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Original Research Article

Trends in paediatric orbital cellulitis: A retrospective observational study

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Abstract

Introduction: Orbital cellulitis is defined as a serious infection that involves the muscle and fat located within the orbit. Although orbital cellulitis can affect individuals of all ages, it is more frequently observed in children. The condition is typically diagnosed based on clinical symptoms, including conjunctival chemosis, restricted eye movements (ophthalmoplegia), pain during ocular motion, and proptosis. It progresses rapidly with an acute onset, making early detection and timely treatment essential to prevent severe outcomes. Treatment of orbital cellulitis includes antibiotics and other supportive therapies.

Aims & Objective: Orbital cellulitis is a severe post-septal infection that can lead to vision loss and life-threatening complications if not treated promptly. This study aims to evaluate the clinical presentation, diagnostic approaches, treatment protocols, and outcomes of paediatric orbital cellulitis cases to identify trends and improve management strategies.

Materials & Methods: A retrospective observational study was conducted at SP Medical College and Hospital, Bikaner, including paediatric patients diagnosed with orbital cellulitis between March 2023 and August 2024. A total of 39 cases were analysed based on demographics, presenting symptoms, visual acuity, diagnostic imaging, microbiological findings, treatment approaches, hospital stay, and recovery outcomes. Statistical evaluation was performed to determine significant trends.

Results: The mean age of affected children was 7 years, with a male predominance (70%). The most common clinical signs included chemosis, eyelid swelling, proptosis, and restricted eye movements ($P < 0.01$). Sinusitis was the primary infection source in 45% of cases. CT imaging confirmed orbital cellulitis in all scanned cases (n=31), detecting orbital and sub-periosteal abscesses in 25 cases ($P < 0.01$). Swab cultures were positive in 40%, primarily isolating Gram-positive *cocci*. All patients received broad-spectrum intravenous antibiotics, and eight required surgical drainage. The mean hospital stay was 11 days, with an 82.1% full recovery rate. No mortality was recorded.

Conclusion: Early diagnosis through clinical and radiological assessment, coupled with a multidisciplinary treatment approach, significantly enhances recovery and minimizes complications in paediatric orbital cellulitis cases.

Keywords: Orbital cellulitis, paediatric infection, ocular emergency, sinusitis, imaging diagnosis, antibiotic therapy

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1. Introduction

Orbital cellulitis is a severe post-septal infection of the orbit, commonly caused by bacterial pathogens.[1] Orbital cellulitis is defined as a serious infection that involves the muscle and fat located within the orbit. The most common cause of orbital cellulitis is bacterial rhinosinusitis.[2] Other potential causes include: Infection of the teeth, middle ear, or face, dacryocystitis, orbital trauma with fracture or foreign body, ophthalmic surgery such as strabismus surgery, blepharoplasty, radial keratotomy and retinal surgery, peribulbar anaesthesia, an infected mucocele that erodes into the orbit, immunodeficiency.[3] It can lead to serious complications such as vision loss, meningitis, cavernous sinus thrombosis, subdural empyema, and brain abscess if left untreated. Orbital cellulitis is a rare complication of bacterial rhinosinusitis.[4] However, in most cases of orbital cellulitis, rhinosinusitis is the source of infection. Data show that in up to 86% to 98% of cases of orbital cellulitis, there is coexisting rhinosinusitis present.[5] Moreover, pansinusitis and ethmoid sinusitis are the forms of rhinosinusitis that most likely to lead to orbital cellulitis The condition is typically diagnosed based on clinical symptoms, including conjunctival chemosis, restricted eye movements (ophthalmoplegia), pain during ocular motion, and proptosis. Orbital cellulitis also

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typically cause eyelid swelling with or without erythema; however, these findings are also seen in another less serious condition called preseptal cellulitis Imaging modalities like CT scans and MRI play a crucial role in confirming the diagnosis.[6] Although orbital cellulitis can affect individuals of all ages, it is more frequently observed in children. It progresses rapidly with an acute onset, making early detection and timely treatment essential to prevent severe outcomes.

Treatment of orbital cellulitis includes antibiotics and other supportive therapies. An ophthalmologist and otolaryngologist should also be consulted for proper examination and because, in some cases, surgery may be required. Without prompt diagnosis and proper treatment, the infection of the orbit can progress and extend to the adjacent anatomical locations and result in serious complications. Those complications include loss of vision, sub periosteal abscess, orbital abscess, and intracranial extension of the infection.

The choice of antibiotics is broad spectrum regimens aimed at covering for organisms such as *S. aureus* including [MRSA], *Streptococcus pneumoniae*, other *Streptococci*, as well as gram-negative *bacilli*.[7] The antibiotic regimen should also include coverage for anaerobes when an intracranial extension is suspected. Antifungals are indicated only when a fungal infection is suspected in the appropriate clinical setting. Further details on specific antibiotics will be explained in the diagnosis section. Analgesics such as NSAIDs and acetaminophen can be used alone or in combination to achieve effective pain control in patients with orbital cellulitis.[8]

1. Aims and Objective

This study aims to analyze cases of orbital cellulitis, focusing on clinical manifestations, diagnostic approaches, treatment protocols, potential complications, and long-term effects. Evaluating recent trends in orbital cellulitis management will contribute to improved early intervention strategies, facilitating faster recovery and reducing the risk of complications.

