Sudan University of Sciences and Technology

College of Graduate Studies

STUDY OF PARANASAL SINUSIS IN SYMPTOMATIC ADULT USING CT.SCAN

دراسة الجيوب الانفيه لدى البالغين باستخدام الاشعة المقطعية

A Thesis Submitted, as a partial fulfillment of award of Master Degree in Diagnostic Radiology

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بسم الله الرحمن الرحيم

(إنما يخشى الله من عباده العلماء إن الله

عزيز غفور)

صدق الله العظيم ،،،

فاطر 28

DEDICATION

Dedicate my dissertation work to my family

and many friends.

A special feeling of gratitude to my loving parents.

I also dedicate this dissertation to my supervisor

Dr. Mohamed Mohamed Omer Mohamed Yousef

Who has supported me throughout the process. I dedicate

this work and give special thanks to my best friend

Dr.SAFA radiology consultant in ALQASMI HOSPITAL IN

SHARJAH-UAE.

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I wish to thank my radiology collage doctors who were more than generous with their expertise and precious time.

A special thanks to Dr. Mohamed Mohamed Omer

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My supervisor for his countless hours of reflecting, reading, encouraging, and most of all patience throughout the entire process I would like to acknowledge and thank my collage division for allowing me to conduct my research and providing any assistance requested. Finally I would like to thank the beginning teachers, mentor-teachers and administrators in our collage division that assisted me with this project.

ABSTRACT

The aim of this study was to study of paranasal sinuses in symptomatic adult using CT. Scan, this study was done in Ajman – Sheikh Khalifa Hospital –UAE CT departments, in the period from December 2015 to June 2016.

This study was conducted retrospectively on paranasal CT scans in the axial and coronal planes of 51 cases (20 male and 31 female). their ages are ranged from 9 to 69 years old patients who were clinically have paranasal sinuses diseases and referred for the CT of paranasal sinus, both scanning techniques (axial and coronal), using Brilliance CT64-channel scanner - Philips.

The results of this study revealed that Patients whose ages ranged from 30-39 years old were the most affected by sinuses diseases. Measurements were compared statistically with relation to side and gender of the patients. The cases were divided into subgroups according to age for each gender and each measurement parameter was also compared among the subgroups. Morphometric features differed significantly in the two gender at different ages and compared with previous studies presented great regional variability. The size of the frontal sinus was seen to be related to age and sex. The knowledge provided in the present study is useful for some surgical procedures and widens the anthropometric knowledge of humanity.

المستخلص

الهدف من هذه الدراسة دراسة الجيوب الانفيه في السكان البالغين بدولة الامارات، وقد تم اجراء البحث في عجمان باقسام الاشعة المقطعية مستشفى الشيخ خليفة، ذلك في الفترة من ديسمبر(2015) إلى يونيو2016 .

وقد أجريت هذه الدراسة على 51 حالة (20 من الذكور و 31 من الإناث). وتراوحت أعمارهم 9-69 سنة وهم مرضى كانوا يعانون من أمراض الجيوب الأنفية . وتم عمل كلا تقنيات المسح الضوئي (محوري والاكليلية)، وذلك باستخدام جهاز جهاز ماركة فيليبس .وكشفت نتائج هذه الدراسة أن المرضى الذين تتراوح أعمارهم بين 30-39 سنة كانت الأكثر اصابة بأمراض الجيوب الأنفية. وتمت مقارنة القياسات الإحصائية مع الجانب المصاب والجنس. تم تقسيم الحالات إلى عمرية. اختلفت الملامح المظهرية بشكل كبير في كلا الجنسين في مختلف الأعمار وتم المقارنة مع الدراسات السابقة. كان حجم الجيب الأمامي ذات علاقة العمر والجنس. اوضحت هذه الدراسة معلومات مفيدة لاجراء بعض العمليات الجراحية وتشخيص امراض الجيوب الانفية.

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List of Abbreviations

CT	Computed Tomography
PNS	Paranasal Sinuses
GE	General Electric
Kvp	Kilo voltage peak
mA	Mill Ampere
AFS	Allergic Fungal Sinusitis
WW	Window Width
WL	Window Level
Hu	Hounds Field Unit
FESS	Functional Endoscopes Sinus Surgery
ESS	Endoscopes Sinus Surgery
SSCT	Screening Sinus CT
AHCPR	Agency for Healthcare Policy and Research

Chapter One

1.1. Introduction

Sinusitis is an inflammation of the mucosal lining of the paranasal sinuses. As the mucosa of the sinuses is continuous with that of the nose, rhinosinusitis is a more suitable term.[1, 2]

Functional endoscopic sinus surgery (FESS) has revolutionized the treatment of sinusitis. The therapeutic benefits of FESS have helped a large number of patients with chronic sinus disease.[3, 4]

Obstruction of the draining pathways of the sinuses is now thought to be the main cause of sinusitis. Examples of these pathways include the ostia of the maxillary sinuses and the hiatus semilunaris, where the anterior group of paranasal sinuses drains. Clearance of this obstruction is the aim of endoscopic surgery.

Imaging has also progressed with FESS, and computed tomography (CT) scanning can now demonstrate the sinus anatomy and patterns of sinusitis in exquisite detail before surgery (Kapoor, 2002).

CT scanning can be helpful in differentiating frontal sinus pathology; diagnosing both acute and chronic sinusitis, neoplastic and inflammatory processes, and other problems as congenital anomalies.

In addition, we need it to identify erosive processes and acquired developmental deficiencies of the bone. CT is also excellent for determining whether there is an intra orbital extension of sino-nasal disease.

When assessing the complications of sinusitis, CT is excellent for imaging of sub periostial abscesses or orbital extension into the orbit.

My challenges and problem of research are The complex anatomy and frequent anatomic variations of the frontal sinus drainage pathways may challenge the skills of the radiologist; however, use of helical CT studies and

multi planar CT reformations now provide the radiologist with a clearer depiction of the anatomy of each patient and a clearer understanding of the anatomic diversity within the population in order to assess different pathology.

1-2- Problem of the study:

PNS are affected by many types of diseases therefore this research was explaining what is the best view (coronal or axial) to evaluate &demonstrate frontal sinuses diseases to produce clear image for good diagnosis & so right treatment.

1-3- Objectives:-

1-3-1 general objective

To study the the role of MSC (multislice computed tomography) in evaluation of anatomic variants and different pathology in the paranasal sinus of adults.

1-3- 2 specific objectives of the study were:

- To study the anatomy and radiological anatomy of the paranasal sinus and its anatomic variance
- To explain what the suitable view (coronal or axial) is that give the full information about paranasal sinuses
- To characterize different pathology of the paranasal sinus using MSCT with multi planar reconstruction and
- To evaluate the role of CT in the assessment of the paranasal sinus in adults in view of our study results.

