

Introduction

Internal jugular venous stenosis can present with variable symptoms, including headache, tinnitus, papilledema, vision changes, and cerebral venous sinus thrombosis. These symptoms are typically due to intracranial hypertension from obstructed venous outflow, caused by either intrinsic or extrinsic stenosis of the dominant internal jugular vein. In some cases of idiopathic intracranial hypertension, intrinsic jugular vein or transverse sinus stenosis can be treated with endovascular stenting, CSF diversion, or optic nerve fenestration. However, extrinsic stenosis can also occur due to external compression from bony structures, typically seen by the styloid process in a rare vascular sub-type of Eagle Syndrome. Very rarely, this compression of the dominant jugular vein can arise from the transverse process of C1, which can be exacerbated by head turning, resulting in symptoms of intracranial hypertension.

Objective and Methods

This case presentation summarizes this patient's extensive workup in order to identify the C1 transverse process as the culprit of her jugular stenosis, as well as the treatment to provide symptomatic relief on her intracranial hypertension. Our surgical plan was to carefully resect the right transverse process of C1 medial enough to decompress the intracranial venous outflow, while preserving the vertebral artery, jugular vein, and large collateral veins.

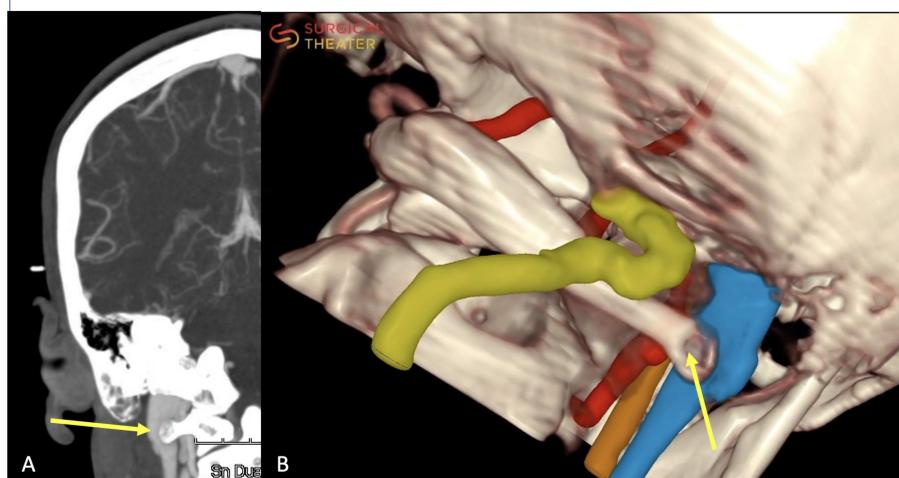


Figure 1: Coronal CT Venogram image (A) and 3D rendering from a posterior oblique view (B) demonstrating the compressed internal jugular vein (Blue), the right C1 transverse process (Yellow Arrow), the right vertebral artery (Red), and a large anastomotic vein (Yellow).

Results

The patient is a 20-year-old female college student who presented with several months of severe headaches and pulsatile tinnitus. CT Venogram showed left sigmoid sinus occlusion, right internal jugular stenosis in the upper cervical region, and exaggerated venous drainage in superficial veins due to anastomotic, compensatory flow (Figure 1). She underwent endovascular stenting of the right internal jugular vein at an outside hospital, but the stent dislodged and required endovascular removal from the pulmonary artery.

She was admitted electively for placement of an intracranial pressure (ICP) monitor in the intensive care unit, where provocative testing demonstrated a consistent pattern of ICP spikes to low 20s mmHg when she turned her head to the right. She then underwent dynamic cerebral angiography which re-iterated predominance of her right transverse sinus, dilation of the proximal right internal jugular vein, with dynamic compression by the right C1 transverse process, which worsened when she turned her head to the right. This correlated to her ICP spikes on the monitor.

She then underwent an extreme far lateral approach through a C-shaped retroauricular incision for the resection of the transverse process of C1 to decompress her intracranial venous outflow (Figure 2). Postop CT venogram shows the decompressed jugular vein with the resection C1 transverse process, as well as preservation of the superficial collateral veins (Figure 3).

She tolerated the procedure well. She experienced some immediate post-operative dizziness and lightheadedness, which improved with vestibular physical therapy. At her 6 month follow-up, she was at her neurologic baseline with resolution of her symptoms.