2. Material and Methods

This retrospective observational study was carried out in the Department of Ophthalmology at SP Medical College and Hospital, Bikaner. The study included all cases of orbital cellulitis that presented between March 2023 and August 2024, selected based on specific inclusion and exclusion criteria. Informed patient consent was obtained.

2.1. *Inclusion Criteria*

Children under 18 years of age diagnosed with orbital cellulitis, confirmed either clinically or through radiological imaging.

2.2. *Exclusion Criteria*

Adults with orbital cellulitis, Cases where orbital cellulitis resulted from malignancy or fungal infections and Immuno compromised patients diagnosed with orbital cellulitis are exclude from the study.

A total of 54 cases of orbital cellulitis were recorded during the study period (March 2023 to August 2024). The distribution of cases was 39 cases in children, 11 cases in adults, 2 cases in immune compromised individuals and 2 cases associated with malignancy.

All 39 paediatric cases were assessed based on age, gender, presenting symptoms, visual acuity at the time of admission, extra ocular movements, duration of hospital stay, average length of antibiotic therapy, swab culture results, initial infection site, final recovery outcomes, and the time interval between symptom onset and seeking medical care. The collected data were analysed and subjected to statistical evaluation.

3. Results

In this study, 39 out of 54 cases (72.2%) were recorded in children under 18 years **Figure 1**. The mean age of affected children was 7 years, with a range of 1 to 17 years. The condition was more frequent in males, accounting for 70% of cases. Common clinical signs included chemosis, conjunctival congestion, eyelid swelling, proptosis, and restricted eye movements, observed in all cases ($P < 0.01$). Periorbital pain was noted in 25 cases (64.1%). Visual acuity assessment was not feasible in 16 cases (41.0%), and one patient had no light perception at the time of admission.

Orbital CT scans were recommended for all 39 paediatric cases; however, only 31 patients underwent imaging, while 8 patients declined the procedure. CT scans confirmed orbital cellulitis in all 31 cases (100%), with orbital and sub periosteal abscesses detected in 25 cases (Orbital: 11, Subperiosteal:14) ($P< 0.01$). Sinusitis was identified as the primary source of infection in 45% of cases. Swab cultures were taken from all patients, but only 40% yielded positive results, primarily isolating Gram-positive *cocci* (*Staphylococcus* and *Streptococcus* species).

Broad-spectrum intravenous antibiotics, covering Gram-positive *cocci*, Gram-negative bacteria and anaerobes, were administered in all 39 paediatric cases, with treatment modified based on culture reports. Abscess drainage was required in eight cases. The average duration of intravenous antibiotic therapy was 9 days, followed by one week of oral antibiotics. The mean hospital stay was 11 days. Complete recovery was observed in 32 cases (82.1%). No mortality was recorded in this study.

