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Role of MRI in non-traumatic orbital lesions

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Abstract
A descriptive study of 50 patients was conducted for evaluation of non-traumatic orbital lesions. The most common presenting symptom was diminution of vision (66%) followed by proptosis (50%). Most commonly encountered lesions were infective and inflammatory lesions, contributing 42% of total lesions. MRI was 100% specific in cases of orbital cysticercosis as scolex could be identified easily. Various other non-traumatic orbital lesions included were Coloboma, retinoblastoma, lacrimal gland pathologies, vascular hemangiomas etc. MRI is the imaging modality of choice for suspected non traumatic orbital lesions except where MRI is contraindicated.

Keywords: Non traumatic orbital lesions, magnetic resonance imaging, intraconal, extraconal, extra ocular muscles

Introduction
Although physical examination and fundoscopy may aid in establishing the diagnosis of retro-ocular lesions, imaging remains a critical step in the evaluation of orbit. The clinician now has wide variety of diagnostic tools from which to choose [1] Introduction of A and B mode ultrasound in late 1950's was a major advance towards obtaining clearer images of orbit. For extraocular orbital lesions, USG is valuable screening modality. The CT scan was first introduced in 1972 and now with multi-slice CT. Tissue contrast is provided by retro orbital fat and extraconal fat. Main advantages of CT over other modalities are in evaluation of bony lesions and bony outlines. Current CT techniques allow very fast evaluation with multiple windows. With contrast, lesions can be evaluated for dynamic enhancement aiding in the diagnosis. Easy availability, operability and speed, make CT affordable diagnostic tool in orbital diseases [2] General advances in techniques of MRI have also had a positive effect on MRI of orbit mainly in the better tissue contrast and evaluation of nerves and soft tissue lesions. Advantages over CT being, no ionizing radiation and better tissue contrast. Disadvantages being, poor bony evaluation, multiple artifacts, time consuming and higher costs [3].
The current approach is first dividing the pathology in one of the compartments. Uni-compartmental or multicompartmental and trans-compartmental pathologies are evaluated and can be given a specific diagnosis based on the characteristics. The orbital compartments are differentiated by means of anatomical structures. The muscle cone, a connection between the four rectus muscles, divides the orbit into the intraconal and extraconal compartment. The optic nerve passing the central part of the intraconal compartment is, as with the rectus muscles themselves, a separate compartment. The outer limit of the extraconal compartment is the bony orbit, followed by the subperiosteal compartment. The lacrimal gland, lacrimal apparatus and the globe are separate compartments. The ventral border of the extraconal compartment is the orbital septum; the upper and lower lids are the anteriorly placed neighboring compartment.

Aim and objectives
The aim of this study was to study the role of magnetic resonance imaging in assessing non-traumatic lesions of the orbit. We characterized the orbital lesions with respect to imaging characteristics, adjacent soft tissue changes and optic nerve involvement. We also correlated the findings of MR imaging with the histopathological findings and evaluated its role in pathologies affecting the lacrimal system.

Patients and Methods

This prospective observational study was carried in a tertiary care hospital in central India over a period of 2 years.

Patient selection

This prospective study included patients with suspected non-traumatic orbital lesions which were detected on Ultrasound and CT as well as patients with symptoms of non-traumatic orbital lesions. Patients with suspected involvement of orbit due to any systemic illness like malignancy, infection and Inflammation were also included. Both inpatients and outpatients were included in the study. All the procedures were conducted with all the necessary equipment to manage contrast reactions kept by the side of the patient for use as and when required. Patients with suspected trauma/foreign body to the eye; with any contraindication to MR Imaging; with ferromagnetic implants, claustrophobia etc. with suspected pregnancy and contraindication to contrast agents were excluded from this study. The imaging was done on either Siemens Avanto Magnetic Resonance Imaging (1.5 Tesla) and Siemens Magnetom VIDA Magnetic resonance Imaging (3 Tesla)using a combination of head and surface coils.First the standard axial FLAIR brain screening with slice thickness 4mm was performed followed by standard axial DWI and GRE sequences. The standard MRI protocol in our institution consists of axial SE T1W and TSE T2W sequences, coronal STIR sequences, and axial and coronal SE T1W sequences with fat saturation obtained after intravenous administration of gadolinium chelates. The slice thickness was 2–3 mm with a 256 x 256 matrix. 3DFT T1W sequences with 0.6-1 mm thin slices (VIBE, THRIVE) after intravenous contrast material administration were additionally used as these volumetric data sets allow multiplanar reconstructions in any given plane, thereby facilitating the evaluation of subtle findings. Routine T1 post contrast axial sequence of the brain was also (slice thickness 5mm) performed in all cases. No specific preparation was required before the scans for patient preparation. Few uncooperative and pediatric patients were sedated before the examination. All the patients were given instructions to remove all metallic belongings prior to the examination.

