Chapter 6

Preseptal Cellulitis

Monika Fida, Kocinaj Allma, Abazi Flora and Arjeta Grezda

Additional information is available at the end of the chapter

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1. Introduction

Periorbital infections are typically classified as either preseptal or orbital cellulites and are common in children and adults. One of the major anatomical structures determining the location of disease is the orbital septum, which is a thin membrane originating from the orbital periosteum inserting into the anterior surfaces of the tarsal plates of the eyelids. The septum separates the superficial eyelid from the deeper orbital structures, forming a barrier that prevents infection in the eyelid from extending into the orbit.

2. Definition

Preseptal cellulitis is an inflammation and infection of the eyelid (also of the periorbital soft tissues), anterior to orbital septum, not involving the orbit or other ocular structures, characterized by acute eyelid erythema and edema[1].

This is a common infection and tends to be less severe a disease than orbital cellulitis (known as postseptal cellulitis). It may result from the spread of the upper respiratory tract infections, external eye infections, or eyelid traumas[2].

In preseptal cellulitis, the soft tissues anterior to the orbital septum are affected and the orbital structures posterior to the septum are not infected but may be infected secondarily causing subperiosteal and orbital abscesses. In severe cases,this may also cause cavernous sinus thrombosis or meningitis. Patients with periorbital edema, erythema and increase in local hyperemia but without proptosis, ophthalmoplegia and visual impairment have been defined as having preseptal cellulitis. Patients with proptosis, ophthalmoplegia andvisual impairment have been defined as having orbital cellulitis. Preseptal cellulitis is usually

managed medically, whereas orbital cellulitis requires an aggressive treatment and may require surgical intervention [3, 4, 5]. Orbital cellulitis is a serious infection, especially in children, and may result in significant complications including blindness, cavernous sinus thrombosis, meningitis, subdural empyema, and brain abscess.

The correct treatment of the preseptal cellulitis during the antibiotic era makes these complications rare but the correct diagnosis and early treatment are important to prevent the life threatening complications [4,5].

3. Etiology

Preseptal cellulitis, as an eyelid infection, may be caused by inoculation following a trauma or skin infection, from spread of sinuses infection, upper respiratory tract infection, and any infection elsewhere disseminated through the blood.

Also, insect (spider) or animal bites, or a chalazion may be followed by eyelid infection[6].

Nearly two thirds of the cases of cellulitis are reported to be associated with upper respiratory tract infections, with one half of these from sinusitis. The most common microorganisms are Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus species, and anaerobes, known organisms that commonly cause upper respiratory tract infections and external eyelid infections[6]. Cold weather and upper respiratory tract infections are sometimes correlated with increased frequency of sinusitis, resulting in orbital cellulitis having seasonal peaks from late fall to early spring [7, 8].

Streptococcus pneumonia predominates when infection arises from sinuses infection, whereas Staphylococcus aureus and Streptococcus pyogenes often accompany local trauma and may be the most important pathology related toperiocular infection in a developing country.

Haemophilusinfluenzae B is now less common and usually occurs following bacteremic spread from a primary focus such as otitis media or pneumonia. Affected patients may have other foci of bacteremic spread including the meninges[9].

Haemophilusinfluenzae was the most common organism isolated in blood cultures before introduction of the vaccine, resulting with positive blood cultures during upper respiratory tract infections and in subcutaneous aspirates in nearly half of the patients with eyelid trauma or external ocular infections[10].

It has also been reported that total cases per year from all pathogens after the introduction of the Haemophilusinfluenzae vaccine declined as well, suggesting that Haemophilusinfluenzae may have played a facilitative role in the pathogenesis of cellulitis[10].

Periorbital cellulitis has also been reported with smallpox and anthrax[6].

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Frequent causes of preseptal cellulitis include Acinetobacter species, Nocardiabrasiliensis, Bacillus anthracis, Pseudomonas aeruginosa, Neisseria gonorrhoeae, Proteus spp, Pasteurellamultocida, Mycobacterium tuberculosis, and Trichophytonspp (the cause of "ringworm"). These pathogens can usually be linked to specific exposures[11-20].

Polymicrobial infections are also common[21, 22, 23].

