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Short Communication

Bilateral orbital complications of paediatric rhinosinusitis

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ABSTRACT

Background: The spread of infection from the ethmoid sinuses to the orbit occurs directly through a congenital dehiscence of the lamina papyracea or via haematogenous spread through ophthalmic venous system. Hence orbital complications of paediatric rhinosinusitis are usually unilateral at presentation.

Methods: We describe three children with bilateral orbital cellulitis that occurred as a complication of rhinosinusitis without intracranial spread of the infection. The children ranged in the age group from 4 to 7 years. All these children had a prolonged hospital stay from 14 to 25 days and underwent multiple surgical procedures to drain the subperiosteal abscess. These children presented to the hospital with bilateral orbital cellulitis without significant past history. All of them on radiological evaluation showed subperiosteal abscess involving only one orbit. They were taken up for functional endoscopic sinus surgery and the subperiosteal abscess was drained endoscopically with partial removal of lamina papyracea. One case required second surgery despite good recovery for two days post first surgery.

Result and conclusion: Two cases had severe unilateral visual loss at presentation but both recovered dramatically after the surgery. All cases had uneventful recovery with no residual disability. The purpose of this article is to discuss the reasons for bilateral orbital complications of rhinosinusitis at initial presentation despite the previous hypothesis of unilateral involvement.

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Case 1

A four and half year old child presented with bilateral orbital swelling involving left more than right eye. One week before he developed upper respiratory tract infection for which he was treated but two days before he developed swelling of the

left eye followed by right eye which rapidly increased in next one day. He was unable to open his left eye at the time of presentation, movements of the left eye were absent and pupillary reflex was sluggish. Movement of the right eye and its pupillary reflex was present. Vision was grossly diminished in the left eye, reduced to perception of light. Patient was

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irritable and had a fever of 102 °F. Child was started on parenteral ceftriaxone, vancomycin and metronidazole in addition to ibugesic, paracetamol, triaminic and decongestant nasal drop. CT & MRI scan revealed bilateral ethmoidal sinusitis with evidence of subperiosteal collection in the left orbit which was pushing the eye laterally. There was no evidence of intracranial infection or cavernous sinus thrombosis. Patient was taken up for surgery and endoscopic decompression of the left orbit. Patient responded well and his eye swelling started decreasing. On third post-operative day the swelling in the right eye started increasing again. Immediate CT scan was taken which showed recurrence of subperiosteal collection in the left orbit. Patient was again taken for surgery and endoscopic decompression of left orbit was done with complete removal of lamina papyracea. Partial turbinatectomy was also done of the posterior half of middle turbinate to improve ventilation of ethmoid sinuses. There was rapid improvement in the patient condition and patient was discharged after 25 days of admission. On discharge patient had no swelling in both eyes, vision was normal and eye movements recovered completely. Patient responded well and was asymptomatic after 10 days with complete restoration of vision. CT scan was done before discharge to rule out any collection of pus. On subsequent follow up for four months the patient is asymptomatic and there is no residual disability as depicted in the Pre-op and Post-op photos (Figs. 1–4).

Case 2

A 6 years old girl presented with bilateral orbital swelling after 4 days of symptoms of rhinorrhoea, nasal obstruction and headache. She had bilateral painful orbital swelling more on the left side. There was bilateral proptosis with restriction of eye movements. Vision was absent on left side with no perception of light. However, on right side finger counting at 3 m was present. Patient was started on parenteral antibiotics and CT scan of nose, PNS and orbit was sought which revealed features of bilateral orbital cellulitis and subperiosteal abscess on left side with no features of intracranial infection.

Fig. 2 – Bilateral orbital cellulitis.

Bilateral functional endoscopic sinus surgery was done to relieve rhinosinusitis and on left side subperiosteal abscess was drained by breaking through lamina papyracea. Post-operatively patient had relief in symptoms and orbital swelling decreased considerably. Parenteral antibiotics were given for fourteen days postoperatively. Vision was restored to normal within 5 days postoperatively. Patient was discharged on the sixteenth post-operative day.

Case 3

A 7 years old male child initially presented with upper respiratory tract infection. Patient was managed on oral antibiotics and antipyretics. Patient reported at emergency after 3 days with history of sudden onset swelling of both eyes since 3 h. Patient was reviewed and found to have temperature of 102 °F, bilateral periorbital oedema, proptosis and restricted eye movements. On ophthalmic review, vision was found to be normal bilaterally. CT scan revealed bilateral orbital cellulitis with subperiosteal abscess on the right side. Bilateral functional endoscopic sinus surgery was done to relieve rhinosinusitis and on right side subperiosteal abscess was drained by

Fig. 1 – MRI pre-op.

Fig. 3 – CT scan 3rd post-op day.

breaking through lamina papyracea. Post-operatively patient had relief in symptoms and orbital swelling decreased considerably. Parenteral antibiotics were given for ten days postoperatively. Patient was discharged on the fourteenth post-operative day.

Comparative analysis of all these three cases is reflected in Table 1.

