بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Characterization of the Maxillary Sinus Pathology Using Multi-Detector Computed Tomography and Endoscope

توصيف أمراض جيب الفك العلوي بإستخدام الأشعة المقطعية متعددة الكواشف والمنظار

Thesis Submitted For Partial Fulfillment of Requirement of the Degree of Master in Radiologic Diagnostic Technology

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2018

الآية

بسم الله الرحمن الرحيم

قال تعالى:

)قَالُواْ سُبْحَانَكَ لاَ عِلْمَ لَنَا إِلاَّ مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ(

صدق الله العظيم

سورة البقرة الآية(32)

DEDICATION

To my dear mother.
To my dear father.
To my husband for his continuous support.
To my sisters and brothers and all whom helped me to complete this study.

ACKNOWLEDGMENT

First thanks to Allah, the almighty for providing me this opportunity to proceed successfully, and the prayers and peace be upon the merciful prophet Mohammed.

I would like to express our great appreciation to my supervisor **Dr. Caroline Edward** who has cheerfully answered my queries, provided me with materials, assisted me in a myriad ways with the writing and helpfully commented on earlier drafts of this Study.

I am sincerely thanks without whom the study would not have been visible, Sudan University OF Science and Technology, Collage of Medical Radiological Science and Radiology department ENT Department of Prince Abdul-Aziz hospital.

Abstract

This study was carried out to find the common sinuses diseases and evaluate the significance of computerized tomography (CT) scan in diagnosing sinus lesions and to determine the correlation between radiological and endoscopic findings as well to evaluate diagnostic value of nasal endoscopy and CT in diagnosing sinuses disease.

The current study was obtained during the period extended from 2015 to 2017, at Prince Abdalazeez hospital - Arar -Saudi Arabia. A total of 96 patients with clinical evidence of sinonasal diseases were evaluated. All patients were subjected to thorough ENT examination. Nasal Endoscopy was done. CT of paranasal sinuses was performed in patients whose symptoms, examination and clinical picture were sufficient to warrant the procedure. 63 (64.3%) were females and 34(35.7 5%) were males. Their ages were between <10 and 50-60 years old. With the maximum affected age were the ages between 21-30 years old constituting 37(37.8%). After a detailed history and thorough clinical examination, they were investigated using standard protocol of investigations, which included CT scan for paranasal sinuses (axial and coronal sections) protocol.

Hence, the present study was carried out to assess the relevance of CT radiological method in diagnosing maxillary sinus lesions and to determine the correlation between radiological and endoscopic findings; Chi square test was performed and showed that there were significant association between the two methods Since P= 0.000 indicates there is a high association between diagnostic endoscopy and CT scan.

Using CT examination is an important tool in detecting pathology. The study recommended using both CT scan and Diagnostic nasal endoscopy when evaluating patients with sinus diseases.

مستخلص الدراسه

أجريت هذة الدراسة لتوصيف امراض الجيب الفكي الشائعة وتقييم أهمية الأشعة المقطعية المحوسبة متعددة الكواشف في تشخيص أمراض الجيب الفكي وتحديد العلاقة بين النتائج الإشعاعية والمنظار الأنفي.

أجريت الدراسة خلال الفترة من 2015 إلي 2017 في مستشفي الأمير مساعد بن عبدالعزيز –عرعر– المملكة العربية السعوديه.

تم تقييم 96 مريض جميعهم خضعوا لفحص شامل بقسم الأنف والأذن والحنجرة كما تم إجراء المنظار الانفي لهم.

تم اجراء الاشعة المقطعية للجيب الفكي للمرضي الذين كانت لديهم الاعراض السريرية كافية.

64.3) 63 ٪ (من الإناث و35.7) 34 ٪ (من الذكور كانت أعمارهم بين 10 و 60-50سنه والحد الاقصي للسن المتأثرة تتراوح أعمارهم بين 30-21 سنة تشكل .(37.8%) 37 بعد تاريخ مفصل وفحص سريري شامل تم تشخيصهم باستخدام برتكول قياسي والذي شمل الاشعة المقطعية.

لتحديد العلاقة بين النتائج الإشعاعية والمنظار ؛ تم إجراء اختبار مربع كاي وأظهر أن هناك ارتباط كبير بين الطريقتين حيث P = 0.000 يشير إلى وجود ارتباط عال بين الفحص بالاشعه المقطعية والمنظار.

يعد استخدام الأشعة المقطعية أداة مهمة في الكشف عن أمراض جيب الفك العلوي. أوصت الدراسة باستخدام كل من الأشعة المقطعية والتنظير الأنفي التشخيصي عند تقييم المرضى المصابين بأمراض الجيوب الانفية.

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List of abbreviation

MDCT	Multi detector computed tomomgraphy
PNS	Paranasal sinus
OMC	Osteomeatial complex
MRI	Magnetic resonance imaging
CT	Computed tomography

Chapter One

Introduction

1.1: Introduction

The MDCT of maxillary sinus:

Computed tomography (CT) scanning is very useful in identifying and evaluating the location, size, and suspected pathological diagnosis of lesions such as cysts, tumors, and infections. At the same time, it aids in the elucidation of bone and surrounding soft tissue invasion of lesions with high resolution (Weber et al., 2003 and Simon et al., 2006). In the maxilla and mandible, teeth are included and the CT capacity there can distinguished a foreign body of only 30 µm. Precise size and location are needed in the evaluation of lesions in the maxilla and mandible based on a high resolution in addition to the suspected pathological diagnosis based on CT findings.

Therefore, multi-detector CT (MDCT) scanning is commonly applied for various kinds of lesions in the maxilla and mandible because of its precision and diagnostic accuracy. Multi-detector CT scanning provides rapid acquisition of numerous thin axial images and more accurate reconstruction images. Multi-detector CT scanning provides accurate information about the height, width, and three-dimensional (3D) evaluation of the maxilla and mandible, as well as detailed information about the location of normal anatomical structures, such as the mandibular canal, mental foramen, mandibular foramen, incisive foramen, and maxillary sinus. In addition, the relationship between lesions and anatomical landmarks, including cortical margins and roots of teeth, can be established. These images are also excellent because MDCT eliminates streak artifacts from dental restorations that degrade direct coronal CT scans. With MDCT, axial images are used to reformat the cross-sectional images, projecting the artifact along the crowns of the teeth rather than over the bone that is the region of interest (Abrahams., 2001). At the same time, CT readings of lesions in the maxilla and mandible measured by MDCT can reflect the nature and inclusion within lesions, from which suspected pathological diagnosis can be estimated. Multi-detector CT scanning provide information about the exact location of neoplasms, lymphadenopathy, and their vascular infiltration or spread (Tyndall et al., 2008).

1.2 Problem of the study:

Because the problem Of superimposition and inability to study all borders clearly in conventional tomography of maxillary sinus disease and there are many problem facing the clinical diagnosis done by endoscope and unable to see what is behind the turbinate as well as mucosal damage or injuries may occur when using endoscope .

The question is to be answered is , can the CT scan become the modality of choice for evaluation of sinus disease as its optimally displays bony details , air ,outline soft tissue and less patient dose .using the CT number of each sinus pathology to reach to the accurate management.

Can the CT complete the view of diagnose for pathologies that cannot be seen in the endoscope.

1.3 Objective:

1.3.1 General objectives:

The general objective of this study is to characterize the maxillary sinus disease using CT.

1.3.2 Specific objectives:

- To identify the maxillary sinus pathologies (inflammatory tumors).
- To evaluate maxillary sinus lesions CT number.
- To correlate between CT scan finding and endoscope finding
- To correlate the diagnostic CT finding VS age, gender and endoscopic finding of Rt. and Lt. maxillary sinus.

1.4 Overview:

This study is concerned with characterization of the Maxillary Sinus Pathology using Multi Detector CT (MDCT), it falls in to five chapters. Chapter one is an introduction, which explain the MDCT of maxillary sinus, problem of the study and study objectives while chapter two will include comprehensive scholarly literature reviews concerning the previous studies .chapter three deals with the methodology, where it provides out line of material and methods use to acquire the data in this study as well as the method of analysis approach. While the result were presented in chapter four, and finally chapter five includes discussion of result, conclusion and recommendation followed by references and appendices.

Chapter two

Theoretical Background and Literature Review

2.1 Anatomy of par nasal sinuses

The nasal cavity is a passage from the external nose anteriorly to the nasopharynx posteriorly. This is divided in two by the nasal septum in the sagittal plane. The nasal septum is part bony and part cartilaginous.

The floor of the nasal cavity is the roof of the oral cavity and is formed by the palatine process of the maxilla, with the palatine bone posteriorly. The lateral walls of the cavity are formed by contributions from the maxillary, palatine, lacrimal and ethmoid bones.

These walls bear three curved extensions known as**turbinates**or **conchae,** which divide the cavity into inferior, middle and superior meati, each lying beneath the turbinate of the corresponding name. The space above the superior turbinate is the **sphenoethmoidal recess** (Ryan et al., 2004).

The development of the paranasal sinuses begins as evaginations of the nasal mucous membranes during the second and fourth months of pregnancy. Further development takes place after birth. The process of development is completed after puberty. All are:

- Lined by respiratory mucosa, which is ciliated and mucus secreting;
- Open into the nasal cavities;
- Innervated by branches of the trigeminal nerve [V] (Drake et al., 2007).

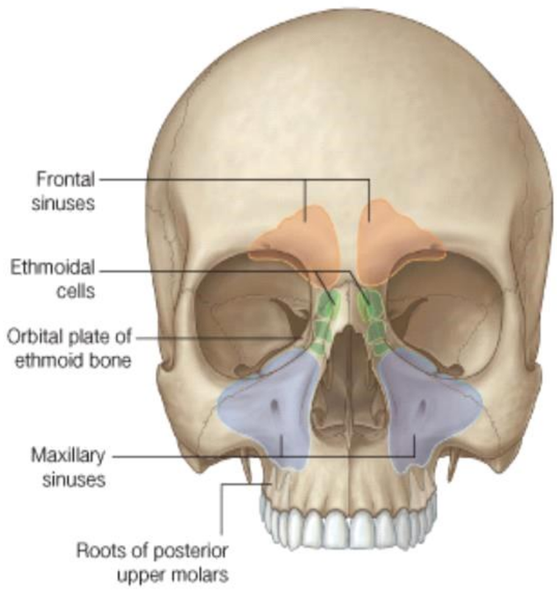


Figure 2.1: Paranasal sinuses, Anterior view (Drake et al., 2007).

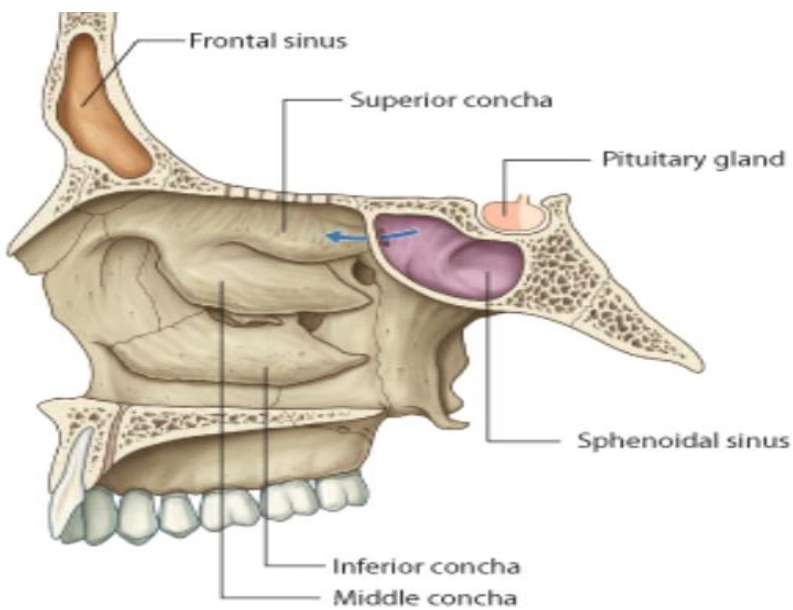


Figure 2.2: Paranasal sinuses, lateral view (Drake et al., 2007).

The frontal, ethmoid, sphenoid and maxillary sinuses form the paired paranasal sinuses and are situated around, and drain into the nasal cavity:

- The sphenoid air cells drain into the sphenoethmoidal recess.

- The posterior group of ethmoidal air cells drains into the superior meatus.
- The frontal sinus opens in the most anterior opening of the middle meatus. The anterior ethmoidal air cells and maxillary sinus drain into the middle meatus at the hiatus semilunaris, below the ethmoid bulla.
- The nasolacrimal duct opens into the inferior meatus, draining the lacrimal secretions.(Ryan et al., 2004).