Observations and Results

The present study "Role of MRI in Evaluation of Non traumatic Orbital lesions" was carried out from July 2017 to September 2019, in the department of Radio diagnosis at our hospital. About 50 patients with various orbital pathologies were included in the study.

Among the 62 patients who underwent MRI orbit study, follow up was lost in 12 patients so they were excluded from our study while remaining 50 with pathological condition were included. Out of the total 50 patients, 7 patients showed bilateral involvement of orbit.

In our study, the male: female ratio was 1.5:1, where majority of patients were males accounting for 60% and female patients accounting for 40%.In the present study, there was predominantly right side (50%) involvement in by the orbital lesions and in n=7 (14%) patients both orbits were involved.

Most of the patients had more than one symptom as presenting complaints. In the terms of incidence, the most common presenting complaint was diminution of vision which was present in 33 patients (66%) followed by proptosis which was present in 25 patients (50%).

In the present series, Infective &inflammatory lesions constituted the bulk of patients with 42% of the total number of cases. Neoplastic lesions are the second most common lesions found in the present study, constituting 30% of all cases.

Intraconal space involvement was seen in 40% of the patients. Among lesions involving intraconal space neoplastic is most common. Extraconal space is involved in most of the orbital lesions constituting 48% of the patients and most lesions were inflammatory followed by neoplastic.

Most of the patients had hyperintense lesions on T2W. 3 patients showed hyperintense signal on T1 images with few showing suppression of signal on T1 STIRs/o fat containing lesions (dermoid). T1 hyperintense lesions were dermoid and Colobomatous cyst. Only 3 (6%) of the patients had hypointense lesions on T2W images and included fungal infection, melanoma and lymphoma.

Total number of patients who had blooming on GRE sequence due to calcification/ haemorrhage was 19, (38%). Out of 19 patients, blooming due to calcification or haemorrhage was most commonly seen in patients (n=8) neoplastic conditions (16%).Involvement of optic nerve was commonly seen in neoplastic condition (n=8, 16%) and infective/inflammatory condition (n=7, 14%). Intracranial extension of the orbital lesions was seen in 10% of the infective (n=5). Extra ocular muscle involvement was common in inflammatory (n=16, 32%) and benign neoplastic conditions (n=11, 22%) and infective lesions.

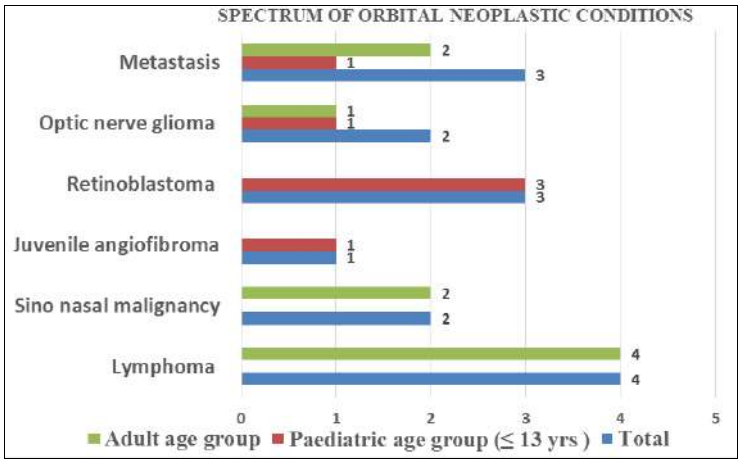
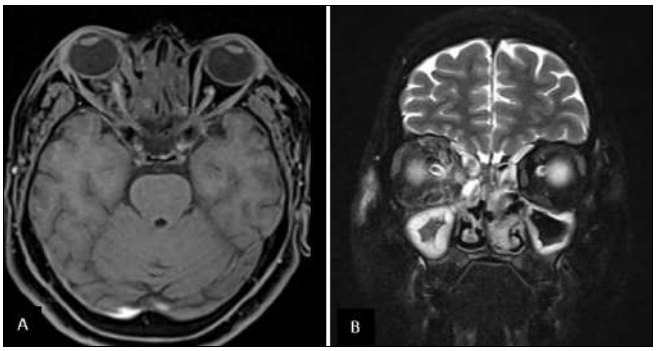


