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Role of Magnetic resonance imaging in Evaluation of Orbital Mass Lesions

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ABSTRACT

Background

The prevalence of orbital pathologies is currently on the rise, likely due to heightened awareness of clinical symptoms, improved access to healthcare facilities, and the introduction of advanced diagnostic and treatment options. Most masses have an effect on the sensory and motor visual pathways. Early identification and the implementation of treatment are necessary to mitigate patient suffering caused by visual complications or the risk of permanent vision loss.

Aim

The aim and objectives of this study were to evaluate the role of MRI in diagnose, characterize & define the extent of various orbital mass lesions, with a focus on distinguishing between benign and malignant orbital lesions.

Methodology

In this cross sectional study, conducted over the duration of two years from December 2022 to November 2024 included 30 patients who came to department of radiodiagnosis, Aarupadai Veedu Medical College, Puducherry under Vinayaka Mission's Research Foundation University, Salem with clinical suspicious of orbital mass lesions. All these patients were subjected to MRI of the orbit with brain sections for further characterization of the mass lesion.

Results

In our study, out of 30 cases, extraconal were more prevalent 16 (53.33%). The most common benign orbital tumors were hemangiomas 5 (16.67%), followed by meningiomas 4 (13.33%), and inflammatory pseudotumors 3 (10%). The most common malignant orbital tumors were lymphomas 5 (16.67%), and metastasis 4 (13.33%).

Conclusion

Magnetic Resonance Imaging (MRI), along with its advanced techniques, has become a crucial imaging tool for assessing orbital lesions due to its exceptional soft tissue and contrast resolution, absence of ionizing radiation, capability for multi-planar imaging, and enhanced lesion characterization. Recent technological innovations such as Diffusion Weighted Imaging, Dynamic Contrast-Enhanced MRI significantly contribute to the diagnosis of various orbital masses.

Keywords: orbital mass, tumor, MRI orbit, orbital lesions.

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INTRODUCTION

A variety of space-occupying lesions may involve the orbit and can present with a wide variety of symptoms. If they are not diagnosed early and treated immediately, they can lead to loss of vision and disability. [1] Many benign tumors, such as capillary hemangioma, lymphangioma, optic nerve sheath meningioma, and asymptomatic orbital cavernous hemangiomano may not require surgery. Therefore accurate diagnosis is necessary which will help in directing the therapy. Orbital tumors are classified based on their location into extraconal, intraconal and ocular tumors. This categorization helps in localization and finalizing the differential diagnosis of the orbital tumors. [2]

Extraconal tumors arise outside the extraconal muscles, mainly from the eyelids. They consist of a number of primary orbital tumors, the commonest being lymphomas. These lesions usually cause proptosis or swelling of the orbit. Intraconal tumors are within the extraocular muscles and involve the retroorbital space. Hemangioma are the common primary tumors in this location. Other tumors are meningioma and optic nerve glioma. These tumors usually produce proptosis or loss of vision. They are predominantly benign tumors. Intraocular tumors are present within the globe itself. [2]

Various modalities are available for detection of orbital tumors and tissue characterization. CT and MRI are the commonly used modalities. The radiological diagnosis is based on the topography of the lesion, characterization into benign / malignant, morphology analysis and presence of secondary changes adjacent to the lesion.Nowadays, MRI is the most commonly used modality for diagnosis of orbital tumors unless there is a contraindication.

Aim & Objectives

The aim and objectives of this study were to evaluate the role of MRI in diagnose, characterize & define the extent of various orbital mass lesions, with a focus on distinguishing between benign and malignant orbital lesions.

Methodology

This cross sectional study was done over the period of one year from December 2022 to November 2024 which included 30 patients who came to department of Radiodiagnosis, Aarupadai Veedu Medical College, Puducherry for magnetic resonance imaging with clinical suspicious of orbital mass lesions.

Inclusion Criteria: Clinically suspected patients of orbital tumor referred from the department of ophthalmology, surgery, otorhinolaryngology and pediatrics with associated symptoms, with or without extraocular movement restriction, palpable mass.

Exclusion Criteria: Patients with polytrauma and poor general condition. A detailed history of the patient in relation to the mode of onset, progression, laterality, associated symptoms like proptosis, diplopia, defective vision and palpable mass was taken and noted. Complete general and ocular examinations including visual acuity, examination of orbit, lids, anterior and posterior segments and other relevant tests were done in the department of ophthalmology. Following which all these patients underwent MRI of the orbit with brain sections for further characterization of the mass lesion using Philips Achieva DS 1.5 Tesla MR machine. Informed signed consent was acquired from all the cases. Ethical approval was obtained for the study from the Ethics Committee of the institute.

