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Original Article

Meningioma limited to the internal auditory canal: a case report

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Abstract: Meningioma limited to the internal auditory canal (IAC) is much less common. Surgery is the primary option of initial treatment. Here is a report of a 46-year-old woman with a 6-month history of decreased hearing and ingravescent high-pitched tinnitus in the right ear, which was diagnosed as meningioma arising from the IAC. The case was diagnosed preoperatively as an acoustic neuroma of IAC. Total tumor resection was carried out through the tranlabyrinthine approach. Histological examination after surgery proved that it was an IAC (WHO class II) atypical meningioma invading the facial nerve. For severe adhesion IAC meningioma, the facial nerve should be carefully separated during the operation to avoid the nerve damage.

Keywords: Meningioma, internal auditory canal

Introduction

Meningiomas limited to the internal auditory canal (IAC) are much less common. Preoperative diagnosis of IAC meningiomas differentiated by acoustic neuroma are a huge challenge due to the lack of typical symptoms and signs and effective diagnostic methods. In this article, a meningioma is described that was limited to IAC, and was diagnosed as an acoustic neuroma before surgery. Meningioma of IAC was confirmed histologically postoperatively. Herein, the diagnostic and therapeutic issues associated with the disease entity are discussed.

Case report

A 46-year-old woman had a 6-month history of decreased hearing and ingravescent high-pitched tinnitus in the right ear. Since the onset of the disease, she was free of purulent discharge in the ear, no dizziness, nausea, vomiting, facial spasm or paralysis. She went to our E.N.T. Department and the diagnosis of an intracanalicular tumor prone to acoustic neuroma was made according to the MRI findings (**Figure 1A-C**). The pre-operative audiologic examination showed that hearing on the right side was decreased to 53 dB pure tone average (500-2000 Hz), with a word recognition score of 65%. She was referred to our institute for tumor resection. The tranlabyrinthine approach was chosen and during surgery it was found that in IAC, the right facial nerve was completely engulfed by a spanned soft mass in a tangled shape (**Figures 2A** and **2B**). The tumor was meticulously dissected including the dural attachment. Post-operatively, the patient's facial nerve function was House-Brackmann grade VI. The histologic examination revealed that it was an atypical meningioma (WHO Grade II) invaded into the facial nerve. Immunohistochemistry results showed that the tumor cells stained vimentin and EMA strongly, but did not stain S-100, consistent with meningioma (**Figure 3A-D**).

Discussion

Meningiomas are known to originate from the arachnoid villi lining cells and often arise along the dural venous sinus where arachnoid granulations are found, especially around the sigmoid sinus, torcula, superior petrosal sinus, and inferior petrosal sinus [1]. Due to the granulations scattered along the cranial nerve foramens (IAC or jugular foramen), IAC meningiomas may occur like the cerebellopontine angle (CPA) ones.

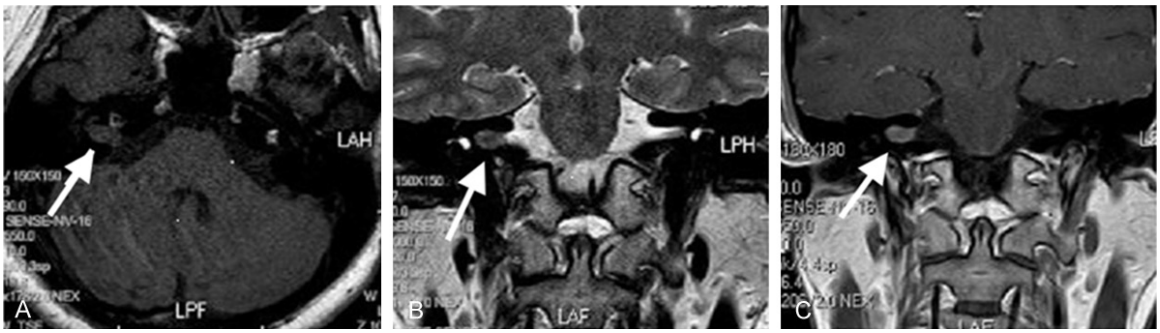

Figure 1. A: Right intra-canalicular mass (arrow indicated) appears isointense on T1-weighted images. B: Right intra-canalicular mass (arrow indicated) appears isointense on T2-weighted images. C: Right intra-canalicular mass (arrow indicated) enhanced uniformly after gadolinium injection.