Decreased immune function, as a side effect after the overuse of antibiotics, penetrating injuries, and diabetes mellitus, are all the factors that favor fungal infections such are aspergillosis or mucormycosis.

Risk factors	Percentage
Conjunctivitis	74.1%
Upper respiratory tract infections	37.4%
Focal lesions on the face or near the orbita	25.2%
Sinusitis	24.5%
Odontogenic infections and dental caries	19.4%
Trauma	10.8%
Allergy	3.6%
Hordeolum	3.6%
Other	6.5%

* Modified from Devrimİ, Kanra G, Kara A, Cengiz AB, Orhan M, Ceyhan M, Seçmeer G. Preseptal and orbital cellulitis: 15-year experience with sulbactam ampicillin treatment. Turk J Pediatr 2008; 50: 214-218.

Table 1. Common risk factors for preseptal cellulitis and orbital cellulitis

Focal lesions on the face or near the orbita	Percentage
Acne	5.8%
Insect bite	5.8%
Herpetic lesions	5.8%
Lesions secondary to trauma	5.8%
Impetigo	5%
Acute dacryocystitis	0.7%

* Modified from Devrimİ, Kanra G, Kara A, Cengiz AB, Orhan M, Ceyhan M, Seçmeer G. Preseptal and orbital cellulitis: 15-year experience with sulbactam ampicillin treatment. Turk J Pediatr 2008; 50: 214-218.

Table 2. Common focal lesions on the face or near the orbita as the risk factors for preseptal cellulitis and orbital cellulitis*

Isolated agent	Percentage
Staphylococcus aureus	43%
Coagulase-negative staphylococcus	26.6%
Streptococcus pneumoniae	10%
Haemophylusinfluenzae type B	6.6%
Streptococcus**	6.6%
Klebsiellapneumonia	3.3%
Pseudomonas aeruginosa	3.3%

* Pus and swab cultures from secretion of conjunctiva

** Other than pneumococci

*** Modified from Devrimİ, Kanra G, Kara A, CengizAB, Orhan M, Ceyhan M, Seçmeer G. Preseptal and orbital cellulitis: 15-year experience with sulbactam ampicillin treatment. Turk J Pediatr 2008; 50: 214-218.

Table 3. Common isolated* microorganisms in cases with orbital and preseptal cellulitis***

The causes of preseptal cellulites are classified as:

- exogenous (trauma, postsurgical)
- endogenous (bacteremia)
- extension from periorbital structures (paranasal sinuses, dental infection, intracranial)
- intraorbital (endophtalmitis, dacryoadenitis).

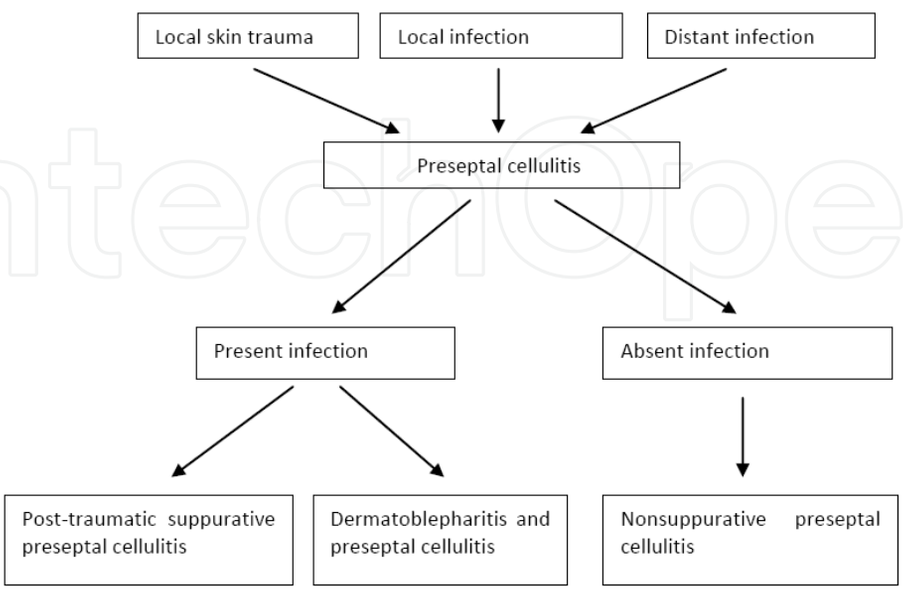


Figure 1. Pathophysiology of preseptal cellulitis

Risk factors [24, 25]

