Anterior circulation aneurysm case series

2023

Intraoperative real-time identification of vascular and surrounding structures in twenty-nine anterior circulation aneurysms and three posterior circulation aneurysm clipping, one STA-MCA bypass, and two carotid endarterectomies were performed in patients using ICG-VA alone, DIVA, ICG-VA with Flow 800 to analyze and compare each of these methods in details.

ICG-VA and DIVA couldn't visualize perforators in twenty-three cases of cerebral aneurysm clipping when used alone. Compared to that by adding Flow 800 perforators were easily visualized. In three cases, occlusion of perforators after clip application was visualized by DIVA and solved by repositioning surgical clips. In one STA-MCA bypass surgery, adequate blood flow to cortical branches of MCA (M4) from STA branches was assessed with ICG-VA, DIVA, and the use of ICG-VA with Flow 800 color mapping. ICG-VA, DIVA, and Flow 800 observed the lack of blood flow and fluttering atherosclerotic plaques in carotid endarterectomy. In one case of basilar tip aneurysm, we used ICG-VA with Flow 800; the intensity diagram drawn after determining regions of interest showed that there was no flow within the aneurysm sac after clipping.

In real-time surgery, a multimodal approach using ICG-VA, DIVA, and ICG-VA with Flow 800 color mapping can serve as useful tools for better visualization of vascular and surrounding structures. The benefits of flow 800 color mapping, such as determining regions of interest, intensity diagrams, and color-coded images, outweigh the advantages over the ICG-VA and DIVA in the visualization of critical vascular anatomy in humans during surgical procedures ¹.

Sweid et al., from the Thomas Jefferson University Hospital analyzed the clinical and angiographic outcomes of 16 individuals with bilateral aneurysms who were treated with a two-stage flow diversion treatment at a tertiary referral center between January 2010 and July 2018.

One patient had two aneurysms treated with a single flow diverter (FD) on the contralateral side. The aneurysms treated were either ophthalmic artery aneurysm, superior hypophyseal artery aneurysm, posterior communicating artery aneurysm, or cavernous carotid aneurysms with an average size of 6.5 mm. There were no major complications such as in-stent stenosis, thromboembolic events, distal intra-parenchymal hemorrhage, re-rupture, stent migration, or neurological death. All patients had good functional outcomes. At 24 months follow-up, 81% of aneurysms showed complete occlusion of all treated aneurysms. No aneurysm required re-treatment.

This study demonstrates that a two-stage flow diversion treatment of bilateral aneurysms is both safe and efficacious. Timing of the contralateral flow diverter stent is critical. They found that 6 months allows for adequate neurological recovery and stent endothelization ²).

2017

Chohan et al. performed a retrospective analysis of all patients >18 years of age with aneurysmal subarachnoid hemorrhage (SAH) from anterior circulation aneurysms between 2008 and 2013 at the

University of New Mexico Hospital. Vasospasm was characterized on days 3 through 14 after SAH based on: (1) angiography, (2) vasospasm requiring angiographic intervention, (3) development of delayed ischemic neurologic deficit (DIND), and (4) radiological appearance of new strokes.

Of 159 patients, 114 (71.6%) had "aggressive" and 45 (28.3%) had standard microsurgery. More than 60% of patients presented with a Hunt and Hess score of \geq 3 and a Fisher grade (FG) of 4. Compared with standard surgery, there was a statistically significant decrease in the incidence of DIND in patients undergoing aggressive surgery (18.4% vs 37.8%, p=0.01). Moreover, there was a reduction in the number of new strokes by 30% in the aggressive surgery group with moderate or higher degrees of vasospasm (46.0% vs 76.5%, p=0.06). In the same group with FG 4 SAH, however, this difference was more than 50% (30% vs 64.7%, p=0.02).

They conclude that aggressive surgical manipulation during aneurysm surgery results in lower incidence of DIND and new strokes. This effect is most pronounced in patients with FG 4 SAH ³⁾.

