RADIOLOGICAL CASE

CLINICS IN DIAGNOSTIC IMAGING (5)

W C G Peh, A P W Yuen

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CASE REPORT

A 48-year-old housewife presented with progressive right-sided hearing loss over a five-year period. She had no history of tinnitus, vertigo, ear discharge, barotrauma or exposure to excessive loud noise. Physical examination revealed normal eardrums bilaterally. However, pure tone audiogram showed profound right deafness and mild left high tone loss.

Plain radiograph (Fig 1) and computerised tomography (CT) (Fig 2 and 3) of the internal auditory canals were performed. What do these demonstrate? What further investigation would be useful in confirmation of the diagnosis?

Fig 1 – Transorbital radiograph of the petrous bone.

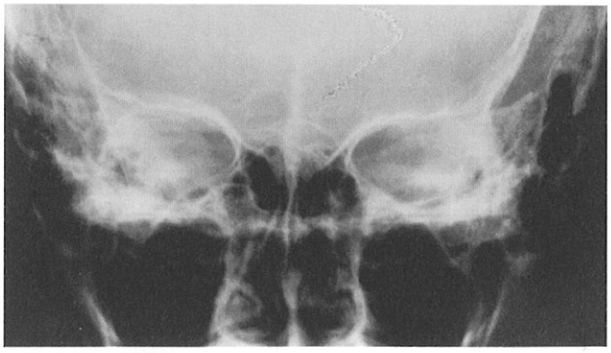


Fig 2 – Axial CT (bone setting) of the skull base

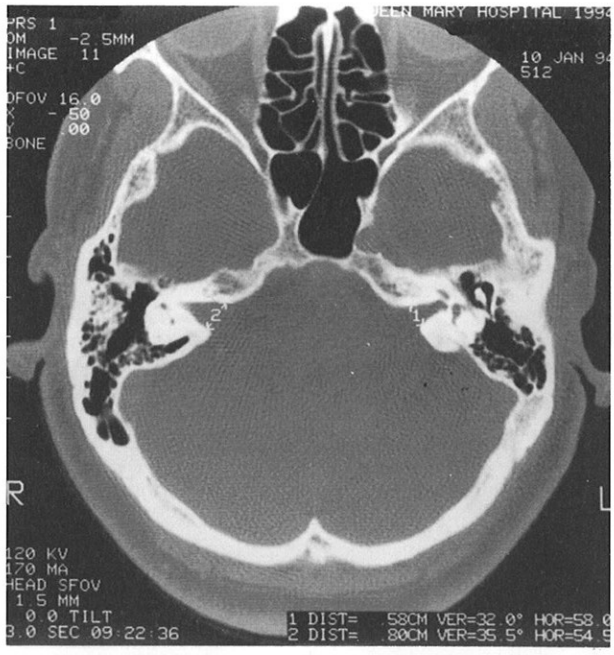
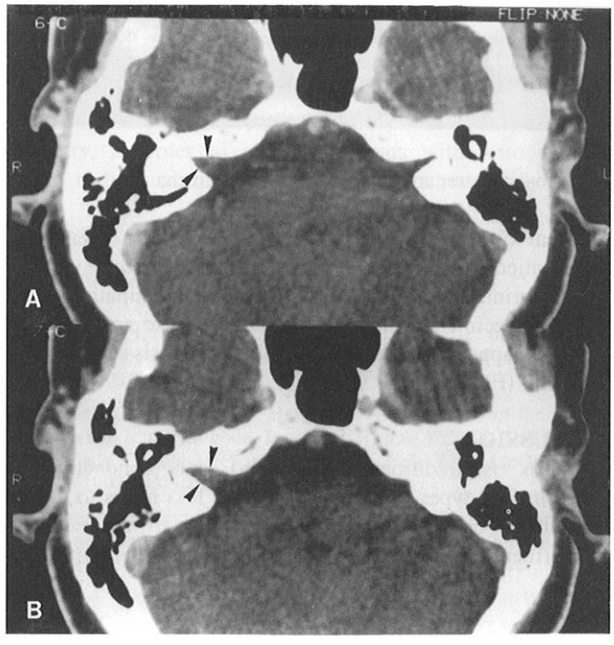


Fig 3 – Post-contrast axial CT (soft tissue setting) of the skull base at 1.5 mm thick contiguous levels, A & B. Fig 3A corresponds to Fig 2.



