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Large cholesterol granuloma of the petrous apex treated via subcochlear drainage

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Abstract

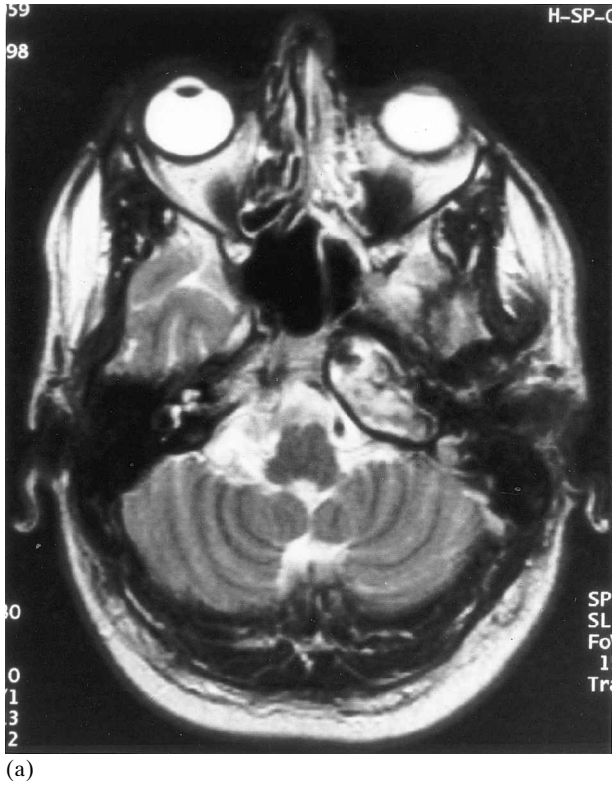
This is a case report of a patient with bilateral cholesterol granuloma of the petrous apex, who presented with unilateral symptoms. Initially suspected as having a dermoid cyst, he underwent posterior fossa exploration, drainage and biopsy. Symptoms recurred one year later and subcochlear drainage of the petrous apex cyst was successfully performed. Follow-up for over 18 months shows no clinical nor imaging signs of recurrence.

A MEDLINE literature search was carried out and relevant paper publications reviewed. Case presentation including initial, pre- and post-operative imaging is presented. This is followed by discussion of current concepts on the presentation and management of large cholesterol cysts of the petrous apex.

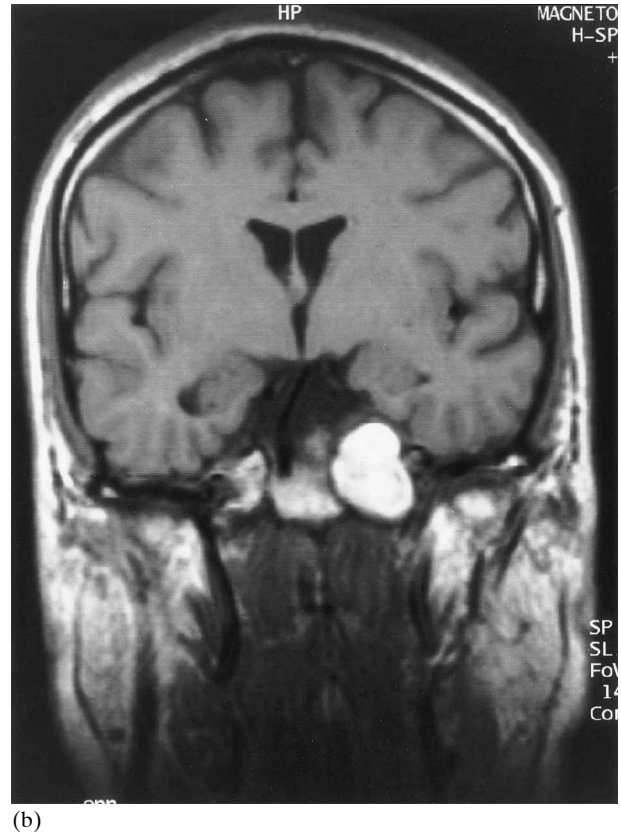
Key words: Petrous Bone; Cholesterol; Granuloma; Foreign Body; Surgical Procedures; Operative

Introduction

A previously healthy male, aged 38 years, presented with a six-month history of slowly progressing diplopia, transient light-headedness and occasional headaches. Physical examination revealed an isolated left VIth cranial nerve palsy. A magnetic resonance scan (MRI) was obtained and revealed a well-defined lesion, size 25 × 20 × 20 mm, in



(a)



(b)

FIG. 1

MRI demonstrating a large lesion in the left petrous apex with high signal in both T1- and T2-weighted sequences. (a) T2 axial view. (b) T1 coronal view.