Statistical analysis: Descriptive and inferential statistical analysis was carried out in present study. The Microsoft Excel 2007 and SPSS 22.0 version software package used for data entry and analysis. The categorical factors are represented by the number and frequency (%) of cases. The continuous variables are represented by measures of central frequency (like mean) and deviation (SD and range) wherever appropriate. Statistical analysis was done by unpaired student's t-test, chi-square test and Univariate analysis of variance. P-value <0.05 was considered as statistically significant.

Results: A total 30 patients satisfying inclusion criteria were included in this study. Among 30 cases, 13(43.33%) were males and 17 (56,67%) were females. Adult population was 25 (83.33%) and

patients in the pediatrics age group were 5 (16.67%) [Table 1]. Left side dominance was noted 16 (53, 33%), right side 12 (40%) and 4 (13.33%) cases had bilateral involvement.

Table 1. Age and Sex wise distribution

Age (in years)	Male	Female	Total
<15	2 (6.67%)	3 (10%)	5 (16.67%)
15 -30	2 (6.67%)	2 (6.67%)	4 (13.33%)
31-45	2 (6.67%)	3 (10%)	5 (16.67%)
46-60	6(20%)	8 (26.67%)	14 (46.66%)
>60	1 (3.33%)	1 (3.33%)	2 (6.67%)
Total	13 (43.33%)	17 (56.67%)	30 (100%)

Out of 30 cases, extraconal were more common 16 (53.33%) followed by Intraconal 9 (30%) and 5 (16.67%) cases were ocular.The most common benign orbital tumors were hemangiomas 5 (16.67%) *(Fig.1)*, meningiomas 4 (13.33%) *(Fig.2)* and inflammatory pseudotumors 3 (10%).The most common malignant orbital tumors were lymphomas 5 (16.67%) *(Fig.3)* and metastasis 4 (13.33%). A total of 3 cases (10%) were of glioma *(Fig.4)* and 2 cases (6.67%) were of retinoblastoma *(Fig.5)*. [Table 2]

Table 2. Compartment wise distribution of Tumors

Extraconal	Number of Cases	Intraconal	Number of Cases	Ocular	Number of Cases
Lymphoma	5	Meningioma	2	Metastasis	2
Pseudotumor	3				
Lacrimal Adenoma	2				
Hemangioma	1	Hemangioma	4	Retinoblastoma	2
Metastases	2				
Meningioma	2	Glioma	3	Choroid melanoma	1
Dermoid cyst	1				
Total	16		9		5

