The Journal of Laryngology & Otology
December 2000, Vol. **114,** pp. 944–946

Osteomyelitis of the frontal bone secondary to frontal sinusitis

A. H. Marshall, B.Sc., F.R.C.S., N. S. Jones, M.D., F.R.C.S.

Abstract

Osteomyelitis of the frontal bone is becoming an increasingly rare complication of frontal sinusitis. We present seven cases that represent the largest series published in the last 50 years. Three cases were associated with intracranial involvement. Osteomyelitis should enter the differential diagnosis when there is a fluctuant swelling on the scalp, or if there is a discharging fistula. Treatment requires aggressive surgery to remove all sequestra in combination with long-term antibiotic therapy. Intracranial complications should be excluded by imaging and treated simultaneously if present.

Key words: Frontal Sinusitis; Osteomyelitis

Introduction

Osteomyelitis of the frontal bone as a complication of paranasal sinus infection was recognized at the end of the 19th century.[1] During the 18th century Percival Pott[2] described a case of a pericranial abscess initiated by trauma. He noted that 'the part struck swells and becomes puffy'. The term Pott's puffy tumour is now in common usage and is defined as a sub-periosteal abscess of the frontal bone associated with frontal osteomyelitis,[3] that marks a departure from the aetiology of Pott's original description. The frontal sinus originates as an expansion between the two compact layers of diploic bone. The vascular supply of the frontal sinus originates in the dura mater for the inner table, the periorbita for the orbital plate and in the cranial periosteum for the outer table.[4,5] The venous drainage of the frontal sinus mucosa is in communication with the drainage of the diploe and dura.[6]

Because of this arrangement of mucosal drainage, infection in the frontal sinus can spread to the overlying bone by two routes, either by direct extension, a so-called 'ruptured frontal sinus'[7] or by propagation of septic thrombi affecting any of the bones of the cranial vault.[6]

The incidence of osteomyelitis secondary to sinusitis is difficult to ascertain. In a series reporting the intracranial complications of sinusitis Clayman *et al.*[8] performed a retrospective case-note examination of 649 patients admitted over a 13-year period with acute or chronic sinusitis, only three (0.5 per cent) developed osteomyelitis. Gallagher *et al.*[9] looked at 176 cases admitted with intracranial suppuration, of which 15 patients had sinusitis, and two patients (13 per cent) had developed osteomyelitis. Larger series have been reported in the pre- and peri-antibiotic era.[10,11]

Materials and methods

We performed a retrospective case-note examination of all patients admitted to the Queen's Medical Centre with osteomyelitis of the frontal bone over an eight-year period. All patients were under the care of the senior author and were either a direct referral from General Practitioners, the Emergency department, or from otorhinolaryngologists at other centres.

The presentation, age and sex distribution, duration of symptoms, history of preceding disease, evidence of other complications of frontal sinusitis, radiological and microbacterial findings along with treatment and outcome were assessed from the case-notes.

Results

Six out of the seven patients were male (Table I). The age range was from 14 to 66 years (mean 39 years). Five patients presented with swelling of the forehead, three had associated frontal pain, one also had an associated toothache and rigors. Two of these patients had a sino-cutaneous fistula, without having any previous surgery. The length of time the forehead swelling had been present varied from five months to two days. Two of these patients were noted to have nasal polyps at presentation.

From the Department of Otorhinolaryngology and Head and Neck Surgery, Queen's Medical Centre, Nottingham, UK.
Accepted for publication: 11 July 2000.

TABLE I
SUMMARY OF CLINICAL DEATHS OF SEVEN PATIENTS WITH OSTEOMYELITIS

Age	Sex	Symptoms	Nasal pathology	Treatment	Culture	Complications
14	M	4 days frontal swelling, headache	Infection	Drainage, osteomyelitic bone drilled	*Strep. milleri*	
15	M	2 days frontal swelling, headache	Infection	Subdural empyema drained, lytic bone drilled	*Strep. milleri*	Subphrenic abscess and pericardial effusion
17	M	2 days frontal swelling, fistula	Infection	Craniotomy, lytic bone drilled	No growth	
46	M	2 months frontal swelling, fistula	Polyposis	Osteomyelitic bone drilled	No growth	
53	M	2 days frontal swelling, headache	Polyposis	Drained extradural and periorbital abscess	*Strep. milleri* *Bacteroides*	Required second drainage procedure
63	M	Frontal swelling, headache, fistula	Polyposis	Riedel's procedure	No growth	
66	F	Frontal swelling, headache, fistula	Polyposis	Riedel's procedure	*S. aureus*/ *Proteus* sp.	MRSA positive infected nasal cavity

M = male; F = female.

