Neurointervention

SE 11 NR(NI)-01

Concurrent segmental ICA agenesis with segmental basilar artery aplasia displaying double inter-ICA communication through intercavernous anastomoses and posterior communicating artery

Yae Won Park¹, Joonsang Yoo², Dong Joon Kim³
¹Ewha Womans University Mokdong Hospital, ²Keimyung University School of Medicine, ³Severance Hospital, Korea.
djkimmd@yuhs.ac

Segmental internal carotid artery (ICA) and basilar artery (BA) agenesis/aplasia are rare vascular anomalies. We report an extremely rare case of combined ICA, BA, and A1 segmental absence presenting with double inter-ICA collateral communication through the intercavernous anastomosis and posterior communicating arteries. The patient presented with diplopia and transient ischemic attack (TIA). The pathogenesis of the anatomic anomalies and clinical symptoms are discussed.

CASE REPORT

A 32-year-old female visited the emergency department with right arm sensory change, right upper and lower extremity weakness, pulsatile headache, and right eyeball pain. CT angiographic images showed absence of left supraclinoid ICA and dysplastic changes of the right ICA (Figure a). Entangled vascular structures were seen in bilateral cavernous sinuses with an intercavernous connection (Figure b). DSA revealed agenesis of the left C7 segment of the ICA. Concurrent agenesis of left A1 and the BA were also noted (Figure c). Two enlarged arteries connecting the bilateral distal ICAs were seen. The proximal intercavernous connection from the left ICA originated just proximal to the ophthalmic artery and coursed through the sellar floor to join the right ICA (Figure e). The distal connection corresponded to the hypertrophied right Pcom supplying the left MCA territory via the right P1, basilar top, left P1, Pcom, and the distal ICA (Figure d). The left VA ended with main supply to the left posterior inferior cerebellar artery. The right VA continued to the BA which ended with supply to the bilateral anterior inferior cerebellar arteries (Figure f). A small persistent trigeminal artery connecting the proximal BA and the dysplastic right cavernous ICA was seen. (Schematic illustration at the right side of figure)

DISCUSSION

Our case of complex double inter-ICA connections due to multisegmental intracranial artery agenesis/aplasia showcase the versatility of the embryonic collateral system that may compensate for defects in development of the arterial system. The pathogenesis of symptoms
in our case may be related to the vertebrobasilar insufficiency due to BA aplasia.

Several recent trials have validated the benefit of endovascular mechanical thrombectomy which was shown to reduce disability and mortality for large vessel ischemic stroke. One important observation following mechanical thrombectomy is PCHD. Following mechanical thrombectomy, a post-interventional CT is performed to rule out bleeding. PCHD after endovascular thrombectomy can be due to either intracranial haemorrhage or contrast staining, and it can occur in up to 60% of post thrombectomy cases. PCHD leads to challenges in patient's management. The intention of this exhibit is to familiarise the readers with the various patterns of PCHD and to review possible methods of discriminating contrast staining versus intracranial haemorrhage suggested in the literature.

Different methods of evaluation in the literature include assessing the Hounsfield unit, the persistence of PCHD, using MRI GRE sequence and dual energy CT. This study will give examples for each method.

SE 11 NR(NI)-03
Emergency carotid artery stenting in patients with acute ischemic stroke due to tandem occlusion: a single-center experience
Sung Eun Park¹, Dae Seob Choi², Hye Jin Baek¹, Hwa Seon Shin³, Kyeong Hwa Ryu¹, Jaebom Na³, Jae Min Cho³, Hocheol Choi³, Mi Jung Park², Hye Young Choi²
¹Gyeongsang National University Changwon Hospital, ²Gyeongsang National University Hospital, ³Gyeongsang National University School of Medicine, Korea.
dschoi@gnu.ac.kr

BACKGROUND: The feasibility, safety and effectiveness of emergency carotid artery stenting (eCAS) in patients with acute ischemic stroke (AIS) due to tandem occlusion are still controversial. We retrospectively review our experience with proximal internal carotid artery (ICA) stenting and stent-assisted thrombectomy of the distal artery.

METHODS: The data included 42 patients that underwent eCAS procedure and mechanical thrombectomy between 2011-2017. The mean time from stroke symptom onset to presentation was 188.9 min (range 30-660 min) and
the mean initial score on the National Institutes of Health Stroke Scale (NIHSS) was 13.24 (range 2-24). Angiographic and clinical outcomes were analyzed; baseline and procedural variables were included in univariate and multivariate analyses to define the independent predictors of good outcome (90-day modified Rankin Scale ≤2).

RESULTS: Twenty-seven patients had total occlusion of the proximal ICA and the remaining 15 patients had near total occlusion (99% stenosis, n=9) or severe stenosis (80-90% stenosis, n=6) (mean degree 97.6%, range 80-100%). Each presented with an occlusion of the proximal ICA, with additional occlusions of the distal ICA (n=7), middle cerebral artery (n=34), or anterior cerebral artery (n=1). Successful stenting was performed in all patients and good outcome was achieved in 64.3% and successful reperfusion score (TICI ≥2B) in 78.6% of the cases, including complete (TICI 3) reperfusion in 45.2%. The mean NIHSS score at discharge was 7.17 (range 0-31). The mean modified Rankin Scale score at 90-day was 2.4±1.83 (range 0-6).

