

“I Woke Up with a Swollen Eye”: Clinical Insights from a Pediatric Periorbital Cellulitis Case in Qatar

Dr. Nada A. Al Mulla, (M.D)^{1,2*}

¹Doctor of Medicine, Weill Cornell Medicine–Qatar

²Independent Researcher, Doha, Qatar | London, United Kingdom

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*Corresponding author: Dr. Nada A. Al Mulla

Doctor of Medicine, Weill Cornell Medicine–Qatar

Abstract

Background: Preseptal and orbital cellulitis represent a diagnostic continuum in pediatric ophthalmology with significantly different management implications. Rapid, accurate differentiation is essential to prevent vision-threatening complications while avoiding unnecessary imaging and hospitalization. **Case Presentation:** A previously healthy 12-year-old girl presented with acute onset right eyelid erythema and swelling for two days. Clinical examination revealed marked periorbital edema with tenderness and erythema confined to the eyelid tissues. Critically, visual acuity remained 20/20, extraocular movements were full and painless, no relative afferent pupillary defect was present, and fundoscopic examination was normal. The patient was afebrile with only mild superior visual field restriction secondary to mechanical ptosis from lid swelling. **Decision-Making:** Based on preserved ocular function and absence of orbital signs, a clinical diagnosis of preseptal cellulitis was established. The decision was made to initiate outpatient oral antibiotic therapy with methicillin-resistant *Staphylococcus aureus* (MRSA) coverage, deferring computed tomography imaging pending clinical response assessment. **Outcome:** The patient demonstrated excellent response to oral antibiotics with complete resolution of symptoms within 5 days, confirming the appropriateness of conservative outpatient management. **Teaching Points:** This case illustrates the critical clinical features distinguishing preseptal from orbital cellulitis, demonstrates evidence-based outpatient management in appropriately selected pediatric patients, and provides a practical algorithmic approach to periorbital infections in children.

Keywords: Periorbital Cellulitis, Orbital Cellulitis, Pediatric Ophthalmology, Eyelid Edema, Clinical Decision-Making, Qatar.

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1. INTRODUCTION

Periorbital infections in children represent a common yet potentially serious presentation in emergency departments and primary care settings. The distinction between preseptal cellulitis (also termed periorbital cellulitis) and orbital cellulitis is fundamental to appropriate management, as these conditions differ markedly in severity, complications, and treatment approach [1].

Preseptal cellulitis is defined as infection and inflammation of the eyelid tissues anterior to the orbital septum, a fibrous extension of the periosteum that separates superficial lid structures from the deeper orbital contents [2]. This anatomical barrier is critical: infections anterior to the septum typically remain

localized and carry minimal risk of vision loss or intracranial complications [2].

In contrast, orbital cellulitis involves infection of the orbital soft tissues posterior to the orbital septum, with potential involvement of extraocular muscles, orbital fat, and adjacent structures [2]. Orbital cellulitis carries significant morbidity, including vision loss from optic nerve compression, extraocular muscle dysfunction, subperiosteal or orbital abscess formation, cavernous sinus thrombosis, meningitis, and intracranial abscess [3]. Mortality, while rare in the modern antibiotic era, has been reported in severe cases with delayed treatment.

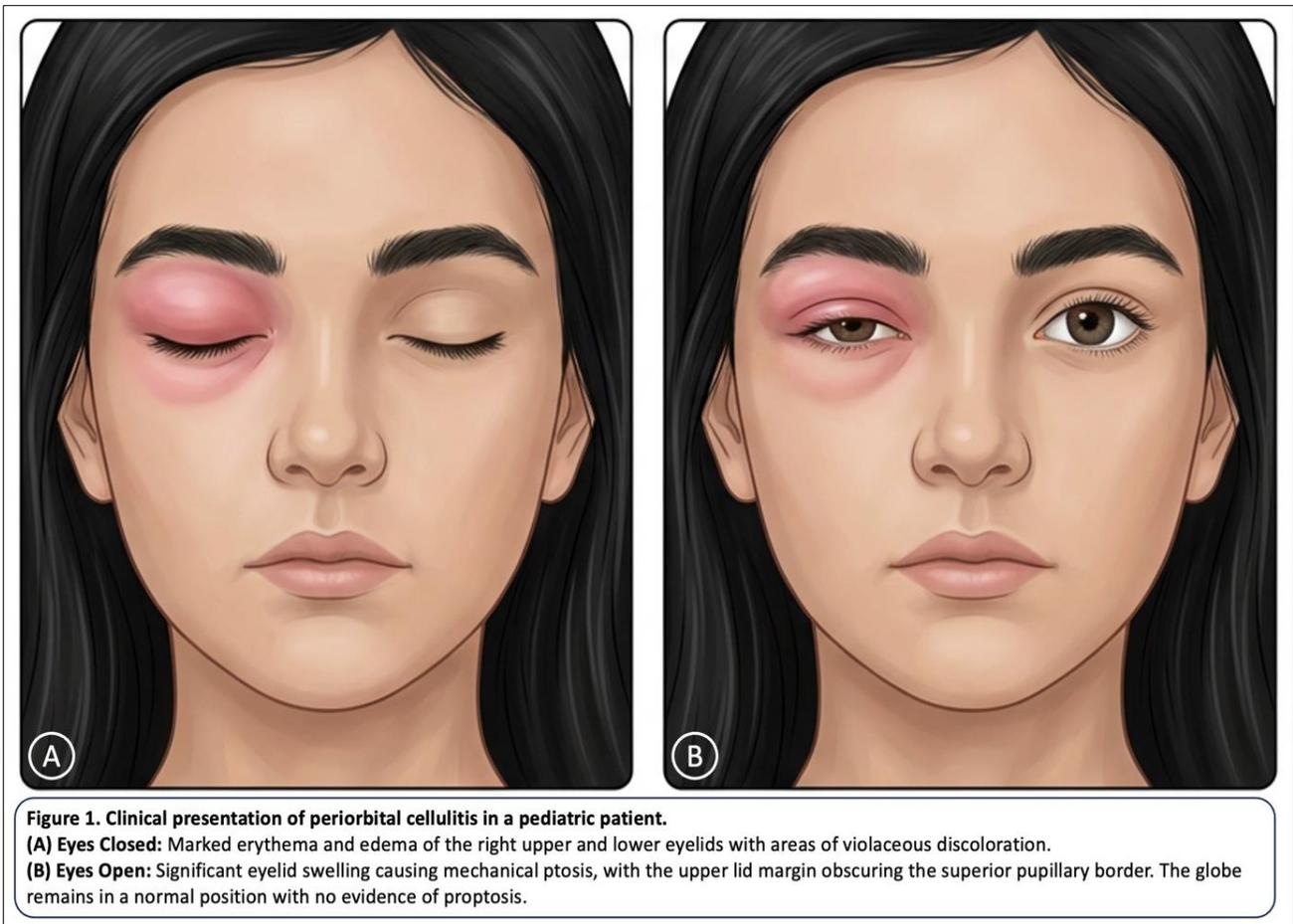
The clinical challenge lies in rapid, accurate differentiation between these entities, particularly in young children who may not reliably report visual symptoms [1]. Preseptal cellulitis can be managed with oral antibiotics on an outpatient basis in most cases, while orbital cellulitis typically requires hospitalization, intravenous antibiotics, and often surgical intervention [1]. Unnecessary imaging exposes children to radiation and sedation risks, while delayed recognition of orbital involvement can result in irreversible complications [4].