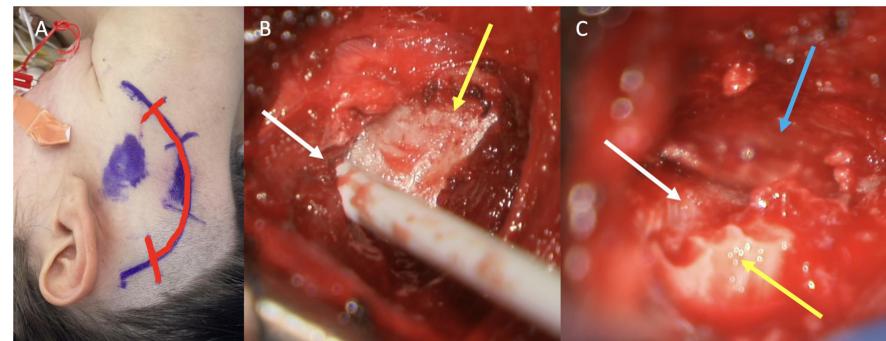


Figure 2: Intra-operative images. (A) Patient positioning and incision (Red). (B) Exposed right C1 transverse process (Yellow Arrow) and the foramen transversarium (White Arrow) being interrogated with a microdoppler. (C) Resected C1 transverse process (Yellow Arrow) with an open foramen transversarium (White Arrow) and decompressed internal jugular vein (Blue Arrow).

Discussion

The goal of the surgical intervention was to decompress the jugular vein through resection of the C1 transverse process, while preserving all of the critical surrounding neurovascular structures and minimizing trauma to the neck muscles. The chosen approach helped to avoid the large superficial veins originating near the suboccipital venous plexus that were providing anastomotic, compensatory flow for the intracranial venous drainage.

An extreme far lateral surgical approach with a retroauricular incision (Figure 2) was used to gain direct access to the transverse process of C1, while avoiding the large superficial veins medially and other neurovascular structures anteriorly. The dissection was carried out in the fascial layers between the upper cervical muscles to avoid muscular injury, using manual palpation of the C1 transverse process as a guide to deepen the dissection. This approach is similar to many of the published upper lateral neck dissection approaches, including an infracondylar approach, while still avoiding the spinal accessory nerve, internal carotid artery, vagus nerve, and the hypoglossal nerve anterior to this patient's pathology.

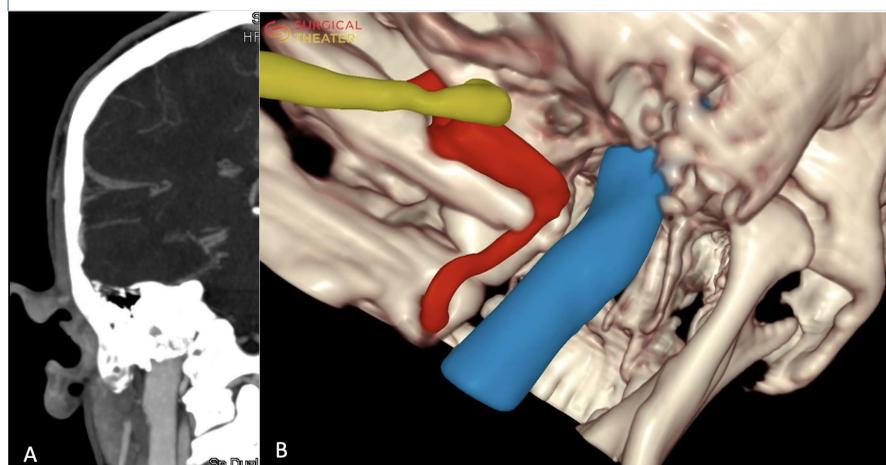


Figure 3: Post-operative Coronal CT Venogram image (A) and 3D rendering from a posterior oblique view (B) demonstrating the decompressed internal jugular vein (Blue) after resection of the right C1 transverse process, as well as the opened foramen transversarium and right vertebral artery (Red).

Conclusions

Careful resection of the C1 transverse process can result in symptomatic improvement for intracranial hypertension secondary to jugular compression. The patient's return to her neurologic baseline without symptoms highlights the importance of early diagnosis of this condition and the use of multi-modality imaging in establishing the diagnosis. Important surgical considerations include preservation of the superficial collateral veins, jugular vein and vertebral artery.

Endovascular stenting should be reserved for cases when venous stenosis is not associated with a bony source of compression, especially if the compression is dynamic.

See the attached link for the Video Abstract of the case presentation and a step-by-step overview of the surgical technique.

Contact

Hayes Patrick, MD
Department of Neurosurgery
George Washington University
hayeshpatrick@gmail.com

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