

Endoscopic Endonasal Approaches to Management of Cholesterol Granuloma of the Petrous Apex

Marie-Claire Jaberoo, B.Med.Sci. (Hons), M.B.Ch.B., M.R.C.S., D.O.H.N.S.,¹ Amro Hassan, M.B.Ch.B., M.R.C.S., D.O.H.N.S.,¹ Maria-Alejandra Pulido, M.D., O.R.L.-H.N.S.,¹ and Hesham A. Saleh, M.B.B.Ch., F.R.C.S., F.R.C.S. (O.R.L.-H.N.S.)¹

ABSTRACT

Cholesterol granulomas are the most common lesion of the petrous apex. Traditionally, lesions of the petrous apex have been accessible via open, infracochlear, and transtemporal approaches. We describe two cases in which the endoscopic transsphenoidal approach was used to manage this lesion. The design of this study is as a review of new endoscopic approaches. The setting of the study is a tertiary referral unit in a London teaching hospital. Case 1: A 53-year-old man diagnosed with bilateral cholesterol granulomas of the petrous apices. Case 2: A 32-year-old woman diagnosed with a right-sided cholesterol granuloma of the petrous apex. The main outcome measures were symptom resolution and postoperative complications. An endoscopic transsphenoidal approach was used in the first case. In the second case, the lesion was approached through the nasopharynx, an approach that has not been described previously. Both patients' symptoms resolved and no complications occurred. Transsphenoidal endoscopic removal of cholesterol granulomas is a recent advance in the extended applications of sinus surgery. It allows for a less invasive procedure with markedly less associated morbidity.

KEYWORDS: Cholesterol granuloma, endoscopic endonasal approach

Cholesterol granulomas are the most common lesion of the petrous apex of the temporal bone with an estimated incidence of ~0.6 per million population.¹ It is an intraosseous cyst contained within a thick fibrous capsule. A cholesterol granuloma is formed through a foreign body giant cell reaction to cholesterol deposits, with associated fibrosis and vascular proliferation. The pathophysiology is unclear. It is generally thought that obstruction of the air cell system within the temporal bone leads to reduced intracavity pressure. Subsequent mucosal inflammation, edema, angiogenesis, and rupture

of blood vessels result in accumulation of cholesterol crystals from hemoglobin breakdown.² These lesions can occur anywhere within the pneumatized spaces of the temporal bone.³

Patients may present with symptoms related to direct pressure on adjacent anatomical structures, for example, headaches, cranial nerve signs (V, VI, VII, or VIII) or may be asymptomatic and the diagnosis made by incidental finding on radiological imaging. Imaging plays a key role in diagnosis of cholesterol granuloma. These lesions are expansile and erosive on computed

¹Department of Otorhinolaryngology, Charing Cross Hospital, London, United Kingdom.

Address for correspondence and reprint requests: Marie-Claire Jaberoo, BMedSci (Hons), MBChB, MRCS, DOHNS, Department of Otorhinolaryngology, Royal Free Hospital, Pond Street, London NW3 2QG (e-mail: mcjaberoo@gmail.com).

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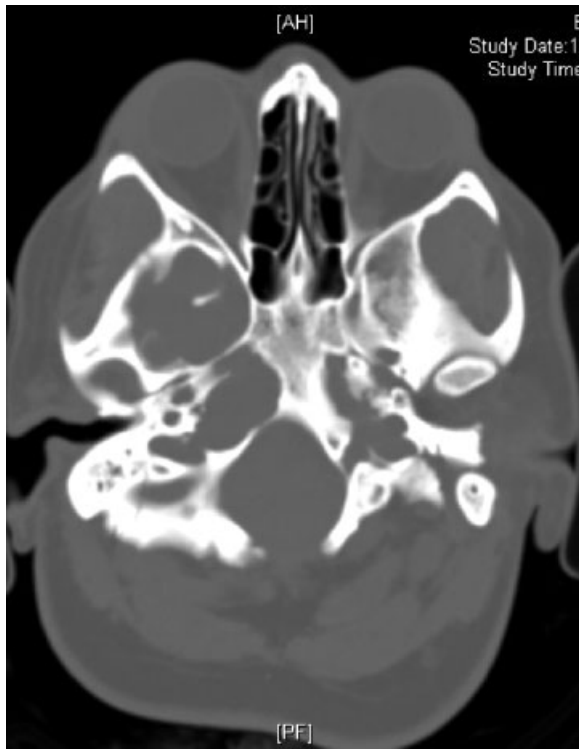


