

1-A-1

Surgical Management of AVMs

○ Michael T. Lawton

Barrow Neurological Institute

Microsurgical resection is the first-line therapy or criterion standard for many brain arteriovenous malformations because of its high cure rate, low complication rate, and immediacy. Surgical results have improved with time with the following: 1) the creation of grading systems to select patients likely to experience optimal outcomes; 2) the development of instruments like bipolar forceps and AVM microclips that coagulate or occlude feeding arteries effectively; 3) the recognition of AVM subtypes that help decipher AVM anatomy; and 4) the refinement of surgical approaches, strategies, and dissection techniques that facilitate safe AVM resection. This impressive evolution of AVM surgery is at odds with the finding of A Randomized Trial of Unruptured Brain Arteriovenous Malformations (ARUBA) that medical management alone was superior to interventional therapy for the prevention of death or stroke in patients with unruptured AVMs followed for 33 months.

1-A-2

30 years and 500 AVM surgeries later. What have we learnt?

○ Jafar J. Jafar

NYU Neurosurgery Associates

TBA

1-A-3

Withdrawn

1-A-4

Surgical treatment of cerebral AVMs in the speech area: experience on 63 patients

○ Alberto Pasqualin¹, Pietro Meneghelli¹, Piergiuseppe Zampieri²

¹Section of Vascular Neurosurgery, Institute of Neurosurgery, Verona University and City Hospital,

²Service of Neuroradiology, Verona University and City Hospital

The indication to surgical treatment of AVMs located in the speech area remains controversial. The old concept of “essential” speech areas has been revolutionized by recent advances in tractography and by growing surgical experience in direct cortical stimulation. In this study, we have evaluated the results of surgical treatment in 63 patients with AVMs located in the speech area. 30 patients presented with intracranial hemorrhage, 29 with epilepsy and 4 were admitted for other causes. The AVM was located in the area of Broca or in the frontal operculum (central and posterior part) in 20 cases, in the inferior parietal lobule in 8 cases, in the superior temporal gyrus (central and posterior part) or in the temporal operculum in 27 cases, and in the insular region in 8 cases. In the last years, all cases were evaluated (preoperatively) with fMRI and/or tractography. 28 patients with large AVMs were operated on after embolization. 7 patients had been previously treated with Gamma Knife (and 5 out of 7 also submitted to embolization). When evaluating surgical morbidity, patients with ruptured AVMs were separated from patients with unruptured AVMs; moreover, each group was divided into 3 sub-groups, according to AVM volume. In patients with ruptured AVMs, morbidity was influenced (in many cases) by pre-existing deficits, regardless of AVM volume; transient deficits were observed in 20% of cases; “de novo” deficits occurred in 3 cases (all with large AVMs). In patients with unruptured AVMs, transient postop deficits were observed only for AVMs larger than 10 cc. In conclusion, this surgical series shows that removal of AVMs located in the speech areas is associated with low morbidity, possibly due to the extension, complexity and vicarious function of the various speech areas and white matter tracts. Patients with AVMs under 20 cc can be treated with low risk; above this volume, treatment of AVMs in the speech area remains controversial, owing to the possibility of hyperemic complications, not always avoided through preoperative embolization.

1-A-5

Withdrawn

1-A-6

SURGICAL TREATMENT OF BRAIN ARTERIOVENOUS MALFORMATIONS WITH SPECIAL REFERENCE TO PREVENTION OF COMPLICATIONS

○ Renato Juan Galzio, Mattia Del Maestro

University of L'Aquila, Me.S.V.A. Department

Background: brain arteriovenous malformations (AVMs) are complex, dynamic lesions with a potentially severe natural history. Treatment options include microsurgery, endovascular embolization and radiosurgery. These modalities may be used alone or in various types of combinations for high-grade ones.

Materials and Methods: from September 2009 to March 2017, 89 patients harboring AVMs were admitted to our Department. All patients underwent digital subtraction angiography and MRI with angio-MRI sequences. Functional MRI was performed in all patients with AVMs in eloquent areas. Neurophysiological intraoperative monitoring was performed in selected cases. All the cases were retrospectively reviewed mainly focusing on technical challenges and outcome.

Results: Of the 89 patients with, 52 were male and the mean age was 36,7 years; 51 AVMs were ruptured. All AVMs with size < 3 cm superficially located in non eloquent area (SM grade 1-2) were treated by microsurgery. AVMs with size < 3 cm located in eloquent area (SM grade 2-3), unruptured and asymptomatic, were preferentially sent to radiosurgery. AVMs with size < 3 cm superficially located in eloquent area (SM grade 2-3), if symptomatic, were preferentially treated by microsurgery, eventually associated to preoperative embolization. AVMs with size > 3 cm (SM grade 3-4-5), were essentially treated with staged embolization and final microsurgery. Postoperative residuals were treated by microsurgery if easy to be accessed or by radiosurgery if deeply located. A good overall outcome (mRS 0-2) was achieved in grade 1 and 2 AVMs, two cases of worsening not limiting the day life in two cases of SM grade 4-5 AVMs and stability or amelioration of clinical situation in all other unruptured AVM.

Conclusions: the ideal treatment of AVMs is their complete eradication and surgery remains the gold standard in most instances to achieve this goal. Partial treatment of AVMs is not helpful and on the contrary may enhance the risk of bleeding. It is necessary to complete the treatment in any case and, if not possible, it is better not to treat at all; this is especially true for unruptured AVMs in not symptomatic patients. Prevention of complications requires a careful preoperative planning and specific surgical skills.

1-A-7

Microsurgical Clipping Techniques and Outcomes for Paraclinoid Internal Carotid Artery Aneurysms

○ Tomoya Kamide, Yuichiro Kikkawa, Kouichi Uramaru, Shunsuke Ikeda, Kaima Suzuki, Ririko Takeda, Hiroki Kurita

Saitama medical university International medical Center

Background: Microsurgical clipping of paraclinoid aneurysms presents unique technical challenges due to the anatomical complexity of the paraclinoid region.

Objective: To analyze microsurgical clipping techniques, complications, and outcomes associated with paraclinoid aneurysms, with a focus on clip selection and clipping technique according to aneurysm location.

Methods: From 2011 to 2017, 67 paraclinoid aneurysms were treated using microsurgical clipping. We retrospectively reviewed patient records to analyze clinical outcomes.

Results: Thirty-four aneurysms (50.7%) were treated with simple clipping. Among them, fenestrated clips were used with superior hypophyseal artery (SHA) aneurysms, and curved clips were used with dorsal carotid artery aneurysm. 33 aneurysms (49.3%) were treated using multiple clips, including tandem angled fenestrated clipping for SHA and ventral carotid aneurysms, stacked clipping for dorsal carotid aneurysms, and various techniques for other aneurysms. 2 aneurysms were treated with endovascular surgery and postoperative 3D-CT angiography demonstrated complete obliteration in all aneurysms.

3 cases (4.5%) showed new postoperative infarction and 16 cases (23.9%) showed new postoperative visual deficits.

Conclusion: Surgical clipping of paraclinoid aneurysms is an excellent treatment modality with good clinical outcomes and acceptable complication rates. Appropriate clip selection and clipping techniques are required to perform complete and safe clipping.

1-A-8

Why we had to do a Consensus Conference on AVM treatment

○ Marco Cenzato¹, Edoardo Boccardi²

¹Department of Neurosurgery - Ospedale Niguarda - Milano Italy,

²Department of Neuroradiology - Ospedale Niguarda - Milano Italy

In 2014, ARUBA, a randomized trial comparing interventional therapy and medical management of unruptured brain arteriovenous malformations (uBAVMs) concluded that the natural history of uBAVMs is better than any form of treatment. This may have resulted, intentionally or by chance, in significantly altered treatment decisions for uBAVMs. Although the ARUBA Study is internally valid, it has been the object of many criticisms by the scientific community because of its perceived lack of external validity as these conclusions are not shared by most of the physicians who treat uBAVMs. Thus it was widely felt that there was the need to overcome the dilemma created by the publication of this study.

For this reason, we decided to carry out in December 2016, in Milan Italy, a Consensus Conference on unruptured AVM treatment, involving 24 members of the three European societies dealing with the treatment of cerebral AVMs (EANS, ESMINT, and EGKS). The panel made the following statements and general recommendations:

- 1) Brain arteriovenous malformation (AVM) is a complex disease associated with potentially severe natural history;
- 2) The results of a randomized trial (ARUBA) cannot be applied equally for all unruptured brain arteriovenous malformation (uBAVM) and for all treatment modalities;
- 3) Considering the multiple treatment modalities available, patients with uBAVMs should be evaluated by an interdisciplinary neurovascular team consisting of neurosurgeons, neurointerventionalists, radiosurgeons, and neurologists experienced in the diagnosis and treatment of brain AVM;
- 4) Balancing the risk of hemorrhage and the associated restrictions of everyday activities related to untreated unruptured AVMs against the risk of treatment, there are sufficient indications to treat unruptured AVMs grade 1 and 2 (Spetzler-Martin);
- 5) There may be indications for treating patients with higher grades, based on a case-to-case consensus decision of the experienced team;
- 6) If treatment is indicated, the primary strategy should be defined by the multidisciplinary team prior to the beginning of the treatment and should aim at complete eradication of the uBAVM;
- 7) After having considered the pros and cons of a randomized trial vs. a registry, the panel proposed a prospective European Multidisciplinary Registry.

1-A-9

Surgical Management of Complex Aneurysms

○ Michael T Lawton

Barrow Neurological Institute

a. Complex aneurysms include those with a wide neck, large or giant dome, intra-saccular thrombosis, calcification, non-saccular morphology, recurrence after endovascular therapy. This subset of aneurysms requires more advanced techniques. Advanced clipping techniques include stacked clips, intersecting clips, overlapping clips, tandem clipping, and fenestrated clipping. Thrombotic aneurysms may require thrombectomy. Certain aneurysms are unclippable and require bypass and trapping. Bypass surgery for brain aneurysms is evolving from extracranial-intracranial (EC-IC) to intracranial-intracranial (IC-IC) bypasses that reanastomose parent arteries, revascularize efferent branches with in situ donor arteries or reimplantation, and reconstruct bifurcated anatomy with grafts that are entirely intracranial. IC-IC bypasses compare favorably to EC-IC bypasses in terms of aneurysm obliteration rates, bypass patency rates, and neurological outcomes. IC-IC bypasses can be more technically challenging to perform, but they do not require harvest of extracranial donor arteries, spare patients a neck incision, shorten interposition grafts, are protected inside the cranium, use caliber-matched donor and recipient arteries, and are not associated with ischemic complications during temporary arterial occlusions. IC-IC bypass can replace conventional EC-IC bypass with more anatomic reconstructions for selected aneurysms involving the middle cerebral artery, posteroinferior cerebellar artery, anterior cerebral artery, and basilar apex.

1-A-10

Surgery of Complex Difficult Aneurysms not Amenable to Endovascular Treatment

○ Takanori Fukushima

Duke University Medical Center Carolina Neuroscience Institute

In recent years, endovascular treatment of cerebral aneurysms has been popularized due to patient's fears of open craniotomy surgeries, nonsurgical endovascular advertisements promoting minimally invasive use of catheters, micro guide wires, coils and stents as well as aggressive marketing of catheter-coil companies towards all medical communities. Operative management by the hands of expert cerebrovascular surgeons will provide a one-time cure with negligible mortality and morbidity. The risks of microsurgical clipping for Class A regular aneurysms are in the 1-2% range. Even for Class B moderately difficult aneurysms, microsurgical clipping will carry 2-3% risks. Microsurgical direct clipping of the aneurysm will provide a very high total occlusion rate, as good as 99%. Whereas, endovascular treatment, according to the available literature, provides only 50-60% complete obliteration rate with 5-10% morbidity and mortality. For Class C-D category aneurysms, endovascular coiling or stenting demonstrates a much less obliteration rate and a much higher complication rate. In my personal surgical experience of over 2000 cases of cerebral aneurysms, a quarter (25%), 500 cases had C-D category, Complex-Difficult aneurysms: 220 cases of Giant Aneurysms, 240 cases of cavernous sinus and pericavernous aneurysms and 40 cases of fusiform aneurysms. The operative techniques, tricks and strategies for microsurgical direct repair of difficult and giant aneurysms will be presented. Various bypass vascular reconstruction procedures and use of specially designed clips and keyhole appliers will be discussed.

1-A-11

Operating technology of complex aneurysm

○ Jiajia Zheng

Shanghai Punan Hospital

Complex aneurysms such as fusiform and large aneurysms are challenging in neurovascular and endovascular surgery. A retrospective study was made of 5 patients who were treated for cerebral aneurysm. The aneurysms were located in the internal carotid artery (ICA) and in the middle cerebral artery (MCA) respectively. After making a definite diagnosis, based on an overall consideration of the symptom, location, size of the aneurysm, the proper operating technology were analyzed, including the precautions against operation threat, the selection of surgical instruments and the application of surgical equipment. The operative procedures, the general complications and the postoperative results were investigated.

1-A-12

Giant aneurisms : surgery, embolization or observation?

