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ROLE OF COMPUTED TOMOGRAPHY AND MAGNETIC RESONANCE IMAGING IN ORBITAL PATHOLOGIES

Radiology

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KEYWORDS

B/L Bilateral, CH Chemosis, CI Conjunctival injection, CT Computed tomography, DV Diminition of vision, ES Ethmoid sinusitis, MRI Magnetic resonance imaging

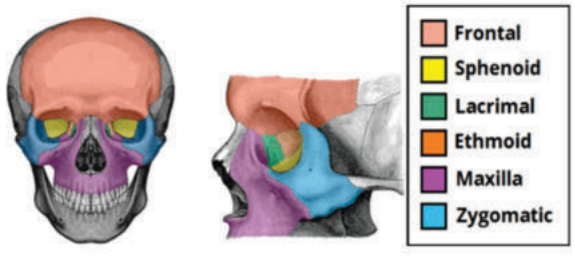
INTRODUCTION

"Eyes are the windows of brain" through which one recognizes the world.

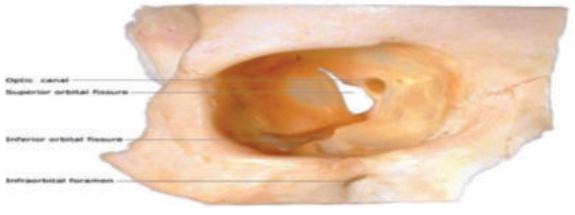
- Throughout the medical history afflictions of eye have been noted for more than any other tissue space appendage or organ of comparable size.
- Diagnosis of orbital disease is often not clear even after a thorough clinical examination. In earlier era this dilemma would necessitate on exploratory orbitotomy in order to determine diagnosis. With advent of CT & MRI, they have become the procedure of choice in arriving at a diagnosis for orbital lesions.
- The clarity of orbital structures on MRI & CT has prompted investigations into detailed multiplanar anatomy of orbit. Tumor margins and inflammatory processes are so clearly defined that one can place the lesion in specific compartments and accurately determine the extent of disease processes3

Embryology Of The Orbit

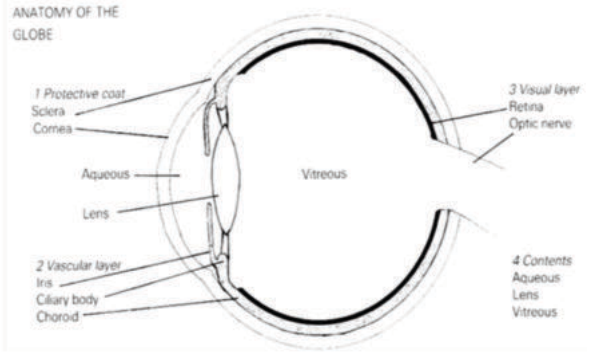
- **Normal Anatomy of Orbit:**



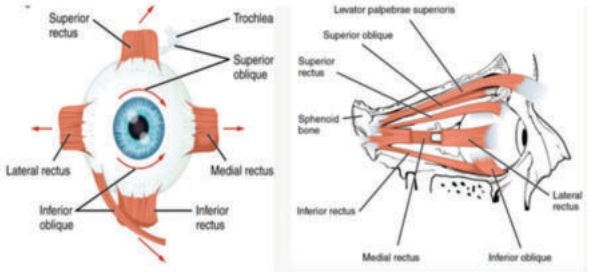
- Orbital anatomy is divided into bony orbit and orbital soft tissues.



II. ORBITAL SOFT TISSUE



Extra Ocular Muscles:



Pathological Lesions Of Orbit

Cystic lesions of orbit :These can be divided into Developmental cysts & Acquired cysts Developmental cysts:

Dermoid/Epidermoid cysts: Orbital choristoma result from the rest of embryonic cells that were anomalously entrapped in or around orbit.

- Orbital choristoma are most commonly represented by dermoid,epidermoid cyst and dermolipoma.
- Dermoid and epidermoid cyst are usually apparent in first four months of life as a subcutaneous nodule of rubbery consistency, situated along or adjacent to orbital rim, most commonly near frontozygomatic suture, cyst may be freely mobile or firmly adherent to underlying periosteum6
- On imaging both dermoid and epidermoid appear as well circumscribed, smoothly marginated, centrally non enhancing masses. There may be slight enhancement of cyst wall.
- Dermoid cysts may have cystic or solid components on imaging, these may show fat, fluid or soft tissue density and occasionally may show calcification6

Colobomatous Cysts6

A coloboma is a congenital ocular anomaly of a fissure or cyst involving the iris, lens, ciliary body, retina, choroids, optic nerve or sclera.

- In a typical coloboma cleft appears in inferonasal quadrant of globe.
- Imaging may show colobomatous defect in globe.13

Aquired Cysts

1. Lymphangioma : This is an unencapsulated mass consisting mostly of bloodless vascular and lymph channels.

- It contains

1. Numerous and variable sized cystic spaces.
2. On imaging lymphangiomas are seen as infiltrative, multilobular masses that demonstrate indistinct borders and poor encapsulation.
3. Extra conal involvement is more common than intraconal space extension. Bony remodeling may be seen.
4. Calcifications are rare6.

Lacrimal Gland Cysts

- Cyst of lacrimal glands can occur due to blockage of the excretory ducts and may be located in palpebral or orbital lobes of main gland; in the accessory lacrimal glands of krause and wolfring or in ectopic lacrimal glands.
- These cysts appear as lowdensity ,non enhancing masses on CT and T2/FLAIR hyperintense lesions on MRI8.

Hematic Cysts
These cysts are deeply placed, incompletely resorbed hematomas which may remains unchanged for long periods of time.CT appearance includes a well defined extraconal, nonenhancing mass in the subperiosteal, medullary or diploic spaces8.

