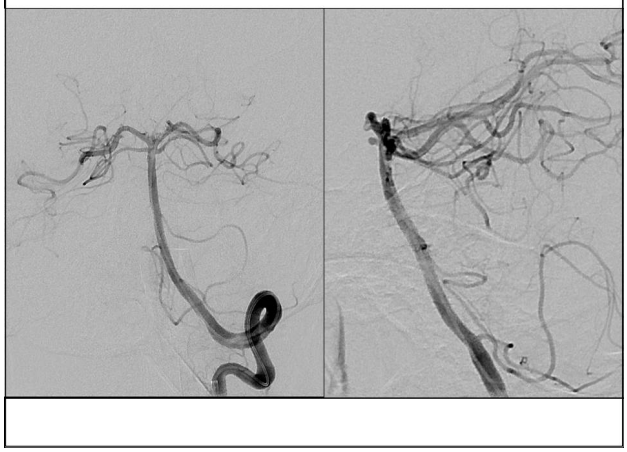

Intra-procedural rupture d/t cath. perforation
microcatheter에 의한 perforation 후 aneurysm size가 더 작아져서 더 이상 selection 무리...


Enterprise 4.5 x 14
Y-stenting 계획


Enterprise 4.5 x 14

Enterprise 4.5 x 14





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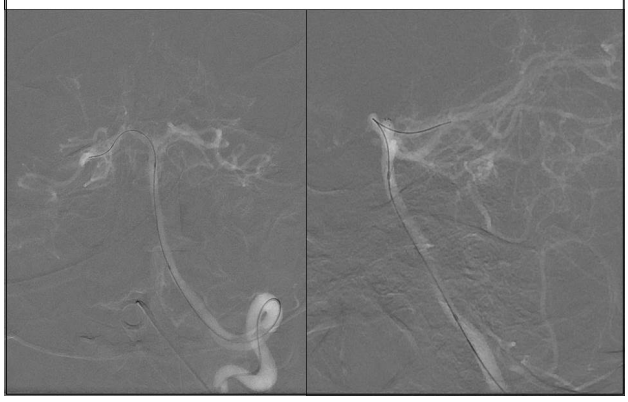

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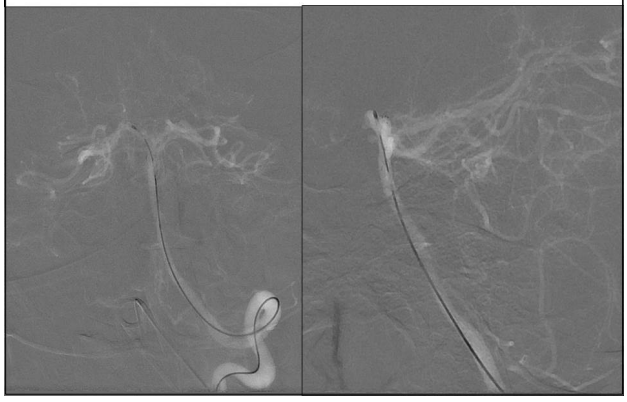

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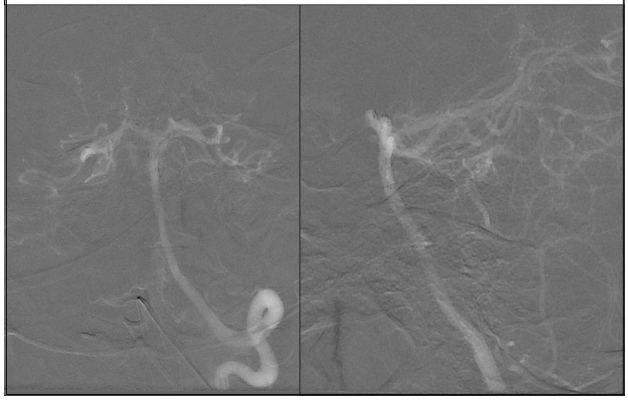