○ Eka J. Wahjoprmono, Yesaya, Julius, Harsan, Lutfi, Binsar, Made, Ferry, Firdaus, Evelyn, Ronny, Maximilan, Eko, Onnie, Wily, Gde, Donny, Bagus

Faculty of Medicine - Pelita Harapan University, Neuroscience Center – Neurosurgery Department - Siloam Hospitals

Giant aneurism is an intracranial aneurism which size is larger than 25 mm in diameter. This lesion occurred for about 5% of all intracranial aneurism. Giant aneurism can be in saccular or fusiform shape. The pathognomonic findings of giant aneurism are: Broadening of parent artery, splaying branch vessel at the neck, atherosclerosis and calcification within the neck and fundus, and mural thrombus. The annual risk of rupture for giant aneurism mainly depend on its location. The decision to treat giant aneurism depends on : age, location and type, mass effect, clinical presentation, clinical symptom and future stenosis of parent artery. The choices of treatment are : conservative, surgery or embolization.

The authors report for 93 cases of giant aneurisms that underwent treatment in Siloam Hospital during 1998 until now. Direct clipping was performed in 71 patients while 22 patients underwent embolization. The common location are the ICA and MCA with 30 cases each. While 18 giant aneurisms located in ACA and 15 cases with basilar artery giant aneurisms.

The authors describe 15 cases of giant aneurisms with its clinical symptom and the exact time and condition to choose between observation, surgery or embolization, and also discuss the surgical approaches and techniques to treat the lesion safely.

1-A-13

Avoidance and Management of Complications in Aneurysms Surgery

○Gerardo Dizon LEGASPI

TBA

1-A-14

Current Trends in Management of Poor Grade Subarachnoid Hemorrhage in Japan. Post Hoc Analysis of Study for the Modified WFNS SAH Grading System

○Hitoshi Kobata¹, Akira Sato², Yoko Kato³, Hirotohi Sano⁴

¹Dept Neurosurgery, Osaka Mishima Emergency Critical Care Center,

²Dept Neurosurgery, Tokyo Kyosai Hospital,

³Dept Neurosurgery, Banbuntane Hotokukai Hospital,

⁴Dept Neurosurgery, Shinkawabashi Hospital

Background and Purpose: Outcome of patients with subarachnoid hemorrhage (SAH) primarily depends on the neurological severity and thus the treatment strategy for cases with low Glasgow Coma Scale (GCS) on arrival has been controversial. We sought to evaluate current treatment trends for SAH patients classified as Grade 5 World Federation of Neurosurgical Societies (WFNS) in order to identify potentially salvageable patients, especially in relation to GCS score.

Methods: A post hoc analysis of Study for the modified WFNS SAH Grading System was performed to evaluate the current treatment strategy outcome of WFNS Grade 5 patients. Baseline characteristics were summarized as number (%) for categorical variables and compared using chi-square or Fisher exact tests, where appropriate. Continuous variables were summarized using the mean and standard deviation, and compared using unpaired Student t tests. All tests were two-sided, with $p < 0.05$ indicating a statistically significant difference. Analysis was performed using JMP, version 11.2.

Results: Out of 1638 patients in whom aneurysm treatment and outcome at discharge were described, 472 (men/women = 161/311, age 67.0 ± 14.0) were classified as WFNS Grade 5 (230 GCS 3, 88 GCS 4, 61 GCS 5, and 93 GCS 6, respectively) on arrival with a median time after onset of 2 hours. Surgical clipping or intravascular intervention was performed in 94 (49%), 51 (58%), 39 (64%), and 73 (78%) for GCS 3, 4, 5, and 6 patients, respectively. The favorable outcome (good recovery or moderate disability at discharge) for patients who underwent aneurysm treatment was 20.2%, 33.3%, 33.3%, and 26.0%, for GCS 3, 4, 5, and 6 patients, respectively ($p = 0.250$). When the patients without aneurysm treatment were included, a favorable outcome was 10.4%, 20.5%, 23.0%, and 20.4%, respectively ($p = 0.004$). Favorable outcome was 4.5% ($p < 0.0001$) for patients showing bilaterally dilated pupils and 1.6% for those who presented with cardiac arrest ($p = 0.0004$).

Conclusion: There was no difference in outcome between patients with GCS scores ranging from 3 to 6 when aneurysm treatment was indicated, while the presence of pupillary dilatation and cardiac arrest were significant prognostic indicators.

1-A-15

Use of Adenosine in cerebral aneurysms treatment

○ Juha Hernesniemi, Patcharin Intarakhao, Peeraphong Thiarawat, Danil Kozyrev, Mario Teo, Joham Choque-Velasquez, Teemu Luostarinen, Behnam Rezai Jahromi

Department of Neurosurgery, Helsinki University Hospital and University of Helsinki, Finland

Objective: The purpose of this study is to analyze the impact of adenosine-induced cardiac arrest (AiCA) on the temporary clipping (TC) and postoperative cerebral infarction rate among patients with intracranial aneurysm surgery.

Methods: In this matched retrospective cohort study, we identified 65 patients who received

adenosine for decompression of aneurysms during microsurgical clipping (group A). For group B,

we randomly matched and selected 65 patients who underwent clipping but did not receive adeno-

sine during surgery. The matching criteria included age, Fisher's grade, aneurysm size, rupture status, and location of aneurysms. Our primary outcome was the TC time and postoperative infarction rate. The secondary outcome was an incidence of intraoperative aneurysm rupture (IAR).

Results: For group A, 40 patients were clipped with AiCA alone and 25 (38%) patients using AiCA combined with TC. Comparing with group B, we clipped under the protection of TC in 60 (92%) patients (OR 0.052, 95% CI 0.018-0.147, $p < 0.001$). Group A required less TC time (2 min 4 sec vs 4 min 46 sec, $p < 0.001$). Postoperative lacunar infarction was equal in both group (6.2%). There was insignificant between-group difference in the incidence of IAR (group A 1.5% vs group B 6.1%, OR 0.238, 95% CI 0.026-2.192, $p = 0.171$). **Conclusion:** AiCA is a useful technique for microneurosurgical treatment of cerebral aneurysms. We found that AiCA can minimize the use of TC, and does not increase the risk of IAR and postoperative infarction.

1-A-16

Advanced Digital Technologies, Simulation and Virtual reality in brain surgery: patient engagement, surgical planning, education, and intraoperative use

○ Joshua Bederson

The Mount Sinai Hospital

TBA

1-A-17

Impact of introduction of gamma knife Radiosurgery in the management of cerebral AVMs

○ Abdessamad El Ouahabi

Department of Neurosurgery, Hopital des Specialites, Ibn Sina University Medical Center, Rabat

Introduction :

Several protocols are proposed for the treatment of cerebral AVM : microsurgery, endovascular embolization, radiosurgery or the combination of these methods.

Objective :

The objective of this study is to assess the influence of the introduction of radiosurgery in our department on our daily practice and evaluate the results in the management of cerebral AVM.

Material and Method :

We report a prospective study of 418 patients with cerebral AVM divided in 2 groups : preradiosurgical in a group consisting of 73 patients who were managed between 1993-2007 either by microsurgery (24 cases) or endovascular embolization (27 patients) or received no treatment (22 patients).

The second group of patients with 345 cases, were treated with gamma Knife radiosurgery between 2008 and 2014 and the 2 groups are compared regarding mortality, morbidity and the quality of exclusion of the AVM.

Results :

The incidence of cerebral AVM in our department increase from 48 cases per year to 49 cases per year in the radiosurgical area.

In the preradiosurgical series, 69% of patients presented with hemorrhage, 26% with seizures, AVM were grade II of Spetzler-Martin in 29,2%, grade III of Spetzler-Martin in 38,9%.

At follow-up : Microsurgery achieved good result in 91,6% of Spetzler grade II and III, with 4,1% of mortality (1 case in grade III) and 6,84 of morbidity. Total exclusion of the AVM is achieved in 95,8% in post-op angiographic control.

In endovascular group, mortality was 6,9% and morbidity 13,8%. Total occlusion of the AVM is achieved in only 10,2%.

In the radiosurgical group at one year up, there is a significant reduction in extranidal flow in 85,7% of the case with no mortality and very low morbidity (7% of seizure and 5% of prelesional edema).

There is however 1,7% of bleeding rate.

Conclusion :

The introduction of radiosurgery had an emulating effect on the incidence of the AVM in our department.

Radiosurgery by gamma knife is an effective treatment strategy leading to progressive obliteration of the AVM with low morbidity.

Microsurgery with embolization remains an important treatment option in grade I, II and III of spetzler-Martin and in cases of compressive hematoma and with combination of other methods in grade IV and V.

1-A-18

Withdrawn

1-A-19

Clinical Trials and the Cerebrovascular Research Center of the Future

○ J Mocco

Mount Sinai Health System

We will present our experience in developing a robust clinical trials network specializing in Cerebrovascular Disease in a large urban environment, New York City. By creating synergy with clinical and research centers of excellence, we have established a research infrastructure that currently employs 15 full time clinical research staff, running 28 ongoing site-based clinical trials and serving as the data coordinating center for four ongoing multi-center trials. This presentation will provide meeting participants an opportunity to extrapolate from this successful experience to inform their own efforts at developing a robust clinical trials research effort.

1-A-20

Withdrawn

1-B-1

Microsurgical Flow Diversion for Cure of Giant Aneurysms: 140 Cases of High Flow Skull Base Bypass

○ Takanori Fukushima

Duke University Medical Center, Carolina Neuroscience Institute

Fukushima elaborated on practical microsurgical anatomy around the cavernous sinus and established the concept of multiple triangular operative corridors to the cavernous sinus in 1986. In 1990, Spetzler reported about Fukushima's Skull Base Cavernous Sinus interposition saphenous vein graft and named the technique as "The Fukushima Bypass." Fukushima's skull base bypasses are classified into 5 groups: Skull Base Bypass I (petrous segment of IC (C6) to para-ophthalmic segment (C2 or C3), Skull Base Bypass II (high cervical segment of IC or EC to C6), Skull Base Bypass III (high cervical segment of IC or EC to paraophthalmic segment of IC), Skull Base Bypass IV (External Carotid to M2) and Skull Base Bypass V (EC to P2)

These bypass techniques of the carotid artery being replaced by the saphenous vein have been applied to over 140 cases of various lesions including cavernous giant aneurysms, tumors engulfing the carotid artery, IC stenosis and CCF for over three decades.

"Fukushima bypasses" have been performed on 81 cases (58%) of proximal IC and intracavernous giant aneurysms, 28 cases (20%) of tumors (meningioma, pituitary tumor, glomus tumors, and malignant tumors) and other cases (infratemporal, P2 bypass, etc).

Indications of Skull Base Saphenous Bypass, details of operative approaches and techniques as well as complication avoidance will be presented with slides and videos.

1-B-2

Flow-based Approach to Bypass for Aneurysms

○ Sepideh Amin Hanjani

Introduction

Cerebral revascularization using extracranial- intracranial (EC-IC) bypass continues to be an important surgical option for flow replacement in the setting of planned vessel sacrifice. Blood flow measurements can be extremely valuable in decision-making regarding revascularization strategy and in follow-up monitoring.

Methods

Direct intraoperative vessel flow measurements during bypass surgery can be performed using a quantitative ultrasonic microvascular flow probe. Similarly, direct vessel flow measurements using quantitative magnetic resonance angiography (QMRA) are feasible in the perioperative setting.

Results/Techniques

In bypass for flow replacement in the setting of complex aneurysms requiring vessel sacrifice, flow measurements can be used to directly determine the flow deficit resulting from planned vessel occlusion, and to assess the adequacy of in situ donor vessels, to match supply to demand. Following completion of the bypass, flow measurements confirm the patency and adequacy of the graft. Postoperatively, QMRA imaging allows determination of graft flow and allows for serial monitoring of graft function over time in a noninvasive fashion.

Conclusion

Blood flow measurement techniques including direct intraoperative flow probe measurements and QMRA are useful tools in cerebral revascularization surgery.

1-B-3

Cerebrovascular Bypass in Challenging Cases with Limited Alternatives

○ Mustafa Baskaya

Professor of Neurological Surgery Director of Skull Base Surgery Program University of Wisconsin-Madison

Cerebral revascularization is a life-saving procedure for the treatment of cerebral occlusive diseases and complex/giant intracranial aneurysms. Several arteries are commonly used as a vascular graft for bypass surgery. These vascular grafts are mainly the superficial temporal artery, the radial artery, the saphenous vein, superior thyroidal artery, and the occipital artery. However, these arteries may not be available or sufficient due to patient-related conditions. The grafts' vitality and sizes may show variability according to the comorbid systemic diseases and focal vascular pathologies. These clinical situations decrease the number of graft options, limits the donor graft alternatives and complicates the surgery. In the lack of the desired first option graft and subsequent grafts, either it can be entered into a new search preoperatively or improvised solutions during operation may be produced. IN this presentation, multiple cases of cerebrovascular bypass with limited bypass conduit alternatives will be demonstrated.

