Original Article

Orbital complications secondary to acute sinusitis– A 10 years retrospective review

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Abstract. Orbital complication may accompany acute sinusitis in all age, commonly preseptal or orbital cellulitis.

To evaluate the clinical presentation, management, and outcome of orbital complications of sinusitis in patients treated at our institution.

A case study of retrospective review of 10 patients with orbital complications secondary to acute sinusitis was conducted in our center over a 10-year period. The clinical presentation, relevant investigations, management and outcome were analysed.

Most of the patients were children. The most common diagnosis was sub-periosteal abscess (SPOA) in five patients (50%), followed by two cases each of preseptal cellulitis, and orbital cellulitis and one of orbital abscess. CT scan plays a major role in diagnosis and disease monitoring. Surgical drainage is recommended in managing orbital abscesses, but we highlight a case of a small orbital abscess which was successfully managed conservatively.

The clinical examination alone is not always helpful and therefore a CT scan is useful to diagnose and monitor the extent of the intraorbital infection. Rigorous medical treatment has an important role not only in preseptal and orbital cellulitis, but also in SPOA and small orbital abscess.

Key words: Orbital cellulitis, paranasal sinus disease, sinusitis, endoscopy

1. Introduction

Orbital complications account for 74-85% of complication arising from acute sinusitis, usually secondary to acute ethmoidal sinusitis (1). Orbital complications of acute sinusitis in the pediatric age group accounts to about 91% (2). Although the incidence and seriousness of these complications have steadily decreased in recent years with the advent of newer generations of antibiotics, orbital complications continue to pose a challenge. In the pre-antibiotic era, 17% patients with orbital infections secondary to rhinosinusitis succumbed to meningitis and 10-20% became blind in the affected eye (2,3). In the presence of ethmoiditis, the infection spreads through the very thin bony wall between the sinus and the orbit, whereas through the orbital floor in maxillary sinusitis and the roof of the orbit in frontal sinusitis. The infection may dissect under the periosteum and lead to subperiosteal abscess (SPOA) with 15% reported incidence (4). A medial SPOA is the most common post-septal orbital complication of sinusitis (5).

Despite aggressive management, 15-30% of these patients developed various visual complications (4). Computed tomography (CT) scanning is the imaging modality of choice in distinguishing pre-septal cellulitis from post-septal infection of the orbit, and helps determine the initial management. Due to the aggressiveness of the disease in the pediatric population and limitation to perform a proper ophthalmology examination, it is prudent to obtain a CT scan even in cases of pre-septal inflammation (6).

Most orbital infections are treated conservatively, especially in children of less than nine years of age, while surgical drainage is usually needed for older patients (7,8). We reviewed all patients admitted with orbital complications secondary to acute sinusitis over a

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10 year period at University Kebangsaan Malaysia Medical Centre (UKMMC), and their clinical outcomes were assessed.

2. Materials and methods

A combined ENT and ophthalmology retrospective review of patients with acute sinusitis with orbital complications admitted to (UKMMC) was performed from January 2000 to December 2010. The medical records were analyzed for demographic data, predisposing factors, clinical presentations, type of orbital complications, treatment prior to admission, CT scan findings, medical and surgical management, culture results and subsequent follow up. Sixteen patients were indentified, but only 10 patients with medical records were attainable. Ocular examinations were performed to detect the presence of periorbital edema, periorbital erythema, chemosis, proptosis, intraocular pressure, and vision assesment, pupillary function and retinal appearance.

3. Results

Ten patients with available medical records were reviewed (Table 1). Nine patients were from the pediatric age group and one adult. The mean age was 10.3 years with a range of 3 years to 33 years old. Three of the pediatric patients were below 5 years of age and 6 were under 18 years. There was equal gender preponderance in this study. The most common diagnosis was SPOA in five patients (50%), followed by two cases each of preseptal cellulitis and orbital cellulitis and one case of orbital abscess.

All the patients had fever at presentation and nine of them presented with periorbital swelling. One of the patients had diplopia and proptosis as the main symptom. Eight out of 10 patients had proptosis but only two of them had elevated intraocular pressure (IOP = 30mmHg) with reduced vision. Two of the patients with chemosis and orbital edema were diagnosed to have SPOA. Fifty percent of the patients had opthalmoplegia to lateral gaze. All 10 patients however had normal pupillary, retinal and optic nerve function. Mean duration of orbital symptoms prior to hospitalization was 2.7 days.

