Computerized Tomography Demonstration of Purely Intracanalicular Acoustic Neuromas

SERHAN ATİLLA, SEDAT IŞIK, ERHAN T. ILGIT, MEHMET ARAÇ, HAKAN ÖZDEMİR

Department of Radiology, Gazi University, School of Medicine, Beşevler 06510 Ankara, TÜRKİYE

Abstract : Three cases of purely intracanalicular acoustic neuromas not causing bony erosion and/or enlargement of the internal acoustic canal walls diagnosed accurately by temporal bone CT examinations are presented. It is suggested that temporal bone CT scans done with the appropriate technique is a sufficient and reliable diagnostic test for intrameatal acoustic tumours, needing confirmation with MRI only in patients who have very narrow internal auditory canals.

Key Words : Neuroma, Acoustic; Intracanalicular; Tomography, X-ray computed; Cerebellopontine angle

INTRODUCTION

Acoustic neuroma, or schwannoma is a benign tumour arising from the schwann sheath of the eighth nerve in the internal auditory canal (IAC). The usual clinical manifestations are sensorineural hearing loss, tinnitus and vestibular disturbances; the severity of the symptoms is closely related to the size of the subarachnoid space in the cerebellopontine cistern which is variable. The tumour is most commonly seen in the fourth and fifth decades of life and accounts for 8-10 % of all intracranial , and 78 % of all cerebellopontine angle tumours [3,12]. It is very slow growing, at a rate of 5mm a year [8], and takes approximately about 2 years to fill the internal auditory canal. It is known to cause expansion of the IAC with smooth bony erosion, but there is no direct relationship between the amount of bony erosion and size of the tumour.

Acoustic neuromas extending to the cerebellopontine cistern out of the internal auditory canal are easily diagnosed and demonstrated in routine computed tomography (CT) examinations. When the tumour is completely confined to the internal auditory canal a definite diagnosis becomes harder to achieve. At the present time, although it has been stated that acoustic neuromas larger than 5 mm in diameter can be detected with a high degree of accuracy with high-resolution CT [6], the commonly accepted belief is that tumours smaller than 1.5 cm. in size completely or mainly confined to the internal auditory meatus cannot be demonstrated by standard temporal bone CT examination; and the definitive diagnostic test is air-CT cisternography or magnetic resonance imaging (MRI) [1,2,4,6,9,10,11].

Enlargement due to bony erosion of 2 mm or more of any portion of one IAC compared to the corresponding segment of the opposite side, and shortening of the posterior wall by at least 3 mm are accepted as indicative of an acoustic neuroma in over 90 % of cases [12]. We are presenting three purely intracanalicular acoustic neuromas much smaller than 1.5 cm diagnosed correctly by contrast enhanced high-resolution CT scans, which do not show the above mentioned diagnostic bony erosion in the IAC walls. Brightness of the contrast enhancement in the intracanalicular soft tissue and obliteration of the CSF space inside the internal auditory canals were seen both in axial and coronal sections. The diagnosis was confirmed by the Auditory Brainstem Response (ABR) test and MRI examinations.

PATIENTS AND METHOD

The patients were examined with using the GE 9800 Quick Hilight CT system in both axial and coronal planes using the standard technique with 1.5 mm thick contiguous sections, standard resolution, 512x512 matrix size, 120 kVp, 100 mA, 4 sec, scan time. The patients were injected with 1.5 cc/kg nonionic iodinated contrast medium. Bone review algorithm images were also reconstructed to see the fine bony detail. Both the standard and bone algorithm images were examined separately with magnification factors ranging from 1.8 to 2.2.

CASE 1:

A 35-year-old female with sensorineural hearing loss in the left ear was referred for temporal bone CT examination. Odiological test results suggested a retrocochlear lesion. There was no tinnitus, vestibular dysfunction or involvement of other cranial nerves. On evaluation of the magnified bone resolution images in both planes, all the external, middle and inner ear structures appeared normal and the internal auditory canal walls were symmetrical showing no bony erosion. The only questionable finding was inability to see the falciform crest on coronal images (Fig.1 A). On examining the magnified soft tissue images, a barely visible contrast enhancement in the left internal auditory canal with no extension to the cerebellopontine angle was noticed (Fig.1 B,C). Compared with the opposite side, contrast enhancement brightness and obliteration of the intracanalicular subarachnoid space was easier to detect. Especially the coronal scans were very helpful in showing intracanalicular contrast enhanced fullness (Fig.1 C). Supporting this finding with the falciform crest erosion, a diagnosis of purely intracanalicular acoustic neuroma was made. Following CT diagnosis, the ABR test was applied, showing a destructive retrocochlear lesion on the left side. The patient was also examined by MRI with the spin echo technique using short and long sequences with Gadolinium-DTPA injection, confirming the diagnosis of an intracanalicular acoustic neuroma (Fig.1 D). The