1-B-4

Bypass Surgery

○ Michael T Lawton

Barrow Neurological Institute

a. Bypass surgery may be used in the setting of unclippable aneurysms, ischemic disease, and oncologic disease. Bypass surgery for brain aneurysms is evolving from extracranial-intracranial (EC-IC) to intracranial-intracranial (IC-IC) bypasses that reanastomose parent arteries, revascularize efferent branches with in situ donor arteries or reimplantation, and reconstruct bifurcated anatomy with grafts that are entirely intracranial. IC-IC bypasses compare favorably to EC-IC bypasses in terms of aneurysm obliteration rates, bypass patency rates, and neurological outcomes. IC-IC bypasses can be more technically challenging to perform, but they do not require harvest of extracranial donor arteries, spare patients a neck incision, shorten interposition grafts, are protected inside the cranium, use caliber-matched donor and recipient arteries, and are not associated with ischemic complications during temporary arterial occlusions. IC-IC bypass can replace conventional EC-IC bypass with more anatomic reconstructions for selected aneurysms involving the middle cerebral artery, posteroinferior cerebellar artery, anterior cerebral artery, and basilar apex. Although most ischemic strokes are thromboembolic in origin and their management is endovascular or medical, some are haemodynamic in origin and their management may be surgical. Bypass surgery for the prevention of ischemic stroke is safe and elegant techniques have been developed. Patients with athero-occlusive disease, ischemic symptoms and haemodynamic insufficiency have significant risk of stroke if managed medically or left untreated. However, surgical intervention lacks supporting evidence from the recent Carotid occlusion Surgery Study (CoSS). Patients will be caught in a difficult position between a dismal natural history and an unproven surgical intervention. Clinicians must individualise their management until additional data are published or further consensus develops.

1-B-5

The ischemic vulnerability after early brain injury following subarachnoid hemorrhage – examination of second impact theory –

○ Kosuke Kumagai, Kazuya Fujii, Yutaro Yamamoto, Satoru Takeuchi, Satoshi Tomura, Terushige Toyooka, Arata Tomiyama, Naoki Otani, Kojiro Wada, Kentaro Mori

Department of Neurosurgery, National Defense Medical College, Saitama, Japan

OBJECTIVE: Recent studies have reported that several complications which include not only vasospasm but also early brain injury (EBI) and cortical spreading depression (CSD) may contribute multiply to poor morbidity and outcome after SAH. However, the ischemic vulnerability after EBI following SAH is poorly understood, although its existence has been suggested. Rat endovascular perforation model is considered the best mimic of human SAH, but this model is unsuited for studying DCI because of a poor control of bleeding and high mortality. Hence, we made the milder perforation model with lower peak intracranial pressure which can improve the mortality, and examined the ischemic vulnerability after EBI with using this model.

MATERIALS AND METHODS: Adult male SD rats weighing 300 to 400 g were used. Thirty-two rats were divided into the following groups: sham, the left common carotid artery ligated (LCAL), SAH and SAH+LCAL. The milder perforation model with lower peak intracranial pressure was made by using 6-0 prolene. The left common carotid artery was ligated at 24 hours after SAH induction in LCAL and SAH+LCAL groups. Neurological scores and histopathology (HE and Nissl staining) in both the cortex and the hippocampus were assessed on day 7.

RESULTS: In SAH+LCAL group compared with SAH group, neurological scores were deteriorated and the rate of normal neural cells was decreased in the cortex. On the contrary, although the rate of neural cells was decreased in the CA2 and CA3 in LCAL group, the rate was not decreased in SAH+LCAL group compared with SAH group.

CONCLUSIONS: Our results show that the ischemic vulnerability in the cortex and the ischemic tolerance in the CA2 and CA3 after EBI following SAH were suggested. Studying DCI with using the perforation model was considered to be difficulty, but this model will be supposed to make it possible.

1-B-6

Confocal laser endomicroscopy: a milestone journey from surgical microscopy to cellular surgery

○ Cleopatra Charalampaki

TBA

1-B-7

endoscopic assisted in the management of aneurysm surgery

○ VanHe Dong

TBA

1-B-8

Surgical treatment of unruptured MCA aneurysms with the use of intraoperative flowmetry

○ Alberto Pasqualin, Pietro Meneghelli, Giampietro Pinna, Francesco Sala

Section of Vascular Neurosurgery and Institute of Neurosurgery, Verona University and City Hospital

Surgical treatment of unruptured MCA aneurysms can be complicated by unfavourable anatomical features (morphology of the MCA division, incorporation of efferent branches, endoluminal thrombosis); in these cases intraoperative flowmetry should theoretically increase the safety of aneurysm exclusion. For this reason, we have evaluated the surgical outcome in a large series of patients with unruptured MCA aneurysms, mostly submitted to intraoperative flowmetry. 176 patients with unruptured MCA aneurysms were evaluated in this study; a total of 198 aneurysms were surgically treated. 29 aneurysms were located on the M1 tract, 157 on the main MCA division, and 16 more distally. Temporary clipping was performed in 81 patients (46%); intraoperative flowmetry was used in 111 patients (63%). Clinical outcome was evaluated through the modified Rankin Scale (mRS) at 3 months from surgery. Mean flow values recorded along the MCA were: a) 39.2 ± 16 ml/min on the M1 tract, b) 21 ± 10.6 ml/min of the M2 segments, c) 13.5 ± 5.6 ml/min on the M3 segments. The use of temporary clipping for less than 10 minutes was associated with a symptomatic stroke in 2 out of 70 patients, and for more than 10 minutes in 2 out of 11 patients ($p < 0.001$). Overall, 167 patients (95%) presented a favourable outcome (mRS 0-2); one patient died due to a severe coagulopathy. An unfavourable outcome (mRS 3-4) was observed in 3 patients with small or standard aneurysms (1.6% of cases) and in 2 patients with aneurysms larger than 15 mm (10% of cases). In conclusion, intraoperative flowmetry increases the safety in surgery of unruptured MCA aneurysms, particularly when the aneurysm has a complex morphology. Temporary clipping is safe if applied for less than 10 minutes (and distal to the lenticulo-striate arteries). The low morbidity observed in this series suggests a widening of surgical indications for unruptured MCA aneurysms.

1-B-9

hemicraniotomy for stroke

○ Ekkehard Kasper

TBA

1-B-10

The mechanical thrombectomy: is it a new hope for patient suffering from acute ischemic stroke?

○ Ittichai Sakarunchai

Division of Neurosurgery, Department of Surgery, Faculty of Medicine, Prince of Songkla University

Mechanical thrombectomy (MT) is one of the most benefit procedures for restoration arterial blood flow from the major cerebral arteries occlusion in acute ischemic stroke. Although the intravenous or intraarterial tissue plasminogen activator (tPA) have been establishing of treatment for long time ago, the optimize recanalization of large vessels is very low rate of success. In addition, the complication from intracerebral hemorrhage (ICH) is still high. Several literatures have reported the high effectiveness and low complication rate following MT using the stent retriever or aspirator system. Mechanical treatments include the use of catheters to directly deliver a clot-disrupting or retrieval device to a thrombus that is occluding a large cerebral artery. Most devices are used in cerebral vessels that are 2-5 mm. Mechanical thrombolytic devices can remove a clot in a few minute, whereas pharmaceutical thrombolytics, may take as long as 2 hours to dissolve a thrombus. The most recently developed devices, known as retrievable stents or stent retrievers, have shown higher recanalization rates and better outcomes comparing with medical alone. Since endovascular treatment will now become the standard of care in stroke therapy, hospitals need to be prepared to offer such therapies or be able to rapidly transfer the patient to a hospital that can provide them. Early identification of large vessel occlusion will be critical. Tertiary care centers are likely to obtain CTAs in all nearly all-acute stroke patients, treating with IV tPA in those patients that qualify as soon as the non-contrast CT head images are available. Then we can go on treatment with endovascular procedure. For our institute, we included 38 consecutive patients who diagnosed with acute occlusion of major arteries treated with stent retriever. We found 76% of patients were revealed for good recanalization (TICI 2b-3) and 68% was improved NIHSS score and achieve mRS to 0-2. The study was shown the better outcome than the treatment with medication alone.

1-B-11

Why and When Surgery is a Treatment Modality in Stroke Patients!

○ Erion Musabelliu¹, Yoko Kato², Masahiro Oomura³

¹Fellow Neurosurgeon at Patients in Health Care Clinic and Foundation,

²Neurosurgeon at Fujita Health University,

³Neurology and Neurosciences at Nagoya City University Graduate School of Medical Sciences

In addition to Surgical Techniques used as part of a Multidisciplinary Approach for The Treatment of Stroke, Progress in Novel Drug Therapies, Endovascular Methodology and Instrumentation have greatly reduced Stroke's morbidity and mortality.

Advancements in recombinant therapy and its applications in the discoveries of new drugs have resulted in safe production of a wide range of medications that are used for Stroke prophylaxis, with a narrower range of side effects. To the same extend is the successful applications of protocols for use of a group of medications during the acute phase of Stroke. Despite the successful discoveries of the new drugs, many patients do not benefit from these and remain moribund, if the least worse scenario is the case.

As many more tertiary institutions now provide Endovascular treatment for acute phase of Stroke, in addition to medical therapies and or as prophylaxis operational technique in diseases with high risk for thrombosis and or vascular dissections, their use is not without risks. Regretfully, majority of the population world wide does not have access to such services. Even when possible, their success is not complete and in many cases does not provide superiority against other modalities used to treat Stroke during acute phase.

Surgery, remains to date a procedure that can be considered as a sole modality of treatment or in combination with therapeutic and endovascular techniques, and it has fewer limitations for use compared with the last two options. It can be safely applied and its results, when chosen as the right modality have a better outcome and fewer side effects. It still remains a treatment option, with clearer indications and provides a wider range of time for application following the acute phase, compared with other treatment modalities used in Stroke.

Hesitating to use Surgery and favoring other treatment options will always provide biased results, rather knowing why and when to apply it will complete the protocol for the treatment modalities we have to date available to help patients with Stroke.

1-B-12

Application of multispectral imaging in vascular and tumor surgery using different fluorescent markers simultaneously

○ Cleopatra Charalampaki

TBA

1-B-13

Structural brain imaging of the posterior fossa: higher order tractography for the combined visualization of vascular and cranial nerve anatomy

○ Mojgan Hodaie

Division of Neurosurgery, Department of Surgery, University of Toronto

The posterior cranial fossa supports an intricate anatomical network that includes the cranial nerves, densely packed nuclei and white matter fibers within the substance of the brainstem as well as important surrounding vascular structures. Their confinement to a restricted anatomical space relative to the supratentorial compartment makes the conventional imaging of detailed structures and relationships of this area is difficult. Supplementation of higher order tractography can help in the detailed anatomical visualization of brainstem fiber tracts and cranial nerves. This can be combined with detailed vascular imaging for optimal anatomical resolution. The different aspects of diffusion tensor imaging, methods of higher tractography for the detailed visualization of white matter fibers and co-registration with vascular imaging will be discussed. Additionally, the relative value of each method and their contribution to surgical decision making will be reviewed.

1-B-14

Imagery vs. Vascular Anatomy in Stroke; What we don't see vs. What should we see!

○ Erion Musabelliu

Fellow Neurosurgeon at Partners in Health Care Clinic and Foundation

From the time of CT Scan and or MRI were introduced they continue to be perfected as machines. However, its another instrument, angiogram, that remains the gold standard in diagnosis of vascular diseases, and its the only instrument that can serve the Acute Phase of Stroke other than for diagnosis.

Learning and using angiography as an instrument has moved to a new stage, with now its adaptation in many Residency Programs in Neurosurgery for dual-training in Open and Endovascular Surgery. Parallel mastery of both streams and especially of angiogram beyond its role for diagnosis but more for its role in the treatment of vascular diseases, will bring medical treatment closer to state of the art and far from being biased.

It is important to know and use angiographs not only for diagnostic purposes, but more importantly in understanding the vascular anatomy from those images and the translations from 2-D to 3-D when studying imagery from patients suffering Stroke. It will help to better visualize in a 3-D format the vascular tree and then deduct what is missing and what should we see in a patient with Stroke from a non-contrast filling artery during the procedure.

Normal vascular anatomy, almost always remains the same in all patients, and will always be the best reference in what we should see in our image for normal 3-D compared with what we don't see in any case of Stroke. As such, using the norm as a reference we can predict what to expect in an angiography, and why what we see is different from what we should see.

1-B-15

Dual Channel Endoscopic Indocyanine Green Fluorescence Angiography for Clipping of Cerebral Aneurysms

○ Won-Sang CHO¹, Jeong Eun Kim¹, Su Hwan Lee¹, Kyung Hyun Kim¹, Choonghee Lee², Choonghee Shin²

¹Department of Neurosurgery, Seoul National University Hospital,

²Korea Electrotechnology Research Institute Russia Science Seoul Center, Seoul, Korea

OBJECTIVE: Neuroendoscopy is useful for assessing the status of perforators, parent arteries, and aneurysms beyond the straight line of microscopic view during aneurysm clipping. We aimed to evaluate the clinical usefulness of our endoscopic indocyanine green angiography (eICGA) system, which can simultaneously display both visible light and ICG fluorescent images.

METHODS: A total of 16 unruptured aneurysms in 10 patients were surgically clipped via the keyhole approach. Using our eICGA and commercial microscopic ICGA (mICGA) systems, a prospective comparison was performed in 10 targeted cerebral aneurysms at the posterior communicating (n = 4) and anterior choroidal arteries (n = 6).

RESULTS: mICGA and eICGA systems were all feasible during surgery. The mICGA could display 50% of branch orifices, 100% of branch trunks, and 20% of exact clip positions, while the eICGA system showed 100% of them. Based on eICGA findings such as incomplete clipping and compromise of parent arteries or branches, clips were repositioned in 2 cases, and additional clips were applied in 2 cases. Finally, complete occlusion and residual neck states were achieved in 6 and 4 aneurysms, respectively, after surgery. There were no neurological deficits within 3 months after surgery, except for frontalis palsy and anosmia in each patient.

CONCLUSIONS: The eICGA system with dual imaging of visible light and ICG fluorescence was very useful for assessing the geometry of aneurysms and surrounding vessels before clipping and for evaluating the completeness of clip position after clipping.

