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"Magnetic Resonance Imaging in Evaluation of Orbital Pathologies"

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Aims and Objectives: -

- *The aim of the study is to emphasize the value of Magnetic Resonance Imaging (MRI) in evaluation of patients with orbital pathologies.*

Material and Methods: -

The present study was carried out in the Department of Radiodiagnosis, in a tertiary care teaching hospital. 30 patients who underwent MR imagingin evaluation of orbital pathologies duringtheperiodbetween October2021to September 2022. The study type was cross sectional study.
This study has been performed using a 1.5T PHILIPS ACHIEVA MRI scan machineusing standard head coil.

Patient Preparation:

No specific preparation was required. Few uncooperative and paediatric patients were sedated before the examination.

MRI Protocol:

- **Pre contrast– FOV – 17 cms. Matrix – 256 x 256**

Sequence	Slice Thickness (mm)	Interslice Gap(mm)
Coronal T1 SPIR	3	0.1
T1 Axial	2	0.1
T2 Axial	2	0.1
Coronal T2 STIR	3	0.1
CoronalT2W*(Gradient)	3	0.1
Postcontrast T1 SPIR sagittal	3	0.1
Post contrast T1 SPIR coronal	3	0.1
Pre and Post contrast T1 SPIR axial	2	0.1

- *Routine T1 MTC pre and post contrast axial sequence of the brain was also (slice thickness 5mm) performed in all cases using Gadolinium in a dose of 0.2mmol/kg body weight.*

- ***Additional sequences:***

The gradient sequence was used for evaluation of foci of haemorrhage and calcification. T2 VISTA sequence was used for evaluation of optic nerve. DWI, MR spectroscopy was done in selected cases.

Inclusion criteria: -

- *All the patients with signs and symptoms of orbital pathologies referred forMRI Orbit in SMIMER,Surat willing to participate in study.*
- *All patients undergoing MRI Orbit giving a well-informed consent for their participation in SMIMER,Surat.*
- *Patient with abnormal CT scan or B-scan findings.*

Exclusion criteria: -

- *Patient not willing and/ or not giving informed consent.*

- *Patients having suspicious metallic foreign body.*
- *Patients having contraindications for MRI such as having metallic implants or cardiac pacemaker in situ.*
- *Patients reported negative or unsatisfactory scan of Orbit at the end of scan.*
- *Patients with isolated involvement of eyelid or conjunctiva without intraorbital extensions were excluded from studies while those with secondary involvement of orbit were included.*

Result: –
According to the data collected from our study,
- *14 (46.6%) patients had primary orbital involvement and 16 (53.4 %) patients had secondary orbital involvement.*
- *20 (66.7%) patients had orbital pathologies confined to single compartment and 10 (33.3%) patients had multispatial involvement.*
- *Maximum cases were infective/inflammatory (53.4%), followed by neoplastic cases (20%).*
- *In neoplasm, 66.7% were malignant rest were benign.*
- *Age wise infective/inflammatory disorders cases were found maximum in >20 years.*
- *Sex wise infective/inflammatory disorders and traumatic injuries were common in males while congenital, vascular and miscellaneous pathologies were common in females. Neoplastic pathologies were found equally in both sexes.*

Conclusion -
Based on our results we concluded that:
- *MRI is superior to other imaging modalities for orbital lesioncharacterization, delineation of the anatomical extent. This helps the clinicians to make a better decision regarding further management, prognosticate and follow up.*

Keywords: -
- *Orbital pathologies,Magneticresonanceimaging.*

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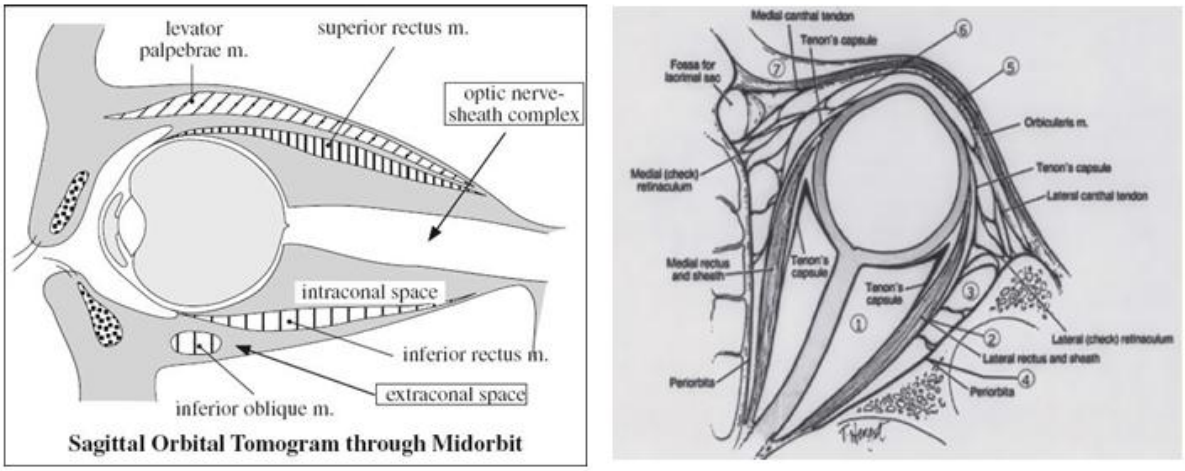
I. Introduction