Department of Diagnostic Radiology
The University of Hong Kong
Queen Mary Hospital
Hong Kong

W C G Peh, FRCR, FHKAM, FAMS
Senior Lecturer and Consultant

Department of Surgery
The University of Hong Kong

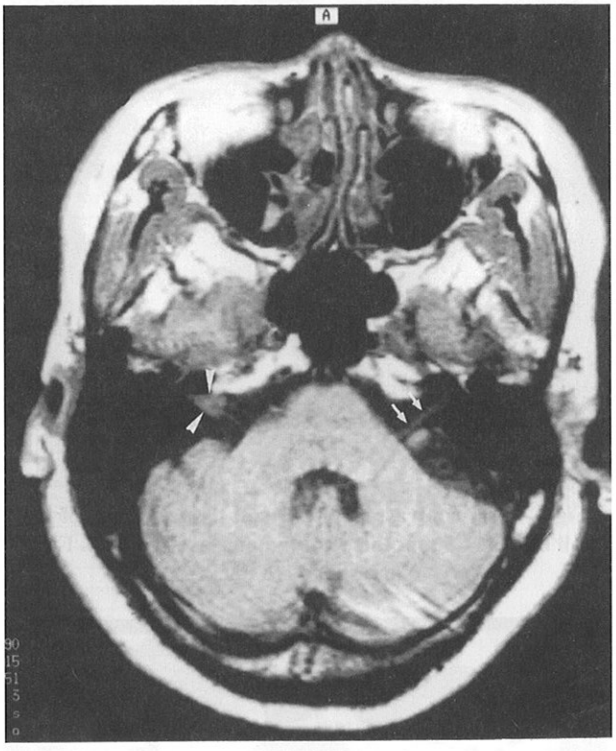
A P W Yuen, DLO, FRCSG, FRCSEd
Lecturer

Correspondence to: Dr W C G Peh

IMAGE INTERPRETATION

Both internal auditory canals appeared normal on the plain radiograph (Fig 1). CT showed asymmetry of the internal auditory canals, measuring 8mm in width on the right side and 5.8mm on the left (Fig 2). There was suggestion of an enhancing soft tissue mass (arrowheads) within the right internal auditory canal (Fig 3). Magnetic resonance imaging (MRI) was performed as an acoustic neuroma was suspected. A cone-shaped mass measuring 8mm in length was demonstrated arising from the intracanalicular part of the right eighth cranial nerve (Fig 4). This mass enhanced markedly after intravenous administration of gadolinium (Gd) - diethylene triamine penta-acetic acid (DTPA), a paramagnetic contrast agent (Fig 5).

Fig 4 – Axial spin-echo T1-weighted (TR 690 msec, TE 15 msec) MRI shows a mildly hypointense cone-shaped mass (arrowheads) arising from the right vestibulocochlear nerve. The normal left vestibulocochlear nerve is arrowed.