Most of the patients' predisposing symptoms were acute respiratory infection for 7 days or less. Allergic rhinitis history was an identifiable cofactor in 2 of the patients. In one patient, he had dental infection prior to the sinusitis. Swimming was noted to be a potential predisposing factor in 2 of our cases since the symptoms worsened following the activity.

Table 1. Data of the ten patients with orbital complications of acute sinusitis

Age & Sex	Orbital lesion	Antibiotic	Surgery	C&S
3/M	Left SPOA	Metronidazole cefiroxime	Endoscopic drainage	No growth
4/F	Left SPOA	Ceftriaxone Metronidazole	External drainage	*Burkho-Ideriacepacia*
5/F	Right preseptal Cellulitis	Ceftriaxone Metronidazole	Nil	No growth
7/M	Left SPOA	Ceftriaxone Metronidazole Cloxacillin	Endoscopic drainage	*Staphylococcus Aureus*
7/F	Orbital abscess	Ceftriaxone	Nil	Nil
8/F	Right preseptal cellulitis	Ceftriaxone Metronidazole	Tooth extraction	Nil
8/M	Left SPOA	Amoxicillin with clavulanic acid	Nil	Nil
11/M	Left SPOA	Amoxicillin with clavulanic acid Metronidazole Ceftazidime	Endoscopic drainage	Mixed growth
17/M	Left orbital celullitis With frontal cerebritis	Ceftriaxone Metronidazole Cloxacillin	Endoscopic drainage	*Staphylococcus Aureus*
33/F	Left orbital cellulitis	Ceftriaxone	Nil	Nil

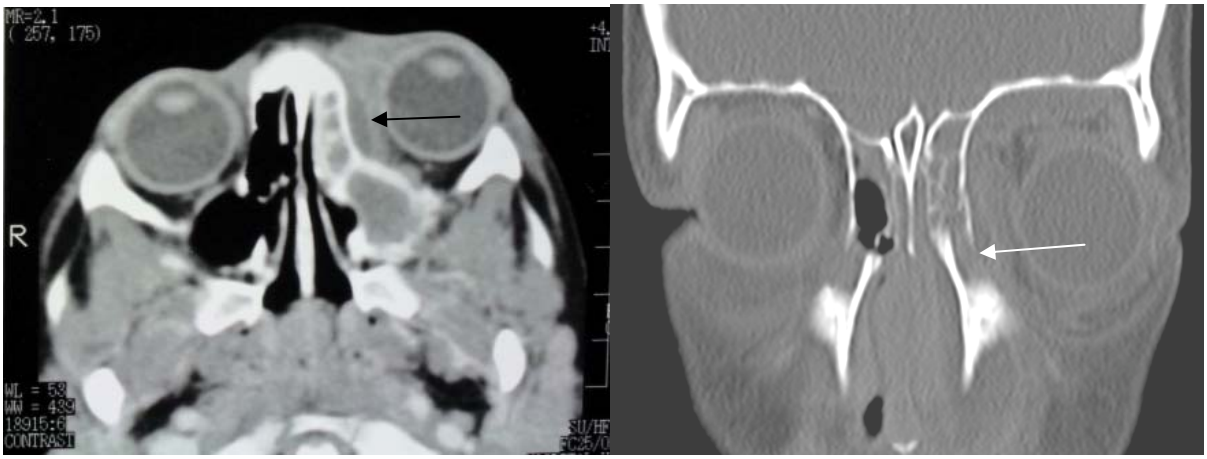

Fig. 1. Axial CT showing left subperiosteal abscess (black arrow) and destruction of left lamina papyrecea (white arrow) with left extraconal extension in coronal view.

