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Case Report

Case Series : Orbital Complications in Pediatric Rhinosinusitis

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Abstract

Background : Acute bacterial rhinosinusitis in children can cause orbital complications, either directly through fissures or indirectly through veins. Proper treatment can reduce morbidity due to orbital complications.
Case : Two cases of orbital complications in pediatric acute bacterial rhinosinusitis caused by adenoid hypertrophy and dental infection. The first case of acute bacterial rhinosinusitis with periorbital cellulitis and left premaxillary abscess accompanied by adenoid hypertrophy and multiple pulp gangrene. The second case of acute bacterial rhinosinusitis with subperiosteal abscess accompanied by adenoid hypertrophy and multiple dental caries. Functional endoscopic sinus surgery (FESS), abscess drainage, adenoidectomy and odontectomy were performed. The culture results of the first patient were *Streptococcus anginosus*, and it was resistant to tetracycline. Meanwhile, the culture results of the second patient, *Staphylococcus epidermidis*, were resistant to amoxiclav, ampicillin, cefoxitin, oxacillin, penicillin G, and tetracyclin.
Conclusion : Acute rhinosinusitis with orbital complications can caused by adenoid hypertrophy and dental infection. Medical treatment with adequate antibiotic followed by FESS, abscess drainage, adenoidectomy and odontectomy give an optimal result.

Keywords : pediatric rhinosinusitis, acute bacterial rhinosinusitis, orbital complication, odontogenic, adenoid hypertrophy

INTRODUCTION

Rhinosinusitis is a significant health problem affecting 5–28% of the general population and up to 2–4% of children. Children have unique risk factors for rhinosinusitis when compared to adults, the paranasal sinuses in children are smaller and are undergoing the process of maturation and development, so they are at higher risk of obstruction. Obstruction of the sinus ostium and osteomeatal complex may be facilitated by the presence of allergic and inflammatory factors, upper respiratory tract infections, and adenoid hypertrophy, which are common conditions in childhood. The prevalence of adenoid hypertrophy is 34% in pediatrics, being the most common cause of nasal obstruction in childhood.[1]

The impact of rhinosinusitis on a child's quality of life is greater than that of other diseases such as asthma, attention deficit hyperactivity disorder (ADHD), juvenile rheumatoid arthritis, and epilepsy.[2] Purulent rhinosinusitis involving the frontal and ethmoid sinuses can cause orbital complications due to spread of infection through the thin lamina papyracea, thrombophlebitis, or through venous drainage.[3,4] Rhinosinusitis causes 66 – 82% of orbital infections, and acute ethmoiditis is the rhinosinusitis most associated with orbital cellulitis, especially in children.[5]

The prognosis of pediatric patients with chronic rhinosinusitis depends on the degree of severity, complications that have occurred, and is influenced by host factors, the environment, and the patient's compliance with treatment. Complications increase patient morbidity and mortality. Pharmacological therapy for chronic rhinosinusitis in children has a success rate of approximately 50%.[2] With the implementation of surgical therapy, the patient's prognosis improves.[6,7]

This article presents 2 cases of orbital complications in pediatric rhinosinusitis with the aim of determining the appropriate diagnosis and management of cases of rhinosinusitis in children with orbital complications thereby reducing morbidity and mortality rates.

CASE

The first patient, a 13-year-old child, was referred with a swollen and painful left eye for 5 days, accompanied by blurred vision, difficulty opening the eyelids, watery eyes and yellowish discharge from the eyes. 2 weeks previously the patient complained of pain in the upper left tooth, then swelling and pain in the left cheek. The results of the physical examination showed edema in the left premaxilla to the inferior palpebra of the left eye, accompanied by hyperemia, tenderness and mucopurulent discharge in the medial canthus. Left eyeball movement and vision were within normal limits. Nasal endoscopy revealed edema of the inferior turbinate, mucopurulent discharge and the lateral wall of the left nasal cavity was pushed medially causing the middle meatus to be closed. Hypertrophic adenoids were seen accompanied by mucopurulent discharge in the nasopharynx.

