2017.12.2 대한뇌혈관내수술학회 정기학술대회 및 총회

대한뇌혈관내수술학회
SKEN
Society of Korean Endovascular Neurosurgeons

"낮부터 밤까지 최선의 노력과 정성을"

대한뇌혈관내수술학회

정기학술대회 및 총회

2017. 12. 2. (토)

수원 노보텔 앰베서더호텔 2층 샴페인홀

주 최 | 대한뇌혈관내수술학회　　주 관 | 대한신경외과학연구재단

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모시는 글

존경하옵는 회원 여러분, 안녕하십니까?

2017년은 우리 대한뇌혈관내수술학회가 창립 20주년을 기념하면서 새로운 도약을 약속한 첫 해로서 한 해의 마무리와 함께 개최되는 본 정기학술대회는 학회의 가장 큰 행사 중 하나입니다. 최근에는 모든 학회가 주제(theme)를 내세우는데, 이번에는 우리 모두의 "일상"을 솔직히 담고 싶었습니다. 모두가 삶의 질을 말하면서 쉽고 위험부담이 적은 일을 찾는 이 시대에, 최단시간 안에 뇌혈관질환 환자들을 치료하고자 모든 팀원이 똘똘 뭉쳐 밤낮으로 뛰고 있는 우리의 "일상"을 널리 알리면서, 서로를 따뜻이 격려해 드릴 수 있는 말은 없을까? 오랜 생각 끝에 결정된 주제가 "낮부터 밤까지 최선의 노력과 정성을" 입니다. 끊임없이 흐르는 한강의 물줄기는 우리가 치료하는 모든 환자분들의 안정적인 뇌혈류를, 밤낮으로 변하는 하늘색과 구름의 모습은 우리가 치료하면서 접하는 모든 예상치 못한 상황을 의미할 수도 있다고 생각됩니다. 이제 우리는 학술대회의 공간을 통해 이 모든 상황을 뚫고 우리가 기울였던 노력과 정성을 서로 공유함으로써, 최선의 결과를 약속 받고자 합니다.

금번 학술대회에서는 흔히 사용되는 각종 기구/기계의 특성, 합병증을 유발할 수 있는 뇌혈관 위험 문합(dangerous anastomosis), 근거중심의학 논문 이해의 핵심인 각종 통계기법 및 의료 소송 대응법 등 우리가 꼭 알고 있어야 할 내용들을 준비했습니다. 장비에서 술기, 결과물 산출 및 대비까지 회원분들의 궁금증 해소에 조금이라도 도움이 되었으면 좋겠습니다.

또한 2018–19년을 이끌어 주실 신임 회장님과 집행부가 본 학회를 마침과 동시에 출범하게 됩니다. 훨씬 훌륭하고 탄탄한 학회로 발전시켜 주실 것을 믿어 의심치 않으며, 새로운 출발을 약속하는 이 뜻깊은 자리에 꼭 참석하시어 자리를 빛내 주십시오.

대단히 감사합니다.

2017년 11월

대한뇌혈관내수술학회 회장 성재훈 올림

2016~2017 대한뇌혈관내수술학회 임원진

명예회장

직 위	성 명	소 속
명예회장	백민우	인봉의료재단 뉴고려병원

회장

직 위	성 명	소 속
회장	성재훈	가톨릭대학교 성빈센트병원

상임이사

직 위	성 명	소 속
총무	유승훈	울산대학교 강릉아산병원
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재무	장철훈	영남대학교병원
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법제윤리	김대원	원광대학교병원
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지회대표(대구/경북)	김문철	에스포항병원
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지회대표(부산/울산/경남)	권순찬	울산대학교병원
감사	권현조	충남대학교병원
간사	김훈	가톨릭대학교 부천성모병원

2016~2017 대한뇌혈관내수술학회 임원진

전임회장단

직 위	성 명	소 속
초대, 제2대	백민우	인봉의료재단 뉴고려병원
제3대	김영준	단국대학교병원
제4, 5대	권도훈	울산대학교 서울아산병원
제6대	안성기(작고)	(전) 한림대학교 성심병원
제7대	신용삼	가톨릭대학교 서울성모병원
제8대	권오기	분당서울대학교병원
제9대	김범태	순천향대학교 부천병원

운영위원

직 위	성 명	소 속
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	박근영	연세대학교 세브란스병원
재무	김종훈	영남대학교병원
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다기관연구	심유식	인하대학교병원

프로그램

08:30-08:45 Registration

08:45-09:00 Opening remark — 대한뇌혈관내수술학회 회장 **성재훈**

Congratulatory remark — 대한신경외과학회 이사장 **장진우**

09:00-10:40 Free paper I Aneurysm

좌장 : 한림대 **이호국,** 영남대 **장철훈**

10:40-11:00 *Coffee break*

"낮부터 밤까지 최선의 노력과 정성을"

2017 대한뇌혈관내수술학회 정기학술대회 및 총회

2017.12. 2. (토) 수원 노보텔 앰베서더호텔 2층 샴페인홀

11:00-12:00 **Special lecture** 좌장 : 가톨릭대 **성재훈**

12:00-13:00 Lunch

13:00-14:00 **Symposium: Review of endovascular devices**

좌장 : 순천향대 **김범태,** 서울대 **권오기**

14:00-15:20 **Free paper II Ischemia** 좌장 : 전남대 **김태선,** 한양대 **이형중**

프로그램

15:20-16:30 **Free paper Ⅲ AVM/AVF etc** 좌장 : 경희대 **고준석,** 순천향대 **윤석만**

16:30-16:50 *Coffee break*

16:50-17:20 총회

17:12-17:30 **Academic award ceremony**

17:30 Closing remarks

18:00 Official dinner

Free paper I Aneurysm

좌장 : 한림대 **이호국,** 영남대 **장철훈**

Long-term Results of Endovascular Treatment with Preservation of the Vertebral Artery in Isolated Dissecting Aneurysms of the Posterior Inferior Cerebellar Artery

장 이 욱 천안충무병원

E-Wook Jang, Byung-Hee Lee

Cerebrovascular Center, Cheonan Chungmu Hospital, Cheonan, Korea

Objective : The endovascular treatment of aneurysm of the posterior inferior cerebellar artery(PICA) is challenged by small size, tortuous vessels, brainstem perforators, and fragility of the sac. Aggressive treatment by sacrificing the vertebral artery increases the probability of ischemic complications. We report favorable outcomes of endovascular treatment with preservation of the vertebral artery avoiding ischemic complication of medulla.

Methods : Twelve patients (mean age: 47.5±15.7 years, M: F = 5:7) with isolated PICA aneurysms were treated by endovascular techniques from 2005 to 2016. Clinical features of acute subarachnoid hemorrhage were presented in nine patients, ischemia in two patients and headache in one patient. Selective occlusion at PICA origin or target lesion was determined by the balloon occlusion test of vertebral artery as a predictive inspection of the preservation of PICA by collaterals.

Result : Endovascular treatment was successful in all patients with complete occlusion of the aneurysm and preservation of PICA flow at the final postprocedural angiogram. One patient developed ipsilateral PICA territory infarction two days after PICA occlusion using coils but fully recovered at discharge. Angiographic follow-up showed total occlusion of aneurysms with well preserved PICA flow by collaterals in all patients. There was no newly developed neurologic event or rebleeding during clinical follow-up periods (mean: 41±13.4 months).

Conclusion : Selective occlusion located at the origin of PICA or near to the aneurysm using preprocedural occlusion test may show favorable results without sacrificing of vertebral artery in preventing recanalization and rebleeding of isolated dissecting PICA aneurysms.

Antiplatelet Premedication for Stent-assisted Coil Embolization of Intracranial Aneurysms: Low-dose Prasugrel vs. Clopidogrel

최 현 호 동국대 일산병원

Hyun Ho Choi[1], Young Dae Cho[2], Moon Hee Han[2,3], Won-Sang Cho[3], Jeong Eun Kim[3], Hyun-Seung Kang[3]

[1]Department of Neurosurgery, Dongkuk University Hospital, Dongkuk University College of Medicine, Ilsan, Korea
[2]Department of Radiology, [3]Neurosurgery, Seoul National University Hospital, Seoul National University College of Medicine, Seoul, Korea

Objective : The use of antiplatelet medications to prevent thrombosis in the treatment of cerebral aneurysms with stents has become widely emphasized. We compared low-dose prasugrel with clopidogrel in stent-assisted coil embolization of intracranial aneurysms.

Methods : This is a retrospective review of 311 aneurysms from 297 patients who underwent stent-assisted endovascular coil embolization of unruptured intracranial aneurysm between November 2014 and March 2017. Thromboembolic and hemorrhagic adverse events were compared between 207 patients who received low-dose prasugrel (PSG group) and 90 patients who received clopidogrel (CPG group).

Result : P2Y12 reaction unit (PRU) values were significantly lower in the PSG group (PSG group vs. CPG group, 132.3 ± 76.9 vs. 238.1 ± 69.1; P 〈 0.001); the percentage of inhibition was also statistically higher in the PSG group (54.0 ± 26.0% vs. 20.8 ± 18.6%; P 〈 0.001). Thromboembolic events occurred less frequently in the PSG group than in the CPG group (0.9% vs. 6.4%; P = 0.01), whereas there was no significant difference in the percentage of hemorrhagic complications (0.5% vs. 2.2%; P = 0.22). In the multivariate analysis, clopidogrel as the antiplatelet medication was the sole significant risk factor for thromboembolism in this series of patients undergoing stent-assisted coil embolization.

Conclusion : Use of low-dose PSG as an antiplatelet premedication is quick, effective, and safe for stent-assisted coil embolization of unruptured intracranial aneurysms. Prasugrel premedication significantly lowered the frequency of thromboembolic events without increasing the risk of hemorrhage.

Relevance of Antiplatelet Therapy Duration after Stent-assisted Coil Embolization for Unruptured Intracranial Aneurysms

김 택 균 분당서울대병원

Tackeun Kim[1,2], Chang Hyeun Kim[3], Si-Hyuck Kang[2,4], Min Jai Cho[1,2], Seung Pil Ban[1,2], O-Ki Kwon[1,2]

[1]Department of Neurosurgery, Seoul National University Bundang Hospital, Seongnam, Korea
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[3]Department of Neurosurgery, Pusan National University Yangsan Hospital, Yangsan, Korea
[4]Division of Cardiology, Department of Internal Medicine, Cardiovascular Center, Seoul National University Bundang Hospital, Seongnam, Korea

Objective : The optimal duration of dual antiplatelet therapy (DAPT) for preventing delayed thromboembolic events (DTEs) remains unclear. We aimed to determine whether longer DAPT provides improved protection against delayed DTEs.

Methods : We performed a retrospective cohort study of 507 stent-assisted coil embolization procedures using a single stent for unruptured intracranial aneurysms. We performed coarsened exact matching according to the duration of maintenance DAPT. DTEs were defined as any neurologic symptoms concerning the stented vascular territory and occurring at 1 month or later after the procedure. After stratification, according DAPT duration (short-term, 〈9 months; long-term, ≥9 months), the log-rank test and Z-analysis were performed to evaluate the efficacy of long-term DAPT for preventing DTEs.

Result : Of 507 treated patients followed-up for a median of 44 months, 25 (4.9%) experienced DTEs at 1 month after the procedure. Among all DTEs, 9 (1.8%) were infarctions confirmed on magnetic resonance imaging. Permanent neurologic deficit (modified Rankin Scale score ≥2) occurred in 2 (0.4%) patients. In procedure-to-event analysis, long-term DAPT was not superior for preventing DTEs. Most events occurred within 1 month of switching from DAPT to single antiplatelet therapy, regardless of DAPT duration. The longest time from the procedure to DTE occurrence was 22 months. Prevalence of hypertension was significantly higher among patients who experienced DTEs.

Conclusion : Compared with short-term DAPT, long-term DAPT delays the occurrence of DTEs but does not lower their incidence. Longer-term DAPT (over 9 months) should be considered after stent-assisted coil embolization for unruptured intracranial aneurysms, and future studies elucidating the efficacy of such long-term DAPT are warranted.

Low-profile Visualized Intraluminal Support Junior (LVIS-Jr) Y-stenting for Coiling of Wide-neck Bifurcation Aneurysms

박 근 영 연세대 세브란스병원

Keun Young Park[1,2], Byung Moon Kim[2], Dong Joon Kim[2], Joonho Chung[1], Jae Hwan Lee[1]

[1]Department of Neurosurgery, [2]Radiology, Severance Hospital Stroke Center, Yonsei University College of Medicine, Seoul, Korea

Objective : The purpose of this study is to evaluate the feasibility and durability of a low-profile visualized intraluminal support junior (LVIS-Jr) Y-stenting for coiling of wide-neck bifurcation aneurysms.

Methods : LVIS-Jr Y-stenting was attempted in 24 patients (mean age, 60 ± 12 years; M:F=8:16) with 24 wide-neck bifurcation aneurysms (3 ruptured and 21 unruptured): 11 basilar artery top, 6 anterior communicating artery, 4 middle cerebral artery bifurcation aneurysms, 1 internal carotid artery (ICA) bifurcation, 1 vertebrovasilar fenestration, and 1 traumatic pseudoaneurysm at anterior cerebral artery A2 segment. The mean dome and neck size were 8.1mm ± 2.9mm and 5.7mm ± 2.0mm, respectively. Procedural success rate, treatment-related morbidity, and clinical and angiographic outcomes were retrospectively assessed.

Result : All attempts of Y-stenting were successful. Treatment-related morbidity occurred in 1 (4.2%), resulting in modified Rankin Scale (mRS) 2. Immediate post-procedural angiograms showed complete occlusion in 66.7% and neck remnant in 33.3%. Except for 1 patient who died from initial subarachnoid hemorrhage, all patients had good (mRS, 0-2) outcome at clinical follow-up for a mean of 12 months (range, 6 - 27 months); mRS 0 in 22, mRS 1 in 1, and mRS 2 in 1 patient, respectively. Follow-up vascular imaging was available in 20 (83.3%) for a mean of 7.5 months (range, 4 - 16 months). All 20 aneurysms showed complete occlusion at follow-up.

Conclusion : LVIS-Jr Y-stenting seemed feasible and to provide durable occlusion for wide-neck bifurcation aneurysms.

Endovascular Coiling of Aneurysm Remnants after Clipping

정 용 수 고려대 안산병원

Yong-Su Chung, Sung-Kon Ha, Sung-Won Jin, Dong-Jun Lim, Se-Hoon Kim

Department of Neurosurgery, Ansan Hospital, Korea University Medical Center, Ansan, Korea

Objective : The vast majority of intracranial aneurysms can be obliterated completely with surgical clipping. However, postoperative remnants occur in about 4 to 8% of patients who undergo postoperative angiography. We present three cases of endovascular treatment for remnant aneurysm after incomplete clipping.

Methods : Three aneurysm remnants after surgical clipping were treated with endovascular embolization using GDC. All aneurysms were ruptured and located in the anterior circulation, two at the anterior communicating artery and one at the middle cerebral artery bifurcation. Two remnants were found on the first week after craniotomy and one on the 6 months after surgery.

Result : All endovascular procedures were successfully performed with simple endovascular coiling techniques. There were no procedural complications with endovascular techniques.

Conclusion : Our experience confirms the feasibility and relative safety of this treatment strategy that may be considered a valid alternative to re-craniotomy for remnant aneurysm after clipping.

Progressive Occlusion of Small Saccular Aneurysms Incompletely Occluded after Stent-assisted Coil Embolization: Analysis of Related Factors and Long-term Outcomes

조 영 대 서울대병원

Young Dae Cho, Jeongjun Lee, Hyun-Seung Kang, Moon Hee Han

Department of Neurosurgery, Seoul National University Hospital, Seoul, Korea

Objective : Incompletely occluded aneurysms in coil embolization are subject to recanalization but occasionally progress to a totally occluded state. Deployed stents may actually promote thrombosis of coiled aneurysms. We evaluated outcomes of small aneurysms

Methods : Between September, 2012 and June, 2016, a total of 463 intracranial aneurysms were treated by stent-assisted coil embolization. Of these, 132 small saccular aneurysms displayed saccular filling with contrast in the immediate aftermath of coiling. Progressive thrombosis was defined as complete aneurysmal occlusion at the 6-month follow-up point. Rates of progressive occlusion and factors predisposing to this end were analyzed via binary logistic regression.

Result : In 101 (76.5%) of 132 intracranial aneurysms, complete occlusion was observed in follow-up imaging studies at 6 months. Binary logistic regression analysis indicated that progressive occlusion was linked to smaller neck diameter (OR=1.533; p=0.003), hyperlipidemia (OR=3.329; p=0.036) and stent type (p=0.031). The LVIS stent is especially susceptible to progressive thrombosis, more so than Neuroform (OR=0.098; p=0.008) or Enterprise (OR=0.317; p=0.098) stents. In 57 instances of progressive thrombosis, followed for ≥12 months (mean, 25.0±10.7 months), 56 (98.2%) were stable, with minor recanalization noted once (1.8%) and no major recanalizations.

Conclusion : Aneurysms associated with smaller diameter necks, hyperlipidemic states, and LVIS stent deployment may be inclined to eventually thrombose, if occlusion immediately after stent-assisted coil embolization is incomplete. In such instances, excellent long-term durability is anticipated.

Long-term Outcomes of Patients with Stent Tips Embedded into Internal Carotid Artery Branches during Aneurysm Coiling

반 승 필 분당서울대병원

Seung Pil Ban, O-Ki Kwon, Si Un Lee, Jae Seung Bang, Chang Wan Oh, Hyun Jean Jeong, Min Jai Cho, Eun-A Jeong, Tackeun Kim

Departments of Neurosurgery, Seoul National University Bundang Hospital, Seongnam, Korea

Objective : During stent-assisted coiling (SAC) for internal carotid artery (ICA) aneurysms, stent tips are sometimes unintentionally embedded into ICA branches. Stent tips can be visualized because they have radiopaque markers. Concerns regarding stent tip misplacement include risks of artery perforation and occlusion. The aim of this study was to evaluate the long-term outcomes of ICA branches with embedded stent tips.

Methods : ICA branches with embedded stent tips were identified among 35 patients with unruptured ICA aneurysms treated using SAC between November 2003 and November 2014. Patient clinical and angiographic outcomes associated with the embedded stent tip were analyzed.

Result : The majority of the 35 studied aneurysms were paraclinoid ICA aneurysms (n = 30). The most commonly involved ICA branch was the posterior communicating artery (26 patients, 74.3%), followed by the anterior choroidal artery (8 patients, 22.9%) and ophthalmic artery (1 patient, 2.9%). During the follow-up period (38.6 ± 17.9 months), no new neurological deficits developed. Neither hemorrhagic nor thromboembolic events occurred. Angiography was performed during the final follow-up evaluation, at a mean of 32.7 ± 18.0 months, and all ICA branches with embedded stent tips showed patent blood flow without severe luminal narrowing.

Conclusion : Placement of a stent tip into ICA branches during SAC appears to be safe.

Intraprocedural Rupture during Endovascular Treatment of Intracranial Saccular Aneurysm

박 영 기 한양대병원

박영기, 최규선, 이형중

한양대 서울병원 신경외과

Objective : Intraprocedural rupture (IPR) is the most dangerous complication during endovascular treatment of aneurysm. This study aimed to evaluate the rate and risk factor of IPR during endovascular treatment of intracranial saccular aneurysm.

Methods : Patients who received endovascular treatment of intracranial saccular aneurysm in single institution between 2010 and 2016 were retrospectively reviewed. Eighty ruptured and 155 un-ruptured saccular aneurysm was enrolled in study. Demographic factors, aneurysm location, treatment method (simple coil or adjunctive) and aneurysm morphology was reviewed.

Result : Rate of IPR was 7.5% (6/80) in ruptured aneurysm and 2.5% (4/155) in un-ruptured aneurysm patients, respectively. IPR occurred at ACoA (ruptured N=5, un-ruptured N=2), PCoA (un-ruptured N=1), MCA (un-ruptured N=1) and basilar top (ruptured N=1), respectively. The most common cause of IPR was by first framing coil embolization (6/10). Independent risk factor for IPR in saccular aneurysm was ACoA (OR 9.07; 95% CI 2.33-44.75; p=0.0025) and aneurysm size (OR 0.62; 95% CI 0.36-0.94; p=0.0466).

Conclusion : ACoA and small size aneurysm seems to be the risk factor for IPR during endovascular treatment. Gentle manipulation of microcatheter and precaution during first coiling is needed to avoid IPR.

Intraprocedural Rerupture(IPR) Management of Intracranial Aneurysm during Coil Embolization by Manual CCA Compression

김 종 훈 영남대병원

Jong Hoon Kim, Young Jin Jung, Chul Hoon Chang

Department of Neurosurgery, Yeungnam University Medical Center, Daegu, Korea

Objective : Incidence of intraprocedural rerupture (IPR) during endovascular coiling of intracranial aneurysms is relatively low. But, IPR of intracranial aneurysms during coil embolization is associated with significant periprocedural disability and death. We report several cases of IPR management during coil embolization by manual CCA compression.

Methods : Between January 2016 and November 2017, 324 patients were treated with endovascular therapy for unruptured and ruptured intracranial aneurysm. Among them, we had experienced 3 cases of IPR management by CCA compression, recently.

Result : Among the 3 patients, there were 2 anterior communicating artery aneurysms, and 1 internal carotid artery aneurysm. In all cases, simultaneously, rapid CCA compression and aneurysm occlusion at the point of suspected IPR was performed, and final angiography showed complete obliteration of the aneurysm. After the procedure, there were no neurologic deterioration in all cases.

Conclusion : Early IPR detection followed by rapid manual CCA compression and aneurysm occlusion can lead to a benign clinical course in most cases.

In-depth Analysis of the Judicial Precedents for the Peri-procedural Mortality of Unruptured Aneurysms

김 범 태 순천향대 부천병원

Bum-Tae Kim

Department of Neurosurgery, Soonchunhayng University Bucheon Hospital, Bucheon, Korea

Objective : In the coil embolization (CE) for the unruptured intracranial aneurysms (UIAs), 0.1~0.5% peri-procedural mortality has been reported. It may influence/increase the medicolegal suits.

Methods : Author have reviewed the published judicial precedents for the peri-procedural mortality from the court. I have performed an in-depth analysis for these UIA cases and discuss the preventive view points.

Results (Case presentation) : Case 1. During CE for the lobulated MCA aneurysm, intra-procedural rupture (IPR) has been occurred. Emergent operation and active care were performed for the cerebral hemorrhage. The court criticized the manipulation of microcatheter and microwire into the aneurysm sac, however, they agreed with proper management of post procedural complications.

Case 2. CE has been performed for the wide neck MCA aneurysm. During the stent deployment, IPR has been occurred. Reversal of anticoagulant and stent assist coil embolization have been continued. However, MCA occlusion was found and mortality has been occurred. The court criticized the procedures but agreed with the duty explanation for patient himself.

Case 3. CE has been performed for the ICA aneurysm. Coil migration has been occurred and it was retrieved finally. However, diffuse subarachnoid hemorrhage has been found after CE. The court criticized the technical errors and excessive manipulations.

Conclusion : According to the in-depth analysis for the judicial precedents, we may understand the judges had information for the detailed CE procedures of microwire works, tension of microcatheters, size of coil selections and justify/decide whether the CE procedure was correct. We know the court ask the operator has a responsibility for the duty explanation not only patient's family but patient him/herself.

Special lecture

좌장 : 가톨릭대 **성재훈**

의학논문의 각종통계 - 나는 제대로 읽고 이해하고 있는가?
가톨릭대 피부과 **배정민**

Dangerous anastomosis: Clinical revelations
연세대 영상의학과 **김동준**

의료사고 및 법적 문제발생 시 대응방법
법무법인 지평 **강호정**

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▶ **경력**

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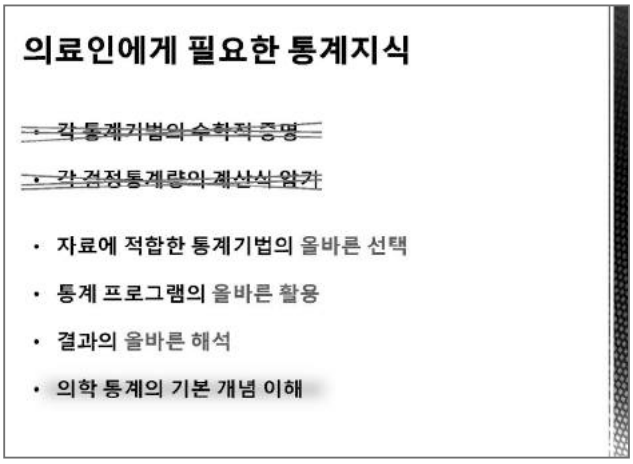
2017. 3.–현재 가톨릭대학교 성빈센트병원 피부과 조교수

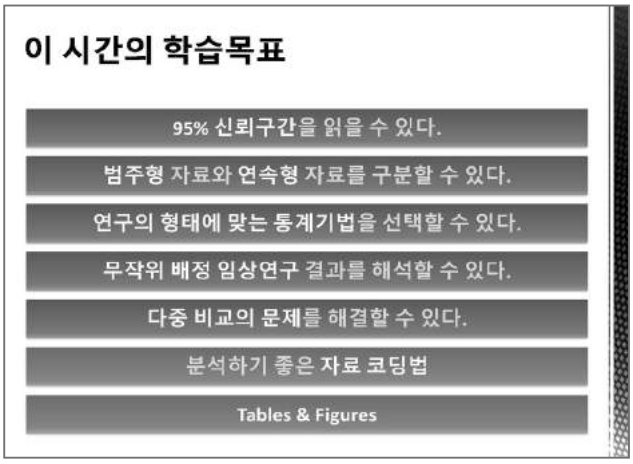
▶ **학회활동**

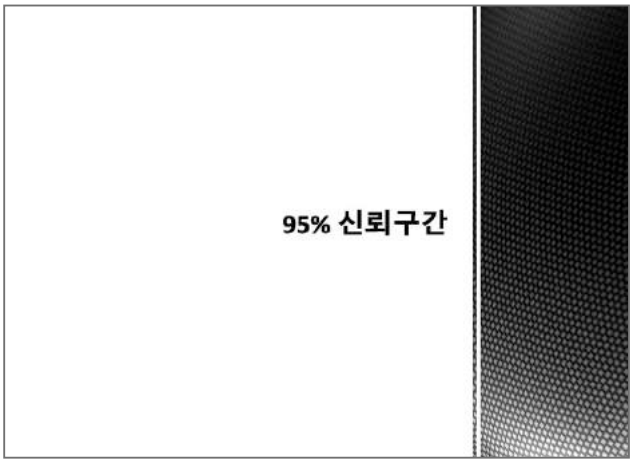
대한피부과학회 정회원
대한백반증학회 대외협력이사

의학논문의 각종통계 – 나는 제대로 읽고 이해하고 있는가?

