Surgical Removal of Chondroma of the Petrous Apex Resulting in Hearing Improvement

—Case Report—

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Abstract

An 18-year-old male presented with a chondroma in the petrous apex manifesting as major complaints of headaches and sensorineural hearing disturbance on the right. Head computed tomography and magnetic resonance imaging revealed a neoplastic lesion in the right petrous apex, which had bulged to compress the internal auditory meatus. Surgical removal improved his hearing with normalization of the postoperative air conduction threshold by reduction of the pressure of the internal auditory meatus, suggesting that the function of the cochlea was retained and the tumor was compressing the cochlear nerve at the level of the internal auditory meatus. Histological examination showed the tumor consisted of hyaline cartilage tissue without cellular atypia and the diagnosis was chondroma.

Key words: chondroma, petrous apex, surgical removal, hearing improvement, differential diagnosis

Introduction

Intracranial chondromas are extremely rare, benign cartilaginous tumors that account for 0.1–0.2% of all intracranial tumors.^{3,4)} The majority of intracranial chondromas occur in the skull base, and most reported cases have occurred in the parasellar region or middle fossa. Only 7 cases of chondroma occurring in the petrous apex have been reported.^{2,4,6,8,10,13,14)} Complete surgical removal is often difficult for chondroma occurring in the skull base and in the cavernous sinus. However, partial removal to reduce pressure seems to be adequate, since chondromas rarely invade the nerves or blood vessels directly.

In the present case, surgical removal of a chondroma of the petrous apex, manifesting as hearing loss, resulted in hearing improvement through pressure reduction of the internal auditory meatus.

Case Report

An 18-year-old male was examined by a local physician for major complaints of headaches and hearing loss on the right, which had progressed for about 2 years. Head magnetic resonance (MR) imaging revealed a well-circumscribed mass in the right petrous apex, and he was

referred to our hospital.

Preoperative pure-tone hearing averages were impaired at 31.3 dB (Fig. 1). The speech reception threshold was 40 dB and the speech discrimination score for the right ear was 60% at 40 dB above threshold. Except for the sensorineural hearing disturbance on the right side, neurological examination showed no abnormalities, even in the facial or trigeminal nerves. Computed tomography (CT) revealed that the pneumatization inside the right petrous

Fig. 1 Pre- and postoperative pure-tone audiograms. Closed squares: preoperative air, open squares: preoperative bone, closed circles: postoperative air, open circles: postoperative bone.

Fig. 2 A: Preoperative computed tomography scan showing that the pneumatization inside the right petrous apex had disappeared, and that the petrous apex had bulged to compress the anterior wall of the internal auditory meatus. B: T₁-weighted magnetic resonance image showing an hyperintense tumor. C: T₂-weighted magnetic resonance image showing an isointense and partial hyperintense tumor. D: Thin slice, heavy T₂-weighted magnetic resonance image showing that the tumor caused mild pressure to the internal auditory meatus. E: Postoperative computed tomography scan showing decompression of the anterior wall of the internal auditory meatus.

apex had disappeared, and that the petrous apex had bulged to compress the anterior wall of the internal auditory meatus. The bone cortex of the internal auditory meatus was intact (Fig. 2A). MR imaging showed the same region as hyperintense on T₁-weighted images (Fig. 2B), and isointense to partially hyperintense on T₂-weighted images (Fig. 2C). Thin slice, heavy T₂-weighted MR images revealed that the tumor caused mild pressure to the internal auditory meatus (Fig. 2D).

Surgery was performed through a right extradural subtemporal approach. The bone cortices of the petrous apex and the internal auditory meatus appeared normal externally, but drilling revealed a multiple pseudocapsule tumor consisting of a mixture of yellow gelatinous content

Fig. 3 Photomicrograph of the tumor showing hyaline cartilage with chondrocytes without definite atypia. Hematoxylin and eosin stain, original magnification $\times 200$.

and extremely hard, calcified material on the inside. The tumor was surgically removed with a high-speed drill, and decompression of the internal auditory meatus was performed (Fig. 2E). No abnormalities were observed in the dura mater of the internal auditory meatus or in the C5 internal carotid artery. Histological examination showed the tumor consisted of hyaline cartilage tissue without cellular atypia, and the diagnosis was chondroma (Fig. 3).

Postoperative pure-tone hearing averages improved to 7.5 dB at 1 month after surgery (Fig. 1). The speech reception threshold was 10 dB, and the patient's speech discrimination score was 95% at 40 dB above threshold.

Discussion

Intracranial chondromas originate from embryonal cartilage cell rests in the basal synchondroses of the skull base, especially in the region surrounding the foramen lacerum. Chondrocytes are believed to form cartilage tumors because they ossify as immature cells, without passing through normal degenerative processes.^{1,8,15} Intracranial chondromas can be classified into (a) sinus chondromas, (b) chondromas of the convexity and intracranial structure, and (c) basal chondromas, arising at the junction of the sphenopetrosal, petro-occipital, and sphenopetrosal synchondroses.¹⁵ However, the vast majority are basal chondromas located in the skull base, especially in the parasellar area and middle fossa. Chondromas occurring in the petrous apex are very rare, with only 7 cases reported.^{2,4,6,8,10,13,14}

Chondromas generally grow slowly, so neurological symptoms are delayed, but unilateral localized neurological symptoms caused by pressure and corresponding to the location of the tumor often appear. Chondromas in the parasellar area often cause impairment of cranial nerves II, III, IV, V, and VI, whereas chondromas of the petrous apex cause symptoms in the internal carotid artery, the mandibular division of the fifth cranial nerve (V₃), the abducens nerve (VI), and the internal auditory canal structures.^{2,4,6,8,10,13,14} In our case, we observed progression of hearing impairment, and preoperative imaging demon-

strated pressure to the anterior wall of the internal auditory meatus. However, the cochlea was not damaged.

CT generally shows various densities, heterogeneous high density in the delayed phase on contrast images, and calcifications in 60–90% of cases and bone destruction in about 50% of cases.^{1,5,11)} MR imaging shows low to high intensity inhomogeneous signals on T₁-weighted images, moderate to high intensity inhomogeneous signals on T₂-weighted images, and various patterns of enhancement with contrast medium. Angiography shows poor vascularity, whereas positron emission tomography shows low uptake of fluorine-18-fluorodeoxyglucose and choline, and high uptake of technetium-99m methyl diphosphonate, which is pathognomonic of bone tumors. These findings allow the differential diagnosis of chordoma, meningioma, cavernoma, and schwannoma.^{3,5,7,16)} However, in cases like ours, where the chondroma is confined to the petrous apex instead of occurring in the parasellar or pericavernous areas or the middle fossa (where chondromas tend to occur), the differential diagnosis also includes cholesteatoma and chondrosarcoma.^{8,9)}

Surgical removal is the standard treatment because radiation therapy is ineffective. If complete removal is accomplished, a favorable course of the disease and long-term prognosis can be expected,¹²⁾ but if the tumor occurs in the skull base or cavernous sinus, complete removal is difficult. However, since chondromas rarely invade nerves or blood vessels directly, partial surgical removal to reduce pressure will probably be sufficiently effective.^{5,8)}

In this case, the tumor was mainly located in the petrous apex and bulged into the internal auditory meatus. However, the tumor did not invade the cochlea, so the surgery was relatively easy. Furthermore, since the postoperative air conduction threshold was normalized by reduction of the pressure of the internal auditory meatus, the function of the cochlea was retained, with the tumor only compressing the cochlear nerve at the level of the internal auditory meatus.

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