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Updates In Frontal Sinus Surgery

An Essay

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By

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Ahmad M Attia

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List of Abbreviations

ABRS	Acute Bacterial Rhino Sinusitis
ACF	Anterior Cranial Fossa
AEA	Anterior Ethmoid Artery
CSF	Cerebrospinal fluid
CRS	chronic RhinoSinusitis
CT	Computerized Tomography
ET	Eustachian Tube
FSOT	Frontal Sinus Outflow Tract
ICA	Internal carotid artery
IJV	Internal jugular vein
ITF	Infratemporal fossa
MRV	Magnetic resonance venography
MT	Middle Turbinate
PNSF	pedicled nasoseptal flap
URI	upper respiratory infection
TMJ	Temporomandibular joint

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Introduction

Frontal sinus surgery continues to remain one of the most challenging areas for sinus surgeons. Many different techniques have been introduced for dealing with the frontal sinus. These can range from conservative, mucus membrane–preserving, strictly endoscopic techniques to radical endoscopic and open procedures using drills and burrs to create large openings, all with the aim of keeping the frontal sinus aerated, disease free, and functional in the long-term. This article deals not only with ways in which surgical techniques can be used to minimize or prevent complications in this difficult area but also on how to deal with complications when they occur **(Javer and Alandejani ,2010)**.

The dramatic change in the practice of frontal sinus surgery has been the adoption of endoscopic techniques as experience in endoscopic sinus Surgery surgery has grown, The technique and equipment have been found to be adaptable for treatment of neoplastic and non neoplastic lesions in frontal sinus tremendous advances in diagnostic imaging, surgical technology and instrumentation and the development of endoscopes and navigation systems has resolutionzed the surgical approach to frontal sinus **(shah , 2007)** .

The osteoplastic flap has historically been the main stay of surgical access to the frontal sinus, but with the advance of the endoscopic revolution, its strangle hold. However, accessing the frontal sinus provides a greater surgical challenge than the other sinuses owing to the anatomical constraints present in an endoscopic approach**(Batra and Lanza ,2005)**.

In this respect, navigating the frontal recess and sinus with its variable array of cells from the cells, agger nasi to the intersinus septal and frontal means that any surgeon approaching this area endoscopically must have sufficient experience**(Batra and Lanza ,2005)**.

Messerklinger developed the endoscopic technique with the aim to relieve diseased sinuses while preserving mucosa and at the same time being minimally invasive, whilst the technique has previously been championed, other endoscopic techniques have gained recent vogue, namely the modified lothrop (frontal sinus drill out) and balloon sinuplasty . Combined and open approaches to the frontal sinus are other available options for example trephination and osteoplastic flaps with or without obliteration (**Khong et al, 2004).**

Aim of the work

This essay aims to review updated approaches of endoscopic and open techniques in management of different frontal sinus lesions and how to select the best approach.

Chapter (1)

Anatomy and physiology of the frontal sinus.

Surgical Anatomy of frontal sinus

As with any surgical procedure, a thorough knowledge of anatomy is the one most important factors in minimizing complications and maximizing one's chances of a good surgical outcome. This is particularly important for otolaryngologists performing frontal sinus surgery, as each and every one of the paranasal sinuses are in close proximity to critical orbital and skull base structures. A good knowledge of anatomy will enable the surgeon to operate with more confidence**(Mosher,1904).**

The frontal sinus is contained within the frontal bone. The frontal bone makes a major contribution to the floor of the anterior cranial fossa and, in doing so, forms the roof of the orbits. The frontal bone articulates with the ethmoid, sphenoid, parietal, and nasal bones, as well as with the zygoma and the maxilla**(Clemente,2005).**

Posteriorly, each sinus borders on the anterior cranial fossa. The lateral portion of the sinus floor overlies the orbital roof, whereas its medial portion is directly over the anterior ethmoid air cells. The bones of the posterior wall and the orbital roof portion of the sinus floor are relatively thin. The anterior sinus wall, especially the part overlying the root of the nose (the nasofrontal beak), is frequently the strongest **(Stammberger and Kennedy,1995).**

At birth, the frontal sinus is rudimentary and has little clinical significance. After the age of 6 to 8 years, the sinus becomes more pronounced as a result of its higher rate of growth. Growth is usually completed by ages 12- to 14 years in women and 16 to 18 years in men**(Kountakis,2005)**.

