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Orbital complication following sinusitis still a problem: Our experience and results

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Abstract

Introduction

The orbital complications of sinusitis including cellulitis and abscess formation are well documented in both children and adults, but remain relatively uncommon. If left untreated, several complications such as orbital complications could progress rapidly, leading to optic neuritis, cavernous sinus thrombophlebitis or life-threatening intracranial complications and orbital cellulitis can manifest including blindness, meningitis, and even death.

Material and Methods

A prospective and observational study of patients presented with orbital complication secondary to sinusitis in our Hospitals from January 2019 to December 2019.

Results

In our study total 60 patients, male patients (63.3%) more common than women (36.6%) with a ratio of 1.7:1. Frequency of age groups of 1-20 years are 23 patients (38.3%) and least were more than 61 years old patients 5%. CT of orbits and sinuses was conducted in all patients, and sinusitis and preseptal cellulitis / orbital abscess was evident in all these cases. Maximum cases were Maxillary Sinusitis (n=41) and least were Sphenoid Sinusitis (n=3). In each of the patients with sinus disease, generally more than 1 ocular symptom were found. Proposes is the highest manifestation of ocular symptoms (n=30) due to diseases of the par nasal sinuses. Other ocular symptoms that least common were decrease visual acuity (n=3) and relative afferent pupillary defect present (n=4). All patients received intravenous antimicrobials, 7(11.6%) with amoxicillin/clavulanate alone, 2(3.33%) with ampicillin/ sulbactam alone, gentamicin in 12 (20%), and the other 39 (65%) with multiple antimicrobials.

Conclusion

Orbital complications, secondary to sinusitis, in the new millennium still pose a serious threat to patient's vision and life; it can lead to irreversible damage if not treated aggressively. Medical treatment is efficient in early stages while surgical drainage (endoscopic or external) in preseptal, sub periosteal or orbital abscess.

Keywords: Orbital complication, experience and results, observational, cellulitis

Introduction

The orbital complications of sinusitis including cellulitis and abscess formation are well documented in both children and adults, but remain relatively uncommon [1]. If left untreated, several complications such as orbital complications could progress rapidly, leading to optic neuritis, cavernous sinus thrombophlebitis or life-threatening intracranial complications and orbital cellulitis can manifest including blindness, meningitis, and even death [2].

Orbital complication accounts for 74–85% of complications arising from acute sinusitis and usually this is secondary to acute ethmoidal sinusitis since the ethmoid sinus is separate from the orbit only by the lamina papyracea [3]. In developing countries, sinusitis is under treated and is one of the leading causes of orbital complications. The introduction of antibiotics has altered the course of sinusitis and its complication. In the pre-antibiotic era, the morbidity and mortality in patients with orbital complications secondary to sinusitis were 20.5% and 17%, respectively [4]. With the advent of stronger antibiotics and newer surgical modalities, rates of morbidity and mortality have declined to 3-11% and 1-2.5%, respectively [5].

Orbital complications are the most common complications encountered with acute bacterial sinusitis. Infection can spread directly through the thin bone separating the ethmoid or frontal sinuses from the orbit or by thrombophlebitis of the ethmoid veins [6]. Diagnosis should be based on an accurate physical examination including ophthalmological evaluation and

appropriate radiological studies. CT scanning is the most sensitive means of diagnosing an orbital abscess, although ultrasound has been found to be 90% effective for diagnosing anterior abscesses. [7]. The classification by Chandler, which is based on physical examination findings, provides a reasonable framework to guide management [8]. This classification consists of 5 groups of orbital inflammation:

- **Group 1:** Inflammatory edema (preseptal cellulitis) with normal visual acuity and extra ocular movement
- **Group 2:** Orbital cellulitis with diffuse orbital edema but no discrete abscess
- **Group 3:** Sub periosteal abscess beneath the periosteum of the lamina papyracea resulting in downward and lateral globe displacement
- **Group 4:** Orbital abscess with chemosis, ophthalmoplegia, and decreased visual acuity
- **Group 5:** Cavernous sinus thrombosis with rapidly progressive bilateral chemosis, ophthalmoplegia, retinal engorgement, and loss of visual acuity; possible meningeal signs and high fever.

Among the classifications by Chandler, surgical drainage of both the infected sinuses and the orbit are advocated for groups 3-5 if inadequate improvement or progression of orbital cellulitis occurs despite medical therapy or if the patient has loss of visual acuity.