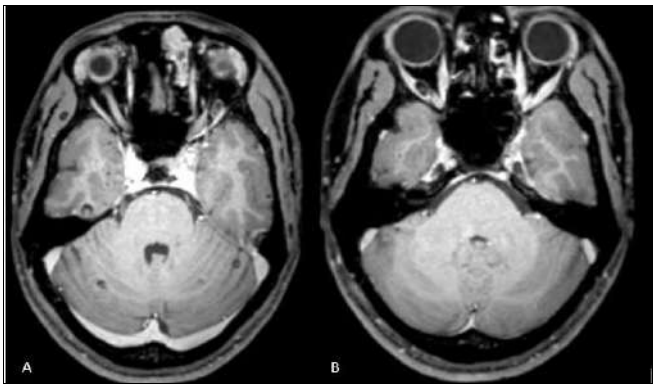
Fig 1: Spectrum of orbital neoplastic condition of study participants.

In the present study, the most common malignant primary orbital pathology was lymphoma which was 4 patients, accounting for 45% of all the primary malignant lesions.
23 patients out of 50(46%) histopathological confirmation of the diagnosis could be done either by true cut biopsy / FNAC or post-operative histopathology. In rest of the patients the diagnosis was made on the basis of MRI findings with its clinical correlation and response to the treatment.The MRI Diagnosis correlated to histological diagnosis in 23(46%) patient. While in 2(4%) patients the diagnosis was changed after MRI. Out of 50 cases, it was possible to reach a single specific diagnosis corresponding with final diagnosis in 48 cases.

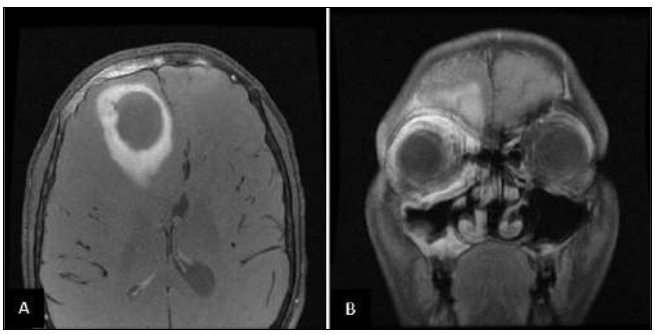
Case gallery
1) Orbital Cellulitis



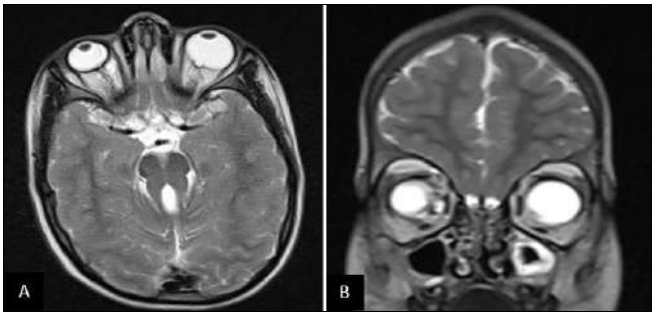
2) Case of orbital cysticercosis with Neurocysticercosis with skull muscle cysticercosis.



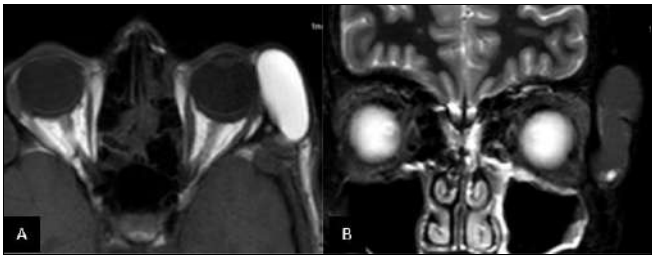
3) Case of orbital infection with intracranial extension.