Figure 1 A CT of the head demonstrating a large lesion in the right petrous apex (case 2).

tomography (CT), with well-defined margins (Fig. 1) though it is difficult to distinguish them from other lesions, such as epidermoids and mucocoeles, using this modality. Magnetic resonance imaging (MRI) provides greater specificity for cholesterol granulomas as they present with high intensity in both T1- and T2-weighted sequences (Fig. 2).⁴

Due to the inaccessibility of the petrous apex, the traditional management of these lesions was surgery through open approaches, for example, infracochlear and transtemporal approaches with neurosurgical input often required.

The aim of this study is to present two cases of cholesterol granuloma of the petrous apex that were managed endoscopically. In the first case, an endoscopic transsphenoidal approach was used. Only 12 cases have been published worldwide in the use of this technique for management of this lesion. In the second case where the cholesterol granuloma extended anteriorly and inferior to the clivus, the lesion was approached through the superior nasopharynx, a technique that has not been described previously in the literature. We describe the procedures and outcomes.

METHODS AND RESULTS

Case 1

A 53-year-old-man presented to the ophthalmology department with a 2-year history of diplopia. Subsequent

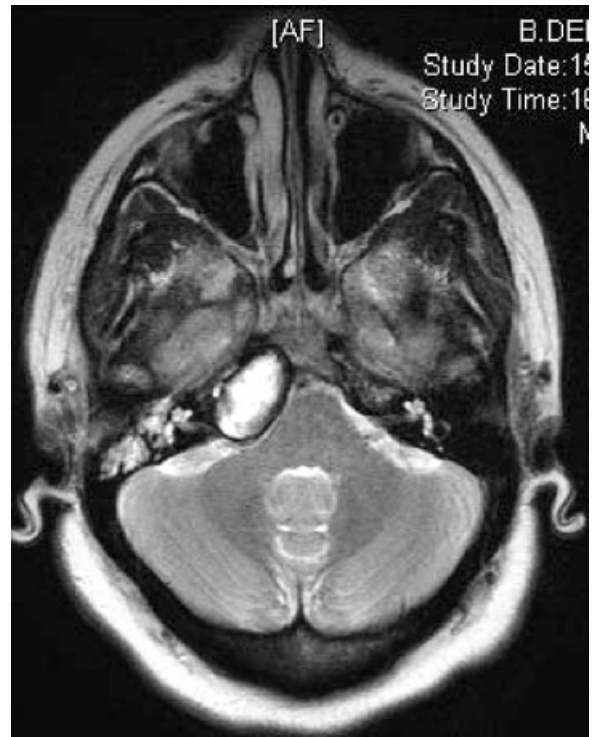


Figure 2 Magnetic resonance imaging (MRI) of the head demonstrating a large lesion with high signal in the right petrous apex (case 2).

MRI revealed bilateral cholesterol granulomas of the petrous apices (Fig. 3). The larger right-sided lesion had resulted in compression of the right abducent nerve. He also had a longstanding history of chronic sinusitis that did not respond to maximal medical therapy. A standard functional endoscopic sinus approach was performed to clear maxillary and ethmoid sinuses. The right cholesterol granuloma was pointing toward the posterior wall of the left sphenoid. For this reason, an endoscopic transsphenoidal approach was used through the left

