



Research Article

Complete Endoscopic Resection of a Vestibular Schwannoma

William Lines-Aguilar^{1,2*}, Alejandro Tintaya M¹, José Calderón S¹, Luis Saavedra R¹, Yelimer Caucha M¹, Jhon Crisanto F³, Dennis Heredia M³, Carlos Hoyos R³, Mao Vásquez P¹

¹Departamento de Investigación, Docencia y Atención Especializada en Neurocirugía del Instituto Nacional de Ciencias Neurológicas. Lima, Peru

²Unidad de Base Cráneo y Neuroendoscopia del Instituto Nacional de Ciencias Neurológicas. Lima, Peru

³Residente de Neurocirugía del Instituto Nacional de Ciencias Neurológicas. Lima, Peru

***Corresponding author:** William Lines-Aguilar, Departamento de Investigación, Docencia y Atención Especializada en Neurocirugía del Instituto Nacional de Ciencias Neurológicas & Unidad de Base Cráneo y Neuroendoscopia del Instituto Nacional de Ciencias Neurológicas. Lima, Peru

Citation: Lines-Aguilar W, Tintaya MA, Calderón SJ, Saavedra LR, Caucha YM, et al. (2022) Complete Endoscopic Resection of a Vestibular Schwannoma. Ann Case Report. 7: 1036. DOI: 10.29011/2574-7754.101036

Received Date: 10 November 2022; **Accepted Date:** 14 November 2022; **Published Date:** 16 November 2022

Abstract

Introduction: Vestibular schwannomas are the most frequent group of nervous system tumors, and the most frequent in the posterior fossa, followed by meningiomas. They are benign lesions of slow growth, grade I according to the 2016 WHO classification. The standard approach is retro sigmoid with a microscope, using an endoscope to explore blind spots under the microscope; however, pure endoscopic approaches with good surgical and functional results have been reported. **Objective:** To present a representative case of pure endoscopic resection of a vestibular schwannoma. **Materials and Methods.** A 54-year-old woman consulted for right hearing loss, with no other neurological signs, and contrast-enhanced MRI revealed a tumor of the cerebellopontine angle with remodeling of the internal auditory canal. Tumor resection was performed entirely using an endoscopic technique. **Results.** There were no intraoperative complications. During the post-operative she presented paresis of the VII cranial nerve House Brackman III. **Conclusions.** In our case, a pure endoscopic approach allowed us to completely resect the vestibular schwannoma.

Keywords: Endoscopic Surgery; Vestibular Schwannoma; Skull Base

Introduction

Vestibular schwannomas (VS) represent between 8 and 10% of intracranial tumors, with an average annual incidence of 0.78 to 1.15 cases per 100,000 inhabitants [1]. They are well-differentiated slow-growing tumors that originate from Schwann cells [1], 95% develop from the VIII cranial nerve, with the V cranial nerve being the second most frequent [2]. According to the WHO-2016 classification, they are grade I [2].

In recent years, some skull base surgeons have begun to experiment with endoscopic techniques for pathology of the cerebellopontine angle (CPA) [3]. Several reports describe a better visualization of neurovascular structures of the CPA with an endoscope compared to the microscope [3-8]. The intracanalicular extension of the lesions is best eliminated under endoscopic control, trying to avoid extensive drilling of the posterior face of the internal auditory canal [8]. Currently the endoscope is mainly used as a complement in conventional surgeries, to explore blind spots under a microscope. VS surgery provides an very suitable scenario for the use of the endoscope in the posterior fossa [9]. We

present a representative case of complete endoscopic resection of VS at the National Institute of Neurological Sciences in Lima, Peru.

Materials and Methods

A 54-year-old woman with no significant medical antecedents consulted for a 2-year history of decreased hearing in the right ear, without any other symptoms. Neurological and neuro-otological evaluation revealed marked hearing loss in the right ear, with no other neurological signs. On magnetic resonance imaging (MRI), an extra-axial lesion in the right CPA can be seen that remodels in the internal auditory canal (IAC), with diameters of 2.5 * 2.7 * 2.3 cm, homogeneously enhancing after gadolinium injection. In the T2-weighted sequence, large right APC cisterns can be seen, which we considered a favorable anatomical detail for the endoscopic approach, making it unnecessary to retract the cerebellar parenchyma to reach the lesion (Figure 1).

