



Management of Pediatric Orbital Cellulitis: Impact of Surgery and Corticosteroid Use on Clinical Outcomes

Pediyatrik Orbital Selülit Yönetimi: Cerrahi ve Kortikosteroid Kullanımının Klinik Sonuçlara Etkisi

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ABSTRACT

Objective: To evaluate the clinical characteristics, treatment approaches including surgical intervention and systemic corticosteroid use, and clinical outcomes in pediatric patients with orbital cellulitis treated at a tertiary referral center.

Methods: Medical records of pediatric patients (aged 0–18 years) diagnosed with orbital cellulitis and treated between January 2015 and January 2025 were retrospectively reviewed. Demographic data, clinical findings, laboratory results, imaging features, microbiological culture results, treatment modalities (medical, surgical, and corticosteroid therapy), and clinical outcomes were analyzed. Statistical analyses were performed using SPSS version 26.0. Continuous variables were expressed as mean \pm standard deviation or median [interquartile range (IQR)], and categorical variables as frequencies and percentages. A p -value ≤ 0.05 was considered statistically significant.

Results: Fifty-eight patients (58 eyes) were included: 26 (44.8%) were female and 32 (55.2%) were male. The mean age was 7.1 ± 4.52 years, with a median age of 6.8 years (IQR: 2.6–12.2). Thirty patients (51.7%) were managed with medical therapy alone, while 28 (48.3%) underwent surgical intervention. The mean age was significantly higher in the surgical group compared to the medical group (9.3 ± 6 vs. 6.5 ± 4.4 years, $p = 0.034$).

Subperiosteal abscesses were detected in 30 patients (51.7%), and 28 of these (93.3%) underwent surgical drainage. Abscesses were most commonly located at the medial orbital wall (73.3%). The overall surgical intervention rate was 48.3%. Mean hospital stay was significantly longer in the surgical group than in the medical group (8.8 ± 7.1 vs. 6.3 ± 3.2 days, $p = 0.028$). Systemic corticosteroids were administered to 24 patients (41.4%). Among surgically treated patients,

Öz

Amaç: Bu çalışmada üçüncü basamak sağlık merkezinde orbital selülit tanısıyla tedavi edilen pediyatrik hastalarda klinik özelliklerin, cerrahi müdahale ve sistemik kortikosteroid kullanımını içeren tedavi yaklaşımlarının ve klinik sonuçların değerlendirilmesi amaçlandı.

Yöntemler: Ocak 2015 ile Ocak 2025 tarihleri arasında orbital selülit tanısı alarak tedavi edilen pediyatrik hastaların (0–18 yaş) tıbbi kayıtları retrospektif olarak incelendi. Demografik veriler, klinik bulgular, laboratuvar sonuçları, görüntüleme özellikleri, mikrobiyolojik kültür sonuçları, tedavi yöntemleri (medikal, cerrahi ve kortikosteroid tedavisi) ve klinik sonuçlar analiz edildi. İstatistiksel analizler SPSS sürüm 26.0 kullanılarak gerçekleştirildi. Sürekli değişkenler ortalama \pm standart sapma veya medyan [çeyrekler arası aralık (IQR)] olarak, kategorik değişkenler ise sayı ve yüzde olarak ifade edildi. İstatistiksel anlamlılık düzeyi $p \leq 0,05$ olarak kabul edildi.

Bulgular: Çalışmaya 58 hasta (58 göz) dahil edildi; bunların 26'sı (%44,8) kadın, 32'si (%55,2) erkekti. Ortalama yaş $7,1 \pm 4,52$ yıl, medyan yaş ise 6,8 yıl (IQR: 2,6–12,2) idi. Otuz hasta (%51,7) yalnızca medikal tedavi ile izlenirken, 28 hastaya (%48,3) cerrahi müdahale uygulandı. Cerrahi grupta ortalama yaş, medikal gruba kıyasla anlamlı olarak daha yüksekti ($9,3 \pm 6$ vs. $6,5 \pm 4,4$ yıl, $p = 0,034$).