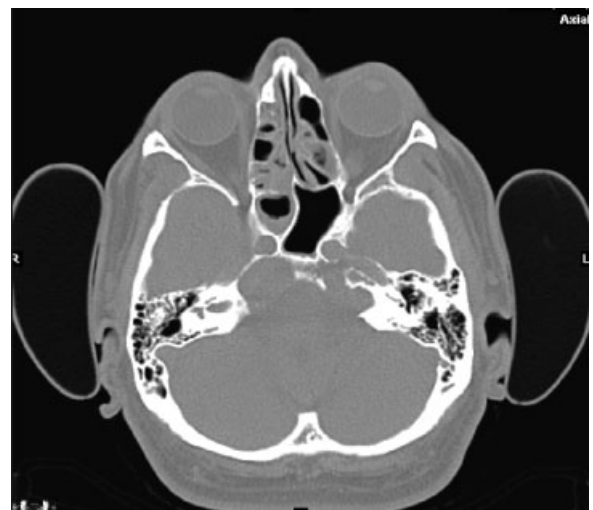


Figure 3 CT scan demonstrating bilateral cholesterol granuloma of petrous apices and chronic rhinosinusitis (case 1).

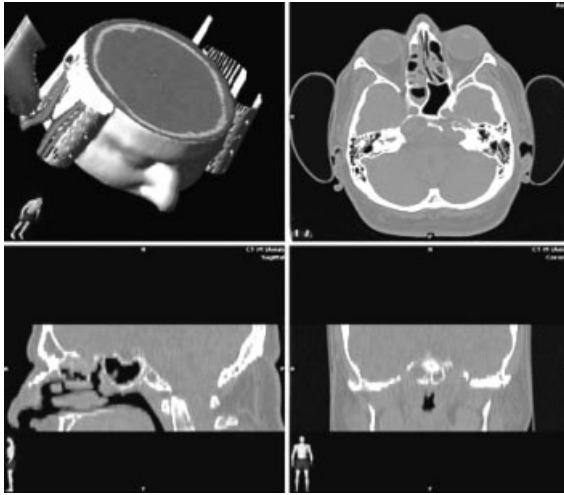


Figure 4 Image guidance (BrainLab) images (case 1).

sphenoid sinus, aimed at marsupialization of the cyst (Figs. 4 and 5). This particular technique was derived from our previously published research involving anatomical measurements obtained during cadaver dissections.⁵ Surgical landmarks were identified and with the assistance of an image guidance navigation system, drilling through the thick bone of the sphenoid could be performed safely. Identification of the precise location of the lesion was determined using the image guidance system (BrainLabTM, AG, Heimstetten, Germany), the aim being to drain and establish a permanent ventilation system. The posterior wall of the left sphenoid was drilled medial to the vertical position of the internal carotid using a standard neurosurgical drill (Medtronic Xomed, Jacksonville, FL). The lesion was opened and the suction was used to remove the contained fluid. A curved curette was then gently used to scrape the epithelium of the cavity with the aim of creating a healthier lining. No

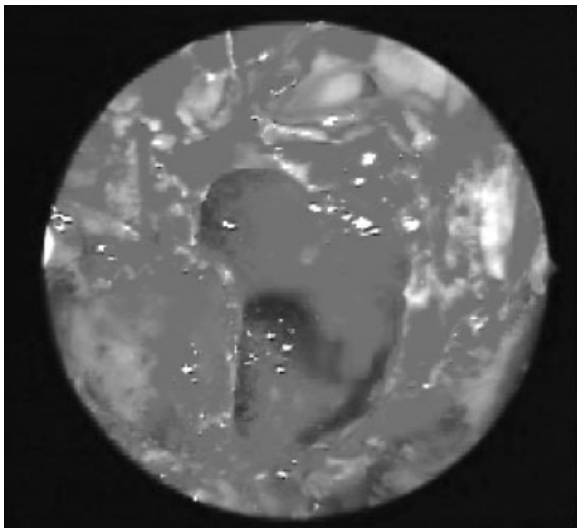


Figure 5 Marsupialization of granuloma through the left sphenoid sinus.

packs were needed and the patient was prescribed standard nasal douches and short course of a broad spectrum antibiotic (Co-amoxiclav). Following surgery, the patient had a successful outcome. The diplopia resolved and the patient was discharged on the second postoperative day. He continues to do well on postoperative follow-up 18 months later with patent drainage.