CONCLUSION: Acute endovascular treatment of tandem anterior circulation occlusions appears to be a technically feasible and effective method for achieving good clinical outcomes.

SE 11 NR(NI)-04
Cataract risk of neurointerventional procedures: a nationwide population-based matched-cohort study
Kai-lun Cheng¹, Jing Yang Huang¹, Chun Lang Su², Kwong Chung Tung³, Jeng Yuan Chiou²
¹Chung Shan Medical University Hospital, ²Chung Shan Medical University, ³National Chung Hsing University, Taiwan.
chengkailun108@gmail.com

AIM: This study aimed to demonstrate the risk of cataract associated with radiation exposure from neurointerventional procedures.

MATERIALS AND METHODS: This was a nationwide population-based, matched-cohort study. The exposed group (group E) was comprised patients diagnosed with an aneurysm, cerebrovascular system anomaly, or subarachnoid hemorrhage who underwent a neurointerventional procedure, such as brain digital subtraction angiography or endovascular embolization. The comparison group (group C) included subjects who were never exposed to radiation from neurointerventional procedures and were propensity score-matched by the date of enrollment, age, sex, and associated comorbidities. Multiple Cox proportional hazard regression analysis was used to estimate the hazard ratio (HR) of cataract risk due to radiation exposure while adjusting for potential confounding factors.

RESULTS: There were 838 patients and 3,352 matched subjects in groups E and C, respectively. The incidence of cataracts was significantly greater among subjects in group E [adjusted HR (aHR) = 1.877; 95% CI = 1.081-3.257], especially those aged > 40 years (aHR = 2.138; 95% CI = 1.161-3.939). The number of computed tomography exams was positively correlated, but not statistically significant, with an increased risk of cataract occurrence.

CONCLUSION: Neurointerventional procedures might be significantly associated with an increased risk of cataract occurrence.

SE 11 NR(NI)-05
Usefulness of high resolution PD image for follow-up after stent-assisted coiling for intracranial aneurysms
Sang Hyeon Kim, Myongjin Kang, Sunseob Choi
Dong-A University Hospital, Korea.
g4439@naver.com

BACKGROUND AND PURPOSE: Follow-up of intracranial aneurysms by stent-assisted coiling with MRA is complicated by imaging artifacts. This study aimed to evaluate the usefulness of high resolution MRI for follow-up after stent-assisted coiling by comparing it with TOF MRA.

MATERIALS AND METHODS: Between March 2016 and May 2017, 40 patients with 41 aneurysms who were performed TOF MRA and HRMRI after stent-assisted coiling were included in our study. 3D TOF MRA and 3D high resolution PD image were obtained on a 3T MR imaging system. The image qualities of stented parent artery with HRMRI was significantly superior to that of TOF MRA. We performed quantitative analyses of relative signal intensity in stented parent artery on HRMRI in 27 of 41 aneurysms compared with that of normal artery. Furthermore, we evaluated the capability of the HRMRI to depict the residual flow within the coiled aneurysms and stented arteries in 13 patients who available follow-up DSA.

RESULTS: Image quality of the stented parent artery on HRMRI was significantly superior to that on TOF MRA. The significant instent signal reduction on HRMRI was not occurred. Although the concordance rate of HRMRI with DSA for evaluating the state of coiled aneurysms was poor, HRMRI showed excellent concordance rate for evaluating the state of stented parent artery.

CONCLUSION: HRMRI maybe useful to evaluate the patency of stented artery additional to other image modality such as TOF MRI to evaluate status of coiled aneurysm after stent-assisted coil embolization for intracranial aneurysms.
SE 11 NR(NI)-06
Persistent trigeminal artery: a pictorial review
Ga Young Lee, Hae Woong Jeong, Jin Wook Baek, Young Jin Heo
Inje University Busan Paik Hospital, Korea.
hwjeong2000@hanmail.net

PURPOSE: Persistent trigeminal artery (PTA) is the most common type of carotid-vertebrobasilar anastomosis after birth, arising from precavernous portion of internal carotid artery (ICA), with a incidence about 0.2%. In this pictorial review, we aim to illustrate the embryological aspects of development of the PTA and to describe the classification and imaging findings of this anatomical variation.

MATERIALS AND METHODS: We retrospectively reviewed all of our cases for 11 years from March 2006 to March 2017, which were diagnosed with the PTA by magnetic resonance angiography (MRA) and digital subtraction angiography (DSA).

RESULTS: Of the 36,178 cases of MRA, 24 cases (0.07%) were identified and among them, 12 cases had taken DSA. The most common type was Saltzman type I PTA, 18 cases. Only 1 case was Saltzman type II PTA. The variation of PTA, Saltzman type III was 5 cases (1 type IIIa, 3 type IIIb, 1 type IIIc). The vascular anomalies were combined in 11 cases; 10 cases with aneurysms and the other case with dural arteriovenous fistula (AVF).

CONCLUSION: Although PTA and PTA variants are rare, neuroradiologists and neurosurgeons should be aware this aberrant vessel before endovascular intervention and surgery to avoid unexpected complication, such as ischemia of brainstem and cerebellum by vascular injury and emboli passing through the PTA or PTA variants.

