

Frontal sinus fractures with suspected outflow tract obstruction: A new approach for sinus preservation



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ABSTRACT

Objective: The description of a new approach for the management of patients with frontal sinus fractures and associated obstruction of the frontal outflow tract to, restore sinus function and avoiding sinus obliteration.

Subjects and methods: In a prospective study, 21 patients with anterior wall frontal sinus fractures associated with potential obstruction of the frontal outflow tract, underwent rigid internal fixation and intraoperative guarded nasal endoscopic debridement of any bony spicules and lacerated mucosa to clear the frontal recess. Patients were followed up clinically and radiologically by CT to assess the status of the frontal sinus and to detect any manifestations of frontal sinusitis or any other complications.

Results: Seventeen patients completed the postoperative follow-up while four patients were excluded from the study. Postoperative follow-up ranged from 6 to 34 months with a mean of 20 months. All patients had associated craniofacial fractures. Follow-up CT scans showed complete restoration of frontal sinus ventilation and mucociliary clearance for 13 patients. Four patients showed frontal sinus mild mucosal thickening without signs of chronic sinusitis.

Conclusion: Patients with anterior wall frontal sinus fractures associated with frontal sinus outflow tract obstruction could be successfully managed with rigid internal fixation and intraoperative guarded endoscopic debridement of any bony spicules and lacerated mucosa to clear the frontal recess. This type of management could increase the chance of frontal sinus preservation and decrease the need for frontal sinus obliteration for similar patients.

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1. Introduction

The management of frontal sinus fractures poses certain dilemmas and there is no broad consensus over treatment. Each frontal sinus depends entirely for its function upon a patent frontal sinus outflow tract, and injuries of this outflow tract can seriously endanger sinus function (Levine et al., 1986; Luce, 1987; Stanely and Becker, 1987; Rohrich and Hollier, 1992; Gerbino et al., 2000). If frontal sinus fractures are associated with suspected injuries or obstruction of the frontal sinus outflow tract, frontal sinus obliteration is widely recommended to prevent serious long term complications (Stanley, 1989; Wilson et al., 1998; Gouty et al., 1999;

D'Addario et al., 2004). It is very difficult to define and identify what constitutes a functional sinus obstruction due to frontal recess fractures or injuries (Harris et al., 1987; Heller et al., 1989; Hosemann et al., 1993). Long term success of frontal sinus obliteration depends on removal of all sinus mucosa and any frontal recess cells. Unlike the osteoplastic flap used for obliteration of the frontal sinus in cases of chronic frontal sinusitis, frontal sinus obliteration during frontal sinus fractures may be very difficult. To remove the whole sinus mucosa, wide exposure is warranted, this may lead to further comminution and devascularization of bone. In addition, associated injuries of the brain, orbit and soft tissues make obliteration difficult and more liable to infection. Most of the traditional series that recommended frontal sinus obliteration were retrospective clinical review papers. These series did not include new patients and had no specific inclusion criteria (Sataloff et al., 1984; Starnmberger, 1986; Wallis and Donald, 1988; Wolfe and Johnson, 1988; Weber et al., 2001; Lanza, 2005; Strong et al., 2006; Chen

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et al., 2006). Recently published studies demonstrated a decline in frontal sinus obliteration and a trend towards sinus preservation (Smith et al., 2002; Gossrnan et al., 2006; Bell et al., 2007).

The purpose of this study is to describe a new management modality for patients with frontal sinus fractures associated with potential involvement of the frontal outflow tract with emphasis on restoration of sinus function and avoiding sinus obliteration. The investigators hypothesize that endoscopically clearing the fractured bony spicules out of the frontal recess and reduction of the central bone fragment of the associated naso-orbital ethmoid (NOE) fracture will increase the chance of mucociliary clearance and ventilation of the frontal sinus with possible sinus preservation.

2. Patients and methods

2.1. Study design

To address the research objectives, the investigators designed and implemented a case series descriptive study. The study population was drawn from patients with fractures of the anterior table of the frontal sinus, with potential involvement of the frontal outflow tract who were managed at the Department of Otolaryngology Head and Neck Surgery, Zagazig University Hospital, Zagazig, Egypt, in the period January 2007 to July 2013. Inclusion criteria were: fracture displacement of the anterior wall of frontal sinus with suspected involvement of the frontal sinus outflow tract alone or associated with NOE (type-I or II) fractures. Patients with associated fracture displacement of the posterior wall, CSF frontonasal rhinorrhea, and/or NOE fracture type-III were excluded from the study. Patients who didn't complete a minimum follow-up period of 6 months were also excluded from the study.

Clinical assessment included: a complete history to define the mechanism of injury and any previous nasal or paranasal sinus surgery; clinical examination; and a high resolution axial CT scan with reconstructed coronal and sagittal cuts to define fracture type, status of the frontal sinus outflow tract, and associated other craniofacial fractures.