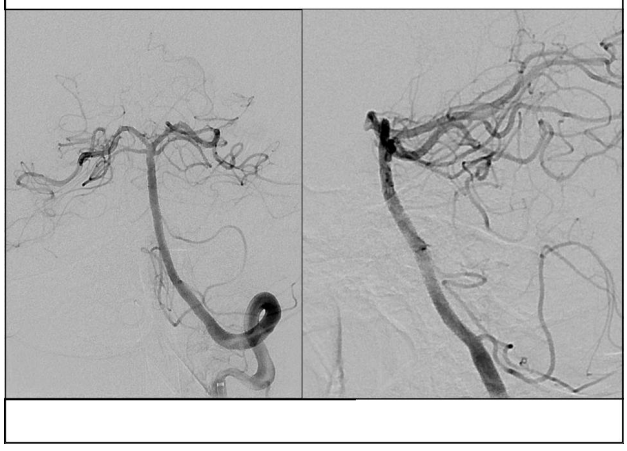

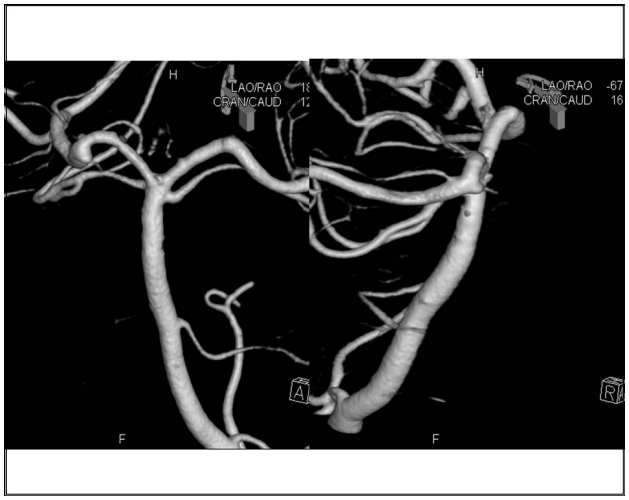

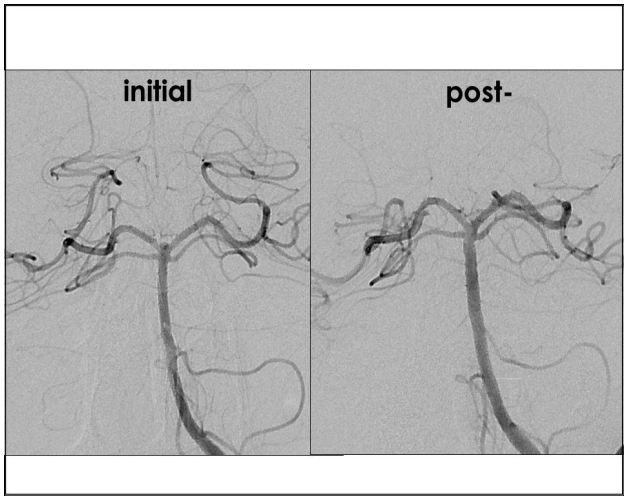
initial
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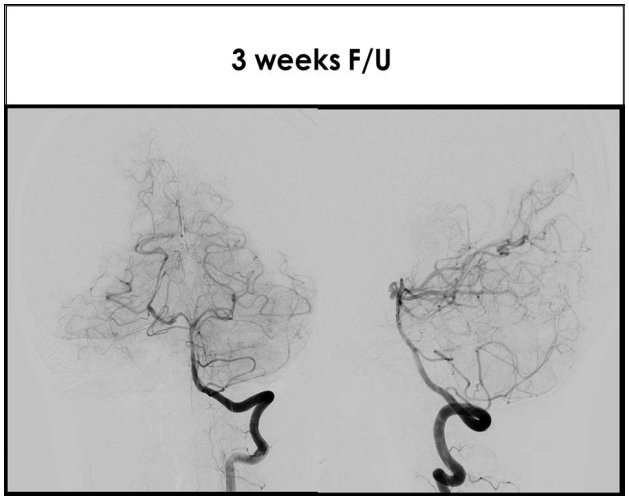
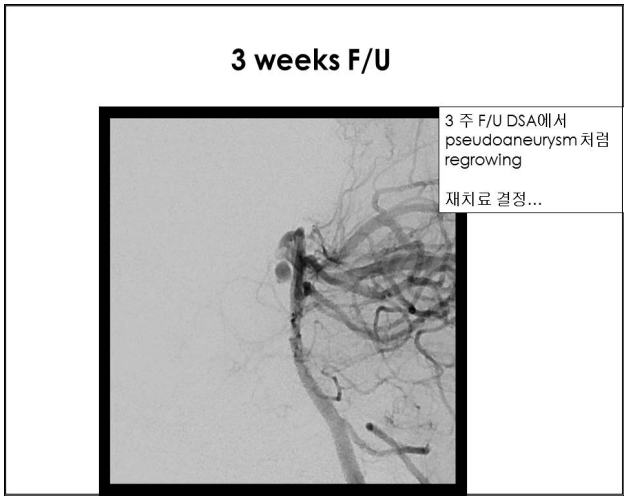
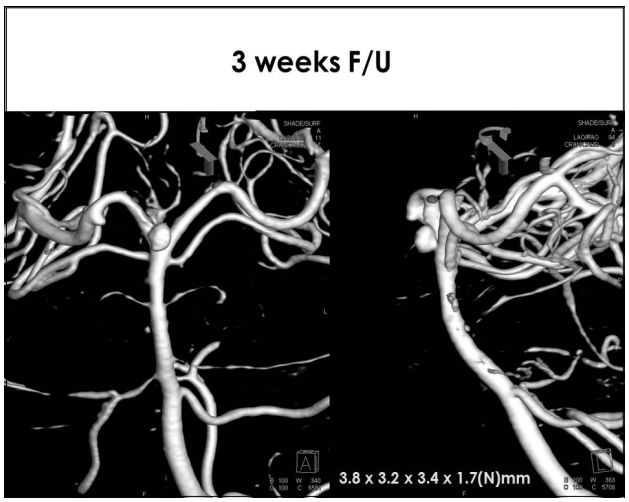
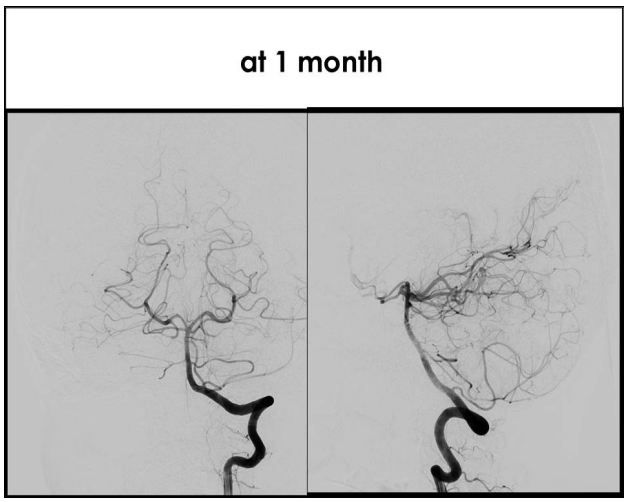
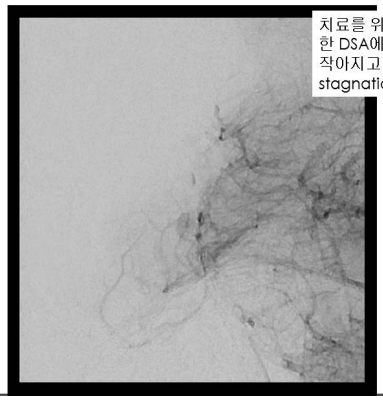

3 weeks F/U


3 weeks F/U
3 주 F/U DSA에서
pseudoaneurysm 처럼
regrowing
재치료 결정...


3 weeks F/U
3.8 x 3.2 x 3.4 x 1.7(N)mm

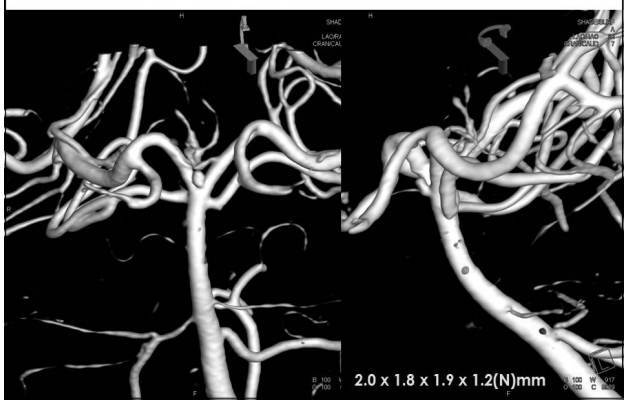

at 1 month

at 1 month

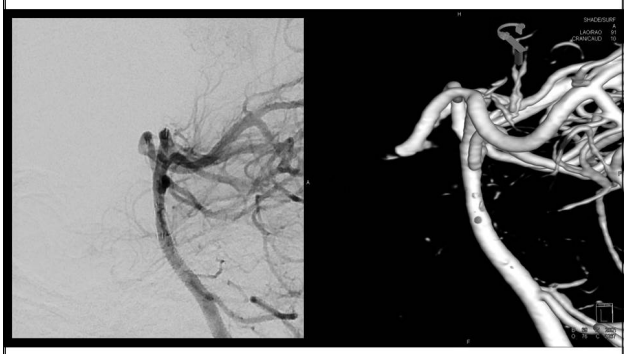


치료를 위한 전신마취 후 시행한 DSA에서 aneurysm 다시 작아지고 contrast-stagnation 소견 보여 종료함.

