East Asian Conference of Neurointervention 2016

Venue: Kobe International Exhibition Hall 2
6-11-1 Minatojima-Nakamachi, Chuo-ku, Kobe 650-0046, Japan
Tel; +81-78-302-1020, Fax; +81-78-302-1870

Dates:
Registration July 2 (Sat) 18:30- at Welcome Party in Kobe Portopia Hotel
July 3 (Sun) 7:00- at Conference Venue
Conference July 3 (Sun) 8:00-16:10

Welcome Party July 2 (Sat) 18:30
Grand Banquet Room “Owada”
at Kobe Portopia Hotel South Wing 1F

Registration fee 10,000 JPY or 100 USD (cash only, Welcome Party included)

Language English

Dress code Smart Casual

Map
Kobe International Exhibition Hall

Hall 2 3F

Director: Moon Hee Han, Jainmin Liu, Nobuyuki SAKAI
Co-Director: Masayuki Ezura, Shigeru Miyachi
Program Chairman: Yasushi Ito
Secretary: Chiaki Sakai

Faculty:

〈China〉
Bing Fang
Yina Wu
Yu Zhou

Conghui Li
Pengfei Yang
Chao Zou

Jiang Liu
Qian Zheng
Qing Zhu

〈Korea〉
Seung Kug Baik
Woo Sang Jung
Young Seo Lee
Shang Hun Shin

Joon Huh
Hyun-Seung Kang
Woong Jae Lee
Dong Hyun Yoo

Hae Woong Jeong
Nam-Joong Lee
Jung Hyun Park
Woong Yoon

〈Japan〉
Yukiko Enomoto
Toshio Higashi
Hirotoshi Imamura
Eiichi Kobayashi
Yasushi Matsumoto
Yasunari Niimi
Kittipong Srivatanakul
Michihiro Tanaka
Wataro Tsuruta

Toshiyuki Fujinaka
Masaru Hirohata
Toshihiro Ishibashi
Ryushi Kondo
Yuichi Murayama
Hidenori Ohishi
Kenji Sugiu
Satoshi Tateshima
Hiroshi Yamagami

Hitoshi Hasegawa
Akio Hyodo
Akira Ishii
Naoya Kuwayama
Ichiro Nakahara
Tetsu Sato
Kenji Sugiu
Tomoaki Terada
Shinichi Yoshimura

Koji Iihara
Takashi Izumi
Yuji Matsumaru
Shigeru Nemoto
Junichiro Satomi
Waro Taki
Tomoyuki Tsumoto
Instruction for speaker

Oral session

1. Presentation Time; Each speaker have **10 minutes including discussion time**. Please remain enough time to discuss.
2. Please prepare in your computer and please preview your presentation data at the PC Center at least 1 hour prior to your presentation, located at the front of room.
3. Audio playback is possible, if you want to use, let us know.
4. We prepare a Mini D-sub 15 pin PC cable connector. If your PC is not compatible with this cable connector, please bring an adaptor to connect your PC to the Mini D-sub 15 pin PC cable connector. And, please bring your AC adapter with you.
5. The resolution of the LCD projector is XGA (1024 x 768). If your computer requires a resolution setting to be changed, please change this setting beforehand.
6. Please also bring your presentation data on a media (either on USB flash memory or CD-R) as a backup file.
7. After checking your data at the PC Center, please bring your PC to the Operation Desk in the session room 30 minutes prior to the start time of your session.
8. Please be seated in the next speaker’s seats located at the front left of your session room at least 20 minutes prior to your presentation start.
9. Remote presentation system is equipped in the each session room. You have a TFT monitor, mouse and USB keyboard on the podium to operate your presentation.
10. Following the conclusion of your session, we will return your computer at the Operation Desk. Please come to the Operation Desk promptly to collect it.
Welcome to EACoN2016

Dear, Friends

On the behalf of organizing committee, we are pleased to welcome all of you to East Asian Conference on Neurointervention (EACoN) 2016 in Kobe, Japan on 3rd July collaboration with Brush-up Seminar of Neuro-Endovascular Therapy (BSNET) 2016 on Jun 30th〜July 2nd. This year, considering recent development of flow diverters, we planned featured symposium, “Flow diverter in East Asia”. Another topics of Neurointervention are also presented in the meeting.

According to the tradition and spirit of EACoN, we strongly believe all attendants of the meeting will strengthen scientific collaboration and friendship through open hearted presentations and discussions.

We are looking forward to seeing all of you in Kobe.

Best regards,

Yasushi Ito
President of EACoN2016

Nobuyuki Sakai
Secretory General of EACoN2016
<table>
<thead>
<tr>
<th>TIME</th>
<th>Event</th>
<th>Speaker/Moderator</th>
<th>Affiliation, Nationality</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00</td>
<td>Registration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8:00</td>
<td>Welcome Message</td>
<td>Nobuyuki Sakai</td>
<td>Japan</td>
</tr>
<tr>
<td>8:05</td>
<td>Opening Ceremony</td>
<td>Seung Kug Baik, Jieqing Wan, Yasushi Ito</td>
<td>Korea, China, Japan</td>
</tr>
<tr>
<td>8:15</td>
<td>Session 1 &quot;Aneurysm 1 &quot;</td>
<td>Moon Hee Han, Conghui Li, Masayuki Ezura</td>
<td>Korea, China, Japan</td>
</tr>
<tr>
<td>1-1</td>
<td>Virtual stent and LVIS Jr. for AcoA / MCA unruptured aneurysm</td>
<td>Naoto Kimura</td>
<td>Iwate prefectural central hospital, Japan</td>
</tr>
<tr>
<td>1-2</td>
<td>Treatment of complex intracranial aneurysms using LVIS stent: Shanghai Experience</td>
<td>Pengfei Yang</td>
<td>Shanghai Hospital, Second Military Medical University, China</td>
</tr>
<tr>
<td>1-3</td>
<td>T-configured stenting with Enterprise VRD2: technical tips</td>
<td>Keisuke Sato</td>
<td>Niigata University, Japan</td>
</tr>
<tr>
<td>1-4</td>
<td>Double Stents Assisted Coil Embolization of Ruptured Supraclinoid Blood Blister-Like Aneurysm of Internal Carotid Artery</td>
<td>Bing Fang</td>
<td>Second affiliated hospital of Zhejiang University, China</td>
</tr>
<tr>
<td>1-5</td>
<td>Interobserver variability of aneurysm morphology: discrimination of the daughter sac</td>
<td>Woo Sang Jung</td>
<td>Gangnam Severance Hospital, Yonsei University, Korea</td>
</tr>
<tr>
<td>9:20</td>
<td>Session 2 &quot;Aneurysm 2 &quot;</td>
<td>Qing Zhu, Yuji Matsumaru, Nam Joon Lee</td>
<td>China, Japan, Korea</td>
</tr>
<tr>
<td>2-1</td>
<td>Microcatheter Looping Facilitates Access to Both the Acutely Angled Parent Artery and Cerebral Aneurysms for Effective Embolization</td>
<td>Conghui Li</td>
<td>China</td>
</tr>
<tr>
<td>2-2</td>
<td>Proximal Anterior Cerebral Artery Aneurysms (A1 segment): Retrospective Review of Characteristics and Endovascular Treatment</td>
<td>Hae Woong Jeong</td>
<td>Inje University Busan Paik Hospital, Japan</td>
</tr>
<tr>
<td>2-3</td>
<td>Coil embolization for unruptured ICA bifurcation aneurysm via anterior communicating artery due to complicated anatomy: case report.</td>
<td>Yu Takahashi</td>
<td>Okayama University Graduate School of Medicine, Japan</td>
</tr>
<tr>
<td>2-4</td>
<td>Safety of Preprocedural Antiplatelet medication in coil embolization of SAH</td>
<td>Jung Hyun Park</td>
<td>Dongtan Sacred Heart Hospital, Hallym University, Korea</td>
</tr>
<tr>
<td>2-5</td>
<td>Delayed Clopidogrel Hyper-response After Neuroendovascular Treatment</td>
<td>Hideki Endo</td>
<td>Nakamura Memorial Hospital, Japan</td>
</tr>
<tr>
<td>2-6</td>
<td>Low-dose prasugrel premedication for endovascular treatment of intracranial aneurysms Break</td>
<td>Hyun-Seung Kang</td>
<td>Seoul National University Hospital, Korea</td>
</tr>
<tr>
<td>10:10</td>
<td>Break</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10:20</td>
<td>Featured Symposium &quot;Flow diverter in East Asia&quot;</td>
<td>Hidenori Oishi, Seung Kug Baik, Yu Zhou</td>
<td>Japan, Korea, China</td>
</tr>
<tr>
<td>S-1</td>
<td>Endovascular therapy of intracranial aneurysm with Pipeline Flex: consecutive 30 cases in Juntendo University Hospital</td>
<td>Kohsuke Teranishi</td>
<td>Juntendo University School of Medicine, Japan</td>
</tr>
<tr>
<td>Session</td>
<td>Title</td>
<td>Speaker(s)</td>
<td>Institution/Location</td>
</tr>
<tr>
<td>---------</td>
<td>------------------------------------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>S-2</td>
<td>Treatment of giant MCA aneurysm using flow-diverter with preservation of arterial branch</td>
<td>Jin-Young Jung</td>
<td>Dong-Eui Medical Center, Busan, Korea</td>
</tr>
<tr>
<td>S-3</td>
<td>Parent artery reconstruction for large or giant cerebral aneurysms using a Tubridge flow diverter(PARAT): a multicenter, randomized, controlled clinical trial</td>
<td>Yu Zhou</td>
<td>China</td>
</tr>
<tr>
<td>S-4</td>
<td>Innovation of Endovascular Treatment Strategy for Large Carotid Cavernous Aneurysms - Safety and Efficacy of Flow Diverter</td>
<td>Shigeru Miyachi</td>
<td>Osaka Medical Collage, Japan</td>
</tr>
<tr>
<td>S-5</td>
<td>Dynamic Volume Change of Thrombosed Giant Aneurysm after Flow-Diverting Stent Deployment: Quantitative Assessment by Computed Tomographic Volumetric Image</td>
<td>Woong Jae Lee</td>
<td>Chung-Ang University College of Medicine, Korea</td>
</tr>
<tr>
<td>S-6</td>
<td>Temporal changes of intra-aneurysmal pressure after placement of Pipeline Embolization Device using elastase-induced aneurysm model in rabbits</td>
<td>Hideo Chihara</td>
<td>Kokura Memorial Hospital Japan</td>
</tr>
<tr>
<td>11:20</td>
<td>Session 3 &quot;CAS, stroke&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-1</td>
<td>Comprehensive Hybrid Strategy for Carotid Artery Stenosis with “Toyama Carotid 8” rules.</td>
<td>Naoya Kuwayama</td>
<td>University of Toyama, Japan</td>
</tr>
<tr>
<td>3-2</td>
<td>Experience of staged angioplasty for carotid artery stenosis to avoid hyperperfusion syndrome</td>
<td>Kazutaka Uchida</td>
<td>Hyogo College of Medicine, Japan</td>
</tr>
<tr>
<td>3-3</td>
<td>Staged Carotid Artery Stenting in Patients with Severe Carotid Stenosis: Multicenter Experience</td>
<td>Dong Hyun Yoo</td>
<td>Seoul National University Hospital, Korea</td>
</tr>
<tr>
<td>3-4</td>
<td>A single center retrospective study of staged angioplasty for cerebral hyperperfusion high risk group of cervical carotid artery stenosis.</td>
<td>Takahiro Morita</td>
<td>Sendai Medical Center, Japan</td>
</tr>
<tr>
<td>3-5</td>
<td>Long-term outcome of endovascular recanalization in patients with Chronic Internal Carotid Artery occlusion: a single-center</td>
<td>Jieqing Wan</td>
<td>China</td>
</tr>
<tr>
<td>3-6</td>
<td>Intracranial Angioplasty and Stenting for Crebral Artherosclerosis : Results of 93 Consecutive Patients</td>
<td>Daehyun Hwang</td>
<td>Dongtan Sacred Heart Hospital, Korea</td>
</tr>
<tr>
<td>3-7</td>
<td>Acute stroke showing major intracranial vessel occlusion: characteristics of cardioembolics and atherosclerosis related in situ stenosis/occlusion</td>
<td>Nobutaka Horie</td>
<td>Nagasaki University School of Medicine, Japan</td>
</tr>
<tr>
<td>12:40</td>
<td>Luncheon lecture (Daiichi-Sankyo)</td>
<td>Masaru Hirohata, Yasaki Ito</td>
<td>Kurume University, Niigata University</td>
</tr>
<tr>
<td></td>
<td>Platelet Reactivity and Recurrence of Ischemic Stroke</td>
<td>Hiroshi Yamagami</td>
<td>National Cerebral and Cardiovascular Center, Japan</td>
</tr>
<tr>
<td></td>
<td>Endovascular treatment of complex cerebral aneurysms</td>
<td>Akira Ishii</td>
<td>Kyoto University, Japan</td>
</tr>
<tr>
<td>13:40</td>
<td>Session 4 &quot;CCF, DAVF, AVM&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13:50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-1</td>
<td>Retreatment by Detachable Balloon for Recurrent</td>
<td>Qing Zhu</td>
<td>China</td>
</tr>
<tr>
<td>Session</td>
<td>Title</td>
<td>Speaker</td>
<td>Institution</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>4-2</td>
<td>Usefulness of DynaCT in the Endovascular Treatment of DCCF</td>
<td>Chao Zou</td>
<td>China</td>
</tr>
<tr>
<td>4-3</td>
<td>The feasibility of hybrid operation room for the treatment of isolated type dural arteriovenous fistula</td>
<td>Hiroaki Neki</td>
<td>Saitama Medical University International Medical Center, Japan</td>
</tr>
<tr>
<td>4-4</td>
<td>Endovascular Embolization for Complex Intracranial Dural Arteriovenous Fistula under Protection of Intra-Sinus Balloon</td>
<td>Qian Zheng</td>
<td>China</td>
</tr>
<tr>
<td>4-5</td>
<td>Penetrable large shunting point in intracranial dural arteriovenous fistulas: providing alternative access route to transarterial intravenous embolization</td>
<td>Dong-Hyun Shim</td>
<td>Pusan National University Yangsan Hospital, Korea</td>
</tr>
<tr>
<td>4-6</td>
<td>Endovascular Treatment of the DAVF at the Petrous Apex Region</td>
<td>Jiang Liu</td>
<td>China</td>
</tr>
<tr>
<td>4-7</td>
<td>Target embolization for ruptured cerebral AVM</td>
<td>Ryushi Kondo</td>
<td>Kitasato University, Japan</td>
</tr>
<tr>
<td>15:00</td>
<td><strong>Session 5 “Thrombectomy”</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5-1</td>
<td>Parametric Digital Subtraction Angiography Imaging for Objective Evaluation of Endovascular Treatment in Cerebrovascular Diseases</td>
<td>Yina Wu</td>
<td>Changhi Hospital, Second Military Medical University, China</td>
</tr>
<tr>
<td>5-2</td>
<td>Interaction between the stent strut and thrombus as characterized by contrast-enhanced high-resolution cone-beam computed tomography during deployment of the Solitaire stent retriever</td>
<td>Tomoyuki Tsumoto</td>
<td>National Kyushu Medical Center, Japan</td>
</tr>
<tr>
<td>5-3</td>
<td>Histological examination of vascular damage caused by stent retriever thrombectomy devices</td>
<td>Daisuke Arai</td>
<td>Kyoto University, Japan</td>
</tr>
<tr>
<td>5-4</td>
<td>Relay Balloon Technique for Recanalization of Acute Symptomatic Proximal ICA occlusion</td>
<td>Sang Hun Lee</td>
<td>Asan Medical Center, University of Ulsan College of Medicine, Korea</td>
</tr>
<tr>
<td>5-5</td>
<td>Recent our results of endovascular recanalization by stent retriever for middle cerebral artery occlusion</td>
<td>Yuchi Matsui</td>
<td>Kobe City Medical Center General Hospital, Japan</td>
</tr>
<tr>
<td>5-6</td>
<td>The impact of tortuosity of the target vessels on intracranial hemorrhage after acute thrombectomy</td>
<td>Manabu Shirakawa</td>
<td>Hyogo College of Medicine, Japan</td>
</tr>
<tr>
<td>16:00</td>
<td><strong>Closing Remarks</strong></td>
<td>Yasushi Ito</td>
<td>Chairman of EACoN2016</td>
</tr>
</tbody>
</table>
Session 1 "Aneurysm 1"
1-1)
Virtual stent and LVIS Jr. for AcoA / MCA unruptured aneurysm