- Non-ionizing property and a good soft tissue contrast have made MRI the choice of investigation in evaluating ocular and orbital pathologies.
- A key approach to the radiological diagnosis of lesions is to narrow the differentials by localizing the lesion to a region or orbital compartment and ascertain the structure of origin.
- Lesions may either be localized to a single compartment or be multi-spatial.
- Orbital lesions form a wide range of pathologies that pose challenges in diagnosis, management and treatment.
- A common diagnostic strategy is the localization of the pathology into the four main orbital compartments: the ocular compartment or globe, the muscle cone and the intraconal and extraconal spaces.



A **B**

Fig A and B. Diagrammatic depiction of orbital anatomy

➢ ORBITAL PATHOLOGIES:

• INTRACONAL PATHOLOGY:

Globe pathologies:

CONGENITAL	**Colobolomas Persistent fetal vasculature Coat's disease**
INFLAMMATION	**Endopthalmitis Posterior scleritis Uveitis**
TUMOR	**Retinoblastoma Uveal melanoma Choroidal metastases Choroidal hemangioma**
DEGENERATIVE	**Choroidal detachment Retinal detachment Vitreous hemorrhage**

▪ OPTIC NERVE COMPLEX LESIONS & RETROBULBAR PATHOLOGY

ETIOLOGY	DISEASES
Congenital	**Optic nerve aplasia and hypoplasia Leber's hereditary optic neuropathy**
Demyelination	**Optic neuritis**
Inflammatory	**Perineuritis, Idiopathic pseudotumor, Sarcoidosis**
Neoplastic	**Glioma, meningioma, metastases, lymphoma**
Ischemic	**AION, PION**
Vascular	**Orbital AVM, cavernous hemangioma, lymphangiomas**

▪ ORBITAL APEX & CAVERNOUS SINUS LESION

ETIOLOGY	DISEASES
Neoplastic	**Primary Meningioma, Nerve sheath tumors, Hemangioma, Epidermoid and dermoid, Direct spread of Pituitary adenoma and Craniopharyngioma, JNA, lymphoma**
Vascular	**Carotid cavernous fistula, ICA aneurysm**
Infections	**Fungal- mucormycosis, herpes**
Inflammatory	**Granulomatosis with polyangiitis, sarcoidosis**

▪ EXTRACONAL PATHOLOGIES

ETIOLOGY	DISEASES
Vasculogenic	**Vasculoproliferative lesion, Infantile capillary hemangioma, Low flow lesions: Venolymphatic malformations and lymphangiomas**
Congenital	**Dermoid, Epidermoid Lymphoma**
Neurogenic	**Schwannoma Neurofibroma**
Mesenchymal	**Rhabdomyosarcoma Infantile fibromatosis**
Lymphoproliferative	**Lymphoma**
Osseous	**Ewing's sarcoma, Fibrous dysplasia**
Infective	**Subperiosteal abscess**

