Preseptal and orbital cellulitis in children

Patrick Watts

Abstract

Orbital cellulitis predominantly affects children. This disease is potentially sight and life threatening and requires prompt recognition, investigations and treatment. An understanding of the anatomical features of the orbit its adnexa and neighbouring paranasal sinuses are essential in the evaluation and management of inflammations of the orbit. In this article we review the anatomy and discuss current thinking with respect to aetiological factors, the clinical presentation, the differential diagnosis, complications, investigations and management of orbital cellulitis.

Keywords orbital cellulitis; periorbital; preseptal

Applied anatomy

The orbit is a quadrilateral pyramid surrounding the eye and its soft tissues. The orbital septum is a layer of fascia, which is attached to the orbital rim and the tarsal plates in the upper and lower eyelids. The septum forms a barrier between the deep orbital soft tissue and the superficial structures. Inflammation limited by the septum causes preseptal cellulitis anteriorly and orbital cellulitis posterior to the septum (Figure 1).

The paranasal sinuses are the commonest source of infection for orbital cellulitis. The ethmoidal sinuses are situated nasally and are separated from the medial orbit by a thin wall called the lamina papyracea. The floor of the orbit forms the roof of the maxillary sinus and the roof orbit forms the floor of the frontal sinus.

Development of the sinuses during childhood

Only the ethmoidal sinuses are well developed at birth, the maxillary sinus develops within the first two years but is not fully developed till 6 years of age and the frontal sinuses only start developing in the 6th year of life. Hence orbital cellulitis secondary to sinusitis is almost exclusively due to ethmoidal sinusitis in the first five years of life and secondary to ethmoidal, maxillary and frontal sinusitis in children over 7 years. The ostia of the sinuses are relatively large compared to the size of the sinuses during early development. As the sinuses enlarge with age the ostia remain the same size, this results in relatively poorer drainage during inflammations of the sinuses in older children and adults. Natural dehiscences may exist in the medial wall and the roof of the orbit promoting spread of infection from the sinuses into the orbit.

The orbit is lined loosely by periosteum, which limits the spread of inflammation to the orbit. Nerves and blood vessels from the sinuses, which are potential avenues for spread of inflammation to the orbit, perforate this lining.

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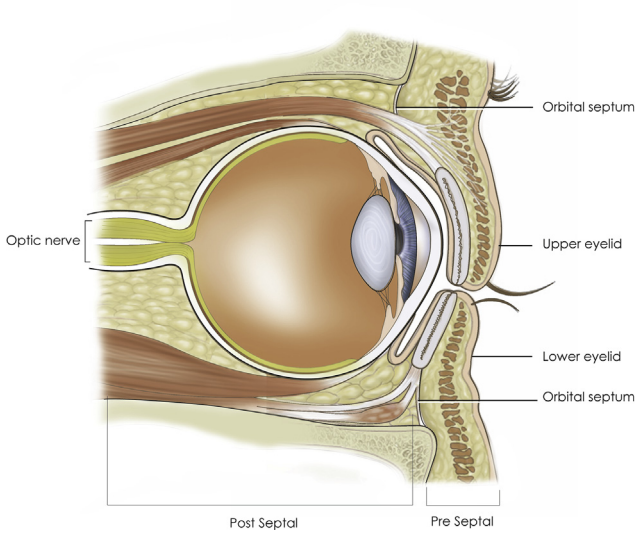

Figure 1 Sagittal cross sectional anatomy of the orbit.

The rich venous plexus in the orbit communicates with the facial veins anteriorly, the sinuses that surround the orbit and the cavernous sinus posteriorly. In young children diploic veins may directly communicate with the anterior cranial fossa through the roof of the orbit. The orbital veins are without valves facilitating a two-way spread of infections.

Definitions

Preseptal cellulitis

This is an inflammatory disease of the orbit limited to the space anterior to the orbital septum. It is characterized by erythema and swelling of the eyelids. The visual acuity, ocular movements are normal. It represents the mild end of the spectrum of orbital inflammation. In young children the intense oedema of the lids may sometimes preclude examination of the eye making the distinction between orbital cellulitis difficult.

Orbital cellulitis

This is an inflammatory disease of the superficial and deep structures of the orbit. It is characterized by lid oedema and erythema, chemosis of the conjunctiva, restricted ocular motility and proptosis.

Periorbital cellulitis

This term has been used to indicate inflammation around the orbit to encompass both preseptal and orbital cellulitis. However it is also used interchangeably to indicate preseptal cellulitis. It has been suggested that this term is best avoided due to confusion of the pathology it indicates.

Pott's Puffy tumour

Both preseptal and orbital cellulitis have been described with this condition. Most reports describe an orbital cellulitis with a subperiosteal abscess as a result of frontal sinusitis. It may be associated with osteomyelitis of the frontal bone and intracranial spread of infection.