Subperiosteal apse 30 hastada (%51,7) saptandı ve bunların 28'ine (%93,3) cerrahi drenaj uygulandı. Apseler en sık medial orbital duvarda (%73,3) lokalizeydi. Genel cerrahi müdahale oranı %48,3 idi. Ortalama hastanede kalış süresi cerrahi grupta medikal gruba göre anlamlı olarak daha uzundu ($8,8 \pm 7,1$ vs. $6,3 \pm 3,2$ gün, $p = 0,028$). Sistemik kortikosteroid 24 hastaya (%41,4) uygulandı. Cerrahi uygulanan hastaların 20'si (%71,4) kortikosteroid tedavisi aldı. Kortikosteroid verilen ve verilmeyen cerrahi hastalar arasında hastanede kalış süresi

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ABSTRACT

20 (71.4%) received corticosteroids. No significant difference in hospital stay was found between corticosteroid-treated and untreated surgical patients (8.2 ± 4.1 vs. 8.0 ± 3.9 days, $p > 0.05$). Leukocyte levels significantly decreased after treatment in both groups; however, no significant difference was found between the medical and surgical groups in pre- or post-treatment leukocyte counts ($p > 0.05$). Culture positivity was detected in 11 of 28 surgically treated patients (39.3%). The most common microorganisms were *Streptococcus pyogenes* and *Streptococcus pneumoniae*. Visual acuity significantly improved postoperatively in surgically treated patients. Complications occurred in 3 patients (5.2%): one had osteomyelitis and two had subdural empyema.

Conclusion: In pediatric orbital cellulitis, subperiosteal abscess and older age were associated with an increased need for surgical intervention and a longer hospitalization. Leukocyte count alone was not a reliable predictor of treatment approach. Systemic corticosteroid use did not significantly reduce the length of hospital stay among surgically treated patients. Multidisciplinary management in tertiary centers remains essential for optimal outcomes.

Keywords: Orbital cellulitis, pediatric, subperiosteal abscess, surgical treatment, corticosteroids, sinusitis

Öz

açısından anlamlı fark saptanmadı ($8,2 \pm 4,1$ vs. $8,0 \pm 3,9$ gün, $p > 0,05$). Lökosit düzeyleri her iki grupta da tedavi sonrası anlamlı olarak azaldı; ancak medikal ve cerrahi gruplar arasında tedavi öncesi ve sonrası lökosit sayıları açısından anlamlı fark bulunmadı ($p > 0,05$). Kültür pozitifliği cerrahi tedavi uygulanan 28 hastanın 11'inde (%39,3) saptandı. En sık izole edilen mikroorganizmalar *Streptococcus pyogenes* ve *Streptococcus pneumoniae* idi. Cerrahi uygulanan hastalarda ameliyat sonrası görme keskinliğinde anlamlı iyileşme gözlemlendi. Üç hastada (%5,2) komplikasyon gelişti: birinde osteomyelit, ikisinde subdural empiyem saptandı.

Sonuç: Pediatrik orbital selülitte subperiosteal apse varlığı ve ileri yaş, cerrahi müdahale gereksinimi ve daha uzun hastanede yatış süresi ile ilişkili bulundu. Lökosit sayısı tek başına tedavi yaklaşımını öngörmeye güvenilir bir belirteç değildi. Sistemik kortikosteroid kullanımı, cerrahi uygulanan hastalarda hastanede kalış süresini anlamlı olarak azaltmadı. Optimal sonuçlar için üçüncü basamak merkezlerde multidisipliner yaklaşım önemini korumaktadır.

Anahtar Sözcükler: Orbital selülit, pediatrik, subperiosteal apse, cerrahi tedavi, kortikosteroid, sinüzit

INTRODUCTION

Preseptal and orbital cellulitis are common causes of hospital admission in the pediatric population, and orbital cellulitis requires careful evaluation because of its potential for life-threatening complications and vision loss. The orbital septum represents a critical anatomical boundary for distinguishing between these two clinical entities. Preseptal cellulitis refers to an infectious inflammation involving the soft tissues anterior to the orbital septum, whereas orbital cellulitis involves infectious inflammation of all tissues posterior to the septum (1-4). Early recognition of orbital cellulitis is crucial because of possible complications such as subperiosteal abscess, cavernous sinus thrombosis, subdural empyema, and leptomeningeal involvement (4,5).

