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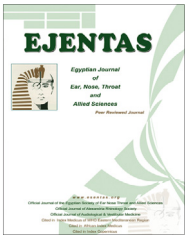


ORIGINAL ARTICLE

# Orbital complications following sinusitis still a problem: Our experience and results


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**KEYWORDS**

Sinusitis;
Orbital complications;
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**Abstract** *Objectives:* To evaluate the incidence, presentations and different treatment outcomes of orbital complications secondary to sinusitis.

*Methods:* We conducted a retrospective chart review of patients with orbital complications secondary to sinusitis seen at Ain-Shams University Hospitals (Department of OtoRhinoLaryngology, Cairo, Egypt) over a period of three years. Data obtained from the charts included clinical presentations, contrast enhanced computed tomography data, type of treatment, surgical approaches used and their outcomes.

*Results:* Thirty-five patients (35) presented to Ain Shams University Hospital over the three year period with orbital complication secondary to sinusitis. Medical treatment was successful in 15 patients; surgical drainage was done in 19 cases (13 cases were done endoscopically and 6 were drained externally) including orbital exenteration and Caldwell Luc procedure which were done in the same patient (fungal infection). One case developed coma and passed away the same day of presentation despite aggressive management and neurological consultation.

*Conclusion:* Orbital complications of sinusitis have a good prognosis when detected early and managed appropriately. The key point here should be increasing physician awareness towards this problem as well as encouraging early referral to specialized centers for the proper management of these cases.

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## 1. Introduction

Many and diverse sinus pathologies can present with an orbital involvement.[1] Primary sinus infection is the most common cause of orbital cellulites.[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.[4] 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.[5] With the advent of stronger

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antibiotics and newer surgical modalities, rates of morbidity and mortality have declined to 3–11% and 1–2.5%, respectively.[6]

Management strategy of orbital complications of sinusitis depends on the severity of affection at initial presentation. Medical treatment is advocated in mild cases with neither visual affection nor remobility restriction. Severe cases and/or failure of medical treatment mandate surgical interference dealing with both the affected sinuses and nearby orbit.[7,8] Sinusitis with orbital complications is a critical situation. Without timely diagnosis and appropriate management it may affect the vision and even become a life threatening disease.[9]

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

## 2. Methods

A retrospective chart review of patients presented with orbital complication secondary to sinusitis at Ain Shams University Hospitals from January 2010 to December 2012 was performed after approval from the internal review board.

Data obtained from the charts included:

- Clinical presentations (eyelid oedema, chemosis, proptosis, impaired vision and restricted mobility).
- Local examination including Otorhinolaryngological and ophthalmological examination.
- Contrast enhanced CT scan data.
- Type of treatment.
- Surgical approaches used and their outcomes.
- Follow up data of the treatment to assess the final outcome of each case.

We included patients who presented with orbital complications secondary to sinusitis and not to other orbital pathology based on symptoms, clinical signs and radiological investigation. Patients with periorbital oedema, erythema, and increase in local hyperemia but without proptosis, ophthalmoplegia and visual impairment were defined as having preseptal cellulitis. Patients with proptosis, ophthalmoplegia and visual impairment were defined as having postseptal orbital cellulitis. The patients consent were obtained.

All the patients had CT scan performed at the time of initial presentation regardless of the clinical staging of the disease. Sinusitis was defined by the presence of opacification or air fluid level on CT scan.

Based on the clinical and radiological examination patients were classified into five groups according to the Chandler classification[10] (Table 1).

Treatment was tailored according to the site, severity and stage of infection, this included medical and surgical measures:

a) Medical treatment
   i. IV antibiotics (the most commonly used being a third generation cephalosporin (ceftriaxone) in a dose ranging from 50 to 100 mg/kg/day for a mean duration of 3 days (range: 1–5), it is reasonable to wait until the patient is free of fever and exhibits a substantial improvement of the orbital signs before shifting to the oral antibiotic. To be followed later by oral amoxicillin clavulanate for the next 2 weeks.
   ii. Saline irrigation.
   iii. Topical and systemic decongestants.
   iv. Anti-inflammatory agents.

b) Surgical approaches. Surgical intervention was entirely based on CT scan showing subperiosteal abscess or orbital abscess; and failure to improve clinically within 48 h. It is either:
   i. Open approaches.
   ii. Endoscopic approaches: drainage of the orbital suppurations and nearby sinuses.