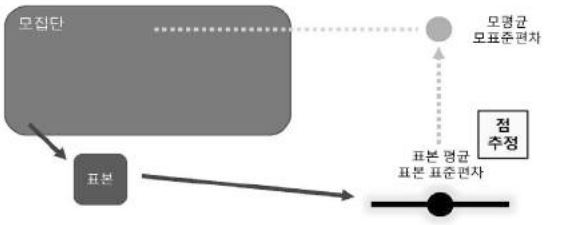
배 정 민
가톨릭대 피부과







점추정과 구간추정

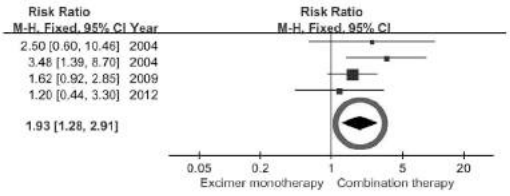


구간 추정

95% 신뢰구간

- 이 구간 내에 모집단의 참값이 있을 확률이 95%
- 참값이 이 구간 밖에 있을 확률이 5%

95% 신뢰구간



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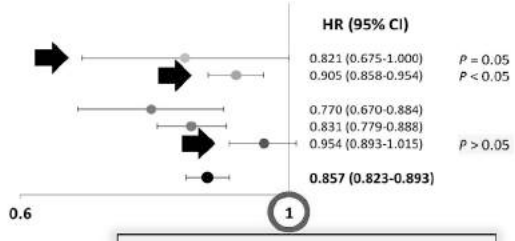

95% 신뢰구간

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- 참값이 이 구간 밖에 있을 확률이 5%

95% 신뢰구간

	Prevalence		Multivariable analysis: Adjusted OR (95% CI)*	Multivariable analysis: P value
Psoriasis				
Healthy control	0.88%	(1097/122,529)	Reference	
IBD	1.56%	(636/40,843)	1.778 (1.611-1.963)	<.0001
Rosacea				
Healthy control	0.08%	(94/122,529)	Reference	
IBD	0.10%	(68/40,843)	2.173 (1.590-2.969)	<.0001
Atopic dermatitis				
Healthy control	1.49%	(1827/122,529)	Reference	
IBD	2.02%	(826/40,843)	1.366 (1.257-1.485)	<.0001
Vitiligo				
Healthy control	0.24%	(293/122,529)	Reference	
IBD	0.29%	(117/40,843)	1.199 (0.967-1.486)	.0980

95% 신뢰구간

- 이 구간 내에 모집단의 참값이 있을 확률이 95%
- 참값이 이 구간 밖에 있을 확률이 5%

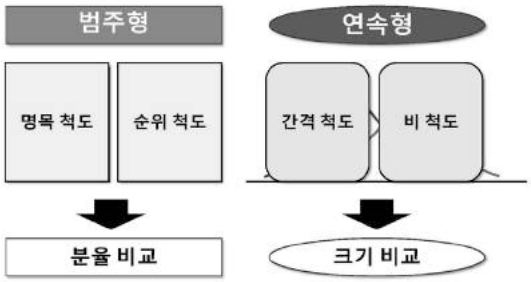
자료의 분류

의학통계에서 흔히 사용되는 통계기법

독립표본 T 검정	Mann-Whitney test	반복측정 분산분석
대응표본 T 검정	Wilcoxon signed rank test	선형 혼합모형
일원배치 분산분석	Kruskal-Wallis test	일반화 추정 방정식
카이제곱 검정	Fisher's exact test	포아송 회귀분석
Pearson's correlation	Spearman's correlation	동등성 검정
단순 회귀분석	다중 회귀분석	비열등성 검정
로지스틱 회귀분석	Kaplan-Meier 생존분석	연구대상수 산출
로그순위법	Cox의 비례위험모형	메타분석

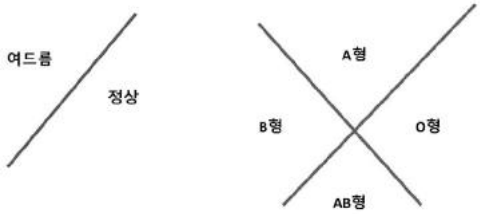
통계 분석의 시작

▪내가 갖고 있는 **자료**가 어떤 형태인가?



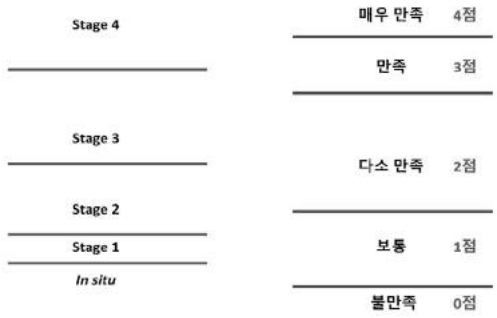
명목 변수

범주형

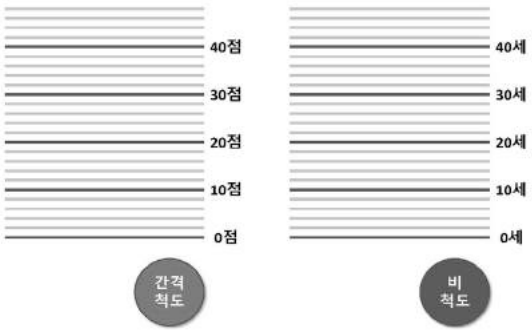


순위 변수

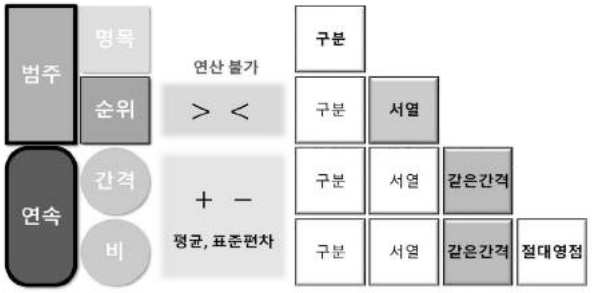
범주형



연속 변수

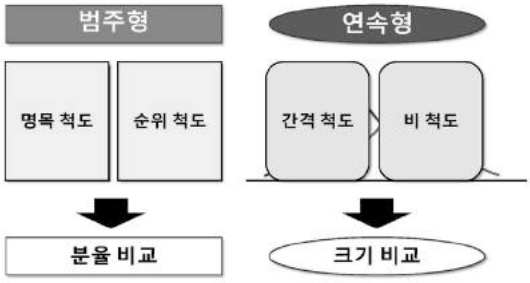


자료의 분류

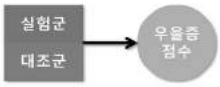


통계 분석의 시작

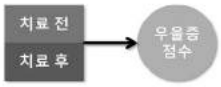
▪내가 갖고 있는 **자료**가 어떤 형태인가?



연속형 자료의 분석

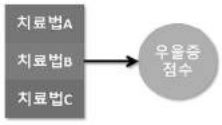


독립표본 T 검정
Mann-Whitney test

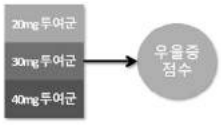


대응표본 T 검정
Wilcoxon signed rank test

연속형 자료의 분석

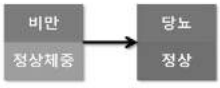


일원배치 분산분석
Kruskal-Wallis test

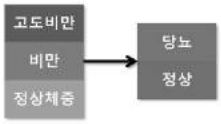


일원배치 분산분석
Kruskal-Wallis test
Jonckheere-Terpstra test

범주형 자료의 분석

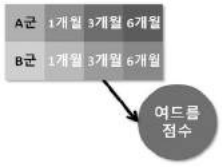


카이제곱 검정
Fisher의 정확한 검정

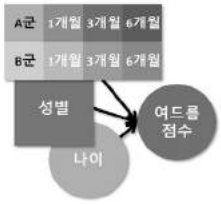


카이제곱 검정
Fisher의 정확한 검정
Cochran-Armitage test

반복측정된 자료의 분석

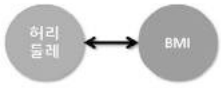


반복측정 분산분석

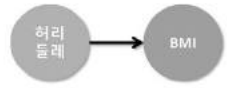


선형 혼합모형
일반화 추정 방정식

연속형 변수 사이의 관계에 대한 분석

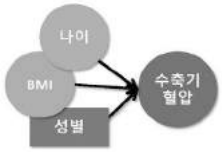


상관분석

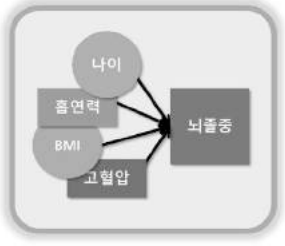


회귀분석

질병의 위험인자에 대한 연구

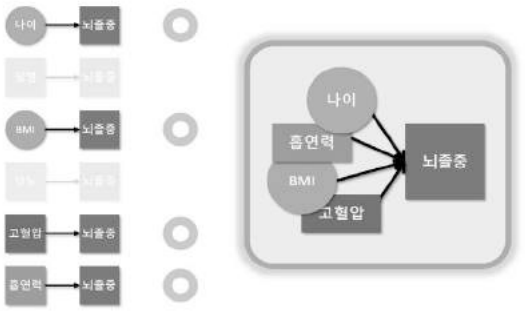


다중 회귀분석

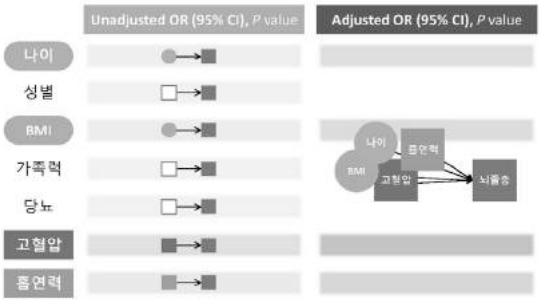


로지스틱 회귀분석

로지스틱 회귀분석 Odds Ratio

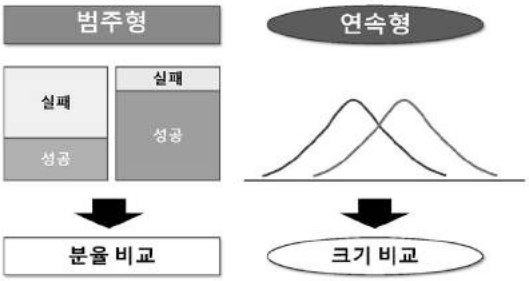


로지스틱 회귀분석 Odds Ratio

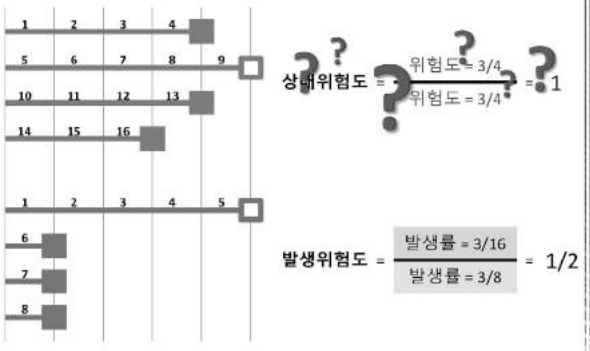


통계 분석의 시작

- 내가 갖고 있는 **자료**가 어떤 형태인가?

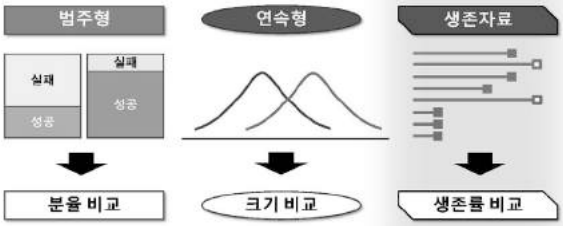


시간에 따른 발생 자료 Time-to-event data

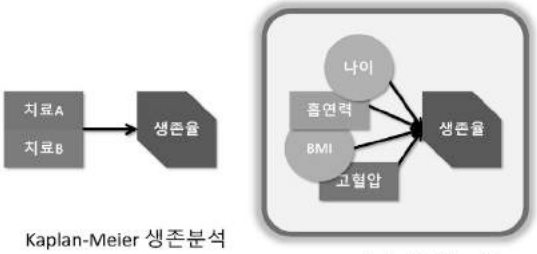


통계 분석의 시작

- 내가 갖고 있는 **자료**가 어떤 형태인가?

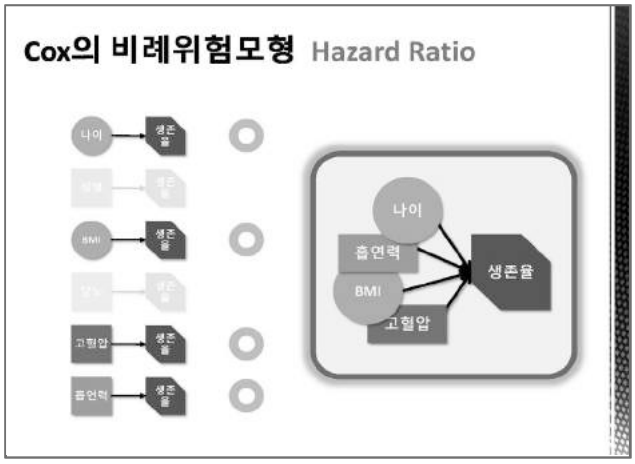


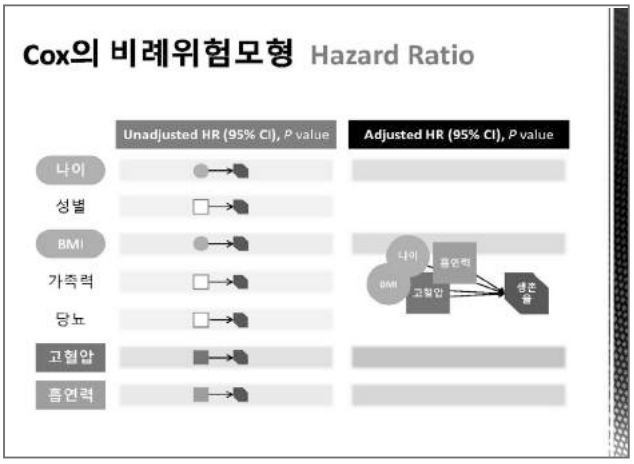
질병으로 인한 생존율에 대한 연구

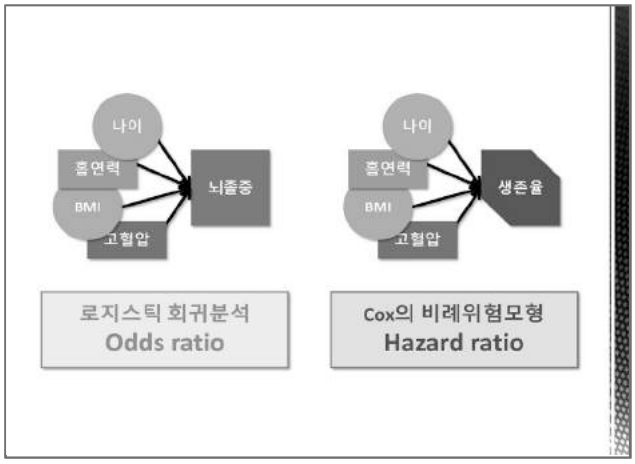


Kaplan-Meier 생존분석
로그순위법
Cox의 비례위험모형

Cox의 비례위험모형

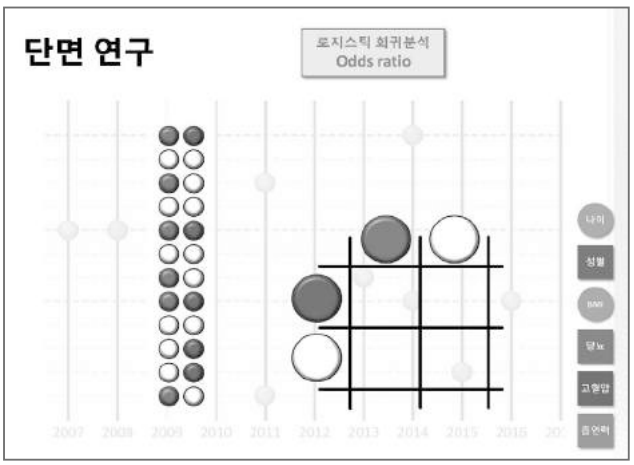

Cox의 비례위험모형 Hazard Ratio
나이
흡연력
BMI
고혈압
생존율


Cox의 비례위험모형 Hazard Ratio
Unadjusted HR (95% CI), P value
Adjusted HR (95% CI), P value
나이
성별
BMI
가족력
당뇨
고혈압
흡연력

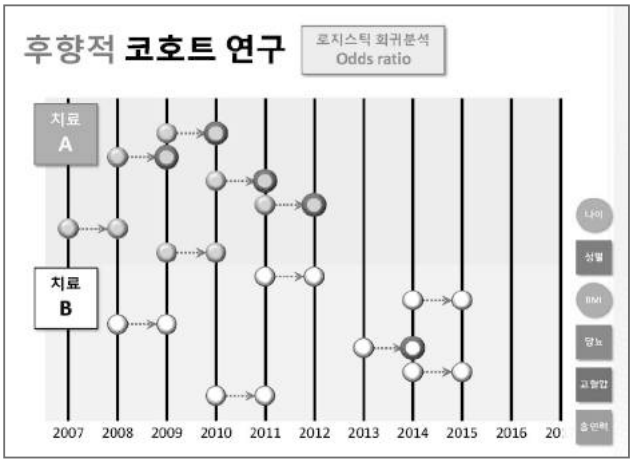

나이
흡연력
BMI
고혈압
뇌졸중
로지스틱 회귀분석
Odds ratio
나이
흡연력
BMI
고혈압
생존율
Cox의 비례위험모형
Hazard ratio

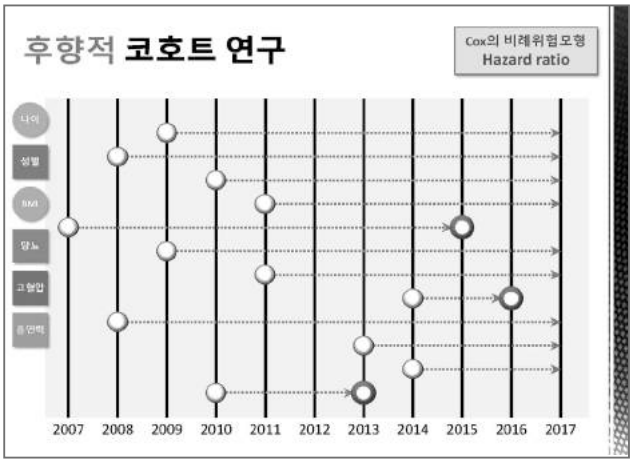

의학 연구의 종류

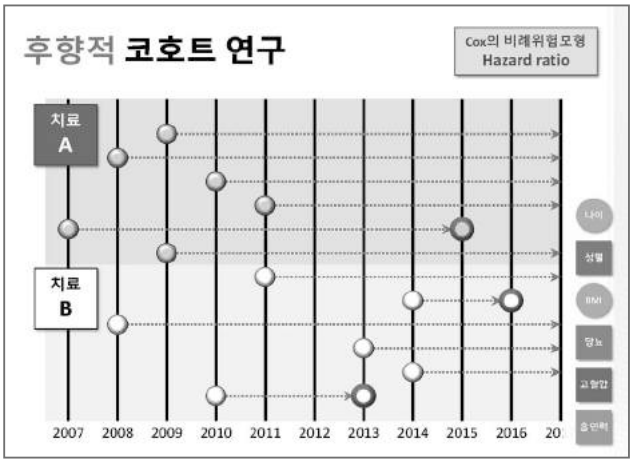

단면 연구
로지스틱 회귀분석
Odds ratio
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

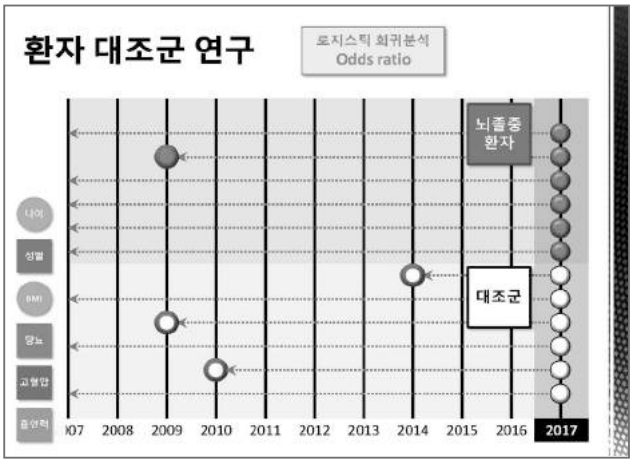

단면 연구
로지스틱 회귀분석
Odds ratio

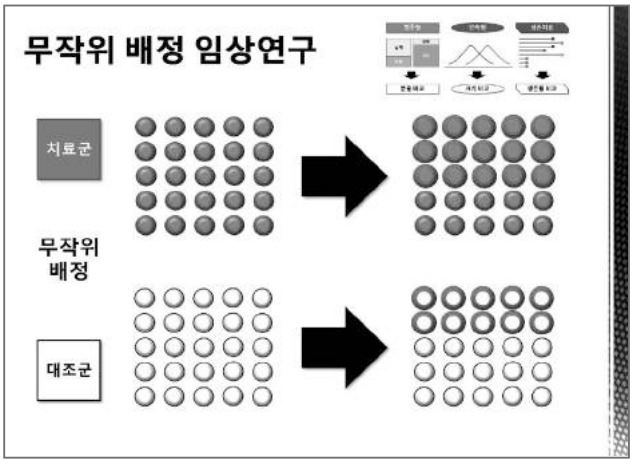

후향적 코호트 연구
로지스틱 회귀분석
Odds ratio
나이
성별
BMI
당뇨
고혈압
흡연력
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017


후향적 코호트 연구
로지스틱 회귀분석
Odds ratio
치료 A
치료 B
나이
성별
BMI
당뇨
고혈압
흡연력
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 20


후향적 코호트 연구
Cox의 비례위험모형
Hazard ratio
나이
성별
BMI
당뇨
고혈압
흡연력
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017


후향적 코호트 연구
Cox의 비례위험모형
Hazard ratio
치료 A
치료 B
나이
성별
BMI
당뇨
고혈압
흡연력
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 20

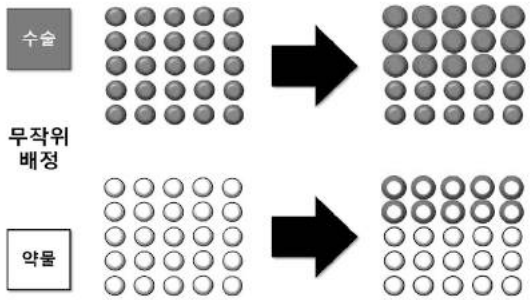

환자 대조군 연구
로지스틱 회귀분석
Odds ratio
뇌졸중 환자
대조군
나이
성별
BMI
당뇨
고혈압
흡연력
07 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017


무작위 배정 임상연구
치료군
무작위 배정
대조군

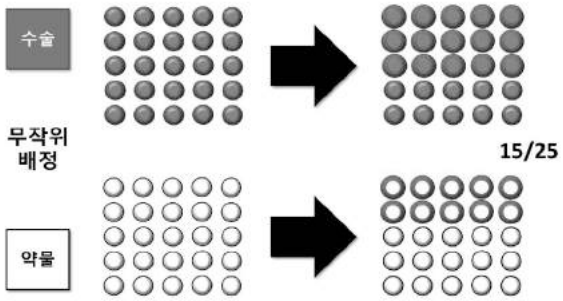
무작위 배정 임상연구

치료의도군 분석Intention-to-treat
치료순응군 분석Per Protocol

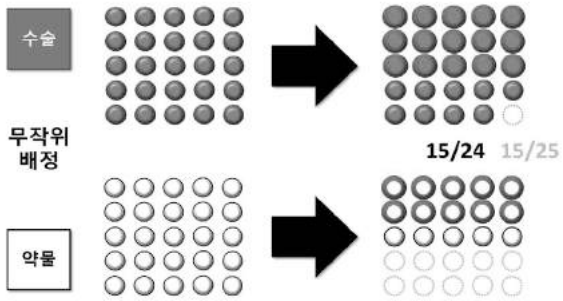
무작위 배정 임상연구



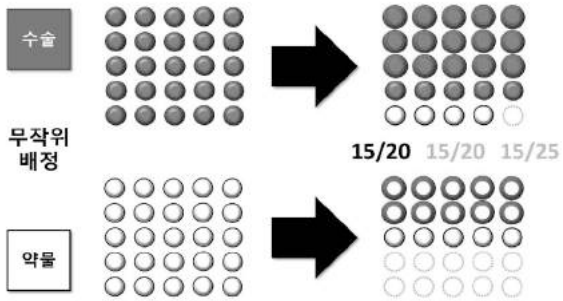
무작위 배정 임상연구 (이상적인 경우)



무작위 배정 임상연구 (loss된 환자)



무작위 배정 임상연구 (치료법이 바뀐 환자)



이상적인 임상시험

- 선정기준과 제외기준을 모두 만족
- 임상시험이 종료될 때까지 배정된 치료법을 시행
- 임상시험계획서 위반이 발생하지 않음
- 결측치 발생하지 않음

완벽하지 않은 실제 임상시험

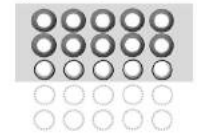
- 선정기준과 제외기준에 맞지 않는 피험자
- 무작위 배정 이후 치료법 A와 B가 바뀜
- 임상시험계획서 위반 (예, 금지된 병용약물의 복용)
- 결측치 발생

결과 해석 방법 1

실제 수술을 받은 20명과 실제 약물치료를 받은 19명의 결과를 비교

- 효과가 작은 군에서 순응도가 낮아서 loss가 많았을 가능성
- 수술군에 있는 매우 상태가 안 좋은 피험자가 수술을 받지 못하고 약물치료군으로 이동했을 가능성
- **명백한 편의(bias) 야기**

15/20 15/20 15/25



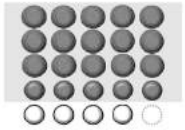
10/19 10/15 10/25

결과 해석 방법 2

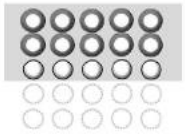
계획대로 수술을 받은 20명과 계획대로 약물치료를 받은 15명의 결과를 비교

- 효과가 작은 군에서 순응도가 낮아서 loss가 많았을 가능성
- 명백한 편의(bias)가 있지만 두 치료법의 효과를 비교할 수 있음.

