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Case Report

Beyond the sinus: orbital extension of acute bacterial rhinosinusitis – a case report and literature review

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ABSTRACT

Orbital complications of acute rhinosinusitis (ARS) are rare but potentially life-threatening, particularly in children. Due to anatomical factors such as thinner bony partitions, increased vascularity, and underdeveloped sinuses, children are more vulnerable to orbital extension of sinonasal infections. Early diagnosis and prompt management are crucial to prevent severe outcomes including vision loss or intracranial spread. We report a case of 4 year old boy presenting with fever, periorbital swelling, and headache secondary to ARS, imaging with contrast-enhanced CT (CECT) scan, successfully managed with endoscopic drainage and medical therapy. Early diagnosis and prompt management are critical in paediatric ARS to prevent vision-threatening or life-threatening complications. A multidisciplinary approach, imaging, targeted antibiotic therapy, and timely surgical intervention contribute to improved outcome. Prompt recognition and combined medical-surgical treatment of orbital complications in paediatric ARS are essential for a favourable prognosis.

Keywords: Acute rhinosinusitis, Osteomeatal complex, Functional endoscopic sinus surgery

INTRODUCTION

Acute rhinosinusitis (ARS) is a condition characterized by inflammation of the nasal cavity and paranasal sinuses that typically lasts for up to 12 weeks according to the European position paper on rhinosinusitis and nasal polyps (EPOS) 2020.[1] ARS is a relatively common disease affecting both children and adults. Its prevalence rate is between 6% and 12% with viral origin in most cases and a bacterial one in only 0.5%-2%. Fungi have been described as causative agents especially in immunocompromised patients.[2] In ARS clinical ENT examination involves nasal endoscopy. CT scan is not recommended unless the course of disease is very severe, if the patient is immunocompromised, or signs of complications are present. Complications of rhinosinusitis is divided into orbital, osseous and intracranial. Orbital involvement is divided according to the Chandler classification into: preseptal inflammatory oedema (periorbital cellulitis), postseptal orbital cellulitis, subperiosteal abscess, orbital abscess, and cavernous sinus thrombosis. Intracranial complications include either meningitis, cerebritis or abscess formation (epidural, subdural, intracerebral), and cavernous sinus thrombosis. Osseous complications are represented by frontal bone osteomyelitis. Their incidence has dramatically decreased when compared to the pre antibiotic era, but it is estimated that in patients affected by acute bacterial rhinosinusitis with intracranial spread, in spite of antibiotic therapy, there is still a high incidence of morbidity, and the mortality rate is between 5% and 10%. The spread of infection into the orbit and intracranially follows natural paths or predisposed routes, (i.e. pathogens can pass through the veins or alternatively,

they may extend behind sinuses directly through a dehiscence (e.g. in the lamina papyracea) or by eroding the sinus bones).[3]

In our case report, we want to discuss a case of 4 year old boy who presented to us with fever, headache, cold and periorbital oedema, that was managed successfully by endoscopic drainage of abscess with complete resolution.

CASE REPORT

A 4 year old boy patient was referred from the ophthalmology department who was presented with a history of fever persisting for 5 days, associated with mild left sided periorbital swelling noted over the last 4 days. The child also complained of headache for the same duration, along with a preceding history of nasal cold for one week. The swelling was gradual in onset, with localized discomfort but no history of trauma, insect bite, or prior ocular disease. There was no significant systemic illness in the past. The clinical profile was suggestive of a possible extension of sinonasal infection to the periorbital region, warranting urgent evaluation to rule out orbital complications. So, he was referred to the department of ENTHNS for further management. The patient belonged to a lower socio economic status, with no previous comorbidity, and was not immunocompromised.

On ENT clinical examination of the eye, there was periorbital oedema which was tender and fluctuant on palpation and proptosis of left eye. Anterior rhinoscopy was done which was revealed congested mucosa, mucopurulent discharge within the nasal cavity. Direct nasal endoscopy and ocular movement were not assessed as patient was not cooperative. At the ophthalmologic examination, he showed a slight exophthalmos, inferior dystopia, upper eyelid oedema and inflammatory signs in his left eye. Bilateral visual acuity was normal.