The nature of the fractures and protocol of surgical intervention with its potential complications were discussed with the patients and their relatives. This protocol entails; complete reconstruction of frontal sinus fractures using rigid internal fixation with Titanium Microsystems without sinus obliteration; intraoperative endoscopic debridement of any bony spicules and lacerated mucosa at the middle meatus and anterior ethmoid cells to clear the frontal recess, and a prolonged follow-up period. Zagazig University Review Board (IRB) approved the study and written consent for the operation was obtained from the patients and/or their relatives. Postoperatively, all patients received broad spectrum antibiotics for 1 month, oral corticosteroids (prednisolone 40 mg tapered off over 10 days), and intranasal corticosteroid spray for 2 months. Patients were advised to come for follow-up at determined dates; or whenever they notice symptoms of sinus infection, frontal headache or heaviness.

Postoperative assessment was done by clinical examination at 1 week, 2 weeks, 1 month, 3 months, 6 months and yearly after surgery. Nasal endoscopy was done during each visit to clear up crusts from the middle meatus and assure patency of the frontal recess region. CT scans were obtained 3 months after the surgery and later, whenever needed, to assess the status of the frontal sinus in terms of ventilation, drainage and esthetic contour.

2.2. Operative intervention

Operative intervention was 2–14 days after trauma. The surgical approach was either through a coronal incision or a preexisting

laceration with extension when needed. A zero degree endoscope was introduced into the frontal sinus cavity through a fracture line after reduction of displaced bone fragments to examine the frontal sinus cavity and outflow tract from the sinus side (Fig. 1). To remove any contamination or debris, irrigation of the frontal sinus with normal saline mixed with gentamycin antibiotic was done. Associated facial fractures were fixed accordingly before rigid fixation of the frontal sinus fractures. Associated NOE fractures were given great attention and concomitantly managed following Markowitz et al., 1991. NOE fractures were classified into three types according to the central bone fragment that had the insertion of the medial canthus tendon. Types-I and II were managed by reduction and fixation of the central bone fragment with rigid fixation. Patients with type-III fractures that require a transnasal canthopexy and frontal sinus obliteration or cranialization were excluded from the study as mentioned earlier. After satisfactory reduction of the NOE fracture, guarded controlled endoscopic debridement using curved microdebrider tips and giraffe forceps was done to remove all displaced bony spicules and trim lacerated mucosa thus clearing the frontal recess. Neither instrumentation nor stenting of the frontal ostium was attempted for any patient and great care was given to preservation of the mucosa at this region. After satisfactory clearance of the frontal recess, endoscopic assessment of the patency of the frontal sinus outflow tract was assured from above through the frontal sinus cavity and below from the nose. The interfrontal sinus septum was removed in most cases, especially in cases associated with NOE fractures to help ventilation and drainage from one side to the other. Lastly, all fractured segments of the anterior wall of the frontal sinus were reduced and fixed with a titanium microplate system (1.1 mm) using plates, screws, and mesh according to the degree of bone fragmentation. Incisions and lacerations were repaired appropriately.

3. Results

Seventeen patients completed the postoperative follow-up while four patients were lost to follow-up and were excluded from the study. All were men with a mean age of 24 years (range 16–44). Postoperative follow-up ranged from 6–34 months with a mean of 20 months. All patients had associated craniofacial fractures; NOE (8 patients), zygomaticomaxillary complex (4), mandible (3), orbital floor (4), superior orbital rim (3), nasal bone (1), and pneumocephally (3). Surgical intervention was within 2–14 days of the injury (Table 1).

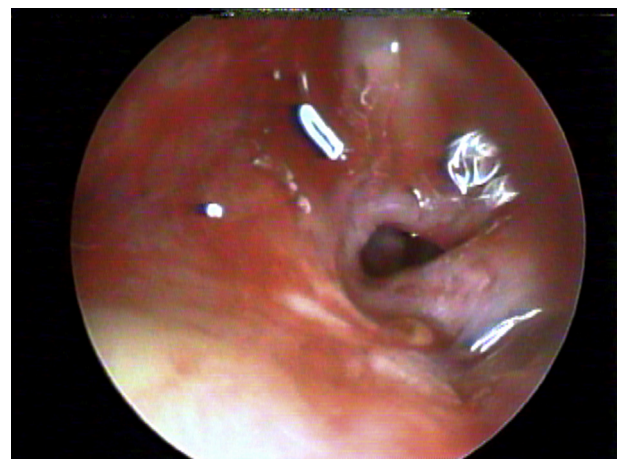


Fig. 1. Endoscopic view from the frontal sinus side, showing a sound functioning frontal sinus outflow tract.

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