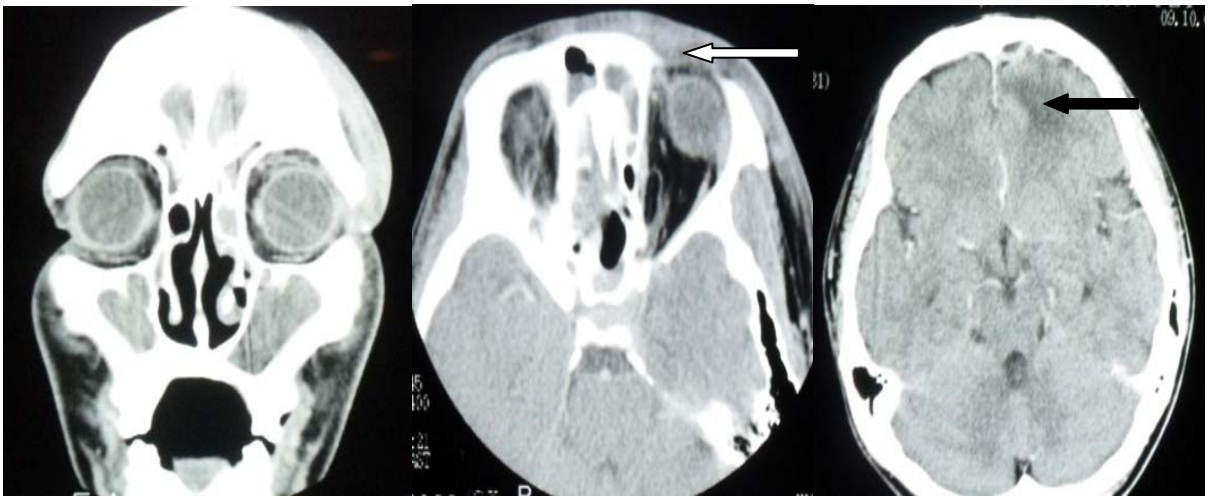

Fig. 2. Coronal and axial CT showing left frontal and ethmoid sinusitis with left supraorbital cellulitis (white arrow) complicated with left frontal extraaxial collection and frontal cerebritis (black arrow).

The diagnosis of the complication had been based on symptoms and signs, complete opthalmological assessment, and in all cases, contrast enhanced computed tomography (CT) of brain, orbit and paranasal sinuses were performed. CT scans confirmed the diagnosis and identified the various types of orbital complications seen in these patients. In two cases, the CT scans were unable to rule out the presence of abscess and a repeat CT scan confirmed the presence of abscess in one case. In four of SPOA cases, medial rectus muscle was edematous and thickened and in one case, there was superior and inferior rectus muscles involvement (Figure 1). Preseptal and periorbital cellulitis were well demonstrated in each with normal optic nerves. Nine patients had unilateral ipsilateral maxilloethmoiditis and one had unilateral ipsilateral posterior ethmoidal sinusitis.

In a 17 year old boy, who presented with nasal symptoms associated with frontal swelling and altered sensorium had frontal sinus involvement complicated with orbital cellulitis and frontal lobe cerebritis (Figure 2). Six patients demonstrated evidence of facial cellulitis corresponding to the area of sinuses involved.

Five patients were successfully treated medically, two had preseptal cellulitis and one of them had orbital cellulitis, one had SPOA and one had orbital abscess. The patient with intraconal orbital abscess with periorbital swelling showed improvement with oral antibiotic and a repeat CT scan after 10 days showed evidence of resolving proptosis.

Five patients (50%) had surgical intervention; four cases (three cases of SPOA and a case of pansinusitis with orbital cellulitis and frontal cerebritis) had emergency endoscopic sinus

surgery (ESS) and one had drainage via external ethmoidectomy within 24 hours of presentation. Two patients required repeated surgical intervention; a three year old boy with left SPOA due to poor compliance to oral antibiotics and the seven years old boy with left SPOA, with postoperative worsening of orbital symptoms. A repeat CT scan showed residual collection of abscess medial to lamina papyracea which was subsequently drained.

Surgical cultures were obtained in the 5 patients that were treated surgically and were positive in four cases. *Staphylococcus aureus* was the most common organism isolated in 2 cases (50%) which was sensitive to cloxacillin, and one case each was positive for *Burkholderia cepacia*, sensitive to cotrimazole and ceftazidime and one was a mixed growth.

Mean duration of stay was 9.6 days. Five patients who responded to medical management had a shorter hospital stay (mean 8.5 days) compared to those who were surgically managed (mean 10.3 days).

