



Getting an Eyeful of Preseptal Cellulitis

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Practitioners are often confronted with the mildly to moderately ill child who presents with an area of distinct redness and/or swelling of the skin around the eyelid. This is often accompanied by purulent conjunctival discharge, fever, purulent rhinorrhea, or concomitant acute otitis media. You must then decide whether this is preseptal cellulitis (peri-orbital cellulitis), orbital cellulitis, an allergic reaction, erythema secondary to trauma, contact dermatitis, or the result of eye rubbing. You must also perform a thorough physical examination, particularly evaluating the child's level of toxicity, and the tympanic membranes, pharynx, lungs, and skin.

Preseptal cellulitis (PC) is an infection of the skin surrounding the eyelid that is localized anterior to the orbital septum — a thin layer of fascia that provides a barrier to deeper invasion by infectious agents. The typical signs of PC are erythema, edema, and pain of the eyelid(s). It is usually unilateral, and may be associated with fever and acute

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Figure 1. An 8-month-old white boy with an upper respiratory infection for the past week has now developed moderate swelling and redness of his right upper eyelid in the last 24 hours, along with a fever of 102.4°F, crankiness, and ear tugging.

otitis media (AOM). Specific management options are addressed in the following cases.

PC must be differentiated from the very serious infection, orbital cellulitis, which usually involves an osteomyelitis and invasion of the orbital bones. The cardinal features of orbital cellulitis are proptosis, chemosis, ophthalmoplegia, visual loss, and restricted ocular mobility. Immediate hospitalization, computed tomography (CT) scan of the orbit, and ophthalmologic referral is essential. Rarely, the swelling of the skin around the eyelid in PC may be so severe that a complete examination of the globe for signs of orbital cellulitis may be difficult or impossible, thus requiring CT imaging of the globe (similar to Figure 1).

DIAGNOSTIC EVALUATION OF PRESEPTAL CELLULITIS

In most cases of children with mild PC and no or low-grade fever, no further

evaluation is needed. If the child has a concomitant purulent conjunctivitis, I prefer to obtain an eye culture, particularly if the child has an associated AOM because of the high pathogen correlation between AOM and conjunctivitis.¹ For cases of PC, this also may provide valuable (and the only) information as to the etiology and pathogen susceptibilities, especially if the recovered pathogen is *Streptococcus pneumoniae*, *Staphylococcus aureus*, or *Streptococcus pyogenes*. However, some experts consider an eye culture in PC to provide minimal information.²

Aspiration of the leading edge of the cellulitis rarely ever recovers a pathogen and is not advocated. I typically consider obtaining a complete blood count (CBC) in any child with PC who has actual fever, moderate to severe PC, and who is younger than 24 months. Blood culture, although rarely positive, and even hospitalization, should be considered in most

children with PC who are unvaccinated; are highly febrile; are toxic appearing; have profound neutrophilic leukocytosis ($> 20,000$ cells/mm³); or are younger than 2 months.

A few days of ceftriaxone injections with careful daily follow-up may be an alternative approach in the nontoxic child outside the newborn period who has nontraumatic PC. The majority of children with nonsevere PC can be managed as an outpatient with oral antibiotics. Antibiotic selection is guided by the assessment of the following etiologies of PC. CT scan of the orbit and ophthalmic referral is typically only necessary for those in whom orbital cellulitis is a diagnostic possibility.

ETIOLOGY OF PRESEPTAL CELLULITIS

Localized Spread

PC can result from contiguous spread of bacterial infection in the conjunctiva, adjacent sinuses, or lacrimal duct/hordeolum (see Figure 1, page 99; and Figure 2) The causative bacterial pathogens of the former two infections are the typical otopathogens of AOM: *S. pneumoniae*; occasionally nontypeable *Haemophilus influenzae*; and rarely Group A streptococcus or *Moraxella catarrhalis*. Infections of the lacrimal duct/hordeolum tend to be *S. aureus*, and only occasionally, otophthogens.

