e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(3); 185-191

Original Research Article

Role of Magnetic Resonance Imaging in Assessing Non-Traumatic Lesions of Orbit

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Received: 26-12-2022 / Revised: 30-01-2023 / Accepted: 10-02-2023

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Conflict of interest: Nil

Abstract

Background: Optical imaging techniques are the major investigation modalities of eye at present, but they have limitations as diagnostic and prognostic tools.

Objectives: Present study was aimed to study the role of magnetic resonance imaging in assessing non-traumatic lesions of the orbit and to characterize them according to location & intensity.

Materials and Methods: Present study was a hospital based cross-sectional study done at a tertiary care hospital of central India region. 60 patients with non-traumatic primary orbital lesions presenting with symptoms of proptosis, diminution of vision, diplopia, or with suspected metastasis to the orbit or invasion from intra- or extracranial lesions underwent MR imaging of orbit according to the following protocol.

Results: Out of 60 patients, 23 had inflammatory lesions, 15 had malignant neoplastic lesions, 10 had vascular lesions, 7 had benign neoplastic lesions and congenital lesions each. Retinoblastoma was common intraocular lesion among pediatric age and lymphoma was most common malignant lesion in adult population. Cavernous hemangioma was common vascular lesion in adults.

Conclusion: MR imaging is valuable for evaluation of orbital neoplasms, as it provides critical anatomic information about ocular structures involved, peri-neural spread, and intracranial extension.

Keywords: Magnetic Resonance Imaging, Orbital Lesions, Intraocular Lesion.

Introduction

The human eye functions like a camera because it can bend light to create images, which in turn trigger the nervous system's processing of visual information. The World Health Organization reported that in 2002, there were 161 million visually impaired people in the world, of whom roughly 37 million had completely lost their vision [1]. The majority of eye research methods now use optical imaging techniques, although these methods have limitations as diagnostic and prognostic instruments [2]. These techniques are limited in their application in many pathological diseases because they require an optically transparent passage of light from the corneal surface via the lens and the retina. Because to the fluid contents of the orbit, ultrasonography has great spatial resolution; but, when compared to cross-sectional modalities like CT or MRI, it has

less deep tissue penetration and is hence less helpful in identifying extra-orbital expansions of the orbit [3]. MRI techniques can be used to fine-tune and clarify challenging situations, as well as to research illness processes and the effectiveness of treatments [4].

The majority of the numerical data produced by MRI is based on measurements of pixel intensity; these measurements yield values for the signal-to-noise ratio (SNR), contrast-to-noise ratio, T1, T2 relaxation durations, and coefficients describing water diffusion or ocular perfusion [5]. The data offered can be used for cellular activity assessments, tumour detection, and differentiating between diseased and normal tissues [6].

The reaction of the brain or even the retina to various stimuli has been measured in functional MRI (fMRI) studies using pixel intensity data [7]. Retinal thicknesses have been quantified using MRI scans of healthy participants and patients with ocular disease, [8] as well as measurements of distances, regions, or volumes.

The eye needs to be viewed using modalities with great spatial resolution because it is a superficially situated, anatomically unique organ with fine components. The majority of its constructions contain a lot of water. The anterior portion of the eye is filled with a transparent liquid called aqueous humour, which has characteristics similar to those of water. The posterior region of the human eye is filled with an avascular jelly called the vitreous humour, which is 98% water [9].

Based on the differences in their water contents, MRI contrast between various eye structures can be established. Based on variations in the ocular structures' relaxation characteristics, which are shown by their T1, T2, and T2* relaxation periods, MRI contrast between the eye structures may also be attained [5]. The diagnosis and treatment of ocular and orbital diseases have taken on a new dimension because of magnetic resonance imaging (MRI). The use of magnetic resonance imaging (MRI) as a crucial imaging tool in ophthalmology is growing. Like CT, proper MRI interpretation enables us to determine the location, size, and pattern of orbital lesions as well as their impact on nearby structures.