However, identifying the stages in children and adult with swollen and/or painful eyes can be more ambiguous. To simplify the classification criteria, complications of the orbital septum including preseptal cellulitis and post septal infections have been proposed [9]. When sinusitis is the primary cause, infection usually spreads from the ethmoid sinuses; however, infection can also spread through the floor of the frontal sinus or the roof of the maxillary antrum. [10]

The orbital complications may be a result of extension of the infection through bony defects, osteitic bone destruction, or through thrombophlebitis of the communicating veins. [11]

Despite medical advances in the diagnostic and therapeutic management of orbital complications from acute sinusitis, they continue to be an important clinical problem with the potential to cause considerable morbidity and mortality. The ophthalmologic complications of sinusitis are well documented and include a group of conditions ranging from per orbital inflammation and orbital cellulitis (OC) to sub periosteal and orbital abscess (SPOA/OA) and, finally, cavernous sinus thrombosis. [12] With the exception of per orbital inflammation or preseptal cellulitis, patients with these conditions present or develop proptosis, chemosis, ophthalmoplegia, and visual impairment [13].

In this study, we have discussed the clinical approaches for ophthalmology and otorhinolaryngology, and their use in treating and managing orbital complications of sinusitis and including sinus drainage and intravenous antibiotics, is advocated for any degree of orbital complication.

The aim of our study was to evaluate the incidence, presentations and outcomes of different treatment modalities of orbital complications secondary to sinusitis.

Material and Methods

A prospective and observational study of patients presented with orbital complication secondary to sinusitis in our Hospitals from January 2019 to December 2019.

Inclusion criteria of our study were inpatients of all age groups presenting with preseptal/orbital inflammation secondary to acute (<1 month), sub acute (1–3 months) or chronic sinusitis (>3 month) of bacterial, fungal or unidentified pathogens. The diagnosis was based on clinical symptoms and signs as well as laboratory tests and radiological investigations. Sinusitis was confirmed by the presence of sinus pacification or air-fluid levels on computerized tomography (CT) or X-ray when CT was not available. The exclusion criteria were haematological bone marrow disorders and sinus/orbital cancers. Cases of orbital cellulitis without concomitant sinusitis were excluded. The data recorded included sex, age, symptoms, medical history, ophthalmic examination findings, systemic and laboratory findings, imaging results and the sinuses involved, culture results, treatments, hospital stay durations, and outcomes.

Staging

In this study, orbital complications of sinusitis were classified via a modified form of the classification system reported by Chandler *et al.* [5] Focal thickening and infiltration of the eyelid anterior to the orbital septum were classified as stage I, preseptal cellulitis. Edema and inflammation of the orbital contents without evidence of abscess formation were classified as postseptal stage II, orbital cellulitis. Abscess formation between the orbital wall and the periorbital was classified as stage III, subperiosteal abscess. Abscess formation with pus or debris within the orbital content was classified as stage IV, orbital abscess. Additional intracranial extension, including cavernous sinus thrombosis, meningitis, cerebritis, or epidural/subdural/ intracerebral abscess or empyema, was classified as stage V.

Results

In our study total 60 patients, male patients (63.3%) more common than women (36.6%) with a ratio of 1.7:1 (Table 1).

Table 1: Distribution by gender

Gender	No. of patients	Percentage (%)
Male	38	63.3
Female	22	36.6
Total	60	100

Table 2: Distribution of age group

Age in years	No. of patients	Percentage (%)
1-20	23	38.3
21-40	18	30
41-60	16	26.6
>61	3	5

In table 2, frequency of age groups of 1-20 years are 23 patients (38.3%) and least were more than 61 years old patients 5%.

Table 3: Incidence of each sinus affection according to CT scan findings according to Chandler typing

Sinusitis	Stage, No. of patients					Total
	Preseptal	Postseptal			Intracranial	
	I	II	III	IV	V	
Maxillary Sinusitis	18	2	7	5	9	41
Ethmoid Sinusitis	14	4	8	6	6	38
Frontal Sinusitis	9	0	7	1	2	19
Sphenoid Sinusitis	1	0	0	1	1	3

In table 3, CT of orbits and sinuses was conducted in all patients, and sinusitis and preseptal cellulitis / orbital abscess was evident in all these cases. Maximum cases were Maxillary Sinusitis (n=41) and least were Sphenoid Sinusitis (n=3).