SE 11 NR(NI)-07
Initial single center experience with newly introduced distal access guiding catheter: clinical efficacy and safety in the treatment of coil embolization
Su Young Yun, Hae Woong Jeong, Young Jin Heo, Jin Wook Baek
Inje University Busan Paik Hospital, Korea.
hwjeong2000@hanmail.net

PURPOSE: The purpose of this study was to evaluate the clinical efficacy and safety of 6F Envoy distal access (DA) guiding catheter, the newly developed distal access guiding catheter, through single center experience.

MATERIALS AND METHODS: We retrospectively reviewed 132 patients who underwent coil embolization using a 6F Envoy DA guiding catheter and 127 patients who underwent coil embolization using the 6F Envoy guiding catheter for comparative study from October 2015 to November 2016 at Inje University Busan Paik Hospital. Of these, 40 cases of posterior circulation aneurysm, 27 cases using double guiding catheter system, and 4 cases using 5F guiding catheter were excluded. The analysis included age, gender, status of rupture, tortuosity of cervical internal carotid artery(ICA), location of initial guiding catheter tip, location of final guiding catheter tip, use of additional catheter to navigate guiding catheter, and the incidence of complication. The comparison between the 6F Envoy guiding catheter and 6F Envoy DA guiding catheter groups was performed with Mann-Whitney U test or Chi-square test.

RESULTS: Among 188 cases, 89 cases used the 6F envoy guiding catheter and 99 used the 6F Envoy DA guiding catheter. There was no case in which the tip of the guiding catheter reached the petrous segment in the group using 6F Envoy guiding catheter. But, 20 cases (10.6%) were observed in the group using 6F Envoy DA guiding catheter group. The guiding catheter tip was located more distally in the group using 6F Envoy DA guiding catheter, significantly (p<0.001). In order to position the guiding catheter in the appropriate position, additional catheter was needed in the group using 6F envoy DA guiding catheter group. (6F Envoy group: n = 7, 3.6%, 6F Envoy DA group: n = 20, 10.6%). There were no statistically significant differences in the age, gender, status of rupture, tortuosity of cervical ICA and incidence of complication between the two groups.

CONCLUSION: Compared with the conventional guiding catheter, the 6F Envoy DA guiding catheter can reach to distal portion without increasing the complication rate. It may be helpful to improve distal accessibility and stability without complication, using 6F Envoy DA guiding catheter.

SE 11 NR(NI)-08
Angiographic perfusion imaging in patients with cerebral arterial spasm following cerebral aneurysm rupture
Soo Mee Lim, Yae Won Park
Ewha Womans University Mokdong Hospital, Korea.
soomee@ewha.ac.kr

PURPOSE: Vasospasm following cerebral aneurysm rupture is one of the most devastating sequelae and the most common cause of delayed ischemic neurological deficit. We evaluated the agreement of severity of perfusion insufficiency in angiographic perfusion imaging (API), peak systolic velocity (PSV) of transcranial Doppler US (TCD), and angiographic findings in patients with cerebral arterial spasm following cerebral aneurysm rupture.

MATERIALS AND METHODS: 15 APIs were acquired
from 12 patients who suspected cerebral arterial spasm after coiling or clipping of ruptured cerebral aneurysms. API was acquired on an AXIOM Artis dBA (Siemens, Forchheim, Germany) and acquisition protocols were as follows. Neuro PSV IR (70kV/0.36 μGy/8 s), dilution (contrast/saline, 50:50), injection volume (85 ml), injection rate (5 ml/s), duration of injection (17s), X-ray delay (9s), catheter position (5F multipurpose catheter placed just above the aortic valve). Reconstruction protocols were full VOI size, 512 slice matrix, smooth image characteristics, Neuro PBV reconstruction mode, Neuro PBV IR viewing preset. We compared the API with both sides internal carotid angiographic findings and PSV of TCD of both M1 segments.

RESULTS: Severity of angiographic findings of spasm and API of both sides was concordant in 8 cases, discordant in 3 cases, questionable in 4 cases. TCD and API severity of both sides was concordant in 9 cases, discordant in 5 cases, questionable in 1 case.

CONCLUSION: We observed good agreement between API, PSV of TCD and angiographic findings in the evaluation of brain perfusion in patients with cerebral arterial spasm following cerebral aneurysm rupture.

ACKNOWLEDGEMENT: This research was supported by the National Research Foundation of Korea (NRF) grant funded by the Korea government (NRF-2015R1A2A2A04003443).

SE 11 NR(NI)-09
Transarterial embolization of dural arteriovenous fistula involving an isolated segment of the transverse sinus: a case report
Yon Kwon Ihn¹, Won Sang Jung², Bum-soo Kim²

¹The Catholic University of Korea, St. Vincent’s Hospital, ²The Catholic University of Korea, Seoul St. Mary’s Hospital, Korea.

This case report illustrates a relatively rare case of dural arteriovenous fistula involving direct supply to an isolated segment of the transverse sinus. Successful transarterial obliteration of the lesion was accomplished with Onyx with clinical cure. We reviewed the related radiologic and therapeutic features of dural arteriovenous fistula involving an isolated sinus and described the feasibility of the use of Onyx.