The results of a CT scan of the paranasal sinuses showed isodense lesions in the left maxillary, ethmoid, frontal and sphenoid sinuses, accompanied by isodense images in the premaxilla to the left inferior eyelid, and no destruction of the lamina papyracea was seen. The patient was diagnosed with acute rhinosinusitis complicated by premaxillary abscess and odontogenic preseptal cellulitis. The diagnosis by the oral surgeon was pulp necrosis 2.4, 5.5, 5.3, 6.5, 7.5. This patient received ampicillin sulbactam and metronidazole intravenous. An endoscopic sinus surgery and adenoidectomy was performed by an ENT doctor followed by an odontectomy and abscess incision by an oral surgeon. During surgery, polyps and mucopurulent discharge were found in the maxillary sinus, ethmoid and left frontal recess. Meanwhile, in the sphenoid sinus, edematous mucosa and mucoid discharge were found. Pus was found in the bucogingival sulcus in the left 2.3 – 2.6 tooth region.

Postoperative evaluation of the left premaxillary region is not edematous and not hyperemic, the left inferior palpebra is slightly edematous but not hyperemic. The results of surgical tissue culture showed *Streptococcus anginosus*, and was resistant to tetracycline.

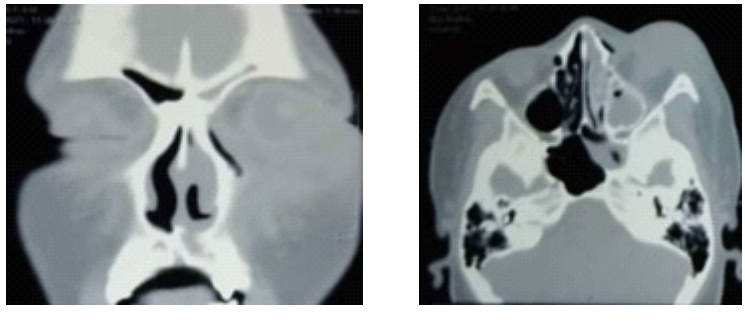

Figure 1. CT scan of the paranasal sinuses A. Coronal section B. Axial section

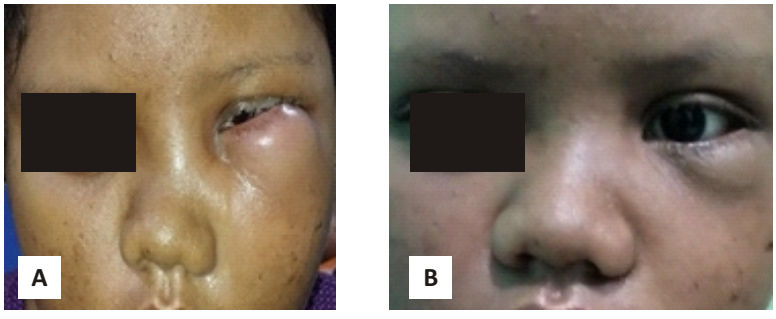

Figure 2. A. Patient profile before surgery. B. Patient profile 3 days after surgery.

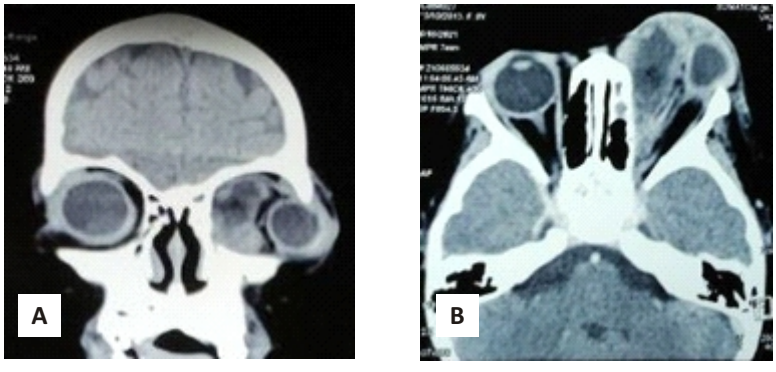

Figure 3. CT scan of the paranasal sinuses A. Coronal section B. Axial section

Patient had cefixime tablet for home treatment.

The second patient, an 8-year-old child was consulted by an ophthalmologist with left eye swelling, pain and redness for 2 weeks. The results of the physical examination revealed lagophthalmos in the left eye, edema in the superior palpebra, accompanied by hyperemia, tenderness, and mucopurulent discharge. Movement of the eyeballs is hampered in all directions accompanied by pain and visual acuity in the left eye is 6/48. Nasal endoscopy revealed edema, hyperemia and mucopurulent discharge in the middle meatus. Hypertrophic adenoids were seen accompanied by mucopurulent discharge in the nasopharynx.