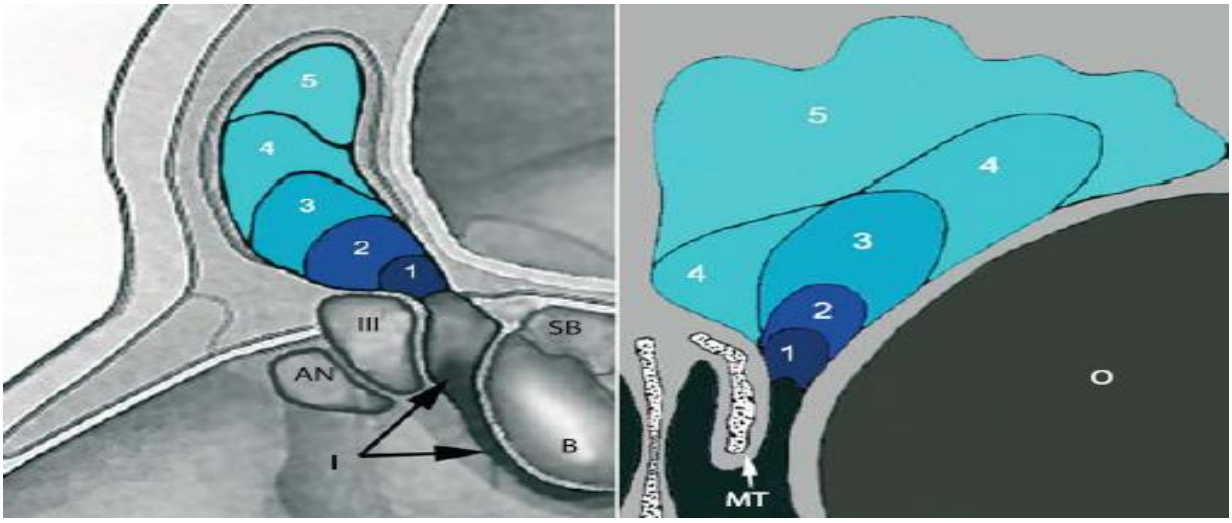

Figure 1.1Sagittal and coronal views of the frontal sinus noting its progressive secondary pneumatization between the ages of 3 and 18 years of age. Between 1 and 4 years of age (1), the frontal sinus starts its secondary pneumatization. After 4 years of age, the frontal sinus may be seen as a small, but definable, cavity (2) .When a child reaches8 years of age (3), the frontal sinus becomes more pneumatized. Significant frontal pneumatization is generally not seen until early adolescence (4), and continues until the child reaches18 years of age (5). The agger nasi air cell (AN), type III frontal infundibular cell (III), ethmoid bulla (B), suprabullar cell (SB),middle turbinate (MT), and orbit (O) **(Kountakis,2005)**.

The anterior wall of the frontal sinus begins at the nasofrontal suture line and ends below the frontal bone protuberance, along the vertical portion of the frontal bone. The height of the cavity at its anterior wall ranges from 1 to 6 cm, depending on the degree of pneumatization **(Peynegre and Rouvier, 1996).**

The anterior wall of the sinus forms the forehead and is by far the thickest of all sinus walls, measuring up to 12 mm. There is a definite trilayered bony structure identical to the rest of the calvaria with anterior and posterior tables and a middle diploe in all of the walls of the sinus. The posterior wall is a plate of thin, compact bone (1-2 mm) whose upper part is vertical. It gradually curves downward and posteriorly until it is almost horizontal (depending on the level of pneumatization of the orbital roofs that has occurred). The posterior wall of the frontal sinus is also the anterior wall of the anterior cranial fossa and can extend as far posteriorly as to the lesser wing of the sphenoid bone**(Kountakis,2005)**.

