

Case Report

Endoscopic Transcanal Approach to Geniculate Ganglion Hemangioma and Simultaneous Facial Nerve Reinnervation: A Case Report

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Hemangioma of the facial nerve (FN) is a very rare benign tumor whose origin is the vascular plexi that surround the nerve. The transpetrous, retrosigmoid, and middle cranial fossa (MCF) routes are the traditional and most widely used approaches to reach these lateral skull base neoplasms. However, this very complex region can be reached through an exclusive transcanal endoscopic procedure in selected cases. One of these was a 42-year-old patient who had been presenting a worsening left FN paralysis (grade VI according to the House–Brackmann scale at the time of visit) for 22 months without a history of trauma or infection. Radiological studies showed a lesion in the region of the geniculate ganglion. A suprageniculate endoscopic approach was performed to remove the lesion, with the sacrifice of the FN and a simultaneous hypoglossal-facial anastomosis. The aim of this minimally invasive surgery is the complete excision of the disease, maintaining the hearing function intact and restoration of facial function, whenever possible, avoiding more invasive approaches.

KEYWORDS: Endoscopic ear surgery, suprageniculate fossa, facial nerve reinnervation, hemangioma

INTRODUCTION

Hemangioma of the facial nerve (FN) is a very rare benign tumor, representing 0.7% of tumors in the temporal region^[1]. These are benign extraneural neoplasms that emerge from the vascular plexi surrounding the nerve^[2]. They grow slowly, and they tend to cause a significant and progressive facial dysfunction/palsy since the early stages. The lesions usually involve the geniculate ganglion (GG), even if they could involve other segments of the FN, such as the internal auditory canal (IAC) area, and the vertical segment of the FN, near the take-off point of the chorda tympani^[3].

The transpetrous, retrosigmoid, and middle cranial fossa (MCF) routes are the traditional and most widely used approaches to reach lateral skull base neoplasms. The use of the endoscope in middle ear surgery has been widely discussed. However, recent advances have permitted to extend the indications also to the inner ear and lateral skull base diseases. The main advantages of those approaches are the natural opening of the external auditory canal (EAC); moreover, they allow a good surgical view of some critical anatomical areas, such as the suprageniculate fossa (SGF), avoiding brain or meningeal manipulations, with shorter and safe postoperative courses.

CASE PRESENTATION

A 42-year-old patient came to our attention with a 22-month worsening left FN paralysis (grade VI according to the House–Brackmann scale at the time of visit), without a history of trauma or infection. No pathological findings were found on otoendoscopic evaluation. Pure tone audiometry showed a bilateral symmetrical mild sensorineural hearing loss at high frequencies, without air–bone gap; the pure tone average was 10 dB. Stapedial reflex and tympanometric findings were normal bilaterally. The computed tomography

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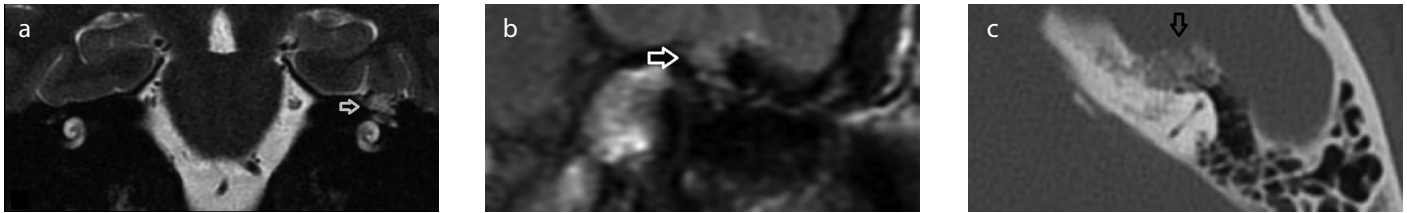


Figure 1. a-c. Left ear. Preoperative imaging. (a) MRI, coronal view, T2-weighted. A lesion extending over the cochlea is detected on the left side (white arrow). (b) MRI, coronal view, T1-weighted with gadolinium. The black spots correspond to those calcifications pathognomonic in these geniculate ganglion lesions (white arrow). (c) CT scan, axial view. A bony erosion is clearly visible at the level of the petrous apex (black arrow).

