

Chapter One

1.1 Introduction

Many historical references to the paranasal sinuses exist. The earliest such references can be dated back to the works of Galen, who described the presence of the ethmoid air cells. Later descriptions of the maxillary sinuses by Leonardo da Vinci (1489), the sphenoid sinuses by Giacomo Berengario da Capri (1521), and the frontal sinuses by Coiter (16th century) introduced early anatomists and scholars to the presence of these craniofacial air cells (Merriam 2002).

The first modern and accurate descriptions of the paranasal sinuses can be traced to the works of the late 19th century Austrian anatomist Emil Zuckerkandl. His detailed study and illustrations of the paranasal sinuses set the standard for generations of anatomists and physicians. Countless 19th and 20th century anatomists, radiologists and surgeons have further contributed to advancing the knowledge of sinus anatomy.

The introduction of computed tomography (CT) and the wider use of it in the last 20 years have further contributed to the physician's ability to appreciate nuances of paranasal sinus anatomy and accurate disease correlation.

The introduction of head and neck CT imaging and the current wider use of this modality have undoubtedly helped the clinician. CT has become a useful diagnostic modality in the evaluation of the paranasal sinuses and an integral part of surgical planning. It is also used to create intraoperative road maps. Today, CT is the radiologic examination of choice in evaluating the paranasal sinuses of patient with sinusitis (Bell 2013).

The use of CT scanning combined with functional endoscopic sinus surgery (FESS) has empowered the modern sinus surgeon to treat patients more effectively, facilitating reduce morbidity and

complications. Physicians who are interested in treating patients with sinus disease must be able to read and interpret sinus CT.Scan. Mastery of sinus anatomy and its variant features form the basis from which radiologic interpretation begins. Familiarization with the radiologic landmarks and cross-sectional anatomy on patient CT scans, along with clinical correlation, can further enhance the reader's ability to understand sinus CT findings (Bilaniuk 1982).

With experience, CT findings can be accurately correlated with the anatomic and clinical realities of the particular patient. As in all radiologic surveys, sinus CT scans must be read with systemic approach. In addition to reviewing the scan to determine the presence of disease, CT.Scan of sinuses can also be reviewed to evaluate potential areas of occlusion and variations of the patient's sinus anatomy is the setting of surgical planning (June et al 1984)

1.2 The Problem of Study

Computed tomography provides high quality images of the maxillary sinuses in axial, coronal and sagittal planes, and demonstrates the anatomical structure of the maxillary sinuses and the pathological conditions of the sinuses.

1.3. Objectives

1.3.1. General objective

- To characterize maxillary Sinuses

1.3.2 Specific objectives

- To study the efficiency of computed tomography in imaging paranasal sinuses.
- To study role of CT imaging technology in the delineation of the maxillary sinuses pathology compared to the conventional methods of radiography

- Discuss the computed tomography techniques used to examine the paranasal sinuses.
- Discuss the anatomical structures of maxillary sinuses and common pathological conditions.

The main task of the researcher is to demonstrate the efficiency of the CT imaging in delineating the sinuses and to compare the results to those obtained from conventional radiography.

1.4 The Rational and Importance of the Study

The study will focus mainly on the role of CT imaging of maxillary sinuses and the impact of the quality imaging on the decision of ENT surgeons to operate patients.

1.5 Hypnosis

The anticipation of this study that the computed tomography would delineate the maxillary sinuses anatomy and their pathological conditions precisely.

1.6 Area and Duration

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Chapter Two

Background and Literature Review

2.1 Anatomy of paranasal sinuses

The paranasal sinuses are air-filled spaces located within the bones of the skull and face. They are centered on the nasal cavity and have various functions, including lightening the weight of the head, humidifying and heating inhaled air, increasing the resonance of speech, and serving as a crumple zone to protect vital structures in the event of trauma. Four sets of paired sinuses exist: maxillary, frontal, sphenoid, and ethmoid (Zollikofer, 2008).

2.1.1 Maxillary sinus

The maxillary sinus is the largest paranasal sinus and lies inferior to the eyes in the maxillary bone. It is the first sinus to develop and is filled with fluid at birth. It grows according to a biphasic pattern, in which the first phase occurs during years 0-3 and the second during years 6-12. The earliest phase of pneumatization is directed

horizontally and posteriorly, whereas the later phase proceeds inferiorly toward the maxillary teeth.

This development places the floor of the sinus well below the floor of the nasal cavity. The shape of the sinus is a pyramid, with the base along the nasal wall and the apex pointing laterally toward the zygoma. The natural ostium of the maxillary sinus is located in the superior portion of the medial wall.

The anterior maxillary sinus wall houses the infraorbital nerve, which runs through the infraorbital canal along the roof of the sinus and sends branches to the soft tissues of the cheek. The thinnest portion of the anterior wall is above the canine tooth, called the canine fossa, which is an ideal entry site for addressing various disease processes of the maxillary sinus.

The roof of the maxillary sinus is the floor of the orbit. Behind the posteromedial wall of the maxillary sinus lies the pterygopalatine fossa, a small inverted space that houses several important neurovascular structures and communicates with several skull base

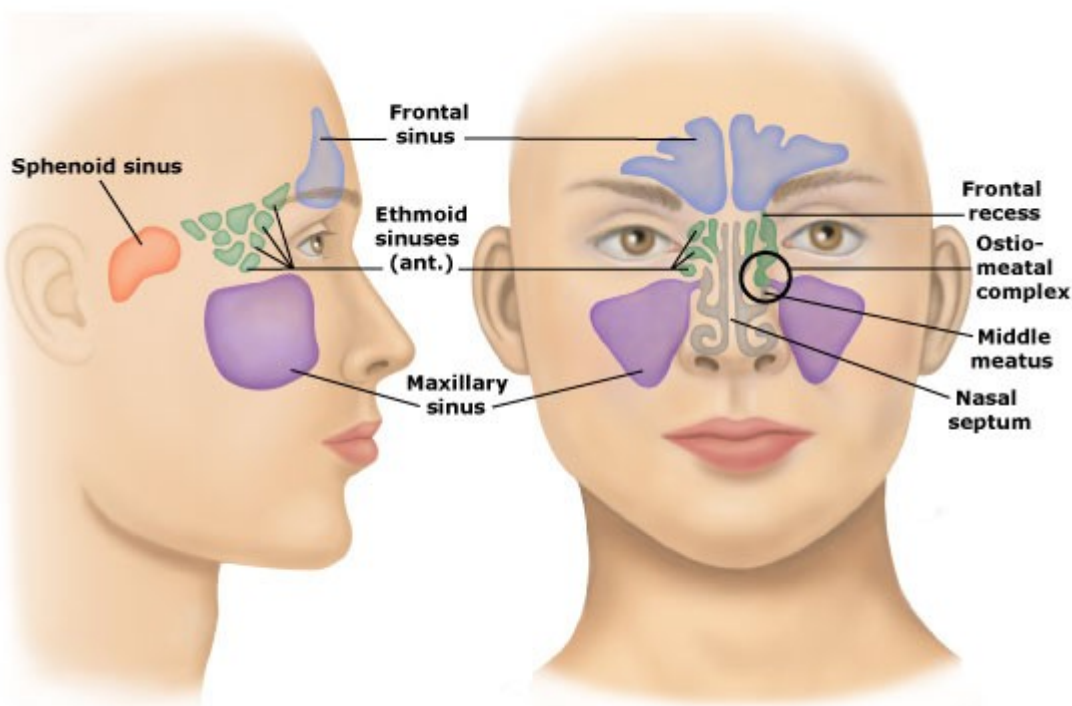


Fig.(1) paranasal sinuses

foramina. The infratemporal fossa lies behind the posterolateral wall of the maxillary sinus.

The maxillary sinus is supplied by branches of the internal maxillary artery, which include the infraorbital, alveolar, greater palatine, and sphenopalatine arteries. It is innervated by branches of the second division of the [trigeminal nerve](#), the infraorbital nerve, and the greater palatine (Zollikofer, 2008).