This makes it easier to develop a sound differential diagnosis and plan effective treatment, including a surgical strategy. The goal of the current study was to examine how magnetic resonance imaging can be used to evaluate non-traumatic lesions of the orbit and to characterize each lesion in terms of its location, intensity, enhancing properties, effects on the surrounding soft tissue, and neural involvement.

Subjects and Methods

Study design, settings and participants:

It was a hospital based prospective observational study conducted over a period of two year from January 2018 to December 2020 in tertiary care teaching hospital in Central India. Patients with non-traumatic primary orbital lesions presenting with symptoms of proptosis, diminution of vision, diplopia, or with suspected metastasis to the orbit or invasion from intra- or extracranial lesions were included in the study.

Patients with suspected metallic foreign body in the eye, or patients with contraindications to MR Imaging: patients with ferromagnetic implants, claustrophobia etc. or contraindication to contrast agents were excluded from the study.

Data collection

All patients' written informed consent was obtained before a thorough history was taken. Patients who met the inclusion and exclusion requirements underwent orbital MR imaging using the following methodology. A 1.5-T magnet MR system was used for all of the

MR imaging tests. Axial T2 FSE/TSE, Coronal T2 FSE/TSE FS, Axial T1, Axial T1 + Contrast, Coronal T1+Contrast, Axial diffusion, and ADC are among the sequences that were performed. Slices of 3mm were obtained. Gadolinium was the contrast material utilised. The patients were assessed with MR using the orbital technique, and gadolinium was used to generate contrast enhancement. Clinical and analytical results were correlated with the diagnosis determined by MR imaging. Histopathology and CT correlations were performed if required.