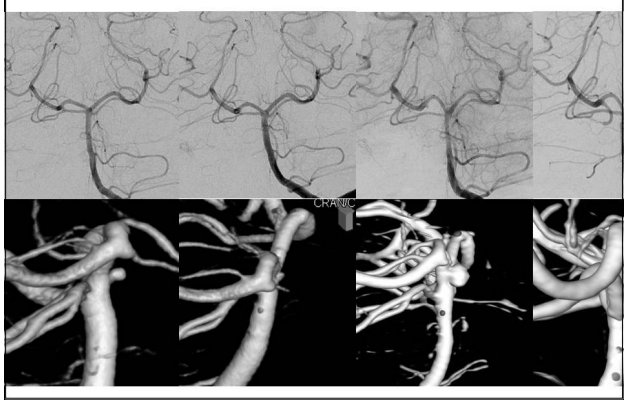
at 1 month

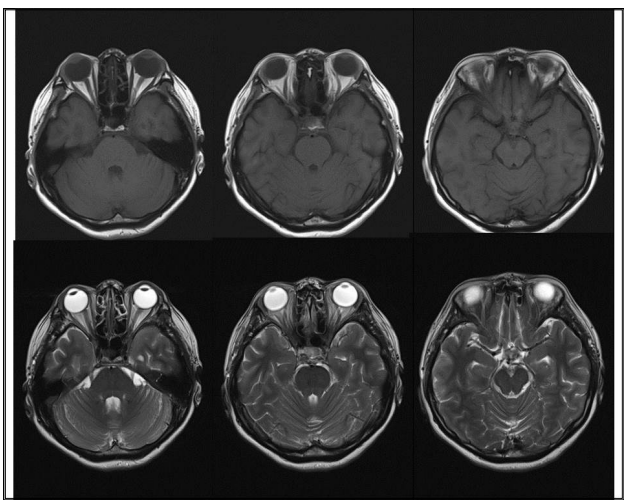


at 3 months



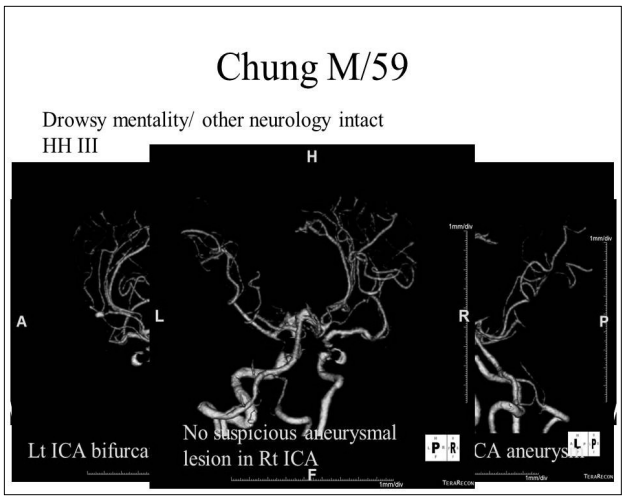
Basilar bifurcation angle의 변화와 그에 따른 **aneurysm**의 크기 변화의 연관성???

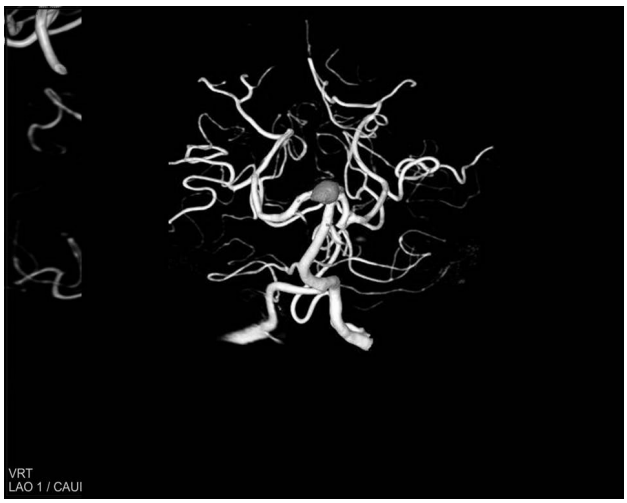


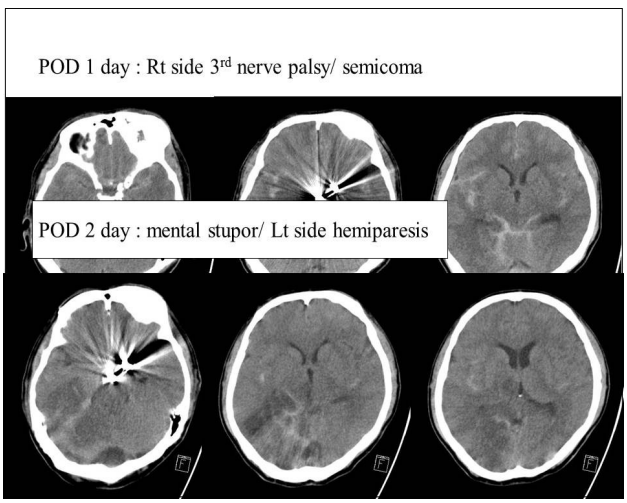


Case 7. PCA infarction after coil embolization

추 연 수
동래봉생







MEMO

ASCENT 2016

The "Debate" session: panel discussion with live audience interaction

좌장 : 계명대 **이창영**

panel: 박석규, 김영우, 정진영

1) Balloon catheter guiding vs Non-balloon catheter guiding
계명대 **김창현** vs 부산대 **이재일**