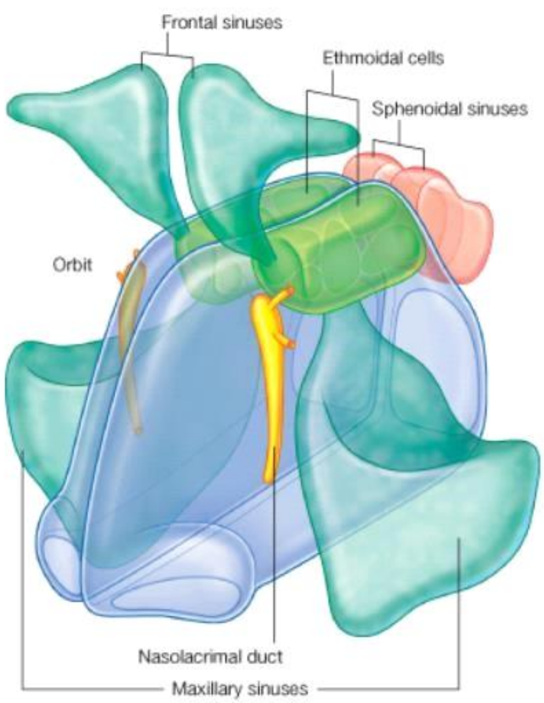
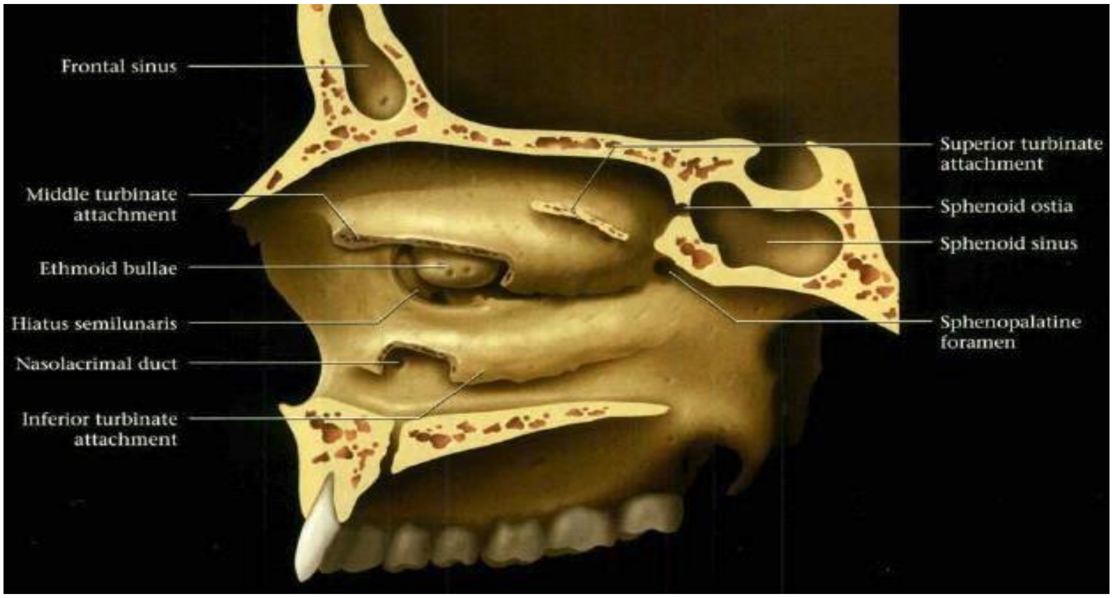


Figure 2.3: The openings of the paranasal sinuses (Drake et al., 2007).



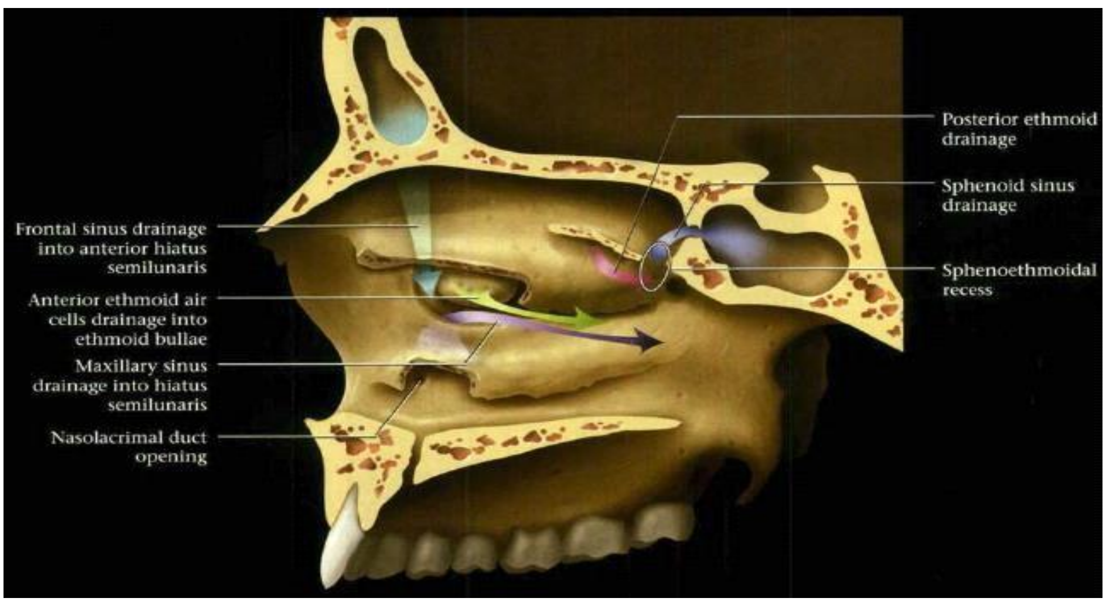


Figure 2.4:(Top) sagittal graphic demonstrate the osseous anatomy of the lateral wall of the nose (The superior & middle turbinate have been resected). The ethmoid bullae and hiatus semilunaris are seen below the middle turbinate attachment. The nasolacrimal duct empties into the anterior aspect of the inferior meatus. **(Bottom)** sagittal graphic of the lateral wall of the nose shows the

draining pathways of the sinuses. The sphenoid and posterior ethmoid sinuses drain into the sphenoethmoidal recess in the posterior nasal cavity. The maxillary sinus drains via the maxillary infundibulum while the anterior ethmoid s mostly drains through the concha bullosa into oseomeatal complex/ middle meatus. The frontal sinus drains in to the anterior middle meatus through the nasofrontal drainage system. (Hansberger et al., 2006).

2.1.1Frontal sinuses

The frontal sinuses, one on each side, are variable in size and are the most superior of the sinuses. Each is triangular in shape and is in the part of the frontal bone under the forehead. The base of each triangular sinus is oriented vertically in the bone at the midline above the bridge of the nose and the apex is laterally approximately one-third of the way along the upper margin of the orbit.

Each frontal sinus drains onto the lateral wall of the middle meatus via the frontonasal duct, which penetrates the ethmoidal labyrinth and continues as the ethmoidal infundibulum at the front end of the **hiatus semilunaris**.

The frontal sinuses are innervated by branches of the supra-orbital nerve from the ophthalmic nerve [V1].

Their blood supply is from branches of the anterior ethmoidal arteries (Drake et al., 2007).

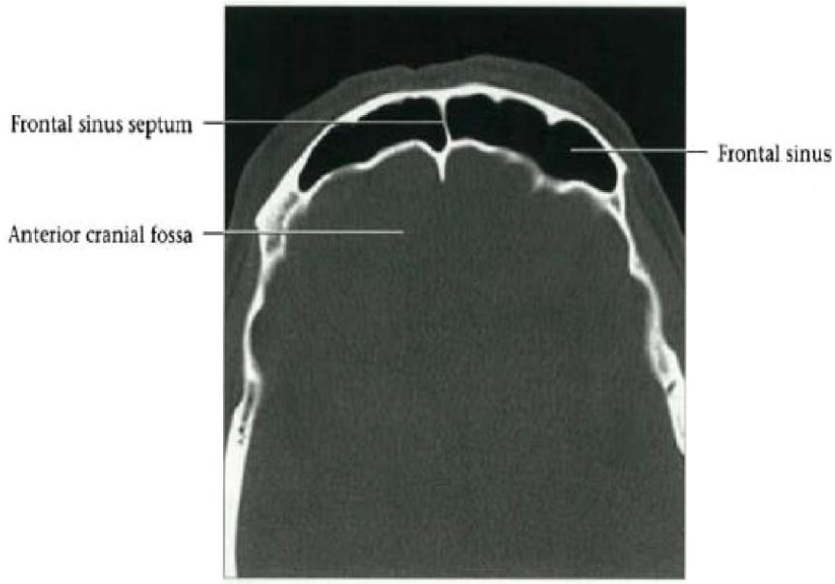


Figure 2.5: axial CT bone window shows the frontal sinuses with their midline septum, and thin posterior wall, separating the sinuses from the anterior cranial fossa. Frontal sinus disease can extend posteriorly in to the cranial vault. (Harnsberger et al., 2006).

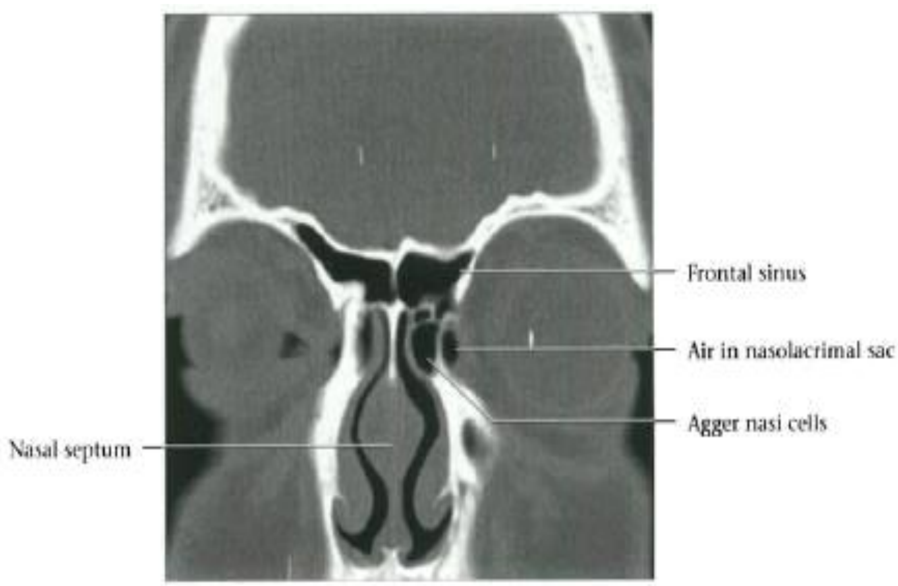


Figure 2.6: Coronal CT bone window shows the frontal sinuses, aggernasi air cells. Notice the normal air-filled left nasolacrimal sac (Harnsberger et al., 2006).

2.1.2 Ethmoidal cells

The ethmoidal cells on each side fill the ethmoidal labyrinth. Each cluster of cells is separated from the orbit by the thin orbital plate of the ethmoidal labyrinth, and from the nasal cavity by the medial wall of the ethmoidal labyrinth.

The ethmoidal cells are formed by a variable number of individual air chambers, which are divided into anterior, middle, and posterior ethmoidal cells based on the location of their apertures on the lateral wall of the nasal cavity:

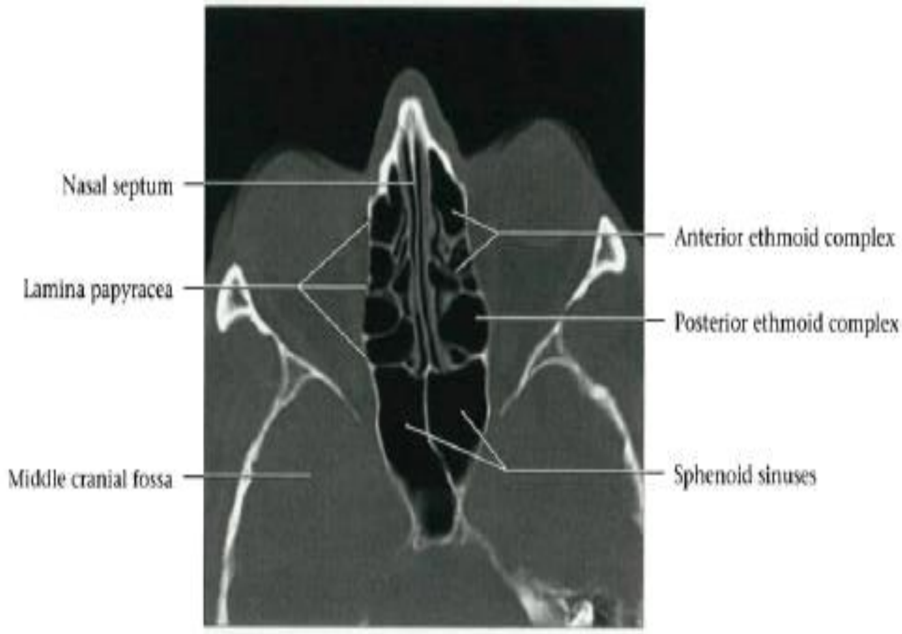
- The anterior ethmoidal cells open into the ethmoidal infundibulum or the frontonasal duct;
- The middle ethmoidal cells open onto the ethmoidal bulla, or onto the lateral wall just above this structure;
- The posterior ethmoidal cells open onto the lateral wall of the superior nasal meatus.

Because the ethmoidal cells often erode into bones beyond the boundaries of the ethmoidal labyrinth, their walls may be completed by the frontal, maxillary, lacrimal, sphenoid, and palatine bones.