1-4 Overview of the study:

Chapter one:

Is a general introduction, which consists of:An introduction, the objectives of the research, methodology of the research, machine used & then concluded with the scope of the study

Chapter two:

It is a literature review, which consists of the following:

Anatomy of the paranasal sinuses

Physiology of the paranasal sinuses

Pathology of the paranasal sinuses

Computed tomography (CT)

Previous study

Chapter three:

It deal with the material & methods

Chapter four:

It included result presentation

Chapter five:

Deal with the discussion, conclusion & recommendation.

Chapter Two

Literature Review

2-1. Anatomy & physiology:

The nasal accessory sinuses are connected system of hollow air field cavities in the skull which communicate with the nasal cavity and lined by ciliated mucous membrane. They develop as out Pouching from the nasal passages and are sufficiently will developed to be demonstrable in radiographs at four or five years of age and do not stop growing until age 20 years old (Warrick , 1969)

In all, there are eight sinuses they are divided into two groups; the anterior and posterior groups the anterior group consist of the two maxillary sinuses (antra), the two frontal sinuses and the two anterior and middle ethmoidal sinuses. The posterior group comprises the two posterior ethmoidal sinuses and the two sphenoidal sinuses. (Warrick , 1969)

The anterior group drainage into middle meatus which is bordered by the middle turbinate bone (figure2-1) and the posterior group drainage into superior meatus (which is a space defined by superior turbinate bone) and the sphenoethmoidal recess.

Although in a minority of patients some of the sinuses do not fully form. These hypoplastic (incompletely formed) or a plastic sinus (completely unformed) are often an incidental finding, usually not associated with any increased sinus problems, although in some instances they should be addressed. (Bolger ,1990),(Tasar, 2007),(Eggesbo, 2001),(Kapoor, 2002).

The purpose of the sinuses is unclear but theories said that sinuses are:

-Decreasing the relative weight of the front of the skull, and especially the bones of the face.

-Increasing resonance of the voice.

-Providing a buffer against blows to the face.

-Insulating sensitive structures like dental roots and eyes from rapid temperature fluctuations in the nasal cavity.

-Humidifying and heating of inhaled air because of slow air turnover in this region.

Humidification and warming of inspired air are accomplished by the watery secretions of the serous glands, which can produce up to 1–2 liters of secretions per day.

While the watery serous secretions play a role in humidification and warming, the secretions of the goblet cells and mucous glands facilitate the removal of particulate matter. This mucous is very effective, trapping up to 80% of particles larger than 3–5 microns (Stamm, 2000) . This includes not only inorganic pathogens but also up to 75% of the bacteria entering the nose (Stamm, 2000). The mucous blanket of the nose is a very dynamic structure, continuously renewing itself every 10–20 minutes (Stamm, 2000). The mucous blanket also defends the body against infection. Besides trapping organic pathogens, the blanket constitutes a rich immunologic barrier within the mucosa. When exposed to the trapped antigens, it can further enhance the response by stimulating the immune system. The ciliated epithelium continually beats, propelling the mucus in a synchronized fashion toward the natural opening or ostium of each sinus. These ostia drain into the nasal cavity. The mucus is then propelled to the nasopharynx to be swallowed. At this point the acid secretions of the stomach can help destroy the inhaled pathogens. (Stamm ,2000),(Wormald, 2007),(Rice, 2003),(Yang, 2000).

The normal function of the sinuses depends on three essential components: thin normal mucus secretions, normally functioning microscopic hairs (called cilia) that move the mucus out of the sinuses, and open sinus drainage openings (called sinus ostium).

These components allow for the continuous clearance of secretions. Interference with any of these three components of the normal sinuses may predispose the patient to sinusitis. In other words, thick secretions malfunction of the microhairs, or blockage of the natural sinus openings may lead to symptoms of sinusitis. The microhairs move at a frequency of 10 strokes per second in a coordinated fashion. The action of these microhairs move any given mucus particle from the sinuses and out into the nose in about 10 minutes. Cilia function is most effective at a temperature above 18 °C and a relative humidity of about 50% (Stamm, 2000).This may be a factor with common colds, which occur in the winter months. For the mucociliary system to clear the secretions from the sinuses, the natural sinus opening must be patent (Alho, 2004)

2-1-1. The maxillary sinus or (antra):

Maxillary sinus (Antrum of Highmore): These paired sinuses lie under the cheek and occupy a central portion in the facial skeleton. It is the largest of the group of paranasal sinuses which are formed as a result of pneumatisation of the maxilla. They are more or less shaped like a pyramid. The capacity of the maxillary sinus is roughly 1 fluid ounze (30ml).

These structures are usually fluid-filled at birth. The growth of these sinuses is biphasic with growth during years 0-3 and 7-12. During the later phase pneumatization spreads more inferiorly as the permanent teeth take their place.

Roof of the sinus is formed by its thin orbital wall which is traversed by the infra orbital foramen containing the infra orbital vessels and nerves. This wall is very fragile and any disease process involving the maxilla is likely to affect the orbit through this wall.

Floor is formed alveolar process of the maxilla and the hard palate. The roots of the first and second molar reach up to the floor of the maxillary sinus. Dental infections involving the 1st and 2nd molars may involve the maxillary sinus

The anterior wall of the sinus corresponds to the anterior surface of the maxilla extending superiorly from the orbital rim above to the teeth below.

The posterior wall is formed by the corresponding surface of the maxilla superiorly, and part of the palatine bone inferiorly.

Laterally: Bounded by the canine eminence which is caused by the canine tooth.

The medial wall of the sinus is shared with the nasal cavity and forms part of the lateral nasal wall within which is present the nasolacrimal duct. Which is drains into the inferior meatus (that is bordered by the inferior turbinate bone). This is one reason why our nose drips when we cry.

The sinus drains into the nasal cavity through its ostium that is present high up in its medial wall and empties in the posterior aspect of the hiatus semilunaris situated in the middle meatus, so the chance that infection maybe spread from frontal and anterior ethmoidal sinuses into the maxillary sinuses is great and branches of the internal maxillary artery supply this sinus. These include the infraorbital (as it runs with the infraorbital nerve), lateral branches of the sphenopalatine, greater palatine, and the alveolar arteries. Venous drainage runs anteriorly into the facial vein and posteriorly into the maxillary vein and jugular vs. dural sinus systems.(Snell, 2000).

The maxillary sinus is innervated by branches of V2. Specifically, the greater palatine nerve and the branches of the infraorbital nerve.

