

# A Study on Orbital Cellulitis Due to Acute Sinusitis: A Multidisciplinary Approach

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## Abstract

**Introduction:** Orbital infection has spread beyond the orbital septum leads to orbital cellulitis. The distinctive features of orbital cellulitis are proptosis and limitation of ocular movements. Additional useful signs are chemosis of bulbar conjunctiva, reduced visual acuity, afferent pupillary defect, and toxic systemic symptoms. Prompt diagnosis and treatment of orbital cellulitis is vital as it is associated with serious complications such as cavernous venous thrombosis, visual loss, meningitis, brain abscess, and sepsis.

**Aims and Objectives:** The purpose of this study is to evaluate clinical presentation, treatment outcomes, and post-surgical complications of diagnosed case of orbital cellulitis.

**Materials and Methods:** This is a cross-sectional study of patients with orbital cellulitis as a complication of acute sinusitis. All the patients were subjected to thorough clinical examination, ophthalmic and radiological evaluation. Computed tomography of paranasal sinuses done. All the patients in this study received appropriate medical and surgical management and follow-up evaluation done at the 1<sup>st</sup> month and 3 months.

**Results:** Orbital cellulitis due to fungal sinusitis is prevalent among uncontrolled type 2 diabetes mellitus patients in our study. Surgical management such as endoscopic sinus surgery with intravenous antibiotic therapy found to be more effective than conservative management alone.

**Conclusion:** Strict diabetic control, appropriate surgical and medical management, and a vigilant follow up resulted to a better outcome.

**Key words:** Acute sinusitis, Endoscopic sinus surgery, Fungal sinusitis, Orbital cellulitis

## INTRODUCTION

Orbital cellulitis is defined as an inflammation of tissue behind the orbital septum. The orbital complications are more commonly seen in the pediatric aged group with the overall incidence of 3–4% in children affected by acute rhinosinusitis. In general, rhinosinusitis is responsible for 66–82% of cases of orbital infection and the acute ethmoiditis represents the most common.<sup>[1]</sup> Diabetes mellitus (DM) and immunosuppression increase the

risk of infection. Orbital involvement can be easily suspected in case of ophthalmoplegia and proptosis. The diagnosis is usually achieved through the combination of clinical examination and radiological findings. Chandler classification still represents the most complete and popular to indicate the severity of the infection.<sup>[2]</sup> Orbital infection originating from paranasal sinuses can cause vision loss and death due to intracranial extension.<sup>[3]</sup> Aggressive antibiotic therapy and surgery can be considered to achieve optimal prognosis. The aim of this study was to report our experience about the prevalence of orbital cellulitis and its management due to a sinus infection.

## MATERIALS AND METHODS

This study was performed in the ENT Department in Chengalpattu Medical College and Hospital. A cross-

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sectional study was done from the period of February 2015 to February 2020.

### Inclusion Criteria

The following criteria were included in the study:

1. Clinical diagnosis of orbital complication of acute rhinosinusitis.
2. Age of patients 5–65 years.
3. Clinical and endoscopic ground with imaging for the diagnosis of acute rhinosinusitis.
4. Patients with diabetes and non-invasive fungal sinusitis.

### Exclusion Criteria

The following criteria were excluded from the study:

1. Age <5 years and >65 years.
2. Previous history of facial trauma.
3. Immunocompromised.
4. Invasive fungal sinusitis and with positive fungal cultures for mucormycosis.

All patients were undergone ophthalmologic evaluation with visual acuity, pupil reactivity testing of the affected eye, and ocular movement impairment. Diplopia could not be detected in the patients with complete eye closure. Diagnostic nasal endoscopy carried out for all patients. Computed tomography (CT) scan of paranasal sinuses with orbit was performed, culture-specific intravenous antibiotic therapy administered and surgical intervention done when necessitated.