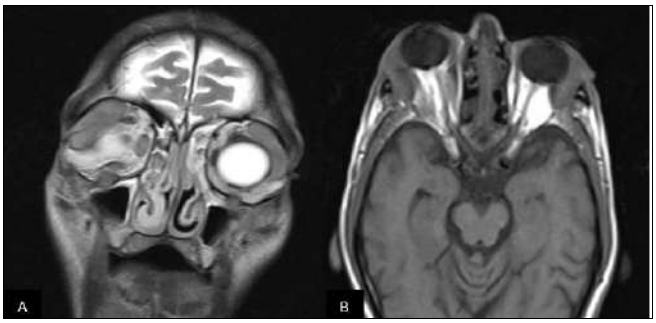
4) Case of coloboma: left eyeball shows coloboma at optic nerve heads. Microopthalmia of the right eye with small Colobomatous cyst noted posterior to right eyeball on nasal side. Right eye shows retinal detachment



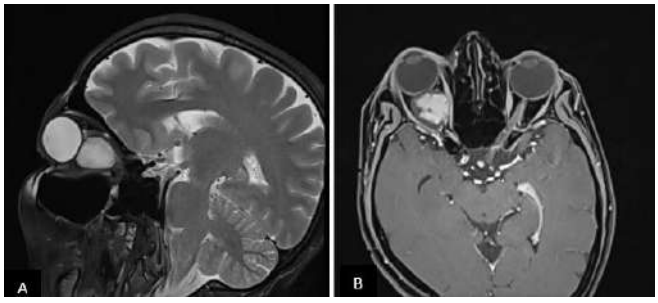
5) Case of dermoid cyst at left lateral wall of orbit



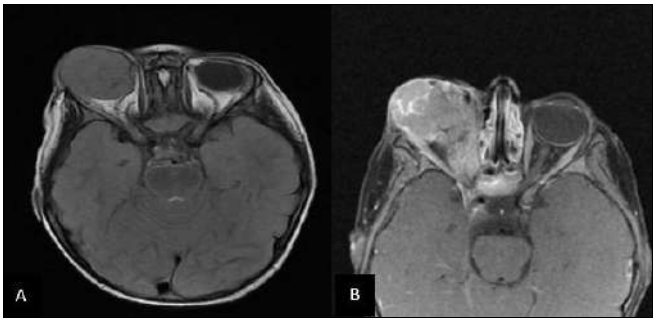
6) Case of Pseudotumor: Showing Bilateral Lacrimal Gland Appearing Bulky With Involvement of Extra Ocular Muscles (Medial, Inferior and Lateral Rectus) On Right Side



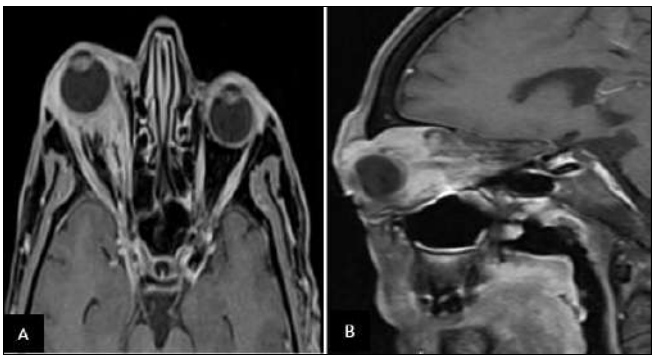
7) Case of cavernous hemangioma showing a well-defined intra conal lesion in the right orbit, in Retro bulbar intra conal compartment causing compression and displacing the optic nerve



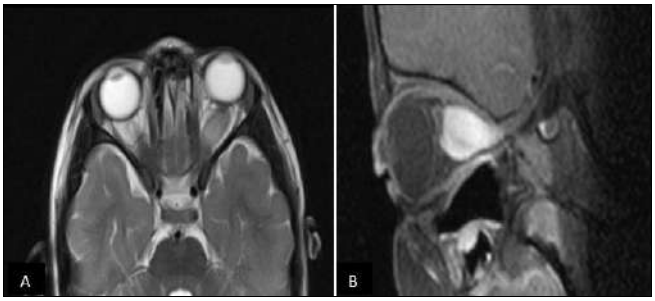
8) Case of retinoblastoma: mass lesion involving right orbit involving all extra ocular muscles and causing proptosis



9) Case of orbital lymphoma: altered signal intensity soft tissue lesion involving both intra and extra conal compartment, retro-orbital space with its epicenter at superiomedial to right globe, involving all extraocular muscles and encasing optic nerve.



