ORIGINAL RESEARCH PAPER
Volume - 12 | Issue - 08 | August - 2023 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

# ROLE OF COMPUTED TOMOGRAPHY IN THE EVALUATION OF ORBITAL PATHOLOGIES

Radio-Diagnosis

**Dr. Hiralal Gaikwad*** Junior Resident, Dept. of Radio-Diagnosis, GMCH, Aurangabad. *Corresponding Author
**Dr. Ajay Vare** Associate Professor, Dept. of Radio-Diagnosis, GMCH Aurangabad.
**Dr. Varsha Rote-Kaginalkar** Professor & HOD, Dept. of Radio-Diagnosis, GMCH Aurangabad

## ABSTRACT

**Introduction:** Pathologies that arise from orbital structures are common indications for the radiological evaluation of the orbit. Clinical symptoms are useful pointers to the likely pathology. CT is the first-line imaging modality for radiological evaluation of the orbit in the acute setting. CT plays a central role in the diagnosis and management of orbital fractures. CT orbit is an excellent imaging tool for assessing patients with orbital trauma, malignancies, suspected congenital malformations, and in a variety of clinical settings. **Materials and Methods:** A total of 70 patients presenting with orbital complaints who underwent CT scans for orbital pathologies were included in this study and evaluated with a Siemens 128-slice CT machine in our institute with the permission of the institutional ethical committee and the consent of the patient. **Results:** A male preponderance was reported in our study, correlating well with studies by other investigators. The most affected age group was 31- 40 years, with a frequency of 15 (21.43%). The maximum number of cases were traumatic, 29 (41.43%), followed by 20(28.57%) infective/inflammatory cases and 12 (17.14%) neoplastic cases, which were predominantly unilateral. Congenital and developmental conditions accounted for 4 (5.71%) cases. Vascular cases were 3 (4.29%), and miscellaneous cases were 2(2.86%). Out of these, 52 (74.29%) patients had unilateral involvement while 18 (25.71%) patients had bilateral involvement. In this study, CT showed a diagnostic accuracy of 86.21 % in orbital trauma, 85 % in orbital infective/inflammatory lesions and 83.33 % in orbital neoplastic lesions. **Conclusion:** CT is the first investigation of choice for orbital pathologies in emergency settings. It is a rapid, noninvasive and reliable diagnostic tool for the evaluation of orbital pathologies. CT is excellent at identifying and characterization of orbital lesions in traumatic, inflammatory, congenital and neoplastic pathologies of the orbit, which helps the clinician to make a rapid decision regarding further management, prognosis & follow-up.

## KEYWORDS

Orbital pathologies; Computed tomography (CT); Trauma; Inflammatory; Lesion; Compartment.

## INTRODUCTION

The orbit is a small paired anatomical space with important structures within. Pathologies that arise from these orbital structures are a common indication for the radiological evaluation of the orbit. Knowledge of the clinical presentation and patient's age is useful to limit the differential diagnosis and to determine the appropriate imaging modality.

Clinical symptoms such as extraocular muscle palsies, proptosis, diplopia, visual impairment, and ocular pain can serve as useful pointers to the likely pathology. However, a biopsy may be needed for confirmation.

Imaging analysis of orbital pathologies is facilitated by a compartmental approach which is useful for differential diagnosis based on the location of the disease processes within the orbit. General visual disturbances and ophthalmoplegia may be caused by tumors, infections, inflammations, trauma and vascular disorders. Computed tomography (CT) and magnetic resonance imaging (MRI) play vital roles in the diagnosis and management of these lesions.

Though CT and MRI are regarded to be complementary to each other CT is the first-line modality for radiological evaluation of the orbit in the acute setting. Understanding the imaging findings in traumatic and non-traumatic orbital conditions such as foreign objects in the eye socket, inflammation, infection & retinal and choroidal detachment is crucial for their accurate diagnosis and optimal treatment.

CT gives excellent details about bony anatomy in fractures and helps to assess the presence or absence of foreign bodies and plays a central role in the diagnosis and management of orbital fractures. CT describes the extent of lesions in inflammatory and neoplastic etiologies, accurately assesses bony destruction in neoplasms and helps in the management of orbital lesions. CT is also valuable in the follow-up of tumor regression after surgery, radiotherapy or chemotherapy.