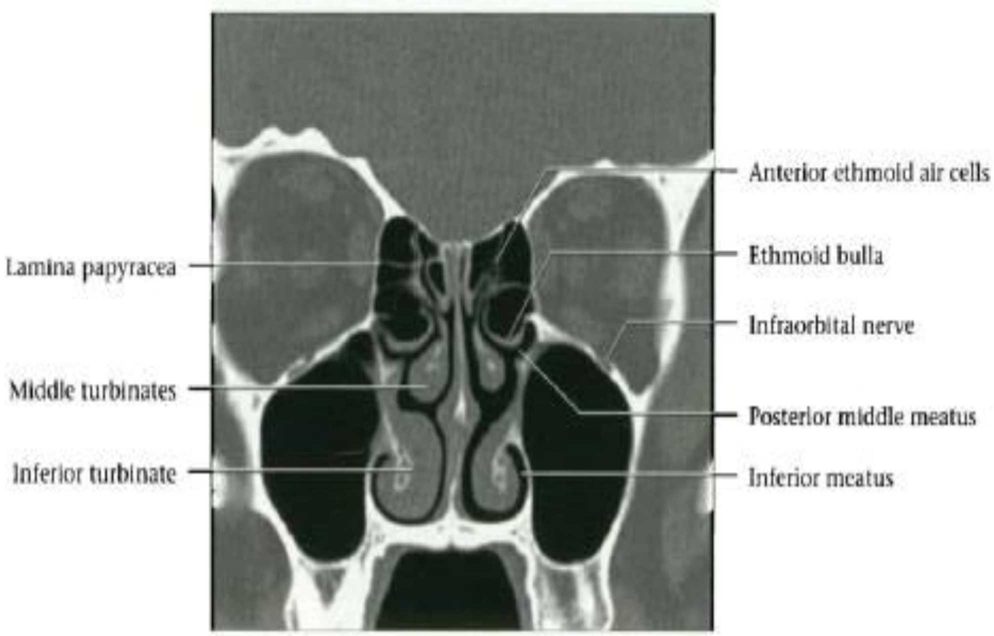
The ethmoidal cells are innervated by:

- The**anterior** and **posterior ethmoidal branches**of the nasociliary nerve from the ophthalmic nerve [V1];
- The maxillary nerve [V2] via orbital branches from the pterygopalatine ganglion.

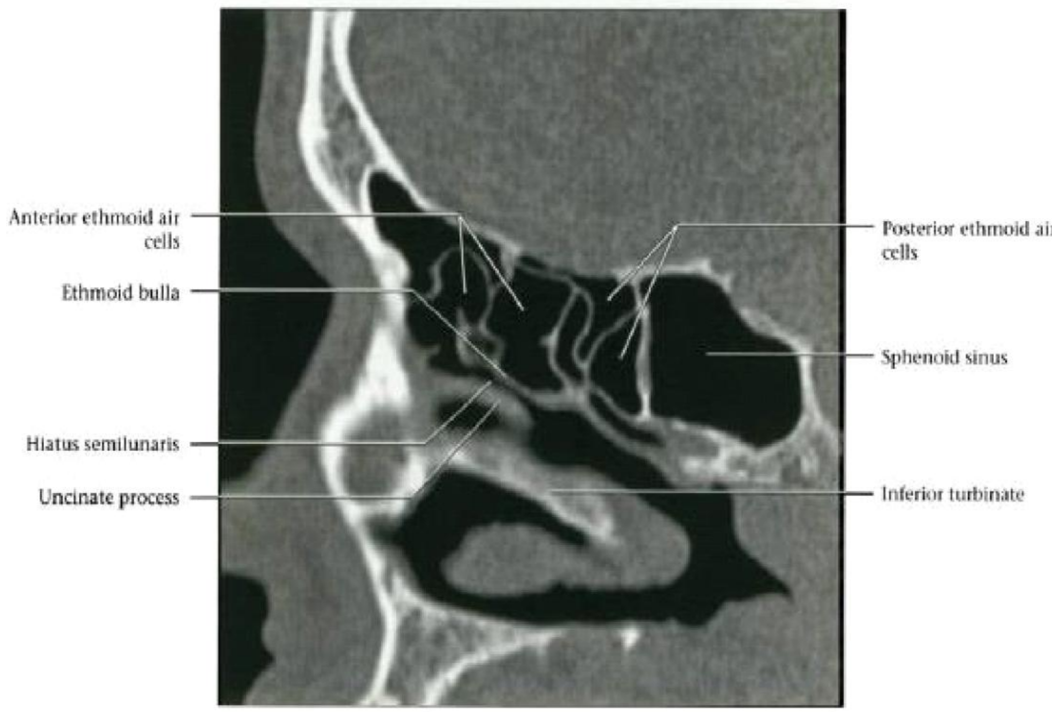
The ethmoidal cells receive their blood supply through branches of the anterior and posterior ethmoidal arteries (Drake et al., 2007).


Nasal septum
Lamina papyracea
Middle cranial fossa
Anterior ethmoid complex
Posterior ethmoid complex
Sphenoid sinuses

(A)


Lamina papyracea
Middle turbinates
Inferior turbinate
Anterior ethmoid air cells
Ethmoid bulla
Infraorbital nerve
Posterior middle meatus
Inferior meatus

(B)



(C)

Figure 2.7: CT bone window: **(A axial)** shows the ethmoidal air cells and sphenoid sinuses. Ethmoid air cell diseases can extend laterally through the thin lamina papyracea (the wall between the anterior ethmoidal air cells and the orbit) to create subperiosteal abscess. **(B coronal)** through the anterior ethmoidal air cells. **(C sagittal)** shows the anterior as well as the posterior ethmoidal air cells (Harnsberger et al., 2006).

2.1.3 Maxillary sinuses

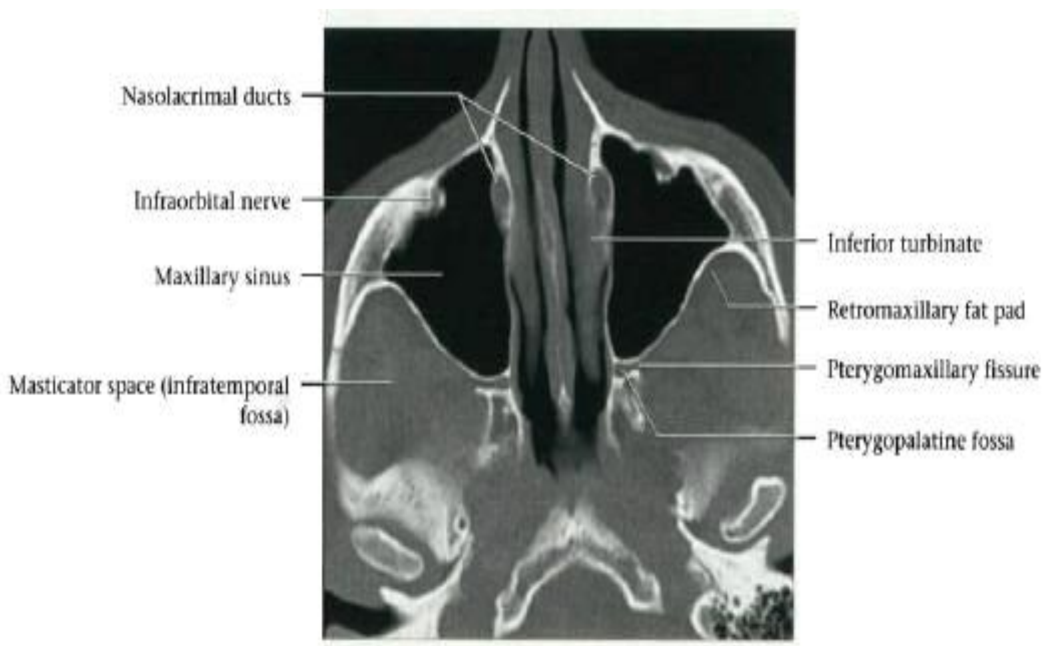
The maxillary sinuses, one on each side, are the largest of the paranasal sinuses and completely fill the bodies of the maxillae. Each is pyramidal in shape with the apex directed laterally and the base deep to the lateral wall of the adjacent nasal cavity. The medial wall or base of the maxillary sinus is formed by the maxilla, and by parts of the inferior concha and palatine bone that overlie the maxillary hiatus.

The opening of the maxillary sinus is near the top of the base, in the center of the hiatus semilunaris, which grooves the lateral wall of the middle nasal meatus.

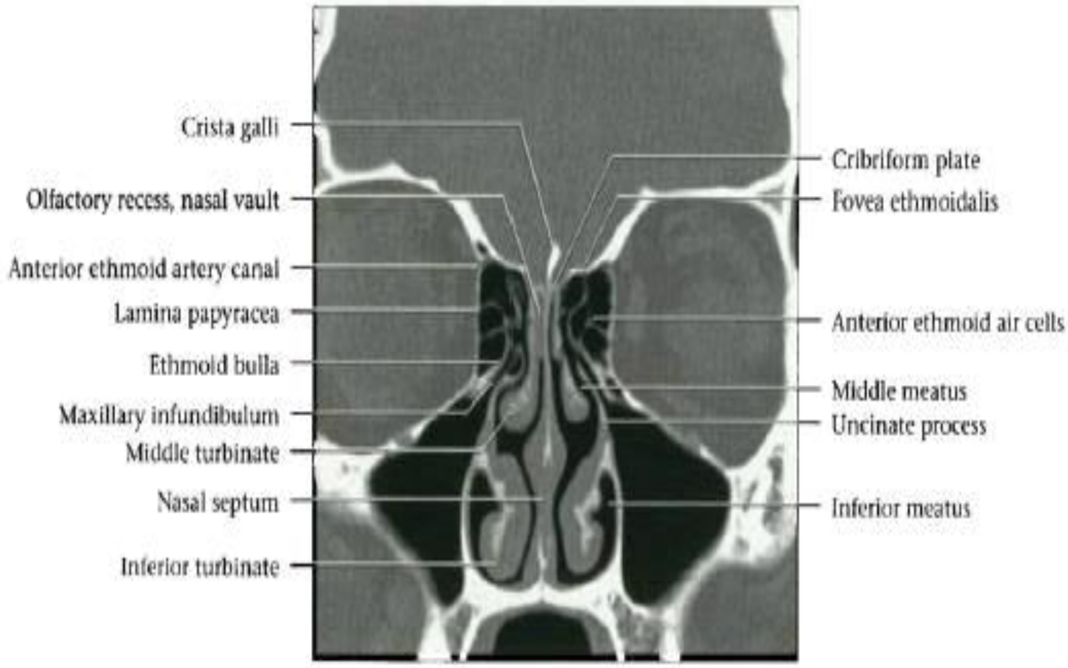
Relationships of the maxillary sinus are as follows:

- The superolateral surface (roof) is related above to the orbit;
- The anterolateral surface is related below to the roots of the upper molar and premolar teeth and in front to the face;
- The posterior wall is related behind to the infratemporal fossa.

The maxillary sinuses are innervated by infra-orbital and alveolar branches of the maxillary nerve [V2], and receive their blood through branches from the infra-orbital and superior alveolar branches of the maxillary arteries (Drake et al., 2007).



(A)



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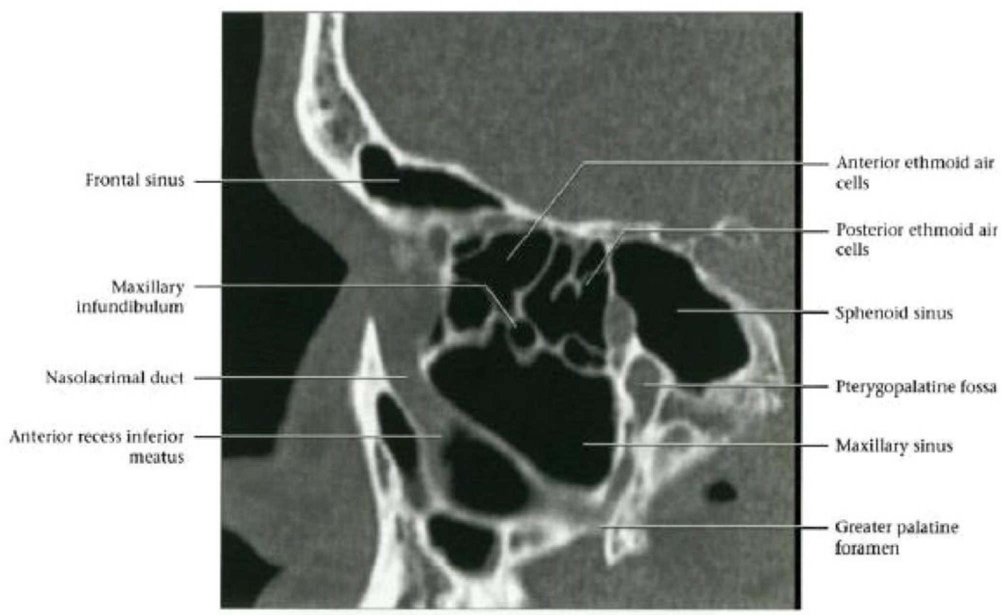

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(C)

Figure 2.8: CT bone window: **(A axial)**through the maxillary sinuses shows their intimate relationship to the nasolacrimal ducts. **(B coronal)**image through the osteomeatal complex shows the maxillary infundibulum draining. The uncinated

process, middle meatus, maxillary infundibulum and ethmoid bulla are the components of OMC. **(C sagittal)** para median plane through the para nasal sinuses. (Harnsberger et al., 2006).

