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False positive MRI in the diagnosis of small intracanalicular vestibular schwannomas

MARTIN J. DONNELLY, F.R.C.S.I.*, ANNE D. CASS, F.R.A.C.S.†, LAURIE RYAN, F.R.A.C.S.†

Abstract

The current gold standard for diagnosing vestibular schwannomas is MRI with gadolinium-DTPA enhancement. This imaging modality is particularly useful in the detection of small intracanalicular tumours which can be missed by CT scanning. We present a case where MRI with enhancement suggested the presence of a 4 mm intracanalicular vestibular schwannoma. Surgical exploration of the internal auditory canal via a retrosigmoid approach, revealed no tumour, but inflammatory arachnoid matter around the vestibular nerve was found. A review of the audiological test results uncovered some results which did not correlate with the interpretation of the MRI scan. We would therefore caution against immediate surgical intervention in patients where the diagnosis of a small intracanalicular vestibular schwannoma is not totally supported by the audiological findings. In such cases rescanning with gadolinium enhancement after a suitable interval is recommended.

Key words: Magnetic resonance imaging; Vestibular schwannoma

Introduction

The diagnosis of a vestibular schwannoma, particularly for small tumours, usually begins with a patient complaining of unilateral ear symptoms. Previously an extensive battery of audiological tests were used to identify retrocochlear pathology (Windle-Taylor *et al.*, 1984). As more sophisticated technology became available many of these tests became redundant. One of the most useful audiological tests now available to detect lesions of the vestibulocochlear nerve is the auditory brain stem response (ABR). The abnormalities suggesting the presence of a vestibular schwannoma are well described (Brackmann and Kwartler, 1990). When such abnormalities are detected the patient is referred for imaging of the internal auditory canal. Magnetic resonance imaging (MRI) is considered the imaging modality of choice, particularly for intracanalicular lesions (Haughton *et al.*, 1988; Runge *et al.*, 1988; Wilms *et al.*, 1989). When used with a paramagnetic contrast agent such as gadolinium-DTPA (Gd-DTPA) this technique has a reported sensitivity of 100 per cent (Curati *et al.*, 1986; Vogl *et al.*, 1986; Mikhael *et al.*, 1987). We present a case in which the use of MRI with Gd-DTPA identified a lesion in the internal auditory canal which was interpreted as a small intracanalicular vestibular schwannoma, but when surgically explored only revealed an apparent localized inflammation of the arachnoid matter covering the vestibular nerve.

Case report

A 53-year-old woman presented to the ENT department with a six-month history of left-sided whistling tinnitus. She did not report hearing loss or dysequilibrium. No abnormalities were found on examination of the ear, nose or throat. Pure tone audiometry revealed a mild high tone sensorineural hearing loss bilaterally, with speech discrimination scores of over 90 per cent, and her acoustic reflexes were normal. ABR testing demonstrated a prolonged wave I to wave V interval of 0.45 ms. In view of these findings a CT scan of the internal auditory meati was performed, however, no abnormality was detected. Air cisternography was then performed to rule out a small intracanalicular lesion, but again no abnormality was detected. The patient was followed-up clinically and audiologically regularly for three years with no change in her status. She then developed mild dysequilibrium and nausea. The hearing threshold was found to have deteriorated in the left ear and the speech discrimination scores in this ear had dropped to 60 per cent, but the acoustic reflexes remained normal. The ABR had a poor waveform pattern and the wave I–V latency was now 1.1 ms. A high resolution CT scan of the internal auditory meati was normal. MRI scanning with Gd-DTPA enhancement revealed a 4 mm enhancing lesion at the distal end of the left internal auditory meatus which was considered to be a small vestibular schwannoma (Figures 1 and 2).

Shortly before surgery repeat audiological testing demonstrated that while the thresholds remained unchanged, the speech discrimination score in the left ear had improved to 70 per cent.

Surgical exploration via a retrosigmoid approach was carried out. The cerebellum was retracted and the vestibulocochlear and facial nerves identified. A 7 mm drill out of the internal auditory canal was carried out to expose the lateral end of the canal. Despite a meticulous search of this area, no tumour was found. The only abnormality identified was inflamed arachnoid matter surrounding the vestibular nerve for a distance of 4–5 mm. Although the underlying nerve appeared normal a small biopsy was taken. Histopathological analysis of this revealed normal neural tissue. Post-operatively the patient made an uneventful recovery, the hearing threshold in the left ear had deteriorated only 5–10 db from the pre-operative level, and facial function was normal.

Discussion

The most sensitive imaging technique for the detection of a vestibular schwannoma is MRI (Haughton *et al.*, 1988; Runge *et*

From the Department of Otolaryngology, University of Melbourne*, and The Royal Victorian Eye and Ear Hospital†, Melbourne, Australia.
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FIG. 1

Axial T_1-weighted image post-gadolinium showing area of enhancement in the fundus of the internal auditory canal (white arrow).