2-1-2. The Frontal Sinus:

Are two in number, and contained within the frontal bone and lie between the inner and outer tables of the frontal bone over root of the nose and inner parts of the orbits.

The frontal sinuses are rarely symmetrical, and they are separated by thin plate of bone (Bony septum).

Each sinus is roughly triangular, extending upward above the medial end of the eyebrow and backward into medial part of the roof of the orbit.

Each frontal sinus opens into the middle meatus of the nose through the infundibulum.(Snell, 2000). The mucous membrane is supplied by the supraorbital nerve.

2-1-3. The ethmoidal cells:

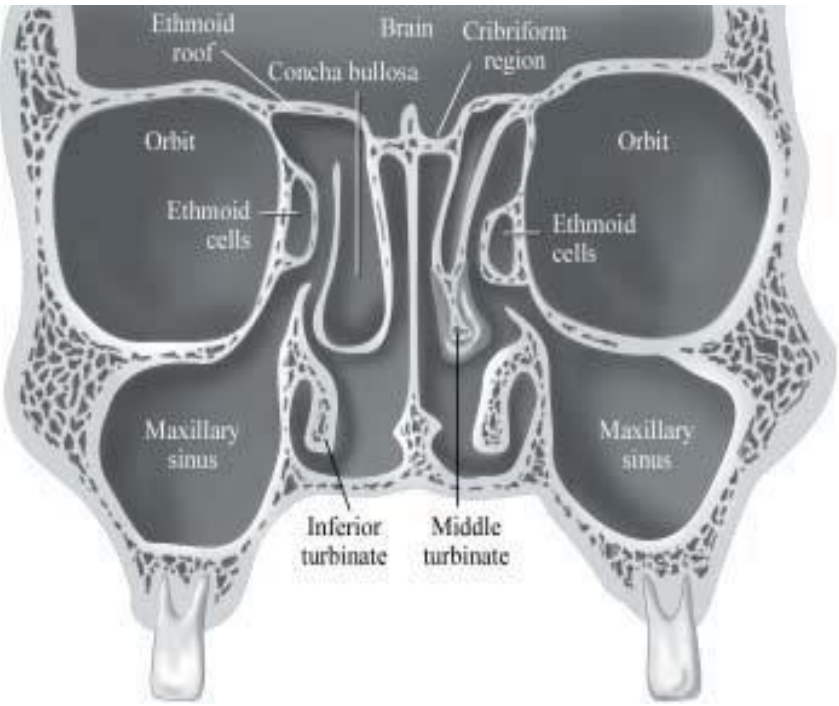
Are contained within the ethmoid bone, between the nose and the orbit. They are separated by a thin plate of bone so that infection can readily spread from the sinuses into the orbit.

It's a collection of several small sinuses, structured like a beehive. It is for this reason that the ethmoid sinuses have varied drainage patterns.

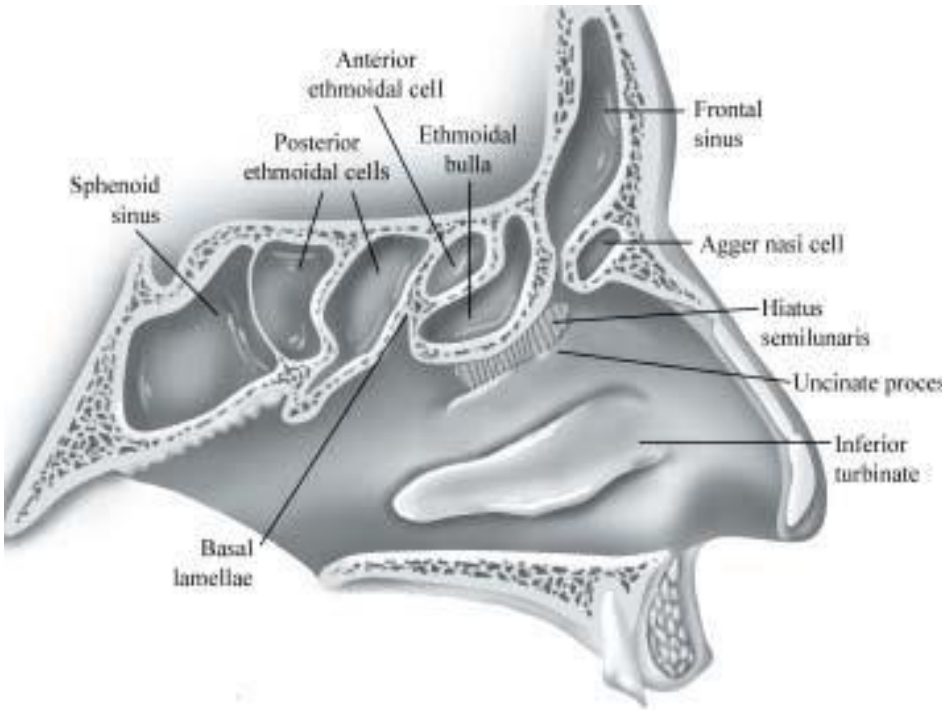
They are divided into three groups: anterior, middle and posterior. The anterior group opens into the infundibulum and middle meatus, the middle group of the air cells open in the middle meatus, or above the bulla ethmoidals, and the posterior group of the air cells opens into the superior meatus(Snell, 2000). The mucous membrane is supplied by the anterior and posterior ethmoidal nerves.

2-1-4. The sphenoidal sinuses:

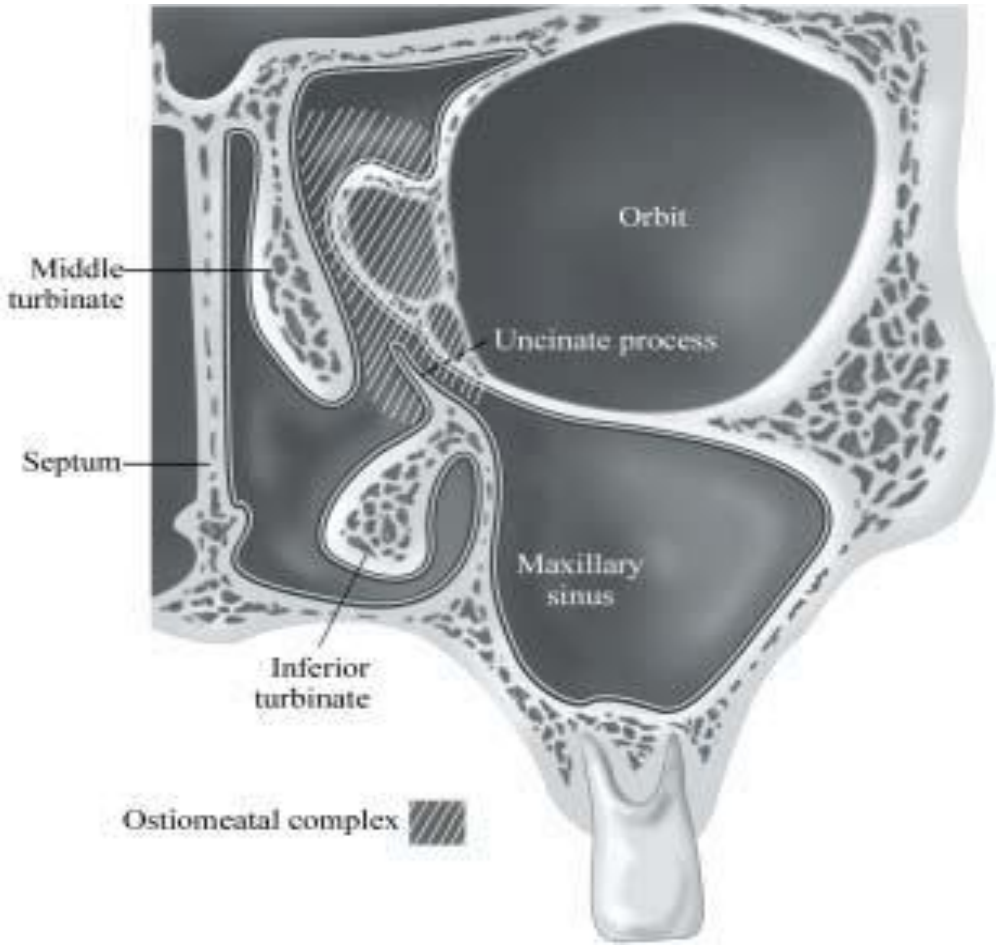
Two in number, lie within the body of the sphenoid bone, each sinus opens into the sphenoethmoidal recess above the superior conchae (Snell, 2000). The mucous membrane is supplied by the posterior ethmoidal nerves.


Ethmoid roof
Brain
Cribriform region
Concha bullosa
Orbit
Orbit
Ethmoid cells
Ethmoid cells
Maxillary sinus
Maxillary sinus
Inferior turbinate
Middle turbinate

A


Anterior ethmoidal cell
Frontal sinus
Posterior ethmoidal cells
Ethmoidal bulla
Sphenoid sinus
Agger nasi cell
Hiatus semilunaris
Uncinate proces
Inferior turbinate
Basal lamellae

B



C

Figure 2.1: A, B – Coronal and sagittal views into the paranasal sinuses.

C – The maxillary, frontal, and ethmoid sinuses drain into the middle meatus, which is bordered by the middle turbinate bone.

The osteomeatal complex (OMC) is the Grand Central Station of the sinuses. Any process that causes swelling and blockage of this critical area contributes to the symptoms of sinusitis.

2-2. Pathology:

2-2-1. Sinusitis:

Refers to the inflammation of the mucous membranes of the paranasal sinuses.

Any condition (Inflammation, neoplasm, foreign body) that interferes with drainage of a sinus renders it liable to infection. If the ostium of a sinus

is blocked, the secretion or exudates accumulates behind the obstruction. Figure (2)

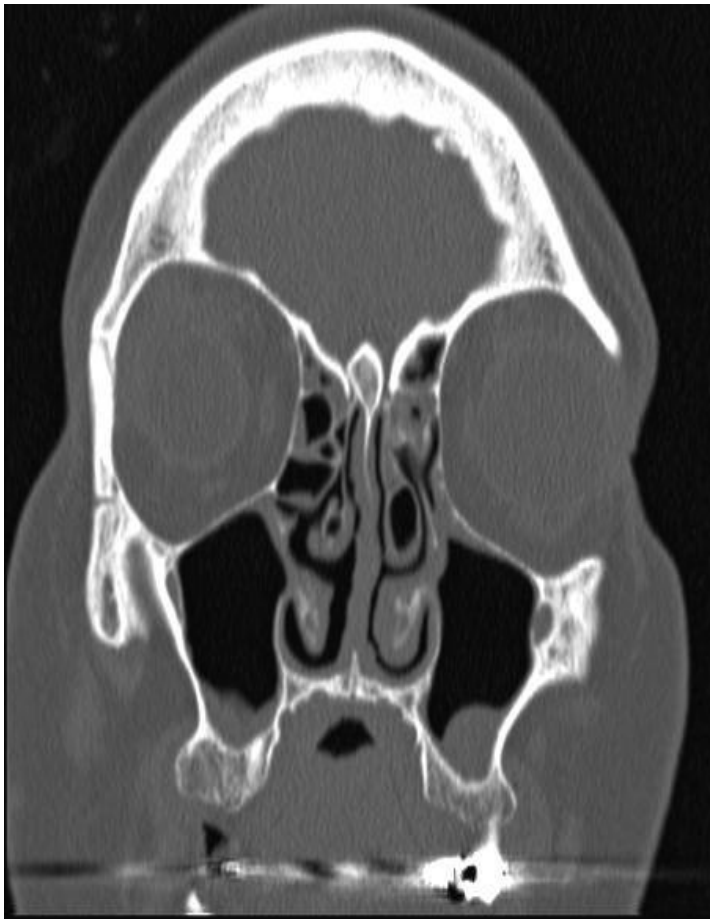


Figure 2.2 – An air filled left sided middle turbinate (concha bullosa) pushes against the patient's nasal side wall and blocks the sinus drainage outflow pathway.

Causative factors in sinusitis can be considered by categories.

- Inflammatory factors include upper respiratory tract infections (example, the common cold), allergic rhinitis, vasomotor rhinitis, recent dental work, barotrauma, and swimming.
- Systemic factors include immunodeficiency, ciliary dyskinesia syndrome, cystic fibrosis, rhinitis of pregnancy, and hypothyroidism.

- Mechanical factors include choanal atresia, sinonasal polyps, deviated septum, foreign body, trauma, tumor, nasogastric tube, turbinate hypertrophy, concha bullosa, adenoid hypertrophy.
- Medicative causes include beta blockers, birth control pills, antihypertensives, aspirin intolerance, rhinitis medicamentosa (overuse of topical decongestants), and cocaine abuse. Many of these causes will be discussed below. (Stamm, 2000), (Pankey, 2000).

There are two types of sinusitis.

2-2-1-1. Acute sinusitis:

Generally a complication of acute infection of the nose (rhinitis) and rarely secondary to dental sepsis.

The ostia are occluded due to inflammation and oedema and the sinuses are full.