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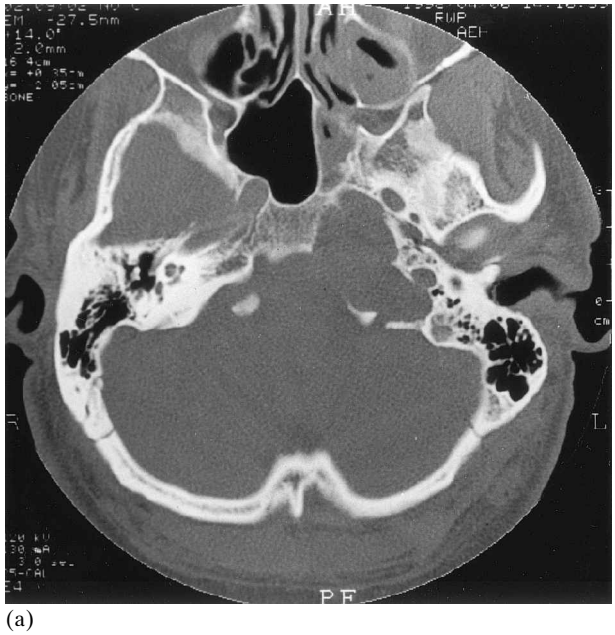
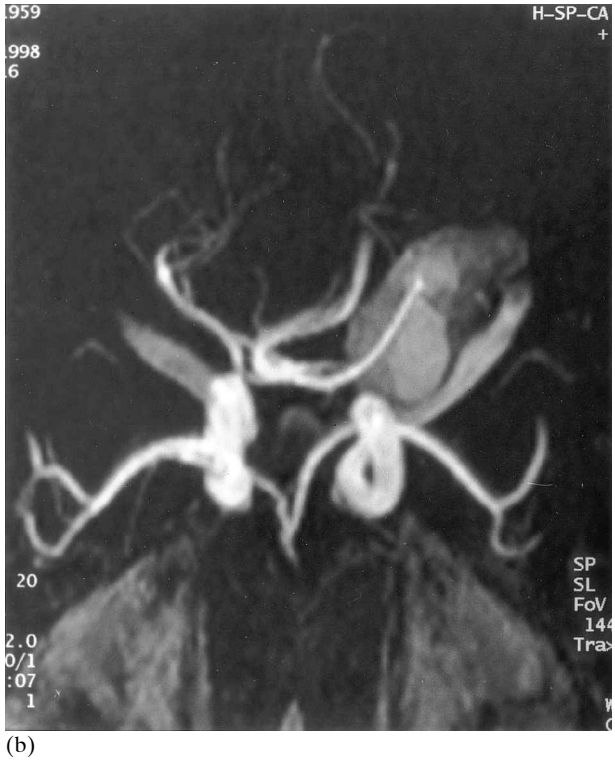


(a)



