ORIGINAL CONTRIBUTION

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Conservative treatment in rhinosinusitis orbital complications in children aged 2 years and younger*

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SUMMARY

Objective: *Orbital complications (OC) secondary to acute rhinosinusitis (ARS) in children are uncommon, but can result in severe morbidity and mortality if not treated appropriately. These complications are more common in older children. We evaluate the disease and its management in children aged 2 and under.*

Material and methods: *Fifty-two records of children aged 2 and younger with OC secondary to ARS between 1993 and 2002 were reviewed retrospectively. Parameters recorded included age, gender, clinical symptoms and signs, CT findings, duration of hospitalization, treatment before and during admission, cultures and outcome.*

Results: *Forty-eight children were diagnosed with periorbital cellulitis, 4 with subperiosteal abscess and none with orbital abscess or cavernous sinus thrombosis. All were managed conservatively except 1 who underwent surgery. CT scan performed in 8 children revealed sinusitis in only 7. Average length of hospitalization was 3.6 days for preseptal cellulitis and 6.5 for postseptal cellulitis.*

Conclusion: *SOC secondary to ARS mandates meticulous multidisciplinary follow-up in hospital. CT scan and surgery are indicated in cases of ophthalmoplegia, proptosis, decreased visual acuity or failure of conservative treatment within 48 hours. However, most children aged 2 and younger respond well to conservative treatment and no surgical intervention is required.*

Key words: sinusitis, pediatric, orbital complications, conservative treatment

INTRODUCTION

Acute rhinosinusitis (ARS) is the most common cause of orbital infections in children. Orbital complications (OC) secondary to ARS can result in permanent blindness or death if not treated promptly and appropriately [(1)]. In the pre-antibiotic era, 17% of the patients with OC died of meningitis, 20% of the patients becoming permanently blind in the affected eye [(2)]. Over time, complication rates have declined; the incidence of vision loss has been reported to be 3 to 11%, and mortality stands at 1 to 2.5% [(3)]. The severity of orbital complications secondary to sinusitis can be grouped into stages according to Chandler's classification introduced in the early 1970's [(4)]. Another simpler classification system divides patients into those having preseptal orbital complications resulting from ARS that do not penetrate the periorbita and those having postseptal complications that penetrate the periorbita and are further subdivided into cellulitis and abscess categories [(5)].

In toddlers, the ethmoid cells are the most developed paranasal sinuses, the frontal sinuses being undeveloped, and the maxillary sinuses only partially formed. The spread of infection from the ethmoid sinuses to the orbit may occur directly through a congenital dehiscence of the lamina papyracea, or via hematogenous spread through the valveless ophthalmic venous system [(6)]. Involvement of the postseptal orbital contents can lead to worsening of the condition and cause other ophthalmic signs and symptoms such as proptosis, limitation of globe movement, diplopia, chemosis and visual loss. Visual compromise may result as the intraocular pressure increases or via traction of the optic nerve following the development of proptosis. A clinical finding of periorbital cellulitis

Footnote: Abbreviations: OC - Orbital complications; ARS - Acute rhinosinusitis; CT- Computed tomography; URI - Upper respiratory tract infection

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in a child mandates multidisciplinary cooperation including a pediatrician, ophthalmologist, otolaryngologist and radiologist for optimal diagnosis, management and outcome. The necessity for CT scan in this group of age due to X-ray radiation exposure has also been challenged. Previous publications have reported the occurrence of OC in older children, mainly above the age of 5 [6-8]. Some studies dealing with children suffering from OC secondary to ARS proposed the possibility of a better prognosis by treating OC conservatively and sparing surgical intervention for conservative management failures. A tendency towards conservative treatment with a good outcome in a younger age is seen in these studies. Our study was conducted in order to evaluate the occurrence, clinical course and management of OC secondary to ARS in children 2 years old and younger over a 10-year period.

