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ROLE OF MRI IN EVALUATION OF NON-TRAUMATIC ORBITAL LESIONS.

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ABSTRACT

Objectives
MR imaging allows insight to the various orbital lesions. We evaluated the usefulness of MRI in diagnosing and characterising orbital lesions using standard MR imaging.

Materials and methods
This prospective study was done in the Department of Radio diagnosis & Krssna diagnostic centre of Mahatma Gandhi Memorial Medical College & M.Y. Hospital, Indore, Madhya Pradesh from March 2015 to August 2016 after getting approval by our Institutional Scientific Review Board and ethical committee. A total of 50 patients were subjected to Magnetic Resonance Imaging of orbit after obtaining informed consent, however the final study group comprised of 40 patients as some patients were excluded from the study because they lost follow up or lacked histopathology correlation. MRI examination was performed on 3 Tesla, and 1.5 Tesla using a dedicated head coil/ surface coil for imaging the orbits.

Results
22 Patients had malignant orbital mass lesions and 06 patients had benign orbital mass lesions and 12 patients were diagnosed inflammatory orbital lesions (reference standard histopathology in 29 cases and clinical follow-up in 11 patients). In DW-MRI we found the mean ADC of malignant masses differed significantly from the mean ADC of benign masses (0.825×10^{-3} mm^2/s and 1.257×10^{-3} mm^2/s, respectively). Adding DWI images improved specificity and sensitivity considerably, being the highest for the combined reading of all sequences.

Conclusion
MRI is a helpful tool in differentiating, characterizing and defining the extension of the orbital lesions, thus guides therapeutic approach and preoperative planning. So it can be included in the routine diagnostic protocol for orbital imaging..

KEYWORDS Orbital masses, orbital MRI, MRI, Diffusion weighted imaging.

INTRODUCTION:

The orbital pathologies now-a-days are rising, which is probably attributed to the increasing awareness to the clinical symptoms, better availability of health care facilities along with newer advanced diagnosis and treatment options. Early diagnosis of orbital lesions is essential for appropriate management, differentiating benign from malignant orbital masses and also identifying lesions which need surgical intervention.

MRI is a competitive and comprehensive modality for assessing the morphology and characteristics of the orbital leisons. It has advantages of being a multi-planar modality, uses no ionizing radiation, and can be used even in patient with deranged renal function. MRI along with DWI helps in better characterizing the orbital lesions along with the extent of involvement of the surrounding structures and optic nerve pathologies because of absence of radiation risk and superior soft tissue contrast required for better imaging details of orbital structures. DW-MRI provides a valuable tool to characterize orbital lesions without the risk of contrast agents and exposure to ionizing radiation. DW MRI can help in characterization of orbital mass lesions and in differentiating benign from malignant lesions and is also thought to be capable of predicting the response to therapy of malignant tumours. However, DWI should always be used in conjunction to conventional MRI since there is considerable overlap between ADC values of benign and malignant lesions.

The purpose of our study was to evaluate role of MRI in characterization of various orbital lesions and in differentiating the benign, and malignant lesions along with assessment of its role in the management of patient affected by orbital lesions.

MATERIAL AND METHODS:

This prospective study was done in the Department of Radio diagnosis & Krssna diagnostic centre of Mahatma Gandhi Memorial Medical College & M.Y. Hospital, Indore, Madhya Pradesh from March 2015 to August 2016 after getting approval by our Institutional Scientific Review Board and ethical committee. A total of 50 patients were subjected to Magnetic Resonance Imaging of orbit after obtaining informed consent. The inclusion criteria was patients referred to our department with strong clinical suspicion of a orbital lesion or having evidence of incidentally detected or symptomatic orbital lesions on ultrasound or CT scan.The final study group comprised of 40 patients as some patients were excluded from the study because they lost follow up or lacked histopathology correlation.