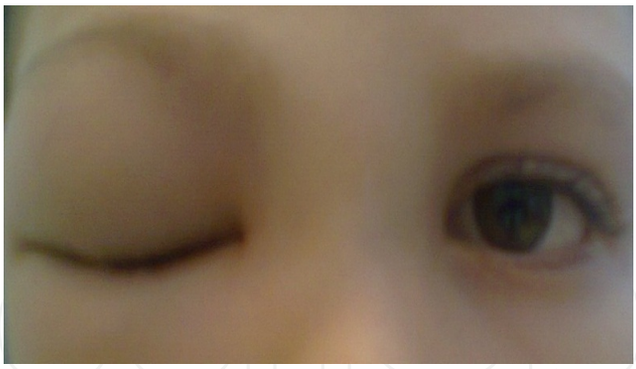
1. Eyelid lesions:
    - Hordeola
    - Chalazia
    - Bug bites
    - Trauma-related lesions
    - Lesions caused by a recent surgical procedure near the eyelids
    - Lesions caused by oral procedures
2. Upper respiratory tract infections (especially sinusitis)
3. Other diseases:
    - Varicella
    - Asthma
    - Nasal polyposis
    - Neutropenia

4. Clinical signs

Patients with preseptal cellulitis clinically complain of eye pain, redness, periorbital lid swelling, and fever. This is a typical clinicalpresentation. Eyelid edema, a violaceous erythema, and inflammation may be severe. Usually the globe is uninvolved; papillary reaction, visual acuity, and ocular motility are not disturbed; pain on eye movement and chemosis are absent. Chemosis may be present in severe cases of preseptal or orbital cellulitis caused by H.influenzae. Focal sinus region tenderness and purulent nasal discharge may be present due to sinus infections. Black eschar within the nasal mucosa indicates a potential fungal infection. Patients diagnosed with preseptal cellulitis have intact extraocular movements and do not have proptoses that differentiate from orbital cellulitis.

Typically, children with Haemophilusinfluenzae cellulites have a history of recent upper respiratory infection and present with high fever, irritability and coryza. A marked leukocytosis may be present but this is evident either in preseptal and orbital cellulites [24, 26, 27].

Preseptal cellulitis: Images show preseptal cellulitis in the second day of inflammation. Marked, isolated, and unilateral periocular inflammation may be noted. The patient presented painless during the eye movement.



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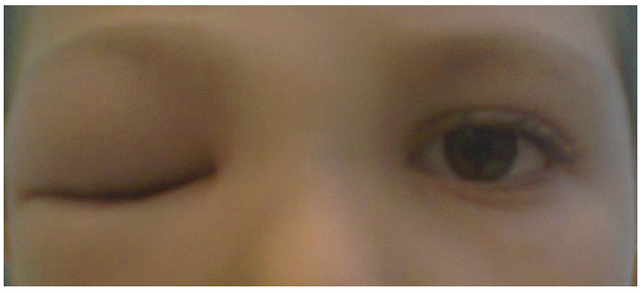
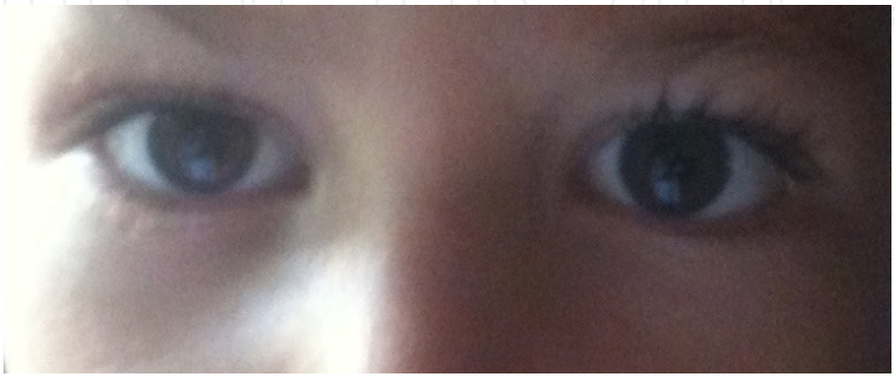


Figure 3.