Parasitic Cysts
Cysticercosis
- It is a disease due to infestation by cysticercosis cellulose, the larval form of the parasitic tapeworn taenia solium.
- Clinically patients present with either a variable subconjuctival cyst or orbital signs due to an extra ocular muscle cyst that is unresponsive to treatment with oral corticosteroids.
- Most of cases examined by imaging show a cystic lesion near or within an extraocular muscle with an eccentric mural dot9

Hydatid Cysts
- Hydatid is larval form of parasitic tapeworm enhinococcus granulosus
- Patients usually present with slowly progressive, painless orbital signs.
- On imaging these cysts may appear as well defined, unilocular or multilocular large cysts, with or without globe displacement9.

Cephalocele
Cephalocele represents herniation of meninges with or without brain parenchyma via defect in bone. CT or MRI shows the bony defect and associated with cystic mass in orbit10.

Pseudotumours11
It represents a nongranulomatous inflammatory process in orbit or eye with no known local or systemic casess. It occurs at any age and histological polymorphic infiltrate predominately lymphocytic. Pain and signs of inflammation are usually evident in acute phase. In chronic phase, differentiation from lymphoma is difficult.15

DacryoadenitisMost frequently involved. There is usually diffuse oblong enlargement of gland. It can be involvement of gland alone or in conjunction with other region.

Diffuse/infiltrative Pseudotumour
A predominant involvement of the orbital fat is present, variable replacement of orbital fat by soft tissue,moulding of the globe without bone erosion. Occasionally intracranial extension can occur12.

Orbital Lymphoma
Lymphoid neoplasms of the orbit range from malignant lymphoma to benign pseudotumours to reactive and atypical lymphoid hyperplasia13. Among patients with orbital lymphoma 75% have or will have systemic lymphoma. True lymphoid tissue inthe eye is found in the subconjunctiva and the lacrimal gland. Location is the anterior portion of superior orbital compartment and retrobulbar area. Bone erosion may be present. They may be seen as bulky retro bulbar masses with a reticular pattern in the adjacent fat16. Pseudotumor can appear as muscle tendon or sheath enlargement, optic nerve thickening, extraocular muscle enlargement, infiltration of retrobulbar fat with marked enhancement and absence of bone changes11.

Lymphoplasmacystic Tumour: (Plasma Cell Tumour)
Tumours composed purely of plasma cells (plasmacytomas) and those composed of B lymphocytes and plasma cells (lymphoplasmacytoid tumours) are closely related to the various lymphomas. These plasma cell tumours, when they affect the orbit and ocular structure displays the same spectrum of clinical involvement seen in the lymphoproliferative disorders. Isolated cases can produce mass which is lobulated, densely enhancing, and well defined and can present, with or without bone erosion.

Neural Lesions
Peripheral Nerve Tumours Of Orbit:
Approximately 4% of all orbital neoplasm's are peripheral nerve tumours and consists primarily of neurofibromatosis, and neurilemmomas or schwannomas of these, 2% of the lesions are isolated neurofibromas, and 1%, are schwannomas. Malignant peripheral nerve tumours (malignant schwannoma, neuro-fibrosarcoma) are extremely rare in the orbit15 .

Neurofibroma: Neurofibromas may occur in one of four patterns:
(1) Plexiform .
(2) Diffuse.
(3) localised or circumscribed.
(4) postpartum neuroma.

Plexiform neurofibroma presents in infancy or childhood and most commonly involve the eyelids. In plexiform neurofibroma involvement of the eyelid is considered to be virtually pathognomic for NF(von reckling hausens disease).

Diffuse neurofibroma have a similar appearance to plexiform neurofibromas with infiltration of orbital fat and extraocular muscles. Circumscribed neurofibroma often present as a slow growing tumor with mass effect and are commonly located in superior quadrant. These lesions show dense contrast enhancement17

Meningioma18: The second most common tumour of the optic nerve sheath complex is meningioma. Middle ag The tumour characteristically involves the optic nerve sheath complex in a continuous rather than segmental fashion producing a fusiform or tubular enlargement, but globoid eccentric tumors are well recognized. Middle aged women17 are most commonly affected14

Meningioma may show calcification on CT and enhances uniformly after contrast administration producing a tram-track sign due to the enveloped non enhancing and attenuated optic nerve.

Optic Nerve Glioma
These are the commonest benign orbital neoplasm in children. In adults (middle age) they are usually malignant ,when bilateral neurofibromatosis should be suspected. On CT they typically demonstrate a marked diffuse, often fusiform, enlargement of an optic nerve often with a characteristic kinking or buckling. On MRI glioma shows T2 central hyperintense area with variable enhancement.

Retinoblastoma
A primary malignant tumour of childhood. 90% of patients diagnosed before 5 years of age.It may be bilateral in 25-30% of cases with multiple sites of origin in the same eye or other eye. In patient giving a family history, a propensity for secondary malignancies usually osteogenic sarcomas is noticed. On CT 90% show calcification which may be small or large and single or multiple and punctuate. The non calcified mass is usually uniform and slight to moderately dense, with moderate enhancement. On MRI T2 hypointense compared to vitreous.

MISCELLANEOUS INTRA ORBITAL TUMOURS

Rhabdomyosarcoma
Commonest primary malignant orbital tumour of childhood com occurring in the superonasal quadrant with extension into adjacent paranasal sinuses and nasal cavity, it may be primary or secondary extending from the paranasal sinuses. The presentation is usually as rapidly developing unilateral proptosis in a child. On CT, a uniformly enhancing isodense to slightly hyperdense mass which may infiltrate the retrobulbar fat and muscle planes.18

On MRI, T1 low to intermediate intensity with areas of hemorrhage and T2 hyperintense lesions with considerable post contrast enhancement. Orbital cellulitis: The infection may be acute, subcute, or chronic acute inflammatory disorder of paranasal sinus origin.Opportunistic infections such; as fungal and parasitic pathogens may be responsible for severe Sino nasal orbital infections.