## RESULTS

Between February 2015 and February 2020, 30 patients were admitted to our institution with the diagnosis of orbital cellulitis as a complication of sinus infection. Their age varied from 5 years to 65 years. Most of the patients belong to the age group of 55 to 65 years [Figure 1]. Twenty-four were male and six were female [Table 1]. Out of 22 patients (73%) in the adult age group, 17 (78%) were diabetic and 5 (22%) were non-diabetic [Figure 2]. Among clinical features, periorbital swelling was common [Figure 3]. Blood cultures were done. The most commonly isolated bacterial species were *Staphylococcus aureus* (40%) and *Streptococcus* (20%) and fungal species *Aspergillus* (26%) [Figure 4]. The most commonly involved sinus in the pediatric age group is maxillary sinus (13%). On the contrary, ethmoid sinus (36.67%) is the most commonly involved in adult age group [Figure 5 and Table 2].

About 73.33% of the patients were given surgical clearance of the sinuses with intravenous antibiotic coverage as primary treatment. About 26.67% was treated conservatively with culture-specific intravenous antibiotics.

**Table 1: Gender prevalence**

Gender	No. of patients
Males (years)	
<15	6 (20)
>15	18 (60)
Females (years)	
<15	2 (7)
>15	4 (13)

**Table 2: Sinus involvement**

Sinus involvement	No. of patients (5)
Single sinus	18 (60)
Two sinuses	10 (33.3)
Multiple sinuses	2 (6.67)

Conservative management was carried out in children <9 years of age and those with uncontrolled type 2 DM. Only 2 young children (6.67%) who treated conservatively had recurrence of orbital cellulitis after 2 months of initial treatment. Three cases (10%) of orbital cellulitis, who were managed conservatively in the pediatric age group had turned into subperiosteal abscess during the course of treatment. Those who developed complications and those had recurrence were taken up for surgery. These patients had no recurrence during follow-up. Overall 90% of the patients in our study were given surgical management while only 10% of the patients had better outcome with conservative management alone.

## DISCUSSION

Orbital cellulitis is the complication of sinusitis where the infectious process has extended beyond the orbital septum in which patient may present with pain, reduced visual acuity, compromised ocular motility, and significant proptosis. The most common predisposing factor for orbital cellulitis is sinus disease especially in children. Sinusitis is the leading cause for the development of orbital cellulitis and anatomic variations of the osteomeatal complex such as concha bullosa and paradoxical middle turbinate can predispose and exacerbate underlying sinusitis.<sup>[4]</sup> Chandler *et al.*<sup>[2]</sup> grouped complication of sinus inflammation into five classes. In Group 1, eyelids may be swollen along with the presence of orbital content edema (preseptal cellulitis). Group II reflects evidence of orbital cellulitis in which inflammatory cells diffusely infiltrate orbital tissues. In Group II, the eyelids may be swollen along with conjunctival chemosis as well as some degree of proptosis. Purulent material may be collecting as subperiosteal abscess between the periorbita and the bony walls of the orbit in Group III. Patients in Group IV (orbital abscess) may present with their abscess being inside