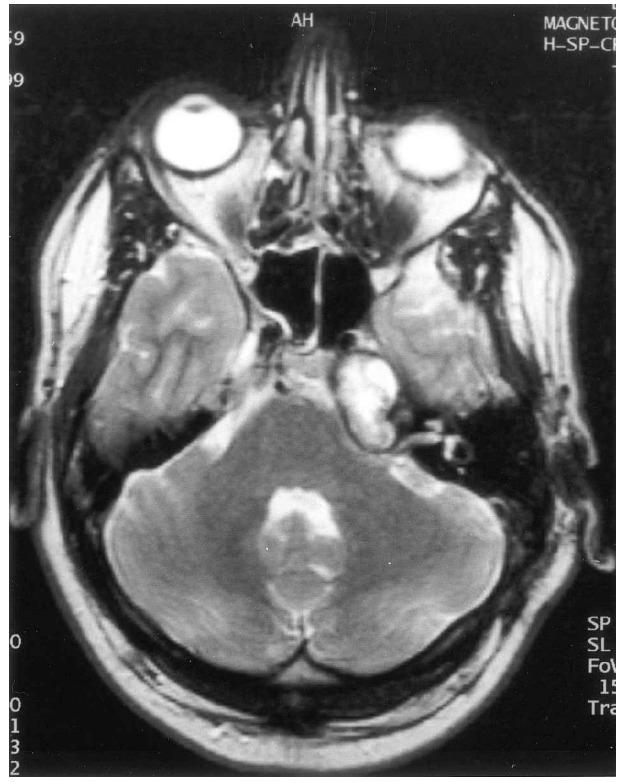
(b)

FIG. 2

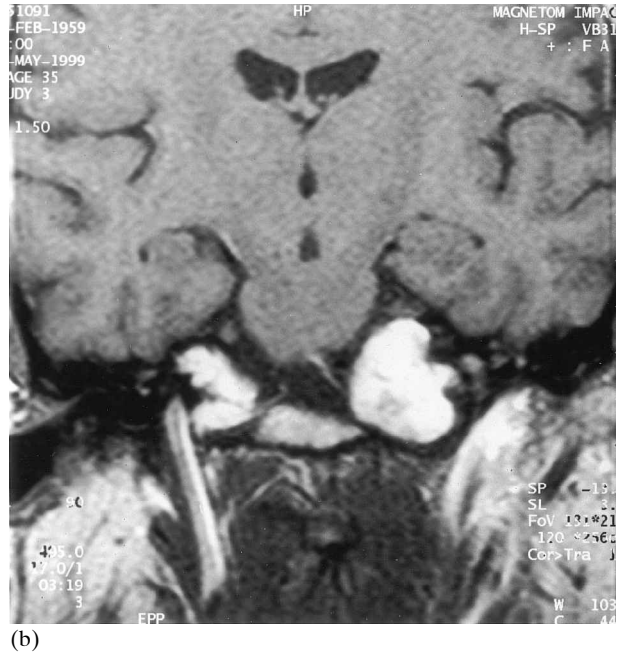
(a) High definition CT scan coronal view. (b) MR angiogram delineating lesion and vasculature.

the left petrous apex. This showed high signal in T1- and T2-weighted sequences. (Figure 1(a), (b)) A smaller contralateral lesion was suspected and a high resolution computed tomography (CT) scan was requested. This was reported as confirmation of a destructive lesion of left petrous apex but no evidence of a contralateral lesion. A magnetic resonance angiogram was also obtained to delimit the extension and blood supply to the lesion. (Figure 2(a), (b))

With a presumptive diagnosis of a dermoid cyst, a left retrosigmoid craniectomy was carried out and the posterior fossa was explored. The lesion was identified and incised, releasing fluid described as 'green-brown machine



(a)



(b)

FIG. 3

MRI views at symptom recurrence (a) T2-weighted axial view, showing evidence of previous left posterior fossa craniotomy and cyst recurrence. (b) T1-weighted coronal (IAM enlargement). Contralateral smaller lesion is confirmed.

oil'; such an appearance is highly suggestive of cholesterol granuloma. Post-operative recovery was uneventful and was followed by full resolution of symptoms and the cranial nerve paresis. Histology showed chronic inflammatory changes compatible with cholesterol granuloma.

