

Orbital Cellulitis- A Review

Ankita,* MS; Apjit Kaur, MS; Richa Gupta,*** MS**

*Senior Resident, King George's Medical University, Lucknow

**PGDHHM, Professor, King George's Medical University, Lucknow

***Junior Resident, King George's Medical University, Lucknow

Abstract :

Orbital cellulitis is an infective process involving ocular adnexal structures posterior to the orbital septum.¹ It is an ocular emergency that not only threatens vision but also can lead to life-threatening complications such as cavernous sinus thrombosis, meningitis, and brain abscess. Visual loss ranges from 7.1% to 23.6%, which may be due to optic atrophy, central retinal artery occlusion, or exposure keratopathy with ulcer formation.^{2,3} Catastrophic local sequelae (infarction of optic nerve, sclera, choroid, retina) and intracranial spread (in sinus infections most common being frontal sinus, followed by ethmoid and maxillary sinuses) occur in untreated cases. The prognosis is good if prompt medical treatment is received.



Orbital cellulitis is an infective process involving ocular adnexal structures posterior to the orbital septum.¹

Source of infection :

Infection into the orbit may spread through direct extension from the paranasal sinuses and other periorbital structure, or direct inoculation of the orbit from trauma or surgery, or through hematogenous spread (bacteremia). Most common infective organism is *Staphylococcus aureus* in adults, and *Streptococcus species* in pediatric population.⁴

Access routes :

Infection can gain access into the orbit through thin bones of the orbital wall, venous channels, foramina and dehiscences. Medial orbital wall is thin and perforated by many valveless blood vessels, nerves and numerous defects (laminapapyracea/Zuckerkanndl dehiscences).⁵

Infections may also spread as direct extensions from ipsilateral ethmoid or frontal sinuses, and indirectly from maxillary sinus, secondary to dental infections. It can be caused by microorganisms indigenous to the mouth, including anaerobes, commonly *Bacteroides species*.

Extension through soft tissue routes occurs posteriorly in the orbit where the fascia between the rectus muscles is thin & often incomplete. This allows easy extension between the extraconal and intraconal orbital spaces.⁶ Also, access can occur through venous route. Orbital veins are valveless which allow passage of infection, both anterograde and retrograde.

Pathophysiology :

Edema of the sinus mucosa results in narrowing of the sinus ostia causing cessation of normal sinus drainage. Subsequently, proliferation of microflora occurs which invade the edematous mucosa resulting in suppuration. Suppurative process is enhanced by the reduced oxygen tension within the obstructed sinus cavity.

Epidemiology and Incidence :

The incidence increases during winter season in western countries whereas in India it increases in monsoon.

The frequency of orbital complications from sinus infection ranges from 0.5% to 3.9%. Ipsilateral ethmoidal disease is usually present, frequently encountered with ipsilateral maxillary sinus infection.³ Frontal sinus involvement is frequently encountered in adolescents and adults.^{2,7,8}

The incidence of orbital or periorbital abscesses varies considerably from 0% to 25% in different studies.⁹

Chandler's classification⁵

- Group 1 Pre septal cellulitis
- Group 2 Orbital/post septal cellulitis chemosis
- Group 3 Sub periosteal abscess
- Group 4 Orbital abscess
- Group 5 Cavernous sinus thrombosis

Pre-septal cellulitis :

Preseptal cellulitis describes an infection of the eyelid and superficial periorbital soft tissues (Figure 1) without the involvement of the globe and orbit. It occurs more commonly than orbital cellulitis and is generally associated with a more favorable prognosis.¹⁰



Figure 1: Clinical presentation of preseptal cellulitis (left side)- eyelid edema and erythema, features characteristic of cellulitis.

It presents with eyelid edema and erythema, with normal vision, absence of proptosis and chemosis, and full ocular motility without pain on movement.

On computerized tomography (CT) scan, diffuse soft-tissue thickening and areas of contrast enhancement anterior to the orbital septum are seen in preseptal cellulitis (Figure 2 and 3).

