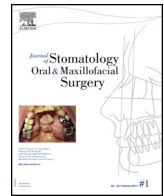




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Technical Note

Surgical approach of isolated fracture of the anterior wall of the frontal sinus: The upper eyelid incision

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ABSTRACT

Fractures of the frontal sinus are classified according to the topography (anterior wall, posterior wall or both), the displacement, and the presence of associated lesions (wound, nasofrontal duct injury, rhinorrhea). Isolated fractures of the anterior wall require surgical management, if the displacement is over 4 mm, to restore the forehead symmetry, to maintain the sinus ventilation and to avoid long-term complications (sinusitis, mucocele, meningitis...). Coronal incision is commonly performed but less invasive techniques are more and more used. We describe a technique of reduction and fixation of isolated anterior wall fractures by upper eyelid incision, allowing a good exposure of the lower portion of the frontal sinus, with a limited scar.

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1. Introduction

Frontal sinus fractures are frequent, representing 5 to 15% of facial fractures. Among them, fractures of the anterior wall are the most common [1–3]. Surgical abstention is commonly proposed in case of no discernable displacement. A surgical procedure is carried on in the case of bone depression over 4 mm, that is considered to be visible [3], and in the case of nasofrontal duct (NFD) injury [2]. A radiographic evaluation using craniofacial tomodensitometry (TDM) is required, particularly to look for direct and indirect signs of NFD lesions (floor fracture of the frontal sinus, fracture of anteromedial portion of the sinus, obstruction of the nasofrontal duct) [4]. The presence of these criterions makes necessary the recanalization or the obliteration of the NFD.

The surgical management of the fractures of the frontal sinus has three objectives: aesthetic by restoring the bony contours, functional by maintaining the sinus ventilation, and preventive to avoid long-term complications due to defect in sinus drainage (sinusitis, mucocele, osteomyelitis, meningitis, cerebral abscess) [5]. The standard procedure uses a coronal incision [6]. This technique allows a large exposure of the frontal bone, but raises the problem of postoperative alopecia, long scar, frontal paresthesia, facial paresia by iatrogenic injury of the frontal branch of the facial nerve, and prolonged recovery

[7]. Alternative procedures are represented by the eyebrow incision [8,9], and the endoscopic approaches [10,11].

The aim of our work is to present the upper eyelid incision to manage anterior wall frontal sinus fractures.

2. Surgical procedure

The incision line is drawn in the superior palpebral sulcus. A silk suture is applied in the palpebral margin of the superior eyelid, allowing to stretch the palpebral skin. Xylocaine with adrenaline 1% is injected in the subcutaneous plan. The skin and the orbicularis muscle are opened. The dissection is continued in the retromuscular and preseptal plan to reach the supraorbital rim (Fig. 1A). The periosteal membrane is opened in its lateral part, and the supraorbital nerve is located and protected (Fig. 1B). In some case the nerve is encased in a bone duct, reducing the risk of damage during the dissection. The plane is then sub-periosteal until the fracture site. The approach allows an open reduction and an internal fixation with miniplate or steel wire (Fig. 3C). The closing concerns the periosteum and the cutaneous plan (Fig. 1D).

A radiographic evaluation with TDM or Cone-beam CT (CBCT) is performed after the procedure to control the frontal symmetry and the good position of the osteosynthesis device (Fig. 2A and B).

3. Discussion

Various techniques have been developed to treat the fractures of the anterior wall of the frontal sinus. Among these techniques,

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Fig. 1. Perioperative photograph of the surgical approach of the right upper lid. A. The dissection is realized in the retromuscular and preseptal plan until the superior orbital rim. B. Visualization and protection of the supraorbital nerve (★), and exposure of the comminuted fracture of the anterior wall of the right frontal sinus. C. Osteosynthesis realized with steel wires. D. Skin closure.

the closed reduction seems to represent an efficient solution for the non-comminuted fracture with visible depression. However, the control of the reduction is difficult, and the internal fixation is not possible [8]. In case of instable fracture of the frontal sinus, an open approach is required. The endoscopic procedure allows a good exposure to achieve the bone reduction and it prevents from visible scars, but no fixation can be carried on [8,10,11]. Furthermore, the operative time and the costs linked

to the equipment are extended [11]. In the case in which an open approach is required, the coronal incision is the gold standard technique, allowing a good exposure of the frontal bone [6]. Though several complications are described with this technique including alopecia, visible scars, frontal paresthesia, and frontal paresia. Alternatives techniques have been proposed. The eyebrow incision enable the reduction of the frontal sinus, but may induce a visible alopecic scar in the eyebrow [8]. The

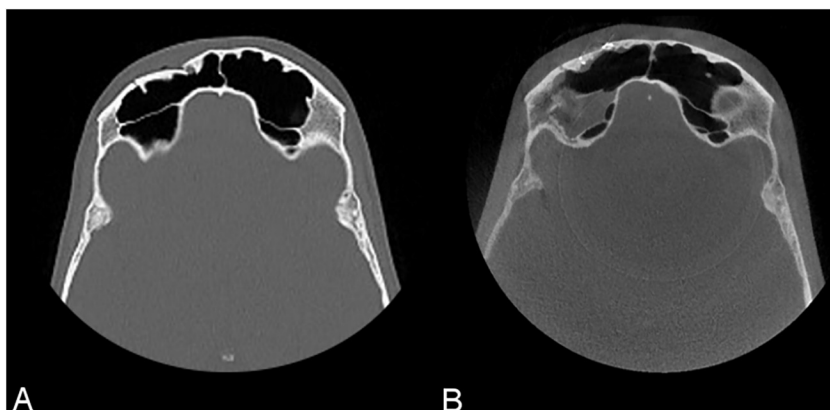


Fig. 2. Radiographic evaluation. A. Preoperative CT scan in axial section showing a displaced fracture of the anterior wall of the right frontal sinus. B. Postoperative CBCT in axial section showing a good reduction of the anterior wall.



Fig. 3. Frontal photographs of patients 3 months after upper eyelid approach, in eyes opened or eyes closed positions. Left operated eyelid (A), right operated eyelid (B, C).

tranlesionnal technique is restricted to the case of wound next to the fracture site.

The upper eyelid incision represents a good solution for the fractures of the anterior wall of frontal sinus. It combines the advantages of an open approach allowing open reduction and

internal fixation, while leaving a palpebral scar hidden in the superior sulcus. In our experience, patients who were giving an upper eyelid approach showed good aesthetic results at 3 months after procedure (Fig. 3). The main limitation of this technique is topographic, since it allows an access to the frontal sinus from the orbital rim to the 2 overhead centimeters (Fig. 4). This technique thus cannot be used to treat frontal fractures in the median and upper portions of the frontal bone. Furthermore, this approach does not allow to treat a NFD lesion.

4. Conclusion

The upper eyelid incision represents an interesting alternative to the coronal approach in isolated displaced fractures of the anterior wall of the frontal sinus. This technique allows an open reduction and an internal fixation, with limited scar.

Disclosure of interest

The authors declare that they have no competing interest.

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Fig. 4. Illustration of the frontal anatomical region accessible with an upper eyelid incision.

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