CASE 1 Lymphovenous Malformation

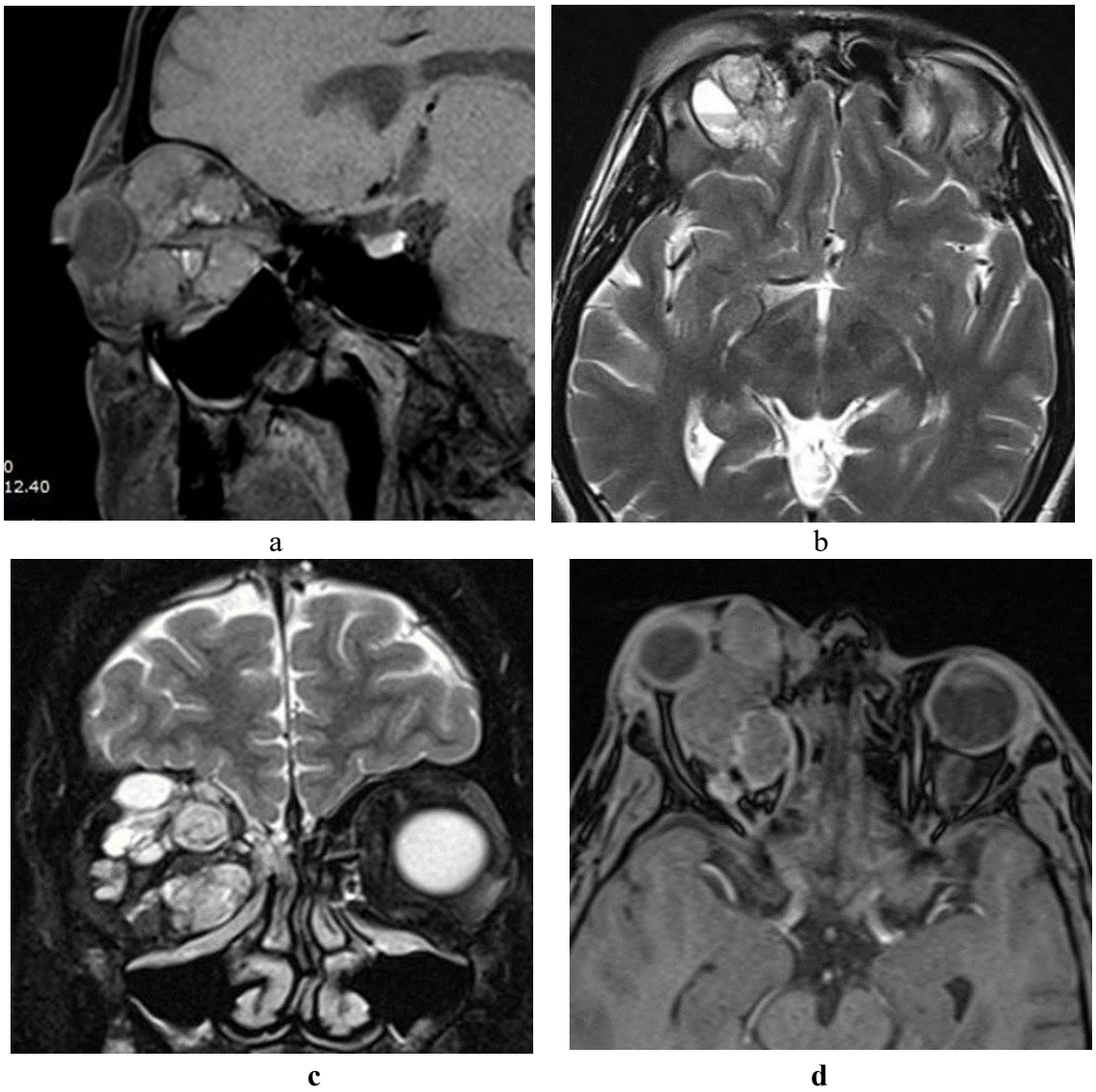

Figure 1: Saital T1 image shows heterogeneous lesion in extraconal space with few T1 hyperintense areas(a), T2 axial and coronal image showing fluid-fluid levels (b,c), T1 post contrast image showing peripheral enhancement.

Observation & Results

Out of 60 subjects with orbital pathologies, highest number of patients were seen in 4th decade (21.7%) followed by <10 years (18.3%) and then equal no of patients in 20-30, 40-50 and 50-60 years. Out of 60 patients, 38 patients were males and 22 patients were females. Right eye was involved in 29 patients and left eye in 27 60 patients. 4 patients showed bilateral involvement. Majority of the lesions involved extra-conal compartment accounting for 38.3%. Few lesions like orbital pseudo- tumor and lymphoma were seen to involve multiple compartments. Inflammatory etiology was most common cause for majority of the lesions accounting for 38% and neoplastic lesions (combining benign and malignant) accounted for 34% and congenital was the least common etiology (table 1) Different type of individual lesion and their spectrum is shown in table 2.

Table 1: Distribution of orbital pathologies based on location & Etio-pathogenesis

	No.	Percentage
LOCATION		
Pre-septal Space	9	15.0%
Intra-conal Space	7	11.7%
Ocular/Globe	8	13.3%
Extra-conal	23	38.3%
Optic Nerve	5	8.3%
Multiple compartments	8	13.3%
Etio-pathogenesis		
Congenital	6	10%
Inflammatory	23	38.3%
Neoplastic-Benign	7	11.6%
Neoplastic-Malignant	14	23.3%
Vascular	10	16.6%

Table 2: Spectrum of different type of pathologies

		No of patients	Percentage
Inflammatory pathologies (n=23)	Preseptal Cellulitis	8	34.7
	Myocysticercosis	3	13
	Graves disease	4	17.3
	Chronic Dacroadenitis	1	3
	Orbital Pseudotumor	3	13
	Dacrocystocele	1	3
	Subperiosteal abscess	1	3
	Lacrimal Sac Mucocele	2	6
Malignant Neoplastic lesions (n=14)	Retinoblastoma	4	28.6
	Lymphoma	5	35.7
	Choroidal Melanoma	3	21.4
	Orbital Rhabdomyosarcoma	2	14.3
Benign neoplastic lesions (n=7)	ON Glioma	2	28.6
	ON Meningioma	2	28.6