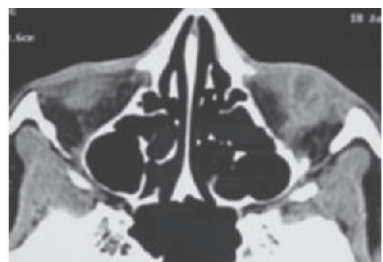


Figure 2 : CT scan (axial section) - diffuse contrast enhancing soft tissue thickening anterior to the orbital septum (left side)

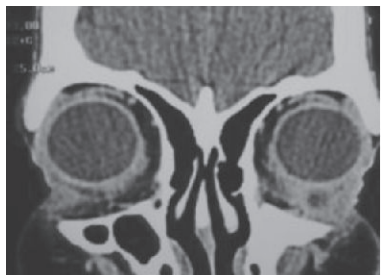


Figure 3 : CT scan (coronal section) - diffuse contrast enhancing soft tissue thickening anterior to the orbital septum (left side)

Subperiosteal abscess :

It results from progression or spread of orbital cellulitis beneath the periosteum of ethmoid, frontal or maxillary bones.

CT Scan-Low density collection beneath the periosteum, adjacent to a sinus (Figure 4).

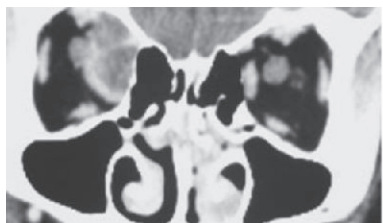


Figure 4 : CT scan (coronal view) showing a superior/ medial orbital subperiosteal abscess on the right side

Orbital cellulitis :

Orbital cellulitis involves infection of tissues posterior to the orbital septum, within the bony orbit (Figure 5). It is more common in the pediatric population. In contrast to the more common preseptal cellulitis, orbital cellulitis may be associated with significant complications, and thus, prompt diagnosis and treatment are important.

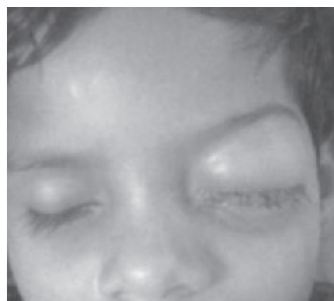


Figure 5 : Clinical picture of orbital cellulitis – proptosis with eyelid erythema and edema (left side)

Risk factors :

- Diabetes mellitus (especially those with diabetic ketoacidosis)
- Multiple blood transfusions
- Immunocompromised patients with severe neutropenia (steroid, non-steroid, disease)

Ocular Signs:

- Eyelid edema and erythema
- Conjunctival chemosis
- Proptosis
- painful ophthalmoplegia
- Decreased vision
- Relative afferent pupillary defect
- Resistance to retropulsion of the globe
- Elevated intraocular pressure
- Vision may be normal early, but it may become difficult to evaluate in very ill children with marked edema.

Systemic Signs :

- Fever
- Headache
- Rhinorrhea
- Malaise

Coexistent conditions :

- In the pediatric group- In more than 91% cases, radiologically confirmed ipsilateral sinus disease is present. The involvement of ethmoid sinus (43% to 75%) is more than maxillary sinuses
- In adolescents and adults, frontal sinus disease is more common.

Laboratory Studies :

- Complete blood count (CBC). Leukocytosis >15,000 with a shift to the left is present.
- Blood cultures are done prior to starting antibiotic treatment.
- Purulent material assessment -Gram stain and Culture in

both aerobic & anaerobic media

Commonly reported bacteria :

- Staphylococcus aureus (most common)
- Staphylococcus epidermidis
- Streptococci(paediatric age group)
- Diphtheroids
- Haemophilus influenza
- Escherichia coli
- No growth in up to 25% of orbital abscesses

Radiology :

- Ultrasonography - in-office screening procedure in cases of suspected orbital abscesses, shows low internal reflectivity. It detects abscesses of anterior orbit or medial wall with 90% efficiency.¹¹ Acute abscess may be poorly delineated.
- Computerized tomography scan- It is the investigative procedure of choice to diagnose orbital infection. Ct scan is necessary to assess orbit & sinuses and presence of any intracranial extension. It is also indicated in cases not responding to intravenous antibiotic therapy even after 24-48 hours. Plain and contrast CT (axial, coronal and sagittal) with thin sections (2mm cuts) are ideal.

