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Case Series

Emergency endoscopic sinus surgery in pediatric complicated sinusitis: case insights and current evidence

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ABSTRACT

Rhinosinusitis is an inflammation of the lining membranes of the nose and sinuses. Complications of rhinosinusitis, such as orbital and intracranial sepsis, are common in pediatric patients, which can be life-threatening if diagnosis and treatment are delayed. In this case series, we illustrate the emergency indications of functional endoscopic sinus surgery (FESS) in complicated rhinosinusitis in children diagnosed and treated at a tertiary hospital in Saudi Arabia. Three different cases of complicated rhinosinusitis with intraorbital and intracranial extension, including orbital abscess, invasive fungal granulomatous sinusitis with orbital extension, and optic nerve and frontal empyema secondary to frontal sinusitis. All cases were managed by a combination of medical treatment in the form of intravenous (IV) antibiotics and an urgent surgical debridement through functional endoscopic sinus surgery FESS to clean the sinuses, orbit, and brain. Postoperative CT scans confirmed no intraoperative or postoperative complications in all cases. Despite the wide use of antibiotics, the serious complications of sinusitis in children still exist. The management of such cases is usually through a combination of medical and surgical treatments. FESS in the pediatric population is a direct, safe, and practical approach in dealing with the serious complication of pediatric sinusitis with low morbidity and excellent outcomes.

Keywords: Orbital complications, Endonasal endoscopic surgery, Rhinosinusitis, Pediatrics, Case series

INTRODUCTION

Rhinosinusitis, commonly known as sinusitis, is an inflammation of the lining membranes of the nose and sinuses.[1] The average healthy child gets between 6 to 8 colds annually, and sinusitis is believed to be involved in 5% to 10% of all upper respiratory tract infections.[2] The American Academy of Otolaryngology-Head and Neck Surgery defines subtypes of rhinosinusitis based on the duration of symptoms: acute sinusitis if less than 12 weeks, chronic sinusitis if more than 12 weeks, and subacute sinusitis if it lasts for 4-12 weeks.[3]

The osteomeatal complex (OMC) is a canal connecting most sinuses (frontal, anterior ethmoids, and maxillary) to the middle meatus. It serves as an entry point and exit for the sinuses from the nasal cavity. Blockage of the OMC is a common cause of sinus disease in children.[4] The anatomical proximity of the paranasal sinuses to the anterior cranial fossa and orbit makes the complication more serious, and the venous drainage of the mid-facial structures into the intracranial venous sinuses.[5] Sinusitis can have serious orbital and intracranial complications due to its proximity to the sinuses, which can be life-threatening in certain situations. The sinonasal disease is present in up to 75% of orbital infections, with the

ethmoid sinus being the most common cause.[6] Moreover, orbital complications include orbital cellulitis, subperiosteal abscess, and intraorbital abscess, all of which can result in blindness due to venous compression around the optic nerve.[1] Frontal sinusitis could cause frontal osteomyelitis (Pott's puffy tumor) and extradural and subdural empyema. Meningitis, intracranial abscess, and cavernous sinus thrombosis may result from sinusitis.[1]

It is usually diagnosed clinically without radiological investigation. However, plain x-rays, computed tomography (CT) scans, magnetic resonance imaging (MRI), and other diagnostic methods may be needed. CT scanning has proven to be the best imaging for the paranasal sinus system, but MRI is more sensitive in evaluating soft tissue involvement and allows adequate discrimination.[7] Rhinosinusitis is usually a self-limiting disease requiring symptomatic treatment. Antibiotics are used in suspicion of bacterial infection and/or complications. A high dose of amoxicillin is often recommended as a first-line treatment. However, some patients are candidates for surgery. Endoscopic sinus surgery is a successful treatment option for patients who have failed medical treatment, with a good outcome. Other surgical options include sinus lavage, adenoidectomy, craniotomy, and open procedures.[8] This case series illustrates the common emergency indications of FESS in complicated sinusitis in the pediatric age group at a tertiary center in Dammam, Saudi Arabia.

CASE SERIES

Case 1: orbital abscess

A 12-year-old girl was referred from the pediatrics hospital as a case of complicated sinusitis presenting with fever, progressive infected left eye, restricted eye movement, and diminished vision (Figure 1A). A CT scan of the sinuses and orbit (Figure 1B) showed severely inflamed frontoethmoid sinuses associated with an extensive frank orbital abscess. The patient was managed with intravenous antibiotics and underwent urgent endoscopic frontoethmoidectomy and endoscopic drainage of the orbital abscess. The patient recovered fully with no complications (Figure 1C).

