

Petrous apex cholesterol granuloma: transsphenoid endoscopic approach

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Abstract

The transsphenoid approach to the petrous apex, a surgical procedure described for the first time by Montgomery in 1977, is a rarely performed approach for the drainage and ventilation of cholesterol granuloma. We consider this approach to be the technique of choice when the cholesterol granuloma is located in the medial section of the petrous apex abutting and/or prolapsing into the posterior wall of the sphenoid sinus. The transsphenoid approach, unlike other lateral approaches to the petrous apex, is highly conservative and spares cochlear and vestibular function; moreover, it allows simple and adequate post-operative endoscopic follow up as an out-patient, with easier treatment in the case of recurrence.

Key words: Cholesterol; Granuloma, Foreign Body; Temporal Bone; Surgical Procedures, Operative

Introduction

Cholesterol granulomas are uncommon, benign, cystic lesions of unknown aetiology. Among the many aetiopathogenetic theories, the best supported is the 'obstruction-vacuum'¹ theory, which entails obstruction of the petrous apex air cell outflow tracts, with consequent development of a vacuum, favouring transudation of blood into the cells. The subsequent catabolism of haemoglobin would lead to cholesterol liberation and incite a foreign body reaction that may result in granuloma formation.

Histologically, cholesterol granulomas are cystic lesions filled with fluid, lipids and cholesterol crystals, surrounded by giant cells and within a thin fibrous lining.

The treatment for petrous apex cholesterol granuloma is surgical drainage of the cystic lesion, aimed at establishing adequate aeration of the obstructed apex cavities. The choice of surgical procedure and approach depends on the surgeon's skills, on the location of the granuloma within the petrous apex and on the pre-operative status of the patient's hearing. A number of surgical approaches have been reported. The translabyrinthine approach is generally performed on patients presenting with severe sensorineural hearing loss, while in patients with spared auditory function access can be achieved by an infralabyrinthine or infracochlear approach. The middle cranial fossa approach is indicated for granulomas with prevalent superior development. When a petrous apex cholesterol granuloma abuts the posterior wall of the sphenoid and/or prolapses into its sphenoid sinus, the anterior transsphenoid approach (which we consider to be the technique of choice) can be performed. This surgical approach, which preserves cochlear and vestibular function, can be made via a direct endoscopic, intranasal route, depending on the anatomic characteristics of the patient's nasal fossa, or via a transthemoid–transsphenoid route, with complete ethmoidectomy, followed by opening of the intersphenoid septum. This surgical procedure, when performed by a skilled surgeon, is relatively noninvasive, highly conservative

and allows adequate post-operative follow up during out-patient revision.

We present a case of petrous apex cholesterol granuloma treated with cyst drainage performed via endoscopic sphenoidotomy.

Case report

A 38-year-old man came for treatment with a 10-year history of recurrent and increasing vertigo; in the previous months, the patient had experienced headache, pain in the retro-orbital area and diplopia. He did not complain of hearing loss or other cochlear signs.

Physical examination revealed no pathology except for a left-sided VIth cranial nerve paralysis.

A computed tomography (CT) scan of the skull base demonstrated a lytic lesion extending from the left superior and medial petrous apex to the carotid canal (Figure 1). The cyst extended anteriorly to the posterior wall of the sphenoid at the level of the intersphenoid septum, with clear involvement of the posterior wall of the left carotid artery siphon, mainly in its vertical development. The lesion was of a soft tissue, homogeneous density. A magnetic resonance imaging (MRI) scan showed this mass to be hyperintense on both T1- and T2-weighted images (Figure 2). An arteriogram demonstrated that the lesion involved the left carotid but did not displace it (Figure 3).

From radiological studies and physical examination, the most probable clinical diagnosis was a petrous apex cholesterol granuloma.