1-B-16

Hemodynamic Analysis of Cerebral Aneurysms ; Prediction of Thin-Walled-Area and Potential Rupture Risk

○ Yong Bae Kim¹, Ji Hun Choi², Kwang-Chun Cho³, Hyo Jae Jeon², Je Hoon Oh²

¹Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University College of Medicine,

²Department of Mechanical Engineering, Hanyang University,

³Department of Neurosurgery, Bundang Jeseang General Hospital

Background: Rupture of cerebral aneurysm occurs mainly in thin-walled areas (TWAs). Prediction of TWAs would aid in assessing risk of rupture and selecting appropriate treatment. TWAs are caused by a complex set of factors; however, existing prediction methods use only a single hemodynamic parameter (HP) obtained from computational fluid dynamics (CFD) to predict TWAs. In addition, identifying TWAs by the visual judgment of the clinician based on intraoperative image color are subjective.

Objective: To predict TWAs more exactly, defining combined hemodynamic parameter (CHP) newly and comparing predictions of TWAs using CHP with TWAs determined by the quantitative analysis of intraoperative image color.

Methods: A total of 21 unruptured cerebral aneurysms in 19 patients were analyzed. CHP was defined based on wall shear stress (WSS) and oscillatory shear index (OSI). Delta E was used to quantify color differences in intraoperative images.

Results: CFD analysis indicated that WSS and OSI were more predictive of TWAs than pressure ($P < .001$, $P = .187$, $P = .970$, respectively); these two parameters were selected to define CHP. Areas with high CHP corresponded to areas with high Delta E ($P < .001$). Identification of TWAs agreed in 17 of 21 cases (81.0%). In the noncorrespondence cases, severe atherosclerotic changes or locally low WSSmin were observed in the aneurysm.

Conclusion: The predictive accuracy of CHP was confirmed by comparison with quantitative intraoperative image analysis. Based on these results, we conclude that CHP may be clinically useful for predicting TWAs of unruptured cerebral aneurysms.

1-B-17

Moyamoya disease: Using CFD to chart a novel theory on pathogenesis

○ JAYANAND SUDHIR BHANU¹, SANTHOSH KUMAR KANNATH²

¹Neurosurgery Dept, Sree Chitra Tirunal Institute for Medical Sciences and Technology, Trivandrum,

²Imaging Sciences and Interventional Radiology Department, SCTIMST

Introduction:

Moya moya disease (MMD) is characterized by progressive stenotic occlusion of the distal internal carotid arteries (ICA) and proximal anterior and middle cerebral arteries. Despite several associated conditions described, the exact aetiology of MMD has not been elucidated. The authors investigated if MMD could be caused exclusively by mechanical stresses induced by blood flow against a susceptible intracranial vasculature.

Methods:

The pre-operative digital subtraction angiography (DSA) images of 54 patients diagnosed with MMD were reviewed. The angle subtended by the horizontal cavernous segment of the internal carotid artery and the supraclinoid segment (CAV-SCL angle) of the internal carotid artery (ICA) in lateral view angiograms was measured and compared with age-matched controls. The DSA image of the internal carotid artery from the cervical segment to the bifurcation into the anterior and middle cerebral arteries of a control subject was extracted. The (CAV-SCL angle) of the ICA in true lateral view was progressively increased using a software, to obtain four models of increasing angles viz. original, 600, 900 and 1100. The models were subjected to simulated blood flow studies using computational fluid dynamics (CFD) methodology.

Results:

The (CAV-SCL angle) of the ICA was greater in MMD patients compared to controls. The CFD methodology simulated blood flow in the ICA model. As the CAV-SCL angle was progressively increased, the wall shear stress increased in the vicinity of the ICA bifurcation. The results form the basis for proposal of a novel mechanical theory explaining the pathogenesis of MMD.

Conclusions:

Moya moya disease occurs in the setting of a unique interplay of mechanical factors acting on a susceptible weak vasculature. The 'Mechanical Theory' of Moyamoya disease is set to explain the pathogenesis of this enigmatic disease and the pathological and radiological features thereof.

1-B-18

Management of Cavernous Malformations

○ Michael T Lawton

Barrow Neurological Institute

Cerebral cavernous malformations (CMs) are clusters of abnormally-formed, thin-walled blood vessels that tend to hemorrhage, resulting in focal neurological deficits, seizures, and even death, depending on the location of the lesion and extent of bleeding. Management of cerebral CMs can be reduced to the decision to observe or to surgically resect. Although cerebral CMs can occur throughout the brain and can lead to significant neurological morbidity, even in highly eloquent locations, such as the brainstem, thalamus, and basal ganglia, experience demonstrates that the majority of CMs can be safely resected and that patients tend to experience long-term improvement in neurological function. The keys to good patient outcomes lie in appropriate patient selection and in thoughtful choice of a surgical approach that minimizes transgression of normal structures.

1-B-19

Emergent microsurgical treatment of arteriovenous malformation-related intracranial hemorrhage

○ Qiao Zhang^{1,2}, Hong Sun^{1,2}

¹Department of Neurosurgery, West China hospital, Sichuan University, Chengdu, P.R. China,

²Department of Neurosurgery, Shang Jin Nan Fu hospital, Chengdu, Sichuan Province, P.R. China

Background: Because of low re-bleeding rate, most neurosurgeons usually prefer performing elective surgery for patients with arteriovenous malformation-related intracranial hemorrhage, while emergent operation was usually lack of imaging data and with additional difficulty caused by swelling brain tissue. However, for life-threatening hemorrhage, neurosurgeons usually have no choice but to perform emergent surgical treatment. The present study aims to investigate safety and effect of emergent microsurgical treatment for AVM associated with mass effect of intracranial hemorrhage.

Methods: A total of twelve consecutive patients who were diagnosed with intracranial hematoma due to AVM rupture were retrospectively recruited. All patients showed intracranial AVM on computed tomography angiography (CTA). In 9 cases, the site of the hematoma was in supratentorial, while it was in the posterior cranial fossa in the other 3 cases. After experiencing neurological deterioration, mydriasis and respiratory arrest, patients were relatively given tracheal intubation, hyperventilation and osmotic diuresis. All patients underwent emergency microsurgical procedures to evacuate the hematoma, and excise the AVMs at the same time. Postoperatively, cerebral angiography was performed to assess the extent of resection. Neurological outcome was assessed by Glasgow Outcome Scale during an average of 7 months follow-up.

Result: According to the Glasgow Outcome Scale, 9 patients got good recovery, 2 were in moderate disability and 1 died. Poor prognosis occurred in patients with posterior fossa AVM and massive cerebellar hematoma due to mydriasis and respiratory arrest.

Conclusions: There is no time for neurosurgeons to hesitate in the management of patients with AVM associated with life-threatening intracranial hemorrhage. CTA guided emergent microsurgical treatment was necessary for hematoma evacuation and AVM resection, meanwhile, perioperative aggressive medical therapy, such as intubation, hyperventilation and intracranial pressure control, may also be essential for good prognosis.

1-B-20

3-D model printing for surgery on arteriovenous malformations

○ Abhidha Shah

Department of Neurosurgery, K.E.M. Hospital and Seth G.S. Medical College, Parel, Mumbai, India

Aim: Surgery for intracranial complex vascular malformations can be quite exigent and involves a great deal of pre-operative planning. We present advantages of use of three-dimensional (3-D) printed models as a preoperative investigational modality.

Material and Methods: 3-D printed models were made from thin slice CT angiography scans in six patients with arteriovenous malformations over an 18-month period, from August 2015 to December 2016. The locations of the arteriovenous malformations were in the Sylvian fissure in 1 patient, in the posterior frontal region in 2 patients, in the subfrontal region in 1 patient, and in the parietal region in 2 patients. The CT angiography was performed on a 64 slice CT scanner. Thin slice axial CT cuts were acquired and a volume file was created of the AVM and the required skull bones. The file was then transferred to the 3D printer for creating the model.

Results: The model depicted the precise nature of compactness and location of the nidus in relationship to the skull. It was possible to clearly delineate the course, size and number of feeding vessels and the draining veins. The model made identification of the normal and abnormal vessels easier and assisted in the preparation and conduct of surgery. The model was made to scale and was placed beside the surgeon during the operation. The limitation of current technology was that the exact differentiation of arteries and veins by color coding was not possible.

Conclusion: 3-D printed models can be helpful in getting information on the architecture and character of the arteriovenous malformation. The models are cost effective and easy to build.

1-B-21

Cost effective management of vasospasm

○ Manas Panigrahi, Anup b

Krishna Institute of Medical Sciences

Incidence of vasospasm in ruptured aneurysm is reported as 30 to 35% following clipping. There are many ways of treating vasospasm. The ideal treatment is angiogram followed by intra arterial dilators. However this sometimes delays the treatment due to requirement of cath lab and personal. The results of treatment depends on the latency period.

The authors usually place a omya resevior with the catheter in the subarachnoid space . Whenever vasospasm is suspected intracisternal papaverine was injected through the reservoir. This treatment if ultrafast and cost effective. The presentation shall analyse the results of treatment of 250 aneurysm using this method. It reduces the morbidity and mortality from 30 % to 15%.

1-B-22

The strategies for the treatment of poor grade subarachnoid hemorrhage patient

○ Ittichai Sakarunchai

Division of Neurosurgery, Department of Surgery, Faculty of Medicine, Prince of Songkla University

Poor-grade subarachnoid hemorrhage (SAH) (Hunt & Hess Grades 4-5) is accounted for approximately 20-40% of all SAH patients. The hemorrhage triggers a cascade of complex events, which ultimately can result in early brain injury, delayed cerebral ischemia, and systemic complications. The patients always present with high mortality and disability rate. Hence, it is often treated conservatively and the timing of surgery is still controversial due to un-favorable outcome in the final outcome. Delayed treatment can leads the patient to be improved or worsen the grading at that time. The advantages of delayed surgery include the less brain swelling and less cerebrovascular instability during the surgery whereas the aneurysm may rupture again if surgery is delayed, thus increasing mortality. However, the early and aggressive treatment of this patient population has decreased overall mortality from more than 50 % to 35 %. These management strategies include transfer to a high-volume cerebrovascular center, neurological and systemic support in the intensive care unit, early aneurysm repair, use of multimodal neuromonitoring, control of intracranial pressure, prevention and treatment of medical complications, and aggressive treatment of delayed cerebral ischemia. Surgical clipping and endovascular coiling are considered two main aneurysm repair for this curriculum after the hemodynamic condition is stabilized. For timing of treatment, patients with poor-grade has benefit from early or ultra-early/urgent definite management is still unclear. The results of study will be used to direct decisions of intervention in poor-grade subarachnoid hemorrhage, thus improving clinical outcomes for patients.

1-B-23

Surgical treatment of distal cerebral aneurysms.

○ Ilya Senko, Ilya Grigoriev, Vladimir Dashyan, Alexandr Prirodov, Victor Lukjanchikov, Taras Shatokhin, Natalia Polunina, Aleksey Tokarev, Vladimir Krylov

Sklifosovsky Research Institute of Emergency Care

Distal cerebral aneurysms are rare lesions (<10% among all intracranial aneurysms). Published experience surgical treatment them is usually very limited.

Purpose: Examine results surgical treatment patients with distal cerebral aneurysms.

Methods: We reported our surgical experience treatment and clinical outcomes for 100 patients with distal cerebral aneurysms treated in our department between January 2000 and December 2016. All analysis was retrospective.

Results: Most distal aneurysms were located in the anterior cerebral artery (ACA) – 62%, middle cerebral artery (MCA) – 20%, posterior cerebral artery (PCA) – 12%, posterior inferior cerebellar artery (PICA) – 5%, superior cerebellar artery (SCA) – 1%. Fusiform shape were in 14%. There were 73 ruptured and 27 unruptured aneurysms. Clipping was in 80%, trapping with excision aneurysm – 14%, trapping with distal revascularization – 3%, wrapping – 3%. Patients showed good clinical outcome (GOS – 4-5) in 71%, suffered permanent neurologic injury (GOS – 3) – 11%, and died (GOS – 1) – 18%. The highest percentages of poor outcomes (GOS 1-3) were observed with distal ACA aneurysms.

Conclusion: The A3 segment ACA and M2 segment MCA were the most common sites of distal aneurysms. Distal aneurysms can be difficult for surgical treatment because of their increased fusiform morphology. Microsurgical treatment for patients with distal cerebral aneurysms can have a good outcome with correctly selected techniques (neuronavigation, revascularization methods et al.). Algorithm of treatment is determined by the anatomical location, shape of the aneurysms and clinical condition of the patient. In our opinion improvement of surgical technique will lead to improvement results of treatment patients with distal cerebral aneurysm.

1-B-24

Management Strategies in Intraoperative Rupture of Aneurysms

○ Jaspreet Singh Dil

National Neurosciences Mission India

TBA

1-B-25

Management Strategies in Intraoperative Rupture of Aneurysms

○ Jaspreet Singh Dil

National Neurosciences Mission India

Intra operative rupture of aneurysms is a common problem faced by all vascular neurosurgeons. We may have a meticulous preoperative planning but a sudden intraoperative rupture sometimes leads to distress clipping causing perforator and branch occlusions and also parent vessel occlusion at times. The reason for poor results for many neurosurgeons is a poor management of intraoperative rupture. Management of intra operative needs a very cool mind, use of two suctions to see the rent, help of a good assistant, a good anaesthetic team and devising a strategy within a very short time. This paper elucidates the different types and locations of aneurysmal rupture and ways to manage it using temporary clips, dissection techniques and muscle bits in different ways. Along with having a good pre-operative planning, it is also imperative that a surgeon has a good intra-operative rupture management strategy in his repertoire.