Paranasal sinusitis is the most common etiological factor for orbital cellulitis; however, skin-derived infections, odontogenic infections, trauma, foreign bodies, exogenous factors, endogenous causes such as bacteremia, and ocular infections including endophthalmitis and dacryocystitis may also lead to orbital cellulitis (5,6).

The causative microorganism in orbital cellulitis is most reliably identified through microbiological culture of samples obtained during surgery. The most frequently isolated organisms are *Staphylococcus aureus* (*S. aureus*), *Streptococcus species*, and anaerobic bacteria (7,8). Due to geographical variability in the prevalence of methicillin-resistant *S. aureus* (MRSA), routine empirical coverage may not always be necessary; however, MRSA should be considered in patients with recent skin trauma or in cases resistant to treatment (4).

Management requires hospitalization, close monitoring, and a multidisciplinary approach. Treatment consists of broad-spectrum empirical parenteral antibiotics effective against *S. aureus* (including MRSA), streptococci, and gram-negative bacilli, and surgical intervention in cases with orbital abscess formation (2-4,7).

Routine use of glucocorticoids as adjunctive therapy in orbital cellulitis is not generally recommended. Although some oculoplastic surgeons advocate the adjunctive use of glucocorticoids, their clinical efficacy remains uncertain, and concerns exist that glucocorticoids may mask inflammatory signs and obscure disease progression.

MATERIALS AND METHODS

This retrospective cohort study reviewed the medical records of pediatric patients aged 0–18 years diagnosed with orbital cellulitis at our center from January 1, 2015, to January 1, 2025. In all patients, the clinical diagnosis and the presence of a subperiosteal abscess were confirmed by contrast-enhanced orbital computed tomography. Empirical antibiotic therapy targeting common pathogens, including MRSA, was initiated in accordance with national and international recommendations. A multidisciplinary team decided on surgical intervention in cases of subperiosteal abscess, inadequate response to medical therapy within 48–72 hours, or deterioration in visual function. Demographic characteristics, clinical findings, laboratory and imaging results, medical and surgical treatments, and treatment responses were evaluated. Patients with incomplete records were excluded.

Statistical analyses were performed using SPSS version 26.0 (Statistical Package for the Social Sciences). Continuous variables were expressed as mean \pm standard deviation or median [interquartile range (IQR)], and categorical variables as frequencies and percentages. The normality of continuous variables was assessed using the Kolmogorov–Smirnov test. Either Student's t-test or the Mann–Whitney U test was applied, as appropriate. Categorical variables were compared using the chi-square test or Fisher's exact test. A p-value ≤ 0.05 was considered statistically significant. Ethical approval was obtained from the Gazi University Faculty of Medicine Clinical Research Ethics Committee (approval number: E-77082166-604.01-1284873, date: 10.07.2025). The study was conducted in

accordance with the Declaration of Helsinki. Due to the retrospective design, informed consent was waived by the ethics committee.

RESULTS

Demographic and clinical characteristics of the patients are presented in Table 1. Fifty-eight eyes from who were 58 patients diagnosed with orbital cellulitis were included. Twenty-six patients (44.8%) were female and 32 (55.2%) were male. The mean age was 7.1 ± 4.52 years, with a median age of 6.8 years (IQR: 2.6–12.2). Thirty patients (51.7%) were managed with medical therapy alone, while 28 patients (48.3%) underwent surgical intervention. The mean age in the medical group was 6.5 ± 4.4 years, compared to 9.3 ± 6 years in the surgical group. The mean age of surgically treated patients was significantly higher than that of the medically treated patients ($p < 0.05$).

A comparison of demographic and clinical characteristics between the medical and surgical groups is shown in Table 2.

Evaluation of etiological factors revealed sinusitis in 38 patients (65.5%), odontogenic infection in 8 patients (13.8%), trauma in 6 patients (10.3%), skin barrier disruption due to insect bite in 2 patients (3.4%), conjunctivitis in 2 patients (3.4%), and skin infection in 2 patients (3.4%). All patients who developed a subperiosteal abscess had concomitant sinusitis.

Mean hospital stay for the entire cohort was 7.5 ± 5.4 days. The surgical group had a significantly longer hospital stay than the medical group (8.8 ± 7.1 vs. 6.3 ± 3.2 days, $p = 0.028$).