Vascular Tumours
Cavernous hemangioma : Cavernous hemangioma is one of most common benign intra orbital lesion and occurs in 2-5th decade and is characterized by proptosis; difficulty in ocular motility and has slowly progressive course. Capillary Hemangioma: These tumours that occur primarily in infants during first year of life. The tumour often increases in size for 6-10 months and then gradually involutes.

Veno lymphaticmal formation: Lymphangiomas: There lesions generally become evident at birth or during early childhood. On clinical evaluation these lesion are reported to show no evidence of change in size with valsalva manuvre. They are unencapsulated; they cross many anatomic boundaries and often insinuate themselves around normal structures.

AIM & OBJECTIVES

- To Study The Role Of Computed Tomography And Magnetic Resonance Imaging In Various Orbital Pathologies.
- To Differentiate Various Causes Of Orbital Pathologies And Different Types Of Infections.
- To Know The Role Of These Modalities In Determinig The Extent Of Spread Of The Tumors For Grading And Staging.

MATERIALS AND METHODS

This analytical cross-sectional study was conducted in the Department of Radiology, Prathima Institute of Medical Sciences , Nagunur,karimnagar for a period of two years from 2019 -2021 after taking the informed consent from the subjects and ethical clearance from the ethical board. All patients presenting to the ophthalmology department with a clinical suspicion of orbital and periorbital swelling,pain and diminution of vision were referred to radiology department where they were first evaluated with CT-ORBITS bone and soft tissue windows taken. A total of 30 patients with clinically apparent orbital lesions irrespective of age and gender were included in this study.

After clinico - radiological analysis of the CT-ORBITS, patients with a high suspicion of primary orbital neoplasms/inflammatory conditions (or conditions mimicking them) and in whom surgery was a viable option, were advised MRI for further characterization and evaluation of the lesions.

METHODS

CT was performed on Philips Ingenuity core 128 slice CT scanner
MRI was performed on Philips Ingenia CX 1.5 Tesla MRI Scanner.
Patient was positioned head first and supine into the gantry.Dedicated orbit coils were used for the part to be imaged. Initially a T1 weighted gradient echo localizer was obtained in three orthogonal planes. Initially T1(FSE) axial with FOV for the orbits and coronal (from chiasm through the orbits) was obtained. This was followed by coronal STIR sequence, axial T2(FSE) weighted sequence and axial DWI,ADC images were obtained.Post contrast T1 weighted images(with FOV for orbits) were obtained in all the three planes.

Fine needle aspiration cytology; or biopsy was done in few cases. In few other patients enucleation of the eye was the treatment of choice, the excised tissue was subjected for histopathological examination. Response to medical management with antibiotics and steroids were also closely watched and recorded

Inclusion Criteria

All the patients having commonest clinical indications such as proptosis/ exophthalmos/ diminished vision, enophthalmos, diploid, leukemia, pain, trauma and tumor.

Exclusion Criteria

- All pregnant cases.
- All cases in whom contrast is contraindicated.
- All cases with metallic implants for MRI.

Approach To Ct Diagnosis Of Orbital Lesions

With or involving globe:
1. Retinoblastoma
2. Melanoma.
3. Detachment and choroidal effusion.

Within The Muscle Cone (intraconal):

1. Optic nerve glioma
2. Optic nerve meningioma
3. Haemangioma (usually cavernous) and arteriovenous malformation
4. Inflammatory orbital pseudotumor
5. Lymphoma and metastases
6.Haematoma
7. Neurofibroma

Arising From The Muscle Cone

1. Inflammatory orbital pseudotumor
2.Dysthyroid ophthalmopathy .
3. Rhabdomyosarcoma

Outside the muscle cone (Extraconal):
1) Orbital cellulitis
2) Lymphoma and metastases
3)Dermoidandteratoma
4)Lymphangioma.

Arising From Orbital Wall

1. Metastases and lymphoma
2.Langerhans cell histocytosis
3. Invasion by ethmoidal or maxillary antral tumours.
4 . Ethmoidal mucocele
5. Spread of ethmoidal or antral infection.

Expansion Of The Bony Orbit

This is reflected as either a difference in size between the left and right orbits or focal abnormality.

Bone Destruction

It can be either permeative (diffuse) or geographic(sharply defined margins) Permeative:
Neuroblastoma
Lymphomas
Leukemia
Rhabdomyosarcoma
Secondary tumours involving the orbit.
Geographic:
Dermoid cyst

Calcification

Phelboliths in haemangioma
Retinoblastoma
Optic nerve meningioma
Metastatic carcinoma
Dermoid
Lacrimal gland tumours
Melanoma
Haemangiopericytoma .

Extension Of The Lesion

- Intracranial tumor extension may be seen with optic nerve gliomas, neuroblastomas and retinoblastoma.
- Extension from the globe into the tenons capsule can occur with melanoma and retinoblastoma.
- Facial extension may be seen with neuroblastoma ,rhabdomyosarcoma, lymphoma, osteoma.

Enhancement

- Optic nerve glioma or meningiomas
- Haemangioma
- Orbital cellulitis
- Pseudotumours
- Neuroblastoma
- Rhabdomyosarcoma
- Lymphoma.

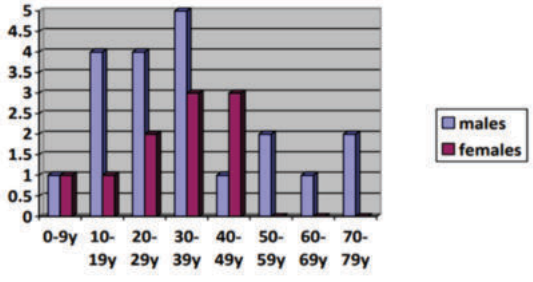
OBSERVATIONS AND RESULTS

- There is a male predilection in my study.
- The maximum no. of patients were less than 50yrs.