Same patient with preseptal cellulitis after the treatment: Images show resolved preseptal cellulitis after a whole course of the recommended therapy.



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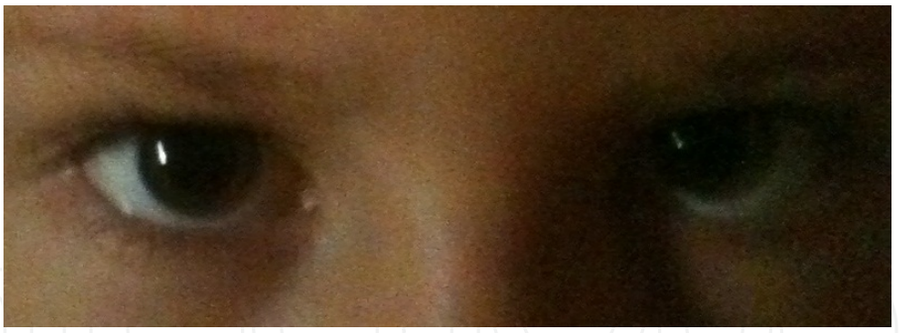

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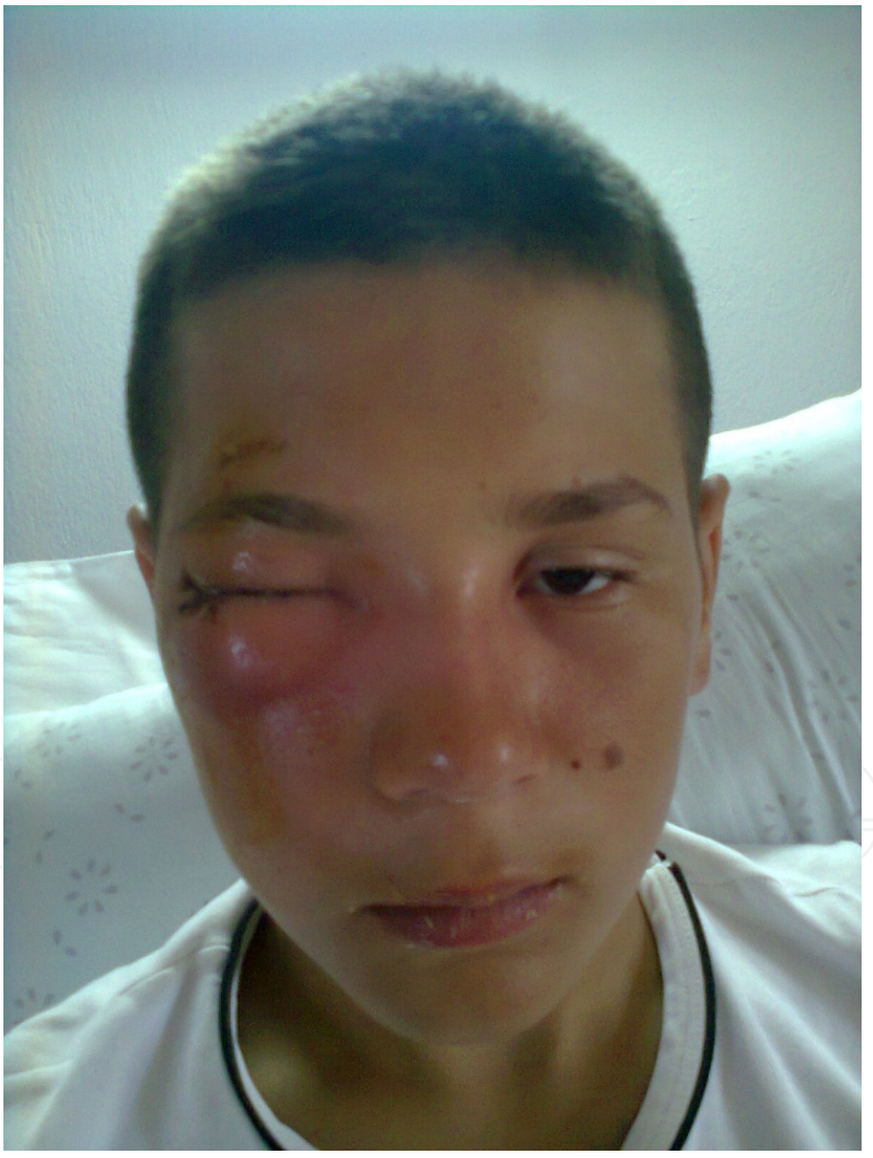