Naoto Kimura, Michiko Yokosawa, Kazushi Hara, and Takayuki Sugawara
Neurosurgical department of Iwate prefectural central hospital, Morioka, Japan

LVIS Jr. is a latest device for neck bridging stent available in Japan. It is compatible for Headway17 thus can approach more distal than previous stent. On the other hand SIEMENS workstation attached to angio suite can construct virtual stent from 3D-DSA data.

We evaluate the efficacy of combination of Virtual stent and LVIS Jr. for Anterior communicating artery (AcoA) / middle cerebral artery (MCA) unruptured aneurysm.

88 aneurysms were treated in Iwate prefectural central hospital from May. 2015 to May 2016. In total, 3 MCA and 5 AcoA aneurysms were treated using LVIS Jr. All treatment were under local anesthesia and dual antiplatelet drugs (Aspirin 100mg, Chripodigrel 75mg/ day )were given at least 1week before treatment.

Virtual stent was performed in all cases. LVIS Jr. was deployed at suitable place in all cases without any trouble. Six cases ended in complete obliteration or small neck remnant, two cases finished with body filing.

LVIS Jr. is nitinol braded stent and has small diameter. Thus, high performance is shown for AcoA / MCA AN. However when it deployed too distal from curvature, success rate of proximal stent opening get worse. Virtual stent is useful to visualize stent diameter and length at parent artery on preferred position. Combination of Virtual stent and LVIS Jr. is useful for AcoA / MCA aneurysm treatment.

1-2)
The safety and efficacy of low profile visualized intraluminal support (LVIS) stents in assisting coil embolization of intracranial saccular aneurysms: a single center experience

Pengfei Yang, Zhengzhe Feng, Yibin Fang, Yi Xu, Bo Hong, Wenyuan Zhao, Jianmin Liu, Qinghai Huang
Department of Neurosurgery, Changhai Hospital, Second Military Medical University, Shanghai, China, 200433

ABSTRACT

Background : The low profile visualized intraluminal support (LVIS) device is a new generation of selfexpanding braided stents recently introduced into China for stent assisted coiling of intracranial aneurysms. This study assessed the clinical safety and efficacy of the LVIS stent for embolization of intracranial saccular aneurysms.

Methods : Patients with intracranial saccular aneurysms treated using the LVIS device in our center between April 2014 and December 2014 were reviewed. The primary outcomes were procedural safety, target aneurysm recurrence, and mid-term follow-up of clinical and angiographic outcomes.

Results : 97 patients with intracranial saccular aneurysms were treated using the LVIS stent, with 100% technical success rate. No mortality was observed. One patient had transient deficit (1/97, 1.0%). Immediate angiographic outcome evaluation showed complete occlusion in 28 (28.8%) and neck remnant in 39 (40.2%) of the 97 patients, respectively. Of the 76 (78.35%) patients who underwent angiographic follow-up at a mean of 8.1 months, complete occlusion was achieved in 64 (84.2%) patients. In the remaining patients, neck remnant in nine (11.8%) and residual sac in three (4%) patients were observed. None of the patients had any target aneurysm recurrence, and the mortality rate was 0%.

Conclusions : The LVIS stent is safe and effective in the treatment of intracranial saccular aneurysms.

1-3)
T-configured stenting with Enterprise VRD2: technical tips

Keisuke Sato, Yasushi Itou, Hitoshi Hasegawa, Kazuhiko Nishino, Yukihiro Fujii
Department of Neurosurgery, Brain Research Institute, Niigata University, Niigata, Japan

Introduction: Indication of aneurysmal coil embolization has been expanding after introduction of Enterprise vascular reconstructive device (VRD). Moreover, Enterprise VRD2 improved in conformability has been launched already both in Japan and Korea, and it will be soon launched in 2017 in China.

Although it has been difficult to treat wide neck aneurysm in either type of terminal or sidewall no matter whether clipping or coiling, we can now successfully perform the coil embolization for such kind of aneurysms by the development of the dual stent techniques, such as Y-configured and T-configured stent-assist coil embolization.

So we report two cases those were performed coil embolization with T-configured stenting using Enterprise VRD2 in our institution in 2016.

The procedure was carried out under general anesthesia. Microcatheter was advanced into the aneurysm with jailing technique in principle.
Case presentation:
Case 1  A 68 y.o. female was diagnosed with an unruptured left IC-PC aneurysm. Left Pcom was fetal type and its orifice was located on the aneurysmal sidewall beside the neck. We decided to introduce first VRD2 into Pcom, then to advance second VRD2 into IC making T-configured shape. The catheterization into Pcom was difficult but was achieved with wrap around technique. After successful T-configured stenting, coil embolization was made without any neurological deficit.
Case 2  A 71 y.o. female had an unruptured right IC-PC incidental aneurysm. We planned T-configured stenting with the same process as case1. But the catheterization into Pcom was so difficult that we needed the exchanges of microcatheters and microguidewires several times. Finally we achieved T-configured stenting ideally and stent-assisted coil embolization was finished successfully. But after the procedure, this patient had moderate left hand motor weakness. MRI diffusion-weighted imaging showed multiple small infarctions at right hemisphere. Now the symptom is getting improved and she continues rehabilitations.