2.1.2 Frontal sinus

The frontal sinus is housed in the frontal bone superior to the eyes in the forehead. It is formed by the upward movement of anterior ethmoid cells after the age of 2. Growth of this sinus increases at the age of 6 and continues until the late teenage years.[\[3\]](#) The frontal sinuses are funnel-shaped structures with their Ostia located in the most dependent portion of the cavities. The posterior wall of the frontal sinus, which separates the sinus from the anterior cranial fossa, is much thinner than its anterior wall.

The frontal sinus is supplied by the supraorbital and supratrochlear arteries of the ophthalmic artery. It is innervated by the supraorbital and supratrochlear nerves of the first division of the trigeminal nerve (Christopher, 2008).

2.1.3 Sphenoid sinus

The sphenoid sinus originates in the sphenoid bone at the center of the head. It arises not from an out pouching of the nasal cavity but from the nasal embryonic lining. The sinus reaches its full size by the late teenage years. The sphenoid sinus is variably pneumatized and may extend as far as the foramen magnum in some patients.

The thickness of the walls of the sphenoid sinus is variable, with the anterosuperior wall and the roof of the sphenoid sinus (the planum sphenoidale) being the thinnest bones. The sphenoid sinus ostium is located on the anterosuperior surface of the sphenoid face, usually medial to the superior turbinate (Christopher, 2008).

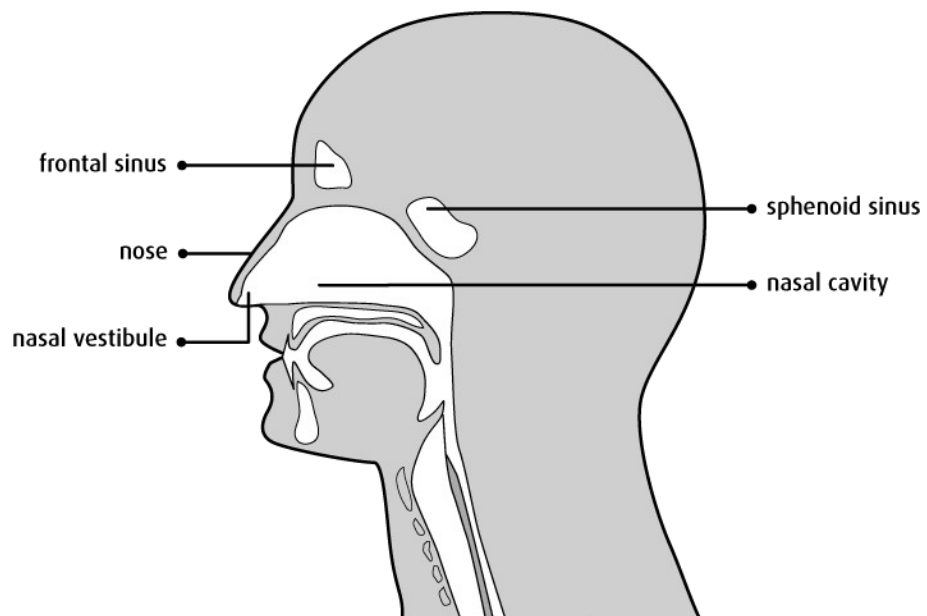
The sphenoid sinus is supplied by the sphenopalatine artery, except for the planum sphenoidale, which is supplied by the posterior ethmoidal artery. Innervations of the sphenoid sinus come from branches of the first and second divisions of the trigeminal nerve (Christopher, 2008).

2.1.4 Ethmoid sinus

The ethmoid sinuses arise in the ethmoid bone, forming several distinct air cells between the eyes. They are a collection of fluid-filled cells at birth that grow and pneumatize until the age of 12. The ethmoid cells are shaped like pyramids and are divided by thin septa. They are bordered by the middle turbinate medially and the medial orbital wall laterally. The ethmoid labyrinth may extend above the orbit, lateral and superior to the sphenoid, above the frontal sinus, and into the roof of the maxillary sinus.

The ethmoid sinuses are supplied by the anterior and posterior ethmoidal arteries from the ophthalmic artery (internal carotid system), as well as by the sphenopalatine artery from the terminal branches of the internal maxillary artery (external carotid system) (Christopher, 2008).

The Nose and Nasal Cavity



Paranasal Sinuses

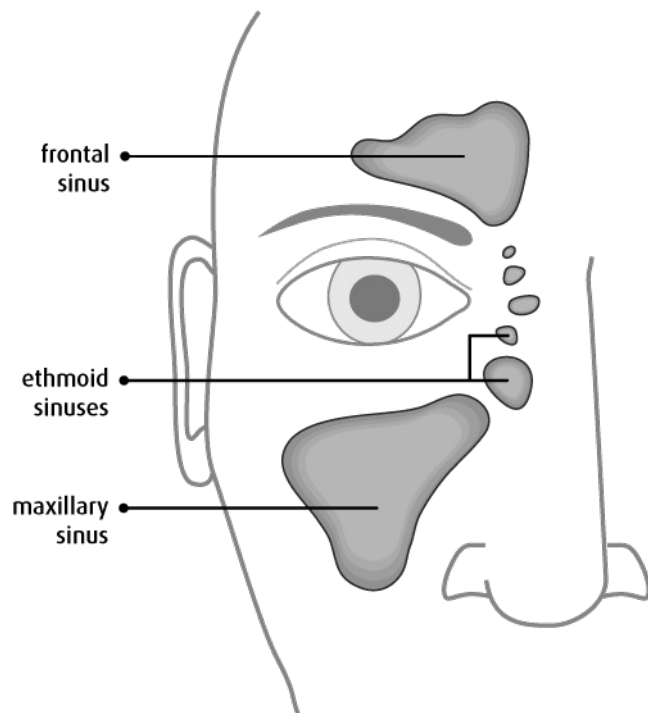


Fig.(2) anatomy of paranasal sinuses

2.2 Gross Anatomy

2.2.1 Ethmoid bone

The medial portion of the ethmoid bone is a cruciate membranous bone that is composed of the crista galli, the cribriform plate, and the superior portion of the nasal septum. The crista galli is a thick piece of bone, shaped like a cock's comb, that projects superiorly into the cranial cavity and serves as an attachment of the falx cerebri. If pneumatized, the crista galli air cell drains into either the left or right frontal sinus.

The cribriform plate contains numerous perforations that transmit olfactory fibers to the superior turbinate and the superior portions of the nasal septum and middle turbinate. The perpendicular plate of the ethmoid connects with the quadrangular cartilage anteroinferiorly and the vomer posteroinferiorly to form the nasal septum (Weissman, 2008).

2.2.2 Ethmoid roof (fovea ethmoidalis)

The vertical lamella of the middle turbinate divides the anterior skull base into the cribriform plate medially and the roof of the ethmoid, or fovea ethmoidalis, laterally. The ethmoid labyrinth of air cells lies lateral to the middle turbinate and terminates at the paper-thin bone forming the medial orbital wall, called the lamina papyracea.

The fovea ethmoidalis slopes inferiorly when travelling in an anterior-to-posterior or lateral-to-medial direction along the skull base. Understanding this orientation is important for preventing inadvertent entry into the skull base during endoscopic sinonasal procedures.

The roof of the ethmoid is composed of a thicker horizontal portion, called the orbital plate of the frontal bone, and a thinner vertical portion, called the lateral cribriform plate lamella (LCPL). The orbital plate comprises most of the ethmoid roof, with the LCPL forming a small medial portion. The height of the LCPL defines the depth of the olfactory cleft, where dura is closely adherent to the bone. The bony thickness of the LCPL ranges from 0.05 mm to 0.2 mm and provides little resistance to injury (Weissman, 2008).

