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Endoscopic Evaluation Of The Maxillary Sinus After Operations

THESIS
Submitted in Partial Fulfilment For The M.D. Degree
In Oto-Rhino-Laryngology, Ain Shams University

By

Abdel-Fattah Sadek Abdel-Fattah
M.B.B.Ch., M.Sc. (E.N.T), Cairo University

رضانة

Supervised By

Prof. Dr. Magdi Hamid
Professor of Oto-Rhino-Laryngology
Ain Shams University

816.212

60756

A.S Prof. Dr. Mahmoud El-Sammaa
Professor of Oto-Rhino-Laryngology
Ain Shams University

Prof. Dr. Reda Hussien Kamel
Professor of Oto-Rhino-Laryngology
Cairo University

Prof. Dr. Mostafa Mohamed Mostafa
Professor of Oto-Rhino-Laryngology
Ain Shams University

Prof. Dr. Laila Rashed Abdel Khalik
Professor of Histopathology
Research Institute Of Ophthalmology



Faculty of Medicine
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Faculty of Medicine

Ain Shams University

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

«وما أوتيتم من العلم إلا قليلاً»

(صدق الله العظيم)

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List Of Abbreviations

ATP	=	Adenosine triphosphate
AID	=	Acquired immunodeficiency syndrome
CBF	=	Ciliary beat frequency
CT	=	Computed tomography
CR length	=	Crown rump length
ESS	=	Endoscopic sinus surgery
EDTA	=	Ethylene diaminetetra acetic acid
FESS	=	Functional endoscopic sinus surgery
IMA	=	Inferior meatal antrostomy
MMA	=	Middle meatal antrostomy
MCC	=	Mucociliary clearance
MCT	=	Mucociliary transport
PAS	=	Periodic acid schiff
PCD	=	Primary ciliary dyskinesia
RA	=	Radical antrum operation
STT	=	Saccharin transit time

Introduction and Aim of The Work

Irrespective of the theories concerning the function of the paranasal sinuses, chronic inflammatory conditions frequently occur in them, especially in the maxillary sinus. Because of the anatomical relationship of the maxillary sinus to the teeth and its unfavorable drainage through the higher located natural ostium, it is often affected by the inflammatory process. Causes of chronic maxillary sinusitis are numerous. In a given individual case one must not be concerned with finding one cause, rather than thinking of the conjunction of several factors (Draf, 1983).

The mucous blanket produced by the combined secretion of the mucosal goblet cells and the mucosal glands, is continuously moved by the epithelial cilia towards the ostia, where it is emptied into the nasal cavity (Chapnick and Bach, 1976).

Many antrostomies can be shown draining mucopus. Thus the appropriate moment for surgical intervention and the nature and degree of that surgery might be determined based on a better understanding of the pathophysiology of the condition and the surgical options available (Lund, 1988).

The presence of the disease in the infundibulum or anterior ethmoid area appears to be a significant cause of failure in both inferior meatal antrostomy and Caldwell - Luc surgery. Performing the antrostomy endoscopically in the area of the natural ositum offers the potential of

removing not only the ostial disease, but also adjacent ethmoid disease, while at the same time restoring mucociliary clearance (Kennedy et al., 1987).

The aim of this work was to study the endoscopic findings and the mucociliary clearance after inferior meatal antrostomy, middle meatal antrostomy and radical antrum operations in the human being.

The Maxillary Sinus

Anatomy :

1. Embryology and development :

In the third fetal month, an evagination or bud in the infundibulum (also known as the uncibullous groove) gives rise to the maxillary sinus. At birth, the sinus has a volume of 6 ml to 8 ml but is fluid filled, making interpretation of plain film radiography difficult (Wasson, 1933).

The sinus then undergoes two periods of rapid growth, one between birth and 3 years and the other between 7 and 12 years. After the second period of rapid growth, subsequent expansion involves pneumatization of the alveolar process of the maxilla. All growth is completed by adulthood, resulting in the descent of the maxillary sinus floor from 4mm above the floor of the nose at birth to the same level at age of 8 to 9 years and finally to 4 mm to 5 mm below this site in the adult (Van Alvea, 1951). In old age, the maxillary sinus returns to its infantile dimension i.e. The height diminishes due to the loss of teeth and absorption of the alveolar process (Williams and Warwick, 1980).

For the nasal mucosa, the first ciliated cells were found in a foetus with a crown-rump length (C.R-length) of 29 mm i.e. corresponding to the end of the 9th week. Goblet cells are found in the 11th week and with high density anteriorly in the nose; in the 17th week. During the following weeks the number of ciliated cells increases strongly, reaching a maximum of 60 - 70 cells/HPPF in the 16th week. From the 16th week to the 23rd week the number of ciliated cells does not change (Romanes, 1981).

The process of resorption of the maxillary bone, with concomitant epithelial growth results in the formation of the two pneumatic maxillary cavities lined by nasal epithelium (Ballantyne and Groves, 1979).

2. Anatomic relations :

Generally a single maxillary sinus is present bilaterally. The sinus occupies the larger part of the body of the maxilla in the adult. It can be described as triangular, measuring 25 mm along the anterior limb of its base, 34 mm deep and 33 mm high. It extends below the orbit (Van Alvea, 1951).