Hematogenous Spread

Currently, the pathogen of pediatric bacteremia in healthy children is nearly always *S. pneumoniae*, which may disseminate from the bloodstream into the periorbital tissue. The recent universal implementation of pneumococcal conjugate vaccine (PCV13) is likely continuing to reduce the overall incidence of hematogenous invasive pneumococcal PC. Although *Haemophilus influenzae* type B (HIB) was a common pathogen in the 1970s, the universal use of HIB vaccine has virtually eliminated HIB infections,



Figure 2. A 16-month-old white male presented with 48 hours of rhinorrhea, low-grade fever, crankiness, and discharge from both eyes (worse on the right). He was still taking his amoxicillin twice daily from an episode of right acute otitis media 1 week prior, when he developed a cellulitis of the right lower eyelid area.

except in those families who still refuse HIB vaccines for their infant. You should consider hospitalization for any infant who looks toxic, or who is unvaccinated with a fever,

Posttraumatic Spread

PC can arise from either penetrating trauma, such as an animal bite or laceration, or direct blunt force. The most common pathogens of these two sources, respectively, would be *Pasteurella multocida*/*S. aureus*/streptococcal species versus *S. aureus*/*S. pyogenes*. With blunt force trauma, you should be most concerned with the possibility of methicillin-resistant *S. aureus* (MRSA), which may be as high as 60% to 75% in many areas of the US.²

CASES OF PRESEPTAL CELLULITIS

Case 1

The 8-month-old white boy in Figure 1 (see page 99) has a moderate upper eyelid PC without purulent conjunctivitis. This degree of orbital edema requires careful evaluation. You feel comfortable that his right eye is able to track your penlight laterally and vertically without any pain, and that he has no chemosis or proptosis. Upon examination, he also has concomitant AOM and significant purulent rhinorrhea. The etiology of his PC is most likely a secondary localized extension from his maxillary or ethmoid sinuses (These

two sinuses are normally aerated and functional after birth.) His leukocyte count is elevated (white blood cell = 18,500 cells/mm³).

Because he is nontoxic, the mother is quite reliable, and the most likely causative pathogen is *S. pneumoniae*, you prescribe oral high-dose amoxicillin-clavulanate (90 mg/kg/day) twice daily for 10 days. Follow-up the next morning reveals a marked resolution of his systemic symptoms, fever and cellulitis.

Case 2

A 16-month-old white boy presented with symptoms of an upper respiratory infection (URI) for 2 weeks, and a purulent conjunctivitis for several days. He was prescribed amoxicillin twice daily for AOM last week, which he is still taking at today's visit. Today, he developed a mild PC of the right lower eyelid (see Figure 2) and his AOM remains unresolved. Aside from the temperature of 100°F, mild peri-oral facial rash, and purulent rhinorrhea, his physical examination is unremarkable. You obtain a routine bacterial culture of the right eye discharge and CBC, which shows a leukocyte count of 12,550 cells/mm³. You know that the most common cause of simultaneous purulent acute conjunctivitis and AOM is non typeable *H. influenzae*, which is most commonly beta lactamase positive.¹ This could account for his lack of response to amoxicillin.

Because he is fully vaccinated with PCV13 and HIB vaccine, typical of all children attending your practice, you think that resistant pneumococcus is unlikely, and you have not seen more than one case of HIB invasive disease in two decades. He is nontoxic and afebrile, his leukocyte count is within normal range, and he has an infection which highly suggests nontypeable *H. influenzae*. You thus prescribe once daily cefdinir as one of two formulary based options (the other being twice daily amoxicillin-clavulanate) with reasonable beta lactamase-stable activity.

Upon follow-up the next day, his PC has markedly improved and his demeanor is much better. Three days later, his eye culture grows beta lactamase-negative *H. influenzae*, which appears to be one of those increasingly common beta lactamase negative ampicillin resistant (BLNAR) strains described recently.^{2,3} Fortunately, the cefdinir was working well despite the alterations in penicillin binding proteins common to BLNAR strains.

Case 3

A 6-year-old white girl presents in your office with a 3-day history of URI and an acute onset of left periorbital edema and lower lid redness today (see Figure 3). She has a fever of 101°F; her tympanic membranes, conjunctiva, and pharynx are normal; the remainder of her physical examination is unremarkable. Her left eye has no chemosis, proptosis, ophthalmoplegia or visual loss. She is nontoxic, and you have ordered a CBC which shows a slightly elevated leukocyte count of 16,800 cells/mm³. She has been fully vaccinated with both HIB vaccine and PCV7 (not PCV13), so that penicillin resistant pneumococcal strains of 19A and 6A/C may be possible. Because of her older age and lack of concomitant AOM, non-typeable *H. influenzae* is much less probable.