치료순응군 분석Per Protocol



15/20 **15/20** 15/25



10/19 **10/15** 10/25

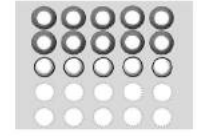
결과 해석 방법 3

실제 치료법과 관계없이 원래 무작위 배정된 수술군 25명과 약물치료군 25명을 비교

- 만족스럽지 않지만 가장 공평한 방법
- 두 치료법을 비교한 것이 아님
- 두 치료 전략을 비교한 것임

치료의도군 분석Intention-to-treat

15/20 15/20 **15/25**



10/19 10/15 **10/25**

무작위 배정 임상연구 결과의 해석

치료의도군 분석
Intention-to-treat, ITT

- Drop-out, missing data, 치료법 바뀜과 관계없이, 무작위 배정에 의하여 정해진 군에 근거하여 두 군을 비교하는 방법
- 편의(bias) 발생을 최소화할 수 있음

치료순응군 분석
Per Protocol, PP

- 임상시험계획서를 잘 준수한 피험자들의 집단을 대상으로 분석하는 방법
- 편의(Bias)는 있으나 치료법의 순수한 효과를 더 잘 비교하리라 예상됨

그럼 둘 중 어떤 방법을 사용할 것인가

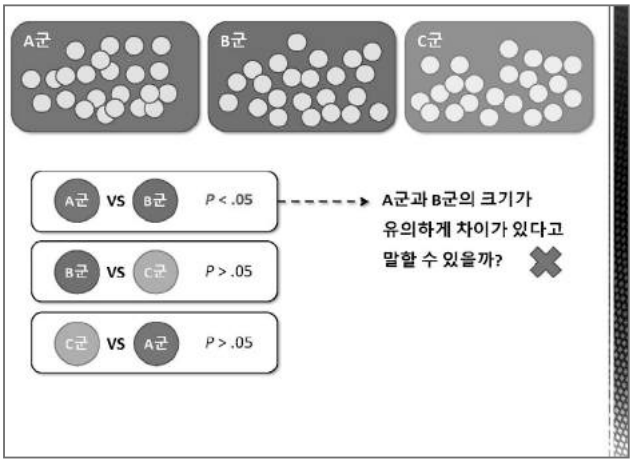
치료의도군 분석 ITT ····· 주분석

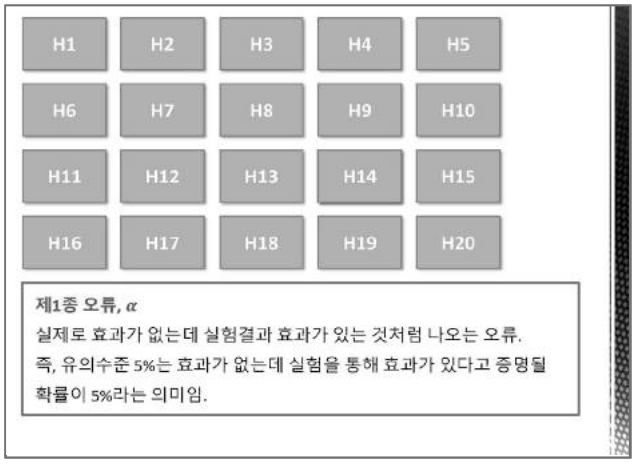
치료순응군 분석 PP ····· 보조분석

치료의도군 분석 ITT = 치료순응군 분석 PP 결과 확신 !!

치료의도군 분석 ITT ≠ 치료순응군 분석 PP 이유 설명 !!

다중비교의 문제





다중비교를 위한 방법

- Bonferroni
- Tukey
- Sidak
- Scheffe
- Duncan
- Hochberg
- Dunnett

다중비교를 위한 방법

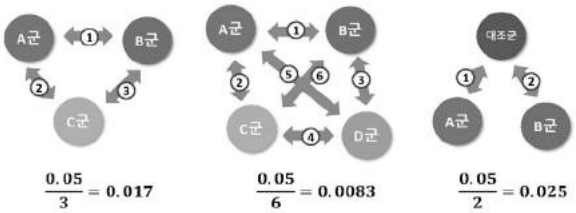
Bonferroni

$$\text{보정된 유의수준} = \frac{0.05}{\text{총 검정의 개수}}$$

- 가장 보수적인 방법 중 하나
- 검정력이 떨어지는 단점
- 직관적인 이해가 가능
- 모든 상황에서 폭넓게 사용될 수 있는 장점

Bonferroni's method

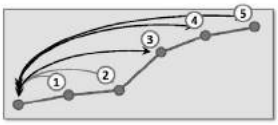
▪ 보정된 유의수준 $= \frac{0.05}{\text{총 검정의 개수}}$

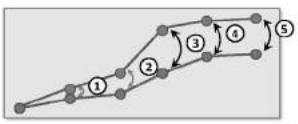


일원배치 분산분석을 먼저 실시한다.

Bonferroni's method

▪ 보정된 유의수준 $= \frac{0.05}{\text{총 검정의 개수}}$





$\frac{0.05}{5} = 0.01$ $\frac{0.05}{5} = 0.01$

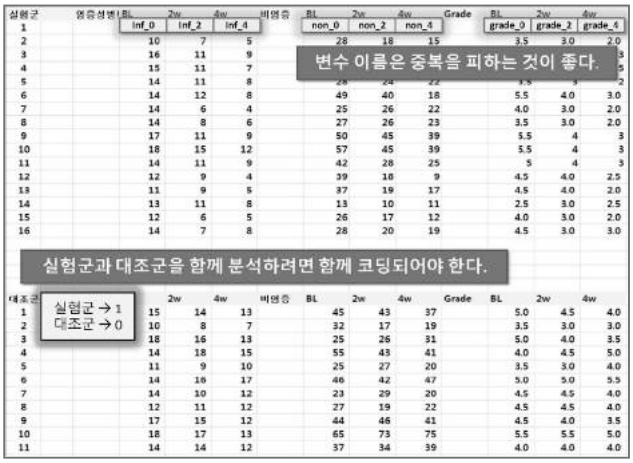
반복측정 분산분석을 먼저 실시한다.

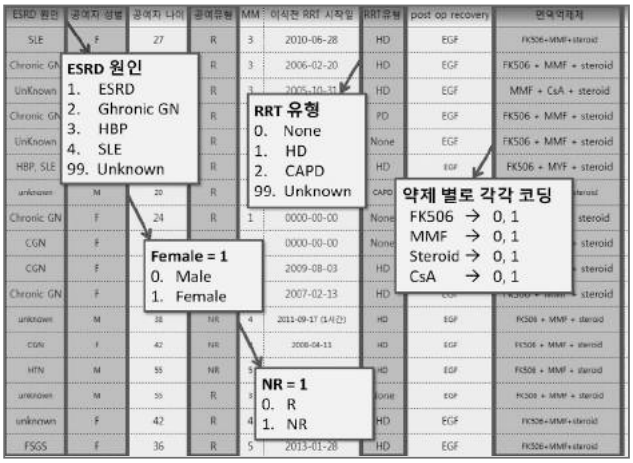
자료 코딩하기

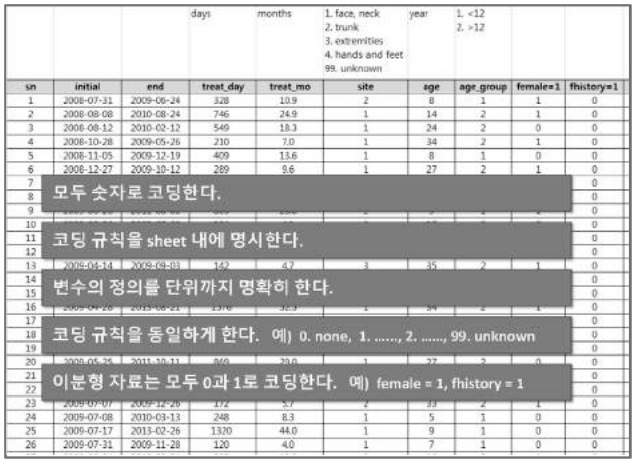
분석하기 좋은 자료 코딩

- 누가 봐도 이해가 **쉽다.**
- 언제 봐도 이해가 **쉽다.**
- 데이터 추가가 **쉽다.**
- 통계프로그램에서 읽기 **쉽다.**
- 통계 분석이 **쉽다.**
- 자료의 변형이 **쉽다.**

Hair loss	Mother's age (mo)
0	55
0	82
0	117
0	141
0	78
0	75
0	104
0	88
0	111
1	95
1	124
1	177
1	142
1	166
1	207

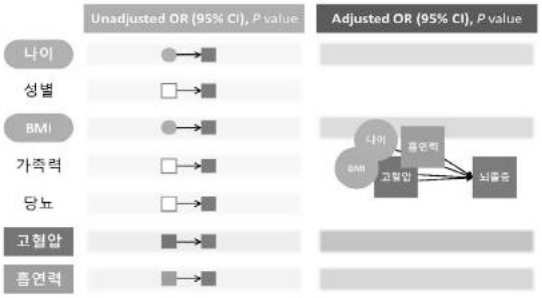






Tables & Figures

로지스틱 회귀분석 Odds Ratio



Cox의 비례위험모형 Hazard Ratio

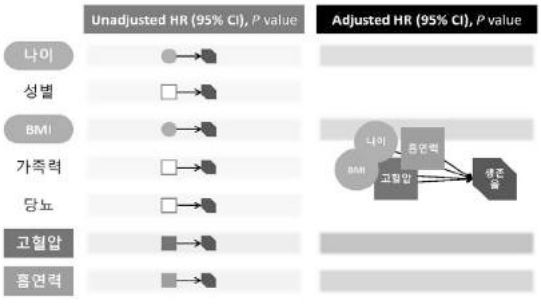
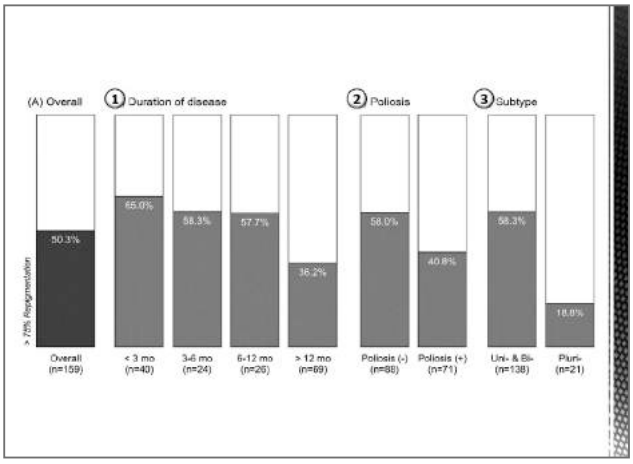
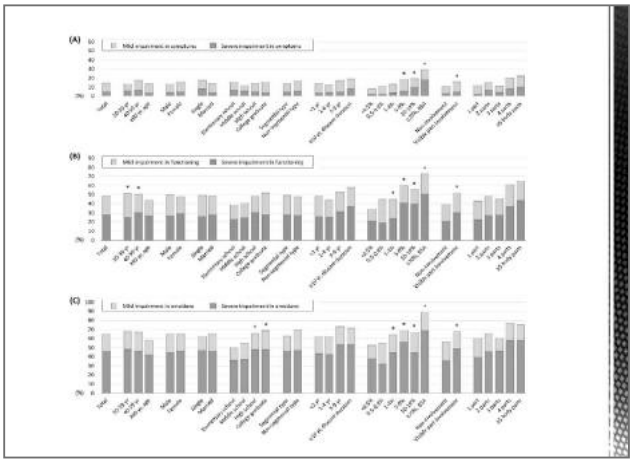
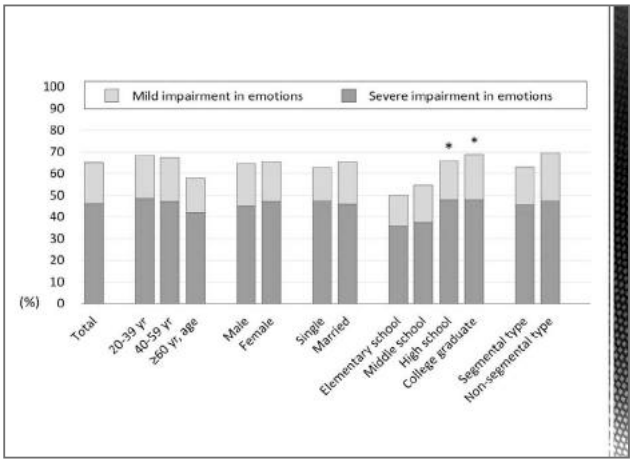


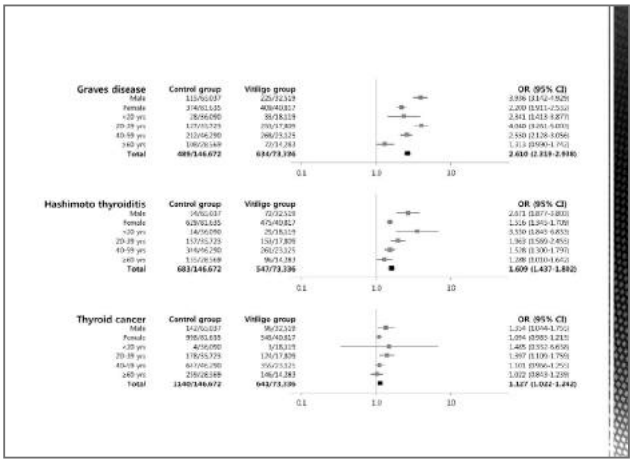
Table II. Prognostic factors influencing the response of patients with segmental vitiligo (n = 159)

	Category	n (%)	Success rate	Univariate analysis Odds ratio (95% CI)	P	Multivariate analysis Odds ratio (95% CI)	P
Gender	Male	66 (41.5)	53.0%	Reference			
	Female	93 (58.5)	48.4%	0.830 (0.441-1.562)	.564		
Age, y	≤12	44 (27.7)	70.5%	Reference			
	>12	115 (72.3)	42.6%	0.311 (0.148-0.656)	.002		
Fitzpatrick skin type	III	50 (31.4)	52.0%	Reference			
	IV	109 (68.6)	49.5%	0.906 (0.464-1.771)	.773		
Site	Head and neck	123 (77.4)	49.6%	Reference	.594		
	Trunk	16 (10.1)	43.8%	0.791 (0.277-2.257)	.661		
	Extremities	20 (12.6)	60.0%	1.525 (0.583-3.989)	.390		
Onset age, y	<12	59 (37.1)	62.7%	Reference			
	>12	100 (62.9)	43.0%	0.449 (0.232-0.868)	.017		
① Duration, mo	<3	40 (25.2)	65.0%	Reference	.020	Reference	.110
	3-6	24 (15.1)	58.3%	0.754 (0.267-2.132)	.594	0.874 (0.289-2.643)	.811
	6-12	26 (16.4)	57.7%	0.734 (0.266-2.023)	.550	0.587 (0.202-1.701)	.326
	>12	69 (43.4)	36.2%	0.306 (0.136-0.691)	.004	0.372 (0.157-0.882)	.025
Side	Right	77 (48.4)	48.1%	Reference			
	Left	82 (51.6)	52.4%	1.192 (0.640-2.222)	.580		
Size, cm^2	<5	64 (40.3)	51.6%	Reference	.465		
	5-10	47 (29.6)	57.4%	1.268 (0.594-2.707)	.539		
	10-20	37 (23.3)	43.2%	0.716 (0.317-1.616)	.421		
	>20	11 (6.9)	36.4%	0.557 (0.143-2.015)	.357		
② Koilesis	(−)	88 (55.3)	58.0%	Reference		Reference	
	(+)	71 (44.7)	40.8%	0.501 (0.265-0.945)	.033	0.494 (0.247-0.988)	.046
③ Subtype	Unisegment and bisegment	127 (79.9)	58.3%	Reference		Reference	
	Plurisegment	32 (20.1)	18.8%	0.165 (0.064-0.430)	<.001	0.175 (0.065-0.474)	.001









이 시간의 학습목표

- 95% 신뢰구간을 읽을 수 있다.
- 범주형 자료와 연속형 자료를 구분할 수 있다.
- 연구의 형태에 맞는 통계기법을 선택할 수 있다.
- 무작위 배정 임상연구 결과를 해석할 수 있다.
- 다중 비교의 문제를 해결할 수 있다.
- 분석하기 좋은 자료 코딩법
- Tables & Figures

의학논문의 각종통계
나는 제대로 읽고 이해하고 있는가

경청해 주셔서 감사합니다.

김 동 준 연세대학교 의과대학 영상의학과

▶ **학력 및 경력**

1994년	연세대학교 의과대학 졸업
2002–2004년	세브란스병원 신경영상 fellowship
2009–2010년	Toronto Western Hospital research fellowship
2004년– 현재	세브란스병원 영상의학과

▶ **학회활동**

1995년–현재	대한영상의학회 정회원
2002년–현재	대한신경중재치료의학회 정회원
2004년–현재	대한뇌졸중학회 정회원
2013년–현재	WFITN 정회원

Dangerous anastomosis: Clinical revelations

김 동 준
연세대 영상의학과

Anastomoses between the external and intracranial arteries result from a close link of embryologic & phylogenetic development of the aortic arches and the organs of the head & neck. These may be dangerous in that the potential anastomotic channels may cause inadvertent intracranial stroke during embolization of the extracranial arteries. On the other hand, these channels may serve as a collateral salvage route when one channel becomes occluded pathologically or during interventional procedures. The anastomotic channels may be revealed when there is increased intra-arterial pressure (during embolization, superselective injection, wedged injection), sump in high flow shunt, and as collateral route in major arterial occlusions.
Often the anastomotic channels follow the cranial nerve along the neural foramen. Thus, the dangerous anastomoses and the relevant cranial nerve supply should always be considered together when planning and performing interventional procedures.

The major dangerous anastomotic channels may be summarized as follows:

Region	Arterial trunk	Specific dangerous branch
Orbit (ophthalmic artery branches)	IMA	InfraorbitalA (orbital branch) SphenopalatineA (ethmoidal) MMA (meningoophthalmic, RecMeningA) AntDeepTempA (orbital branch) Superficial temporalA (supraorbital br)
Parasellar region (carotid siphon)	IMA	MMA (cavernous ramus) AMA (cavernous ramus) Artery of foramen rotundum
	APA	Superior pharyngeal (carotid branch) Jugular artery (LatClival branch) Hypoglossal artery (MedClival branch)
Temporal bone (Intrapetrous ICA)	IMA	Anterior tympanic artery Vidian artery
	APA	Superior pharyngeal (Mandibular) Inferior tympanic artery
	PA or OA	Stylomastoid branch
Upper cervical spaces (VA)	OA	C1 anastomotic branch C2 anastomotic branch
	APA	Hypoglossal A (odontoid arch system) Musculospinal A Lateral spinal A
	AscCervA	C3,4 anastomosis
	PostCervA	C2,3,4 anastomosis
	ECA trunk	C4 collateral

강 호 정 법무법인 지평

▶ **학력**

이화여자대학교 법과대학 및 동 대학원 졸
2000년 (42회) 사법시험 합격, 사법연수원 32기

▶ **경력**

전) 수원지방검찰청 형사부 검사
전) 대전지검 천안지청 형사부 검사
전) 창원지방검찰청 형사부 검사
전) 부산지검 동부지청 형사부 검사
전) 서울 서부지방검찰청 형사부 검사
전) 강호정 법률사무소 변호사
현) 법무법인 지평 구성원 변호사
현) 동의대학교 법학과 겸임교수

의료사고 및 법적 문제발생 시 대응방법

강 호 정
법무법인 지평

Symposium:
Review of endovascular devices

좌장 : 순천향대 **김범태,** 서울대 **권오기**

Stroke devices
가톨릭대 **박상규**

Overview of detachable coils
한림대 **전홍준**

Stent for aneurysm coiling
연세대 **정준호**

박 상 규 가톨릭대학교 인천성모병원

▶ **학력 및 경력**

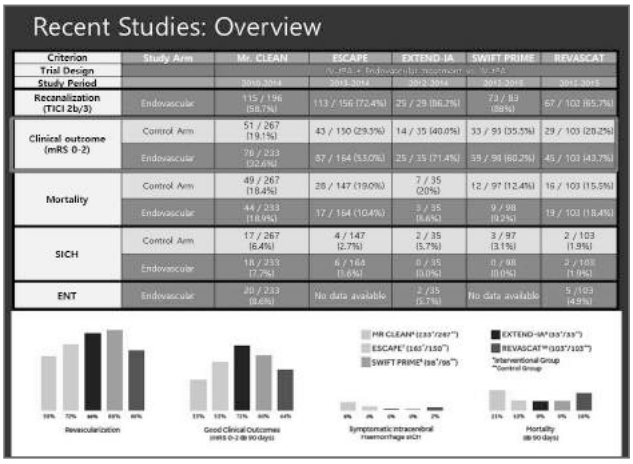
2003년	한양대학교 의과대학 졸
2008년	한양대학교 신경외과 수료
2009년	아주대학교 임상강사
2010–현재	가톨릭대학교 인천성모병원

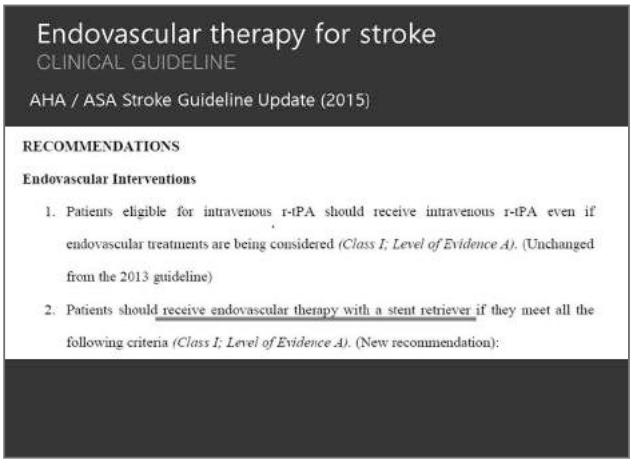
▶ **학회활동**

대한 신경외과학회, 뇌혈관내수술학회, 뇌혈관중재수술학회, 뇌졸중학회

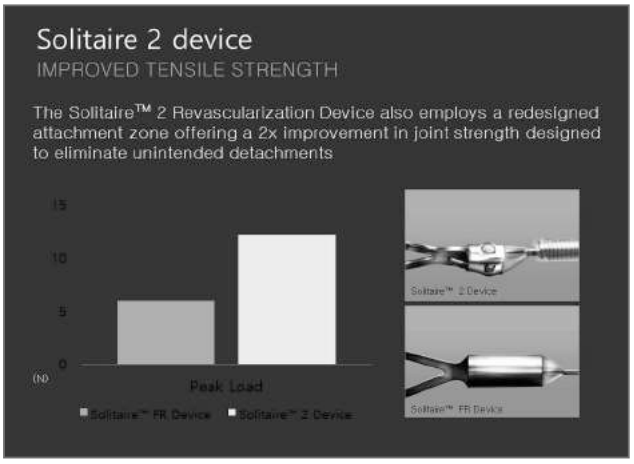
Stroke devices

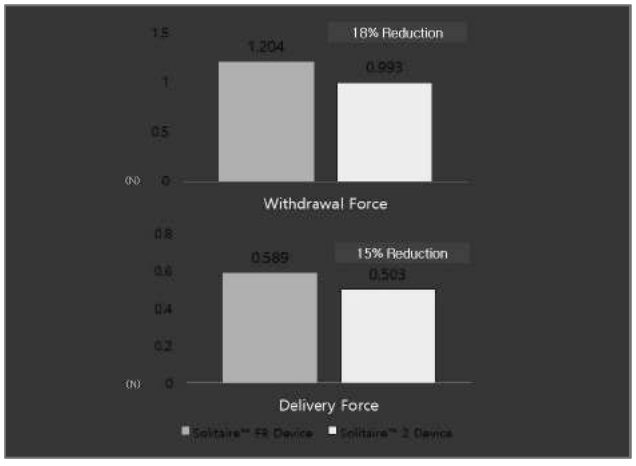
박 상 규
가톨릭대



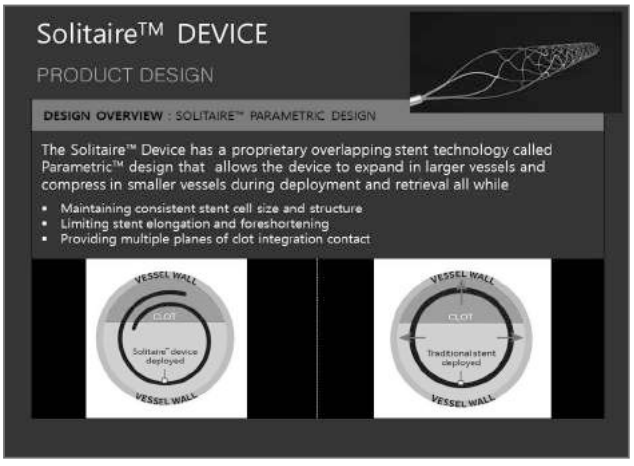


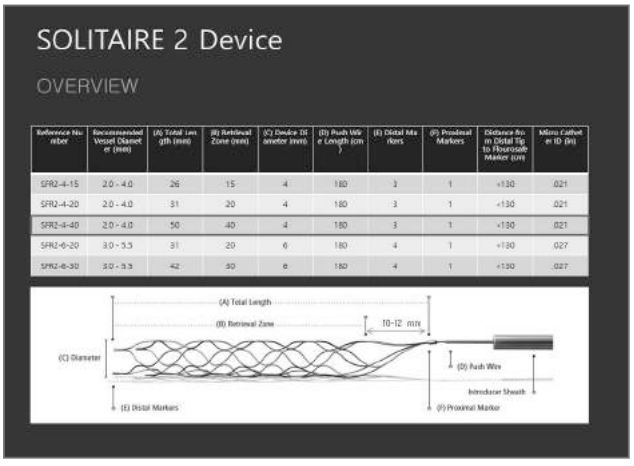

Medtronic
SOLITAIRE™ PLATINUM
REVASCULARIZATION
DEVICE


Solitaire 2 device
IMPROVED TENSILE STRENGTH
The Solitaire™ 2 Revascularization Device also employs a redesigned attachment zone offering a 2x improvement in joint strength designed to eliminate unintended detachments
15
10
5
0
(N)
Peak Load
Solitaire™ FR Device
Solitaire™ 2 Device
Solitaire™ 2 Device
Solitaire™ FR Device


1.5
1
0.5
(N) 0
1.204
18% Reduction
0.993
Withdrawal Force
0.8
0.6
0.4
0.2
(N) 0
0.589
15% Reduction
0.503
Delivery Force
Solitaire™ FR Device
Solitaire™ 2 Device


Solitaire 2 device
RAPID DELIVERY
When every second counts, the Solitaire™ 2 revascularization device accelerates device deployment with a fluorosafe marker on the proximal push wire
1"
A 1" long fluorosafe marker located 130cm from distal tip of the pushwire


Solitaire™ DEVICE
PRODUCT DESIGN
DESIGN OVERVIEW : SOLITAIRE™ PARAMETRIC DESIGN
The Solitaire™ Device has a proprietary overlapping stent technology called Parametric™ design that allows the device to expand in larger vessels and compress in smaller vessels during deployment and retrieval all while
Maintaining consistent stent cell size and structure
Limiting stent elongation and foreshortening
Providing multiple planes of clot integration contact
VESSEL WALL
CLOT
Solitaire™ device deployed
VESSEL WALL
VESSEL WALL
CLOT
Traditional stent deployed
VESSEL WALL


SOLITAIRE 2 Device
OVERVIEW
(A) Total Length
(B) Retrieval Zone
10-12 mm
(C) Diameter
(D) Push Wire
Introducer Sheath
(E) Distal Markers
(F) Proximal Marker

Solitaire™ 2 DEVICE

COMPLETE STROKE ZONE COVERAGE

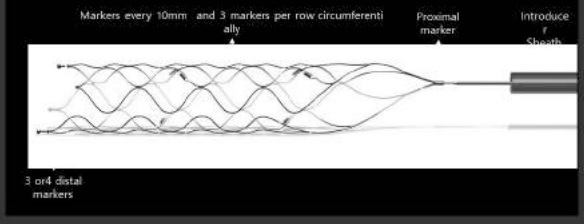
Simplified placement with proximal ophthalmic alignment providing the complete stroke zone coverage from ICA to M2

Solitaire™ platinum

PRODUCT DESIGN

DESIGN OVERVIEW : SOLITAIRE™ PLATINUM DESIGN

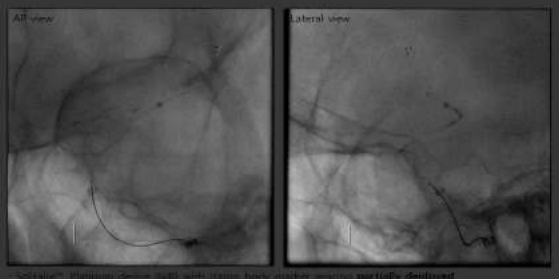
The Solitaire™ Platinum device **provides true, meaningful visualization to assist physicians** during their interventional stroke procedures.