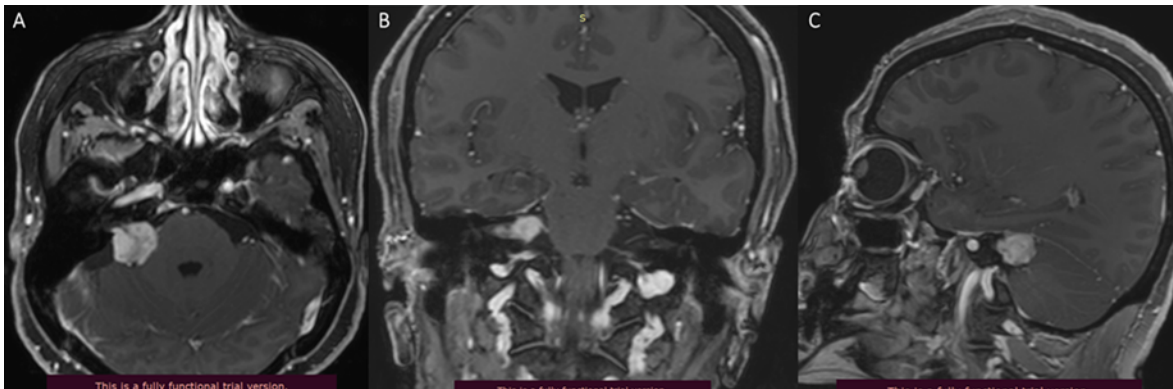


Figure 1: Gadolinium enhanced magnetic resonance images in axial, coronal, and sagittal views: extra-axial tumor homogeneously enhancing after contrast, which slightly displaces the pons and right middle cerebellar peduncle. Widened internal auditory canal with part of the tumor inside and large cerebellopontine angle cisterns.

Procedure

Patient with Mayfield head in left $\frac{3}{4}$ lateral position. A standard retrosigmoid craniotomy of approximately 3 cm in diameter was performed. 0°, 4mm and 18 cm optics were used, and a fourhanded approach was performed. After the durotomy based on the sigmoid sinus, the optics entered at the level of the union of the transverse and sigmoid sinuses. Cerebrospinal fluid was drained to widen the approach space and thus avoid retracting the cerebellum (Figure 2, 3). The tumor and its medial, lateral, cephalic and caudal margins were defined, identifying and protecting the VII-VIII cranial nerve

complex that was observed in the posterior-inferior margin of the tumor. The tumor was resected using the instruments for endonasal surgery, straight instruments, initially as internal decompression to finally resect the capsule. Since the main difficulty of this surgical technique is the limited maneuverability in such a small space, the straight endonasal surgeries instruments, in our opinion, favor maneuverability in this reduced space. The tumor was a soft, poorly vascularized, yellowish-colored tumor typical of VS. There were no complications during surgery, achieving total resection of the tumor.

