Histopathological and Histochemical changes in Antral Mucosa Following Functional Endoscopic Surgery on the ostiomeatal complex for Treatment of Chronic Maxillary Sinusitis

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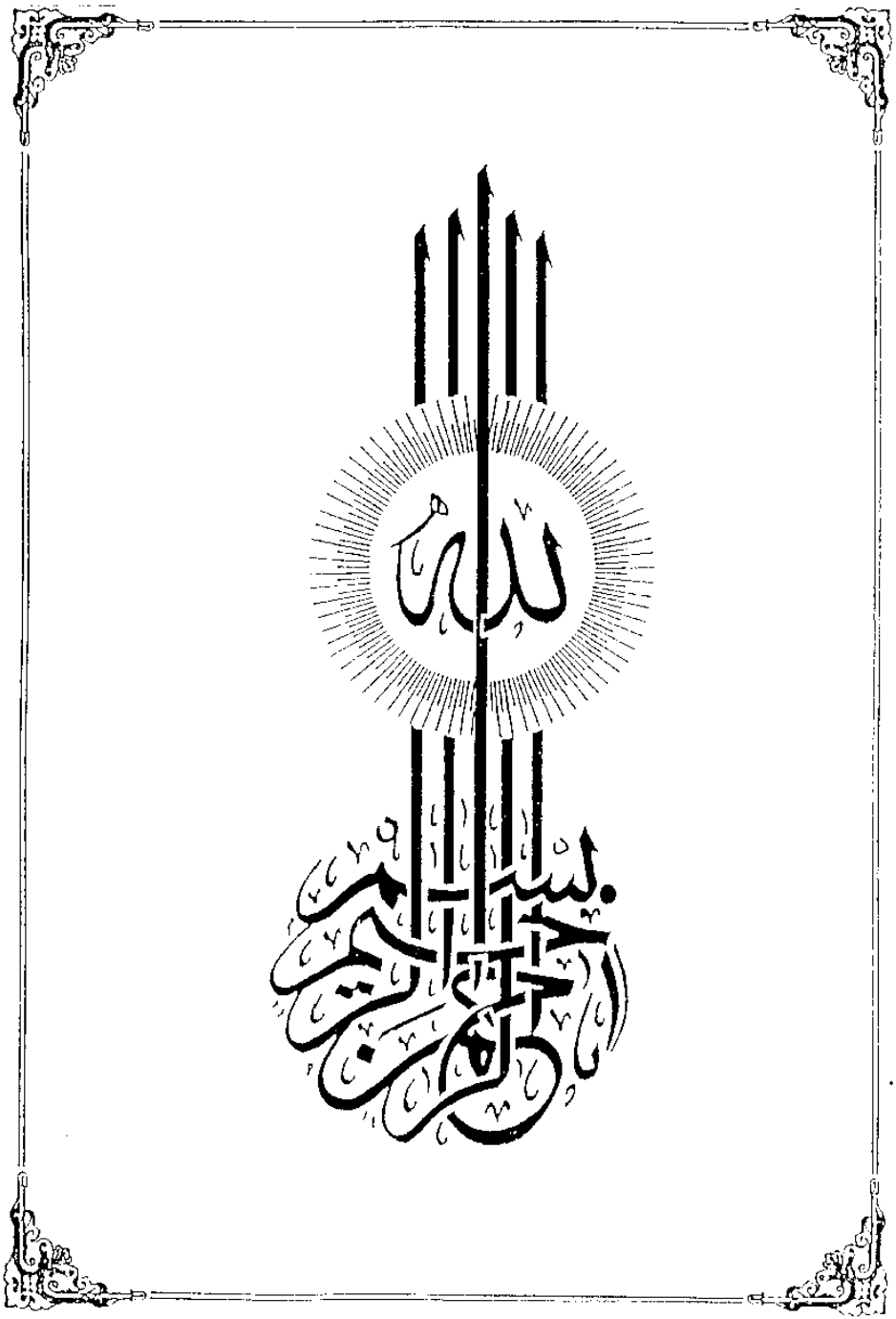

CONTENTS

INTRODUCTION AND AIM OF THE WORK

Early pioneers of rhinology have recognised the importance of localised disease and anatomic variations in the antrior ethmoid and middle meatus in the pathogenesis of frontal nad maxillary sinusitis, (HAJEK in 1926 and ZUCKERKANDL In 1926)

However, Messerklinger was the first to document such intimate relationship based on his meticulous studies of mucociliary drainage and careful endoscopic and radiographic studies of sinus pathology (MESSERKLINGER, 1978) .

