

# Is MRI a Suitable Option in Diagnosing Acoustic Neuroma? A Comparative Analysis with Histopathology

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## ABSTRACT

**Background:** Acoustic neuroma also known as vestibular schwannoma is the most common benign tumor of the cerebellopontine angle and makes up eight to ten percent of the primary intracranial tumors. Magnetic Resonance Imaging or MRI is diagnostic imaging method of choice for acoustic neuromas. It allows adequate visualization and characterization of the tumor helping the neurosurgeons in determining the boundaries and location of the tumor. **Objective:** To evaluate the accuracy of MRI in the diagnosis of acoustic neuroma, at a tertiary care hospital in Karachi Pakistan. **Study Design:** Prospective case series. **Settings:** Abbasi Shaheed Hospital and Civil Hospital, Karachi Pakistan. **Duration:** 03 years starting from January 2019 to December 2021. **Methods:** Included patients had a suspicion of acoustic neuroma as referred to the Department of Radiology. Exclusion criterion was patients who have had a metastatic, residual or recurring acoustic neuroma, or those patients whose data was incomplete. Various demographic variables, history, clinical examination and radiographic data was recorded in a proforma. The same MRI machine was used for all the patients. The cases included in the study underwent a surgical removal of the tumor with histopathologic examination. **Results:** The final study population in our case series is n= 45 patients. The mean age of the patients was 51.9 +/- 10.5 years. N= 20 patients were male and rest were female. We accurately diagnosed all the cases on MRI and they were confirmed on histopathology as well. The total number of cases in our study population were n= 35 (77.77%), the rest of the patients either had meningioma, arachnoid cyst, abscess or epidermoid tumors. The specificity of the MRI diagnosis was 91.7% and the sensitivity was found to be 97.7%. The positive predictive value and negative predictive values were 97.6% and 91.8% while the overall accuracy was found to be 96.5%. **Conclusion:** MRI is a safe, convenient, and accurate instrument for the diagnosis and evaluation of acoustic neuromas and is useful for the mitigation of unnecessary interventions in this population.

**Keywords:** Acoustic Neuroma, Cerebellopontine angle, cerebral tumors, Magnetic resonance imaging.

## INTRODUCTION

Acoustic neuroma also known as vestibular schwannoma is the most common benign tumor of the cerebellopontine angle and makes up eight to ten percent of the primary intracranial tumors. Other common tumors are meningiomas and rare epidermoid tumors.<sup>1,2,3</sup> Acoustic neuroma arises from Schwann cells, and adults between the ages of 45 to 58 years show an increased incidence of this benign tumor.<sup>4,5</sup> Acoustic

neuroma is made up of two types of histologically different cells the Antoni types A and B. Antoni type A tissue due to its histologic properties appears dark on the T2 weighted magnetic resonance imagery and the Antoni type B cells appear brighter. The characteristic look of acoustic neuroma on imaging is due to the presence of these two types of cells.<sup>6</sup> Various symptoms have been reported in literature of acoustic neuromas including tinnitus and deafness, vertigo, incremental hearing loss, loss of balance and facial numbness or rarely involvement

on the facial muscles.<sup>7</sup> Magnetic Resonance Imaging or MRI is diagnostic imaging method of choice for acoustic neuromas. It allows adequate visualization and characterization of the tumor helping the neurosurgeons in determining the boundaries and location of the tumor.<sup>8,9,10</sup> According to the trends in the literature MRI is considered superior to the computer tomography (CT) scan technique in the visualization and evaluation of the internal auditory apparatus and is considered to be more sensitive. Currently, the contrast enhanced magnetic resonance (CEMR) based on the gadolinium contrast medium is considered to be the most accurate and reliable for the diagnosis of acoustic neuroma in patients, achieving a sensitivity between 94 to a 100% and a specificity of between 94 and 98% respectively.<sup>8,11</sup>

The aim of this current study is to evaluate the accuracy of MRI in the diagnosis of acoustic neuroma, in a tertiary care hospital in Karachi Pakistan. The MRI imaging technique provides a noninvasive, convenient and safe method of diagnosis compared to biopsy.

## METHODS

The type of study is a prospective case series, that was undertaken for a period of 2-year duration from the beginning of April 2017 to end of April 2019. The study was approved by the hospital's ethics committee. All the included patients had signed an informed consent to participate in the study, had a suspicion of acoustic neuroma as referred to the Department of Radiology from the Department of Neurosurgery were included in the study. Exclusion criterion was patients who have had a metastatic, residual or recurring acoustic neuroma, or those patients whose data was incomplete. Various demographic variables, as well as history and clinical examination and radiographic data was recorded in a proforma. The same MRI machine was used for all the patients and both contrast enhanced T1 images and T2 images were obtained for all patients in various planes such as coronal, sagittal and axial planes. All the cases included in the study underwent a surgical removal of the tumor and histopathologic examination was done. Mean and standard deviation was used for quantitative variables and frequencies and percentages was analyzed for qualitative variables. All the data was analyzed using IBM SPSS version 23.0 for windows.