This case report presents a systematic approach to evaluating acute unilateral eyelid edema in a pediatric patient, demonstrating the clinical reasoning process that enables confident differentiation of preseptal from orbital cellulitis and appropriate selection of outpatient management.

2. CASE PRESENTATION

2.1 Patient Information and Clinical Presentation

A 12-year-old previously healthy girl from Qatar presented to the pediatric urgent care clinic with a chief complaint of right eye redness and swelling for two days (Figure 1). The patient's mother reported that the child had awakened that morning with mild right eyelid puffiness, which progressively worsened throughout the day. The patient denied eye pain, vision changes, double vision, or difficulty with eye movements. There was no history of recent trauma, insect bite, or foreign body exposure. The patient reported mild nasal congestion over the preceding week but denied fever, headache, or systemic symptoms. Past medical history was unremarkable with no history of sinusitis, allergies, or immunocompromising conditions. Immunizations were up to date. The patient was not taking any medications and had no known drug allergies.



2.2 Physical Examination

Vital Signs:

- **Temperature:** 37.2°C (98.9°F) – afebrile
- **Heart rate:** 82 beats per minute
- **Blood pressure:** 108/68 mmHg
- **Respiratory rate:** 16 breaths per minute
- **Oxygen saturation:** 99% on room air

Ophthalmologic Examination:

Right Eye (Affected):

- **Eyelids:** Marked erythema and edema of both upper and lower lids with violaceous discoloration. Lids warm and tender to palpation. No fluctuance or pointing abscess. Mechanical ptosis present with upper lid margin obscuring superior pupillary border.

- **Visual Acuity:** 20/20 (Snellen chart)
- **Visual Fields:** Mild superior field restriction by confrontation testing, attributed to mechanical obstruction from ptotic lid; otherwise full to confrontation
- **Pupils:** 4 mm, round, reactive to light and accommodation; no relative afferent pupillary defect (RAPD)
- **Extraocular Movements:** Full in all directions of gaze; no pain with eye movements; no diplopia
- **Proptosis Assessment:** No anterior displacement of globe; exophthalmometry not performed but no clinically apparent proptosis
- **Conjunctiva:** Mild injection; no chemosis
- **Cornea:** Clear; no epithelial defect on fluorescein examination
- **Anterior Chamber:** Deep and quiet; no cells or flare
- **Fundoscopy Examination:** Optic disc sharp with normal color and contour; cup-to-disc ratio 0.3; macula normal; vessels normal; no hemorrhages or exudates

Left Eye (Unaffected):

- Normal examination in all respects

Head and Neck Examination:

- No facial asymmetry or swelling beyond the right periorbital region
- Nasal mucosa mildly erythematous with clear discharge

- No sinus tenderness to percussion over frontal or maxillary sinuses
- No preauricular or cervical lymphadenopathy
- Oropharynx clear without erythema or exudate

General Examination:

- Well-appearing, interactive, and cooperative
- No signs of systemic toxicity or distress

2.3 Timeline

- **Day 0 (Morning):** Patient awakens with mild right eyelid puffiness
- **Day 0 (Afternoon):** Progressive worsening of swelling and redness; presentation to urgent care
- **Day 0 (Evening):** Initiation of oral antibiotic therapy
- **Day 1:** Stable appearance; no progression of swelling
- **Day 2:** Mild improvement in erythema and tenderness
- **Day 3:** Significant reduction in edema; improved lid opening
- **Day 5:** Complete resolution of erythema and swelling; normal lid appearance

3. Differential Diagnosis

The differential diagnosis for acute unilateral eyelid edema in a pediatric patient is broad and requires systematic consideration of infectious, inflammatory, traumatic, and neoplastic etiologies. Table 1 presents a structured differential diagnosis with distinguishing clinical features.

Table 1: Differential Diagnosis of Acute Unilateral Eyelid Edema in Children

Diagnosis	Key Clinical Features	Distinguishing Characteristics	Likelihood in This Case
Preseptal Cellulitis	Eyelid erythema, edema, warmth, tenderness; preserved vision and eye movements; no proptosis	Infection anterior to orbital septum; normal ocular function; may follow URI or minor trauma	High: All features consistent
Orbital Cellulitis	Eyelid edema plus proptosis, ophthalmoplegia, pain with eye movements, vision changes, RAPD	Infection posterior to orbital septum; impaired ocular function; usually from sinusitis	Low: Absent orbital signs
Allergic Edema	Bilateral (usually), pruritic, non-tender, rapid onset/resolution; history of allergen exposure	Non-infectious; often bilateral; no warmth or erythema; responds to antihistamines	Low: Unilateral, tender, warm
Hordeolum (Stye)	Localized lid margin nodule; focal tenderness and erythema; may have purulent discharge	Infection of eyelash follicle or meibomian gland; focal rather than diffuse	Low: Diffuse involvement
Chalazion	Non-tender lid nodule; chronic course; may have mild surrounding inflammation if inflamed	Chronic granulomatous inflammation; typically painless unless secondarily infected	Low: Acute onset, diffuse
Dacryocystitis	Medial canthal swelling, erythema, tenderness; may have purulent discharge from punctum	Infection of lacrimal sac; localized to inferomedial canthus; may express pus	Low: Diffuse lid involvement
Trauma/Hematoma	History of trauma; ecchymosis; may have subconjunctival hemorrhage	Clear traumatic etiology; bruising pattern; no warmth	Low: No trauma history

