ORIGINAL ARTICLE

DIAGNOSTIC ACCURACY OF MAGNETIC RESONANCE IMAGING IN DETECTION OF ACOUSTIC NEUROMA

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ABSTRACT

Introduction: Acoustic neuroma is the most frequent benign tumour at cerebellopontine angle. It accounts for 8 – 10% of all primary intracranial tumours and 80% of Cerebellopontine angle tumours.[2] Meningioma constitutes 5 – 10% of Cerebellopontine angle tumors, with rare tumours constituting only a small percentage out of which epidermoid cyst is the most frequent. This study was performed to determine the diagnostic accuracy of magnetic resonance imaging in the detection of acoustic neuroma that is taking histopathology a gold standard. It is a cross sectional study conducted in the Department of Diagnostic Radiology, Lahore General Hospital, Lahore from 14-07-2012 to 14-07-2013.

Patients and Methods: The study comprised of 55 patients with clinical suspicion of acoustic neuroma. Magnetic resonance imaging on a 1.5-T Philips whole body magnetic resonance system was performed. The cases were operated and histopathological results were recorded. The results of magnetic resonance imaging and histopathology were compared taking histopathology as gold standard.

Results: Out of 55 patients, 43 patients (78.2%) had acoustic neuroma on magnetic resonance imaging. After comparison of results of magnetic resonance imaging with histopathology, the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of magnetic resonance imaging were 97.7%, 91.7%, 97.7%, 91.7% and 96.4% respectively.

Conclusion: Magnetic resonance imaging is a highly accurate, non-invasive, safe and convenient imaging modality for the evaluation of acoustic neuroma and is valuable for guiding surgical biopsies thereby decreasing unnecessary intervention. It allows detection of small tumors which is very useful in tumor characterization and plays an integral role in early detection, planning management and estimating patient's prognosis.

Key words: Acoustic neuroma, Magnetic resonance imaging, Cerebellopontine angle.

INTRODUCTION

Acoustic neuroma is the most frequent benign tumour at cerebellopontine angle.[1] It accounts for 8 – 10% of all primary intracranial tumours and 80% of Cerebellopontine angle tumours.[2] Meningioma constitutes 5 – 10% of Cerebellopontine angle tumours, with rare tumours constituting only a small percentage out of which epidermoid cyst is the most frequent.[3] Acoustic neuroma is a benign tumor arising from Schwann cells.[4] It is usually diagnosed in adults with mean age ranging from 46 – 58 years, with clinical incidence of 10 – 15%/ million / year.[5] The tumor is generally composed of Antoni A and B types of tissues histologically.[2] Type A tissue is highly cellular with little extra cellular matrix while type B tissues are less cellular with more loosely arranged cells. These histological types may influence the imaging characteristics.[6]

Patients with acoustic neuroma can present with a wide range of symptoms, such as tinnitus, progressive hearing loss, sudden hearing loss, fluctuating deafness, and dizziness. It is detected in 41% of patients presenting with hearing loss.[7]

Diagnosis of acoustic neuroma has been simplified considerably by computed tomography and magnetic resonance imaging.[8] However magnetic resonance imaging is the modality of choice for preoperative workup of cerebellopontine angle tumors as it is reliable, non-invasive and easily available and allows precise localization and characterization of these tumors because of its multiplanar and multi-parameter capabilities.[9,10] Magnetic resonance imaging is more sensitive than computed tomography for internal auditory canal. Currently, a gadolinium enhanced magnetic resonance imaging scan is considered an accurate indicator

of whether or not an individual has an acoustic neuroma.[8]

Magnetic resonance imaging has a sensitivity of 94% to 100% and specificity 94% to 98% for detection of acoustic neuroma.[11]

The rationale of performing this study is to assess the diagnostic accuracy of magnetic resonance imaging for acoustic neuroma so as to consider it as a valuable, non-invasive, safe and convenient imaging modality

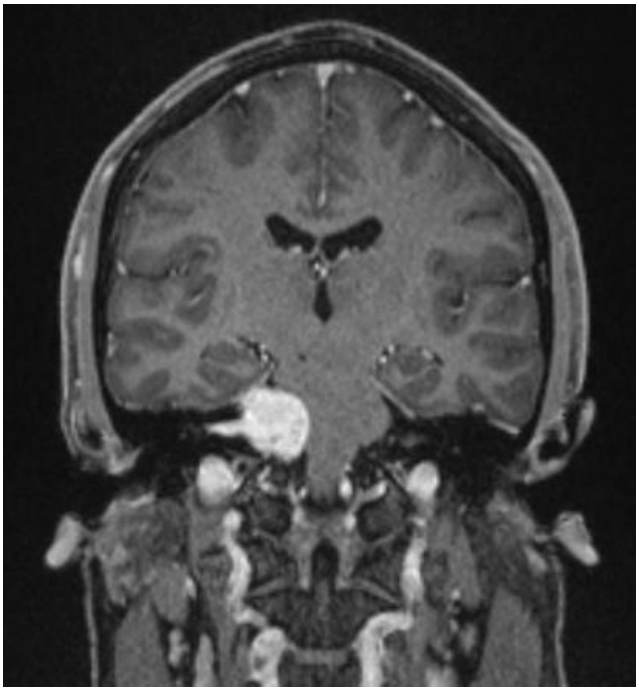

Fig. 1: *Coronal Gadolinium enhanced MR image shows a rounded enhancing Acoustic neuroma in right CP angle extending into right internal acoustic meatus.*