Treatment outcome was measured by resolution of the complication or the development of permanent visual loss and/or neurological insult. Follow up CT scans were ordered whenever feasible 1 month after resolution of the condition.

## 3. Results

Thirty-five patients presented to Ain Shams University Hospital over the three year period with orbital complication secondary to sinusitis. Twenty-five (71.42%) cases presented to our causality while 10 cases (28.57%) were referred from the Ophthalmology department.

### 3.1. Patient demographics

Age of the patients ranged from 3.5 to 66 years with a mean age of 35 ± 9.4 years. There were 12 patients (34%) in the paediatric age group (less than 18 years) while the rest of the patients (66%) were adults. Twenty-one patients (60%) were males while fourteen (40%) were females with a male to female ratio of 1.5:1. Orbital complications were encountered more commonly on the right side compared to the left side. The right orbit was involved in 19 cases (54%) while the left orbit was involved in 16 cases (46%).

### 3.2. Clinical presentation and radiographic findings

Fifteen of the patients (43%) had a history of recent upper respiratory tract infection, 12 patients (34%) gave a history of chronic sinus diseases. Eyelid erythema and oedema are present in almost all cases. Twenty of the patients (57%) presented with proptosis, limited eye movements in 14 cases and total loss of vision in 2 cases (Table 2).

Oedematous mucosa was observed by nasal endoscopy in all patients. The visual acuity and the fundus examination were abnormal in seven cases (20%).

There were 15 cases with pre-septal and 20 cases with post-septal infections. Patients were grouped following chandler's classification into 5 stages: 15 (43%) in stage I, 5 (14%) in stage II, 13 (37%) in stage III and 2 (6%) in stage V (There is no patient in group IV) (Table 3). Orbital manifestations of the patients included in the study were staged according to the chandler staging of the disease (Table 4).

Reviewing the CT scan results showed that the ethmoiditis was present in all the patients either alone or associated with other sinus affection (Tables 5 and 6). Twenty-seven patients showed essentially unilateral sinus disease, with only 8 patients showing bilateral involvement in which the ipsilateral side of orbital inflammation was markedly involved than the other.

**Table 1** Chandler classification for orbital complications of sinusitis.[10]

| Stage | Description |
|---|---|
| Type I (Pre-septal cellulitis) | Oedema of the eyelid, no limitation of ocular movement, normal visual acuity |
| Type II (Subperiosteal oedema) | Diffuse oedema of the orbital contents; infiltration with inflammatory cells and bacteria with or without reduction of the visual acuity |
| Type III (Subperiosteal abscess) (SPA) | Collection of pus between periorbita and bony wall of orbit; globe is usually displaced |
| Type IV (Orbital abscess) | Collection of pus within the orbital tissues; marked proptosis and chemosis; ophthalmoplegia; visual impairment |
| Type V (Cavernous sinus thrombosis) | Extension of inflammation posteriorly into cavernous sinus; bilateral eye signs, cranial nerve palsy |

**Table 2** Ophthalmologic signs and symptoms in patients of the studied group.

| Signs and symptoms | Number | Percent affected % |
|---|---|---|
| Erythema/oedema of the eyelids | 35 | 100 |
| Proptosis | 20 | 57 |
| Limited extraocular motility | 10 | 29 |
| Decreased visual acuity | 5 | 14 |
| Lost vision | 2 | 6 |

**Table 3** Distribution of infections by Chandler typing.

| Chandler stage | (Number) ($n$ = 35) | Percent % |
|---|---|---|
| I | 15 | 43 |
| II | 5 | 14 |
| III | 13 | 37 |
| IV | 0 | 0 |
| V | 2 | 6 |

**Table 6** Incidence of each sinus affection according to CT scan findings.

| Sinus | No. | (%) |
|---|---|---|
| Anterior ethmoids | 35 | 100 |
| Posterior ethmoids | 14 | 40 |
| Maxillary | 22 | 63 |
| Frontal | 16 | 46 |
| Sphenoid | 10 | 30 |

