Abstract ID:140351

Vestibular Schwannoma: Surgical Technique

Eduardo Vellutini, PhD[1]; Carolina Junger, MD[1] ,Vinicius Trindade, MD[1]; Marcelo Prudente, PhD[1]
[1] University of São Paulo, Division of Neurosurgery, Neurology Department, São Paulo - Brazil

Introduction

Vestibular Schwannomas represents 80% of tumors in the cerebellopontine angle and an incidence range from 3.0 to 5.2 per 100,000 person-years[1]. The Obsteiner-Redlich zone, the transition between oligodendrocytes and Schwann cells, situated at the IAC, is supposed to be the place of origin of this tumor. Many authors pursued to describe the surgical anatomy of vestibular schwannomas. Yasargil postulated an epiarachnoidal origin of the tumor, pushing medially the CPA arachnoid, as it grows outwards the meatus, and also defended the idea of even duplicated or triplicated arachnoid layers around the mass[2]. However, this theory was doubted by the presence of cerebrospinal fluid inside the meatus fundus in some cases. Lescanne made an anatomical study showing that CP arachnoid cistern merges with the meatus dura becoming an unique CSF sleeve along VII-VIII complex and VS would originate outside this subarachnoid space[3]. Our main surgeon believes that VS arise in the subarachnoid space at the OR zone and is surrounded by multiple arachnoid membranes, considering the CP cistern layer as the one that extend until the meatus entry and can be duplicated at this point, whereas the cranial nerves contribute with their individual arachnoid sheathes crossing all the way into the IAC. Then VS would behave as an “extra-cisternal” tumor. We advocate that keeping safe the arachnoid planes is the key to preserve nerve function post operatively.

Objectives

Describe the “extra-cisternal” technique for Vestibular Schwannomas.

Surgical case

The patient is a 35-year-old male, complaining of tinnitus and progressive hearing loss for a few months. MRI revealed a T4a VS on the right side. (Fig1). Surgery was the treatment of choice counting on intraoperative neurophysiological monitoring.

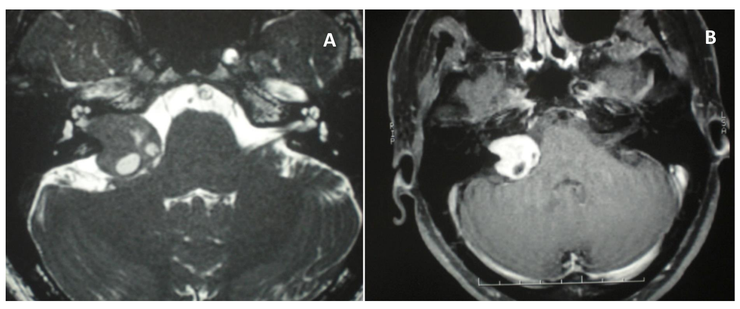
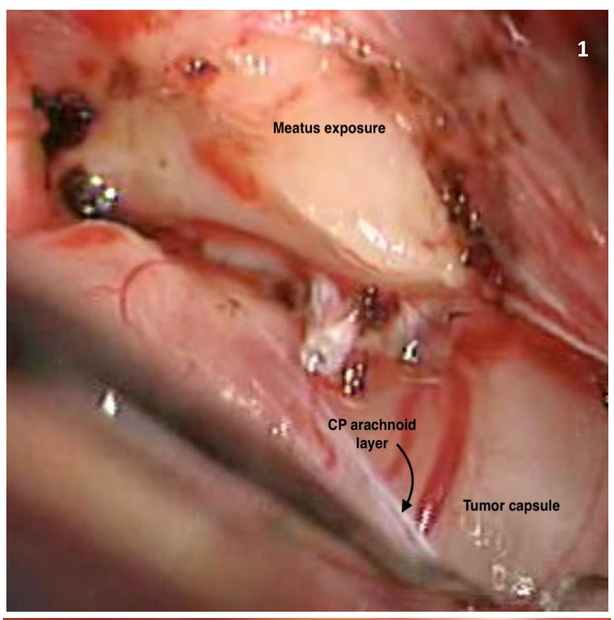
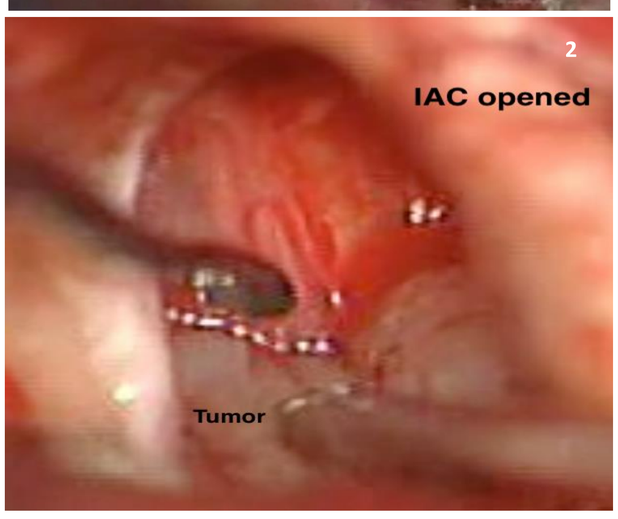


