

# Complications of rhinosinusitis

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## Introduction

Sinusitis may be complicated by the spread of infection beyond the normal bony confines of the sinuses. Antibiotic use is now widespread in the treatment of infections of the nose and paranasal sinuses. However, host factors, bacterial pathogenicity and late presentation continue to adversely affect outcomes of otherwise common infections within the paranasal sinuses. Acute complicated sinusitis can result in severe and potentially life-threatening complications causing functional and social disabilities. Intracranial spread of infection has a high mortality despite the use of antibiotics.

Complications of rhinosinusitis are classified as orbital, intracranial and osseous. Some unusual complications namely lacrimal gland abscess, mucocoeles and nasal septal perforations have been reported.

Adequate treatment of acute infections, a high index of suspicion of impending complications, prompt diagnosis and appropriate therapeutic intervention will positively impact on outcomes of patients who present with sinusitis.

## Epidemiology of sinusitis complications

Global prevalence data on the incidence of complications secondary to rhinosinusitis is lacking. Complications of rhinosinusitis with significant intracranial involvement have been reported.<sup>1</sup> The overall estimated incidence of complications of rhinosinusitis in the Netherlands has been quoted as 1:12000 cases a year for acute bacterial rhinosinusitis (ABRS) in children and 1:32000 cases a year of ABRS in adults; this study recorded 48 patients over a period of one year.<sup>2</sup> Tshifularo, in a 10-year prospective study conducted in Pretoria, reported 89 cases of complicated rhinosinusitis.<sup>3</sup> These patients were mostly in the paediatric and peripubertal age group with a mean age of 13 years. These figures confirm that complications of rhinosinusitis are common in both the developed and the developing worlds.

## Mode of spread of paranasal sinus infections

Sinus infections can spread through the following routes:

- A. Through the bony wall of the sinus
  - Osteomyelitis in compact bone
  - Via fracture lines from an infected sinus after trauma
  - Via natural bony dehiscences (e.g. infraorbital nerve from maxillary sinus to orbit)
- B. Venous spread
  - Septic venous thrombosis
  - Thrombosis in minute veins in the sinus mucosa
  - Septicaemia and pyaemia
- C. Lymphatic spread via perivascular lymphatics through vascular foramina
- D. Spread via perineural spaces (olfactory nerves to subarachnoid spaces)
- E. Spread via ethmoidal artery foramina from the ethmoidal sinuses to the orbit and brain

## Classification of complicated sinusitis

1. Orbital (Chandler's classification) [Table I]
2. Intracranial (meningitis, extradural and intradural complications)

## Orbital complications

The paranasal sinuses all share boundaries with the orbit. The eye is therefore often involved by complicated sinusitis and a high clinical suspicion of sinus disease should be considered in any patient presenting with acute orbital cellulitis, chemosis or proptosis. Ethmoidal sinus infection may spread to the eye via the thin and sometimes dehiscent lamina papyracea (thin bony division between the ethmoids and the orbit) or through the valveless venous drainage system. The infraorbital nerve lies within the roof of the maxillary sinus (which is also the floor of the orbit) and may serve as a portal for spread of infection to the orbit from the maxillary sinus. Infections of the floor of the frontal sinus may also spread directly to the orbit and cause orbital complications. Venous spread can lead to superior and inferior ophthalmic vein thrombosis with resultant cavernous

sinus thrombosis that can cause blindness, ophthalmoplegia and death.

Clinical features of orbital involvement include fever, pain referred to the eye (usually aggravated by eye movements), chemosis, diplopia (because of oedema, ophthalmic vein thrombosis, abscess formation), restricted eye movements and engorgement of retinal veins observed on fundoscopy. Blindness may result from central retinal artery occlusion, optic neuritis or corneal ulceration secondary to proptosis. It is worth noting that in children, orbital complications may be painless. A "false history" of trauma may often be attributed to these orbital complications. A recent history of an upper respiratory tract infection (URTI) should increase the suspicion of a possible complicated rhinosinusitis. The immunosuppressed patient may present without fever. It is important to exclude a dentoalveolar cause of complicated maxillary sinusitis. A history of a toothache should be elicited, and a thorough examination of the teeth carried out.

Chandler classified orbital complications (Chandler I-V) according to the progression of the infection – from preseptal cellulitis, orbital cellulitis, subperiosteal abscess, orbital abscess to a cavernous sinus thrombosis. A mortality rate of 30% and morbidity of 60% has been reported for cavernous sinus thrombosis in the adult population. The clinical features of each entity are summarised in Table I.

**Table I.** Chandler's classification of orbital complications

Complication	Clinical findings
Preseptal cellulitis	Eyelid oedema and tenderness Unrestricted extraocular movement Normal visual acuity
Subperiosteal abscess	Proptosis and impaired extraocular muscle movement.
Orbital cellulitis	Eyelid oedema and erythema, proptosis and chemosis. No limited impairment or extraocular movement. Normal visual acuity.
Orbital abscess	Significant exophthalmos, chemosis, ophthalmoplegia and visual impairment.
Cavernous sinus thrombosis	Bilateral orbital pain, chemosis, proptosis and ophthalmoplegia.