10) Case optic nerve glioma: the intra orbital and intra Canalicular segments of the left optic nerve show fusiform enlargement and expansion causing proptosis of the left eye globe.



Discussion

The present study was undertaken to study the "Role of MRI in Evaluation of non-traumatic orbital lesions" and the imaging findings were correlated with histopathological and or clinical/ surgical findings as applicable. A total of 50 patients were evaluated.

In the present study, the most common orbital lesion is inflammatory & infective followed by neoplastic. However our results were similar to Aravind *et al.* [4] studied spectrum of orbital pathologies in 6328 patients and reported that most common orbital lesion is inflammatory (34.1%).In present study 48% (n=24) of the lesions were located in extraconal compartment, 40% (n=20) in intraconal compartment while 12% (n=6) involved both compartment.

In the present study; there were 3cases of congenital and developmental anomalies, 1 case of dermoid cyst and 2 cases of coloboma cyst.

There were2 cases of coloboma in the present study. It was a 3 year old girl with ankyloblepheron and 5 year old boy who presented with micropthalmia. MRI orbit study revealed micropthalmia with well-defined cystic lesion appearing T1 hypointense and T2 hyperintense. Lesion is typically being located in the retro bulbar region and closely abutting the globe. Kaufmann LM *et al.* [5] observed that coloboma was easily identified by both CT and MR. These cysts were typicallyT1hypointense and T2 hyperintense.

Of 3 cases proptosis and pain was the most common complaint. Associated sinusitis was noted in two cases. Both cases show intracranial extension and cerebral abscess. MRI was diagnostic in all cases both with heterogeneous enhancement in one & ring enhancement seen in two cases. Gorospe L *et al.* [1] pointed that orbital infections are related to sinusitis often. The MR imaging often shows T1 isointensity and T2 hyperintensity, representing the inflammatory exudates within the orbit. There is associated soft tissue swelling with orbital preseptal, postseptal thickening or inflammatory changes seen.

In present study there were 2 cases of orbital fungal infection, which was proved to be a case of mucormycosis and the patient was having diabetes mellitus. Specificity of MRI was 100%. Mahmood F. Mafee [6] found that MRI has the advantage over CT in differentiating invasive aspergillosis or mucormycosis from aggressive tumors.Also signal intensity is decreased on both T1W and T2W sequences.

In the present study there were two cases of orbital cysticercosis complaining of restricted eyeball movement with proptosis. MRI brain study revealed numerous neurocysticercosis and ocular imaging revealed two cysticerci in superior and lateral rectus muscle. Whole body scan was done in this patient which revealed studding of muscles with cysticerci. As stated by Kaufman *et al.* [5], nearly all cases of orbital cysticercosis examined by CT show a cystic lesion near or within an extra ocular muscle.

In the present study, there were 10 cases of orbital pseudo tumor. Presentation was acute in all cases. Of the 10 patients with pseudo-tumors, 7 (70%) were male and 3 (30%) were female. These results were similarto studies performed by J Yan *et al.* [7].

Enhancement was seen in the entire lesion and 80% enhancement intensely on post contrast fat saturated T1W images. None of the lesion showed bone destruction or intracranial extension. In study by Cytryn *et al.* [8], all pseudo tumors were isointense to muscle on T1W imaging, approx. 84% of the lesions were isointense to fat on T2W imagines. Only 15% lesions appeared brighter on T1W images than T2W images.

In present study of 4patients (8orbits) of Graves' Ophthalmopathy, presentation was bilateral in both cases though it was asymmetrical. All four patients were females. On MRI apart from muscle enlargement, the other notable feature was signal intensity of enlarged muscles on T2 W images. Study done by RA Nugent *et al.* [9] and Hosten *et al.* [10] in terms showed similar findings.