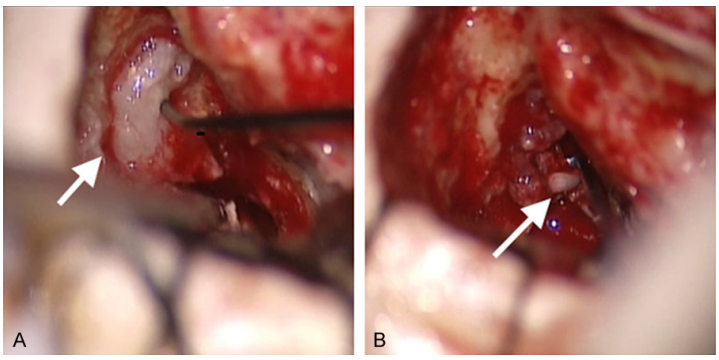

Figure 2. A: In the IAC, a soft mass (arrow indicated) crossed through the facial nerve and was entirely engulfed. B: Intra-operatively, the tumor (arrow indicated) was severely adhered to the facial nerve, and it was difficult to be resected with the preservation of facial nerve function.

Meningiomas are the second most common tumors of CPA following acoustic neuroma. The incidence of CPA meningiomas is 3.1%-12%, while acoustic neuroma accounts for 76%-91.3%. Meningiomas invading IAC from CPA are considered rare. In contrast, meningiomas limited to IAC are even more uncommon. Preoperative diagnosis of intra-canalicular meningiomas is quite difficult due to the lack of typical clinical manifestations and effective diagnostic methods. Intra-canalicular meningiomas occur more frequently in women (male to female ratio, 1:1.6). The usual age of initial presentation ranges between 14 and 75 years, with a mean age of 49.5 ± 12.2 years [2].

Although the majority of meningiomas are benign, they may have malignant presentations. Classification of meningiomas is based upon the WHO classification system: Benign (Grade I) which occupy the 90% of the patients; Atypical (Grade II) that the ratio of incident is 7%; Anaplastic/malignant (Grade III) that it is 2% [3]. Grade I induces symptoms that are primarily caused by the neighboring neural structures compression, while Grade II and III can invade the dura, nerve, or the bone. According to the histologic result of local hyperplasia, necrosis and neural invasion, the case herein is diagnosed as atypical meningioma. Since Virchow reported the first case of histologically confirmed intracerebral meningioma in 1863, 39 cases have been reported in the English literature to date [2, 4-7].

Patients of intra-canalicular meningiomas have the common complaint of unilateral sensorineural hearing loss alone or associated with tinnitus [4]. A restricted intra-canalicular tumor associated with a rapidly progressive hearing loss or facial spasm or facial nerve weakness even facial nerve paralysis should be taken into consideration to be intra-canalicular meningiomas [8]. The relatively obvious difference between IAC meningioma and the acoustic neuroma is the more common involvement of the facial nerve in IAC [1].

Meningiomas originate solely within the IAC usually lack the typical MRI characters including “dual tail” sign, calcification of the tumor, hyperostosis of petrous bone, with a broad base of attachment along the posterior petrous surface, and even the tympanic bone destruction of eroding into the semicircular canals, vestibule, or cochlea. On MRI, IAC meningiomas appear isointense on both T1-weighted and T2-weighted images, as IAC acoustic neuroma appear isointense on T1-weighted images and

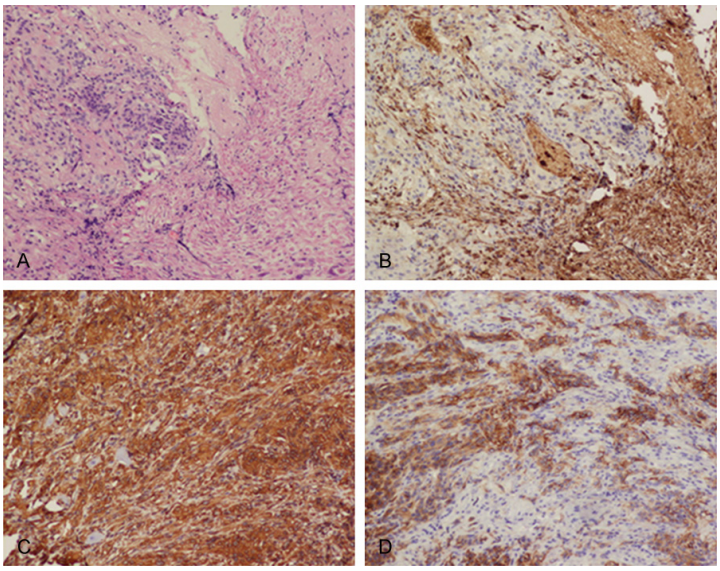

Figure 3. A: Photomicrograph of resected neoplasm shows the cells arranged in sheets and whorls, characteristic of meningioma and neural invasion (hematoxylin-eosin staining, ×100). B: Immunohistochemistry shows that the tumor cells were not stained by S-100, demonstrating indirectly the relation between the meningioma and the facial nerve (×100). C: Immunohistochemistry shows that the tumor cells were stained by vimentin strongly. (×100). D: The IAC tumor shows positive cytoplasmic and membranous staining for EMA (×100).