ILLUSTRATIONS

Age(yrs)	Males	Females
0-9	1	1
10-19	4	1
20-29	4	2
30-39	5	3
40-49	1	3
50-59	2	0
60-69	1	0
70-79	2	0

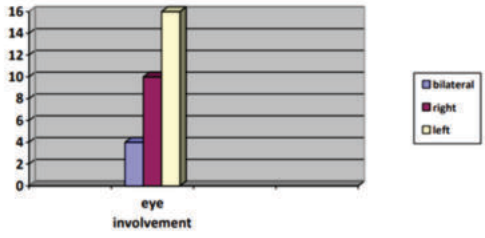
Graph 1: showing age and sex determination



Side affected

Side affected	Eye involvement	Percentage
Bilateral	4	13%
Right	10	33%
Left	16	20%

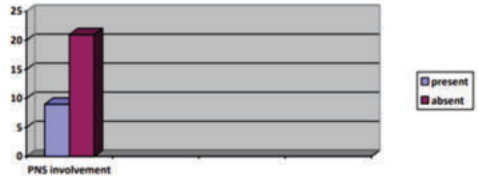
Graph 2: showing eye involvement



PNS involvement

Present	9	30%
Absent	21	70%

Graph 3: showing PNS involvement.



Muscle involvement

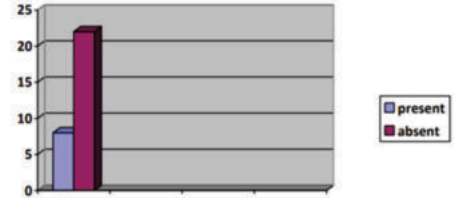
Present	12	40%
Absent	18	60%

Graph 4: showing muscle involvement.

Optic nerve involvement

Present	8	27%
Absent	22	73%

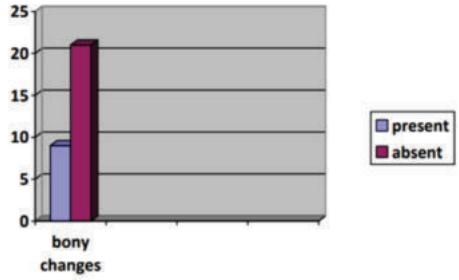
Graph 5: showing optic nerve involvement



Bony changes

Present	9	30%
Absent	21	70%

Graph 6: showing bony changes



NAME : M
AGE/SEX : 39Y/F DATE OF EXAM : 26/07/21
The patient came with C/o diminished vision

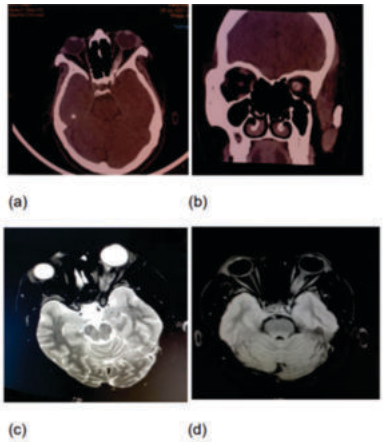


Fig.(a-d) : LT.Optic nervesheath meningioma. (a-b) axial and coronal CT-ORBITS showing thickened left intra- orbital optic nerve with peripheral calcifications.(c-d)axial T2 and post contrast T1fat-sat W images showing T2 heterogenously hyperintense lesion in LT. optic nerve sheath causing compression of the nerve with vivid enhancement on post contrast T1 fat-sat images sparing optic nerve.

NAME : L
AGE/SEX : 35Y/M DATE OF EXAM : 22/06/21
Patient came with C/o periorbital swelling and pain, post covid-19 with H/o steroid use and k/c/o DM-II

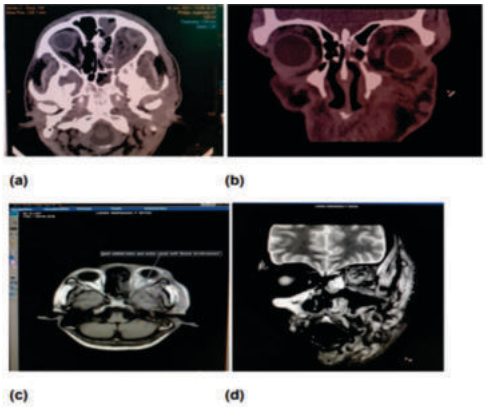
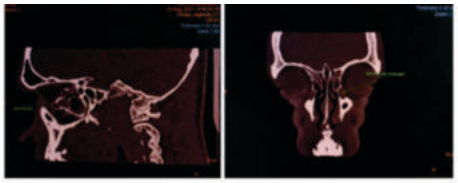
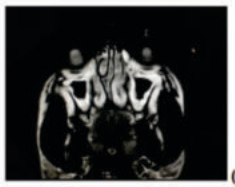


Fig.(a-d) : LT.rhino-occulo-cerebral mucormycosis. (a-b) axial and coronal CT-ORBITS showing soft tissue attenuated material with in the intra and extra-conal compartments of LT.orbit extending into PNS and inferior temporal fossa.(c-d) axial T1w and coronal T2w MR images showing T2 hyperintense granulomatous lesion involving PNS with fluid levels and showing rim enhancement on post contrast with orbital and inferior temporal fossa extension.

NAME : S
AGE/SEX : 35Y/M DATE OF EXAM : 25/08/21
Patient came with C/o eye watering from LT. eye with swelling, headache and B/L nasalobstruction.



(a) (b)



(c)

Fig.(a-c) : LT.Dacryocystitis. (a-b) sagital and coronal CT-ORBITS showing hypodense fluid collection at medial canthus of left orbit involving lacrimal sac. (d) axial T2w MR image showing hyperintense fluid collection at medial canthus involving lacrimal sac with mucosal thickening involving B/L maxillary sinus.