2015

Zhang et al. retrospectively assessed the records of 103 patients with ruptured, Hunt and Hess grade IV or V, anterior circulation cerebral aneurysms. The patients were divided into 2 groups (conservative group and surgical group). In surgical group, patients were divided into 2 subgroups according to surgical time (within 24 hours and at 24-48 hours). Clinical outcome was assessed at the 6-month follow-up and categorized according to modified Rankin Scale (mRS) score.Twenty percent of patients (9/44) in conservative group obtained good outcome, while 54% (32/54) in surgical group (P<0.05). Mortality was 73% in conservative group and 40% in surgical group, respectively. In surgical group, age, Hunt and Hess grade (IV or V), and timing of intervention (<24 hours or later) influenced the clinical outcome of the patients (P<0.05), while sex, Fisher grade, hydrocephalus, the location of aneurysms, and cerebral vasospasm (CVS) not (P>0.05). Furthermore, 65% of patients (22/34) operated within 24 hours after onset of hemorrhage had a good outcome compared with 20% of patients (5/25) operated at 24 to 48 hours in surgical group (P<0.05). The results indicate that keyhole approach combined with external ventricular drainage is a safe and reliable treatment for ruptured, poor-grade, anterior circulation cerebral aneurysms in early stage, which will reduce mortality ⁴.

22 elective aneurysm clippings on patients \leq 55 years of age were performed by the same dual fellowship-trained cerebrovascular/endovascular neurosurgeon. One patient (4.5%) experienced transient post-operative complications. 18 of 22 patients returned for follow-up imaging and there were no recurrences through an average duration of 22 months. A search in the NIS database from 2008 to 2010, also for patients aged \leq 55 years of age, yielded 1,341 hospitalizations for surgical clip ligation of unruptured cerebral aneurysms. Inpatient length of stay and hospital charges at our institution using the minimally invasive thumb-sized pterional technique were nearly half that of NIS (length of stay: 3.2 vs 5.7 days; hospital charges: \$52,779 vs. \$101,882). The minimally invasive thumb-sized pterional craniotomy allows good exposure of unruptured small and medium-sized supraclinoid anterior circulation aneurysms. Cerebrospinal fluid drainage from key subarachnoid cisterns and constant bimanual microsurgical techniques avoid the need for retractors which can cause contusions, localized venous infarctions, and post-operative cerebral edema at the retractor sites. Utilizing this set of techniques has afforded our patients with a shorter hospital stay at a lower cost compared to the national average ⁵.

Fourteen patients with anterior circulation aneurysms underwent clipping via the endoscopic keyhole approach (supraorbital approach and minipterional craniotomy). Seven patients had anterior communicating (ACom) artery aneurysms, four had middle cerebral artery (MCA) bifurcation aneurysms, two had internal carotid artery bifurcation aneurysms, and one had a posterior communicating artery aneurysm. Ten patients presented with subarachnoid hemorrhage (Hunt and Hess grade I in 6 and grade II in 4 patients), whereas the remaining four were incidentally detected. The pre-clipping dissection as well as the clipping were successfully performed endoscopically in all patients. The post-clipping inspection revealed inclusion of a perforator within the clip blades in 2 patients (ACom and MCA bifurcation) that required clip readjustment. There was no residual neck/incompletely clipped aneurysm detected on post-clipping inspection. There was no morbidity directly attributable to the use of keyhole approach or the endoscope.

Endoscopic keyhole approach for intracranial aneurysms combines the advantages of both keyhole approach and endoscopy. Endoscopic visualization can help to reduce chances of an incompletely clipped aneurysms/residual neck and the risk of parent vessel/perforator occlusion. However, the use of an endoscope in narrow corridors with space constraints has a learning curve that can be overcome by practicing on cadavers and initially performing several simple endoscopic procedures ⁶⁾.

1)

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