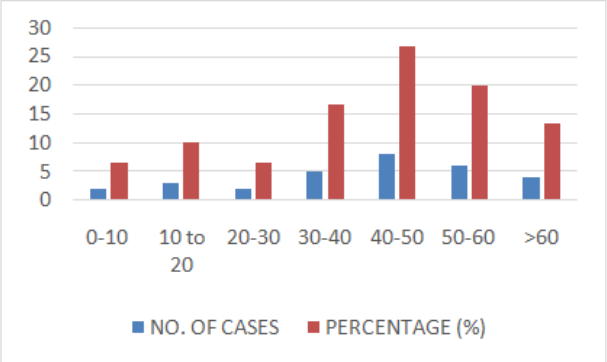
- For coloboma heavily T2 weighted sequences such as FIESTA, SPACE or CISS are ideal. Advanced myopia, posterior staphyloma may mimic coloboma, MRI can differentiate. MRI is also useful to rule out colobomatous cysts (1).
- MRI is also useful in the evaluation of posterior scleritis. It is seen as eccentric scleral thickening and enhancement, which may demonstrate nodularity or mass-like appearance mimicking melanoma. Areas of focal thinning may indicate impending rupture.Periscleral cellulitis seen as fat stranding on T2FS with postcontrast enhancement.
- Detachments of the retina, choroid and vitreous can be differentiated based on their morphology (2). In both, the detached membranes are best visualized on T2-weighted images as hypointense linear structures. Unlike retinal detachment, choroidal detachment is not limited anteriorly by the ora serrata. Retinal detachment tends to converge toward the optic disc.
- In endophthalmitis, uveal thickening may be apparent on T2-weighted images with prominent postcontrast enhancement. Associated chorioretinal or vitreous detachment may be present. Proteinaceous exudates within the vitreous may demonstrate hyperintense signal on fluid-attenuated inversion recovery (FLAIR) and T1 with frank purulent content showing diffusion restriction (3). Panophthalmitis shows variable often extensive extrascleral involvement seen as hyperintensity on T2 fat-saturated (T2FS) images and postcontrast enhancement reflecting inflammatory changes of the orbital fat.
- MRI is invaluable in evaluating the extent of retinoblastoma. The tumor appears T2 hypointense and T1 hyperintense relative to the vitreous (4). It may show diffusion restriction with moderate postcontrast enhancement. Foci of calcification. Vitreous seeding, a marker of poor prognosis, can be identified as TI hyperintense, T2 hypointense foci against the fluid signal of the vitreous cavity. (5)
- Uveal melanoma is the most common primary malignant intraocular tumor inadults. Melanin being paramagnetic appears TI hyperintense and T2 hypointense giving the tumor its characteristic appearance. Amelanotic and mixed variants. hence, may not show TI hyperintensity making their recognition more difficult. (6)
- Uveal metastases most commonly occur from the breast and lung primaries. They occur as exophytic masses that are usually T1 hypointense and T2 hyperintense with postcontrast enhancement. (7)
- Primary intraocular lymphomas are a rare subset of primary central nervous system (CNS) lymphoma. MRI has a poor sensitivity for detecting these lesions. Postcontrast T1 images are most useful in suspected cases and may reveal subtle to extensive plaque like thickening of the uvea. (8)
- Optic neuritis manifests as high T2 signal intensity with or without optic nerve swelling on T2FS images. This hyperintensity per se is nonspecific since this may represent a combination of ischemia, inflammation, edema, or demyelination. AION shows a greater degree of cytotoxic edema that manifests as diffusion restriction and breakdown of the blood-brain barrier at the optic nerve papilla, resulting in focal intravitreal bulging and enhancement of the optic nerve head, best seen on volumetric T2-weighted images such as FIESTA [Fig. 13]. This appearance is termed the central bright spot sign and has a strong negative predictive value.i.e.,its absence reliably indicates NAION(9)
- Optic nerve sheath meningioma (ONSM) may be primary or secondary (perineural extension of intracranial meningioma). ONSM is T1 and T2 hypointense and shows moderate to intense enhancement in a tram-track (axial) or doughnut target pattern. ONSM can be mimicked by many other neoplastic infiltrative disorders and should be closely followed clinicoradiologically. (10).
- Graves' ophthalmopathy or Thyroid Eye Disease (TED) is the most common cause of proptosis in adults. Both CT and MRI show morphological findings of disproportionate fusiform enlargement of the EOMS (mid-belly thickness of >5 mm) with relative sparing of the tendinous globe attachments (Coke-bottle appearance). MRI provides an added advantage of allowing differentiation of the acute inflammatory phase from the chronic phases. In the acute phase, the EOMS show STIR hyperintense edema which can be quantified as a ratio of signal intensity to the temporalis muscle for serial follow-up and monitoring. (11)

II. Result

The study included total 30 patients. There were 15 males (50%) and 15 females (50%).Majority of the cases were from unilateral eye(73.3%).

TABLE1:DISTRIBUTION ACCORDING TO AGE GROUP

AGE (YEARS)	NO. OF CASES	PERCENTAGE (%)
0-10	2	6.6
10-20	3	10
20-30	2	6.6
30-40	5	16.6
40-50	8	26.6
50-60	6	20
>60	4	13.3
Total	30	100



Out of 30 patients maximum orbital pathologies were found in age group of 40-50 years (26.6%) followed by 50-60 years (20%).

