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ORIGINAL ARTICLE

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**Magnetic resonance imaging for acoustic neuromas**

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**OBJECTIVE:** The aim of this retrospective study was to evaluate the use of magnetic resonance imaging (MRI) of the internal auditory meatus (IAM) in identifying acoustic neuromas.

**MATERIALS AND METHODS:** Retrospective case review involving 335 patients who presented to the Department of Otolaryngology in Leighton Hospital, United Kingdom for the treatment of various otologic symptoms.

**RESULTS:** In 3 of the 335 patients evaluated, an MRI scan revealed an acoustic neuroma in the cerebellopontine (CP) angle. MRI scans of 326 patients did not show a pathologic condition in the CP angle. Six patients did not undergo MRI because of various contraindications, 2 patients presented with both a progressive asymmetrical sensorineural hearing loss of > 15 dB and tinnitus, and 1 patient presented with a unilateral hearing loss, tinnitus, and vertigo (all of which were sudden in onset). None of the patients with NIHL (10 dB at 4 kHz) or with vertigo alone had a pathologic condition of the CP angle. Most of study subjects had been exposed to loud noise in the past.

**CONCLUSIONS:** Magnetic resonance imaging of the internal auditory meatus should be considered for patients in whom clinical examination does not reveal the cause of a unilateral or asymmetrical hearing loss of > 15 dB and concomitant tinnitus. We found that hearing loss was more significant if it was progressive or of sudden onset. Patients with noise-induced hearing loss (10 dB at 4 kHz), vertigo without hearing loss (a disorder unlikely to result from an acoustic neuroma), or asymmetrical hearing loss due to Eustachian tube dysfunction were unlikely to have an acoustic neuroma and therefore did not require magnetic resonance imaging. Evaluation with pure tone audiometry should always be considered before magnetic resonance imaging of the internal auditory meatus is performed. The results of magnetic resonance imaging should be compared with those of previous pure tone audiometric studies, and any change in frequency thresholds should be noted. This approach prevents the unnecessary imaging of healthy patients and decreases both the radiology staff workload and the cost of patient care.

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## INTRODUCTION

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The most effective protocol for identifying acoustic neuromas has been debated for decades. A magnetic resonance imaging (MRI) scan of the internal auditory meatus (IAM) is accepted as the gold standard for the diagnosis of that tumor.<sup>1</sup> Our goal was to identify the types of patients with a suspected acoustic neuroma in whom MRI would be most effective so that the workload of the radiology department staff and the cost of patient care could be managed most effectively

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## MATERIALS AND METHODS

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In this retrospective case review, we studied 335 patients (154 men and 181 women) who presented to the Department of Otolaryngology in Leighton Hospital, United Kingdom for the treatment of various otologic symptoms including hearing loss, tinnitus and vertigo. Patients who presented with concomitant sensorineural hearing loss, tinnitus, and vertigo were included in the study, regardless of their age. Individuals who presented with earache or ear discharge were not included. One hundred seventy-two of the study subjects had been referred directly to the consultants, and the remaining 163 patients had been referred to junior physicians in the Department of Otolaryngology. A proforma was used to collect the data. All subjects were evaluated with pure tone audiometry and MRI of the IAM. The analysis of the data was tabulated as shown in Table 1 & 2 and results were drawn.

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## RESULTS

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In 3 of the 335 patients evaluated, an MRI scan revealed an acoustic neuroma in the cerebellopontine (CP) angle. MRI scans of 326 patients did not show a pathologic condition in the CP angle. Six patients did not undergo

MRI because of various contraindications, 2 patients presented with both a progressive asymmetrical sensorineural hearing loss of > 15 dB (decibels) and tinnitus, and 1 patient presented with a unilateral hearing loss, tinnitus, and vertigo (all of which were sudden in onset). None of the patients with Noise Induced Hearing Loss (NIHL) of 10 dB at 4 kHz or with vertigo alone had a pathologic condition of the CP angle. Most of study subjects had been exposed to persistent loud noise in the past.

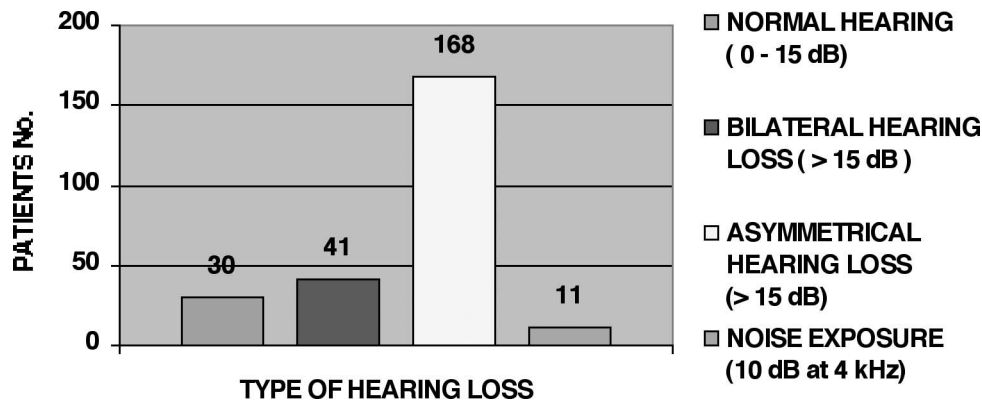
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## DISCUSSION