KEY WORDS: Dural arteriovenous fistula, isolated sinus, Onyx, Embolization

SE 11 NR(NI)-10
The results of endovascular and medical treatment of acute ischemic stroke with occlusion of proximal internal carotid artery: single center experience
Yoon Seok Choi, Hae Woong Jeong, Young Jin Heo, Jin Wook Baek, Jeong Hwa Seo, Eun-Gyu Kim
Inje University Busan Paik Hospital, Korea.

hwjeong2000@hanmail.net

BACKGROUND AND PURPOSE: Proximal internal carotid artery occlusion (ICAO) is associated with large infarcts and with a 3-fold increased likelihood of poor recovery. The purpose of this study was to evaluate for clinical impact of the endovascular treatment (EVT) for acute ischemic stroke (AIS) patients with ICAO.

METHODS: After retrospectively reviewed a registry of patients with AIS who underwent EVT from January 2005 to December 2016, 60 patients with ICAO within 8 hours from stroke onset were enrolled regardless of whether accompanied tandem occlusion or not. Whether a patient was treated with EVT or medical treatment decided after cerebral angiography. We classified two patient groups as an EVT group (n=46) and medical group (n=14) according to the treatment methods. We compared the baseline characteristics and clinical outcomes between the groups.

RESULTS: Baseline characteristics including age, sex and arrival time from stroke onset, initial NIHSS score, and stroke risk factors were not significantly different between two groups. The good recanalization (TICI 2b-3) was achieved 63% in EVT group. The good clinical outcome of the modified Rankin Scale score ≤2 at 3 months was more frequent in the EVT group than in the medical group (52.2% vs. 14.3%; P=0.001).

CONCLUSION: This study showed more good clinical outcome after EVT compared with medical treatment in AIS with ICAO. We think that it would be worth attempting EVT for revascularization in AIS with ICAO.

SE 11 NR(NI)-11
Early rebleeding after coiling for ruptured cerebral aneurysm and the value of 3D rotational angiography as a predictor of rebleeding
Dasom Kim, Hae Woong Jeong, Jin Wook Baek, Young Jin Heo, Sung Tae Kim, Young Gyun Jeong
Inje University Busan Paik Hospital, Korea.

hwjeong2000@daum.net

BACKGROUND AND PURPOSE: In treatment of ruptured cerebral aneurysm, rebleeding event occurs frequently in coil embolization compared to clipping. In addition, early rebleeding could suggest that treatment may have been performed incompletely. However,
it would be difficult to decide exactly whether the aneurysm is treated well or isn’t just by biplane digital subtraction angiography. The purpose of this study is to investigate incidence, characteristics and value of 3D rotation angiography in early rebleeding cases after coil embolization for ruptured cerebral aneurysm.

**METHODS:** From January 2013 to May 2017, the cases treated with coil embolization in the patients with ruptured cerebral aneurysms were reviewed. There were 255 patients with 255 cerebral aneurysms. The mean age of the patients was 58.1 years. The number of female patient was 173. 212 aneurysms were located in anterior circulation. Early rebleeding was defined as occurring within 30 days after coil embolization. Clinical and angiographic data and rescue treatment result were analyzed retrospectively from a prospectively collected database.

**RESULTS:** There were 6 aneurysms that rebleeding event occurred in. The age of the patients ranged from 35 to 80 years. There were four women and two men. Four aneurysms were A-com aneurysm, and two were P-com aneurysm. Radiologic occlusion rate seems like remnant neck status on Raymond-Roy Occlusion Classification. All of the 4 cases of rebleeding were detected within second day, 1 case was on 5th day, and 1 case was detected on 10th day. We performed clipping in 3 cases and additional coiling including parent artery occlusion in 1 case. The other cases was treated conservatively. In 5 cases of angiography, the clue that looks like blood flow to rupture site was detected. Furthermore, in one case, blood flow in the dome of aneurysm was detected during operation, even though there was coil mesh in the aneurysm. The modified Rankin Scale was 6 points in 3 patients, 4 points in 2 patients, and 1 point in 1 patient.

**CONCLUSION:** Early rebleeding rate after coil embolization of ruptured cerebral aneurysm was 2.35%. The prognosis of early rebleeding was poor. The most common site was A-com artery. 3D rotation angiography after coiling may be helpful to predict rebleeding after coiling.

**SE 11 NR(NI)-12**

Comparison of stent thrombectomy and suction thrombectomy for treatment in patients with acute ischemic stroke with Basilar artery occlusion: single center experience

Jungwon Park, Hae Woong Jeong, Young Jin Heo, Jin Wook Baeik, Jeong Hwa Seo, Eun-Gyu Kim

*Inje University Busan Paik Hospital, Korea.

hwjeong2000@daum.net

**BACKGROUND AND PURPOSE:** Despite advances in efficient thrombectomy technique using stent and suction devices, acute ischemic stroke (AIS) with basilar artery occlusion (BAO) is a devastating neurological condition with high mortality rate and poor clinical outcomes. We compared our experience about two representative thrombectomy techniques; stent and suction thrombectomy in patients with AIS with BAO.

**METHODS:** Between March 2009 and March 2017, 55 patients with BAO within 8 hours from stroke onset were treated with endovascular treatment using stent or suction thrombectomy. The first device between Stent and Suction devices for EVT was selected according to the neurointerventionist preference. We classified two groups as Stent group (n=20) and Suction group (n=35) according to the first selected device. We compared the angiographic and clinical outcomes between the each group.