2) Stent retriever vs Suction device
울산대 **권순찬** vs 충남대 **권현조**

1) Balloon catheter guiding vs Non-balloon catheter guiding

계명대 **김창현** vs 부산대 **이재일**

2) Stent retriever vs Suction device

울산대 **권순찬** vs 충남대 **권현조**

ASCENT 2016

“My first case” by the young guns

좌장 : 가톨릭대 **성재훈**

1) Uruptured ICA aneurysm — 영남대 **김종훈**

2) Uruptured paraclinoid aneurysm — 고신대 **최재영**

3) Uruptured paraclinoid aneurysm — 가톨릭 관동대 국제성모 **김소연**

ASCENT 2016

Review of current stroke RCTs

좌장 : 서울대 **강현승**

1) Acute ischemic stroke — 순천향대 **신동성**

2) Flow diverter — 연세대 **박근영**

1) Randomized clinical trials of current acute ischemic stroke

신 동 성
부천순천향병원

MR CLEAN

Multicenter Randomized Clinical Trial of Endovascular Treatment for Acute Ischemic Stroke in the Netherlands (MR CLEAN)

A Randomized Trial of Intraarterial Treatment for Acute Ischemic Stroke

Intravenous alteplase administered within 4.5 hours after symptom onset is the only reperfusion therapy with proven efficacy in patient with acute ischemic stoke. However, well-recognized limitations of this therapy include the narrow therapeutic time window and contraindications. Moreover, intravenous alteplase appears to be much less effective at opening proximal occlusions of the major intracranial arteries.

We assessed whether intra-arterial treatment plus usual care would be more effective than usual care alone in patients with a proximal arterial occlusion in the anterior cerebral circulation that could be treated intra arterially within 6 hours after symptom onset.

Methods

Patients and participating centers

The study was conducted at 16 centers in the Netherlands. Patients were 18 years of age of older (no upper age limit). Occlusion site established with CT, CTA, MRA, DSA. The imaging committee evaluated the findings on baseline noncontrast CT for ASPECT score.

Intervention

Mechanical treatment could involve thrombus retraction, aspiration, wire disruption, or use of a retrievable stent.

Results

Between December 2010 and March 2014, a total of 502 patients underwent randomization in 16 Dutch centers. Two patients withdrew. The mean age of the 500 study participants was 65 years

Treatment assignment and crossovers

In total, 233 patients (46,6%) were assigned to the intervention group and 267 patients (53.4%) were assigned to the control group.

Intervention details

Actual intra-arterial therapy was performed in 196 of the 233 patients in the intervention group (84.1%). In 88 patients (37.8%), general anesthesia was used. Retrievable stents were used in 190 patients(81.5%).

Primary outcome

There was a shift in the distribution of the primary-outcome (the score on the mRS at 90 days) scores in favor of the intervention. The adjusted common odds ratio was 1.67. The shift toward better outcomes in favor of the intervention was consistent for all categories of the mRS, except for death. The absolute between-group difference in the proportion of patients who were functionally independent(mRS 0 to 2) was 13.5 percentage points in favor of the intervention (32.6% vs. 19.1%), with an adjusted odd ratio of 2.16.

Secondary outcomes

All clinical and imaging secondary outcomes favored the intervention. An absence of residual occlusion at the target site was more common in the intervention group (75.4%) than in the control group (32.9%). The between-group difference in infarct volume favored the intervention group. Good reperfusion was achieved in 115 of 196 patients (58.7%) in the intervention group.

Safety

There was no significant between-group difference in the occurrence of serious adverse evets during the 90-day follow-up period.

Subgroup analyses

There were no significant interactions between subgroups and treatment effect. The treatment effect remained consistent in all predefined subgroups. Including those based on age, NIHSS score, and ASPECTS.

Discussion

Our results show that intra-arterial treatment have a benefit in acute ischemic stroke within 6 hours onset (anterior circulation). Unlike the INS III trial and SYNTHESIS expansion trial, MR CLEAN required a radiologically proven intracranial occlusion for study eligibility. MR CLEAN study benefited from the widespread availability of retrievable stents, which were used in 82% of the patients in the intervention group. MR CLEAN had several limitation. The reperfusion rate was relatively low as compared with the rate in recent case series, which were 80% or higher.

In conclusion, intra-arterial treatment in patients with AIS cause by a proximal intracranial occlusion of the anterior circulation was effective and safe when administered within 6 hours after stroke onset.

ESCAPE

Endovascular Treatment for Small Core and Anterior Circulation Proximal Occlusion with Emphasis on Minimizing CT to Recanalization Times (ESCAPE)


The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

Recent studies have shown the superiority of retrievable stents over the previous generation of thrombectomy devices. The recently reported MR CLEAN used this technology, and the result of that trial showed clinical benefit with endovascular treatment. ESCAPE trial was designed to test whether patients with AIS, who were selected on the basis of result of CT and CTA, would benefit from rapid endovascular treatment involving contemporary endovascular techniques

Methods

participants

Eligible participants were adults (no upper-age limit). Enrollment could occur up to 12 hours after the onset of stroke symptoms. CT and CTA were performed to identify participants with a small infarct core, an

occluded proximal artery in the anterior circulation, and moderate-to-good collateral circulation. MR imaging for patient selection was discouraged.

Treatments

The use of retrievable stents was recommended. During thrombus retrieval, suction through a balloon guide catheter in the relevant internal carotid artery was also recommended. Participants in both groups received intravenous alteplase within 4.5 hours after the onset of stroke symptoms.

The target time form study CT to groin puncture was 60 minutes or less and from study CT to first reperfusion was 90 minutes or less.

Results

Early termination of the study

An unplanned interim analysis was conducted after the release of the MR CLEAN results, which showed efficacy of endovascular therapy. The ESCAPE trial was stopped early.

Patients

At 22 centers, a total 316 participants underwent randomization before the trial was stopped.

Primary outcome

Analysis of the primary end point showed a common adds ratio of 2.6 favoring the intervention. The median 90-day mRS was 2 in the intervention group and 4 in control group. The proportion of patients with a mRS of 0 to 2 at 90 days was 53.0% in the intervention group and 29.3% in the control group. Rate of symptomatic intracerebral hemorrhage was 3.6% in the intervention group and 2.7% in the control group.

Secondary outcomes and subgroup analyses

Secondary clinical and imaging end points favored the intervention group. A total of 49 patients underwent randomization 6 or more hours after stroke onset; in the analysis of a mRS of 0 to 2 at 90 days, the direction of effect favored the intervention in these patients, but the between-group difference was not significant.