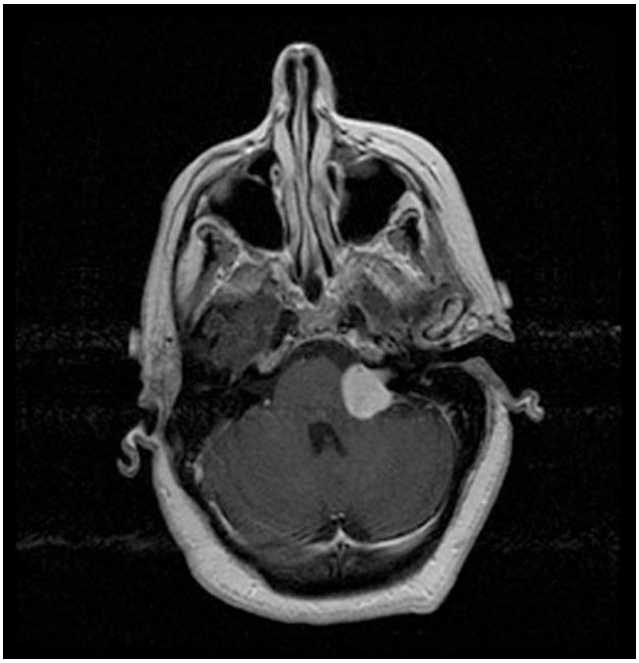

Fig. 2: *Axial Gadolinium enhanced MR image shows an enhancing Acoustic neuroma in left CP angle extending into left internal acoustic meatus.*

for early detection of acoustic neuroma in our setting and obviate the role of biopsy.

METHODOLOGY

This cross – sectional study was performed in Department of Diagnostic Radiology, Lahore General Hospital, Lahore from 14 – 07 – 2012 to 14 – 07 – 2013 on a patient sample of 55 with a 10% margin of error, 95% confidence level, taking sensitivity and specificity of magnetic resonance imaging 94% and 98% respectively and percentage of acoustic neuroma 41%.

All patients presenting with clinical suspicion of acoustic neuroma referred by neurosurgeons from outdoor of Lahore General Hospital, Lahore meeting the inclusion criteria were taken. Patients with residual, recurrent or metastatic acoustic neuroma were excluded from the study to avoid confounding variables. Informed consent for magnetic resonance imaging and histopathology from all the patients included in the study was taken. All the patients were recorded for their demographic features i.e. age, gender and address. Magnetic resonance imaging on a 1.5-T Philips whole body MR system using standard imaging coil was then be carried out. T_2 – weighted and both unenhanced and contrast – enhanced T_1 – weighted images in the axial, sagittal and coronal projections were obtained. Magnetic resonance imaging diagnosis i.e. presence or absence of acoustic neuroma was recorded made by the same observer. The cases were operated and histopathological results were recorded. The results of magnetic resonance imaging and histopathology were compared taking histopathology as gold standard. All this information was collected through a specially designed proforma.

All the data was analyzed with SPSS version 10.

RESULTS

This study was conducted on 55 patients with clinical suspicion of acoustic neuroma amongst which 20 patients (36.4%) were males and 35 patients (63.6%) were females. The age of patients ranged from 10 to 70 years with mean age 51.9 ± 10.5 years. The highest number of patients were aged between 51 – 60 years i.e. 25 (45.5%). Thirteen patients (23.6%) were aged between 41 – 50 years. Out of 55 patients, 43 patients (78.2%) had acoustic neuroma on magnetic resonance imaging while 12 patients (21.8%) had no acoustic neuroma on magnetic resonance imaging. Out of 55 patients, 43 patients (78.2%) had acoustic neuroma on histopathology while 12 patients (21.8%) had no acoustic neuroma on histopathology. Out of the 55 patients, 43 patients (78.2%) had acoustic neuroma, 07 patients (12.7%) had meningioma, 03 patients (5.5%) had epidermoid cyst, 01 patient (1.8%) had arachnoid cyst and 01 patient (1.8%) had abscess on magnetic resonance imaging. Out of the 55 patients, 43 patients (78.2%) had acoustic neuroma; 08 patients (14.5%) had meningioma; 02 patients (3.6%) had epidermoid cyst; 01 patient (1.8%) had arachnoid cyst and 01 patient (1.8%) had abscess on histopathology. Comparison of results of magnetic resonance imaging with histopathology is shown in table below. The sensitivity of magnetic resonance imaging was 97.7%, specificity 91.7%, diagnostic accuracy 96.4%, positive predictive value 97.7% and negative predictive value 91.7%.