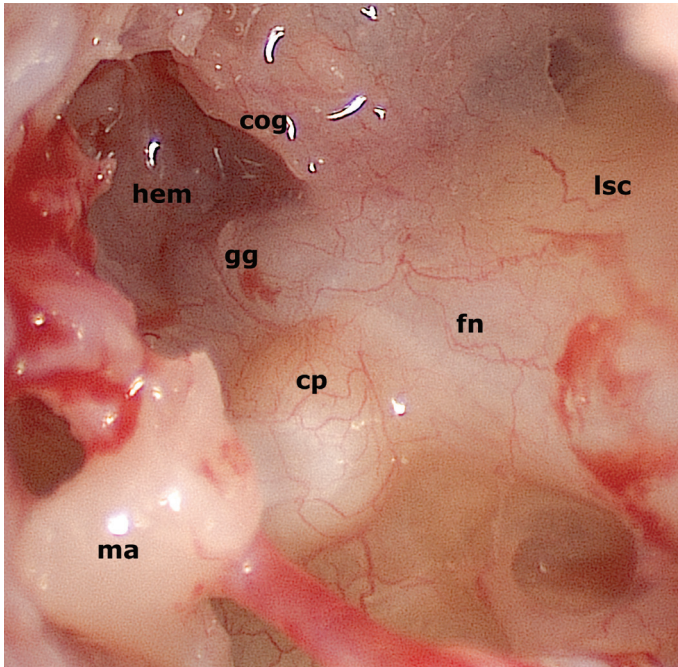


Figure 2. Left ear. Anatomical overview of the suprageniculate region. The hemangioma lies exactly over the geniculate ganglion. Transverse crest (cog) is a useful landmark to find the ganglion's area.
Cog: transverse crest; hem: hemangioma; gg: geniculate ganglion; lsc: lateral semicircular canal; fn: facial nerve; cp: cochleariform process; ma: malleus.

(CT) scan revealed erosion of the petrous bone at the first tract of the FN with extension toward the dura of the middle cranial fossa (MCF). The magnetic resonance imaging (MRI) scan with gadolinium showed a lesion, hypointense in T1-weighted sequences and hyperintense in T2-weighted sequences, in the region of the GG (Figure 1).

The patient underwent surgery for excision of the left GG's tumor through an exclusive endoscopic transcanal approach, with the sacrifice of the FN (involved by the pathology) and simultaneous hypoglossal-facial anastomosis through a cervicotomic incision. A 3 mm diameter, 15 cm length, 0° and 45° rigid endoscope was inserted through the EAC. After the injection of adrenalinic solution and local anesthetic under the skin of the posterior wall of the EAC, a wide tympanomeatal flap was created by a posterior semicircular incision on the skin of the EAC and elevated to gain an optimal view of the anatomical structures in the tympanic cavity. To obtain optimal access to the upper part of the tympanic cavity, an atticotomy with diamond burr was performed. The incus and the malleus' head were removed to provide access to the SGF, which is the triangular anatomical area between the FN (tympanic portion), the GG and the greater petrosal nerve caudally, the MCF dura cranially, and the labyrinthine bloc dorsally (Figure 2)⁽⁴⁻⁷⁾.

Through this approach, we were able to reach the area of the petrous apex over the cochlea and to identify the main anatomical structures to preserve, such as the lateral semicircular canal and the stapes. The dissection was performed using piezosurgery (Piezoelectric device; Mectron, Carasco, Italy) to attempt to preserve the FN and the integrity of the dura of the MCF.

The endoscope allowed the surgeon to magnify the FN and an easily bleeding mass, strictly connected to the GG. The tumor was inseparable from the VII c.n., as we could expect due to preoperative FN palsy; therefore, the section of the great petrosal superficial nerve and part of the first and the second tracts of the FN were mandatory to remove the entire pathology (Figure 3). Bleeding made the surgical procedure very difficult, in particular in the tympanic cavity, but we were able to solve this problem by bipolar cautery, cottonoids, and the use of self-suctioning dissection instruments (Panetti instruments). At the end of the procedure, an epitympanic obliteration was performed with autologous muscle; the scutum was reconstructed with cartilage, and the perichondrium was harvested from tragus cartilage. Then, an ossiculoplasty was performed by interpositioning a remodeled incus between the stapes and the handle of the malleus to restore good hearing results.

After the endoscopic stage, a hypoglossal-facial anastomosis through cervicotomic access was made. The FN was sectioned at the level of the stylomastoid hole, whereas the hypoglossal nerve was sectioned at its distal tract, together with the hypoglossal loop. An end-to-end technique, using eight 9-0 Ethilon stitches positioned in the epiperineural fashion, was made (Figure 4). The anastomosis was then covered with a fragment of the vein and the parotid gland for better protection.

No complications were noticed after surgery. In particular, no cerebrospinal fluid leakage and no meningitis or vertigo was reported. The patient was discharged from our department on postoperative day 3, and there were no signs of recurrence at the last follow-up. The patient also underwent tongue rehabilitation in the first postoperative period, followed by the FN. The last follow-up showed a FN palsy, grade III House-Brackmann, without speech or swallowing impairment. The last audiological control showed 20 dB air-bone gap on the left side. Consent was obtained from the patient for publication of the case.