Most patients' with orbital signs and symptoms showed completely resolution within 2 weeks of review in outpatient clinics. Permanent visual squealed either as a result of the disease or treatment was not encountered. All patients were discharged well with oral antibiotics for a duration of two weeks. The average follow-up length was 2 months after discharge with no recurrence.

4. Discussion

Orbital complication is the most common complication implicated in acute sinusitis especially in infants and young children (1), while intracranial complications tend to affect older children (preteens) as shown in Table 1 (9). As reported in literature, our series also support that ethmoiditis involved 90% of pediatric age group and 10% in adult group. Incidence of intracranial complications of acute sinusitis has been reported to be about 13% (10) with higher incidence in the third world countries (38.5%) (11). Four out of 10 patients had frontal sinus involvement, and one of the patient with pansinusitis, had frontal cerebritis.

In spite of the close proximity of the orbit to all the paranasal sinuses, the ethmoidal labyrinth plays the main role in the development of infection (12). Furthermore, dehiscence of lamina papyracea as demonstrated in our series gave a significant impact on progression of the complications of acute rhinosinusitis. Most sinus infections are secondary to upper respiratory tract infection (URTI). It is estimated between 5 to 13% of viral URTI in children may be complicated by a secondary bacterial sinusitis, consistence in 9/10 patients in our series (13,14). Underlying atopic disease and positive family history of atopy are also potential contributing factors that predisposes to 20% of bacterial sinus infections (13) as documented in 3 cases in our series. The congested mucosa in allergic rhinitis interferes with normal physiological mucus drainage and aeration of the sinuses, which predisposed to infection of sinuses, and subsequently complicated with orbital involvement. On the other hand, swimming as a possible contributing factor, was identifiable in 2 of our cases, in which symptoms worsened following this activity. Swimming has a predisposed risk of seeding infection from contaminated water and chemical irritation (e.g., chlorine exposure) in patient with superimposed URTI (15). Acute maxillary sinusitis following dental infection complicated with preseptal cellulitis is another causative factor noted in our study.

In the pathogenesis of the disease, the infection in the sinus may reach the orbit through the dehiscence of its bony walls (Figure 2) or by means of interference with venous drainage of the orbital contents. Direct connections between the valveless orbital veins and the paranasal veins also facilitate this spread (16-18).

The classification for orbital complications was introduced in 1970 by Chandler et al (16) which is widely used today. Opthalmological examination is mandatory. With the presence of diplopia, opthalmoplegia and proptosis, these symptoms commonly accompanies postseptal complication (Chandler's stages II-V), which mandates urgent radiological imaging.

CT scan of the nasal, paranasal, orbits and brain in coronal and axial views, is the gold standard for diagnosing and delineating the staging (Figure 1 and 2). It also serves as a baseline in monitoring and evaluating the progress of the disease especially in those with postseptal disease managed medically. Moreover, it provides an anatomical guideline for surgery when contemplated (15). The indications for CT scans are; [1] when clinically an abcess is suspected. [2] when an orbital cellulitis does not responded to medical therapy and [3] when there is impaired visual aquity. The accuracy was reported up to 82% (19). The MRI may be reserved for an assessment of the continued progressive neurologic changes resulting from intracranial complications (11).

The nature of orbital complications observed in this series were preseptal cellulitis (2 cases), 2

cases of orbital celulitis, a case of orbital abscess, and subperiosteal abscess (5 cases). The type of orbital involvement in acute sinusitis reflexes the prognosis as well as management decisions. Harris et all in 2001 and Younis et al in 2002 (7,8) recommended that most orbital infections are treated conservatively, especially in children younger than 9 years of age, because they were infected with less virulent organisms. In addition nonsurgical treatment is reserved for patients without signs of significant ocular deficits. In view of the anticipated pathogens in children 9 years or older, surgical intervention should be considered even with orbital cellulitis secondary to sinusitis to prevent orbital or intracranial complications such as abscess formation (7). A proper guideline for the treatment depends on the Chandler classification staging. Most cases of preseptal and orbital cellulitis may be effectively managed with intravenous antibiotics. The indications for surgery in cases of orbital complications are recommended as in table 2 (20).