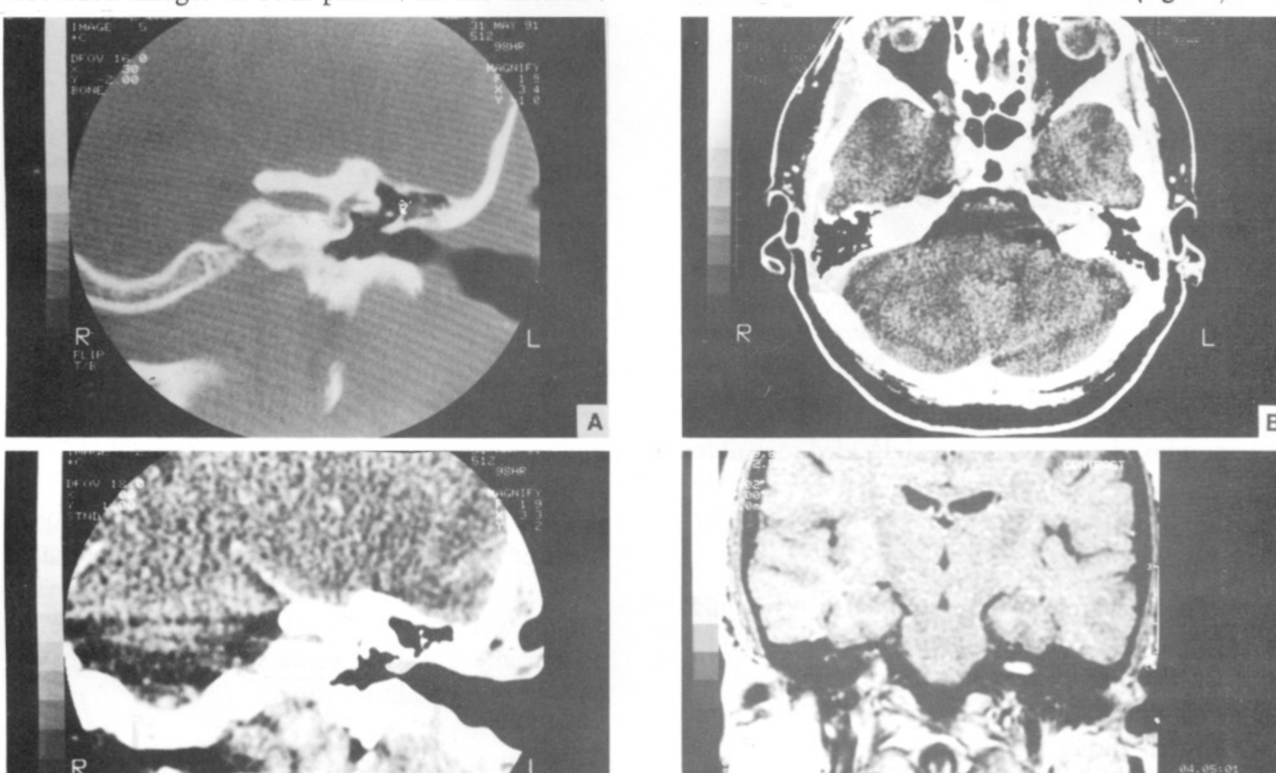

Figure 1 A-D: (Case 1) Coronal plane magnified bone review algorithm image of left temporal bone with normal internal acoustic canal walls. Note that normal extension of the falciform crest is not seen (A). Axial standard resolution CT section from the level of the left internal acoustic canal showing intracanalicular contrast enhancement with normal cerebellopontine cistern (B). Magnified coronal standard resolution CT section of left temporal bone shows a contrast-enhanced soft tissue increase obliterating the intracanalicular CSF space (C). Coronal plane short TRTE spin echo MR image with Gd-DTPA injection reveals a hyperintense acoustic neuroma in the left internal auditory canal (D).