Superiorly a bony ridge is usually present in the roof of the sinus. This is the bone around the infraorbital canal, which houses the infraorbital nerve and blood vessels. Dehiscences may be present in this bony wall, resulting in a direct contact between the infra-orbital structures and the sinus mucosa.

Inferiorly the sinus is closely related to the apices of the maxillary molar and premolar teeth, particularly the second premolar and the first permanent molar. The apices of these teeth often protrude slightly above the level of the sinus floor. They may remain separated from the sinus mucosa by a thin layer of bone, but occasionally they are in direct contact with the mucosa.

Anteriorly the sinus wall is closely applied to branches of the infra-orbital nerve and blood vessels, which provide innervation and vascularisation to the maxillary canine and incisor teeth and the surrounding periodontal tissues. The blood vessels and nerves may run directly below the sinus mucosa.

Posteriorly and laterally the posterior superior alveolar nerves and blood vessels are present. They supply the maxillary premolars and molars, as well as the tissues surrounding those teeth.

The medial part of the posterior maxillary sinus wall forms the anterior boundary of the pterygopalatine fossa (Buiter, 1976) (Fig. 1 & 2).

3. Endoscopic anatomy :

The maxillary sinus has an average volume of 15 cm³. The maxillary sinus of the woman is usually smaller than that of a man. There is a wide range of variations extending from 2 to 30 cm³. The sinus can be partially compartmentalized by septae and in rare cases, separate cavities can exist in the posterior part of the sinus, which can be a source of continual infection (Son et al., 1984). The natural ostium of the maxillary sinus is located in the superior aspect of the medial wall of the sinus. The maxillary ostium, seen from the interior of the antrum is a canal 3 to 6 mm wide 6 to 8 mm long running to the hiatus semilunaris in the direction of the choana and drains into the ethmoid infundibulum or hiatus semilunaris, depending on the terminology (Myerson, 1932). Most ostia are in the region of the posterior half of the infundibulum or posterior to the mid point of the bulla ethmoidalis (Van alvea, 1936).

The pneumatization of the bulla and the high (e.g. medial and superior projection) of the uncinate process help to form a canal leading to the maxillary sinus, which varies in depth, orientation and accessibility via the nose (Myerson, 1932). Besides the canalis maxillaris there is also, in 15% to 40% of cases, as examined by various authors, an accessory ostium

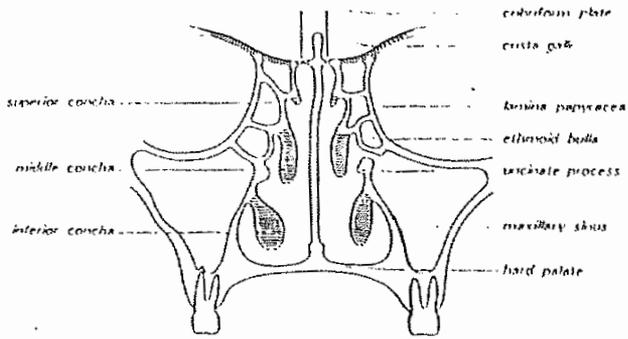


Fig. (1) : Frontal section of the nasal cavity and paranasal sinuses.

(Buiter, 1976)

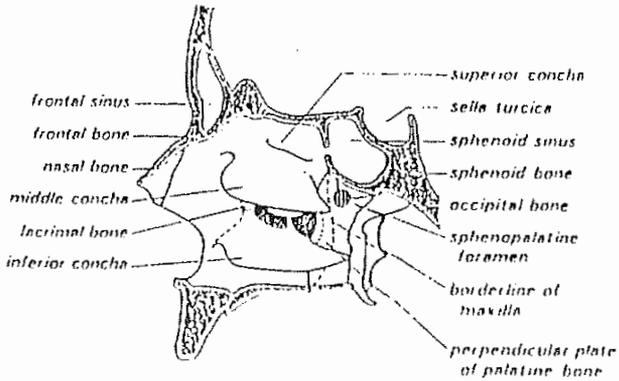


Fig. (2) : The lateral nasal wall.

(Buiter, 1976)

sometimes even two ostia. These ostia may be located in the infundibulum or the membranous region of the medial sinus wall, the latter being only a reduplication of the mucosa of the sinus and lateral nasal wall. This region is located inferior to the uncinate process and superior to the insertion of the inferior turbinate. Clinically this site is particularly important because it may be used as an alternative to opening the natural ostium, when the latter cannot be found during antrostomy (Ritter , 1978).

The lateral nasal wall :

The medial aspect of the ethmoid is known as the turbinates. They are ends of bony lamellae. They extend laterally to the lamina papyracea, superiorly to the lamina cribrosa and between the ethmoidal foveolae to the frontal bone. The first incompletely developed lamella is represented by the uncinate process. The second is the bulla lamella. It extends anteriorly to the frontal recess. Pneumatization of the bulla lamella results in the formation of the ethmoidal bulla. The third ground lamella is the middle turbinate, which is completely formed and separates the anterior and posterior ethmoidal labyrinths. The fourth ground lamella is formed by the superior turbinate. The occasionally present, smaller supreme turbinate is a fifth lamella. The passages between these ground lamellae are the interturbinal meatus (Stammler and Hawke, 1993) (Fig. 3).