MRI EQUIPMENT

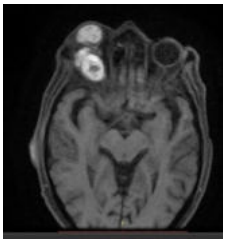
MRI examination was performed on 3 TESLA, 97 CHANNEL MAGNETIC RESONANCE IMAGING equipment using a dedicated head coil/ surface coil for imaging the orbits. MRI parameters are summarised in Table 1. A three plane localizer is obtained for planning of the various sequences. A T1W spin echo sequence with TR/TE of 800/10.9 ms and flip angle of 111° with 2.5 mm slice thickness is obtained. An FOV of 180 mm is used with a 360x200 matrix in the axial plane. A T2W spin-echo with TR/TE of 5000/109 ms and flip angle of 111° with 2.5 mm slice thickness is obtained. An FOV of 180 mm is used with a 300x300 matrix in the axial plane. This is followed by DWI obtained through a multisection spin-echo single shot echo planar sequence in the transverse plane, using b values of 0, 500 and 1000 sec/mm2. A TR/TE of 5850/71.6 ms, and slice thickness of 3 mm are used. FLAIR spin echo sequence is obtained in the axial plane using TR/TE of 9000/93.2 ms and with flip angle of 1600. TI of 2470 and 2mm slice thickness is used. An SWI gradient echo sequence with TR/TE of 56.4/24.5 ms with flip angle of 10o, slice thickness of 2.5 mm and TI of 24.7 is obtained. Additional sequences like T2 coronal FS, T2 axial FS, T2 oblique sagital and T1 axial were also obtained as and when required. Analysis of ADC is an automated process available as an application on our scanner.

REFERENCE STANDARD

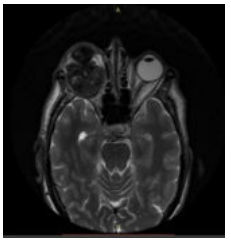
Follow up of all patients was done with surgical, clinical, and histopathological correlation with biopsy or FNAC used as a reference standard. The final diagnosis was then made and results obtained were compared with the MRI study.

STATISTICAL ANALYSIS

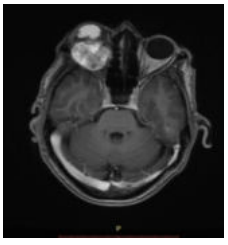
Statistical analysis of data was done using SPSS software version.20 and the results were evaluated using Mann-Whitney test.



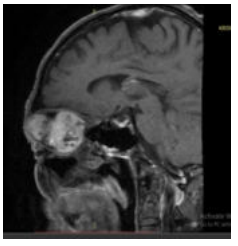
A. AXIAL T1



B. AXIAL T2



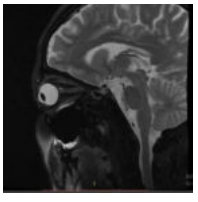
C. AXIAL T1C



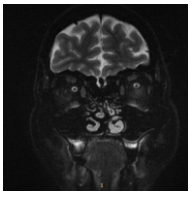
D. Sagittal

Fig. 1. Axial and Sagital T1WI MR (A, D) image demonstrates well defined, hyperintense lesion in the right orbit, which is retro-orbital and intraconal ,the mass appears heterogenous on T2WI axial (B) and intensely enhancing (C) in Gd Contrast MR images.

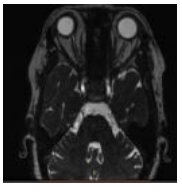
CAVERNOUS HAEMANGIOMA



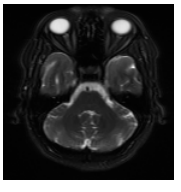
A. Sagital T2



B. Coronal T2 FS ASPIR



C. Axial 3



D FIESTAD. AXIAL T2

Fig. 2. The SAGITAL T2WI(A) and axial T2WI (D) shows hyper intense signal with in the optic nerve, Coronal T2 FS ASPIR (B) altered signal (hyperintense) seen with in the nerve, which is also demonstrated in 3D FIESTA axial image.

OPTIC NEURITIS.

RESULTS

In the present study the most common age group of patients was 0-9 years (30%) with mean age of 25 years. The mean age of patients with benign lesions was 24 years and of patients with malignant lesions was 20 years. On MRI, 28% of orbital lesions were classified as inflammatory, 15% lesions were benign and the remaining 57% of orbital lesions were classified as malignant lesions. Among the inflammatory lesions thyroid orbitopathy and pseudotumor were the most common inflammatory orbital lesions followed by orbital cellulitis, endopthalmitis/panophthalmitis. We also found a case of orbital cysticercosis and two cases of optic neuritis. Cavernous haemangioma was the most common benign orbital mass lesion in our study followed by optic nerve glioma. Single cases of carotico-cavernous fistula and optic nerve meningioma were also found. Retinoblastoma was the most common malignant lesion in our study constituting 25% of the total orbital lesions followed by rhabdomyosarcoma, orbital lymphoma and choroid melanoma respectively.