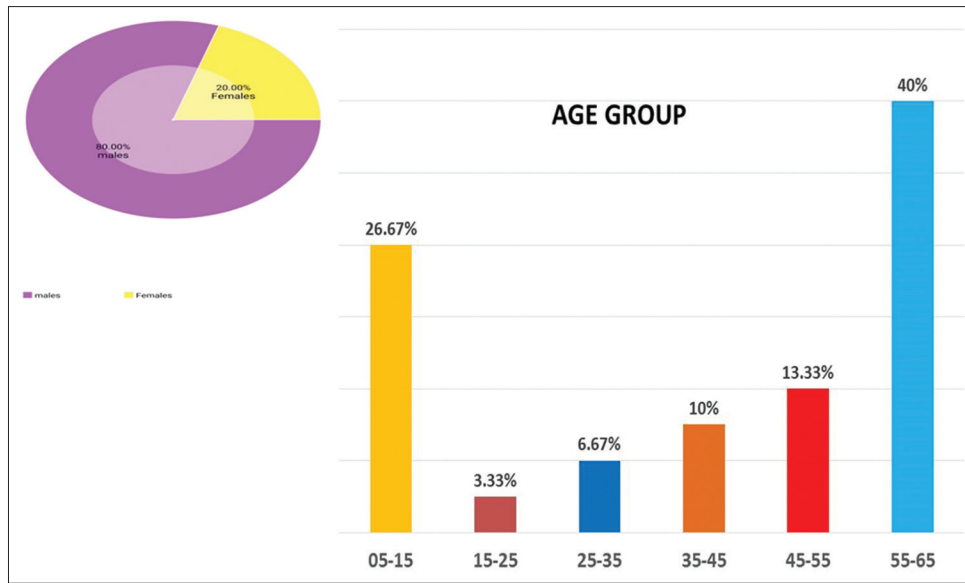


Figure 1: Age-wise distribution of orbital cellulitis

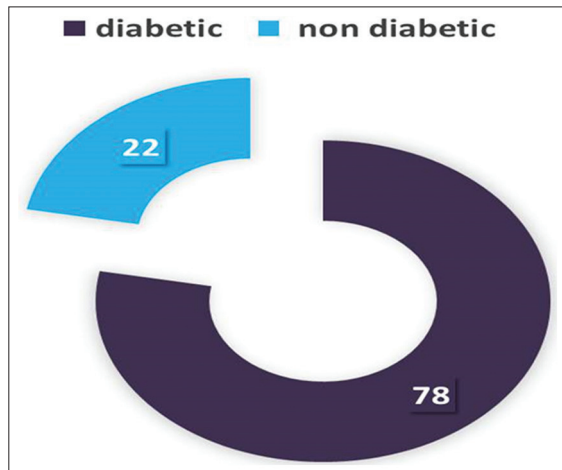


Figure 2: Orbital cellulitis in adult diabetic

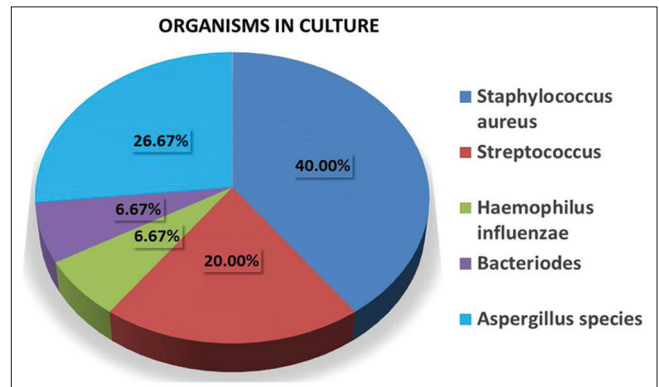


Figure 4: Microbiological profile of orbital cellulitis

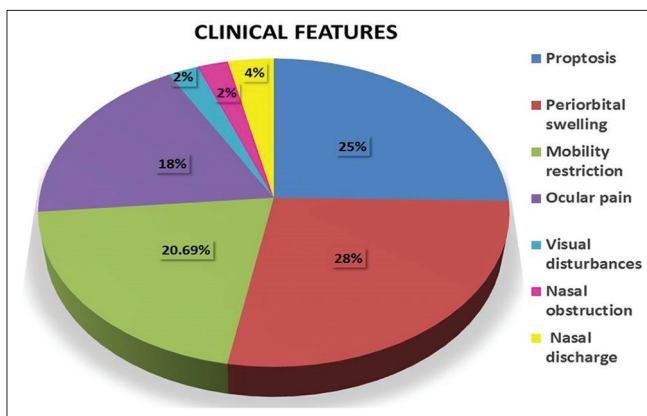
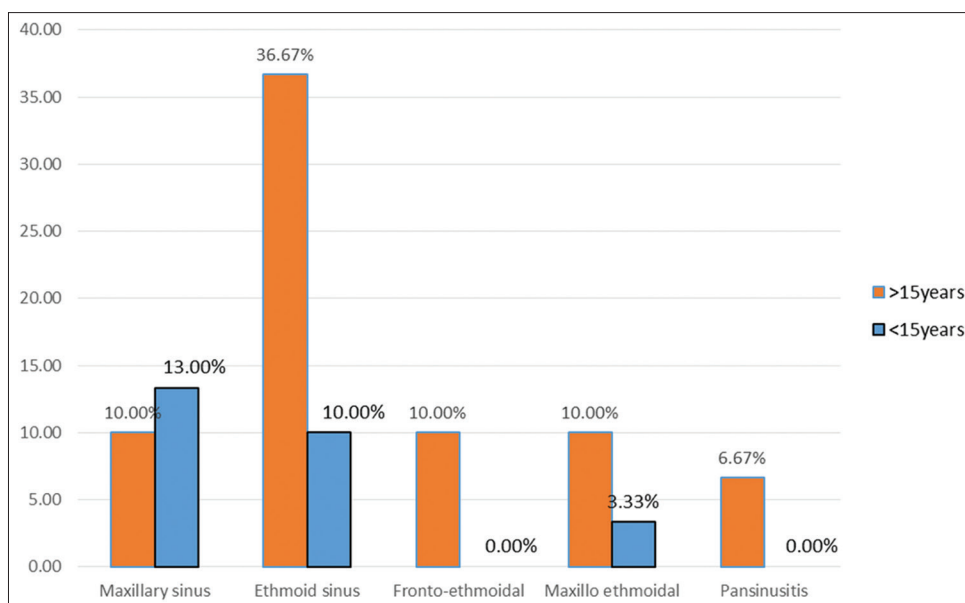


Figure 3: Clinical presentation of orbital cellulitis

or outside the muscle cone following untreated orbital cellulitis. Patients in Group V may present with bilateral eyelid edema along with involvement of the third, fifth,

and sixth cranial nerves which is thought to due to the extension of the infectious process into the cavernous sinus with formation of thrombosis. Radiographic imaging should be performed to confirm involvement of the orbit and degree of orbital involvement, evaluate for potential source of infection, and presence of abscess. Parenteral broad spectrum antibiotic such as a third-generation cephalosporin (cefotaxime or ceftriaxone) or a combined penicillin (ampicillin-sulbactam; amoxicillin/clavulanic acid) and surgical clearance of the sinuses remains main stay of treatment.