hyper-intense on T2-weighted images. After gadolinium injection, acoustic neuroma enhance to a greater degree than meningioma. However, the mini distinction is not enough for differentiating IAC meningiomas from acoustic neuroma [2, 9]. The tumors may be differentiated by time-intensity curves and relaxation-rate increments [10]. But detailed data associated with IAC meningiomas and acoustic neuroma is unknown and being further proven.

Treatment of meningioma consists of observation, surgery, radiation therapy and chemotherapy. In the tumors that have caused symptoms, it is not recommended to observe, especially IAC meningioma. The labyrinthine bone and VII, VIII cranial nerves are easy to be invaded, resulting from the limited available space of IAC [11]. At this time, surgical intervention may be considered the choice of initial treatment. The primary goal of surgical treatment of intra-canalicular meningiomas should be to achieve safe and total tumor removal with preservation of facial nerve function and conservation of serviceable hearing whenever possible. The surgical approach options include the retrosigmoid approach, the middle fossa approach, and the tranlabyrinthine approach. In this situation of the IAC, the tranlabyrinthine approach was more commonly selected in the literatures reported, because of the less invasive and advantage of reaching to the lateral portion of the temporal bone more easily, but at the cost of hearing, especially for elderly people with poor basic condition or poor hearing. Intraoperatively, the positon of the facial or cochlear nerve is predictable for acoustic neuroma, adhering to the surface of the tumor and removed from the surface more easily like peeling an onion. In contrast, intra-canalicular meningioma holds an intricate relation with the cranial nerves. The majority of IAC meningiomas lie anteriorly within the canal and displace the nerves posteriorly, whiles sometimes the nerves course through the mass, and can be difficult to be separated from the tumor [1]. In this case, they may require a meticulous sharp dissection but a high risk of facial nerve damage occurs, resulting in the possibility of facial paralysis. IAC meningioma invades the facial nerve more commonly than acoustic neuroma [1] that corresponds to the clinical signs and symptoms.

The incidence of recurrence of the meningioma after surgery may be estimated by the extent of surgery by the Simpson Criteria [12]. If invasion of the adjacent bone occurs, it is almost impossible to completely remove. The complete removal including underlying bone and associated dura reduces the recurrence greatly. The ratio of 10-year recurrence after completing removal ranges from 9% to 29%, while the recurrent ratio after subtotal resection is up to 40%. However, it is unknown whether all intracanalicular meningiomas behave this way. In contrast, for AN, there is little recurrence after complete resection and there is no need to remove the underlying bone and associated dura, Therefore, correct diagnosis before or during surgery or before the surgery is completed, the frozen sections of meningioma play an important role in treatment and prognosis.

Medical difficulties in IAC meningioma include: 1. Establish accurate preoperative diagnosis; 2. Perform a biopsy before surgery; 3. Adhesion of tumors and cranial nerves. So the radiation

therapy is not the main primary choice for the IAC meningioma. Radiotherapy is not the primary choice for IAC meningioma. It can be used in individuals with a tumor that has been largely resected, or in patients with a WHO grade III meningioma post-opertatively [13]. It is controversial whether to give grade II tumor radiotherapy after complete resection. The patient in this case chose postoperative observation. Recently, Bruce et al. [14, 15] found that radiosurgery is an effective therapy to control the mass and an excellent alternative to surgical excision for meningiomas extending into the IAC due to the lower risk of facial weakness or hearing loss. Current chemotherapies are not in effective and are being further evaluated [16].

Conclusion

Here, a meningioma limited to IAC is described, where preoperative diagnosis of acoustic neuroma and postoperative histology were confirmed as IAC meningioma. Sometimes the chief complaint, radiologic images, or even the intraoperative findings will help the surgeons establish a diagnosis to guide the surgery and avoid tumor recurrence. Surgery is the primary option of initial treatment, while radiation therapy or chemotherapy is only considered in the selected patient group. The facial nerve, often with severe adhesion of IAC meningioma, should be carefully separated during the operation to avoid it being damaged.

Disclosure of conflict of interest

None.

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