2-2-1-2. Chronic sinusitis:

Acute sinusitis may become chronic due to incomplete resolution of acute inflammation and from damage to the mucous membrane, inadequate drainage of the sinuses, nasal obstruction due to polyps, or enlargement of the nasopharyngeal lymphoid tissue (adenoids).

Sinusitis acute or chronic may be followed by a number of complications.

2-2-1-3 Mucocele:

Accumulation of mucous secretions in a nasal sinus, infection of mucocele result in empyema.

Mucocele occur most often in anterior ethmoid sinus, frontal sinus and maxillary antra. Mucocele of the sphenoid sinus is rare, and may be large enough to displace the contents of the orbit.

2-2-1-4 Osteomyelitis:

Bone infection result from the extension of a supparative infection in the frontal sinuses to the bone, and infection may spread to periosteumproducessingpreosities and a subperisteal abscess.

If these occur on the orbital side of the bone orbital abscess forms.

2-2-1-5 Septic thrombophlebitis:

Infection in the sinuses may penetrate the bone and spread to the frontal and dipole venous systems.

Intracranial Infections: Spread of infection to the cranial cavity also may complicate sinusitis. Lesions include epidural, subdural, and cerebral abscesses and purulent leptomenigitis.

2-2-1-6 septal deviation

The nasal septum divides the right and left nasal cavities. The septum is comprised of both bone and cartilage with a mucosal lining, and sits roughly in the midline of the nose. It is not uncommon for the nasal septum to be slightly deviated. In some instances, however, this septal deviation may be significant. Severe septal deviation will not only cause nasal obstruction by blocking the airflow into the affected side, but may also impact mucociliary clearance by “pushing” the middle turbinate and other structures towards the infundibulum leading to impairment of this sinus drainage outflow tract (figure 3). (Stamm, 2000),(Wormald, 2007),(Rice, 2003),(Becker, 2003),(Cook. et al, 1995).

Figure 2.3: Coronal CT scan of the sinuses demonstrating septal deviation towards the patient's right side. The ostiomeatal complex is swollen and blocked.

2-2-1-7 Concha bullosa

The middle turbinate is a normal structure that provides the medial boundary for the middle meatus where the maxillary, ethmoid, and frontal sinuses drain. A paradoxically curved middle turbinate may push against the infundibulum blocking the sinus outflow pathway. A concha bullosa, or air filled middle turbinate, may impede drainage of the infundibulum on its own side of the nose or, in extreme circumstances, may push the septum to the opposite side of the nose and block drainage on that side.

2-2-1-8 Nasal Polyps:

Are focal inflammatory swellings of the mucosa of the nose and paranasalsinuses. Figure (4)

Figure (4) – This coronal CT of a patient with polyps shows significant blockage of the nasal airway, as well as the sinuses. The patient also has a septal deviation.

2-2-1-8 Allergic Polyps:

Recurrent allergic reactions cause chronic mucosal oedema and enlargement of the turbinate (conchae) and that leading to localized bulging of the mucosa and the formation of polyps.

Allergic polyps of the nose are usually multiple and appear as smooth, pale, movable, rounded tumors, which protrude in to the airway and cause symptoms of nasal obstruction.

They may be sessile or pedunculated, and allergic polyps are lined externally by respiratory epithelium.

2.2.1-10 Non Allergic polyps:

These lesions arise in cases of chronic rhinitis and chronic sinusitis and are not related to allergic diseases of the nose.

2.2.1.11 Granulomas:

Many granulomatous inflammations may involve the nose- this include: tuberculosis, leprosy, syphilis, scleroma, fungal infection, leishmaniasis, Wegener Gramulomatosis and lethal midline granucloma (polymorphic reticulosis).

2.2.1.12 Tuberculosis:

Tuberculosis infection of the nose is almost always the result of tuberculosis of the lungs, may spread to the nasal vestibule and then to nasal mucosa. Glaucomatous tuberculosis of the nasal mucosa usually originates on the anterior nasal septum.

Tuberculous infection may spread to paranasal sinuses or along the nasolacrimal duct to cause tuberculousdacryocystitis and conjunctivitis.

2.2.1.13 Syphilis:

May involve the nose in congenital form causing destruction of the septum. The mucosal lesions of secondary syphilis are commonly observed in the nose and nasopharynx.

May destroy nasal cartilage and bone and the collapse of the nasal bridge produces so-called saddle nose.

Destruction of the bony walls of the nose may also lead to perforation of the nasal septum, hard plate, wall of the orbit, or maxillary sinus.

2.2.1.14 Leprosy:

Begins as a nodule that the skin around the anterior nasal mucosa shows nodules, ulceration, or perforations.

Nasal involvement is important because leprosy is spread through nasal secretion that with bacilli.

2.2.1.15 Scleroma:

Is chronic inflammatory process that usually begins in the nose and remains localized to that site, although it may extend slowly into the nasopharynx, larynx, and trachea. Rarely scleroma is seen in other locations including the paranasal sinuses.

2.2.1.16 Fungal Infections:

Pathogenic fungi involve the nose and paranasal sinuses.

Types of fungal infection:

Candiasis: Is the most common fungal infection of the nasal mucosa.

Aspergillosis: Is uncommon and usually occurs in a paranasal sinus. Aspergillus organisms may disseminate to the venous sinuses, meninges, and brain.

Rhinosporidiosis: The nasal mucosa affected with Rhinosporidiosis contains vascular polypoid masses. Similar lesions occur in the mucosa of other parts of the upper respiratory tract.

Leishmaniasis: The nose is a frequent site of mucocutaneous form of leishmaniasis, in some patients lesion develops in the nose or upper lip and the infection spread by nasal contact with contaminated fingers.

Bacterial infection may lead to destruction of the soft tissues and collapse of the anterior cartilaginous nasal septum.

Wegener Gramulomatosis: Affects the upper airways, first manifested as mucosal thickening and granulation in the nose. The resulting “runny nose”, sinusitis, and nose bleeds may be accompanied by some symptoms, such as fever, malaise, and weight loss.

Lethal midline Granulomal (polumorphic Reticulosis): The nasal mucosa becomes focally swollen and indurated and eventually ulcerated

that destroys cartilage and bone. This destruction causes defects of the nasal septum and necrosis of tissues and does not respond to antibiotic.

Tumors: The tumors of nose; nasal cavity and paranasal sinuses are uncommon. However benign and malignant tumors of epithelial as well can occur.

2.2.1.18 Tumors:

Capillary Hemangioma: Common benign lesion in the septum of nose, and if the surface ulcerated and lesion contains inflammatory cells infiltrate, it resemble inflammatory granulation tissue and is called hemangioma of granulation tissue type.