The inferior wall of the frontal sinus is formed by the orbital roof on the lateral side and the nasoethmoid floor on the medial side. The most anterior area of the sinus floor is directly above the roof of the nose. It consists of a very thick bony mass of the nasal spinous process of the frontal bone, or internal nasal spine (spina nasalis interna) passing through the inferior border of the angle of the mandible inferiorly **(Clemente ,2005).**

It has a superior vertical, and a smaller inferior horizontal, portion. The horizontal portion will form part of the orbital roof. Both posterior walls join inferiorly to form the internal frontal crest, to which the falx cerebri inserts (Fig. 3.6). The posterior table of the frontal sinus can also be inherently thin **(Cryer ,1907).**

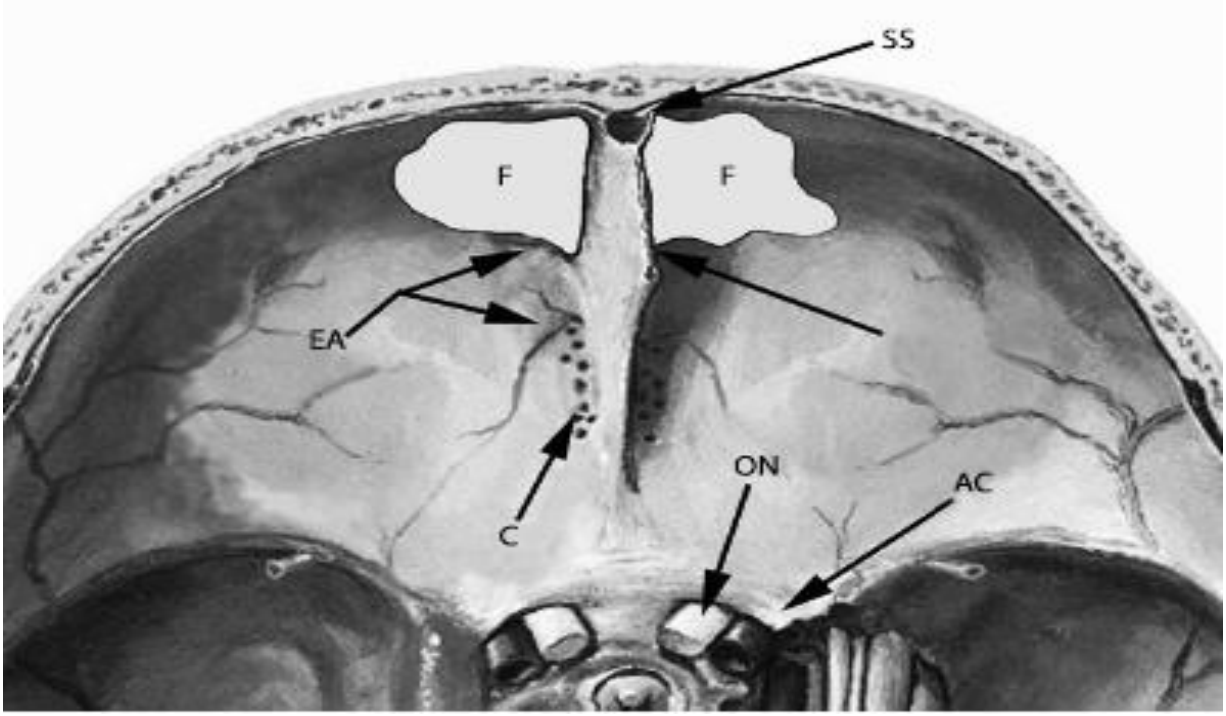

Figure 1.2:View of the anterior cranial fossa and orbital roof. The posterior table and extent of the f s (F) are identified. The crista galli (CG) and superior saggital sinus (SS). The cribriform plate (C) is seen on either side of the crista galli. Branches of the anterior ethmoid artery (EA) are seen reentering intracranially. The optic nerve(ON) is seen entering the optic canal medial to the anterior clinoid process (AC)**(Clemente, 2005).**