Messerklinger`s concept of minimally invasive endoscopic surgery on the osteomeatal complex (anterior ethmoid - middle meatus) for treating chronic frontal and maxillary sinusitis has been followed by many rhinologists allover the world with high success rates.

The result of surgey have been assessed both endoscopically and radiologically.

The aim of this thesis is to assess the result of surgery histologically and histochemically .

DEVELOPMENT AND GROWTH OF THE PARANASAL SINUSES

The paranasal sinuses develop late in fetal and postnatal life. They are developed as out - growths from the lateral wall of the nasal cavities, bounded by the three conchae and the adjacent roof and floor.

The maxillary sinus begins to develop in the 4th month of inrauterine life (WARWICK & WILLIAMS,- 1973).

It is initially represented as a depression in the nasal wall below the middle turbinate. The depression rapidly becomes a groove, grows laterally and invades the body of the maxilla. The process of resorption of the maxillary bone with concomitent epithelial growth results in the formation of two pneumatic cavities lined by nasal epithelium (BALLANTYNE, AND GROVES, 1979).

At brith the maxillary sinus is just a slit like space with elongated antroposterior dimension and flattened latero-medially. It lies just near the lateral nasal wall i.e. it does not acquire enough depth in the maxilla. It grows in spurts associated with eruption of the molar teeth. With advancing age,gradual expansion of the sinus occurs in all directions with relatively greater expansion mediolaterally.

The sinus reaches its full size after the time of eruption of the permanent dentation (BALLANTYNE AND GROVES,

1979). In adult, the vertical diameter is the longest one due to full development and pneumatization of the avleolar process. However, in old age, the maxillary sinus reverts to its infantile dimension i.e. the height is diminished due to loss of teeth and absorption of the alveolar process (WARWICK & WILLIAMS, 1973).

The frontal sinus develops as an up ward growth of one of the anterior groups of the ethmoidal air cells. It does not penetrate the frontal bone, as a rule until after birth. It invades the bone in the first and second year of age: undergoes a growth spurt about the ninth year and reaches its full size at about age twenty.

The ethmoidal air cells, growing from the superior and middle meatuses, are present at birth, then grow slowly and reach thier full development at about puberty (DAVIES 1980).

The sphenoidal air sinuses are not enclosed by bone at birth . They increase rapidly about the third year and show additional growth at puberty (DAVIES, 1980).

ANATOMICAL CONSIDERATIONS

Functional endoscopic sinus surgery as described by MESSERKLINGER (1978 & 1985),KENNEDY (1985a & b), STAMMBERGER (1986) concentrates primarily on intranasal ethmoidectomy of variable extension with middle meatal antrostomy when required.

The related anatomy of the ethmoid sinus and lateral nasal wall, areas should be familiar to the sugeon endoscopically. In particular the relation between the ethmoid cells and the surrounding structures including the drainage sites of the frontal and maxillary sinuses and some of the anatomical variations in this region will be reviewed in this chapter.

The ethmoid sinuses:

The ethmoid labyrinth is a group of cells on each side located between the nasal fossa and the orbit.

It is roughly block shaped with its longer axis anteroposteriorly (4-5 cm), and is wider posteriorly (1-1.5 cm) than anteriorly (0.5 cm). Its anterior limits are marked by the frontal process of the maxilla and lower anterior extremity of the frontal bone . Laterally its thin wall composed of several bones.

In front, the lacrimal bone below and the frontal bone above. Behind them, the lamina papyracea above, and the palatine vertical lamina and upper section of the medial wall of the maxilla below (FIG. 1.1).