In addition, increasing depths of the olfactory cleft correlate with a greater risk of inadvertent injury during surgery. Injury may often result in a [cerebrospinal fluid leak](#), pneumocephalus, or [intracranial bleeding](#). The Keros classification divides the ethmoid roof into 3 configurations: shallow type I (1-3 mm), medium type II (4-7 mm), and deep type III (8-16 mm). The type III configuration, being the deepest, is at greatest risk for complications during endoscopic endonasal surgery.

One additional anatomic variant exists in which the orbital plate is thinner and the LCPL runs in a more horizontal direction. An even greater risk of inadvertent injury exists if the surgeon perceives the thinner orbital plate to be part of a superior ethmoid cell, rather than the actual skull base (Weissman, 2008).

2.2.3 Lateral nasal wall

2.2.3.1 Turbinates

Three (sometimes 4) projections, called turbinates or conchae, emanate from the lateral nasal wall: the inferior, middle, superior, and supreme turbinates. The inferior turbinate has a different embryologic origin: it is derived from the maxilloturbinal, whereas the middle, superior and supreme turbinates are all derived from the ethmoturbinal.

Each turbinate extends the length of the nasal cavity and has a space associated with it, called a meatus. Each meatus is named for the turbinate above it. The turbinates function to warm, humidify, and purify the air before it enters the lower airway.

The middle turbinate is a prominent, easily visualized turbinate and serves as an important anatomic landmark for endoscopic sinus and [skull base surgery](#). It comprises the body, the anterior buttress, the posterior buttress, the horizontal lamella, and the vertical lamella.

The anterior buttress is a point of attachment of the turbinate to the lateral nasal wall in the agger nasi region. The posterior buttress is a point of attachment to the lateral nasal wall near the posterior end of the middle turbinate. The vertical lamella attaches to the LCPL and marks the boundary between the cribriform plate and the ethmoid roof. The horizontal lamella (also called the basal lamella or ground

lamella of the middle turbinate) attaches to the lateral nasal wall and marks the division between the anterior and posterior ethmoid air cells.

Preserving the anterior buttress, posterior buttresses, and vertical lamella of the turbinate during surgery is important to prevent lateralization of the turbinate and consequent obstruction of outflow. Preservation of the inferior portion of the horizontal lamella further decreases the risk of turbinate lateralization (JOHN, 2008).

2.2.3.2 Uncinate process and ethmoid infundibulum

The Uncinate process is a saber-shaped ethmoid bone that attaches to the lateral nasal wall through multiple bony and fibrous attachments. The Uncinate lies lateral to the middle turbinate and has a free edge that runs from the maxillary sinus ostium inferiorly to below the frontal recess superiorly. The Uncinate forms the medial wall of the ethmoid infundibulum, a 3-dimensional space that accepts drainage from the maxillary, frontal, and anterior ethmoid sinuses.

The infundibulum is bordered medially by the Uncinate process, laterally by the medial orbital wall (lamina papyracea), superiorly by the frontal recess, and inferiorly by the maxillary sinus ostium.

The Uncinate process usually attaches to the medial orbital wall superiorly but may attach to the skull base or the middle turbinate. The site of attachment of the Uncinate influences the drainage pattern of the frontal sinus. When attached to the medial orbital wall, the frontal sinus drains into the middle meatus, defined by the space under the middle turbinate. If the Uncinate process is attached to the skull base or the middle turbinate superiorly, the frontal sinus drains directly into the infundibulum (A.R.S, 2011).

2.2.3.3 Ethmoid bulla and semi lunar hiatus

The ethmoid bulla is a constant landmark during endoscopic surgery and is usually the largest of the anterior ethmoidal cells. It lies posterior to the Uncinate process, superior to the infundibulum, and anterior to the basal lamella. The ethmoid bulla often extends all the way to the skull base but sometimes is attached to the skull base via the bulla lamella.

The space between the lateral/inferior surface of the ethmoidal bulla and the superior surface of the Uncinate process is called the hiatus semilunaris (semi lunar hiatus). This 2-dimensional space connects the infundibulum to the middle meatus.

If the ethmoidal bulla has a posterior surface, the space between the bulla and the basal lamella is called the retrobullar recess or sinus lateralis. The 2-dimensional opening into the retrobullar recess is called the hiatus semilunaris posterior (posterior semi lunar hiatus). The retrobullar recess may communicate with the suprabullar recess, which is a cleft that forms between the superior surface of the ethmoidal bulla and the fovea ethmoidalis.

The basal lamella represents the division between the anterior and posterior ethmoidal cells. Anterior ethmoidal cells drain into the middle meatus via the ethmoid infundibulum. Posterior ethmoidal cells, which are fewer in number, drain into the superior meatus (A.R.S, 2011).

2.2.3.4 Ostiomeatal complex

The Ostiomeatal complex (OMC) represents a 3-dimensional space that is bordered by the lamina papyracea laterally, the middle turbinate medially, the frontal recess superiorly, and the maxillary sinus ostium inferiorly. This space includes the Uncinate process, ethmoid infundibulum, semi lunar hiatus, and clefts between Uncinate and middle turbinate and between ethmoid bulla and middle turbinate. Chronic inflammation and edema of the OMC causes anatomic and functional obstruction, leading to chronic inflammation of sinuses draining into the area (Bent J, 1994)

2.2.3.5 Haller cell (infraorbital ethmoid cell)

The Haller cell, or infraorbital cell, is an anterior ethmoidal cell that pneumatizes into the maxillary sinus ostium just below the inferior orbital wall. The presence of a Haller cell may contribute to persistent maxillary sinus disease in some cases of chronic sinusitis. This is

typically secondary to mucosal inflammation of the common wall between the Haller cell and the maxillary sinus ostium (Bent J, 1994)

2.2.3.6 Accessory Ostia

The lateral nasal wall has 2 areas deficient in bone that lie anterior and posterior to the Uncinate process. Often, these areas, called fontanelles, are accessory Ostia that are sometimes confused with the natural maxillary sinus ostium. Although sometimes functional, these Ostia rarely function as the true ostium, because the mucociliary clearance pattern of the maxillary sinus flows to the natural ostium (Badino C, 2004).

2.2.4 Frontal recess (sinus)

In broad anatomic terms, the frontal recess is bordered posteriorly by the sloping anterior skull base and anteriorly by the beak of the frontal process. Its anatomy is made complex by the wide variety of anterior ethmoidal cells that populate the space. Some of the more common frontal recess cells include the agger nasi cell, supraorbital ethmoid cell, interfrontal sinus septal cell, frontal bulla cell, suprabullar cell, and 4 types of frontal cells (types I-IV). The most prominent cells include the agger nasi cell, supraorbital cell, and 4 types of frontal cells.

Although the exact configuration and pathway of the frontal recess vary, this structure is usually bounded anteriorly by the posterior wall of the agger nasi cell, superiorly by the frontal sinus, medially by the lateral cribriform plate lamella, laterally by the lamina papyracea, and posteriorly by the anterior wall of the ethmoidal bulla, or suprabullar recess.

The risk of a cerebrospinal fluid leak from the olfactory fossa, damage to the anterior ethmoidal artery with potential visual loss, and orbital injury make dissection in the frontal recess particularly challenging for the endoscopic sinus surgeon (Badino C, 2004).

2.2.5 Agger nasi cell

The agger nasi cell is the most anterior of all the ethmoidal cells found in the lacrimal bone anterior and superior to the anterior buttress of the middle turbinate. It is also the most prominent and constant

ethmoidal cell, characterized as the bulge in the lateral nasal wall and found in over 90% of computed tomography (CT) scans.[\[3\]](#) It is the first anterior ethmoidal cell to undergo pneumatization.

The medial and posterior walls of the agger nasi cell often lie in close association with the vertical lamella of the middle turbinate and the skull base, respectively. The posterior wall usually represents the anterior face of the frontal recess. The superior surface (or cap) of the agger nasi cell, if left in place during frontal recess surgery, may contribute to iatrogenic frontal sinus obstruction (Bolger WE, 2001).

