CASE REPORT

The Role of Magnetic Resonance Imaging (MRI) in Diagnostics of Acoustic Schwannoma

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ABSTRACT

Background: Acoustic neuromas are also called vestibular schwannoma, acoustic neurinoma, vestibular neuroma, and acoustic neurofibroma. These are tumors that evolve from Schwann cell sheath and can be either intracranial or extra-axial. They usually occur adjacent to the cochlear or vestibular nerve. Anatomically, acoustic neuromas tend to occupy the cerebellopontine angle. About 20% of internal carotid artery (ICA) tumors are meningiomas and may occur elsewhere in the brain. Bilateral acoustic neuromas also tend to be exclusively in individuals with type 2 neurofibromatosis. **Objective:** The aim was to asses the role of MRI in evaluation of cerebellopontine angle acoustic schwannomas, the role of the cyber knife treatment in eliminating the tumor with a maximum protection of healthy tissue. **Methods:** MRI, GE 1.5 Tesla unit and standard protocol: Pre-contrast MRI images of the temporal bones and posterior fossa were obtained using Ax 3D Fiesta T2W Hi-resolution; Ax 3D T1 Fat-Suppressed, Thin-slice (2mm) Coronal T2W, Sag 3D FiestaT2W Hi-resolution images. Post-contrast images were obtained using Ax 3D T1 Fat-Suppressed Cor 3D T1 Fat-suppressed sequences. FLAIR sequence axial). **Case report**: A woman 62 years of age, reported sudden tinnitus, dizziness, hearing loss in her left ear. After one years she began to experience vertigo, headache. **Results:** MRI of brain temporal bone with contrast show acoustic schwannoma measuring 20x9 mm on the left cerebellopontine angle extending into and enlarging the left IAC, solid enhancing component is seen the acoustic meatus and peripheral contrast cystic component in the left cerebellopontine angle, after cyber knife treatment MRI result was the solid component of the mass, filling the left internal acoustic canal shows marked post-contrast enhancement and is measured 10x5x4mm, cystic component of it filling the left cerebellopontine angle cistern is enlarged to 25x19x12mm), it extends down till the left lateral aspect of medullary cistern, abutting the CN-XII at its entrance to left hypoglossal canal. After 5 month control show, a 15mm long and 5mm thick neoplastic soft-tissue in the left internal acoustic canal, with post-contrast enhancement, measured up to 12mm at the level of porus acusticus but cystic component of the mass in left cerebellopontine angle cistern is no longer visible in this MRI exam. **Conclusion:** The sensitivity of MRI for correctly diagnosing acoustic schwannoma was 100 % and specificity was 92.86 % with a positive predictive value of 94.12 % and accuracy of 96.67 %. MRI is considered as an excellent noninvasive investigation for pontocerebral angle Schwannoma's.

Keywords: Acustica schwannoma, cerebellopontine angle, Magnetic Resonance Imaging, cyber knife treatment.

1. INTRODUCTION

Acoustic neuromas are also called vestibular schwannoma, acoustic neurinoma, vestibular neuroma, and acoustic neurofibroma. These are tumors that evolve from Schwann cell sheath and can be either intracranial or extra-axial. They usually occur adjacent to the cochlear or vestibular nerve. Anatomically, acoustic neuromas tend to occupy the cerebellopontine angle. About 20% of internal carotid artery (ICA) tumors are meningiomas and may occur elsewhere in the brain. Bilateral acoustic neuromas also tend to be exclusively in individuals with type 2 neurofibromatosis (1-3).

Acoustic **S**chwannoma (AS) accounts for 6–10% of all brain tumors and is a histopathologically benign tumor, commonly arising from the sheath of cranial nerve VIII (4). When the tumors grow, they compress cranial nerves VII, VIII, and V, as well as the brainstem, causing tinnitus, hearing loss, dizziness, vertigo, and gait instability (5). Today, viable treatment options for AS include observation, microsurgery, and radiation therapy, and the optimal indication for each individual should be determined on the basis of the size and location of the tumor, as well as the hearing level and patient age (6).