**RESULTS:** Successful recanalization rates (Thrombolysis in Cerebral Infarction (TICI) score ≥2b: 85.0% vs. 91.4%, p=0.47) and good clinical outcomes (modified Rankin Scale scores ≥2 at 3 months: 40.0% vs. 37.1%, p=0.84) were not different between stent and suction group. Use of rescue method for recanalization was less frequent in Stent group than Suction group (20.0% vs. 45.7%, p=0.06). In a multivariable analysis, age and use of rescue method were independent predictors for good clinical outcomes.

**CONCLUSION:** The two thrombectomy techniques were showed with similar recanalization rates and clinical outcomes in AIS with BAO. However, stent thrombectomy technique seemed to more appropriate technique to reduce of rescue method in AIS with BAO.

**SE 11 NR(NI)-13**

Endovascular treatment of ruptured intracranial aneurysm. How do we fare?

Mohd Farris Mohd Roslan, Sandeep Singh Sidhu

*Ministry of Health Malaysia, Malaysia.

drsidz79@gmail.com

**INTRODUCTION:** Endovascular treatment by coiling is the first line treatment for ruptured intracranial aneurysms. The ISAT trial published in 2002 provided definitive evidence of improved outcome using endovascular embolization compared with neurosurgical clipping. ISAT results demonstrated that 73.9% of patients presenting with subarachnoid haemorrhage (SAH) were functionally independent when followed up 2 months after endovascular treatment [1]. Eight years after ISAT trial, in the year 2010, Wessex Neurological Centre (WNC) conducted a similar study, they reported 80% of patients presenting with ruptured aneurysm were functionally independent when followed up 3 months after embolization[2].

**METHODS:** Data collected from a total of 347 patients...
diagnosed with ruptured intracranial aneurysm at Sungai Buloh Hospital between January 2008 until December 2015 using the existing computerized (e-His) system. Patients clinical grade prior to receiving endovascular treatment were determined using the World Federation of Neurological Surgeons (WFNS) criteria. 3 months post procedure, patients’ functional status was assessed using the Oxford Handicap Scale.

**RESULTS:** Out of 126 patients with ruptured intracranial aneurysm who were treated endovascularly, 75.2% had good outcome at 3-month follow-up. We are almost at par with WNC as they reported 80% of their patients had good outcome at 3-month follow-up [2]. For patients with good WFNS grades (1 to 2), the proportion of good outcomes (OHS 1-2) is low at 64.3% as compared to WNC study which is at 89% [2]. Only 6 patients (4.6%) out of the 129 patients had a poor outcome (OHS 3-5). Most patients with a poor outcome were in the high WFNS grade to begin with. The likelihood of a poor outcome for patients with poor clinical grade prior to treatment (WFNS 3-5) in Sungai Buloh is 19.3%, which is much lower as compared to WNC with 45.3% [2].

**CONCLUSIONS:** Our result reveals that we are almost at par with the international standard we aim to follow. WNC study has more patients with good clinical grades (WFNS grade 1 or 2) amounting to 74% as compared to ours at 70%. There is considerably good outcome observed in our practice despite a case mix comprising of a higher proportion of poor grade patients with worse prognosis.

---

**INTRODUCTION:** Endovascular treatment of cerebral aneurysm was performed in open way where no clip could be used, in the past decade with development of new technologies it was considered as a low risk method, thus becoming an option of aneurysm treatment in developed countries.

**MATERIALS AND METHODS:** The operations were performed with Philips Allura Xper FD 20/20 between June 2016 and April 2017 using roadmap and 3D reconstruction program. 26 patient of 25-60 years age group with cerebral aneurysm unattainable to clip the aneurysm by open method were operated using stents and micro coil. 16 cases were of grade I-III according to the Hunt and Hess scale, and got complication with subarachnoid hematoma (SAH); 10 cases were circumscribed aneurysm. There were 20 female and 6 male. In partial and vascular severe cases, an operation was performed with Seldinger techniques with local and general anesthesia of MICROVENTION chaperon 5-6 Fr double router catheter, surgery headway micro-catheter, striker micro-catheter, hydro fill and bare micro coil, using self-expandable 3.5 x 23 mm 4.5 x 23-35 mm stents.

**RESULTS:** In total 26 aneurysm surgery has been performed including 6 of A.Basillaris, 16 of A.Carotid interna, 2 of A.Cerebralis posterior and 1 of A.Communicating anterior. A patient who had ampulla and giant aneurysm of A.Basillaris had complication with ischemia after the surgery, 18 patient discharged from the hospital without any symptoms. There were 6 cases of blister like aneurysm which had not treated with A.Carotid interna micro coil one them treated with both of open and endovascular treatment while another one treated with in stent in stent technique, and last one treated with trapping both relevant vessel, and its aneurysm due to communicating arteries well. Stent-assisted coiling was done in 4 cases. In two case, thrombus left in stent but no loss of consciousness and aneurysm surgery were done after the 3 months anti-coagulation therapy. There was no loss of consciousness and patient’s status was improved. Focal SAH was detected in 4 patients during the surgery. They were discharged without loss of consciousness after the therapy.

**CONCLUSION:** Endovascular treatment of cerebral aneurysm by using micro coil and self-expendle is modern alternative, effectiveness and minimally invasive method and it is possible to use in Mongolia. In the future, short and long-term study on endovascular...
treatment result of cerebral aneurysm is need to be done.