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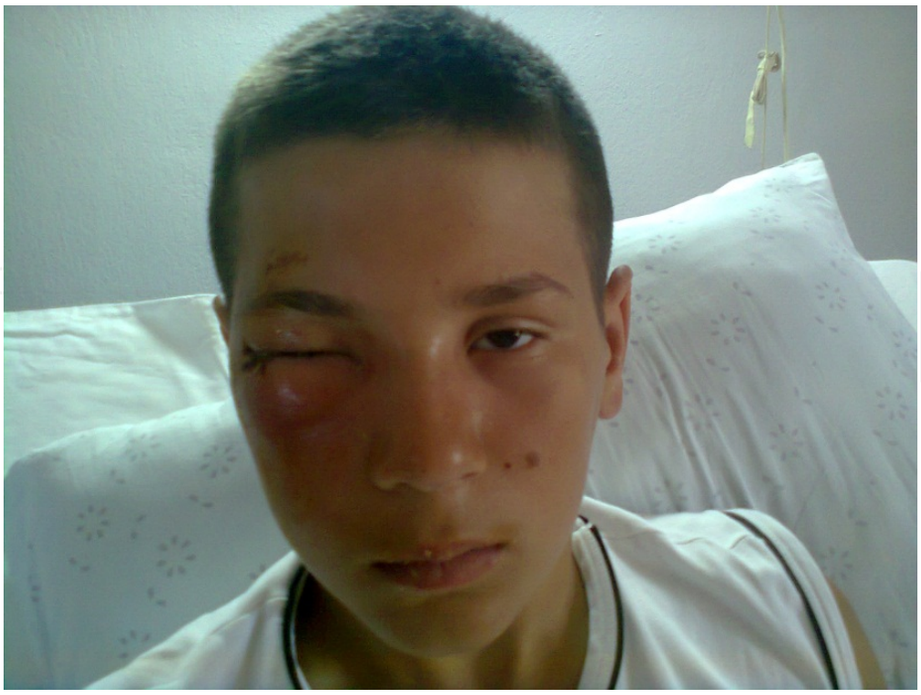

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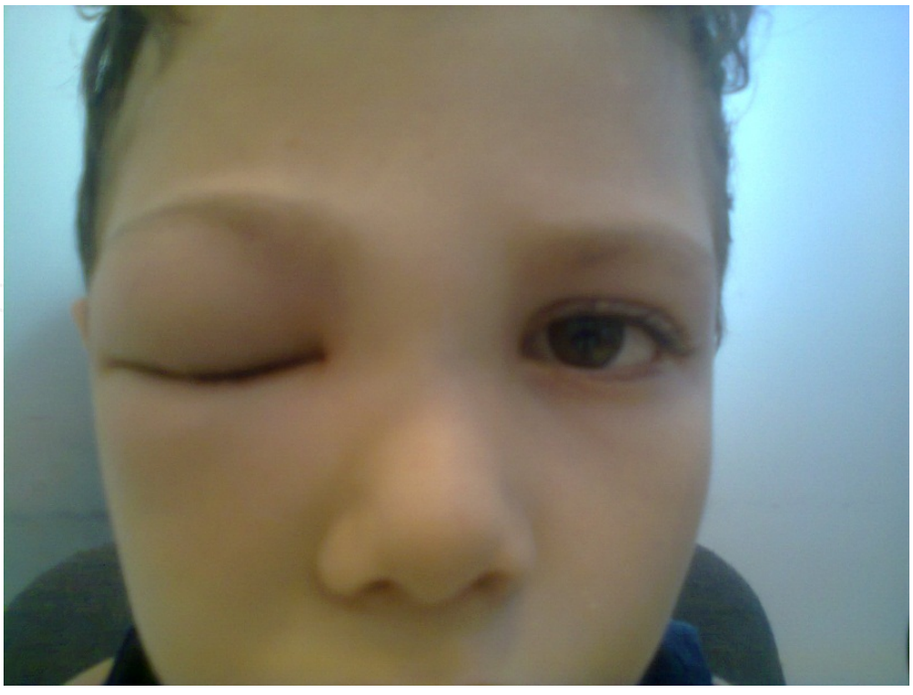