Classification

Initial classifications of infective orbital cellulitis predated current imaging techniques. A modification of Chandler's classification is still favoured by some clinicians includes five groups (Table 1). Uzcategui et al. attempted to correlate the groups with computerized tomography findings. The weakness of this classification is that it suggests the disease evolves through distinct stages, however clinical presentation does not follow a temporal sequence of stages. In addition this classification does not include intracranial abscesses, which are more commonly reported than cavernous sinus thrombosis in children.

A practical classification suggested by Jain and Rubin (Table 2) is useful both from a prognostic, diagnostic and therapeutic perspective and is easily adapted into clinical practice. It is generally thought that preseptal disease is milder and not associated with intracranial complications, however this is not an invariable rule and there are case reports of intracranial complications with preseptal disease. It is hence important that each case is assessed and monitored thoroughly for complications.

Epidemiology

Infections causing inflammation of the orbital tissues are common, particularly in children. Preseptal cellulitis probably accounts for 84–87% of cases. Population based surveys indicate that the incidence of *orbital* cellulitis is much higher in children than in adults (16-fold higher in a recent Scottish study with an incidence of 1.6 per 100,000 for children). In childhood, it commonly follows upper respiratory infection and sinus disease (almost half of cases reported a preceding upper respiratory tract infection); however, in adults, preceding illness and trauma are more common. Respiratory pathogens including *Streptococcus* (two-thirds of cases) and *Haemophilus* (almost half of cases) are common in affected children and antibiotic choices should reflect this.

Chandler's classification system

Group 1	Inflammatory oedema – preseptal cellulitis
Group 2	Orbital cellulitis
Group 3	Subperiosteal abscess
Group 4	Orbital abscess
Group 5	Cavernous sinus thrombosis.

Table 1

Jain and Rubin classification

1. Preseptal cellulitis
2. Orbital cellulitis (with or without intracranial complications)
3. Orbital abscess (with or without intracranial complications)
   (i) Intraorbital abscess – which may arise from a collection of purulent material from orbital cellulitis
   (ii) Subperiosteal abscess, which may lead to infection of orbital soft tissue.

Table 2

Children with preseptal cellulitis are usually younger than 5 years of age and those with orbital cellulitis present at a mean age of 7 years. Earlier reports have indicated a slightly higher prevalence of orbital cellulitis. This may be in part due to better imaging techniques that allow a clearer distinction between preseptal and orbital cellultis or earlier treatment, or both.

Clinical features

The child usually presents with an upper respiratory tract infection accompanied with eyelid swelling and erythema. They are typically febrile and occasionally have an obvious source of skin infection like an infected insect bite, impetigo or erysipelas. Insect bites on their own without infection may cause an allergic swelling of the eyelids on both sides; the child is usually well and the swelling settles within 48 hours. Less commonly children may present with pain and swelling around the orbit without pyrexia.

Preseptal cellulitis is distinguished from orbital cellulitis by being localized anterior to the orbital septum with lid oedema and erythema. The visual acuity, ocular movements are normal. Occasionally the lids may be shut tight with swelling and it may be difficult to rule out underlying orbital involvement (Figure 2a). An ophthalmologist may use retractors to examine the globe and CT scanning may be necessary to rule out orbital involvement (Figure 2b).

Orbital cellulitis in addition to the features of preseptal cellulitis may have chemosis of the conjunctiva, limited extraocular movements with diplopia and proptosis (Figure 3a and b). The child with orbital cellulitis is systemically unwell. Excessive lethargy drowsiness with neurological signs or seizures may herald the onset of intracranial complications.

Aetiology

The bacterial infections of the orbit are caused through three routes.

1. Extension from neighbouring regions

Spread from the paranasal sinuses is the most common cause of orbital (87%) and some cases of preseptal cellulitis. This may be either through direct spread through naturally occurring dehiscences in the bones lining the medial wall of the orbit, through a process of infective thrombophlebitis or through the communication of valveless veins of the orbit and the sinuses. The ethmoid sinuses are the most common source of infection. Dacryocystitis and infections of the skin may also lead to preseptal celluitis. Odontogenic and middle ear infections have been reported to cause inflammation of the orbit. Inflammation and infection of the lacrimal gland or globe (endophthalmitis) may rarely lead to orbital cellulitis. Surgical procedures on the eye for strabismus, glaucoma and retinal detachment have been reported to cause orbital cellulitis. Trauma to the oral mucosa has been complicated with preseptal cellultis.

2. Direct infection of the orbit

Superficial trauma to the skin including infected insect bites and eyebrow piercing may lead to preseptal cellulitis. Trauma to the orbit with or without retained foreign bodies is associated with