CT scan allows us to discern the location, extent and configuration of the lesion and its effect on the adjacent structures. It also allows us for understanding the possible tissue mass composition. Contrast study involves imaging of the particular area, after injection of the radiological contrast medium intravenously.

CT remains a quick, clinically effective, precise tool in emergency settings. Particular attention to the orbital apex, the anterior chamber, the position of the lens, the posterior segment of the globe, bleeds or abnormal fluid collections should be given.

CT orbit is an ideal imaging tool for comprehensive imaging assessment of patients with orbital trauma, malignancies, suspected congenital malformations and in various clinical settings.

## AIMS AND OBJECTIVES

The aim was, to evaluate the role of CT in orbital pathologies.

**Primary Objectives:**

- To determine the role of CT in orbital pathologies.
- To find CT imaging characteristics in orbital pathologies.
- To provide a systematic diagnostic approach in clinically suspected/symptomatic patients of orbital pathologies.

**Secondary Objective:**

- To distinguish between the primary and secondary orbital pathologies.
- To know the origin and extent of concerned orbital pathologies.
- To distinguish between benign and malignant orbital pathologies.

## MATERIALS AND METHODS

This was a cross-sectional study carried out in a tertiary care hospital in the department of radio-diagnosis from 2021 to 2022. In this study, 70 patients presenting with orbital complaints underwent CT scans were evaluated.

All the CT scans were performed on Siemens Definition AS+ 128 slice machine in our institute after permission of the institutional ethical committee. A brief history was obtained and any contraindication to CT was assessed. Consent was taken from patients before the procedure. Appropriate CT protocols were applied, non-contrast & contrast-enhanced images were obtained and scan images were analyzed subsequently.

## RESULTS AND ANALYSIS

A total of 70 patients having orbital pathologies on CT imaging were included in this study and their results were analyzed.

The most affected age group was 31- 40 years with a frequency of 15 (21.43%) (Table No.1). Out of 70 patients, there were 46 (65.71%) males and 24(34.29%) females with a male: female ratio of 1:0.52. Maximum cases were traumatic 29 (41.43%) followed by infective/inflammatory 20(28.57%) cases and 12 (17.14%) neoplastic cases which were predominantly unilateral. Congenital & developmental conditions accounted for 4(5.71%) cases. Vascular cases were 3(4.29%) and miscellaneous cases were 2(2.86%) (Fig.1).

Traumatic and neoplastic pathologies were more common in males. Infective/ inflammatory pathologies were equal in males and females while congenital & developmental and vascular pathologies were more common in females. Out of these, 52 (74.29%) patients had unilateral(U/L) involvement while 18 (25.71%) patients had bilateral(B/L) involvement (Table no.2). Out of 70 patients, 63 (90%) patients had pathologies confined to the single orbital compartment and 7(10%) patients had multicompartmental involvement. Amongst the patients with unicompartmental involvement, 46 patients had purely extraconal involvement and out of these 36 had unilateral and 10 had bilateral involvement. A total of 6 patients had lesions confined solely to the intraconal compartment which were unilateral. Traumatic conditions account for the maximum number of cases in the age group of 21-30 years accounting for 11 cases followed by 9 cases in the age group of 31-40 years (Fig.2). The maximum number of infective/inflammatory cases was in the age group of 41-50 years (Fig.3&4). Neoplastic and congenital pathologies were predominantly found in the age group of 0-10 years (Fig.5). Most of the pathologies were predominantly confined to a single compartment of orbit. Out of 29 trauma patients, 27 cases were males and only 2 cases were females. Out of 12 neoplastic cases, 3 were benign and 9 cases were malignant. In this study, CT was 96.15 % sensitive and 66.67 % specific in diagnosing orbital trauma with a diagnostic accuracy of 86.21 %. It was 93.33 % sensitive and 60 % specific in diagnosing orbital infective/inflammatory lesions with a diagnostic accuracy of 85 % as well as 88.88 % sensitive and 66.66 % specific in diagnosing orbital neoplastic lesions with a diagnostic accuracy of 83.33 %.