Etiology: Acoustic neuroma is allied to neurofibromatosis type 2 (defect on Chromosome 22) bilateral disease. Studies have shown that acoustic neuroma had a causative predisposition mutation. Radiation exposure may predispose a patient to the development of that condition as well (7).

Epidemiology: Approximately 8% of all intracranial tumors which manifest clinically are attributed to schwannomas. The majority of acoustic neuromas are unilateral and sporadic. Bilateral acoustic neuromas are in fact genetic and constitute a bit less than 5% of all schwannomas. Acoustic neuromas in general, tend to present between the fourth to sixth decades of life. Acoustic neuromas developing in individuals with neurofibromatosis type 2 (NF II) are likely to present earlier, with a peak incidence around the third decade of life. Although rare, acoustic schwannomas can occur in children. There is a small female preponderance with an aggravation of problems during pregnancy. Hereditary acoustic neuroma occurs in NF II much more often compared to neurofibromatosis type 1 (NF I), although the latter is much more common. Unilateral acoustic neuroma has been reported exclusively in 24% of cases with NF I, while bilateral acoustic schwannoma is a hallmark of NF II. Both these conditions are autosomal dominant. The defective genetic locus has been localized to chromosome 17 in NF I and chromosome 22 in NF II (8).

History: Due to the involvement of Cranial Nerve VIII

Auditory: a) Hearing impairment: the most common symptom, slowly progressive, high frequency retrocochlear sensorineural type. May pass unnoticed due to its insidious onset. May be examined in the physical through speech discrimination, using tuning forks of wide-range frequencies, Weber's test as well as Rinne's test; b) Tinnitus: also a common symptom, can be intermittent.

Vestibular: Instability while moving the head and nystagmus.

The diagnosis of an acoustic neuroma is made with a contrast MRI or a CT scan. Contrast is essential; otherwise, the non-enhanced scan can miss small tumors. If hearing impairment is present, audiometric tests are needed. Auditory brainstem evoked response is not used frequently to screen for acoustic tumors as it can miss small malignancies (9).

2. AIM

The aim of presentation this case report was to assess the role of MRI in evaluation of cerebellopontine angle acoustic schwannomas, the role of the cyber knife treatment in eliminating the tumor with a maximum protection of healthy tissue.

3. METHODS

In diagnostics and treatment of our case was using of MRI, GE 1.5 Tesla unit and standard protocol: Pre-contrast MRI images of the temporal bones and posterior fossa were obtained using Ax 3D Fiesta T2W Hi-resolution; Ax 3D T1 Fat-Suppressed, Thin-slice (2mm) Coronal T2W, Sag 3D FiestaT2W Hi-resolution images. Post-contrast images were obtained using Ax 3D T1 Fat-Suppressed Cor 3D T1 Fat-suppressed sequences. FLAIR sequence axial). A woman 62 years of age, reported sudden tinnitus, dizziness, hearing loss in her left ear. After one years she began to experience vertigo, headache.

4. CASE REPORT

A woman 62 years of age, reported sudden tinnitus, dizziness, hearing loss in her left ear. After 1 years she began to experience vertigo, headache. Audiometry show moderate sensorineural hearing loss in the left ear that has not been investigated.

We following with MRI with protocol MRI of brain temporal bone with contrast: MRI was carried out on GE 1.5 Tesla unit and standard protocol consisted of T1WI, T2WI, DWI and FLAIR images in axial, sagittal and coronal planes and extra sequence: Pre-contrast MRI images of the temporal bones and posterior fossa were obtained using Ax 3D FiestaT2W Hi-resolution, Ax 3D T1 Fat-Suppressed, Thin-slice (2mm) Cor T2W, Sag 3D FiestaT2W Hi-resolution images. Post-contrast images were obtained using Ax 3D T1 Fat-Suppressed and Cor 3D T1 Fat-suppressed sequences. FLAIR sequence in axial