Diagnosis	Key Clinical Features	Distinguishing Characteristics	Likelihood in This Case
Acute Sinusitis with Periorbital Edema	Sinus symptoms, facial pain, purulent nasal discharge; may progress to preseptal or orbital cellulitis	Inflammatory edema from adjacent sinusitis; may be bilateral; less erythema	Moderate: Mild URI symptoms
Insect Bite/Sting	History of bite; may have central punctum; pruritic; rapid onset	Often pruritic rather than painful; may see bite mark; less warmth	Low: No bite history or punctum
Orbital Tumor (Rare)	Gradual onset; progressive proptosis; may have vision changes; painless	Chronic course; no acute inflammation; requires imaging	Very Low: Acute presentation

3.1 Diagnostic Reasoning

In this patient, the clinical presentation strongly favored preseptal cellulitis based on the following key features:

1. **Preserved Visual Function:** Visual acuity of 20/20 with no true visual field defects (superior restriction was mechanical from ptosis, not neurologic).
2. **Normal Pupillary Examination:** Absence of RAPD excluded optic nerve involvement.
3. **Full, Painless Extraocular Movements:** No ophthalmoplegia or pain with eye movements ruled against orbital muscle involvement.
4. **No Proptosis:** Globe position normal, excluding posterior orbital mass effect.
5. **Normal Fundoscopic Examination:** No optic disc edema or venous congestion.
6. **Confined Inflammation:** Erythema and edema limited to eyelid tissues without deep orbital signs.

The absence of orbital signs effectively excluded orbital cellulitis, which would be expected to demonstrate at least one of the following: proptosis, restricted or painful extraocular movements, decreased vision, RAPD, or optic disc changes [5].

Alternative diagnoses were considered but deemed less likely based on clinical features. The acute onset, unilateral presentation, warmth, and tenderness argued against allergic edema. The diffuse nature of the swelling without a focal lid margin lesion excluded hordeolum or chalazion. The lack of medial canthal localization made dacryocystitis unlikely. No history or physical findings suggested trauma or insect bite.

4. Investigations

4.1 Diagnostic Approach

The diagnosis of preseptal cellulitis is primarily clinical, based on characteristic physical examination findings in the appropriate clinical context. The decision to pursue additional investigations, particularly imaging, depends on clinical assessment of orbital involvement risk.

4.2 Indications for Imaging

Computed tomography (CT) with contrast of the orbits and sinuses is the imaging modality of choice when orbital cellulitis is suspected [1]. Indications for urgent CT imaging include:

- Proptosis or globe displacement

- Restricted or painful extraocular movements
- Decreased visual acuity
- Relative afferent pupillary defect
- Optic disc edema or other fundoscopic abnormalities
- Severe eyelid edema preventing adequate examination
- Age <1 year (higher risk of rapid progression)
- Toxic appearance or systemic signs
- Failure to improve or clinical worsening after 24-48 hours of appropriate antibiotic therapy

Magnetic resonance imaging (MRI) may be considered when superior soft tissue detail is needed, particularly for suspected intracranial extension, cavernous sinus thrombosis, or when CT findings are equivocal [1].

4.3 Laboratory Investigations

Blood cultures and inflammatory markers are not routinely indicated in uncomplicated preseptal cellulitis but should be obtained in the following circumstances:

- Suspected orbital cellulitis requiring hospitalization
- Systemic toxicity or fever >38.5°C
- Age <1 year
- Immunocompromised state
- Failure of outpatient management
- When obtained, typical laboratory studies include:
 - Complete blood count with differential (leukocytosis with left shift suggests bacterial infection)
 - C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) (elevated in bacterial infection)
 - Blood cultures (positive in 25-30% of orbital cellulitis cases, rare in preseptal cellulitis)

Wound or abscess cultures should be obtained if there is a drainable collection or open wound, to guide antibiotic therapy, particularly for MRSA detection.

4.4 Investigations in This Case

In the present case, no imaging or laboratory studies were performed at initial presentation based on the following clinical reasoning:

1. Comprehensive ophthalmologic examination was possible despite lid edema, allowing confident assessment of orbital function.
2. All orbital signs were absent, meeting clinical criteria for preseptal cellulitis.
3. Patient was afebrile and non-toxic appearing, without systemic signs of severe infection.
4. Age 12 years with reliable follow-up, allowing safe outpatient trial of oral antibiotics with close monitoring.

The decision to defer imaging was made in accordance with evidence-based guidelines recommending clinical diagnosis of preseptal cellulitis when examination findings clearly exclude orbital involvement. This approach avoids unnecessary radiation exposure and healthcare costs while maintaining patient safety through structured follow-up.

Contingency Plan: CT imaging was discussed with the family and would be obtained urgently if any of the following developed:

- Worsening of swelling despite antibiotics
- Development of proptosis or eye movement abnormalities
- Vision changes or pupillary abnormalities
- Increasing pain, particularly with eye movements
- Fever or systemic symptoms
- No improvement within 48 hours

5. Management and Outcome

5.1 Treatment Approach

Based on the clinical diagnosis of preseptal cellulitis without orbital involvement, outpatient management with oral antibiotic therapy was initiated. The treatment plan incorporated the following evidence-based principles:

5.2 Antibiotic Selection

Empiric antibiotic coverage for preseptal cellulitis must address the most common causative organisms:

- *Staphylococcus aureus* (including MRSA in areas of high prevalence)
- *Streptococcus pyogenes* (Group A Streptococcus)
- *Streptococcus pneumoniae*
- *Haemophilus influenzae* (less common since Hib vaccination)

A. Selected Regimen:

The patient was prescribed trimethoprim-sulfamethoxazole (TMP-SMX) at 8–12 mg/kg/day (based on the TMP component) orally, divided twice daily, plus cefpodoxime at 10 mg/kg/day orally,

administered in divided doses every 12 hours for 10 days (for children ≥ 2 months of age) [1].

Rationale for Dual Therapy

- Cefpodoxime provides excellent coverage for methicillin-susceptible *Staphylococcus aureus* (MSSA) and Streptococcus species.
- TMP-SMX adds MRSA coverage, important in regions where community-acquired MRSA prevalence exceeds 10–15%.
- The combination provides comprehensive coverage of the most likely pathogens while allowing for fully oral administration, appropriate for outpatient management.