Solitaire™ platinum

IMPROVED VISIBILITY

Clearly see the working length of the Solitaire™ Platinum stent in and o ut of the microcatheter and easily check if the stent is open or closed



Solitaire™ platinum

SOLITAIRE™ PLATINUM REVASCULARIZATION DEVICE

The Solitaire™ Platinum Revascularization Device is the next generation into the Solitaire™ family which has an enhanced visibility that provides feedback during the treatment of stroke patients.

The Solitaire™ Platinum Revascularization Device is designed to restore blood flow in patients experiencing ischemic stroke due to large intracranial vessel occlusion. The device is designed for use in the neurovasculature such as the internal carotid artery, M1 and M2 segments of the middle cerebral artery, basilar, and the vertebral arteries.

SOLITAIRE™ PLATINUM REVASCULARIZATION DEVICE PRODUCT ORDERING INFORMATION

Reference Number	Recommended Vessel Diameter (mm)	Minimum Micro Catheter ID (mm)	Push Wire Length (cm)	Dia. (mm)	Total Length (mm)	Proximal Marker to Distal Marker Length (mm)	Distance from distal tip to Proximal marker (cm)	Radiopaque Markers: Dist.	Radiopaque Markers: Prox.	Radiopaque Stent Markers Spacing (mm)
SRD5-4-20-10	3.0-4.0	0.021	180	4	20	11	<150	3	1	10
SRD5-4-40-10	3.0-4.0	0.021	180	4	40	30	<150	3	1	10
SRD5-6-20-10	3.5-5.5	0.027	180	6	20	11	<150	4	1	10
SRD5-6-40-10	3.5-5.5	0.027	180	6	40	47	<150	4	1	10

Arc™ stroke support catheter

THE ARC™ SUPPORT CATHETER IS THE MOST NAVIGABLE, MOST POWERFUL ASPIRATING 6F TAPERED SUPPORT CATHETER AVAILABLE AND WHEN COMBINED WITH THE SOLITAIRE™ DEVICE, WILL PROVIDE IMMEDIATE REPERFUSION AND THE FASTEST ROUTE TO RECANALIZATION"

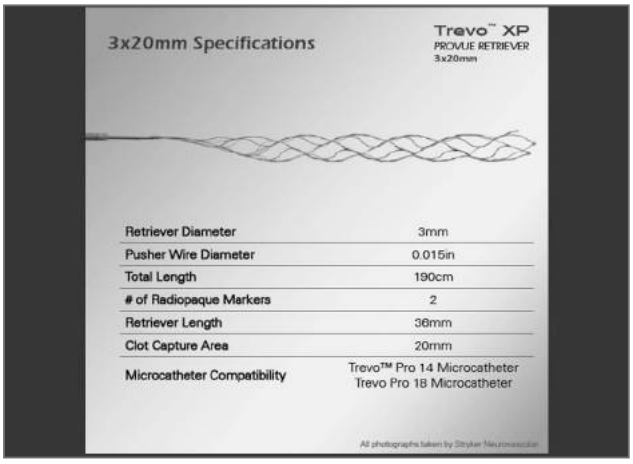
Arc™ stroke support catheter

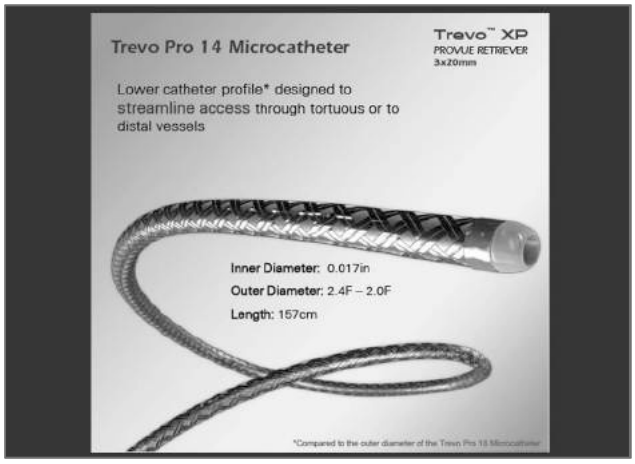
PRODUCT OVERVIEW

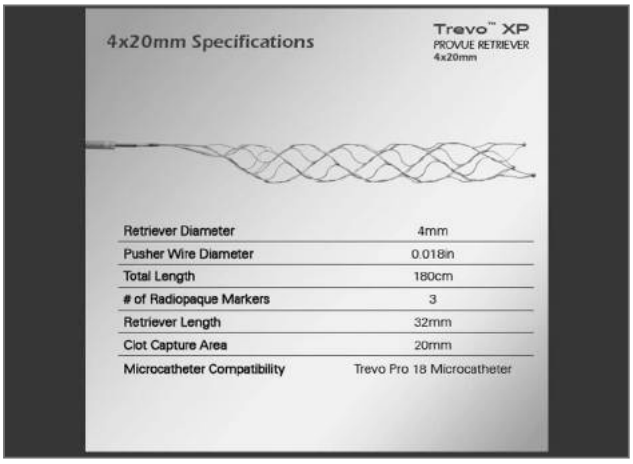
ARC™ SUPPORT CATHETER SERIES PRODUCT ORDERING INFORMATION

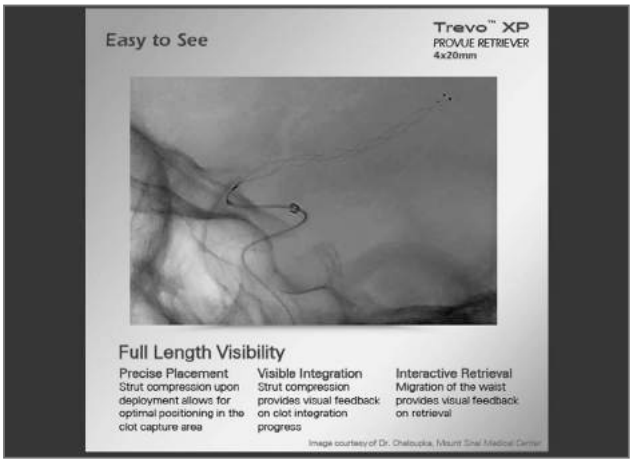
Reference Number	Product Name	Working Length (A)	Proximal Outer Diameter (B)	Distal Outer Diameter (C)	Proximal Inner Diameter (D)	Distal Inner Diameter (E)	Max Wire Compatibility
ARCA-132	Arc™ catheter	132 cm	0.080"	0.069"	0.069"	0.061"	0.038"
ARCA-160	Arc™ Mini catheter	160 cm	0.060"	0.044"	0.044"	0.038"	0.032"

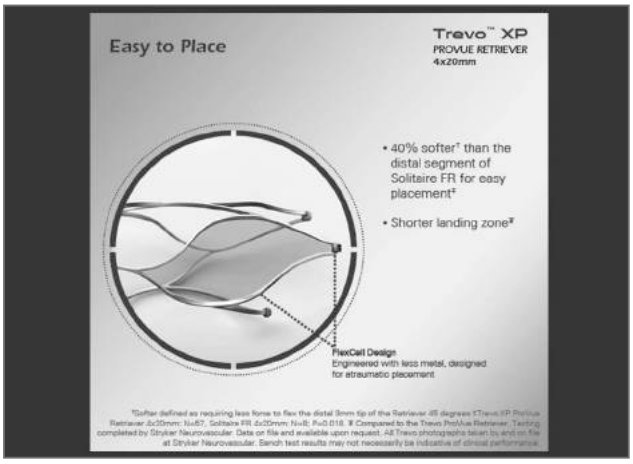

Trevo™ XP
PROVUE RETRIEVER
stryker
Neurovascular
3x20mm
Softer and Smaller
4x20mm
Take Control. Capture More.
Ordering Information
Stroke: Our Only Focus. Our Ongoing Promise.

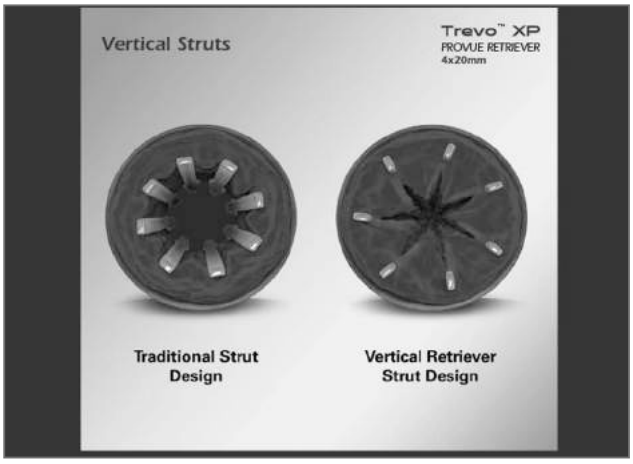

3x20mm Specifications
Trevo™ XP
PROVUE RETRIEVER
3x20mm
Retriever Diameter 3mm
Pusher Wire Diameter 0.015in
Total Length 190cm
# of Radiopaque Markers 2
Retriever Length 36mm
Clot Capture Area 20mm
Microcatheter Compatibility Trevo™ Pro 14 Microcatheter
Trevo Pro 18 Microcatheter

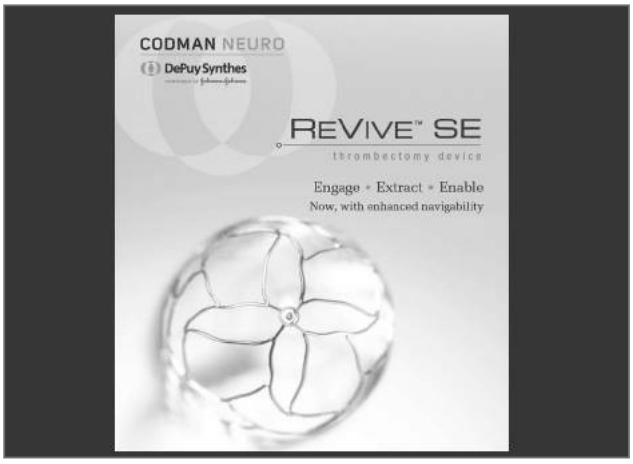

Trevo Pro 14 Microcatheter
Trevo™ XP
PROVUE RETRIEVER
3x20mm
Lower catheter profile* designed to streamline access through tortuous or to distal vessels
Inner Diameter: 0.017in
Outer Diameter: 2.4F – 2.0F
Length: 157cm

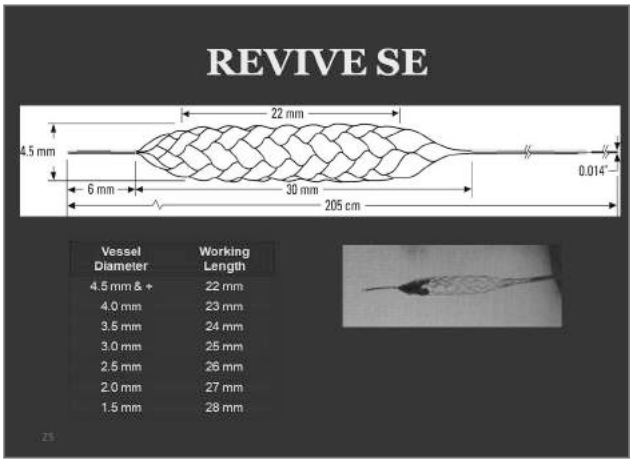

4x20mm Specifications
Trevo™ XP
PROVUE RETRIEVER
4x20mm
Retriever Diameter 4mm
Pusher Wire Diameter 0.018in
Total Length 180cm
# of Radiopaque Markers 3
Retriever Length 32mm
Clot Capture Area 20mm
Microcatheter Compatibility Trevo Pro 18 Microcatheter

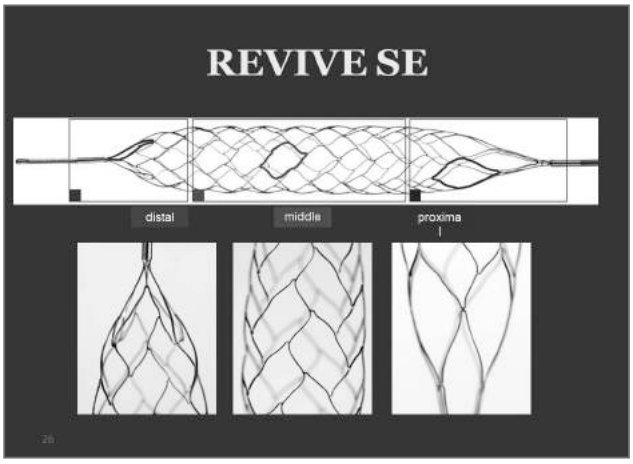

Easy to See
Trevo™ XP
PROVUE RETRIEVER
4x20mm
Full Length Visibility
Precise Placement
Strut compression upon deployment allows for optimal positioning in the clot capture area
Visible Integration
Strut compression provides visual feedback on clot integration progress
Interactive Retrieval
Migration of the waist provides visual feedback on retrieval

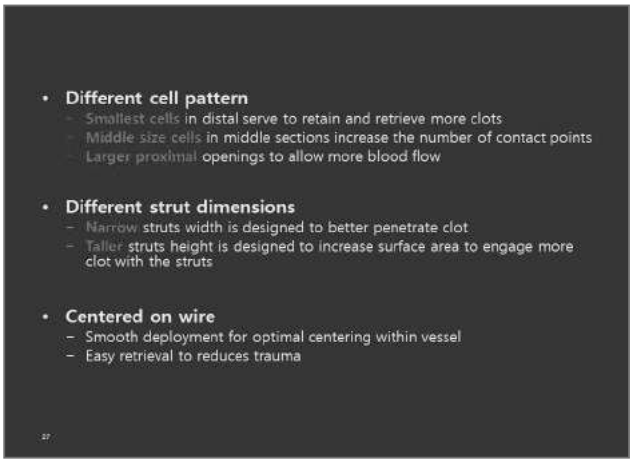

Easy to Place
Trevo™ XP
PROVUE RETRIEVER
4x20mm
• 40% softer† than the distal segment of Solitaire FR for easy placement‡
• Shorter landing zone¥
FlexCell Design
Engineered with less metal, designed for atraumatic placement

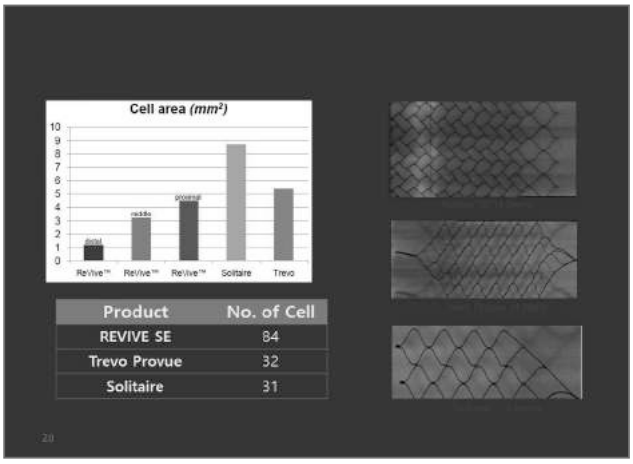

Vertical Struts
Trevo™ XP
PROVUE RETRIEVER
4x20mm
Traditional Strut Design
Vertical Retriever Strut Design

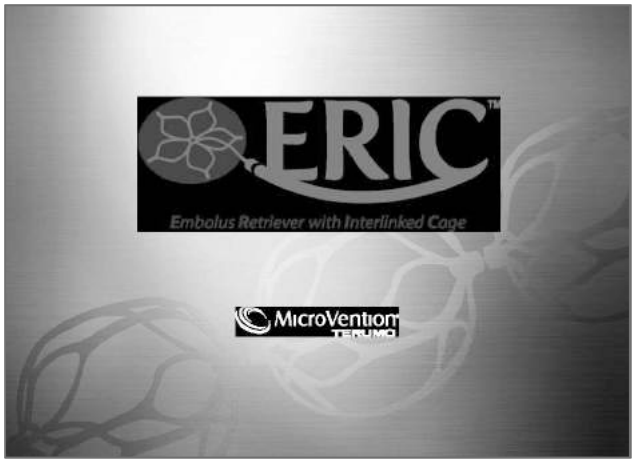

CODMAN NEURO
DePuy Synthes
REVIVE™ SE
thrombectomy device
Engage • Extract • Enable
Now, with enhanced navigability

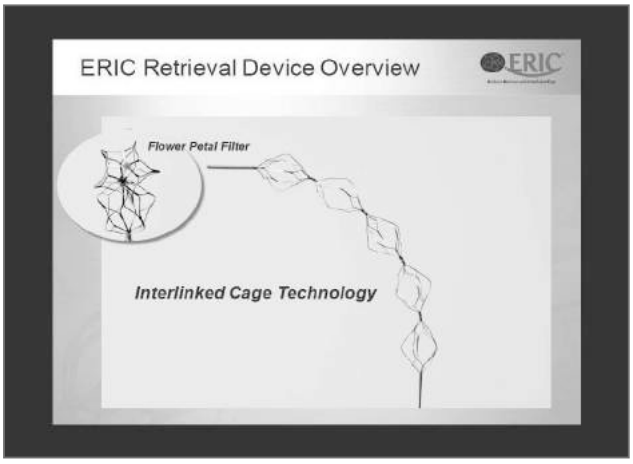

REVIVE SE
22 mm
4.5 mm
0.014"
6 mm
30 mm
205 cm
Vessel Diameter
Working Length
4.5 mm & +
22 mm
4.0 mm
23 mm
3.5 mm
24 mm
3.0 mm
25 mm
2.5 mm
26 mm
2.0 mm
27 mm
1.5 mm
28 mm

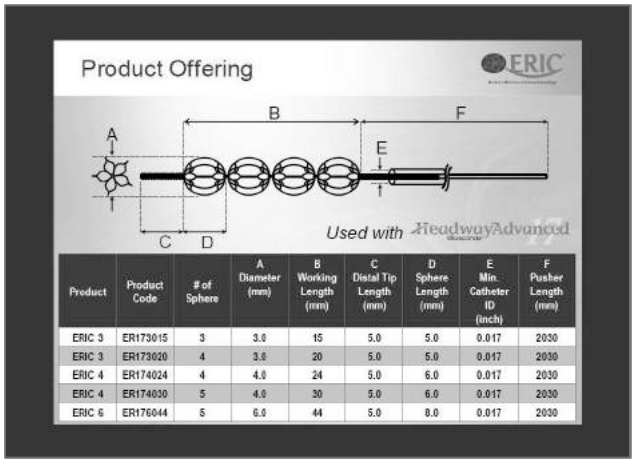

REVIVE SE
distal
middle
proxima


• Different cell pattern
– Smallest cells in distal serve to retain and retrieve more clots
– Middle size cells in middle sections increase the number of contact points
– Larger proximal openings to allow more blood flow
• Different strut dimensions
– Narrow struts width is designed to better penetrate clot
– Taller struts height is designed to increase surface area to engage more clot with the struts
• Centered on wire
– Smooth deployment for optimal centering within vessel
– Easy retrieval to reduces trauma

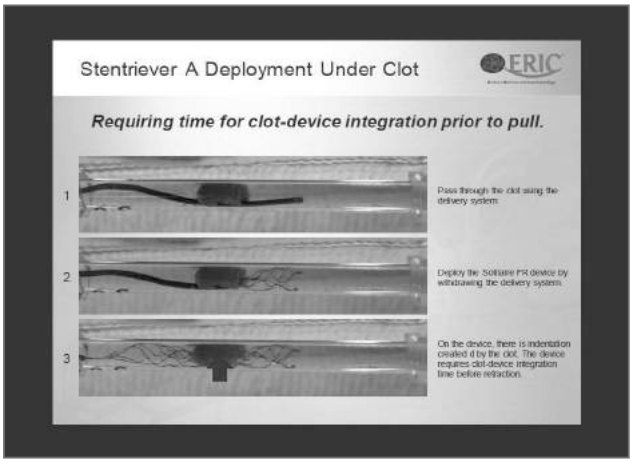

Cell area (mm²)
10
9
8
7
6
5
4
3
2
1
0
distal
middle
proximal
ReVive™
ReVive™
ReVive™
Solitaire
Trevo
Product
No. of Cell
REVIVE SE
84
Trevo Provue
32
Solitaire
31

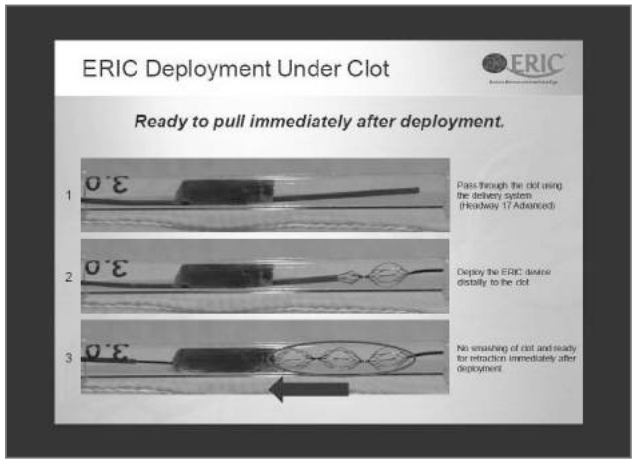


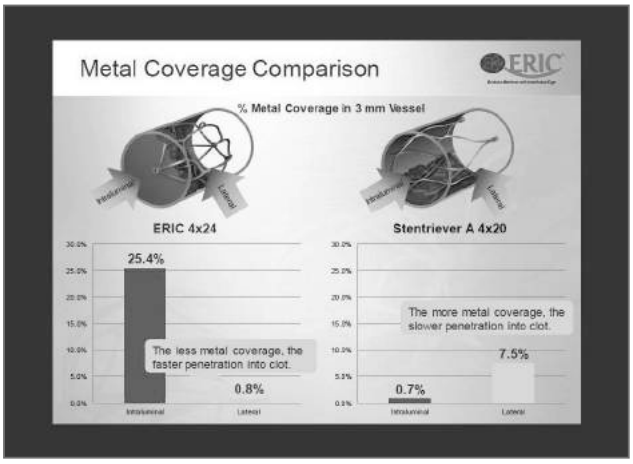




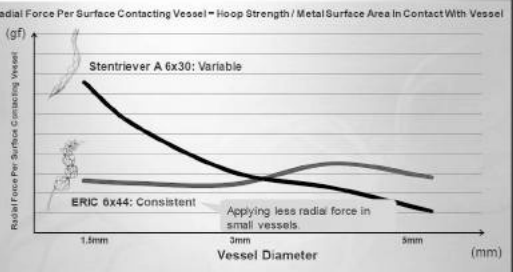
Product	Product Code	# of Sphere	A Diameter (mm)	B Working Length (mm)	C Distal Tip Length (mm)	D Sphere Length (mm)	E Min. Catheter ID (inch)	F Pusher Length (mm)
ERIC 3	ER173015	3	3.0	15	5.0	5.0	0.017	2030
ERIC 3	ER173020	4	3.0	20	5.0	5.0	0.017	2030
ERIC 4	ER174024	4	4.0	24	5.0	6.0	0.017	2030
ERIC 4	ER174030	5	4.0	30	5.0	6.0	0.017	2030
ERIC 6	ER176044	5	6.0	44	5.0	8.0	0.017	2030





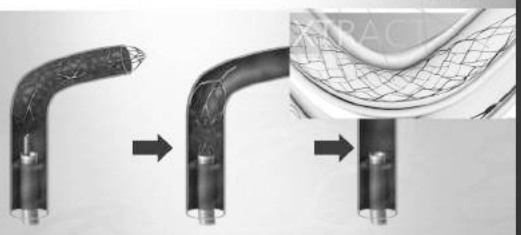


Radial Force Per Surface Comparison



- High radial force for is NOT required for the ERIC because the device is designed to deploy distally to the clot.