2.2.6 Supraorbital ethmoid cell

The supraorbital ethmoid cell is an anterior ethmoidal cell that pneumatizes into the orbital plate of the frontal bone. This cell extends over the orbit and sometimes pneumatizes all the way to the lateral wall. When extensively pneumatized, this cell may be mistaken for the frontal sinus or a septate frontal sinus. Often, this cell may be completely missed by the endoscopic sinus surgeon, especially when it is hidden behind the bulla lamella (Bolger WE, 2001).

2.2.7 Frontal sinus cells

Four types of frontal cells pneumatize above the agger nasi cell, thereby contributing to the complexity of frontal recess anatomy. A type I frontal sinus cell lies above the agger nasi cell. A type II frontal sinus cell is a configuration of 2 cells stacked above the agger nasi cell. A type III cell is a large frontal sinus cell that pneumatizes into the frontal sinus and occupies nearly 50% of the sinus. Finally, a type IV frontal sinus cell is a single isolated cell that exists completely within the frontal sinus and has no connection to the frontal recess (Bolger WE, 2001).

2.2.8 Sphenoid bone

The sphenoid bone is a butterfly-shaped bone that is divided into 4 main parts: the body sphenoid centrally, 2 greater and lesser wings laterally, and the pterygoid processes inferiorly.

The lesser wing and the planum sphenoidale (the roof of the sphenoid sinus) form the medial portion of the anterior cranial fossa. The medial portion of the middle cranial base is formed by the body of the sphenoid bone, the tuberculum sella, the pituitary fossa, the middle and posterior clinoid processes, and the dorsum sellae. The lateral portion of the middle cranial base is formed by the lesser and greater wings of the sphenoid bone (Casiano RR, 2001).

2.2.9 Sphenoid sinus

The sphenoid sinuses are a pair of large paranasal sinuses located posterior to the ethmoid sinuses. These paired sinuses develop separately from the nasal capsule of the embryonic nose, often divided by a single vertical intersinus septation. However, multiple complete and incomplete bony septations, with vertical, horizontal, or oblique orientations, may further subdivide the sinus.

In one radiologic study, 80% of sphenoid sinuses were found to have a single sphenoid septation, and 20% were found to have a double septation. These septations often localize to the carotid artery, underscoring the importance of a traumatic dissection to avoid a catastrophic vascular injury.

In a study of 54 sphenoid sinuses, 27 sphenoid sinuses were examined with high-resolution CT scanning, and the other half were examined in fresh frozen cadaveric heads. Of the radiographically examined sinuses, 85% had at least 1 sphenoid septation, and 41% had at least 2 septations inserted into the internal carotid arteries. Of the sinuses in the cadaveric group, 89% had 1 septation, and 48% had 2 septations. Only 13% of specimens had an isolated midline septation (Casiano RR, 2001).

2.2. 10 Pneumatization patterns

Pneumatization of the sphenoid sinus is highly variable and can extend as far as the clivus inferiorly, the sphenoid wings laterally, and the foramen magnum inferiorly. Pneumatization of the vast majority of sinuses reaches the sella turcica by age 7. Three major

pneumatization patterns for sphenoid sinus have been noted: sellar (80%), presellar (17%), and conchal (3%).

A sellar sphenoid sinus has pneumatization anterior and inferior to the sellar prominence. A presellar sphenoid sinus has pneumatization only anterior to the sella. A conchal sphenoid sinus has minimal to no pneumatization. A conchal configuration poses the greatest anatomic challenge to the endoscopic management of sphenoid, pituitary, or anterior skull base pathology.

There is 1 more pattern that is sometimes seen, the postsellar pattern. This configuration consists of presellar pneumatization followed by bone, a smaller pneumatization behind the sella. This pattern is important to recognize during endoscopic skull base surgery (Chan R, 2006).

2.2.11 Endoscopic anatomy

The endoscopic anatomy of the sphenoid sinus has several critical anatomic landmarks that are important for the endonasal endoscopic surgeon. The midline posterior wall of the sphenoid sinus reveals the sellar protuberance, inferior to which lies the clivus, separated by the sellar-clival junction. Superior and anterior to the sella lies the planum sphenoidale, separated by a thick ridge of bone called the tuberculum sellae, which corresponds to the chiasmatic sulcus intracranially.

The lateral wall of the sphenoid sinus reveals 4 prominences and 3 depressions. The 4 prominences, from superior to inferior, are the optic nerve, the parasellar internal carotid artery, the maxillary division, and the mandibular division of the trigeminal nerve. The 3 bony depressions of the lateral sphenoid sinus wall are the lateral opticocarotid recess, the depression between the cavernous sinus apex and the maxillary nerve, and the depression between the maxillary and mandibular divisions of the trigeminal nerve.

In addition, the space medial to the junction between the optic nerve and the carotid arteries, called the medial opticocarotid recess, has been labeled the anatomic keyhole in endonasal skull base surgery.[\[10\]](#) Nearly 25% of patients may have a bony dehiscence over critical structures such as the optic nerve

and the carotid artery. Caution must be exercised in the removal of these septations in order to prevent visual or vascular injury (Chan R, 2006).

2.2.3.12 Sphenoid ostium and sphenoethmoid recess

The natural sphenoid sinus ostium is located 1.5 cm superior to the posterior choanae on the anterior sphenoid sinus wall. The natural ostium is elliptical in shape and is found in close association with the superior turbinate in the sphenoethmoid recess. In 83% of cases, the ostium is located medial to the superior turbinate and may be visualized with gentle lateralization of the superior turbinate.

Another anatomic landmark for identifying the sphenoid ostium involves dividing the superior turbinate into thirds. The natural ostium lies at the junction of the inferior and middle thirds of the superior turbinate.

The sphenoethmoid recess is the narrow vertical corridor enclosed by the septum medially and the superior turbinate laterally. It is defined superiorly by the cribriform plate and inferiorly by the floor of the nasal cavity. The natural sphenoid ostium drains into this corridor, as do the posterior ethmoid cells (Duque CS, 2005).

2.2.3.13 Parallelogram box theory

The sphenoid sinus can be entered not only through the natural sphenoid sinus ostium but also through the posterior ethmoid cells. The so-called parallelogram box concept provides a safe mechanism for entering the sphenoid sinus through the posterior ethmoid complex.

The parallelogram box is defined by the medial orbital wall laterally, the vertical lamella of the superior turbinate medially, the fovea ethmoidalis superiorly, and the horizontal lamella inferiorly. An oblique line drawn from the superior medial corner of the box to the inferior lateral corner divides the parallelogram into 2 equal halves. The safest route of entry into the sphenoid sinus is through the medial-inferior triangle of the sphenoid face because the optic nerve and carotid artery lie in the superior-lateral triangle of the box (Graney DO, 1998).

2.2.3.14 Onodi cell

The Onodi cell, or sphenoethmoid cell, is a posterior ethmoidal cell that pneumatizes posterior, lateral, and superior to the sphenoid face. It is present in 7-25% of patients and nearly 50% of patients from the Far East.

Recognizing the presence of this cell before and during endoscopic sinus or skull base surgery is important. An Onodi cell may often encompass the optic nerve laterally in the posterior ethmoid sinus, making it potentially vulnerable to injury. Also, the presence of an Onodi cell places the sphenoid sinus in a more medial and inferior position, thereby increasing the risk of intracranial penetration if the surgeon expects the sinus to be behind the last posterior ethmoid cell (Graney DO, 1998).

2.2. 15 vascular supply:

The nose and the paranasal sinuses are supplied by the internal and external carotid arterial system. The anterior ethmoidal artery (AEA) and posterior ethmoidal artery (PEA) arise from the ophthalmic artery, the first branch of the supraclinoid internal carotid artery. These ethmoidal arteries traverse the orbit and pierce the lamina papyracea to supply the nose and paranasal sinuses.

