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The Groote Schuur hospital classification of the orbital complications of sinusitis

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Abstract
The complications of sinusitis have been well described. The most common classifications used for orbital complications have been that of Chandler *et al.* (1970) and Moloney *et al.* (1987). With the ready availability of high-resolution computed tomography (CT) scanners, limitations of these classifications have become apparent. The aims of this study were to determine the relative frequency of the various complications associated with acute sinusitis, to determine which groups of sinuses were most frequently involved and to correlate the orbital signs with a new proposed classification of orbital complications. Over a five-year period, 87 consecutive patients were admitted with acute sinusitis. Sixty-three patients (72.4 per cent) had one or more complications. When orbital complications were classified under the proposed classification, all patients with proptosis and/or decreased eye movement had post-septal infection. Visual impairment occurred only in the post-septal group. Most complications had a combination of sinus involvement with the maxillary/ethmoid/frontal combination being the most common. The authors propose a modification of Moloney's classification for orbital complications of acute sinusitis that allows a clear differentiation between pre- and post-septal infection and a radiological differentiation to be made between cellulitis/phlegmon and abscess formation. The latter is of importance when a decision is made on whether surgical intervention is appropriate or not.

Key words: Sinusitis, complications

Introduction

The complications of sinusitis are grouped into soft tissue, osteitic, intra-cranial and orbital (Morgan and Morrison, 1980; Pickard, 1987; Stainkiewicz *et al.*, 1993). Soft tissue infections are a rare complication of sinusitis (Shugar *et al.*, 1982; Pickard, 1987) while osteitis appears to be more common (Harrington, 1976; Gardiner, 1986). The most frequently reported complications are intracranial and orbital complications. Intra-cranial complications are usually classified into meningitis, cerebritis, epi- or subdural empyema, cerebral abscess and venous (cavernous or superior sagittal) sinus thrombosis (Remmler and Boles, 1980; Clayman *et al.*, 1991; Stankiewicz *et al.*, 1993). Orbital complications were classified by Chandler *et al.* in 1970 before this classification was modified by Moloney *et al.* in 1987. These classifications are similar with both authors delineating infections anterior to the orbital septum before describing a progression of infections in the orbit

TABLE I
ACCEPTED CLASSIFICATIONS OF INTRA-ORBITAL COMPLICATIONS WITH AUTHORS PROPOSED MODIFICATIONS TO MOLONEY'S CLASSIFICATION

	Chandler's classification	Moloney's classification	Authors' modified Moloney's classification
Group	Inflammatory oedema	Pre-septal cellulitis	Pre-septal
1			a) Cellulitis
			b) Abscess
2	Orbital cellulitis	Subperiosteal abscess	Post-septal (subperiosteal)
			a) Phlegmon/cellulitis
			b) Abscess
3	Subperiosteal abscess	Orbital cellulitis	Postseptal (intraconal)
			a) Cellulitis
			I. localized (orbital apex syndrome)
			II. diffuse
4	Orbital abscess	Orbital abscess	b) Abscess
5	Cavernous sinus thrombosis	Cavernous sinus thrombosis	*

*Cavernous sinus thrombosis not included as it is considered an intracranial complication.

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(Table I). Although these classifications have been in common use, they were both described in the age prior to the ready availability of high resolution CT scanners and consequently do not utilize this technology. Even though the complications of acute sinusitis have often been individually reported, the relative frequency of the various groups of complications remains unclear.

The sinuses are enclosed in bone and this should provide a barrier to the spread of infection from the lumen of the sinus outwards. This spread may occur as a result of either resorption of bone between the sinus and orbit/intracranial area due to osteitis; by thrombophlebitis of the communicating veins; or via bony defects, either congenital or acquired (surgery or fracture lines) (Osguthorpe and Hochman, 1993).

The most common sinus giving rise to orbital complications appears to be the ethmoid sinuses (Schramm *et al.*, 1978; Fearon *et al.*, 1979; Goodwin, 1985; Shahin *et al.*, 1987; Samad and Riding, 1991) with the frontal sinuses associated more with intracranial complications and osteitis (Remmler and Boles, 1980; Wenig *et al.*, 1983; Gardiner, 1986; Daya and To, 1990). Although the sphenoid sinus is rarely affected in paranasal sinus infections (Lew *et al.*, 1983), it is commonly associated with complications (57 per cent) (Kibblewhite *et al.*, 1988). These descriptions of which sinuses cause which complications were made by the proximity of the sinus to the complication rather than by direct evidence. It is often difficult to tell in a combined frontal and ethmoid sinusitis which sinus gave rise to the orbital complication.

The aims of this paper were as follows:

(1) to determine the relative frequency of the various groups of complications;
(2) to determine which sinuses or groups of sinuses were likely to give complications;
(3) to determine how the orbital signs related to the pathology diagnosed in the orbit as based on the accepted classifications of orbital complications;
(4) to review the classifications of orbital complications secondary to sinusitis.