B. Alternative Empirical Oral Antibiotic Options for Acute Periorbital Cellulitis

In children, oral empirical therapy may be initiated only if reliable daily reassessment is available and there are no orbital signs [1]. If MRSA is suspected, consider adding MRSA-active therapy (clindamycin or trimethoprim-sulfamethoxazole) to a third-generation cephalosporin or amoxicillin-clavulanate. Typical treatment duration: 7–10 days. Regimens should be reviewed with an infectious disease specialist when possible. A generalized algorithm is summarized in Figure 2.

Primary Oral Antibiotic Options

Cefpodoxime

- Children ≥ 2 months:
 - 10 mg/kg/day orally, divided every 12 hours

Or

Amoxicillin-Clavulanate

- Children ≥ 3 months:
 - 20–40 mg/kg/day orally, divided every 8 hours

Add MRSA Coverage (Only If Needed)

Used when MRSA is suspected or local prevalence is high.

Add ONE of the following:

Trimethoprim-Sulfamethoxazole (TMP-SMX)

- Children ≥ 2 months:
 - 8–12 mg/kg/day (TMP component), divided every 12 hours

Or

Clindamycin

- Children:
 - 8–40 mg/kg/day orally, divided every 6–8 hours

C. Inpatient Management (If Hospitalization Required)

Acute periorbital cellulitis with systemic toxicity, concern for orbital involvement, or failure of outpatient therapy. Causative organism not identified; MRSA suspected.

Recommended regimen:

- Vancomycin
 - Children: 40–60 mg/kg/day IV, divided every 6–8 hours

And

- Cefotaxime
 - Children: 50–200 mg/kg/day IV, divided every 4–6 hours
 - Maximum: 12 g/day

And

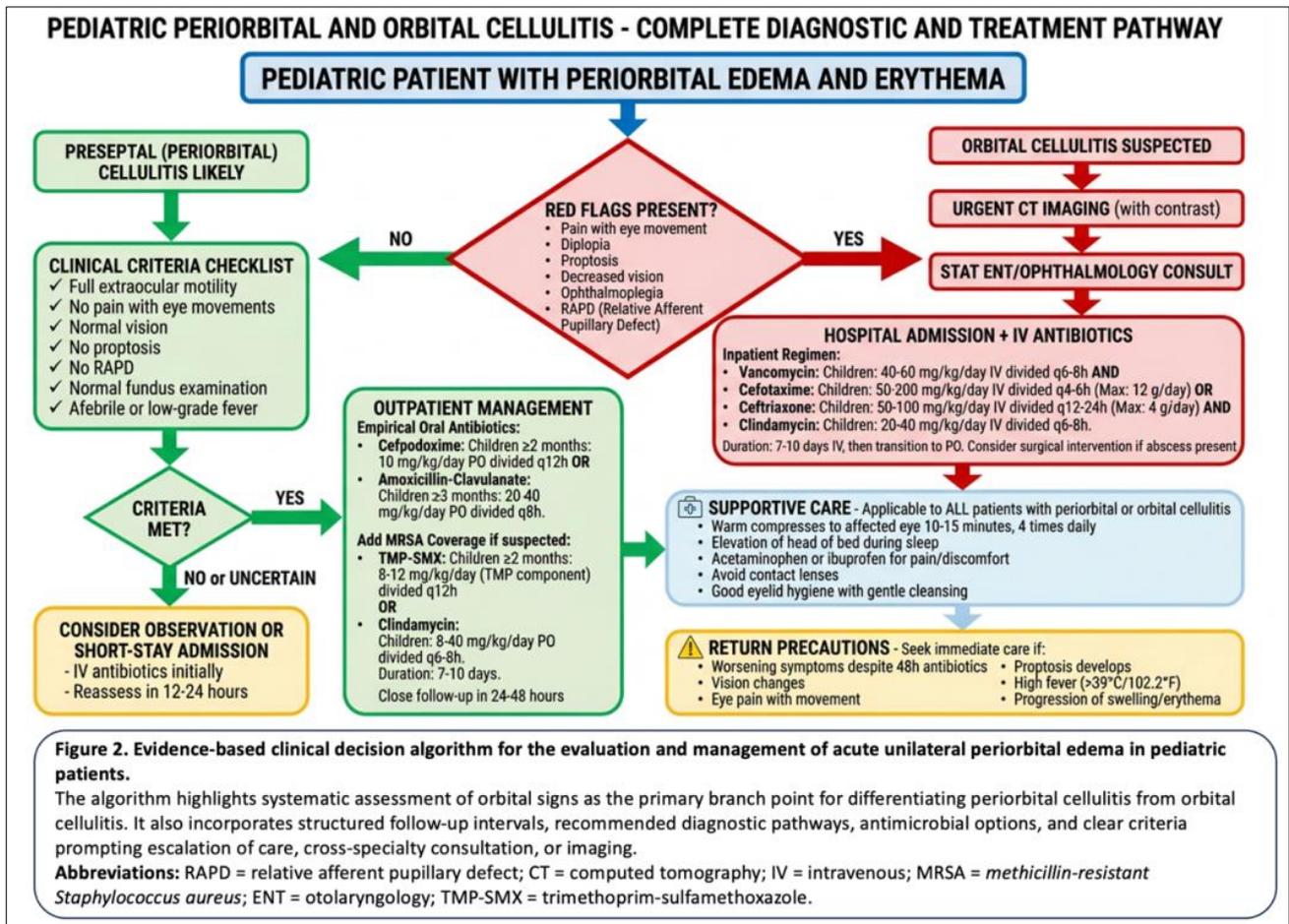
- Clindamycin
 - Children: 20–40 mg/kg/day IV, divided every 6–8 hours

Typical treatment course: 7–10 days.