The patient was started on broad-spectrum intravenous antibiotics and a CECT paranasal sinus was done which revealed a mucoinflammatory changes in left side of maxillary sinus, ethmoidal air sinus and sphenoid sinus. Left osteomeatal complex (OMC) was completely blocked. Soft tissue swelling and thickening showing mild post contrast enhancement noted at left medial periorbital region seen extending to medial aspect of retroocular region and left lacrimal fossa.

The patient was posted for functional endoscopic sinus surgery (FESS) and disease was cleared from sinuses. Lamina papyracea over the medial orbital wall on the left side was removed. Approximately 10 cc of pus was drained from left maxillary sinus and pushing the periorbital laterally, a gush of pus was noted from the subperiosteal space which was sent for culture and sensitivity report. The intra-operative swab findings of the pus drained from the subperiosteal abscess came out to be *Staphylococcus aureus*. The patient was managed postoperatively with antibiotics and steroids. Consent was taken from patient's parents for the usage of the images for academic purpose.

Figure 1: Pre operative image, (A) lateral view and (B) front view.

Figure 2: Pre operative CECT PNS. (A) Coronal view and (B) axail view.

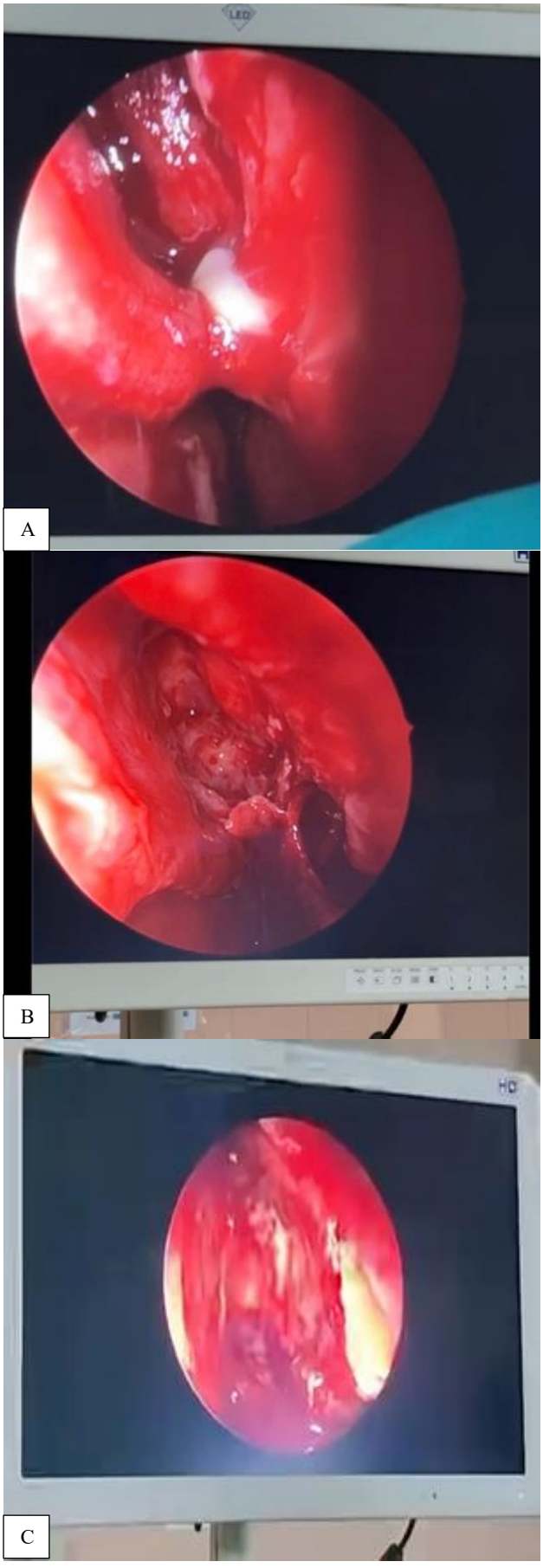

Figure 3 (A-C): Intra operative images.

Figure 3: Post operative 10 days image of patient.