Case 2

A 32-year-old woman presented to the accident and emergency department with dizziness. She reported a 7-month history of persistent right-sided temporal headaches and a chronically discharging right ear for the past 3 years. Ophthalmological examination revealed papilloedema. Neurological examination was otherwise normal. CT and MRI of the head demonstrated a large lesion (27 mm × 15 mm) with high signal on T1- and T2-weighted images in the right petrous apex (Figs. 1 and 2) as well as mild cerebellar tonsillar descent and mild crowding of foramen magnum. The ventricles appeared normal. There was no evidence of bony erosion demonstrated on CT and the contralateral petrous apex was well aerated. Imaging also confirmed the appearance of cholesteatoma in her right mastoid. The patient underwent a drainage procedure on the basis of her neurological symptoms and imaging. She was also referred for mastoid surgery under the care of our otologist.

The lesion was approached using an endoscopic endonasal transpharyngeal route using image guidance system (BrainLab) (Figs. 6 and 7). This approach was deemed most suitable as the patient had a diploid sphenoid bone, making a transphenoidal route more hazardous. A right-sided sphenopalatine artery cauterization was performed (Fig. 8). The buccopharyngeal fascia/mucosa was opened at right choana using a microdebrider with a

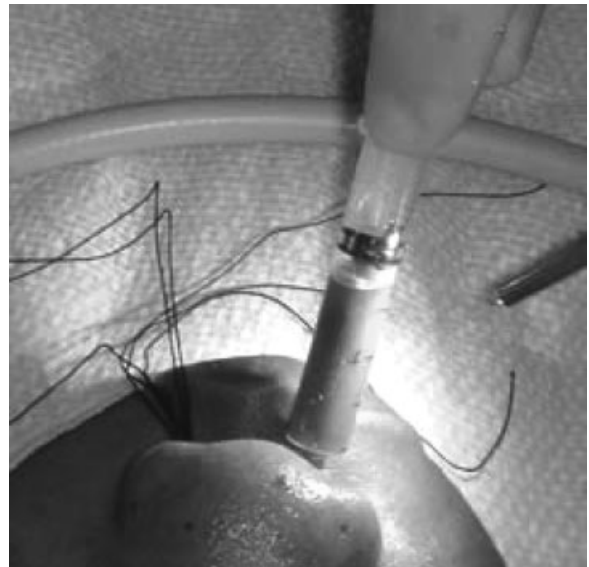


Figure 6 Aspiration of cholesterol granuloma (case 2).



Figure 7 Image guidance (BrainLab) intra-operative image (case 2).

2.9-mm diamond burr (Medtronic Xomed). A 1-cm × 1-cm stoma created to allow drainage of the cholesterol granuloma in the petrous apex (Fig. 9). Complete exteriorization of the cyst was achieved through the endoscopic approach (Fig. 7) and the operating time was less than 1 hour. The postoperative field is illustrated in Fig. 5. The patient was nursed head up at 30 degrees for 24 hours and was commenced on antibiotics, nasal douches, and prednisolone for 1 week. The patient made an uneventful recovery and was discharged 2 days after the procedure. Her headache resolved completely within the first week of the postoperative period. Histology confirmed cholesterol granuloma. At 2 years follow-up, the patient reported significant improvement in the headaches that she had experienced preoperatively. The mucosa of the nasopharynx had healed completely.

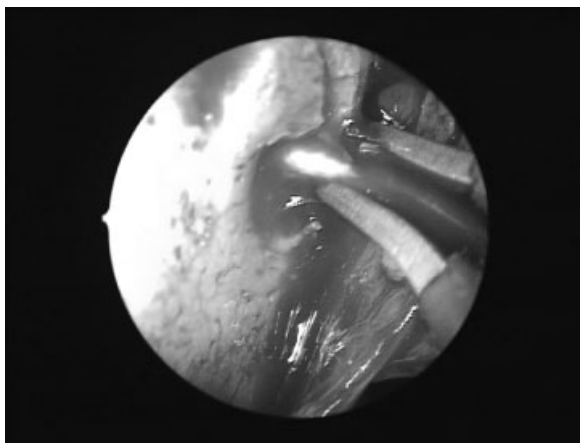


Figure 8 Right sphenopalatine artery cauterization was performed.