	ON Schwannoma	1	14.2
	Lacrimal Adenoma	2	28.6
Vascular lesions (n=10)	Hemangioma	4	40
	Lymphovenous Malformation	1	10
	Cortico-cavernous Fistula	1	10
	Superior Opthalmic Vein Thrombosis	2	20
	Coats Disease	1	10
	Cavernoma	1	10

Discussion

In the current study, the majority of patients (21.6%) were in their fourth decade. Ages ranged from one month to 76 years. Of the total 60 patients, there was a predominance of male attachment with 38 and 22 male patients. Out of 60 patients, 29 had right eye involvement, 27 had left eye involvement, and 4 had bilateral eye involvement. The two most frequent reasons for an MR examination of the eye were discomfort and proptosis. Extraconal space was the most frequently affected orbital compartment.

Preseptal cellulitis, one of a totals of 23 inflammatory lesions, was the most prevalent orbital lesion identified in the current investigation, accounting for 8 cases (34.7%); patients' ages ranged from 1 months to 76 years. Grave's disease was the second most prevalent condition, occurring in 4 instances, with 2 occurrences each in males and females. The patients were in their third and fourth decades of age. In 3 cases, the right eye was involved, and in 1, both eyes were. Proptosis was present in every case. The current study is consistent with a study by Lim NC *et al*. [10], which found that proptosis was the most prevalent symptom among south Asian patients with thyroid eye illness.

Three cases—two female and one male—of myocysticercosis were discovered. The youngest patient, a 6-year-old with involvement of the right medial rectus, was Proptosis and eye edoema were the patients' primary symptoms. The results of the current investigation were compared to those from a study conducted by Rath S. *et al* [11] among 171 patients with ocular cysticercosis.

Out of a total of 60 cases in the current investigation, malignant neoplastic lesions were found in 14 cases (23.3%). The most frequent malignant condition was lymphoma, which was identified in 5 instances, followed by retinoblastoma (4 cases), choroidal melanoma (3 cases), and orbital rhabdomyosarcoma (2 cases). Patients over 40 years old and up to 76 years old were diagnosed with lymphoma. The youngest patient with retinoblastoma was 2 years old and presented with bilateral eye damage in all cases. In the fourth and fifth decade, choroidal melanoma was observed. The second decade of orbital rhabdomyosarcoma. The most frequent tumour found in the adult population was lymphoma, and the most frequent tumour found in children was retinoblastoma.

This was also mentioned in the study by Hakan Demirci *et al* [12] and K. Ohtsuka [13], which found that lymphoma was the most prevalent tumour in the adult population. The most frequent cancer seen in children was retinoblastoma.

Out of a total of 60 patients in the current study, benign neoplastic lesions made up 7 cases (11.6%). There were 5 cases affecting

the optic nerve, 2 cases each of ON meningioma and glioma, and 1 case of ON schwannoma. A 13-year-old male kid patient and a 32-year-old female patient both had ON gliomas. According to the Mc Lean *et al*. study [14], the first and second decades of life were the most common age brackets for ON glioma incidence. Two cases of ON meningioma were found, one of which involved both eyes.

The imaging result showed an enlargement of the optic nerve and appeared like a tram track. The results are in line with the research done by Mafee MF *et al*. [15] There were 2 cases of lacrimal gland adenomas.

10 instances out of 60 had vascular lesions, making up 16.6% of the cases. In addition, there were 1 instance each of Coats disease, lymphovenous malformation, cortico-cavernous fistula, and capillary haemangioma. There were also 4 cases of haemangioma, 2 cases of superior ophthalmic vein thrombosis, and 4 cases of haemangioma. The most frequent vascular lesion in the adult population was a cavernous haemangioma, with one case of a capillary haemangioma in a female patient younger than 10 years old. There were 4 patients, 3 of which were female and 1 male. These results were in line with the research done by Ansari SA *et al*. [16]

Conclusion & Recommendations

The orbit is affected by a range of clinical disorders. They include infections, vascular lesions, inflammatory diseases, congenital lesions, benign and malignant neoplasms, and infections. Imaging can be used to accurately pinpoint a lesion, to help with accurate diagnosis, to produce a differential diagnosis that directs patient therapy, or to monitor the course of a known lesion.