In our study, sinusitis-induced orbital cellulitis is found to be predominant among 55–65 years age group with mean age of 59.3 years. The second most commonly affected group in our study are younger children among 5–15 years age group with mean age of 9.7 years. Males are predominantly affected than females. This correlates with Choudhary *et al.*<sup>[5]</sup> a study of 218 patients of orbital cellulitis, found sinusitis as the most common predisposing



**Figure 5: Comparison of sinus involvement in adult and children**

factor in children. This correlates with Ferguson *et al.*<sup>[6]</sup>, Meara *et al.*<sup>[7]</sup>, and Bedwell *et al.*<sup>[8]</sup> studies where pediatric age group is predominantly affected.

Among adult population, 78% were found to be diabetic, which forms the major predisposing factor for fungal sinusitis. In our study, fungal sinusitis with orbital cellulitis due to *Aspergillus* species has alone taken into account though mucormycosis is predominant among diabetic individuals. Orbital cellulitis with proptosis (28%), periorbital edema (25%), extraocular movements restriction (20.69%), ocular pain (18%), visual disturbances (4%), and nasal symptoms (4%) has been reported in our study, correlates with Ferguson *et al.*<sup>[6]</sup> and Chaudhry *et al.*<sup>[9]</sup> studies where periorbital swelling, proptosis, mobility restriction, and ocular pain were the most commonly presented symptoms of orbital cellulitis in those patients they studied.