In the present study, there were 3 patients of cavernous hemangioma which constituted about 50% of all vascular malformation of orbit. All three cases of cavernous hemangioma were females. In present study out of 3 cases 2 were intraconal in location while one was predominantly intraconal with extraconal extension

There was one case of capillary hemangioma. Patient was 1-yearold child presented with complaint of proptosis, which had gradually increased in size since birth. On MRI the lesion was T2/T2FS hyperintense with internal septae. It showed few vascular flow voids. Location of the lesion was extraconal. Contrast study revealed intense enhancement. Most common orbital vascular tumor in infants is capillary hemangioma. They begin to involutes around puberty. Advantages of MRI are in differentiation of the capillary hemangioma from venous lymphatic malformations and rhabdomyosarcoma.

In present study there was one case of histologically proven lacrimal gland carcinoma. On MRI, Carcinoma of the lacrimal gland revealed a heterogeneously enhancing mass involving the lacrimal gland with evidence of infiltration into retro bulbar space and adjacent bone erosion.

In the present study, there were 15 cases of various tumors. Of which 60% (n=9) were malignant while 40% (n=6) were benign. In the study by Shields *et al.* [11] consisting of1264 consecutive patients showed 64% of neoplastic lesions were malignant while 36% were benign. Our findings were similar to above mentioned study.

All the Sino-nasal malignancy showed primary mass located in the maxillary sinus which eroded through the superior wall to reach the extraconal compartment with heterogeneous enhancement on contrast study. There was. The diagnostic specificity of MRI was 100% as compared to CT scan on which it was 100% only when second possible diagnosis was also considered.

There was one case of juvenile angiofibroma in present study. A 12year old boy presented with epistaxis and diminution of vision. Curtin HD *et al.* [12], stated that angiofibroma mostly seen in adolescent age group and mostly in boys. Typical extensions being orbital apex through the pterygopalatine fossa superiorly. It is not limited by bony margins. Characteristic post contrast intense enhancement helps in the diagnosis. The findings in the present case are also similar.

In the present study, there were 3 cases of retinoblastoma. All the patients were in age group between 3-7years. Two patients were male and one was a female child. MR revealed a large heterogeneously enhancing mass with foci of calcification filling whole of left orbit with no visible ocular structure was seen. There was involvement of optic nerve. MRI was 100% diagnostic. In a study by Kiratli H *et al.* [13] on sixteen patients with unilateral orbital involvement of intraocular retinoblastoma, it was found that eight patients had orbital involvement at initial presentation.

In the present study, there were 2 cases of optic nerve glioma. On MRI there was optic nerve sheath enlargement appearing T2 hyperintense and showing moderate contrast enhancement. MRI revealed thicken optic nerve sheath with signal characteristics similar to glioma. There was extension of tumor along the optic nerve up to the chiasma. Hollander MD *et al.* [14], stated that on CT, calcifications are not typically seen in previously untreated glioma as compared with optic nerve meningiomas. Findings in present study correlate well with above described findings.

There were 4 patients with lymphoma of which 2 were male and 2 females. Ages of patient ranged from 25 years to 70 years with majority of the patient were aged above the 4th decade. Only one patient was below 30 years. J Yan *et al.* [7], found a strong male preponderance in their study with 70% of patients being male. 2(66.67%) patients had bilateral involvement and both this patients had associated systemic disease. The signal intensities were nonspecific with all the tumors appeared isointense with muscle on T1W imaging, while all were isointense on T2W and hyperintense to fat on T2W Imaging.

There were three cases of orbital metastasis in present study. One patient was elderly, 57 years with known case of Ca breast. Holland D *et al.* [15] in their study of 20 patient with metastasis to the orbit found mean age of presentation to be 65 years and extraocular muscle involvement was seen in 35% of the patients with medial rectus involvement been most common. Breast was the most common site of primary neoplasm in their study.