Diplopia and headaches recurred 12 months after the initial drainage. An MRI showed an apparent enlargement of the left petrous apex cyst into the area of the internal acoustic meatus (IAM). (Figure 3(a), (b))

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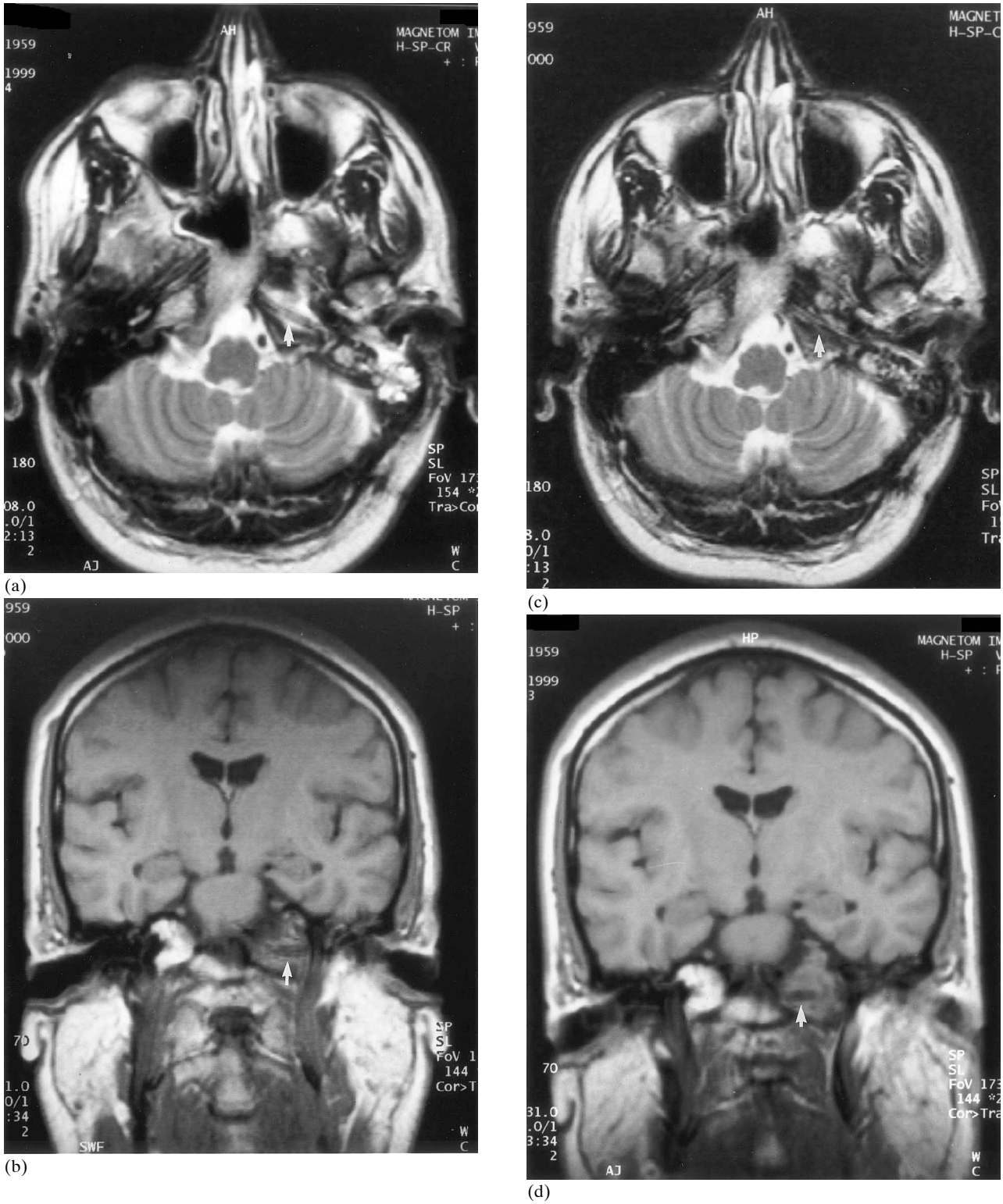

FIG. 4

MRI views at 8 weeks (a), (b) and 48 weeks (c), (d) following subcochlear drainage of left large cholesterol cyst of the petrous apex. Arrow shows position of drainage tube.

The patient was referred to Otolaryngology for external drainage of the lesion. Initial assessment confirmed a left VIth cranial nerve palsy and mild sensorineural hearing loss of the higher frequencies in the left ear.

