Evaluation of patients with orbital infections

Deniz Aygün¹, Cezmi Doğan², Mustafa Hepokur², Osman Şevki Arslan², Haluk Çokuğraş¹, Yıldız Camcıoğlu¹

¹Istanbul University, Cerrahpaşa Medical Faculty, Department of Pediatrics, Division of Immunology-Allergy and Infectious Diseases, Istanbul, Turkey

²Istanbul University, Cerrahpaşa Medical Faculty, Department of Ophthalmology, Istanbul, Turkey

Cite this article as: Aygün D, Doğan C, Hepokur M, Arslan OŞ, Çokuğraş H, Camcıoğlu Y. Evaluation of patients with orbital infections. Turk Pediatri Ars 2017; 52: 221-5.

Abstract

Aim: Orbital tissue infections are common infections of childhood that can lead to severe complications. Herein, we aimed to evaluate the etiologic factors, diagnosis, follow-up, and treatment procedures in pediatric patients with orbital infections.

Material and Methods: This study was performed retrospectively between January 2014 and December 2015 in Cerrahpaşa Medical Faculty Pediatric Infectious Disease Unit. Patients were studied for age, ophthalmologic examination features, laboratory and radiology results, treatment modalities, and the response to these treatments.

Results: Thirty-six patients (21 males, 15 females) with an average age of 71.43±42.24 months (5-168 months) participated in the study in the two-year period. Thirty-two patients (88.9%) had preseptal cellulitis, and four (11.9%) had orbital cellulitis. All patients had eyelid

hyperemia, edema, and ocular pain, with chemosis in seven and proptosis in four cases. Twenty-five patients were admitted with fever. All cases were unilateral and 44.4% occurred secondary to paranasal sinusitis. All cases were treated with intravenous cefazolin-amikacin. The mean of duration of hospitalization was 12.02±8.75 days (range, 3-28 days) and the duration of parental antibiotics was 12.83±8.18 days (range, 7-21 days). All patients recovered without any vision loss, only one patient experienced subdural empyema complicating preseptal cellulitis.

Conclusions: Most orbital tissue infections occur secondary to paranasal sinusitis in childhood. Orbital tissue infections can be complicated by brain abscess, cavernous sinus thrombophlebitis, and vision loss. Early diagnosis and proper antibiotic treatment are essential to prevent these life-threatening complications.

Keywords: Preseptal cellulitis, orbital cellulitis, sinusitis

Introduction

Orbital tissue infections are a significant clinical condition that affects the orbital tissues and adnexal structures of the eye and may lead to life-threatening complications. The orbital septum is a significant anatomic structure in the definition and evaluation of orbital infections. The orbital septum is a thin fibrous tissue, which is attached to the orbital base margins and separates the tissues inside the orbit and the palpebral soft tissues from each other. Infection of the tissues in front of the orbital septum is called preseptal cellulitis, whereas infection of the tissues behind the septum is defined as orbital cellulitis (1-3). Infections may develop as a result of regional invasion of pathogenic agents in the adjacent tissues, sinuses, and nasopharynx, trauma, surgical intervention, blood-borne

infections or dental infections. If early treatment is not initiated, preseptal cellulitis can easily progress to orbital cellulitis and lead to conditions and complications with high mortality rates including meningitis, brain abscess, and cavernous sinus thrombosis, because it is connected to the spaces in the middle part of the septum and cranial veins of the orbital venous system (4, 5).

Patients presenting with signs of orbital tissue infection should be hospitalized, and broad-spectrum antibiotic treatment should be initiated immediately after laboratory and imaging tests directed to the agent and clinical findings are ordered.

In this study, we aimed to evaluate the etiologic factors and diagnostic, follow-up, and therapeutic methods in

Address for Correspondence: Deniz Aygün E-mail: fdenizaygun@gmail.com

Received: 28.02.2017

Accepted: 20.06.2017

©Copyright 2017 by Turkish Pediatric Association - Available online at www.turkpediatriarsivi.com

DOI: 10.5152/TurkPediatriArs.2017.5511

patients who were hospitalized and treated with a diagnosis of orbital tissue infection in our clinic.

