

# Key perspectives on Woven EndoBridge device for wide-necked bifurcation aneurysms, endoscopic endonasal clipping of intracranial aneurysms, retrosigmoid versus translabyrinthine approaches for acoustic neuromas, and impact of local intraoperative steroid administration on postoperative dysphagia following anterior cervical discectomy and fusion

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## SAFETY AND EFFICACY OF ANEURYSM TREATMENT WITH WOVEN ENDOBRIDGE: RESULTS OF THE WEBCAST STUDY<sup>[6]</sup>

**Study Question:** What is the safety and efficacy of the Woven EndoBridge (WEB) device?

Despite the great overall success of endovascular therapy for treatment of both ruptured and unruptured aneurysms, the endovascular treatment of wide-necked bifurcation aneurysms remains challenging. The WEB device was created as a novel treatment for these aneurysms, for which balloon- or stent-assisted coiling, and surgery remain as alternatives, although often challenging. The WEBCAST

study was a prospective, observational, multicenter, controlled study among 10 European neurointerventional centers and represents the first large study to assess the safety and efficacy of WEB in a prospective fashion.<sup>[6]</sup> A similar study (French observatory) was run simultaneously in France. Pierot *et al.* present the combined data from these two studies, representing the largest published cohort of aneurysms treated with WEB.<sup>[7]</sup>

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The WEB device was successfully deployed in 97% of cases though adjunct treatment with coils or stents were required in 10% of cases. Thromboembolic events occurred in 15% of cases with only one patient (1.8%) having clinical sequela. The aneurysms were specifically selected by a multidisciplinary group including neurosurgeons. The cohort was largely unruptured aneurysms (91%), with the majority of which were in the middle cerebral artery (MCA) (52%), followed by anterior communicating artery (18%), basilar artery terminus (18%), and internal carotid artery terminus (11%).

Treatment was determined to be efficacious at 6 months, with complete aneurysm occlusion in 56.1% and adequate (Raymond I or II) in 85%, with relative stability of obliteration at 1 year.

**Perspective:** The study was well designed and outcomes were dutifully reported. However, the details of the aneurysms treated were unclear. Although they were all bifurcation aneurysms with a mean neck size of 5.57 mm, it is unclear about the percentage of patients with narrow neck aneurysms.

The basis of the WEB device is the concept of flow disruption, not dissimilar from flow diversion. Disruption of flow by the device causes stasis and gradual thrombosis, with the lattice at the neck allowing for eventual endothelialization to reconstruct the parent artery. WEB, as an endosaccular device, is not thrombogenic in the way an endoluminal stent or flow diverter is, and thus may be used without the use of antiplatelet agents, allowing its use in patients with subarachnoid or intraventricular hemorrhage. Despite this theoretical advantage, the authors found that any antiplatelet use (not required per protocol) was associated with a significant lower rate of thromboembolic events and the rate of thromboembolic events appeared to be comparable to stent-assisted coiling (15% total, 1.8% symptomatic).<sup>[12]</sup> The cohort of aneurysms treated were largely unruptured (87%), making the applicability of these results to ruptured aneurysms difficult.

The authors noted the complete and adequate occlusion rates of 56% and 82%, respectively, which is comparable to other endovascular series such as MAPS and CLARITY. Noninferiority to these treatments falls short of the expectation of the WEB device, namely, that it would be superior to stent- or balloon-assisted coiling. Further, several cases (10%) required these adjuncts for satisfactory treatment, abbreviating the enthusiasm over its standalone efficacy.

Most of the aneurysms included in this series are MCA bifurcation aneurysms, and they would have been amenable to surgical treatment with very high obliteration rates and low morbidity.<sup>[8]</sup> As neurosurgeons, we challenge that a complete occlusion rate of 56%

for MCA bifurcation aneurysms as being ideal when compared to open microsurgery.