Thus you wish to target antibiotic



Figure 3. A 6-year-old white girl has had rhinorrhea and cough for 3 days. She developed redness and tenderness of the left lower eyelid on the third day.



Figure 4. A 7-year-old white boy who has had rhinorrhea for 5 days and a hordeolum on right upper eyelid for 2 days. He was hit by a softball over the right zygoma/lateral orbit 2 days ago as well. His physical examination also reveals a right acute otitis media and right upper eyelid swelling and redness. therapy specifically towards pneumococcal infection. She does not look ill enough to warrant a blood culture, thus no cultures will be available later to guide therapy. You prescribe twice daily amoxicillin at 50 mg/kg/day, aware that the use of high dose 90 mg/kg/day becomes almost prohibitive in a 25 kg child (over 1 gram per dose of amoxicillin). At the important follow-up visit after 24 hours, she has responded well to your therapy. Thus you do not need to consider treating her with parenteral ceftriaxone for clinical failure suspicious of resistant pneumococcus etiology.

Case 4

A 7-year-old white boy presents with a history of having had rhinorrhea for 5 days, an untreated right upper eyelid hordeolum for 2 days, and a traumatic contusion from a softball onto the right zygoma/eyelid also from 2 days ago (see Figure 4). In addition, his right ear has been hurting for 2 days.

His physical examination reveals a

right tympanic membrane full of yellow pus, and a swollen erythematous right upper eyelid. Once you are able to gently pry the right eyelid open you can see that he has no chemosis or proptosis, and that he can easily track your penlight laterally and horizontally without pain. You also note that his vision is normal, but obtaining a decent fundoscopic examination of his eye is impossible due to his discomfort. However he does not complain of any floaters or other visual field defects. He is afebrile, nontoxic but feels poorly, and the remainder of his physical examination is normal. You obtain a CBC which is normal. He is fully vaccinated with HIB and PCV7.

Antibiotic selection is quite problematic for you. You will have no cultures to potentially guide you either. Traumatic PC is most commonly caused by *S. aureus*, especially in light of his hordeolum, for which you would normally prescribe either clindamycin or trimethoprim-sulfamethoxazole to cover for the high likelihood of MRSA. But neither antibiotic

has reasonably broad AOM coverage, particularly for *H. influenzae*. Nontraumatic PC at this older age is most frequently associated with pneumococcus. However, AOM is most commonly caused by both pneumococcus and nontypeable *H. influenzae*, even at this age.

Because he has reliable vigilant parents, you elect to use two different oral antibiotics to supplement the pathogen weakness coverage, respectively. You prescribe the slightly more palatable twice-daily trimethoprim sulfamethoxazole (for MRSA), and the once-daily cefdinir (for pneumococcus and nontypeable *H. influenzae*). This should help limit palatability issues, diarrhea issues (associated with amoxicillin-clavulanate), MRSA clindamycin resistance (up to 20%)⁴ and heightened concerns of antibiotic-induced colitis (with clindamycin). Your next concern would be resistant pneumococcus and MRSA failure if he

did not improve within the next 24 to 48 hours. Then you would consider either hospitalization for parenteral antibiotics, or outpatient management with concomitant intramuscular ceftriaxone and oral clindamycin — if he was still not ill appearing and his leukocyte count were stable. Fortunately, your double oral antibiotic gambit pays off, and he is much improved the next day at follow-up.

CONCLUSION

In fully vaccinated children, some of the caveats to your outpatient approach to children with PC require reliable parental vigilance and office access over the next several days; the ability to fully assess the eye for chemosis, proptosis, ophthalmoplegia, and intact extra ocular movements — particularly in cases of notable eyelid edema or younger age.

With careful and thorough ocular examinations, most cases of mild to mod-

erate PC will not require CT scanning of the orbit to assess for the highly serious infection of orbital cellulitis. Antibiotic selection for PC is often complicated by real life presentations, additional concomitant infections, taste issues, and social issues.

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