The results of the MSCT scan revealed an inhomogeneous lesion in the extraconal left orbital cavity (measure ± AP 3.7 x LL 2.1 CC 2.6 cm) which was pressing on the medial rectus muscle, optic nerve and bulbus oculi to the left antero-infero-lateral. The lesion extended to the anterior ethmoid sinus and maxillary sinus, accompanied by destruction of the left lamina papyracea. Dental examination showed carious and loose teeth 5.2, 5.4, 6.2, 6.4, 6.5, 7.1, 7.4, 7.5, 8.1, 8.4, and 8.5

The patient was diagnosed with acute rhinosinusitis complicated by subperiosteal abscess. This patient initially received ampicillin sulbactam and metronidazole therapy, but was later replaced with ceftriaxone because there was no significant improvement. Endoscopic sinus surgery was performed with orbital decompression and adenoidectomy by an ENT doctor and incision of the abscess by an ophthalmologist. During surgery, polyps and mucopurulent discharge were found in the maxillary sinus, ethmoid and left frontal recess. There was a defect in the left lamina papyracea, orbital decompression was performed and purulent discharge was found from the left medial orbit. The action was continued by the oral surgeon to eradicate the focal infection.

Postoperative evaluation showed that the eyelids were slightly edematous but not hyperemic. The results of surgical tissue culture showed that *Staphylococcus epidermidis* was resistant to amoxiclav, ampicillin, cefoxitin, oxacillin, penicillin G, and tetracycline. Patient had ciprofloxacin tablet for home treatment.

DISCUSSION

Rhinosinusitis in children according to EPOS is defined as the presence of two or more symptoms, one of which must be nasal congestion/obstruction/congestion or nasal discharge (anterior or posterior), which may be accompanied by pain/pressure on the face or coughing. This needs to be supported by the results of a nasal endoscopic examination, or relevant changes in a computed tomography (CT) scan of the sinuses.[2] To distinguish between acute and chronic rhinosinusitis, it is judged by the onset of symptoms, with a cut-off of

Figure 4. A. Patient profile before surgery. B. Patient profile 3 days after surgery.

TABLE 1
Orbital complications based on Chandler classification.[13]

Classification	Description	Signs and symptoms
Periorbital cellulitis	Inflammation and edema of the anterior orbital septum	Eyelid edema Inhibition of eye movement (-) Vision loss (-)
Orbital cellulitis	Extension of inflammation and edema beyond the orbital septum	Diffuse edema in the orbital contents Inhibition of eye movement (+) Vision loss (+)
Subperiosteal abscess	Collection of pus in the lamina papyracea, periorbital and orbital bone walls	Eyeballs are destroyed/squeezed
Orbital abscess	Purulent collections occur within the orbital	Proptosis (+) Chemosis (+) Ophthalmoplegia (+) Vision loss (+)
Cavernous sinus thrombosis	On both eyes. Caused by the extension of infection to the posterior side through the superior ophthalmic vein and cranial nerves.	Cavernous sinus thrombosis, meningitis, subdural empyema, and brain abscess can develop if not treated appropriately.

12 weeks. It is said to be acute if the onset is less than 12 weeks and chronic if 12 weeks or more.[2]

In this case report, acute rhinosinusitis was found in both patients, characterized by complaints of one-sided nasal congestion, runny nose with thick mucus and cough with an onset of less than 12 weeks. Only the first patient complained of facial pain, namely the left cheek, VAS 6, due to swelling of the gums, cheek and left eye. On endoscopic examination, the mucosa was edematous, hyperemic and purulent discharge in the middle meatus of both patients and the CT-scan image showed mucosal changes in the unilateral paranasal sinuses which supported the diagnosis of acute rhinosinusitis in this case.

The pathogenesis of rhinosinusitis arises from changes in the homeostasis of sinus and nasal drainage, which under normal conditions is guaranteed by the patency of the sinus ostium, adequate and active mucus production, and effective ciliary function. However, children have unique risk factors for rhinosinusitis when compared to adults. In children, the paranasal sinuses and ostia are smaller and are undergoing the process of maturation and development, so they are at higher risk of obstruction. Obstruction of the sinus ostium and osteomeatal complex is supported by the presence of allergic and inflammatory factors, upper respiratory tract infections, and hypertrophic adenoids, which are common conditions in childhood.[1]

The risk factors found in both cases were adenoid hypertrophy and dental caries. The prevalence of adenoid hypertrophy is 34% in pediatric settings and is the most common cause of nasal obstruction in childhood. Adenoid hypertrophy causes inflammation in the nasopharynx, nasal cavity and can cause rhinosinusitis. When the osteomeatal complex is obstructed due to mucosal edema, negative pressure and hypoxia develop in the sinuses, stimulating the production of mucus and favoring its retention, leading to bacterial growth and the onset of acute rhinosinusitis.[1]