5.3 Supportive Care

In addition to antibiotics, the following supportive measures were recommended:

- Warm compresses to the affected eye for 10-15 minutes four times daily to promote comfort and circulation
- Elevation of head of bed during sleep to reduce dependent edema
- Acetaminophen or ibuprofen for pain and discomfort as needed
- Avoidance of contact lens wear (not applicable in this case)
- Good eyelid hygiene with gentle cleansing



5.4 Monitoring and Follow-Up Plan

A structured follow-up plan is essential for safe outpatient management of preseptal cellulitis. The following schedule was implemented:

24-Hour Phone Follow-Up:

- Parent contacted clinic to report stable appearance with no progression of swelling
- No new symptoms or concerning features
- Good medication compliance

48-Hour In-Person Re-Evaluation:

- Mild improvement in erythema and tenderness noted
- No development of orbital signs
- Continued outpatient management

Day 5 Follow-Up:

- Complete resolution of erythema and swelling
- Normal eyelid appearance and function
- Antibiotic course completed as prescribed

5.5 Red Flag Symptoms and Return Precautions

The family received detailed written and verbal instructions to return immediately or seek emergency care if any of the following developed:

- Worsening swelling despite antibiotics
- Bulging of the eye (proptosis)
- Double vision (diplopia)
- Decreased vision or vision loss
- Severe pain, especially with eye movements
- Fever $>38.5^{\circ}\text{C}$ (101.3°F)
- Increasing redness spreading beyond the eyelid
- Severe headache or altered mental status
- No improvement within 48 hours of starting antibiotics

5.6 Outcome

The patient demonstrated excellent clinical response to oral antibiotic therapy. By day 2, erythema and tenderness had begun to improve. By day 5, complete resolution of all signs and symptoms was achieved. No complications occurred, and no imaging or hospitalization was required. The patient returned to normal activities including school attendance.

This favorable outcome validates the appropriateness of outpatient management in carefully selected patients with preseptal cellulitis who have:

- Clear absence of orbital signs on thorough examination
- Reliable caregivers capable of monitoring for warning signs
- Access to prompt medical re-evaluation if needed
- Good compliance with medication regimens

6. DISCUSSION

6.1 Clinical Significance and Diagnostic Challenges

This case exemplifies the critical decision point faced by clinicians evaluating children with acute periorbital swelling: distinguishing preseptal cellulitis from orbital cellulitis. While preseptal cellulitis is approximately 5-10 times more common than orbital cellulitis in pediatric populations, the consequences of misdiagnosis are significant [6].

The orbital septum serves as the key anatomical landmark. This fibrous extension of the periosteum originates from the orbital rim and inserts into the tarsal plates of the eyelids, creating a barrier between superficial lid structures and the deeper orbital contents. Infections anterior to this septum (preseptal) typically remain localized, while those posterior to it (orbital) have access to orbital fat, extraocular muscles, optic nerve, and vascular structures including the ophthalmic veins that communicate with the cavernous sinus.

6.2 Evidence-Based Differentiation

Multiple studies have validated clinical examination as the primary tool for differentiating preseptal from orbital cellulitis [1]. The most reliable clinical features indicating orbital involvement include: High Specificity for Orbital Cellulitis ($>90\%$):

- Proptosis (>2 mm difference between eyes)
- Ophthalmoplegia or painful extraocular movements
- Decreased visual acuity (≥ 2 lines on Snellen chart)
- Relative afferent pupillary defect
- Optic disc edema or pallor

Moderate Specificity (70-90%):

- Severe chemosis
- Resistance to retropulsion of globe
- Severe pain, particularly with eye movements
- Fever $>38.5^{\circ}\text{C}$
- Toxic appearance

In a prospective study of 315 children with periorbital infections, Nageswaran *et al.*, found that the presence of any orbital sign had 91% sensitivity and 94% specificity for orbital cellulitis confirmed by CT imaging [7]. Conversely, the absence of all orbital signs had a negative predictive value of 97% for excluding orbital cellulitis, supporting clinical diagnosis of preseptal cellulitis without imaging in such cases [8].

6.3 Role of Imaging

The decision to obtain CT imaging must balance diagnostic certainty against radiation exposure, sedation risks in young children, healthcare costs, and emergency department. Current evidence supports selective imaging based on clinical criteria rather than routine imaging for all periorbital infections.

Appropriate use of CT imaging:

- Mandatory: When any orbital sign is present or examination is limited by severe lid edema
- Strongly recommended: Age <1 year, immunocompromised state, toxic appearance, or failure to improve after 24-48 hours of antibiotics
- Not routinely indicated: Clear preseptal cellulitis with normal ocular function, reliable follow-up, and appropriate clinical response

A retrospective study by Rudloe *et al.*, analyzing 1,041 children with periorbital infections found that 43% underwent CT imaging, but only 14% of those imaged had findings requiring change in management [8]. This suggests significant overuse of imaging in low-risk patients. Conversely, delayed imaging in patients with subtle orbital signs has been associated with worse outcomes, including need for surgical drainage and prolonged hospitalization.

6.4 Microbiology and Antibiotic Considerations

The microbiology of preseptal cellulitis has evolved significantly over recent decades. Prior to *Haemophilus influenzae* type b (Hib) vaccination, *H. influenzae* was the predominant pathogen, often associated with bacteremia [9]. In the post-Hib vaccine era, *Staphylococcus aureus* and *Streptococcus* species have become the most common causative organisms.

The emergence of community-acquired MRSA has further complicated antibiotic selection. MRSA prevalence in pediatric skin and soft tissue infections varies geographically but exceeds 30% in many regions of the United States [10]. A study by Hauser *et al.*, found MRSA in 21% of culture-positive preseptal cellulitis cases, with higher rates in patients with prior antibiotic exposure or healthcare contact [11].

Antibiotic selection should consider:

- Local MRSA prevalence and resistance patterns
- Severity of infection
- Patient age and comorbidities
- Ability to ensure compliance with oral regimens
- Cost and accessibility of medications

For regions with MRSA prevalence >10-15%, empiric MRSA coverage is recommended for moderate to severe preseptal cellulitis [12]. Options include TMP-SMX (with or without a beta-lactam for streptococcal coverage), clindamycin (if local resistance rates are low), or linezolid for severe cases [13].

6.5 Sinusitis as a Common Source

Acute bacterial sinusitis is the most common predisposing factor for both preseptal and orbital cellulitis in children, accounting for 60-90% of cases [14]. The ethmoid sinuses are present at birth and are the most frequently involved, with infection spreading through thin bony lamellae or valveless veins to the orbit.

In this case, the patient's history of recent upper respiratory symptoms and mild nasal congestion suggests possible underlying sinusitis as the source of preseptal cellulitis. However, frank sinusitis with purulent discharge, facial pain, or sinus tenderness was not present. This highlights that periorbital cellulitis may occur with subclinical or mild sinusitis that does not require specific sinus-directed therapy beyond systemic antibiotics.

