

# Endoscopic trans-sphenoidal drainage of petrous apex cholesterol granulomas

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## Summary

Cholesterol granulomas of the petrous apex are rare lesions that pose challenging surgical decisions and approaches when attempting surgical drainage. In this article we present 2 cases of successful surgical management using an endoscopic trans-sphenoidal approach and review the requirements and considerations for this procedure.

Cholesterol granulomas and giant cholesterol cysts (GCCs) of the petrous apex are rare lesions of the temporal bone.<sup>1,2</sup> Graham *et al.* reported them to be distinct clinical entities on the basis of histological differences.<sup>1,3</sup> Both of these progressively enlarging cystic lesions cause symptoms due to a mass effect and erosion of bone.<sup>1,2</sup>

The treatment of choice is surgical drainage. However, the current literature has not shown which surgical approach provides the best long-term outcome.<sup>2</sup>

In this article we present 2 patients successfully treated by an endoscopic trans-sphenoidal surgical approach and discuss the indications, contraindications, benefits and potential complications of this procedure.

## Case reports

We report on 2 patients with petrous apex cholesterol granulomas who presented to the Division of Otolaryngology and were treated at the UCT Private Academic Hospital, Cape Town.

The first patient, a 51-year-old man, presented with vertigo and left-sided hemifacial spasm. He had undergone surgical drainage of a petrous apex cholesterol granuloma 5 years before. Surgery had involved a microscope-assisted trans-sphenoidal approach, with a medial maxillectomy for access to the lateral sphenoid. The findings on examination of his ears, nose and throat were essentially normal, except for evidence of the earlier nasal surgery.

The second patient, also a 51-year-old man, presented with profound sensorineural hearing loss and facial nerve palsy on the left side. He had a past medical history of diabetes mellitus and peripheral vascular disease. He was found to

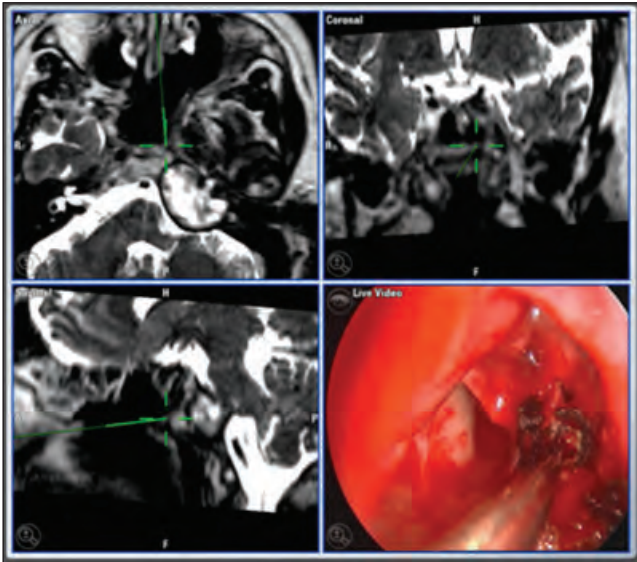


**Fig. 1. Case 2. CT scan showing the location of the petrous apex cholesterol granuloma (large arrow) in relation to the ICA (small arrow) and sphenoid sinus (\*).**

have uncomplicated bilateral central tympanic membrane perforations. The rest of his ENT examination was normal.

Computed tomography (CT) and magnetic resonance imaging (MRI) were done on both patients and revealed cholesterol granulomas of the left petrous apex (Fig. 1). In the first case the previous surgery was evident, as was re-accumulation of the cyst in the same region.

The patients both underwent surgical drainage using an endoscopic trans-sphenoidal approach. A neuro-navigational image guidance system (BrainLab) was utilised in both cases (Fig. 2). The lesion was accessed through an endoscopic transnasal 'four-handed' approach with an otorhinolaryngologist and a neurosurgeon operating



**Fig. 2. Image guidance system (from top left to bottom right): axial, coronal and sagittal views, and corresponding endoscopic view during the surgical approach.**

simultaneously. Surgery consisted of a posterior septectomy and bilateral sphenoidotomies with removal of the anterior face of the sphenoid and inter-sinus septum. The internal carotid artery (ICA), optic nerve prominences, pituitary fossa and clivus were identified. After this, a corridor was drilled medial to the ICA and lateral to the clival dura to gain access to the lesion. The cyst wall was opened and the fluid drained. A Silastic drain was left in place to facilitate continuous drainage into the nasal cavity. A free mucosal flap and DuraSeal were used to close the surrounding bony defect and cerebrospinal fluid leak.