Summary Written by: Visish M. Srinivasan, MD and Peter Kan, MD

## ENDOSCOPIC ENDONASAL CLIPPING ON INTRACRANIAL ANEURYSMS: SURGICAL TECHNIQUE AND RESULTS<sup>[4]</sup>

**Study Question:** Is endonasal aneurysm clipping a reasonable option for patients with intracranial aneurysms?

The authors review a retrospectively accrued database of patients to assess the safety and effectiveness of endonasal intracranial aneurysm clipping at a single institution by a single treating team comprised a neurosurgeon and otolaryngologist. Presenting signs, aneurysm size and location, ability to obtain proximal and distal vascular control, additional procedures, occlusion rate, and postoperative complications were analyzed. All patients obtained an intraoperative angiogram. Decision-making, technical nuances, and challenges with the operation were also discussed.

A total of approximately 400 patients had intracranial aneurysms treated through endovascular (about 75%) or open transcranial approaches over a 2-year period at this institution. A total of 10 patients with 11 aneurysms underwent an endonasal approach for aneurysm clipping during the same time span. Mean age was 50 years and 8 of the patients were women. Seven patients presented with incidental findings and one patient each presented with subarachnoid hemorrhage, vision loss/hypopituitarism, and an oculomotor nerve palsy. Aneurysm size varied from 4 mm to giant, with the majority of treated aneurysms in the 4–11 mm range. Six ophthalmic artery, three superior hypophyseal artery, one basilar apex, and one posterior cerebral artery aneurysms were treated. Proximal and distal control was obtained in every single case purely through the endonasal approach except for one patient with a giant, thrombosed aneurysm that required a craniotomy for distal control. Intraoperative angiogram demonstrated complete aneurysm occlusion in all cases. The two patients that presented with mass effect had improvement in their cranial nerve palsies and pituitary dysfunction. Postoperative complications included three patients with cerebrospinal fluid (CSF) leaks, two of whom developed meningitis. These patients were treated with additional endonasal skull base reconstruction and antibiotics. Both patients with posterior circulation aneurysms suffered lacunar strokes; one has recovered completely while the other has mild disability. No endocrine dysfunction was noted.

**Perspective:** The discussed decisions to proceed with the endonasal corridor center around the low occlusion/high recurrence rates and need for antiplatelet medication with endovascular aneurysm embolization, the theoretical benefit of immediate cessation of mass effect with aneurysm clipping, and the favorable anatomy for this surgical approach with inferomedially-projecting paraclinoid and ventrally-projecting vertebrobasilar aneurysms. Transcranial approaches for microsurgical clipping often require optic nerve manipulation and neck dissections for proximal control in treating paraclinoid aneurysms as well as significant brain retraction and a long working corridor for low-lying basilar apex/posterior cerebral artery aneurysms. Proposed advantages of the endonasal approach include the ability to obtain proximal control along the cavernous segment of the internal carotid, better visualization, and a more direct approach for certain aneurysms, minimal neurovascular retraction, and a potentially more comfortable recovery.

Several limitations exist with the endonasal approach for aneurysm clipping. Recognized restraints include the small working space with this corridor. With current single shaft applicators having limited degrees of freedom and in the setting of aneurysmal rupture or multiple clips needing to be placed for vessel reconstruction and obtaining proximal control, the narrow channel with this approach will be a drawback. The rate of intraoperative aneurysmal rupture in this manuscript is not stated. In addition, the challenge of modifying endonasal skull base reconstruction techniques to accommodate clips protruding into the sphenoid sinus may have led to the higher than usual incidence of postoperative CSF leakage and resultant infection in this series. Furthermore, no mention is made of the other paraclinoid and posterior circulation aneurysms treated with endovascular embolization or transcranial clipping during this time span at this institution. This information would be helpful to determine the preoperative selection bias in this series.

Although controversial, the endonasal approach has been shown to be safe and effective for limited aneurysms in several cadaveric studies and multiple other clinical case reports and case series and should rarely be considered as an alternative for limited patients in select high-volume centers. With higher recurrence rates and the potential need for long-term antiplatelet therapy tempering unbridled enthusiasm with current technical advancements in endovascular neurosurgery, transcranial clipping remains a viable and reliable option. Basic cerebrovascular principles can be maintained through the endonasal route for aneurysms with favorable anatomy, making this an infrequent option that should follow a multidisciplinary vascular board review to first discuss available transcranial and endovascular approaches.