Material and Methods

The medical records of patients who were hospitalized in the Pediatric Infectious Diseases Ward in Istanbul University, Cerrahpaşa Medical Faculty, between January 2014 and December 2015 because of orbital infection were examined retrospectively. The patients were evaluated in terms of age, ophthalmic findings, infectious markers, laboratory and imaging results, predisposing factors, treatments administered, hospitalization period, treatment outcomes, and complications. Ophthalmic examinations were performed by the Ophthalmology Clinic in our Faculty. Infection limited to the tissues in the anterior part of the orbital septum and to the palpebrae was defined as preseptal cellulitis, whereas infections behind the orbital septum were considered orbital cellulitis. The study was approved by Istanbul University, Cerrahpaşa Medical Faculty Local Ethics Committee (Project number: 162181). Written informed consent was obtained from the patients' parents for the objective of using the clinical and laboratory data.

Statistical Analysis

Statistical analysis was performed using the SPSS 20.0 for Windows program in this study. In the statistical analyses, the Shapiro-Wilk test was used to determine if the data were compatible with normal distribution. Descriptive values are expressed as mean±standard deviation (SD) and minimum-maximum values.

Results

Preseptal cellulitis was found in 32 (88.9%) of 36 patients who were hospitalized and treated with a diagnosis of orbital tissue infection between January 2014 and December 2015, and orbital cellulitis was found in four (11.9%). Fifteen (41.7%) of the patients were female and 21 (58.3%) were male. The mean age was 71.43±42.24 months (range, 5-168 months). In all of these patients, redness, swelling, and pain were present in the eye. These symptoms were accompanied by chemosis (edema in the conjunctiva) in seven patients and by proptosis (forward shifting of the eye caused by any space-occupying formation in the orbit) in four patients. Orbital cellulitis was present in all patients with proptosis. The patients with chemosis were as-

sessed using computerized tomography (CT); three patients were diagnosed as having preseptal cellulitis and four patients were diagnosed as having orbital cellulitis.

At presentation, the mean axillary temperature was found as 37.82±0.93°C (range, 36-39°C). The mean white blood cell count value was found as 13,130±5039 /mm³ (range, 4500-28,700 /mm³), 7788±4383 /mm³ for neutrophils, 11.75±4.5 g/dL (range, 9.2-13.7 g/dL) for hemoglobin, 346,688±84,864 /mm³ (range, 189,000±635,000 /mm³) for platelets, 46.77±2.42 mm/h (range, 12-108 mm/h) for erythrocyte sedimentation rate (ESR) and 9.27±8.85 mg/dL (range 1.8-22.4 mg/dL) for C-reactive protein (CRP). Our patients were evaluated in terms of immune deficiency and their immunoglobulin values were found to be age-appropriate. Orbital assessment was performed using CT in 24 patients who had findings suggesting orbital tissue infection on physical examination and could not undergo efficient ophthalmologic examination because of young age.

The predisposing factor for preseptal and orbital cellulitis was found to be sinusitis in 16 (44.4%) patients, upper respiratory tract infection in nine (25%), conjunctivitis in four (11.1%), dental abscess in four (11.1%), and insect bite in one patient (2.7%). In addition, one (2.7%) patient was being followed up and underwent surgery in the ophthalmology clinic because of retinal degeneration, and one (2.7%) patient was being followed up and underwent surgery because of a nasolacrimal duct obstruction. Intravenous cefazolin and amikacin treatment was initiated in all our patients.

The mean hospitalization period was found as 12.02±8.75 days (range, 3-28 days) and the mean period of parenteral antibiotic use was 12.83±8.18 days (range, 7-21 days). When the clinical conditions of our patients improved, oral treatment was initiated and antibiotic treatment was administered for a total period of 15.19±7.7 days (range, 10-21 days). Thirty-five of 36 patients who had a diagnosis of orbital tissue infection were treated with intravenous cefazolin and amikacin and no complications occurred. One patient developed subdural empyema following preseptal cellulitis that developed after sinusitis. This patient was referred to our hospital for continuance of antibiotic treatment from another center where surgical intervention was performed and neurologic sequela did not develop after treatment.

Discussion

Orbital tissue infections are significant clinical conditions that occur more frequently in the childhood age group compared with adulthood, and may lead to complications that threaten vision and life. Orbital tissue infections are not as rare in children as presumed and some studies have reported 0.3-1.31 hospital admissions monthly (6). They most commonly occur between the ages of four months and 16 years (the mean age has been reported as 5.8 years) (7, 8). The ages of our patients ranged between five months and 14 years, similar to the literature, and the mean age was found as 71.43 ± 42.24 months.

Among the orbital tissue infections, preseptal cellulitis occurs more frequently compared with orbital cellulitis (9, 10). In the series published by Jackson et al. (11), preseptal cellulitis was found with a rate of 72%, whereas orbital cellulitis was found at a rate of 28%. In our study, preseptal cellulitis was present in 32 (88.9%) of 36 patients and orbital cellulitis was found in only four patients.