**SE 11 NR(NI)-15**  
Growing blood-bluister aneurysms - Techniques of endovascular management  
Ankit Balani, Suresh Giragani, Anandh Balasubramaniam, B. J. Rajesh  
Yashoda Hospital, Secunderabad, Telangana, India, India.  
drankitbalani@gmail.com

**INTRODUCTION:** Blood bluster aneurysms (BBA) are a rare cause of subarachnoid haemorrhage (SAH). Although miniature looking, blood blisters can rapidly grow and re-rupture resulting in poor clinical outcomes if untreated. Pathologically they are focal wall defects covered by thin layer of fibrous tissue and adventitia; making surgery difficult with high risk of premature rupture. We wish to describe endovascular techniques of management of growing BBA.

**AIMS:** To evaluate the clinical presentation, imaging findings and endovascular techniques of management of growing BBA.

**METHODS:** Hospital based retrospective study wherein patient records and image database of patients with SAH between January 2015 and March 2017 were studied. Inclusion criteria included patient with SAH and presence of blood bluster aneurysm on 3D rotational angiography. Observations were tabulated under the headings of age, gender, clinical grading (WFNS), Fischer grading, site of aneurysm, 3D rotational angiography findings, interval growth and endovascular technique of management.

**RESULTS:** Out of the 103 patients presenting with SAH, 5 patients had BBA on imaging. All the 5 patients were females with mean age of 41.8 years (range of 26-58 years). The most common location of aneurysm was dorsomedial wall of internal carotid artery (n=3); basilar artery (n=1) and anterior cerebral artery (n=1) were other sites. 4 out of 5 lesions showed interval growth on imaging. All the patients were managed with endovascular management. The techniques of endovascular management included: flow diverter stent placement in the parent vessel across the aneurysm (n=3), telescopic stenting (n=1) and jailing of parent vessel by flow diverter stent placement (n=1). The technical success rate was 100% with complete resolution of BBA. All patients were regularly followed up in outpatient department of hospital with the mean follow-up of 12 months. There were no major complications related to the procedure. Two patients had complications due to vasospasm and were managed conservatively.

**CONCLUSION:** BBA are a rare cause of SAH. Endovascular treatment is the preferred treatment. Endovascular techniques including flow diverter stent placement, telescopic stenting and jailing of parent vessel by flow diverter stent placement are technically feasible, effective and minimally invasive treatment options.

---

**SE 11 NR(NI)-16**  
Evaluation of magnetic resonance perfusion dynamics in patients with intracerebral aneurysms treated with endovascular coil embolization  
Gokhan Polat, Suat Eren, Akin Levent, Hayri Ogul, Recep Sade, Berhan Pirimoglu, Mecit Kantarci  
Ataturk University, Turkey.  
berhan.dr@gmail.com

**BACKGROUND AND PURPOSE:** Aneurysms affect the cerebral hemodynamics and brain perfusion with the development of mass effect due to intra saccular filling or hemorrhage and vascular spasm in case of rupture. Aim of the treatment consists of eliminating the possibility of hemorrhage by ceasing its connection from systemic circulation and relieving the mass effect as well as restoring the normal blood flow in the associated artery. In addition to those complications, our study aimed to detect the effect of intra saccular turbulence on the main arterial stream and assess the changes in cerebral perfusion related to this effect.

**MATERIALS AND METHODS:** Between 2014 and 2017, sixty patients who received endovascular aneurysm treatment in radiology department of Ataturk University Medical School were evaluated. Twenty-six patients were excluded from study due to exclusion criteria. Brain perfusion parameters (rCBV, rCBF, MTT and TTP) were acquired pre-and post-operatively and one month after operation. Perfusion parameters were compared to those from posterior circulation and changes in perfusion values were assessed statistically.

**RESULTS:** Mean age of the study population was
52 years (range: 21-69). All measured aneurysms were smaller than 10 mm and classified in small aneurysm group. Perfusion values acquired pre- and post-operatively and one month after operation were compared and there were no statistically significant differences detected pre- and post-operation values regarding the rCBV, rCBF, and MTT parameters. P values regarding the pre-operation versus post operation and pre-operation versus one month after operation were 0.652 and 0.612 for rCBV; 0.563 and 0.523 for rCBF and 0.865 and 0.749 for MTT respectively. Values derived from TTP maps showed statistically significant elongation in post-operative values compared to pre-operation and contraction in one month after operation compared to pre-operative values (p: 0.025 and 0.049 respectively).

CONCLUSION: Small aneurysms (<10 mm) do not alter rCBV and rCBF hence perfusion related complications (hyperperfusion syndrome) are not expected during the treatment of those aneurysms. Alteration of TTP maps even in small aneurysms enables its usage in the assessment of perfusion as a quantitative parameter.