Odontogenic rhinosinusitis is an inflammatory

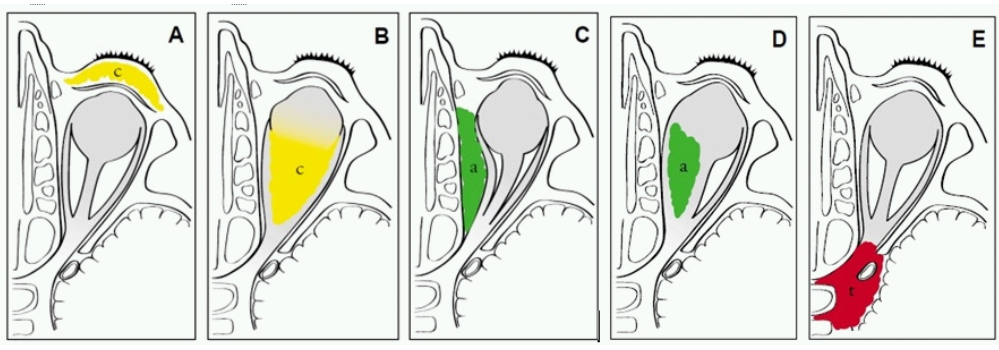

Figure 5. Classification of sinusitis with orbital complications:
A. Periorbital cellulitis, B. Orbital cellulitis, C. Periorbital abscess, D. Orbital abscess, E. Cavernous sinus thrombosis.[14]

TABLE 2
Comparison of eye examination and CT scan

Variable	Case 1	Case 2
Signs and symptoms	Swollen eyes	Swollen eyes, eye movement disorders
Physical examination	Edematous inferior eyelids, hyperemic, purulent discharge, eye movements and visual acuity are within normal limits	Lagophthalmus, edema and hyperemia of the palpebra, obstructed eye movement, decreased vision
CT scan (sinus paranasal)	Isodense lesions in the left maxillary, ethmoid, frontal and sphenoid sinuses, accompanied by inhomogeneous lesions in the premaxilla to the left inferior eyelid, no visible destruction of the lamina papyracea.	Inhomogeneous lesion in the extraconal left orbital cavity that pushes the medial r ectus muscle, optic nerve and bulbus oculi to the left antero-infero-lateral. Isodense lesions of the anterior ethmoid sinus and maxillary sinus, accompanied by destruction of the lamina papyracea.

condition in the paranasal sinuses which is the result of dental pathology based on the results of clinical, radiographic and/microbiological examinations.[8] Approximately 10% of all sinusitis cases are the result of an odontogenic process. Secondary odontogenic rhinosinusitis accounts for 10–14% of total maxillary sinusitis. Of the total cases of unilateral maxillary sinusitis, odontogenic causes account for approximately 75% of cases.[9]

Odontogenic infections begin with the attachment of bacteria to the outer surface of the tooth, eventually destroying the outer enamel and inner dentin and entering the vital pulp. Once the infection enters the pulp, it causes necrosis and pus formation. Bacteria invade the apical part of the root and cause periapical infection. Bacteria from the lesion can spread to adjacent tissues and activate a reaction from the Schneiderian membrane epithelium. Extrusion of dental material used in root canal therapy into the maxillary sinus also has a high risk of CRS.[8] Maxillary dental caries was found in both patients, which could become a focal infection resulting in unilateral rhinosinusitis.

The spread of odontogenic infections to the orbit can be through various routes, including: 1) inferior orbital fissure or previously formed gap in the floor of the orbit, 2) canine fossa, spreading to the periorbital tissue directly, 3) premaxillary fascia above the thin buccal cortical plane which can be easily eroded, 4) the infratemporal fossa or pterygopalatine fossa and reaches the orbit through the infraorbital fissure, 5) The medial orbital wall or lamina papyracea which has natural dehiscence and thin neurovascular perforations can be easily damaged due to sinus infection, 6) another route is through Facial thrombophlebitis, which includes retrograde spread of the ocular veins.[2,9-11] In the first case, a premaxillary abscess was found in the region of teeth 2.3 – 2.6, so the possible route of infection to the orbit was through the premaxillary fascia, canine fossa and inferior orbital fissure. In the second case, there was maxillary sinusitis, ethmoiditis and destruction of the lamina papyracea so that the possible route of infection to the orbit was through the inferior orbital fissure and lamina papyracea defects in the ethmoidal sinus.