## RESULTS

The final study population in our case series is n=45 patients. The mean age of the patients was  $51.9 \pm 10.5$  years, the age range was 60 years with a minimum value being 10 years and the maximum value being 70 years respectively. N=20 patients (44.44%) were in the 51 to 60 years age group. N=20 patients were male and n=25 patients were female, the rest of the demographic

variables are given in table 1. We accurately diagnosed all the cases on MRI and they were confirmed on histopathology as well. The total number of cases in our study population were n= 35 (77.77%), the rest of the patients either had meningioma, arachnoid cyst, abscess or epidermoid tumors, see table 1. In the MRI diagnosis group we had one patient who was tested as false positive and one patients who was tested as false negative. The specificity of the MRI diagnosis was 91.7% and the sensitivity was found to be 97.7%. The positive predictive value and negative predictive values were 97.6% and 91.8% while the overall accuracy was found to be 96.5%.

**Table 1: Demographic and other variables for patients with acoustic neuroma**

	Variable	Frequency	Percentage
<b>Gender</b>	Male	20	44.44%
	Female	25	66.66%
<b>Acoustic Neuroma on MRI</b>	Yes	35	77.77%
	No	10	33.33%
<b>Acoustic Neuroma on histopathology</b>	Yes	35	77.77%
	No	10	33.33%
<b>All MRI diagnoses made</b>	Acoustic Neuroma	35	77.77%
	Meningioma	7	15.55%
	Epidermoid	1	2.22%
	Abscess	1	2.22%
	Arachnoid cyst	1	2.22%
<b>All histopathology cases</b>	Acoustic Neuroma	35	77.77%
	Meningioma	6	13.33%
	Epidermoid	2	4.44%
	Abscess	1	2.22%
	Arachnoid cyst	1	2.22%

## DISCUSSION

Magnetic resonance imaging is considered as the first line imaging method for patients who are suspected cases of acoustic neuroma.<sup>12,13</sup> With the addition of a contrast medium, tumors as small as 2mm in size can be easily visualized.<sup>14,15,16</sup> The characteristic hyperintense appearance of the acoustic neuroma on T2 weighted images and isointense appearance on T1 weighted images. Meningiomas also exhibit gadolinium enhancement while epidermoid tumors do not show enhancement.<sup>17,18</sup> Different tumors require different management protocols and acoustic neuroma is the same.<sup>20,21</sup> In order to safeguard the patients hearing early treatment is necessary, which also reduces the post-operative complications to of the patient.<sup>22,23</sup> In our study 77.77% if the patients had acoustic neuroma while the rest had other pathologies, which is according to the literature cited which reports a total prevalence of acoustic neuroma as 70 to 80% of all the tumors of the cerebellopontine angle.<sup>2,24,25</sup> The meningiomas (10 to 15%) and epidermoid tumors (5%) are the second and third most common tumors of this area, which was also observed in our study.<sup>24,25</sup> The age range and mean ages of the patients in our study was also similar to other

studies, they have reported the mean age of the patients being 56.6 years and the patients in our study had a mean age of 51.9 years. The highest number of patients in our study were between the 51 to 60 years of age group, which is in accordance with similar studies.<sup>26,27</sup> Acoustic neuroma has a female to male ratio of 3:2 which was also observed in our study.<sup>27</sup> We observed an overall sensitivity of magnetic resonance imaging (MRI) for the diagnosis of acoustic neuroma to be 97.6% and the specificity to be 91.8% and the accuracy of the diagnostic test was 96.5%, these results are similar to a study by Haque S et al. who reported a sensitivity of MRI to be 96% the specificity to be 88.2% the accuracy being 92.86%, the positive predictive value being 92.31% and the negative predictive value being 93.75% respectively.<sup>28</sup> These results and the results of other similar studies have shows us that MRI is a reliable diagnostic modality for acoustic neuroma.<sup>29</sup>

## CONCLUSION

MRI is a safe, convenient, and accurate instrument for the diagnosis and evaluation of acoustic neuromas and is useful for the mitigation of unnecessary interventions in this population.

## LIMITATIONS

Sample size is small and limited to one setup only.

## SUGGESTIONS / RECOMMENDATIONS:

MRI is the best tool for diagnosing Acoustic Neuroma but it is recommended that the study to be conducted on more patients

## CONFLICT OF INTEREST / DISCLOSURE

None.

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