Surgery for large and giant cerebral aneurysm

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[Introduction]
Treatment strategy for large/giant cerebral aneurysm is changing with the coming of Flow-Diverter era. We utilize some specific procedures for such aneurysmal surgery. Temporary parent artery occlusion (PAO) is usually required for a relatively long time, and it’s not easy to identify and preserve critical perforators. Here, we introduce the strategy and tips of treatment for large/giant aneurysm.

[Patients and Methods]
Since September 2008, we had 25 cases of aneurysmal size more than 12mm in diameter. 20 cases are unruptured aneurysms and 5 cases are ruptured one occurring SAH. These aneurysms were located in ICA (16), MCA (3) A-com A (2), VA (2), AC distal A (1) and PICA (1). MEP and ICG angiogram was introduced in all cases. Adjunctive bypass surgery was used for long-time PAO (9 cases/ 36%). Heparinization was introduced for prevention of thrombosis during PAO (16 cases/ 64%). Arterioplastic clipping with suction decompression proximal to the aneurysm was performed in 4 cases. If clipping is impossible, we chose high-flow bypass and trapping/ligation (4 cases). In all cases, we used thin bioabsorbable mesh for avoiding perforators, other critical arteries around the aneurysm.

[Results]
Clipping was performed in 20 cases. High-flow bypass and trapping/ligation was done in 4 cases, and aneurysmal resection and bypass surgery was done in 1 cases. 19 cases (95%) of unruptured aneurysms showed good prognosis like mRS 0-1.

[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.
The management of inadvertent vascular injury during the surgery of complex intracranial aneurysms

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Treatment of complex intracranial aneurysm rank high among the most technically demanding neurosurgical pathologies. The management of these aneurysms are challenging, and surgeons often experience unexpected problems during surgery. In this presentation, we report three cases of unusual complications from vascular injury those were managed successfully; one with thrombosed middle cerebral artery (MCA) aneurysm, one with recurred anterior communicating artery (AcomA) aneurysm after clipping surgery and lastly, ruptured giant ICA (internal carotid artery) dissecting aneurysm.

Case 1: A 51-year-old male patient with unruptured AcomA aneurysm underwent clip operation in 2008. The aneurysm recurrence was revealed in a routine follow-up and reoperation was planned. Intraoperatively, a thick fibrous scar tissue was surrounding the recurred aneurysm portion which was attached to both A2 arteries. The reoperation was successful, and the patient was recovered with no neurologic symptoms. However, after an hour of recovery from anesthesia, the patient developed acute SDH (subdural hematoma) and SAH (subarachnoid hemorrhage) on CT scan. Subsequently, Digital subtraction angiography (DSA) revealed a pseudoaneurysm at right proximal A2 artery which seemed to be dissected during the surgical procedure. Reoperation was scheduled and the pseudoaneurysm was repaired with a direct suture and wrapping technique using bambi sheet with removal of SDH.

Case 2: A 72-year-old male patient visited our hospital with a large left MCA bifurcation aneurysm. Atherosclerotic thickening or calcification of the neck of aneurysm was suspected. Intraoperatively, aneurysm neck was teared during a direct neck clipping procedure. The bleeding was controlled with a proximal occlusion of M2 with STA – MCA bypass and the aneurysm was occluded with a direct neck clipping technique.

Case 3: A 38-year-old male patient diagnosed with a ruptured giant ICA dissecting aneurysm was referred to our hospital after unsuccessful surgical treatment from other institute. The bleeding from the aneurysm was observed intraoperatively and it was controlled via a proximal occlusion of cervical ICA. STA – MCA bypass was performed using a short radial artery graft followed by successful coiling of the aneurysm and parent artery.

Patients of case 1, 2 discharged from minor deficits. and on 3 month OPD follow up, showed full recovery from minor neurological deficits. Case 3 patient showed mild hemiparesis at first OPD F/U 3 month after surgery.
Treatment of complex intracranial aneurysms is still challenging and technically demanding that are usually associated with poor outcomes due to their treatment difficulties posed by its own nature and the need for increased operative skills. To minimize the complication of these aneurysms, a systematic contingency plan is mandatory prior to surgery.
Coil embolization with multiple overlapping stenting for ruptured blood blister-like aneurysms

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Purpose: Coil embolization with multiple overlapping stents has been performed as an alternative treatment option of BBA. However, the placement of coils into the BBA has the inherent risk of rupture. Incomplete coil packing could result in early rebleeding or regrowth of aneurysms. Here we describe a safely dense coil packing technique into and just proximal BBA using a semi-jailing technique for the treatment of the ICA BBA.

Materials: The technique involves partial deployment of a self-expanding, retrievable stent from the ICA bifurcation to a mid-portion of BBA. Coil embolization was then performed with gradual unsheathing of stent from BBA to just proximal portion of BBA followed by multiple stents deployments with the same technique. Sixteen patients (10 women; mean age, 47.1 years) were treated with this technique. The safety, feasibility, and follow-up angiographic results were evaluated.

Results: All procedures were successfully performed without any procedure-related complications. Immediate posttreatment angiograms showed total obliteration of the BBA in all patients. Follow-up angiography available in 14 patients showed complete resolution of BBA.