Papillomas: May occur in the nasal vestibule, nasal cavity and paranasal sinuses. They are mainly of two types. Fungi form papilloma with exophatic growth, and inverted papillomawithinereted growth. Each of this may be lined with combination of epithelia: respiratory, squamous, and mucous type.

2.2.1.17.1 Malignant Tumors:

Olfactoryneuroblastoma: It occurs over the olfactory mucosa as a polypoid mass that may invade to the paranasal sinuses or skull. Usually a polypoid and highly vascular, and the tumors cells are larger than lymphocytes.

Carcinoma of the nasal cavity and paranasal sinuses: More than half of these tumors orifinate in the antrum of the maxillary sinus, one third in the nasal cavity, 10% in the ethmoid sinus, and 1% in the sphenoid and frontal sinuses.

Most cancers of the nasal cavity and paranasal sinuses are squamous cell carcinomas. About 15% are abenocarcinomas, transitional cell carcinoma, or anaplastic carcinoma. The tumor extends locally to

involve the surrounding bone and soft tissues and also metastasizes widely.(Mac. Et al, 1992),(KUMAR et al, 1997)

2.3. Diagnostic testing

The physical examination may not be helpful, particularly in sphenoid sinus diseases. Not all patients are febrile, and sinus tenderness is not always present. Pus is not always seen in sphenoid sinusitis. Kibblewhite and associates found purulent exudate in only 3 of 14 patients (Laine , et al, 1992), Transillumination of the sinuses has low sensitivity and specificity (Hamdan , et al, 2001) and routine anterior rhinoscopy performed with a headlight and nasal speculum allows only limited inspection of the anterior nasal cavity.

2-3-1. Standard radiography

Standard radiography is inadequate for the clinical evaluation of sinuses diseases because it does not evaluate the anterior ethmoid air cells, the upper two thirds of the nasal cavity, or the infundibular, middle meatus, or frontal recess air passages (Rice, and Schaefer, 2003). .

2-3-2. Neuroimaging

CT is the optimal radiographic study to assess the paranasal sinuses for evidence of disease. The mucosa of the normal, noninfected sinus approximates the bone so closely that it cannot be visualized on CT.

Therefore, any soft tissue seen within a sinus is abnormal (Wallace et al, 1990) . CT may demonstrate mucosal thickening, sclerosis, clouding, or air-fluid levels.

Imaging must be performed in the coronal plane to adequately demonstrate the ethmoid complex. It can reveal the extent of mucosal disease in the ostiomeatal complex. The test-retest reliability of CT in the assessment of chronic rhinosinusitis was high and stable in a prospective series of patients scheduled for endoscopic sinus surgery (deFreitas et al ,2008). The prevalence of reversible sinus abnormalities on CT in

patients who have the common cold is high (Alho, 2004) This suggests that CT may not be specific for bacterial infections (Shapiro and , Rachelefsky, 1992).Middle meatus involvement was present in 72 of 100CT examinations of patients who had chronic sinusitis. Anterior ethmoid sinus infection was found in every patient who had frontal or maxillary sinuses disease. Middle meatal disease was found in the rest of these patients; it extended to, and occluded, the frontal recess in the patients who had frontal sinus diseases and extended to, and occluded, the infundibulum in all cases of maxillary mucoperiosteal disease (Stamm, and Draf, 2000) .

Incidental anatomic abnormalities within the paranasal sinuses are common. Incidental anatomic abnormalities on CT scans occur in 27% to 45% of asymptomatic individuals (Scribano , et al, 1997) . Patients undergoing endoscopic sinus surgery for chronic rhinosinusitis were evaluated with CT and staged according to the Lund system. (Each paranasal sinus [anterior ethmoid, posterior ethmoid, maxillary, frontal, and sphenoid sinus for each side] was given a score of 0 for no opacification, 1 for partial opacification, or 2 for total opacification.) The ostiomeatal complex was assigned a score of 0 for patent or 2 for obstructed. The Lund score ranged from 0 to 24. Controls were patients undergoing sinus CT for other reasons. In the disease-positive group of patients who had chronic rhinosinusitis, the mean Lund score was 9.8 (9.0–10.6). The mean Lund score of the control group (without disease) was 4.3 (3.5–5.0). The AUC for the receiver-operator characteristic was 0.802 (P \ .001).

Using a Lund score cut-off value of greater than 2 as abnormal, the sinus CT exhibited sensitivity and specificity of 94% and 41%, respectively. Increasing the cut-off value to 4 changed the sensitivity and specificity to 85% and 59%, respectively (Stamm, and Draf,2000).

Sinus CT scan discriminates with good sensitivity and moderate specificity between patients who do and do not have chronic rhinosinusitis.

The positive and negative predictive values depend on the a priori prevalence of chronic rhinosinusitis. Lund scores of 0 or 1 are unlikely to represent true chronic rhinosinusitis, whereas Lund scores of 4 or greater are highly likely to represent true chronic rhinosinusitis. Lund scores of 2 to 3 are ambiguous, and further clinical evaluation or follow-up is warranted (Stamm, and Draf,2000).

During the edematous phase of the nasal cycle, normal nasal mucosa on T2-weighted image can resemble pathologic change. Despite these specificity problems, MRI is more sensitive than CT in detecting fungal infection .(Rice, and Schaefer, 2003) .

Maxillary mucosal thickening >6 mm, complete sinus opacification, and air-fluid levels on neuroimaging correlate to positive sinus cultures (Waguespack, 1995).

Thirty percent to 40% of the normal population, however, has mucosal thickening on CT evaluation (Myller et al, 2006). The 1999 Agency for Healthcare Policy and Research (AHCPR) meta-analysis of six studies showed that sinus radiography has moderate sensitivity (76%) and specificity (79%) compared with sinus puncture in the diagnosis of acute bacterial rhinosinusitis. CT or MRI is necessary to definitively diagnose sphenoid sinusitis, because plain radiographs are nondiagnostic in approximately 26% of cases (Stamm,et al Draf W,2000) . CT scanning is the gold standard for the diagnosis of sphenoid sinus disease; MRI is an adjunct.

Transillumination, ultrasonography, and anterior rhinoscopyTransillumination of the sinuses has low sensitivity and specificity (Hamdan et al,2001). Ultrasonography has lower sensitivity and

specificity than sinus radiography (Hamdan et al,2001). Routine anterior rhinoscopy performed with a headlight and nasal speculum allows only limited inspection of the anterior nasal cavity.

2-3-3. Diagnostic fiberoptic endoscopy

The flexible fiberopticrhinoscope allows direct visualization of the nasal passages and sinus drainage areas (ostiomeatal complex) and is complementary to CT or MRI. A trained operator can perform this procedure easily, and the patient tolerates it well. Infection is easily diagnosed if purulent material is seen emanating from the sinus drainage region.