The AEA crosses the medial rectus, penetrates the lamina papyracea, and runs across the anterior fovea ethmoidalis before branching and supplying the cribriform plate and anterior and superior nasal septum. The AEA runs at a 45 ° angle from lateral to medial along the skull base. It usually travels at the base of the frontal recess or behind the ethmoid bulla. If the bulla lamella (attachment of the ethmoidal bulla to the skull base) exists, the AEA runs in it or just posterior to it.

Usually the AEA is flush with the skull base, but 14-43% of the time it lies in a mesentery hanging from the skull base, thereby exposing it to a greater risk of injury during surgery.

The PEA crosses the medial rectus, penetrates the lamina papyracea, and courses through the posterior ethmoid cells near the anterior face of the sphenoid in close association with the skull base. This artery supplies the posterior ethmoidal sinuses, superior posterior septum, and portions of the superior and middle turbinates. The location of the posterior ethmoidal artery is parallel to the optic nerve near the orbital vertex.

Either the AEA or the PEA may be dehiscent, and caution is necessary to prevent injury and retraction of these arteries into the orbit, resulting in an orbital hematoma and potential visual loss.

The sphenopalatine artery, a terminal branch of the internal maxillary artery, provides blood to the posterior nasal cavity, as well as to portions of the maxillary, ethmoid, and sphenoid sinuses. It passes through the pterygopalatine fossa through the sphenopalatine foramen and branches into the posterior septal artery and the posterior lateral nasal artery.

The sphenopalatine artery is located at the posterior edge of the maxillary sinus ostium and is transmitted between the orbital processes of the palatine bone. It is visualized after reflection of the mucosa of the maxillary sinus laterally and the nasal mucosa medially. Removal of the bone that remains leads to the pterygopalatine and infratemporal fossa (Graney DO, 1998).

2. 2 .16 Microscopic Anatomy

The nasal and paranasal sinuses are lined with pseudostratified ciliated columnar epithelium. Four types of cells are noted in the sinonasal cavity: ciliated columnar epithelial cells, nonciliated columnar cells, goblet cells, and basal cells.

The ciliated columnar epithelial cells have 50-200 cilia per cell, which beat 700-800 times a minute. These cilia move the mucous blanket at an approximate rate of 9 mm/min. Nonciliated cells have microvilli on the apical surfaces that enhance humidification and warming of air before it enters the lower airway.

The goblet cells secrete glycoproteins, which influence the character of the mucus. The parasympathetic input to these glands produces thicker mucus, whereas the sympathetic innervations produces thinner, watery mucus. The function of the basal cells is unknown (Kainz J, 1988).

2.2 Physiology of Paranasal Sinuses

Physiologies of paranasal sinuses have undergone rapid advancement since the days of Galen. It was Galen who described the anatomy of paranasal sinuses as "Porosity of skull" in the second century AD. It was Leonardo da Vinci who made a detailed anatomical illustration and description of the paranasal sinuses. His illustrations contained description of frontal sinuses and maxillary sinus ostium.

The physiological role played by paranasal sinuses have always been conjectural. Several

Hypothesis has been made. For easier understanding these hypothesis have been grouped under three main heads: Structural theories, evolutionary theories and eunctional theories (Kainz J, 1988).

2.2.1 Structural theory:

Fallopio's theory: Fallopio in 1600 hypothesized that these para nasal sinuses are present to make the skull bone lighter thereby reducing the load on neck musculature which supports the head.

Another theory belonging to this group suggests that these sinuses contribute to the Maintenance of equilibrium and the positioning of the head by lightening the anterior portion of the cranium.

Proetz theory: suggests that the paranasal sinuses play a role in remodeling of facial bones.

Evolutionary theory: This theory is very innovative. It considers the paranasal sinuses as the evolutionary response of anthropomorphic monkeys to shift from terrestrial environment to the aquatic one. This theory was proposed by Hardy. According to him the African monkeys were forced to take to water when the whole of Africa was surrounded by sea about 6.5 million years ago. The necessity to cross large stretches of water enabled them to develop these air filled sinus cavities which helped them to keep afloat for long hours in water. This occurred due to an evolutionary process known as Natural selection (Kainz J, 1988).

2.2 .2 Functional theories:

Bartholini's theory: Bartholin considered these cavities as organs of resonance which added quality and resonance to the voice.

Cloquet's theory: Cloquet hypothesized that paranasal sinuses contained olfactory epithelium aiding in the function of smell. This theory has been disproved as olfactory epithelium has not been demonstrated in the sinus cavity.

The most acceptable theory is that these sinuses improve nasal function. The fact that these paranasal sinuses embryologically originates as invaginations from the nose and its histological continuity with the nasal mucosa leads credence to this theory. These sinuses have been shown to strengthen the defence function through additional secretion of lytic enzymes and immunoglobulin.

Ventilatory function: Since the mucosal lining of the paranasal sinuses are in continuity with that of nasal mucosa they play an important role in Ventilatory function. Gaseous exchanges are known to occur between the inspired air and blood supply of the sinus mucosal lining. Gaseous exchanges are determined by active and passive phenomena. During respiration the nasal valve transforms the inspired air into a laminar flow. When this laminar flow reaches the middle meatus area turbulence starts to occur. This turbulence causes uniform mixing of air. There is a pressure gradient between the nasal cavity and para nasal sinuses causing airflow in to the sinus cavities. Air enters the sinuses at the end of every inspiration and at the beginning of the following expiration.

This is because only during these times a positive pressure exists in the nasal cavities driving air into the sinuses.

It has been estimated that only 1/1000 of the air volume inside the sinuses are exchanged through a single respiratory act. The patency of the ostium is very important for the gaseous exchange to take place.

Mucociliary clearance: The nose and paranasal sinuses form the first line of defence for the lower airways. They protect the lower airways from noxious substances and microbes. They play a vital role in specific and non specific modes of defence. Among the nonspecific protective mechanisms, mucociliary clearance plays an important role. This mechanism depends on the integrity of the mucociliary system which includes the ciliated cells, goblet cells and the quality of the mucus secreted. Goblet cells are more numerous in maxillary sinus than other sinuses. The mucociliary transport mechanism needs continuous supply of oxygen. This mechanism clears the nasal and sinus cavity. The microbes and particulate matter if any gets entrapped in the secretions and are transported out.

Immune defence: This defence mechanism can be divided into nonspecific (phylogenetically older) and specific (phylogenetically newer) mechanisms. The older non specific mechanism is also known as natural immunity. This is brought about by factors like: Lysozyme - which destroys the bacterial cell wall, interferon, complement and enzymes

Specific immunity is provided by macrophages and immunoglobulin secreting lymphocytes. This immunity is highly specific against microbes invading the nasal cavity. Nose associated local immune tissue (NALT) has been attributed with this function (Kainz J, 1988).

The main functions of the nasal cavity are: filtering, warming and humidifying the air we breathe, provides a sense of smell, giving vibration or resonance to the voice, reducing the weight of the bones of the face and give strength and shape to the face and eyes.

The nasal cavity and paranasal sinuses make about 1 L of mucus a day. As the mucus moves through the nasal cavity and sinuses, it moisturizes and cleans the mucous membrane, which filters bacteria, dust and other particles from the air breathed through the nose. The mucus drains into the throat and is swallowed, where the acid in the stomach destroys any bacteria that were in the mucus (Kainz J, 1988).

2.3 Pathology of Paranasal Sinuses

Sinusitis is inflammatory condition of the mucous membrane lining of the sinuses. It may progress to pus formation.

- Sinusitis may be acute and chronic.
- Inflammation of the maxillary sinus is called maxillitis;
- Inflammation of the ethmoid sinus is called ethmoiditis;
- Inflammation of the frontal sinus is called frontal sinusitis;
- Inflammation of the sphenoid sinus is called sphenoiditis;
- Hemi sinusitis – the involvement all sinuses on one side into inflammation process;
- Pan sinusitis- all sinuses are involved;
- Polisinusitis- several sinuses, but not all, are involved.