Case 2: subdural empyema

A 10-year-old girl presented with unresolving sinusitis associated with fever, headache, vomiting, and drowsiness. Diagnosed on CT brain as a case of subdural empyema (SDE) (Figure 2A and B) as a complication of frontal sinusitis. The patient was managed by systemic intravenous antibiotics. Endoscopic frontal sinusotomy to drain the frontal sinus and frontal mini craniotomy to drain the empyema by the neurosurgery team. The patient recovered well with no complications, as shown in the follow-up CT scan six weeks postoperatively (Figure 2C).

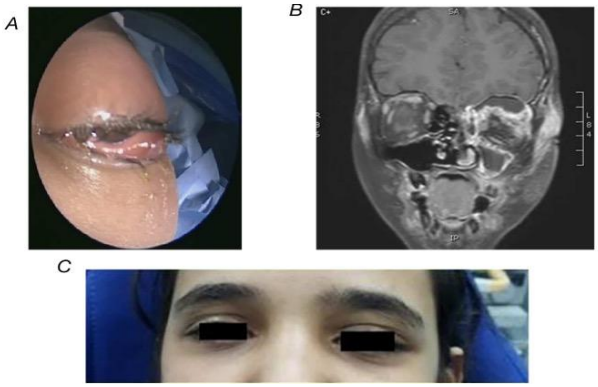

Figure 1: (A) Severely infected left eye with restricted movement, (B) CT sinuses and orbit with inflamed frontoethmoid sinuses and orbital abscess, and (C) the child is fully recovered six weeks post-treatment.

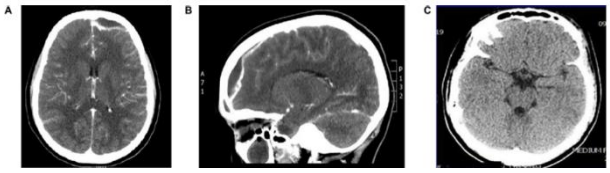

Figure 2: (A) Axial CT brain with subdural empyema, (B) sagittal CT scan with subdural empyema, and (C) post drainage CT brain with complete resolution of subdural empyema.

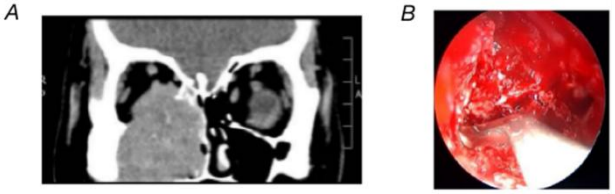

Figure 3: (A) Coronal CT; sinuses showed the aggressive, destructive lesion to the inferior orbital rim reaching the optic nerve and (B) post-endoscopic debridement of the granulomatous fungal infection.

Case 3: orbital inversion and proptosis

A 14-year-old male, a known case of cerebral palsy and mental retardation, was referred from a private hospital with a history of right-sided cheek swelling and right proptosis with suspicion of a malignant lesion. On endoscopic examination, a hard mass is felt occupying the lateral nasal wall. On endoscopic examination, there was a compressible bulge on the medial wall of the maxillary sinus and a solid granulomatous mass filling the anterior ethmoid, posterior ethmoid, and maxillary sinuses, with dehiscence of the medial orbital wall. A CT scan of the sinuses showed a mass in the right maxillary sinus measuring 5×3 cm with evidence of bone destruction and orbital invasion (Figure 3A), and a diagnosis of chronic invasive granulomatous fungal sinusitis was made. Endoscopic medial maxillectomy, anterior and posterior ethmoidectomy, and orbital

decompression were performed to remove and debulk the granulomatous tissue from the orbit (Figure 3B). The tissues were sent for histopathology, which confirmed the presence of numerous granulomas featuring epithelioid and multinucleated giant cells and the presence of fungal hyphae within the giant cells and the adjacent connective tissue.

DISCUSSION

Orbital complications are the most common complication resulting from sinusitis, accounting for around 80% of all complications. The infection spreads from sinuses to neighboring tissues through lamina papyracea, especially in children, as they have thin lamina papyracea.[9] An orbital abscess is one of the most dangerous complications; it is known as inflammatory purulent pus accumulation in retro-orbital adipose tissue. Upon reviewing the previously reported cases from 1999 to 2009, it revealed that this complication was discovered in three out of 35 cases of orbital complications. Moreover, inflammatory edema is a common initial manifestation of this condition. The upper eyelid may then display specific changes because of fluid accumulations induced by the venous return being restricted. The vision usually is unaffected at this point, and eyeball movement is expected. If left untreated, this will grow and become more serious when proptosis appears, indicating that the infection is moving toward cellulitis. Due to the compression on the optic nerve, the problem will get increasingly severe, which might deteriorate the vision and restrict eyeball movement. As a result, if it remains untreated, it can develop into an orbital abscess, leading to purulent inflammation.