CT-scan Signs :

- localized, generally homogenous elevation of the periorbita
- loss of delineation of tissue planes (Figures 6 and 7)
- Abscess -thick hyperdense wall with central hypodensity. (Figure 8)
- Thickening of ocular coats and Optic Nerve.
- opacified sinuses (ipsilateral)
- X-ray- Air-fluid level present, in an abscess cavity. However, gas-free abscesses may not be readily visible.⁶

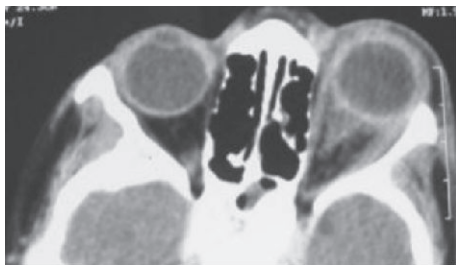


Figure 6 : CT scan (axial view) showing multiple loss of tissue planes in the left orbit.

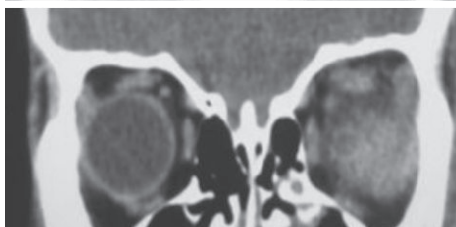


Figure 7 : CT scan (coronal view) showing diffuse inflammation in the intraconal and extraconal space of the left orbit.

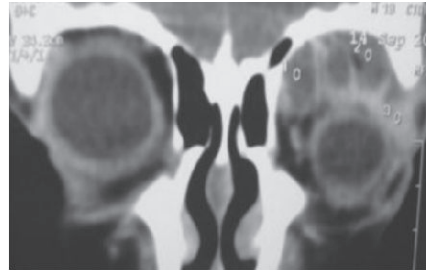


Figure 8 : CT scan (coronal view) showing multiple thick walled cavities (abscesses) in the left superior orbit.

Treatment :

- Medical Therapy-Hospital based
- Antibiotic therapy: empirical intravenous broad spectrum antibiotics. Oral antibiotics are given on discharge.
- Anti-inflammatory: NSAID +/- Corticosterid
- Supportive treatment in form of supplementation of multivitamins, treatment of sinusitis and concurrent systemic illnesses.

Inter-speciality Consultation :

- Otorhinolaryngology consultation
- Other specialists – paediatrician, infectious disease specialist and radiologist.
- Neurosurgical consultation is indicated if brain abscesses appear

Surgical therapy for orbital abscesses :

- Surgical procedures- drainage of abscesses, canthotomy and cantholysis in orbital compartment syndrome.
- Influenced by visual status, size and location of orbital abscess and associated intracranial complications.
- Harris and Garcia recommendations for surgery in orbital cellulitis: presence of compromised optic nerve or retinal function, large abscesses and intracranial complications.¹²

Indications for Drainage :

- Poor response to appropriate antibiotic therapy within 24-48 hours
- CT scan shows opacified sinuses
- Intraorbital abscess / subperiosteal abscess, especially in an adult.

An expectant approach :

- Patients younger than 9 years of age in whom simple infections are suspected. Surgery may be warranted if:
- There is no clinical improvement in a timely manner
- Relative afferent pupillary defect develops at any time
- Fever does not abate within 36 hr
- Deterioration despite 48 h

- Improvement of CT findings lag behind the clinical picture

Follow-up :

Patients with severe orbital cellulitis often follow a protracted course. Repeat surgery may be required.

Patients are ideally monitored by an ophthalmologist, ENT specialist, and infectious disease specialist until symptoms, fever, WBC count, and imaging confirm that antibiotics can be discontinued.

Complications :

- Cavernous sinus thrombosis - bilateral disease with ophthalmoplegia and loss of vision.¹³
- Imaging studies are indicated when neurologic signs are present, to rule out associated epidural or subdural empyema, brain abscess, or cavernous sinus.^{10,13,14}

Loss of Vision :

Mechanism – exposure keratopathy, optic neuritis, ischemia from thrombophlebitis and compressive central retinal artery occlusion.^{15,16}

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Cataract surgery appears safe for patients with cancer

This is the first matched population-based analysis to assess the risk of endophthalmitis in patients with cancer. Researchers identified 23,362 Taiwanese adults who underwent bilateral cataract surgery at an average of 4.3 years after a cancer diagnosis. The rate of endophthalmitis during the 3-month follow-up period was similar between the cancer and matched noncancer groups (0.24% vs. 0.23%; P=0.892). Given these findings, the authors suggest cataract surgery can be performed in cancer patients when indicated. *American Journal of Ophthalmology*, March 2019