For their origination sinusitis may be primary and secondary. Primary sinusitis are rare diseases, they appear as result of trauma or allergy. But usually infection spreads to sinuses from other focuses.

Sinusitis may divided into:

- Rhinogenous-infection spread from the nasal cavity. It is the most common way for infection and such sinusitis is the complication of the flu.
- Odontogenic –infection spreads from upper teeth this way is typical only for maxillary sinus. The pathologic process may spreads from 4, 5,6 cheek teeth apex to the inferior wall of the maxillary sinus.
- Traumatic
- Hematogenic
- Allergic (Davinder J, 2010).

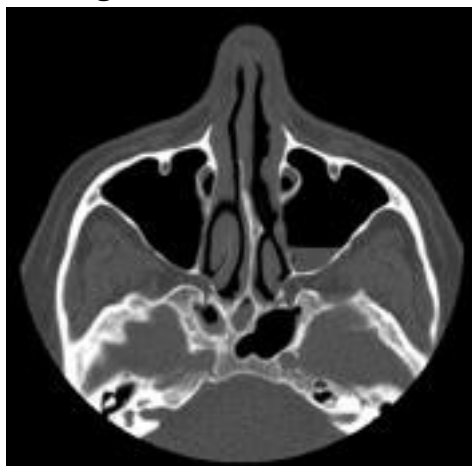


Fig. (3) Acute sinusitis

2.3 1 Pathogenesis of sinusitis

There are three main factors lead to the sinusitis development:

-The most important factor is the opening of the sinus hole. It may be blocked due to different reasons. As a rule, the hole maybe blocked by the swollen mucous membrane. The other reason may be an anomaly of anatomical structures. The retain of secret, decrease the pressure of oxygen contribute the bacteria multiplication.

- the other important factor is the defect of self-cleaning mechanism of the mucous membrane of sinus. Bacteria, Viruses damage the respiratory epithelium and cause t he immobility of the cilia.

Changes of secret quality are taken place in the development of sinusitis.

Secret becomes more concentrated and stick and therefore it cannot be eliminated from the sinus.

There are two additional factors:

-Immunodeficiency.

-Pathological changes of nose and nasopharynx that make difficulties for normal outflow from the sinuses (septum deviation, hypertrophic rhinitis, adenoids).

Acute sinusitis is divided into:

-Catarrhal.

-Purulent.

-Necrotic.

Chronic:

-Purulent.

-Polyps of sinuses.

-Mixed.

2.3 2 Symptoms of sinusitis

Common symptoms:-Rise in temperature. -Lost of appetite. -Sleep disturbances.

-Changes of the blood (leukocytosis).

Local symptoms: -Pain located in the affected sinus. -Nasal obstruction.

-Purulent discharge from the nose. -Oedema of facial tissues. -Watering.

-Smell disturbances (hyposmia) (Davinder J, 2010).

2 .4 Cancer of sinuses and Nasal cavity

The most common cancer of the nasal cavity and paranasal sinuses is squamous cell carcinoma. The maxillary antrum is the most common site, while cancers of the nasal cavity are rare. Adenocarcinoma, sarcoma, melanoma, lymphoma, and minor salivary gland cancers also occur. Esthesioneuroblastoma is an uncommon cancer that arises from olfactory mucosa at the superior aspect of the nasal cavity. It readily invades the ethmoid sinuses and can involve the orbit. In the nasopharynx, squamous carcinomas, 80% of which are nonkeratinizing, also predominate. Lymphoepithelioma, a subgroup of

nonkeratinizing squamous carcinoma, is poorly differentiated, lacks squamous or glandular differentiation, and has a lymphocytic component. It is highly radiosensitive. Cancers of the skin of the vestibule of the nose can drain to parotid, submandibular, or upper jugular nodes. Nasal cavity and maxillary sinus cancers rarely metastasize to the regional lymph nodes unless they are advanced and have invaded adjacent structures. The nasopharynx is richly supplied with lymphatics, and cancers in this region readily drain bilaterally to upper and mid jugular lymph nodes and to posterior triangle lymph nodes. Cervical lymph node metastases occur in 80% of patients with this cancer. Palpable cervical lymphadenopathy is the initial manifestation of 50% of patients with nasopharyngeal cancer. Unlike other squamous cell carcinomas, cancers of the nasopharynx can metastasize to the posterior triangle in the absence of jugular lymph node involvement.

Cancers of the nasal cavity, paranasal sinuses, and nasopharynx are frequently advanced at presentation. Early symptoms such as nasal obstruction, nasal discharge, and sinus congestion are so commonly associated with benign conditions that they are not frequently investigated for the presence of a cancer. Hemorrhage can occur. Bone invasion and involvement of adjacent soft tissue structures are common. Along with the tonsillar fossa, the tongue base, and the piriform sinus, the nasopharynx is an important site of clinically occult primary cancer. Cancers of the maxillary sinus can invade the hard palate and enter the oral cavity. They can also invade the orbital floor, causing visual symptoms and proptosis. Anterior invasion through the skin can occur. In advanced maxillary sinus cancers, cervical lymph node metastases can be the initial manifestation. Cranial nerve symptoms result from invasion of the skull base (David W, 2009).

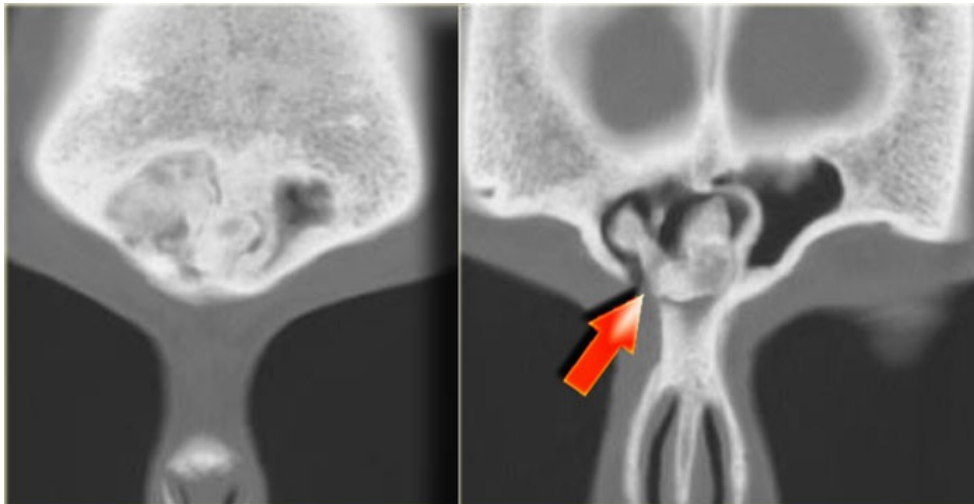


Fig.(4)Osteoma of the frontal sinuses

2.3.4 Fungal disease of Paranasal Sinuses

Fungal infections of the sinuses have recently been blamed for causing most cases of chronic rhinosinusitis. The evidence, though, is still controversial. Most fungal sinus infections are benign or noninvasive, except when they occur in individuals who are immunocompromised. Several reports are available that have shown invasive fungal infections in immunocompetent individuals.

Distinguishing invasive disease from noninvasive disease is important because the treatment and prognosis are different for each.

Fungal infections of the paranasal sinuses are uncommon and usually occur in individuals who are immunocompromised. However, recently, the occurrence of fungal sinusitis has increased in the immunocompetent population.

The most common pathogens are from *Aspergillus* and *Mucor* species. Aspergillosis can cause noninvasive or invasive infections. Invasive infections are characterized by dark, thick, greasy material found in the sinuses. Invasive infections can cause tissue invasion and destruction of adjacent structures (e.g., orbit, CNS). Noninvasive infections cause symptoms of sinusitis, and the sinus involved is opacified on radiographic studies. Routine cultures from the sinuses rarely demonstrate the fungus. However, the fungus is usually suspected upon reviewing the CT scan result and is detected on removal of the secretions from the sinus (Jeffrey2014).