In preseptal cellulitis, patients generally present with sudden-onset redness, swelling, eye pain, and fever. Clinical findings including limitation in eye movements, pain, reduced vision, proptosis, and diplopia should suggest orbital cellulitis, which is an infection of the tissues behind the orbital septum. Although chemosis is observed in patients with severe preseptal cellulitis, it is generally a finding of orbital cellulitis (11, 12). All our patients had redness, swelling, and eye pain at presentation; chemosis accompanied these symptoms in seven patients and proptosis accompanied in four patients. Chemosis was found in three (9.3%) patients who had preseptal cellulitis. In the literature, chemosis has been reported with a rate of 13.4-14% in preseptal cellulitis (11). Proptosis was found on physical examination only in the patients who had orbital cellulitis.

It has been shown that paranasal sinusitis is responsible for 60-91% of orbital infections (13). Orbital cellulitis in children mostly emerges as a complication of sinusitis because the orbital septum is a very significant barrier against bacteria. Especially in ethmoidal sinusitis, invasion from the lamina papricea and ethmoidal air spaces into the periorbital area occurs easily. The fact that the structure of the orbital venous system is different compared with the other venous circulation also enhances spread of infections. The venous drainage of the para-

nasal sinuses and the middle part of the face is connected with the pterygoid and cranial venous system via the orbital venous system. The absence of valves in the orbital venous system also enables upgrading or downgrading of infections (14, 15). Although the most important risk factor for the development of orbital cellulitis is paranasal sinusitis, any infection including conjunctivitis, dacryoadenitis, and hordeolum or trauma in the eye and adjacent tissues may lead to preseptal cellulitis. In a study conducted by Ambati et al. (10) in which 315 children with orbital tissue infections (297 patients with preseptal cellulitis and 18 patients with preseptal cellulitis) were examined retrospectively, paranasal sinusitis was reported as a predisposing factor in all patients with orbital cellulitis and in 44 of the patients with preseptal cellulitis. In all our patients with orbital cellulitis, the most common predisposing factor was found to be paranasal sinusitis. Kanra et al. (16) from our country reported that 43% of cases of orbital tissue infection developed secondary to sinusitis. Again, Çiftçi et al. (17) reported that infections developed following paranasal sinusitis with a rate of 65% in a study in which 20 patients were evaluated. Ferguson et al. (18) reported that the frequency of orbital tissue infections showed seasonal variance and patients presented more frequently in winter months during which upper respiratory tract infections are observed frequently. In our study, infection followed sinusitis in 16 (44.4%) of 36 patients, upper respiratory tract infection in nine (25%), conjunctivitis in four (11.1%), dental abscess in four (11.1%), and insect bite in one (2.7%). One (2.7%) patient was being followed up because of retinal degeneration and underwent surgery in our ophthalmology clinic, and another patient (2.7%) was being followed up and underwent surgery because of a nasolacrimal duct obstruction.

Any microorganism that causes acute or chronic sinusitis may lead to periorbital or orbital cellulitis. The most commonly isolated agents include *Staphylococcus aureus*, *Streptococcus pyogenes*, *Hemophilus influenzae*, *Streptococcus pneumoniae*, and anaerobic bacteria (19).

Streptococcus pneumoniae and *Hemophilus influenzae* type B (Hib) generally lead to orbital tissue infections in relation with bacteremia. With administration of conjugated Hib vaccine, Hib-related orbital tissue infections have reduced in parallel with the reduced frequency of invasive Hib disease. Currently, the main causative agent in orbital infections in childhood is *Streptococcus pneumoniae*. In cases developing after trauma in which

skin integrity is disrupted, the most common causative agents include *S. aureus* and *S. pyogenes*. In a study in which 38 patients were evaluated, growth was found in surgical drainage culture in 22 patients who developed abscess (20). The most commonly isolated agent was found to be *S. aureus* and methicillin resistance was found with a rate of 36%. *Streptococcus* species were found to be the second most common causative agent. Although the rate of isolation of microorganisms in blood culture is very low, blood culture should be obtained in all patients who are hospitalized because of orbital tissue infection. Blood culture was obtained in all our patients and growth was not found in the cultures. Ocular discharge culture or nasopharyngeal swab cultures may be obtained, but they are not helpful in specifying the causative agent. Sinus aspirate or orbital abscess drainage cultures are more reliable. Drainage cultures could not be sent in our patient who developed subdural empyema because surgical intervention was performed in another center and the other patients did not develop complications that required surgical intervention.

