Bilateral Orbital Complications of Pediatric Rhinosinusitis

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Orbital complications of pediatric rhinosinusitis are usually unilateral at presentation. We describe 3 children with bilateral orbital cellulitis that occurred as a complication of rhinosinusitis. The children ranged in age from 11 to 14 years, had prolonged hospital stays that ranged from 10 to 19 days, and underwent multiple surgical procedures to drain subperiosteal and intraorbital abscesses. They appeared to have direct spread of disease from the ethmoid sinuses to both orbits, without intracranial spread of infection. Therefore, the presence of bilateral orbital complications of rhinosinusitis does not necessarily imply spread of disease to the cavernous sinus. Children who present with bilateral orbital complications of rhinosinusitis should be treated aggressively from the outset, since they suffer from a more widespread form of the disease.


Pediatric rhinosinusitis usually implies bilateral inflammation of the nasal mucosa and the paranasal sinuses, in particular the ethmoid sinuses. It is rather curious, therefore, that orbital cellulitis, a complication of pediatric rhinosinusitis, is most commonly unilateral. To our knowledge, bilateral orbital cellulitis at presentation has not been reported in published studies of the complications of rhinosinusitis in children to date.1-7 However, if unilateral orbital cellulitis is not treated adequately, it can lead to cavernous sinus thrombosis and bilateral orbital cellulitis.8 It has been assumed that bilateral orbital cellulitis is secondary to cavernous sinus thrombosis. The hypothesis is that disease spreads from the orbit to the cavernous sinus through the ophthalmic veins and then centrifugally to the contralateral eye through a pathway provided by the dura mater of the cavernous sinus that is contiguous with the periostium of the orbit.8 However, direct spread of disease from the ethmoid sinuses to both orbits has not been proposed as a mechanism to explain bilateral orbital cellulitis.

In this report, which has the approval of the Institutional Review Board of the University of New Mexico, Albuquerque (Human Research Review Committee Approval No. 01-428), we describe the findings in 3 cases involving children who presented initially with bilateral orbital cellulitis as a complication of rhinosinusitis. To our knowledge, there have been no previously reported cases involving children with bilateral orbital cellulitis at initial presentation. The purpose of this article is to discuss the reasons for bilateral orbital complications of rhinosinusitis at initial presentation in these 3 children and to evaluate hypotheses that have been proposed previously to explain the fact that these complications are normally unilateral.

REPORT OF CASES

CASE 1

A 13-year-old boy presented with bilateral orbital swelling. One week before presentation, he had symptoms of an upper respiratory tract infection, including fever and a sore throat. Other symptoms included nausea with vomiting, fatigue, and headache. On the fifth day of symptoms,
he developed bilateral periorbital swelling that was worse on the left side. He was unable to open his eyes. His medical history was insignificant except for seasonal allergies. He had a toxic appearance on admission, with a fever of 39.6°C. He was communicative and answered questions appropriately. Marked periorbital erythema and edema were present bilaterally. The anterior cervical lymph nodes were enlarged and slightly tender to palpation. The white blood cell count was 19,500/µL, and the erythrocyte sedimentation rate was 89 mm/h.

Ampicillin sodium–sulbactam sodium (Unasyn) therapy was initiated after blood and throat cultures were obtained. A computed tomographic (CT) scan revealed severe bilateral maxillary sinusitis and ethmoiditis and a subperiosteal abscess in the left orbit that displaced the globe laterally. The patient was taken to surgery on the day of admission, and the subperiosteal abscess was drained through an external ethmoidectomy. Cultures from swabs of both nasal cavities and from fluid aspirates of the abscess yielded a heavy growth of *Arcanobacterium haemolyticum*. The blood and throat cultures were sterile.

The patient’s temperature continued to spike, and he had persistent orbital edema 4 days after admission. A CT scan showed recurrence of the subperiosteal abscess and severe panrhinosinusitis. The abscess was drained a second time using a dual intranasal and external approach. An opening was created in the lamina papyracea under direct endoscopic visualization, and the external ethmoidectomy was reopened. There was rapid improvement of the bilateral orbital edema after surgery. The patient was discharged home after 10 days of hospitalization. At 1 month after discharge, he had full recovery of eye movement and normal visual acuity.