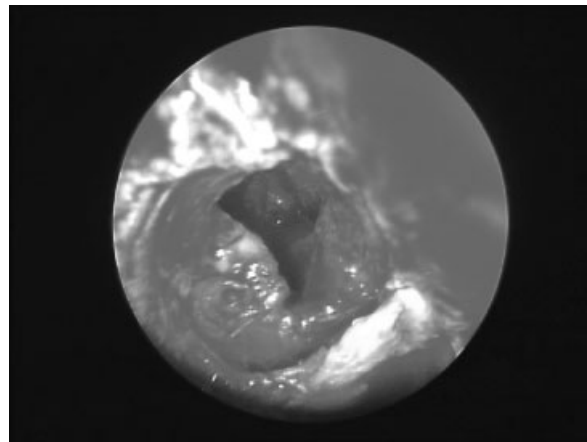


Figure 9 Stoma created to allow drainage of the cholesterol granuloma in the petrous apex.

DISCUSSION

Cholesterol granuloma is a benign lesion. However, this lesion can behave aggressively and depending on the anatomical location and involvement of adjacent structures clinical manifestations can ensue. A retrospective study performed by Mosnier et al⁶ identified patterns of clinical symptoms: retrocochlear signs by involvement of the internal auditory meatus, headaches by traction on the dura, and serous otitis media by compression of the Eustachian tube.

Traditionally a variety of otological approaches have been used in the management of cholesterol granuloma of the petrous apex. These include transcanal, infracochlear, transmastoid, infralabyrinthine, middle fossa, and translabyrinthine approaches. The transsphenoidal approach (external procedure) was first described by Montgomery⁷ in 1977. Fucci then modified this in 1994 using a nasal endoscope.⁸

There are several advantages in using the endoscopic approach; reduced risk to the facial nerve and vestibulo-cochlear function (compared with middle and lateral fossa approaches), reduced operative time and hospital stay, and ease of nasendoscopic examination of the postoperative site in the out-patient department.⁹ Maddox reported that the addition of endoscopic visualization to the traditional microsurgical approaches allowed exposure of areas within the lesions and removal of septae that would not have been identified with the operating microscope alone.¹⁰

Debate has arisen regarding the best surgical method for prevention of recurrence of the cyst, that is, complete excision or marsupialization. Silastic stents and drains have been used with varying success. In 2002, a series published by Brackmann and Toh reported no recurrence of cholesterol granuloma when a stent was used but a recurrence rate of 30% when no stent was inserted.³ In comparison, Mosnier reported that recurrence of the lesion most commonly occurred secondary to stent occlusion.⁶ Georgalas et al highlighted the

importance of location of the lesion. If situated adjacent to the posterior wall of the sphenoid sinus then marsupialization is likely to be more successful and amenable to endoscopic exteriorization that allows drainage via sinonasal mucociliary clearance.¹¹ From our study, neither procedure involved insertion of a stent, and to date there has been no evidence of recurrence. All the previously reported cases were adjacent to thinned posterior wall of the sphenoid. In our first case, the wall of the sphenoid was thick—with the need for drilling—and the anatomical arrangement of the cyst dictated drainage from the opposite side. This has not been reported previously and was done safely using known anatomical landmarks aided by image guidance system. The second case was drained through the nasopharynx because of its anatomical position. None of the previously reported cases were drained through a similar route. It can be argued that the chance of stenosis is higher in this situation. However, previously reported long-term follow-up in patients whose surgical stoma had stenosed showed no recurrence of symptoms.¹¹ It is possible, therefore, that the combination of drainage and marsupialization is sufficient for cyst obliteration.

CONCLUSION

Cholesterol granuloma is a benign lesion, and surgical management should remain as low a risk as possible. Endonasal endoscopic removal of cholesterol granuloma is a recent advance in the extended applications of sinus surgery. It allows for a less invasive procedure with markedly less associated morbidity.

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