METHODS

The study was approved by the Assaf Harofeh Medical Center Institutional Review Board. Four hundred and seventy-five records of children who were admitted to Assaf Harofeh Medical Center (a tertiary medical center), between January 1993 and December 2002 with a presenting symptom of periorbital edema were reviewed. Children over the age of 2 and those with a history of local trauma, insect bite, foreign body, allergic reaction and conjunctivitis were excluded. Fifty-two records of children 2 years old and younger having periorbital cellulitis (periorbital edema) and symptoms and findings suggesting ARS were included in the study. The children were grouped according to the basic classification of preseptal and postseptal cellulitis [6]. Postseptal cellulitis was considered when the ophthalmologic status revealed exophthalmos, limitation of globe movement, and vision deterioration. Furthermore, prolonged fever in spite of appropriate intravenous antimicrobial therapy was another factor pointing to postseptal cellulitis. Month of admission, age, gender, symptoms and physical findings such as purulent rhinitis and fever, complete blood count, imaging findings, treatment before and during admission, surgical treatment, outcome, the final diagnosis, and length of hospitalization were taken into consideration. Ophthalmologic and otolaryngologic consultation was conducted regarding the need for CT scan and surgical intervention according to the patient's clinical status.

RESULTS

Fifty-two children out of 101 with periorbital cellulitis as a result of ARS fit the criteria of our age group; 27 male and 25 female. The average age of the patients was 1.2 years (range, 2 months to 2 years). Forty-eight (92%) were diagnosed with periorbital cellulitis and 4 (8%) with postseptal cellulitis that, after further evaluation, were diagnosed with orbital subperiosteal abscess; none had intraorbital abscess or cavernous sinus thrombosis. There was a clear seasonal distribution of this pathology as shown in Figure 1. The majority of the children, 39 (75%), were admitted during winter time (November through April) and a minority, 13 (25%), during the summer period (May through October).

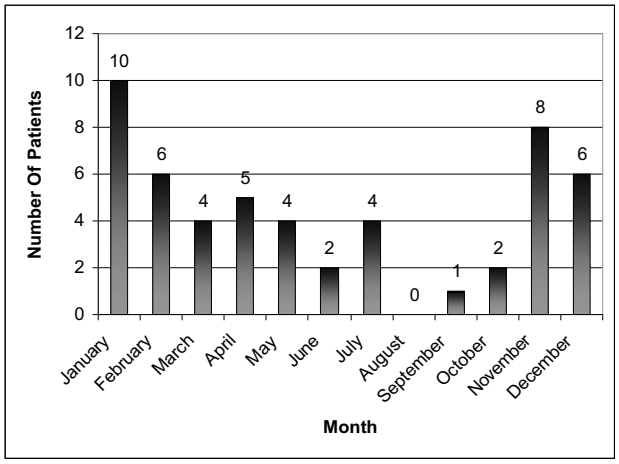

Figure 1. Seasonal distribution of orbital cellulitis.

All children were examined on admission by a pediatrician, 41 (79%) by an ophthalmologist and only 22 (42%) by an otolaryngologist. All children arrived to the emergency room due to periorbital erythema and edema while 18 (35%) had received oral systemic antibiotic treatment prior to admission, either due to symptoms and signs of ARS or the appearance of periorbital edema. The right side was involved in 30 patients compared to 22 with left side involvement. There was no bilateral ocular involvement. Movement limitation and proptosis of the involved globe were the most common ophthalmologic findings, both being found in 3 (6%) children when subperiosteal abscess was diagnosed. Signs and symptoms suggesting ARS with OC and upper respiratory infection (URI) were the most common. These are summarized in Table 1.

Leukocytosis on admission was found in 43 children (83%) out of which 24 (46%) had a high neutrophil rate, 30 (58%) had predominant lymphocytosis and 14 (27%) had monocytosis. A CT scan was performed in 8 children (15%). The main indications

Table 1. Signs and symptoms in orbital cellulitis due to acute rhinosinusitis in 52 infant patients.

Signs and symptoms	Number	%
Rhinorrhea	51	98%
Fever	43	83%
Leukocytosis	43	83%
Cough	21	40%
Limitation of globe movement	3	6%
Proptosis	3	6%

Table 2. Paranasal sinus involvement in 52 infants according to CT.