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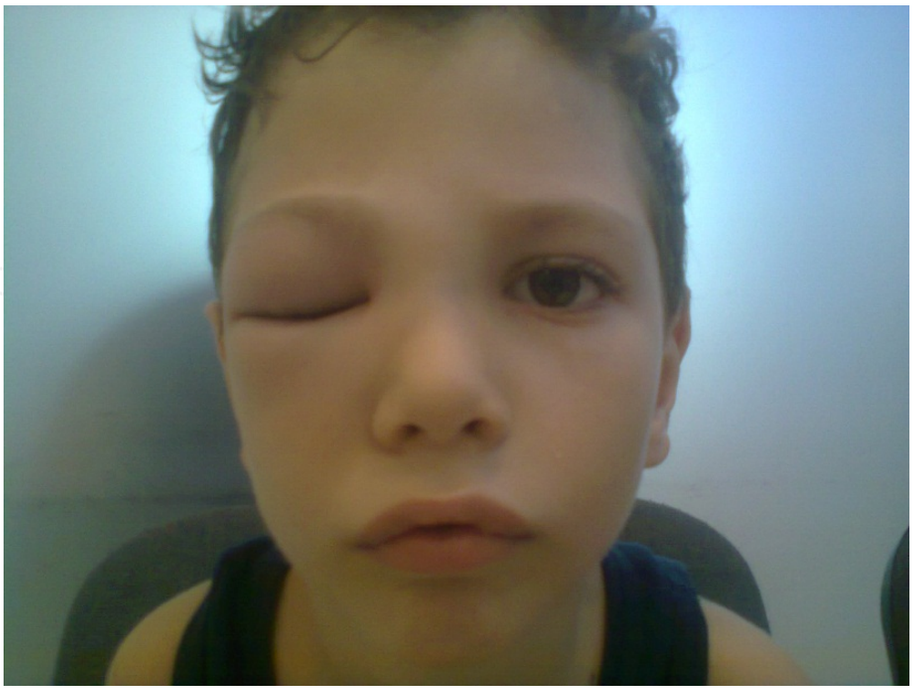

Figure 9.

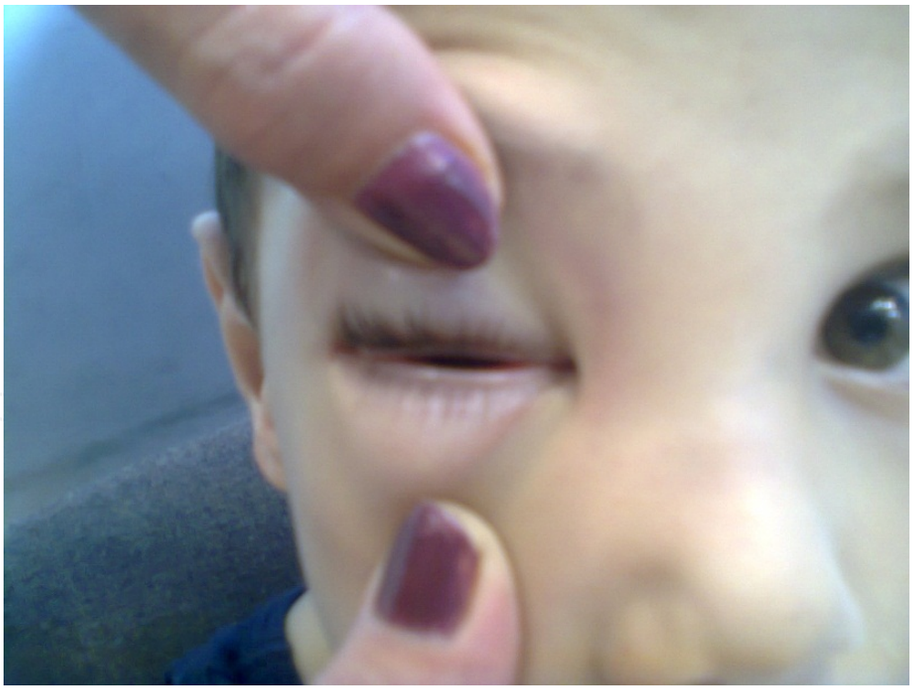

Figure 10.