2.1.4 Sphenoidal sinuses

The sphenoidal sinuses, one on either side within the body of the sphenoid, open into the roof of the nasal cavity via apertures on the posterior wall of the spheno-ethmoidal recess. The apertures are high on the anterior walls of the sphenoid sinuses.

The sphenoidal sinuses are related:

- Above to the cranial cavity, particularly to the pituitary gland and to the optic chiasm;
- Laterally, to the cranial cavity, particularly to the cavernous sinuses;
- Below and in front, to the nasal cavities.

Because only thin shelves of bone separate the sphenoidal sinuses from the nasal cavities below and hypophyseal fossa above, the pituitary gland can be surgically approached through the roof of the nasal cavities by passing first through the anteroinferior aspect of the sphenoid bone and into the sphenoidal sinuses and then through the top of the sphenoid bone into the hypophyseal fossa.

Innervation of the sphenoidal sinuses is provided by:

- The posterior ethmoidal branch of the ophthalmic nerve [V1];
- The maxillary nerve [V2] via orbital branches from the pterygopalatine ganglion.

The sphenoidal sinuses are supplied by branches of the pharyngeal arteries from the maxillary arteries (Drake et al., 2007).

2.2 Physiology:

The maxillary sinus is speech and voice resonance, reduce or lighten the weight of the skull, warmth inhaled oxygen, filter of the inspire air, immunological barrier (body defense), humidity for inspire air, regulation of intranasal pressure, acts as a shock absorber, regulation of intra nasal pressure, increase surface area for olfaction, contributes to facial growth. (www.indiandentalacademy.com).

2.3 Pathology & radiographic features

2.3.1 Acute sinusitis

Acute inflammation of the sinuses may occur due to viral, bacterial, fungal, or allergic causes. It means that the infection develops quickly (over a few days) and lasts a short time. Many cases of acute sinusitis last a week or so but it is not unusual for it to last 2-3 weeks (that is, longer than most colds). Sometimes it lasts longer.

2.3.1.1 Clinical presentation

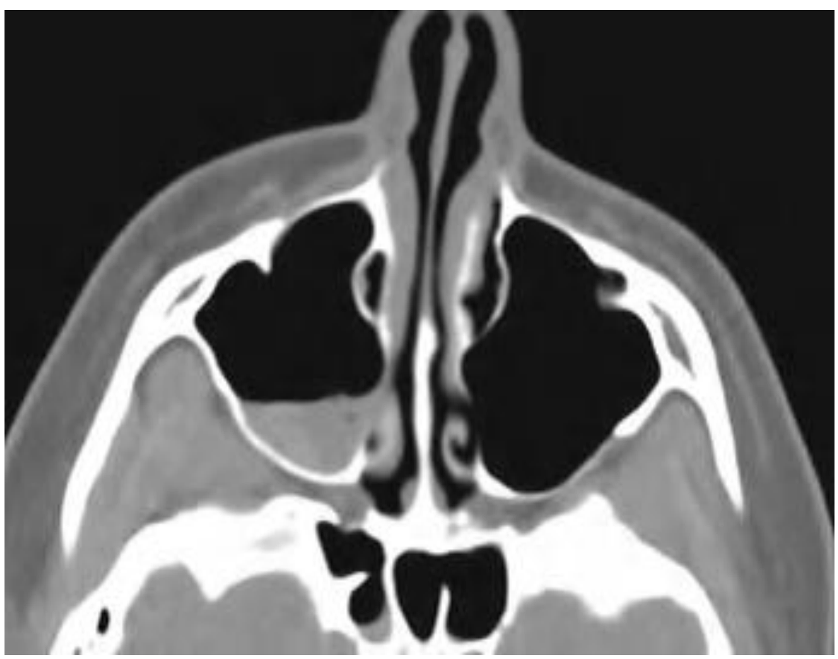
Fever, headache, postnasal discharge of thick sputum, nasal congestion and abnormal smell. Usually following viral upper respiratory tract infection. Tooth caries, abscess and or antral lead to a spread of infection to the maxillary sinus. Cystic fibrosis and allergy are risk factors.

Other anatomical variants that may predispose to the inflammation include nasal septal deviation, spur and/or front ethmoidal recess variants ***(Bruno et al).***

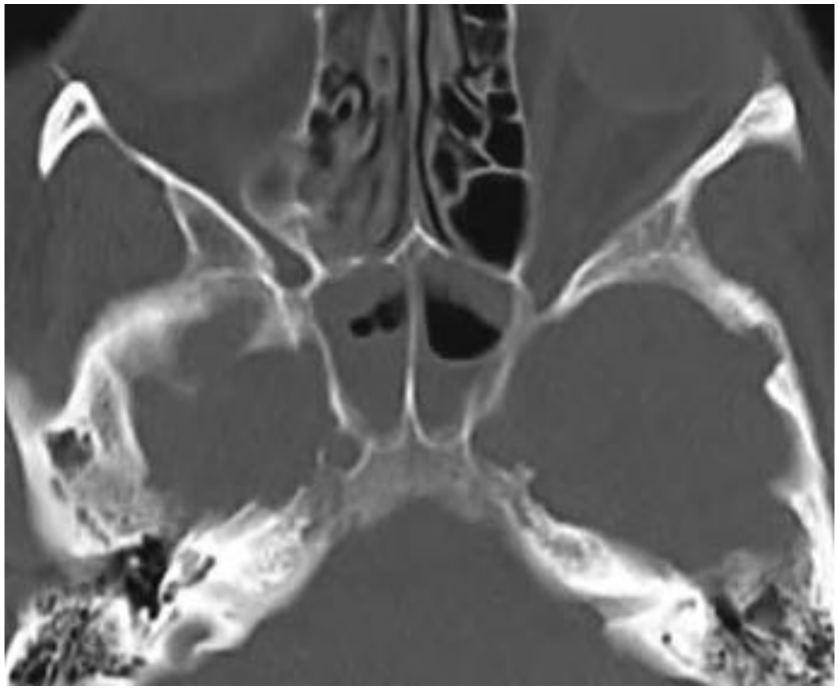
- **Complications**
  - Erosion through bone.
  - Subperiosteally abscess.
    - Frontal sinus superficially (Pott puffy tumor).
    - Frontal or ethmoidal sinuses into orbit.
  - Dural venous sinus thrombosis.
  - Intracranial extension.
  - Meningitis.
  - Subdural empyema.
  - Cerebral abscess formation.(Cornelius et al., 2013).

2.3.1.3 Radiographic features

- **Plain radiograph:**Plain radiography in the evaluation of Sino nasal disease plays a minor role. One may rarely encounter a Waters' view of the paranasal sinuses, obtained todemonstrate the presence of fluid/fluid level sin the setting of acute sinusitis ***(Raghavan et al., 2014)***. Opacification of the sinuses and air/fluid level best seen in the maxillary sinus. Cannot assess the extent of inflammation and its complications.
- **CT:** Better anatomical delineation and assessment of inflammation extension, causes and complications. Peripheral mucosal thickening, air/fluid level, air bubbles within the fluid and obstruction of the osteomata complexes are recognized findings.



(a)



(b)

Figure 2.9: Acute sinusitis a, b: Fluid levels, in the appropriate clinical setting, indicate acute sinusitis (Raghavan et al., 2014).

2.3.2 Chronic sinusitis:

Is a persisting inflammatory condition of one or sinuses. It is less common than acute sinusitis but appears to be getting more common in all age groups. Various treatments may be tried. Surgery to improve the drainage of the sinus is an option if other treatments fail, and usually works well. http://patient.info/

2.3.2.1 Clinical presentation

The most prominent symptom is usually a blocked nose (nasal obstruction), runny nose (The discharge may be green/yellow), reduced sense of smell, pain.

Other symptoms that sometimes occur include:

- Headache

• Bad breath

• Toothache

• Cough

• A feeling of pressure or fullness in the ears

• Tirednesshttp://patient.info/

2.3.2.2 Radiographic features

- **CT:** A characteristic feature on CT sinuses is sclerotic thickened bone involving the sinus wall from a prolonged mucoperiosteal reaction. Intrasinus calcification may be present. The presence of opacification is not a good distinguisher from an acute sinus infection.

Figure 2.10: Axial non contrast bone window chronic maxillary sinusitis

2.3.3 Fungal Sinusitis

Fungal disease of the paranasal sinuses is usually diagnosed when an apparent routine infection fails to respond to normal antibiotic treatment (Sutton., 2003).

Fungal sinusitis manifest in four different forms: allergic fungal sinusitis, noninvasive fungal sinus colonization (mycetoma), acute invasive fungal sinusitis, and chronic invasive fungal sinusitis (Raghavan et al., 2014).

2.3.3.1 Radiographic features

- CT:On CT fungal disease appears as a high-density central mass separated by mucoid secretions. Areas of calcification may be present. The calcification may be diffuse, nodular or linear and may be accompanied by bone expansion and bone destruction in the invasive form of the disease (Sutton., 2003).

2.3.3.2 Allergic fungal sinusitis

Is the commonest and occurs as a result of an IgE-mediated hypersensitivity response to fungal antigens. It is usually caused by fungi of the Fusaria, Bipolaris, and Aspergillus species, among others. Affected sinuses contain inspissated mucin which gradually accumulates, expands, and thins bony sinus walls. Commonly, all the sinuses and the nasal cavity are simultaneously affected. The mucin contains concentrated protein and fungal elements and heavy metals such as iron and manganese, resulting in hyperdensity on CT (Raghavan et al., 2014).

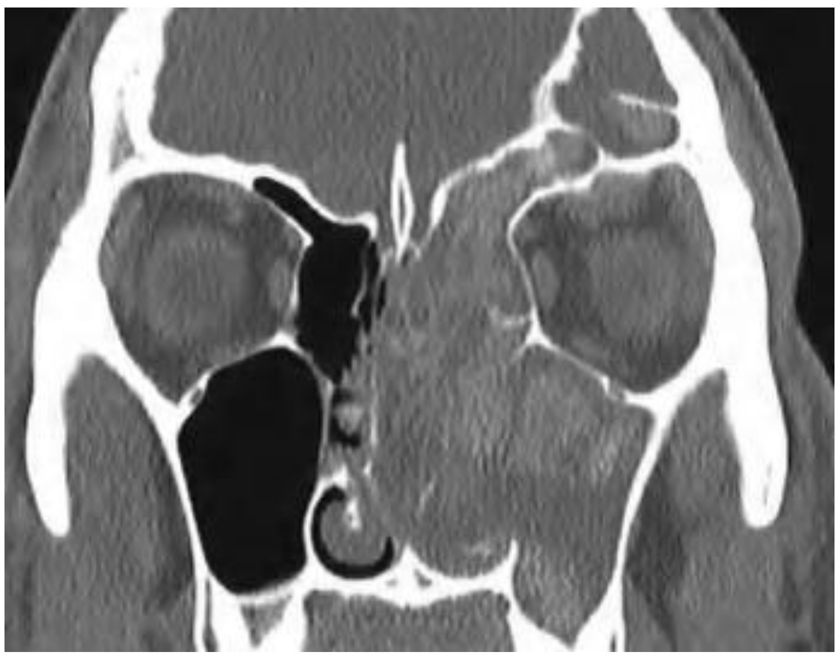


Figure 2.11: Allergic fungal sinusitis: The hyperdense appearance of the inspissated secretions in theleft frontal ethmoid and maxillary sinuses is typical of this entity (Raghavan et al., 2014).

2.3.3.3Noninvasive fungal sinus colonization (Mycetoma)

A mycetoma results from colonization of a chronically inflamed sinus, usually the maxillary, and appears as a calcified mass on CT. An irregular, calcified mass within a chronically inflamed sinus is almost always a mycetoma (Raghavan et al., 2014).