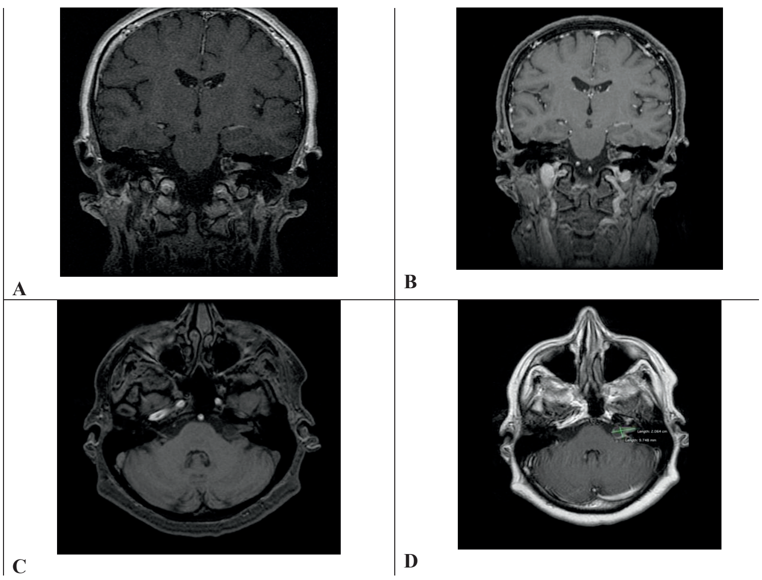

Figure 1. a, b–Coronal Plane pre and post contrast, c–transversal plane pre contrast, d–transversal plane post contrast images shows: There is a solid-cystic mass measuring 20x9 mm on the left cerebellopontine angle extending into and enlarging the left IAC, solid enhancing component is seen the acoustic meatus and peripheral contrast cystic component in the left cerebellopontine angle.

plane through brain was added.

Results of MRI investigation show acoustic schwannoma measuring 20x9 mm on the left cerebellopontine angle extending into and enlarging the left IAC, solid enhancing component is seen the acoustic meatus and peripheral contrast cystic component in the left cerebellopontine angle Figure 1 a, b, c, d. Specialist of Oncology was performed to do it cyber knife treatment for left acoustic schwannoma. After that MRI result was the solid component of the mass (acoustic schwannoma) filling the left internal acoustic canal shows marked post-contrast enhancement and is measured 10x5x4mm (stable as compared to previous MRI), cystic component of it filling the left cerebellopontine angle cistern is enlarged to 25x19x12mm (CCxAPxTR) and today it extends down till the left lateral aspect of medullary cistern, abutting the CN-XII at its entrance to left hypoglossal canal Figure 2 a, b, c, d , e, f, g, h. Their doctor preferred control after 5 month and MRI result: There is a 15mm long and 5mm thick neoplastic soft-tissue in the left internal acoustic canal, with post-contrast enhancement. Its height is measured up to 12mm at the level of porus acusticus. But Cystic component of the mass in left cerebellopontine angle cistern is no longer visible in this MRI exam. Figure 3 a, b, c, d, e.