Diagnosis is usually based upon the clinical findings, microbiological and radiological examination.

Findings on examination include pain on eye movement, afferent pupillary defect, limited extraocular motions, and resistance on retropulsion.

Blood cultures should be obtained as they correlate with orbital pathogens far better in childhood cases than do cultures from the nasopharynx or conjunctiva. Samples of conjunctival discharge, eyelid lesions, and lacrimal sac material should be sent for culture. Blood culture results are positive in less than 10% of cases of preseptal cellulitis, whereas skin culture results tend to be negative.

White blood cell (WBC) counts tend to be elevated and cannot be used to differentiate preseptal cellulitis from orbital cellulitis. Levels of ESR and CRP can help in the differentiation of preseptal and orbital cellulitis. However, it must be kept in mind that all of those high values of routine laboratory results can be seen in preseptal cellulitis.

Biopsy shows edema and polymorphonuclear leukocytes infiltrating tissue planes.

Lumbar puncture may be considered in affected children but not for routine use in the absence of meningitis signs.

Orbital ultrasonography can help in diagnosing orbital inflammation, although it requires experienced observers and specialized equipment.

A computed tomography (CT) scan can delineate the extent of orbital involvement[28].

CT scan findings in preseptal cellulitis include the following:

- Swelling of the eyelid and adjacent preseptal soft tissues
- Obliteration of the fat planes or details of the preseptal soft tissues
- Absence of orbital inflammation

It is quite difficult to distinguish periorbital (preseptal) and orbital cellulitis based just on clinical findings, especially in children. Many of the clinical signs of orbital cellulitis are distinctive, such are proptosis andophthalmoplegia, but the correct diagnosis of orbital cellulitis is best confirmed by CT scan with contrast infusion of the orbit[29, 30, 31, 32].

5. Differential diagnoses

There are several entities to be considered in the differential diagnosis of preseptal cellulitis: [33]

- Rhabdomyosarcoma
- Retinoblastoma
- Orbital pseudotumour (idiopathic orbital inflammation)
- Perioculartinea
- Cellulitis, Orbital

http://dx.doi.org/10.5772/52709

- Conjunctivitis
- Dacryoadenitis
- Dacryocystitis
- Dermatitis, Contact
- Herpes Simplex
- Herpes Zoster
- Hordeolum

6. Staging

A computed tomography (CT) scan can delineate the extent of orbital involvement [28, 31, 32].

The modified Chandler staging system is as follows:

- Stage I - Preseptal cellulitis
- Stage II - Inflammatory orbital edema
- Stage III - Subperiosteal abscess
- Stage IV - Orbital abscess
- Stage V - Cavernous sinus thrombosis

Complications of preseptal cellulitis may be progression to stage II and behind of orbital infections. Preseptal cellulitis in infants and children under the age 5 may be associated with bacteremia, septicemia, and meningitis, and therefore the treatment should start as soon as possible including consultations with a pediatrician. Late complications of preseptal cellulitis include lid abscess, cicatricialectropion, and lid necrosis. Unless appropriately treated, periorbital and orbital cellulitis can result in optic neuritis, opticatrophy, blindness, cavernous sinus thrombosis,superior orbital fissure syndrome, orbital apex syndrome, meningitis, brain abscess, subdural empyema, and even death [34, 35].

7. Treatment

Earlier diagnosis, expeditious treatment, and improved antibiotics have led to a reduction in serious ocular and central nervous system complications in patients with preseptal cellulitis. Treatment involves management of predisposing conditions, antibiotic therapy, and close observation[36]. Starting the antibiotic therapy at all ages should provide coverage for pathogens associated with acute sinusitis (*S. pneumoniae*, *H. influenzae*, *M. catarrhalis*, *S. pyogenes*) as well as anaerobes and *S. aureus*[37, 38].