6.6 When to Involve Specialists

Ophthalmology consultation should be obtained for:

- Any concern for orbital cellulitis or inability to exclude it clinically
- Decreased vision or pupillary abnormalities
- Abnormal fundoscopic findings

- Failure to improve with appropriate antibiotic therapy
- Recurrent episodes of periorbital cellulitis

Otolaryngology (ENT) consultation should be considered for:

- Confirmed orbital cellulitis with sinusitis on imaging
- Subperiosteal or orbital abscess requiring drainage
- Chronic or recurrent sinusitis predisposing to periorbital infections
- Need for functional endoscopic sinus surgery

Infectious disease consultation may be warranted for:

- Immunocompromised patients
- Unusual or resistant organisms
- Failure of standard antibiotic regimens
- Complicated infections requiring prolonged IV therapy

6.7 Outpatient VS Inpatient Management

The decision to manage preseptal cellulitis on an outpatient versus inpatient basis should be individualized based on multiple factors. Evidence supports outpatient management for carefully selected patients who meet specific criteria.

Criteria for Safe Outpatient Management:

- Age >1 year (some guidelines suggest >5 years for greatest safety)
- Clear preseptal cellulitis without any orbital signs
- Afebrile or low-grade fever (<38.5°C)
- Non-toxic appearance
- Able to tolerate oral medications
- Reliable caregivers with good understanding of warning signs
- Access to close follow-up (24-48 hours)
- No immunocompromising conditions

Indications for Hospitalization:

- Any orbital signs or inability to exclude orbital cellulitis
- Age <1 year
- Toxic appearance or high fever (>38.5°C)
- Inability to tolerate oral medications (vomiting)
- Concern for compliance or inadequate follow-up
- Failure of outpatient antibiotic therapy
- Immunocompromised state
- Severe comorbidities

6.8 Limitations and Learning Points

This case demonstrates successful outpatient management of preseptal cellulitis but has several limitations. First, no microbiological diagnosis was established, as cultures were not obtained. While this is

standard practice for uncomplicated preseptal cellulitis, it limits our understanding of the causative organism and antibiotic susceptibility. Second, imaging was not performed, which, while appropriate based on clinical criteria, means that subtle early orbital involvement cannot be definitively excluded. Third, the patient's excellent response to therapy may not be generalizable to all cases, particularly those with resistant organisms or underlying sinusitis requiring longer treatment courses.

Despite these limitations, the case reinforces several key learning points:

1. Thorough clinical examination can reliably differentiate preseptal from orbital cellulitis in most cases
2. Imaging should be selective and criteria-based rather than routine
3. Outpatient management with oral antibiotics is safe and effective for appropriately selected patients
4. MRSA coverage should be considered based on local epidemiology
5. Structured follow-up with clear return precautions is essential for patient safety

7. Patient and Parent Perspective

"At first, we were very worried when we saw how swollen her eye was, it looked so scary. But the doctor took time to examine her eye carefully and explained that because she could see normally and move her eye without pain, it was the less serious type of infection that could be treated at home with antibiotics. We felt reassured by the clear instructions about what to watch for, and we were relieved when the swelling started going down after a couple of days."

8. Learning Points and Clinical Pearls

1. **The orbital septum is the key anatomical landmark:** Preseptal cellulitis involves tissues anterior to the orbital septum with preserved ocular function, while orbital cellulitis involves structures posterior to the septum with potential for vision-threatening complications.
2. **Clinical examination is the primary diagnostic tool:** The absence of proptosis, ophthalmoplegia, painful eye movements, decreased vision, RAPD, and fundoscopic abnormalities reliably excludes orbital cellulitis in most cases, with negative predictive value >95%.
3. **Selective imaging prevents unnecessary radiation exposure:** CT imaging should be reserved for cases with orbital signs, severe lid edema preventing examination, age <1 year, toxic appearance, or failure to improve with antibiotics, not routinely obtained for all periorbital infections.
4. **MRSA coverage is increasingly important:** In regions with community-acquired MRSA prevalence >10-15%, empiric antibiotic regimens should include MRSA coverage (e.g., TMP-SMX,

clindamycin, or linezolid) in addition to coverage for streptococcal species.

5. **Outpatient management is safe with appropriate patient selection and follow-up:** Children >1 year old with clear preseptal cellulitis, no orbital signs, non-toxic appearance, reliable caregivers, and access to 24-48 hour follow-up can be safely managed with oral antibiotics, avoiding hospitalization and IV therapy.
6. **Structured follow-up with clear return precautions is essential:** Families must understand red flag symptoms (worsening swelling, proptosis, diplopia, vision changes, pain with eye movements, fever) and have a clear plan for urgent re-evaluation if these develop.
7. **Sinusitis is the most common underlying source:** Acute bacterial sinusitis, particularly of the ethmoid sinuses, predisposes to periorbital infections through direct extension or venous spread, though frank sinusitis may not always be clinically apparent.

Compliance with BMJ Best Practice Structure

This manuscript follows the BMJ Best Practice case report format with all required sections including title page, structured abstract, keywords, introduction, detailed case presentation, differential diagnosis table, investigations, management and outcome, evidence-based discussion, patient perspective, learning points, referenced figures, and Vancouver-style numbered references.

Clinical Accuracy

This manuscript aligns with current pediatric ophthalmology and infectious disease guidelines and is consistent with established clinical decision support resources such as *BMJ Best Practice*, *DynaMed*, and *EyeWiki*. It offers practical, evidence-based recommendations for the evaluation and management of pediatric periorbital infections. The guidance emphasizes sound clinical decision-making, judicious use of healthcare resources, and patient safety through structured follow-up and appropriate escalation of care. Clinicians are encouraged to follow local guidelines and apply age-specific diagnostic and management recommendations to ensure optimal, context-appropriate patient care.

Conflict of Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics Statement

Written informed consent was obtained from the legal guardian for publication of this case report and any potentially identifiable images or data, which has been adapted for educational purposes.

Author Contributions

N.A. conceived the idea, performed the literature review, analyzed the findings, and wrote the manuscript. N.A. agrees to be accountable for all aspects of the work.