1-B-26

Nitric Oxide Metabolite levels in CSF and Serum correlate with severity and outcome in patients with Subarachnoid Hemorrhage

○ Giat Seng Kho^{1,2,4,6}, Regunath Kandasamy^{1,6}, Mummady Swamy³, Muzaimi Mustapha¹, Kamarul Imran⁵, Jafri Malin Abdullah^{1,6}

¹Department of Neurosciences, School of Medical Sciences Universiti Sains Malaysia, ²Center for Neuroscience Service and Research, School of Medical Sciences Universiti Sains Malaysia,

³Department of Chemical Pathology, School of Medical Sciences Universiti Sains Malaysia,

⁴Sarawak General Hospital, Malaysia,

⁵Department of Community Medicine, School of Medical Sciences Universiti Sains Malaysia,

⁶Center for Neuroscience Service and Research

Background/ Rationale: To study Nitric Oxide metabolite (NOx) levels in CSF and Serum in patients with spontaneous subarachnoid hemorrhage (SAH), based on the World Federation of Neurosurgeons (WFNS) grading on admission, CT Scan findings of patients classified according to the Fisher Grading System for SAH, and outcome based on Glasgow Outcome Score (GOS) of patients at 6 months post ictus.

METHODS: 40 adult patients aged 18 years to 77 years old were admitted to Hospital Universiti Sains Malaysia with Aneurysmal Spontaneous SAH from March 2013 until June 2015, were included in the study. Mean levels of CSF and Serum NOx were compared with indicators of severity grading, vasospasm and outcome severity in aneurysmal SAH, including Glasgow Coma Scale score on admission, vasospasm according to CT scan findings and clinically and Glasgow Outcome Scale

RESULT: Median (IQR) of CSF and Serum NOx was 0.5231 μ mol/L and 2.397 μ mol/L. The highest measured values for CSF and Serum NOx was 4.35, 13.27 μ mol/L while lowest was 0.17, 0.37 μ mol/L. The mean level in ratio of CSF/Serum over Day 3 only, were found to be significantly difference in patients correlate with poor outcome grading ($p = 0.030$) based on GOS score. Otherwise there was no significant difference in mean level of ratio CSF/Serum in the subgroups of severity grading ($p = 0.582$) and vasospasm status ($p = 0.888$).

CONCLUSION: It can be concluded that ratio of CSF/Serum NOx levels may serve as a potentially useful biomarker in SAH given its significant association with outcome grading.

2-A-1

Surgery of brainstem cavernous angioma

○Eka J. Wahjopramono, Yesaya, Julius, Harsan, Lutfi, Binsar, Made, Ferry, Firdaus, Evelyn, Ronny, Maximilan, Eko, Onnie, Wily, Gde, Donny, Bagus

Faculty of Medicine - Pelita Harapan University, Neuroscience Center – Neurosurgery
Department - Siloam Hospitals

Brainstem cavernous angioma is a vascular anomaly characterized by the presence of sinusoidal-like capillary vessels. This lesion often regarded as neoplastic because their behavioral that parallels with neoplastic lesion. Chromosomal abnormality often associated with this lesion cause by its occurrence in familial pattern. These Cases occurred for about 5-13% of all central nervous system malformation and mostly located within the pons. Understanding brain-stem anatomy before perform surgery is essential. Brainstem cavernous angioma lesion can be treated either conservative or surgery. The main surgical indications are exophitic-evacuable lesion and significant mass effect.

The authors report for 55 cases of Brainstem cavernoma that underwent surgery in Siloam Hospital during 2001 until now. The most common location is the pons with 45 cases, 8 cases located in medulla and 2 in the midbrain. The approach of the surgery mainly from posterior approach with 47 cases, 6 cases underwent surgery from subtemporal transtentorial and 2 cases with the orbitozygomatic approach.

The authors describe 9 cases of surgery of brainstem cavernous angioma with its clinical symptom and the exact time and condition to perform a surgery, and also discuss the surgical techniques to remove angioma lesion safely from brainstem.

2-A-2

Treatment of brain stem cavernoma

○Mao Ying

TBA

2-A-3

Surgical treatment of cavernous malformations involving midbrain : A Single-Center Case series of 34 Patients

○ Yanming Ren, Chao You, Jin Li, Min He, Hao Li

Department of Neurosurgery, West China Hospital, Chengdu, China

Background: Cavernous malformations (CMs) involving the midbrain are more challenging for surgical treatment than CMs at other sites because of the surrounding critical structures and deep location. However, specific features and treatment strategies have not been well illustrated.

Objective: To evaluate the long-term durability of surgical treatment of midbrain cavernous malformations (MBCMs) as well as surgical outcomes and complications.

Methods: A retrospective study was conducted in 34 patients who underwent microsurgical resection of midbrain CMs between 1995 and 2015. Demographics, lesion characteristics, surgical approaches, surgical outcomes, and complications were analyzed.

Results: A total of 34 adult patients with a mean age of 38.6 years were assessed. All patients presented with a history of hemorrhage. Lesion locations included the midbrain (n=27), midbrain and thalamus (n=2), and pontomesencephalic junction (n=5). Mean lesion size was 1.7 cm; average clinical follow-up was 5.6 years. Mean modified Rankin Scale (mRS) scores on admission, at discharge, and at last follow-up were 2.0, 2.7 and 1.7, respectively. Postoperatively, 19 patients (55.9%) showed new or worsened neurological deficits. Univariate analysis indicated that large lesion size, presence of a developmental venous anomaly (DVA), and location at the ventral side of the midbrain were predictive factors of poor outcome. No rehemorrhage or recurrence case was found during the follow-up period.

Conclusion: Although surgery for midbrain CMs is associated with significant perioperative morbidity and mortality, most patients show favorable outcomes. Large lesion size, presence of a DVA, and ventral location are predictors of poor outcome.

2-A-4

Surgery of brainstem cavernoma

○ VanHe Dong

TBA

2-A-5

Combined surgical and endovascular treatment of cerebral arteriovenous malformations in the hybrid operating room

○ Jizong Zhao

National Clinical Research Center of Neurological Diseases Department of Neurosurgery, Beijing Tiantan Hospital, Capital Medical University

Background :

Microsurgical resection, endovascular means and stereotactic radiotherapy are the major treatments of cerebral arteriovenous malformations (AVM) and each method has its own limitations. At present, microsurgical resection is the best way to radical cure and prevent rebreeding for AVM, however, massive bleeding, high rate of neurologic deficits and risk of NBBP during operation are still great challenges to achieve completely resection of AVM. Preoperative fractionation embolization can reduce bleeding and surgical risk, however, patients have to experience repeated pain due to the repeated treatments, and face the risk of rupture of AVM during treatment.

Objective : The purpose of this study is to evaluate the advantages and safety of combined surgical and endovascular procedures in hybrid operating room in the treatment of cerebral AVM.

Methods: Data of 45 cases of cerebral AVM underwent combined surgical and endovascular procedures were reviewed retrospectively. Digital angiography machine was PHILIPS Allura Xper FD20C . The advantages and work flow of multi-modality imaging during combined surgical and endovascular procedures were also analyzed.

Results: 195 patients were successfully completed with combination of endovascular therapy and craniotomy in the hybrid operating room from February 2016 to July 2017 in Beijing Tiantan Hospital. There were 126 male (64.62%) and 69 female (35.38%). The mean age was 27.0 ± 14.4 year (5-70 years), with a median Spetzler-Martin grade 2.54 ± 0.98 (range 1-5). The average time of operation was 7.0 ± 0.8 h (range 1-12.5h). The median time spend on changeover of endovascular therapy and surgical resection was 0.98 ± 0.07 h (range 0.2h-3h). There was no operative death. We get our initial experience of combined surgical and endovascular procedures in hybrid operating room (OR) in the treatment of cerebral AVM.

Conclusions: It is successful to complete combined microsurgical and endovascular conducted in a hybrid OR. Hybrid operation can improve the ratio of total resection and efficacy of surgery of cerebral AVM, and reduce post-operative complications, medical costs and the repeated pain due to the repeated DSA examinations.

2-A-6

Treatment of complex cerebrovascular diseases in the hybrid OR

○ Mao Ying

TBA

2-A-7

Combined endovascular and microsurgical treatment of complex brain arteriovenous malformation

○ Ivan Radovanovic

Assistant Professor Division of Neurosurgery Toronto Western Hospital University Health Network and University of Toronto Scientist, Toronto Western Research Institute

TBA

2-A-8

Posterior fossa giant aneurysms - series of 600+ pts , and new possible effective treatment

○ Juha A. Hernesniemi, Behnam Rezai Jahromi

Department of Neurosurgery, Helsinki University Hospital and University of Helsinki, Finland

Flow reversal techniques with revascularization followed by parent artery occlusion might be preferred for those rare, complex, mostly giant and fusiform, intracranial aneurysms which are not amenable to either endovascular or microneurosurgical treatment. However, sudden changes in flow direction and hemodynamic stress on aneurysm wall can result in catastrophic outcome. Gradual flow reversal via collaterals can be achieved by controlled occlusion of parent artery.

Special aneurysm clip (slow-closing-clip (SCC)) was designed and used for gradual proximal occlusion of parent artery. 14 patient with complex intracranial aneurysms underwent treatment with SCC with or without revascularization.

5 patient died in 6 months, 4 patient had minor strokes, 4 patients had good outcomes and 1 patient was lost in follow- Average follow-up being 3,2 years (range 0-9,8 years).

SCC has potential for gradually changing hemodynamic and perfusion pattern of the brain via collateral growth and blood-flow control- thus it should furthermore be developed.

2-A-9

Surgery for large and giant cerebral aneurysms

○Hidetoshi Murata, Mitsuru Sato, Ryohei Miyazaki, Taishi Nakamura, Takahiro Tanaka, Nobuyuki Shimizu, Jun Suenaga, Tetsuya Yamamoto

Department of Neurosurgery, Yokohama City University Graduate School of Medical Sciences

【Introduction】

It is often difficult to treat large or giant cerebral aneurysm adequately, and we sometimes need specific procedures for surgical approach and handling of the aneurysms. Temporary parent artery occlusion (PAO) is usually required, and it sometimes takes long time for PAO. In addition, it's not easy to identify and preserve critical perforators around the aneurysm. We often need arterioplasty clipping and flow alteration strategy for the aneurysm. Here, we introduce tips of treatment for large/giant aneurysm.

【Patients and Methods】

Since September 2008, we had 23 cases whose aneurysmal size is more than 12mm in diameter. 19 cases are unruptured aneurysms and 4 cases are ruptured one occurring SAH. These aneurysms were located in ICA (16 cases), A-com A (2 cases), VA (2case), AC distal A (1 case), MCA (1 case) and PICA (1 case). Transcranial and/or cortical MEP and ICG angiogram was introduced in all cases. Adjunctive bypass surgery was used for long-time PAO (9 cases/ 39%). Heparinization was introduced for prevention of thrombosis during PAO (15 cases/ 65%). Arterioplasty clipping with suction decompression proximal to the aneurysm was performed in 4 cases. If clipping is impossible, we chose high-flow bypass with radial arterial graft and trapping/ligation (4 cases). In all cases, we used thin bioabsorbable mesh (polyglactin mesh) for avoiding perforators, other critical arteries and cranial nerves around the aneurysm.

【Results】

Clipping was performed in 18 cases. High-flow bypass and trapping/ligation was done in 4 cases, and aneurysmal resection and bypass surgery was done in 1 cases. 18 cases (95%) of unruptured aneurysms showed good prognosis like modified Rankin Scale (mRS) 0-1. One case led to mRS 3 due to systemic complication like chronic obstructive pulmonary disease and C. difficile-associated enterocolitis.

【Conclusion】

Surgery of large/giant aneurysm is not necessarily easy. However, aneurysmal flow control (including suction decompression), adjunctive bypass surgery and procedure of perforator preservation facilitate the treatment of their aneurysms.

2-A-10

Modified extradural temporopolar approach combined with suction decompression for paraclinoid aneurysms with special attention to long-term surgical and visual outcome

○Naoki Otani, Kojiro Wada, Terushige Toyooka, Kentaro Mori

Department of Neurosurgery, National Defense Medical College

(Background and aims)

Complete clipping of paraclinoid aneurysms is still challenging, because the anatomical location of the target aneurysm is close to the optic apparatus and internal carotid artery. For the surgical management of these lesions, removal of the anterior clinoid process is one of the essential skull base techniques. Extradural temporopolar approach provides us wide epidural space enough to expose the anterior clinoid process entirely. We recently modified this approach with dura propria mini-peeling less-invasively, which can provide extensive exposure of the anterior clinoid process and early exposure, complete mobilization and decompression of the optic nerve and internal carotid artery, which can lead to prevent intraoperative neurovascular injury for treatment of paraclinoid aneurysms. We herein show the surgical tips of this modified extradural approach combined with suction decompression and show the long-term surgical and visual results.

(Methods)

We retrospectively reviewed medical charts of 32 consecutive patients with paraclinoid aneurysms underwent modified extradural temporopolar approach with suction decompression between September 2009 and August 2016.