**Table 4** Orbital manifestations of the patients according to Chandler typing.

| Chandler stage | ($n$ = 35) | Eyelid oedema | Proptosis | Limited extraocular motility | Impaired vision |
|---|---|---|---|---|---|
| I | 15 | 15 | 0 | 0 | 0 |
| II | 5 | 5 | 5 | 3 | 1 |
| III | 13 | 13 | 13 | 5 | 4 |
| IV | 0 | 0 | 0 | 0 | 0 |
| V | 2 | 2 | 2 | 2 | 2 |
| | 35 | 35 | 20 | 10 | 7 |

**Table 5** Site distribution of sinusitis in the 35 patients.

| Sinus | No. | (%) |
|---|---|---|
| Ethmoidal sinusitis only | 11 | 31 |
| Maxillary + ethmoidal + frontal | 14 | 40 |
| Maxillary + ethmoidal | 6 | 17 |
| Frontal + ethmoidal | 2 | 6 |
| Maxillary + ethmoidal + sphenoidal | 2 | 6 |

Other CT scan findings included:

- Erosion of lamina papyracea in 4 patients (11%).
- Inward displacement of the periosteum with adjacent extraocular muscles in 13 patients with SPA (37%).
- Diffuse oedema of the orbital contents and extraocular muscles as in 5 patients with orbital cellulitis (14%).

MRI with gadolinium contrast was obtained in 2 cases in stage V to confirm the diagnosis of cavernous sinus thrombosis:

### 3.3. Management

All patients were kept on a wide range of IV antibiotics regimen after admission in our department for 48–72 h. A nasal decongestant, either topical or oral; mucolytics; and saline irrigations were given to promote sinus drainage. The surgical intervention was either an external approach or endoscopic endo-nasal drainage using a 0 degree and 30 degree endoscope.

The surgical intervention was entirely based on CT scan showing subperiosteal abscess, orbital abscess and failure to improve clinically within 48 h.

The patients were divided into 2 groups according to the initial presentation. Group A included 20 patients of stages I and II in which medical treatment was started. Group B included 14 patients of stages III and V in which surgical treatment was planned from the start (one patient died after diagnosis despite aggressive management).

Among group A; 15 cases out of 20 responded well to antibiotics and the remaining 5 were surgically drained:

- Two patients did not show any improvement on medical treatment and progressed to develop preseptal abscess and necessitated external drainage with the help of ophthalmology service and endonasal approach using FESS was done to address the sinus pathology.
- Three cases diagnosed as subperiosteal oedema (stage II) deteriorated clinically and were taken for surgery after 48 h of medical treatment. The patient developed subperiosteal abscess that required surgical drainage.

Among group B (Table 7): 13 cases with Chandler's classification stage III who showed evidence of subperiosteal abscess were considered for surgical intervention depending on the location of the abscess. Three cases with chandler's classification stage II from group A in which medical treatment failed and the patient condition deteriorated were added to them. These 16 cases were surgically drained as follows:

**Table 7** Percentage of the used surgical procedures used to drain the abscess.

| Surgery | No. | (%) |
|---|---|---|
| Maxillary antrostomies | 15 | 79 |
| Endoscopic ethmoidectomies | 14 | 74 |
| Frontal sinusotomies | 8 | 42 |
| Endoscopic sphenoidotomies | 6 | 32 |
| External ethmoidectomies | 5 | 26 |
| Frontal trephination | 3 | 16 |
| Caldwell Luc procedure | 1 | 5 |
| Orbital exenteration | 1 | 5 |

- Ten cases were done by endonasal approach using FESS in medially located abscesses (the extent of endoscopic clearance of the sinuses depends on the extent of the disease and ranged from simple ethmoidectomy to complete sphenoethmoidectomy, middle meatal antrostomy (MMA) and frontal sinusotomy),
- Six cases were performed by external approach via frontal sinus trephination and external ethmoidectomy.

Also among group B; there were 2 cases with Chandler's classification stage V included. One case presented with severe bilateral ophthalmoplegia with disturbed level of conscious, developed coma and passed away the same day of presentation despite aggressive management. The other case was immune-compromised diabetic patient who had severe fungal infection with intracranial extension (cavernous sinus) and underwent orbital exenteration and Caldwell Luc procedure but died 1 week after surgical intervention with cavernous sinus thrombosis although Amphotericin B was started. The pathology of these two cases revealed invasive fungal sinusitis (mucor mucosis).