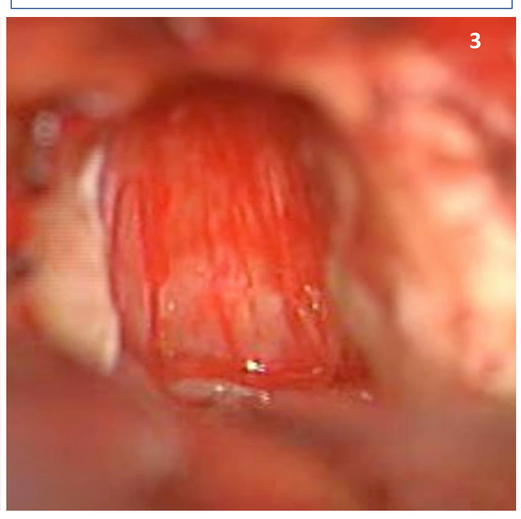
Fig1.- Right CP angle tumor and an enlarged IAC suggestive of a T4-a Hannover vestibular schwannoma. Quite homogeneously hyperintense on T1 post GD with few small cystic areas (1.B) showing correlation with VII-VIII NC complex on Fiesta sequence (1.A).

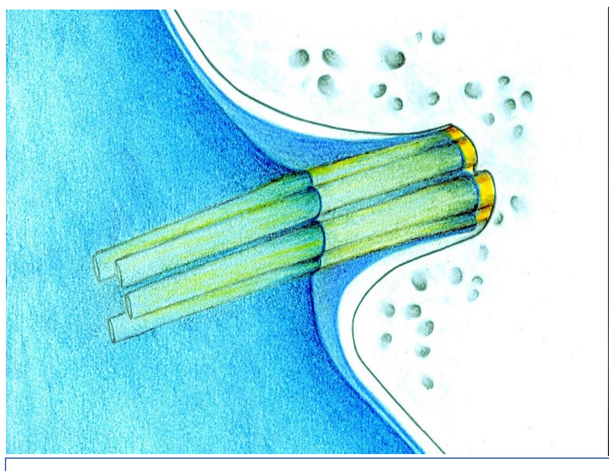
The usual surgical position is supine with rotated shoulders 30 degrees and head tilted 45 degrees to the contralateral side. A classical retrosigmoid approach was performed. The main surgical step-by-step is described as follows:



1- Exposure starts by dissecting CPA arachnoid layer above tumor capsule. Initial central debulking is done in that case of a big size VS and proceeds with IAC opening. After displacing medially the dura, drilling starts with a cutting burr and finishes with a diamond one. The limits of vestibular duct are respected and awareness of a high jugular bulb must be prior to the procedure. 2,3- Identifying the tumor in the fundus and pushing medially to the CPA cistern. The cisternal dissection begins near the porus where the arachnoid layer is thicker and easier to encircle the tumor borders (fig2). Then it continues around the cerebellar surface.