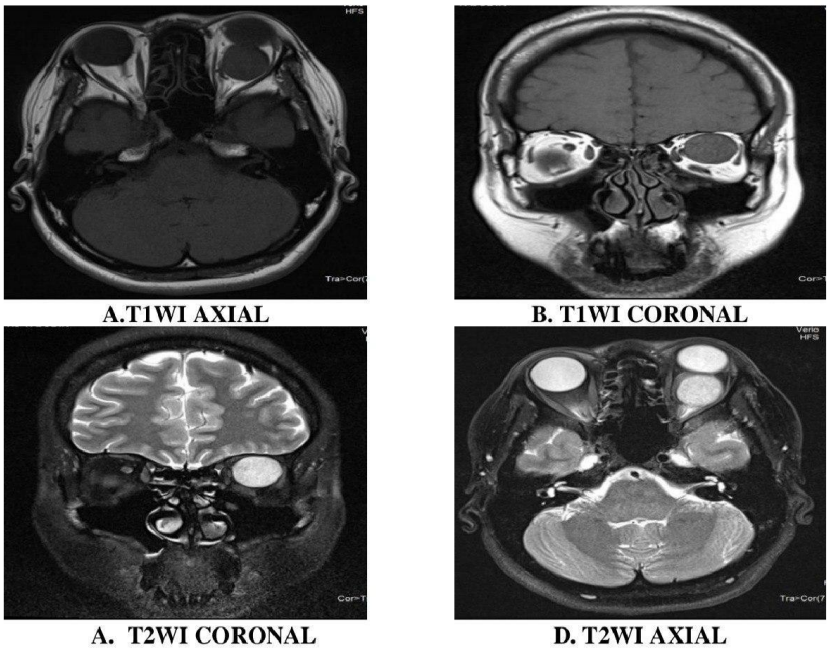

Fig 1. Showing MR images of a case with hemangioma

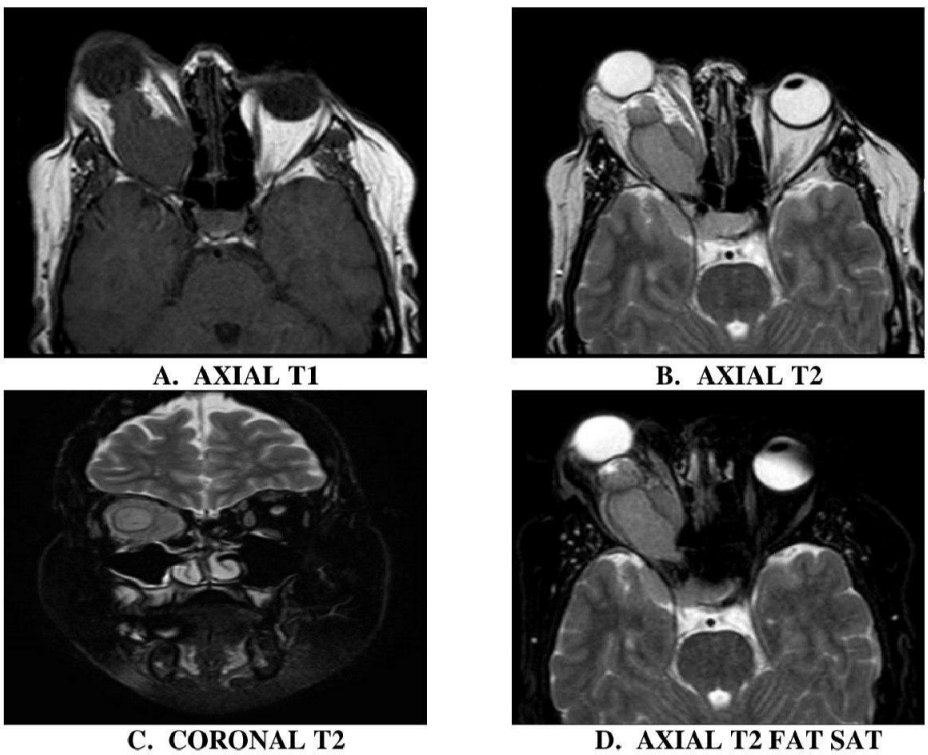

Fig 2. Showing MR images of a case with meningioma

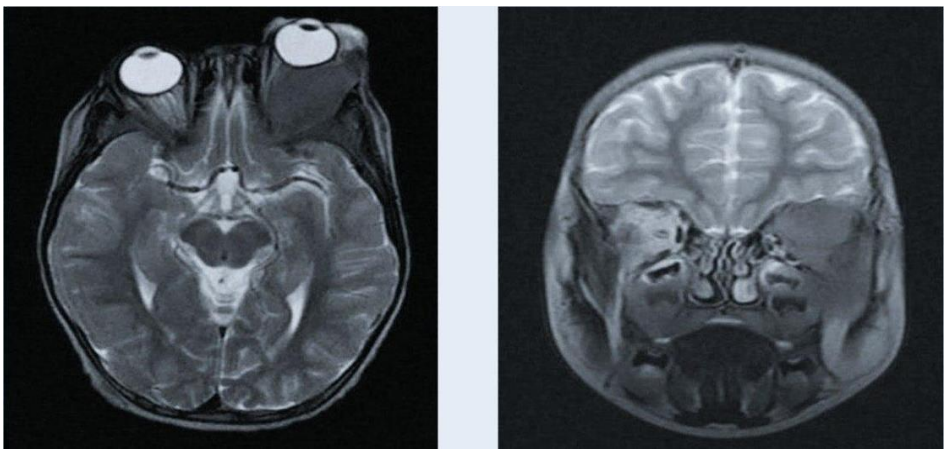

Fig 3. Showing MR images of a case with lymphomas

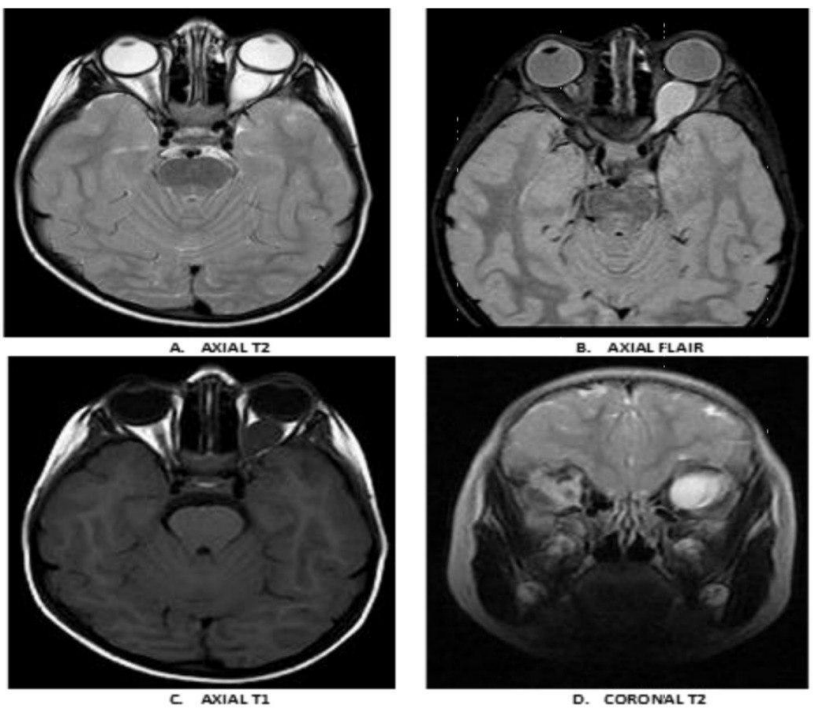

Fig 4. Showing MR images of a case with glioma

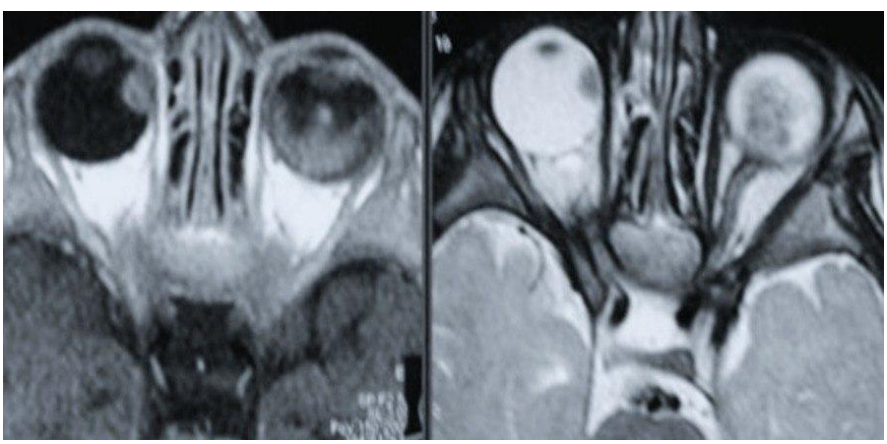

Fig 5. Showing MR images of a case with retinoblastoma

Out of 25 (83.34%) adult cases, 13 (43.33%) were extraconal. Intraconal were 8(26.67%) and ocular were 4 (13.33%). Among Pediatric tumors 10 (30%) were extraconal, 1 (3.33%) was of Intraconal and 1(3.33%) was ocular. Proptosis was the most common symptom. Among all the cases of hemangioma and glioma had proptosis as the main symptoms. In the cases of lymphomas and ademona cases swelling of orbit was the main symptom. Blurring of vision was the most common in metastases cases [Table 3].

Table 3. Compartmental distribution in adult and paediatrics population

	Extraconal	Intraconal	Ocular	Total
Adults	13 (43.33%)	8 (26.67%)	4(13.33%)	25(83.34%)
Paediatrics	30(10%)	1(3.33%)	1(3.33%)	5(16.66%)

Discussion

MRI has many advantages like high contrast resolution, the ability to obtain images in any plane, lack of ionizing radiation makes it a favored modality. Magnetic resonance imaging (MRI) is preferred for diagnosis of orbital masses as it helps in delineating extension and involvement of surrounding structures and grading of orbital masses.

In the present study the majority age group of patients were between the age of 46 to 60 years (46.66%) with mean age of 28.6 years. The mean age of patients with benign lesions was 24.5 years and of patients with malignant lesions was 25.5 years. Majority of patients were females (17) constituting (56.67%) of cases. This finding had been in concordance with the study of N. Khandelwal and R.T. Nair et al. [3].The most common presenting complaint was proptosis seen in 68% of cases followed by pain 58% of cases. Diminution of vision or loss of vision and diplopia were seen in 45% of each cases . Similar clinical findings were seen in studies by Sarah N. Khan, MD; Ali R. Sepahdari et al. [4]. Amongst the malignant lesions detected on MRI in our study, the most prevalent cases were lymphomas 5 (16.67%) followed by metastasis 4 (13.33%) . Similar findings were seen in Rolando Enrique, D Domingo et al. [5].

Optic nerve glioma were typically isointense on T1-weighted images and hyperintense on T2-weighted images of MRI, which were sharply circumscribed, fusiform enlargement of optic nerve and diffuse involvement of the nerve which differentiate the optic nerve glioma from the optic sheath meningiomas this was reported similar to study findings by Tina D. et al. [6]. The optic nerve meningioma on MRI appeared as isointense on T1W1 however, the substance of the nerve is spared as ' tram track' appearance which was also observed by Tina D. et al. [6]

Strength and Limitations

This study's strength includes a comprehensive data collection, clinical relevance, and adequate diagnosis of various orbital lesions. However, the limitations were its single-centre nature, and limited number of cases.

Conclusion:

This study aimed at differentiating orbital masses lesions based on the various imaging properties of the lesion using magnetic resonance imaging. We can conclude that magnetic resonance imaging is a very valuable noninvasive tool for the identification, characterization and differentiation of orbital mass lesions.

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