CASE 2

An 11-year-old girl presented with bilateral orbital swelling after 2 days of pain in her left eye, neck discomfort, lethargy, nausea, and vomiting. One week before presentation, a migraine that did not respond to pain medication had been diagnosed. On admission, her temperature was 39.9°C. She had bilateral orbital edema that was more prominent on the left side. Her left eye also had severe proptosis, and her eye movements were restricted. There was marked periorbital swelling. The white blood cell count was 15,400/µL. Nafcillin sodium, ceftriaxone sodium, and ampicillin sodium–sulbactam sodium (Unasyn) therapy was initiated. Samples were obtained from the blood, the throat, and a lumbar puncture and sent for culture; they were all negative for microorganisms. A CT scan showed a subperiosteal abscess in the left orbit and maxillary and ethmoidal rhinosinusitis bilaterally. The findings of ophthalmic evaluation were consistent with paresis of cranial nerves III, IV, and VI on the left side. The right eye had a normal range of movement.

Bilateral functional endoscopic sinus surgery was performed to relieve rhinosinusitis, and the subperiosteal abscess on the left side was drained using endoscopic visualization. Two days after surgery, the orbital swelling persisted. A magnetic resonance imaging scan showed an intraorbital abscess on the left side. The abscess was located adjacent to the superior rectus muscle and the superior ophthalmic vein. Initially, it was drained percutaneously with the patient under local anesthesia. Three days later, a second, more extensive
drainage was carried out through an anterior orbitotomy. The patient was hospitalized for a total of 16 days. At the time of her discharge, the swelling of her right eye had resolved. On the left side, visual acuity was normal but there was paralysis of the abducens nerve and complete loss of levator function.

CASE 3

A 14-year-old boy presented to the emergency department with a upper respiratory infection. Within a 48-hour period, pain and swelling in his right orbit had spread to the contralateral side. He had no significant medical history and was not taking medication. On admission to hospital, his temperature was 39.6°C. His eyelids were tender and erythematous, and both orbits were swollen. There was limited motion in both eyes, but both pupils reacted normally to light. The white blood cell count was 8000/µL. A CT scan showed extensive bilateral orbital cellulitis, bilateral panrhinosinusitis, and a right subperiosteal orbital abscess (Figure). Swabs of the nose and throat were sent for cultures, and nafcillin sodium, cefotaxime sodium, and metronidazole therapy was initiated. Cultures of fluid aspirates from the abscess were positive for group C streptococci. Cultures from the nose and throat yielded 1 colony of Staphylococcus aureus.

Bilateral functional endoscopic sinus surgery was performed to relieve rhinosinusitis, and the subperiosteal abscess on the right side was drained using endoscopic visualization. A CT scan obtained 48 hours later showed recurrence of the subperiosteal abscess. The abscess was drained again, this time through an external ethmoidectomy. The swelling persisted, and 2 days after surgery a magnetic resonance imaging scan showed a right intraorbital abscess. The intraorbital abscess was drained, and a Penrose drain was kept in situ for 48 hours. After removal of the drain, 2 more drainage procedures were required before the swelling resolved. The patient was hospitalized for a total of 19 days. On discharge, the swelling in his left eye had completely resolved, but his right eye remained mildly swollen.

**COMMENT**

The most common complications of rhinosinusitis in children occur in the orbit. These complications include the following in order of increasing severity: orbital cellulitis, subperiosteal orbital abscess, intraorbital abscess, and cavernous sinus thrombosis.4-6 Although the incidence of complications from rhinosinusitis has decreased since the advent of antibiotics,7 the risk of orbital involvement remains significant.8,9 Upper respiratory infections are common in children; therefore, complications of rhinosinusitis remain a major cause of orbital inflammation and visual impairment.3 Orbital complications arise from rhinosinusitis that spreads from the ethmoid sinus to the subperiosteal space underlying the lamina papyracea. Neurovascular foramina, congenital or acquired bony dehiscences, and valveless venous channels provide potential routes for bacteria to spread from the sinus through the lamina papyracea to the periosteum of the orbit.9

The modality of choice for the diagnosis of the orbital complications of rhinosinusitis is CT. The subperiosteal abscess caused by spreading inflammation from rhinosinusitis appears as a hypodense area within a convex elevated periosteum adjacent to an infected sinus. Air or gas may be noted within the fluid-filled abscess, and surrounding orbital tissues, including the extraocular muscles, may be displaced.10 Surgical decompression of the abscess is the preferred therapy. Decompression may be achieved by an open procedure, such as external ethmoidectomy, or by functional endoscopic sinus surgery.11