Table2:DISTRIBUTION ACCORDING TO GENDER

GENDER	NO. OF CASES	PERCENTAGE
MALE	15	50
FEMALE	15	50

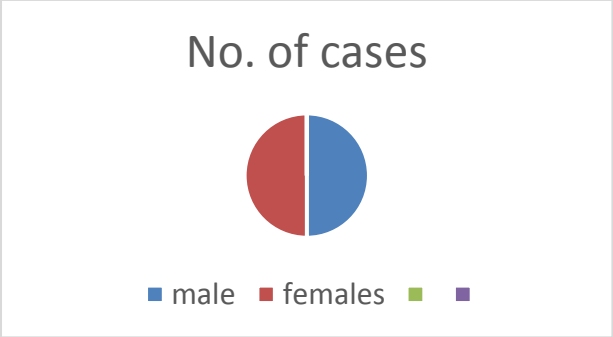


Table3:DISTRIBUTION OF ORBITAL PATHOLOGIES AS PER LATERALITY

LATERALITY	NO. OF CASES	PERCENTAGE
UNILATERAL	22	73.3
BILATERAL	8	26.7

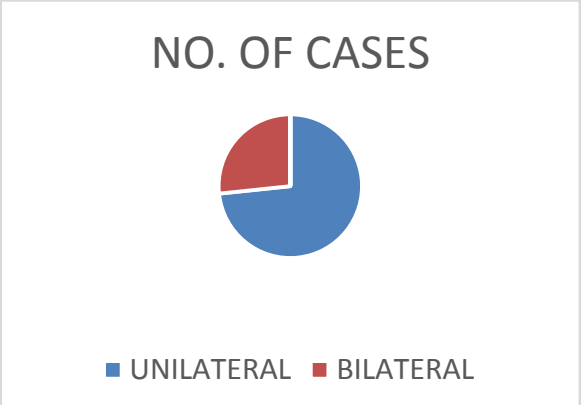


Table 4: DISTRIBUTION OF ORBITAL PATHOLOGIES ACCORDING TO PRIMARY AND SECONDARY

Type of involvement	No. of cases	Percentage (%)
Primary	14	46.6
Secondary	16	53.4
Total	30	100

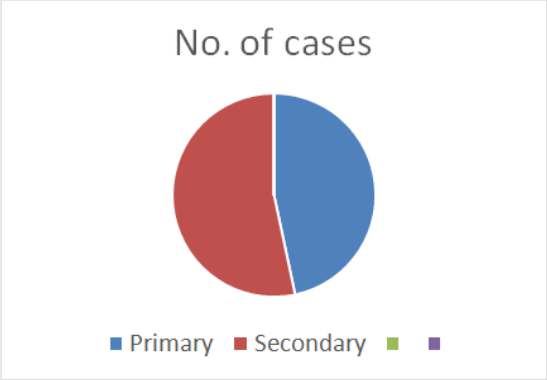


Table 5:DISTRIBUTION OF ORBITAL PATHOLOGIES ACCORDING TO ETIOLOGY

ETIOLOGY	NO. OF CASES	PERCENTAGE (%)
INFECTIVE/ INFLAMMATORY	16	53.4
VASCULAR	1	3.3
TRAUMATIC	3	10
NEOPLASTIC	6	20
CONGENITAL	1	3.3
ENDOCRINE AND SYSTEMIC	3	10
TOTAL	30	100

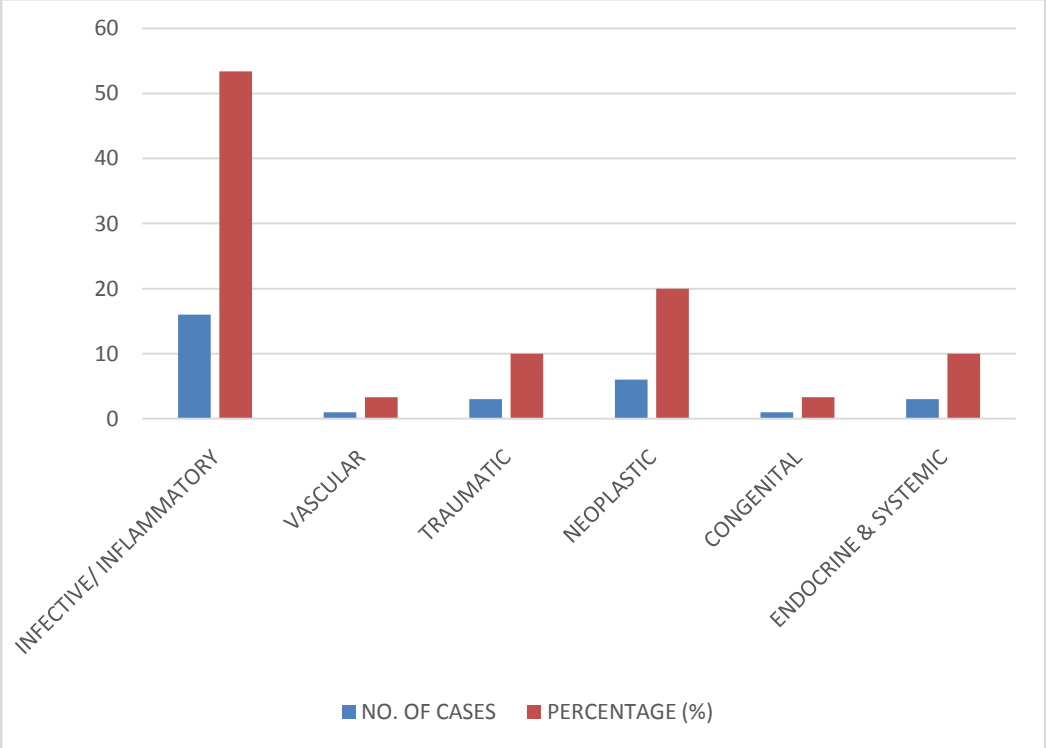
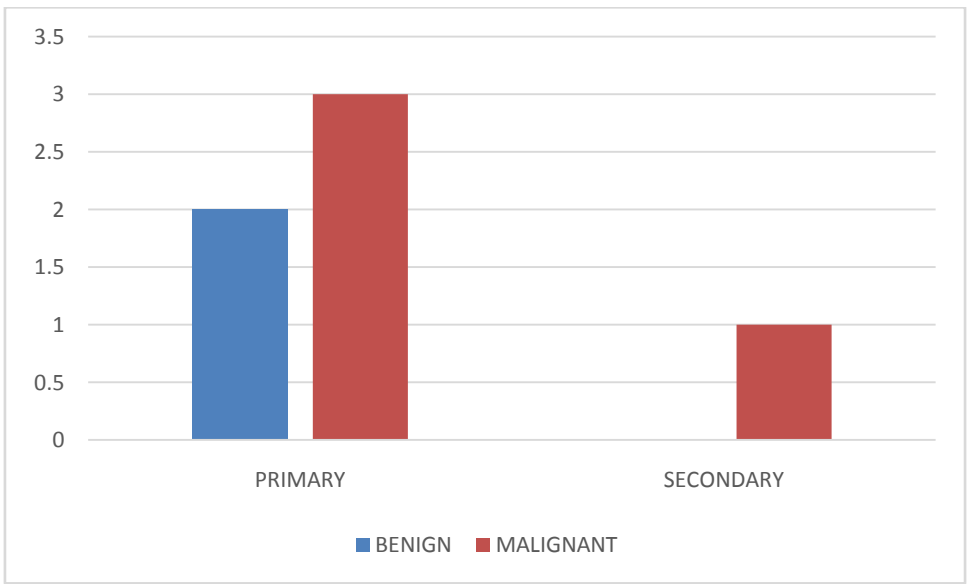