Preseptal cellulitis treatment is based on oral antibiotics (outpatient treatment) and antiseptic treatment locally provided that a close follow-up can be ensured. Hospitalization is recommended if there is no improvement within 48 hours (or even 24 hours), and parenterally antibiotics (broad-spectrum intravenous antibiotics) are necessary once appropriate cultures have been obtained, undergoing a CT scan to evaluate for orbital cellulitis and its complications. Patients with subtle clinical and/or radiographic findings, suggesting that the orbit is involved, should be treated as a case of orbital cellulitis given the serious complications of this entity.

Also, children younger than one year of age, those who cannot cooperate fully, and patients who are severely ill should generally be admitted to the hospital and managed according to the recommendations.

Teenagers and adults usually respond quickly to appropriate oral antibiotics and there is no need for hospitalization unless orbital involvement cannot be excluded or when the clinical situation is severe.

Initial antibiotic selection is based on the history, clinical findings and laboratory studies, and is almost always empiric and based upon knowledge of the common infecting organisms. Staphylococcus aureus is the most common pathogen in patients with preseptal cellulitis resulting from trauma. The infection usually responds quickly to penicillinase-resistant penicillin. Third-generation cephalosporins or ampicillin have both a broad spectrum coverage including activity against Haemophilusinfluenza, and should be initiated immediately after obtaining the cultures.

Lid abscesses should be drained surgically with the incision and drainage usually performed directly over the abscess, avoiding the damage of the levatoraponeurosis.

In order to avoid contamination of the orbital soft tissue, the orbital septum should not be opened.

One of the following regimens is suggested for empiric oral treatment of preseptal cellulitis: [39]

- Clindamycin (in children: 30 to 40 mg/kg per day in three to four equally divided doses, not to exceed 1.8 grams per day; in adults: 300 mg every eight hours) as monotherapyor
- Trimethoprim-sulfamethoxazole (TMP-SMX; in children: 8 to 12 mg/kg per day of the trimethoprim component divided every 12 hours; in adults: 8 mg/kg per day of the trimethoprim component divided every 8 or 12 hours) plus one of the following:
- Amoxicillin (in children: 80 to 100 mg/kg per day in divided doses every eight hours; in adults: 875 mg orally every 12 hours) or
- Amoxicillin-clavulanic acid (in children: 45 mg/kg per day divided every 12 hours; in adults: 875 mg every 12 hours) or
- Cefpodoxime (in children: 10 mg/kg per day divided every 12 hours, not to exceed 200 mg per dose; in adults: 400 mg every 12 hours) or

- Cefdinir (in children: 7 mg/kg twice daily, maximum daily dose 600 mg; in adults: 300 mg twice daily)

The use of clindamycin alone has shown good efficacy for skin and soft tissue infections caused by staphylococci and streptococci.

One of the combination regimens should be used if the patient has not been immunized against Haemophilusinfluenzae.

Topical antibiotics have no role in the treatment of this infection.

Generally, the treatment is recommend for 7 to 10 days, but if signs of cellulitis persist, treatment should be continued until the eyelid erythema and swelling have resolved or nearly resolved[40, 41].

Recurrent preseptal cellulitis — preseptal cellulitis rarely recurs. When it does, it is usually due to an underlying cause that has not been diagnosed or due to an anatomic abnormality[42, 43].

The presence of subperiosteal or intraorbital abscess is an indication for surgical drainage in addition to antibiotic therapy [44, 45]. Surgical drainage is indicated for complete ophthalmoplegia and/or significant visual impairment (acute optic nerve or retinal compromise) or large well-defined abscesses [46,47,48]. Depending on the patient condition,sinus surgery and sinus endoscopy are recommended,and for patientswith orbital cellulitis, intracranial abscess drainage, orbital surgery or ethmoidectomy.

Author details

Monika Fida[1], Kocinaj Allma[2], Abazi Flora[2] and Arjeta Grezda[1]

1 University Hospital Center “Mother Teresa”, Tirana, Albania

2 University Clinical Center of Kosova, Prishtina, Kosovo

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