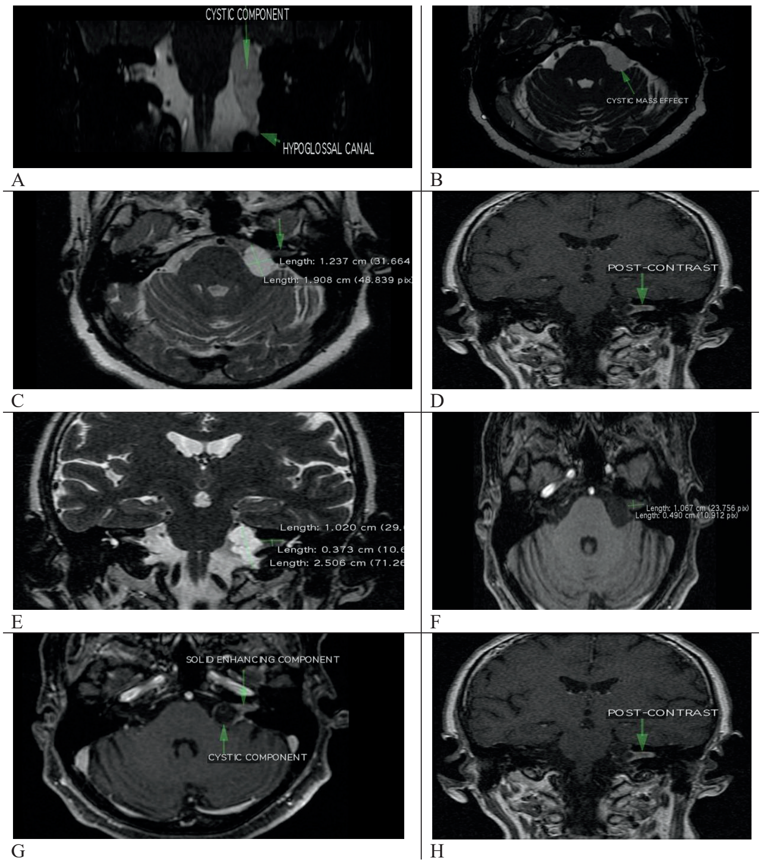

Figure 2. a–Coronal plane and b–transversal plane post contrast, c–transversal plane T2 sequence, d–coronal plane post contrast, e–coronal plane T2 sequence, f–transversal plane T1 sequence, 02 g–post contrast T1 sequenc, h–coronal plane post contrast.

The solid component of the mass (acoustic schwannoma) filling the left internal acoustic canal shows marked post-contrast enhancement and is measured 10x5x4mm. The cystic component of it filling the left cerebellopontine angle cistern is enlarged to 25x19x12mm (CCxAPxTR) and today it extends down till the left lateral aspect of medullary cistern, abutting the CN-XII at its entrance to left hypoglossal canal. This cystic component has non-enhancing septations and a thin contrast-enhancing peripheral capsule. Upper border of the cystic mass compresses the left anterolateral aspect of pons at root entry zone and displaces (elevates) the cisternal segment of left trigeminal nerve (CN-V).

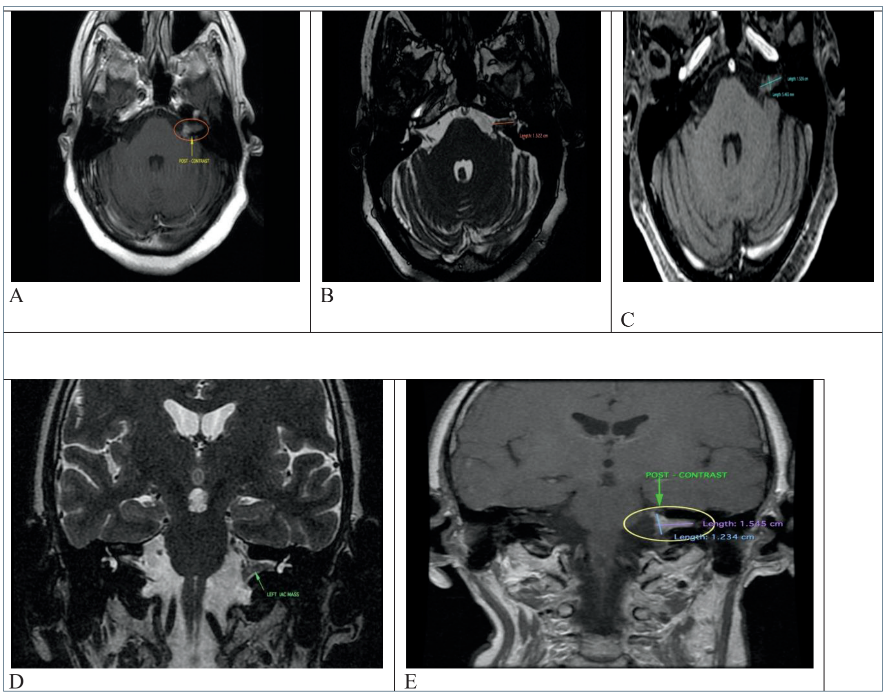

Figure 3. a–transversal T1sequenca post contrast, b and c–transversal Fiesta sequenca, d–Fiesta sequenca pre contrast coronal, e–post contrast coronal.

