

## CASE REPORT

# Lobulated Petrous Apex Cholesterol Granuloma Treated with Infracochlear and Transsphenoidal Approaches

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Petrous apex cholesterol granulomas are relatively rare lesions. They are usually unilocular and treated with simple fenestration. However, lobulated lesions require total removal of debris inside the cysts. Herein, we report a first case with a lobulated petrous apex cholesterol granuloma. The lesion extended from cerebello-pontine angle to the clivus. It was lobulated and contained debris, meaning that total surgical access was necessary to avoid intra-lesional obstruction. Consecutive infracochlear and transsphenoidal approach under image guidance enabled total removal of debris and successful drainage without causing further neurological deficits.

Submitted : 06 March 2009

Revised : 08 July 2009

Accepted : 09 July 2009

Petrous apex cholesterol granulomas are relatively rare lesions. They are formed following obstruction of the petrous apex air cells and haemorrhage within the cavity. They gradually expand and cause numerous neurological deficits including headaches, dizziness, hearing loss, and facial palsy<sup>[1,2]</sup>. The treatment of choice is surgical drainage<sup>[3]</sup>, although some authors recommend total removal of lesions<sup>[4]</sup>. Cholesterol granulomas are usually unilocular and filled with brownish serous fluids and they are drained well with simple fenestration. In this report, we present a case of lobulated petrous apex cholesterol granuloma containing debris, which required consecutive infracochlear and transsphenoidal approach.

### Case Report

A 30-year-old man was referred to our hospital because of a left cerebello-pontine angle tumor. The patient had suffered from left hearing loss since childhood. Eight years ago, he received magnetic resonance imaging (MRI) because of head trauma, and a cerebello-pontine angle tumor was incidentally pointed-out.

He did not undergo any treatment. About 4 years ago, he noticed left facial palsy, which had been developing. His otoscopic examination showed accumulation of effusion in the middle ear. The pure tone audiogram showed air-bone gap of 31.7 dB in the left ear, but no sensorineural hearing loss was observed. His facial palsy was House-Brackmann grade IV. No other cranial nerve symptom was observed. A computed tomography (CT) scan showed remarkable bone destruction around the petrous apex and clivus. Middle ear cavity was filled with soft tissue density mass. Bony structures around the petrous internal carotid artery were also destroyed, and the artery was shifted anteriorly and superiorly. The eustachian tube was totally involved in the lesion. The MRI revealed a heterogeneous lobulated lesion that expanded from the cerebello-pontine angle to the clivus. On T1 weighted image, the lesion was isointense with hyperintense rim. On T2 weighted images, it was hypointense with hyperintense rim (Figure 1-a). Under the diagnosis of petrous apex cholesterol granuloma, surgical drainage was performed.

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First, the lesion was drained through infracochlear approach. Canal wall down mastoidectomy was done to allow wide access to the lesion. The air cells in the hypotympanium were drilled and cyst wall was exposed. Cyst wall was opened as widely as possible. The cyst was filled with brown fluid and debris. The cavity was irrigated with saline and the debris inside the cavity was removed (Figure 2-a). These procedures were done under image guidance (VectorVision, BrainLAB, Germany). The universal pre-calibrated instruments (VectorVision Pointer, BrainLAB, Germany) were used. The image guidance showed that petroclival area was not accessible through this approach (Figure 3). A silastic tube with 5 mm in the outer diameter was placed in the opening, and a ventilation T-tube was placed in the tympanic membrane. The post-operative course was uneventful and no sensorineural hearing loss or worsening of facial palsy was observed. The result of histopathological examination of the cyst wall was consistent with that of cholesterol granuloma. The MRI obtained 11 months after the surgery revealed that cholesterol granuloma was not drained in the petroclival area (Figure 1-b).