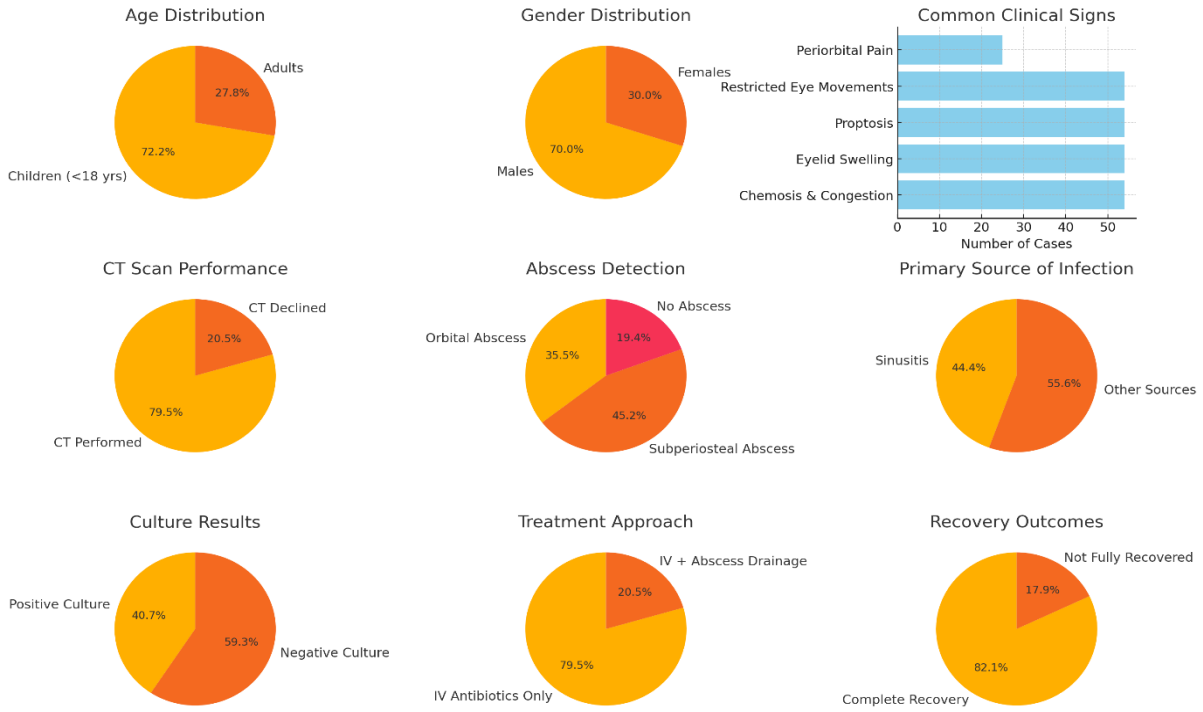

Figure 1: The figure presents various clinical and demographic characteristics. Age distribution shows 72.2% of cases in children (<18 yrs) and 27.8% in adults. Gender distribution indicates 70% males and 30% females. Common clinical signs include chemosis, eyelid swelling, proptosis, restricted eye movements, and periorbital pain. CT scans were performed in 79.5% of cases, while 20.5% declined. Abscess detection reveals 19.4% had no abscess, 45.2% had subperiosteal abscess, and 35.5% had orbital abscess. Infection sources were 44.4% sinusitis and 55.6% other sources. Culture results showed 40.7% positive and 59.3% negative. Treatment approaches included 79.5% receiving IV antibiotics only and 20.5% requiring abscess drainage. Recovery outcomes showed 82.1% fully recovered, while 17.9% did not.

4. Discussion

Orbital cellulitis is a serious ophthalmic emergency, with approximately 70% of cases occurring in children, a trend consistent with findings reported by Mukund *et al*. (2019).[1] A male predominance was observed, with boys accounting for 70% of cases, a pattern also noted in studies conducted by Nageswaran *et al*.[2] and Sobol *et al*.[3] The most frequently observed clinical features included chemosis, conjunctival congestion, eyelid swelling, proptosis, and restricted ocular movements, all of which were statistically significant ($P < 0.01$). Similar presentations were documented in research conducted by Mukund et al.,[1] Chaudhary et al.,[4] Murphy et al.,[5] and Alam et al.[6]

Interestingly, fever was noted in only 25% of cases, highlighting that the absence of fever or systemic symptoms should not delay treatment initiation. Computed tomography (CT) imaging of the orbit confirmed the diagnosis in 31 out of 39 cases, a finding of statistical significance ($P < 0.01$), as also reported by Basraoui et al.[7] Additionally, CT scans facilitated the detection of orbital abscesses and sub periosteal abscesses when present.

Microbiological analysis revealed that Gram-positive *cocci*, particularly *Staphylococcus* and *Streptococcus* species, were the most frequently isolated pathogens in swab cultures.[8] The primary source of infection was sinusitis, predominantly affecting the ethmoid and maxillary sinuses, a trend corroborated by Tzelnick et al. (2019).[9] Other sources included trauma and dental infections.

The most commonly administered antibiotic regimen comprised intravenous ceftriaxone, metronidazole infusion, and amikacin, with dosages adjusted based on the child's body weight. In cases where culture results indicated methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin was introduced into the treatment plan.[10-12] Surgical drainage of abscesses was performed in eight cases, as noted in studies by Chaudhary et al.[4] and Murphy et al.[5] Given the frequent association with sinusitis, a multidisciplinary approach involving both ophthalmologists and otolaryngologists was crucial for timely diagnosis and management.[13-15]

5. Conclusion

Orbital cellulitis remains a significant ophthalmic emergency, with a strong predilection for pediatric patients,

particularly males. The findings reinforce previous studies, showing that approximately 70% of cases occur in children, with a male predominance of the same proportion. Clinical presentations such as chemosis, eyelid swelling, proptosis, conjunctival congestion, and restricted ocular movements were highly prevalent, highlighting the importance of recognizing these signs early. Notably, fever was absent in 75% of cases, suggesting that systemic symptoms should not be relied upon for diagnosis or treatment initiation.

Imaging studies, particularly CT scans, played a crucial role in confirming diagnoses and identifying complications such as orbital and subperiosteal abscesses. Sinusitis was the most frequent underlying cause, primarily involving the ethmoid and maxillary sinuses. Other sources included trauma and dental infections. Culture results indicated Gram-positive *cocci* as the predominant pathogens, emphasizing the need for targeted antibiotic therapy. The standard treatment regimen included IV ceftriaxone, metronidazole, and amikacin, with vancomycin added in MRSA cases. Surgical intervention was necessary in select cases with abscess formation.

A multidisciplinary approach involving ophthalmologists and otolaryngologists is critical for prompt diagnosis and management. Early recognition, appropriate imaging, and timely medical or surgical intervention are key to optimizing outcomes and preventing complications.

6. Financial support

None.

7. Conflicts of interest

There are no conflicts of interest.

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