Table 1. Demographic and clinical characteristics of patients.

Variable	Entire cohort (n = 58)
Age (mean \pm SD), years	7.1 ± 4.52
Median age (IQR), years	6.8 (2.6–12.2)
Sex	
Female	26 (44.8%)
Male	32 (55.2%)
Presumed etiologic factors	
Sinusitis	38 (65.5%)
Odontogenic infection	8 (13.8%)
Trauma	6 (10.3%)
Skin barrier disruption due to insect bite	2 (3.4%)
Conjunctivitis	2 (3.4%)
-Skin infection	2 (3.4%)
Presence of subperiosteal abscess	30 (51.7%)

SD: Standard deviation, IQR: Interquartile range.

Table 2. Comparison of medical and surgical treatment groups.

Variable	Medical group (n = 30)	Surgical group (n = 28)	p-value
Age (mean \pm SD), years	6.5 ± 4.4	9.3 ± 6.0	<0.05
Length of hospital stay (days)	6.3 ± 3.2	8.8 ± 7.1	<0.05
Pre-treatment leukocyte count (/mm ³)	14,350	14,800	>0.05
Post-treatment leukocyte count (/mm ³)	6,440	8,530	>0.05

SD: Standard deviation.

A subperiosteal abscess was detected in 30 patients (51.7%). The localization distribution is presented in Table 3. Surgical intervention was performed in 28 of these patients (93.3%). The overall surgical rate in the cohort was 48.3%. The mean age of patients with subperiosteal abscess was 9.0 ± 4.5 years. Abscess localization was the medial wall in 22 patients (73.3%), medial + inferior wall in 4 (13.3%), the superior wall in 2 (6.7%), and the inferior wall in 2 (6.7%).

The mean pre-treatment leukocyte count was $14,350/\text{mm}^3$ in the medical group and $14,800/\text{mm}^3$ in the surgical group. Post-treatment leukocyte counts were $6,440/\text{mm}^3$ and $8,530/\text{mm}^3$, respectively. Although leukocyte levels decreased markedly in both groups, no significant differences were found between groups in baseline or final leukocyte counts ($p > 0.05$), indicating that peripheral leukocyte count was not a discriminative predictor of treatment modality.

Culture positivity was detected in 11 of 28 surgically treated patients (39.3%). Overall culture positivity was 19.0%. The isolated microorganisms were: *Streptococcus pyogenes* (27.3%), *Streptococcus pneumoniae* (27.3%), *S. aureus* (18.2%), *Neisseria meningitidis* (9.1%), *Haemophilus influenzae* (9.1%), and *Streptococcus anginosus* (9.1%).

Antibiotic regimens included ampicillin/sulbactam plus clindamycin in 28 patients (48.3%), vancomycin in 8 patients (13.8%), teicoplanin in 6 patients (10.3%), piperacillin/tazobactam in 3 patients (5.2%), ampicillin/sulbactam alone in 6 patients (10.3%), clindamycin in 3 patients (5.2%), ceftriaxone in 3 patients (5.2%), and ceftazidime in 1 patient (1.7%).

Systemic corticosteroids (1–2 mg/kg/day) were initiated in 24 patients (41.4%) at a mean of 4.01 ± 1.2 days after starting antibiotics. No significant difference in hospital stay was observed between patients receiving corticosteroids and those who did not (8.2 ± 4.1 vs. 8.0 ± 3.9 days, $p > 0.05$). Among surgically treated patients, 20 (71.4%) received adjunctive corticosteroids and 8 (28.6%) did not. In

Table 3. Characteristics of subperiosteal abscesses.

Characteristic	n (%)
Presence of subperiosteal abscess	30/58 (51.7%)
Surgically treated	28/30 (93.3%)
Abscess location	
Medial wall	22 (73.3%)
Medial + inferior wall	4 (13.3%)
Medial + superior wall	2 (6.7%)
Inferior wall	2 (6.7%)
Mean age (years)	9.0 ± 4.5

this subgroup, corticosteroid use did not significantly affect length of hospital stay ($p > 0.05$).