Several prospective studies place the incidence of

orbital abscess at 1.6/100,000 in children and 0.1/100,000 in adults.[12] More than 70% of orbital infections develop as complications of paranasal sinusitis, while the remaining 30% originate from the eyelids, tonsils, intracranial areas, middle ear, and odontogenic structures.[2] The orbits are affected in 85% of acute sinusitis with complications.[13] The classification of orbital complications according to Chandler consists of periorbital cellulitis, orbital cellulitis, periorbital abscess (subperiosteal abscess), orbital abscess, and cavernous sinus thrombosis.[14,15]

Orbital complications based on Chandler's criteria in the first case correspond to the description of preseptal cellulitis while the second case corresponds to the description of subperiosteal abscess (Table 2).

The principle of management of rhinosinusitis with orbital complications is to eradicate infection and inflammation of the sinus by opening the ostium, restoring drainage and ventilation of the sinus, and providing access for drainage of orbital abscess. Therapy is given according to etiology, classification of rhinosinusitis and classification of orbital complications according to Chandler. Antibiotics are the therapy of choice in acute bacterial rhinosinusitis, given for 10–14 days even if the clinical symptoms have disappeared. The antibiotic chosen is a broad spectrum, namely the penicillin group such as amoxicillin. If there is antibiotic resistance, amoxicillin-clavulanate or 2nd generation cephalosporin can be given. The initial antibiotic for both of our patient was ampicillin sulbactam and metronidazole, and it give good result for first patient. The second patients change to ceftriaxone because there was no improvement, and this is relate with the sensitivity result which is show resistance to amoxiclav, ampicillin, and penicillin G. Sinus culture is very important in determining which antibiotic to use.[1] Other symptomatic therapies that can be given include analgesics, mucolytics (oral or topical steroid guaifenesin), irrigation/nasal wash with NaCl.[2,16] The first and second patients were found to be resistant to tetracycline, the second patient was also resistant to the penicillin group, including amoxicillin and amoxicillin clavulanate. Both patients received ampicillin sulbactam before the culture and sensitivity results were available. After surgery, the second patient's antibiotic was changed to ciprofloxacin according to the antibiotic sensitivity results and because patient resistant to amoxiclav, ampicillin, and penicillin G.

Management of orbital complications depends on the stage of the Chandler classification. Most cases of periorbital cellulitis and orbital cellulitis can be treated effectively with intravenous antibiotics. Indications for surgery in cases with stage I or II orbital complications if the patient's condition worsens within 24–48 hours after administration of antibiotics, decreased visual function, increased levels of proptosis and ophthalmoplegia, and there is an abscess on radiological examination with CT scan.[17] Both patients underwent functional endoscopic sinus surgery (FESS) according to the presence of visible sinuses, adenoidectomy and odontectomy to eradicate the focal infection. The indication for surgery in the first patient was no clinical improvement and CT scan results of the paranasal sinuses after intravenous antibiotic administration. Meanwhile, in the second patient, the indication for surgery was due to the presence of a subperiosteal abscess.

The second patient underwent orbital decompression to drain the sub-periosteal abscess. Treatment of subperiosteal abscesses must be done immediately, namely drainage of the abscess with orbital decompression. Orbital decompression can be performed via lateral canthotomy, inferior cantholysis or incision of the periorbital periosteum after removal of the lamina papyracea.[17] According to Froenhlich *et al*, as quoted by Sciaretta *et al*, treating periorbital abscesses with endoscopy by performing anterior ethmoidectomy and opening the anterior part of the lamina papyracea is adequate for drainage of the abscess. Orbital decompression with endoscopic sinus surgery is an option for treating periorbital abscess.[17]

According to Pat and Manning, orbital and sinus surgery in cases of orbital abscess is carried out if clinically and radiologically there are signs of suppuration, decreased visual acuity in immunocompromised patients, more serious complications such as blindness and afferent pupillary defects with ipsilateral cellulitis, and the presence of progression in the orbit despite administration of intravenous antibiotics. Clinical and radiological examination showed signs of suppurative inflammation so that incision and drainage were necessary. This procedure is to prevent further complications such as septicemia and pneumonia.[17]

CONCLUSION

Pediatric acute rhinosinusitis with orbital complications can cause by adenoid hypertrophy and dental infection. Morbidity can be prevented by administering adequate antibiotics according to culture and sensitivity testing accompanied by surgery. The surgical management consist of FESS, abscess drainage, adenoidectomy and odontectomy give an optimal result and reduce the possibility of recurrency.

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