The patient therefore underwent surgical drainage. The lesion was accessed endoscopically via a transsphenoid approach, since it involved the posterior wall of the sphenoid sinus. We used a transsphenoid approach, rather than any of the other, more frequently used approaches, since it is less invasive and allows easier post-operative monitoring and treatment in case of recurrence.

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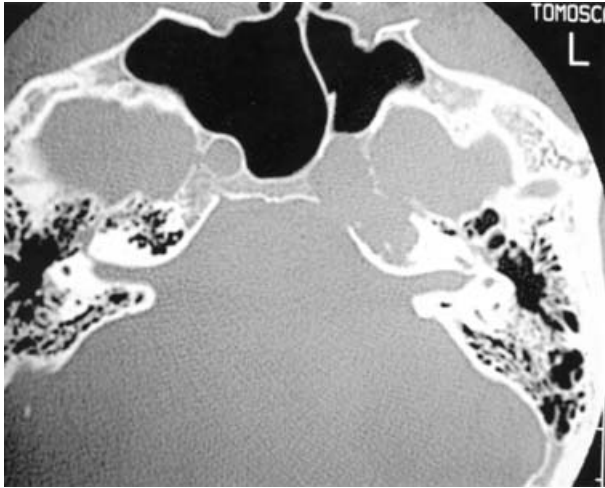


FIG. 1

Computed tomography scan of the skull base, showing a lytic lesion of homogeneous, soft tissue density extending into the left petrous apex, with involvement of the posterior wall of the sphenoid sinus.

After resection of the left middle turbinate, a transnasal approach to the sphenoid sinus was cleared by creating a wide opening in its anterior wall (Figure 4). The intersphenoid septum was removed to allow a better position for surgery. No lesion abutting the sinus lumen was seen, but a dark area appeared through the left posterior-lateral wall, behind the carotid axis, showing indentation but not destruction.

An opening was made at this site, using a burr, to expose a membranous black wall, pulsing for its short distance to the carotid, which was incised, leaking dark brown fluid. The sinus mucosa was used to create a permanent fistula. The communication between the petrous apex cyst and the sphenoid sinus seemed occluded due to sinus mucosal hyperplasia. The mucosa was therefore removed and the bone opening was widened and, finally, the cyst, containing a dark fluid, was evacuated. A T-shaped stent was then placed to prevent closure of the cyst and to allow adequate aeration.

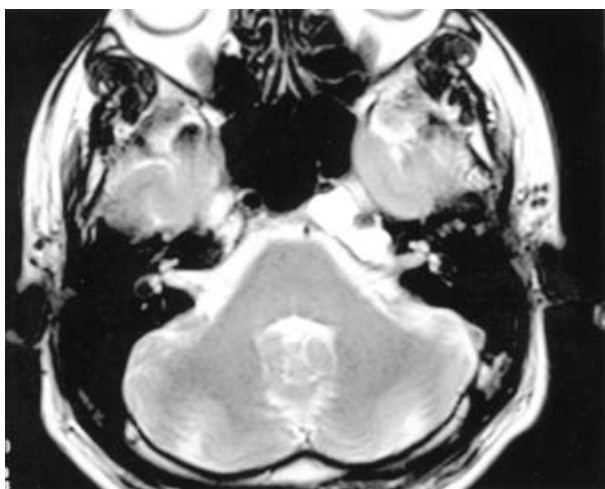


FIG. 2

Magnetic resonance imaging scan showing a petrous apex cyst that is hyperintense in T1- and T2-weighted images.