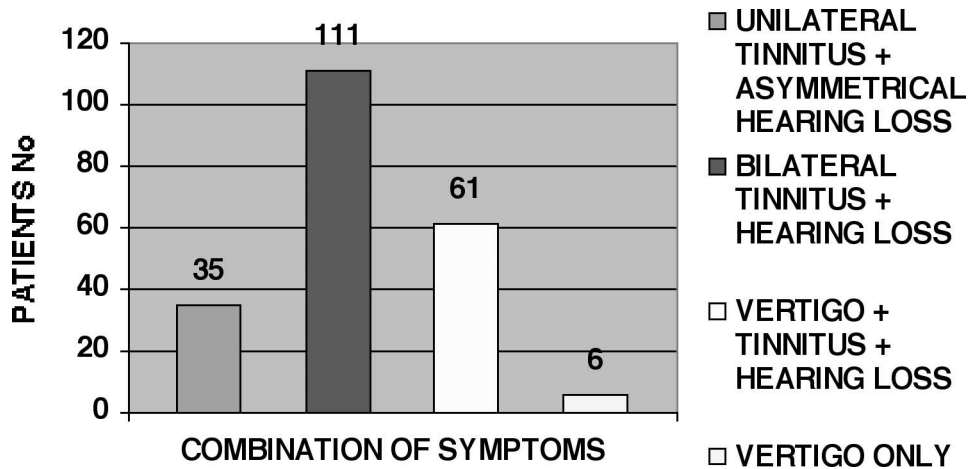
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Acoustic neuromas account for approximately 6% of all intracranial neuromas and for 80% of tumors found in the CP angle. Acoustic neuromas are most often unilateral but can develop bilaterally in patients with neurofibromatosis type II, which is an autosomal recessive disorder caused by the functional inactivation of both copies of the NF2 gene on chromosome 22.<sup>2</sup> The diagnostic modalities for acoustic neuromas include pure tone audiometry, speech discrimination testing, and MRI (with or without contrast) of the IAM. Pure tone audiometry is the baseline investigation for all patients with hearing loss. Contrast-enhanced T1-weighted MRI of the IAM is accepted as the gold standard for the diagnosis of acoustic neuroma.<sup>1</sup>

Thirty of the study subjects had no hearing loss (i.e. they had a hearing loss of < 20 dB in 1 or both ears), 41 patients had a bilateral hearing loss of > 15 dB, and 168 patients had an asymmetrical hearing loss of > 15 dB (Table 1). A noise-induced hearing loss of < 10 dB at 4 kHz was noted in 11 patients (Table 1). An analysis of the various combinations of symptoms showed that 111 patients had a bilateral hearing loss of > 15 dB with tinnitus; 35 patients had unilateral tinnitus with an asymmetrical hearing loss of > 15 dB; 61 patients had vertigo, tinnitus, and hearing loss of > 15 dB; and 6 patients had vertigo alone.



**Table 1:** Types of hearing loss in the study subjects.



**Table 2:** Symptoms in the study subjects.

### CONCLUSION

MRI of the IAM should be considered in patients with a unilateral or asymmetrical hearing loss of > 15 dB and tinnitus and in whom the results of clinical examination have ruled out another cause. Hearing loss is more significant if it is progressive or of sudden onset. Patients with any of the following conditions are unlikely to have an acoustic neuroma and therefore do not require MRI: Those with a noise-induced hearing loss (10 dB at 4 kHz), patients with vertigo and no hearing loss (in such individuals, a diagnosis of labyrinthitis, benign paroxysmal positional vertigo, or Meniere's disease should be considered first), and those with an asymmetrical hearing loss due to Eustachian tube dysfunction. A pure tone audiometric evaluation should always be performed before MRI is used to scan

the IAM. The results of pure tone audiometry should be compared with all available previous pure tone audiometric evaluations, and any change in the frequency thresholds should be noted. This approach prevents the unnecessary imaging of healthy patients and decreases the workload of the radiology department staff as well as the cost of patient care.

### REFERENCES

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