**Table No1: Distribution of cases according to age**

| Age (Years) | Number of cases (N) | Percentage (%) |
|---|---|---|
| 0-10 | 11 | 15.71 |
| 11-20 | 5 | 7.14 |
| 21-30 | 14 | 20 |
| 31-40 | 15 | 21.43 |
| 41-50 | 10 | 14.29 |
| 51-60 | 6 | 8.57 |
| 61-70 | 6 | 8.57 |
| > 70 | 3 | 4.29 |
| Total | 70 | 100% |

**Table No. 2: Distribution of Orbital Pathologies According to Nature and Laterality of Pathology.**

| Nature | U/L | B/L | Total | % |
|---|---|---|---|---|
| Traumatic | 23 | 6 | 29 | 41.43 |
| Infective/Inflammatory | 16 | 4 | 20 | 28.57 |
| Neoplastic | 7 | 5 | 12 | 17.14 |
| Congenital & Developmental | 2 | 2 | 4 | 5.71 |
| Vascular | 3 | 0 | 3 | 4.29 |
| Miscellaneous/Others | 1 | 1 | 2 | 2.86 |
| Total | 52 | 18 | 70 | 100% |

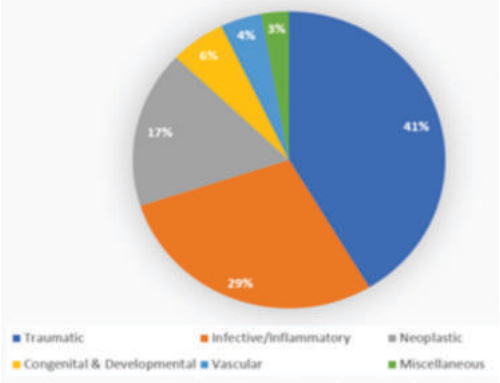


**Fig.1:** Distribution of Orbital Pathologies according to its nature.

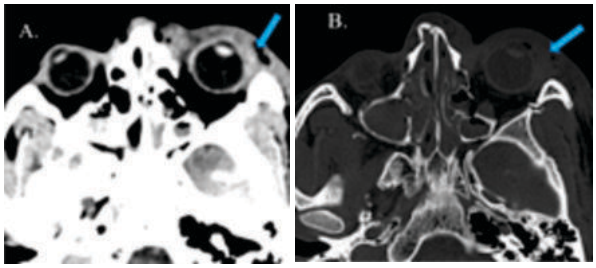


**Fig. 2. Trauma:** In this 17year old trauma patient, NCCT soft tissue window (A) and bone window (B) show periorbital soft tissue edema and pre-septal edema and emphysema on the left side.

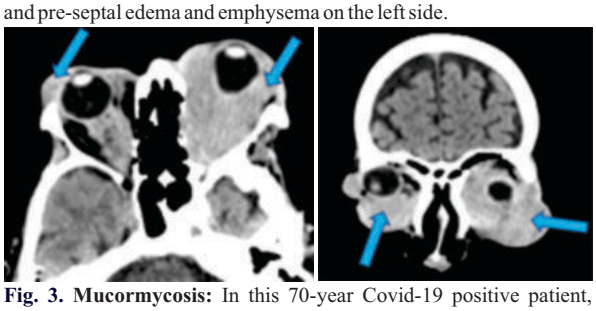

**Fig. 3. Mucormycosis:** In this 70-year Covid-19 positive patient, NCCT axial and coronal soft tissue windows show heterogenous soft tissue thickening in bilateral orbits causing bilateral proptosis.

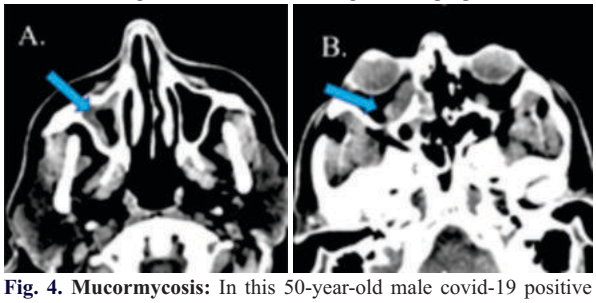


**Fig. 4. Mucormycosis:** In this 50-year-old male covid-19 positive patient NCCT axial images show heterogenous mucosal thickening in the right maxillary sinus with extension into the right orbit.

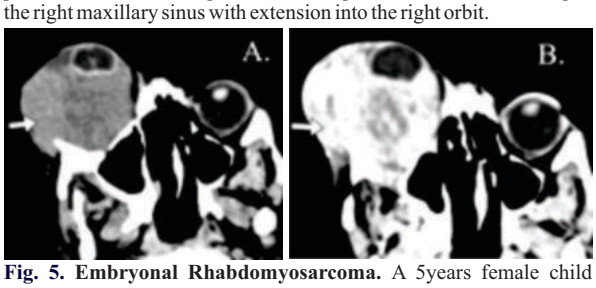


**Fig. 5. Embryonal Rhabdomyosarcoma.** A 5years female child presented with right orbital swelling. CT plain axial (A) contrast-enhanced (B) images show ill-defined soft tissue density heterogeneously enhancing lesions in the right orbit and maxillary region involving the inferior rectus and inferior oblique muscle with proptosis.