### 3.4. Outcome and follow up

Thirty-three patients (94%) had a good outcome (Figs. 1,2,3 and 4). None of them developed permanent visual loss or neurological sequelae. Five patients (14%) continued to have intermittent eye pain and minimal eyelid oedema and required a second surgical intervention in the form of total ethmoidectomy with middle meatal antrostomy to clear residual sinusitis, after which they also had a good outcome with no more complaints. Four patients (11%) had a decreased visual acuity.

**Figure 1** A case of preseptal cellulitis of the right eye, before and after medical treatment.

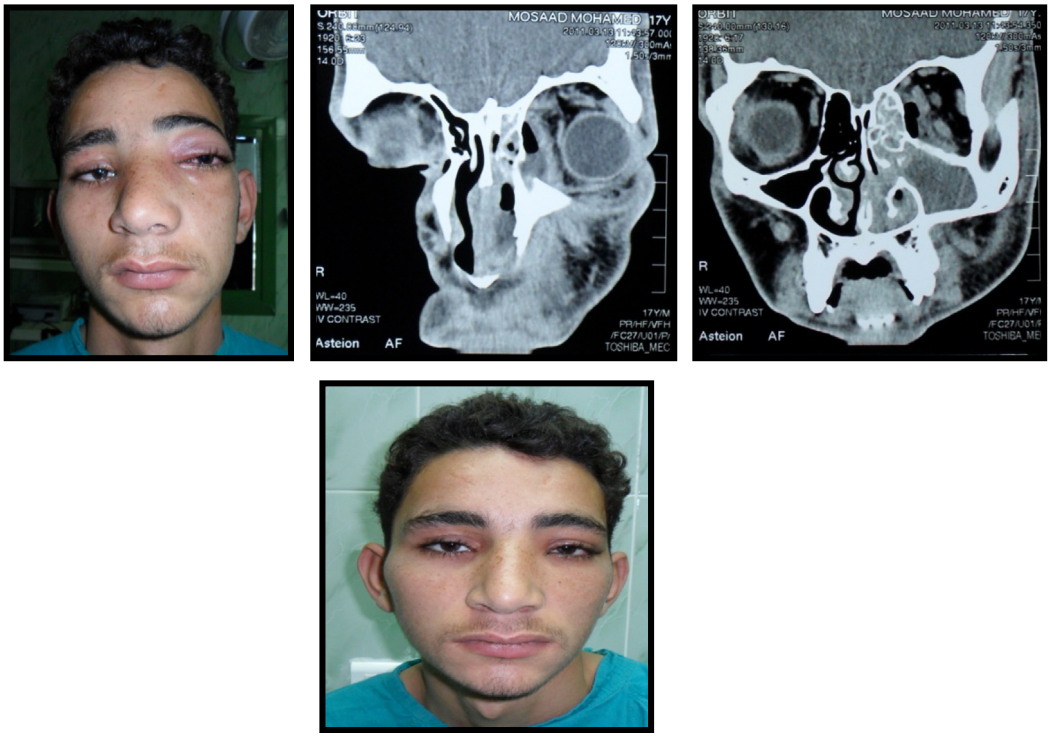


**Figure 2** Before and after endoscopic drainage for medial subperiosteal abscess in the left side.

Two patients (6%) had their vision lost. Two patients (5.7%) in stage V had passed away with cavernous sinus thrombosis.