**Preseptal/periorbital cellulitis** will usually respond to oral antibiotics with maximum nasal decongestion achieved using oxymetazoline or xylometazoline. Patients presenting with conjunctival oedema (chemosis), proptosis (protruding eyeball), ocular pain or tenderness and decreased eye movements secondary to complicated sinusitis, require prompt local and systemic treatment. These patients should be admitted to hospital on intravenous antibiotics that cover aerobic and anaerobic bacteria, nasal decongestants, and cultures should be taken for sensitivity. A contrasted CT of the sinuses should include orbital sequencing showing axial and coronal views. An

ophthalmologist should be consulted urgently to document the visual acuity in all patients with orbital complications. Orbital exploration and drainage is often required to salvage vision and should be done within six hours of visual deterioration. An inability to distinguish the colour red is often the first sign of impending visual loss and all patients should be evaluated for loss of colour differentiation.

### Intracranial complications

Infections from the frontal, ethmoid and sphenoid sinuses may cause meningitis and other intracranial complications (Table II). Signs and symptoms of intracranial involvement include soft tissue oedema (superior eyelid or over the frontal bone), high fevers, severe headaches, meningeal irritation with nausea and vomiting, diplopia, photophobia, decreased level of consciousness, papilloedema on fundoscopy, and focal neurological deficits. Intracerebral complications usually begin as a cerebritis, progressing to necrosis and liquefaction of brain tissue and resultant capsule formation and the development of an abscess cavity. One should have a low threshold to surgically drain an isolated sphenoid sinusitis to avoid intracranial complications, especially if it does not respond to medical treatment within 24 hours.

**Table II.** Complications of acute rhinosinusitis – intracranial

Complications	Clinical findings
Meningitis	Headache, neck stiffness and high fever.
Epidural abscess	Headache, fever, altered mental status and local tenderness. Unenhanced CT reveals a hypodense or isodense crescent-shaped collection in epidural space.
Subdural abscess	Headache, fever, meningism, focal neurologic deficit and lethargy with rapid deterioration. CT reveals a hypodense collection along a hemisphere or along the falx. MRI demonstrated low signal on T1 and high signal on T2 image with peripheral contrast enhancement
Intracerebral abscess	Fever, headache, vomiting, lethargy, seizures and focal neurological deficits. Frontal deficits can include changes in mood and behaviour. MRI demonstrates a cystic lesion with distinct hypointense, strongly enhancing capsule on T2 images.

### Osseous complications

Frontal sinusitis may rarely be complicated by osteomyelitis, more frequently in young adults. Osteomyelitis of the maxillary sinus from sinusitis has also been reported in infants. It is caused by spread of infection via marrow spaces or thrombosis in diploic veins resulting in subperiosteal abscess formation and subsequent bone sequestra. Initial symptoms are a dull localised pain with an associated headache. The key clinical feature is oedematous skin or a mass (Pott's Puffy tumour) over the forehead or frontal bone [Figure 1]. A CT scan of the sinuses will reveal bony erosion of the sinus wall [Figure 2].



**Figure 1.** Pott's Puffy tumour in an adolescent

### General principles of management of complicated sinusitis

- A multidisciplinary team involving an ophthalmologist, neurosurgeon and ENT surgeon.
- CT scan of the sinuses is mandatory in any patient presenting with orbital/periorbital swelling or features suggestive of complicated sinusitis.
- Intravenous antibiotics (aerobic and anaerobic cover) – 3<sup>rd</sup> generation cephalosporin, metronidazole, and cloxacillin is recommended until culture and sensitivities are known.
- Nasal decongestion with xylometazoline/oxymetazoline.
- Monitoring of Glasgow Coma Score (GCS), seizures and visual acuity.
- Drainage of subperiosteal, orbital or intracranial collections.
- Surgery is advised if there is a poor response to medical treatment or worsening of symptoms despite adequate medical treatment; or for any visual deterioration secondary to an orbital complication; or any intracranial complication; or



**Figure 2.** Contrast CT Sinuses Coronal view demonstrating intracerebral abscess, maxillary sinusitis and subperiosteal abscess formation in the left orbit

to obtain a culture if there is no response to IV antibiotics after 24 hours.

- Surgery usually consists of immediate source control by draining any abscess collections and washing out the maxillary and frontal sinuses, depending on which sinuses are involved. In some instances, more aggressive endoscopic sinus surgery is indicated to achieve drainage of the paranasal sinuses. This is usually indicated if repeat drainage of any intracranial collections are required.
- In the acute phase, surgery may be limited by bleeding and swelling, and elective sinus surgery may be delayed until the acute infection has settled.

### References

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