DISCUSSION

In our study of 30 cases with orbital pathologies majority of the patients are presented with pain and periorbital swelling as chief complaints and few of them presented with diminution of vision, loss of vision along with proptosis of eye ball.

All patients were first evaluated with CT-orbits followed my MRI-orbits plain or contrast depending on the requirement for confirming the diagnosis and determining the clear extent of the lesion.

These patients were then followed up with regard to post operative and histopathological correlation wherever required.

Demographic Data

Optic Nerve Sheath Meningiomas

In this study it is observed that 10% of patients with orbital pathologies was diagnosed with optic nerve sheath meningiomas between the age groups of 20y-40y with slight male preponderance.

This present study correlated with the study conducted by Tailor, T. D., Gupta, D., Dalley, R. W., Keene, et.al. optic nerve sheath meningiomas are the second most common optic nerve tumor, accounting for 2% of space-occupying orbital masses. As with intracranial meningiomas, optic nerve sheath meningiomas are more common in women. Patients usually present in the 5th decade of life (mean age, 48– 50 years). However, because the substance of the nerve is spared, a "tram-track"configuration is often observed at axial contrast-enhanced CT or MR imaging, since enhancing tumor lies on either side of the nerve. CT better shows bone remodeling and calcification, the latter of which occurs in 20%–50% of cases.

These are the 2nd most common optic nerve sheath tumors. All 3 cases were showing Tram-Track sign on post contrast CT and MRI images in our study.

In the study done by Kanamalla, Uday S. The optic nerve tram-track sign is most commonly described in relation to optic nerve sheath meningiomas. Meningiomastend to cause segmental or diffuse circumferential thickening of the optic nerve sheath. Once intravenous contrast material has been administered, the optic nerve can be seen on CT or MR images as an unenhanced central linear structure (negative defect) surrounded by the enhanced meningioma. On transverse or sagittal images this produces a tram-track sign, which is composed of two enhanced areas of tumor separated from each other by the negative defect of the optic nerve.

The corresponding finding on coronal images is a doughnut configuration. Though it is less common, the tram-track sign may be evident at unenhanced CT when there is linear calcification of the optic nerve sheath meningioma. Both the studies correlate regarding the Tram-Track appearance of optic nervesheath meningioma on post contrast CT and MRI images.

Inflammatory Lesions Of Lacrimal Glands

Out of 30 cases in this study 6 cases that is 20% were inflammatory diseases of lacrimal glands which are acute and chronic dacryocystitis and dacryoadenitis falling in the age group of 5y-36y.

In a similar study done by Jung, W. S., Ahn, K. J., Park, M. R., Kim, J. Y., Choi, J.et.al Inflammatory diseases of the lacrimal gland may be categorized into acute andchronic inflammation. Acute dacryoadenitis commonly develops in children and young adults. It is mostly unilateral and responds rapidly to treatment. Inflammatory diseases of the lacrimal gland can cause diffuse oblong enlargement of the gland.

On imaging, acute dacryoadenitis lesions show marked contrast enhancement that includes the surrounding tissue, and this may be accompanied with myositis of the lateral rectus muscle.

Idiopathic Orbital Inflammation/pseudotumor

In our study of 30 orbital pathologies CT has found 6 (20%) cases of idiopathic orbital inflammation or orbital pseudotumor in which all the masses are involving extraoccular muscles with 1 case showing PNS involvement also and 5(83%) out of 6 cases were unilateral out of which MRI was correlating with only 2 cases with both of them involving extraoccular muscles and both are unilateral which are even HPR positive.

In the study done by Ding, Z. X., Lip, G.,et.al. Orbital myositis is a common component of IOP with 90-95% of cases being unilateral. Unilateral single muscle inflammation with tendon involvement is the most common presentation. The most frequently involved muscle is the medial rectus, followed by the superior rectus, lateral rectus, and inferior rectus. It is often difficult to differentiate IOP from lymphoma based on CT or MRI findings. Immunophenotypic and molecular genetic analyses can differentiate IOP from lymphoma based on polyclonal proliferation in IOP and monoclonal in lymphoma. On CT and MRI, the tendon enlargement together with the muscle bundle involvement lead to a tubular configuration.

Enlarged inflammatory muscles reveal marked enhancement, which also occurs in normal extraocular muscles and, therefore, may have no significant diagnostic implications. IOP is a relatively common, benign cause of orbital mass lesions affecting various anatomical structures within the orbit with occasional intracranial extension. Both CT and MRI have a role in investigating patients presenting with orbital disease, with MRI being more sensitive than CT and it is important to consider IOP in the differential diagnosis of orbital imaging abnormality. Yuen, Sonia J. Ahn is the other similar study to our study reviewed 90 eyes in 65 patients out of which the following dignoses were isolated dacryoadenitis (n=21), isolated myositis(n=19) ,concurrent dacryoadenitis and myositis(n=5),orbital apex syndrome(n=6) and idiopathic inflammation involving optic nerve and tenon capsule(n=14) with a mean age of 45yrs. Pain and periorbital swelling are the most common symptoms correlating with our study however the mean age of presentation in our study was 30yrs and our study also shows 1 case with concurrent myositis and idiopathic orbital inflammation.

In this study of 30 cases with orbital pathologies 17(56%) cases out of which the number and percentage in each general category are as follows optic nerve meningioma in-3(17%), thyroid-related orbitopathy-4(23%), other inflammatory lesions-3(17%), cystic lesions-2(11%). idiopathic orbital inflammation-2(11%), myogenic tumors-3(17%). The most common diagnoses were: thyroid-related orbitopathy-4(23%), myogenic tumors-3(17%) optic nerve meningioma-3(17%).