Discussion/Conclusion:T-configured stent-assist technique can achieve dense coil packing into the aneurysm, preserving the parent vessels while avoiding the confliction of two stents. So it is quite possible that T-stenting reduce the risk of thromboembolic complication compared with Y-stenting. However, it seems to be more difficult to deploy stents without the interspace between each stent. Because the system of neck bridge stent makes it difficult to predict the optimal position of the proximal flare during deployment period even in expert physicians.
We will report several specific tips and attentions regarding T-configured stenting technique through the valuable practical experiences.

Bing Fang, Jing Xu, Xianyi Chen, Dingyao Jiang, Jun Yu
Second affiliated hospital of Zhejiang University, Department of Neurosurgery
Hangzhou, China.

OBJECTIVE:
Blood blisters-like aneurysms (BBAs) are unique due to their high risk of recurrent bleeding associated with their fragile neck. The best treatment for BBAs is still controversial. This paper sought to evaluate the safety and efficacy of double stent overlapping and assisted coiling in the treatment of BBAs.

METHODS:
eight consecutive patients with ruptured BBAs managed with double stent overlapping and assisted coiling were enrolled in this study. The clinical characteristics, procedural data, angiographic outcome, and follow-up results were reviewed.

RESULTS:
double stent overlapping and assisted coiling were successfully performed in all 8 cases. The instant angiographic result was total occlusion in 6 cases, residual aneurysm in 2 cases. Angiographic follow-ups revealed stable in all 6 cases which were total occlusion. One of the residual aneurysms was stable and another one was progressed. The modified Rankin Scale score at 12-16 months follow-up was 0 in 7 cases, 1 in 1 case.

CONCLUSION:
Stent-assisted coiling and double overlapping stents are feasible and safe for BBAs.

1-5) Interobserver variability of aneurysm morphology: discrimination of the daughter sac

Woo Sang Jung, Sang Hyun Suh
Department of Radiology, Gangnam Severance Hospital, Yonsei University, Seoul, Korea

Background and Purpose: Several definitions have been proposed to distinguish the daughter sac when treating unruptured intracranial aneurysms. The aim of this study was to evaluate interobserver variability of aneurysm morphology, including the daughter sac, using criteria from the International Study of Unruptured Intracranial Aneurysms (ISUIA) and the Unruptured Cerebral Aneurysm Study of Japan (UCAS).

Materials and Method: After approval by the institutional review board, we analyzed three morphological features (daughter sac, lobulation, and irregular margin) from the ISUIA and UCAS using angiographic images from 102 saccular aneurysms. Four independent readers interpreted each morphological criterion using dichotomized scales (existence or not). The κ statistic was used to measure interobserver agreement, and κ>0.6 was considered substantial agreement.

Results: For discrimination of the daughter sac, interobserver agreement among the four readers was substantial using the UCAS criteria (κ=0.626 for two-dimensional (2D) and 0.659 for three-dimensional (3D) images) but not for the ISUIA criteria (κ=0.487 for 2D and 0.473 for 3D images; significant difference). Irrespective of the images used, pairwise pooled κ values for the UCAS were >0.6, except for one case (score of 0.54 between readers A and B). Regarding the proportion of positive reads, there was a significant difference between reads for the daughter sac using the UCAS and ISUIA criteria.

Conclusion: For discrimination of the daughter sac, the UCAS definition showed a higher reliability than the ISUIA. However, a further prospective study is necessary to validate this definition as the treatment standard for unruptured intracranial aneurysms.
Session 2  “Aneurysm 2”
2-1) Microcatheter Looping Facilitates Access to Both the Acutely Angled Parent Artery and Cerebral Aneurysms for Effective Embolization

LI Cong-hui.
Department of Neurosurgery, Shijiazhuang First Hospital, Shijiazhuang, 050011, China

Abstract : Objective To discuss the safety and effectiveness of microcatheter looping technique for super-selective catheterization into acute angle parent vessel.

Methods The data of 21 patients using microcatheter looping technique for acute angle parent vessel were analyzed retrospectively. This technique was used in nineteen patients whose ten aneurysms were at the posterior communicating arteries, 2 at optical artery segment of internal carotid artery (ICA), 4 at M1 segment of middle cerebral artery (MCA) and 3 at posterior inferior cerebellar artery (PICA), and in the other two patients who developed AVM or AVF. Microcatheter α loop was used to super-select parent vessel.

Results The microcatheter looping technique was successfully used in twenty-one patients while only one patient developed mild vasospasm.

Conclusions Microcatheter looping technique to super-select acute angle branch will be more safely and effectively.

Key Words: microcatheter; looping technique; endovascular treatment; aneurysm; acute-angle bifurcation

2-2) Proximal Anterior Cerebral Artery Aneurysms (A1 segment): Retrospective Review of Characteristics and Endovascular Treatment

Young Seo Lee 1,2, Hae Woong Jeong 1, Jin Wook Baek 1, Sung Tae Kim 1, Jung Hwa Seo 1, Soon Chan Kwon 5, Myong Jin Kang 2, Tae Hong Lee 7, Seung Kug Baik 8

1. Inje University Busan Paik Hospital, Department of Radiology
2. Inje University Busan Paik Hospital, Department of Neurosurgery
3. Inje University Busan Paik Hospital, Department of Neurology
4. Inje University Haeundae Paik Hospital, Department of Neurosurgery
5. Ulsan University Hospital, Department of Neurosurgery
6. Dong-A University Hospital, Department of Radiology
7. Pusan National University Hospital, Department of Radiology
8. Pusan National University Yangsan Hospital, Department of Radiology

Background and Purpose: Aneurysms of the proximal segment of the anterior cerebral artery (A1 segment) are rare and challenging to treat. The aim of this study was to review the characteristics and clinical outcome after treatment of A1 segment aneurysms via endovascular approach.

Materials and Method: Sixty-nine patients with 69 A1 segment aneurysms which were treated via endovascular approach in Inje University Busan Paik Hospital, Inje University Haeundae Paik Hospital, Ulsan University Hospital, Pusan National University Hospital, Pusan National University Yangsan Hospital, and Dong-A University Hospital from September 2005 to April 2016 were retrospectively reviewed. Each aneurysm was classified as proximal, middle, or distal by location. Characteristics of aneurysms, technique for treatment, complication of treatment, and angiographic outcome of the patients were assessed. Angiographic outcome was assessed by Raymond classification. Also follow up radiologic outcomes were assessed.

Results: Total 69 aneurysms were retrospectively reviewed. Aneurysms were classified as proximal (n=46), middle (n=10) and distal (n=13). Posterior or posterolateral direction was the most common direction (n=45). Single microcatheter technique was most commonly used technique for embolization (n=33), followed by balloon assisted (n=14), stent assisted (n=13), and multiple microcatheter technique (n=9). Complete occlusion was achieved in 42 aneurysms. Residual neck was noted in 17 aneurysms and 10 aneurysms show residual aneurysm. Total 40 patients were performed follow-up study, with MRA or DSA, mean interval of follow-up was 21.3 months. Among them stable aneurysmal occlusion was obtained in 36 of the patients.

Conclusion: Endovascular treatment of A1 segment might be performed safely and efficaciously, considering the anatomical configuration of aneurysms with appropriate technique.

2-3) Coil embolization for unruptured ICA bifurcation aneurysm via anterior communicating artery due to complicated anatomy: case report.

Yu Takahashi, Kenji Sugiu, Tomohito Hishikawa, Masafumi Hiramatsu, Jun Haruma, Yuji Takasugi, Yukei Shinji, Shingo Nishihiro, Naoya Kidani, Isao Date
Background and Aims: Persistent primitive trigeminal artery (PPTA) is well recognized variant artery of cerebral artery. It rarely exists but it often associated with aneurysm. We report a successful case of coil embolization from contralateral ICA via anterior communicating artery (AcomA) for IC bifurcation unruptured aneurysm coexist with PPTA.

Case: A 45-year-old man with incidentally found aneurysm was referred to our hospital. DSA showed left ICA bifurcation unruptured aneurysm (Fig.1) and PPTA (Fig.2) with hypoplasia of ipsilateral cervical ICA (Fig.3). Endovascular treatment was planned through 1) ipsilateral ICA, 2) contralateral ICA via AcomA, 3) VA-BA via PPTA. First, we tried ipsilateral ICA approach to the aneurysm but we could not advance guiding catheter, because ICA was narrow and catheter did a wedge to the vessel. VA-BA approach was seemed difficult because tortuosity of the vessel. So we placed a guiding catheter at contralateral ICA and derived a micro catheter successfully into the aneurysm via AcomA. Then we performed coil embolization with good angiographical result. Postoperative course was uneventful, and he discharged without neurological deficit.

Conclusion: We report a rare case of IC bifurcation aneurysm with PPTA. When access to aneurysm is difficult due to anatomical variant, another access route should be considered via communicating arteries.
2-4) Safety of Preprocedural Antiplatelet medication in coil embolization of SAH

Jung Hyun Park, Il Yong Sin, Hyung Sik Hwang, Hyo Sub Jeon.
Dongtan Sacred Heart Hospital, Hallym University, South Korea

Background and Purpose: Preoperative antiplatelet medication for coil embolization during acute period of SAH is not common. We tested the hypothesis that preprocedural antiplatelet medication in SAH may prevent complications due to ischemia or induced bleeding.

Materials and Method: Retrospectively reviewed 23 patients who received preprocedural antiplatelet medication that underwent coil embolization. Total 200mg Aspirin and 150mg Clopidogrel were administered at least 1 hour before coiling. Systemic heparinization was also done after inserted Guiding system.

Results: Among 23 cases, assisted techniques were used in 14 cases. There was no case that we inserted intracranial stent. Postoperative EVD or lumbar drainage was done in 2 and 14 cases, but there was no bleeding complication. And there was no thrombotic complication case.

Conclusion: Preoperative antiplatelet medication leads to a low rate of thromboembolic complications and may have no adverse effect on bleeding complications.

2-5) Delayed Clopidogrel Hyper-response After Neuroendovascular Treatment

Hideki Endo, Tatsuya Ogino, Koichiro Shindo, Yohei Maruga, Hirohiko Nakamura
Department of Neurosurgery, Center for Endovascular Neurosurgery, Nakamura Memorial Hospital, Sapporo, Japan

Background and Purpose: Antiplatelet therapy is very important in endovascular treatment. However, it is recognized that there are the patients with resistance or hyper-response to antiplatelet agents. The VerifyNow assay was reported to be useful for identifying high or low on-treatment platelet reactivity. We report the cases of delayed clopidogrel hyper-response after neuroendovascular treatment.