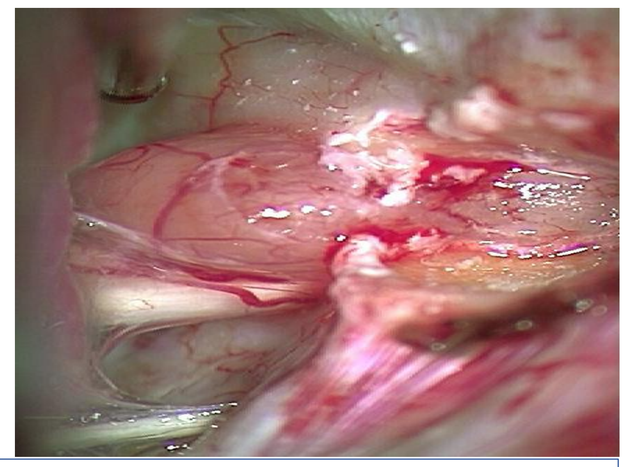
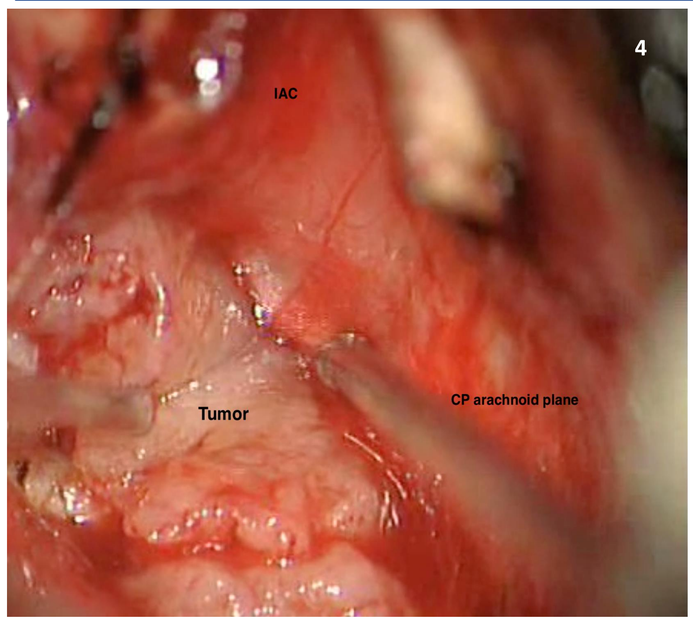
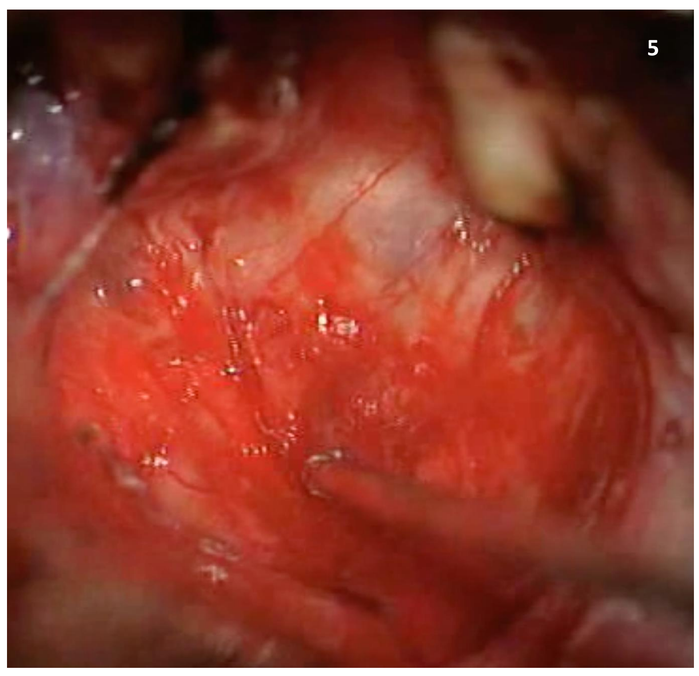