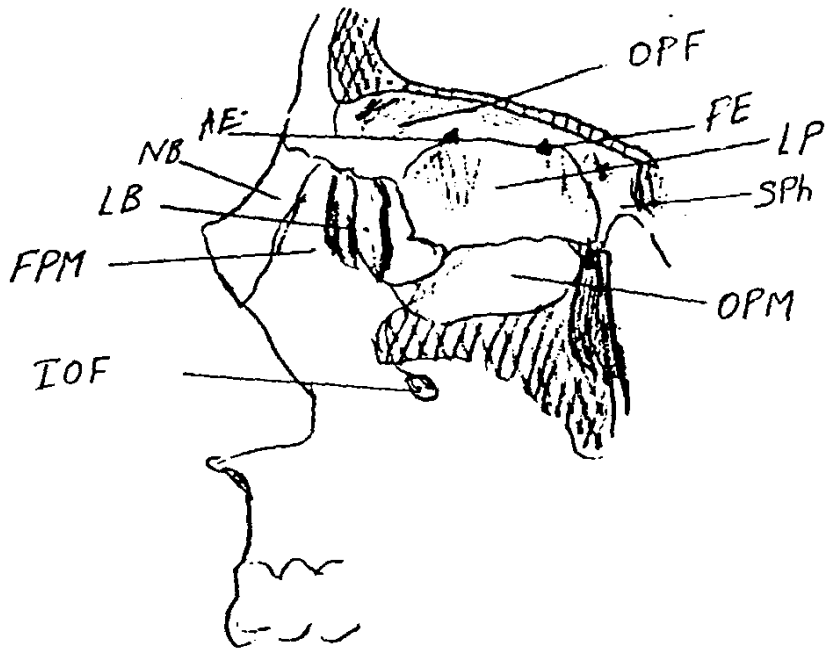

Fig. 1.1 - Lateral wall of the ethmoid sinus.
(from Hajek 1926).

AE = Anterior ethmoid foramen.
FPM = Frontal process of the maxilla.
IOF = Infra orbital foramen.
LP = Lamina papyracea.
NB = Nasal bone.
OPF = Orbital process of frontal bone.
OPM = Orbital process of maxilla.
PE = Posterior ethmoid foramen.
Sph = Sphenoid bone.

Posteriorlly , the ehmoid is bordered by the lateral two thirds of the anterior wall of the sphenoid and superiorly, by the inferior wall of the frontal sinus, frontal bone (fovea ethmoidalis) and the sphenoid bone.

The inner wall of the ethmoid labyrinth is formed by the lamina of two or three ethmoid turbinates (Fig.1.2),

That of the inferior ethmoid turbinate (middle nasal turbinate) anteroinferiorly, and those of the middle and superior ethmoid turbinates posterosuperiorly.

The inferior limit of the ethmoid labyrinth is the middle meatus, and could be marked by a horizontal plan passing along the lower margin of the inferior ethmoidal turbinate. (MOSHER 1929, BAGATELLA 1983).

The ethmoid cells are extremely variable in their anatomical characteristics. Studied individually, however, they are found to be no more variable than the other nasal sinuses and may be readily identified in groups, each having its own area of drainage in the nose, and having no communications with the cells of another group.

Previous authors have arranged the various transverse bony lamellae which occur at intervals across the ethmoid labyrinth into five principal ones (Fig 1.3). These lamelleaare generally attached to the ethmoid roof and extend laterally through the ethmoid capsule, curving posteriorly while they descend , to divide the ethmoidal cells into seperate groups.

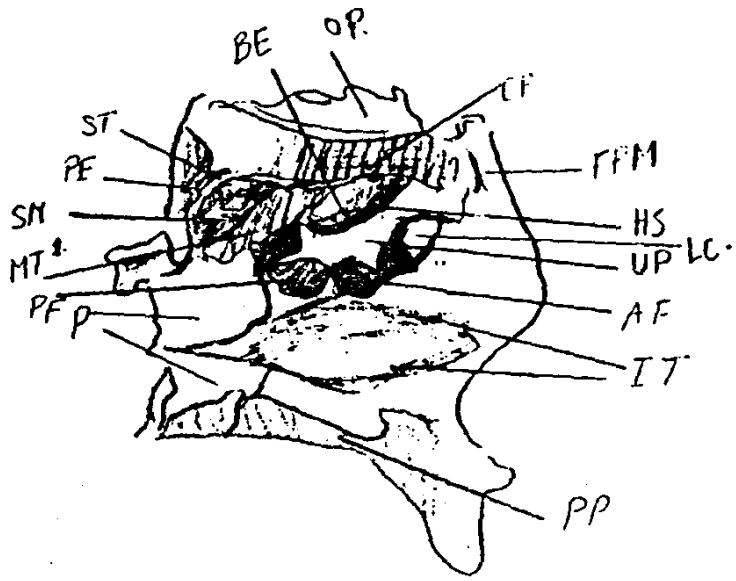

Fig. 1.2 - Bony structures of the lateral nasal wall (middle and superior turbinates removed) (from Hajek 1926).