Given the very steep learning curve with these particular cases, they should only be attempted on an individual patient basis by neurosurgeons experienced in endoscopic endonasal and cerebrovascular neurosurgery and otolaryngologists familiar with endoscopic skull base surgery and reconstruction. Advancements in endoscopic vascular imaging and clip applicator technology, along with additional studies and cases, particularly those showing the effectiveness of this approach despite intraoperative aneurysmal rupture, may enhance this approach.

Summary Written by: Anand V. Germanwala, MD

## **RETROSIGMOID VERSUS TRANSLABYRINTHINE APPROACH FOR ACOUSTIC NEUROMA RESECTION: AN ASSESSMENT OF COMPLICATIONS AND PAYMENTS IN A LONGITUDINAL ADMINISTRATIVE DATABASE<sup>31</sup>**

**Study Question:** Is there a difference in complications and reimbursements in the retrosigmoid versus translabyrinthine approach for vestibular schwannoma resection?

The authors conducted a retrospective analysis of the nationwide complication and payment rates in translabyrinthine and retrosigmoid approaches for vestibular schwannomas. The study included 346 and 130 patients who underwent retrosigmoid and translabyrinthine approaches, respectively, from the 2010 to 2012 MarketScan nationwide database.

The authors found no difference in patient characteristics, comorbidities, and hospitalization characteristics between the two groups. There was a significant regional difference in the surgical approach used. In the 30-day postoperative period, the rate of general neurological or neurosurgical complications was similar between the two approaches. The retrosigmoid approach had an increased rate of specific complications, including postoperative dysrhythmia (8.4% vs. 2.3%,  $P = 0.022$ ), dysphagia (10.4% vs. 3.1%,  $P = 0.0089$ ), and cranial nerve (CN) VII injury (20.2% vs. 10%,  $P = 0.0096$ ). Comparing surgeons who performed two or more acoustic neuroma procedures annually to those who performed <2 annually, there was a decreased incidence of CN VII injury (18.7% vs. 2.6%,  $P = 0.0072$ ) and postoperative dysphagia (8.9% vs. 2.6%,  $P = 0.24$ ), as well as a trend toward decreased need for repair of cerebrospinal fluid (CSF) leak (12% vs. 2.6%,  $P = 0.11$ ), in the more experienced group. While the authors found no significant difference in the incidence of lumbar drain placement (11.2% vs. 6.9%,  $P = 0.23$ ) or repair of CSF leak (11.2% vs. 11.5%,  $P = 0.87$ ), fat graft use during surgical repair of CSF leak was significantly higher in the translabyrinthine approach (19.8% vs. 60.2%,  $P < 0.0001$ ). Among patients

who received fat graft, the retrosigmoid approach trended toward a greater rate of requiring CSF leak repair (15.9% vs. 6.4%,  $P = 0.11$ ); while in those without fat grafts, the need for CSF leak repair was higher in the translabyrinthine group (10% vs. 19.2%,  $P = 0.093$ ). The authors also noted that undergoing the translabyrinthine approach and receiving a fat graft resulted in a lower rate of CSF repair requiring surgical repair (6.4% vs. 19.2%,  $P = 0.047$ ). In terms of reimbursement, the retrosigmoid approach resulted in higher median total payments (\$67,774 vs. \$50,918,  $P = 0.0004$ ) and hospital payments (\$50,351 vs. \$36,855,  $P = 0.0025$ ) than the translabyrinthine approach. There was no difference in median physician payments or aggregate 90-day postoperative payments between the two approaches. In addition, there was no difference in the length of stay, follow-up, or discharge home between the two groups.