DISCUSSION

In the present study the sensitivity and specificity of MRI in predicting inflammatory orbital lesions turned out to be 83% and 90% respectively. Thyroid orbitopathy depicted hypertrophied muscles bellies isointense on T1WI and iso to hyperintens on T2WI depending on the activity of the disease with sparing of the tendinous insertion of the extraocular muscles, i.e. active Graves' disease showed more hyperintense muscle on T2WI, and 1 out of three cases showed restriction of diffusion and appeared bright on DWI. Orbital pseudotumor was distinguished from thyroid orbitopathy via involvement of tendinous insertion, which is spared in TAO, and additional inflammation of surrounding tissue. Endophthalmitis on MR imaging showed thick uveal tissue, and demonstrated retinal/choroidal detachment, vitreal exudates and peribulbar inflammation, and depicted restriction of diffusion. Orbital cellulitis appeared low signal on T1WI, high signal on T2WI, and bright on DWI with preseptal soft tissue involvement. One case of cysticercosis was seen in our study. The MRI features of orbital cysticercosis was isointense on T1WI and hyperintense with hypointense scolex on T2 weighted images. The affected extraocular muscle (lateral rectus) showed fusiform enlargement of its belly and contained a well-defined, spherical cyst with a nodule attached to its wall. Clinical improvement with praziquintal seen on follow up.

The sensitivity and specificity of MRI in predicting benign orbital lesions turned out to be 83% and 97% respectively. Cavernous haemangioma appeared as well defined, intraconal , unilateral, solitary lesion causing mass effect, appeared isointense on T1WI and hyperintense on T2-weighted images with one of them showing hypointense pseudocapsule on T2WI. DWI MRI of the lesion showed restriction of the diffusion in one case of our study. Optic nerve glioma were typically isointense on T1- weighted images and hyperintense on T2-weighted images, which were sharply circumscribed ,fusiform enlargement of the optic nerve, Diffuse involvement of the substance of the nerve differentiates optic nerve glioma from optic nerve sheath meningioma. DWI MRI showed significant restriction of the diffusion in both the cases. Optic nerve meningioma appeared as isointense on T1WI and iso to hyperintense on T2WI, however, because the substance of the nerve is spared, a "tram-track" configuration was observed at axial T2WI MR Images, doughnut sign was demonstrated in coronal T2WI MR Images. On DW MR Images lesion showed significant restriction of diffusion.

The sensitivity and specificity of MRI in predicting malignancy turned out to be 91% and 87% respectively. Retinoblastoma was the most common malignant neoplasm (25%) in our study, were found bilateral in 30% of cases in our study. Retinoblastoma approximates the signal of grey matter on MR imaging, with the tumor appearing hyperintense to vitreous on T1- weighted images and hypointense to vitreous on T2-weighted images and hypointense on FLAIR imaging, and SWI MR images showed drop out of signals with in it as blooming i.e. hypo intensities within the lesion, indicating calcification and haemorrhage with significant restriction of diffusivity seen on DW MRI. Rhabdomyosarcoma was the second most common malignant intraorbital lesion seen in our study, with 12.5% of the cases. On MR imaging, Rhabdomyosarcoma appeared isointense to muscle on T1-weighted images and hyperintense to muscle on T2-weighted images, most of them appearing isointense with cerebral cortex, with decreased diffusivity seen on DWMRI. One of them showed haemorrhage on SW MRI and one case showed intra cranial

extension with erosion of underlying cranium bone.

Three cases of orbital lymphoma was seen in our study. On MRI Lymphoma appeared characteristically homogeneous and isointense on T1WI and on T2-weighted MR images appeared isointense to hyper intense with white matter, showed significant restriction of diffusivity on DWI, most of the lesions involved mainly superior-lateral quadrant and the orbital structures. Choroid melanoma on MRI was depicted as mildly hyperintense on T1-weighted MR images and hypo intense to vitreous on T2-weighted MR images, demonstrated significant restriction of diffusivity on DWI. One case of orbital metastasis was detected in our study, in a known case of breast carcinoma, in which ill defined, solid T1 isointense and T2 hyperintense lesion, showing significant restriction of diffusion, in superolateral quadrant was seen.

From this study, we found that, the overall accuracy of MRI with diffusion weighted imaging in the identification and characterization of orbital lesions was excellent. Good correlation existed between the study findings and the findings obtained on follow up.

CONCLUSION

Accurate characterisation of orbital masses is essential to ensure appropriate case management and prognosis and to identify lesions that need early surgical intervention. DWI along with MRI obviates the need for multiple diagnostic procedures and can act as a one stop shop for diagnosing all the orbital lesions.

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