Interlinked Cage: Less Shaving of Clot

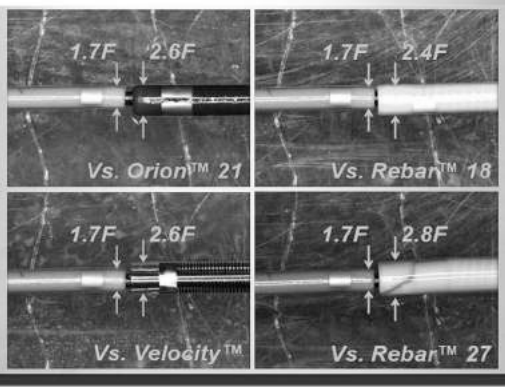


- Clot is retained inside or in-between the Cages. Clot may be retracted into the guiding catheter with less clot sheared off around the tip.

Interlinked Cage: Minimum & Parallel Contact

- Surface of the struts contacting vessel is minimum (0.8% with the ERIC 4x24 in 3mm vessel).
- Arrangement of the struts contacting vessel is designed to be parallel to device pull just like skiing.

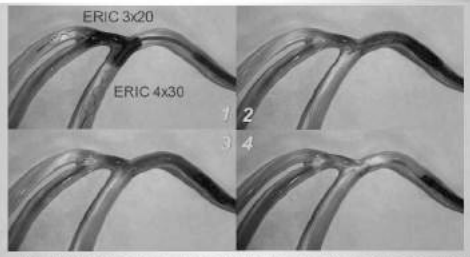
Delivery System Profile Comparison



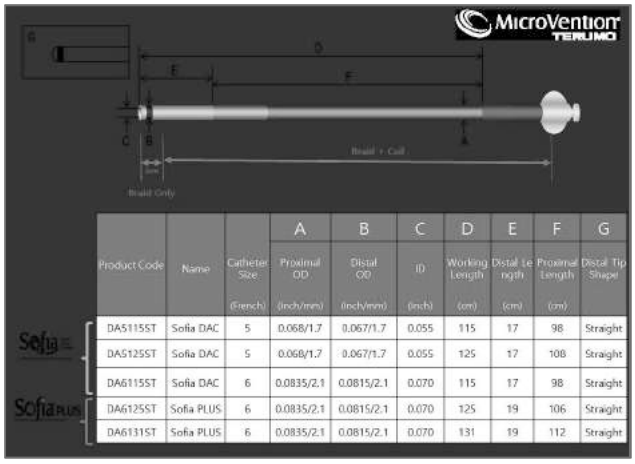
Suction Flow Rate Comparison

- Flow rate varies directly with the fourth power of radius of a catheter with all other conditions remaining the same.
- The delivery system of the ERIC device can improve suction flow because of its smaller profile compared to delivery systems of the traditional stentrievers

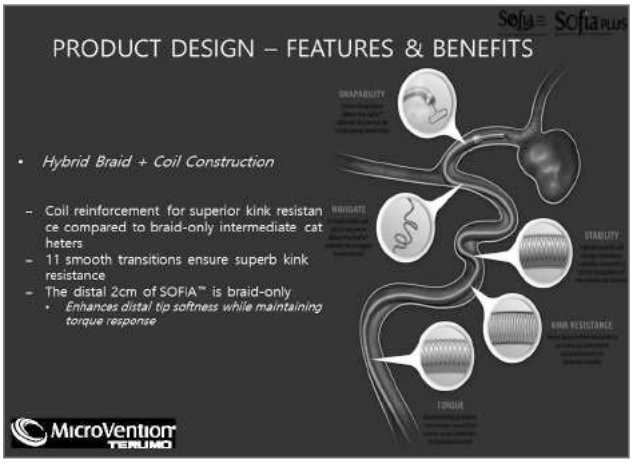
Double ERIC Retraction

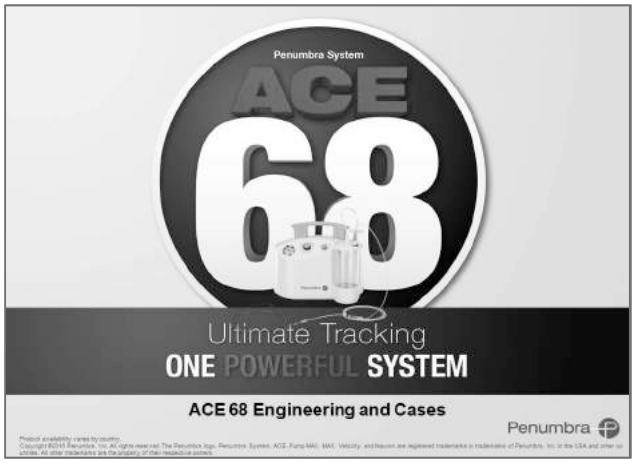


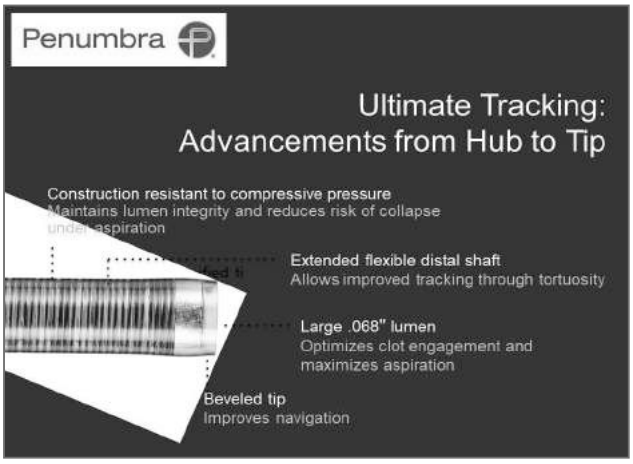
- Two ERIC devices (any size combinations) can be used in one guiding catheter with more than 0.063" ID.
- Two devices are overwrapped to enhance thrombectomy in challenging anatomies.

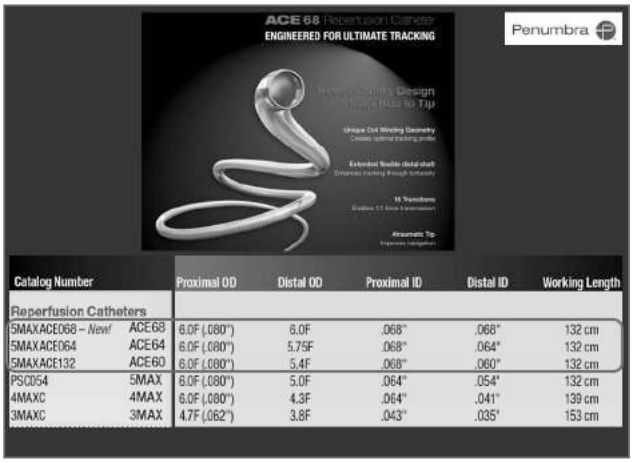


	Product Code	Name	Catheter Size	A Proximal OD	B Distal OD	C ID	D Working Length	E Distal Length	F Proximal Length	G Distal Tip Shape
			(French)	(inch/mm)	(inch/mm)	(inch)	(cm)	(cm)	(cm)	
Sofia	DA5115ST	Sofia DAC	5	0.068/1.7	0.067/1.7	0.055	115	17	98	Straight
Sofia	DA5125ST	Sofia DAC	5	0.068/1.7	0.067/1.7	0.055	125	17	108	Straight
Sofia	DA6115ST	Sofia DAC	6	0.0835/2.1	0.0815/2.1	0.070	115	17	98	Straight
Sofia PLUS	DA6125ST	Sofia PLUS	6	0.0835/2.1	0.0815/2.1	0.070	125	19	106	Straight
Sofia PLUS	DA6131ST	Sofia PLUS	6	0.0835/2.1	0.0815/2.1	0.070	131	19	112	Straight

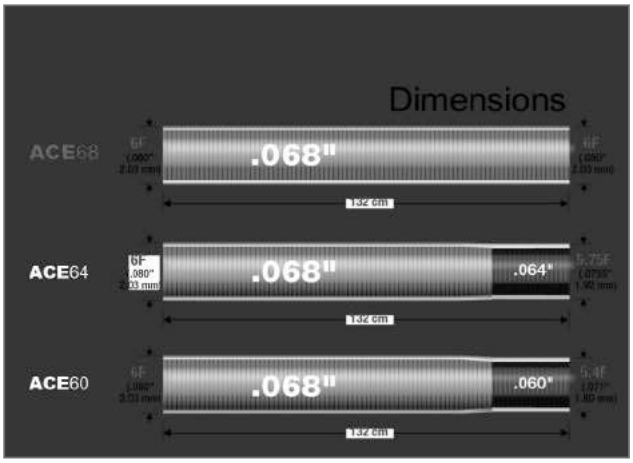


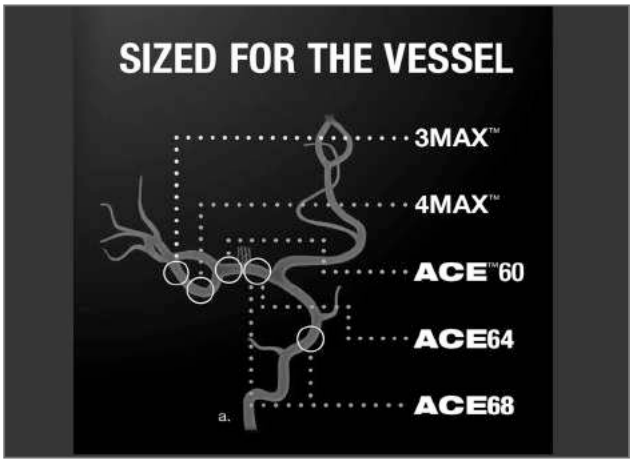






Catalog Number		Proximal OD	Distal OD	Proximal ID	Distal ID	Working Length
Reperfusion Catheters						
5MAXACE068 – *New!*	ACE68	6.0F (.080")	6.0F	.068"	.068"	132 cm
5MAXACE064	ACE64	6.0F (.080")	5.75F	.068"	.064"	132 cm
5MAXACE132	ACE60	6.0F (.080")	5.4F	.068"	.060"	132 cm
PSC054	5MAX	6.0F (.080")	5.0F	.064"	.054"	132 cm
4MAXC	4MAX	6.0F (.080")	4.3F	.064"	.041"	139 cm
3MAXC	3MAX	4.7F (.062")	3.8F	.043"	.035"	153 cm





Stroke support catheter

6F	MEDTRONIC		MICROVENTION	PENUMBRA			STRYKER
	NAVIEN	ARC	SOFIA PLUS	ACE 60	ACE 64	ACE 68	AXS
Tapered	No	Yes	No	Yes	Yes	No	No
Working Length (cm)	95, 105, 115, 125, 130	132	125,131	125,127,132	115, 120, 125, 127, 132		132
OD (Proximal)	0.084"	0.080"	0.0825"	0.083"	0.084"	0.084"	0.079"
OD (Distal)	0.064"	0.063"	0.0815"	0.074"	0.080"	0.084"	0.071"
ID (Proximal)	0.072"	0.063"	0.070"	0.068"	0.068"	0.068"	0.068"
ID (Distal ID)	0.072"	0.061"	0.070"	0.060"	0.064"	0.068"	0.068"
ID (Average)	0.072"	0.061"	0.070"	0.066"	N/A	0.068"	0.068"

Stroke support catheter

	OD
Sofia 5F	0.068
Navien 5F	0.070
AXS 6	0.079
ACR 032	0.080
ACE 60-86	0.080
5 MAX	0.080
Sofia Plus	0.0835
Navien 6F	0.084
Neuron 6F 070	0.084

	ID
5 MAX	0.054
Sofia 5F	0.055
Navien 5F	0.058
AXS 6	0.060
ACE 60-68	0.060-0.068
ARC 032	0.061
Sofia Plus	0.070
Neuron 6F 070	0.070
Navien 6F	0.072

전 홍 준 한림대 강동성심병원

▶ **학력**

한림대학교 의과대학(04)
한림대학교 의학석사(09)

▶ **경력**

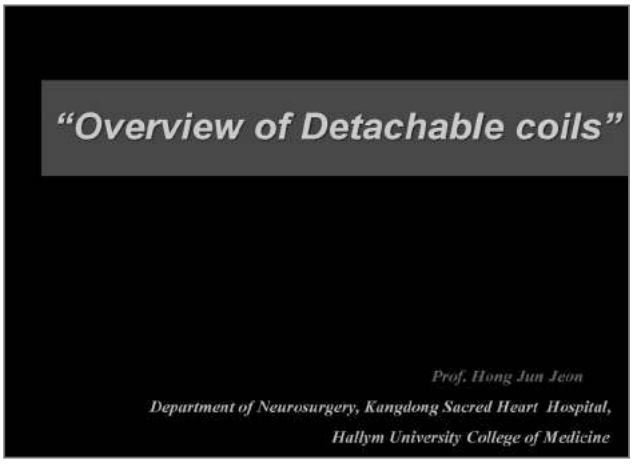
2012–2013 연세대 신촌세브란스 병원 신경외과 임상연구 조교수, 임상강사
2013–2015 연세대 신촌세브란스 병원 영상의학과 임상연구 조교수
2015–현재 한림대 강동성심병원 신경외과 조교수
Cerebrovascular anastomosis training course at the ASAN Medical center(2013)
Skull Base surgical approach training course at Severance Medical center(2013)
Visitor training to Micheal Lawton at the UCSF(2014)

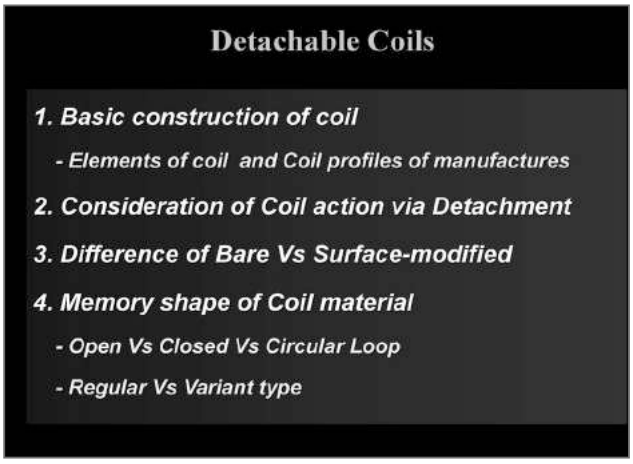
▶ **학회활동**

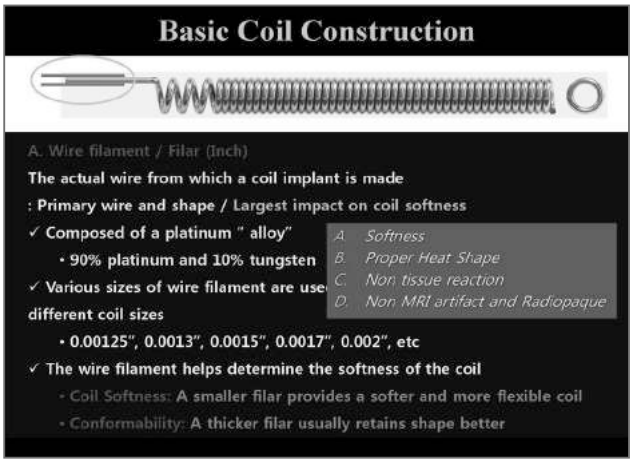
대한신경외과학회 정회원
대한뇌혈관외과학회 종신회원
대한신경중재치료의학회 정회원
대한뇌혈관내수술학회 정회원

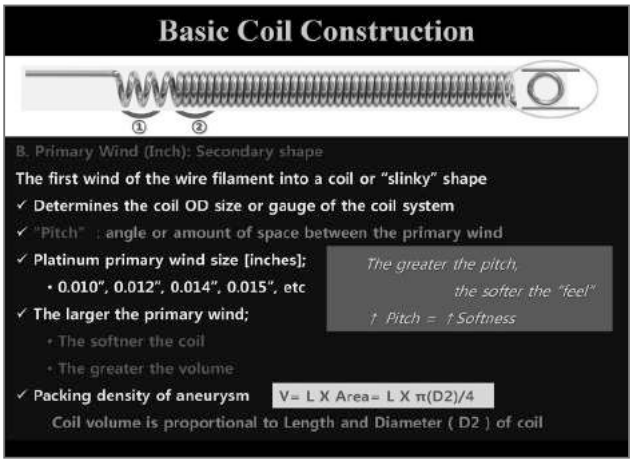
Overview of detachable coils

전 홍 준
한림대

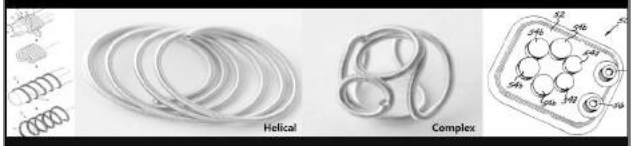








Basic Coil Construction

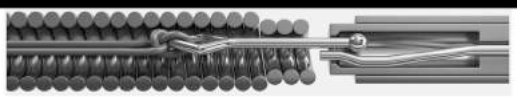


C. Secondary Wind (Tertiary shape): **The second wind of the primary wind that puts the coil into a specific shape or configuration**
(Helical, 3D or 360, Complex)

✓ The secondary wind identifies the coli loop size and shape.
- Helical 4mm and Complex 6mm

(Heat shape process)
✓ Heat shape fixture (mandrel) onto oven => Cooling

Basic Coil Construction



D. Strech-Resistant (SR) Strands (Polypropylene synthetic)
Located within the coil O.D.
- Connected to distal and proximal ends
- Prevent coil from stretching
- Material: Polypropylene

Increase of softness :
Smaller filar / Large coil O.D. / High pitch / Smaller SR strands
Other considerating factors:
Conformability / Packing density
Filar => 0.00125", 0.0013", 0.0015", 0.0017", 0.002", etc
O.D. => 0.010", 0.0108", 0.012", 0.014", 0.015", etc

Manufacture	Coil Name	2° wind D.	Filar	1° wind
Stryker	Target XL	5~16 mm	0.0025"	0.014"
Stryker	Target Standard	6~12 mm	0.002"	0.010"
Stryker	Target Soft	6~12 mm	0.00175"	0.010"
Stryker	Target Ultra	2~5 mm	0.0015	0.010"
Stryker	Target Nano	1~1.5 mm	0.00125	0.010"
Medtronic	Axium Prime ES	1~3.5mm	0.0013"	0.0108"
Medtronic	Axium Prime SS	4~6mm	0.0015"	0.0115"
Medtronic	Axium	7~10mm	0.00225"	0.0135"
Medtronic	Axium	12~25mm	0.00275"	0.0145"

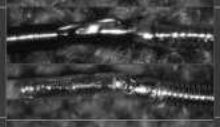
Manufacture	Coil Name	2° wind D.	Filar	1° wind
Microvention	Hypersoft	All	0.00125"	0.010"
Microvention	Hypersoft 3D	All	0.00125"	0.010"
Microvention	Cosmos 10	2~2.5	0.002"	0.010"
Microvention	Cosmos 10	3~6	0.002"	0.012"
Microvention	Cosmos 10	7~10	0.002"	0.012"
Microvention	Cosmos 18	10~24	0.003~0.004"	0.0140~0.0150"
Microvention	VFC	1~3	0.002"	0.010"
Microvention	VFC	3~6	0.002"	0.011"
Microvention	VFC	6~10	0.002"	0.012"

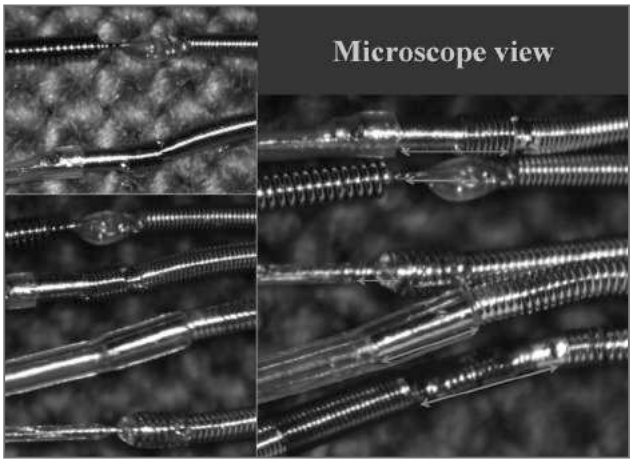
Manufacture	Coil Name	2° wind D.	Filar	1° wind
Microvention	VFC	10~20	0.002"	0.014"
Microvention	Hydrosoft	All	0.002"	0.013"
Microvention	Hydroframe	2~4	0.0175"	0.013"
Microvention	Hydroframe	5~10	0.0175"	0.0135"
Microvention	Complex 10	2~3	0.015"	0.0095"
Microvention	Complex 10	4~10	0.015"	0.010"
Microvention	Helical soft	All	0.015"	0.0095"
Microvention	Helical regular	All	0.015"	0.010"

Manufacture	Coil Name	2° wind D.	Filar	1° wind
CNV	Orbit Galaxy Xtrasoft	2~5mm	0.0015"	0.012"
CNV	Orbit Galaxy Fill	4~12mm	0.002"	0.012"
CNV	Presidio 10	4mm	0.00175"	0.0105"
CNV	Presidio 11	5~8mm	0.002"	0.0105"
CNV	Presidio 12	8~20mm	0.003"	0.015"
CNV	Micrusphere 10	2~4mm	0.00175"	0.010"
CNV	Micrusphere 10	5~10mm	0.002"	0.0105"
CNV	Cashmere 14	2~4mm	0.00175"	0.0135"
CNV	Cashmere 14	5~12mm	0.00225"	0.0135"
CNV	Deltapaq 10	1.5~10mm	0.0015"	0.0105"
CNV	Deltaplush 10	1.5~4mm	0.0013"	0.010"

Manufacture	Coil Name	Coil Diameter.	1° wire D.	2° wire D.
Blockade	Barricade Complex Frame 10	5~10mm	0.002"	0.012"
Blockade	Barricade Complex Frame 10	2~4mm	0.0015"	0.011"
Blockade	Barricade Complex Finish 10	3~5mm	0.0015"	0.010"
Blockade	Barricade Complex Finish 10	1~2.5mm	0.00125"	0.010"
Blockade	Barricade Helical Finish 10	3~5mm	0.0015"	0.010"
Blockade	Barricade Helical Finish 10	1~2.5mm	0.00125"	0.010"

Coil Detachment segment

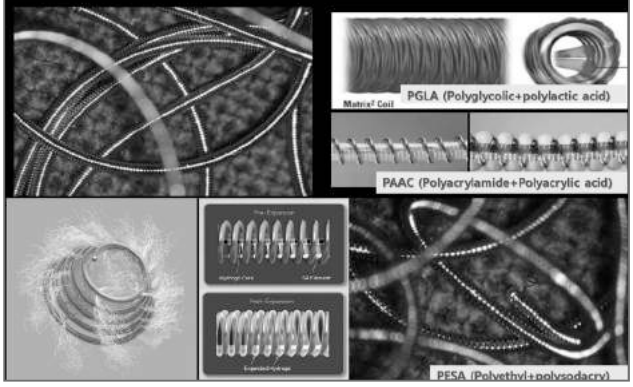
Manufacture	Coil Attachment Point	Delivery System	Time Duration
Stryker		Electrolytic	3~5 sec
Codman		Hydraulic	Instantly
Microvention and Codman		Electrothermal	0.75~3 sec
Medronic		Mechanical	Instantly
Blockade		Electrolytic	5~7 sec



Pushing force and Deflection (Only consideration of detach segment)

	Pushing force	Deflection
Stryker® Target	+ -	+ -
Codman® Neurovascular Micrus and Delta	+ + -	+ + -
ORBIT GALAXY	+ - -	+ +
Microvention® Terumo	+ +	+ + -
Medtronic eV3® Axium	+ -	+ +
Blockade® Barricade	+	+ -

Differences between Bare and Surface modified



Shape of Coil

1. Interaction
   - *Previous Basket or Loop*
2. Microcatheter action
   - *Back and forth or Sway*
3. Entering Velocity of Coil segment
4. Independent (memory) characteristics of Coils
   - *Helical or Complex*
   - *Variant style*

Memory shape of coil
- Open / Closed / Circular Loop -

	Predictability	Conformability	Variation Action range	Feeling softness	Controlling
Open	+	++	+++	++ +	+++
Closed	++	+++	+	+	++
Circular	+++	++	++	++	++

Memory shape of coil
- Regular Vs Variant types -

Regular	Variant
3D, 360, Helical	Orbit Galaxy, Deltapaq, Cashmere, Cosmos, Hydroframe, VFC

Comprehesion

Spatial Predictability

Movement Velocity

Directional Nature

Proficient level

Memory shape of Coil
Open Loop Design

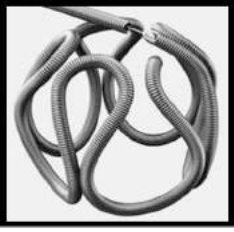
" Parabolic or Wave design "

- Different looseness in aspect of each company
- Different loop turn (Short turn or not)
- Target 360, Axium 3D, Barricade complex

Memory shape of Coil
Closed Loop Design

Unique "Omega shape" design

- Tight nature, concentric nature and shape memory basket
- Coil loops deploy along with Omega shape
- Target 3D, CNV Micrusphere

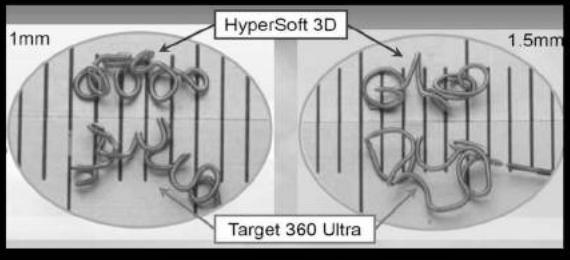


Memory shape of Coil
Interlocking Circular Loop Design

"Interlocking Loop" design

- Concentric nature and shape memory basket
- Coil loops deploy in a 90 degree-fashion
- Microvention Hypersoft 3D, Cosmos, CNV Presidio

Memory shape of Coil
Open Vs Circular Size discrepancy



Memory shape of Coil

Complex Random Loop Design

"Diverse Loop" formation
- Randomly loop shape
- Constraint original mold
- Coil loops deploy in a irregular fashion