Table 6:DISTRIBUTION OF PRIMARY AND SECONDARY ORBITAL NEOPLASMS

ORBITAL NEOPLASM	PRIMARY	SECONDARY
BENIGN	2	0
MALIGNANT	3	1
TOTAL	5	1



All benign neoplasm were primary. Total 4 malignant neoplasm were present. Out of which 3 were primary and 1 was secondary

COMPARTMENT	NO. OF CASES	PERCENTAGE
INTRACONAL	5	16.7
EXTRACONAL	7	23.3
CONAL	2	6.6
OCCULAR	3	10.0
MULTISPATIAL	10	33.3
OTHERS	3	10.0
TOTAL	30	100

Table 7:DISTRIBUTION OF ORBITAL PATHOLOGIES CONFINED TO SINGLE ORBITAL AND MULTISPATIAL INVOLVEMENT

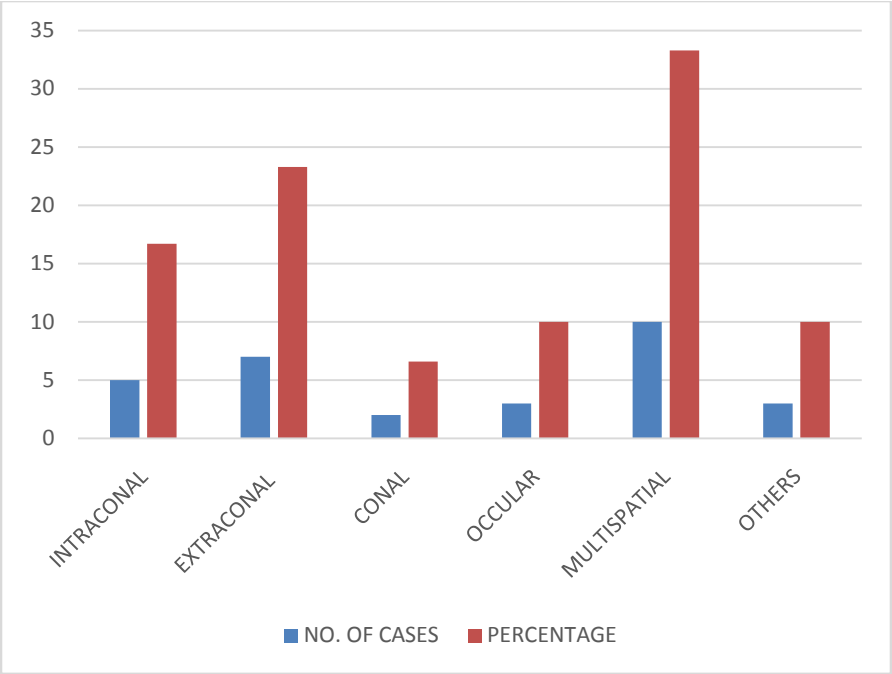
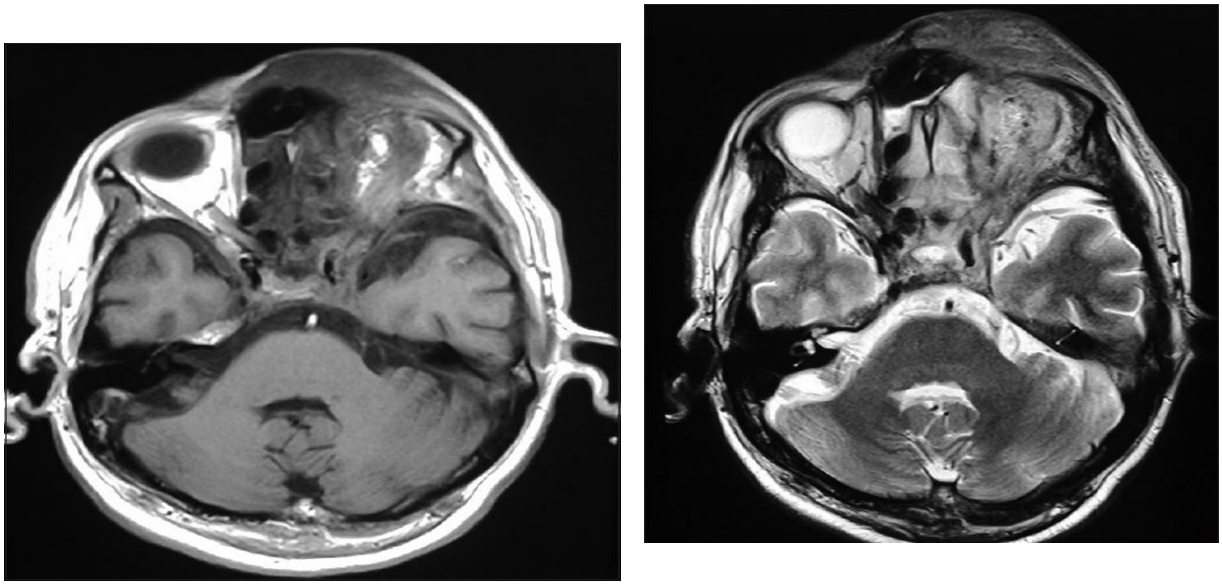


