RESEARCH PAPER

Orbital Cellulitis in a Pediatric Population - Experience From a Tertiary Center

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From the ¹Department of Pediatrics C, ²Ophthalmology Unit, and ³Otolaryngology (Ear, Nose and Throat) Unit, Schneider Children's Medical Center of Israel, Petah Tikva, Israel; and ⁴Sackler Faculty of Medicine, Tel Aviv University, Tel Aviv, Israel.

Correspondence to: Dr Noa Tal Shifman, Department of Pediatrics C, Schneider Children's Medical Center of Israel, Petah Tikva, Israel. noatal10@gmail.com Received: April 23, 2021; Initial review: June 06, 2021; Accepted: August 03, 2021. **Objective**: To describe our experience in treating children afflicted with orbital cellulitis. **Methods**: A retrospective analysis of hospital records of children afflicted with orbital cellulitis was conducted between 2005-2018. Clinical, laboratory and radiology characteristics as well as management, microbiological data, and outcomes were collected. **Results**: Of the 94 patients, painful restriction of ocular motility was observed in 37.2% and proptosis in 34%, whereas, only 18% of the children presented with both classical signs. Children aged older than 9 years presented with markedly elevated inflammatory markers i.e., leukocytosis and C-reactive protein (CRP). Only a minority (12, 12.4%) required functional endoscopic sinus surgery. **Conclusion**: Our data support the general approach that orbital cellulitis should be initially managed conservatively with close monitoring; since, only a minority of patients require surgical intervention.

Keywords: Management, Subperiosteal abscess, Streptococcus, Surgery.

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rbital cellulitis, an inflammation of the postseptal tissue of the eye, is more prevalent in the pediatric population, and is considered a serious medical condition with potential lifethreatening complications, ocular as well as intracranial. In most cases, the infection results mostly from sinus disease. Worldwide, pediatric centers differ in their diagnostic and clinical practice, consequently, practice guidelines for the management in children are lacking [1]. Although, several studies have endeavored to outline criteria for surgical management, the majority have only been small case series [2,3]. Therefore, we share our tertiary center's experience in treating a relatively large cohort of children with orbital cellulitis in order to discover the specific population who could benefit from one approach over the other.

METHODS

This review of hospital records was conducted at the Schneider Children's Medical Center of Israel, the largest pediatric hospital in Israel. Medical records of all previously healthy hospitalized children between January 1, 2015 and 31 December, 2018 were included. Orbital cellulitis was defined as any clinical sign of orbital involvement, proptosis, painful extraocular motion, ophthalmoplegia, visual impairment or chemosis, and/or post-septal inflammation observed on computed tomo-graphy (CT) [4]. Children were excluded due to any anatomic defects of the orbit or known chronic medical

history. For each enrolled case, demographic, clinical, laboratory, microbiology and imaging data were obtained. Broad coverage with beta-lactam antibiotics (mainly, second and third generation cephalosporin) and clinda-mycin was initiated. Imaging studies were performed in cases of severe manifestation or suspected complications.

The study was approved by the institutional Helsinki committee and our institutional review board.

Statistical analysis: All analyses were performed using the IBM-SPSS program (IBM Corp.) Version 22.0. Chi-square test and one way ANOVA were used for the analysis. A *P* value of <0.05 was considered statistically significant in the regression analysis.

RESULTS

During the study period, we treated 94 cases (62 males) of orbital cellulitis, all unilateral. Mean age at presentation was 5.6 years (range: 9 months-16 years). At presentation, fever >38 °C (72.3%) and nasal congestion (20.2%) were most commonly recorded (**Table I**). Interestingly, fever was significantly more common in younger than 9 year children compared to older children (P<0.05). Clinically, whereas, all children presented with periorbital edema, a painful restriction of ocular motility was observed in 37.2% and proptosis in 34%. Only 17 (18%) children presented with both classical signs (proptosis and pain in ocular motility). The

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average white blood cell count (WBC) was 14.7×10^{9} /L (range: $4.4-35 \times 10^{9}$ /L) and C-reactive protein 9.2 mg/dL (range 0.06-35 mg/dL). The levels of acute phase reactants were significantly higher in the younger children (**Table I**). In 57 (60.6%) of the cases, sinusitis was observed either by an ENT examination or imaging. Of the 94 cases, 67 (68%) had undergone a CT (35 at admission and 34 during hospitalization); two children underwent a second CT during hospitalization. Of these, 30 (44.7%) were diagnosed with a subperiosteal abscess.

Seven children, out of the 12 who had undergone functional endoscopic sinus surgery (FESS), demons-trated positive cultures with Group A streptococcus. An analysis of these patients showed no correlation between any of the clinical, laboratory or imaging findings, inclu-ding the presence of a subperiosteal abscess and surgical intervention. To date, all of the children have fully recovered.