At the frontal sinus floor close to the anteromedial aspect of the intersinus septum rests the frontal sinus ostium. The frontal sinus ostium marks the site where pneumatization of the sinus began. The frontal sinus drainage pathway has an hourglass shape composed of three distinct segments: The top part of the hourglass is the frontal infundibulum, which is the inferior portion of the frontal sinus cavity narrowing like an upright funnel toward the second segment, the frontal ostium.The third segment is the inferior air chamber'named the frontal recess. This functional unit for frontal sinus drainage has been referred to as the frontal sinus outflow tract. **(Clemente , 2005).**

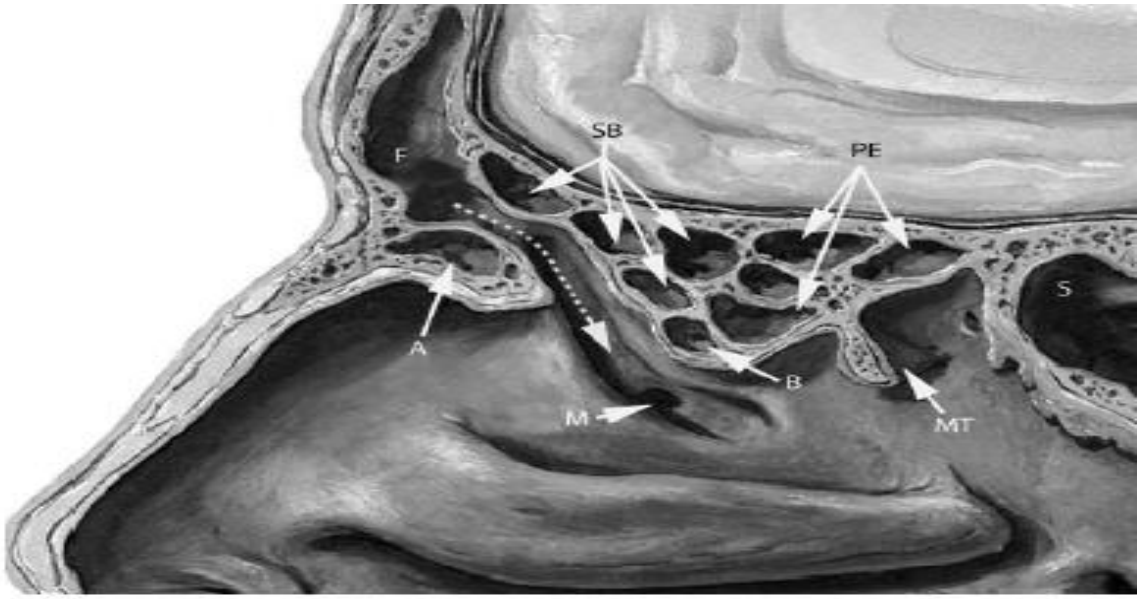

Figure 1.3:Sagittal section through the agger nasi (A), ethmoid bulla (B), suprabullar cells (SB), posterior ethmoid (PE), andlateral sphenoid (S). The frontal sinus (F) outflow tract is noted by the dotted arrow, The uncinate process has been removed to expose the maxillary ostium (M). The tail of the middle turbinate (MT)**(Clemente ,2005).**

The frontal sinus infundibulum is formed by the most inferior aspect of the frontal sinus. It has the form of a funnel that points towards the ethmoid in a posteromedial direction. The angulation (posteromedially)and maximum diameter of this funnel may vary greatly between patients**(Kountakis,2005)**.