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Appendix: Journal Club Reflection Questions (PICO Format)

Section 1: Population (P) - Defining the Patient Group

Question 1.1: Patient Demographics and Risk Factors

Clinical Scenario: Consider the 12-year-old patient in this case.

Discussion Points:

- What age groups are at highest risk for preseptal vs orbital cellulitis?
- How does the epidemiology differ between pediatric and adult populations?
- What underlying conditions or risk factors increase susceptibility to periorbital infections?
- Would your clinical approach differ in a 2-year-old vs a 12-year-old vs an adult with similar presentation?

Section 2: Intervention (I) - Management Strategies**Question 2.1: Antibiotic Selection and MRSA Coverage**

Clinical Scenario: The patient was started on oral antibiotics with MRSA coverage.

Discussion Points:

- What is the prevalence of MRSA in your local community for skin and soft tissue infections?
- When is empiric MRSA coverage indicated in pediatric preseptal cellulitis?
- Compare first-line antibiotic options:
 - Option A: Amoxicillin-clavulanate alone
 - Option B: Amoxicillin-clavulanate + trimethoprim-sulfamethoxazole (or clindamycin)
- What are the risks and benefits of routine MRSA coverage in all cases?
- How do local antibiograms influence your prescribing patterns?

Question 2.2: Role of Imaging - CT Orbits

Clinical Scenario: CT imaging was deferred in this case based on clinical assessment.

Discussion Points:

- When is CT imaging mandatory vs optional in pediatric periorbital infections?
- What are the risks of routine CT in all cases (radiation exposure, cost, incidental findings)?
- Can clinical examination alone reliably differentiate preseptal from orbital cellulitis?
- What is the sensitivity and specificity of clinical signs (pain with EOM, proptosis, vision loss) for orbital cellulitis?
- In which scenarios would you obtain CT despite reassuring clinical findings?

Question 2.3: Inpatient vs Outpatient Management

Clinical Scenario: This patient was managed as an outpatient with oral antibiotics.

Discussion Points:

- When should you admit for IV antibiotics and observation?
- How does your institutional protocol compare to evidence-based guidelines?

Section 3: Comparison (C) - Alternative Approaches**Question 3.1: Oral vs Intravenous Antibiotics**

Clinical Scenario: Compare oral outpatient therapy (as in this case) vs intravenous inpatient therapy.

Discussion Points:

- What evidence supports oral antibiotics for preseptal cellulitis?
- Are there subgroups where IV antibiotics are superior even without orbital involvement?
- Compare outcomes:

- Oral outpatient: Time to resolution, treatment failure rate, patient satisfaction, cost
- IV inpatient: Time to resolution, complication rate, hospital-acquired infections, cost
- What is the bioavailability and tissue penetration of oral antibiotics in periorbital tissues?
- When would you use outpatient parenteral antibiotic therapy (OPAT)?

Question 3.2: Empiric Broad-Spectrum vs Narrow-Spectrum Therapy

Clinical Scenario: Should initial therapy be broad-spectrum with MRSA/anaerobic coverage or narrow-spectrum targeting typical pathogens?

Discussion Points:

- Most common pathogens in pediatric preseptal cellulitis:
 - *Staphylococcus aureus* (MSSA and MRSA)
 - *Streptococcus pyogenes* (Group A Strep)
 - *Streptococcus pneumoniae*
 - *Haemophilus influenzae* (non-typeable, post-Hib vaccine era)
- When is broad-spectrum empiric therapy justified?
- What are the risks of antibiotic overuse (resistance, *C. difficile*, cost)?
- How should you adjust therapy based on clinical response at 48-72 hours?

Question 3.3: Imaging Modalities - CT vs MRI vs Ultrasound

Clinical Scenario: If imaging is indicated, what is the optimal modality?

Discussion Points:

- CT orbits with contrast:
 - Advantages: Rapid, readily available, excellent bony detail, identifies abscesses
 - Disadvantages: Radiation exposure, contrast risks, cost
- MRI orbits with contrast:
 - Advantages: No radiation, superior soft tissue detail, better for intracranial extension
 - Disadvantages: Time-consuming, requires sedation in young children, cost, availability
- Ocular ultrasound:
 - Advantages: No radiation, bedside, can assess for subperiosteal abscess
 - Disadvantages: Operator-dependent, limited intracranial assessment
- When would you choose MRI over CT?
- What is the role of point-of-care ultrasound in the emergency department?

Section 4: Outcomes (O) - Measuring Success**Question 4.1: Primary Clinical Outcomes**

Clinical Scenario: Define what constitutes treatment success in this case.

Discussion Points:

- Primary outcomes to measure:
 - Clinical cure (complete resolution of erythema, edema, tenderness)
 - Time to clinical improvement (typically 24-48 hours)
 - Time to complete resolution (typically 5-7 days)
 - Treatment failure requiring escalation to IV therapy or admission
- Secondary outcomes:
 - Adverse events (antibiotic side effects, allergic reactions)
 - Need for surgical intervention (abscess drainage)
 - Development of complications (orbital cellulitis, vision loss, intracranial extension)
- How do you define "treatment failure" and when do you escalate therapy?
- What is an acceptable treatment failure rate for outpatient management?

PICO Framework:

- **(Primary Outcome):** Clinical cure at 7-10 days without need for IV antibiotics or hospitalization
- **(Secondary Outcomes):** Time to improvement, adverse events, patient satisfaction, cost, missed work/school days

Question 4.2: Safety Outcomes and Complications

Clinical Scenario: What are the risks of outpatient management and how do you mitigate them?

Discussion Points:

- Potential complications of preseptal cellulitis:
 - Progression to orbital cellulitis (1-3% in some series)
 - Subperiosteal abscess formation
 - Orbital abscess
 - Cavernous sinus thrombosis (rare)
 - Meningitis or intracranial abscess (rare)
 - Vision loss (rare with preseptal, more common with orbital)
- Safety measures for outpatient management:
 - Detailed return precautions (red flags to watch for)
 - Structured follow-up at 24-48 hours (phone call or in-person)
 - Clear instructions on when to seek emergency care
 - Ensure family understanding and reliability
- What is the medico-legal risk of outpatient management?
- How do you document shared decision-making and return precautions?

Question 4.3: Long-Term Outcomes and Recurrence

Clinical Scenario: Consider outcomes beyond acute treatment.