Mucosal sinus thickening frequently is present in normal, nonsymptomatic patients. In these cases, endoscopy should be positive before a diagnosis of sinusitis is made (Wormald, 2007),(Yang et al, 2000). Sphenoid sinusitis is an exception to this generalization.

Endoscopy should be considered when a patient who is suspected of having a sinus-related problem fails conservative medical treatment and has an inconclusive CT or MRI. Some physicians use endoscopy before neuroimaging.

Negative neuroimaging and endoscopy usually, but not always, rules out sinus disease (Rice,and Schaefer, 2003).

2-4. Computed Tomography (CT):

CT utilizes a conventional X-Ray tube a bank of detectors, which rotate around the patient to produce a finely focused series of projections, which are reconstructed by computers to produce across-sectional image, usually transaxial image. Figure 5(a, and b)

CT image has low spatial resolution but it has high contrast resolution in comparison with the conventional radiograph.

CT scan can now be obtained in about 1 second and new spiral scanners which combine continuous table movement and continuous X-Ray tube emission allow volumes of tissue up to 60 cm in length to be scanned, with slice obtain anywhere with this volumes. This allows better multiplaner reconstruction.

Finally the image can be stored on magnetic tapes or optical disk and recorded permanently on C-Ray film.

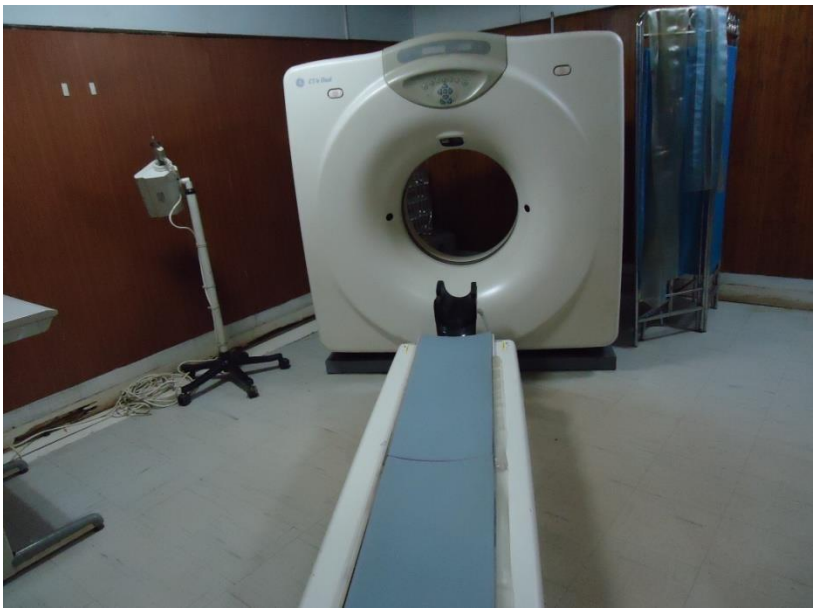
The advantages of CT are as follow:

Excellent contrast resolution.

Transaxial image with no tissue superimposition.

Excellent anatomical display can be used to guide biopsies.

Figure 5. CT scan machine -a and B A- CT scan console



2.6 CT Gantry and Table

2-4.1 CT Technique of Paranasal Sinuses:

2-4-1-1. Preparation:

You should wear comfortable, loose-fitting clothing to your exam. You may be given a gown to wear during the procedure.

Metal objects including jewelry, eyeglasses, dentures and hairpins may affect the CT images and should be left at home or removed prior to your exam. You may also be asked to remove hearing aids and removable dental work.

Straps and pillows may be used to help the patient maintain the correct position and to hold still during the exam. (http://www.radiologyInfo.org, Radiological Society of North America)

2-4-1-2. Axial Projections:

Patient should be positioned lying supine with the head in axial head holder. Scan should be taken parallel to the orbitomeatal line (0-10) degree gantry tilt; 5mm slice thickness should be taken forward through the

entire face till we examined all sinus or area of interest.(Ballinger Philip w, frank engine d ,1999)

2-6-2-1. Soft Tissue Windows:

Window Width (WW) (300)

Window Level (WL) (50)

2-6-2-2. Bone Windows:

Window Width (WW) (2000)

Window Level (WL) (300)

2-4-1-3. Coronal Projection (direct):

Coronal images are obtained directly, with the patient prone or supine with the neck in hyperextension (hanging head) position.

The gantry should be angled perpendicular to the hard palate.

Scan should be taken forward 5mm slice thickness until we cover all sinuses. Be reconstructing coronal from axial cuts, we can obtain images in coronal plane.(Ballinger Philip w, frank engine d ,1999).

2-6-3-1. Soft Tissue Windows:

Window Width (WW) (300)

Window Width (WL) (50)

2-6-3-2. Bone Windows:

Window Width (WW) (2000-2500)

Window Level (WL) (200-350)

2-4-1-4. Exposure Factor:

Kvp (120)

mA (77)

Second (S) (4.8)

2-4-1-5. Contrast medium:

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.

You may be asked to hold your breath during the scanning. Any motion, whether breathing or body movements, can lead to artifacts on the images. This is similar to the blurring seen on a photograph taken of a moving object.

When the examination is completed, you will be asked to wait until the technologist verifies that the images are of high enough quality for accurate interpretation.

The actual CT scan takes less than a minute and the entire process is usually completed within 10 minutes. (http://www.radiologyInfo.org, Radiological Society of North America)

2-4-1-5. Experience during and after the procedure:

CT exams are generally painless, fast and easy. With helical CT, the amount of time that the patient needs to lie still is reduced.

Though the scanning itself causes no pain, there may be some discomfort from having to remain still for several minutes. If you have a hard time staying still, are claustrophobic or have chronic pain, you may find a CT exam to be stressful. The technologist or nurse, under the direction of a physician, may offer you a mild sedative to help you tolerate the CT scanning procedure.

If an intravenous contrast material is used, you will feel a slight pin prick when the needle is inserted into your vein. You may have a warm, flushed sensation during the injection of the contrast materials and a metallic taste in your mouth that lasts for a few minutes. Some patients may experience a sensation like they have to urinate but this subsides quickly.

When you enter the CT scanner, special lights may be used to ensure that you are properly positioned.

With modern CT scanners, you will hear only slight buzzing, clicking and whirring sounds as the CT scanner revolves around you during the imaging process.

You will be alone in the exam room during the CT scan. However, the technologist will be able to see, hear and speak with you at all times.

With pediatric patients, a parent may be allowed in the room but will be required to wear a lead apron to minimize radiation exposure.