Signs and symptoms	Number	%
Ethmoid	7	88%
Maxillary	3	37%
Sphenoid	0	0
Frontal	0	0

for performing a CT scan were limitation of globe movement (6%), proptosis (6%), changes in visual acuity on admission in 1 child and a failure of treatment after 48 hours in another. ARS was diagnosed in 7 out of the 8 CT scans. Table 2 summarizes the most commonly involved sinuses.

All children were hospitalized and received intravenous antibiotics (except 1 patient who received intramuscular and 1 who received oral treatment).
Since these children were treated in different departments with different treatment policies, 28 (54%) received cefuroxime, (3 together with metronidazole), 22 (42%) amoxicillin/clavulanate, and 1 (2%) ceftriaxone. In addition, 10 (19%) patients received topical nasal decongestants and 11 (21%) nasal saline drops. One child with a subperiosteal abscess underwent an ethmoidectomy via the external approach due to severe deviation of the nasal septum and an inaccessible middle meatus. During the operation, no pus collection was demonstrated and no culture was taken. There were no complications in the postoperative period and the child made a complete recovery from the infection.
The average length of hospitalization was 3.6 days for children with preseptal cellulitis compared to 6.5 days for those with postseptal cellulitis. Children were discharged on oral antibiotic and topical decongestant treatment to complete 2 weeks of treatment.

DISCUSSION

Most of the children (92%) with OC secondary to ARS in our study were classified as preseptal cellulitis, stage 1 according to Chandler's classification. The pediatrician should accurately diagnose and promptly manage these children in order to prevent progress to postseptal cellulitis. These cases should be identified as early as possible by means of consultations with an ophthalmologist and otolaryngologist. The role of the ophthalmologist is crucial for detecting early signs of orbital involvement and deterioration during the follow up in hospital. Cooperation of the pediatrician, the ophthalmologist and the otolaryngologist is essential to ensure a good outcome. Most orbital infections respond to medical therapy [3]. Periorbital cellulitis, and to some extent subperiosteal abscess with less restriction of ocular motility can be successfully treated conservatively.
During a period of 10 years, 52 children under the age of 2 suffering from periorbital cellulitis were admitted to Assaf Harofeh Medical Center, which serves a mid to low socioeconomic population. The average age of the children in our group was 1.2 years, which is by definition younger than previously reported [2,6,9,10]. Males were affected almost the same as females (27 and 25 respectively). Out of 101 records of all children with OC secondary to ARS that were reviewed, 52% were 2 years of age and younger, suggesting that young children, especially those who are under the age of 2, are more susceptible to OC due to ARS.
It is clear that the outcome of OC has improved significantly over the past 2 decades. Moreover, such complications occur less frequently, largely due to the introduction of the *Haemophilus influenza* type B vaccination. In a large series conducted in 1978 [11] including pediatric (75% of the patients) and adult patients, complications such as blindness, meningitis and cavernous sinus thrombosis were reported. In later reports in 1993, one study [7] described complications including recurrent subperiosteal abscess, cerebritis and frontal empyema in 3 out of 22 pediatric patients, while another study [8] reported no postoperative complications and no evidence of either visual or central nervous system sequelae.

In our series, 7 children had involvement of the ethmoid cells while 3 had maxillary sinus involvement, according to the CT scan findings. In 1 child, the origin of the subperiosteal abscess was the maxillary sinus. The diagnosis of orbital complications in ARS is based on clinical signs and symptoms, which can be confirmed by CT scan. These young children, who cannot yet communicate, present a challenge with respect to the diagnosis of ARS and differentiating it from URI or acute rhinitis.
The indications for CT scan of the orbits/sinuses to exclude suppurative orbital complications are proptosis, impaired visual acuity, or impaired extraocular mobility when present on examination [1]. CT is also mandatory when intracranial complications are suspected or when signs and symptoms of postseptal inflammation progress over a period of 24 to 48 hours despite therapy. In our study, children underwent CT scan (axial with coronal reconstruction) to evaluate the involvement of the orbit and sinuses and for planning the surgery. Since high resolution CT scans are better than radiographs at defining sinus and orbital pathology [12-16], they should be obtained whenever surgical drainage is planned [6]. In the present series, only 8 (15%) infants underwent CT scan, 7 demonstrated involvement of the sinuses, and in all cases the ethmoid cells were found to be opaque. One child with purulent rhinitis had clear sinuses. The authors assume that acute purulent rhinitis by itself may cause a hematological spread that results in periorbital edema.