## DISCUSSION

A total of 70 patients having orbital pathologies were included in this study. Maximum patients were found amongst the age group of 31-40 years with a frequency of 15 (21.43%) cases followed by the age group of 21-30 years with 14 (20 %) cases. Above 70 years only 3 (4.29%) cases were recorded.

A similar study by Aarti Anand et al. showed the maximum distribution of cases in the age group of 21-30 years [24%]. A study by Nisha et al. of 50 patients showed the maximum distribution of cases in the age group of 39-58 years (34%) and the least number of patients in <1 year (6%). In our study of 70 patients, 46(65.71 %) cases were males and 24 (34.29%) were females. In a similar study by Nisha et al., there was an equal distribution of cases in males [50%] and females [50%]. In a similar study by Nilesh Chaudhari et al., the maximum number of cases were males [54.2%] and the remaining cases [45.8%] were females. In our study, the distribution of orbital pathologies according to their nature showed a maximum of 29(41.43%) cases were traumatic which were followed by infective/inflammatory 20

(28.57%) cases. Neoplastic cases accounted for 12 (17.14%) cases. Congenital & developmental conditions accounted for 4(5.71%) cases. A total of 3 (4.29) cases were vascular and 2 cases were miscellaneous (Graves ophthalmopathy and phthisis bulbi).In a similar study by Nisha et al, the maximum cases (36%) were inflammatory followed by neoplastic and traumatic. In the study done by Durrani et al., among 26 patients most common lesion was neoplastic (46%) followed by infections (28%), inflammation (18%), trauma (6%) and vascular (2%). In another study by Nilesh Chaudhari et al., the maximum cases (31.4%) were inflammatory/ infective followed by neoplastic (20%). The least number of cases were congenital (2%). In a study by Aarti Anand et al., the maximum cases were inflammatory and infective (35%) followed by neoplastic (31%). The least number of cases were traumatic (4%). In a study by Usha Kim et al., the maximum cases (34.1%) were inflammatory and infective followed by systemic conditions (31%). The least number of cases were vascular (5.8%). In a study by Kennedy et al., the maximum number of cases were neoplastic (40.4%) followed by Inflammatory and infective (23.9%). In a study done by PK Shah et al., out of 50 cases, 22 had neoplastic lesions, 15 had infective and inflammatory lesions, 3 had congenital and developmental lesions, 2 had parasitic lesions, 1 had a vascular lesion, 3 had miscellaneous lesions (bony and PNS lesions) and 4 had traumatic lesions. Mahsud in his study on 50 cases of proptosis showed that 28 were neoplastic, 12 were inflammatory, 7 were congenital and 3 were traumatic.

Traumatic and neoplastic conditions are more common in males while congenital and vascular pathologies are more common in females. Infective/ inflammatory pathologies were equal in males and females. A total of 52 (74.29%) cases were unilateral and 18(25.71%) cases had bilateral involvement.

Out of 70 patients maximum of 63 patients had orbital pathologies confined to the single compartment and 7 patients had multicompartmental involvement both of which were predominantly unilateral. Amongst unicompartmental pathologies, a maximum of 36 patients had exclusively extraconal involvement.

According to its nature and laterality, we found that out of 70 cases, a maximum of 31(44.29%) cases were traumatic which were predominantly unilateral followed by infective/inflammatory 20(28.57%) which were also predominantly unilateral. Neoplastic conditions accounted for 12(17.14%) cases and were predominantly unilateral. Congenital & developmental conditions were predominantly unilateral and accounted for 5(7.14%) cases. The least number of case(s) 2(2.86%) were vascular and were exclusively unilateral.