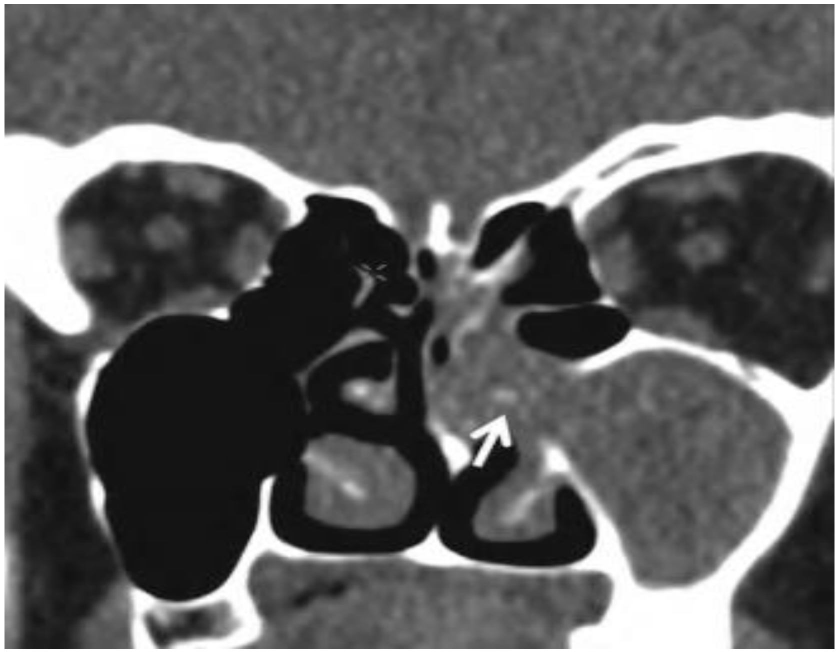


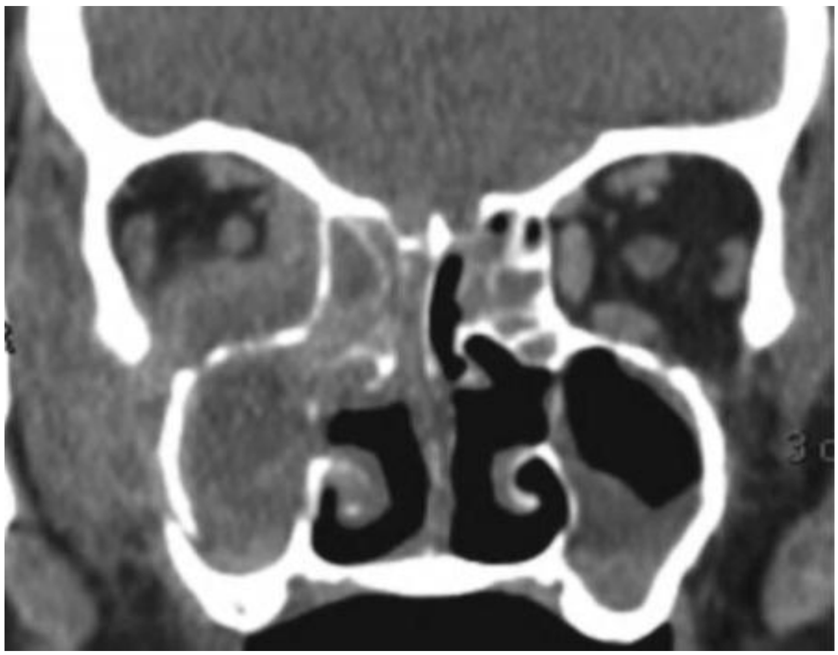
Figure 2.12: Mycetoma: The CT demonstrates expansion of the left infundibulum by a soft tissue lesion containing foci of calcification (*arrow*) (Raghavan et al., 2014).

2.3.3.4Acute invasive fungal sinusitis

Usually occurs in immunocompromised patients. Imaging findings can be exceedingly subtle and must be actively sought in the context of immunosuppression. The culprit fungi are usually Rhizopus, Mucorales, Absidia, and Mucor. They are angioinvasive and can thus erode the sinus walls and access the orbits and intracranial compartment even in the presence of only minimal sinus imaging findings. The bony changes are best seen on CT while intracranial and orbital spread is best assessed by MRI (Raghavan et al., 2014).

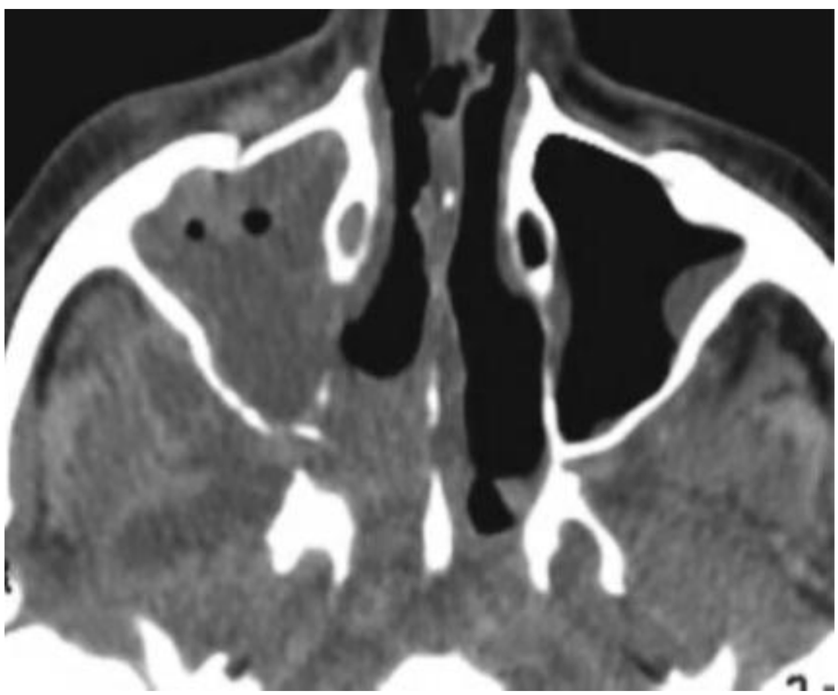
2.3.3.5 Chronic invasive fungal sinusitis

Follows a more indolent course and can occur in immunocompetent patients as well. A combination of sinus opacification, bone destruction, and extra-sinus soft tissue is typical these findings can mimic malignant neoplasms or other entities such as sarcoidosis and Wegener's granulomatosis, and definitive diagnosis may not be possible with imagingalone (Raghavan et al., 2014).



(a)

(b)



(c)

Figure 2.13: Invasive fungal sinusitis (a, b, c) a patient with diabetes mellitus and invasive Aspergillus sinusitis. Fungal sinusitis can rapidly spread from the sinonasal cavities to theorbits **(b)** and skull base as in this case. Note the

permeative bone destruction of the maxillary sinus wall in **(a)** (arrow), a finding typical of this entity. The inflammatory process can also spread along pathways of least resistance such as the pterygopalatine fossa (*arrow* **c**) (Raghavan et al., 2014).

2.3.4 Sinonasal polyposis

The polyps in sinonasal polyposis are soft-tissue pedunculated masses of oedematous hyperplastic upper respiratory mucosa. The commonest site of sinonasal polyposis is the ethmoids, followed by the maxillary antra and then the sphenoid sinus. The cause remains unclear but there is an association with atopic rhinitis (allergic and non-allergic), asthma, infection, cystic fibrosis, aspirin intolerance and Kartagener's syndrome (Sutton., 2003).

2.3.5 Antrochoanal polyps (ACP):

Are solitary sinonasal polyps that arises within the maxillary sinus but passes through and enlarges the sinus ostium and posterior nasal cavity to the nasopharynx. Antrochoanal polyps represent only ~5% of sinonasal polyps . They are most commonly seen in young adults and in 3rd to 5th decades. They are slightly more common in males compared to females (Towbin et al., 1979).

2.3.5.1 Clinical presentation:

Clinical presentation is usually with an obstructed nasal passage and/or sinus symptoms. Occasionally, larger masses may prolapse posteriorly enough that they may be visible through the mouth as they hang down from the nasopharynx(Bruce., 2008).Unlike other sinonasal polyps, antrochoanal polyps are usually found in non-atopic patients(Towbin et al., 1979).

2.3.5.2 Radiographic features:

Plain radiograph Plain films are no longer considered adequate in assessment of sinus pathology. However, they continue to be performed in some cases. Features include:

- Unilateral opacification of the maxillary sinus
- Nasopharyngeal mass is occasionally seen
- Frequently bilateral sinus involvement (23-42%) (Towbin et al., 1979).

- **CT**: is a preferred method for diagnosis since it is able to give exquisite bony detail of the paranasal sinus anatomy. In general, a non-contrast scan suffices. Although classification system exists, detailed description is usually preferred (see classification of antrochoanal polyps). Typically, antrochoanal polyps have the following features:
    - Defined mass with mucin density is seen arising within the maxillary sinus.
    - Widening of maxillary ostium and extending into the nasopharynx.
    - No associated bony destruction but rather smooth enlargement of sinus.

These features are best appreciated on true coronal or coronals reformat scans. Although pathologically antrochoanal polyps have a narrow pedicle or stalk, this is usually not defined on CT,Occasionally, antrochoanal polyps may have a higher density and HU values if they are long standing and/or have an associated fungal infection. A contrast scan is not necessary but may demonstrate peripheral enhancement (Momeni et al.,2007).

Figure 2.14: Antrochoanal polyp: Coronal and axial non-contrast CT show a polypoid lesion (arrows) involving the left maxillary sinus and nasopharynx, with erosion of the middle turbinate and medial wall of the maxillary sinus (Mandell., 2013).

2.3.6 Maxillary sinus mucoceles:

Mucoceles most likely occur as a result of obstruction of the ostium of a sinus due to inflammation, trauma, mass lesion, etc., with resultant accumulation of mucus and eventual expansion of the sinus. Some authors (the minority) believe that they represent a mucous retention cyst that gradually enlarges, eventually filling the whole sinus(Mafee et al., 2004).Chronic non-invasive fungal sinusitis has also been associated with the formation of mucocoeles(Van et al., 1989).From the point of view of radiologists, which of these hypotheses is correct is immaterial.

The content of the mucocele is variable, and this impact on the imaging appearances (see below). Most simple mucocoeles are formed by clear thick mucous. If the mucocoele has been infected (pyocoele) then the content is similar to pus.

2.3.6.1 Radiographic features

Mucocoeles are best imaged with a combination of CT (to assess bony changes) and MRI (to assess any extension into the orbit or intracranial compartment).

- **Plain radiograph**Skull radiographs do not have a significant role to play in the diagnosis of mucocoeles. If obtained, they demonstrate opacification and expansion of the affected sinus.
- **CT**: On CT mucoceles have mucoid attenuation collection with remodelling of the wall. The bone may be locally thinned or eroded but the overall picture is of remodelling and hone preservation (Sutton., 2003).

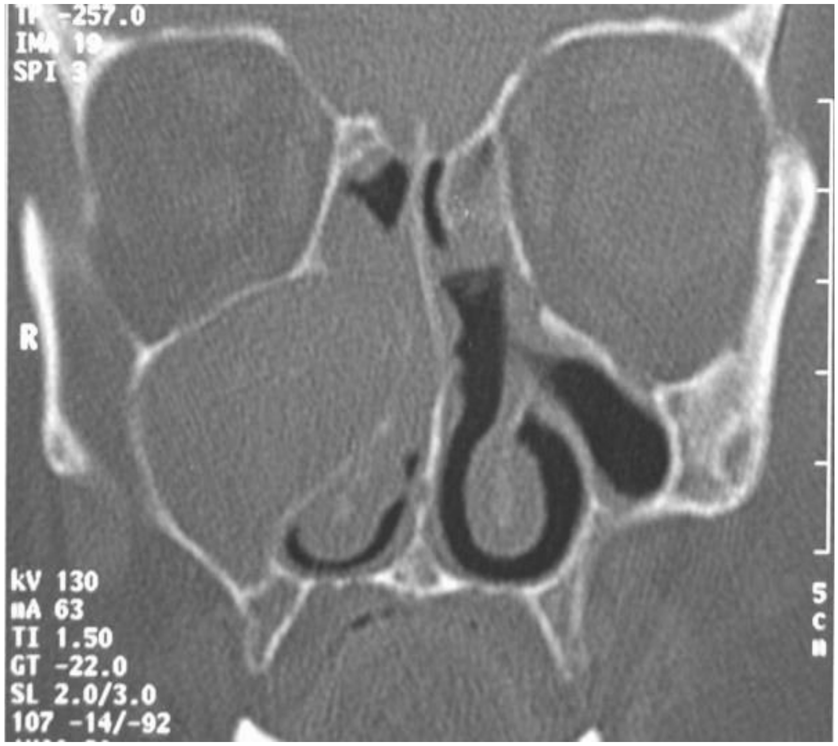


Figure 2.15: Right maxillary mucocele;opacified maxillary sinus with medial bulging causing expansion of the sinus and obstruction of the right nasal cavity.

2.3.7 Pseudocysts and retention cysts of the maxillary sinus

The dome-shaped radiopaque shadows frequently seen on the floor of the maxillary sinus, and sometimes inaccurately referred to as antral mucoceles, appear to represent focal accumulation of inflammatory exudate that lifts the epithelial lining of the sinus and the periosteum away from the underlying bone to form the characteristically shaped structures. Their histologic appearance is therefore that of normal or inflamed maxillary sinus lining. There is no epithelium-lined cavity present beneath the sinus mucosa; consequently, the term pseudocyst of the maxillary sinus is advocated. Less commonly, epithelium-lined retention cysts, similar to those of the minor salivary glands, are found, but mucoceles of the type found in the oral cavity apparently do not occur in the maxillary sinus (David., 1984).

2.3.7.1 Radiographic features

They are slow growing lesions, but mucosal and cortical integrity is preserved.

- **Plain radiograph:** On radiographs, they are radiopaque, dome-shaped structures with a rounded edge, located on the floor of the maxillary sinus.
- CT: appearance is of a smooth, broad-based soft-tissue mass with a well-defined outline. They may occasionally enlarge to fill the sinus (Sutton., 2003).