## 4. Discussion

Inflammation of the paranasal sinus remains one of the most common medical problems.[11] Orbital infection has long been the most common complication of sinusitis. It is an ocular emergency that threatens not only vision but also life from complications such as meningitis, cavernous sinus thrombosis, and brain abscess.[12]

The location of an orbital infection is described with respect to the orbital septum, as either preseptal (periorbital) or postseptal (orbital). The distinction between periorbital and orbital processes is clinically important because postseptal infections are treated more aggressively to prevent devastating complications such as cavernous sinus thrombosis and meningitis.[11] Physical examination differentiations between orbital infections from periorbital infections include proptosis, chemosis, and ophthalmoplegia.[13] CT scanning may assist in diagnostic differentiation, as well as in determining which patients will benefit from surgical intervention.[14] Common contrast-enhanced CT scan findings of orbital abscess include ring-enhanced lesion or an air-fluid level in the extraconal space, displacement of adjacent rectus muscle, marked proptosis, and in advanced cases osteomyelitis of the orbital wall.[15]

In this study, CT scan showed preseptal cellulitis in 15 cases (43%) followed by subperiosteal abscess in 13 cases (37%) and subperiosteal oedema in 5 cases (14%). In three cases, however, an abscess cavity could not be diagnosed radiologically but was confirmed at surgery after failure of improvement on medical treatment for 36 h and this coincides with Krohel et al. who noted that an abscess developing over 24–38 h may produce only non-specific inflammatory signs on CT scan and not identify an abscess.[16] CT is relatively nonspecific in showing the point where inflammation and phlegmon become liquified abscess, and studies have shown a significant false negative rate. Thus, absence of a definite abscess on CT should not preclude surgical drainage in the face of progression of orbital signs and symptoms.[17] A homogeneous opacity on the scan – i.e. the appearance of cellulitis – may be either caused by cellulitis alone or may indicate early abscess formation. In our study two cases which were diagnosed as subperiosteal abscess were found to be just oedema of the periorbital tissue with a CT accuracy 84%. This coincides with the study done by Demetrios et al. who found that CT scans were found to be accurate predictors of sub periosteal abscess in 80%.[19]

The most common pattern of sinus involvement causing orbital cellulitis was the combination of maxillary, ethmoidal and frontal sinuses which is similar to the result of Mortimore et al.[22] It is also observed that the ethmoid sinuses are either involved solitary in 30% of cases or in conjunction with other sinuses. However, the ethmoidal and maxillary sinuses were most frequently involved in the study by Swift et al.[23] The multiple sinus involvement is probably an indication of the severity of the infection and the continuous nature of the mucosal lining of the paranasal sinuses.

The decision about the necessity and timing of a subperiosteal abscess surgical drainage is complex and involves the assessment of many factors including response to the antibiotic treatment, age, size and location of the fluid collection.[18]

In our opinion, orbital abscesses (stage IV) and subperiosteal abscess (stage III) should be drained without any delay as they can lead to intracranial complications and to visual impairment. It is well known that intravenous antibiotics can penetrate the abscess,[20] but without drainage their antibacterial activity within the abscess is poor, probably because the