In a similar study done by Jerry A Shields, MD Carol L Shields, MD Richard Scartozzi, MD Among 1264 consecutive patients, the number and percentage of lesions in each general category were as follows: cystic, 70 cases (6%); vasculogenic, 213 cases (17%); peripheral nerve lesions, 23 (2%); optic nerve and meningeal tumors, 105(8%); myogenic tumors, 36 (3%); thyroid-related orbitopathy, 67 cases (5%); other inflammatory lesions, 133 cases (11%); and miscellaneous other lesions, 13 (1%). The most common diagnoses were: lymphoid tumor (139cases;11%), idiopathic orbital inflammation (135 cases; 11%), cavernous hemangioma (77cases; 6%), lymphangioma (54

cases; 4%), meningioma (53cases; 4%), optic nerve glioma (48 cases; 4%), metastatic breast cancer (44cases;4%), orbital extension of uveal melanoma (41 cases; 3%), capillary hemangioma (36 cases;3%), rhabdomyosarcoma (35 cases; 3%), dermolipoma (31 cases; 3%), herniated orbital fat (30 cases; 2%), dermoid cyst (26 cases; 2%), varix (26 cases; 2%), dacryops (19 cases; 2%), and other less common lesion.

Benign tumors like IOI and optic nerve sheath meningioma are the common lesions in both the studies.

Rhabdomyosarcoma

Out of 30 cases in our study 3(10%) cases were diagnosed as orbital rhabdomyosarcoma on both CT and MRI with in the age group of 12-14yrs slight male preponderance (M:F-2:1) came with proptosis, periorbital swelling and pain as the chief complaints. On CT the lesion appears isodense to muscle and showing extension into PNS in 1 out of 3 cases causing bony erosions. On MRI the lesion is T2 hyperintense to muscle and T1 isointense to muscle showing vivid enhancement on post-contrast study.

In the similar study done by Conneely, Mark F.; Mafee, Mahmood F. Rhabdomyosarcoma occurs most commonly in patients between the ages of 2 and 5; however, cases have been reported in all age groups, from birth to adulthood. The age distribution is bimodal. In a recent study reviewing 1264 consecutive patients with orbital tumors and simulating lesions, the 35 biopsy-proved cases of rhabdomyosarcoma ranged from 0 to 68 years of age. The prevalence is slightly higher in males, with a male to female ratio of 5:3.

On imaging, the tumors typically have moderately well-defined to ill-defined margins and an irregular shape, with mild to moderate contrast enhancement. They exhibit soft tissue attenuation values on CT. Calcification is infrequent but can occur. On MR imaging, the tumors are generally isointense to muscle on T1- and hyperintense to muscle on T2-weighted images. Adjacent bone destruction is common, occurring in up to 40% of cases. Invasion of paranasal sinuses and intracranial extension can also occur. CT and MR imaging can be complimentary in evaluation and staging of orbital rhabdomyosarcoma. MR imaging, with its superior soft tissue contrast, multiplanar capability, and lack of ionizing radiation, is well suited for tumor staging. Conversely, CT offers superior resolution and better demonstrates the extent of bone involvement.

Thyroid Associated Orbitopathy

In 30 cases of orbital pathologies our study reported 4(13%) cases were reported as thyroid associated orbitopathy with female preponderance (M:F=1:3) and with in an age group of 20-45yrs, in all these cases lower quadrants muscle groups are involved including inferior, lateral and medial recti muscles, none of the patient seem to have superior rectus involvement.

Nugent, R A; Belkin, R I; Neigel, J M; Rootman, J et.al. studied CT scans and medical records of all patients (19 men, 52 women) with Graves orbitopathy who were referred to a single ophthalmologist (J.R.) between November 1983 and April 1986. The 71 patients had been clinically diagnosed with Graves orbitopathy with female preponderance. Results suggest a greater percentage of superior muscle group involvement (63.4%) in dysthyroid orbits than had previously been noted. We also found that the superior muscle group is the most commonly involved muscle. when only a single muscle is involved (6.3% of all orbits), as opposed to previous data disclosing more common solitary enlargement of either the medial or inferior rectus muscle.

However in our study this is not the scenario. Our study shows inferior rectus to be the most commonly involved in 75% of the cases and both inferior and medial recti are involved in 50% of the cases.

N Nianiaris, J J Hurwitz, J C Chen, G Wortzman et.al. compared two (CT &MRI) imaging techniques for use in severe Graves' orbitopathy. Thirty-nine orbits of 20 consecutive patients with severe Graves' disease (19 with optic neuropathy and 20 without optic neuropathy) were examined clinically. CT and MRI were performed, and the radiologic images were assessed for five measures chosen to illustrate overall muscular changes, tissue plane changes of the orbital apex, optic nerve changes and proptosis. The MR images were significantly more reliable than the CT scans for two measures in particular: degree of fat effacement (a measure of optic nerve compression) and minimal optic nerve index (a measure of optic nerve thickness), both of which involve the orbital apex. We conclude that MRI is a better technique than CT for imaging the apex in Graves' optic neuropathy.

Our study also concludes that MRI is a much better technique than CT to look into fat and optic nerve thickness because of its degree of image quality and contrast, however due to its high cost and difficulty in availability CT is performed in more number of cases. N I Dodds, A W Atcha, D Birchall, A Jackson reviewed Magnetic resonance appearances of 32 normal subjects and 27 patients with Graves' disease were evaluated using T(1) weighted volume imaging with multiplanar reformats along the course of the optic nerve. The optic nerve diameter was measured at seven positions along its course. Patients with thyroid orbitopathy were evaluated clinically and categorised into those with (n = 6) and without (n = 48) optic neuropathy. The mean diameter of the optic nerve in normal subjects ranged from 2.2-5.2 mm. The average orbital nerve diameter decreased the further the distance from the globe within the orbit; however, it increased within the optic canal and in the pre-chiasmal region. Optic nerve diameter in patients with Graves' disease without neuritis was not significantly different from that of subjects with normal optic nerves. In patients with optic neuritis, the optic nerve was narrower throughout the length of the nerve but narrowing was most marked in the apex of the orbit and in the pre-chiasmal intracranial optic nerve. The normal optic nerve has a variable but predictable diameter throughout its course. In Graves' optic neuropathy the diameter of the nerve is significantly reduced in the orbital apex and in the pre-chiasmal portion. The study supports the hypothesis and provides further evidence that the likely mechanism of Graves' ophthalmopathy is compression of the optic nerve at the apex.