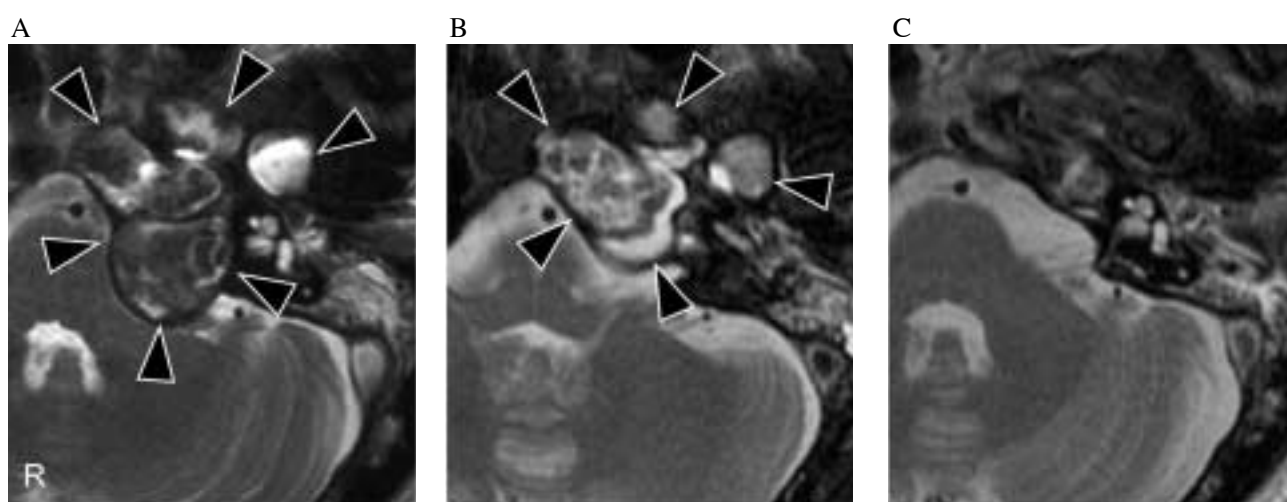
Fifteen months after the first operation, endoscopic transsphenoidal surgery was performed to drain the residual lesion. A navigation system was used again (Kolibri, BrainLAB, Germany). The pre-calibrated

pointing instruments (VectorVision Pointer, BrainLAB, Germany) were used. Posterior part of the nasal septum was removed and the sphenoid sinus was widely opened. Posterior wall of the sphenoid sinus was gently removed at midline and cyst wall was exposed. With the removal of the cyst wall, a brown fluid and debris flowed out. The cavity was irrigated with saline and debris was removed under direct view. The fenestration was made as large as possible using image guidance (Figure 2-b). A penrose drainage tube was placed at the opening. The irrigated saline flowed from the ear canal through the ventilation T-tube, which warranted the patency from the sphenoid sinus to the external auditory canal. The hearing threshold and facial palsy did not deteriorate after the second surgery. The post-operative MRI confirmed that debris inside the cyst was totally removed, and the penrose drainage tube was removed 3 months after the surgery.

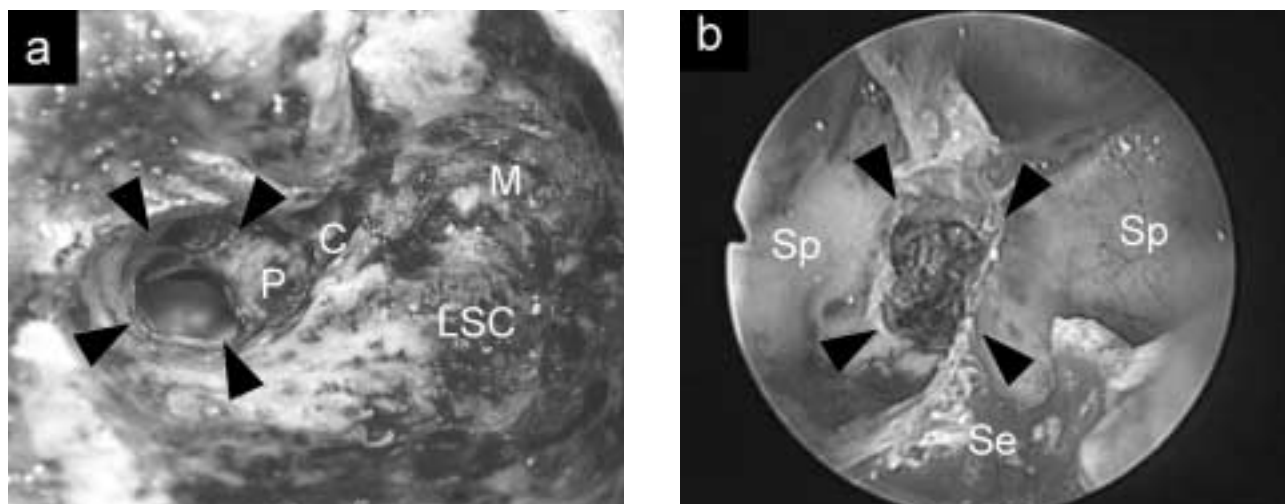
The patient is asymptomatic during the 24 months follow up and the MRI showed total collapse of the lesion (Figure 1 c).

