



**ORBITAL CELLULITIS**

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**ABSTRACT**

Orbital cellulitis (OC) is referred to inflammatory process that involves the tissues located posterior to the orbital septum. It reveals with erythema and edema of the eyelids, vision loss, fever, proptosis, chemosis, and diplopia. OC usually develops from sinus infection, infection of the eyelids or face, and even hematogenous spread from distant locations. OC can affect all age groups but is more frequently seen in the pediatric population. Despite of advances in diagnostic and therapeutic options; OC can still lead to serious sight- and life-threatening complications in the modern antibiotics era. Therefore, prompt diagnosis and treatment remain critical. Antibiotic coverage, computed tomography imaging, and surgical intervention have shown promising results and changed the disease prognosis.

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**INTRODUCTION**

Orbital cellulitis is defined as purulent inflammation of the cellular tissue of the orbit.<sup>1</sup> Orbital cellulitis is one of the clinical emergencies in Ophthalmology. This condition mostly affects children and young adults. Patients come with inflammation and distension of lids fever, periorbital pain, redness, swelling, local rise of temperature, chemosis, proptosis, decreased vision, painful and difficult eye movement and ophthalmoplegia.<sup>2</sup> It is referred to the infection of the soft tissues of orbit posterior to the orbital septum, differentiating it from preseptal cellulitis.<sup>3</sup>

It is one of the few ophthalmic emergencies which can have severe systemic implications besides causing loss of vision, if appropriate management is not instituted in the right time.<sup>4</sup>

**Surgical Anatomy of the Orbit**

Orbital septum is a strong fascial structure that is attached to the superior orbital rim in the upper eyelid and inferior orbital rim in the lower eyelid. The orbital septum divides the orbit and periosteum. The septum with periosteum fuses at the orbital rim is known as arcus marginalis and serves as barrier to spread of infection. In the upper eyelid, the orbital septum fuses with the levator aponeurosis and in the lower eyelid it inserts into capsulopalpebral fascia and inferior tarsal border. There are four surgical spaces in the orbit intraconal space, extraconal space, subperiosteal space, subtenon space<sup>5</sup>

The periosteum serves as protective barrier to spread of orbital infections.

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Orbits are closely related to paranasal sinuses. Numerous nerves and vessels perforate the thinnest portion of the medial wall, also called lamina papyracea. Multiple other defects are found in the lamina are known as Zuckerkandl's dehiscences<sup>6</sup>

**Pathogenesis**

Orbital cellulitis is known to occur through following situations i.e., due to extension of the infection from the periorbital and intraocular structures or through direct inoculation of the orbit or either from embolic source.

Extension of the infection from the periorbital and intraocular structures more commonly from paranasal sinuses occurring in 0.5 to 3 percent of the patients with acute sinusitis.<sup>7</sup>

In more than 90% of cases, it occurs as a secondary extension of acute or chronic bacterial sinusitis.<sup>8</sup> The main factor predisposing the orbit to spread of sinus infection is the free vascular communication between the orbit and the sinuses.<sup>9</sup> The orbital veins are valveless, and the flow occurs in either direction,<sup>10</sup> through the anterior and posterior ethmoidal foramina. Also, the medial orbital wall has got numerous defects (Zuckerkandl dehiscences).<sup>6</sup> Orbital fracture can also spread existing chronic sinus infection into the orbit.<sup>3</sup>

Other periorbital structures causing spread of orbital cellulitis occurs from sources in the cervical region is 15 %<sup>2,11</sup>. From dental surgical procedures or an infected dental cyst<sup>12</sup>

Direct inoculation of the orbit from trauma or surgery i.e., surgery of eyelid, dacryocystorhinostomy, strabismus and retinal surgery result in orbital cellulitis.<sup>13</sup>

Retained foreign bodies is also one of the cause for orbital cellulitis. Embolic source arising from subacute bacterial endocarditis.<sup>4</sup>

## **Causes**<sup>8</sup>

Extension from periorbital structures i.e from paranasal sinuses, face and eyelids, lacrimal sac, dental infection. Through exogenous causes as from orbital trauma or after periorbital or orbital surgery. From bacteremia with septic embolization. Orbital cellulitis could be due to intraorbital causes such as endophthalmitis or dacryoadenitis.<sup>8</sup>

## **Predisposing Factors**

Age: orbital cellulitis is more common in children, more severe in diabetics and immunocompromised patients.<sup>14,15</sup> Laterality: unexplained preponderance of left sided orbital infections as compared with right sided infections is seen.<sup>16</sup> There is no sex or race predilection seen.