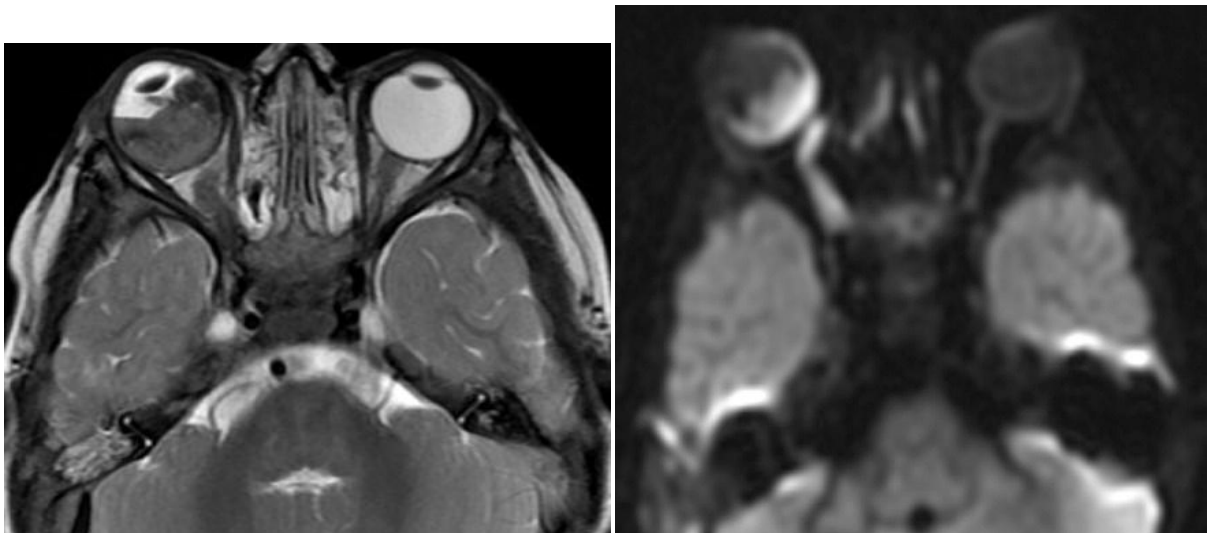
Table 8:DISTRIBUTION OF ORBITAL PATHOLOGIES ACCORDING TO ETIOLOGY AND GENDER

ETIOLOGY	MALE	FEMALE	TOTAL	PERCENTAGE (%)
INFECTIVE/ INFLAMMATORY	9	7	16	53.4
VASCULAR	0	1	1	3.3
TRAUMATIC	2	1	3	10
NEOPLASTIC	3	3	6	20
CONGENITAL	0	1	1	3.3
ENDOCRINE AND SYSTEMIC	1	2	3	10
TOTAL	15	15	30	100