Discussion

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. 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. Over time, complication rates have declined; the incidence of vision loss has been reported to be 3–11%, and mortality stands at 1–2.5%. The spread of infection from the ethmoid sinuses to the orbit may occur directly through a congenital dehiscence of the lamina papyracea, or via haematogenous spread through the valveless ophthalmic venous system. Paediatric rhinosinusitis usually implies bilateral inflammation of the

nasal mucosa and the paranasal sinuses, in particular the ethmoid sinuses.^{1–6} It is rather curious therefore that the orbital complications of paediatric complications are usually unilateral. Unilateral orbital cellulitis if not treated aggressively leads to cavernous sinus thrombosis and causes bilateral orbital cellulitis. The hypothesis is that disease spreads from the orbit to the cavernous sinus through the ophthalmic veins and then to the contralateral eye through a pathway provided by the dura mater of the cavernous sinus that is contiguous with the periosteum of orbit. However, this involves spread of the infection intracranially. Direct spread of disease from the ethmoid sinuses to both orbits has not been proposed as a mechanism to explain bilateral orbital cellulitis without. The severity of orbital complications secondary to sinusitis can be grouped into stages according to Chandler's classification introduced in the early 1970's.⁷

Orbital complications of rhinosinusitis are rare and dangerous. Their incidence increases in children. These complications include following in order of increasing severity, orbital cellulitis, subperiosteal abscess, intraorbital abscess and cavernous sinus thrombosis.^{3,7} Although the incidence of complications of rhinosinusitis has decreased since the advent of antibiotics, the risk of orbital involvement remains significant.⁵ Orbital complications arise from rhinosinusitis that spreads from the ethmoid sinus to the subperiosteal space underlying the lamina papyracea.⁸ Neurovascular foramina, congenital or acquired bony dehiscence's and valveless venous channels provide potential routes for bacteria to spread from the sinuses to the periosteum of the orbit.⁶

The investigation of choice for the diagnosis of the orbital complications of rhinosinusitis is CT scan. 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.⁹ Unless an abscess is demonstrated by radiological or other investigation, non-surgical management of rhinosinusitis complications would be the first choice.^{10–12} 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.¹³

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. Acquired dehiscences are usually asymmetrical, since they are caused by trauma that rarely affects both sides of the face equally. These asymmetries would favour the spread of disease to one orbit. Bony dehiscences are readily demonstrable in CT scans of the paranasal sinuses.

To explain the bilateral 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 14–25 days (mean 18 days), and the number

Fig. 4 – Periorbital swelling 3rd post-op day.

Table 1 – Comparative profile of the 03 cases.

S no	Symptoms	Signs	Imaging	Per-operative findings
Case 1	>Bilateral orbital swelling L > R >Diminished vision Lt	>Left eye movements absent >Sluggish pupillary reflex >Fever of 102 °F	>Bilateral ethmoidal sinusitis >Subperiosteal collection in the left orbit pushing the eye laterally >No features of intracranial infection	>Pus between lamina papyracea and periosteum
Case 2	>Bilateral orbital swelling after 4 days of symptoms of rhinorrhoea, nasal obstruction and headache	>Bilateral proptosis >Restriction of eye movements >No perception of light on left side >Finger counting at 3 m on right side	>Bilateral orbital cellulitis >Subperiosteal abscess on left side >No features of intracranial infection	>Rhinosinusitis >Left side subperiosteal abscess
Case 3	>Sudden onset swelling of both eyes since 3 h	>Temperature of 102 °F >Bilateral periorbital oedema >Proptosis and restricted eye movements >Normal vision bilaterally	>Bilateral orbital cellulitis >Subperiosteal abscess on the right side >No features of intracranial infection	>Rhinosinusitis >Right side subperiosteal abscess

of surgical procedures ranged from 1 to 2. In each of the 3 the orbital complications on one side were more problematic (left side – 2 children; right side – 1 child).

Mann et al¹³ studied 26 children who had orbital complications of rhinosinusitis. Surgery failed initially in 6 (23%) of the 26 children, are they required revision procedures. Mann et al 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, only 1 patient required revision surgery, indicating that he was affected by advanced disease.

The average age of the 3 children described in this study was younger at the time of presentation than that reported in previous studies of unilateral subperiosteal orbital abscess. Skedros et al⁵ reviewed 30 cases involving children with subperiosteal orbital abscess who ranged in age from 2 to 14 years (mean age, 7 years). Arjmand et al² reviewed 22 cases of subperiosteal orbital abscess and reported an average age of 9 years for the children in the study. In contrast, the average age of the 3 children in the present study was 5 years (age range, 4–7 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.

Surgical intervention is often required for treatment of rhinosinusitis and that of complications. Both are usually carried out in the same sitting with basic principles of drainage of pus and establishing ventilation of sinuses. When complications have arisen out from acute rhinosinusitis, it is likely that the operative field will be very haemorrhagic, making endoscopic surgery much more difficult than in the presence of chronic rhinosinusitis alone. Contraindications

for an endoscopic approach include intracranial complications and osteomyelitis of frontal bone.

In summary, bilateral orbital cellulitis at presentation as a complication of rhinosinusitis in children is rare. One child in this series required multiple surgical procedures whereas all children had prolonged hospital stay. Orbital complications affected one eye more severely than the other. These findings suggest that 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.

Conflicts of interest

All authors have none to declare.

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