Although laboratory findings are helpful in the diagnosis, they are not very directive in the differential diagnosis. Infectious markers were found to be positive in most of our patients.

Imaging methods are considerably helpful in the diagnosis of orbital tissue infections and in the differentiation of preseptal/orbital cellulitis. Computerized tomography (CT) is frequently preferred, especially for showing the orbital bone structure. However, it is controversial to perform CT imaging for each child with a suspicion of preseptal cellulitis. Orbital assessment with CT should be performed in patients who have physical examination findings suggestive of orbital cellulitis including limitation in eye movements, pain, reduction in visual acuity, proptosis, and ophthalmoplegia, whose ophthalmologic examination cannot be performed efficiently because of young age and who do not respond to parenteral antibiotic treatment. In addition, CT should also be performed when necessary because it shows the presence of complications including orbital abscess and subperiosteal abscess and accompanying sinusitis (21, 22). Magnetic resonance (MR) is preferred for the assessment of soft tissues in terms of cavernous sinus thrombosis. In our study, assessment with CT was performed in 20 of 36 patients because of the presence of suspicious orbital cellulitis and the inability to perform efficient physical examination due to young age.

Presence of paranasal sinusitis was shown with CT in 16 of 20 patients. MR imaging was performed before and after treatment in our patient who developed subdural empyema.

There is no definite treatment protocol for the treatment of preseptal and orbital cellulitis. Treatment is initiated empirically because blood cultures are generally negative and it is difficult to obtain samples for culture from the area of infection. Although some authors argue that children older than one year who do not have toxic findings might be treated with oral antibiotics without hospitalization, all patients should be hospitalized and broad-spectrum parenteral antibiotic treatment directed to aerobic and anaerobic microorganisms should be initiated because it is difficult to clinically differentiate preseptal cellulitis from orbital cellulitis and because of potential complications (12, 23). In adult and pediatric patients, a first-generation cephalosporin and amikacin combination is used frequently. We used cephazolin and amikacin in all our patients and no complications developed in our patients. Use of clindamycin, which is known to have a high level of anaerobic efficiency and a high level of penetrance into the soft tissue, is recommended, especially for the treatment of preseptal cellulitis. However, its use is limited because of antibiotic-related colitis (24). The patient who had subdural empyema had a history of using ampicillin-sulbactam in the stage of preseptal cellulitis. It has been reported that good results can be obtained with ampicillin-sulbactam in the treatment of orbital tissue infections, but we think that the cephalosporin- amikacin combination is a favorable option because the anatomic structure of the orbit in children is suitable for advancement of infection and complications. In recent years, the use of vancomycin has increased because of the increase in the growth of methicillin-resistant *S. aureus*, especially in cases of orbital cellulitis, and the increase in resistant pneumococci in the community. It is appropriate to add vancomycin to treatment in resistant cases in which fever does not subside by the 72nd hour of treatment; there is a risk of vision loss and complication development. One may switch to broad-spectrum oral antibiotic treatment in cases in which clinical improvement is observed after dual antibiotic treatment, blood culture is negative at the 48th hour of treatment, and families are adherent with treatment (2, 23).

Our study has some limitations. The most helpful method for showing the causative agent leading to periorbital or orbital cellulitis is blood culture and swab cul-

tures obtained from the infection site. Although blood cultures was obtained from all patients who had fever, swab cultures were not obtained from any patients. The absence of confirmed growth and initiation of empirical treatment are limitations of our study.

In conclusion, orbital tissue infections are important clinical conditions that are observed commonly in the childhood age group and generally develop after sinusitis and upper respiratory tract infections. The frequency of complications can be reduced with early diagnosis and treatment.

Ethics Committee Approval: Ethics committee approval was received for this study from Istanbul University Cerrahpasa Medical Faculty Ethic Committee (15.04.2016/No:162181).

Informed Consent: Written informed consent was obtained from the parents.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - D.A., H.Ç., Design - D.A., Y.C.; Supervision - D.A., H.Ç., Y.C.; Funding - D.A., C.D., M.H.; Materials - D.A., M.H.; Data Collection and/or Processing - D.A., C.D., O.S.A.; Analysis and/or Interpretation - D.A., M.H.; Literature Review - Y.C., H.Ç., O.S.A.; Writing - D.A., C.D.; Critical Review - Y.C., H.Ç., O.S.A.; Other - D.A., C.D.

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

Financial Disclosure: The authors declare that this study has received no financial support.