Methods and materials

The records of all patients admitted to Groote Schuur Hospital for acute sinusitis over a five-year period from 1989 to 1993 were retrospectively reviewed. Sinusitis was diagnosed on the combination of history, endoscopic examination of the nose and sinus X-rays. Once the diagnosis had been made, all patients with sinus tenderness or pansinusitis were admitted to hospital. Patients with an isolated sinusitis or without sinus tenderness on palpation were treated initially as an outpatient and only admitted if symptoms failed to resolve. According to protocol, admitted patients were treated with intravenous antibiotics (empirically ampicillin and metronidazole until a cultured organism was available), nasal and systemic decongestants, and bilateral antral washouts (under local anaesthetic) with insertion of polyethylene tubes to facilitate subsequent four-hourly bedside antral washouts with warm isotonic saline.

Patients who were suspected on clinical grounds of having a complication from sinusitis had a coronal and axial CT scan of the sinuses and of the area suspected of having a complication (brain, orbit). A lumbar puncture was performed if meningitis was suspected after intracranial empyema had been radiologically excluded. Orbital complications were treated in consultation with the ophthalmologists and intracranial complications were managed with the neurosurgeons.

The patients' notes and CT scans were reviewed to determine which sinuses were involved, whether a complication was present or not and if the complication was orbital, to classify them according to the author's proposed classification. Length of hospital stay and patient outcome were also noted.

Results

There were 87 admissions from 82 patients over the five-year period. Sixty-four were males and 23 females (ratio male: females 2.6:1) with an average age of 25.0 years (range eight to 76 years, standard deviation (STD) 12.3 years). The majority of the patients (71 per cent) were in their second and third decades of life (Figure 1).

The average duration of illness prior to presentation was 8.0 days (standard deviation (STD = 13.2 days). The average hospital stay was 8.0 days (STD = 9.2 days). Patients with no complications had an average hospital stay of 4.0 days (SD = 1.5 days) while those with complications had a stay of 13.3 days (SD = 11.5 days). There was also a difference in length of stay between orbital and soft tissue complications (both had an average of 9.4 days) and intracranial complications (average 25, SD = 22.3 days).

Twenty-four patients (33.6 per cent) had uncomplicated sinusitis, while 63 patients (72.4 per cent) had one or more complications. The breakdown of the complications is presented in Table II. Some patients had more than one complication while others had bilateral complications.

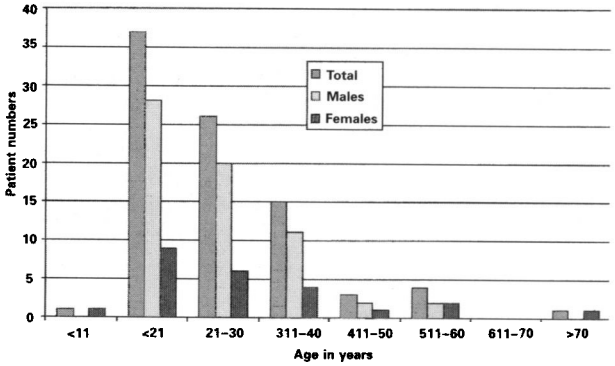

FIG. 1
Age distribution

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TABLE II
BREAKDOWN OF THE SITE AND FREQUENCY OF THE COMPLICATIONS OF ACUTE SINUSITIS

Complications							
Orbital		Intracranial		Soft tissue		Osteitis	
Preseptal cellulitis + abscess	28	Meningitis	4	Abscess over maxilla	4	Subperiosteal abscess	11
Subperiosteal abscess + phlegmon	17	Extradural	1	Maxillary cellulitis	1	Fistula	2
Orbital cellulitis	5	Subdural	2	Temporal abscess	1		
Orbital abscess	1	Cerebritis	1				
		Brain abscess	0				
Total*	51		8		6		13

*Some patients had more than one complication.

The orbital complications are presented in Table III according to our proposed classification (a modification of Moloney *et al.*'s classification (1987)). This classification was also correlated with the orbital signs noted at the time of admission (Table III). The 26 patients in Group 1 had normal eye movements (two were not documented) while no patient with post-septal inflammation (Groups 2 and 3) had normal eye movements. Chemosis was present in 15 patients with post-septal and one with pre-septal involvement. Of the five patients presenting with reduced visual acuity, all had post-septal involvement. None of these patients had any recovery of vision once the complication had resolved.

In the eight patients who presented with an intracranial complication, five had a reduced level of consciousness (Glasgow Coma Scales 3 × 14, 10 and 9) and one patient had an associated third and sixth nerve palsy. Two patients had no clinical evidence of an intra-cranial complication. In contrast to the orbital complications, all patients had full neurological recovery with resolution of the intracranial complication.

The sinus or sinuses involved in each complication are summarized in Table IV. The most common pattern of sinus involvement causing complications was the combination of maxillary/ethmoid/frontal sinusitis ± sphenoid sinusitis. This combination accounted for 79 per cent of the complications. Multiple sinus involvement is probably an indication of the severity of the infection and the continuous nature of the mucosal lining of the nose.

