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Clinical Record

Magnetic resonance imaging: is a single scan ever enough for the diagnosis of acoustic neuroma?

M D Kernohan, K J Blackmore*, I J M Johnson*, I Zammit-Maempel†

Abstract

A patient presented with unilateral, right-sided hearing loss and tinnitus and underwent gadolinium-enhanced magnetic resonance imaging (MRI). A pure tone audiogram showed a right-sided sensorineural hearing loss. The MRI scan was initially negative but when repeated seven years later, following a further deterioration of symptoms, it showed a 2 mm, right-sided acoustic neuroma.

This case has great potential significance for the diagnosis of acoustic neuroma, and it may raise medico-legal issues regarding the exclusion of this diagnosis. The case illustrates that a single negative scan may not be adequate if pure tone audiograms show deterioration in hearing loss.

Key words: Neuroma, Acoustic; Magnetic Resonance Imaging; Diagnosis; Hearing Loss

Introduction

Acoustic neuromas are rare, benign tumours of the VIIIth cranial nerve. They have a quoted incidence of 10 per 1 000 000 people per year or greater.[1,2] The diagnosis is normally confirmed by magnetic resonance imaging (MRI). There is considerable debate over which clinical signs and symptoms indicate the need for an MRI.[1,3]

There are many factors to balance in the debate, not the least of which are the long waiting times for over-subscribed MRI scanners in most NHS facilities and the broad clinical indications for scanning. This case report is the first to illustrate that MRIs performed four and 11 years after the onset of the same neuro-otological symptoms resulted initially in a negative scan but later in the diagnosis of a 2 mm acoustic neuroma.

Case report

A 41-year-old woman was initially referred in 1991 with unilateral, right-sided hearing loss and tinnitus. In 1995, pure tone audiometry showed a sustained, right-sided, mean sensorineural hearing loss of 35 dB over 0.5, 1, 2, 4 and 8 kHz, and she underwent MRI.

The MRI was performed on a recently installed 1.0 Tesla Siemens Magneton unit (Siemens, Erlangen, Germany). The study included a thin section fast spin echo T2-weighted sequence (head coil, Repitition time (TR)/Time to echo (TE) = 4000/112, echo train length 15, slice thickness 3 mm, field of view 250, matrix 390 × 5120) and a gadolinium-enhanced T1-weighted coronal sequence (head coil, TR/TE = 450/15, slice thickness 3 mm, field of view 200, matrix 192 × 256, 10 ml of intravenous gadopentate meglumine (Schering, Magnevist^{TM})). The MRI was normal, with no abnormal enhancement in relation to either internal auditory meatus (Figure 1).

The patient was kept under observation until 1999 but was lost to follow up thereafter. During the period of observation, she underwent serial pure tone audiometry at varied intervals. There was no objective change during this time.

In 2002, the patient was re-referred as she had experienced a deterioration of her symptoms. She felt that over the years her hearing had deteriorated further, and she had lately been wearing a right-sided hearing aid. She had no other new symptoms. Pure tone audiogram showed a further right-sided, mean sensorineural deterioration of 14 dB over 0.5, 1, 2, 4 and 8 kHz; however, more significantly, a left-sided, mean sensorineural deterioration of 25 dB over the same frequencies was also seen.

Because of the new findings of left-sided hearing loss, a second MRI was performed, using the same 1.0 Siemens machine, with T1-weighted coronal pre- and post-gadolinium sequences (with similar parameters and amount of contrast as in the previous scan) and T1-weighted axial post-gadolinium sequences. This second scan revealed a 2 mm, right-sided, enhancing focus deep within the internal auditory meatus, presumed to be an acoustic neuroma (Figure 2). A retrospective review of the original 1995 MRI by several experienced radiologists confirmed no abnormality.

Table I shows a summary of the patient's pure tone audiometry results at the time of the two scans.

Discussion

This case has great potential significance for the diagnosis of acoustic neuroma, and it may raise medico-legal issues regarding the confident exclusion of this diagnosis. In our patient, the diagnosis of a small acoustic neuroma after