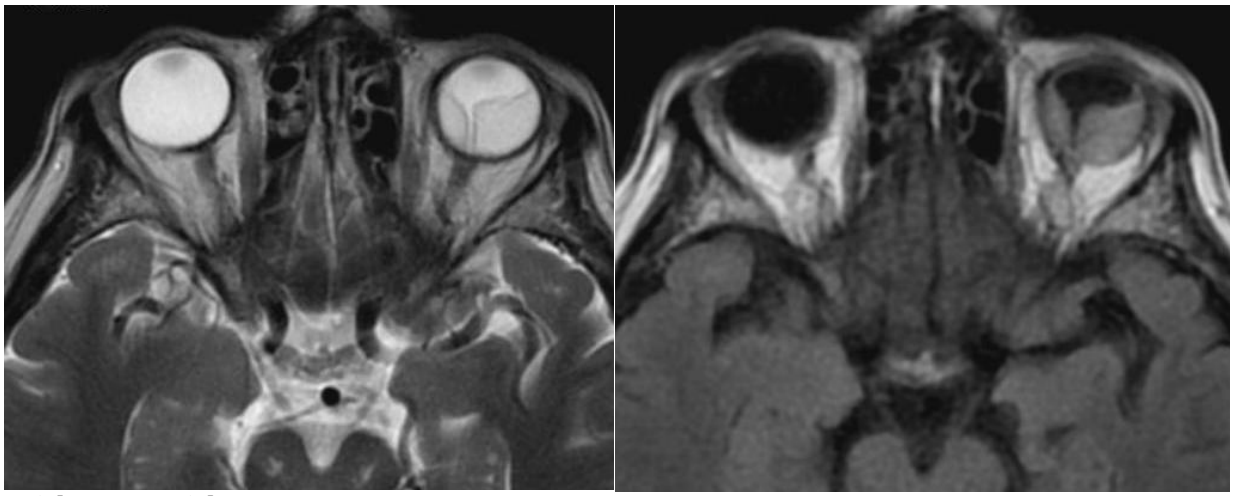
AXIAL T1WAXIAL T2W

Rhino-orbital mucormycosis involving left orbit



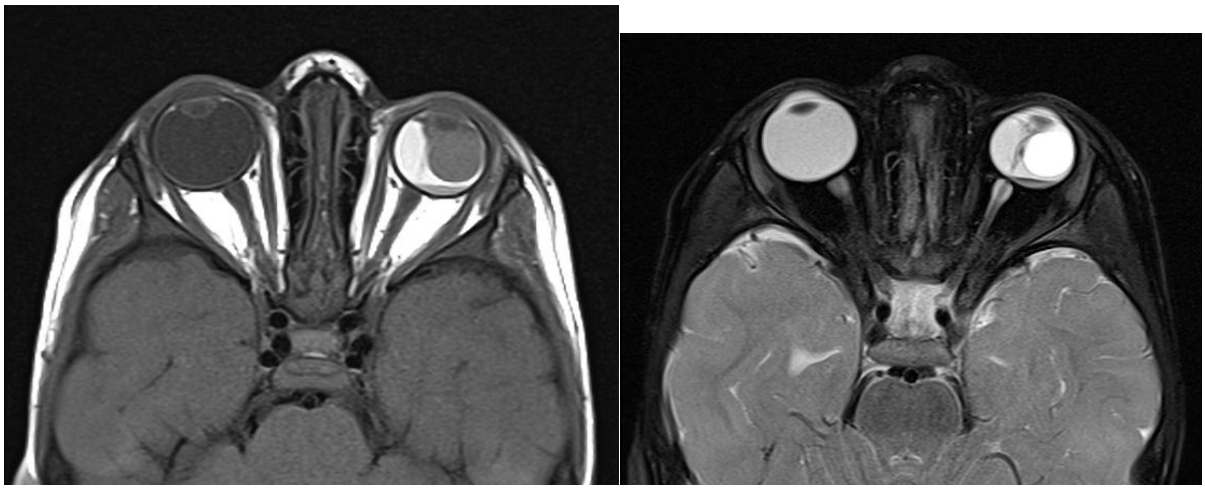
AXIAL T2WDWI: showing restriction

Retinoblastoma – Right ocularinvolvement

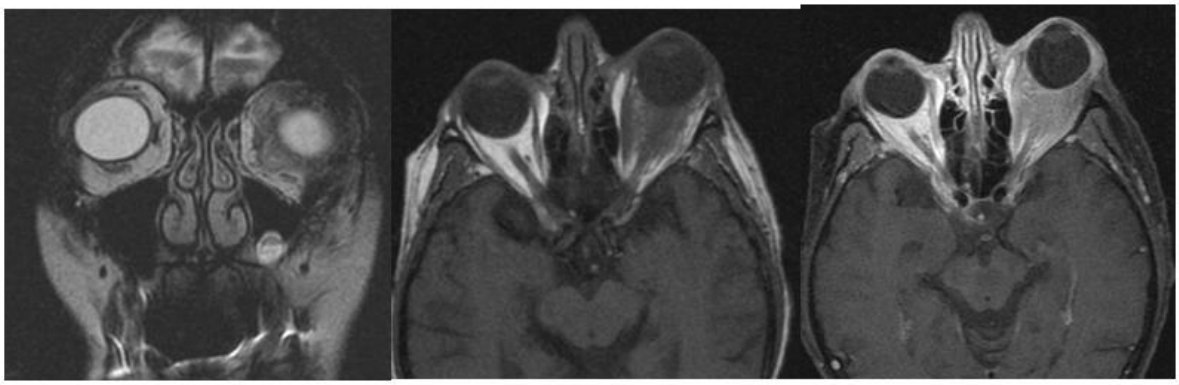


Axial FLAIRAxial T2W

Retinal detachment



Axial T1W Axial T2 FS
PHPV



CORONAL T2WAXIAL T1W POST CONTRAST T1W FS

ORBITAL LYMPHOMA

III. Discussion

• Out of 30 patients maximum orbital pathologies were found in age group of 40-50 years (26.6%) followed by 50-60 years (20%).