Table 4: Distribution of ophthalmological finding of the patients according to Chandler typing

Ophthalmological finding	Stage, No. of patients					Total
	Preseptal	Postseptal			Intracranial	
	I	II	III	IV	V	
Limited Extra ocular motility	1	5	9	2	4	21
Proptosis	1	7	18	1	3	30
IOP > 23 mmHg	2	1	3	2	3	11
Decrease Visual acuity	1	0	0	1	1	3
Relative afferent pupillary defect present	0	0	1	1	3	4

In each of the patients with sinus disease, generally more than 1 ocular symptom were found. Proptosis is the highest manifestation of ocular symptoms (n=30) due to diseases of the paranasal sinuses. Other ocular symptoms that least common were decrease visual acuity (n=3) and relative afferent pupillary defect present (n=4).

Table 5: Distribution according to sinus disease diagnosis which have orbital complication with the management of therapy

Therapy	No. of patients	Percentage (%)
Amoxicillin/clavulanate	7	11.6
Ampicillin/sulbactam	2	3.33
Gentamicin	12	20
Multiple antimicrobials	39	65

All patients received intravenous antimicrobials, 7(11.6%) with amoxicillin/clavulanate alone, 2(3.33%) with ampicillin/sulbactam alone, gentamicin in 12 (20%), and the other 39 (65%) with multiple antimicrobials.

Table 6: Surgical procedures used to drain the abscess

Surgery	No. of patients
Maxillary antrostomies	30
Endoscopic ethmoidectomies	24
Frontal sinusotomies	16
Endoscopic sphenoidotomies	6
External ethmoidectomies	9
Frontal trephination	6
Caldwell Luc procedure	1
Orbital exenteration	1

Discussion

To our best knowledge, this is the first study analysing disease stage and risk factors, manifestations, diagnosis, treatments, and outcomes associated with orbital complications of sinusitis conducted in North Indian population. Sinusitis is the most common cause of orbital infections in children and adults, and acute exacerbation of chronic sinusitis is often the cause of serious orbital complications in adults. Most orbital infections respond to medical management. Our approach to treating serious complications of sinusitis has evolved over the past 2 decades. Increased awareness of possible complications and the introduction of advanced diagnostic tools, new broad-spectrum antibiotics, and innovative surgical techniques have improved the management of these infections. Surgical intervention to drain the sinuses and abscesses is reserved for patients who have more advanced disease and for those who do not respond to medical therapy [14].

Classification of infections: The classification of orbital infections was introduced by Hubert and refined by Smith and Spencer [15, 16]. The most recent system was introduced in the 1970s by Chandler et al and is widely used today". Their system classifies orbital infections into five stages: periorbital cellulitis (stage I), orbital cellulitis (stage II), subperiosteal abscess (stage III), orbital abscess (stage IV), and cavernous sinus thrombosis (stage V) [8].

Another classification approach categorizes orbital infections as either preseptal (superficial) or postseptal (deep). 'The dividing line that designates an infection as either pre- or postseptal is the orbital septum and the tarsal plate that is contiguous with the periosteum official bone. Because no lymphatic or venous connection exists between these two compartments, the orbital septum acts as a barrier to the spread of infection from the face to the deep or bit [5].

In our study, male patients found more common than women by a ratio of 1.7:1. Although in another study by Kayhan FT *et al.* also found the number of male patients were more common than women by a ratio of respectively 3.5: 1 and 2: 1 but Patt BS *et al.* get the opposite result with the ratio of men compared to women is 1:4 [17, 18].

In our study, the largest age group are in the age range 1-20 years (38.3%, n=23). In the study by Williams BJ *et al.* age range of the patients obtained also broad enough that from the age of 1-75 years with the largest age group is 31-40 years (26.67%) [19]. This is concordant with results reported by Souliere CR, and may be attributable to incomplete paranasal sinus development and thinner bony barriers in such patients [20]. In contrast, acute exacerbation of chronic sinusitis is often the cause of serious complications in adults, and a history of chronic sinusitis was identified in 45.8% of adults versus 22.9% of children in this study.

Predisposing factors of sinusitis include anatomic derangements, impaired sinus drainage, and inhibition of mucociliary transport, which promote bacterial overgrowth [21].