There is a 15mm long and 5mm thick neoplastic soft-tissue in the left internal acoustic canal, with post-contrast enhancement. Its height is measured up to 12mm at the level of porus acusticus. Cystic component of the mass in left cerebellopontine angle cistern is no longer visible in this MRI exam.

MRI has become the prime modality of investigation to detect intracranial tumors specially Acoustic Schwannoma. MRI is considered as an excellent noninvasive investigation for pontocerebral angle schwannoma's. Examination was reviewed by three radiologists and compared to MR findings.

5. DISCUSSION

Intra-cranial tumors are the most devastating illness in human being. In the developed world, cerebral tumors account for 2% all death at all ages. The incidence of Primary intracranial cerebollo-pontine (CP) angle Schwannoma account approximately 8-10% of all neoplasms. The most common cerebollo-pontine angle (CPA) mass is Acoustic Schwannoma. Among the CPA masses, vestibular Schwannoma accounts 75% of the lesions (10). With the advent of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) there is revolutionary change in the detection of intracranial tumor. Now the availability and cost effectiveness with greater accuracy and fewer false negative cases, MRI has become the prime modality of investigation to detect intracranial tumors specially Acoustic Schwannoma. In MRI, multi planner imaging, cross sectional anatomical detail sagittal coronal axial reformat with contrast and FLAIR images plays excellent role and remains as a major imaging technique for detection and localization of CPA Acoustic Schwannoma (11). Modern 1.5 Tesla or above high resolution MRI with Diffusion Weighted image and Perfusion Weighted image and gradient Echo, FLAIR images will localize and characterize the vast majority of cerebello-pontine angle Acoustic Schwannoma (12).

The Cyber Knife (CK), which was first introduced by John Adler in 1994, is a dedicated robotic LINAC-based system, with the features of real-time image guidance, no rigid immobilization, and nonisocentric planning system. In other words, the CK system is an improvement over the prior frame-based and single-staged techniques for patients with acoustic schwanoma, but its clinical outcomes and risk factors in acoustic schwanoma patients are still limited to the best of our knowledge (13). A Cyberknife treatment eliminates the tumor with a maximum protection of healthy tissue.

The most common cerebollo-pontine angle (CPA) mass is AS. Among the CPA masses, AS accounts 75% of the lesions (14). With the advent of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) there is revolutionary change in the detection of intracranial tumor (15). Now the availability and cost effectiveness with greater accuracy and fewer false negative cases, MRI has become the prime modality of investigation to detect intracranial tumors specially Acoustic Schwannoma. In MRI, multi planner imaging, cross sectional anatomical detail sagittal coronal axial reformat with contrast and FLAIR images plays excellent role and remains as a major imaging technique for detection and localization of CPA Acoustic Schwannoma (16). Modern 1.5 Tesla or above high resolution MRI with Diffusion Weighted image and Perfusion Weighted image and gradient Echo, FLAIR images will localize and characterize the vast majority of cerebello-pontine angle Acoustic Schwannoma.

This is especially true for any lesions in the cerebellopontine angle, where the sensitivity and specificity of MR imaging with its multidimensional imaging capabilities are far superior to that of CT. The high contrast resolution and multi planar capabilities of MR helps to delineate shape and margins, extent, mass effect, intensity at MR imaging, enhancement and adjacent bone reaction (17).

The MR imaging technique described is simple and non-invasive. Therefore we evaluate the role of MRI in evaluation of cerebellopontine angle schwannomas.

The main radiological diagnostic goal is the description of the relation of the tumor to IAM, the brain stem and cerebellar hemispheres. The second line basic information is if the lesion is extra- or intracerebral (18).

This study was carried out with an aim to establish the usefulness of MRI in detection of acoustic Schwannoma and to compare the post cyber knife treatment diagnosis of CPA Schwannoma with the MRI along with its validity tests by calculating sensitivity, specificity of MRI (19).