SE 11 NR(NI)-17
Increase of fluoroscopic radiation dose rate during multi-stage Onyx embolization of brain AVMs
Yuan Yuan Jiang¹, Jae jon Sheen², Deok Hee Lee³
¹Dongguk University, China; ²Asan Medical Center, Korea; ³Asan Medical Center, University of Ulsan College of Medicine, Korea. dhlee@amc.seoul.kr

BACKGROUND AND PURPOSE: Multi-stage of embolization is one of the treatment options of brain arterio-venous malformations (AVMs). Recently Onyx (Medtronic) has become the most popular embolic materials for this purpose. Different from the first embolization procedure, the successive procedures usually are suffering from presence of radiodense Onyx
cast in the nidus, which could hamper the successive procedures. In this study we focused on the influence of the Onyx cast in the fluoroscopic radiation dose since presence of the any radiopaque material in the field could increase the exposure setting due to automatic exposure control system of the angiographic machine.

**MATERIALS AND METHODS:** During last 3 years, there were 18 patients who underwent multi-stage Onyx embolization (more than twice) for brain AVM. From the radiation dose chart of each procedure, total fluoroscopic duration (min), dose-area product (DAP, $\mu$Gym$^2$) of both frontal and lateral planes were obtained. For the simplification of the dose comparison, we compared the frontal and lateral fluoroscopic dose (DAP)/time (min) (dose rate, $\mu$Gym$^2$/min) of initial and lateral stages of the embolization (paired t-test).

**RESULTS:** Three sets of data were analyzed including a pair of total fluoroscopic dose per minute on A/B plane separately, a pair of DAP Dose per minute on A/B plane separately and a pair of air kerma (AK) Dose per minute on A/B plane separately. All of them indicating a significant difference between the doses per minute in the initial and the last session except for the total fluoroscopic dose on the A plane.

**CONCLUSION:** Due to the function of automatic exposure control during fluoroscopy, successive Onyx embolization procedures could increase the fluoroscopic radiation doses for multi-stage brain AVM embolization. Active use of collimation with less magnificent may help prevent inadvertent radiation exposure burden.

**SE 11 NR(NI)-18**

**Non-invasive assessment of collateral flow using vessel-selective ASL perfusion in patients with steno-occlusive disease**

Eunjung Lee$^1$, Chul-Ho Sohn$^2$, Won-Sang Cho$^1$, Ji-hoon Kim$^1$, Seung Hong Choi$^1$, Young Dae Cho$^1$, Tae Jin Yun$^1$, Koung Mi Kang$^1$, Roh-Eul Yoo$^1$, Sang Won Cho$^1$, Dong Jae Shin$^1$

$^1$Seoul National University Hospital, $^2$Seoul National University College of Medicine, Korea. 903lej@naver.com

**PURPOSE:** For revascularization surgery in patient with moyamoya disease, digital subtraction angiography (DSA) is used as gold standard to evaluate the existence and the amount of transdural blood flow in preoperative period, and the patency and the amount of bypass flow in postoperative period, despite the invasiveness of the DSA. Our purpose was to evaluate the diagnostic performance of vessel-selective arterial spin labeling (VS-ASL) perfusion magnetic resonance (MR) imaging in identifying transdural blood flow using DSA as the criterion standard.
### Neuroradiology-Informal Scientific Presentation