Diagnosis: Intracanalicular acoustic neuroma

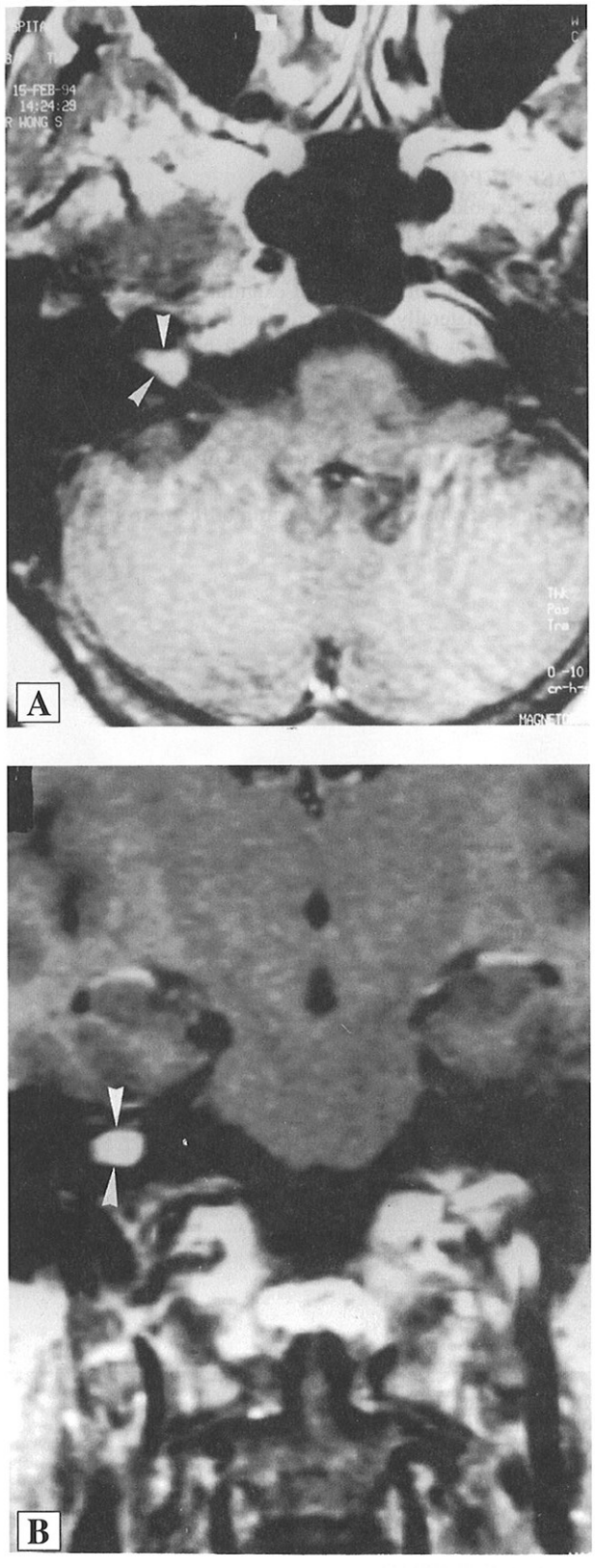
Clinical Course

The patient underwent removal of the tumour via the translabyrinth approach. Histopathological examination of the excised specimen, which corresponded in size and shape to the MR appearance, confirmed the diagnosis of acoustic neuroma (Fig 6).

DISCUSSION

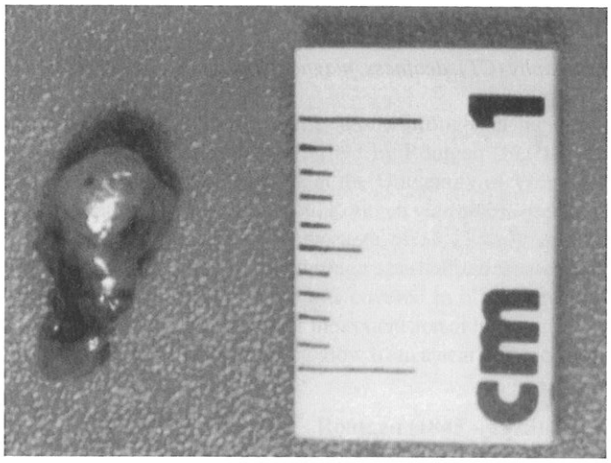
Deafness is traditionally classified into conductive or sensorineural types. Conductive hearing loss refers to failure of sound conduction from the exterior to the cochlea. Sensorineural hearing loss (SNHL) is due to either abnormal-

Fig 5 – T1-weighted MRI images performed after Gd-DTPA injection, in the (A) axial and (B) coronal planes, show intense enhancement of the right acoustic tumour (arrowheads).



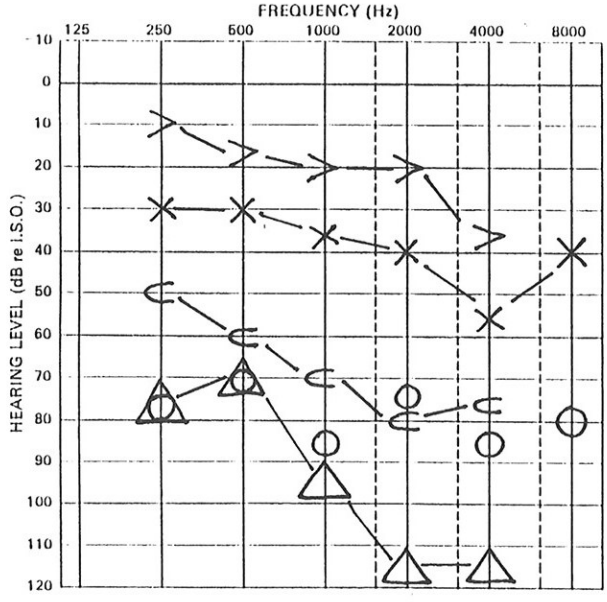
ity of the cochlea resulting from damage to the organ of Corti (sensory or cochlear subtype) or an insult to the retrocochlear auditory pathway, which extends via various neural fibres from the cochlear nerve to the superior temporal gyrus (neural or retrocochlear subtype). Conductive hearing loss and SNHL can be differentiated clinically by pure tone audiometry (Fig 7). Further audiological investigation is required to differentiate cochlear from retrocochlear subtypes, especially if SNHL is unilateral[1,2].