On follow-up with imaging both patients had successful drainage, no re-collection of the lesions and no other complications.

## Discussion

Both cholesterol granulomas and GCCs of the petrous apex may present similarly with cranial nerve deficits, hearing loss and vertigo.<sup>1</sup> The current literature is unclear concerning the exact cause and mechanism of formation. It is thought that cholesterol granulomas originate from a chronic poorly pneumatised or obstructed eustachian tube and are more common in the middle ear or mastoid, whereas GCCs tend to arise in well-pneumatised temporal bones and generally originate in the petrous apex.<sup>1,2,4</sup>

Cholesterol is derived from tissue breakdown or the catabolism of haemoglobin. It is not clear why this cholesterol fluid accumulates in the abovementioned areas.<sup>4</sup> The progressive nature of this accumulation leads to growth of the lesion and resultant bone erosion.<sup>4</sup> The brownish fluid tends to be thick and glue-like in cholesterol granulomas and thinner in GCCs.<sup>1,2</sup>

The diagnosis is based on symptoms, clinical findings, and imaging in the form of CT and MRI. MRI shows the lesion to be hyperintense on T1-weighted sequences and shows progressive lowering in signal intensity on first and second echoes of the T2-weighted sequences.<sup>1</sup> The differential diagnosis of lesions in this area includes congenital cholesteatomas, meningiomas, schwannomas, apical petrous

abscesses, carotid aneurysms, glomus tumours, metastasis, lymphomas, chordomas and histiocytosis. The above imaging as well as angiography will be able to distinguish between the various lesions.<sup>1</sup>

The histological differentiation described by Graham *et al.*<sup>1,3</sup> shows cholesterol granulomas to have cholesterol crystals surrounded by multinucleated giant cells, macrophages and round cells. The adjacent mucosa undergoes metaplasia to ciliated columnar respiratory epithelium. In the case of GCC, there is a fibrous wall with no endothelial or epithelial lining and thin fluid with cholesterol crystals.<sup>1,4</sup>

The best method of surgical drainage is not clearly documented, but depends largely on the anatomical location. Cholesterol granulomas can be managed through various approaches. Middle cranial fossa, lateral transtemporal (subdivided into infralabyrinthine, translabyrinthine, infracochlear and transcochlear) and trans-sphenoid procedures have all been described.<sup>1,2</sup> The latter may be through an external approach or endoscopically.<sup>1,2</sup> Removal of the entire cyst, as opposed to marsupialisation, and the placement of a drain to facilitate drainage into a ventilated cavity will depend on the surgical approach used.<sup>2</sup> The literature does not show one particular method to have a better success rate than the others in terms of the long-term recurrence rate, but the morbidity associated with the lateral temporal approaches is significant.<sup>2</sup>

The viability of the endoscopic trans-sphenoidal approach depends on the suitability of the patient as well as the anatomical location of the lesion. Favourable criteria are an adequately developed sphenoid sinus (sellar or presellar; contraindicated in a conchal-type sphenoid), lesions located immediately adjacent to the sphenoid or posterior ethmoids, and safe location of the ICA and optic nerve relative to the lesion.<sup>1</sup> The lesion should extend medially to the vertical segment of the ICA.<sup>2</sup> An image guidance system assists in localisation of the lesion and improves the safety of the procedure.<sup>2</sup> The complications of this approach are a CSF leak and injury to the ICA and optic nerve.<sup>1,2</sup>

The advantages of the endoscopic trans-sphenoidal approach are that it avoids intracranial and temporal bone surgery, it is minimally invasive, and it has a lower incidence of morbidity and conserves hearing and vestibular function in patients in whom these have not been affected pre-operatively.<sup>1,2</sup> Follow-up in the outpatient setting is also made easier with direct visualisation with the endoscope.<sup>2</sup> Re-insertion of a drain in the event of re-accumulation of the lesion is also easily achieved using the trans-sphenoidal approach, since a 'surgical corridor' already exists.

## Conclusion

After reviewing the supporting literature and managing 2 cases successfully with this technique, we advocate the endoscopic trans-sphenoidal approach for the surgical management of cholesterol granulomas and giant cholesterol cysts of the petrous apex in cases suitable for this approach. Careful case selection, surgical expertise, endovascular back-up and image guidance systems are prerequisites for this approach.

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