Of 165 participants assigned to the intervention group, 151 (91.5%) underwent endovascular treatment. Retrievable stents were used in 130 of the 151 participants (86.1%). 100 of these 130 participants (77%) received a Solitaire stent (Covidien). In the intervention group, the median time from symptom onset to first reperfusion was 241 minutes, the median time from study CT to first reperfusion was 84 minutes. And the median time from groin puncture to first reperfusion was 30 minutes. Successful reperfusion was observed in 113 of 156 participants (72.4%) in the intervention group.

Discussion

The ESCAPE trial achieved shorter interval times than those seen in past trials. A pre-specified efficiency target for the time from CT to reperfusion encouraged fast image acquisition and interpretation and fast

decision making.

Endovascular treatment appeared to benefit all ages, both sexes, patients with moderate stroke and those with severe stroke, patients who received intravenous alteplase and those who did not, and patients with and those without occlusion in the ICA.

A total of 49 participants (15.5%) underwent randomization 6 or more hours after symptom onset, and the study was not powered to assess endovascular therapy among patients presenting 6 to 12 hours after symptom onset.

In conclusion, the ESCAPE trial, in which fast and efficient workflow, innovative imaging, and effective thrombectomy device were used, provides evidence of the benefit of endovascular treatment in patients with moderate-to-severe ischemic stroke.

EXTEND–IA

Extending the Time for Thrombolysis in Emergency Neurological Deficits-Intra-Arterial (EXTEND-IA)

Endovascular Therapy for Ischemic Stroke with Perfusion-Imaging Selection

In the, EXTEND-IA, we sought to test the hypothesis that patients with AIS who are selected with a dual target of vessel occlusion and evidence of salvageable tissue on perfusion imaging within 4.5 hours after the onset of stroke will have improved reperfusion and early neurologic improvement when treated with early endovascular thrombectomy with the use to the Solitaire FR stent retriever after intravenous administration of alteplase

Methods

Study patients

We planned to enroll 100 patients at 14 centers in Australia and New Zealand. Patients were eligible as seen occlusion on CTA. In addition, CT perfusion imaging, which was processed with the use of fully automated software(PAPID), was used to identify potentially salvageable brain tissue.

Endovascular therapy had to be initiated within 6 hours after stoke onset and completed within 8 hours after onset. There were no restrictions on age.

Study treatments

All patients received alteplase at a dose of 0.9mg per kilogram as standard care. The site of vessel occlusion

was confirmed with the use of DSA. The Solitaire FR retrievable stent was deployed at the site of occlusion and then removed under negative-pressure aspiration.

Results

Characteristics of the patients

From August 2012 through October 2014, a total 70 patients underwent randomization. Approximately 25% of clinically eligible patients with vessel occlusion were excluded on the basis of perfusion-imaging criteria.

Efficacy

Endovascular therapy resulted in increased reperfusion at 24 hours and probability of reperfusion of more than 90% without symptomatic ICH.

Endovascular therapy led to greater early neurologic recovery at 3 day and improved functional outcome in an ordinal analysis of the mRS. We determined that 2.8 patients would need to be treated with endovascular therapy to achieve improvement of a t least 1 point on the functional score as compared with the use of alteplase alone and determined that 3.2 patients would need to be treated to achieve an independent outcome, as compared with alteplase alone.

Discussion

The magnitude of the clinical benefit of endovascular thrombectomy in our study was larger than that in pervious trials, despite similar clinical severities and demographic characteristics. Key differences between our study and the pervious trials include the use of CT perfusion imaging to select patients with the greatest potential to benefit from endovascular therapy, shorter time to the onset of treatment, and improved rates of angiographic revascularization.

Unique feature of or study was the use of standardized, universal CT perfusion-imaging selection to exclude patients with large ischemic cores and without evidence of clinically significant salvageable ischemic brain. CT perfusion imaging was also performed in about 65% of patients in the MR CLEAN trial. Such imaging was not required according to the protocol for the MR CLEAN trial but may have influenced patient's selection.

The interval between the initiation of alteplase and randomization was 39 minutes in our study, as compared with 100 minutes in the MR CLEAN trial, because of our approach of identifying patients with the greatest potential to benefit from reperfusion and then maximizing early reperfusion with the use of combined alteplase and endovascular therapy, rather than waiting to assess clinical response to alteplase.

The rate of successful revascularization immediately after the procedure was higher in our study than in previous randomized trials. This finding probably related to the use of Solitiare FR stent retriever was used. The reperfusion rate in our study was also higher than the 58% reported in MR CLEAN, in which stent retrievers were used in 81.5% of patients. There is some evidence that the success of recanalization is increased in patients with good collateral flow, which correlated strongly with the presence of a "mismatch" pattern on perfusion imaging between a small, irreversibly injured ischemic core and a larger perfusion lesion indicating the presence of salvageable ischemic penumbra.

Strengths of our study include the selection of patients who were most likely to benefit from reperfusion,

earlier intervention, and a standardized stent-retriever intervention with more complete revascularization.

SWIFT PRIME

Solitaire with the Intention for Thrombectomy as Primary Endovascular Treatment (SWIFT PRIME)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Stent-Retriever Thrombectomy after Intravenous t-PA vs. t-PA Alone in Stroke

SWIFT PRIME trial establish the efficacy and safety of rapid neurovascular thrombectomy with the stent retriever in conjunction with intravenous t-PA versus intravenous t-PA alone in patients with AIS.

Methods

Patients and participating centers

All study centers were required to have performed at least 40 mechanical-thrombectomy procedures, including at least 29 procedures with the Solitaire stent retriever, annually.

To identify patients with salvageable tissue, at trial use a target-mismatch penumbral profile. Penumbral imaging analysis was performed with the use of RAPID(iSchemaView), an operator-independent image post-processing system.

Results

From December 2012 through November 2014, 196 patients underwent randomization.

Intervention

In the intervention group, the time from symptom onset to groin puncture was 224 minutes, the time from the start of intravenous t-PA to groin puncture was 77 minutes. The median time from groin puncture to first deployment of the stent retriever was 24 minutes. General anesthesia was used in 36 patients (37%) in the intervention group.

Primary outcome

Thrombectomy treatment was associated with a favorable shift in the distribution of global disability scores on

the mRS at 90 days. (Number needed to treat for one additional patients to have a less-disabled outcome, 2.6.) And functionally independent at 90 days was higher in the intervention group than in the control group, with an absolute difference of 25percentage points.