In 18 surgically treated patients, visual acuity was assessed preoperatively and on postoperative day 1 and postoperative week 1. Mean visual acuity (logMAR) improved from 0.42 ± 0.30 preoperatively to 0.30 ± 0.20 on day 1 and 0.18 ± 0.15 at week 1. Visual acuity at week 1 showed a significant improvement compared with preoperative values ($p = 0.01$).

Complications occurred in 3 patients (5.2%): osteomyelitis in 1 (1.7%) and subdural empyema in 2 (3.4%).

DISCUSSION

Orbital cellulitis is a common pediatric condition that may lead to life-threatening complications. This single-center study evaluated the epidemiological, clinical, and laboratory characteristics and the medical and surgical treatment strategies in patients with orbital cellulitis. The mean patient age (7.1 ± 4.52 years) was consistent with previously reported series (4,8,9).

Paranasal sinus infection—particularly ethmoid sinusitis—is the most frequent etiological factor in orbital cellulitis (4,6,10-13). In our study, sinusitis was present in 65.5% of patients, consistent with rates reported in the literature (60–90%) (8,14). Odontogenic, traumatic, and skin-derived infections were less common, showing distributions similar to published data (6,13). The presence of sinusitis in all patients with subperiosteal abscess supports the pivotal role of paranasal sinus infection in orbital complications (7,15,16). The frequent coexistence of maxillary and ethmoid sinusitis (63.2%) aligns with prior studies reporting ethmoid sinus as the most commonly involved sinus due to its anatomical proximity to the orbit (8,14).

The mean age was significantly higher in the surgical group. Previous studies indicate that younger children respond better to medical therapy, whereas older children more frequently require surgery (11,12). Age-related anatomical changes in sinus ostia and increasing anaerobic infection risk may contribute to more complex infections and reduced response to medical therapy (11,12). Consistent with prior reports, our findings confirm increasing surgical requirement with advancing age (11,17).

The hospital stay was significantly longer for surgically treated patients, consistent with prior series (12). However, unlike some studies, we found no significant difference in leukocyte counts between treatment groups, suggesting that leukocyte level alone may not reliably predict disease severity or surgical need (13-16).

Culture positivity was higher in surgically drained cases, supporting the diagnostic value of surgical sampling. Isolated microorganisms predominantly included *Streptococcus* and *Staphylococcus* species, consistent with existing literature (7,8,14). The relatively low overall culture positivity rate may be attributable to antibiotic treatment prior to referral.

The surgical intervention rate (48.3%) was near the upper range reported in the literature, which likely reflects referral of more severe cases to our tertiary center and the availability of multidisciplinary orbital and ear, nose and throat surgical management.

Subperiosteal abscesses were most commonly located along the medial wall, consistent with previous reports. Superior wall abscesses, considered high-risk for intracranial spread, were surgically treated in all affected patients (15).

Adjunctive systemic corticosteroids did not reduce the length of hospital stay in either the overall cohort or the surgically treated subgroup. These findings align with pediatric series evaluating steroid use and outcomes; evidence remains inconsistent across studies (18-22).

Study Limitations

The retrospective design resulted in non-standardized treatment protocols and incomplete data in some records. The single-center tertiary-care setting may have introduced selection bias toward more severe cases, limiting generalizability. Additionally, variability in the timing and indications for corticosteroid initiation hindered the standardized evaluation of steroid efficacy.

CONCLUSION

Subperiosteal abscess and older age predict increased surgical need and longer hospitalization in pediatric orbital cellulitis. Leukocyte count alone is insufficient to guide treatment decisions. Systemic corticosteroids do not significantly shorten hospital stay in surgically treated patients. Multidisciplinary care remains essential.

Ethics

Ethics Committee Approval: Ethical approval was obtained from the Gazi University Faculty of Medicine Clinical Research Ethics Committee (approval number: E-77082166-604.01-1284873, date: 10.07.2025). The study was conducted in accordance with the Declaration of Helsinki.

Informed Consent: Due to the retrospective design, informed consent was waived by the ethics committee.

Footnotes

Authorship Contributions

Surgical and Medical Practices: B.T., O.K., Concept: B.T., O.K., Design: B.T., O.K., Data Collection or Processing: B.T., O.K., Analysis or Interpretation: B.T., O.K., Literature Search: B.T., O.K., Writing: B.T., O.K.

Conflict of Interest: No conflict of interest was declared by the authors.

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