We observed that from the 60 cases of sinus disease in this study, the maxillary Sinusitis (n=41) and ethmoid Sinusitis (n=38) are the most involved sinus. Our finding that the maxillary and ethmoidal sinuses were the most common sources of infection causing orbital/intracranial complications is concordant with previous studies. [22] Liao S *et al.* found that the ethmoid sinus (50%) are most involved sinus. [23] Maxillary sinus (46.2%) and ethmoid (38.5%) is the highest sinus involved in the sinus infection. Ryan JT *et al.* also found that the maxillary sinus (60%) are the most widely sinus involved in acute sinusitis in children. [24] However, the ethmoidal and maxillary sinuses were most frequently involved in the study by Brown CL *et al.* [23]

Infection in the ethmoidal sinus may spread directly into the orbit via the thin bone of the lamina papyracea, or indirectly to the brain via septic thrombophlebitis. [26] Frontal sinusitis occurred in 19 patients in the current study. Notably however, infection in the frontal sinus spreading to the brain via the thin bone of the anterior cranial fossa, resulting in frontal lobe abscess, is reportedly the most common intracranial complication of sinusitis [27].

In this study, found that the highest manifestation of ocular symptoms of the disease in the paranasal sinuses is proptosis (n=30). Other ocular symptoms that common are limited extraocular motility (n=21). Generally, there are more than 1 ocular symptoms were found in each patient. Schwartz GR *et al.* also found proptosis (66.66%) as the largest clinical manifestations followed by a decrease in visual acuity (25.9%) and ophthalmoplegia (11:11%). Direction which occur proptosis can be an important clue of the location of the paranasal sinuses that involved. Proptosis in sinusitis with orbital complications occur due to inflammation and diffuse edema in the soft tissues of the orbit. The presence of subperiosteal abscess will drive eyeballs to a certain direction. In their study, proptosis occurs laterally in 1 patient with periorbital abscess. [28]

Ocular manifestations in the form of a decrease in visual acuity showed the presence of optic nerve involvement. The underlying pathophysiology may be caused by direct compression on the nerve lesions, no perfusion of the blood vessels that lead to ischemic orbital nerve or inflammation in response to infection around the nerve. In our study, there is a decrease in visual acuity to no light perception in 3 patients with sinusitis. Ophthalmoplegia can be caused by a mechanical restriction on extraocular muscles or nerves paresis innervating the extraocular muscles. Force duction test can distinguish between the causes of which the results of the test will be positive if the etiology is due to mechanical restrictions. Abnormal ocular motility can cause diplopia both at the primary gaze position and the position of the extremes gaze [29].

While recommendations of antimicrobial treatment for orbital complications of sinusitis vary, most clinicians suggest multi-drug combinations or a single broad-spectrum antimicrobial, to safe-guard against polymicrobial pathogens including anaerobes. [30] Some agree that amoxicillin/ clavulanate, which has historically often been used (alone or in combination) and was used in our study is effective against beta-lactamase-producing aerobes and anaerobes, is suitable for use in all age-groups [31].

The goals of surgery for orbital complications of sinusitis are to drain the abscess adequately, release pressure in the orbit, and obtain material for culture. Endoscopic sinus surgery, introduced in the 1980s, was the most frequently used procedure in the current study [30]. It has several advantages over an open procedure, including the negation of an external wound, less postoperative edema, and more rapid recovery. The likelihood of surgery increased with more advanced stages of orbital complications in the current study [31].

Out of 21 patients diagnosed as subperiosteal abscess in which surgical interventions were used, 9 cases underwent external drainage, while 13 patients were drained endoscopically. However, the route of surgical drainage is determined by localization of the orbital sub periosteal abscess [32]. External surgery may be required if there is difficulty in visualizing a sub periosteal abscess located superomedially in the orbit [33]. In our study 9 of the patients managed by external approach were scheduled for endoscopic drainage but failed due to severe oedema and congestion of the nasal mucosa. In our experience, endoscopic approaches are reserved for infection in the subperiosteal space. Intraconal infection, fortunately rare, is approached externally with the ophthalmology service.

Conclusion

Orbital complications, secondary to sinusitis, in the new millennium still pose a serious threat to patient's vision and life; it can lead to irreversible damage if not treated aggressively. Orbital examination and CT scan are mandatory before dealing with those patients for staging and choosing the suitable line of treatment. Medical treatment is efficient in early stages while surgical drainage (endoscopic or external) in preseptal, subperiosteal or orbital abscess. These complications are largely due to ignorance and under treatment on the part of the patients and delayed/missed diagnosis on the part of the clinicians.

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