Secondary outcome

The proportion of outcomes indicating functional independence at 90 days was significantly higher in the intervention group than in the control group. (number needed to treat for one additional patient to be functionally independent, 4.0)

In the intervention group, reperfusion at the end of the procedure occurred in 88% who underwent placement of the stent retriever. Successful reperfusion at 27 hours, assessed by means of perfusion CT or MRI, was more frequent in the intervention group than in the control group.

Discussion

For every 2.6 patients who were treated, 1 additional patient had an improved disability outcome; for every 4.0 patients who were treated, 1 additional patient was functionally independent at 90-day follow-up

Our trial emphasized speedy endovascular therapy in patients selected by means of imaging, similar to the protocol used in the ESCAPE trial, and achieved onset-to-reperfusion time that were faster than those in MR CLEAN.

The high reperfusion rate is probably due in part to the more homogeneous patient population and the more homogenous intervention in this trial than in earlier trials. The frequency of functional independence in the intervention group was high in our trail (60%) and was greater than that observed in MR CLEAN (33%) and similar to that observed in the ESCAPE trial (53%) and EXTEND IA trial (71%). The high frequency of this outcome probably reflects the earlier start of the intervention, the exclusion of patients with large core infarcts on the basis of imaging, and the greater reperfusion rate in our trial, as compared with the other trials.

One third of the patients were treated with intravenous t-PA at an outside hospital. These patients had less favorable outcomes overall; however, their relative benefit from endovascular therapy did not differ significantly from that observed in patients who received intravenous t-PA at the study site.

REVASCAT

Randomized Trial of Revascularization with Solitaire FR Device versus Best Medical Therapy in the Treatment of Acute Stroke Due to Anterior Circulation Large Vessel Occlusion Presenting within Eight Hours of Symptom Onset (REVASCAT)

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Thrombectomy within 8 Hours after Symptom Onset in Ischemic Stroke

The aim of this study was to determine the efficacy and safety of neurovascular thrombectomy with the Solitaire stent retriever in conjunction with medical therapy versus medical therapy alone

Method

From November 2012 through December 2014, we screened patients at four study centers. Eligible patients were between the age of 18 to 80 years, had an occlusion that could be treated within 8 hours. The main exclusion criteria on imaging were evidence of large ischemic ore, as indicated by ASPECTS on CT or MRI.

Study sites and interventionists

Study sites consisted of certified comprehensive stroke centers that treat more than 500 patients with AIS and perform more than 60 mechanical thrombectomy procedures annually and are staffed by trained neurointerventionalists who are required to have performed at least 20 thrombectomies with the Solitaire device.

Results

Primary outcome

Common odds ratio of improvement in the distribution of the mRS of 1.7 favoring thrombectomy. The absolute between group difference (functionally independent) was 15.5 percentage points, favoring thrombectomy (43.7% vs. 28.2%)

Secondary outcomes

Also favored the thrombectomy group. Successful revascularization was achieved in 66% of patients in the

thrombectomy group.

Discussion

Solitaire stent retriever was safe and led to improved clinical outcomes, as compared with medical therapy alone. Rate of functional independence were increased by 15.5 percentage points in the thrombectomy group, which means that /65 patients would need to be treated with thrombectomy to prevent one case of functional dependency or death.

We aimed to avoid inclusion of patients who had an early response to intravenous alteplase. A enroll requirement was imaging proof of the presence of a occlusion 30 minutes after the administration of alteplase, a factor that partially explains the longer times from arrival to reperfusion and the lower rate of reperfusion, as compared with SWIFT PRIME, ESCAPE, EXTEND-IA study

Because ASPECTS is less accurate in estimating the core volume, it may have allowed the inclusion of larger infarct sized patients than other trials, this factor, in conjunction with longer times of reperfusion, etc, may explain the lower treatment effect seen in this study than in the SWIFT PRIME, ESCAPE, and EXTEND IA. This study was similar to that observed in MR CLEAN, with which our study shared many features

2) Review of Current Study of Flow-Diverter

Keun Young Park
Department of Neurosurgery, Severance Hospital, Yonsei University College of Medicine

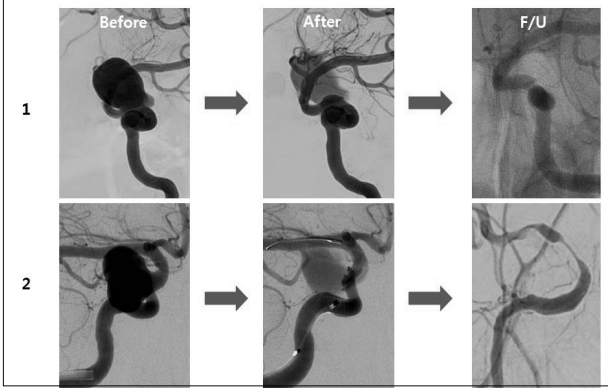
Indications of FD

- ✓ Large-Giant aneurysm
- ✓ Fusiform aneurysm
- ✓ Dissecting aneurysm
- ✓ Blood blister-like aneurysm

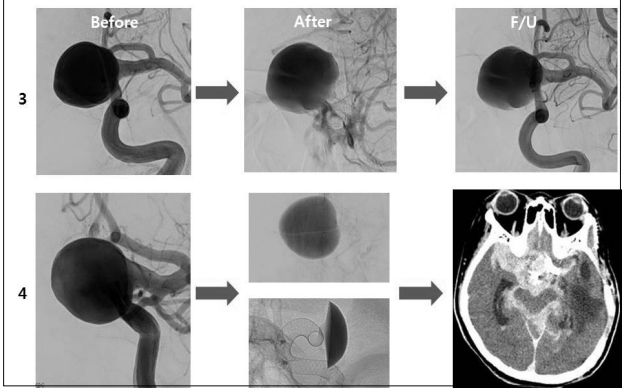
Complications of FD

- ✓ Thromboembolism
- ✓ In-stent Stenosis
- ✓ Remote Hemorrhage
- ✓ Incomplete Occlusion & Post-FD Rupture

CASE



CASE



AJNR Am J Neuroradiol. 2012 Jun;33(6):1150-5. doi: 10.3174/ajnr.A2907. Epub 2012 Feb 2.

Flow-diverter silk stent for the treatment of intracranial aneurysms: 1-year follow-up in a multicenter study.

Berge J[1], Biondi A, Machi P, Brunel H, Pierot L, Gabrillargues J, Kadziolka K, Barreau X, Dousset V, Bonafé A.