- Distribution of MRI orbital pathologies according to gender,Out of 30 patient's half no. of cases 15 (50%) were Males and another half were females 15 (50%). In a similar study by Nilesh Chaudhari et al || maximum number of cases were males [54.2%] and few cases were females [45.8%].
- Distribution of orbital pathologies as per laterality where we found maximum (73.3%) cases were unilateral and only (26.7%) cases had bilateral involvement.
- Distribution of orbital pathologies as per primary versus secondary orbital involvement. Maximum patients 16 (53.4%) had secondary orbital involvement and only 14 (46.6%) had primary orbital involvement.
- Maximum cases were infective/inflammatory (53.4%), followed by neoplastic cases (20%), traumatic and endocrine with systemic causes (10 % each). In a similar study by Nisha et al II, maximum cases (36%) were inflammatory followed by neoplastic and traumatic. Another study by Nilesh Chaudhari et al II. maximum cases (31.4%) wereinflammatory infective followed by neoplastic (20%). Least cases were congenital(2%). In study by Aarti Anand et al. maximum cases were inflammatory and infective (35%) followed by neoplastic (31%). Least cases were traumatic (4%).
- All benign neoplasm were primary. Total 4 malignant neoplasm were present. Out of which 3 were primary and 1 was secondary. In study by Usha Kim et al showed that most of the orbital neoplasms (90%) were found to be primary and 10% were secondary.
- 20 (66.7%) patients had orbital pathologies confined to single compartment and 10 (33.3%) patients had multispatial involvement.
- According togender wise distribution infective/inflammatory disorders and traumatic injuries were common in males while congenital, vascular and miscellaneous pathologies were common in females. Neoplastic pathologies were found equally in both sexes.

IV. Conclusion

- MRI is superior to other imaging modalities for lesion characterization, delineation of the anatomical extent, presents additional advantages including comprehensive screening of the rest of the neuraxis and repeatability given the lack of ionizing radiation.
- Thus the role of MR imaging is irreplaceable by CT or routine ophthalmology instruments.
- This allows the clinician to make a better-informed decision regarding further management, prognosticate and follow up.

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Conflicts of interest: There are no conflicts of interest.

References

[1]. Gala F. Magnetic resonance imaging of optic nerve. Indian J Radiol Imaging 2015:25:421-38
[2]. Hallinan JT. Pillay P. Koh LH. Goh KY, Yu WY. Eye globe abnormalities on MR and CT in adults: An anatomical approach. Korean J Radiol 2016:17:664-73.
[3]. Rumboldt Z. Moses C. Wieczerzyski U, Saini R. Diffusion-weighted imaging apparent diffusion coefficients, and fluid-attenuated inversion recovery MR imaging in endophthalmitis, AJNR Am J Neuroradiol 2005:26:1869-72.
[4]. Kazek AA. Elkhamury S. MRI of retinoblastoma. Br J Radiol 2011:84-775-84.
[5]. Silvera VM. Guerin JB. Brinjikji W. Dalvin LA. Retinoblastoma: What the neuroradiologist needs to know. AJNR Am J Neuroradiol 2021:42:618-26
[6]. Lemke AJ, Kazi I. Felix R. Magnetic resonance imaging of orbital tumors. EurRadiol 2006:16:2207-19.
[7]. Li CD, Meltzer DE. Case 206: Persistent hypertrophic primary vitreous.
[8]. Kuker W. Herrlinger U, Gronewaller E. Rohrbach JM. Weller M. Ocular manifestation of primary nervous system lymphoma: What can be expected from imaging? J Neurol 2002,249,1713-6.
[9]. [10:12 pm, 25/08/2022] BHUSHAN: Remond P. Attye A. Lecler A. Lamalle L. Boudiar N. Aptel F, et al. The central bright spot sign: A potential new MR imaging sign for the early diagnosis of anterior ischemic optic neuropathy due to giant cell arteritis AJNR Am J Neuroradiol 2017:38:1411-5.
[10]. Kim JL. Mendoza PR, Rashid A. Hayek B. Grossniklaus HE. Optic nerve lymphoma: Report of two cases and review of the literature. SurvOphthalmol 2015:60:153-65.
[11]. Goyal P. Lee S, Gupta N. Kumar Y. Mangla M, Hooda K, et al. Orbital apex disorders: Imaging findings and management. Neuroradiol J 2018:31:104-25.

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