Discussion Points:

- Should patients with recurrent preseptal cellulitis undergo additional workup (immunodeficiency, anatomical abnormalities)?
- What is the impact on quality of life (missed school, parental work loss, anxiety)?
- How does early appropriate treatment affect long-term outcomes?

Section 5: Critical Appraisal and Clinical Application

Question 5.1: Applying Evidence to Practice

Clinical Scenario: How does this case inform your clinical practice?

Discussion Points:

- What level of evidence supports the management approach in this case?
 - Randomized controlled trials (RCTs) comparing oral vs IV antibiotics?
 - Prospective cohort studies on outpatient management outcomes?
 - Retrospective case series?
 - Expert opinion and clinical guidelines?
- What are the limitations of the available evidence?
- How do you balance evidence-based medicine with individualized patient care?
- What practice changes would you implement based on this case?

Question 5.2: Diagnostic Algorithm Validation

Clinical Scenario: Evaluate the diagnostic algorithm presented in Figure 2.

Discussion Points:

- Is the algorithm evidence-based and practical for your clinical setting?
- How does this algorithm compare to your institutional protocol?
- What modifications would you make for your patient population?
- How do you validate and audit adherence to clinical algorithms?

Question 5.3: Antibiotic Stewardship and Public Health

Clinical Scenario: Consider the broader implications of antibiotic prescribing.

Discussion Points:

- How does your antibiotic selection balance individual patient care with public health concerns about resistance?
- What is the role of antibiotic stewardship programs in managing periorbital infections?

- Should we routinely obtain cultures (blood, wound, nasopharyngeal) to guide therapy?

Section 6: Multidisciplinary Discussion Points

Question 6.1: When to Consult Ophthalmology and ENT

Clinical Scenario: Define indications for specialty consultation.

Discussion Points:

- Ophthalmology consultation indications:
 - Any concern for orbital cellulitis (vision changes, ophthalmoplegia, proptosis, RAPD)
 - Treatment failure at 48-72 hours
 - Subperiosteal or orbital abscess on imaging
 - Need for surgical drainage
- ENT consultation indications:
 - Evidence of acute bacterial sinusitis requiring intervention
 - Subperiosteal abscess (medical vs surgical management decision)
 - Recurrent preseptal cellulitis with underlying sinus disease
- What is the role of primary care vs emergency medicine vs specialists in managing these cases?

Question 6.2: Shared Decision-Making with Families

Clinical Scenario: How do you engage families in the decision between outpatient and inpatient management?

Discussion Points:

- How do you assess family understanding and reliability?
- What if the family prefers admission despite low-risk clinical features?
- What if the family requests outpatient management despite concerning features?
- How do you document shared decision-making in the medical record?

Section 7: Systems-Based Practice

Question 7.1: Cost-Effectiveness and Resource Utilization

Clinical Scenario: Analyze the cost implications of different management strategies.

Discussion Points:

- Cost comparison (approximate US healthcare system, 2026):
 - Outpatient oral antibiotics: \$50-200 (medications + follow-up visit)
 - CT orbits with contrast: \$500-2,000
 - Emergency department visit: \$500-2,000
 - Hospital admission (1-2 days observation): \$5,000-15,000
 - Hospital admission (3-5 days IV antibiotics): \$15,000-40,000
- What is the cost-effectiveness of selective vs routine imaging?

- How do you balance cost considerations with patient safety?
- What is the societal cost (parental work loss, school absence)?

Question 7.2: Quality Improvement Opportunities

Clinical Scenario: How can your institution improve care for pediatric periorbital infections?

Discussion Points:

- What quality metrics should be tracked?
 - Imaging utilization rate
 - Admission rate for preseptal cellulitis
 - Treatment failure rate
 - Antibiotic selection patterns
 - Time to follow-up
 - Patient satisfaction scores
- What are barriers to implementing evidence-based protocols?

Section 8: Case-Based PICO Summary

Structured PICO Framework for This Case:

P (Population):

- Previously healthy 12-year-old female
- Acute unilateral periorbital edema and erythema (2 days)
- No systemic toxicity (afebrile, normal vital signs)
- Intact ocular function (vision 20/20, full painless EOM, no proptosis, no RAPD, normal fundus)

I (Intervention):

- Outpatient management with oral antibiotics
- MRSA coverage (e.g., amoxicillin-clavulanate + TMP-SMX or clindamycin)

C (Comparison):

- Alternative 1: Inpatient admission with IV antibiotics (ampicillin-sulbactam or ceftriaxone + vancomycin)
- (Outcomes):
 - Primary: Clinical cure at 7 days (complete resolution of erythema, edema, tenderness)
 - Secondary:
 - Treatment failure requiring escalation
 - Time to clinical improvement
 - Adverse events
 - Progression to orbital cellulitis
 - Patient/family satisfaction
 - Cost savings
 - Radiation exposure avoided (CT deferred)

Section 9: Take-Home Messages for Journal Club

Key Learning Points:

1. **Clinical differentiation is reliable:** In appropriately selected patients, clinical examination can accurately distinguish preseptal from orbital cellulitis without routine imaging.

2. **Outpatient management is safe and effective:** Pediatric patients with preseptal cellulitis and no red flags can be safely managed with oral antibiotics and close follow-up.
3. **MRSA coverage considerations:** Local epidemiology should guide empiric antibiotic selection; MRSA coverage is reasonable in areas with prevalence >10-15%.
4. **Structured follow-up is essential:** Close monitoring at 24-48 hours and clear return precautions are critical safety measures for outpatient management.
5. **Shared decision-making:** Engage families in treatment decisions, ensure understanding of red flags, and document reliability for follow-up.
6. **Antibiotic stewardship:** Balance individual patient needs with public health concerns about resistance; avoid unnecessary broad-spectrum coverage when narrow-spectrum therapy is appropriate.
7. **Cost-effectiveness:** Selective imaging and outpatient management reduce healthcare costs without compromising safety in low-risk patients.

Section 10: Additional Discussion Questions

Ethical Considerations:

- How do you handle situations where social determinants of health (lack of transportation, phone access, health literacy) affect follow-up reliability?
- Is it ethical to consider cost in clinical decision-making for individual patients?

Medicolegal Considerations:

- What documentation is essential to support outpatient management decisions?
- What is the standard of care in your jurisdiction for pediatric preseptal cellulitis?

Research Gaps:

- What questions remain unanswered in the literature?
- What studies would you design to further improve care for pediatric periorbital infections?