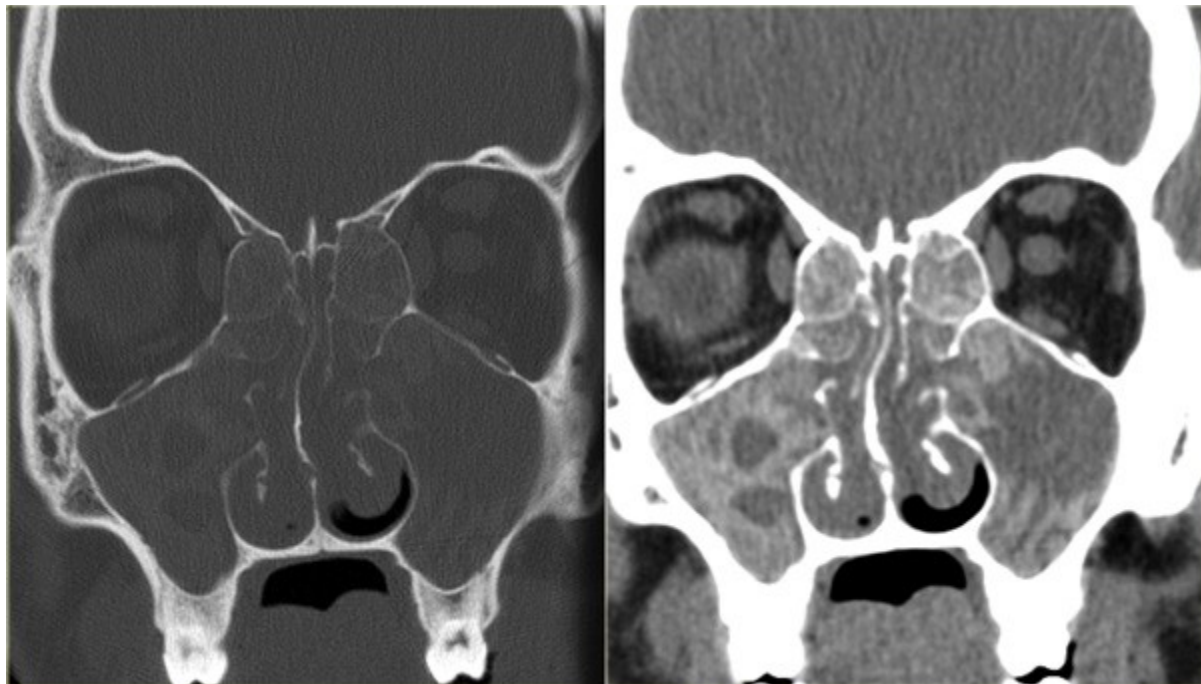


Fig. (5) Allergic fungal sinusitis

Chapter Three

Materials and Methods

3.1 Materials:

3.1.1 Study sample:

I carried out a study for 60 scans of paranasal sinuses of subjects of both genders. Study cases were (50 patients), control cases (10 patients). It was conducted at the department of radiology-Saqr hospital RasAlkhaimah, U.A.E. The scans included in the sample presented with diagnosis compatible with inflammatory sinus disease. Scan of postoperative cases of paranasal sinuses, tumor masses and extensive pan sinusitis. Age range of patients is between (15-70 years) because maxillary sinuses acquire their adult format at about the age of 13-14 years. The scans were discussed and diagnosed by two consultant radiologists and two ENT surgeons in Saqr Hospital Ras Alkhaimah.

3-1-2 Machine used:

CT scans were performed using Siemens Somatom Definition 128 slice. The protocol included axial images from the frontal sinuses (upper limit) down to the hard palate with patients in supine neutral head position, with correct head sections conducted .6 mm with high resolution filter. The images were made at 120KV and 35 mAs. Tomographic windows used were 1500-2000 for (bone and soft tissue Kernel) 3D Volume rendering used to obtain coronal and sagittal views of paranasal sinuses.

Coronal views were considered in this study as the reference views in collecting the data and axial views were essential for obtaining full details. CT scan images were analyzed concerning presence of paranasal sinuses pathological findings in these cases.

Siemens SOMATOM Definition 128:

The Definition 128 is a third generation multislice helical CT scanner, featuring a 100 Kw generator, 5.3 MHU tube and a fastest gantry rotation time (0.28 seconds). In helical mode it is capable of imaging 128 slices per rotation, with slice widths of 2mm from acquisition of 128 x .6 mm, as well as smaller numbers of wider slices.

Technical Specifications:

Scanner type – 3rd generation

Gantry aperture – 78 cm

Slip ring for power supply - low voltage

Tilt range (degrees) – 30

Positioning lights planes – Transaxial, sagittal, coronal (laser)

X-ray generator – High frequency, located in gantry cooling by air

Power rating 100kw, kV settings 80,100,120,140

MA range and step size is 20-800(1 ma steps)

X-ray tube – Siemens stration

Focal spot size (mm) - .07*.07

Anode heat capacity (MHU) – 30 equivalents

Method of tube cooling - direct oil

Detector type – solid state array

Detector material – Siemens (UFC)

Maximum number of slices – 128

Number of detector elements per row – 736

Number of detector elements along Z axis – 64

Couch top material – carbon fiber

Couch top length and width (cm) – 240*45

Horizontal movement range (cm) – standard 160

Maximum weight (kg) – 200

Maximum helical scan coverage using 1 mm imaged slice thickness and a pitch of 1.5(mm) – 2000

System start up and calibration:

Total time from stand-by mode to scanning (mins) – 0

Power –on to ready to warm-up (mins) – 3

Stand by to ready to warm-up (mins) – 0

Tube warm-up time (mins) – 0

Detector calibration at warm-up part of warm-up

Operator's Console - Number of monitors at console is two (acquisition /review and processing) (shared database).

Control methods mouse and keyboard.

CT principles and protocol for sinuses

Computed tomography, more commonly known as a CT or CAT scan, is a diagnostic medical test that, like traditional x-rays, produces multiple images or pictures of the inside of the body.

The cross-sectional images generated during a CT scan can be reformatted in multiple planes, and can even generate three-dimensional images. These images can be viewed on a computer monitor, printed on film or transferred to a CD or DVD.

CT images of internal organs, bones, soft tissue and blood vessels typically provide greater detail than traditional x-rays, particularly of soft tissues and blood vessels.

A CT scan of the face produces images that also show a patient's paranasal sinus cavities. The [paranasal sinuses](#) are hollow, air-filled spaces located within the bones of the face and surrounding the [nasal cavity](#), a system of air channels connecting the nose with the back of the throat. There are four pairs of sinuses, each connected to the nasal cavity by small openings.

CT of the sinuses primarily is used to:

Detect the presence of inflammatory diseases.

Plan for surgery by defining anatomy or giving further information about tumors of the nasal cavity and sinuses.

Evaluate sinuses that are filled with fluid or thickened sinus [membranes](#).

Help diagnose [sinusitis](#).

In many ways CT scanning works very much like other x-ray examinations. Different body parts absorb the x-rays in varying degrees. It is this crucial difference in absorption that allows the body parts to be distinguished from one another on an x-ray film or CT electronic image.

In a conventional x-ray exam, a small amount of radiation is aimed at and passes through the part of the body being examined, recording an image on a special electronic image

recording plate. Bones appear white on the x-ray; soft tissue, such as organs like the heart or liver, shows up in shades of gray, and air appears black.

With CT scanning, numerous x-ray beams and a set of electronic x-ray detectors rotate around you, measuring the amount of radiation being absorbed throughout your body. Sometimes, the examination table will move during the scan, so that the x-ray beam follows a spiral path. A special computer program processes this large volume of data to create two-dimensional cross-sectional images of your body, which are then displayed on a monitor. CT imaging is sometimes compared to looking into a loaf of bread by cutting the loaf into thin slices. When the image slices are reassembled by computer software, the result is a very detailed multidimensional view of the body's interior.