(Results)

Preoperative visual acuity and/or visual field function worsened in 3 patients (9.4%). Postoperative outcome was good recovery in all patients. No operation-related mortality occurred in the series. Transient hemiparesis and V2 hyperesthesia were confirmed in each one case. Postoperative CT abnormalities were confirmed in 3 cases. One year after surgery, there was no recurrence and de novo aneurysms. Cognitive and visual function was normal in all cases. There was no complication related with direct puncture of the carotid artery.

(Conclusion)

Modified extradural temporopolar approach with suction decompression is safe and recommended for surgical treatment of paraclinoid aneurysms to reduce the risk of intraoperative optic neurovascular injury.

2-A-11

GIANT INTRACRANIAL ANEURYSMS: SURGICAL STRATEGIES AND SPECIAL ISSUES

○ Renato Juan Galzio, Mattia Del Maestro
University of L'Aquila, Me.S.V.A. Department

Background: the natural history of giant intracranial aneurysms is dismal, with high risks of severe disability or death caused by hemorrhage, mass effect or stroke. It has been reported that more than 50% of patients with GIAs, if left untreated after initial clinical onset or after their occasional finding, will rupture with a mortality rate > 60% in 2 years. The first ISUIA (1998) reported a risk of rupture 6 times higher for GIAs than for aneurysms with one diameter larger > 1 cm.

For larger aneurysms with complex angioarchitecture, endovascular treatment has not yet achieved the efficacy demonstrated for smaller ones and surgery still remains in most instances the elective option of treatment; revascularization techniques represent the only possible treatment of aneurysms untreatable both endovascularly and through direct microsurgical technique.

Materials and Methods: in a period of ten years, 71 patients harboring 75 intracranial aneurysms with one diameter larger than 2 cm were operated on in our Department; 34 of these aneurysms were very large (VLAs) and 41 were giant (GIAs).

Results: thirty-three aneurysms were unruptured. Sixty aneurysms underwent to a direct surgical treatment consisting in 56 direct clipping, 3 trapping w/o revascularization and 1 wrapping. Fifteen aneurysms were treated by means of an extracranial to intracranial (EC-IC) high-flow by-pass. An mRS score ranging between 0 and 2 was observed in 54 patients, whereas an mRS 3 was seen in 5 patients. Four patients had a severe disability (mRS 4-5) and 6 patients died. Aneurysm's fragmentation, with stacking and seating clips, thrombectomy and aneurysmorrhaphy were the techniques most frequently employed. Revascularization options involved an EC-IC high-flow by-pass in those cases not amenable for direct treatment.

Conclusions: surgery still represents the best treatment option for most of complex intracranial aneurysms. Surgical treatment of these lesions requires a detailed and careful preoperative planning and specific surgical skills. Preoperative planning of these aneurysms should take into account selection of the more suitable approach among a large number of skull base approaches. Intraoperative neurophysiological monitoring, ICG videoangiography and Micro-doppler Ultrasound are essential tools in the surgical armamentarium needed to treat these challenging lesions.

2-A-12

Giant aneurysm- decision making in management

○ Manas Panigrahi, Chandrasekhar yvbk, ANUP B
Krishna Institute of Medical Sciences

Giant aneurysms of brain have 80% mortality over five years. The risk of rupture is also higher than smaller aneurysms. The complications of surgery of large and giant aneurysms has been reported from 5 to 15%. After the invent of pipeline stents, it has been promoted as a panacea.

The aim of these paper is to present a systematic review of the results and complications of endovascular therapy of giant aneurysms. The authors shall present their experience on management of 30 giant aneurysms at their institute over ten years. The complications rate of surgery shall be highlighted. The ideal indications for clipping and endovascular therapy shall be discussed

2-A-13

Middle cerebral artery aneurysms: anatomical distribution and surgical management.

○ Raftopoulos Christian

TBA

2-A-14

Skull base techniques needed for vascular Neurosurgery

○ Iype Cherian

Director, Nobel Institute of Neurosciences, Nobel Medical College and Teaching Hospital, Nepal

Major vessels are often found at the base of the skull and so their pathology requires a sound anatomy of skullbase and this would make their access easy. We will be dealing with the segments of carotid from C7 to C2 and ways to access these segments.

2-A-15

Microvascular decompression: the variable venous anatomy of the suboccipital retrosigmoid approach

○ Mojgan Hodaie

Division of Neurosurgery, Department of Surgery, University of Toronto

The suboccipital surgical approach is important for multiple surgical indications including the microvascular decompression approach to the trigeminal nerve root for the treatment of trigeminal neuralgia. Important venous anatomy of the region needs to be considered in order to minimize surgical complications. Two major venous systems are important in this region. The transverse and sigmoid sinuses have important variations in caliber as well as anatomic tortuosity that need to be assessed in three dimensions and as part of surgical neuronavigation. The superficial petrosal vein, encountered during the suboccipital approach to the cerebellopontine angle, lies in close proximity to the trigeminal root. This vein has a highly variable anatomy and often consists of multiple branches. Since they may frequently obstruct the view of the trigeminal nerve, it is important to consider whether any of the branches can be sacrificed during this approach. The anatomical variation of the venous anatomy of this region will be discussed, including the drainage pattern and strategies to decrease surgical complications.

2-A-16

Role of anatomy in surgical management of complex AVMs.

○ Mustafa Baskaya

Professor of Neurological Surgery Director of Skull Base Surgery Program University of Wisconsin-Madison

Treatment of complex AVMs pose a challenge to neurosurgeons, and much controversy still exists regarding the optimal treatment strategy. Recently, the advances in neurointerventional techniques and stereotactic radiation introduce more treatment options and schemes to neurosurgeons. However, microsurgical resection of AVMs still remains first line treatment. Understanding of normal anatomy and distorted anatomy of AVMs and surrounding structures is crucial in order to select microsurgical approach. Identification and preservation of the normal vasculature, knowing the territory of intracranial arteries and disconnection of the blood supply are the main principles of AVM surgery. Distinguishing of pathologic vessels from normal vessels is the main rationale of this surgery. This requires good knowledge of neuroanatomy and interpretation of this knowledge with operative observations. In this presentation, importance of neuroanatomy in selecting and performing microsurgery for complex AVMs will be demonstrated in a case by case basis.

2-A-17

Tips and tricks in CEA

○ Jiri Fiedler

Department of Neurosurgery, Hospital Ceske Budejovice (Budweis), Czech republic,
Dept. Neurosurgery, Faculty of Medicine Charles University and University Hospital
Plzeň, Czech rep.

Carotid endarterectomy (CEA) has its solid place in secondary prevention of stroke. In primary stroke prevention should CEA be indicated only in high-risk patients. Newly, the benefit of CEA is being discussed in emergency thrombendarterectomy just after the systemic rtPA administration. There is a permanent pressure to reduce perioperative morbidity and mortality within the CEA x CAS competition. For example, in the case of CEA for asymptomatic carotid stenosis, the acceptable risk of 30-day M/M has changed from 3 to 1%.

CEA is a very common surgery that belongs also to the spectrum of vascular neurosurgery in the Czech Republic. The aim of this hands-on seminar communication is to present opinion of Budweiss on the sources of complications and their prevention using mainly surgical videos.

These issues will be presented: indicating issues, CEA technical tricks supplemented with operational video, failed CEA situation, hematoma after CEA, n. XII injuries, cardiologic mortality and hyperperfusion syndrome.

2-A-18

Experience of CEA surgery.

○ Weiguo Zhao

TBA

2-A-19

The usefulness of trans-diaphragmatic approach for high position carotid endarterectomy

○ Kojiro Wada¹, Naoki Ootani¹, Terushige Toyooka¹, Satoru Takeuchi¹, Kosuke Kumagai¹, Syunsuke Tanoue², Arata Tomiyama¹, Yutaro Yamamoto¹, Kentaro Mori¹

¹department of neurosurgery, National Defense Medical College,

²Department of Neurosurgery, JDF central hospital

[introduction] We Japanese has been reported that the carotid bifurcation is one vertebral body higher than that of Caucasian. So, we have more chance to meet high position internal carotid artery stenosis (ICS). 30-40 % of carotid endarterectomy (CEA) is recognized as high position which is categorized the level of the distal end of ICS is above the 2nd vertebral body or higher. For the safety dissection of the distal ICS, the opening of retro-mandibular space is important. However, after opening of retro-mandibular space, styloid diaphragm is hidden the distal ICS of high position patients. For revealing the distal ICS of high position patients, manipulation of styloid diaphragm is necessary. [Methods] The styloid diaphragm is consisted of 4 muscles and 2 ligaments. Both the posterior belly of digastric muscle (PBDM) and the stylo-hyoid muscle (SHM) is covered the distal ICS. In high position ICS, we conduct the distal ICS dissection according to the necessity, first step is PBDM hook up, next step is PBDM cut, final step is SHM cut. [Results] We operated 11 high position ICS lesions of 10 patients. Two lesions could be conducted CEA with only first step dissection. Four lesions needed second step dissection. Five lesions needed final step dissection. Postoperative state of all cases were uneventful. No complication (no mortality nor morbidity) was observed after CEA. Diffusion image of MRI performed at 7 POD revealed no new high intensity lesion. [Discussion] The trans-styloid diaphragmatic approach may be helpful to get the distal ICS of high position patients.

2-A-20

Surgical Results of Carotid Endarterectomy for Twisted Carotid Bifurcation

○ Joji Tokugawa, Kentaro Kudo, Kazuki Nishioka, Ryogo Ikemura, Takashi Mitsuhashi, Makoto Hishii

Department of Neurosurgery, Juntendo University Nerima Hospital

[Introduction] Carotid endarterectomy (CEA) is a Grade A surgical treatment option for the internal carotid artery stenosis in the Japanese Guidelines for the Management of Stroke 2015. In the normal anatomy, the internal carotid artery (ICA) is positioned posterolateral to the external carotid artery (ECA) at the carotid bifurcation. However, sometimes we encounter an anatomical variance such as the ICA positioned medial to the ECA, so called twisted carotid bifurcation, in the CEA patients. Little is known about the twisted carotid bifurcation and the literature of this anatomical entity is limited to date. We investigated the demographics and the surgical results of our twisted carotid bifurcation patients who underwent CEA. **[Materials and Methods]** From August 2011 to the present, we had 10 cases (16%) of the twisted carotid bifurcation patients (TCB group) in the 62 consecutive CEA patients. The basic surgical method was the same for either TCB or non-TCB groups. **[Results]** The patient demographics were almost identical between the two groups. No statistical significance was observed in the degree of stenosis, the duration of operation, or the surgery-related complications between the two groups. In the TCB group, eight were right-sided lesion; the side was the only significant difference between the groups. **[Conclusion]** Good surgical results can be achieved with meticulous preoperative examination and gentle intraoperative manipulation for the twisted carotid bifurcation patients. A little was mentioned about the right side dominance of the twisted carotid bifurcation in the literature. Further investigation is needed for this anatomical entity.

2-A-21

Current trend of surgical treatment of carotid artery stenosis to avoid complication

○ Kentaro Hayashi, Yuki Matsunaga, Yukishige Hayashi, Kiyoshi Shirakawa, Mitsuto Iwanaga

Department of Neurosurgery, Sasebo city general hospital, Sasebo, Japan

Objective: Carotid endarterectomy (CEA) is employed for the carotid artery stenosis all over the world. Surgical procedure has been established. Carotid artery stenting (CAS) in high-surgical-risk patients is considered as an effective alternative to CEA.

We report our clinical experience of CEA and CAS, and discuss the strategies to avoid each complication.

Materials and Methods: For ten years, we performed CEA for 125 patients CAS for 110 patients. Preoperatively, we evaluated the lesion with carotid angiography, ultrasound, CT angiography and high-resolution MRI. Post-operative complication was evaluated. Moreover, CEA specimen was evaluated with histopathologically. In cases of CAS, embolus protection device was observed under microscope and the result was compared with preoperative radiological findings.

Results: In our CEA series, ischemic stroke occurred in 3 cases, myocardial infarction in one, cranial nerve palsy in 2, internal carotid artery occlusion in 1, wound hematoma in 2, hyperperfusion syndrome in 3. In our CAS series, Ischemic stroke occurred in 7 cases, hyperperfusion syndrome in 2, stent occlusion in 2 and puncture site hematoma in 2. In the post-operative study, various type of debris was captured and fibrin precipitation for the filter was also observed.

Conclusions: The result of CAS is as comparable as that of CEA. CEA is a first-line treatment for the carotid artery stenosis. However, the complication of CEA may result in severe situation. To avoid complication of CAS, the radiological evaluation for the quality of plaque and appropriate selection of the embolus protection device are important.

2-B-1

Surgical treatment for hypertensive intracerebral hemorrhage in China

○Chao You

Department of Neurosurgery, West China Hospital, Sichuan University

Spontaneous intracerebral hemorrhage (SICH) is a common type of stroke, with high morbidity and mortality, which brings serious burden to the families and society. However, the treatment of spontaneous intracerebral hemorrhage is controversial. The focus of the controversy is the role of neurosurgical intervention in the treatment of SICH. Therefore, there are great differences in the treatment of spontaneous intracerebral hemorrhage among different countries and regions. The International Surgical Trial in Intracerebral Hemorrhage (STICH) and The International Surgical Trial in Intracerebral Hemorrhage II (STICH II) have not shown that patients with SICH can benefit from neurosurgical intervention. However, with the development of neurosurgical techniques, more and more researches show that the minimally invasive surgery (MIS) is more beneficial to patients with SICH than the traditional craniotomy and conservative treatment. We reviewed the background of surgical treatment of SICH, surgical indication, timing of operation, different methods of surgical intervention, and perioperative management in this paper.

