alternative to carotid artery endarterectomy (CEA) and approved by the central medical service (CMS) after the results of CREST trial. However, the incidence of cerebral ischemic event (CSE) was higher in CAS group compared to the CEA in CREST trial. DPD may not be utilized to patients who possess extreme tortuous vessels or near complete carotid artery stenosis, and many potential beneficiary CAS candidates are excluded. Objective of our study is to evaluate the incidence of CIE between groups who underwent CAS with or without the use of DPD. Additionally, we like to compare the overall perioperative complications between these two groups. Methods: From a prospectively maintained database, Consecutive patient who underwent CAS were collected and retrospectively analyzed from January 2008 to December 2018. Patients demographics, procedural techniques and perioperative events were captured. Outcome was measured using modified ranking scale (mRS) and NIHSS. Results: 165 consecutive patients (74% symptomatic; stroke 35.25%, TIA 38.85%) with median age 69 (39–91) female 30.7% underwent CAS (right ICA 57.55%, left ICA 42.45%) in two community based tertiary care facilities from 2008 to 2018. Median stenosis was 79% (70%–99%). DPD was used in 66% and 35% did not receive DPD due the anatomy. Demographic characteristics were similar between DPD (baseline mRS $0.33 \pm .67$) and non-DPD group ($0.59 \pm .15$). The incidence of CIE was observed in 2 cases and both developed in DPD group; TIA in one and lacunar stroke NIHSS of 2, resolved in 90 days. Non-CIE related major complications was observed in two female patients; retroperitoneal hemorrhage related cardiac arrest leading to death in one in group without DPD and femoral angioseal related occlusion in one in DPD group who required repair and achieved mRS 0 in 90 days. Minor complications related to anterior small hematoma in 3 cases without impairing baseline mRS or hospital stay. In regards to the outcomes, 90 days mRS for DPD and non-DPD group was 0.49 ± 1.1 and 0.19 ± 0.55 respectively. Conclusions: Our study revealed no difference in the incidence of cerebral ischemic event in carotid artery stenting patients who were either treated with the use of DPD or without DPD. However, the overall incidence of CIE was low in our study and non-CIE related events were observed more in female patients. Larger CMS sponsored studies are required.

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E-086

UNILATERAL CEREBRAL VASOCONSTRICTION FOLLOWING COMBINED CAROTID NEUROSURGICAL AND ENDOVASCULAR CAROTID REVASCARIZATION

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Introduction Reversible cerebral vasoconstriction syndrome (RCVS) can occur spontaneously or may be a secondary response. RCVS is rarely reported in literature following carotid revascularization and thought to be a possible result of chronic cerebral hypoperfusion with disturbance of cerebral autoregulation. There is no standard treatment for this condition. Here we report occurrence and management of cerebral vasoconstriction following unique combined neurosurgical and endovascular carotid revascularization for symptomatic carotid occlusion.

Methods We review a patient's clinical and imaging characteristics following carotid artery revascularization.

Results A female patient in her 70 s with history of hypertension, controlled type 2 diabetes mellitus, and current smoker presented with recurrent episodes of transient left sided limb shaking. She was found to have a right internal carotid artery (ICA) occlusion at the cervical origin with a non-flow limiting 40% stenosis of the left ICA associated with an acute infarct in the right frontal white matter. A diagnostic cerebral angiogram confirmed the occlusion of the right ICA with limited and delayed retrograde filling from the vertebrobasilar system via the right posterior communicating artery and smaller collateral contribution via right external carotid to ophthalmic artery. Notably, there was no anterior communicating artery for contralateral cross-filling. She had several outpatient visits and hospital admissions for hypotensive episodes associated with recurrent stereotypic symptoms. Repeat imaging demonstrated overall small stroke burden and no hemorrhage. Upon careful discussion and review of possible options, a combined neurosurgical-endovascular carotid revascularization was performed with endarterectomy of an occlusive plaque involving the distal common carotid to the proximal ICA, and direct mechanical thrombectomy with aspiration and stentriever of the cervical ICA to the terminus. Additional angioplasty and stenting of proximal petrous ICA segment was performed via femoral access after closure of the surgical site. She clinically was doing well until 5 days post-operatively, when she developed recurrent symptoms. Imaging showed small new ischemic strokes without hemorrhage. Continuous video-EEG

Abstract E-086 Figure 1 Initial and interval cerebral angiograms of right internal carotid artery (ICA) Figure A is an anterior view of the abrupt right cervical ICA occlusion at the bifurcation (arrow). Figure B demonstrates robust right ICA filling upon final review of combined neurosurgical-endovascular revascularization of the right ICA (lateral view). Following symptom recurrence, Figure C is a repeat angiogram demonstrating interval right ICA focal severe segmental irregularities consistent with cerebral vasoconstriction. Figure D.1 is a magnified view of Figure B, followed 10 minutes post intra-arterial verapamil treatment with improvement in vessel caliber on Figure D.2.

monitoring was negative for seizures. Transcranial doppler monitoring over the next few days demonstrated worsening velocities, with a repeat angiogram confirming severe focal segmental irregularities isolated to the right anterior territory. The surgical and stenting site remained widely patent. Her vasospasm was successfully treated with intra-arterial verapamil with improvement in vessel caliber and clinical symptoms.