Fig2. Schematic presentation and a comparative intraoperative image showing different arachnoid layers into CPA cistern and IAC. CPA membrane extends till the porus entry and cranial nerves arachnoid sleeves continue till the fundus. Vestibular nerve may be part of that arachnoid complex considering tumor origin thus making harder to keep it intact by the end of surgery.





4- Tumor capsule remains devascularized due to arachnoid vessels displacement what makes clear the different surgical planes. Arachnoid layers near the porus superior or inferior borders are the easiest to find but also the most adherent part to the cranial nerves, especially the distal half of the nerve segment between cerebellar surface and IAC so should be left for the last stage. Progressive debulking with ultrasonic aspiration turns the tumor more malleable thus making dissection less aggressive. Our technique involves a combined blunt dissection with micro-suction tube and low power aspiration while meticulous pulling of the tumor is done with microsurgical dissectors or forceps. 5- Final result showing a continuous CPA-IAC arachnoid veil and the preserved cranial nerves behind this by translucency. Inspection of IAC is done with an oto-endoscope and it is usually closed with a small piece of muscle or fat covered by fibrin glue in order to avoid CSF leak.

Discussion

The classical surgical technique describes tumor debulking and identification of cranial nerves based on its trajectory along brainstem surface and IAC. The change in the surgery paradigm is not to chase the nerves but the CPA-IAC arachnoid veil. Particularly for large tumors it’s difficult to identify the nerve itself even after partial debulking as previously postulated. Starting the CPA dissection close to the meatus on this superior or inferior borders turns out easier to find the arachnoid plane which is thicker here. Opening the meatus in the beginning or by the end is a controversial topic but our group preference is the first as seems to favor the early vascular supply to the injured nerves and possibly be associated with a better functional recovery what is most associated with facial nerve preservation. The main surgeon experience after applying this extra-cisternal technique is made of good (HB I-II) and regular (HB III) outcomes in most cases despite tumor size[4]. This reported case ended up as a HB I and previous hearing loss was not reversible as expected because of VS origin and low preservation rates of VIII nerve in the literature.

Conclusions

Understanding the CPA and IAC arachnoid complex architecture proves the theory of an extra-cisternal tumor and its designed surgical technique. Lesser exposure of the nerves means decreasing morbidity rate and improving VS surgery safety.

Contact

Carolina Junger, MD
Skull Base Fellow at University of São Paulo
cfjunger@gmail.com

VIDEO CODE

https://drive.google.com/file/d/14ZrOSFs6440c2m7qYIO8XK59XkdU2yp8/view?usp=share_link

References

1. [illegible]
2. Yasargil M, Smith R, Gasser J. Microsurgical approach to acous- tic neurinomas. In: Krayenbuhl H, ed. Advances and Technical Standards in Neurosurgery. Vol 4. Wien, Austria: Springer-Verlag, 1977:93Y129.
3. Lescanne E, François P, Bakhos D, Velut S, Robier A, Pollak A. Vestibular schwannoma: dissection of the tumor and arachnoidal duplication. Otol Neurotol. 2008 Oct;29(7):989-94. doi: 10.1097/MAO.0b013e3181845812. PMID: 18667937.
4. Vellutini EA, Beer-Furlan A, Brock RS, Gomes MQ, Stamm A, Cruz OL. The extracisternal approach in vestibular schwannoma surgery and facial nerve preservation. Arq Neuropsiquiatr. 2014 Dec;72(12):925-30. doi: 10.1590/0004-282X20140152. Epub 2014 Dec 2. PMID: 25465777.