DISCUSSION

ARS is a common condition that can sometimes lead to serious complications, particularly orbital complications, which are especially concerning due to the risk of vision loss or even life-threatening outcomes. Children are more susceptible to these complications due to several anatomical differences compared to adults. These include diploic-type facial bones, thinner bony partitions between the sinuses and the orbit, and greater vascularity. Additionally, the higher incidence of upper respiratory infections in children further increases their vulnerability to orbital involvement. The incidence of orbital complications from ARS has significantly decreased due to improved diagnostic tools and the implementation of advanced management protocols.[4]

The spread of infection beyond the paranasal sinuses can occur through several routes including the bony walls of the sinuses via osteomyelitis, fracture lines following trauma to an infected sinus, or through natural bony dehiscence, via venous pathways, through perivascular lymphatics passing through vascular foramina, along perineural spaces, through the ethmoidal artery foramina, allowing the infection to extend from the ethmoidal sinuses to the brain and orbit, potentially leading to serious complications.[5]

The pathogens involved in sinus infections vary depending on the patient's age and the underlying cause. Streptococcus pneumoniae is the most commonly identified organism in sinus infections, whereas *Staphylococcus aureus* and *Streptococcus pyogenes* are more frequently observed when the infection follows local trauma. Haemophilus influenzae type b was once a common pathogen, but its incidence has significantly declined following the introduction of widespread vaccination. Fungal pathogens are rare but may cause orbital cellulitis, particularly in diabetic or immunocompromised individuals.[6] In paediatric patients up to 15 years of age, infections are typically

polymicrobial, involving both aerobic and anaerobic bacteria. In contrast, younger children under the age of 9 are more likely to have infections caused by a single aerobic organism.[7]

Currently, the management of orbital inflammation resulting from rhinosinusitis involves a combination of local and systemic antibiotic therapy, along with anti-inflammatory medications and antihistamines. In some cases, surgical intervention to treat the underlying rhinosinusitis is required, with or without drainage of the associated suppurative orbital focus.[8]

Initial antibacterial therapy was initiated empirically, in accordance with standard management protocols for orbital cellulitis. Given that *Staphylococcus* and *Streptococcus* species are the most frequently implicated pathogens, intravenous penicillins and cephalosporins are selected as first-line agents. Following microbiological analysis of nasal secretions, the antimicrobial regimen is tailored based on the identified organisms and their antibiotic susceptibility profiles, taking into account regional resistance patterns and the clinical presentation.[8] Importantly, the selected antibiotics are chosen for their ability to cross the blood-brain barrier, in order to mitigate the risk of intracranial extension of the infection. Surgical intervention is also considered, as literature indicates that intraorbital inflammatory conditions of rhinosinusitis origin may require surgical management in approximately 12-66% of cases, depending on the severity and response to medical therapy.[8]

According to the American academy of ophthalmology, the management of orbital cellulitis requires hospitalization and prompt initiation of broad-spectrum intravenous antibiotics targeting the most common causative organisms.[9] Diagnostic workup may include blood cultures and swabs of nasal or pharyngeal secretions, with subsequent adjustment of antibiotic therapy based on culture and sensitivity results. In infants, initial treatment typically involves a third-generation cephalosporin such as cefotaxime, ceftriaxone, or ceftazidime, combined with a penicillinase-resistant penicillin. For older children and adults where sinusitis is often caused by both aerobic and anaerobic bacteria clindamycin is a commonly used alternative. Metronidazole is also being used more frequently in paediatric cases to cover anaerobic pathogens. In cases where methicillin-resistant *Staphylococcus aureus* (MRSA) is a concern, vancomycin may be added to the regimen. As emphasized, antibiotic therapy should be adjusted as needed based on microbiological findings.[10] Intravenous corticosteroids may also be administered in the management of paediatric orbital cellulitis.[8] The use of corticosteroids in the treatment of orbital cellulitis is controversial. The possibility of suppressing the immune system and worsening the disease process should be considered.[11]

Appropriate timing of surgical intervention was essential to optimize outcomes for patients requiring drainage procedures. Medical treatment alone was sufficient for some patients, particularly those with preseptal cellulitis, while others required surgical intervention, including endoscopic sinus surgery and external drainage for subperiosteal abscess cases. EPOS 2020 suggests that for orbital complications except for preseptal cellulitis, surgical drainage is recommended if there is no response to intravenous antibiotics within 48 hours.[1] In the present case report, surgical intervention was eventually required for patients. A multidisciplinary approach among otorhinologists, ophthalmologists, radiologist, paediatrician, neurosurgeon and general physicians is always necessary to avoid complications of sinusitis.[12]

CONCLUSION

Orbital complications of ARS are common in paediatric age group. It carries high morbidity and changes radically the prognosis. Surgical drainage procedures in conjunction with aggressive medical management remain the standard of care for this condition to achieve a good prognosis.

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