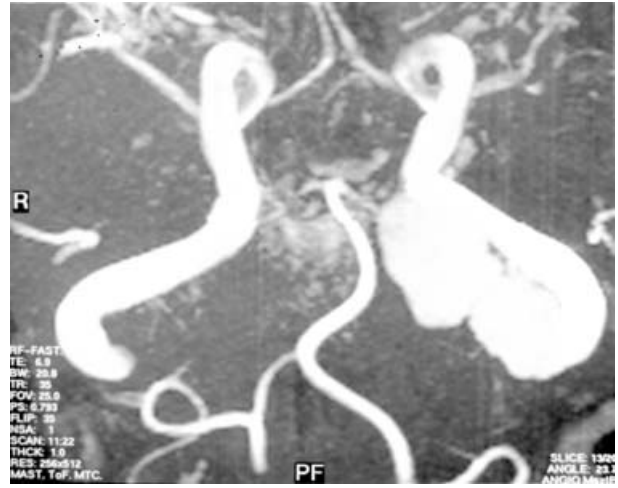


FIG. 3

Carotid arteriogram demonstrating lesion involvement of vascular structures but without signs of their displacement.

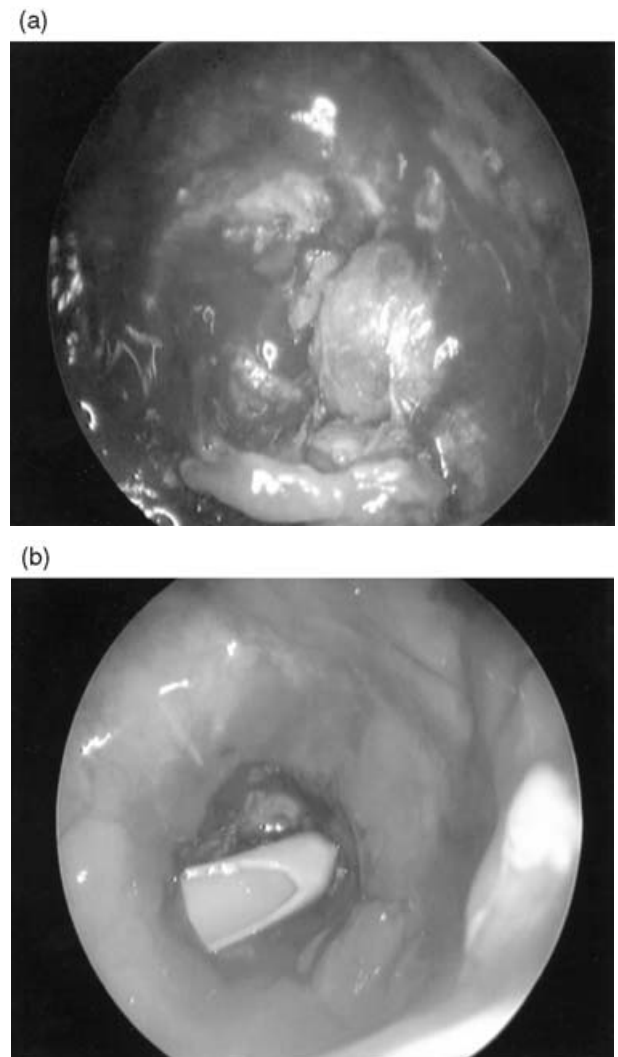


FIG. 4

(a) Transsphenoid approach, showing drainage of the petrous apex cyst lesion by creating a wide opening in the posterior wall of the sphenoid, using diamond burrs. (b) Endoscopic view after drainage of the cholesterol granuloma and silicone stent insertion.

Post-operative follow up was managed as per the patient's previous hospitalization. At three-month post-operative follow up the patient was completely asymptomatic.

Discussion

Cholesterol granulomas are benign, cystic lesions filled with brownish-yellow fluid, lipids and cholesterol crystals, surrounded by giant cells and with a thin fibrous lining. Their exact pathological aetiology has not been established.