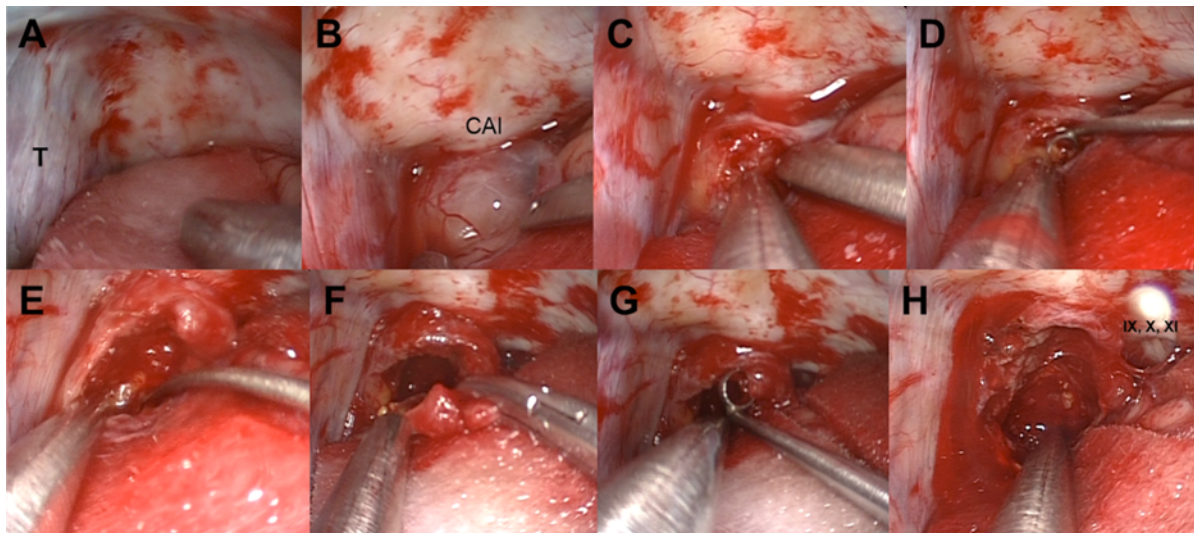


Figure 2: Intraoperative images. A) Initial view of the tentorium (T) on the right and the petrous portion of the temporal bone. B) Recognition of tumor, margins and its relationship with the internal auditory canal. C to G) Tumor resection in different phases. H) Final stage, the lower cranial nerves can be seen caudally.

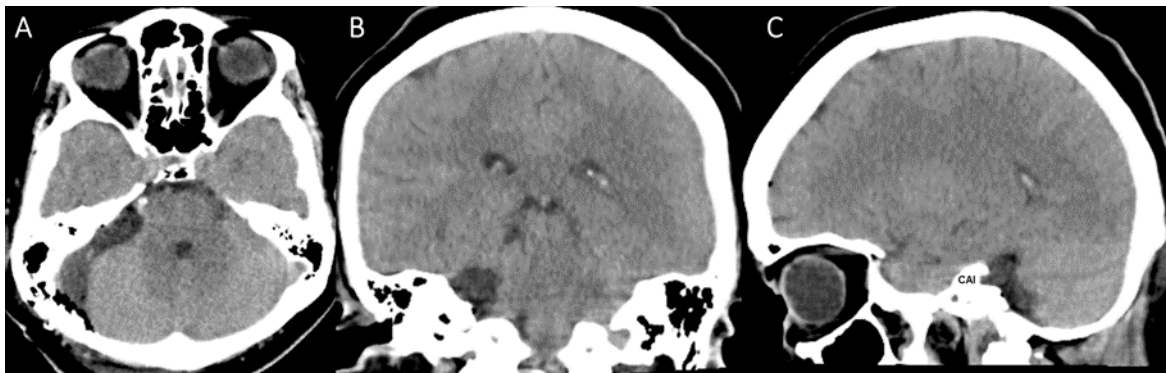


Figure 3. Post-surgical brain computed tomography images in axial, coronal, and sagittal views, with no evidence of residual tumor and no other findings. In the sagittal view the internal auditory canal is seen free of tumor.

Results

Postoperatively, the patient presented paresis of the VII cranial nerve, House-Brackmann (HB) III, with no other neurological problems. The pathology result confirmed the diagnosis of vestibular Schwannoma (WHO grade I). The patient was discharged after 3 days and referred to the Physical Medicine and Rehabilitation service.

Discussion

The retrosigmoid microscopic approach is the standard approach for VS. However, the development of endoscopic techniques has provided a suitable alternative. Although the operating scope was first introduced in cerebellopontine angle surgery as far as in 1917, the operating microscope remains the standard approach. [10] In 1960 when the surgical microscope was introduced, it proved to be superior to the endoscope in many ways. However, microscopy alone also has some limitations. The linear light source generates many blind spaces that are difficult to explore, for which it is necessary in most cases to retract the cerebellar parenchyma, which could cause inadvertent lesions in adjacent structures [3, 11]

Technological improvements in image resolution and illumination allowed for the reintroduction of endoscopic techniques in skull base surgery throughout the 1990s. [12] However, logistical concerns have significantly limited the use of the endoscope, especially into the CPA. Vital structures at the base of the skull, compromised by tumor pathology, require great precision to avoid catastrophic complications. [7] In the endonasal and ventricular approaches, this is easily achieved by using an assistant surgeon because the operative field can comfortably accommodate two surgeons and four hands working in unison, and develop proprioception to compensate for the bi-planar field. The small working area of the retro-sigmoid approach creates a difficult setting for a fourhanded approach. Because of this impediment, the endoscope was initially relegated to an adjunct and used only to inspect the area of interest before and after the procedure was performed. Early reports highlighted the superiority of endoscopic visualization compared to microscopy in the surgery of the CPA [3, 6, 8] demonstrating the potential benefits of the endoscope and fostering motivation to overcome existing logistical barriers [4, 7, 13].