The large cyst was surgically drained into the middle ear cleft via a subcochlear approach to the left petrous apex. The patient was positioned supine with the head turned away from the side of the lesion. A post-auricular incision was made; the skin was elevated from the inferior half of the external auditory canal down to the level of the annulus. The middle-ear space was opened and the tympanic membrane reflected upwards. Exposure of hypotympanic cells was achieved by drilling the inferior rim of the tympanic ring. The facial nerve was identified in the posterior aspect of the dissection, but it was not exposed. Good pneumatization allowed anteromedial

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TABLE I
SURGICAL APPROACHES FOR PETROUS APEX GRANULOMA IN THE REVIEWED LITERATURE

Authors	Year	Approaches used	Number of cases
Crisante *et al.*[3]	2000	Middle cranial fossa	8
Telischi *et al.*[14]	1999	Supracochlear	1
Muckle *et al.*[10]	1998	Subcochlear	12
		Infralabyrinthine	11
		Middle cranial fossa	6
		Translabyrinthine	5
		Transcochlear	2
		Retrolabyrinthine	1
Griffith *et al.*[15]	1996	Transsphenoid (endoscopic)	2
Brodkey *et al.*[1]	1996	Infralabyrinthine	8
		Subcochlear	2
		Translabyrinthine	1
Gianoli *et al.*[16]	1994	Infralabyrinthine	14
		Transsphenoid	6
		Suboccipital	3
		Translabyrinthine	2
Goldofsky *et al.*[2]	1991	Infralabyrinthine	7
		Translabyrinthine	1
		Suboccipital	1
Thedinger *et al.*[7]	1989	Transethmoid-transsphenoid	5
		Infralabyrinthine	3
		Transcochlear	2
		Middle cranial fossa	1
		Suboccipital	1
Gherini *et al.*[4]	1985	Infralabyrinthine	5
		Translabyrinthine	3
		Middle cranial fossa	2
Graham *et al.*[6]	1985	Transmastoid	3
		Middle cranial fossa	1
		Infralabyrinthine	1

exploration below the cochlea. Dissection continued in a triangular window limited by the basal turn of the cochlea superiorly, the carotid artery anteriorly and the jugular bulb posteriorly. The wall of the cyst was identified and incised, draining thick fluid. The cyst opening was enlarged and debris flushed out. A Silastica® tube was inserted to stent the cyst opening into the hypotympanic aircells. The tympanomeatal flap was repositioned over a temporalis fascia graft and the incision was closed.

Recovery was uneventful and follow-up revealed no further headaches, recovery of eye movements and formation of small areas of granulation tissue at the tympanomeatal flap incision. One year after the procedure no recurrence of symptoms was observed, the hearing had improved slightly and the inflammatory changes in the ear had settled. After 18 months the patient remained asymptomatic.

Imaging carried out in the follow-up period corroborated the clinical findings. An area of intermediate signal characteristics has replaced the original high signal lesion at MRI. The smaller contralateral cyst is unchanged. (Figure 4(a), (b))

Discussion

Cholesterol granuloma is a benign inflammatory condition of the temporal bone of unknown origin. It can appear anywhere in the air cell system and is often associated with cholesteatoma or chronic otitis media. Cholesterol cysts in the petrous apex are less common and are not associated with other ear disorders.[1–3] Numerous aetiopathological hypotheses have been proposed but most authorities support the concept of air cell tract blockage in a well-pneumatized petrous apex.[1,3–4] Negative pressure and/or hypoxia with subsequent haemorrhage within the mucosal lining lead to a foreign body reaction with progressive accumulation of the typical brownish glistening fluid. This natural history is based on observation of animal models and series of clinical cases.[1–4]

Clinical presentation typically includes cranial nerve compression, cerebellopontine angle syndrome with involvement of cranial nerves V to VIII and cerebellar signs. Differential diagnosis should include cholesteatoma, epidermoid cyst,[1] arachnoid cyst,[5] meningioma, schwannoma, glomus, cartilaginous tumour, lymphoma, histiocytosis X,[2] infectious process and vascular malformations.[6,7]

Large cholesterol granuloma or giant cholesterol cyst of the petrous apex is arguably a separate entity among the group of cholesterol granulomas of the temporal bone. Graham describes a series of five cases and suggests that giant cholesterol cysts differ from cholesterol granulomas in location and clinical presentation.[6] The former appear in a well pneumatized petrous apex with gradual enlargement and bone destruction; whereas the latter do so, with rare exception, in the middle ear and mastoid segment with an association with a history of otitis media.[6,8] On the other hand, Thedinger *et al.*[7] consider in their description of a series of 10 cases, that the terms of cholesterol granuloma