From the Department of Plastic and Reconstructive Surgery, Royal Victoria Infirmary, and the Departments of *Otolaryngology and †Radiology, Freeman Road Hospital, Newcastle-upon-Tyne, UK.
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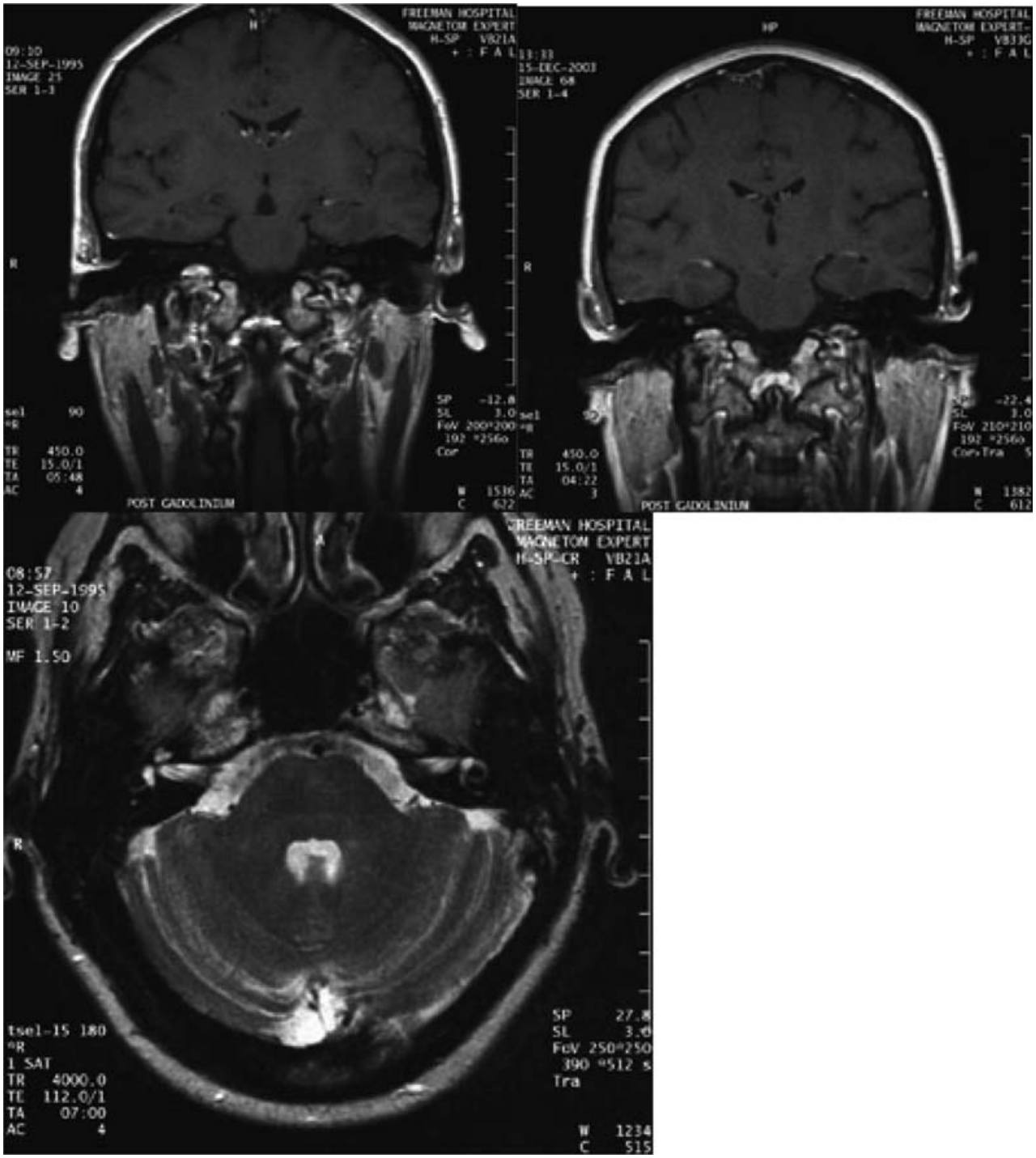

FIG. 1
Initial MRI showing no abnormality.

a second MRI was, in part, a chance finding, as the patient re-presented at an outlying hospital which had no paper records or correspondence regarding her previous investigations; in addition, her sensorineural hearing loss was on the opposite side.

There are no national guidelines for diagnosing acoustic neuroma in the United Kingdom. Several centres have published regional guidelines[3–5] which cover a range of clinical parameters. Dawes and Jeannon[3] proposed that an asymmetrical sensorineural hearing loss of 20 dB or greater at two adjacent frequencies was an indication for MRI. This indication was discussed at the British Society of Neuro-otology meeting in Leicester, in October 2002.[6] The sensitivity and specificity of published selection criteria for MRI were presented. The meeting concluded that a threshold of 15 dB interaural difference at two adjacent frequencies, in the absence of other indications or strong clinical suspicion, was enough to indicate the need for an MRI. It was also concluded that more elaborate protocols, incorporating tinnitus and vertigo did not increase

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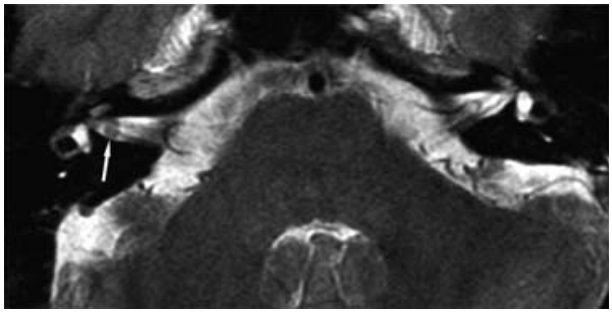

FIG. 2
Second MRI after 7 years showing abnormality within right internal auditory meatus.

TABLE I
PURE TONE AUDIOMETRY RESULTS

Audiometry result*	1992	2002
Right (dB)	57	63
Left (dB)	20	43

*Average of audible frequencies.

the sensitivity or specificity. Of the screening protocols reviewed in the literature, none indicate MRI for progressive sensorineural hearing loss.

- **This paper reports the case of a patient with unilateral hearing loss and tinnitus. Initial screening with gadolinium-enhanced MRI was negative**
- **Seven years later, following deterioration of hearing, a further MRI revealed a 2 mm acoustic neuroma**
- **A single negative MRI may not be sufficient to exclude an acoustic neuroma. A further scan may be required if there is subsequent hearing deterioration**

The present case illustrates the fact that the current protocols for MRI indication may not be adequate for diagnosis of acoustic neuroma. Serial MRI is likely to be the safest method of avoiding false negative diagnoses in patients with deteriorating symptoms. There are at least 11 reports of false positive diagnoses of acoustic neuroma in the literature[6] but no reports of false negative diagnoses. Little is known about the progression of acoustic neuroma. A retrospective study of serial MRI examinations on a selected group of conservatively managed patients concluded that the overall growth rate of non-surgically managed acoustic neuromas was 0.91 mm per year.[7] However, there is no literature available on the subsequent scanning results of patients with an initial negative diagnosis.

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Address for correspondence:
Mr Michael D Kernohan,
17 Parkside Crescent,
Tynemouth,
Newcastle-upon-Tyne NE30 4JR, UK.

E-mail: mdkernohan@ukgateway.net

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