Retrospective, Multicenter (6 centers), Single-arm (SILK) (6 months & 12 months F/U)

- ✓ **Inclusion Criteria**
  - **Unruptured or Recurrent (previous ruptured s/p coiling)**
  - **Saccular and Fusiform/Dissecting aneurysm**
- ✓ **Antiplatelet protocol**
  - **-pre: Aspirin 160~250mg + Clopidogrel 75mg (3~7 days)**
  - **-post: Aspirin 160~250 mg + Clopidogrel 75mg (2~3 months)**

SILK

AJNR Am J Neuroradiol. 2012 Jun;33(6):1150-5. doi: 10.3174/ajnr.A2907. Epub 2012 Feb 2.

Flow-diverter silk stent for the treatment of intracranial aneurysms: 1-year follow-up in a multicenter study.

Berge J[1], Biondi A, Machi P, Brunel H, Pierot L, Gabrillargues J, Kadziolka K, Barreau X, Dousset V, Bonafé A.

- ✓ **65 patients (Female: 51, mean age: 54) with 77 aneurysms**
  - **UIA: 66 (87%), Recurrent: 11 (13%)**
  - **Symptomatic: 39 (60%)**
  - **Saccular: 52 (68%), Fusiform/Dissecting: 25 (32%)**
- ✓ **Aneurysm size/location**

77 Included Aneurysms	<7 mm	7–12 mm	13–24 mm	>24 mm
Cavernous carotid	4	3	10	12
ICA/MCA/ACA	10	8	17	4
Vertebrobasilar	0	4	3	2

Aneurysm location	
ICA extradural	33 (43%)
ICA intradural	31 (40%)
MCA	2 (2.5%)
ACA	2 (2.5%)
Vertebrobasilar	9 (12%)

SILK

AJNR Am J Neuroradiol. 2012 Jun;33(6):1150-5. doi: 10.3174/ajnr.A2907. Epub 2012 Feb 2.

Flow-diverter silk stent for the treatment of intracranial aneurysms: 1-year follow-up in a multicenter study.

Berge J[1], Biondi A, Machi P, Brunel H, Pierot L, Gabrillargues J, Kadziolka K, Barreau X, Dousset V, Bonafé A.

- ✓ **Technical success rate: 64/65 (98.5%) including 9/72 (12.5%) of misdeployment → 6 PAO**
- ✓ **Major ischemic stroke: 6 (9.3%)** → **• Misdeployment • Clopidogrel resistance or stop**
- ✓ **Major Hemorrhagic stroke: 2.6% SAH (one death) 1.3% CCF**
- ✓ **Severe hemorrhage during Tumor surgery: 1 (1.3%) -Death**
- ▪ **Overall Morbidity/Mortality at 6M: 5(8.6%)/2(3.4%)**

SILK

AJNR Am J Neuroradiol. 2012 Jun;33(6):1150-5. doi: 10.3174/ajnr.A2907. Epub 2012 Feb 2.

Flow-diverter silk stent for the treatment of intracranial aneurysms: 1-year follow-up in a multicenter study.

Berge J[1], Biondi A, Machi P, Brunel H, Pierot L, Gabrillargues J, Kadziolka K, Barreau X, Dousset V, Bonafé A.

- ✓ **Incomplete Occlusion of Aneurysm : 32% (6 months), 15.7% (12 months)**
- ✓ **In-stent stenosis (>50%): 0 at 6 months**

SILK

AJNR Am J Neuroradiol. 2012 Jun;33(6):1150-5. doi: 10.3174/ajnr.A2907. Epub 2012 Feb 2.

Flow-diverter silk stent for the treatment of intracranial aneurysms: 1-year follow-up in a multicenter study.

Berge J[1], Biondi A, Machi P, Brunel H, Pierot L, Gabrillargues J, Kadziolka K, Barreau X, Dousset V, Bonafé A.

Limitations

- ✓ **Retrospective design**
- ✓ **Relatively small size aneurysms**
- ✓ **NOT strict antiplatelets regimen**

Radiology. 2013 Jun;267(3):858-68. doi: 10.1148/radiol.13120099. Epub 2013 Feb 15.

Pipeline for uncoilable or failed aneurysms: results from a multicenter clinical trial.

Becske T[1], Kallmes DF, Saatci I, McDougall CG, Szikora I, Lanzino G, Moran CJ, Woo HH, Lopes DK, Berez AL, Cher DJ, Siddiqui AH, Levy EI, Albuquerque FC, Fiorella DJ, Berentei Z, Marosfoi M, Cekirge SH, Nelson PK.

Prospective, Multicenter (10 centers), Single-arm (Pipeline) (6 months & 12 months F/U)

- ✓ **Inclusion Criteria**
  - **- Large-giant (>10mm) and wide-neck aneurysm (>4mm)**
  - **- Saccular and Fusiform aneurysm**
  - **- Petrous to superior hypophyseal ICA**
- ✓ **Antiplatelet protocol**
  - **-pre: ① Aspirin 325mg (2 days) + Clopidogrel 75mg (7 days)**
  - **② Clopidogrel 600mg loading**
  - **-post: Aspirin 325 mg (at least 6 months) + Clopidogrel 75mg (at least 3 months)**

PED

Radiology. 2013 Jun;267(3):858-68. doi: 10.1148/radiol.13120099. Epub 2013 Feb 15.

Pipeline for uncoilable or failed aneurysms: results from a multicenter clinical trial.

Becske T[1], Kallmes DF, Saatci I, McDougall CG, Szikora I, Lanzino G, Moran CJ, Woo HH, Lopes DK, Berez AL, Cher DJ, Siddiqui AH, Levy EI, Albuquerque FC, Fiorella DJ, Berentei Z, Marosfoi M, Cekirge SH, Nelson PK.

- ✓ 108 patients (Female: 96, mean age: 57)
  Cranial nerve palsy: 71 (65.7%)
- ✓ Aneurysm size: mean 18.2mm, neck 8.8mm
  Large: 86 (79.6%), Giant: 22 (20.4%)
- ✓ Aneurysm location

Petrous	4 (3.7)
Cavernous	44 (40.7)
Carotid cave	2 (1.9)
Superior hypophyseal	10 (9.3)
Lateral clinoidal	2 (1.9)
Paraophthalmic	35 (32.4)
Supraclinoid	10 (9.2)
Posterior communicating	1 (0.9)

PED

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- ✓ Technical success rate: 107/108 (99%)
- ✓ Major ischemic stroke: 3 (2.8%)
- ✓ Major Hemorrhagic stroke: 1 (0.9%), 0% SAH, 0.9% CCF
  Possible hemorrhagic stroke: 1 (0.9%)-Death
- ✓ Traumatic ICH: 2 (1.9%)-Death
- ▪ Overall Morbidity/Mortality at 6M: 3(2.8%)/3(2.8%)

PED

Radiology. 2013 Jun;267(3):858-68. doi: 10.1148/radiol.13120099. Epub 2013 Feb 15.