The two other patients had had previous sinus surgery, one for polyposis, the other for a laterally placed mucocele. They had undergone previous sinus obliteration several years before developing osteomyelitis. They both presented with recurrent swelling of the forehead and pus discharging via a sino-cutaneous fistula. Three of the patients also developed a subdural empyema demonstrated by computed tomography (CT) or magnetic resonance imaging (MRI). CT was performed in all seven patients.

Organisms were cultured in four out of the seven patients. In three instances *Steptococcus milleri* was cultured, one of these cases also grew *Bacteroides* sp. In another patient *Staphylococcus aureus* and *Proteus* sp. were grown.

The extent of the osteomyelitis varied from an extensive area of the cranial vault (see Figure 1) to one of the walls of the frontal sinus being eroded. In all cases a drainage procedure was performed. As well as draining the pus all sequestra (see Figure 2) and 'moth-eaten' bone was removed, until only healthy bone remained. When a subdural empyema was present this was drained simultaneously with the neurosurgeons. Post-operatively all patients were commenced on antibiotics that were altered in the light of the organisms cultured. The duration of antibiotic therapy lasted up to eight weeks. Often the patients had been given antibiotics by their general practitioners prior to their surgery. One patient required a second drainage operation 19 days after the first as his forehead swelling recurred and he had developed a frontal lobe empyema.

One patient developed both a pericardial effusion and a sub-phrenic abscess as a result of his septicaemia.

The two patients who developed osteomyelitis on a background of multiple sinus operations required radical debridement of their sinuses to eradicate their disease. In both instances a Riedel's procedure was performed removing the anterior wall of the frontal sinus along with all mucosa and smoothing the posterior wall with a diamond burr to help ensure the removal of any mucosal fragments. No patients died, and none were left with any neurological deficit.

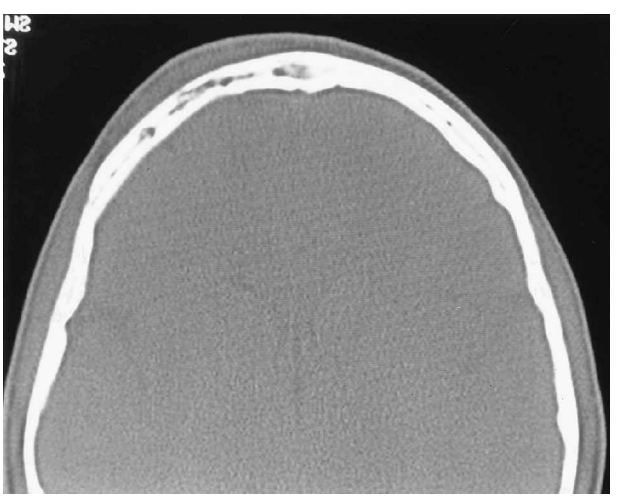

FIG. 1
Frontal bone osteomyelitis which extended to the parietal bone and zygomatic arch.

Discussion

Osteomyelitis is one of the complications of frontal sinusitis, that may occur alone or in combination with intracranial infection or systemic sepsis. Osteomyelitis of the frontal sinus has become progressively rare in the post-antibiotic area. Nevertheless its existence and management deserve review although it remains essentially unchanged from the

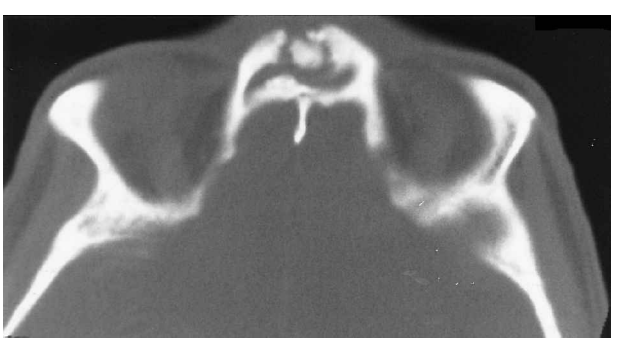

FIG. 2
Sequestrum in the frontonasal area.