AF = Anterior fontanelle.
BE = Bulla ethmoidalis.
CP = Cribriform plate.
FPM = Frontal process of maxilla.
HS = Hiatus semilunaris.
IT = Inferior turbinate.
MT = Attachment of the middle turbinate.
OR = Orbital roof.
P = Palatine bone.
PE = Posterior ethmoid cell.
PP = Palatine process.
SM = Superior Meatus.
ST = Attachment of the superior turbinate.
UP = Uncinate Process.

These lamellae also serve as attachments to the various ethmoid structures which project into the nasal cavity, namelythe three ethmoidal turbinates, the ethmoidal bulla and the uncinate brocess.

The ethmoid lamellae arranged antero-posteriorly are as follows : (HAJEK, 1926, VAN ALYEA 1942).

The uncinate process, this is a crescent shaped bone curving downwards and backwards and forms the first principle lamella. It is inserted obliquely into the lateral nasal wall below and behind the attachment of the middle turbinate, to the ascending process of the maxilla and lacrimal bone (FIG. 1.2&1.3,).

It is the only principle lamealla which is neither attached superiorly to the ethmoid roof, nor does it extend laterally to join the medial wall of the ethmoid capsule. It then extends freely where it ends in the pars membranacea, which seperates the nasal fossa from the maxillary sinus, here it splits into .several slender extensions to the inferior turbinate and palatine bones which reinforce the pars membranacea and divides it into anterior and posterior fontanells. The uncinate process forms with the ethmoidal bulla the anterior and posterior borders of the hiatus semilunaris, respectively, which leads from the middle meatus to the ethmoid infundibulum. The ethmoid infundibulum is bounded medially by the uncinate process, and inferomedially by the lacrimal and maxillary bones (MESSERkLINGER 1978) (FIG. 1.4).

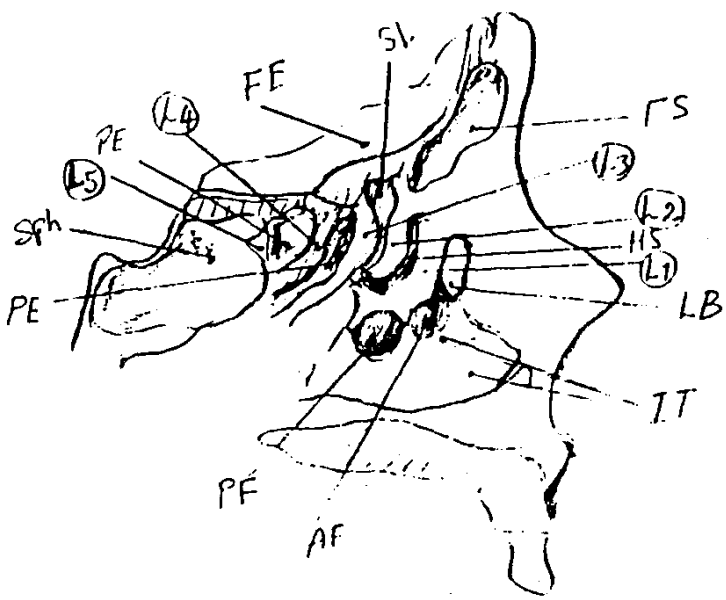

Fig. 1.3 - Nasal surface of the ethmoidal labyrinth of an adult showing the principle lamellae (from Hajek 1926).

AF = Anterior fontanelle.
FE = Fovea ethmoidalis.
FS = Frontal sinus.
HS = Hiatus semilunaris.
IT = Inferior turbinate.
L1 = 1st priciple lamella (uncinate process).
L2 = 2nd ,, ,, (Bulla ethm.).
L3 = 3rd ,, ,, (middle turbinate).
L4 = 4th ,, ,, (superior turbin.).
L5 = 5th ,, ,, (sphenoid sinus).
PE = Posterior ethmoid cell.
PF = Posterior fontanelle.
SL = Sinus lateralis.
Sph = Sphenoid sinus.