References

- Doğru Ü. Preseptal ve orbital sellülit. *J Pediatr Inf* 2009; 3: 90-3.
- Olitsky SE, Hug D, Smith LP. Orbital infections. In: Kliegman RM, Behrman RE, Jenson HB, (eds). *Nelson Textbook of Pediatrics*. Philadelphia: Saunders Elsevier; 2007.p. 2611-2.
- Rana AY. Preseptal selülit, orbital sellülit, orbital abse. *Turk J Ophthalmol* 2012; 42: 52-6.
- Baring DEC, Hilmi OJ. An evidence based review of periorbital cellulitis. *Clin Otolaryngol* 2011; 36: 57-64. [CrossRef]
- Jain A, Rubin PA. Orbital cellulitis in children. *Int Ophthalmol Clin* 2001; 41: 71-86. [CrossRef]
- Beech T, Robinson A, McDermott AL, Sinha A. Pediatric periorbital cellulitis and its management. *Rhinology* 2007; 45: 47-9.
- Upile NS, Munir N, Leong SC, Swift AC. Who should manage acute periorbital cellulitis in children? *Int J Pediatr Otorhinolaryngol* 2012; 76: 1073-7. [CrossRef]
- Berk AT, Ayhan Z, Yaman A, Ecevit C. Diagnosis and treatment of preseptal cellulitis in pediatric age group. *Turk J Ophthalmol* 2010; 40: 227-31. [CrossRef]
- Chaudhry IA, Shamsi FA, Elzaridi E, et al. Outcome of treated orbital cellulitis in a tertiary eye care center in the middle East *Ophthalmology* 2007; 114: 345-54.
- Ambati BK, Ambati J, Azar N, Stratton L, Schmidt EV. Periorbital and orbital cellulitis before and after the advent of *Haemophilus influenzae* type B vaccination. *Ophthalmology* 2000; 107: 1450-3. [CrossRef]
- Jackson K, Baker SR. Clinical implications of orbital cellulitis. *Laryngoscope* 1986; 96: 568-74. [CrossRef]
- Liu IT, Kao SC, Wang AG, Tsai CC, Liang CK, Hsu WM. Preseptal and orbital cellulitis: a 10-year review of hospitalized patients. *J Chin Med Assoc* 2006; 69: 415-22. [CrossRef]
- Oxford LE, McClay J. Complications of acute sinusitis in children. *J Otolaryngol Head Neck Surg* 2005; 133: 32-7. [CrossRef]
- Lee S, Yen MT. Management of preseptal and orbital cellulitis. *Saudi J Ophthalmol* 2011; 25: 21-9. [CrossRef]
- Koornneef L. Orbital septa: anatomy and function. *Ophthalmology* 1979; 86: 876-80. [CrossRef]
- Kanra G, Secmeer G, Gonc EN, Ceyhan M, Ecevit Z. Periorbital cellulitis: a comparison of different treatment regimens. *Acta Paediatr Jpn* 1996; 38: 339-42. [CrossRef]
- Çiftçi E, Oygar P, İnce E, Doğru Ü. Ampicillin-Sulbactam In The Treatment Of Periorbital and Orbital Cellulitis. *Ankara Üniversitesi Tıp Fakültesi Mecmuası* 2002; 55: 265-70.
- Ferguson MP, McNab AA. Current treatment and outcome in orbital cellulitis. *Aust N Z J Ophthalmol* 1999; 27: 375-9. [CrossRef]
- Chang CH, Lai YH, Wang HZ, Su MY, Chang CW, Peng CF. Antibiotic treatment of orbital cellulitis: an analysis of pathogenic bacteria and bacterial susceptibility. *J Ocul Pharmacol Ther* 2000; 16: 75-9. [CrossRef]
- McKinley SH, Yen MT, Miller AM, Yen KG. Microbiology of pediatric orbital cellulitis. *Am J Ophthalmol* 2007; 144: 497-501. [CrossRef]
- Yang M, Quah BL, Seah LL, Looi A. Orbital cellulitis in children-medical treatment versus surgical management. *Orbit* 2009; 28: 124-36. [CrossRef]
- Pereira FJ, Velasco E, Cruz AA, Anselmo-Lima WT, Elias Júnior J. Computed tomographic patterns of orbital cellulitis due to sinusitis. *Arq Bras Oftalmol* 2006; 69: 513-8. [CrossRef]
- Starkey CR, Steele RW. Medical management of orbital cellulitis. *Pediatr Infect Dis J* 2001; 20: 1002-5. [CrossRef]
- Leblebicioğlu H. Anaerob infeksiyonlarda antibakteriyel tedavi. *ANKEM Derg* 2001; 3: 600-10.