Methods: The patients with clopidogrel hyper-response after treatment were included in this study, among the patients who underwent neurointerventional procedures at Nakamura Memorial Hospital from June 2014 to June 2015. The platelet function was measured using the VerifyNow assay. Clopidogrel hyper-response was defined as P2Y12 Reaction Units (PRU) <60. Endovascular procedures, duration of antiplatelet agents, results of the VerifyNow assay, and hemorrhagic events were retrospectively evaluated.

Results: Eleven patients were enrolled in this study. We performed coil embolization of intracranial aneurysm in 6 patients, in which stent-assisted coiling in 5 cases, and carotid artery stenting in 4 patients, and percutaneous transluminal angioplasty and stenting in 1 patient. All patients were premedicated with aspirin and clopidogrel, and given after successful procedures. The duration of clopidogrel therapy before procedures was about one week in 8 patients, and 4-5 weeks in 2 patients. One patient presenting subarachnoid hemorrhage was taken just before the procedures. Initial VerifyNow examination demonstrated no cases with clopidogrel hyper-response (PRU 157.6 ± 61.2). However, the follow-up VerifyNow examination after treatment demonstrated clopidogrel hyper-response (PRU 9.4 ± 8.3). At the follow-up study, the duration of clopidogrel therapy was 2-3 weeks in 9 patients, 1-2 months in 2 patients. Nine (81.8%) patients had confirmed hemorrhagic events. The values of Aspirin Reaction Units showed no significant change during the observation period.

Conclusions: We reported 11 cases of delayed clopidogrel hyper-response after neuroendovascular treatment, which was associated with hemorrhagic complication. The antiplatelet effect appears to have not reached a plateau after one week of taking clopidogrel.
Low-dose prasugrel premedication for endovascular treatment of intracranial aneurysms

Hyun-Seung Kang, Won Sang Cho, Eun Jin Ha, Young Dae Cho, Jeong Eun Kim, Moon Hee Han
Seoul National University Hospital, Seoul National University College of Medicine

Background and Purpose: The effectiveness of antiplatelet premedication is widely accepted for endovascular treatment of intracranial aneurysms. Newer generation antiplatelet agents may useful in this clinical setting. We investigated a series of patients taking low-dose prasugrel for endovascular treatment of aneurysms in terms of platelet function test, procedure-related complications, and clinical outcome.

Materials and Method: During the period between November 2014 and May 2016, 260 patients (186 females and 74 males; mean age, 57.9 ± 10.5 years) with 318 aneurysms underwent endovascular treatment for their intracranial aneurysms and low-dose (20 mg) prasugrel was given the day before endovascular treatment. Stent-supported coil embolization was performed in 94 aneurysms (29.6%) and Pipeline flow diverter was installed in 1. Response to the antiplatelet medication was measured by the VerifyNow assay. Events of procedural bleeding and thromboembolism, and clinical outcome were investigated.

Results: VerifyNow assay demonstrated mean PRU value of 130.2 ± 80.2 and mean percentage inhibition of 56.8 ± 26.1%. When we set the PRU of 285 as the cut-off value determining the resistance to ADP antagonists, 6 patients (2.3%) showed resistance to low-dose prasugrel loading. There was 1 procedural bleed (0.3% per aneurysm), with no clinical consequence, and there was no procedural thromboembolic event.

Conclusion: Low-dose prasugrel premedication was effective in preventing procedural thromboembolism without increased risk of bleeding. Resistance to low-dose prasugrel loading was rare.
Featured Symposium  “Flow diverter in East Asia”
S-1) Endovascular therapy of intracranial aneurysm with Pipeline Flex: consecutive 30 cases in Juntendo University Hospital

Kohsuke Teranishi 1, Kazumoto Suzuki 1, Seisuke Iseki 1, Kenji Yatomi 1,
Senshu Nonaka 3, Munetaka Yamamoto 1, Hidenori Oishi 1,2
Department of Neurosurgery, Juntendo University School of Medicine1
Department of Neuroendovascular Therapy, Juntendo University School of Medicine 2
Department of Neurosurgery, Juntendo Urayasu Hospital 3, Japan

Background: Flow diverter stents have been widely used for large-giant intracranial aneurysm throughout the world. Pipeline Flex has initially approved in Japan for endovascular therapy since last year.

Objective: To report our initial series of patient treated with Pipeline Flex stent in Juntendo University Hospital.

Methods: All the data were collected from consecutive 31 aneurysm (20 sacular, 11 fusiform) 30patient (women 28 / age 21-80 years: mean 62.3) treated from October 2015 to May 2016 in Juntendo University Hospital, Japan.

Results: Size and location of all the aneurysm were 10.0-27.1mm (mean 16.5) in the anterior circulation (due to indication for use in Japan). Nine patients had symptoms (oculomotor, abducens nerve palsy) before treatment. 20 aneurysms were treated with single stent, 11 aneurysms were treated with multiple stent. Eclipse sign was observed in 16 patients immediately after stent placement. Two cases had symptomatic ischemic event occurred.

Conclusions: Pipeline flex play a great role for endovascular treatment of large and giant intracranial aneurysm. Continuous data collection should be needed.

S-2) Treatment of giant MCA aneurysm using flow-diverter with preservation of arterial branch

Jin-Young Jung M.D., Ph.D.
Department of Neurosurgery, Cerebrovascular Center, Dong-Eui Medical Center, Busan, Korea

Purpose: Flow-diverting devices now offer a new treatment alternative for complex cerebral aneurysm such as giant or fusiform aneurysm. We present the results of a partially thrombosed giant aneurysm patients treated with the Pipeline embolization device (PED), including mid-term angiography follow-up.

Material and Methods: A 53-year-old male patient presented with acute onset of left hemiparesis. Magnetic resonance imaging (MRI) showed acute cerebral infarction at right basal ganglia and PCA territory. Contrast enhanced MRI revealed partially thrombosed giant aneurysm at right MCA trunk. ASA 100mg was given and 6months follow up CTA showed recanalization of thrombosed part and growing of aneurysm. ASA administration was discontinued but the aneurysm was continuously increased.

Results: Pipeline embolization device (PED) was placed at right MCA. Almost immediately the blood flow to the aneurysm was reduced, and the complete occlusion of the aneurysm occurred without procedural complication. Complete occlusion of aneurysm and preservation of an adjacent small MCA branch was confirmed at 4 months follow up angiography.

Conclusions: Flow diverter can occlude the partially thrombosed giant aneurysm with preservation of arterial branch.

S-3) Parent artery reconstruction for large or giant cerebral aneurysms using a Tubridge flow diverter (PARAT): a multicenter, randomized, controlled clinical trial

PARAT investigators

Yu Zhou
Department of Neurosurgery, Shanghai Hospital, Second Military Medical University,
China

Background: Treatment of large or giant aneurysms remains technically challenging, with a high complication and recanalization rate. The Tubridge Flow Diverter (FD) may improve outcome of these aneurysms compared with conventional stent-assisted coiling with comparable safety.

Methods: This study was a multicenter, randomized, controlled clinical trial conducted at twelve hospitals in China. Enrolled were adults with unruptured large/giant intracranial aneurysms. Using an online central randomization system, study collaborators randomly assigned participants (1:1) to receive either Enterprise stent-assisted coiling or Tubridge flow diverter implantation (with or without coils). The core laboratory evaluating patients’ outcome were masked to the treatment allocation. Primary analysis was comparison of complete occlusion rate at 6-month follow-up between treatment and control group. The analysis was done in a modified intention-to-treat population using \( \chi^2 \) method, with multivariable logistic regression adjusted for unbalanced factors.
A sensitivity analysis was done to assess the effect of missing data. The trial was registered on the Chinese Clinical Trial Registry: ChiCTR-TRC-13003127, and is now closed.

**Finding:** Finally, 185 patients were enrolled, 41 of them quit the trial before procedure initiation. Overall, 82 patients received attempted Tubridge implantation, while 62 patients were primarily treated with stent assisted coiling. During the 6-month follow up, complete occlusion rate was 75.34% (55/73) for Tubridge group, and 24.53% (13/53) for control group, and calculated common odds ratio was 9.4(95% [CI], 4.14 to 21.38). Sensitivity analyses and adjusted results also showed much better results for the Tubridge group. There were no significant differences in technique success rate, mortality or stroke related with target vessels, parent artery occlusion/stenosis, or general adverse events.

**Interpretation:** Compared with conventional Enterprise stent assisted coiling, Tubridge flow diverter is an effective tool for the treatment of large or giant intracranial aneurysms with comparable safety.

Funding: MicroPort Medical Company (Shanghai, China); National Science and Technology; Shanghai Science and Technology Commission

S-4)

**Innovation of Endovascular Treatment Strategy for Large Carotid Cavernous Aneurysms - Safety and Efficacy of Flow Diverter**

Shigeru Miyachi\(^1\), Hiroyuki Onishi\(^1\), Ryo Hiramatsu\(^1\), Takashi Izumi\(^2\), Noriaki Matsubara\(^3\), Toshihiko Kuroiwa\(^1\)

1. Department of neurosurgery and Endovascular Neurosurgery, Osaka Medical College, Osaka, Japan
2. Department of Neurosurgery, Nagoya University Graduate School of Medicine, Nagoya, Japan

**ABSTRACT**

**Background and Purpose:** Until recently large carotid cavernous aneurysms (CCAs) have been treated with an endovascular approach by stent-assisted coiling (SAC) or parent artery occlusion (PAO) with or without an external-internal arterial bypass, particularly in cases with mass effect. The flow diverter (FD) is a promising device to promote aneurysm occlusion by rectifying blood flow without sacrificing the parent artery. We retrospectively compared the safety and efficacy of these three strategies for the treatment of large CCAs.

**Material and methods:** Between January 2001 and December 2015, 49 patients (43 women, 6 men; 36–83 yrs old, mean age 63.4 yrs) with large (max. dia. ≥10 mm) with a broad-necked, unruptured CCA underwent endovascular treatment at our institution. PAO, including proximal artery occlusion and internal trapping, was performed in 22 patients, SAC with neck-bridge stents was performed in 18 patients, and flow diversion (FD; with the deployment of the Pipeline™ embolic device) was done in nine patients. Safety and efficacy were assessed in all patients by periodic clinical and radiological examinations during a 6-month follow-up.