TABLE II
TOTAL NUMBER OF CASES IN EACH APPROACH GROUP

Approach	Number of cases
Infralabyrinthine	49
Middle cranial fossa	18
Subcochlear	14
Transsphenoid	13
Translabyrinthine	12
Suboccipital	5
Transcochlear	4
Transmastoid	3
Supracochlear	1
Retrolabyrinthine	1
Total	120

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and cholesterol cyst are clinically and histologically synonymous, adding that the lesions show little or no growth.

Management of these lesions includes differential diagnosis and surgical treatment for symptomatic cases. Imaging studies such as MRI and CT scan are complementary for diagnosis and treatment planning.[1,2,5,7,9,10] Cholesteatoma and epidermoid cysts are the lesions to distinguish from cholesterol granuloma.[1] The latter commonly shows bone destruction while cholesteatoma and epidermoid cysts show bone erosion at CT scan. On MRI studies, cholesterol granuloma appears with a high signal on both T1- and T2-weighted sequences, the other two lesions appear bright only on T2-weighted ones.[1,2,5,7,9,11] The goal of surgery is drainage and permanent aeration to prevent recurrence. The historical strategy of drainage and complete excision of the capsule has been replaced by procedures to drain the cyst into the paranasal sinuses, (transsphenoid approach), or middle-ear cleft (transmastoid, transcanal). Numerous alternatives to access the petrous apex have been described (Tables I, II); they include suboccipital, transmastoid, retro- trans- and infralabyrynthine, trans-supra- and sub-cochlear, middle cranial fossa, and transethmoid-transsphenoid.[1,3,11–16] The choice of surgical approach depends on location, extension of the lesion and quality of hearing. The anterior approaches provide drainage into the paranasal sinus system and preserve hearing but dissection is limited laterally by the optic nerves and carotid arteries. The posterior approach ie. suboccipital, requires cerebellar retraction and does not establish external drainage. Lateral approaches provide more direct access with extensive exposure and establish drainage into the middle-ear complex. Translabyrinthine and transcochlear routes destroy the hearing but provide wide exposure. Infralabyrinthine, subcochlear and middle fossa routes preserve cochlear function in exchange for more limited exposure and increased risk of stricture of the drainage pathway. Access through the middle fossa requires temporal lobe retraction and the drainage into the mastoid cells may prove difficult to establish. A high jugular bulb precludes an infralabyrinthine access and poor development of hypotympanic air cells obscure a subcochlear approach.[16]

Infralabyrinthine or subcochlear approaches are preferred in the patient with useful hearing when the lesion does not abut the posterior wall of the sphenoid sinus (in which case an approach through the paranasal sinuses can be contemplated). Labyrinthine-destroying routes are used when the patient shows no serviceable hearing. Suboccipital and middle cranial fossa approaches enjoy acceptance in the neurosurgical literature.[1–3] The supracochlear route was used to drain a cyst in an infant with poor mastoid pneumatization.[14] Each technique may be applied in particular situations and especially tailored to the individual patient.

In the case presented, a subcochlear approach was favoured for the following reasons: the patient showed good hearing and extensive mastoid pneumatization. With an adequate window between the carotid artery and jugular bulb inferior to the cochlea, this is the shortest route to reach lesions in the anterior petrous apex. Haberkamp, in a comparative study of 20 temporal bones, found the subcochlear approach to give the most consistent exposure to the petrous apex.[12] Finally, this inferior route was chosen to obtain dependent gravitational drainage into the middle-ear cleft space. Stricture of the draining passage is a common cause of recurrence.[16] A Silastic® stent was left in the drainage conduit to prevent narrowing in the post-operative period.

Long-term follow-up is important to detect early signs of recurrence and in this particular case to monitor the contralateral petrous apex cyst which has remained asymptomatic. Regular MRI scan of the cranial base is the imaging modality of choice.[2,7,9]

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