< Coil deployments in 4mm glass aneurysm model >

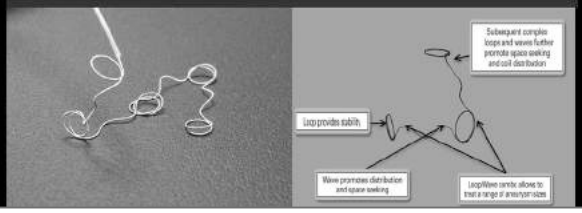
Memory shape of Coil

Revolutionary coil design with complex loops and waves
Allows for improved coil distribution, greater packing density, and easier placement
Seeks and fills open spaces

Single coil fills a range of diameters
May significantly reduce coil inventory levels

Long length options
Greater volume fill potential with a single coil

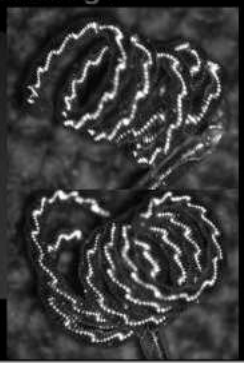
Progressive diameter design
Less microcatheter movement



Memory shape of Coil

Deltawind Twisted Design

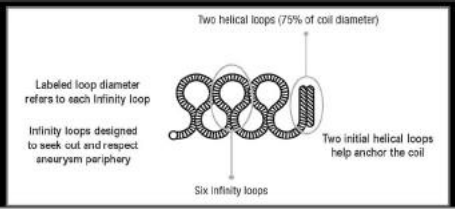
- Triangular loops ***PRECESS*** along the coil axis in a spiral
- Precession is a **change in the orientation of the rotation axis** of a rotating body
- Snaking like action due to **Rotatory vector**



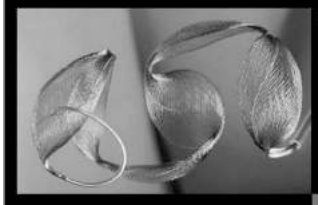
Memory shape of Coil

Infinity Loop Design

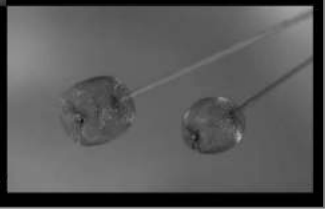
Conformable to irregular shape
- Seek out and respect aneurysm peripheral wall
- 14 system (0.0135) increase packing density
- Coil loops deploy in a 90 degree-fashion



New type of coils

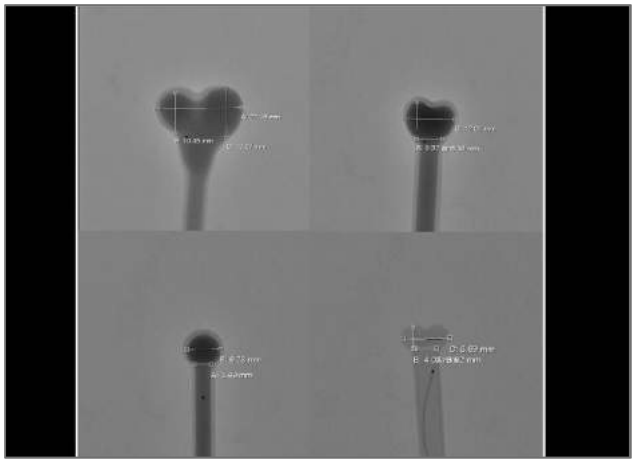


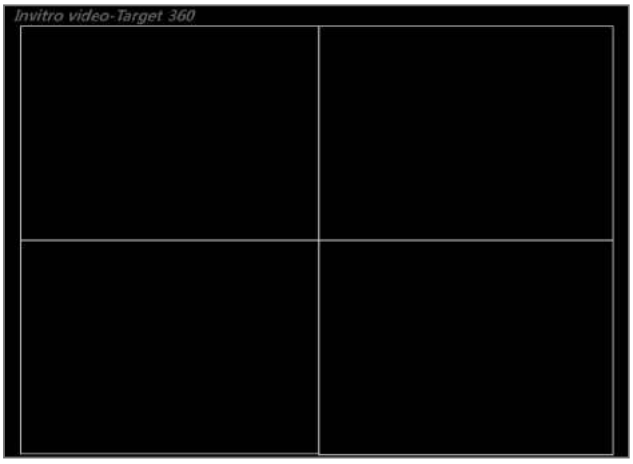
Medina (Medina medical)

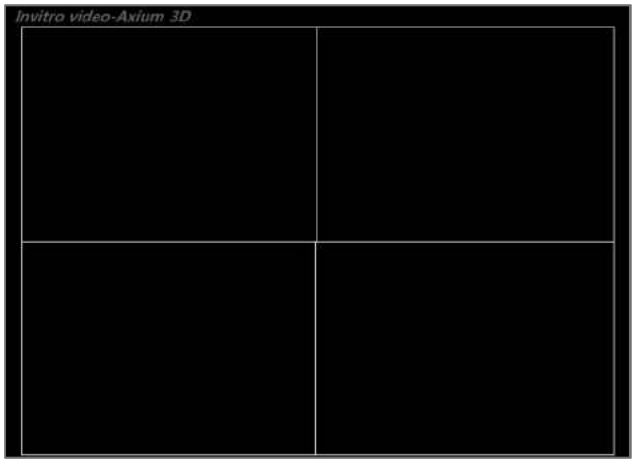


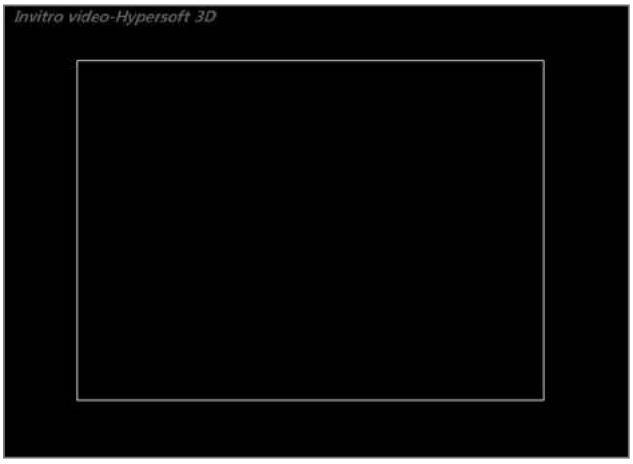
Woven EndoBridge, WEB (Sequent Medical)

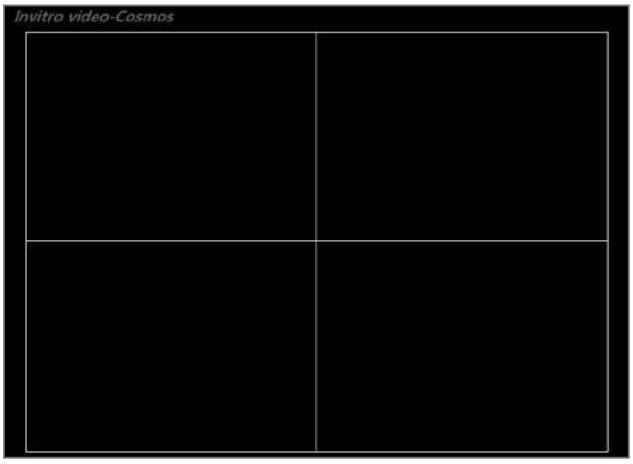
Invitro action of coils and Cases series

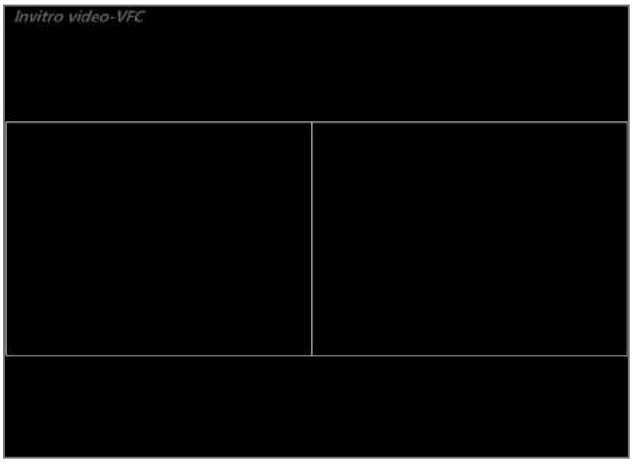


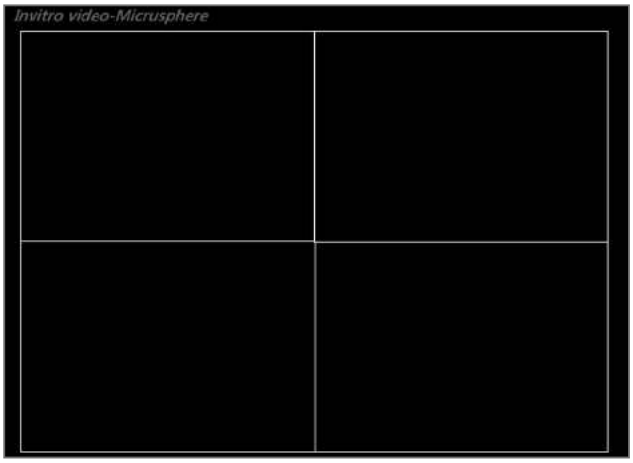

Invitro video-Target 360


Invitro video-Axium 3D

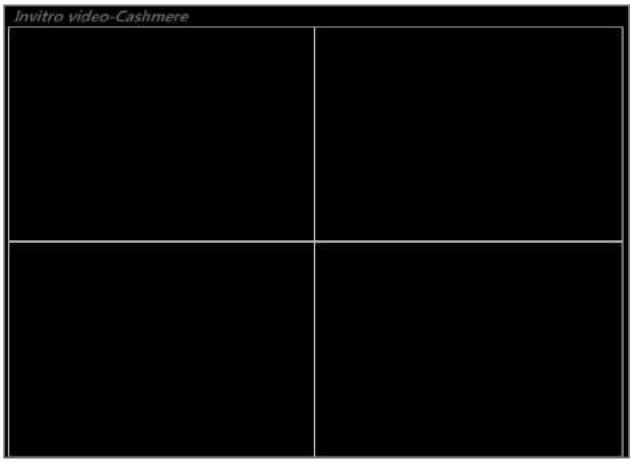

Invitro video-Hypersoft 3D

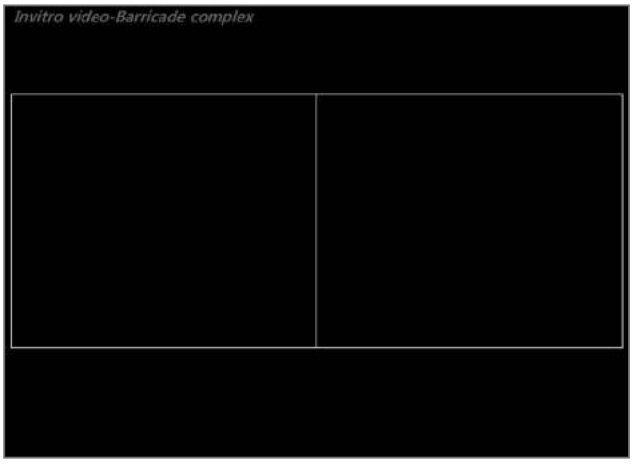

Invitro video-Cosmos

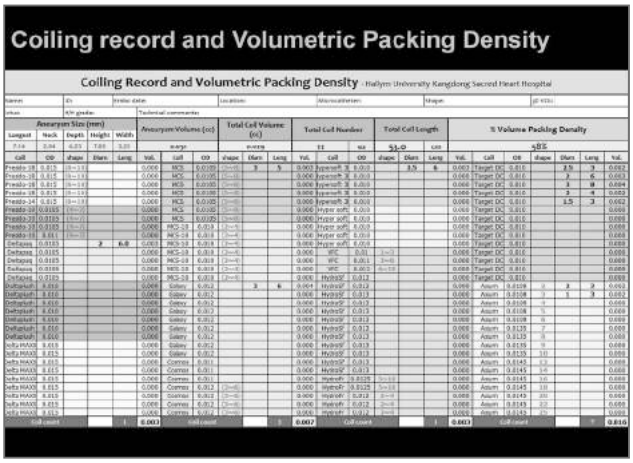

Invitro video-VFC

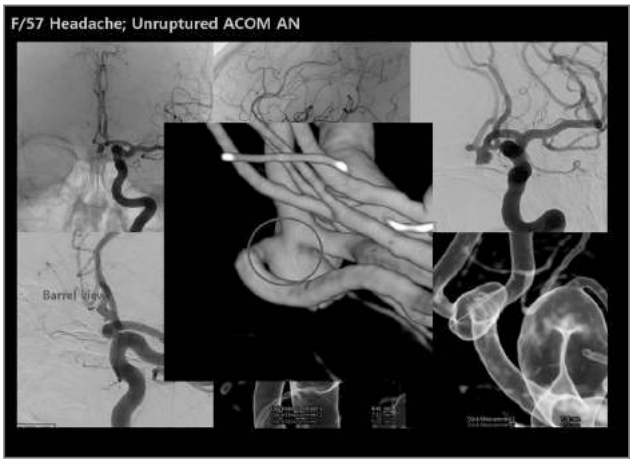

Invitro video-Micrusphere

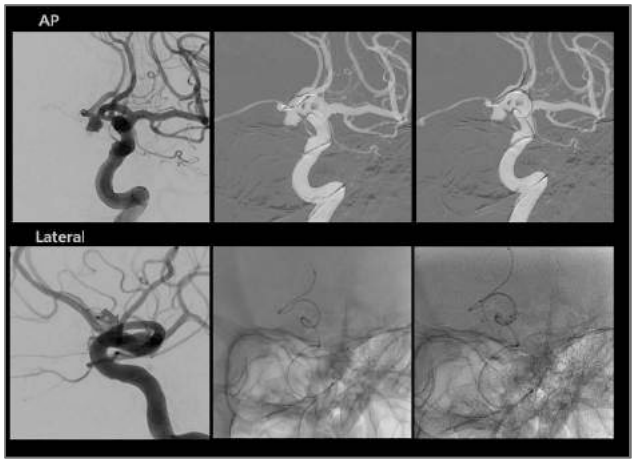

Invitro video-Orbit Galaxy

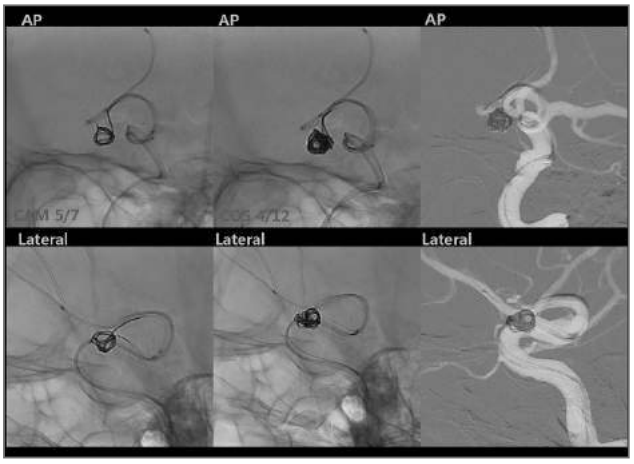

Invitro video-Cashmere

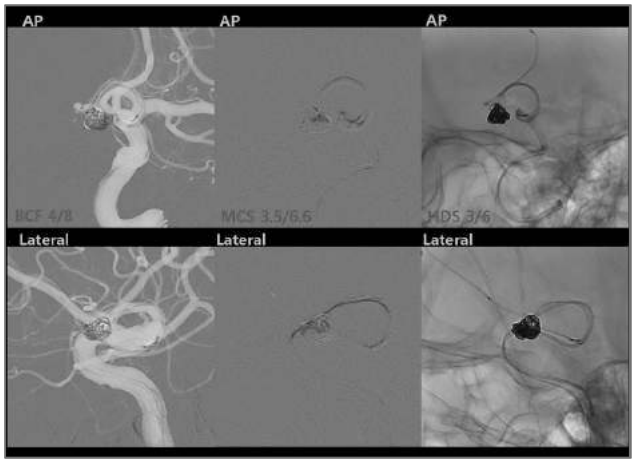

Invitro video-Barricade complex


Coiling record and Volumetric Packing Density
Coiling Record and Volumetric Packing Density - Hallym University Kangdong Sacred Heart Hospital


F/57 Headache; Unruptured ACOM AN
Barrel view


AP
Lateral


AP
AP
AP
Lateral
Lateral
Lateral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AP
Lateral
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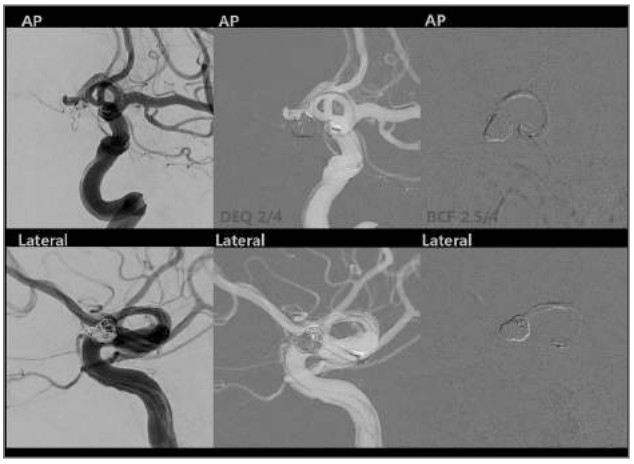
Lateral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Lateral
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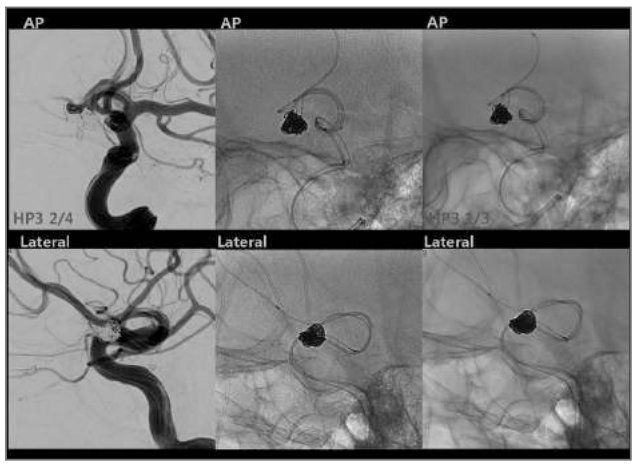
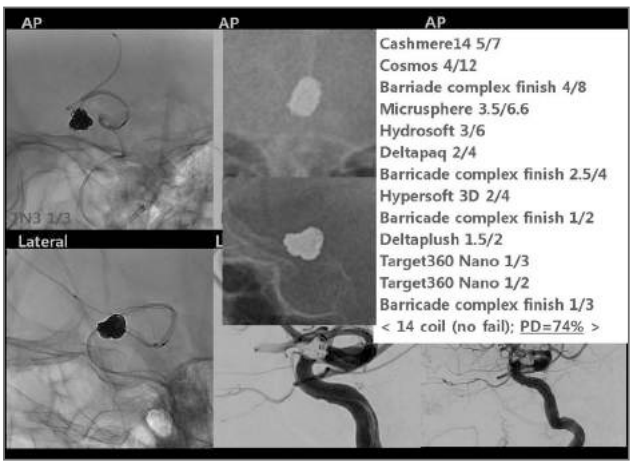
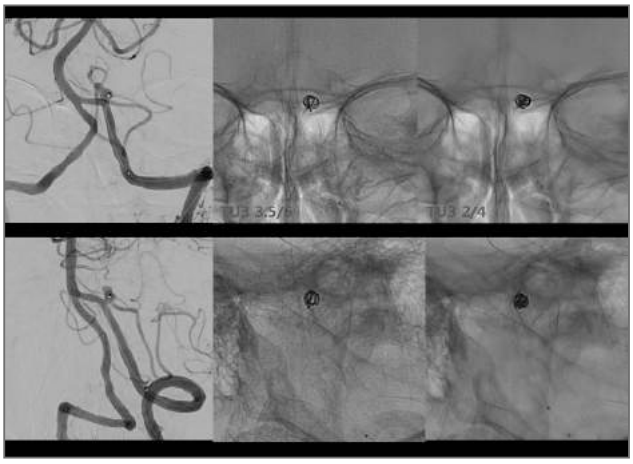
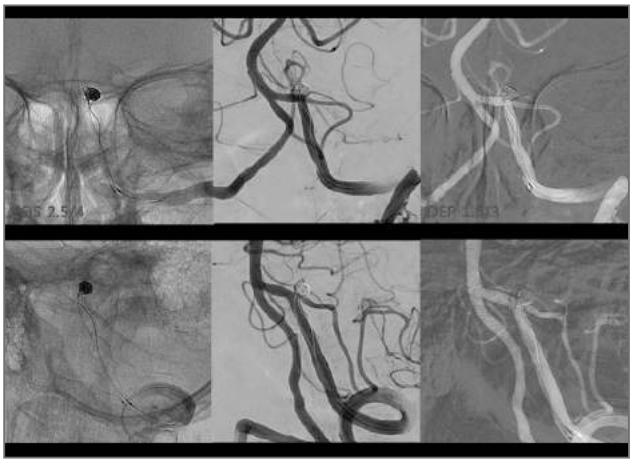
Lateral

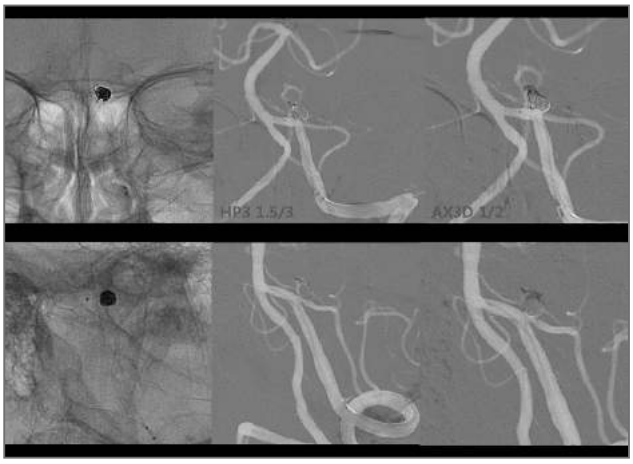

AP
AP
AP
HP3 2/4
Lateral
Lateral
Lateral

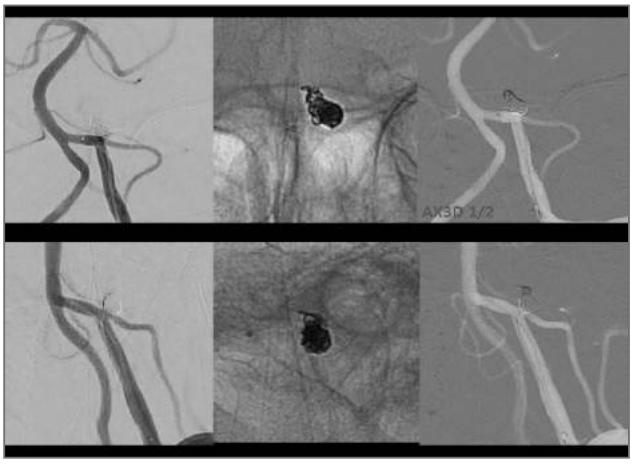

AP
AP
AP
Cashmere14 5/7
Cosmos 4/12
Barriade complex finish 4/8
Micrusphere 3.5/6.6
Hydrosoft 3/6
Deltapaq 2/4
Barricade complex finish 2.5/4
Hypersoft 3D 2/4
Barricade complex finish 1/2
Deltaplush 1.5/2
Target360 Nano 1/3
Target360 Nano 1/2
Barricade complex finish 1/3
< 14 coil (no fail); PD=74% >
Lateral