The use of endoscopy in CPA surgery was initially introduced as a support technique. Endoscopy has shown successful results in microvascular decompression, [10, 12, 14, 15] vestibular neurectomy, [16-18] and resection of various tumors such as epidermoid cysts [19] and vestibular schwannomas. [16, 20, 21] The endoscope allows complete visualization of the CPA from the IV cranial nerve to the foramen magnum, as well as from the cerebellar hemisphere to the entire petrous portion of the temporal bone. In addition, angled endoscopes, such as the 30-degree one, allow better visualization into the IAC, which is necessary to explore in some circumstances.

[6] Despite these improvements, a large part of CPA surgeries continued to be performed under microscopy because adequate endoscopic restraint did not exist. [9] Thus, suboptimal viewing is still being used during the most critical and dangerous parts of these procedures. In addition, significant cerebellar retraction, more soft tissue dissection, and a larger craniotomy were required, all of which increase potential morbidity. [11]

Since the clamping arm can be easily moved in all planes with the push of a button and return to a rigid position with its release, fully endoscopic techniques were developed, allowing optimized visualization, smaller cranial openings, reduced need for cerebellar retraction, and minimizing manipulation of neurovascular structures. Jarrahy *et al* [11] were the first to describe a very endoscopic approach for microvascular decompression in the CPA. Since then, several authors have reported excellent results, both in clinical results and in recovery times. [22-24].

Only a few reports of complete endoscopic tumor resection can be found in the literature. De Divitiis *et al* [25] and later Krass

et al [26] reported successful surgeries for resection of epidermoid tumors using this technique. Shahanian *et al* [27] obtained successful results with a very endoscopic approach for VS.

Before starting with this type of approach, rigorous training and a lot of experience in endoscopic surgery is necessary, which allows us to understand exactly the limitations and possible risks of these procedures. This is our first experience of a purely endoscopic approach for VS. Our main limitation was the lack of intraoperative neurophysiological monitoring, which is standard in these procedures.

Conclusions

In our case, complete resection of a vestibular schwannoma was achieved, with residual paresis of the VII cranial nerve (HB III). Experience and rigorous training in endoscopic surgery is essential to plan this type of procedure.

References

1. Goland J. Schwannoma Vestibular: Revisión de Conceptos Actuales [Internet]. León Turjanski; 2001 [citado 2 de marzo de 2022]. Disponible en:
2. Sinning M (2017) Clasificación de los tumores cerebrales. *Rev Médica Clínica Las Condes*. 1 de mayo de; 28: 339-42.
3. Cappabianca P, Cavallo LM, Esposito F, de Divitiis E, Tschabitscher M (2002) Endoscopic examination of the cerebellar pontine angle. *Clin Neurol Neurosurg*. septiembre de; 104: 387-91.
4. Takemura Y, Inoue T, Morishita T, Rhoton AL (2014) Comparison of microscopic and endoscopic approaches to the cerebellopontine angle. *World Neurosurg*. octubre de; 82: 427-41.
5. Mathews S, Nandhan R, Natarajan K, Kameswaran M (2021) Endoscopy of the cerebello-pontine angle: an overview. *J Hear Sci*. 31 de agosto de; 11: 19-22.
6. Borucki L, Szyfter W, Leszczyńska M (2004) [Microscopy and endoscopy of the cerebellopontine angle in the retrosigmoid approach]. *Otolaryngol Pol Pol Otolaryngol*; 58: 509-15.
7. Van Rompaey J, Bush C, McKinnon B, Solares AC (2013) Minimally invasive access to the posterior cranial fossa: an anatomical study comparing a retrosigmoidal endoscopic approach to a microscopic approach. *J Neurol Surg Part Cent Eur Neurosurg*. enero de; 74: 1-6.
8. Magnan J, Chays A, Lepetre C, Pencroffi E, Locatelli P (1994) Surgical perspectives of endoscopy of the cerebellopontine angle. *Am J Otol*. mayo de; 15: 366-70.
9. Marchioni D, Carner M, Rubini A, Nogueira JF, Masotto B, Alicandri-Ciuffelli M, et al. (2016) The Fully Endoscopic Acoustic Neuroma Surgery. *Otolaryngol Clin North Am*. octubre de; 49: 1227-36.
10. Broggi M, Ferrolì P, Acerbi F, Tringali G, Franzini A, Broggi G (2012) 162 The Value of Endoscopy in Microvascular Decompression Procedures. *Neurosurgery*. 1 de agosto de; 71: E564.
11. Jarrahy R, Berci G, Shahanian HK (2000) Endoscope-assisted microvascular decompression of the trigeminal nerve. *Otolaryngol-Head Neck Surg Off J Am Acad Otolaryngol-Head Neck Surg*. septiembre de; 123: 218-23.