6. CONCLUSION

The sensitivity of MRI for correctly diagnosing acoustic schwannoma was 100 % and specificity was 92.86 % with a positive predictive value of 94.12 % and accuracy of 96.67 %. MRI is considered as an excellent noninvasive investigation for pontocerebral angle schwannoma's. It can identify the site and extension of the lesions as well as the characteristic signal. Apart from diagnosing, MR imaging plays an important role in stratifying patients into appropriate treatment options.

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- **Conflict of interest:** none declared.
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REFERENCES

1. West N, Sass H, Møller MN, Cayé-Thomasen P. Facial nerve schwannomas presenting with vestibular dysfunction: a case series. Acta Neurochir (Wien). 2018 Dec; 160(12): 2315-2319.
2. Meola A, Chang SD. Bilateral Vestibular Schwannomas in Neurofibromatosis Type 2. N. Engl J Med. 2018 Oct 11; 379(15):1463.
3. Braunstein S, Ma L. Stereotactic radiosurgery for vestibular schwannomas. Cancer Manag Res. 2018; 10: 3733-3740.
4. Lassaletta L, Gavilan J. An update on the treatment of vestibular schwannoma. Acta Otorrinolaringológica Española. 2009; 60(2): 131-140.
5. Propp JM, McCarthy BJ, Davis FG, Preston-Martin S. Descriptive epidemiology of vestibular schwannomas. Neuro-Oncology. 2006; 8(1):1-11.
6. Quesnel AM, McKenna MJ. Current strategies in management of intracanalicular vestibular schwannoma. Current Opinion in Otolaryngology and Head and Neck Surgery. 2011; 19(5): 335-340.
7. Zhao F, Yang Z, Chen Y, Zhou Q, Zhang J, Liu J, Wang B, He Q, Zhang L, Yu Y, Liu P. Deregulation of the Hippo Pathway Promotes Tumor Cell Proliferation Through YAP Activity in Human Sporadic Vestibular Schwannoma. World Neurosurg 2018 Sep; 117: e269-e279.
8. Miller AB, Morgan LL, Udasin I, Davis DL. Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). Environ. Res. 2018 Nov; 167: 673-683.
9. Sweeney AD, Carlson ML, Shepard NT, McCracken DJ, Vivas EX, Neff BA, Olson JJ. Congress of Neurological Surgeons Systemat-

ic Review and Evidence-Based Guidelines on Otologic and Audiologic Screening for Patients with Vestibular Schwannomas. Neurosurgery. 2018 Feb 01; 82(2): E29-E31.
10. Cowan AL, Gadre Arun B, Mathew R. Cerebellopontine Angle Masses, Grand Rounds Presentation UT MB Dept. of Otolaryngology, University Texas, Medical Branch, 2004; June 2.
11. Mulkens TH, Parizel PM, Martin JJ, Degryse HR, Heyning PH, Forton GE. Acoustic Schwannoma MR Findings in 84 tumor. 1993; 160: 395-398.
12. Smirniotopoulos James G, Chang N, Rusbing E. Cerebellopontine Angle Masses Radiologic Pathologic Correlation. Radiographics. 1993; 13: 11311147.
13. Sakamoto GT, Blevins N, Gibbs IC. Cyberknife radiotherapy for vestibular schwannoma. Otolaryngologic Clinics of North America. 2009; 42(4): 665-675.
14. Bonneville F, Savatovsky J, Chiras J. Imaging of the cerebellopontine angle lesions: an update. J Eur Radiol. 2007; 17(11): 2908–2920. doi: 10.1007/s00330-007-0680-4.
15. Imhof H, Henk CB, Dirisamer A, Czerny C, Gstottner W. CT and MRI characteristics of tumours of the temporal bone and the cerebello-pontine angle. Radiologe. 2003; 43: 219-226. doi: 10.1007/s00117-003-0870-2.
16. Swieszewska, Ewa Izycka, Szurowska, Edyta, Kloc, Wojciech, Rzepko, Rubert, Wybieralska, Mirostawa, Dubaniewicz, Skurek A. Cerebello pontine angle tumors radiologic-pathologic correlation. Folia Neuropathol 2006; 44(4): 274-281.