In our study of 4 cases of thyroid orbitopathies optic neuropathy is seen only in 1(25%) case which is evaluated with MRI on cranial nerve sequence showed minimal narrowing of intra canalicular segment of optic nerve is seen with minimal fat stranding around it, however rest of the optic nerve in its respective segments appears normal.

Rhino Orbito Cerebral Mucormycosis

In our study of 30 orbital pathologies 3(10%) cases of rhino occulo cerebral mucormycosis cases were reported on CT and MRI in the age group of 35-55yrs (all are males) with the previous history of steroid usage during covid-19 infection. These patients show 100% involvement of ethmoid,sphenoid and maxillary sinuses along with orbital extension causing bony erosions which are more evident on CT.out of 3 cases 1(33.3%) case have shown anterior temporal lobe extension on MRI. CT showed minimally enhancing hypodense soft tissue thickening as the predominant finding in involved areas, while MRI showed T2 isointense to hypointense soft tissue thickening and heterogeneous post contrast enhancement as the main finding. In a similar study done by Therakathu, Jacob; Prabhu, Shailesh; Irodi, Aparna; Sudhakar, Sniya Valsa; Yadav et.al. CT and MR imaging of 43 patients showed predominant involvement of the ethmoid (37, 86%) and maxillary (34, 79%) sinuses. Extension to the orbit (32, 76%) and face (24, 57%) preceded involvement of the deep skull base (5, 12%) and brain (13, 31%). CT showed minimally enhancing hypodense soft tissue thickening as the predominant finding in involved areas, while MRI showed T2 isointense to mildly hypointense soft tissue thickening and heterogeneous post contrast enhancement as the main finding. Bone erosion was seen less often (17, 40%), with rest (26, 60%) of the patients showing extrasinus extension across grossly intact appearing bones on imaging.

Both these studies conclude that CT and MRI shows a spectrum of findings in rhino cerebral mucormycosis. Imaging plays a major role in assessing the extent of involvement and complications.

Orbital Cellulitis

In our study of 30 cases 2(7%) cases were reported as orbital cellulitis with in the age group of 60-70yrs,both of them were males with history of trauma and came with complaints of periorbital swelling, proptosis and loss of vision. Both the 2 cases were showing preseptal and post septal cellulitis and unilateral involving left eye. Sinuses were not involved in both the cases and trauma is the major predisposing factor among them. Ruchir Jyani, Dilip Ranade, and Priscilla Joshi et.al. conducted A prospective study in a tertiary care hospital. Fifteen patients of all age groups, of either sex, presenting with clinical findings suggestive of orbital cellulitis, referred for MRI of orbits, were included in the study. Written informed consent was obtained prior to the study. Patients' demographic data such as age and gender,

associated comorbidities, complications, and the pattern of spread of disease on MRI were recorded and evaluated and the results were : Orbital/periorbital abscess was found to be the most common complication of orbital cellulitis (eight cases, 53.3%), followed by optic neuritis/perineuritis (four cases, 26.67%), intracranial involvement (four cases, 26.67%), dacryoadenitis (three cases, 20%) and cavernous sinus thrombophlebitis (three cases, 20%). Seven cases (46.67%) had right orbital involvement. Sinusitis was found to be the most common predisposing factor.

Amongst the cases associated with sinusitis, the commonest inflammed paranasal sinus was found to be the ethmoid sinus (twelve cases). Amongst the fifteen cases of orbital/periorbital cellulitis, there were only two cases of isolated preseptal cellulitis (13.33%), five cases of postseptal cellulitis (33.33%) and eight cases of both preseptal and postseptal orbital cellulitis (53.33%). Both the studies concluded that MRI is the imaging modality of choice in the evaluation of orbital cellulitis because of its superior soft tissue and contrast resolution. It is vital to evaluate the extent of the orbital infection, underlying paranasal sinus involvement, as well as detect complications of orbital cellulitis, especially intracranial spread.

CONCLUSION

To conclude, in the present study of 30 cases of orbital pathologies, inflammatory lesions(36%) were more common. Most common lesion in the study group was dacryocystitis(13%). Lesions were more common in males (66.6%) than females (33.3%) with a maximum number of patients in the age group of 30-39 years (26.6%). MRI is more superior than CT in identifying and characterising the lesions of orbit if done by appropriate scanning technique using appropriate protocols, however CT is the modality to identify and localise the lesion and to some extent it can tell the extent of the lesion. On CT the differentiation between orbital rhabdomyosarcoma and pseudotumor was difficult as both are soft tissue lesions having similar attenuation, however on MRI plain and contrast studies the pattern of enhancement differs between them thereby coming to the most probable diagnosis and treatment. In our study of 30 cases of orbital pathologies MRI was more superior to CT when done with appropriate technique.

SUMMARY

- Both these modalities were helpful in narrowing down the differential diagnosis and CT is superior for any guided interventions if required.
- In general retinoblastoma was the most common tumor in children but our study reported no case of retinoblastoma.
- Thyroid orbitopathy and pseudotumor were common in adults followed by paraorbital tumors.
- On CT the presence of calcifications and bony involvement can be seen but on MRI clear delineation of the lesion with its extent can be seen.