The lamella of the bulla ethmoidalis, (FIG. 1.2 & 1.3) forms the second principal lamella, it lies few millimeters above and behind the uncinate process and extends postero-inferiorly to be attached to the third principle lamella (the basal lamella of the inferior ethmoidal turbinate) forming the bular sulcus between the two lamellae. Occasionally a space seperates the bulla ethmoidalis from the basal lamella froming the sinus lateralis (MESSERKLINGER 1978) which may extend upwards to the ethmoid roof (FIG.1.2).

The lamella of the inferior ethmoid turbinate; forms the third principle lamella and is the most constant and most important lamella, as it forms the barrier between the anterior and posterior ethmoid cell groups. The third principle lamella consists of two parts, one lateral (lamina basalis or basal lamella) (FIG.1.3) and the other medial (lamina recurvata) perpendicular to each other (BAGGATELLA 1983) (FIG.1.4).

The lamina basalis runs obliquely downwards and backwards from the anterior ethmoid roof to a small crest of the vertical part of the palatine bone near the sphenopalatine foramen.

Laterally it is attached to the lamina papyracea, madial wall of the maxillary sinus and palatine vertical lamina.

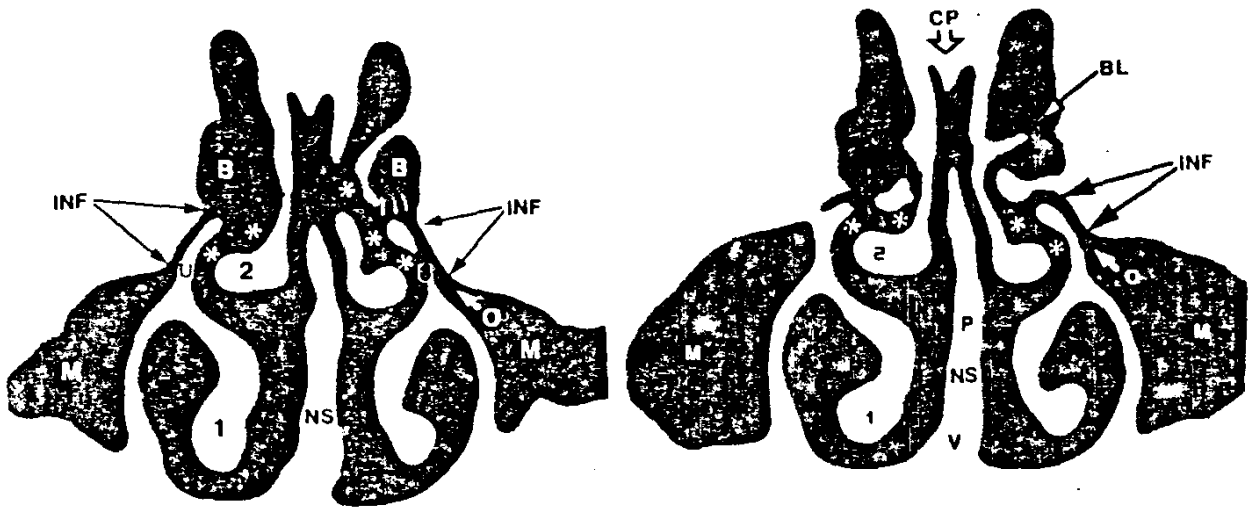

Fig. 1. 4 - Normal CT anatomy of the ostiomeatal unit in two consecutive coronal sections (Lt. section is anterior to Rt.).
(from Zinreich 1987).

Lt.: The infundibulum (INF) is delimited inferiorly by the maxillary sinus ostium (O) , medially by the uncinate process (U), superiorly by the ethmoidal bulla (B), and laterally by the inferomedial orbit.

Rt.: The middle turbinate (2) has dual attachments ; a high vertical one to the roof of the ethmoid (seperating the latter from the cribriform plate,CP) and a horizontal one to the lamina papyracea, the basal (or principle) lamella (BL). The air containing space between the uncinate process (U) and the middle meatus (*).

NS= nasal septum, P= perpendicular plate of ethmoid, V= Vomer
M= maxillary sinus, 1= inferior tubinate.