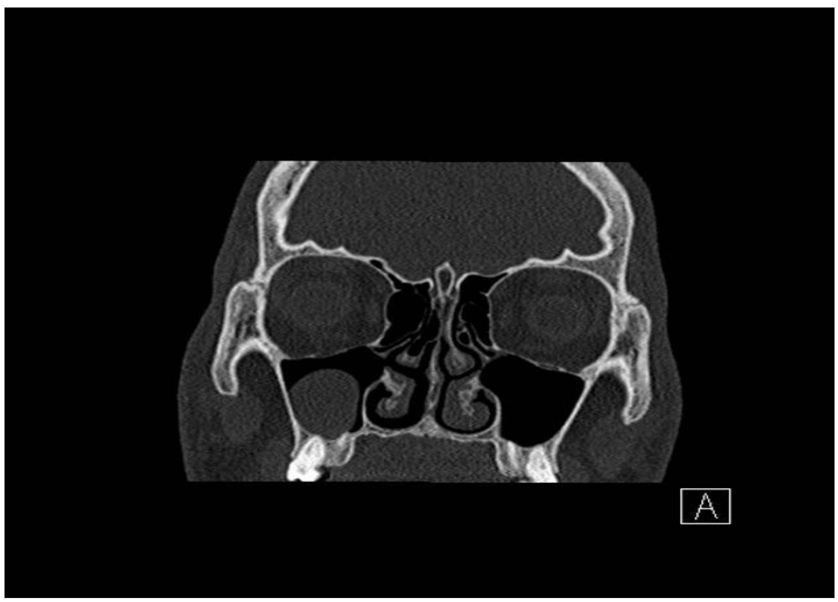


Figure 2.16: Coronal bone window mucous retention cysts of maxillary sinus.

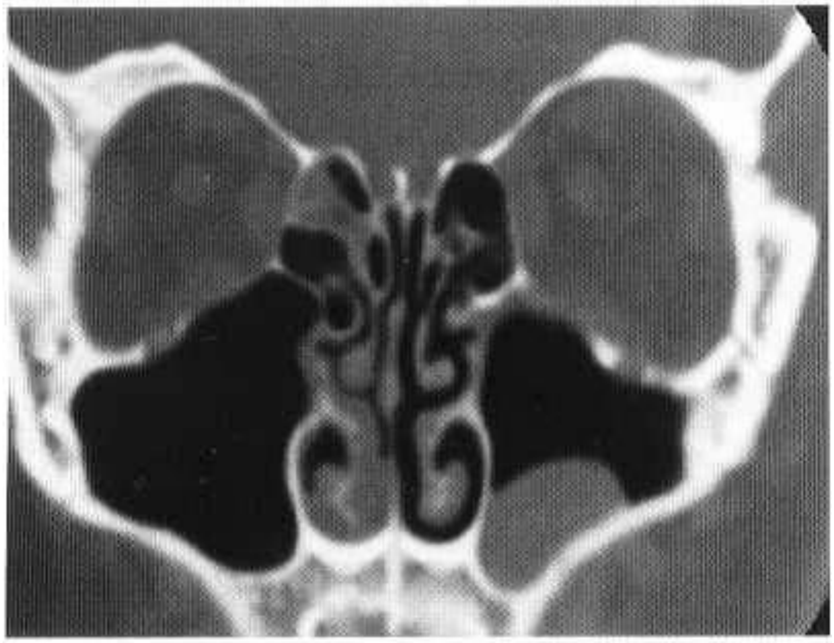


Figure 2.17: Coronal CT scan demonstrates the typical appearance of the retention cyst within the right maxillary antrum (Sutton., 2003).

2.3.8 Maxillary antral carcinoma:

Are an uncommon head and neck malignancy. They usually present late despite growing large since it remains confined within themaxillary sinus and produces no symptoms.

2.3.8.1 Epidemiology:

Most commonly affects patients aged over 45 years and has a strong male predilection (M:F = 5:1). Maxillary antral carcinomas are more in common in Africa and Asia than in Europe and North America**(*Warnakulasuriya&Tilakaratna ., 2014).***

2.3.8.2 Clinical presentation:

When symptoms occur, they include, unilateral stiffness and obstruction, blood tinged nasal discharge, proptosis, diplopia, pain resembling toothache and enlargement and ulceration of the palate.

2.3.8.3 Pathology:

The underlying histology of maxillary antral carcinomas variable:

- Squamous cell carcinoma (80%)
- Adenoid cystic carcinoma (10%)
- Adenocarcinoma
- Verrucous carcinoma
- Malignant melanoma
- Sarcoma
- Lymphoma
- Metastases.

(Warnakulasuriya&Tilakaratna ., 2014).

2.3.8.4 Etiology

- The exact cause of maxillary antral carcinomas but exposure to wood dust along with EBV and HPV infection have been implicated in its pathogenesis (Warnakulasuriya&Tilakaratna ., 2014).

2.3.8.5 Radiographic features:

It appears as irregular radiopacity within the sinus, perforating the sinus wall.

2.3.8.6 Treatment and prognosis:

It includes a combination of surgery and radiation therapy. Prognosis is extremely poor with a 5-year survival of ~10% (Rajendran., 2012).

Figure 2.18: 40 years male axial non contrast Maxillary antral carcinoma

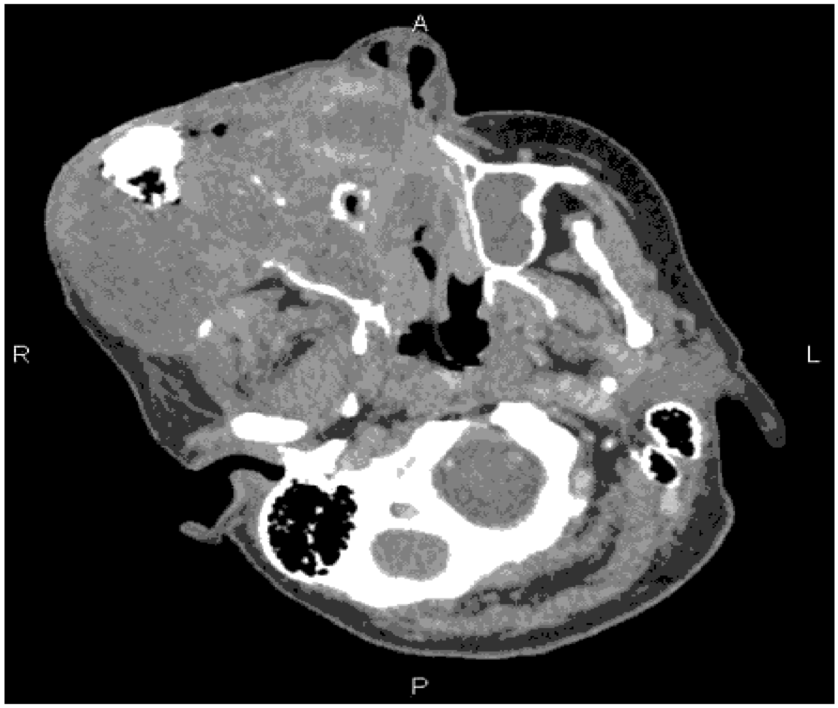


Figure 2.19: Axial soft tissue window hemorrhagic maxillary antrum carcinoma

2.4 Imagining techniques for sinus:

CT:

CT imaging of the sinus has been acquired in the axial and coronal planes, using non-contrast high-resolution 3-mm thick contiguous scans. Axial images are obtained with the patient supine on the scanning table and maintaining normal position of the scanning gantry. This differs from the coronal scans, which are enabled by extension of the patient's neck in either prone or supine position and angling of the scanning gantry to approximate the sinus coronal plane. An increasing number of institutions have abandoned the separate coronal acquisition, because the very thin overlapping sections obtained on newer multidetector scanners can be reformatted to nearly the same quality as a native coronal acquisition. The coronal imaging plane offers best visualization of the drainage pathways of the sinuses, whereas some drainage pathways (such as sphenoid sinus ostia) and sinus walls oriented close to the coronal plane are better seen on axial images.

The initial scanning data are typically reconstructed with two different imaging algorithms (Figs. 1 and2). The bone, or edge, algorithm enhances the interface between tissues of substantially differing densities, so that osseous margins and intact bone are easily distinguished from demineralized or eroded bone. However, this bone algorithm causes artifact and noise in structures of similar density, such as mucosal thickening of the sinus margin. Therefore, soft-tissue algorithm images are also generated to eliminate this artefactualnoise in homogeneous structures and allow better visualization of soft-tissue structures and abnormalities. Because evaluation of both bone and soft tissue is crucial in the assessment of sinuses, both algorithms are scrutinized for evidence of pathology.(Babbel et al., 1991; Mulkens et al., 2005).

MRI:

Although the CT is ideal for assessing the osseous margins of sinuses the inherently superior soft-tissue resolution and multiplaner capabilities render MRI is superior for assessment of soft-tissue masses and extension of infectious/malignant disease processes beyond the Para nasal sinuses.MR imaging must include high resolution (3mm) T-weighted and T2-weighted images. Image should be acquired in both axial and coronal planes sagittal or oblique planes can be added as necessary. in addition to contrast enhancement T1-weighted images are routinely obtained . Gadolinium is contrast agent injected in MRI areas of high vascularity appear hyperintence on T1-weighted imaging. Because fat will also appear hyperintence in T1-weighted images fat saturated T1techniques are usually included to increase the sensitivity for enhancement and thus improve the detection of local disease extent and presence of disease beyond paranasal sinuses. (Hudgins, 1996).

Also MR have disadvantages like un ability to study bones clearly and long scanning time so some patients moving during the exam.

Endoscope:

The advent of endoscopic technologies and techniques has expanded the limits of conventional endoscopic sinus surgery .the expanded endonasal approach describes a series of surgical modules in the sagittal and coronal planes that allow surgical modules access to the entire ventral skull base .the sagittal planes extends from the frontal sinus to the second cervical vertebra .the coronal plane extends from the midline to the roof of the orbit ,the floor of the middle cranial fossa and the jugular foramen .using of the endoscope to enhance visualization and manual tumor discussion under direct visualization particular challenges of the expanded endonasal approach are identification of anatomical structure using unfamiliar land mark ,hemostasis ,and dural reconstructure we have demonstrate that endoscopic endonasal surgery can be performed with minimal mortality.

(Keio journal of medicine sep 2009).

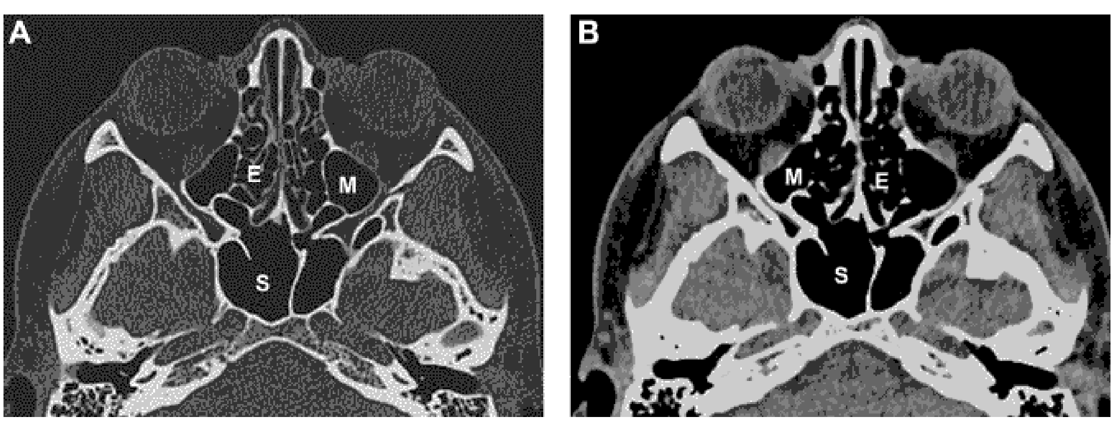


Figure 2.20: Axial CT scans of the paranasal sinuses at the level of the ethmoid sinuses, (A) bone algorithm and (B) soft-tissue algorithm images demonstrating the importance of visualizing paranasal scans using the two different window image processing techniques. The bone algorithm windowing helps to better evaluate the bony structures such as the walls of the sinuses as well as cartilage bounded by nasal or sinus lumen. The soft-tissue algorithm and windowing help to better evaluate the adjacent soft-tissue structures. Also, note that the posterior walls of the paranasal sinuses, which are oriented at or near the coronal plane, can be better assessed on the axial scans than in the coronal images. M, maxillary sinus; E, ethmoid sinus; S, sphenoid sinus.