Usually these lesions remain clinically silent for long periods but may become symptomatic if adjacent vascular or nervous structures become involved. In such cases, a CT scan is essential to assess bone erosion, and MRI scans performed with and without gadolinium enhancement are also helpful as there is a high signal intensity on both T1- and T2-weighted images.^{2,3} Such imaging is therefore essential to assess the feasibility of different surgical approaches as well as to distinguish the lesion from other possible pathologies, such as vascular abnormalities (haemangiomas and aneurysms), neoplasia, cholesteatomas and mucoceles.⁴

The symptoms associated with cholesterol granulomas are often 'soft' and depend on the location of the lesion in the temporal bone. Patients with petrous apex lesions involving the internal auditory meatus (sometimes associated with an erosion of the otic capsule) present with otologic and vestibular symptoms such as sensorineural hearing loss, tinnitus, imbalance and vertigo. Petrous apex cholesterol granulomas causing compression of the dura of the temporal bone and posterior cranial fossa present with symptoms such as severe headache and facial pain. If the lesion involves Meckel's cave it can damage the trigeminal and abducens cranial nerves. Early symptoms of a petrous apex cholesterol granuloma obstructing the eustachian tube include recurrent episodes of serous otitis media, while advanced lesions can lead to deficits of the VIIIth cranial nerve. Cholesterol granulomas are diagnosed from MRI scans performed with and without gadolinium ('gadolinium enhancement'), together with petrous apex cholesterol granuloma scan evaluation.^{2,3} Computed tomography scans are essential in assessing erosion of the bone structures adjacent to the lesion and in determining its precise location, as well as involvement of surrounding structures. Magnetic resonance imaging scans show high signal intensity on both T1- and T2-weighted images in areas which do not enhance after gadolinium injection. Radiographic imaging is therefore essential to assess the feasibility of different surgical approaches and to distinguish cholesterol granulomas from other lesions of the petrous apex, such as vascular lesions (haemangioma and aneurysms), neoplastic lesions (carcinoma and chordoma), malignant otitis, petrous apicitis, cholesteatoma and mucocele.⁴

The treatment for petrous apex cholesterol granuloma is surgical drainage, and a number of different surgical approaches are possible; the choice of approach depends on the location of the lesion and on the pre-operative status of the patient's hearing.^{5,6} The different surgical approaches to the petrous apex that have been reported include infralabyrinthine, infracochlear, translabyrinthine, transsphenoid and middle cranial fossa approaches. The transsphenoid approach, a surgical procedure described for the first time by Montgomery in 1977,⁷ is not frequently performed or reported in the literature. Two different variations of this approach to the sphenoid sinus can be applied: the direct intranasal transsphenoid approach or the transethmoid-transsphenoid intranasal approach. The choice of approach to the sphenoid sinus mostly depends on the anatomic characteristics of the patient's nasal fossa.

The availability of endoscopes capable of working at different angles and the recent advances in endoscopic surgery now allow adequate and safe transsphenoid approaches to the petrous apex for the treatment of cystic lesions abutting and/or invading the posterior and/or lateral wall of the sphenoid sinus.⁸

Pre-operative imaging studies must be accurate to determine the precise location of the cholesterol granuloma relative to the sphenoid sinus, to detect the most accessible nasal fossa for the surgical procedure, and to detect any possible displacement of the internal carotid artery and optical nerve, which could complicate the procedure.

The transethmoid-transsphenoid variant of the transsphenoid approach starts with resection of the middle turbinate and anterior and posterior ethmoidectomy, followed by sphenoidotomy with removal of the intersphenoid septum, providing full exposure of the sphenoid posterior wall. Drainage of the cyst cavity is then carried out by keeping the optic nerve and the internal carotid artery as the lateral limit, followed by fistulization of the cyst into the sphenoid sinus, achieved with a septal mucosal flap and the insertion of a silicone stent, providing adequate and permanent aeration of the petrous apex air cells.

This surgical procedure allows a less invasive approach, spares hearing and preserves labyrinth structures which would probably be removed in a transmastoid approach. It also requires short post-operative hospitalization and allows good follow up via out-patient endoscopic revision. The drawback of this surgical approach is the possible recurrence of the lesion due to stent stenosis. However, the availability of endoscopic revisions, with stent lavage and cleaning, have now reduced such risks.

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