Fig 6 – Operative photograph showing excised cone-shaped acoustic neuroma.



Of those patients suffering from unilateral retrocochlear SNHL, cerebellopontine angle tumour has to be excluded. Acoustic neuromas constitute about 85% of all cerebellopontine angle tumours, with the second commonest neoplasm at this site being meningiomas[1]. Acoustic neuromas generally arise from Schwann cells, particularly those located near Scarpa's ganglion of the superior vestibular portion of the vestibulocochlear (eighth) nerve. Hence, they should more correctly be described as acoustic schwannomas. These tumours grow slowly, typically expand the medial end of the internal auditory canal and mostly protrude into the cerebellopontine angle by the time of diagnosis.

Fig 7 – Pure tone audiometric chart of our patient. Key: (>) left bone conduction, (x) left air conduction, (⊂) right bone conduction, (O) right air conduction without marking, (Δ) right air conduction with marking.



Meningiomas may, however, resemble acoustic neuromas superficially. Unlike acoustic neuromas, meningiomas typically have broad-based attachments to the petrous bone, rarely enlarge the internal auditory canal, and frequently cause adjacent hyperostosis or have dense focal calcifications. Another helpful differentiating feature is identification of a small amount of enhancing tissue extending from the tumour along a dural surface, the so-called "tail sign" of meningioma[3].

In patients with suspected retrocochlear abnormalities, CT has gradually been replaced by MRI for detection of the cerebellopontine angle lesions, demyelinating disease and for identification of small medullary infarctions. CT however remains the modality of choice for imaging the temporal bone and cochlea[4]. High resolution thin-section CT, using both bone and soft tissue windows, is generally sensitive in detecting acoustic neuromas if they are large enough or if there is a cerebellopontine angle mass, but may not be reliable in small or intracanalicular tumours due to beam hardening or petrous bone artefacts[5]. CT air meatography is reliable in delineation of these small tumours[6,7], but has now been superceded by Gd - enhanced MRI as it is both safer and more cost-effective[3,5].

MRI is now the definitive test for diagnosis of acoustic neuromas, as even small intracanalicular tumours can be detected effectively[3]. Acoustic neuromas typically show intense enhancement after administration of intravenous Gd-DTPA[8,9]. This is explained by the fact that these extra-axial tumours do not have blood-brain barriers, hence their high degree of enhancement (mean 300%) compared to intracranial tumours[8]. On unenhanced MR images, most acoustic neuromas either have a signal intensity equal to that of adjacent brain or are slightly hypointense. Smaller tumours tend to be oval or round in shape, with a homogeneous signal intensity pre- and post- contrast administration. Larger tumours are usually polylobular or irregular in shape and show more heterogeneous signal intensity. This inhomogeneous appearance may be due to cysts, areas of different cellular histology, calcifications or haemorrhage[10].

MRI, though accurate in detection of acoustic neuromas and other cerebellopontine angle tumours, is not cost-effective as a screening test, bearing in mind that only 1% of patients with unilateral hearing loss referred from ENT clinics have tumours[5]. Symptomatic patients should therefore be screened, using clinical and brain-stem evoked response audiometry, in order to identify patients with retrocochlear SNHL to be further investigated by CT or preferably MRI.

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ABSTRACT

A 48-year-old Chinese woman presented with progressive right-sided sensorineural hearing loss. Computerised tomography showed asymmetrical widening of the right internal acoustic canal. Post-gadolinium magnetic resonance images demonstrated marked enhancement of an intracanalicular tumour. The diagnosis of acoustic neuroma was confirmed surgically. The approach to imaging of deafness, particularly of unilateral sensorineural hearing loss, is discussed. Magnetic resonance imaging is currently the definitive test for diagnosis of acoustic neuromas.

Keywords: *acoustic neuroma, cerebellopontine tumour, computerised tomography (CT), deafness, magnetic resonance imaging (MRI), schwannoma*