Orbital and Preseptal Cellulitis

Description[1]

Orbital cellulitis
Orbital cellulitis is a potentially sight-threatening and life-threatening (but uncommon) ophthalmic emergency characterised by infection of the soft tissues behind the orbital septum. It can occur at any age, although it is most commonly seen in children. It usually originates from locally spreading infection[2].

Orbital cellulitis is characterised by eyelid oedema, erythema and chemosis, with orbital signs (such as proptosis, gaze restriction and blurred or double vision) and systemic signs (such as fever).

Preseptal cellulitis
Preseptal cellulitis is a much more common and less serious infection anterior to the orbital septum. It is common in young children. It rarely involves postseptal anatomy. Physical examination reveals eyelid oedema in the absence of orbital signs such as gaze restriction and proptosis[2].

Very occasionally, preseptal cellulitis progresses to orbital cellulitis; this is more likely in children. Orbital cellulitis and preseptal cellulitis are not terms that can be used interchangeably. However, there is some overlap in presenting features. When diagnosing preseptal cellulitis it is therefore essential to consider orbital cellulitis in the differential diagnosis.

Upper respiratory infection and sinusitis are the most important predisposing factors for periocular infection in children. Streptococcus spp. are the predominant causative agents[3].

Anatomy
The orbital septum is a membraneous sheet which acts as the anterior boundary of the orbit. It arises from the periosteum around the orbital margin. Centrally, it fuses into the tarsal plates. It effectively separates the eyelids from the contents of the orbital cavity.

The orbital septum separates the intra-orbital fat from eyelid fat and orbicularis oculi muscle. It provides a barrier against spread of infection between the preseptal space anteriorly to postseptal space (the orbit proper).

Orbital cellulitis: pathophysiology[2]
Orbital cellulitis occurs when infection develops in the postseptal orbit, through local or haematogenous spread. Possible infection sources include:

- Extension of an infection from the periorbital structures. This is the most common route. Infections which may breach the orbital septum and extend in this way include the paranasal sinuses, especially ethmoid sinusitis, the face, the globe, the lacrimal sac and dental infection via intermediary maxillary sinusitis.
- Extension of preseptal cellulitis, particularly in young children in whom the orbital septum is not fully developed. This is a less common route of infection[1].
- Direct inoculation of the orbit from trauma. Post-traumatic orbital cellulitis tends to develop within 72 hours of the injury.
- Post-surgery - including orbital, lacrimal, strabismus and vitreoretinal surgery.
- Haematogenous spread from distant bacteraemia.

The pathogens most commonly involved are the aerobic, non-spore-forming bacteria - Streptococcus pneumoniae, Staphylococcus aureus, Streptococcus pyogenes and Haemophilus influenzae (the latter mainly found in children)[3]. Meticillin-resistant S. aureus (MRSA) is is a frequent causative organism[4].
Mucormycosis is a rare cause. This very rare and rapidly spreading infection caused by fungi of the order Mucorales is often fatal. Risk factors, such as diabetic ketoacidosis and neutropenia, are present in most cases. Severe infection of the facial sinuses is the most common presentation[5, 6].

**Preseptal cellulitis: pathophysiology**

Cellulitis anterior to the orbital septum is usually caused by the spread of local infection. Usual sources are[3]:

- Local skin trauma such as lacerations and insect bites.
- Spread from local infection such as dacrocystitis, hordeolum and paranasal sinuses[7].
- Spread from distant infection from the face, or from the upper respiratory tract.

The most common pathogenic organisms are *S. aureus*, *S. epidermidis*, streptococci and anaerobes. MRSA has also been isolated[3].

Anthrax is a potential cause of preseptal cellulitis. Smallpox, should there ever be a recurrence, is also a cause.

The orbital septum limits spread to associated structures such as the central nervous system.