<table>
<thead>
<tr>
<th>Presenting No.</th>
<th>Final Abstract No.</th>
<th>Title</th>
<th>Presenting Author</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISP 02_NR 01</td>
<td>SE 09 NR-04</td>
<td>Clinical experience of synthetic MRI as routine protocol in the daily practice: a single-center pilot study</td>
<td>Kyeong Hwa Ryu</td>
<td>555</td>
</tr>
<tr>
<td>ISP 02_NR 02</td>
<td>SE 09 NR-05</td>
<td>Initial clinical experience with dual-layer detector spectral CT in patients with acute intracerebral hemorrhage: a single-center pilot study</td>
<td>Hye Jin Baek</td>
<td>555</td>
</tr>
<tr>
<td>ISP 02_NR 03</td>
<td>SE 09 NR-17</td>
<td>High resolution vessel wall MR imaging in the diagnosis and follow-up of intracranial vertebral artery dissection</td>
<td>Young Jin Heo</td>
<td>560</td>
</tr>
<tr>
<td>ISP 03_NR 01</td>
<td>SE 09 NR-21</td>
<td>Determining the pathology of an intradural extramedullary spinal tumor from location on MR imaging</td>
<td>Tileujan Khanat</td>
<td>562</td>
</tr>
<tr>
<td>ISP 03_NR 02</td>
<td>SE 09 NR-26</td>
<td>Distinction between mixed post-RT necrosis and recurred tumor on perfusion MRI with pathological correlation</td>
<td>Tae Kun Kim</td>
<td>564</td>
</tr>
<tr>
<td>ISP 03_NR 04</td>
<td>SE 09 NR-28</td>
<td>Pilocytic astrocytoma: variable imaging manifestation and differential diagnosis</td>
<td>Yubin Lee</td>
<td>565</td>
</tr>
<tr>
<td>ISP 04_NR 01</td>
<td>SE 09 NR-31</td>
<td>Imaging of intracranial lesions mimicking brain tumors</td>
<td>Jong Hyeon Kim</td>
<td>567</td>
</tr>
<tr>
<td>ISP 04_NR 02</td>
<td>SE 09 NR-38</td>
<td>The pearls and pitfalls in arterial spin-labeling (ASL)-MRI in various intracranial pathologic condition</td>
<td>Aleum Lee</td>
<td>570</td>
</tr>
<tr>
<td>ISP 04_NR 04</td>
<td>SE 09 NR-45</td>
<td>MP RAGE and SNAP imaging can increase the detection rate of intraplaque hemorrhage: evaluation of the diagnostic performance</td>
<td>Jung hun Lee</td>
<td>573</td>
</tr>
<tr>
<td>ISP 05_NR 01</td>
<td>SE 09 NR-47</td>
<td>The role of 3D heavily T2-weighted MR myelography in the detection and evaluation of treatment response in the patients with CSF leak</td>
<td>Da Mi Kim</td>
<td>574</td>
</tr>
<tr>
<td>ISP 05_NR 02</td>
<td>SE 09 NR-54</td>
<td>Role of brain MRI in evaluation of neurological manifestations in HIV patients</td>
<td>Nikita Khobragade</td>
<td>576</td>
</tr>
<tr>
<td>ISP 05_NR 03</td>
<td>SE 09 NR-65</td>
<td>Perfusion abnormality during periictal period in patients with seizure: evaluation with arterial spin labeling perfusion MR imaging</td>
<td>Dae Seob Choi</td>
<td>581</td>
</tr>
<tr>
<td>ISP 01_NR(HN) 01</td>
<td>SE 10 NR(HN)-09</td>
<td>Imaging findings of proatlantal intersegmental artery versus persistent hypoglossal artery</td>
<td>In Ho Lee</td>
<td>589</td>
</tr>
<tr>
<td>ISP 01_NR(HN) 02</td>
<td>SE 10 NR(HN)-10</td>
<td>CT of vagal schwannoma</td>
<td>Abhishek Kotwal</td>
<td>590</td>
</tr>
<tr>
<td>ISP 01_NR(HN) 03</td>
<td>SE 10 NR(HN)-14</td>
<td>Unusual parotid lesions: a pictorial review</td>
<td>M. Sarthak Swarup</td>
<td>592</td>
</tr>
<tr>
<td>ISP 01_NR(HN) 04</td>
<td>SE 10 NR(HN)-15</td>
<td>Pediatric parotid and periparotid lesions: a pictorial review</td>
<td>M. Sarthak Swarup</td>
<td>593</td>
</tr>
<tr>
<td>ISP 01_NR(HN)/ TH 01</td>
<td>SE 10 NR(HN)-23</td>
<td>Imaging findings of non-bifurcating cervical carotid artery</td>
<td>Hye Seon Kang</td>
<td>598</td>
</tr>
<tr>
<td>ISP 01_NR(HN)/ TH 02</td>
<td>SE 10 NR(HN)-26</td>
<td>Role of multidetector CT in evaluation of jaw lesions</td>
<td>Biswanath Sahu</td>
<td>599</td>
</tr>
<tr>
<td>Presenting No.</td>
<td>Final Abstract No.</td>
<td>Title</td>
<td>Presenting Author</td>
<td>Page No.</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
</tr>
<tr>
<td>ISP 06_NR 01</td>
<td>SE 11 NR(NI)-02</td>
<td>Various imaging manifestations of post-endovascular thrombectomy cerebral hyperdensities (PCHD) in ischemic stroke patients. Is it contrast staining or intracranial haemorrhage?</td>
<td>Andrew Makmur</td>
<td>601</td>
</tr>
<tr>
<td>ISP 06_NR 02</td>
<td>SE 11 NR(NI)-03</td>
<td>Emergency carotid artery stenting in patients with acute ischemic stroke due to tandem occlusion: a single-center experience</td>
<td>Sung Eun Park</td>
<td>601</td>
</tr>
<tr>
<td>ISP 06_NR 03</td>
<td>SE 11 NR(NI)-05</td>
<td>Usefulness of high resolution PD image for follow-up after stent-assisted coiling for intracranial aneurysms</td>
<td>Sang Hyeon Kim</td>
<td>602</td>
</tr>
<tr>
<td>ISP 06_NR 04</td>
<td>SE 11 NR(NI)-06</td>
<td>Persistent trigeminal artery: a pictorial review</td>
<td>Ga Young Lee</td>
<td>603</td>
</tr>
<tr>
<td>ISP 07_NR(NI) 01</td>
<td>SE 11 NR(NI)-07</td>
<td>Initial single center experience with newly introduced distal access guiding catheter: clinical efficacy and safety in the treatment of coil embolization</td>
<td>Su Young Yun</td>
<td>603</td>
</tr>
<tr>
<td>ISP 07_NR(NI) 02</td>
<td>SE 11 NR(NI)-10</td>
<td>The results of endovascular and medical treatment of acute ischemic stroke with occlusion of proximal internal carotid artery: single center experience</td>
<td>Yoon Seok Choi</td>
<td>604</td>
</tr>
<tr>
<td>ISP 07_NR(NI) 03</td>
<td>SE 11 NR(NI)-11</td>
<td>Early rebleeding after coiling for ruptured cerebral aneurysm and the value of 3D rotational angiography as a predictor of rebleeding</td>
<td>Dasom Kim</td>
<td>604</td>
</tr>
<tr>
<td>ISP 07_NR(NI) 04</td>
<td>SE 11 NR(NI)-12</td>
<td>Comparison of stent thrombectomy and suction thrombectomy for treatment in patients with acute ischemic stroke with Basilar artery occlusion: single center experience</td>
<td>Jungwon Park</td>
<td>605</td>
</tr>
</tbody>
</table>