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- ✓ Incomplete Occlusion of Aneurysm
  : 26.4% (6 months), 13.2% (12 months)
- ✓ In-stent stenosis (>50%): 2 (1.9%) at 6 months

PED

Radiology. 2013 Jun;267(3):858-68. doi: 10.1148/radiol.13120099. Epub 2013 Feb 15.

Pipeline for uncoilable or failed aneurysms: results from a multicenter clinical trial.

Becske T[1], Kallmes DF, Saatci I, McDougall CG, Szikora I, Lanzino G, Moran CJ, Woo HH, Lopes DK, Berez AL, Cher DJ, Siddiqui AH, Levy EI, Albuquerque FC, Fiorella DJ, Berentei Z, Marosfoi M, Cekirge SH, Nelson PK.

Limitations

- ✓ Lack of control group
- ✓ Aneurysm Location
- ✓ Lack of precise description about CN palsy (F/U)

AJNR Am J Neuroradiol. 2015 Jan;36(1):96-107. doi: 10.3174/ajnr.A4078. Epub 2014 Aug 14.

Surpass flow diverter in the treatment of intracranial aneurysms: a prospective multicenter study.

Wakhloo AK[1], Lylyk P[2], de Vries J[3], Taschner C[4], Lundquist J[2], Biondi A[5], Hartmann M[6], Szikora I[7], Pierot L[8], Sakai N[9], Imamura H[9], Sourour N[10], Rennie I[11], Skalej M[12], Beuing O[12], Bonafé A[13], Mery F[14], Turjman F[15], Brouwer P[16], Boccardi E[17], Valvassori L[17], Derakhshani S[18], Litzenberg MW[19], Gounis MJ[20], Surpass Study Group.

Prospective, Multicenter (24 centers), Single-arm (Surpass) (1,3, 6 months & 12 months F/U)

- ✓ Inclusion/Exclusion Criteria
  - Any intracranial aneurysms with wide-neck aneurysm (>4mm, Dome to neck ration<2), Unsuitable to conventional treatment
  - NOT SAH history within 30 days
  - Contraindications for dual antiplatelets or non-responder for ASA/Clopidogrel
- ✓ Antiplatelet protocol
  -pre: ① Aspirin 81mg (≥3 days) + Clopidogrel 75mg (≥3 days)
  ② Aspirin 350mg and Clopidogrel 150mg loading
  -post: Aspirin 81 mg (life long) + Clopidogrel 75mg (at least 3 months)

AJNR Am J Neuroradiol. 2015 Jan;36(1):96-107. doi: 10.3174/ajnr.A4078. Epub 2014 Aug 14.

Surpass

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- ✓ 165 patients (Female: 72.4%, mean age: 57.1) with 190 aneurysms
  - UIA: 31.8%
  - SAH (not acute): 3.9%
  - Recurrent: 21.7% + 2.3%
  - Symptomatic: 27.2%
  - Saccular: 125 (67.2%), Fusiform/Dissecting: 54 (29.0%), Blister: 7 (3.8%)
- ✓ Aneurysm size: mean 10.4mm, neck 6.0mm
  - Small & medium: 117 (62
  - Large & Giant: 69 (37.1%
- ✓ Aneurysm location

ICA	123 (66.1%)
Petrocavernous ~ Supraclinoid	77 (41.4%)
ICPcom	36 (19.4%)
ICCho~ICA terminus	10 (5.4%)
ACA	12 (6.4%)
MCA	24 (12.9%)
VBA	27 (14.5%)

Surpass

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- ✓ **Technical success rate: 161/165 (97.5%)**
  including 4 (2.1%) of misdeployment
- ✓ **Major ischemic stroke: 5 (3.1%)**
- ✓ **Major Hemorrhagic stroke: 10 (6.2%)**
  Wire perforation: 5 (3.1%)
  SDH: 1 (0.6%)
  ICH: 3 (1.9%)
  SAH: 1 (0.6%)
- ▪ **Overall Morbidity/Mortality at 6M: 9(6.0%)/4(2.7%)**

Surpass

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- ✓ **Incomplete Occlusion of Aneurysm : 25.0% (6 months)**
- ✓ **In-stent stenosis (>50%): 8 (5%) at 6 months**

Surpass

AJNR Am J Neuroradiol. 2015 Jan;36(1):98-107. doi: 10.3174/ajnr.A4078. Epub 2014 Aug 14.

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Limitations

- ✓ **Lack of control group**
- ✓ **Relatively small size aneurysms**

Ongoing Trial

AJNR Am J Neuroradiol. 2014 Jul;35(7):1341-5. doi: 10.3174/ajnr.A3968. Epub 2014 May 15.

Flow diversion versus traditional endovascular coiling therapy: design of the prospective LARGE aneurysm randomized trial.

Turk AS 3rd[1], Martin RH[2], Fiorella D[3], Mocco J[4], Siddiqui A[5], Bonafe A[5].

Neuroradiology. 2015 Jan;57(1):49-54. doi: 10.1007/s00234-014-1439-7. Epub 2014 Oct 4.

EVIDENCE trial: design of a phase 2, randomized, controlled, multicenter study comparing flow diversion and traditional endovascular strategy in unruptured saccular wide-necked intracranial aneurysms.

Turjman F[1], Levrier O, Combaz X, Bonafé A, Biondi A, Desal H, Bracard S, Mounayer C, Riva R, Chapuis F, Huot L, Armoiry X, Gory B.

ASCENT 2016

Introduction of new devices (by company)

좌장 : 울산대 **유승훈**

ASCENT 2016

인쇄일 | 2016년 6월 14일
발행일 | 2016년 6월 17일

발행처 | 대한뇌혈관내수술학회
서울시 서초구 서초동 1678-2
동아빌리트 2타운 407호
Tel : 02) 2279-9560
Fax : 02) 2279-9561

인쇄처 | 아이비기획
서울시 성동구 성수이로7길 7
한라시그마밸리 2차 603호
Tel : 02) 2274-9275
Fax : 02) 2274-9272