The involvement of single sinus (60%) and two sinuses (33%) was mostly encountered while 7% have multiple sinuses involvement. Among the reported cases of pediatric orbital cellulitis, ethmoid sinus (10%) and maxillary sinus (13%) were most commonly affected. Studies such as Ferguson *et al.*<sup>[6]</sup> and Chaudhry *et al.*<sup>[5]</sup> reported that maxillary sinus and ethmoid sinus were the most commonly involved sinuses in pediatric age group. Adult population have predominant involvement of ethmoid sinuses (36.67%), followed by maxillary sinus (10%), maxilloethmoidal (10%), frontoethmoidal (10%), and pan sinusitis (6.67%). In Morgan *et al.*<sup>[10]</sup>, Fearon *et al.*<sup>[11]</sup>, and Harris *et al.*<sup>[12]</sup> studies, frontal sinus disease has been frequently identified, especially in series in which a large number of adults and adolescents have been studied.

On imaging studies, there may be evidence of inflammatory/infective changes in the sinus areas as well as orbital structures, breach in lamina papyracea, lateral displacement of the medial rectus, and periosteum pushed away from the lamina papyracea and low-density mass effect without enhancement and air-fluid level in cases of abscess suspected. CT scan is indicated in all patients with periorbital inflammation in which proptosis, ophthalmoplegia, or decrease in visual acuity develop severe eyelid edema prevents an adequate examination and when surgery is contemplated.

Bacterial culture isolates were *S. aureus* (40%), *Streptococcus* (20%), *Haemophilus influenza* (6.67%), and *Bacteroides* (6.67%). *S. aureus* is most common isolated organism in our study. This correlates with Hornblass *et al.*<sup>[13]</sup> studies where *S. aureus* was reported as most common causative organisms for orbital cellulitis and formation of orbital abscess. Ferguson and McNab's study, *S. aureus* was the most commonly encountered organism and anaerobes were much less common which correlates with what we have been reported. Fungal cultures revealed *Aspergillus* species (26.67%) most commonly noted in diabetic individuals in our study.

Surgical clearance of the sinuses with perioperative and post-operative intravenous antibiotic therapy given in 63.33% of patients as initial treatment strategy. Children <9 years and those with uncontrolled type 2 diabetes were given intravenous culture-specific antibiotic therapy. About 10% of the patients developed complication such as subperiosteal abscess had taken up for surgical drainage of the abscess along with surgical clearance of the sinuses.

About 6.67% of the patients had recurrence after 1 month of initial treatment and these individuals were taken for surgery and had no recurrence during further visits. All diabetic individuals in our study were given good glycemic control as per physician opinion with oral hypoglycemic drugs and insulin therapy. Although conservative management had significant better outcomes, surgical indulgence had much more better results and speedy recovery and most importantly with no further progression to complications and no further troublesome episodes of orbital cellulitis during follow-up. This correlates with Setz *et al.*<sup>[14]</sup>, Ferguson *et al.*<sup>[6]</sup>, Chaudhry *et al.*<sup>[9]</sup>, and Bedwell *et al.*<sup>[8]</sup> noted in majority of the cases, surgical intervention is indicated for significant underlying sinus disease, orbital or subperiosteal abscess, or both in the children and for older patients, sinus surgery remains the most common surgical intervention. Combined endoscopic sinus surgery with transnasal abscess drainage was carried out in patients with sinusitis.

## CONCLUSION

Orbital complications of sinusitis tend to occur in children and aged individuals. DM becomes the main predisposing factor. Extraocular muscle limitation and proptosis predicted post-septal involvement and reduced visual acuity and the presence of RAPD indicates the likelihood of intra cranial complication which poses a risk of blindness and death. Imaging modalities and prompt consultation with otorhinolaryngologists and ophthalmologists and neurologists, intravenous antibiotic therapy, and prompt

surgical drainage whenever indicated, results in better outcome.

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