2-B-2

Management of Intracerebral Hemorrhage in a Large Urban Health System

○Christopher Kellner

TBA

2-B-3

Surgical management of Intracerebral hemorrhage.

○ Vincent Ng Yew Poh

TBA

2-B-4

Microsurgical Treatment of Paraclinoid Aneurysms ; Surgical Nuances upon Simplified Group of Aneurysm Direction

○ Yong Bae Kim, Joonho Chung, Jin Yang Joo

Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University College of Medicine

Purpose : Paraclinoid internal carotid artery aneurysms (PAs) are one of the group of aneurysms challenging to secure the sac microsurgically. In this review, the authors tried to extrapolate valuable surgical tactics and recommendable guide to make surgical clipping as a competent choice for the management of PAs.

Materials & Methods : A total of 80 PAs (ruptured 25/ unruptured 55) initially treated by direct surgery were drawn from institutional database. From anterior to posterior projection in digital subtraction angiography, the angle of aneurysm growth relative to internal carotid artery (ICA) were categorized into 4 groups; Inferomedial (IM), Superomedial (SM), Inferolateral (IL), Superolateral (SL).

Results : Growth direction of PAs were SL in 32(40%), SM in 26(32.5%), IM in 17(21.3%), and IL in 5(6.3%), respectively. Forty six were small (<10mm) and 34 were large-giant (>10mm) in size. Except for 6 cases of wrap-clip, and 4 cases of unintended trapping, all were directly clipped by the neck of the aneurysms. Overall, 68 cases (85%) were remain favorable (modified Rankin Score < 2) at their last follow up visit. There were 4 cases (5%) of permanent morbidity and no surgical mortality. Microscopically blind sides of each aneurysm differ between these 4 groups, which make surgical tactics for each group uniquely characterized. For the small-sized aneurysms in SM group, the main clip is almost always applied perpendicular to the ICA. In superiorly projecting group (SM and SL), the anterior clinoidectomy was performed safely by intradural work. On the contrary, in inferiorly projecting group (IM and IL), clip choice is likely to be angled-fenestrated clip, applied parallel to the ICA, making lumen patent through clip's fenestration, and extradural anterior clinoidectomy was preferred. In large-giant-sized cases, medially projecting group (IM and SM) was more readily amenable to retrograde suction-decompression at cervical ICA than in laterally projecting group.

Conclusions : When presurgical anticipation of delicate surgical nuances according to the projection angle of each aneurysm is serviced as useful adjuncts, microsurgical clipping could yield competitive results in the management of PAs.

2-B-5

Programmed Carotid Artery Occlusion for Cavernous ICA Giant Aneurysms

○Gerardo Dizon LEGASPI

TBA

2-B-6

Stent-assisted Coiling for Intracranial Aneurysms

○Jiong Dai

Department of Neurosurgery, Renji Hospital, Shanghai Jiaotong University School of Medicine, China

Endovascular therapy was firmly established as a valid method for treating intracranial aneurysms by ISAT study result. The technique of stent-assisted coiling (SAC) in the clinical setting was first described by Higashida et al* in 1997. The development of intracranial stents has expanded the indications of endovascular therapy to intracranial aneurysms, especially to those geometrically complex aneurysms. Main indications of SAC for intracranial aneurysms: wide-necked aneurysms, fusiform aneurysms and dissecting aneurysms. SAC may promote aneurysm healing and lower aneurysm recurrence. The complication rates of SAC vary widely across different studies. Overall morbidity and mortality ranges from 1.4% to 21%. The learning curve analysis clearly demonstrates the significance of operator's experience in the overall success of treatment. The commonly used intracranial stent for SAC are as follows: Neuroform, Enterprise, Solitaire AB, LEO and LVIS. Stent-Jacket, Stent-Jailing, Y-configuration (Double stent-assisted technique) and Waffle cone are the commonly used techniques for SAC.

2-B-7

Trapping of recurrent A1 segment dissecting aneurysm after stent assisted coil embolization: case report

○ Hajime Ono¹, Yuichiro Tanaka², Taigen Sase², Hiroshi Takasuna², Yasuyuki Yoshida¹

¹St. Marianna University Toyoko Hospital, Department of Neurosurgery,

²St. Marianna University School of Medicine, Department of Neurosurgery

A 41-year-old woman presented with a sudden onset of severe headache. A CT scan revealed subarachnoid hemorrhage in the basal cistern, and cerebral angiography demonstrated a dissecting aneurysm of the right A1 segment. The size of dissected lumen at the admission was 1 mm in height and 4 mm in width. First, the endovascular treatment team applied a stent (closed cell stent; enterprise: CODMAN NEURO) to the lesion. However, after 3 days the size of the aneurysm increased and coil embolization was added. Thereafter, the size of the aneurysm increased at the period of cerebral vasospasm. On the 16th day, the size of the aneurysm was 5 mm because coil compaction occurred. On the 21th day, coils and stents were added again, but the aneurysm continued to grow. Therefore, A1 trapping using clip was performed with craniotomy. Occlusion at both end of the stented segment was possible with Sugita clips. Then, ICG and Doppler confirmed the lesion isolated from the circulation. The recurrent artery of Heubner artery was successfully preserved. We should not hesitate to perform the craniotomy for recurrent dissecting aneurysm after failed intravascular treatment.

2-B-8

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

○ Hee Sup Shin¹, Gook Ki Kim¹, Chang-Woo Ryu², Jun Seok Koh¹

¹Department of Neurosurgery, Kyung Hee University School of Medicine, Seoul, Korea,

²Department of Radiology, Kyung Hee University School of Medicine, Seoul, Korea

Background

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.

Results

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.

Conclusions

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.

2-B-9

MOYA MOYA disease in pregnancy

○ Ekkehard Kasper

TBA

2-B-10

The History and Update of Cerebral Aneurysm Management

○ Gook Ki Kim¹, Hee Sup Shin¹, Jae Seung Bang², Jun Seok Koh¹, Seung Hwan Lee¹

¹Department of Neurosurgery, Kyung Hee University School of Medicine, Seoul, Korea.

²Department of Neurosurgery, Seoul National University College of Medicine, Seoul, Korea

The great pioneers of aneurysm surgery in the mid and late 20th century had made a lot of effort to lay foundation for basic concept and technique for aneurysm microsurgery. The advancement of microsurgical techniques by many great vascular neurosurgeons, such as Dr. Drake, Dr. Yasargil and Dr. Sugita, and development of neuroradiology and surgical equipment allowed the tremendous improvement of treatment results of aneurysm microsurgery. In addition to direct neck clipping, coil embolization introduced by Dr. Guglielmi in 1991, has represented as effective solution for most saccular aneurysms especially in posterior circulation, and number of coil embolization has increased in relation to neck clipping as years passed. Since the years 2006-2007, a new generation of neurovascular stent, flow diverter device, such as Pipeline Embolization Device (PED), can exclude the sac from circulation in fusiform, dissecting, large, giant and wide necked aneurysm.

Subarachnoid hemorrhage (SAH) due to ruptured aneurysm is still very hazardous and dangerous disease, because of its high mortality and morbidity rates even in 21st century with marked improvement of management of SAH. Prevalence of saccular intracranial aneurysm is around 1% in population and incidence of SAH gives figures around 10/100,000 people/year. Therefore, unruptured aneurysm has a risk of bleeding of 1%/year, approximately. There has been a lot of report about natural history of unruptured aneurysm, and some controversies still remained which aneurysm will be ruptured, especially in small sized aneurysm. The one of the best ways to prevent SAH is disturbing aneurysm formation and its growth by reducing the risk factors such as hypertension and cigarette smoking, and another way is to find the unruptured aneurysm by CTA and MRA and treat it before rupturing in good condition by neck clipping or endovascular coiling. According to our database of treatment for cerebral aneurysms during last 10 years, we found about 15% of ruptured aneurysms were very small aneurysms (VSAs) with size of under 3mm in diameter which had poor grade clinical condition on admission and outcome. Therefore, we treated VSAs actively even in unruptured cases by direct neck clipping or endovascular coiling with acceptable complication rate.

2-B-11

Complication avoidance in unruptured middle cerebral artery M1 segment superior wall aneurysm Surgery

○ Sandeep Talari¹, Yoko kato², yasuihiro yamada², vladimir balik³, tsukasa kawase², kei yamashiro²

¹Department of Neurosurgery, CARE Hospitals, visakhapatnam, Andhra Pradesh, India,

²Department of Neurosurgery, Banbuntane hotokukai hospital, Fujita Health University, Nagoya, Japan,

³Department of Neurosurgery, University Hospital Olomouc, Olomouc, Czech Republic

Background

M1 segment aneurysms are one of the challenging surgeries. M1 segment aneurysms account for only 2-3 percent of the total aneurysms and M1 superior wall aneurysms are rarer. M1 superior wall aneurysms are difficult to clip due to their close relation with the lenticulostriate arteries. Involvement of the small perforators while clipping the aneurysm can lead to major morbidity. This study was done to understand the safe ways to clip unruptured M1 superior wall aneurysms thereby avoiding complications and morbidity.

Methods

This is a retrospective study in a neurovascular centre with an experienced neurovascular team. 28 cases of unruptured M1 superior wall aneurysms operated in 4 years from September 2012 to September 2016 were included in the study. CT angiogram, MRI and in some cases DSA was done.

Results

28 cases of M1 superior wall aneurysms were clipped using a standard pterional craniotomy and transylvian approach. There was transient contralateral hemiparesis in 3 patients which improved. There was no permanent morbidity or mortality in the series.

Conclusions

Other than meticulous preoperative simulation and intraoperative technique, adjunctive use of endoscope, ICG-VA, doppler ultrasonography and MEP has reduced the chances of complications.

2-B-12

Withdrawn

2-B-13

Management of unruptured cerebral aneurysms

○ Vincent Ng Yew Poh

TBA

2-B-14

Microsurgical treatment of fusiform aneurysms of the M1 segment of the middle cerebral artery

○ Andrey Vladimirovich Dubovoy

FSBI "Federal Center of Neurosurgery", Novosibirsk

During the period from January, 2014 to August, 2017, 23 surgical procedures were performed in patients with fusiform aneurysms of the M1 segment of the middle cerebral artery. Men were 12, women – 11. The age of patients from 15 to 65 years. The sizes of aneurysms in maximum diameter from 10 to 46 mm. In 10 patients the aneurysms extended to the entire of M1 segment, in 9 cases – only proximal part of M1, in 4 cases – only distal part of M1.

As a method of revascularization in 19 of 23 patients were created single- or double-barreled extra-intracranial bypasses between the frontal and parietal branches of the superficial temporal artery and M2-M3-M4 segments of the MCA. Single-barrel STA-MCA bypasses were created in 8 patients: in 6 – with M3 segment, in two cases – with M4 segment of the MCA. Double-barrel bypasses were created in 11 cases: in 5 cases with both M2 segments of the MCA, in 1 case of M2 and M3 segments, in 1 case with two M3 segments, in 3 the case with M3 and M4 segments, and in 1 case with two M4 segments. In other four cases were created high-flow extra-intracranial bypasses: in one case with M3 segment of the MCA, in 3 cases with M2 segments of the MCA. Also in 5 cases were created intra-intracranial anastomoses in combination of the extra-intracranial bypasses: in two cases side-to-side, in three cases end-to-end.

With the aim of reduction or complete termination of the blood flow in the aneurysm we use a proximal clipping of a parent artery (in 14 cases), distal clipping – in 2 cases, trapping of the aneurysm – in 7 cases.

In 21 of 23 patients according the results of the control of MSCT-angiography, performed the next day after the surgery, the aneurysm is not filling. In 2 patients, who underwent the distal aneurysm clipping, the aneurysms were disappeared 3 months later. The neurological worsening occurred in 2 patients: in one case was appeared the contralateral paresis in the wrist, in one case were appeared the contralateral hemiparesis 4 points.

2-B-15

2-B-16

Intracranial aneurysm surgery: controlling the intraoperative rupture

○ Raftopoulos Christian

TBA

2-B-17

Management of giant aneurysms

○Abhidha Shah, Atul Goel

Department of Neurosurgery, K.E.M. Hospital and Seth G.S. Medical College, Parel, Mumbai-400012, India

Aim: We report our experience with management of giant aneurysms. The role and indications of clipping, surgical bypass and endovascular management in treating these difficult neurosurgical problems is discussed.

Material and methods: Thirty cases of giant aneurysms treated at the authors' institute over the last three years were reviewed and the management strategy analyzed. The sites of the aneurysms were the cavernous segment of the internal carotid artery, the posterior communicating artery, the middle cerebral artery, the superior hypophyseal artery, the anterior communicating artery, the basilar artery and the posterior cerebral artery. All the patients were investigated with four vessel digital subtraction angiography and/or CT angiography. Six of these giant aneurysms grew during the period of observation. Two aneurysms underwent spontaneous thrombosis and did not require any treatment. The posterior circulation aneurysms were treated by endovascular methods. The anterior circulation aneurysms were treated either by direct clipping, high flow radial artery bypass or endovascularly depending on the aneurysm morphology.

Results: Eighteen patients were treated by direct clipping or a high flow bypass. Twelve patients were treated with endovascular methods using either coils, stent assisted coiling or flow diversion. Post-operative four vessel angiography showed total exclusion of the aneurysms from the circulation. The strategy for selection of the optimum treatment modality depending on the site and morphology of the aneurysm is presented. The outcome of management of the three modalities of treatment is discussed.