Refinements in detector technology allow nearly all CT scanners to obtain multiple slices in a single rotation. These scanners, called multislice CT or multidetector CT, allow thinner slices to be obtained in a shorter period of time, resulting in more detail and additional view capabilities.

Modern CT scanners are so fast that they can scan through large sections of the body in just a few seconds, and even faster in small children. Such speed is beneficial for all patients but especially children, the elderly and critically ill, all of whom may have difficulty in remaining still, even for the brief time necessary to obtain images.

For children, the CT scanner technique will be adjusted to their size and the area of interest to reduce the radiation dose.

For some CT exams, a contrast material is used to enhance visibility in the area of the body being studied.

For a CT scan of the sinuses, the patient is positioned lying flat on the back. The patient may also be positioned face-down with the chin elevated.

Straps and pillows may be used to help the patient maintain the correct position and to hold still during the exam.

Some patients require an injection of a [contrast material](#) to enhance the visibility of certain tissues or blood vessels. A nurse or [technologist](#) will insert an [intravenous](#) (IV) line into a small vein in the patient's hand or arm. The contrast material will be injected through this line.

Next, the table will move quickly through the scanner to determine the correct starting position for the scans. Then, the table will move slowly through the machine as the actual CT scanning is performed. Depending on the type of CT scan, the machine may make several passes (International Journal of Diagnostic Imaging,2002).

3.2 Methods:

3.2.1 SinusVol (Adult): Scanner default protocol

SIEMENS DEFINITION: Head

Siemens Definition 128 Slice MDCT Protocols: Head: SinusVol (Adult)										
Protocol	Range	Series Description	kV	Quality Ref. mAs	(Eff.) mAs	CAREdose/CAREdose 4D	CAREdoseType	CTDIvol	RotTime	Pitch
SinusVol (Adult)	Topogram	Topogram 0.6 T20s	120	0	99	Off	CAREdose	0	0.500	1.0000000
	Sinus		120	80	80	Off	CAREdose4D	12.176	1.000	0.90
		Sinus 5.0 H60s								
		Sinus 3.0 SPO cor								
		Sinus 3.0 SPO cor								

Coll.	Slice	Recon increment	Images	Kernel	Window	API	Comment1
0.60	0.60		1	T20s	Topogram Head	None	
0.60						None	
	5.00	5.0	17	H60s	Sinuses		
	3.00	3.0	37	H30s	Sinuses		
	3.00	3.0	37	H60s	Sinuses		

3.2.1 Images interpretation:

All obtained images axial and reformat coronal for all patients were study by constant radiologist for pathological changes, whether Sino-nasal infections. Sino-nasal and skull base lesions, Fibro-osseous lesions or others.

Study cases:

CT scans were performed for 60 patients:

- 50 study cases.
- 10 control cases.

50 patients complaining of chronic sinonasal symptoms and signs (nasal obstruction, headache...etc) were seen by the ENT team and referred to radiology department for sinuses CT.

CT scans were performed in supine position and the axial images obtained were reconstructed in coronal and sagittal planes of the paranasal sinuses. Coronal views were selected to be the master views of the study because precise delineation of the sinuses anatomical architecture can be visualized clearly.

Control cases:

10 cases of different gender, nationalities and age, were the control cases of the study. Cases selected were requested for neck and dental CT and the field of view was extended to include the nasal cavity and

paranasal sinuses (images reconstructed in three planes). Individuals of this group had no chronic sinuses complaints.

Chapter Four

Table (4.1): study group gen

Total	50	100
-------	----	-----

Table (4.2) control group gender

Gender	No. of cases	Percentage
Male	7	70
Female	3	30
Total	10	100

Graph (4.2) control group
gender

Table (4.3) study cases age

age	No. of cases	Percentage
14-39	38	76
40-69	12	24
Total	50	100

Graph (4.3) study cases age

Table (4.4) control cases age

		e
14-39	6	60
40-69	4	40
Total	10	100

Graph(4.4) control cases age

Table (4.5) study cases of chronic sinusitis

cases	not cases	percentage
N	10	20
Y	40	80
Total	50	100

Table (4.6) control cases of chronic sinusitis

Y	7	70
Total	10	100
cases	No. of cases	Percentage

Graph (4.6) control cases of chronic sinusitis

Table (4.7) study cases of pan

cases	No. of cases	Percentage
-------	--------------	------------

N	38	76
Y	12	24
Total	50	100

Graph (4.7) study cases of pan
sinusitis

Table (4.8) control cases of pan
sinusitis

cases	not cases	percentage
N	9	90
Y	1	10
Total	10	100

Graph (4.8) control cases of pan
sinusitis

Table (4.9) study cases of polyps

cases	no. of cases	percentage
N	32	64
Y	18	36
Total	50	100

Graph (4.9) study cases of polyps

Table (4.10) control cases of polyps

cases	No. of cases	Percentage
N	8	80
Y	2	20
Total	10	100

Graph (4.10) control cases of
polyps

case s	No. of cases	Percentage
N	47	94
Y	3	6
Total	50	100

Table (4.11) study cases of tumors

Graph (4.11) study cases of
tumors

Table (4.12) control cases of

cases	No. of cases	Percentage
N	10	100
Y	0	0
Total	10	100

Graph (4.12) control cases of
tumors

Chapter Five

Discussion, Conclusion of research and Recommendations:

MDCT is a revolutionary new imaging modality introduced to delineate the nasal cavity and paranasal sinuses. It provides precise view of the nasal cavity and paranasal sinuses not afforded by other imaging modality. Conventional radiology does not provide the accurate delineation required to outline the structures of the paranasal sinuses and nasal cavity.

Before making the decision to perform endoscopic surgery CT should be done because it provides an excellent display of the Ostiomeatal complex, as well as other nasal and paranasal sinuses anatomy.

Computerized tomography (CT) of the paranasal sinuses is usually required prior to endoscopic sinus surgery, because it demonstrates both the extent of disease(s) and the anatomical variations that may predispose to rhinosinusitis and nearby vital structures that iatrogenic damage can be avoided.

The aim of this work is to study the diseases of the paranasal sinuses and nasal cavity in a study group of 50 patients and control group of 10 cases. Using MDCT Unit

(Siemens Definition AS 128) MPR card for reviewing and studying the reconstructed coronal views.

The images obtained demonstrate extremely high resolution reconstruction of the anatomical structures. The technique applied for study cases was supine position and axial scans performed covering from the frontal region of the head to hard palate including all sinuses with the orbitomeatal line parallel to the direction of the beam. Using the protocol of Siemens Definition AS128.

The images were interpreted and evaluated by consultant radiologist and ENT surgeon in Saqr Hospital.

The control group included 10 cases without any complaints of the sinonasal region diseases. Coronal images obtained from the 3D reconstruction of brain, neck and dental scans.

In the study we found that 80% of the study cases and 70% of control cases had chronic sinusitis .Also 24% of study cases and 10% of control cases had pan sinusitis. In the study there are 36% of study cases and 20% of control cases had polyps. Also found 6% of the study cases had tumor and 0% from control cases.

- Multidetector computed tomography is considered at present as the modality of choice for the paranasal sinuses imaging because it provides a precise view of the anatomical structures and clear the pathology.
- With the aid of computer reformation of the axial section, reconstructed coronal and sagittal sections can be obtained delineating the sinuses from different aspects.
- Imaging of paranasal sinuses will provide a full understanding and diagnosis of individual patient's disease.
- CT imaging of paranasal sinuses enables the endoscopic surgeons to be aware and fully oriented during operations thus decreasing possible complications that may be appear.
- Competent CT radiographers and radiologists will facilitate achievement of successful operations by delineating the

- paranasal sinuses precisely and attaining an almost accurate diagnosis for the patient condition.
- Proper diagnostic tools like MDCT should be available for accurate diagnosis especially in ENT centre's.
 - Trained CT staff is one of the factors that lead to successful operations.
 - Continuous training for CT staff helps to achieve the goals of health care providers

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