DISCUSSION

The management of diseases of the GG region is still controversial. Nevertheless, the transcanal endoscopic approach to treat middle ear pathologies is still not accepted as preferable to conventional microscope-based approaches. The suprageniculate route should be

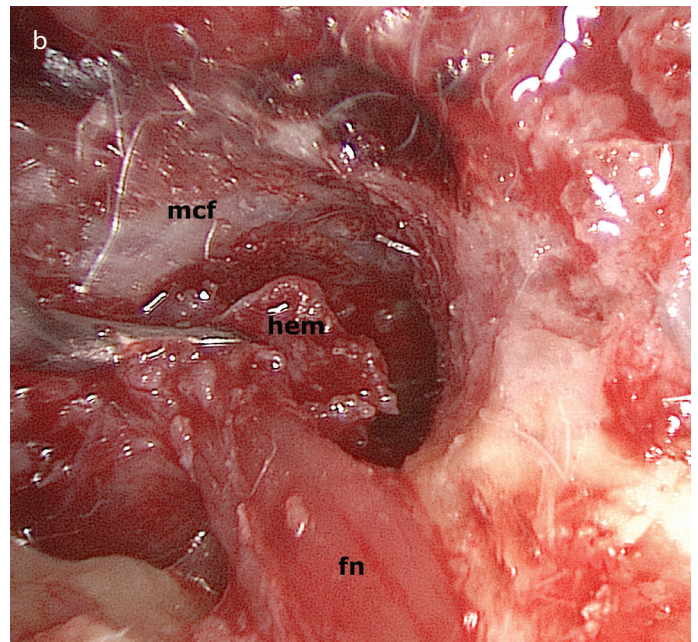
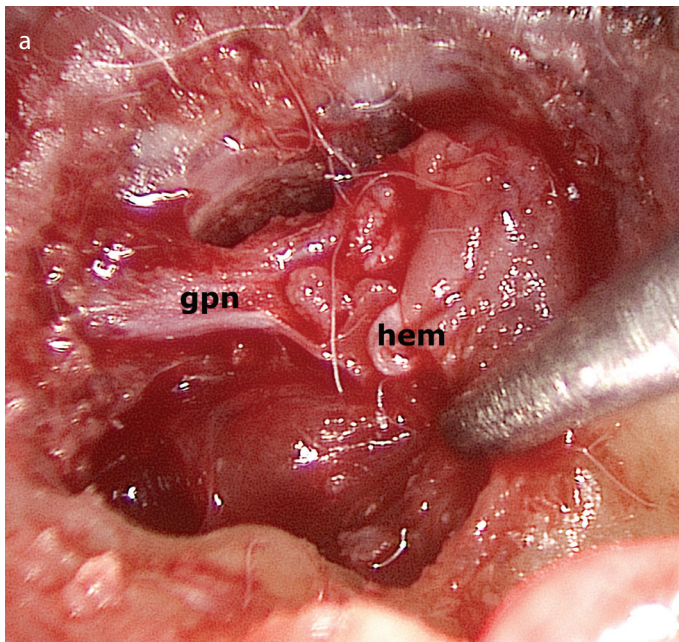


Figure 3. a, b. Left ear. (a) Relationship between the pathology and the great petrous nerve, involved by the tumor. (b) Dissection of the hemangioma from the second tract of the facial nerve. In this case, the nerve is cut to remove the pathology and to reach the radicality of excision. Hem: hemangioma; gpn: great petrous nerve; mcf: middle cranial fossa dura.

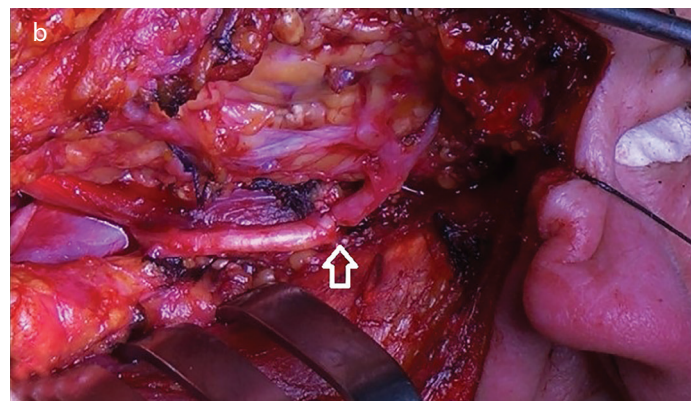
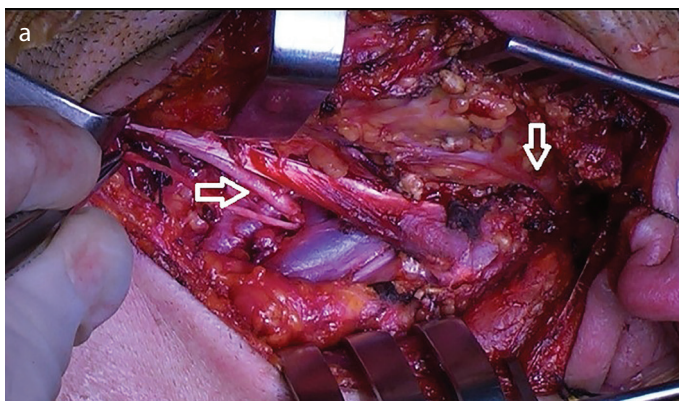