REFERENCES

1) Forbes G. CT of Orbit. RCNA 1982; 20 (1): 37-49.
2) Tamraz JC. Tamraz CO and Saban R. MRI anatomy of the optic pathway. RCNA 1993; 37 (1): 10-12.
3) Dubey RB, Tara NP and Sisodiyer KN. Computed tomography evaluation of orbital lesions Pictorial essay. Ind J Radiol 2003; 13 (3): 261-270.
4) Son PM, Curtin DH. Head and Neck Imaging. In: Orbit: Embryology, Anatomy and pathology.Mafee MF (ed) 4 th edition,533-543.
5) Aids to radiologicl differential diagnosis. Stephen Chapman and Richard Nakielny (eds),4th edition,2003:pp375-377.
6) Kaufman LM, Villablanca JP. and Mafee MF. Diagnostic imaging of cystic lesions in child's orbit. RCNA 1998; 36: 1149-1164.
7) Aviv IR, Casselman J and Misztrid K. Orbital imaging. Clinical radiology 2005; 60 (3): 279-307.
8) Vashist S, Ghai S, Hatimota P, Ghai S, Betharia SM. Cystic lesions of orbit: A CT spectrum. Ind J Radiol Imaging 2003; 13: 139-144.
9) Dubey RB, Tara NP, Sisodiya KN. Computerized tomographic evalution of orbital lesions. Pictorial essay. Ind J Radiol Imaging 2003; 13: 261-70.
10) Harsh Kandpal, Sushma Vashisht, Raju Sharma, Ashu Seith. Imaging spectrum of pediatric orbital pathology. A pictorial review. Ind J Ophthalmol 2006; 54: 227-36.58
11) Weber AL, Romo LV. Pseudotumour and orbit: Clinical pathological and radiological evaluation. Radiological Clinics of North America 1999; 37 (1):151-168.
12) Som PM, Curtin DH. Head and neck imaging. 4th edition, 584-590.
13) Valvasori GE, Sabnis SS. Imaging of orbital lymphoproliferative disorders.RCNA 1999; 37: 135-150.
14) Peyster RG, Hoover ED, Hershey BL, Haskin ME, "High resolution CT oflesions of the Optic Nerve" AJR 140; 869-874 May 1983.
15) Caroll GS, Haik BG, Fleming JC, Robert A. Weiss and Mafee MF. Peripheralnervetumors of Orbit. RCNA Jan 1999 (37:1)1999; 195-202.
16) Flanders AE, Epinosa GA. Orbital lymphoma. RCNA 1987; 25: 601-612.
17) Mafee MF, Goldberg MF. "Persistent hyperplastic primary vitreous; Role of computed tomography and Magnetic resonance. RCNA vol 25 (4) July 1987; 683-691.
18) Weber ATL, Caruso P, Sabates NR. The optic nerve radiological clinical and pathological evaluation, Neuroimaging. Clinics of North America 2005; 15: 175-201.
19) Aryasit O, Tiraset N, Preechawai P, Kayasut K, Sanghan N, Sittivarakul W.BMC Ophthalmol. 2021 Oct 8;21(1):356. doi: 10.1186/s12886-021-02115- x. 59
20) Ruchir Jyani, Dilip Ranade, and Priscilla Joshi Cureus. 2020 Aug; 12(8): e9663. Published online 2020 Aug 11. doi: 10.7759/cureus.9663PMCID: PMC7485920 PMID: 32923259
21) Therakathu, Jacob; Prabhu, Shailesh; Irodi, Aparna; Sudhakar, Sniya Valsa; Yadav, Vikas K.; Rupa, V. (2018). Imaging features of rhinocerebral mucormycosis: A study of 43 patients. The Egyptian Journal of Radiology and Nuclear Medicine, 49(2), 447–452. doi:10.1016/j.ejrnm.2018.01.001
22) Diogo, M. C.; Jager, M. J.; Ferreira, T. A. (2016). CT and MR Imaging in the Diagnosis of Scleritis. American Journal of Neuroradiology, (), ajnr.A4890–. doi:10.3174/ajnr.A4890
23) Tailor, Tina D.; Gupta, Divakar; Dalley, Roberta W.; Keene, C. Dirk; Anzai, Yoshimi (2013). Orbital Neoplasms in Adults: Clinical, Radiologic, and Pathologic Review. RadioGraphics, 33(6), 1739–1758. doi:10.1148/rg. 336135502
24) Burns, N. S., Iyer, R. S., Robinson, A. J., & Chapman, T. (2013). Diagnostic Imaging of Fetal and Pediatric Orbital Abnormalities. American Journal of Roentgenology, 201(6), W797–W808. doi:10.2214/ajr.13.10949
25) Mysore, Naveen; Gonçalves, Fabrício Guimarães; Chankowsky, Jeffrey; del Carpio-O'Donovan, Raquel (2012). Adult Orbital Masses: A Pictorial Review. Canadian Association of Radiologists Journal, 63(1), 39–46. doi:10.1016/j.carj.2010.09.003
26) Amit Mahajan; Alison Crum; Michele H. Johnson; Miguel A. Materin (2011). Ocular Neoplastic Disease. , 32(1), 28–37. doi:10.1053/j.sult.2010.12.001 60
27) Ding ZX, Lip G, Chong V. Idiopathic orbital pseudotumour. Clin Radiol 2011;66:886–92 doi:10.1016/j.crad.2011.03.018 pmid:21546008
28) Razek AA, Elkhamary S, Mousa A. Differentiation between benign and malignant orbital tumors at 3-T diffusion MR-imaging. Neuroradiology 2011;53:517–22 doi:10.1007/s00234-011-0838-2 pmid:21286695
29) Drier A, Haroche J, Savatovsky J, Godenèche G, Dormont D, Chiras J, Amoura Z, Bonneville F.Radiology. 2010 May;255(2):586-94. doi: 10.1148/radiol.10090320. PMID: 20413768
30) Chan LL, Tan HE, Fook-chong S et-al. Graves ophthalmopathy: the bony orbit in optic neuropathy, its apical angular capacity, and impact on prediction of risk. AJNR Am J Neuroradiol. 2009;30 (3): 597-602. doi:10.3174/ajnr.A1413