**Results:** All 22 aneurysms treated with PAO disappeared immediately after treatment, but in the SAC group, complete occlusion was obtained in only 5 of the 18 patients. All aneurysms in the FD group resulted in body filling. We encountered one intraoperative symptomatic embolic complication in the PAO group. Perioperative ipsilateral temporary ischemic events occurred in six cases (PAO 4, SAC 2, FD 0). Delayed deterioration or new onset of cranial nerve symptoms was observed in 10 cases (PAO 3, SAC 3, FD 4), almost all of which recovered within 3 months. During the 6-month follow-up, clinical improvement and a stable asymptomatic state were obtained in all 43 patients. In the PAO group, radiologically, all treated aneurysms showed a decrease in size and no evidence of recanalization, except for three patients with multiple untreated aneurysms which showed enlargement presumably due to postoperative hemodynamic changes. In the SAC group, 12 aneurysms showed neck remnants, and marked recanalization occurred in four cases, two of which required retreatment. Six aneurysms in the FD group, other than the three with a small neck remnant, were completely occluded.

**Conclusion:** The FD provided excellent final results (particularly in symptomatic patients), despite transient worsening from the inherent acute inflammatory reaction after intra-aneurysmal thrombosis. In contrast, PAO involves risks of ischemic complications due to decreases in cerebral perfusion, and SAC is prone to risks of recanalization due to an incomplete block of inflow at the aneurysmal orifice. These two conventional treatments also require large amounts of coils. Although further long-term follow-up is essential, from a cost-effective and time-saving viewpoint, FD is a relatively safe and reliable method for the treatment of large CCAs.

S-5)

**Dynamic Volume Change of Thrombosed Giant Aneurysm after Flow-Dverting Stent Deployment: Quantitative Assessment by Computed Tomographic Volumetric Image**

Woong Jae Lee, MD\(^1\), Jun Soo Byun, MD, PhD\(^1\), Jae Kyun Kim, MD\(^1\), and Taek Kyun Nam MD, PhD\(^1\)

Departments of \(^1\)Radiology and \(^2\)Neurosurgery, Chung-Ang University College of Medicine, Seoul, Republic of Korea
**Background and Purpose:** Pipeline Embolization Device (PED) provides a safe and efficacious treatment for giant intracranial aneurysms resulting high occlusion rate and low incidence of complication. However, incomplete obliteration or recanalization after PED may potential for aneurysm growth and rupture. Angiographic follow-up is necessary to determine the optimal treatment that leads to the highest rate of obliteration and the best clinical outcome. We present a case of the giant thrombosed aneurysm treated with PED and follow-up assessment of residual sac change on CT volumetric image (CTVI).

**Materials and Method:** Conventional Brain CT angiography was performed before and 1 week, 1, 3, 4, 6, 9, and 15 months after PED deployment. CTVI including volume data (mm\(^3\) with HU) and 3D volume rendering images was obtained by semi-automated methods on dedicated workstation (Extended BrillianceTM Workspace, version 4.5.2.). Dose-length product (DLP) of each CTA was 1269.2 mGy-cm and calculated total patient effective radiation dose (ED) was 11.2 mSv per year.

**Summary of case:** Sixty-two year-old female with a giant, thrombosed, right cavernous internal carotid artery aneurysm (25 mm in maximal diameter, 5.5 mm neck) was treated with endovascular obliteration using a single PED. A completion angiogram with Dyna CT showed appropriate position of the PED in relation to the aneurysm with decreased jet flow. Patient was premedicated with clopidogrel 75 mg and aspirin 100 mg daily for 1 week prior to the procedure and followed after PED. Preoperative aneurysm volume was measured 3883.8 mm\(^3\) (except of thrombosed portion, 100%) and progressive shrinkage was observed at 1 week after PED (756.6 mm\(^3\), 19.5%). However, aneurysm volume was inversely increased with morphologic change at 1 month (1385.4 mm\(^3\), 35.7%) and at 3 months (1565.7 mm\(^3\), 40.3%). There was no stent shifting or endoleak on CT angiography. We presumed patient’s coagulant status might be the cause of progressive aneurysm recanalization. We decided to change anti-coagulant of low dose aspirin alone and further follow-up. Aneurysm steadily decreased in volume at 4 months of 954.7 mm\(^3\) (24.6%) and at 6 months of 413.6 mm\(^3\) (10.6%). On the basis of sequential CT scans with CTVI, we decided to further follow-up rather than apply additional PED. Residual sac was further decreased in volume at 9 months (461.8 mm\(^3\), 11.9%) and near complete obliteration at 15 months of 124.5 mm\(^3\) (3.2%). Patient was uneventful during follow-up period.

**Conclusion:** Quantitative assessment of residual sac change using CTVI is feasible method for determine optimal treatment in patient of PED.

**S-6)**
Temporal changes of intra-aneurysmal pressure after placement of Pipeline Embolization Device using elastase-induced aneurysm model in rabbits

Hideo Chihara\(^1\), Akira Ishii\(^2\)
Kokura Memorial Hospital, Department of Neurosurgery, Japan\(^1\)
Kyoto University, Department of Neurosurgery, Japan\(^2\)

**ABSTRACT:**
Pipeline Embolization Device (PED, ev3, Irvine, California) has provided a new intervention capacity to treat cerebral aneurysms with its diseased parent artery. The results of PED have encouraging, with large or giant achieving complete occlusion at 12-month follow-up. Major clinical reports have described a slow progressive thrombosis and gradual increase in complete aneurysm obliteration rate. Despite promising early results, some miserable hemorrhagic complications to PED have been encountered.

Delayed rupture mechanisms have variously proposed. One of them has been a change of intra-aneurysmal pressure after PED implantation. Some case reports have described no change of intra-aneurysmal pressure in clinical case using a pressure wire for coronary intervention. However, those cases have a limitation on the length of the measurement time for clinical cases.

We sought to evaluate more delay phase intra-aneurysmal pressure using elastase-induced aneurysm model in rabbits. 5 elastase-induced aneurysms in rabbits were treated with PED. Pressure wires (ComboWire, Volcano Corporation, Rancho Cordova, California) were placement in aneurysms with jailing technique. Temporal changes of intra-aneurysmal pressure and parent artery pressure were measured up to 6 hours after PED implantation. Angiographic evaluation was performed as appropriate. The mean aneurysms size was 7.31mm (4 to 14mm). 4 cases were used single device and one case was performed overlap stenting. In all cases, intra-aneurysmal pressures were reduced on 6 hours after PED implantation in comparison with the parent artery pressures. Furthermore, it was suggested that parent artery pressure and metal density of the aneurysm neck participated in advent period of pressure gradient. The present study demonstrated that intra-aneurysmal pressure was reduced by the PED implantation.
Session 3  “CAS, Stroke”
3-1) Comprehensive Hybrid Strategy for Carotid Artery Stenosis with “Toyama Carotid 8” rules.

Naoya Kuwayama, Naoki Akioka, Daina Kashiwazaki, Satosi Kuroda

Department of Neurosurgery, University of Toyama, Japan

We report their preliminary results of carotid endarterectomy (CEA) and carotid artery stenting (CAS) for patients with carotid artery stenosis according to their “Toyama Carotid 8” rules. This prospective study included total 104 patients who underwent CEA or CAS for carotid artery stenosis in our hospitals between March 2012 and January 2015. “Toyama Carotid 8” rules primarily recommend CEA for symptomatic and CAS for asymptomatic lesions with crossover between these two modalities for high treatment risk patients in each group. As other rules of “Toyama Carotid 8”, monitoring of platelet functions is quite important prior to CAS. Internal shunting and near infrared spectroscopy monitoring are essential in CEA. Temporary cardiac pacing is mandatory in CAS. The choice of protection device and stent depends on the results of MR plaque imaging. Cerebral blood flow measurement should be always measured before and after CEA/CAS. No age limitation is indicated.

As the results, 52 CEA and 52 CAS were performed for 55 symptomatic and 49 asymptomatic lesions. The crossover happened in 10 (18%) of 55 symptomatic lesions (CEA to CAS) and 7 (14%) of 49 asymptomatic lesions (CAS to CEA). The 30-day morbidity rate was 1.9% in CEA and 1.9% in CAS group. Postoperative diffusion-weighted imaging detected fresh ischemic lesions in 5 (10%) CEA patients and 9 (18%) CAS patients. Hyperperfusion syndrome occurred in one CEA patient (1.0%). There were no morbidities in each group during perioperative period. Establishment of in-hospital management rule is useful for medical team to share their opinions and improve the short-term results of CEA/CAS for carotid artery stenosis. Further studies would be warranted to evaluate the long-term outcome.

3-2) Experience of staged angioplasty for carotid artery stenosis to avoid hyperperfusion syndrome

Kazutaka Uchida, Shinichi Yoshimura, Manabu Shirakawa, Kiyofumi Yamada, Junko Kuroda, Toshinori Takagi

Department of Neurosurgery, Hyogo College of Medicine, Japan

Objective: Hyperperfusion syndrome after carotid artery stenting (CAS) is a condition, which may lead to serious complications such as intracranial hemorrhage. We have previously reported staged angioplasty for avoidance of hyperperfusion syndrome after CAS. Here we report our treatment results and discuss the issues regarding this procedure.

Subjects: The study included 50 cases of patients in whom preoperative single photon emission CT (SPECT) showed severely impaired cerebral blood flow (CBF), for which SAP was subsequently performed. The analyzed subjects are as follows: 45 males and 5 females, or 39 symptomatic and 11 asymptomatic lesions with mean age of 74 ± 7.9 years old.

Methods: Staged angioplasty was performed in patients in whom SPECT had provided the ratio of the CBF of the affected to unaffected hemisphere (asymmetry index) of < 0.8 with its cerebrovascular reactivity of less than 10%. First, balloon angioplasty was performed using an undersized (2.0-2.5mm) balloon, and then finished once when 2 mm or more dilatation was confirmed by intravascular ultrasound. Subsequent approximately two weeks after the initial treatment, CAS was performed. Just after that quantitative SPECT was conducted to confirm the presence or absence of radiologic hyperperfusion. In the case of inadequate dilatation or extensive dissection, stent placement was performed just after the initial balloon angioplasty.

Results: In 46 of 50 cases (92%), staged angioplasty was successfully completed in avoiding hyperperfusion syndrome, although 3 (6%) inadequate dilatations and 1 (2%) vascular dissection shifted into immediate CAS. Among them, 49 cases (98%) showed favorable course except for that intracranial hemorrhage developed in one and ischemic complication occurred in the following day of balloon angioplasty in another one. Staged angioplasty completions exhibited hyperperfusion phenomenon on SPECT.

Conclusions: This method was relatively simple procedure in avoiding hyperperfusion. But the appropriateness and optimal conditions of the method should be further examined in the future.