**Epidemiology**

- Orbital cellulitis is much less common than preseptal cellulitis although data relating to the incidence are scant.
- Both conditions occur more commonly in the winter months as a result of the increased incidence of paranasal sinus infection.
- There is no predilection for gender or race (except in children where orbital cellulitis affects four times as many girls as boys).
- Both conditions are more common in children: orbital cellulitis more frequently affects those aged 7-12 years, whereas preseptal cellulitis occurs at younger ages (80% of patients are under 10 years of age and most are younger than 5 years with a mean age of 21 months)[8].
- Preseptal and orbital cellulitis have both been described following eyebrow piercing[9].

**Presentation**[1]

Children with red swollen eyes frequently present to emergency departments. Differentiation between preseptal and orbital cellulitis can be difficult in the early stages, so a degree of suspicion is essential[10]. Delayed recognition of the signs and symptoms of orbital cellulitis can lead to serious complications such as total loss of vision, meningitis and cerebral abscess[11].

Features which should increase the suspicion of orbital cellulitis include decreased visual acuity, proptosis and external ophthalmoplegia. Temperature greater than 37.5°C and leukocytosis resulting in fever are more prominent features in the paediatric group.

**Preseptal cellulitis**

- Acute onset of swelling, redness, warmth and tenderness of the eyelid.
- Eyelid oedema in the absence of orbital signs such as gaze restriction and proptosis.
- Fever, malaise, irritability in children.
- Ptosis.

**Orbital cellulitis**[2]

- Anterior features:
  - Acute onset of unilateral swelling of conjunctiva and lids.
  - Oedema, erythema, pain, chemosis.
Orbital features: external eye muscle ophthalmoplegia and proptosis are the most common. Decreased visual acuity and chemosis are less frequently seen:
- Proptosis (there may be exposure keratopathy).
- Pain with movement of the eye, restriction of eye movements.
- Blurred vision, reduced visual acuity.
- Diplopia.
- Relative afferent pupillary defect (RAPD). See separate Examination of the Eye article.
- Involvement of the optic nerve may produce papilloedema or neuritis with rapidly progressing atrophy resulting in complete loss of vision.

Systemic features:
- Fever.
- Severe malaise.

Differential diagnosis[2, 11]
- Orbital/preseptal cellulitis.
- Necrotising fasciitis.
- Chalazion.
- Allergic lid swelling.
- Severe viral conjunctivitis.
- **Cavernous sinus thrombosis:** symptoms include chemosis, proptosis, headaches and paralysis of the cranial nerves, and decreased ocular motility; visual loss may be severe in these cases. Systemic features are usual.
- Erysipelas.
- Other orbital conditions - eg, thyroid eye disease, orbital tumours/pseudo-tumours, orbital vasculitis.
- Other conditions- eg, insect bite, angio-oedema, maxillary osteomyelitis.

Investigations[2]
- Diagnosis is usually made based on the clinical findings and investigations are aimed at identifying the root cause of the infection.
- Investigations are carried out in the hospital setting.
- FBC frequently shows a leukocytosis (>15 x 10^9) but blood cultures are frequently negative in adults with either condition.
- Any discharge from skin breaks should be swabbed and sent to microbiology. Throat swabs and samples of nasal secretions may also help diagnosis.
- CT of the sinuses and orbit ± brain is indicated for children and if orbital cellulitis is suspected in an adult:
  - If intracranial abscess is suspected, CT is the gold standard imaging modality to identify subperiosteal abscesses, paranasal sinusitis or cavernous sinus thrombosis, and for retained orbital or intraocular foreign body.
- MRI may complement CT in diagnosing cavernous sinus thrombosis.
- If cerebral or meningeal signs develop, lumbar puncture is indicated. However, a lumbar puncture is contra-indicated for suspected orbital cellulitis until a CT scan has ruled out raised intracranial pressure[12].

Management[1, 2, 12]

**Emergency referral**
Emergency referral to secondary care is required for:
- All children with suspected preseptal cellulitis, as they should be considered to have orbital cellulitis until proven otherwise[11].
- Any patient with suspected orbital cellulitis.
- All patients with features of either condition who are systemically unwell.
- All patients in whom there is doubt over the diagnosis.
Any patient not responding to treatment for preseptal cellulitis.
When drainage of a lid abscess is required.