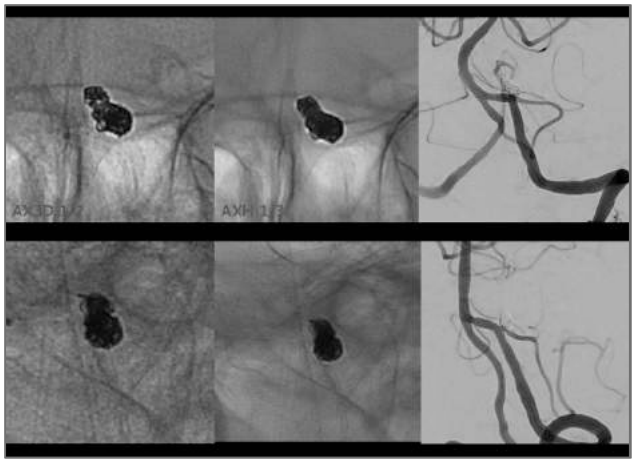

F/65 Headache
; Ruptured PICA AN

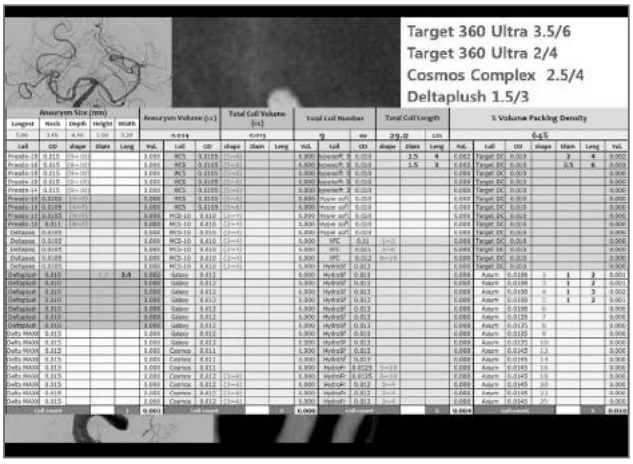


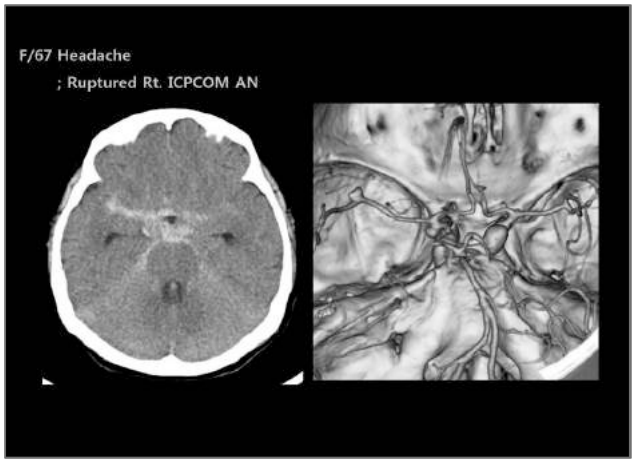


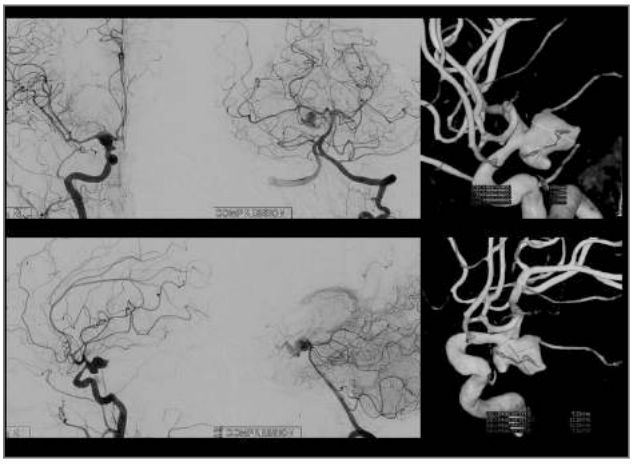


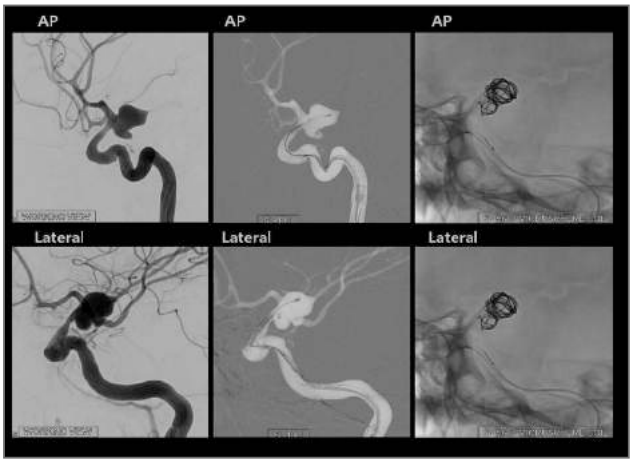


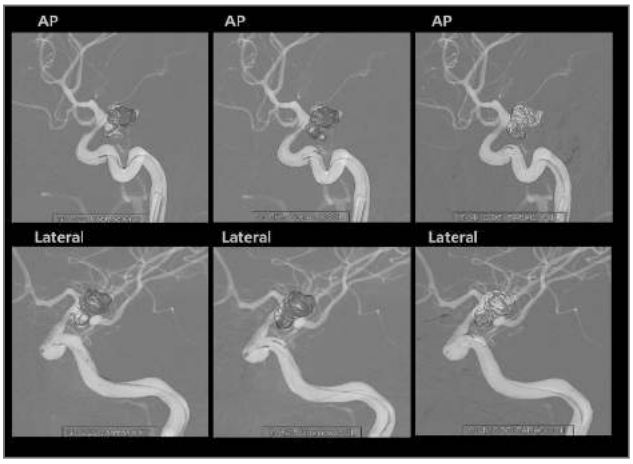



Target 360 Ultra 3.5/6
Target 360 Ultra 2/4
Cosmos Complex 2.5/4
Deltaplush 1.5/3


F/67 Headache
; Ruptured Rt. ICPCOM AN




AP
AP
AP
Lateral
Lateral
Lateral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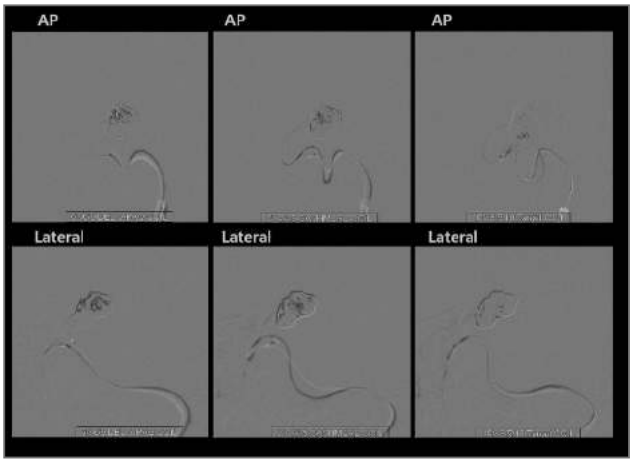
AP
Lateral
Lateral
Lateral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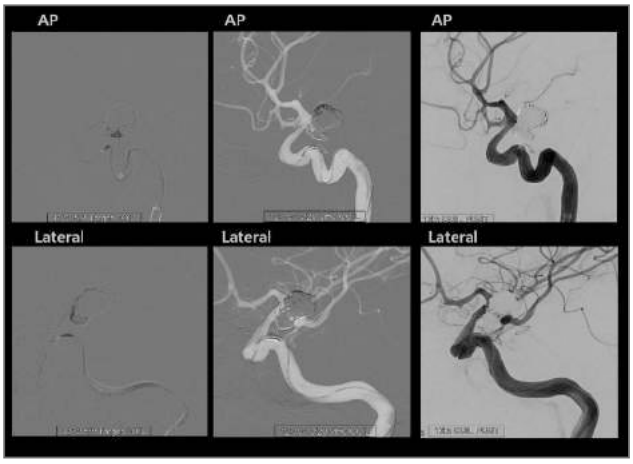
AP
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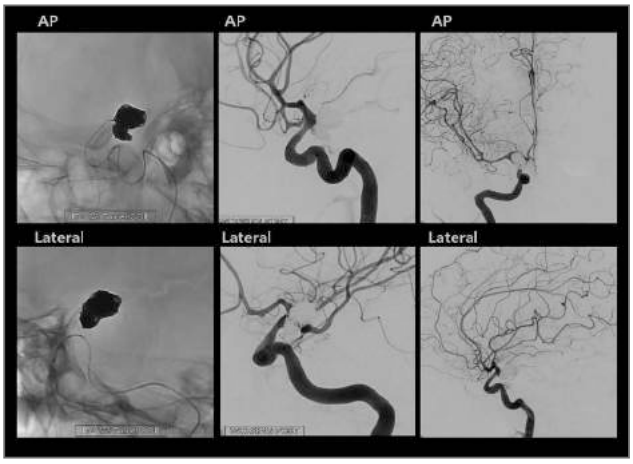
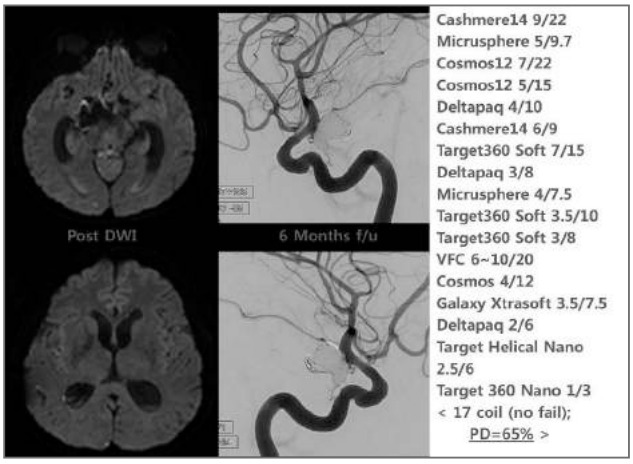
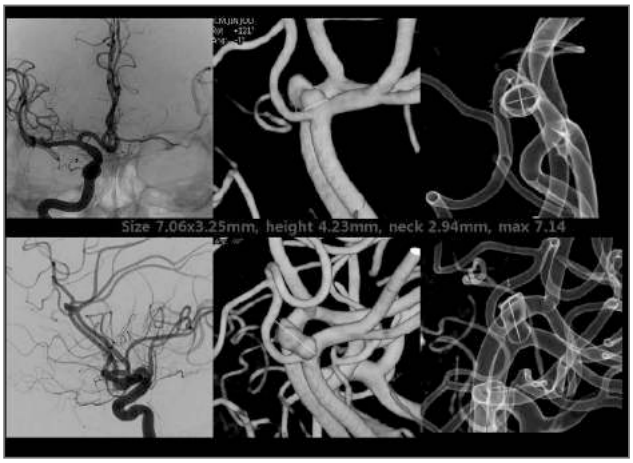
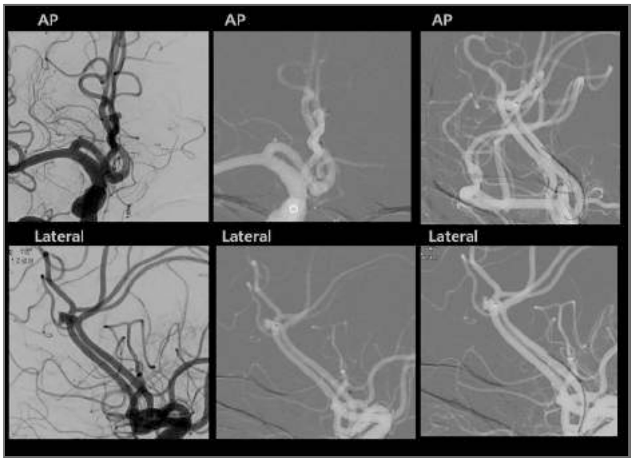
AP
Lateral
Lateral
Lateral

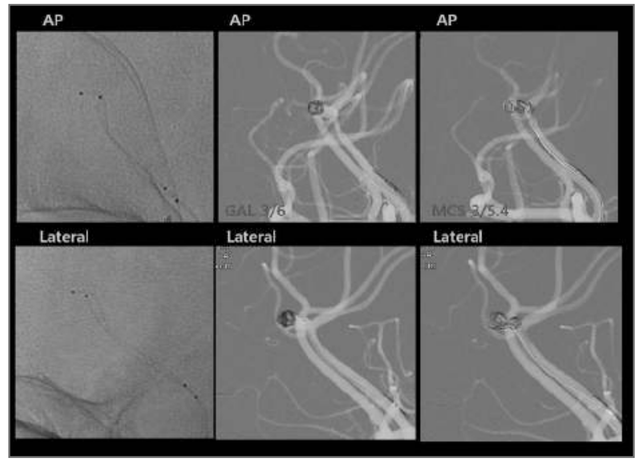

AP
AP
AP
Lateral
Lateral
Lateral

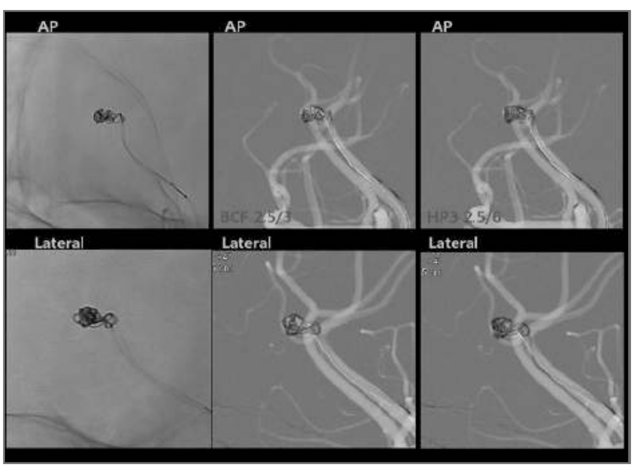

Post DWI
6 Months f/u
Cashmere14 9/22
Micrusphere 5/9.7
Cosmos12 7/22
Cosmos12 5/15
Deltapaq 4/10
Cashmere14 6/9
Target360 Soft 7/15
Deltapaq 3/8
Micrusphere 4/7.5
Target360 Soft 3.5/10
Target360 Soft 3/8
VFC 6~10/20
Cosmos 4/12
Galaxy Xtrasoft 3.5/7.5
Deltapaq 2/6
Target Helical Nano 2.5/6
Target 360 Nano 1/3
< 17 coil (no fail);
PD=65% >

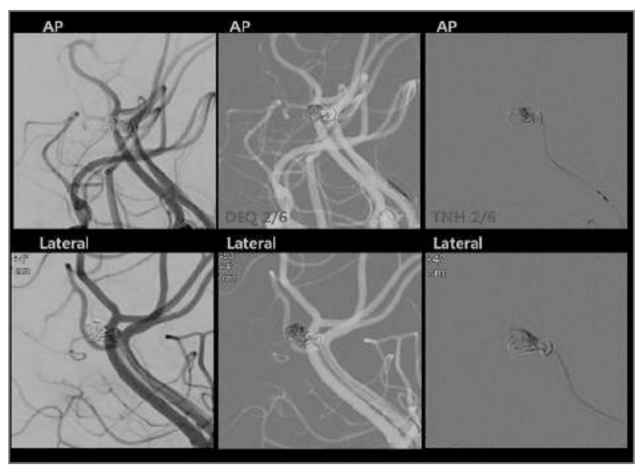

F/67 Headache
; Ruptured DACA AN

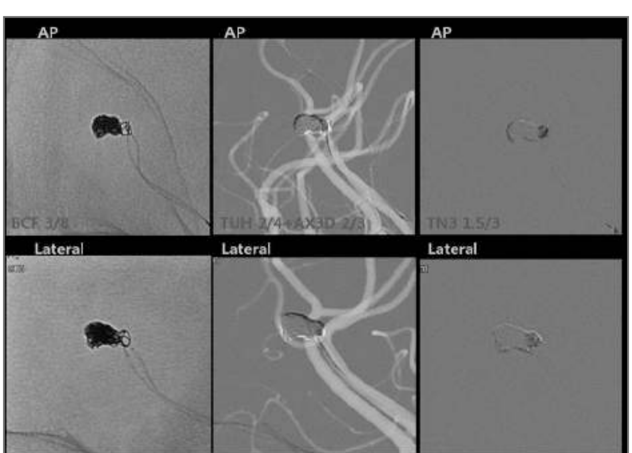

Size 7.06x3.25mm, height 4.23mm, neck 2.94mm, max 7.14

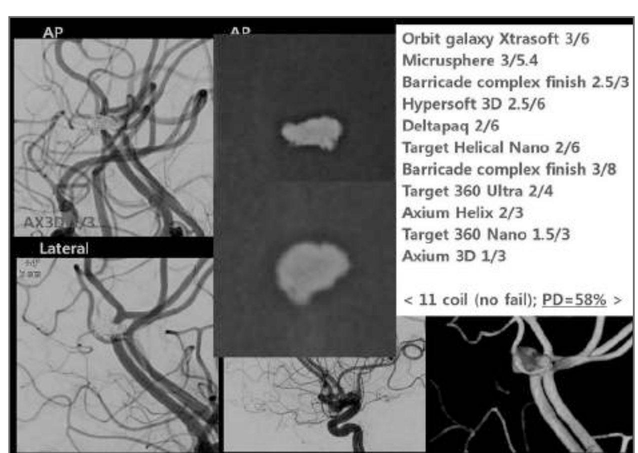

AP
AP
AP
Lateral
Lateral
Lateral

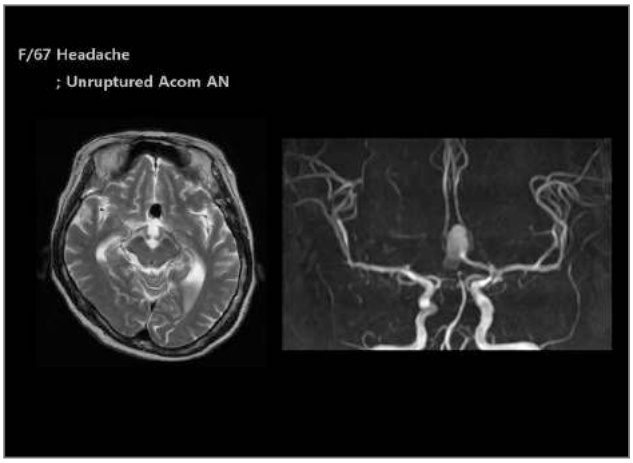

AP
AP
AP
GAL 3/6
MCS 3/5.4
Lateral
Lateral
Lateral

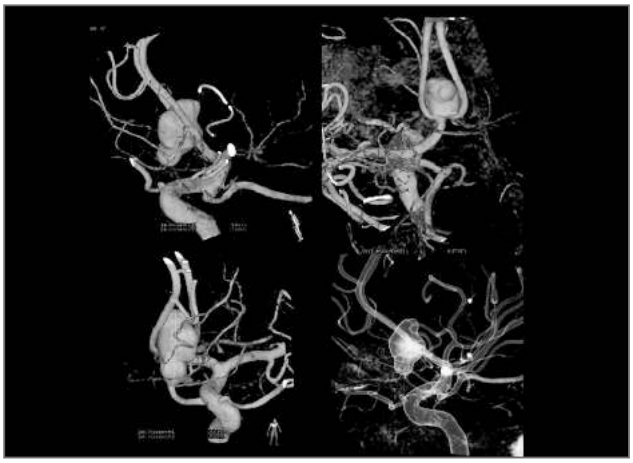

AP
AP
AP
BCF 2.5/3
HP3 2.5/6
Lateral
Lateral
Lateral

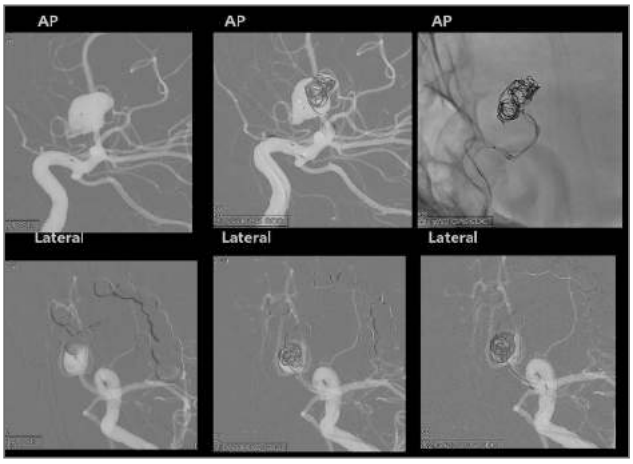

AP
AP
AP
DEQ 2/6
TNH 2/6
Lateral
Lateral
Lateral


AP
AP
AP
BCF 3/8
TUH 2/4+AX3D 2/3
TN3 1.5/3
Lateral
Lateral
Lateral


AP
AP
Lateral
Orbit galaxy Xtrasoft 3/6
Micrusphere 3/5.4
Barricade complex finish 2.5/3
Hypersoft 3D 2.5/6
Deltapaq 2/6
Target Helical Nano 2/6
Barricade complex finish 3/8
Target 360 Ultra 2/4
Axium Helix 2/3
Target 360 Nano 1.5/3
Axium 3D 1/3
< 11 coil (no fail); PD=58% >


F/67 Headache
; Unruptured Acom AN

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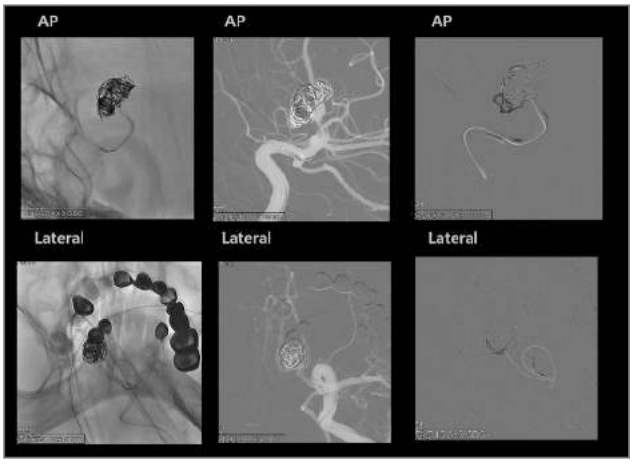
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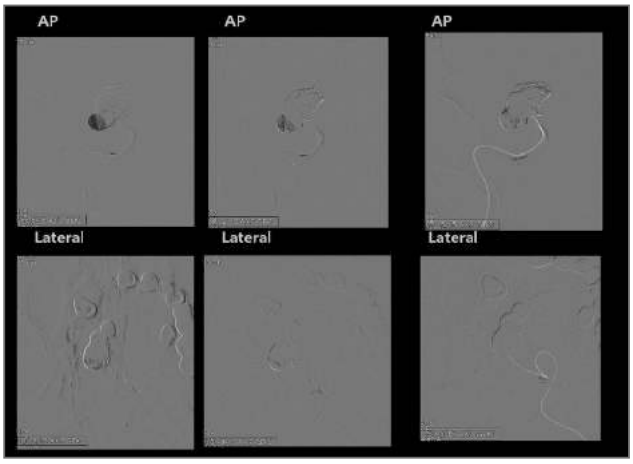
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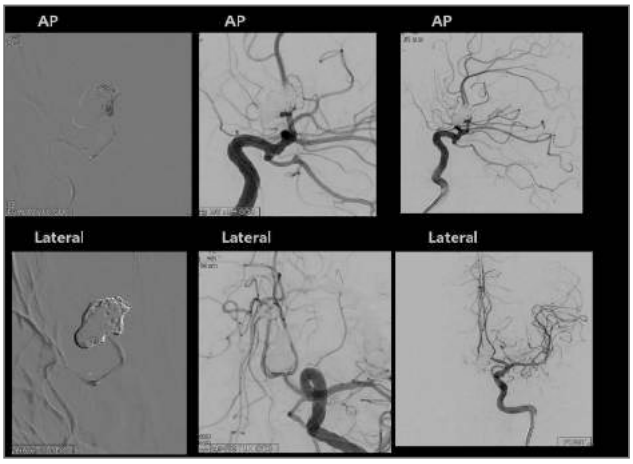
AP
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Lateral
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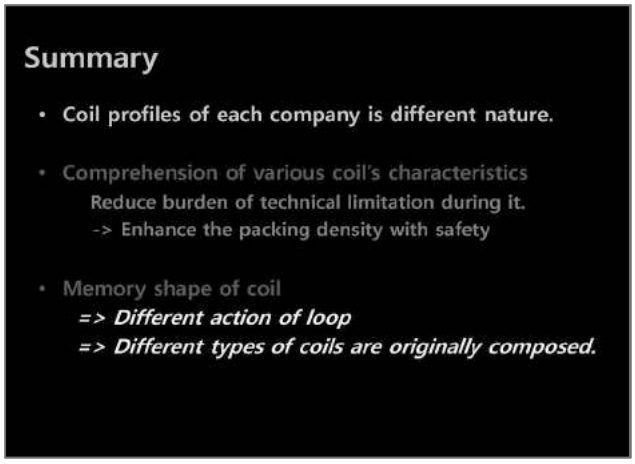
Summary
• Coil profiles of each company is different nature.
• Comprehension of various coil's characteristics
Reduce burden of technical limitation during it.
-> Enhance the packing density with safety
• Memory shape of coil
=> Different action of loop
=> Different types of coils are originally composed.

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▶ 학력 및 경력

2002년 2월	인하대학교 의과대학 졸업
2005년 8월	의학석사 취득 (인하대학교)
2007년 2월	신경외과 전문의 자격증 취득
2010년 2월	의학박사 취득 (인하대학교)
2010년 3월–2012년 9월	인하대학교 의과대학 신경외과학교실 조교수
2012년 9월–2014년 2월	연세대학교 의과대학 신경외과학교실 임상조교수
2014년 3월–현재	연세대학교 의과대학 신경외과학교실 조교수
2016년 3월–2017년 7월	해외연수 (RUSH University Medical Center, Chicago)

▶ 학회활동

2012년–현재	Editor, Journal of Cerebrovascular and Endovascular Neurosurgery
2014년–현재	Review Board, Journal of Korean Neurosurgical Society
2016년–현재	대한뇌혈관내수술학회 보험위원회 운영위원
2017년–현재	대한뇌혈관외과학회 보험위원회 간사
2017년–현재	대한뇌혈관외과학회 역사편찬위원회 운영위원
2017년–현재	대한뇌혈관외과학회 국제교류위원회 운영위원

Stents for Aneurysm Coiling

정 준 호
연세대 신경외과

Endovascular treatment (EVT) of intracranial aneurysms has been increasingly accepted worldwide. Increasing the number of patients being referred for EVT and thus further emphasizing the need to enhance the ability to treat intracranial aneurysms effectively. However, large, giant, and wide-necked aneurysms can be difficult to treat by EVT due to the risk of coil protrusion into the parent artery and aneurysm recurrence. Introduction of stents designed as an adjunct tool for coiling has been shown to be of beneficial value for those aneurysms. However, a variety of devices, different in their designs, was used with the potential risk of periprocedural complications including both hemorrhage and thromboembolism. While new techniques and devices for EVT seek to strengthen endovascular procedure by increasing the simplicity of the procedure as well as decreasing the risk of recurrence, it is mandatory to know about the devices in order to reduce recanalization and retreatment rates without impacting procedural safety. Here, stents for assisting aneurysm coiling were reviewed and would be introduced, especially in the aspect of new devices.

Free paper II Ischemia

좌장 : 전남대 **김태선,** 한양대 **이형중**

Clinical Implications of Arterial Spin-labeling(ASL) MR compared with Single-photon Emission Computed Tomography(SPECT) in Patients with Intracranial Occlusive Disease

신 동 성 순천향대 부천병원

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순천향대 부천병원 신경외과[1], 영상의학과[2]

Objective : Arterial spin-labeling (ASL) is MR perfusion method for quantitatively measuring cerebral blood flow (CBF) by taking advantage of arterial water as a freely diffusible tracer. Because ASL is completely noninvasive and provides absolute cerebral blood flow (CBF) information, ASL has been increasingly used for patients with acute or chronic cerebrovascular disease. SPECT with rest and Diamox (acetazolamide) challenge can supply cerebral vascular reactivity and inform the misery perfusion regions, however SPECT modality have some disadvantages, such as high cost, radioisotope exposure, relatively longer examination period (more two days) and institutional limitations. In the patient who diagnosed with intracranial artery occlusive disease, we took SPECT with DIAMOX challenge image and ASL image simultaneously for comparison of both image diagnosis.

Methods : 12 patients included for 2 years, and each image were evaluated by one nuclear medicine specialist and the another neuroradiologic specialist. Demographic characteristics, diagnosis, affected lesions and vascular reservation have been analyzed.

Result : There are 7 males and 5 females. Mean age was 49.5-year-old. All patients show relatively same affect lesions side, vascular reserve pattern with same opinions in both specialists. However, ASL images showed more detail anatomical information rather than SPECT images, because of resolution difference in our institution.

Conclusion : ASL is noninvasive MR perfusion modality and may show equivalent image compared with SPECT. moreover, ASL shows high resolution images and it make possible to get detail information on pathologic lesions.

Collateral Status Affects the Onset-to-reperfusion Time Window for Good Outcome

김 병 문 연세대 세브란스병원

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Objective : To characterize the time window in which endovascular thrombectomy (EVT) is associated with good outcome, and to test the differential relationship between functional outcome and onset-to-reperfusion time (ORT), depending on collateral status.