Summary and conclusions

Present study entitled “Role of MRI in evaluation of non-traumatic orbital lesions” was carried out at the Department of Radio diagnosis, in Western India between the time periods July 2017- September 2019. The prospective study was carried out on 50 patients with orbital lesions, comprising 30 (60%) males and 20 (40%) females. Thus, there was male preponderance. Maximum number of patients were seen in the age group of 31 to40 years (n= 9) (18%) followed by 0-10years (n=8) (16%).The most common presenting symptom was diminution of vision (66%) followed by proptosis(50%).In patients with inflammatory lesion, painful proptosis and motility dysfunction was the most common presentation. Most commonly encountered lesions were infective and inflammatory lesions, contributing 42% of total. Hypo-intensity on T2 was one important MR imaging finding in mycotic infection. MRI was 100% specific in cases of orbital cysticercosis as scolex could be identified easily. Retinoblastoma can be diagnosed easily on MRI due to signal intensity, enhancement and age. But MRI is poor in determining presence of calcification.

MRI is better than CT in differentiating paranasal sinus fungal infections from sinus tumors infiltrating the orbit because of typical T2 signal intensity. Hence, to summarize, MRI is better than CT due to Better soft tissue resolution and characterization of lesion and better imaging of optic nerve, CNS & cavernous extension

In conclusion, MRI Should be the imaging modality of choice for suspected non traumatic orbital lesions except where MRI is contraindicated.

References

1. Gorospe L, Royo A, Berrocal T, Garacia-Raya P, Moreno P, Aberairas J *et al*. Imaging of orbital disorders in paediatric patient. Eur Radiol. 2003; 13:2012-26.
2. Hendee WR. Cross sectional medical imaging: A history. Radio Graphics. 1989; 9:1155-80.
3. Lemke AJ, Kazi I, Felix R. Magnetic resonance imaging of orbital tumors. Eur Radiol. 2006; 16:2207-19.
4. Usha Kim, HadiKhazaei, William Stewart, Akash Shah. Aravind eye hospital. Spectrum of Orbital Disease in South India: An Aravind Study. The American Opthal Plastic Reconstr Surg. 2010; 26(5):315-22.
5. Kaufman LM, Villablanca JP, Mafee MF. Diagnostic imaging of cystic lesions in the child's orbit. Radiol Clin North Am. 1998; 36:1149-63.
6. Mahmood F. Mafee. Orbit: Embryology, Anatomy, and

Pathology. Som PM, Curtin HD, editors. In: Head and Neck imaging. 4th ed. Missouri: Mosby, 2003, 529-645.
7. Jianhua Yan, Zhongyao Wu, Yongping Li. The differentiation of idiopathic inflammatory pseudotumor from lymphoid tumors of orbit: Analysis of 319 cases. Orbit. 2004; 23(4):245-254.
8. Cytryn Albert S, Putterman Allen M, Schneck Gideon LM, Beckman, Enrico MD. Predictability of Magnetic Resonance Imaging in Differentiation of Orbital Lymphoma from Orbital Inflammatory Syndrome Ophthalmic Plastic and Reconstructive Surgery, 1997, 13-2.
9. Nugent RA, Belkin RI, Neigel JM, Rootman J, Robertson WD, Spinelli J *et al* Graves Orbitopathy: correlation of CT and clinical findings. Radiol. 1990; 177:675-82.
10. Hosten N, Sander B, Cordes M, Schubert JC, Schrner W, Felix R. Graves Ophthalmopathy: MR Imaging of the Orbits. Radiol. 1989; 172:759-62.
11. Shields JA, Shields CL, Scartozzi R. Survey of 1264 patient with orbital tumors and simulating lesions: The 2002 Montogomery Lecture, Part 1. Ophthalmology. 2004; 111:997-1008.
12. Curtin HD, Rabinov JD. Extension to the orbit from Paraorbital disease. Radiol Clin North Am. 1998; 36:1201-13.
13. Kiratli H, Bilgic S, Ozerdem U. Management of massive orbital involvement of intraocular retinoblastoma. Ophthalmol. 1998; 105:322-26.
14. Hollander MD, Fitz Patrick M, G. O'Connor S, Flanders AE, Tartaglino LM. Optic Gliomas. Radiol Clin North Am. 1999; 37:59-71.
15. Holland D, Maune S, Kovacs G *et al*. Metaststictumors of the orbit: A retrospective study. Orbit. 2003; 22:15-24.