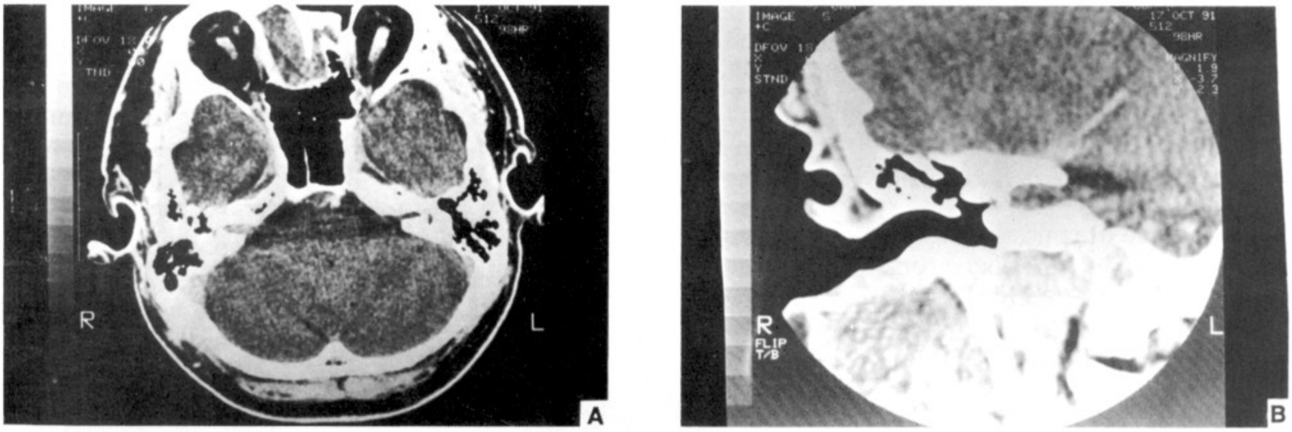

Figure 2 A,B: (Case 2) Axial CT section through the level of IACs shows a contrast-enhanced acoustic tumour filling the right internal auditory canal (A). Magnified standard resolution coronal CT section of the right temporal bone reveals fullness of the intracanalicular space with no significant bony erosion (B).

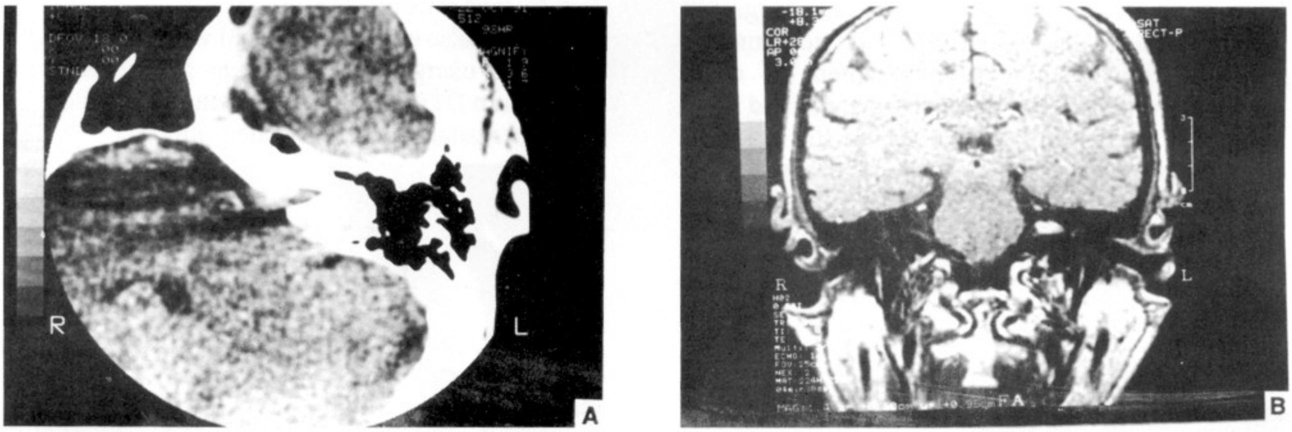

Figure 3 A,B: (Case 3) Magnified soft tissue CT image of left temporal bone showing a contrast-enhanced intracanalicular acoustic neuroma with intact IAC walls (A). Contrast-enhanced coronal short TRshort TE MR image of the same patient confirming the diagnosis of intracanalicular acoustic neuroma on the left side (B).

patient refused an operation and decided to wait for a while.