Conclusions Post carotid revascularization cerebral vasoconstriction may be an unusual cause of clinical worsening after revascularization for chronic carotid stenosis or occlusion. Intra-arterial treatment with verapamil can be a safe and effective mode of therapy.

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E-087

HYBRID OPEN AND ENDOVASCULAR APPROACH FOR OCCIPITAL ARTERIOVENOUS FISTULA WITH COMPLETE OBLITERATION: TECHNICAL NOTE

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Background Dural arteriovenous fistulas (DAVFs) are acquired abnormal shunting connexions between the meningeal arteries and dural sinus or cortical veins and are an important cause of intracranial hemorrhage. Lesions with retrograde cortical venous reflux carry a higher risk of bleeding and endovascular embolization is currently the first-line treatment for these lesions. We present a case of DAVF with cortical venous reflux not amenable to conventional transarterial or transvenous endovascular embolization treated with direct surgical access to the occipital artery and Onyx embolization.

Method A 67-year-old man with a history of seizure disorder who presented with a tonic-clonic seizure one month after stopping his antiepileptics. Neurologic examination was unremarkable aside from diminished hearing on the right. The patient presented for neurosurgical evaluation due to imaging findings performed for work-up of his most recent seizure. Non-contrast head CT was unremarkable. CT and MR angiogram were performed, demonstrating prominent cortical veins overlying the right temporal convexity, suspicious for dural AV fistula or arteriovenous malformation. Digital subtraction angiography confirmed a dural AV fistula with arterial supply from the right occipital and middle meningeal arteries and shunting to the transverse sinus with multiple dilated cortical veins, compatible with a Borden 3, Cognard 4 lesion. In addition, there was a type 3 aortic arch with an extremely tortuous right common carotid artery, precluding selective access to the external carotid artery by either transfemoral or transradial approach. Due to the inability to access the right external carotid artery via conventional endovascular approaches, we elected to perform a hybrid procedure with surgical cutdown for direct access to the right occipital artery for Onyx embolization.

Result Using ultrasound guidance, the right occipital artery was tracked over the posterior nuchal line. A linear incision was designed over it and the artery was exposed and catheterized with a short 5F sheath. Vessels loops were used to secure the sheath to the artery. An onyx compatible microcatheter was used to access the nidus of the fistula and under direct fluoroscopy the fistula was embolized. A Post-embolization

angiogram from the right occipital artery demonstrated no residual filling of the fistula. The postoperative was unremarkable and follow up angiogram at 6 months shows complete obliteration.

Conclusion A variety of hybrid open and endovascular approaches have been described and the majority describes approaches involve a combination of a craniotomy followed by Onyx or NBCA embolization after direct cannulation of the artery or vein. In this case, we report a combined surgical and endovascular approach for Borden III DAVF that was inaccessible to standard endovascular approaches due to tortuous carotid anatomy via a direct cut-down. Direct cannulation of the occipital artery provided an elegant access to the fistula distal to the tortuous carotid anatomy with minimally invasive surgery without requiring a craniotomy, and a large volume of Onyx was able to be injected via the prominent occipital artery. Direct cannulation of feeding vessels to dural AVF represent a treatment option in patients that are not good candidates for conventional endovascular or open approaches.

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E-088

PSYCHOLOGICAL IMPACT OF PULSATILE TINNITUS IN THE US POPULATION

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Introduction/Purpose Pulsatile tinnitus (PT) is the auditory perception of a rhythmic, cardiac-synchronized, 'whooshing' type of sound in the absence of an external source that affects 3–5 million Americans. In addition, several of the anomalies that cause PT can have serious sequelae such as ischemic stroke, blindness, or intracranial hemorrhage. In addition, it is common for patients to describe an inability to continue to function in their families and in society due to the psychological impact of PT (which may be depression, anxiety, or a combination). In our experience, treating the underlying cause of PT not only mitigates the risks of the vascular anomaly, but also the patients' psychiatric illness. However, the prevalence of depression and anxiety in the PT population is unknown. The purpose of this study was to quantify the prevalence of depression and anxiety in the United States PT population, as well as identify relationships between patient characteristics, effects of PT on various aspects of life, depression, and anxiety.

Materials and methods Local IRB approval was obtained to survey the pulsatile tinnitus community. The survey used the validated Tinnitus Functional Index (TFI) to determine the severity of the PT condition (intrusive, sense of control, cognitive, sleep, auditory, relaxation, quality of life, emotional). In addition, the PHQ-9 and GAD-7 was used to obtain the prevalence of concurrent depression and anxiety, respectively. Logistic multiple regression analysis was performed for determining the associations of clinical and demographic variables with TFI total score. Additionally, PHQ9 and GAD7 scores (binarized to indicate depression/anxiety) were modeled with TFI total score as the main exposure