Exophthalmos, ophthalmoplegia, and vision loss are some of the symptoms that can arise, in addition to those already listed. Additional complications may arise because of orbital abscesses such as septic thrombosis of the cavernous sinus or intracranial spread along neural pathways.[10] In this case, surgical intervention is the only option, as conservative medical therapy will not be as effective. Suhaili et al. reported a similar case of an 8-year-old female with an orbital abscess, which was managed by endoscopic drainage.[11]

Pott's puffy tumor (PPT) is a complication of frontal bone osteomyelitis with a subperiosteal abscess, mostly caused by frontal sinusitis.[12] PPT often affects children and is considered to be rare in adults.[13] Symptoms of PPT are nonspecific in children. However, when the forehead develops a tender swelling with pitting edema, PPT should be suspected.[12] In the majority of cases, antibiotics, as well as subcutaneous or endoscopic sinus surgery, are adequate in treating this condition. On the other hand, if there is intracranial involvement, a craniotomy may be required.[14]

PPT could cause intracranial complications such as epidural and subdural abscesses and meningitis.[15] The transfer of infection from the frontal sinus to the anterior cranial fossa leads to abscess formation, causing these intracranial complications.[14] Epidural and subdural abscesses are found to be the most common intracranial complications, while in other studies, meningitis is found to be the most common.[16]

SDE usually presents as a systemic infection. CT scans can establish a diagnosis of SDE, and it usually appears as hypodense crescent-shaped lesions.[14,15] The management of SDE is combined with antibiotics, FESS, and craniotomy to drain the empyema by the neurosurgery team due to its unresponsive, rapidly progressive nature.[17]

One of the most common consequences of unresolved sinusitis is meningitis, which is a complication of frontal sinusitis.[18] It is usually present, as the classical features of acute bacterial meningitis are fever, neck stiffness, and headache. The diagnosis is made with lumbar puncture (LP), cerebrospinal (CSF) fluid analysis, and CT. LP is performed if increased intracranial pressure is suspected. MRI is useful for postoperative follow-up.[16] Patients are usually managed with intravenous antibiotics, and if there is no response for two to three days, they should undergo endoscopic drainage of the sinuses as a main surgical management.[15]

Fungal infection is a common cause of sinusitis. It is classified into two main categories, invasive and noninvasive, based on histopathological invasion. The invasive fungal infection is classified into acute, chronic, and granulomatous. Our case was diagnosed with chronic invasive granulomatous fungal sinusitis, which mainly affects immunosuppressed patients and is caused by aspergillus. The patients most commonly presented with unilateral proptosis, in addition to severe nasal congestion/obstruction, sinus pain/pressure, headaches, and facial numbness.[19] CT scans will show hypodense or hyperdense, unilateral lesions in only 1 to 2 sinuses.[20] Bony erosion is usually present. The usual treatment includes an effective systemic antifungal therapy and surgical debridement.

FESS is a successful treatment option for patients who have failed medical treatment. It is effective in managing the intraorbital complications of frontal sinusitis.[10] However, no clear role has been found in managing intracranial complications. It was found to be 91.7% successful as a primary treatment and 100% with revision surgery of orbit and skull base cases.[21] The idea behind FESS is to remove tissue obstructing the ostiomeatal complex and facilitate drainage while preserving the non-obstructing anatomy and mucous membrane.[22] Even though FESS is less commonly used in pediatrics due to the risk of retardation of the growth of the midface.[23,24] Many studies showed the effectiveness of FESS in pediatrics with an 88% success rate in improving quality of life, as well as in reducing the number of days missed

from school, the severity of asthmatic symptoms, and the number of antibiotics prescribed.[25]

CONCLUSION

Despite the widespread use of antibiotics, severe complications of sinusitis in children still exist, ranging from orbital, subdural, and epidural abscesses to meningitis. With excellent outcomes, the management consists of a combination of systemic antibiotics and urgent surgical drainage in the form of FESS. FESS is a safe, direct approach in managing complicated sinusitis in children with minimal morbidities and excellent outcomes.

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