Discussion

Two interesting demographic features emerged from this survey. The first was a significant male predominance (two to three times more frequent) in both uncomplicated and complicated acute sinusitis. Male predominance of intracranial complications was previously noted by Lebovics *et al.* (1989). While reasons for this remain unclear, Kenny and Gray (1971) and Childs (1965) have suggested that females are possibly more immunologically competent. The second interesting demographic feature was the predominance of young patients who developed complications from acute sinusitis (Figure 1). This predisposition of teenagers and young adults to complications from acute sinusitis has been confirmed by other authors (Moloney *et al.*, 1987; Lebovics *et al.*, 1989) but the reasons remain unclear. Fearon *et al.* (1979) has suggested that complicating sinusitis is commoner in the younger age group

TABLE III
PRESENTING SIGNS IN PATIENTS CLASSIFIED ACCORDING THE AUTHORS' MODIFIED MOLONEY'S CLASSIFICATION. THERE WERE NO PATIENTS IN GROUP 4 (CAVERNOUS SINUS THROMBOSIS) OF THIS CLASSIFICATION

Sign		Orbital complication					
Total patients n = 51		Pre-septal Group 1 n = 28		Post-septal (subperiosteal) Group 2 n = 17		Post-septal (orbital) Group 3 n = 6	
		Cellulitis	Abscess	Phlegmon	Abscess	Cellulitis	Abscess
Proptosis	yes	1	0	4	10	4	1
	no	23	3	0	1	0	0
	NR	0	1	0	2	1	0
Chemosis	yes	1	0	1	10	3	1
	no	23	4	3	3	2	0
Movement reduced	yes	3	1	4	13	5	1
	no	21	1	0	0	0	0
	NR	0	2	0	0	0	0
Vision reduced	yes	0	0	1	3	1	1
	no	24	4	3	10	4	0
APD	yes	0	0	1	3	2	1
	no	24	4	3	10	3	0

NR = no record; APD = afferent pupil defect

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TABLE IV
SUMMARY OF SINUS INVOLVEMENT FOR EACH GROUP OF COMPLICATIONS

Complication*	Sinuses involved							
	max	max/eth	max/fr	fr	sp	max/eth/fr	max/eth/fr/sp	NR
Soft tissue (n = 6)	1	1	0	0	0	2	2	0
Bony (n = 13)	0	1	0	1	0	11	0	0
Orbital (n = 51)	0	8	0	0	1	30	10	2
Intracranial (n = 8)	0	0	0	0	1	4	3	0
Totals	1	10	0	1	2	47	15	2
None (n = 24)	3	0	5	2	0	12	0	2

max = maxillary; eth = ethmoid; fr = frontal; sp = sphenoid; NR = no record; n = number of patients.
*Some patients had more than one complication.

because vascular development is greater with softer and more diploic bone that allows infection to spread with greater ease.

The most common complication of acute sinusitis was orbital (80 per cent) and this prompted us to review the accepted classifications of orbital complications (Table I). Chandler *et al.*'s (1970) and Moloney *et al.*'s (1987) classifications are anatomically based but lack a clear differentiation between pre-septal and post-septal complications. They also fail to differentiate between cellulitis/phlegmon and abscess formation although this was probably due to a lack of CT scanners at the time. These features are important for prognostication and for deciding when and if surgical intervention is indicated. The incidence of reduced visual acuity from post-septal inflammation ranges from six to 15 per cent (Welsh and Welsh, 1974; Patt and Manning, 1991). In this study it was 26 per cent which is similar to the incidence of blindness in the pre-antibiotic era (Gamble, 1933) and probably reflects a delay in presentation of these patients. No cases of reduced visual acuity were found in cases with only pre-septal inflammation. The most useful clinical signs of post-septal inflammation were the presence of proptosis and reduced eye movement. The close monitoring of proptosis with an exophthalmometer and eye movement by the ophthalmologists is considered an important part of the initial assessment and ongoing management. If these clinical signs fail to improve or worsen on conservative treatment or after surgical intervention, radiological re-assessment of the patient with a view to surgical intervention is indicated. Increasing proptosis is thought to cause decreased visual acuity by anoxic damage caused by pressure on the optic nerve. Other possible causes are an obliterative thrombophlebitis or inflammation causing an optic neuritis (Schramm *et al.*, 1978; Patt and Manning, 1991).

Our proposed Moloney's classification clearly differentiates between pre- and post-septal involvement, subperiosteal and intra-orbital involvement and allows a radiological differentiation to be made between cellulitis/phlegmon and an abscess. Cavernous sinus thrombosis was left out of this modified classification as it is considered an intracranial complication and not an orbital complication. The clinical signs of proptosis and reduced eye movement were only present in patients who had post-septal involvement.

In this review intracranial complications composed 10 per cent of all admissions and 13 per cent of complications, which was similar to that of other authors (Bluestone and Steiner, 1965). However, in contrast to the poor recovery of visual acuity after the treatment of orbital complications, there were no permanent sequelae from the intracranial complications in this study. An important feature of intracranial complications of sinusitis is that they may be silent (Wenig *et al.*, 1983; Daya and To, 1990). Two cases in this series had no clinical evidence of intra-cranial complications and it is important to CT scan the brain in any patient with pansinusitis not responding to treatment.

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