Figure 4. a, b. (a) identifications of the hypoglossal nerve (horizontal arrow) and facial nerve inside the parotid gland (vertical arrow). (b) Hypoglossal-facial anastomosis performed through a cervical incision and under microscopic view (arrow).

considered when a disease is limited in the suprageniculate fossa. An endoscopic approach may represent a minimally invasive technique that could allow surgical treatment for different diseases, sparing hearing and facial function, whenever possible.

The management of a hemangioma depends on both the characteristics of the patient and of the tumor, in particular, size, grade of FN infiltration, and dural involvement. In case of preoperative normal FN function with intraoperative findings of pathological tissue, if the tumor has a very close relationship with the nerve, some authors reported a subtotal tumor excision to keep the nerve intact. However, the first aim of surgery is to completely remove the tumor, even in cases when FN interruption and repair are required to restore functionality of the nerve. To spare the auditory function, several authors suggested, in case of good preoperative hearing level, an MCF approach; however, this technique implies a wide craniotomy, with temporal lobe retraction^[8]. This approach can lead to possible complications, such as cerebrospinal fluid leakage, cerebellar bleeding, subdural or epidural hematoma, and the onset of epileptogenic foci or brain hematomas^[9].

In case of preoperative poor hearing level, the translabyrinthine approach could be an alternative approach. However, the translab technique requires a large number bone removal and meningeal manipulation to reach the pathological tissue^[10].

Nevertheless, we strongly think that an otologic surgeon should be able to perform the traditional microscopic approaches, such as translab or middle fossa, before starting to employ the endoscopic corridor.

Nevertheless, transcanal endoscopic approach to the suprageniculate fossa may represent a viable alternative to remove pathological tissue from that anatomical area. Moreover, it allows the surgeon to avoid MCF craniotomy and brain tissue manipulation. This can be a valid alternative if the patient does not accept a craniotomy. Naturally, it is mandatory to perform an accurate diagnostic work-up with CT and MRI scans to correctly plan the transcanal endoscopic route through the EAC. Radiological imaging allows the surgeon to evaluate the exact extension of the tumor through the petrous apex, the

cochlea, the vestibule, the IAC, and its anatomical relationships within the tympanic cavity.

This approach may have some restrictions. First, an inadequate dimension of the EAC could limit surgical endoscopic maneuvers. Moreover, the endoscopic approach may impede ossicular chain preservation as a disarticulation and excision of the incus may be necessary to obtain a good view of the FN; however, an ossiculoplasty can be performed at the end to restore hearing function.

In our experience, hypoglossal-facial anastomosis represents an effective technique for resuscitation of the FN, especially after surgery of the cerebellopontine angle^[11]. Moreover, it is essential to perform a well-structured postoperative rehabilitation on the tongue, as well as on the facial muscles, for an optimal result^[12].

The middle fossa approach would allow an anastomosis of the nerve with the help of a fibrin glue or a direct suture. It remains crucial to remember how an anastomosis at the level of the GG is technically complex even by very experienced surgeons, and that the region is difficult to manage due to its anatomical characteristics.

In fact, we think that the FN rehabilitation made by expert professionals is fundamental to obtain good FN functional outcomes and to ensure a good quality of life to the patient^[13].

CONCLUSION

The exclusive endoscopic transcanal approach for treatment of diseases with limited extension to the lateral skull base is a relatively new technique, with only a few cases reported in the literature. The main aim of this minimally invasive surgery is the complete removal of the disease, without hearing impairment and by maintaining the facial function intact, whenever possible. The most common surgical procedures used to reach this anatomical district are the MCF approach and the translabyrinthine approach. These techniques remain the gold standard, and it is necessary to know them to approach innovative techniques. In our opinion, the great advantage of the endoscope is that it allows to explore a wider part of the tympanic cavity, especially with the angled lenses, and the magnification of the image provides more anatomical details. Moreover, the possibility to search behind the corner is very helpful to control spreading routes of pathologies, in relationship to anatomical variations as well.

With regard to the supragenulate region, this technique allows a less invasive surgical approach in avoiding a wide craniotomy, such as MCF approach. Moreover, the tympanic FN can be completely visualized, even in hidden regions, such as the second genu and GG, thus reducing the morbidity associated with traditional microscopic surgery.

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