Key words: staged angioplasty, carotid artery stenosis, stenting, hyperperfusion syndrome

3-3) Staged Carotid Artery Stenting in Patients with Severe Carotid Stenosis: Multicenter Experience.

Dong Hyun Yoo1, Hyun-Seung Kang2, Young Dae Cho1, Moon Hee Han1,2, Hong Gee Roh3, Seo-Sung Choi4, Se Jeong Jeon4

1 Department of Radiology, Seoul National University Hospital, Seoul National University College of Medicine, 101 Daehangno, Jongno-gu, Seoul, Korea
2 Department of Neurosurgery, Seoul National University Hospital, Seoul National University College of Medicine, 101
Background and Purpose: Cerebral hyperperfusion syndrome (CHS) is uncommon but critical complication after carotid artery stenting (CAS). Intracranial hemorrhage (ICH), which is the most severe manifestation of the syndrome, may lead to profound morbidity and mortality. Due to the irreversible and devastating outcome of the ICH, prevention of CHS is of vast importance when performing CAS. The purpose of this study was to evaluate the safety and efficacy of staged carotid artery stenting (SAP) in patients with severe carotid artery stenosis, particularly in regard to preventing hyperperfusion syndrome.

Materials and Method: From January 2005 to February 2016, 53 patients with SS severe carotid artery stenosis lesion underwent SCS in three institute. The procedure consisted of two sessions including delayed carotid artery stenting (CAS) preceded by balloon angioplasty using 2 to 4mm undersized balloon, and were performed at the discretion of the operators considering clinical status and imaging studies of the patients. Postprocedural outcomes including immediate result, complication, and hyperperfusion syndrome was retrospectively analyzed.

Results: The stenosis degree was improved in all patients following balloon angioplasty (90.±5.6% to 70.5±12.9) and delayed CAS (to 16.1±14.1). Immediate complication was present in three patients after balloon angioplasty and three patients after delayed CAS, including one symptomatic thromboembolism after each procedure. Headache was complained by 7 patients after balloon angioplasty and 10 patients after delayed CAS, while one patient developed focal neurologic deficit due to hyperperfusion. There was no other manifestation of hyperperfusion syndrome including intracranial hemorrhage.

Conclusion: SCS could be an effective treatment option for selected patients with severe carotid stenosis in preventing hyperperfusion syndrome including intracranial hemorrhage.

3-4)
A single center retrospective study of staged angioplasty for cerebral hyperperfusion high risk group of cervical carotid artery stenosis.

Takahiro Morita, Masayuki Ezura, Daiki Aburakawa, Ryuzaburo Kochi, Takashi Inoue, Hiroki Uchida, Tomoo Inoue, Kensuke Murakami, Shinsuke Suzuki, Hiroshi Uenohara
Sendai Medical Center, Department of Neurosurgery, Japan

Cerebral hyperperfusion is the serious complication of treatment for carotid artery stenosis. Treatment is beneficial for severe cervical carotid artery stenosis, but severe carotid artery stenosis has the risk of post-operatice hyperperfusion. Recently, staged angioplasty (SAP) is performed for cerebral hyperperfusion high risk group of cervical carotid artery stenosis. However, its adaptation or method is not yet established.

This time, we analyzed continuous 52 cases which was performed angioplasty for severe carotid artery stenosis accompanied by the risk of cerebral hyperperfusion syndrome (CHS) between Jan 2012 to Apr 2016. We defined the risk of CHS, (1) laterality of cerebral blood flow in single photon emission CT (SPECT), (2) laterality of the visualization of middle cerebral artery in MRA, and (3) delay of ipsilateral intracranial artery visualization in angiography. Hyperperfusion was measured by post-operative SPECT. We excluded the case which was difficult to analyze correct laterality in pre-operative SPECT, MRA or angiography because of bilateral severe cervical carotid artery stenosis or intracranial carotid artery stenosis, and the case which was not measured hyperperfusion by SPECT.

In all 52 cases, SAP was performed for 19 cases. 33 cases were performed carotid artery stenting (CAS) in one stage. Post operative hyperperfusion was observed 4 cases in SAP group (21 %) and 19 cases in CAS group (36 %) (p=0.35). The other, we performed CAS in first stage and balloon angioplasty in second stage in several case of SAP group, and all these cases have finished successfully the operation.

We concluded which SAP is definitely effective for the prevention of post operative hyperperfusion, and several method is considered for SAP, we use depending on the case.

3-5)
Long-term outcome of endovascular recanalization in patients with Chronic Internal Carotid Artery occlusion: a single-center experience

Wan Jieqing , Sun Wenhua
Department of Neurosurgery
Renji Hospital, Shanghai Jiaotong University School of Medicine, China

Abstract:
Objective: To analyze the feasibility, safety and long-term efficacy of Carotid Artery Stenting in patients with Chronic Internal Carotid Artery occlusion
Method: The clinical data of patients with chronic internal carotid artery occlusion underwent endovascular recanalization at Renji Hospital affiliated to Shanghai Jiaotong University school of medical, from January 2008 to August 2015 were analyzed retrospectively. The perioperative complications and clinical efficacy were analyzed.

Results: 52 patients (47 men, 5 women, mean age 59.04 years, range from 33 years to 82 years) were enrolled in this research. Successful recanalization was achieved in 45 of 52 patients (86.5%). Intracranial hemorrhage was occurred in one patient, without any sequelae. The average follow-up time was \((22.1 \pm 15.5\) months, and the rate of follow-up was 91.1%(41/45). Only one patient suffered frequent TIA. Follow-up imaging revealed re-occlusion developed in only one patient, restenosis developed in two patients (<70%).

Conclusion: stent-assisted endovascular recanalization shows a long-term satisfactory, safety and efficacy in patients with chronic internal artery occlusion.

Key Words: endovascular recanalization; chronic internal artery occlusion, stent, follow-up.

3-6)
Intracranial Angioplasty and Stenting for Crebral Artherosclerosis : Results of 93 Consecutive Patients

Joon Huh, Daehyun Hwang, Jeonghyun park, Insoo Kim*, Dalsoo Kim**, Choowoong Hurh**
Dongtan Sacred Heart Hospital, Hallym University, Kimpo Uri Hospital* Myungji Saint Mary’s Hospital, Seoul, Korea

Background and Purpose: Stroke is most common cause of life threatening neurological disease and also it is leading cause of adult disability and third leading cause of death. Intracranial atherosclerosis is 8 to 10% of all ischemic strokes and reported poor outcome and high rate of morbidity and mortality.

Materials and Method: We evaluated 93 consecutive patients (age mean 60, range 34-80 years, M:F = : ) who underwent intracranial stenting between March 2004 and December 2013. The location of lesion was MCA(n=25), distal ICA (n=31), Petro-cavernous ICA(n=6), Basilar artery(n=3), Vertebral artery(n=28) and mean stenosis was 72.8%

Results: The procedural success rate was 93.5%. 6 cases are unable to reach the target and performed Balloon angioplasty. There were overall three complications (3.3%) within period of follow up (six months) ; these included one minor strokes (1.1%), and one deaths(1.1%), one restenosis(1.1%). The kind of stent was Endeavor (n=29), Vision(n=15), Cypher (n=14), Neuroform (n=10), Flexmaster (n=10), Arthos pico (n=7), Tsunami (n=5), Guidant (n=3), Abbott (n=1), JM PTCA (n=1).

Conclusion: In selected patients, endovascular revascularization of intracranial arteries with stent assisted angioplasty is technically feasible, effective and safe. Randomized multicenter trial comparing angioplasty and stenting with medical management alone must be performed.

3-7)
Acute stroke showing major intracranial vessel occlusion: characteristics of cardioembolics and atherosclerosis related in situ stenosis/occlusion


*Departments of Neurosurgery, Neurology and Strokology, and Radiology, Nagasaki University School of Medicine, Nagasaki, Japan

Abstract

Acute ischemic stroke showing major intracranial vessel occlusion is commonly due to cardioembolics or atherosclerosis related in situ stenosis/occlusion, and immediate identification of these subtype is very important for the treatment strategy. The aim of this study is to clarify the difference in clinical presentation, radiological findings, neurological temporal course and outcome between these etiologies, which has not been fully evaluated. Consecutive emergency patients showing acute ischemic stroke were retrospectively reviewed. Among them, patients showing stroke with major intracranial vessel occlusion were analyzed focusing on clinical and radiological findings, and compared between cardioembolics and atherosclerosis related in situ stenosis/occlusion. Of 1053 patients, 80 patients showed stroke with acute major intracranial vessel occlusion (45 exhibited cardioembolics, and 35 exhibited atherosclerosis related in situ stenosis/occlusion). Interestingly, susceptibility vessel sign (SVS) on T2* weighted MR angiography was highly detected in cardioembolics (80.0%) compared with atherosclerosis (in situ stenosis: 5.9%, chronic occlusion: 14.3%). Moreover, proximal intra-arterial signal (IAS) on arterial spin labeling and distal IAS on fluid attenuated inversion recovery was lowery detected in chronic occlusion (27.3% and 50.0%, respectively) compared with acute occlusion due to cardioembolics or in situ stenosis. Multivariate regression analysis showed that SVS is significantly related to cardioembolism (Adjusted OR: 21.68, P=0.004). Clinical characteristics of acute stroke showing major intracranial vessel occlusion is different depending on the etiology, cardioembolics and atherosclerosis. SVS and proximal/distal IAS on MR imaging are useful to distinguish between cardioembolics and atherosclerotic related in situ stenosis/occlusion.
Key Words: Acute stroke, major vessel occlusion, cardioembolics, atherosclerosis
Session 4 “CCF, DAVF, AVM”
4-1) 
Retreatment by Detachable Balloon for Recurrent Traumatic Carotid Cavernous Fistulae

ZHU Qing, CHEN Ailin, CHEN Yanming, WANG Zhongyong, XU Liang, LAN Qing
Department of Neurosurgery, Second Affiliated Hospital of Soochow University, Suzhou 215004, China

【Abstract】Objective To discuss the clinical efficacy and technique of retreatment by detachable balloon for recurrent traumatic carotid cavernous fistulae. Methods The clinical data of 16 patients presented as recurrence of traumatic carotid cavernous fistulae, who were retreated by detachable balloon, were analyzed retrospectively. All of them experienced endovascular treatment by detachable balloon previously. Results 14 patients were cured by detachable balloon(s), and double balloons technique was used in 6 of them during endovascular treatment. Another 2 patients were failed by detachable balloon(s), and cured by detachable coils and Matas’ training respectively. Parent artery of all cases were preserved without ischemic events. Conclusion Retreatment by endovascular strategies was effective and safe for recurrent traumatic carotid cavernous fistulae based on the characteristics of lesions. Detachable balloon, double balloons technique especially, is a relative good choice for retreatment of recurrent traumatic carotid cavernous fistulae.