Current recommendations [1] for intravenous antibiotic treatment include ceftriaxone (100 mg/kg/d in 2 divided doses) or ampicillin-sulbactam (200 mg/kg/d in 4 divided doses). This treatment is given empirically since the accuracy of microbacterial studies taken from the nasal cavities is low in children. Vancomycin (60 mg/kg/d in 4 divided doses) may be added in children in whom infection is either known or likely to be caused by *Streptococcus pneumoniae*, which are highly resistant to penicillin. Cefuroxime or amoxicillin/clavulanate constitute appropriate antibiotic treatment in small children. All the children in our study received intravenous antibiotics - either cefuroxime alone or with metronidazole or amoxicillin/clavulanate, except 1 who received intramuscular ceftriaxone and 1 who received oral amoxicillin/clavulanate. Saline nose drops and nasal spray have been studied in patients with acute bacterial sinusitis. Significant benefit was not observed [17]. However, by preventing crust formation and liquefying secretions, they may be helpful [1]. In addition, saline may also act as a mild vasoconstrictor of nasal blood flow [18].

Nineteen percent of the children in our study received a topical nasal decongestant, and 21% received topical saline upon the recommendation of the otolaryngologist.

Ophthalmologic examination comprising globe movements, proptosis and visual acuity, is essential in evaluating the involvement of the orbit, in order to differentiate between preseptal cellulitis and postseptal complications. Based on the ophthalmologic findings, a CT scan may be considered to further clarify the existence orbital involvement.

Surgical drainage is recommended by Younis et al. when one of 5 conditions exists [3]:

1. Evidence of abscess formation on CT.
2. 20/60 (or worse) visual acuity on initial evaluation.
3. Severe orbital complications (e.g., blindness or afferent pupillary reflex) on initial evaluation.
4. Progression of orbital signs and symptoms despite therapy
5. Lack of improvement within 48 hours despite medical therapy.

In the present study, 8% of the children under 2 years of age developed a subperiosteal orbital abscess, only 1 of which required surgery. There was neither visual loss nor intracranial complications in our study. Although suppurative orbital abscess or subperiosteal abscess generally requires prompt surgical drainage, we recommend intravenous antibiotic treatment in the young age group for the first 24 to 48 hours for a detected small subperiosteal abscess on a CT scan or minimal ocular abnormalities, while performing frequent visual and mental status checks to rule out deterioration. Precautionary measures must be taken to ensure that frequent examinations are performed by an otolaryngologist, and whenever deterioration occurs under antibiotic treatment, prompt surgical drainage is strongly advised.

Although the child in our study underwent surgery via an external approach, the endoscopic approach is recommended owing to the fact that it does not require an external incision, produces less postoperative edema, clears the infected sinuses in the direction of the abscess, and allows for a shorter period of hospitalization [6].

CONCLUSION

We studied 52 children under the age of 2 years with OC secondary to ARS. This age group is susceptible to OC, the relatively high number of cases suggesting a need for increased awareness among physicians regarding the importance of treating this condition. Most orbital complications from ARS respond well to medical therapy and the management should primarily be conservative. Evaluation and careful follow up by a pediatrician, otolaryngologist and ophthalmologist is mandatory because this disease poses a risk of serious and irreversible damage if not treated promptly. Surgery is indicated when ophthalmologic evaluation suggests orbital involvement or there is no improvement within 48 hours of IV treatment. Axial and coronal CT scans are recommended when needed for evaluation of the disease and planning the surgery.

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