Table 1: *Comparison of MRI and Histopathology n = 55.*

MRI	*Histopathology (Gold Standard)*		*Total*
	Positive	*Negative*	
Positive	42 (TP)	01 (FP)	43
Negative	01 (FN)	11 (TN)	12
Total	43	12	55

DISCUSSION

Magnetic resonance imaging is a non-invasive and safe imaging modality and in current clinical practice magnetic resonance imaging is the first – line investigation for the identification of suspected acoustic neuroma in appropriately selected patients.[12,13] At present the definitive examination is a gadolinium enhanced magnetic resonance scan. This can detect lesions of 2 mm in diameter and probably smaller.[14] The magnetic resonance imaging findings of the acoustic neuroma are well known and specific,[15-16] but unusual features may also be encountered.[17] Acoustic neuromas are isointense relative to the pons on magnetic resonance T_1 – weighted images, mildly hyperintense on magnetic resonance T_2 – weighted images, and enhance intensely after i.v. administration of gadolinium – DTPA. Meningiomas demonstrate homogeneous gadolinium – DTPA enhancement. Epidermoid cysts do not enhance on magnetic resonance imaging.[18]

Acoustic neuromas are benign, slow – growing tumours that originate from schwann cells lining the vestibular nerves, most commonly the superior vestibular nerve[19] constituting the most common tumour of the cerebellopontine angle and the posterior fossa in adults, but one in five cerebellopontine angle tumours are not acoustic neuroma. These tumours may require different management strategies.[20,21] Early diagnosis is the most important factor in the preservation of hearing after surgery; furthermore it decreases the rate of surgical complications.[22,23] In this study, out of the 55 patients with clinical suspicion of acoustic neuroma, 43 patients (78.2%) had acoustic neuroma and 12 patients (21.8%) had other cerebellopontine angle lesions. This is in agreement to literature findings which state that acoustic neuromas account for about 70 – 80% of cerebellopontine angle tumours.[2,24] Out of 12 non-aco-

ustic lesions, meningiomas and epidermoid cyst were 12.7% and 5.4% respectively which is again an agreement to previous study which stated that meningioma and epidermoid cysts are second and third most common cerebellopontine angle lesions constituting 10 – 15% and 5% of cerebellopontine angle tumours.[24]

In this study age range of the patients is 10 – 70 which lies close to the literature in which age range was 26 – 80 years.[25] Similarly mean age of the patients in this study is 51.9 ± 10.5 years which is close to the mean age documented in literature i.e 56.5 years.[26] The highest number of patients was aged between 51 – 60 years i.e. 25 (45.5%). This is in accordance to literature stating majority of the acoustic neuromas appear after 50 years of life[27]. In this study, out of 55 patients 35 (63.6.0%) were females and 20 (36.4%) were males. This is also in accordance with the literature, which states that the acoustic neuroma is commoner in females with female to male ratio 3:2.[28]

Most of the acoustic neuromas in this study were better visualized after contrast enhancement. This fact is supported by a study which states that contrast enhanced T_1 – W MR image enhances the capacity to visualize the tumour margins and its intrameatal component.[29]

In the present study, on comparison of results of magnetic resonance imaging with histopathology taken as gold standard, out of 55 patients, 42 patients were true positive, 11 patients were true negative, while 1 patient was false positive and 1 patient was false negative. The overall sensitivity of magnetic resonance imaging was 97.7%, specificity 91.7% and diagnostic accuracy 96.4% while the positive predictive value of magnetic resonance imaging was 97.7% and its negative predictive value was 91.7%. These results are close to results of another study in which magnetic resonance imaging was reported to have a sensitivity of 96%, specificity of 88.2%, diagnostic accuracy of 92.86, Positive predictive value 92.31 and Negative predictive value of 93.75.[28] Results of the present study are also supported by other studies.[11,30,31] This shows that the sensitivity, specificity and diagnostic accuracy of magnetic resonance imaging is high to allow reliable diagnosis of acoustic neuroma, therefore, it is doubtlessly the best imaging modality for detection of acoustic neuromas.

It is ***concluded*** that Magnetic resonance imaging is a highly accurate, non-invasive, safe and convenient imaging modality for the evaluation of acoustic neuromas and is valuable for guiding surgical biopsies thereby decreasing unnecessary intervention. It allows detection of small tumours which is very useful in tumour characterization and plays an integral role in early detection, planning management and estimating patient's prognosis.

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