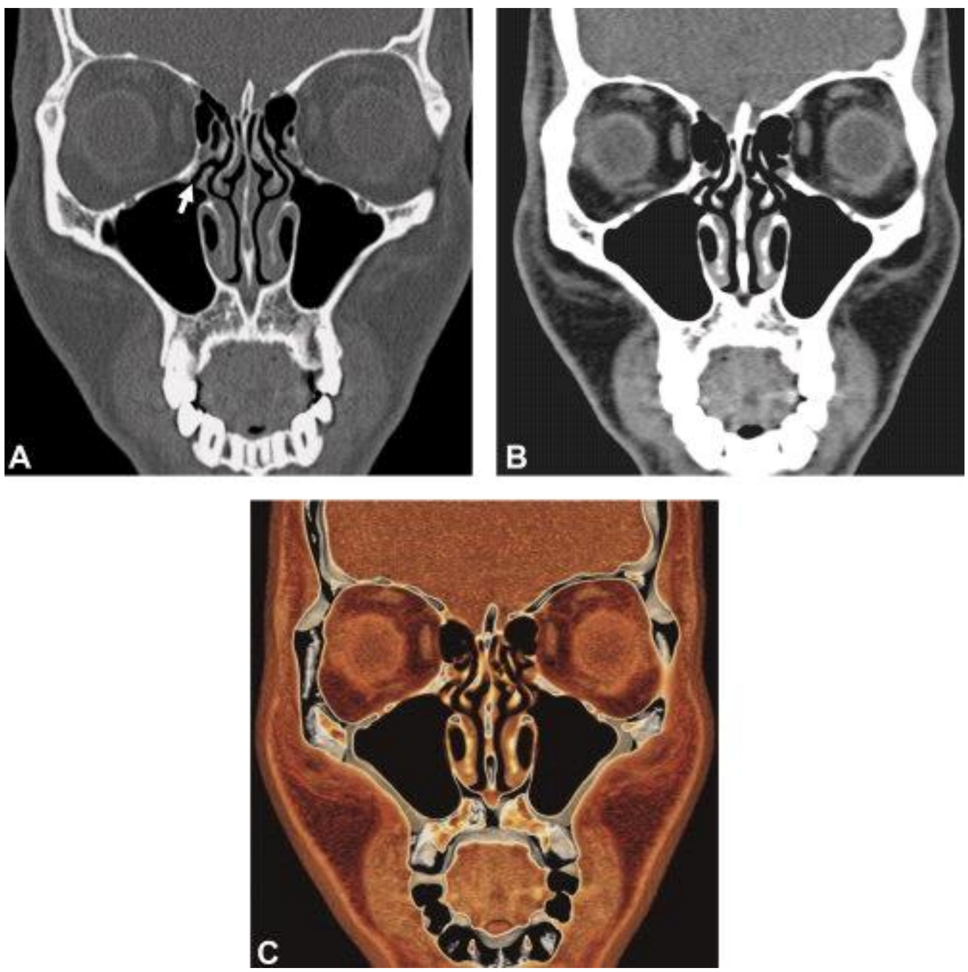


Figure 2.21: Coronal CT scans of the paranasal sinuses at the level of the alveolar recess of the maxilla, (A) bone algorithm, (B) soft-tissue algorithm, and (C) 3D constructions demonstrating the importance of visualizing scans in the coronal plane. Certain structures, including important

drainage pathways such as the osteomeatal units (arrow), are best demonstrated in the coronal plane.

2.5 Previous study:

Done by Hirshoren N. et al. (2013) Under title of Maxillary air density measurements for differentiating between acute and chronic rhinosinusitis,Maxillary sinus air-fluid levels and sinus pacification may appear similar in cases of acute and chronic rhino sinusitis. The study aim was to evaluate whether air density analysis in addition to air-fluid level can be used as a metric to differentiate between cases of acute and chronic rhino sinusitis.

Mean air density was significantly higher in the acutely inflamed sinuses compared with chronic sinusitis and healthy aerated sinuses (-846.6 vs -980 and-975.8 HU, respectively; $p < 0.05$). Sinus air density SD was greater in the acutely inflamed sinus than in chronic sinusitis and healthy sinuses (78.3 vs 17.9and 6.8 HU, respectively; $p < 0.05$).Increased sinus air density and heterogeneity may help differentiate acute from chronic rhino sinusitis.

J CraniomaxillofacSurge (1994) studied the CT scan in diagnosis of sinus aspergillosis .in this study 19 patients with radio dense sinus concretions found on standard radiography underwent a preoperative computed tomographic examination of the sinus maxillaries and the sinus concretions. 13 patients (68.4%) with the Occurrence of radio-denseconcretions presented postoperative histologicallyand microbiologically diagnosed sinus aspergillosis infection. In 13 patients, the sinus concretions had a density higher than 2000 HU (Hounsfield unit) and 6 patients had concretions with a density lower than 2000 HU. 12

(92.3%) of 13 patients with concretions having a density greater than 2000 HU had a postoperatively diagnosed sinus aspergillosis infection. The incidence of diagnosed sinus aspergillosis increased from 68.4% by standard radiography to 92.3% by computed tomographic examination on the supposition that the concretions have a density higher than 2000 HU. The computer tomography (CT)-density of sinus concretions in patients with diagnosed sinus aspergillosis was 2826.7 +/- 362.8

HU. The concretions of patients without sinus aspergillosis had a lower density (788.1 +/- 916.8 HU; $p < 0.001$). CT-density of root filling material presented nearly the same number in patients with aspergillosis infection (2789.3 +/- 287.5 HU) and in patients without sinus aspergillosis infection (2635.0 +/- 367.8 HU). Inpatients with diagnosed sinus aspergillosis, a significant correlation between the density of sinus concretions and the density of adjoined dental root filling material was found. Our study demonstrates that an additional preoperative paranasal sinus CT inclusive densitometry of the sinus concretions present is more sensitive than standard radiography for predicting the diagnosis of sinus aspergillosis.

Lenglinger FX et al (1996) studied Radio dense concretions in maxillary sinus aspergillosis pathogenesis and the role of CT densitometry The purpose of this study was to investigate by CT the origin of radio dense maxillary sinus concretions and whether CT densitometry is effective in the prediction of maxillary sinus aspergillosis and in the differentiation of the origin of these concretions. In a prospective study in 21 patients with radio dense maxillary sinus concretions detected by radiography, a preoperative CT study of the paranasal sinuses and the concretions was undertaken. Additional scans of the upper alveolar ridge were also performed. Radiological findings were compared with clinical symptoms and with CT findings, especially CT densitometry of the Sinus concretions and dental root-filling material. All patients underwent a functional Caldwell-Luc operation; histological and microbiological examinations were performed. Fifteen of the 21 patients (71.4%) with radio dense concretions had a histological and microbiological diagnosis of sinus aspergillosis. The sinus

Concretions had CT densities higher than 2000 HU (Hounsfield units) in 15 patients and lower than 2000 HU in 6. Fourteen of 15 patients (93.3%) with concretions having CT densities higher than 2000 HU had a postoperative diagnosis of maxillary sinus aspergillosis. The mean CT density of the sinus concretions in patients with maxillary sinus aspergillosis was 2868 HU (range1870-3070 HU), and in patients without aspergillosis was 778 HU (range 228- 2644 HU). The mean CT density of the dental root-filling material was 2866 HU (range 2156-3070 HU). Paranasal sinus CT with CT densitometry of a sinus concretion has a higher accuracy than standard radiography and clinical findings in the prediction of maxillary sinus aspergillosis (93.3% vs 71.4%). CT Densitometry helps to confirm the dental origin of maxillary sinus concretions and to explain a possible dental pathogenesis of maxillary sinus aspergillosis.

Killeen DE, Sedaghat et al (2014)Objective radiographic density measurements of sinus opacities are not strong predictors of noninvasive fungal disease studied the Of 133 maxillary sinus opacities, 22 were ultimately consistent with noninvasive fungal disease: 11 allergic fungal rhino sinusitis and 11 fungal balls. Fungal balls had higher-density components and were more heterogeneous and allergic fungal mucin was generally more radio dense. These findings were reflected by statistically significant ROC curves for maximum HU (p = 0.019) and HUstd (p =0.023) for fungal balls and for average HU (p = 0.002) for allergic fungal mucin. A maximum HU cutoff of 334.0 detected fungal balls with 90.9% sensitivity and 72.7% specificity. An average HU cutoff of 42.9 HU detected allergic fungal mucin with 100% sensitivity and 46.3% specificity, although specificity improved to 73.2% with inclusion of nasal polyposis as a second requirement. Higher average HU more accurately predicts allergic fungal mucin whereas heterogeneity/high-density components more accurately predict fungal balls. No objective radiographic density measure, in isolation, is both sensitive and specific in predicting noninvasive fungal sinusitis.

Jafari-Khouzani K,et al ,(2011) studied Three-dimensional volumetric measurements and analysis of the maxillary sinus. Multiple chronic rhino sinusitis (CRS) staging systems have been developed in an attempt to correlate symptoms with radiological imaging results. Currently, no perfect system exists. We sought to analyze the maxillary sinus (MS) using three-dimensional volumetric measurements and advanced high-resolution CTImaging Three-dimensional volumetric analysis combined with HU calculations and bony thickness measurements represents a new and unique way to evaluate CT scans in patients with CRS. Additional studies correlating symptoms with imaging findings as well as analysis of all paranasal sinuses is the next step toward anovel staging system.

Sedaghat AR, Bhattacharyya N. (2012) under title Radiographic density profiles link frontal and anterior ethamoid sinuses behavior in chronic rhinosinusitis**,**The study was a retrospective chart review of CRS patients with available sinus CT scans. Radiographic density profiles of sinus opacities were assessed by raw measures of densities (in Hounsfield units [HU]). Radiographic density profiles of the different affected sinuses were compared to each other,checked for correlation, and finally, checked for evidence of clustering using a principal component analysis Radiographic properties of sinus opacities suggest the nature of sinus opacities are related not only to some common underlying pathology but also to factors related to the specific sinus as well as other spatially close affected sinuses. This suggests an anatomic orientation for sinus pathophysiology in CRS.Krennmair G, Lenglinger(1995) under title Maxillary sinus aspergillosis diagnosis and differentiation of the pathogenesis based on computed tomography densitometry of sinus concretions The efficacy of preoperative computed tomography (CT) densitometry in evaluating the origin of sinus concretions (SC) in sinus aspergillosis (SA) and its value for differentiation between a dental (endodontic)and an aerogenic pathogenesis were examined.CT densitometry allows a classification of SC into two subgroups. The correlation between the density of root filling materials and that of radio dense sinus concretions seems to point to a "dental" origin of some concretions in SA. However, "organic" masses found in CT densitomentricExaminations represent endogenous fungal products, which indicate an aerogenic pathogenesis of SA. Additional CT examinations of radio dense sinus concretions may thus be of some value for diagnosing SA and differentiating their pathogenesis.

Krennmair G, Lugmayr H, Lenglinger F.(1993) studied the Radio-opaque structures in the lumen of the maxillary sinus--value of computerized tomography in the diagnosis of maxillary aspergillosis ,11 patients with radio-opaque concrements in the sinus maxillaries underwent a preoperative computerized tomographic examination of the sinus maxillaries and the sinus concrements. 8 patients (72.7%) with the occurrence of radio-opaque concrements presented postoperative a histological and microbiological infection with aspergillus fumigatus. The CT-numbers of radio-opaque concrements in patients with aspergillus were 2802 +/- 302.4 HU (Hounsfield Unit). Concrements of patients without aspergillus infection (n = 3) had lower density (368.6 +/- 149.1HU; $p < 0.001$). The root filling materials showed nearly the same CT-numbers in patients with aspergillus infection (2537 +/- 398.5 HU) and in patients without aspergillus infections (2544.3 +/- 460.6 HU). Density of root filling material was at the same level as density of radiopaque concrements in patients with aspergillus infections. According to CT-examinations a direct connection between root filling materials and aspergillus infection was noted. Therefore in patients with radio-opaque concrements computerized tomographic examination helps to determine the kind of sinus infection.

Chapter three

Materials and Methods

3.1 Materials:

3.1 .1 machine used:

The CT machine which used in this study was Brilliance 16 slice, high frequency generator using KV rang (90-120-140) and mA range (20-500), the tube MRC600, the detector type is solid state array made of gadolinium oxysulphide. The real time image display less than 5 s after scan, the CT uniformity HU -+3, (HU -1024+3072), Ram GB 4 and power 480v.

Scan Parameters used when patient position being “head first supine scan type was axial / helical table speed =81.2mm /sec ; scan lengths depending on area covered scanning time being 5 Secs, collimation = 64×0.625 mms slice thickness 3mms pitch =1.026 rotation time 0.50 secs, field of view 250-300 mms voltage 120KVs current =120-140, image matrix 512×512, CT dose length volume =5.4 mGys .

3.1.2 Study area and Duration:

The study was carried out in 94 patients, (63 female 35 male) of maxillary sinuses disease suspected of having different maxillary pathologies (previously performed nasal endoscopy) in ENT department of prince Abdalazeez hospital Arar Saudi Arabia from Nov 2015- Dec 2017.

Written informed consent was obtained from each patient or from parents in cases of pediatric patient.

Inclusion and exclusion patients:

All patients have clinical symptoms of sinus diseases was included.

Patients contraindicated for nasal endoscopy, and sever inflammation, traumatic patients of maxillary sinus and unstable patients to do CT scan were excluded

3.2 Method:

3.2.1 Technique used :

CT :

Scan to evaluate the mucosal thickening of maxillary sinus was obtained. coronal scans with the patient supine to complete pathologic characterization. Coronal imaging with the patient supine can also be used for the rare patient who is unable to assume the prone position. Scan angle is important to the optimal definition of the structures of the OMU. Coronal images are attempted in all patients initially, with supplemental axial images through the lower maxillary sinus obtained only in the rare circumstances where dental amalgam artifacts are severe. Full axial images with coronal reconstructions are used only in those few patients who are physically unable to assume either coronal scanning position.
No preparation for patient whose undergone CT maxillary sinus.

3.2.2 Endoscope:

Patients seated up right in the examination chair During the endoscopic examination. Patients head manipulated as needed to afford better viewing of the sinus area

After applying nasal decongestant and local anesthetic to the nasal cavities, the endoscope was introduced. antifog solution applied before it is introduction into the nasal cavity .

The ENT doctor performs three separate passes of the scope in each nasal cavity with each pass the appearance of the nasal mucosa and the structures of the sinus was examined , the ENT doctor notes the color of nasal mucosa ,the presence of inflamed or hypertrophic mucosa ,the presence of nasal polyps or secretions (purulent ,thick ,or thin),and any visible anatomic abnormality (septal deviation) .