The spectrum of orbital pathologies according to their nature in different age groups revealed the maximum number of cases in the age group of 21-30 years accounting for 11 cases followed by 9 cases in the age group of 31-40 years. The maximum number of infective/inflammatory cases was found in the age group of 41-50 years. Congenital and neoplastic lesions were maximum in the age group of 0-10 years. Most of the orbital pathologies are predominantly confined to a single compartment of orbit. Out of 29 trauma patients, 27 cases were males and only 2 cases were females with maximum incidence in the age group of 21-30 years (37.93%). This showed the maximum incidence was in the young active population and most of the cases were associated with road traffic accidents. Out of 12 neoplastic cases, 3 (25%) were benign and 9(75%) were malignant. In a similar study by Nisha et al., most of the orbital neoplasms were malignant (80%) and 20% were benign. A study by Usha Kim et al, showed that most of the orbital neoplasms (90%) were found to be primary and 10% were secondary.

Distribution of clinical features among study participants showed maximum cases came with the complaint of orbital swelling followed by pain and proptosis.

In our study, CT showed 86.21 % diagnostic accuracy in orbital trauma, 85 % in infective/inflammatory lesions and 83.33 % in neoplastic lesions. Ushalatha et al. reported 86% accuracy of CT in the diagnosis of orbital tumors. Shah et.al. reported the range of sensitivity, specificity and accuracy of MDCT for diagnosing nontraumatic lesions in the range of 50-100%, 96.95-100% and 96-100% respectively and overall, 95.65% sensitivity of MDCT in non-traumatic ocular and orbital lesions.

## CONCLUSION

CT is the first investigation of choice in emergency settings and when MRI is contraindicated. CT is a rapid, noninvasive, reliable diagnostic tool for the evaluation of orbital pathologies. CT is excellent in identifying and characterization of orbital fractures and assessing the location of foreign bodies. CT provides essential information for treatment and follow-up in traumatic, inflammatory, congenital and neoplastic lesions of the orbit. Hence CT scan is an excellent diagnostic modality for orbital pathologies which helps the clinician to make a rapid decision regarding further management, prognosis & follow-up.

## REFERENCES


1. LeBedis, C. A., & Sakai, O. (2008). Nontraumatic orbital conditions: diagnosis with CT and MR imaging in the emergent setting. Radiographics: a review publication of the Radiological Society of North America, Inc, 28(6), 1741–1753.
2. Betts, A. M., O'Brien, W. T., Davies, B. W., & Youssef, O. H. (2014). A systematic approach to CT evaluation of orbital trauma. Emergency radiology, 21(5), 511–531.
3. Anand, A., Disawal, A., Bathwal, P., Bandgar, A., & Patwa, D. (2017). Magnetic Resonance Imaging in Evaluation of Orbital Pathologies. International Journal of Current Medical and Applied Sciences, 16(1), 46–50.
4. Nisha. C. (2020) A clinical study on Role of Radioimaging like CT/MRI in diagnosis and management of Orbital lesions, 1(1), 1-92
5. Chaudhari, N., Garse, P., & Prasla, S. (2018). Magnetic Resonance Imaging Evaluation of Various Orbital Pathologies. International Journal of Science and Research (IJSR), 7(8), 207–211.
6. Kim, U. R., Khazaei, H., Stewart, W. B., & Shah, A. D. (2010). Spectrum of Orbital Disease in South India: An Aravind Study of 6328 Consecutive Patients. The American Society of Ophthalmic Plastic and Reconstructive Surgery, 26(5), 315–322.
7. Shah, P., Rauniyar, R., Gupta, M., & Badhu, B. (2015). Role of imaging (MDCT) in ocular and orbital lesions. Health Renaissance, 13(3), 24–36.
8. Mahsud, Z. S., & Suraya Bano. (2002). Diagnostic role of CT scan in proptosis in paediatric age group. Journal of Postgraduate Medical Institute, 18(3), 439–466.
9. Kokilam. Diagnostic Value of Ct scan in Orbital Diseases with Histopathological Correlation. repository-tnmgrmu.ac.in/id/eprint/3358. 2010;(3).
10. Parthasarathy, E. A., Sulaiman F, A., Prabhu, A. D., Ahmed B, A., & Saravanan, K. (2018). Computed Tomography in Orbital Pathology with Clinicopathological Correlation. International Journal of Contemporary Medicine Surgery and Radiology, 3(2), B60–B64.
11. Ushalatha, B., &. Sambasivarao, K. (2016). Role of Ct in the Evaluation of Orbital Tumors. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, *15*(4), 16–19.
12. Kubal W. S. (2008). Imaging of orbital trauma. Radiographic: a review publication of the Radiological Society of North America, Inc, 28(6), 1729–1739.