CASE 2:

A 28-year-old man with right-sided sensorineural hearing loss and a doubtful odiological test result for retrocochlear lesion was referred for temporal bone CT examination. CT scans in the axial and coronal planes with direct intravenous contrast injection showed an intracanalicular soft tissue lesion on the right side with no extension to the cerebellopontine cistern (Fig.2 A,B). Soft tissue window settings revealed marked contrast enhancement and obliteration of the subarachnoid space in the right IAC suggesting the diagnosis of intracanalicular acoustic neuroma. Bone review algorithm images were also examined for bony erosion in the IAC walls. The right IAC was 1 mm wider than the left in the middle part. The posterior wall of the right IAC was 0.5 mm shorter than the left and the falciform crest was amputated on the right side. MRI confirmed the diagnosis. The patient was operated using a translabyrinthine approach and a schwannoma was excised from the right internal auditory canal.

CASE 3:

A 39-year-old male patient complaining of tinnitus and left sided hearing loss was examined for suspected retrocochlear lesion. Odiological tests revealed bilateral sensorineural hearing loss more significant on the left side. Bone tissue window settings showed no significant enlargement in any portion of the IAC. Soft tissue window settings examined with magnification revealed a contrast enhanced intracanalicular acoustic neuroma on the left side obliterating the cerebrospinal fluid areas of the IAC without extension to the cerebellopontine angle cistern (Fig.3 A). ABR test and MRI confirmed the diagnosis (Fig.3 B) and the patient was operated using the translabyrinthine approach.

DISCUSSION

Acoustic neuroma is a benign, slow-growing tumour making surgical treatment necessary when the symptoms become severe. In the radiological demonstration of acoustic neuroma, the main purpose for the radiologist is to diagnose it accurately and also ensure that there is no possibility of a negative surgical exploration. This may be accomplished by the use of various different examination techniques or evaluation of follow-up examinations.

The CT density of an acoustic neuroma is variable before contrast injection, and shows moderate contrast enhancement making the use of contrast agents essential. Tumours extending to the cerebellopontine angle cistern or causing significant erosion of the IAC are easily demonstrated by routine CT scans. In addition, we propose that tumours confined to the IAC which do not cause a significant bony erosion regardless of size, can also be diagnosed accurately using contrast enhanced high-resolution CT in the axial and coronal planes if all the soft tissue and bone resolution views are examined by a radiologist familiar with these images. Brightness of the contrast enhancement filling the IAC completely and obliterating the intracanalicular CSF spaces, detected both in axial and coronal planes suggests the diagnosis of intracanalicular acoustic tumour. The coronal plane is especially very helpful in demonstrating intracanalicular fullness caused by the tumour. Erosion of the falciform crest is another very important early sign of acoustic neuroma. Vascular loops which may be a possible cause of eighth nerve disorders or a neurovascular bundle entering the internal auditory meatus may sometimes simulate this lesion, especially in patients with narrow canals. Most can easily be discriminated from a soft tissue mass, but in patients with narrow internal auditory canals (2-4 mm), CT diagnosis of acoustic neuroma becomes harder needing confirmation with other diagnostic tests [5]. It is no use performing CT pneumocisternography which has no advantages over high-resolution CT scans done with standard technique in the diagnosis of acoustic neuromas as it is an invasive examination procedure reported to give a have 22 % false positive rate. The use of this procedure should be confined to demonstrating intracanalicular vascular loops [5,11]. In patients with narrow internal acoustic canals presenting doubtful images of intracanalicular tumour in standard temporal bone CT examinations, MRI should be the procedure of choice to confirm or rule out a soft tissue mass as it has a diagnostic accuracy of 100% with no false positive or negative results when examined with the appropriate technique using thin slices, and sagittal, coronal and axial views [6,7,10,11]. Considering cost and availability, we think that high-resolution temporal bone CT examinations with standard technique is a sufficient and reliable examination modality for showing intracanalicular acoustic neuromas in patients with normal-sized internal auditory canals.

Correspondence : Erhan T. Ilgıt, M.D.
Gazi Üniversitesi Tıp Fakültesi
Radyodiagnostik A.B.D.
Beşevler 06510 Ankara, Türkiye
Tel : 2126565 / 273

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