**Perspective:** In the current health care climate of changing reimbursement rates and fee structure, this study provides us with the data to determine how we can both improve patient care and decrease health care costs for patients with acoustic neuromas. As the authors have found that the translabyrinthine approach achieves a lower rate of postoperative facial nerve injury, dysphagia, and dysrhythmia than does the retrosigmoid approach. Further, the total costs were lower in the translabyrinthine approach. The differences in complication rates between the two procedures may have had an effect on the cost differences between them. Higher volume centers and more experienced surgeons are also able to achieve lower complication rates leading to decreased hospital stays and decreased costs, whereas low volume centers and surgeons are more likely to utilize the retrosigmoid approach which provides greater tumor access but is associated with greater complication rates.<sup>[10,11]</sup> Similarly, Semaan *et al.* found that the retrosigmoid approach resulted in greater hospital and Intensive Care Unit length of stay and greater adjusted total costs compared to the translabyrinthine approach.<sup>[9]</sup> While these studies provide compelling data for the use of the translabyrinthine approach for acoustic neuromas to decrease both patient complications and health care costs, a prospective randomized trial is needed to provide definitive evidence.

Summary Written by: Panayiotis Pelargos and Isaac Yang, MD

## THE EFFECT OF LOCAL INTRAOPERATIVE STEROID ADMINISTRATION ON THE RATE OF POSTOPERATIVE DYSPHAGIA FOLLOWING ANTERIOR CERVICAL DISCECTOMY AND FUSION<sup>[1]</sup>

**Study Question:** What is the effect of local intraoperative steroid administration on the rate of postoperative dysphagia?

The goal of the study is to identify if local use of steroids during anterior cervical discectomy and fusion (ACDF) has an effect on postoperative dysphagia, length of stay, infection, or wound infection rates within 90 days of surgery. Based on current procedural terminology (CPT) coding, the authors used a Medicare database within PearlDiver, an insurance-based patient records database, to identify 245,745 patients undergoing an ACDF between 2005 and 2012. Then, the “J” code was used to identify intraoperative use of local steroid. Patients were divided into treatment (use of local steroid) versus nontreatment (control) groups, and each was assessed for International Classification of Diseases (ICD)-9 codes related to dysphagia and both CPT and ICD-9 codes for infection and wound complications. Associated demographics were compared. In the short ACDF (1–2 segments) group, 1770 patients received local steroid versus 198,230 who did not. For long construct ACDF (3 or more segments), only 322 patient received steroids compared to 45,432 who did not. Overall, intraoperative steroids were used more commonly in females, patients <70 years of age, and those with a history of obesity, smoking, and diabetes mellitus. Interestingly, dysphagia within 90 days was significantly lower for patients receiving steroids for long ACDF (9% vs. 14.6%, odds ratio [OR] 1.7,  $P = 0.005$ ) but not short ACDF procedures (7.5% vs. 8.4%, OR 1.1,  $P = 0.198$ ) when compared to their respective controls. The length of stay was 1 day shorter for all patients receiving local steroids ( $P < 0.0001$ ), and there was no difference in rates of infection or wound breakdown.

**Perspective:** Postoperative soft tissue swelling is a serious morbidity with an incidence reported to be as high as 71% in the first 2 weeks and 12–14% at 1 year.<sup>[2]</sup> While many studies are published regarding the factors associated with dysphagia post-ACDF, few have looked at preventative measures. Known risk factors include female gender, multi-level fusion, prolonged surgical duration, fusion levels of cervical 4–6, and advanced age.<sup>[2]</sup> Studies have provided conflicting reviews on postoperative use of intravenous steroids and only one prior study evaluated the use of triamcinolone application to the retropharyngeal space.<sup>[5]</sup> The authors of the above article have provided an interesting observation that using local steroids for long ACDF constructs may be worthy of adaptation into daily practice. The study is powered by size and is likely representative of the larger population as a whole, but the accuracy of data assessed is of question. First, CPT codes and ICD-9 codes can both underrepresent and over represent actual pathology as miscoding and noncoding are known errors. Second, we are not given the details regarding the diagnosis, severity, or duration of dysphagia. Dysphonia, another common complaint, was not included either. In addition, the database gives no specific details about the steroids used. It is imperative to compare the agent used, application

technique, dosage, and use of postoperative drains to better assess results and make opinions regarding personal use. Further studies investigating the use of local steroids may help identify a protocol that can be adapted into common practice. It may be worthwhile to assess the use of preoperative steroids both alone and in combination with local and postoperative steroid as well.

Summary Written by: Angela Bohnen, MD

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### Conflicts of interest

There are no conflicts of interest.

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