https://doi.org/10.1258/0022215001904671 Published online by Cambridge University Press

early 20th century. Of importance in this series is the finding that three out of seven patients also had intracranial involvement. Altman *et al.*[11] noted that in his series of seven patients with complicated frontal sinusitis, three had frontal bone osteomyelitis, but only one of these was in isolation of other complications. One of the other patients also had a subdural abscess, whilst the final patient also had preseptal cellulitis and a subgaleal abscess. *Streptococcus milleri* was cultured in three out of seven cases, either alone or in combination with another organism, which is in line with Gallagher *et al.*[9] who identified *Streptococcus milleri* in 51 per cent of the cases where a positive culture was obtained. Any patient presenting with swelling of the forehead, with or without associated symptoms such as headache, should be suspected of having frontal osteomyelitis. This is more likely if a discharging fistula is present.

Other complications of sinusitis need to be excluded by imaging, either CT and/or MRI. Treatment involves drainage of the abscess and removal of any infected bone. This may be a fairly limited procedure if the problem is acute, but requires radical surgery if there is more extensive osteomyelitis. We realise that a radical procedure such as Reidel's is not without cosmetic consequences, but we agree with Lawson[12] who believes that it continues to have application in patients with chronic osteomyelitis of the frontal bone who are refractory to antibiotic therapy and require resection of portions of non-viable bone. Surgery should be followed by a prolonged course, we recommend six weeks, of culture-specific antibiotic therapy.

References

1 Luc H. A fatal case of frontal empyema. *Br Med J* 1899;**2**:993

2 Pott P. *Observations on the Nature and Consequences of Wounds and Contusions of the Head*. London: C. Hitch and L. Hawes, 1760

3 Babu RP, Todor R, Kasoff SS. Pott's puffy tumour: the forgotten entity. *J Neurosurg* 1996;**84**:110–2

4 Wenig BL, Goldstein MN, Abramsom AL. Frontal sinusitis and its intracranial complications. *Int J Paediatr Otorhinolaryngol* 1983;**5**:285–302

5 Remmler D, Boles R. Intracranial complications of frontal sinusitis. *Laryngoscope* 1980;**90**:1814–24

6 Thomas JN, Nel JR. Acute spreading osteomyelitis of the skull complicating frontal sinusitis. *J Laryngol Otol* 1977;**91**:55–62

7 Dawes JDK. The management of frontal sinusitis and its complications. *J Laryngol* 1961;**75**:297–344

8 Clayman GL, Adams GL, Paugh DR, Koopmann CK. Intracranial complications of paranasal sinusitis: A combined institutional review. *Laryngoscope* 1991.**101**:234–9

9 Gallagher RM, Gross CW, Phillips CD. Suppurative intracranial complications of sinusitis. *Laryngoscope* 1998;**108**:1635–42

10 Jones AC. Osteomyelitis of the frontal bone with report of thirteen cases. *Ann Otol* 1940;**49**:713–27

11 McNally WJ, Stuart EA. A thirty-year review of frontal sinusitis treated by external operation. *Ann Otol* 1954;**63**:651–86

12 Altman KW, Austin MB, Tom LWC, Knox GW. Complications of frontal sinusitis in adolescents: case presentations and treatment options. *Int J Padiatr Otorhinolaryngol* 1997;**41**:9–20

13 Lawson W. Frontal sinus. In: Blitzer A, Lawson W, Friedman WH, eds. *Paranasal Sinuses,* 2nd edn. Philadelphia, USA: W. B. Saunders Company, 1991:189

Address for correspondence:
Professor N. S. Jones,
Department of Otorhinolaryngology and Head and Neck Surgery,
Queen's Medical Centre,
Nottingham NG7 2UH, UK.

E-mail: nick.jones@nottingham.ac.uk

Professor N. Jones takes responsibility for the integrity of the content of the paper.
Competing interests: None declared