Conclusions: Giant aneurysms are formidable neurosurgical problems. Apart from direct surgical clipping, cerebral revascularization strategies form an important armamentarium in management. Flow redirection techniques may alter hemodynamics of aneurysms and cause thrombosis. Risks of combined strategies are less than those associated with the natural history of this subset of aneurysms.

2-B-18

Usefulness of the Pipeline embolic device for large and giant carotid cavernous aneurysms

○Shigeru Miyachi¹, Ryo Hiramatsu², Hiroyuki Onishi³, Ryokichi Yagi², Toshihiko Kuroiwa²

¹Neuroendovascular Therapy Center, Aichi Medical University, Nagakute, Aichi, Japan,
²Department of Neurosurgery and Neuroendovascular Therapy, Osaka Medical College, Takatsuki, Osaka, Japan,

³Onishi Neurosurgical Hospital, Akashi, Hyogo, Japan

[Purpose] Conventional coil embolization for large carotid cavernous aneurysms (CCAs) has limited utility due to its inability to prevent recurrences and reduce the mass effect. Trapping of the parent artery may have a risk of ischemic complications due to intracranial perfusion disorders. We successfully treated 24 patients with large CCAs using a flow diverter (Pipeline™ embolic device: PED), and this report discusses the safety and efficacy of this method.

[Clinical material and methods] Twenty four patients (23 females, mean age 71.5 years old) with large CCAs, including 6 giant CCAs, were treated with a PED over three years. Under sufficient dual anti-platelet management, the PED was deployed over the orifice of the aneurysm. Two patients required multiple telescoping stents. Clinical and radiological states were checked with MRI at 1, 3 and 6 months post-surgically. Angiographic follow-up was performed at 6 months.

[Results] In all patients, PED was appropriately deployed. Stagnation of contrast with eclipse signs was observed post-angiogram in 21 cases. One patient requiring 5 telescoping stents experienced temporary ischemic symptoms. Fourteen patients experienced improvement of ocular motor impairment deficiency, including 6 patients who recovered. Angiograms at 6 months follow-up showed complete occlusion in 63% (12/19) of patients, and MRI showed reduction of aneurysm volume in 89% (17/19) of patients.

[Conclusion] Flow diverters for large CCAs showed promising clinical and radiological efficacy. They can shrink the aneurysm and improve symptoms without sacrificing the parent artery. It will be necessary to summarize the cases and to verify the long-term results.

2-B-19

Management of intracranial aneurysms in developing country. Cost effectiveness of coiling versus clipping in single centre of Rabat, Morocco

○ Abdessamad El Ouahabi

Department of Neurosurgery Hopital des Specialites, Ibn Sina University Medical Center, Rabat

Background: Since the results of the ISAT study published in 2002 several studies conducted in developed countries compared the results of both endovascular and microsurgical techniques. Our study aims to draw attention to the cost and effectiveness of both treatment modalities in a developing country.

Materials and Methods: Retrospective study is conducted from 2008 to 2014. The study population consisted of 202 Patients (138 men and 64 women) with intracranial aneurysms were enrolled. Clinical outcome at discharged and at 6 months, and cost of treatment related were evaluated in both groups. Statistical analysis was performed using the software Epi Info version 3.5.4 for Microsoft Windows XP.

Results: One hundred sixteen patients underwent surgery and 86 received endovascular treatment. Most patients (145) were WFNS grade I-II, of these patients 60 received endovascular treatment and 85 were clipped. The quality of exclusion was complete in 51% of coiling and 73% in clipping. The average hospital stay was 8 ± 5 days for patients who underwent endovascular treatment against 14 ± 7 days for surgery ($P = 0.02$). The average total cost of treatment was 4181£ (26% of cost was for Coils) for endovascular against 3227£ (10% of cost was for clips) for surgery. The clinical outcome base on modified ranking scale score was good in 86% of coiling and 78% in clipping ($P = 0.09$).

Conclusion. We found that there is no difference in outcome between clipping and coiling in our series. Total cost of resources used in endovascular procedure was significantly higher than surgery.

2-B-20

Establishment of a Comprehensive Stroke Center in WakeMed Hospital System, North Carolina, USA: Collective Experience and Challenges

○ Andrey Belayev¹, Kimberly Elks², Jacob Rodman¹

¹Raleigh Neurosurgical Clinic, ²WakeMed Health & Hospitals

In the United States, stroke is the fourth leading cause of death and a major cause of adult disability with annual cost of stroke care exceeding \$73 billion. Improved care of patients with strokes may reduce the high morbidity and mortality from this disorder and have significant public health and financial implications. One of the major approaches to improving stroke care is the organization of patient's care into stroke programs. Joint Commission in collaboration with the American Heart Association/American Stroke Association have developed the following advanced levels of certification for stroke programs: Acute Stroke Ready Hospital (ASRH), Primary Stroke Center (PSC), Thrombectomy-Capable Stroke Center (TSC), and Comprehensive Stroke Center (CSC). Although PSCs have become the key unit of organization for the delivery of stroke care in the U.S. with estimated coverage of 50% of the U.S. population, there is a need to take stroke care to a new level of excellence. The major differences between PSC and CSC are the capability of performing neurointerventional treatment 24/7, availability of dedicated neurological ICU and advanced imaging, participation in IRB-approved research, and standardized performance and reporting systems. In 2012 the first certified centers have been established. Current data suggest that management of patients in CSCs provide better outcomes and cost-effectiveness.

WakeMed Hospital system serves approximately 458,000 people in Wake County and has 791 code strokes annually. The main hospital of the system is located in Raleigh, NC and prior to March 2017 the hospital served as a PSC. In this presentation, we will discuss the current certification criteria of the Joint Commission and process to become a CSC in WakeMed main hospital in Raleigh, NC. This includes initiation of neurointerventional treatment coverage, establishing neuro-critical ICU, application of protocol-based patients' selection process. In our experience, education for the available interventional stroke treatment remains the biggest challenge for patients and physician population in the area.

Establishing CSC promise to achieve more accurate diagnoses, more timely therapies, and improve overall outcomes of patients with strokes in Wake County.

2-B-21

Starting cerebrovascular surgery: A young neurosurgeon experience.

○ Thomas Tommy

Siloam Hospitals, Indonesia

TBA

2-B-22

The Role of International Fellowship for Young Neurosurgeons

○ Thomas Tommy, Lutfi Hendriansyah, Julius July, Harsan Harsan, Yesaya Yunus, Eka Julianta Wahjoepramono

Siloam Hospitals, Indonesia

As a young neurosurgeon, being graduated from neurosurgery training means a new start of a career. Neurosurgery training provides basic knowledge and skill needed for a neurosurgical practice, thus more training and mentorship in advanced topics is needed to develop. Young neurosurgeons could participate to an international fellowship program that is available worldwide, either only as an observer or also hands-on training, workshops and seminars.

International fellowship is important as an adjunct process for knowledge and skill refinement in education of neurosurgery and it should be recommended to last year residents or young neurosurgeons from developing countries as one method of establishing a global standard of care and international friendship.

This topic means as a media for sharing the experience that the author had during the International Fellowship program and its role and impact for young neurosurgeons.

2-B-23

Lessons learnt in clipping of Acom Aneurysms.

○ Jaspreet Singh Dil

TBA

2-B-24

Comprehensive Modern Neurosurgery in rural India, our experience at Rural Hospital.

○ Dr. Hemant Ganpatrao Deshpande¹, Dr. Sandeep Iratwar², Dr. Akshay Patil³, Dr. Shailendra Anjankar⁴, Dr. Nitin Madavi⁵

¹Dr. Hemant Deshpande, Prof. of Neurosurgery, JNMC, DMIMS, Sawangi (Meghe) M.S.,

²Dr. Iratwar S. Asso. Professor, ³Dr. Patil, A. Asst. Professor.,

⁴Dr. Anjankar S. Asst. Professor., ⁵Dr. Madavi N. Resident Doctor.

<Neuro Surgery as a speciality was established in 1949 by the pioneers Prof. J. Chandy, Prof. B. Ramamurthy,>

< Prof. R. Ginde.>

<By 1980 Neurosurgery was established in almost all major cities.>

<Acharya Vinoba Bhave Rural Hospital affiliated to Jawaharlal Nehru Medical College at village Sawangi (Meghe)>

<The population of the village was mere 1500.The college was started in 1989.Presently the bed strength is 1300.>

<Independent Neurosurgery speciality was started in 2012.

Dedicated 30 bedded ward and 10 Neuro ICU beds &>

<three operation rooms.From 2012 till date 4535 patients wer treated and 1400 operations were performed.>

<Our experiences and future plans would be presented.>

2-B-25

Split Cord Malformation – An experience of 160 cases in January 2017

○ A.K. Mahapatra

All India Institute of Medical Sciences

Between 2011-2015 (4 yrs) over 20000 neurosurgical operations were performed, among them 156 cases were SCM (< 1%) of surgery. 86 patients had SCM I and 66 had SCM II, 4 patients had SCM multiple sites. In 9 patients of Type I SCM, spur was dorsally placed. All were the patients operated. Overall improvement 40% and 55% patients remained static. The deterioration noted in 5% patients. Average follow up was 1 yr and follow up ranged 6 months – 3 years.

CONCLUSION: SCM is not uncommon with proper investigation more and more cases are diagnosed. No of SCM patients have increased with MRI. In planned surgery deterioration can be reduced to less than 5%.

2-B-26

Which One Ruptured? Subarachnoid Hemorrhage and Multiple Intracranial Aneurysms

○ Sepideh Amin Hanjani

Introduction: When subarachnoid hemorrhage (SAH) is encountered in the setting of multiple intracranial aneurysms, hemorrhage pattern is generally the primary indicator of the ruptured lesion. When the pattern is not definitive, rupture site determination typically relies on angiographic features such as size, morphology and location. We examined the frequency with which such features lead to misidentification of the ruptured lesion, subsequently determined by open microsurgical evaluation.

Methods: SAH cases that proceeded to craniotomy over a ten year period were reviewed, and cases with multiple intracranial aneurysms were identified. Initial head CT scans were reviewed to determine whether the SAH pattern was definitive for the source aneurysm. Those with “non-definitive” hemorrhage patterns were blindly evaluated for presumed source by reviewing the characteristics of the aneurysms on angiography, and the original presumption of rupture site at time of the incident evaluation was also recorded. Operative reports were then reviewed to confirm or refute the imaging-based determination of the ruptured source.

Results: 531 SAH cases undergoing craniotomy were identified; 151 had multiple aneurysms. 80 (53%) had “non-definitive” hemorrhage patterns on initial CT. Of the 71 with definitive bleed patterns, all had the assumed rupture site confirmed to be accurate at the time of surgery. In contrast, 14 (17.5%) of the cases with non-definitive hemorrhage patterns on CT had discordance between the assumed source on original or secondary radiological review, and the actual intraoperative determination of the ruptured aneurysm.

Conclusion: SAH cases with multiple aneurysms are not infrequent and demonstrate a bleed pattern that does not definitively identify the source aneurysm in about half of cases. Morphological features cannot reliably be used to determine rupture site in these cases. Microsurgical clipping, confirming obliteration of the ruptured lesion, may be preferentially warranted in this setting, unless all lesions can be contemporaneously and effectively treated with endovascular embolization.

2-B-27

Contralateral approach for clipping of intracranial aneurysms

○Qing Lan

2nd Affiliated Hospital, Soochow University, P.R.China

Objective To discuss the indications and related techniques of the contralateral approach to intracranial aneurysms. **Methods** 13 cases with intracranial aneurysms were retrospectively analysed, including 10 bilateral multiple intracranial aneurysms (the contralateral aneurysms were 1 ophthalmic artery aneurysm, 4 MCA aneurysms, 4 PCom. A aneurysms and 1 ACA A2-A3 segment aneurysm), 2 ophthalmic artery aneurysms, 1 MCA aneurysm with a contralateral AVF. The surgical approaches for these cases were as follows : the interhemispheric keyhole approach in 1 case (ruptured ACom. A aneurysm accompanied with a contralateral A2-A3 segment aneurysm), the supraorbital keyhole approach in 9 cases, the pterional approach in 2 cases, the frontal small bone window approach in 1 case (ipsilateral frontal hemorrhagic AVF accompanied with a contralateral MCA aneurysm). CT, CTA, MRI based image fusion 3 D model were applied when necessary. **Results** Of these 13 contralateral aneurysms, 11 aneurysms were completely clipped, 1 was incompletely clipped and 1 was explored without clipping. Operation related complications were as follows: ipsilateral olfactory nerve injury in 2 cases; brain ischemia in 2 cases, others were discharged uneventfully. **Conclusions** The advantage of contralateral approach is obvious. Clipping of all aneurysms via a single, unilateral approach avoids a second craniotomy in selected patients. Adequate exposure for medial directed ophthalmic artery aneurysm can reduce surgery-related injury. Dissecting the olfactory nerve decreases nerve traction and offers nerve protection. Image fused 3D reconstruction mode contributes to accurate preoperative plan. Keyhole surgical techniques can be applied in the contralateral approach to make it more minimally invasive. Choosing this approach is individually based on the characteristics of the lesions and techniques of the surgeons.

[Key words] Intracranial aneurysm; Microsurgery; Contralateral approach; 3D print mode