## **Organisms Causing Orbital Cellulitis**<sup>4</sup>

**Bacteria-** In children diagnosed with orbital cellulitis the species isolated is *Staphylococcus aureus*, *Streptococcus* species and anaerobic species.<sup>17</sup> *H influenzae* is most commonly seen in children younger than age 4 and is rare after that age.

In adults: It is noted that *S. aureus*, *E. coli*, *Streptococcus pneumoniae*, and mixed flora including anaerobes are the most common organisms responsible for orbital cellulitis.<sup>4</sup>

Other organisms isolated being *Enterococcus*, *Echinococcus granulosus*, *Pseudomonas aeruginosa*, *Klebsiella* species, *E. coli*, *Treponema pallidum*,<sup>18</sup> *Eikenella Corrodens*,<sup>19</sup> *Mycobacterium tuberculosis*<sup>20</sup> and *M. avium*

**Fungi-**Fungal elements are More common in diabetics and immunocompromised patients causative fungi are *Phycomycetes* (*Mucor*) and *Ascomycetes* (*Aspergillus* species).<sup>4</sup>

**Parasites-**seen most commonly are *Echinococcus granulosus*, *Taeniasolium*, *Trichinella spiralis*, and *Toxoplasma gondii*.<sup>4</sup>

## **Classification**

Chandler's classification of orbital cellulitis<sup>4</sup>

- Group I-Preseptal cellulitis
- Group II-Orbital cellulitis
- Group III-Subperiosteal abscess
- Group IV-Orbital abscess
- Group V-Cavernous sinus thrombosis.

## **Jain and Rubin's classification**<sup>21</sup>

1. Preseptal cellulitis
2. Orbital cellulitis (with or without intracranial complications)
3. Orbital abscess (with or without intracranial complications)
  - a. Intraorbital abscess
  - b. Subperiosteal abscess

## **Clinical Presentation**

### **Symptoms**

Orbital cellulitis may present with pain, globe displacement, diplopia or vision loss. Other associated symptoms may be fever, headache, malaise, nausea, vomiting and prostration.<sup>4,22</sup>

## **Signs:**<sup>4</sup>

**Lid edema:** Lid edema in orbital cellulitis is secondary to a decrease in venous outflow

**Chemosis:** of conjunctiva is usually marked, which may protrude and become desiccated or necrotic.

**Proptosis:** usually axial and rapidly progressive.

Restriction of eye movements

Intraocular pressure may be raised.

Visual impairment may occur rapidly.

## **Complications**<sup>4</sup>

**Optic neuropathy:** Characterized by, relative afferent pupillary defect and optic nerve head findings as optic disk edema

**Central retinal vein occlusion (CRVO) or Central retinal artery occlusion (CRAO):** Due to increase in orbital pressure

**Exposure keratitis and corneal ulceration:** Due to marked chemosis and proptosis

**Intraocular spread of infection:** Hypotony, choroidal folds and anterior segment inflammation with hypopyon

**Subperiosteal or orbital abscess:** can be seen in 7 to 9 percent cases.

**Orbital apex syndrome:** Characterized by signs of 3rd, 4th and 6th nerve involvement and anaesthesia in the region supplied by the ophthalmic division of trigeminal nerve, occurs when infection spreads to the orbital apex.

**Brain abscess or meningitis (2%):** Can result from any stage of orbital infection

**Cavernous sinus thrombosis (1%):** May occur when the infection spreads posteriorly through the superior orbital fissure. Cavernous sinus thrombosis manifests with bilateral symptoms, bilateral orbital apex syndrome, ophthalmoplegia, proptosis and corneal anaesthesia.

## **Septicemia or pyemia**

## **Differential Diagnosis**

Thyroid eye disease

Idiopathic inflammatory orbital pseudotumor

Orbital myositis<sup>23</sup>

Orbital abscess<sup>24</sup>

Ruptured dermoid cyst

Necrotic intraocular melanoma

Orbital trauma

Orbital foreign body

Orbital vasculitis

Wegener's granulomatosis

Carotid-cavernous fistula

Rhabdomyosarcoma

Mucormycosis, sarcoidosis and allergic reactions.