### Discussion

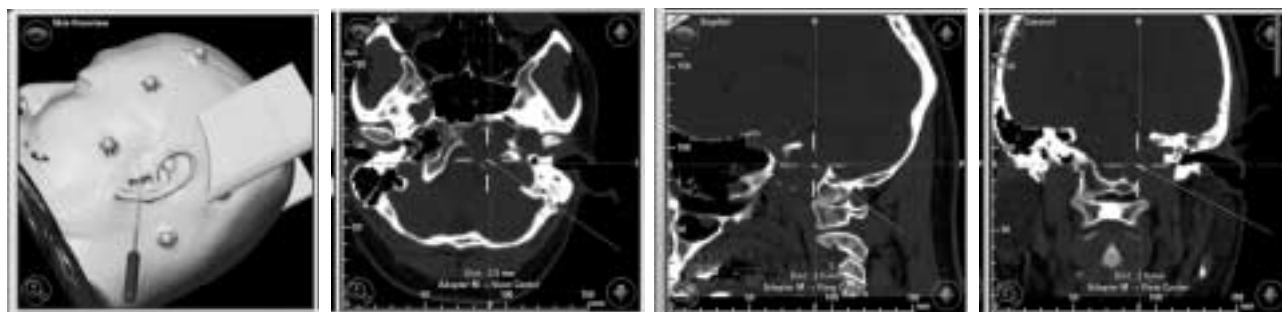
Cholesterol granulomas are usually unilocular. They are filled with brownish serous fluids and sometimes contain debris<sup>[5]</sup>. In previous reports, such debris did not cause obstruction inside the lesions, and chole-



**Figure 1.** T2 weighted axial MRI obtained before surgery (a) showed the heterogeneous lesion expanding from the cerebello-pontine angle to the petroclival area. MRI obtained 11 month after the first surgery (b) showed cholesterol granuloma remained in the petroclival area. MRI obtained 24 month after the second surgery (c) revealed that the lesion totally collapsed.



**Figure 2.** Fenestrations were made through infracochlear approach (a) and transsphenoidal approach (b). The fenestrations were widened as large as possible. Arrow heads indicate the fenestrations. P: promontorium, C: chorda tympani, M: malleus head, LSC: prominence of the lateral semicircular canal, Sp: sphenoid sinus, Se: septum of the sphenoid sinus



**Figure 3.** The image of the intraoperative navigation system. The tip of the pointer was inserted beyond the cerebello-pontine angle. The petroclival area was not accessible with this approach.

terol granulomas were drained well with simple fenestration. To drain a petrous apex cholesterol granuloma, numerous approaches have been described <sup>[6]</sup>. In most cases, lesions are connected to the middle ear cavity. Inner ear function is preserved with infralabyrinthine and infracochlear approach. However, surgical exposure is limited in these approaches. Transcochlear and translabyrinthine approach provides wide access to the lesion, although inner ear function is lost. Middle fossa approach also allows good surgical exposure with preservation of inner ear function, while drainage route is long and the creation of a pathway of permanent drainage is difficult <sup>[1]</sup>. Transsphenoidal approach is selected in cases with petroclival extension, while this approach provides only small access <sup>[7]</sup>. In patients with remaining inner ear function, infracochlear

approach is recommended because it is less invasive than the other approaches <sup>[8]</sup>. We used this approach first and most of the debris was removed. However, the petroclival lesion was unaccessible and the left debris caused intra-lesional obstruction at the bottleneck of the lesion. Therefore, we added transsphenoidal approach to remove residual debris. With the two approaches, debris inside the lesion was totally removed and the lesion was fully drained.

Recently, the usefulness of a navigation system in the treatment of petrous apex lesions has been reported <sup>[2,5]</sup>. In both infracochlear and transsphenoidal approaches, fenestrations were made near the internal carotid artery. To avoid injury to the internal carotid artery and other vital structures, we used a navigation system in opening the lesion. The navigation system correctly

pointed out surrounding structures including the internal carotid artery, cochlea, jugular bulb and facial nerve. The navigation system was also used in removing the debris. The hand piece was inserted inside the cyst after removal of debris through the infracochlear approach. The navigation system showed that debris in the cerebello-pontine angle was removed, while petroclival lesion was left untouched. The post-operative MRI confirmed the intra-operative findings. The navigation system was very useful in the intraoperative evaluation of the extent of surgical manipulation.

In this case, we performed infracochlear approach first, and then used transsphenoidal approach. However, it may be discussed to perform the two approaches simultaneously. The problem of simultaneous operation is that vital structures including carotid artery may shift after the opening of the lesion. In the present case, bony structures around the petrous internal carotid artery were destroyed. After we opened the cholesterol granuloma through infracochlear approach, the internal carotid artery moved from the prior position. Therefore, in case of simultaneous infracochlear and transsphenoidal approach, preoperative imaging and navigation system do not provide accurate information. Staged operation may be safer in a case with massive bone destruction.

### **Conclusion**

We report a case of a lobulated petrous apex cholesterol granuloma. Consecutive infracochlear and transsphenoidal approach enabled successful drainage. The consecutive two approaches provided total access to the petrous apex with minimum invasion. The image guidance was useful in the two approaches.

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