Table 2. The indications for surgery in cases of orbital complications

1. In stage I or II, if the patient's condition fails to improve significantly within 24–48 hours after appropriate antibiotic administration.
2. Immediately if the visual acuity drops.
3. Increasing levels of proptosis and ophthalmoplegia.
4. An abscess demonstrated on CT scan

Both cases of preseptal and orbital cellulitis in our study were successfully treated with multiple parenteral antibiotics, except one patient with acute pansinusitis complicated with left orbital cellulitis and frontal cerebritis mandating urgent endoscopic surgical drainage of his sinuses. The treatment of an orbital SPOA is controversial. Some authors advocate an initial trial of intravenous antibiotics despite radiographic evidence of SPOA. Even with the appropriate treatment, there is a significant complication rate of 20% and visual loss rate of 33% (21). Several authors have reported series of patients with medial SPOA treated successfully with medical therapy (22-25).

A case of SPOA in our study was managed via external ethmoidectomy approach. However with the advent of endoscopic sinus surgery (ESS) in providing a quick and safe drainage technique, the trend has changed in which 3 out 5 cases of SPOA had surgical drainage via this approach. The changing trend not only reflects availability of expertise but also acknowledgment of the benefit of endoscopic drainage such as avoidance of facial scar and early post-operative recovery. It was established in literature that surgical intervention is indicated in group IV (26), however, interestingly in one of the patients, a 7 year old girl with small intraconal abscess, she was successfully treated with medical therapy alone.

Initial empirical antimicrobial therapy is based on the expected aetiological agents. Although surgical intervention remains as an essential treatment, selected patients may respond to high-dose antibiotics to directed cultures when given for an extended period of time (27). All our patients in this series had received empirical multiple antibiotic at their initial presentation. Ceftriaxone, with its potent ability to cross the blood brain barrier had become the most commonly used antibiotics in combination with Metronidazole (active against strict anaerobic bacteria), were used in 50% and was used alone in 20% of our patients respectively as suggested in literature (28-30). For patients who fail to respond to the initial therapy, the antibiotic should be changed according to culture and sensitivity studies.

The American Academy of Pediatrics (AAA) had made recommendation for indication of antibiotic therapy of amoxicillin if a child presented with fever and purulent nasal discharge for at least 3-4 days to ensure rapid resolution of acute sinusitis and avoidance of possible complication (15). On the contrary, SPOA may not be preventable with comparison between two groups of pre and post AAA criteria guideline of antibiotics (31). As documented in our study in spite of 50% of the cases having received pre hospital antibiotics, yet they presented with orbital complications.

The principal bacterial pathogens of acute bacterial rhinosinusitis are: *S. pneumoniae* (30-40%), *Haemophilus influenzae* (20-30%), *M. catarrhalis* (12-20%) and *S. pyogenes* (3%) (29). Other pathogens, found less frequently, are *Staphylococcus aureus*, *Neisseria species*, and other Gram positive and Gram-negative bacilli. Fungi are most commonly observed in immuno compromised and diabetic individuals (32). In cases of SPOA, young children harbour single aerobe organism namely *Staphylococcus* and *streptococcus*, whereas beyond 9 years children harbour more polymicrobial and anaerobic organisms (25). In our cases with post-rhinosinusitis complications, the cultivated bacterial spectrum was inconsistent with the results of other literature studies (29). Four out of 10 were positive cultures, two grew *Staphylococcus sp* sensitive to oxacillin, a case

with *Burkholderia Cepacia*, sensitive to co-trimazole as well as ceftazidime and a case with mixed growth. In cases with negative cultures were likely due to initiation of pre-culture antibiotic. In all of our cases, the antibiotic therapy was supplemented with local decongestant, mucolytic and, if necessary, antihistaminic drugs.

These patients were managed by a multidisciplinary team composed of an otolaryngologist, a neurologist, a neurosurgeon, an intensive therapy specialist, an ophthalmologist, a radiologist, a pediatrician and an infectious disease specialist.

5. Conclusion

In conclusion, orbital complications of acute sinusitis need urgent multidisciplinary approach and prompt treatment is needed to avoid visual loss or intracranial complications. Clinical examination alone is not always helpful and therefore a CT scan can be useful to diagnose, and monitor the extent of the intraorbital infection. Medical treatment has an important role not only in preseptal and orbital cellulitis, but also in SPOA as well as in small orbital abscess. Previously, abscess were drained via external drainage, however the trend has changed, with increasing naso-endoscopic approach for surgical drainage.

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