Retinoblastoma<sup>25</sup>

## **Management**

### **Investigations**

### **Lab studies**

Complete hemogram with TLC, DLC: Leukocytosis more than 15000 with a shift to the left is commonly seen<sup>26</sup>

Blood culture: Needle aspiration of the orbit is contraindicated.<sup>4</sup>

ESR may be elevated in orbital cellulitis.  
ASO titre

### Imaging Studies

1. **X-Ray:** In the past plain radiographs were performed looking for mucosal thickening or sinus opacification but their value is of doubtful significance as reports have failed to demonstrate the correlation between opaque sinuses and infection.<sup>3</sup>
2. **Ultrasound:** USG is another modality to assess the presence of infection posterior to septum. This modality is sufficient to evaluate the orbital apex, paranasal sinuses or intracranial involvement.<sup>27</sup>
3. **CT SCAN:** extent of sinus disease can be estimated through CT scan. Sinuses may show features of osteomyelitis. With intraconal involvement; proptosis is seen with obliteration of the normal soft tissue shadows. "Patchy enhancement" of the intraconal fat in orbital cellulitis has been described.<sup>28</sup> CT scan with contrast is now the most comprehensive imaging technique in patients with suspected orbital infection. The rectus muscles, particularly the medial rectus, and the optic nerve may be thickened.<sup>4</sup>
4. **MRI:** On MRI with gadolinium contrast enhancement, orbital cellulitis may show a smearing or a linear streaking of the normal fat shadows on T2-weighted images. MRI is superior to CT in the diagnosis of cavernous sinus thrombosis.<sup>4</sup>
5. **Other Tests:** Fiberoptic nasopharyngeal endoscopy: It is done if any suspicion of mucormycosis exists. Rapid Plasma Reagin (RPR) is particularly required in cases of insidious onset or those with a history of syphilis.<sup>4</sup>

### Treatment<sup>4</sup>

#### Medical Care

The patient with orbital cellulitis need to be hospitalized for treatment.

Intravenous broad-spectrum antibiotics should be started immediately until the choice of antibiotics can be altered for specifically identified pathogens identified on cultures.

Classically, intravenous antibiotic therapy should be continued for 1-2 weeks and then followed by oral antibiotics for an additional 2-3 weeks.

Fungal infection requires intravenous antifungal therapy along with surgical debridement<sup>4</sup>

#### Antibiotics For Treatment of Orbital Cellulitis<sup>4</sup>

Age	Drugs Used	Efficacy of the drug used
In children younger than age of 4 years	— Ticarcillin-Clavulanic acid 200-300 mg/kg/day in four divided doses — Cefotaxime 80-120 mg/kg/day in four divided doses — Cefuroxime 75-150 mg/kg/day in three divided doses	Effective against — H. influenzae — S. aureus and Streptococcus
In patients allergic to penicillin	— Clindamycin 24-40 mg/kg every 6 hrs — Chloramphenicol 50-100 mg/kg every 6 hrs	
In adults	— Cefuroxime 750 mg-1.5 mg every 8 hours — Ceftriaxone 1-2 g/day	Effective against most of gram positive and gram negative organisms except pseudomonas, methicillin resistant staphylococcus, many strains of group D Streptococci.
To the above add metronidazole 15 mg/kg over 1 hour followed by 7.5 mg/kg over 1 hr. every 6 hrs. After loading doses		

- a. Anti-inflammatory drugs
- b. Nasal decongestants.

### Surgical Care<sup>4</sup>

#### Indications

Progressive loss of vision. Proptosis progresses despite appropriate antibiotic therapy. The size of the abscess does not reduce on CT scan within 48-72 hours after appropriate antibiotics have been administered. Suspicion of orbital abscess or foreign body Extraocular motility deficit

#### Procedure

- free incision is made into the abscess when it points under the skin or conjunctiva.
- Subperiosteal abscess is drained by 2-3 cm curved incision in the upper medial aspect.
- In most cases it is necessary to drain both the orbits as well as the infected paranasal sinuses.
- If brain abscesses develop and do not respond to the antibiotic therapy, craniotomy is indicated.

### CONCLUSION

Despite of advent of more potent antimicrobials orbital cellulitis is still a potential killer because of delay in diagnosis, inadequate treatment of virulent and resistant strains, otherwise results are satisfactory if cornea or optic nerve are not involved early.

In any patient presenting with adnexal, facial or dental infection when orbital pain, proptosis, limitation of ocular motility, lid edema, or orbital congestion, orbital cellulitis should be suspected and hospitalisation of the patient is mandatory.

Immediate CT scan or X-ray should be obtained to rule out sinusitis and the the patient should be started on broad spectrum intravenous antibiotic therapy.

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