DISCUSSION

Our study examined the clinical presentation and outcomes of a relatively large cohort of pediatric orbital cellulitis cases presented to a large affiliated center. In accordance with previous studies [5-7], our data supports the finding that sinusitis is a major preceding cause of orbital cellulitis in children. Of interest, in our study, pansinusitis was the

 Table I Demographic and Clinical Characteristics of Pediatric Patients With Orbital Cellulitis (N=94)

Characteristic	All patients	Age < 9y $n = 70$	Age≥9 y n=24
Male	62 (65.9)	46 (65.7)	16 (66.7)
Fever>38°C	68 (72.3)	59 (84.3)	9 (37.5)
Previous antibiotic treatment	19 (20.2)	16 (22.8)	3(12.5)
Length of hospital stay (d) ^c	8.63 (3.1)	8.61 (3.0)	8.7(3.6)
Symptoms			
Nasal congestion	19 (20.2)	11 (15.7)	8(33.3)
Headache	16 (17)	10(14.3)	6(25)
Examination findings			
Redness/swelling of eyelid	94 (100)	70 (100)	24 (100)
Limitation/pain in eye movement	35 (37.2)	24(34.2)	11 (45.8)
Proptosis	32 (34)	25 (35.7)	7 (29.1)
Laboratory markers ^b			
Leukocytosis >15×10 ⁹ /L ^a	38 (40)	32 (45.7)	6(25)
$CRP > 10 \text{ mg/dL}^a$	33 (35.1)	28 (40)	5 (20.8)
Imaging findings	(<i>n</i> =67)	(n=47)	(n=20)
Cellulitis and/or sinusitis	37 (55.2)	25 (53)	12(60)
Subperiosteal abscess	30 (44.7)	21(44.7)	9 (45)

Values in no. (%) or ^cmean (SD). $^{a}P<0.05$ for comparison between the two age groups. $^{b}before/at$ presentation.

leading diagnosis comparable to other studies [7], and the classic presenting symptoms of orbital cellulitis were seen in only 18% children.

Severe ocular presentation remain a classic indicator for surgery [6], nevertheless, previous studies have reported other risk factors for a more severe disease. Rudloe, et al. [8] found that proptosis, pain with external ocular movement, and ophthalmoplegia were associated with a more serious disease and presence of an abscess [8]. Yet, 50.5% of our patients afflicted with an abscess, did not experience these symptoms. We believe that in addition to these signs, a clinical evaluation with a high index of suspicion is warranted, especially in cases of periorbital edema which often limits the physical exam. In these suspected cases, a CT examination should be considered [9,10]. Our rate of CT scans is similar to a large US-based multicenter observational study reporting a median CT scan rate of 74.7% [11]. At present, no universal imaging protocol exists [12]. We believe that a CT scan should be reserved for those pediatric patients where the results would assist in determining a change in medical treatment from antibiotic treatment only to surgical intervention. Other reasons for contemplating imaging studies is the inability to perform a complete eye evaluation, proptosis, ophthalmoplegia, pain with external ocular movement, deteriorating visual acuity or central symptoms (i.e. seizures, focal neurologic deficits, or altered mental status) [10-12].

At our center, the children diagnosed with orbital cellulitis were treated with a combination of intravenous 2nd/ 3rd generation cephalosporins and clindamycin, considering the local prevailing organisms [13,14].

In the past, orbital cellulitis was considered a surgical disease, especially in the presence of a subperiosteal or intraorbital abscess, necessitating immediate surgical drainage in addition to antibiotic therapy [15]. Surgical intervention was required for only the minority of our described cases. Interestingly, no clinical findings or laboratory markers had predicted which patients would require an intervention, including age, as had been previously described [16]. When reviewing each specific case, 10 out of the 12 children showed clinical and laboratory deterioration (eye examination and laboratory results). Overall, our data support the general approach that orbital cellulitis in children should be initially conservatively managed. Closely monitoring this treatment protocol is essential since a minority of patients who fail to respond to empiric therapy can rapidly deteriorate, and develop complications as previously described [17,18].

Our study has several limitations. Firstly, its retrospective nature. Secondly, due to the relatively rarity of orbital cellulitis, the number of children enrolled in the study

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WHAT THIS STUDY ADDS?

• Orbital cellulitis in children can be successfully managed with a conservative approach, and only a minority of patients requires surgical intervention, if they show no improvement in clinical and laboratory parameters.

was limited. Nonetheless, this is still one of the largest pediatric cohorts reported. Furthermore, the fact that the study occurred in one large affiliated center gave us the opportunity to observe trends which might change over time. Although, strong recommendations regarding proper surgical interventions were not presented due to the small number of cases requiring surgical intervention, our study stresses the importance of proper management and close monitoring of pediatric cases.

We believe, that most children diagnosed with orbital cellulitis can be managed conservatively, with only a few requiring surgical intervention. Pediatricians as well as ear, nose and throat physicians and ophthalmologists should be aware of every aspect of this uncommon but, nevertheless, serious medical condition. Larger prospective studies are essential in order to update our knowledge and find the optimal management for each child.

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