Conclusion: The forward coil embolization with multiple overlapping stents might be a safe and effective reconstructive endovascular technique that facilitates the treatment for BBA.
Postoperative course of symptomatic large internal carotid artery aneurysm: Comparison between parent artery occlusion and flow diverter placement

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Purpose: Flow diverter placement (FD) is a revolutionary treatment for cerebral aneurysms. We compared FD and parent artery occlusion (PAO) focusing on cranial nerve palsy occurrence.

Method: 20 symptomatic IC aneurysms treated with FD and 10 treated with PAO were included. Postoperative course of cranial nerve palsy and predictive factor were analyzed.

Result: In PAO group, mean age of patients was 67 and mean size of aneurysm was 24.7mm. The ratio of paraclinoid aneurysms with visual disturbance was 30%, and the others were cavernous aneurysms with 3-6th nerve palsy. Complete palsy was seen in 40%. In FD group, mean age was 67 and mean size was 20.3mm. The ratio of paraclinoid aneurysms with visual disturbance was 5%, and the rest were cavernous aneurysms with 3-6th nerve palsy. Complete palsy was seen in 20%. Minor complication was seen in 10% in both groups, with no morbidity. Improvement of symptoms was seen in 90% of PAO and in 80% of FD, and symptoms completely resolved in 50% of PAO and 45% of FD group. The effectiveness was equal between both methods. The significant predictive factors for resolution of symptoms were treatment within 6 months of cranial nerve palsy and incomplete palsy. There were no association with size of aneurysm, coil placement in aneurysm, and decrease in aneurysm size. Conclusion: Flow diverter placement has a similar treatment effect for IC aneurysms with cranial nerve palsy as PAO. The interval between onset of palsy to treatment associates with postoperative symptom resolution.
SYV-5

Experiences of Bypass surgeries in cerebral aneurysm cases

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**Introduction** The treatment of giant aneurysms, fusiform aneurysms, Blood-blister like (BBL) aneurysms, pseudo aneurysms, serpentine aneurysms are still difficult to treat due to long temporal occlusion time and occlusion of parent arteries, and needed remade recirculation.

**Methods** The bypass surgeries were used in 24 cases (1.7%) of 1374 aneurysms of surgically treated from 2011 to 2017 in our hospital. 22 cases were SAH patients and 2 cases were unruptured cases. The aneurysm locations were ICA aneurysms were 15 cases, which are BBL aneurysms 10 cases, giant paraclinoid aneurysms 2 cases, ICA fusiform aneurysms 2 cases, anterior choroidal artery aneurysm which was recurred 1 case; giant MCA aneurysms were 4 cases, VA-PICA aneurysms were 2 cases, ACA aneurysms were 3 cases which were A-com fusiform giant aneurysm, A4 pseudoaneurysm and A2 fusiform giant aneurysm. The types of bypass surgeries were STA-MCA (M4), STA-MCA double barrel, CCA-RA(radial artery)-M2, A3-A3, A4-A4, ECA-RA-M2, STA-M2, OA-PICA, IC-IC (end to end, side by side), STA-RA-M2 bypasses.

**Results** Bypass surgery related morbidity was early occlusion of ECA-RA-M2 in 1 case with some morbidity. 1 case was ICA occlusion after stent insertion and STA-MCA double barrel bypass. 1 case was giant thrombosed MCA aneurysm with clipping and STA-MCA bypass case. There was no mortality.

**Conclusions** In the surgical or interventional treatment of complex aneurysms the results were difficult to predict. The bypass techniques were helpful to reduce the morbidity and mortality and occasionally lead to successful condition in some selected cases.
Application of Skull Base Surgery for Complex Aneurysm

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Skull base surgical techniques are needed in a surgery for unusual or complex intracranial aneurysm.

Anterior petrosal approach can secure the operative space in between internal auditory meatus and trigeminal foramen by drilling temporal rhomboid. Furthermore, combined petrosal approach by adding posterior petrosectomy can provide wider operative window in between internal auditory meatus and jugular foramen, which makes it easy to manipulate complex aneurysm of basilar trunk and to clip the aneurysm with various apply angle.

Transcondylar fossa approach can make a sufficient surgical field around intracranial proximal vertebral artery or dural ring of vertebral artery by skeletonizing foramen magnum and hypoglossal canal after cutting and dividing posterior condylar emissary vein between vertebral venous plexus and posterior condylar emissary canal.

Actual surgical procedures will be discussed in this lecture.
Vascular Reconstruction for Complex Intracranial Aneurysm

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Giant and/or thrombosed, previously clipped and previously coiled aneurysm are very complicated and are difficult to treat without neurological deficit. Those kind of complex aneurysms has a relatively bad or unhealthy vascular condition of the parent artery, therefore preservation of small arteries such as anterior choroidal arteries or anterior thalamoperforating arteries which are relating the aneurysm is difficult and even if those important small arteries could be dissected and preserved during the process of the surgery, long temporary occlusion of parent artery is required in general. Low flow bypass or high flow bypass is helpful in order to achieve a safe treatment for complex aneurysms.

Various vascular reconstruction and the management of complicated aneurysms will be discussed in this lecture.