12. El-Garem HF, Badr-El-Dine M, Talaat AM, Magnan J (2002) Endoscopy as a Tool in Minimally Invasive Trigeminal Neuralgia Surgery. *Otol Neurotol*. marzo de; 23: 132-5.
13. O'Donoghue GM, O'Flynn P (1993) Endoscopic anatomy of the cerebellopontine angle. *Am J Otol*. marzo de; 14: 122-5.
14. Chen MJ, Zhang WJ, Yang C, Wu YQ, Zhang ZY, Wang Y (2008) Endoscopic neurovascular perspective in microvascular decompression of trigeminal neuralgia. *J Cranio-Maxillo-fac Surg Off Publ Eur Assoc Cranio-Maxillo-fac Surg*. diciembre de; 36: 456-61.
15. Duntze J, Litré CF, Eap C, Théret E, Bazin A, Chays A, et al. (2011) [Adjunctive use of endoscopy during microvascular decompression in the cerebellopontine angle: 27 case reports]. *Neurochirurgie*. abril de; 57: 68-72.
16. Miyazaki H, Deveze A, Magnan J (2005) Neuro-otologic surgery through minimally invasive retrosigmoid approach: endoscope assisted microvascular decompression, vestibular neurectomy, and tumor removal. *The Laryngoscope*. septiembre de; 115: 1612-7.
17. Cutler AR, Kaloostian SW, Ishiyama A, Frazee JG (2012) Two-handed endoscopic-directed vestibular nerve sectioning: case series and review of the literature. *J Neurosurg*. septiembre de; 117: 507-13.
18. Wackym PA, King WA, Barker FG, Poe DS (1998) Endoscope-assisted vestibular neurectomy. *The Laryngoscope*. diciembre de; 108: 1787-93.
19. Schroeder HWS, Oertel J, Gaab MR (2004) Endoscope-assisted microsurgical resection of epidermoid tumors of the cerebellopontine angle. *J Neurosurg*. agosto de; 101: 227-32.
20. Göksu N, Bayazit Y, Kemaloğlu Y (1999) Endoscopy of the posterior fossa and dissection of acoustic neuroma. *J Neurosurg*. noviembre de; 91: 776-80.
21. Magnan J, Chays A, Cohen JM, Caces F, Locatelli P (1995) Endoscopy of the cerebellopontine angle. *Rev Laryngol - Otol - Rhinol*; 116: 115-8.
22. Artz GJ, Hux FJ, Larouere MJ, Bojrab DI, Babu S, Pieper DR (2008) Endoscopic vascular decompression. *Otol Neurotol Off Publ Am Otol Soc Am Neurotol Soc Eur Acad Otol Neurotol*. octubre de; 29: 995-1000.
23. Eby JB, Cha ST, Shahinian HK (2001) Fully endoscopic vascular decompression of the facial nerve for hemifacial spasm. *Skull Base Off J North Am Skull Base Soc Al*. agosto de; 11: 189-97.
24. Halpern CH, Lang SS, Lee JYK (2013) Fully endoscopic microvascular decompression: our early experience. *Minim Invasive Surg*; 2013: 739432.
25. de Divitiis O, Cavallo LM, Dal Fabbro M, Elefante A, Cappabianca P (2007) Freehand dynamic endoscopic resection of an epidermoid tumor of the cerebellopontine angle: technical case report. *Neurosurgery*. noviembre de; 61: E239-240.
26. Krass J, Hahn Y, Karami K, Babu S, Pieper DR (2014) Endoscopic assisted resection of prepontine epidermoid cysts. *J Neurol Surg Part Cent Eur Neurosurg*. marzo de; 75: 120-5.
27. Shahinian HK, Eby JB, Ocon M (2004) Fully endoscopic excision of vestibular schwannomas. *Minim Invasive Neurosurg MIN*. diciembre de; 47: 329-32.