3.2.3 Image interpretation:

Patients was examined by endoscope at ENT department and clinically diagnosed with maxillary sinus pathology then refer to CT department for further evaluation according to the ENT doctor request.

For evaluation of images and to measure the CT number of maxillary sinus the bone window setting from coronal cuts was used .by observation of radiologist and me , image was read and CT number was measured by putting the curser in the affected area Both maxillary sinuses was identified and nasal cavity was also been evaluated.

3.2.4 Data Analysis:

It carry out by statically package for social sciences SPSS .

Frequency and percentage of age, gender and diagnosis of right and left maxillary were calculated.

Also frequency and percent of endoscopic finding for right and left and frequency of clinical history .

The endoscopic finding vs CT diagnosis of right and left maxillary sinus cross tabulation ,chi square p-value .(p-value =0.000<0.05)

Table (1): Frequency and Percent of gender :

Gender	*Frequency*	*Percent (%)*
Male	62	63.9
Female	34	35.41
Total	96	100.0

Figure (1) : the Percent of gender :

Table (2): Frequency and Percent of Age :

Age	***Frequency***	***Percent (%)***
Less than 15	**5**	**5.2**
15 - 30	**41**	**42.7**
30 - 45	**43**	**44.3**
Greater than 45	**7**	**7.2**
Total	**96**	**100.0**

Figure (2) : The Percent of Age :

Table (3): Frequency and Percent of Diagnosis Rightand Left:

DIAGNOSIS	*DIAGNOSIS RIGHT*		*DIAGNOSIS LEFT*	
	Frequency	*Percent (%)*	*Frequency*	*Percent (%)*
Normal	4	4.1	17	17.3
AcuteRhinitis	5	5.2	8	8.2
Acute Sinusitis	26	27.8	16	16.3
Chronic Sinusitis	20	20.6	18	18.4
Polyp	30	30.9	29	29.6
Mucocels	9	9.3	7	7.1
Mass	2	2.1	3	3.1
Total	96	100.0	96	100.0

Figure (3) : the Percent of Diagnosis Right and Left:

Table (4): Frequency and Percent of Enoscopic Finding Right and Left :

ENOSCOPIC FINDING	*ENOSCOPIC FINDING RIGHT*		*ENOSCOPIC FINDING LEFT*	
	Frequency	*Percent (%)*	*Frequency*	*Percent (%)*
Enoscopic Normal	4	4.1	16	16.5
Enoscopic Hypertrophy of Nasal	30	30.9	15	15.5
Enoscopic Mucosal	39	40.2	45	46.4
Enoscopic Polypoid	11	11.3	7	7.2
Enoscopic Sinonasal	13	13.4	14	14.4
Total	96	100.0	96	100.0

Figure (4): ThePercent of Enoscopic Finding Right and Left:

Table (5): Frequency and Percent of Clinical History:

CLINICAL HISTORY	*Responses*		*Percent of Cases*
	N	*Percent*	
Headache	77	46.4%	79.4%
Both Nasl Obstruction	25	15.1%	25.8%
Right Nasl Obstruction	12	7.2%	12.4%
Left Nasl Obstruction	8	4.8%	8.2%
Bilateral Nasal Discharge	30	18.1%	30.9%
Right Nasal Discharge	9	5.4%	9.3%
Left Nasal Discharge	5	3.0%	5.2%
Total	166	100.0%	171.1%

Figure (5): ThePercent of Clinical History:

Table (6) the endoscopic findings VS CT diagnosis of the Right maxillary sinuses cross tabulation , Chi square , P-Value :

Endoscopic finding	*Endoscopic finding versus CT diagnosis of the right maxillary sinuses cross tabulated*								
		CT findings							*Total*
		Norm	*Acute Rhiniti*	*Acute Sinusiti*	*Chronic Sinusiti*	*Polyp*	*Mucoc*	*Mass*	
	Normal	3	-	-	-	-	-	-	3
		3 %	-	-	-	-	-	-	3 %
	Hypertrophy	-	-	14	3	7	6	-	30
	of Nasal	-	-	14.6%	3.1%	7.3%	6.2%	-	31.2%
	Mucosal	-	5	11	14	4	3	2	39
	Thickening	-	5.2%	11.5%	14.6%	4.2%	3.1%	2.1%	40.6%
	Polypoid	-	-	2	3	6	-	-	11
	Mucosa	-	-	2.1%	3.1%	6.2%	-	-	11.5%
	Sinonasal	-	-	-	-	13	-	-	13
		-	-	-	-	13.5%	-	-	13.5%
Total		3	5	27	20	31	9	2	96
		3.1%	5.2%	28.1%	20.8%	31.2%	9.4%	2.1%	100.0%

Chi –Square Tests			
	Value	*df*	*Asymp .(2-sided)*
Pearson Chi-Square	*156.149*	*24*	*.000*
Liklihood Ratio	*90.177*	*24*	*.000*
Linear –by-Linear Association	*10.593*	*1*	*.001*

Table (7) the linear- by- linear association of endoscopic findings versus CT diagnoses of the right maxillary sinus cross tabulation.

Table (8) the endoscopic findings VS CT diagnosis of the Left maxillary sinuses cross tabulation , Chi square , P-Value :

Endoscopic finding	*Endoscopic finding versus CT diagnosis of the left maxillary sinuses cross tabulated*								
		CT findings							*Total*
		Norm	*Acute Rhinitis*	*Acute Sinusiti*	*Chronic Sinusiti*	*Polyp*	*Muco*	*Mass*	
	Normal	13	-	-	-	1	-	-	14
		13.8%	-	-	-	1.1%	-	-	14.9%
	Hypertroph of Nasal	-	3	4	4	5	1	1	18
		-	3.2%	4.3%	4.3%	5.3%	1.1%	1.1%	19.1%
	Mucosal Thickening	-	6	11	12	4	7	1	41
		-	6.4%	11.7%	12.8%	4.3%	7.4%	1.1%	43.6%
	Polypoid Mucosa	-	-	-	1	5	-	1	7
		-	-	-	1.1%	5.3%	-	1.1%	7.4%
	Sinonasal	-	-	-	-	14	-	-	14
		-	-	-	-	14.9%	-	-	14.9%
Total		13	9	15	17	29	8	3	94
		13.8%	9.6%	16.0%	18.1%	30.9%	8.5%	3.2%	100.0%

<u>Table (9) the linear- by- linear association of endoscopic findings versus CT diagnoses of the right maxillary sinus cross tabulation.</u>

Chi –Square Tests			
	Value	***df***	***Asymp .(2-sided)***
Pearson Chi-Square	***141.499***	***24***	***.000***
Liklihood Ratio	***125.337***	***24***	***.000***
Linear –by-Linear Association	***32.768***	***1***	***.000***

Chapter Five

Discussion Conclusion Recommendation

5.1 Discussion

All the included patients in our study underwent diagnostic nasal endoscopy followed by CT scan. Among the parameters that were correlated: the diagnostic endoscopy was found to be: for the left sinus9(9.6%) of the cases were diagnosed to have acute rhinitis by CT scan, however endoscopic results showed that of the 9; 3 (3.32%)have Hypertrophy of nasal turbinate and 6 have mucosal thickening constituting (6.4%).15(16.0%) of the cases were diagnosed to have acute sinusitis by CT scan, however endoscopic results showed that of the (4.3%)have hypertrophy of nasal turbinate and 11 have mucosal thickening constituting (11.7%).

17(18.1%) of the cases were diagnosed to have chronic sinusitis by CT scan, however endoscopic results showed that of the (4.3%)have Hypertrophy of nasal turbinate and 12 have mucosal thickening constituting (12.8%) and 1(1.1%) has polypoid mucosa .CT scan was found to give positive result as polyps in 1(1.1%) patient which was found to be normal in the endoscope, 5 (5.3%) have Hypertrophy of nasal turbinate and 4(4.3%) have mucosal thickening and 5(5.3%) have polypoid mucosa and 14(14.9%) have sinonasal polyposis. Mucocele and mass were found in 2 patients 2.2% when diagnosed by CT and were diagnosed to have Hypertrophy of nasal turbinate in the endoscope test. CT showed that 7(7.4%) of the patients with mucocele and 1(1.1%) patient with mass, have polyploidy mucosa in the endoscope results.

for the right sinus :5 (5.2%) of the cases were diagnosed to have acute rhinitis by CT scan, however endoscopic results showed that they have mucosal thickening .27(28.1%) of the cases were diagnosed to have acute sinusitis in CT scanning ,however endoscopic results showed that of the 27 ;14 (14.6%) have hypertrophy of nasal turbinate and 11 have mucosal thickening constituting (11.5%) and 2(2.1%) have polypoid mucosa.20(20.8%) of the cases were diagnosed to have chronic sinusitis by CT scan, however endoscopic results showed that of the 20 ; 3 (3.1%)have Hypertrophy of nasal turbinate and 14 have mucosal thickening constituting (14.6%) and 3(3.1%) has polypoid mucosa .

CT scan was found to give positive result as polyps in most of the patients which was found to have different results in the endoscope, 7 (7.3%)have Hypertrophy of nasal turbinate and 4(4.2%) have mucosal thickening and 6(6.2%) has polypoid mucosa and 13(13.5%) have sinonasal polyposis. Mucocele was found in 11 patients 11.5% when diagnosed by CT and were diagnosed to have hypertrophy of nasal turbinate and mucosal thickening in the endoscope test. CT showed that 2(2.1%) of the patients with mass, have only mucosal thickening in the endoscope results. These were presented in tables (6,8)

Hence, the present study was carried out to assess the relevance of CT radiological method in diagnosing maxillary sinus lesions and to determine the degree correlation between radiological and endoscopic findings; Chi square test was performed and showed that there were significant association between the two methods (table 7,9) Since P= 0.000 indicates there is a high association between diagnostic endoscopy and CT. Hence, the advantages of diagnostic endoscopy are optical intensity, clear field of vision, easy handling, low cost. Yet various parameters could not be visualized during our study at diagnostic endoscopy as: middle turbinate, middle meatus, bulla ethmoidalis, hiatus semilunaris, frontal recess and sphenoethmoid recess. This is because in some of the cases it was impossible to pass the endoscope beyond certain point due to presence of gross pathology like extensive polyposis . CT scan proved to be very helpful in these cases as well giving the contrast media give the CT scan great value in evaluation and differentiation between the masses and mucosal thickening in most of the cases.

CT scans provided most of the information required for an endoscopic clearance. Advantages of CT scan are it shows progressively deeper structures as uncinate process, bulla ethmoidalis, and sphenoid sinus. CT scan delineates the extent of disease, anatomical and pathological results.

CT scan should be used to provide supplementary clinical data to the history and assist in directing acknowledged treatment to the affected areas. Studies have mentioned that the primary task of CT scan in sinuses, it is considered as a planning method for patients necessitating functional endoscopic sinus surgery. The pre-operative scan is used to highlight any potential surgical hazards, and to delineate the extent of disease reducing unnecessary intervention in disease-free areas. White et al, believed that it is unsuitable for CT to be used purely as a diagnostic investigation for sinus disease. On the other hand; studies firmed that endoscopy should be performed prior to scanning to reduce unnecessary CT demand (Otorhinolaryngol Head Neck Surg. Jan;2(1):30-34).

However according to Kasapoglu et al ; CT and nasal endoscopy are added to each other in preoperative assessment of patients with chronic sinusitis (Kulak Burun Bogaz Ihtis Derg.; 19(4):184-91).

Anatomic variations situated at the middle meatus can easily be identified with nasal endoscopy but information on their anatomic details and expansion of the sinus disease cannot be obtained. On the other hand, CT examination permits relating anatomic information and development of the sinus diseases.

Studies have mentioned that the endoscope is a helpful implement to spot the origin of the soft tissue pathology and also reduce unnecessary scanning procedures. The results of endoscopy and CT comparison in our study indicated that although for most of the findings, there was almost perfect to substantial level of agreement between the results of the two methods, some differences existed in some of the patients. 1 patient had normal endoscope findings based on the ENT doctor report, while demonstrated nasal polyps during CT evaluation. On another study reported by Zojaji et al in his study, in which patients who had negative CT scans, showed endoscopic exams with nasal polyposis was documented (. Iran J Radiol.;5(2):77-82.)

5.2 Conclusion:

This was a prospective descriptive clinical study with objective of correlating the endoscopic and CT finding , carried out on 94 symptomatic patients with different maxillary sinus diseases , patients who underwent CT maxillary sinus in both coronal and axial sections .most patients were in the 3rd and 4th decades of their lives with different diseases incidence in male and female the most common complaint with which they presented was nasal obstruction followed by headache and nasal discharge .the most common pattern of inflammation was sinonasal polyposis . CT scan for detection of mucosal abnormality was very good .computed tomography had best statistical results in evaluating maxillary lesion (malignance or benign)

There is high association between both CT findings and diagnostic endoscopic results.

5.3 Recommendations:

After the enumeration of the results that the related to the following thesis, there are some ideas which could help further in the field of research and better to be recommended as follow:

- CT scan could be used as routine checkup, follow up to help diagnosed treatment and control of maxillary disorders.
- CT scan is very important modality in maxillary sinus disease patients to detect complication to avoid advance symptoms and reach the accurate management .
- CT scan proves to be the most reliable of preoperative assessment of patients undergoing for sinus surgery.
- CT scan should be used with endoscope and both must be used prior to sinus surgery .

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