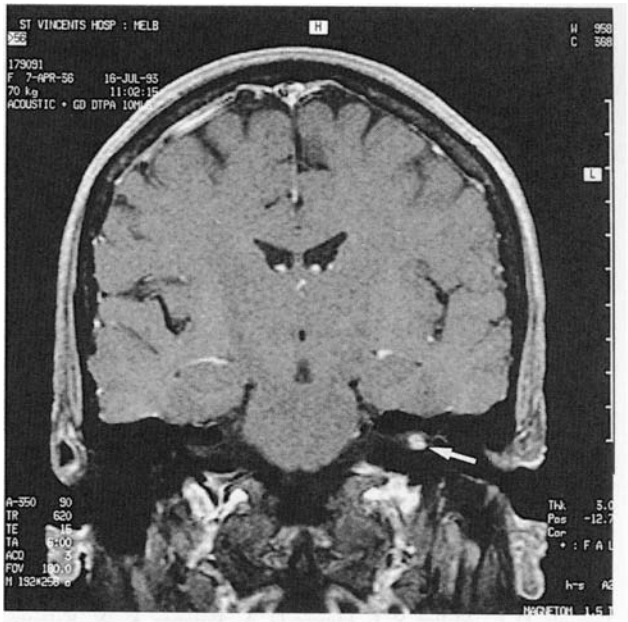

FIG. 2

Coronal post-gadolinium image showing area of enhancement in the lateral end of the internal auditory meatus (white arrow). This was identified as an intracanalicular vestibular schwannoma, but at surgery no tumour was found.

al., 1988). Most tumours can be seen on the non-enhanced T_1-weighted image but are better defined after Gd-DTPA enhancement (Daniels *et al.*, 1987; Enzmann and O'Donohue, 1987; Stack *et al.*, 1988; Jackler *et al.*, 1990). However, this technology is not yet routinely available and high resolution CT scanning with enhancement is often the modality of first choice. Tumours larger than 1 cm are routinely detectable on a modern CT scan, but small intracanalicular tumours however, present a problem for diagnosis with CT scanning (Wilms *et al.*, 1989; Shaffer, 1991). To demonstrate tumours of these dimensions air cisternography in conjunction with CT scanning has been used successfully (Bird *et al.*, 1985). This procedure has some morbidity and has been largely superseded by MRI with Gd-DTPA enhancement (Haughton *et al.*, 1988).

Until recently it had been felt that MRI was 100 per cent sensitive for the diagnosis of vestibular schwannomas (Curati *et al.*, 1986; Vogl *et al.*, 1986; Wilms *et al.*, 1989). Haberman and Kramer (1989) reported a false positive MRI diagnosis of a vestibular schwannoma but they had not used gadolinium enhancement. The surgical findings were a vascular loop compressing the VIIIth cranial nerve. In another report two cases of false positive MRI diagnoses of intracanalicular acoustic neuromas were presented (von Glass *et al.*, 1991). At surgery arachnoiditis was found in the fundus of the internal auditory canal in both cases. This is similar to the findings in our case. Additional inflammatory lesions of the nerves in the internal auditory canal which can be confused with a vestibular schwannoma include the Ramsay Hunt syndrome (Anderson and Laskoff, 1990), although this produces a different clinical picture. Similar enhancement of neural tissue within the temporal bone has been noted in the facial nerve canal in Bell's palsy (Millen *et al.*, 1987; Tien *et al.*, 1990), and in the labyrinth in 'viral labyrinthitis' (Seltzer and Mark, 1991). It must be assumed therefore that the inflammatory lesion accumulates Gd-DTPA producing an image similar to an acoustic neuroma.

This raises the dilemma of the necessity of exploring all patients with a gadolinium enhanced MRI scan suggesting a small intracanalicular vestibular schwannoma. Under such circumstances it is important to review carefully the clinical and audiological test results. In this case the patient had an asymmetrical hearing loss associated with tinnitus and vestibular symptoms. Speech discrimination and ABR testing showed progressive deterioration initially. However, the speech discrimination score was showing some improvement just before surgery. This may have been an indicator of a degree of resolution in an inflammatory condition. Also the acoustic reflexes remained normal and this too perhaps should have raised a doubt about the diagnosis. Abnormal acoustic reflexes have a 97 per cent specificity in the diagnosis of acoustic tumours (Hirsch and Anderson, 1980), therefore normal reflexes should indicate a very low probability of a tumour being present. Von Glass *et al.*, (1991) have recommended that when there is some doubt despite an apparently positive MRI diagnosis of a vestibular schwannoma, confirmation should be sought using CT air cisternography. However, the latter technique is also associated with false positive results (Robertson *et al.*, 1983; Barrs and Vedder, 1986; Larsson and Holtas, 1986). We propose that rather than subject the patient to an uncomfortable procedure, that follow-up with repeat GdMRI scanning should be carried out at least on a yearly basis. There is evidence to suggest that with inflammatory lesions the enhancement decreases, although more slowly than the clinical resolution (Millen *et al.*, 1987). Obviously if an acoustic neuroma is present the area of enhancement will persist and probably enlarge as the average growth rate is 2 mm or less per year (Wazen *et al.*, 1985; Gardner *et al.*, 1986). In addition recently developed MRI techniques such as the three dimensional Fourier-transformation (3DFT) sequence–'constructive interference in steady-state' (CISS) can provide much information about the cochlea and internal auditory meatus which may aid in the differential diagnosis of small vestibular schwannomas (Casselman *et al.*, 1993). When used in conjunction with gadolinium enhanced T_1-weighted images false positive scans should be less likely.

As MRI techniques improve and more scanners become available, MRI may become used as a screening procedure for all patients suspected of having a vestibular schwannoma. Although GdMRI is undoubtedly the best method for detecting vestibular schwannomas, as this case illustrates even this technique is not 100 per cent reliable, particularly for small intracanalicular lesions. We believe that baseline audiological screening tests still have a place and that the clinician must review all the information critically and not dismiss as unimportant anomalous test

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results which do not support the radiological diagnosis. If doubts about the diagnosis of a small intracanalicular lesion are raised repeat GdMRI with the addition of a 3DFT sequence are recommended to reduce the risk of a negative exploration.

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Address for correspondence:
Mr Martin J. Donnelly,
University of Melbourne,
Department of Otolaryngology,
The Royal Victorian Eye and Ear Hospital,
32 Gisborne Street,
East Melbourne,
Victoria 3002,
Australia.

Fax: 61–3–6631958.