【Keywords】traumatic carotid cavernous fistulae; endovascular treatment; detachable balloon

4-2) 
Usefulness of DynaCT in the Endovascular Treatment of DCCF

Zou chao, Li qiang, zhou yu, yang pf, huang qinghai, Liu jianming
Department of Neurosurgery, Changhai Hospital, Second Military Medical University, China

Background: Precise delineation of angioarchitecture and location of the fistula points is the key of Treatment of Direct Carotid-Cavernous fistula (DCCF). Superselective DSA in various projection can evaluate it through high doses of contrast, long examination times and substantial exposure to radiation. DynaCT provides more accurate information than conventional DSA. Objective: To evaluate this method using treatment of DCCF Materials and methods: DynaCT reconstruction through Rotation angiography from dominant feeding artery in 8 patients compared with 2D DSA images. Results: DynaCT demonstrate angioarchiehture of DCCF, relationships between the fistulous points and osseous structures, the cavity of cavernous sinus which connects with ICA and its size and shape, also provide image from the axial, coronal, sagittal or any other views. Conclusion: DynaCT digital angiograms provide a reliable visualization of vessels and fine osseous structures of DCCF, is quite helpful in deciding the treatment strategy.

4-3) 
The feasibility of hybrid operation room for the treatment of isolated type dural arteriovenous fistula

Hiroaki NEKI[1], Shinya KOHYAMA[1], Toshihiro OHTSUKA[1], Jun MATSUMURA[1], Azusa YONEZAWA[1], Aoto SHIBATA[1], Eisuke TSUKAGOSHI[1], Nahoko UEMIYA[2], Shoichiro ISHIHARA[2], Fumitaka YAMANE[1]
1) Department of Endovascular Neurosurgery, Stroke Center, Saitama Medical University International Medical Center, Japan
2) Department of Neurosurgery, Saitama Sekishinkai hospital, Japan

OBJECT:
Isolated type dural arteriovenous fistulas (DAVF) were associated with a high hemorrhagic risk. DAVF is mainly treated by transarterial or transvenous embolization. Surgery or a combination with surgery and embolization is occasionally needed for DAVF treatment. Burr hole approach and direct sinus puncture with embolization is an effective method for isolated type DAVF. However, the operators sometimes suffer from the decision of burr hole location and sinus puncture way. The hybrid operation room is utilized for this burr hole approach in our institution. We report six cases treated with direct transsinus embolization using a single burr hole approach in hybrid operation room.

METHODS:
Six patients underwent direct transsinus embolization of isolated DAVF in the hybrid operation room. Five cases are transverse sinus DAVFs and one case is superior sagittal sinus DAVF. Three dimensional digital subtraction angiography (3DDSA) was obtained after fixation of cranium with 3-pins. Burr hole point was determined by 3DDSA. We treated with packing of coils and injection of n-butyl cyanoacrylate (nBCA).

RESULTS:
Hybrid operation room allowed accurate placement of the burr hole. The surgical approach consisted in a minimal exposure of the sinus. We could check the burr hole location and puncture point under digital subtraction angiography at all times. Only single burr hole and small skin incision sufficed for direct transsinus embolization for each case.

CONCLUSION:
Direct transsinus embolization of isolated type DAVF is minimally invasive and effective when transvenous embolization is not indicated. Hybrid operation room is useful in accurate positioning the burr hole.

4-4) Endovascular Embolization for Complex Intracranial Dural Arteriovenous Fistula under Protection of Intra-Sinus Balloon

Qian Zheng, Jianan Li, Qi Zhang, Qiang Li, Yi Xu, Jianmin Liu
Department of Neurosurgery, Changhai Hospital, Second Military Medical University, China

Abstract:
Object: Endovascular embolization has been proven effective and safe option to treat most dural arteriovenous fistulas (DAVF). However, especially in some complex DAVF cases, the treatment goal isn’t only to guarantee complete occlusion of fistula, but to ensure the unobstructed cerebral venous drainage. Intra-sinus balloon protection technique is suitable for cases which affected sinus still have drainage function. We retrospectively report our experience in the use of intra-sinus balloon protection and clinical outcome in complex DAVFs.

Methods: We performed a retrospective study of 13 patients (three females and ten males) with complex DAVF who underwent endovascular treatment under intra-sinus balloon protection at our institute from 2012 to 2015. We collected all clinical presenting symptoms, image features and follow-up outcomes to evaluate the effect of intra-sinus balloon protection technique.

Results: All of the 13 patients belong to Cognard IIa+IIb, the location of DAVFs included sigmoid sinus (n=2), sinus confluence (n=1), transverse sinus (n=1), transverse-sigmoid sinus (n=4), superior sagittal sinus (n=1) and multiple fistula (n=4). Intra-sinus balloon protection technique was used in all cases to protect the drainage function of sinus. Complete fistular occlusion was demonstrated by immediate angiograms in 4 patients, and total fistular occlusion in 9 patients. Immediate symptoms were improved in all patients, mean angiograms follow-up period of 12 patients was 8 months.

Conclusion: The intra-sinus balloon protection technique can avoid embolization of sinus to maintain normal drainage function of sinus.

4-5) Penetrable large shunting point in intracranial dural arteriovenous fistulas: providing alternative access route to transarterial intravenous embolization

Dong-Hyun Shim, Jieun Roh, Young Soo Kim, Seung Kug Baik
Department of Radiology, Pusan National University Yangsan Hospital, Pusan National University School of Medicine, Yangsan, Korea

Objective: Transvenous and transarterial embolization is the most common treatment method for the management of intracranial dural arteriovenous fistulas (dAVFs). However, such an approach is not always feasible such as dAVF involving an isolated sinus and multiple arterial feeder. We present dAVFs that were treated with transarterial intravenous embolization of the proximal venous outlet, as well as possible cases previously treated another route at out facility.

Methods: This study included 47 patients who had undergone endovascular treatment of the dAVF (4 cases of transarterial intravenous embolization). Every data including clinical, angiographic, and procedural data were retrospectively collected from medical charts or the literature and recorded on standardized forms by a physician. The angiograms were analyzed by two independent neurointerventionists. The dAVFs were classified according to the angiographic type and venous drainage pattern.

Results: In 47 patients, 17 (36%) cases have possible penetrable large shunting point with distal enlargement. In 4 cases, treatments were performed via transarterial intravenous coil embolization of proximal venous site by using the penetrable large shunting point; those resulted in complete obliteration in all cases. The access route for 12 of the 17 cases was the middle meningeal artery, for 2 was the meningo-hypophyseal artery, and for each 1 case were deep temporal and occipital artery. Five of the 17 cases have multiple possible penetrable large shunting point. Most cases (94%) were restrictive type (mature type) of angiographic classification

Conclusion: If a distally enlarged feeding artery is observed among the multiple feeding arteries, it suggests the existence of a large fistula and may serve as an access route for transarterial intravenous embolization. The penetrable large shunting point with distal enlargement should not be overlooked as a potential access route for transarterial intravenous embolization in cases where traditional endovascular access is limited; this approach does not carry the same risks that are generally associated with pure transarterial embolization along this pathway. Also it may offer a more treatment option for
4-6) Endovascular Treatment of the DAVF at the Petrous Apex Region

Liu Jiang¹ Ma Yong-jie² Li Gui-lin² Wang Zhi-chao¹ Zhang Hong-qi²
¹ Department of neurosurgery, Beijing Haidian Hospital, Beijing, China.
² Department of neurosurgery, Xuan Wu Hospital, Capital Medical University, Beijing, China.

Object: To investigate the endovascular treatment strategy of the DAVF at the petrous apex region.

Methods: Clinical dates of 9 patients with dural arteriovenous fistula at the petrous region that were diagnosed and treated from May 2013 to May 2016 in Xuan Wu hospital and Hai Dian hospital (8 in Xuan Wu hospital and 1 in Hai Dian hospital). All patients have undertaken endovascular embolization. DSA and MRI were performed before and after treatment.

Results: There are 6 males and 3 females of the 9 patients. Their clinical presentations were weakness and numbness of extremities and sphincter disturbance, also including some cranial nerves disorders, the mean course of disease was 6 months. All of the patients underwent embolization, and DSA follow-up post embolization. and all of them got anatomic cure, the disorders relieved or disappeared.

Conclusion: Dural arteriovenous fistula at the petrous apex region is a rare kind of cerebral vascular malformation. Embolization treatment should be the first choice if the condition of vessels is suitable for intervention.

4-7) Target embolization for ruptured cerebral AVM

Ryushi Kondo¹, Hiroyuki Koizumi¹, Daisuke Yamamoto¹, Kazuhiro Miyasaka¹, Toshihiro Kumabe¹, Yasushi Matsumoto²
¹) Department of neurosurgery, Kitasato University, Sagamihara, Japan
²) Department of neuroendovascular therapy, Kohnan Hospital, Sendai, Japan

Abstract

Objective: Patients with ruptured cerebral AVMs are at considerable risk of repeat haemorrhage, particularly when associated intranidal aneurysms are present. Although the complete exclusion of the AVM is necessary for prevention of rebleeding, it is sometimes difficult to achieve when the nidus sit in the eloquent area. We report two cases of ruptured cerebral AVM, successfully treated by target embolization for intranidal aneurysms associated with initial bleeding.

Case presentation: Case 1: A 73-year-old woman presented with sudden headache and was transferred to the hospital. CT demonstrated subarachnoid haemorrhage surrounding brainstem. Angiography showed a pontine AVM with an intranidal aneurysm as the source of haemorrhage. The right short circumferential artery arising from the basilar artery was feeding the nidus. The transarterial embolization (TAE) using NBCA was performed. The obliteration of intranidal aneurysm and partial obliteration of the nidus was achieved. No rebleeding was observed for 9 months after the TAE. Case 2: A 37-year-old man with left frontal AVM received the partial embolization using ONYX followed by the stereotactic radiosurgery. He had intracerebral haemorrhage 4 years after the first embolization and radiosurgery. He suffered 3 haemorrhagic attacks in total for 4 months. Angiography showed a left frontal AVM. The nidus with intranidal aneurysm as the origin of haemorrhage was located in the left frontal lobe including the motor cortex. The targeted embolization of the intranidal aneurysm by using NBCA was performed and the obliteration of the aneurysm was achieved. No rebleeding was observed for 3 months after the target embolization.

Conclusion: Target embolization for intranidal aneurysm associated with haemorrhage may reduce the risk of repeat haemorrhage.
Section 5 “Thrombectomy”
5-1) Parametric Digital Subtraction Angiography Imaging for Objective Evaluation of Endovascular Treatment in Cerebrovascular Diseases

Yina Wu
Department of Neurosurgery, Shanghai Hospital, Second Military Medical University, China

PURPOSE: To report the feasibility of parametric color-coded digital subtraction angiography (DSA) in complementing the traditional, subjective way of treatment evaluation in cerebrovascular disease.