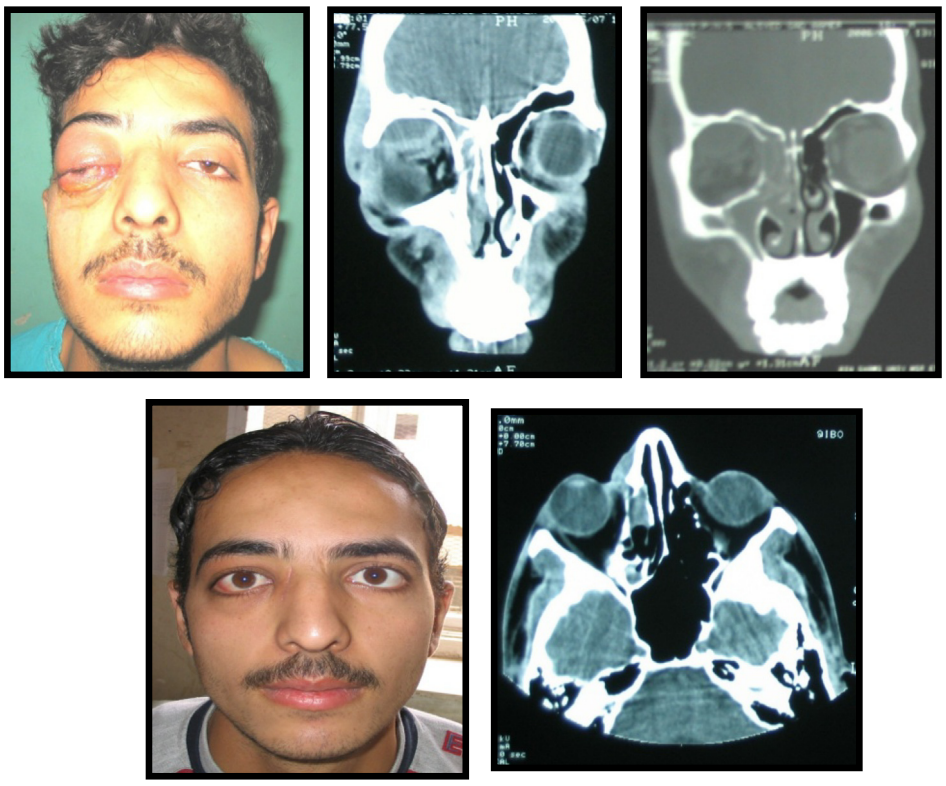

**Figure 3** Before and after surgical external approach drainage for a superiorly located Subperiosteal abscess in the right side.

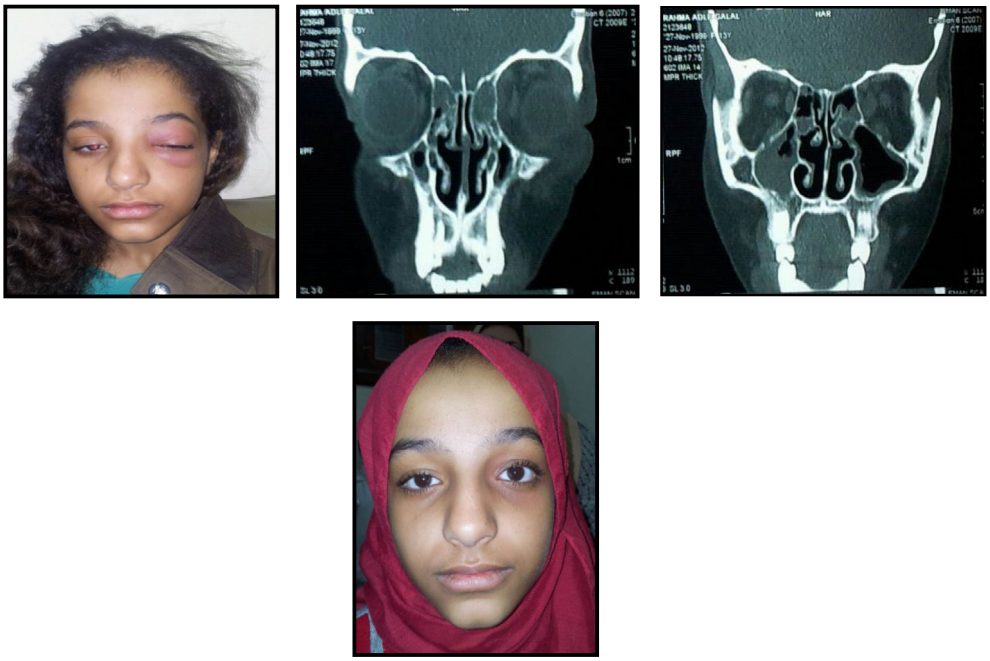

**Figure 4** Before and after endoscopic endonasal drainage for the ethmoids on both sides.

purulent milieu protects the microorganisms by enzymatic degradation of antibiotics.[21] Therefore; the risk of such cases to originate intracranial complications is high. In addition, an orbital abscess provokes a rapid expansion of the orbital contents, carrying an extremely high risk of visual impairment. In our study, patients belonging to group I and group II (Chandler's classification) were treated successfully with IV antibiotics, and the role of surgery is limited to those patients who did not respond to antibiotics.

Out of 16 patients diagnosed as subperiosteal abscess in which surgical interventions were used, 6 (37.5%) cases underwent external drainage, while 10 patients (62.5%) were drained

endoscopically. However, the route of surgical drainage is determined by localization of the orbital sub periosteal abscess.[24] External surgery may be required if there is difficulty in visualizing a sub periosteal abscess located superomedially in the orbit.[25] In our study 3 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.

## 5. 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.

## Conflict of interest

There is no conflict of interest and no financial disclosures.

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