Methods : This is a retrospective analysis of clinical and imaging data of 554 consecutive patients who had recanalization success by EVT for anterior circulation large artery occlusion from the prospectively maintained registries of 16 comprehensive stroke centers between September 2010 and December 2015. The patients were dichotomized into good and poor collateral groups based on computed tomographic angiography. We tested whether the likelihood of good outcome (modified Rankin scale, 0-2) by ORT is different between two groups.

Result : ORT was 298 minutes ± 113 minutes (range, 81 to 665 minutes), and 84.5% of patients had good collaterals. Age, diabetes mellitus, previous infarction, National Institute of Health Stroke Scale, good collaterals (OR, 40.766; 95%CI, 10.668-155.78; p

Conclusion : Earlier successful recanalization was strongly associated with the good outcome in poor collateral group, but this association was weak during the tested time window in good collateral group. This suggests that the ORT window for good outcome can be adjusted based on collateral status.

Predictive Value of CT Angiography-determined Occlusion Type in Stent Retriever Thrombectomy

김 병 문 연세대 세브란스병원

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Objective : To investigate whether occlusion type identified with computed tomography angiography (CTA-determined occlusion type) could predict endovascular treatment (EVT) success using stent retriever (SR) thrombectomy.

Methods : Consecutive stroke patients who underwent CTA and then EVT for intracranial large artery occlusion were retrospectively reviewed. CTA-determined occlusion type was classified into truncal-type occlusion or branching-site occlusion and compared with digital subtraction angiography (DSA-determined occlusion type) during EVT. Three rapidly- and readily-assessable preprocedural findings (CTA-determined occlusion type, atrial fibrillation [AF], and hyperdense artery sign [HAS]), which may infer occlusion pathomechanism (embolic versus non-embolic) before EVT were evaluated for association with SR success along with stroke risk factors and laboratory results. In addition, the predictive power of the 3 preprocedural findings for SR success were compared with receiver operating characteristic curve (ROC) analyses.

Result : A total of 238 patients (mean age, 70.0 years; male, 52.9%) were included in this study. CTA-determined occlusion type corresponded adequately with DSA-determined occlusion type (p = 0.453). AF (odds ratio [OR], 2.73; 95% confidence interval [CI], 1.29 - 5.79) and CTA-determined branching-site occlusion (OR, 7.73; CI, 3.26 - 18.4) were independent predictors for SR success. For predicting SR success, the area under the ROC curve value for CTA-determined branching-site occlusion (0.695) was significantly greater than atrial fibrillation (0.597, p = 0.045) and hyperdense artery sign (0.603, p = 0.023).

Conclusion : CTA-determined occlusion type was significantly associated with SR success. Furthermore, among the 3 rapidly- and readily-assessable preprocedural findings, CTA-determined occlusion type had the greatest predictive power for SR success.

Differentiation between Brain Hemorrhage and Contrast Medium after Intra-arterial Treatment in Acute Ischemic Stroke Using Spectral Detector-based CT

진 성 원 고려대 안산병원

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Objective : Assessment of intracerebral hemorrhage after intra-arterial treatment in acute ischemic stroke is an important factor in the decision of medical treatment after the procedure. This study was performed to evaluate the usefulness of spectral detector-based CT compared with conventional CT after intra-arterial treatment.

Methods : From January 2016 to October 2017, Twenty-six consecutive acute ischemic stroke patients following intra-arterial treatment were included. They were examined with conventional CT or spectral detector-based CT. By taking spectral detector-based CT images, conventional images, virtual unenhanced non-contrast(VNC) images and iodine density images were calculated using a dedicated brain hemorrhage algorithm.

Result : Of the 26 patients, 22 patients underwent conventional CT and three of them had intracerebral hyperdense areas, and one of them disappeared from follow up brain CT, indicating extravasation. The remaining 4 patients underwent spectral detector-based CT and two of them showed intracerebral hyperdense areas in the conventional image, but all of them were identified as extravasation in the VNC image.

Conclusion : Spectral detector-based CT could improve accuracy and diagnostic confidence in early differentiation between intracerebral hemorrhage and contrast medium extravasation in acute stroke patients following intra-arterial treatment.

A Useful Diagnostic Method to Reduce the In-hospital Time Delay for Mechanical Thrombectomy: Volume Perfusion Computed Tomography with Added Vessel Reconstruction

이 호 준 가톨릭대 성빈센트병원

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Objective : Volume perfusion CT (VPCT) with added CT angiography (CTA)–like reconstruction from VPCT source data (VPCTA) can reveal multiple intracranial parameters. We examined the usefulness of VPCTA in terms of reducing the in–hospital time delay for mechanical thrombectomy.

Methods : A total of 180 patients who underwent mechanical thrombectomy at our institution from January 2014 to March 2017 were divided into two groups: a CT angiography based thrombectomy decision group (Group 1: CTA) and a VPCTA based decision group (Group 2: VPCTA). Multiple time interval categories (from symptom onset to groin puncture, from hospital arrival to groin puncture, procedure time, from symptom onset to reperfusion, and from hospital arrival to reperfusion) were reviewed. All patients underwent clinical assessment with the NIHSS score and modified Rankin Scale (mRS), and radiologic results were evaluated by the thrombolysis in cerebral infarction (TICI) score.

Result : In all of the time interval categories except for procedure time, the VPCTA group showed a significantly shorter in–hospital time delay during the pre–thrombectomy period than the CTA group. The 3–month mRS score was significantly lower in the VPCTA group (2.8) compared to the CTA group (3.5) (p=0.003). However, there were no statistically significant differences between the two groups in the other clinical and radiologic outcomes.

Conclusion : Compared to CTA, VPCTA significantly reduced the in–hospital time delay during the pre–thrombectomy period.

Clinical Manifestations of Isolated Chronic Middle Cerebral Artery Occlusion in relation to Angiographic Features

신 희 섭 경희대병원

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Background and Purpose : Isolated chronic middle cerebral artery occlusion (ChMCAO) is not a rare condition, and it is known to cause hemodynamic stroke. The purpose of this study was to evaluate differences in the clinical manifestations and prognosis of isolated ChMCAO in relation to angiographic features.

Methods : Fifty-six patients with isolated ChMCAO were enrolled in this retrospectively study. In accordance with the degree of antegrade collateral flow (AF) on angiography, patients were categorized into poor and good AF groups. The 2 groups were assessed and compared for the presence and recurrence of neurologic symptoms.

Result : Of the 56 patients, 33 were in the poor AF group and 23 were in the good AF group. The prevalence of ischemic symptoms was significantly higher in the poor AF group than in the good AF group ($P<0.05$). During an average follow-up period of 33.8 months, recurrent ipsilateral symptoms occurred in 6 of 45 patients. The hazard ratio conferred by poor AF was 5.36 (95% confidence interval, 1.08-26.57) for recurrent symptoms.

Conclusion : Our results showed that AF through the basal collateral network may be related to clinical manifestations of ChMCAO. Good AF in isolated ChMCAO may play an important role in preventing the recurrence of an ischemic event.

Combined Stent-retriever Plus Aspiration Thrombectomy for Acute Ischemic Stroke and Its Clinical Efficacy

허 원 명지병원

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Objective : After utilization of an intermediate catheter as an aspiration catheter, our institute switched the strategy of mechanical thrombectomy for acute ischemic stroke from stent-retriever thrombectomy to combined stent-retriever plus aspiration thrombectomy. Herein we describe detailed method of combined approach and report its clinical efficacy.

Methods : The combined approach was performed using a balloon guiding catheter in the cervical ICA. After an intermediate catheter was positioned at the petrous or cavernous ICA segment, a 0.021 inch microcatheter was advanced past the thrombus. The stent-retriever was then deployed across the thrombus. Through the angiography performed with an intermediate catheter, we delineated the thrombus. And the intermediate catheter was advanced as close to the proximal aspect of the thrombus as possible. After balloon inflation, the combined stent-retriever plus intermediate catheter system was carefully removed as a unit under manual aspiration through the intermediate catheter. This procedure was repeated until successful reperfusion was achieved or the procedure was terminated. A retrospective data analysis was performed to identify patients treated with mechanical thrombectomy, stent-retriever alone or combined approach.

Result : From 1 May 2016 until 1 November 2017, 23 patients underwent stent-retriever thrombectomy and 15 patients treated with combined approach. Clinical characteristics between two groups was not different. And the procedural success (TICI 2b or 3) rates were not different (87.0% and 86.7%, respectively, p=1.000). Statistically not significant, but the combined approach showed tendency of lower number of device passes through the thrombus (mean=1.33, range 1-3, SD 0.62) compared with that of stent-retriever group (mean=2.04, range 1-4, SD 1.15). And the combined approach, also showed tendency of decreased time from puncture to reperfusion (mean=34.3 min, range 20-60, SD 14.25) compared with that of stent-retriever group (mean=44.3 min, range 20-90, SD 19.73).

Conclusion : Our study shows the feasibility and efficacy of combined stent-retriever plus aspiration thrombectomy.

Combined Aspiration and Stent Retriever Technique for Large Vessel Occlusion Using Intermediate Catheter (SOFIA)

정 진 영 동의의료원

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Objective : To describe our initial experience of combined aspiration and stent retriever technique for mechanical thrombectomy (MT) using intermediate catheter (SOFIA)

Methods : We retrospectively analyzed 23 consecutive MT patients with 24 procedures using combined aspiration and stent retriever technique. Primary endpoint was successful recanalization (TICI 2b or 3) with first pass aspiration using Sofia. Secondary endpoints were final success rate (TICI 2b or 3) with combined stent retriever technique

Result : First-pass aspiration with TICI 2b or 3 reperfusion was achieved in 6 out of 24 cases (25%). The final successful revascularization rate (TICI 2b or 3) was 87.5% (21 out of 24 cases). Symptomatic reperfusion hemorrhage was occurred in one patient, but was unrelated to procedure itself

Conclusion : Combined aspiration and stent retriever technique for mechanical thrombectomy (MT) is safe and effective. Using a highly trackable intermediate catheter (SOFIA) as aspiration device might contribute to faster and more effective recanalization for large vessel occlusion

Free paper III AVM/AVF etc

좌장 : 경희대 **고준석**, 순천향대 **윤석만**

Proximal Coil-protected Embolization for Cranial and Spinal Shunt Diseases with N-butyl Cyanoacrylate or Onyx

김 병 문 연세대 세브란스병원

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Objective : To evaluate the effectiveness and safety of proximal coil-protected embolization with NBCA or Onyx for the treatment of cranial and spinal shunt diseases.

Methods : All patients who underwent proximal coil-protected liquid embolization for cranial and spinal shunt diseases were identified from a prospectively maintained neurointerventional database. This technique was employed because tortuous feeding arteries prohibited microcatheter navigation close enough to a target lesion or for prevention of unintentional reflux. Angiographic and clinical outcomes were retrospectively evaluated.

Result : Fifteen patients with cranial (n=9) and spinal (n=6) arteriovenous fistulas (n=10) or malformations (n=5) underwent proximal coil-protected embolization. A total of 22 feeders were embolized with NBCA (n=17) or Onyx (n=5). Penetration of embolic agents into the target lesion was successful in all 22 feeders without any unintentional reflux or premature occlusion of the major draining veins. Post-embolization angiographies revealed complete occlusion in 10, near complete in 3, and partial in 2 patients. There was no treatment-related morbi-mortality. Four patients received additional treatments (1 Onyx embolization, 2 r-knife, and 1 microsurgery). All patients showed complete occlusion on a follow-up angiography (mean, 6 months). Symptoms improved completely in 10 and partially in 4, and remained unchanged in 1 patient.

Conclusion : Proximal coil-protected technique seemed safe and effective for NBCA or Onyx embolization of cranial and spinal shunt diseases when it was difficult to navigate feeding arteries close enough to the target lesion.

Endovascular Stenting for Symptomatic Carotid Dissection with Hemodynamic Insufficiency

신 태 희 부산대병원

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Objective : To date, no controlled studies on the treatment of carotid artery dissection (CAD) have been reported. The purpose of this study was to demonstrate the technical feasibility and clinical efficacy of stent-supported angioplasty (SSA) as primary treatment for acute stroke due to CAD.

Methods : A review of medical records identified 21 patients who underwent SSA as primary treatment for acute stroke related to CAD between 2008 and 2014. The inclusion criteria were recent transient ischemic attack (n = 7, 33.3%) or acute infarct (n = 14, 66.7%) due to CAD (≥70% narrowing) with hemodynamic impairment. Technical success rates, complications, and angiographic and clinical outcomes were analyzed retrospectively.

Result : SSA was technically successful in all patients. Of 21 patients, 8 (38.1%) showed an additional intracranial occlusion. Intracranial recanalization to a thrombolysis in cerebral infarction ≥2b flow was achieved in 50% of the cases. Procedure-related mortality was 4.8%, and morbidity was 9.5%. Five (35.7%) of 14 patients presenting with an acute infarct showed significant improvement (decrease in National Institutes of Health Stroke Scale score of ≥4 points compared with admission score) at 7 days after SSA. During the observation period (mean, 20.5 months), stroke recurrence occurred in only 1 patient (5%), resulting in an annual stroke risk of 2.9%. A favorable outcome (modified Rankin Scale score ≤2) was achieved in all 7 patients with a transient ischemic attack (100%) and in 7 of 14 patients with an acute infarct (50%) at the 90-day follow-up.

Conclusion : Our results provide evidence that SSA is a feasible and effective strategy as primary treatment for steno-occlusive CAD patients with significant hypoperfusion or a large penumbra.

Transarterial Balloon-assisted Onyx Embolization of Intracranial Arteriovenous Malformations Using a Dual-lumen Balloon Microcatheter: Two Case Reports

김 태 곤 차의과학대 분당차병원

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Objective : The Onyx system has been well established in recent years as a very important material in the treatment of arteriovenous malformations (AVMs). When using the Onyx, it is essential to wait for the creation of a plug around the tip of the catheter, which enables the effective forward penetration of Onyx.

Methods : Recent reports have shown that the introduction of a dimethyl sulfoxide compatible dual-lumen balloon microcatheter improves the efficiency of AVM embolization. We report our recent experience of two cases of intracranial AVM embolization using Onyx and the transarterial balloon-assisted technique.

Result : In both cases, the procedures were successfully performed and the nidus of the AVM was totally occluded in a relatively short time.

Conclusion : This technique may enable immediate forward flow and penetration of Onyx without concern about reflux. It may also reduce the procedure time and increase the angiographic occlusion rate. Navigation of the dual-lumen balloon microcatheter nevertheless remains a challenge.

Transcervical Access via Direct Neck Exposure for Neuro-interventional Procedures at the Hybrid Angiosuite

전 홍 준 한림대 동탄성심병원

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Objective : A complicated course of the common femoral route for neurointervention can prevent approaching of the target. Thus, we advocate transcervical access via neck exposure in a hybrid angiosuite.

Methods : From January 2014 to March 2017, 17 (3.75%) of 453 cases were treated with this approach: 11 cerebral aneurysms (four ruptured, seven unruptured), four acute occlusions of the large cerebral artery, one proximal internal carotid artery (ICA) stenosis, and one direct carotid cavernous fistula (CCF).

Result : All patients were older (mean age, 78.1 years). The main cause was severe tortuosity from the supra-aortic course alone or combined with the infra-aortic course (eight and five cases, respectively) and orifice disturbance (four cases). Under neck vessel exposure, 6-8Fr guiding catheters were placed through subcutaneous tunneling to provide stability and enhance device support. All cerebral aneurysms were favorably embolized (eight complete and three neck remnants) by the combination of several additional devices due to the complex shape. Mechanical stent retrieval under an 8Fr balloon guiding catheter was successfully achieved by few runs (mean, two times; range, 1-3) within the proper time window (mean skin to puncture, 17 ± 4 min; mean puncture to recanalization, 25 ± 4 min). Each stent of the proximal ICA and direct CCF was satisfactorily deployed without catheter kick-back. All puncture sites were closed by direct suturing without complications

Conclusion : In the hybrid angiosuite, transcervical access via direct neck exposure is feasible in terms of device profile and support in which the femoral route cannot overcome unfavorable anatomy.

Does Cervical Sagittal Balance Affect a Vascular Tortuosity and Spontaneous Cervical Artery Dissection without Connective Tissue Disease?

전 효 섭 강원대병원

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Objective : Higher vascular tortuosity may be associated with spontaneous cervical artery dissection. We hypothesized that cervical sagittal balance affect a weakening the vascular wall and consequently an arterial tortuosity and cervical dissection.

Methods : A retrospective analysis of data from 30 Cervical artery dissection (CAD) patients in whom magnetic resonance angiography (MRA) and cervical radiograph. Age- and sex-matched healthy adults who underwent MRA in a routine health examination were used as controls were obtained at the same time. The vascular tortuosity in MRA was measured automatically from the carotid artery(CA) and vertebral artery (VA) arteries. Vascular tortuosity index (VTI) was defined as: [(actual / Straight)-1×100] in each arteries. The radiographic parameters in cervical radiograph measured were C2-7 Cobb angle (cervical lordosis) and C2-7 sagittal vertical axis (SVA C2-7). The relationships between the parameters and VTI were analyzed with the Pearson correlation coefficient and multiple linear regression.

Result : The healthy group (n=30) had significantly lower VTI than CAD group (n=30). (mean 3.7 ±2.5 VS 6.2 ± 3.8) The cervical lordosis was significantly smaller for the CAD compared with the control group (11.32으 ± 6.2으 vs 26.06으 ± 7.3으). The SVA C2-7 was significantly greater for the CAD compared with the control group (10. 5 ± 4.8으 mm vs 7.06 ± 3.6 mm) the control group. Also, in each group, the VTI had significant correlations with the SVA C2-7(r= 0.428), ($p < 0.01$) and a close negative correlation existed between the VTI and cervical lordosis (r= −0.475), ($p < 0.01$).

Conclusion : Cervical sagittal balance could be one of the various factors that increased vertebral artery tortuosity and CAD.

Usefulness of Intraoperative Neurophysiologic Monitoring during Endovascular Treatment for Intracranial Vascular Lesions

심 재 현 순천향대 천안병원

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Objective : Endovascular treatment (EVT) for intracranial vascular lesions have potentially risk of ischemic or hemorrhagic complications. Because most of procedures are performed under general anesthesia, intraoperative neurophysiological monitoring (IONM) is the only way to obtain information on neurological status. The propose of this study is to evaluate the usefulness of IONM during EVT.

Methods : A retrospective review of 149 cases of EVT with IONM for intracranial vascular lesions (131 intracranial aneurysms, 6 AVMs, 5 CCFs, and 7 AVFs) was performed. Somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) were used. A significant IONM changes were defined as ≧50% reduction in the amplitude of SSEP and/or a 10% delay in latency, and loss of MEP.

Result : Nineteen (12.8%) patients experienced IONM changes (SSEP 8/19; MEP 15/19). All IONM changes occurred during coil embolization in patients with intracranial aneurysms. The causes of IONM changes were categorized as follows; 3 of intraprocedural aneurysm rupture, 2 of during balloon remodeling, 2 of distal emboli, 4 of in–situ thrombosis, 5 of coil loop herniation to parent artery, 1 of compromise of anterior choroidal artery from coil mass, and 2 of false positive. In 16 of 19 patients with the IONM changes, the procedure were altered immediately. Among them, 7 patients showed full recovered SSEP and/or MEP and did not show neurological deteriorations. The remaining 9 patients did not recover IONM changes, and 6 had newly developed neurologic deficit. The symptoms were correlated with IONM changes. Two false negative results were found, and the specificity of IONM was 98.4%. One of them was a minor leak and the other one showed a perforator flow restriction, but the IONM did not change.

Conclusion : IONM is an effective monitoring tool to reduce complications during EVT for intracranial vascular lesions.

Progressive Occlusion of Small Saccular Aneurysms Incompletely Occluded after Stent-assisted Coil Embolization: Analysis of Related Factors and Long-term Outcomes

조 영 대 서울대병원

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Objective : Incompletely occluded aneurysms in coil embolization are subject to recanalization but occasionally progress to a totally occluded state. Deployed stents may actually promote thrombosis of coiled aneurysms. We evaluated outcomes of small aneurysms (<10 mm) wherein saccular filling with contrast was evident after stent-assisted coiling, assessing factors implicated in subsequent progressive occlusion.

Methods : Between September, 2012 and June, 2016, a total of 463 intracranial aneurysms were treated by stent-assisted coil embolization. Of these, 132 small saccular aneurysms displayed saccular filling with contrast in the immediate aftermath of coiling. Progressive thrombosis was defined as complete aneurysmal occlusion at the 6-month follow-up point. Rates of progressive occlusion and factors predisposing to this end were analyzed via binary logistic regression.

Result : In 101 (76.5%) of 132 intracranial aneurysms, complete occlusion was observed in follow-up imaging studies at 6 months. Binary logistic regression analysis indicated that progressive occlusion was linked to smaller neck diameter (OR=1.533; p=0.003), hyperlipidemia (OR=3.329; p=0.036) and stent type (p=0.031). The LVIS stent is especially susceptible to progressive thrombosis, more so than Neuroform (OR=0.098; p=0.008) or Enterprise (OR=0.317; p=0.098) stents. In 57 instances of progressive thrombosis, followed for ≥12 months (mean, 25.0±10.7 months), 56 (98.2%) were stable, with minor recanalization noted once (1.8%) and no major recanalizations.

Conclusion : Aneurysms associated with smaller diameter necks, hyperlipidemic states, and LVIS stent deployment may be inclined to eventually thrombose, if occlusion immediately after stent-assisted coil embolization is incomplete. In such instances, excellent long-term durability is anticipated.

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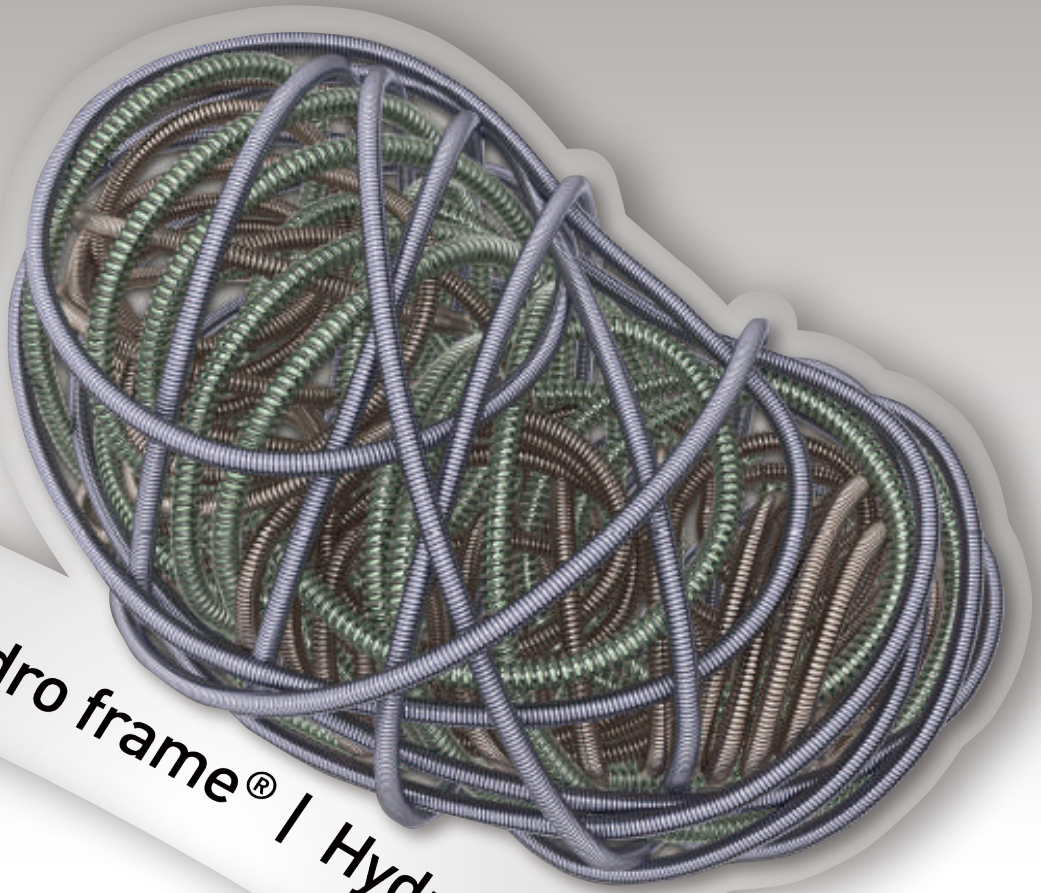

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100153HFRM-V	1.5	3	100256HFRM-V	2.5	6
100154HFRM-V	1.5	4	100258HFRM-V	2.5	8
100202HFRM-V	2	2	100304HFRM-V	3	4
100203HFRM-V	2	3	100306HFRM-V	3	6
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100405HFRM-V	4	5	100715HFRM-V	7	15
100408HFRM-V	4	8	100728HFRM-V	7	28
100510HFRM-V	5	10	100817HFRM-V	8	17
100515HFRM-V	5	15	100833HFRM-V	8	33
100612HFRM-V	6	12	100931HFRM-V	9	31
100619HFRM-V	6	19	101036HFRM-V	10	36

HUGEL meditec HydroCoil® EMBOLIC SYSTEM

Clip technology for extravascular closure

StarClose SE
Vascular Closure System

Secure[1]

Easy

Extravascular

The security[1] of suture

Perclose ProGlide
Suture-Mediated Closure System

Simple

Secure[1]

Control

On the move with Secure[1] Closure
CHALLENGE AND CONFIRM On the Table

Reference 1. Data on file at Abbott Vascular

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A Promise for Life

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Seek & Feel the Difference

Orbit GALAXY™
DETACHABLE COIL SYSTEM

Soft Polymer Gripper
for smooth,
controlled delivery

Stand Alone to maintain
it's own size and shape

.012" Large OD
for higher packing density
than comparable .010" coils[2]

Random Break Deployment may ease
coil repositioning during embolization[1]

Source: Fluoroscopic image of Orbit Galaxy 9mm x 25cm
in 10mm x 8mm Aneurysm model, Tokyo Science Center, 2017

1) Ahmad Khaldi, The Orbit Galaxy XTEASOFT Coils: a Multicenter Study of Coil Safety and Efficacy in both Ruptured and Unruptured Cerebral Aneurysm, Journal of Vascular and Interventional Neurology, 2012
2) Juan A. Lorezo, XTRASOFT GALAXY Endovascular Finishing Coil, World Neurosurgery, 2011

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