To our knowledge, this is the first report of bilateral orbital complications of rhinosinusitis at initial presentation in children. To explain this phenomenon, it is helpful to consider the aspects of medical history that our patients had in common, as well as their symptoms and signs. All 3 children had advanced disease that resulted in a prolonged hospital stay and multiple surgical procedures. The range of hospital stay was 10 to 19 days (mean, 15 days), and the number of surgical procedures ranged from 2 to 5 (mean, 3.3). In each of the 3 children, the orbital complications on one side were more problematic (left side, 2 children; right side, 1 child). Previous studies have shown that the orbital complications of rhinosinusitis do not affect either the left or the right side preferentially.11,13

Mann et al13 studied 26 children who had orbital complications of rhinosinusitis. Surgery failed initially in 6 (23%) of the 26 children, and they required revision procedures. Mann and colleagues stated that the most common reason for revision surgery was either inadequate removal of the lamina papyracea and the associated abscess or an abscess that was positioned superiorly or laterally in the orbit and as a consequence was more difficult to drain. In the present case series, all 3 patients required revision surgery, indicating that they were affected by advanced disease.

In case 1, cultures of fluid aspirate from the orbital abscess yielded A haemolyticum; cultures in case 3 yielded group C streptococci and S aureus; and cultures in case 2 were sterile. To our knowledge, A haemolyticum has not been isolated previously from a subperiosteal orbital abscess. This organism has been recognized as an infrequent cause of acute pharyngitis, with a peak incidence in teenagers and young adults and clinical features that may be indistinguishable from pharyngitis caused by Streptococcus pyogenes.5,14 The patient who was infected with A haemolyticum was treated with high-dose ampicillin-sulbactam therapy, and the infection improved after surgical drainage.

The fact that orbital complications found in association with rhinosinusitis in children are usually unilateral is probably related to asymmetries in the anatomy of the lamina papyracea on the infected and noninfected sides. Dehiscences of the lamina papyracea, the so-called Zuckerkandl dehiscences, are distributed asymmetrically.13 Acquired dehiscences are usually asymmetrical, since they are caused by trauma that rarely affects both sides.
of the face equally. These asymmetries would favor the spread of disease to one orbit. Bony dehiscences are readily demonstrable in CT scans of the paranasal sinuses. Indeed, the Figure shows a unilateral dehiscence of the lamina papyracea on the right side that was probably caused by trauma, because it is larger than a congenital dehiscence and has ragged margins.

However, neurovascular foramina might also mediate the spread of infection. These foramina are below the resolution of CT scanning. Consequently, it is not possible to map their symmetry in CT scans from affected patients and establish a causal relationship between the asymmetrical distribution of neurovascular foramina and the unilateral spread of infection. It remains possible, of course, that infection spreads routinely from the sinuses to both orbits but remains subclinical on 1 side.

The average age of the 3 children described in this study was older at the time of presentation than that reported in previous studies of unilateral subperiosteal orbital abscess. Skedros et al reviewed 30 cases involving children with subperiosteal orbital abscess who ranged in age from 2 to 14 years (mean age, 7 years). Arjmand et al reviewed 22 cases of unilateral orbital abscess and reported an average age of 9 years for the children included in the study. In contrast, the average age of the 3 children in the present study was 12.7 years (age range, 11-14 years). An acquired traumatic dehiscence is much more likely to be present in older children. An acquired dehiscence provides a pathway for the spread of disease in addition to congenital dehiscences and neurovascular foramina. The presence of multiple pathways for the spread of infection together with advanced disease may make bilateral complications of rhinosinusitis more probable in older children. However, the incidence of rhinosinusitis in older children is relatively low, which may explain the absence of reports of bilateral orbital complications of pediatric rhinosinusitis at presentation in the literature.

In summary, bilateral orbital cellulitis at presentation as a complication of rhinosinusitis in children is rare. Each child in this series required multiple surgical procedures and a prolonged hospital stay. Orbital complications affected one eye more severely than the other. These findings suggest that adolescent children who present with bilateral orbital complications of rhinosinusitis should be treated aggressively from the outset to prevent further spread of the infection. However, the presence of complications in both orbits does not necessarily imply the concurrent presence of disease in the cavernous sinus.

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