METHODS: 18 consecutive patients with acute MCA occlusion and 70 patients with large intracranial aneurysms who received endovascular treatment were recruited for investigation. The changes of the delay time of distal development of parent artery, time to peak flow, flow area under the curve and maximum slope in aneurysms were analyzed by generating a time density curve. The target downstream territory (TDT) of MCA and reference point at terminal internal carotid artery of each patient was contoured by 5 raters independently on the basis of anteroposterior 2-dimensional DSA. Two parameters of relative maximum density of TDT(rDensitymax) and peak time interval(ΔPT) between reference and TDT were extracted by the use of parametric DSA analysis software. Interrater reliability was tested with intraclass correlation coefficients. Parameters with sufficient interrater reliability entered validity evaluation.

RESULTS: For the patients with aneurysms, compared with the pre-operation results, the parent artery distal delay time decreased (Mean 0.61s), the flow area under the curve in aneurysms (Relative value) and the maximum slope (Relative value) reduced 0.7 and 0.49, respectively. The rAUC/rMS/ATD are effective indices for better short-term result. The therapeutic strategy was effective when rAUC>1.280±0.148, and when the value raise to 1.340±0.199, the long-term result was much better. The therapeutic strategy was effective when ATD>0.583±0.174, and the result got better when the value raise to 0.723±0.032. For the patients with acute MCA occlusion, the parameter rDensitymax showed a strong correlation with the American Society of Interventional and Therapeutic Neuroradiology collateral grading system score and mRS at 3 months, whereas ΔPT average did not. A cut-off point of 0.224 in rDensitymax predicted a favorable clinical outcome with high sensitivity and specificity.

CONCLUSIONS: The relative change of contrast density in the intracranial vessels on 2-dimensional DSA measured by parametric imaging technique appears to be a simple and reliable metric for the assessment of endovascular treatment for cerebrovascular diseases.

5-2) Interaction between the stent strut and thrombus as characterized by contrast-enhanced high-resolution cone-beam computed tomography during deployment of the Solitaire stent retriever

Tomoyuki Tsumoto, MD, PhD; Yuichiro Tsurusaki, MD; So Tokunaga, MD
Department of Neuroendovascular Surgery, National Kyushu Medical Center, Clinical Research Institute, Fukuoka, Japan

Abstract

Background and Purpose
The mechanism by which the stent retriever removes intraluminal thrombus from an occluded vessel has not been discussed in humans. This study performed contrast-enhanced high-resolution cone-beam computed tomography (CE-HRCBCT) during deployment of the stent retriever to observe the interaction between the strut and intraluminal thrombus intraoperatively. We also discuss the mechanism by which the thrombus is retrieved.

Materials and Methods
In eleven patients, mechanical thrombectomy was performed with the Solitaire stent retriever. The presence or absence of flow restoration (FR) was evaluated immediately and at least 5 minutes after deployment. Stent retriever findings on CE-HRCBCT was divided into two groups: (1) complete expansion, and (2) incomplete expansion.

Results
FR was observed in all eleven cases (100%) immediately after deployment of the Solitaire stent retriever. Complete expansion was observed only in one case, and incomplete expansion was observed in ten cases. The thrombus was observed mainly near and out of the strut of a stent retriever in CE-HRCBCT. Loss of FR was recognized only in one of eleven cases. Regardless, successful recanalization was achieved only with the stent retriever in nine of eleven cases.

Conclusion
CE-HRCBCT showed that the Solitaire stent retriever rarely expanded fully and thrombus was mainly near and out of the strut. It may not be necessary to wait a long time to allow the stent to expand fully into the thrombus because the main capture mechanism seems to be engagement of the clot between the crossings of the struts of the Solitaire.

5-3)
Histological examination of vascular damage caused by stent retriever thrombectomy devices

Daisuke Arai, Akira Ishii, Hideo Chihara, Hiroyuki Ikeda, Susumu Miyamoto

Department of Neurosurgery, Kyoto University Graduate School of Medicine, Kyoto, Japan

Background and Objectives
Although the recently-marketed stent retriever thrombectomy devices have demonstrated a high recanalization rate and favourable clinical outcomes, cases of late vascular stenosis and vascular occlusion have also been reported. In the present study, the Solitaire™ Flow Restoration System and Trevo™ Retriever were used in a histopathological comparison of vascular injuries caused by stent retriever thrombectomy devices.

Methods
Rabbit carotid arteries were used in the experiments with stent retriever thrombectomy devices. Carotid artery samples were harvested either one or two weeks postoperatively for histological examination.

Results
With the SolitaireFR4mm, intimal and medial thickening was observed one week postoperatively, and progression of intimal thickening was observed two weeks postoperatively. The extent of intimal thickening tended to be greater with the SolitaireFR6mm than with the SolitaireFR4mm, but this difference was not significant. Compared to the SolitaireFR4mm, the Trevo had a significantly smaller area of intimal thickening.

Conclusions
Although there are some differences among devices, results from this study indicated that stent retriever thrombectomy devices induce vascular damage that extends to the medial layer.

5-4)
Relay Balloon Technique for Recanalization of Acute Symptomatic Proximal ICA occlusion

Sang Hun Lee, MD; Dong Geun Lee, MD; Sun U. Kwon, MD; Deok Hee Lee, MD

Departments of Radiology and Neurology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Republic of Korea

Background and Purpose: Endovascular recanalization of an acute symptomatic occlusion of the proximal internal carotid artery (ICA), due to underlying atherosclerotic stenosis, could be technically challenging due to possible thrombotic component. This is especially true when there is not enough of a landing zone for a balloon-guided catheter (BGC) at the bulb portion. The purpose of this study is to review the safety and effectiveness of a novel "relay balloon technique" which was devised to to prevent any thromboembolism during angioplasty and stenting.

Materials and Method: Endovascular recanalization with the ‘relay-balloon technique’ was attempted in 10 consecutive patients with acute symptomatic proximal ICA occlusions from February 2013 to February 2015. The distal common carotid artery (CCA) was occluded with a BGC during balloon dilatation with an angioplasty catheter (APC) for the underlying proximal ICA stenosis. Then the inflated APC was repositioned a little upward assuring flow arrest so that the BGC could be repositioned into the bulb portion for further ICA flow arrest and aspiration of the occluded ICA after removing the deflated APC. After full recanalization of the ICA and elimination of any combined distal embolic lesions, the proximal ICA was stented while the BGC was removed (Figure). We analyzed the technical success rate and reviewed the early clinical and angiographic outcomes.

Results: The time required for the procedure ranged from 25 to 127 minutes (mean, 80 minutes). Successful revascularization was achieved in all patients (thrombolysis in cerebral infarction [TICI] 2a/b and 3). Post-procedural infarct extension occurred in one patient. Despite of the extension of infarction, the increment of the NIHSS was not observed. The mean NIHSS score at discharge was 3.55 (range 0–18) and the mean modified Rankin Scale score at three months was 1±1.67 (range 0–6).

Conclusion: The relay balloon technique can be safely and effectively applied to the endovascular revascularization of acute symptomatic proximal ICA occlusions, which otherwise seem to have high risk of distal thromboembolism due to insufficient landing zone for the balloon guiding catheter.

5-5)
Recent our improvement of endovascular recanalization by stent retriever for middle cerebral artery occlusion


Neurosurgery, Neurology and Comprehensive Stroke Center, Kobe City Medical Center General Hospital, Japan
【Purpose】Since five studies showed efficacy of endovascular treatment (EVT) for acute ischemic stroke (AIS) in 2015, we have been paid attention to shorten time to recanalization as a factor related to treatment result. We reviewed in-hospital protocol; MRI skips by an initial image evaluation in case of within 4.5 hours from onset to admission to start EVT faster and reform of sense of short time to all medical stuff. We examined the influence of shortening of recanalization time gave in the results of endovascular treatment for AIS.

【Materials and methods】Since July, 2013 to January, 2016, we experienced 23 cases of middle cerebral artery (MCA) occlusion, admitted within 4.5 hours from onset and treated by stent retriever. We examined treatment results by divided into first half group before protocol review and the latter period group. We excluded cases of modified Rankin Scale (mRS) is 3 or more before onset, occlusion vessel is except MCA, and so-called Drip-ship treatment.

【Results】First group are 12 cases and latter group are 11 cases. The average age is 78.3 year old and 77.4 years old, respectively. Occlusion portion (M1 proximal: M1 distal: M2) are 4:4:4 and 2:4:5, respectively. MRI performed before EVT in all cases of first group and 5 of 11 (45%) in latter group. We do not recognize the significant difference in a ratio of intravenous rt-PA prior to EVT, 58% in first group and 82% in latter group, (p=0.240). Average time from onset to admission is 66.9 minutes and 65.4 minutes (p=0.992). Average time from admission to puncture is significantly short in latter group (97.1 minutes in first group, 52.6 minutes in latter group, p<0.05). The ratio of mRS 0-2 at 90days was tend to better in latter group (33.3% in first roup, 72.7% in latter group 72.7%, p=0.063).

【Conclusion】Results of EVT using stent retriever for MCA occlusion within 4.5 hours from onset to admission improved by shortening time to recanalization.

5-6)
The impact of tortuosity of the target vessels on intracranial hemorrhage after acute thrombectomy

Manabu Shirakawa, Shinichi Yoshimura, Kazutaka Uchida, Seigo Shindo
Department of Neurosurgery, Hyogo College of Medicine, Japan

Purpose: The purpose of this study was to elucidate the effect of tortuosity of the target vessel on the intracranial hemorrhagic complication.

Materials and Methods: A total of 75 consecutive patients who underwent mechanical thrombectomy for acute large vessel occlusion between Sep. in 2013 and June in 2015 were included. The patients were classified into two groups; hemorrhagic group and non-hemorrhagic group, based on the findings on head CT performed 12 to 24 hours after the procedure. Vessel tortuosity was assessed by measuring the distance between the highest and lowest points of M1 in the middle cerebral artery (MCA).

Results: Among 75 patients, 27 (36%) were classified into hemorrhagic group and 44 (64%) were in non-hemorrhagic group. Baseline characteristics were no significant difference in both groups. The distance of highest and lowest points in M1 was significantly larger in hemorrhagic group compared to non-hemorrhagic group (8.8 vs 7.0, p=0.01). The percentage of the favorable outcome (modified Rankin Scale 0-2) on discharge was less in hemorrhagic group compared to non-hemorrhagic group (19% vs 53%, p=0.003).

Conclusion: The results obtained in the present study indicated that the incidence of intracranial hemorrhagic after thrombectomy was significantly correlated with tortuosity of the target vessel.