For evaluating orbital neoplasms, MR imaging is helpful because it offers vital anatomic details about the affected ocular structures, perineural dissemination, and intracranial extension. For a precise diagnosis, it is frequently necessary to use the right imaging techniques (such as delayed contrast-enhanced imaging for cavernous malformations and prone imaging for orbital varices) and recognise pathognomonic features (such as multiple fluid-fluid levels in lymphatic malformations and progressive delayed enhancement in cavernous malformations).

References

1. Resnikoff S, Pascolini D, Etya'ale D, Kocur I, Pararajasegaram R, Pokharel GP, Mariotti SP. Global data on visual impairment in the year 2002. Bull World Health Organ. 2004; 82:844-51.
2. Ciardella AP, Borodoker N, Costa DL, Huang SJ. Cunningham ETJr, Slakter JS. Imaging of the posterior segment of the eye. Ophthalmol Clin North Am. 2002; 15:281-96.
3. Berkowitz BA, Roberts R. Prognostic MRI biomarkers of treatment efficacy for retinopathy. NMR Biomed. 2008; 21:957-67.
4. Townsend KA, Wollstein G, Schuman JS. Clinical application of MRI in ophthalmology. NMR Biomed 2008; 21:997-1002.
5. Haacke EM, Brown RW, Thompson MR, Venkatesan R. Magnetic resonance imaging: physical principles and sequence design. John Wiley & Sons, New York, New York; 1999.
6. Jackson A, Buckley DL, Parker GJM. Dynamic contrast-enhanced Magnetic Resonance Imaging in oncology. Springer-Verlag Berlin Heidelberg, Germany 2005.
7. Duong TQ, Ngan SC, Ugurbil K, Kim SG. Functional Magnetic Resonance Imaging of the Retina. Invest Ophthalmol Vis Sci. 2002; 43:1176-81.
8. Bahn MM, Gordon RE, Wippold FJ,

Grand MG. Findings of retinitis on gadolinium-enhanced turbo fluid attenuated recovery images. Retina. 1998; 18:164-8.

9. Caprioli J. The ciliary epithelia and aqueous humor. In: Adler's physiology of the eye, 9th ed., Hart WM Jr (ed). Mosby, Inc.: St. Louis, MO 1992;233–24.
10. Lim NC, Sundar G, Amrith S, Lee KO. Thyroid eye disease: a Southeast Asian experience. Br J Ophthalmol. 2015 Apr;99(4):512-8.
11. Rath S, Honavar SG, Naik M, Anand R, Agarwal B, Krishnaiah S, Orbital cysticercosis: clinical manifestations, diagnosis, management, and outcome. Ophthalmology. 2010 Mar;117(3):600-5.
12. Demirci H, Shields CL, Shields JA, Honavar SG, Mercado GJ, Tovilla JC. Orbital Tumors in the Older Adult Population Ophthalmology 2002 Feb;109(2):243-8.
13. A review of 244 orbital tumors in Japanese patients during a 21-year period was conducted by K Ohtsuka, M Hashimoto, Y Suzuki Jpn J Ophthalmol. 2005; 49:49–55.
14. Domingo RE, Manganip LE, Castro RM. Tumors of the eye and ocular adnexa at the Philippine Eye Research Institute: a 10-year review. Clin Ophthalmol. 2015 Jul 9; 9:1239-47.
15. Mafee MF, Goodwin J, Dorodi S. Optic nerve sheath meningiomas: role of MR imaging. Radiol Clin North Am. 1999;37(1):37–58.
16. Ansari SA, Mafee MF. Orbital cavernous hemangioma: role of imaging. Neuroimaging Clin N Am. 2005; 15:137–158.