**Preseptal cellulitis** [11]
- Children are initially admitted to hospital, as they should be considered to have orbital cellulitis until proven otherwise (ie repeated examinations normal, good response to antibiotics in the first 24 hours and normal CT scan).
- Oral co-amoxiclav may be used both for adults and for children as long as there is no allergy to penicillin. Clinical improvement should occur over 24-48 hours.
- Hospital management may involve intravenous therapy (eg, intravenous ceftriaxone until response is seen) and further investigation to confirm preseptal cellulitis (only) and that there are no unusual organisms involved.
- The ENT team is generally consulted if sinusitis is present.

**Orbital cellulitis**
- Hospital admission is mandatory, usually under the joint care of ophthalmologists and the ENT surgeons [11].
- Intravenous antibiotics are used (eg, cefotaxime and flucloxacillin) with addition of metronidazole in patients over 10 years of age with chronic sinonasal disease.
- Clindamycin plus a quinolone are used where there is penicillin sensitivity. Vancomycin is also an alternative.
- Optic nerve function is monitored four-hourly (pupillary reactions, visual acuity, colour vision and light brightness appreciation).
- Treatment lasts for 7-10 days.
- Surgery is indicated where there is CT evidence of an orbital collection, where there is no response to antibiotic treatment, where visual acuity decreases and where there is an atypical picture which may warrant a diagnostic biopsy. Drainage of infected sinuses may be performed at the same time [3].

**Complications**

**Preseptal cellulitis**
- Progression of infection to orbital cellulitis, especially in young children.
- Unusual complications include:
  - Lagophthalmos (inability to close the eyelids completely over the globe).
  - Lid abscess.
  - Cicatricial ectropion.
  - Lid necrosis.

**Orbital cellulitis** [2]
- **Ocular**:
  - Exposure keratopathy (which can lead to visual loss through permanent damage to the cornea).
  - Raised intraocular pressure.
  - Central retinal artery or vein occlusion.
  - Endophthalmitis.
  - Optic neuropathy.

- **Orbital abscess**:
  - More often associated with post-traumatic orbital cellulitis.
  - Total loss of vision can occur through direct extension of the infection to the optic nerve.

- **Subperiosteal abscess**:
  - Usually located along the medial orbital wall. This may progress intracranially.

- **Intracranial (rare)**:
  - Meningitis.
  - Brain abscess.
  - Cavernous sinus thrombosis.
Prognosis

Preseptal cellulitis
Prompt diagnosis and treatment usually result in an uncomplicated course and full recovery.

Orbital cellulitis
Early recognition and appropriate treatment carry a good prognosis, particularly in the absence of complications. However, immunosuppressed individuals are more susceptible to complications. Fungal cellulitis, which is associated with immune impairment and with diabetic ketoacidosis, has a high rate of mortality.

Prevention

Haemophilus infection
*H. influenzae* type b (Hib) vaccination.

Preseptal cellulitis
Prophylactic antibiotics are prudent in the management of surgical and accidental trauma to the eyelid. Chloramphenicol ointment is a good first choice, applied qds to the clean wound for a week. Traumatic lid laceration also benefits from a review after 48-72 hours to identify emerging preseptal cellulitis early.

Orbital cellulitis
There is no specific preventative management other than the optimal treatment of precipitative factors such as sinusitis and, in cases of ocular trauma and ocular surgery, the appropriate use of antibiotics.

Further reading & references

1. Clinical management guidelines: Cellulitis preseptal and orbital; The College of Optometrists (2011)
8. Sadowsky R; Distinguishing periorbital from orbital cellulitis. American Family Physician, March 2003
12. Periorbital and Orbital Cellulitis - Clinical Practice Guidelines; The Royal Children’s Hospital, Melbourne

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