After a CT exam, you can return to your normal activities. If you received contrast material, you may be given special instructions. (http://www.radiologyInfo.org, Radiological Society of North America)

2-4-1-6. Limitations of CT of the Sinuses:

While CT is occasionally used to detect the presence of tumors, magnetic resonance imaging (MRI) is the primary choice for this purpose.

A person who is very large may not fit into the opening of a conventional CT scanner or may be over the weight limit for the moving table which is usually about 450 pounds. (http://www.radiologyInfo.org,Radiological Society of North America)

2-4-2. CT Appearance

2-4-2-1. Inflammatory disease:

CT scanner can be helpful in the diagnosis of acute and chronic sinusitis.

Acute Sinusitis: Opacification, air-fluid level and thickened localized mucosa. Non-specific CT finding, including thickened turbinate or diffusely thickened sinus mucosa, may be associated with several sinonasals conditions.

Chronic Sinusitis: Include mucosal thickening, air cells, bony remodeling, narrowing or blockage of the osteomeatal unit and bony thickening due to inflammatory osteitisod the sinus cavity. Bony erosion can occur in severe cases, especially if associated with massive polyps, mucocele, sinonasal tumors or granulomatous disease processes.

Sinonasal polyps: Sinonasal polyps appear on CT scan as nodular or rounded masses in the nasal cavity, with widening of the infundibulum, opacification of the sinuses, and thinning of sinus walls and the nasal and ethmoid septa. Bony remodeling can occur.

Mucocele: On CT Mucocele have mucoid attenuation collection with remodeling of the wall. The bone may be locally thinned or erroded.

Frontal Sinus Mucocele: CT will show the full extent of the expansion of the sinus.

Sphenoid Sinus Mucocele: CT shows rounder or partially rounded expansion of the sinus.

Fungal Sinusitis: Can be divided into invasive fungal sinusitis, chronic noninvasive fungal sinusitis (Mycetoma), and allergic fungal sinusitis.

Invasive Fungal Sinusitis: On CT appears as a high-density central mass separated by mucoid secretion. Area of calcification may be present and may be diffuse, nodular or linear and may be accompanied by bone expansion and bone destruction.

Noninvasive fungal sinusitis (Mycetoma): CT finding may include localized sinus, opacification, homogenous mass that does not change

shape with head position and a mass with presence of calcification (found in 25% of cases).

Allergic fungal sinusitis (AFS): On CT scan heterogeneous opacification can be seen with a typical pattern of central hyper dense area of opacification surrounded by less dense areas of opacification and calcified areas can seen sometimes. Bony destruction can be seen in advanced cases.

2-4-2-2. Granulomatous diseases:

There are non-specific finding on imaging. A diagnosis of granulomatous disease should be considered when there is evidence of nasal mass with septal erosion on imaging.

2-4-2-3. Tumors of the paranasal sinuses:

Benign Tumors: CT finding as very dense lesion if the osteoma comprises compact mature bone and may be confused with retention cysts or polyps.

Papilloma's: On imaging, the appearances of all Papilloma's can vary from a small nasal polypoid mass to an expansile nasal mass with remodeling of the nasal cavity and extension into the sinuses with secondary obstructive sinusitis. CT is required to stage these tumors in order to visualize the extent of tumors beyond the sinuses. CT is sensitive to bone destruction.

malignant tumors: CT is required to stage these tumors in order to visualize the extent of tumors beyond the sinuses. CT is sensitive to bone destruction.

Carcinoma of the sinuses: CT plays important roles in the staging of these tumors, the location and extent of disease.

Carcinoma appears as aggressive soft-tissue that occludes sinus Ostia, exhibit local soft-tissue invasion, and cause bone destruction.(john Vartaian,MD ,2005)

2-5. previous study:-

(A.Cowan ,1990) University of otago, New Zealand, studied the importance of CT scan in the discovering of sinuses pathology. And said that: CT imaging provides detailed information about PNS diseases and now well established as an alternative to standard radiographs, and the safety of surgery to the PNS is greatly improved by CT imaging.

(TM.Bernhardt, 1998). PhD Study in Otto-von-Guericke University, Germany. Compared axial CT with reconstruction in the coronal direction versus direct coronal CT (Pt prone or hyperextend position), studied in 52 pts , aged from (43-72) years & result that : Direct coronal CT scan position is a well established technique for: microsurgery of the PNS, The infundibulum region , septa deviation , blockage of infundibulum , osseous variations of the ethmoid sinus and mucous hyperplasia

The effect of pt lens dose is reduced when pt prone in direct coronal than in axial scan. Both dental fillings and motion (especially in hyperextend position) produce sever artifacts in direct coronal scanning & so limiting diagnostic quality.

Direct coronal images are significant proper diagnostic PNS disease incomparison to axial and reconstructed coronal.

(X.Chen, 1999) Xinjiang medical University, China. studied the application and evaluation of CT scan in the diagnosis of PNS diseases , studied in 20 pts and result that : The helical CT could reveal anatomical structure, the location and extent of the lesions .in addition CT pass easily through the spaces such as nasal sinuses, narrow nasal passages and the distal site of blocked area compared with nasal endoscopic examination. So CT technique provides a non invasive, economic and safe image logic

procedure and the used of MPR and CTVE combine with axial and coronal CT can increase the diagnostic information and improve the validity of diagnosis.

(N.Suojanen, 1993) compared the quality of direct coronal with reconstructed coronal. Studied a total of thirty pts their ages range from(21-79) years in (Siemens, Iselin, NJCT scanner) and result that the reconstructed images did not demonstrate minimal membranous thickening or some fine ethmoidalseption .and the direct coronal give more osteomeatal unit anatomy of Bony detail than reconstructed image.

(J.Beus, 1997) studied the coronal paranasal sinus CT using the spiral technique. And result that, Spiral CT is reduced the duration of sinuses examination because coronal scanning of PNS requires a prone position and hyperextension of the head as those positions are very uncomfortable for the patients Radiation exposure on the pts head surface is reduced by 3 mGy in the spiral mode compared with conventional mode.

(W.Mohr, 2000) studied the ct findings in pts with sinuses disease that were divided by age, and result that: age (39and younger), complained of facial pain, nasal discharge, and allergies diagnosed in CT as (Acute and chronic sinusitis)

pts aged from (40_59) related to environmental allergies diagnosed in CT as (polyps). aged (60_86) years highly susceptible to a distorted sense of smell diagnosed as (olfactory disorders).

Chapter Three

Materials & Methods

3-1. Place and time of the study:

This study was done in Ajman –Sheikh Khalifa Hospital –UAE CT departments, Data were collected in the period from April 2011 to October 2015.

3-2. Patient's population:

Random samples of (51) patients who were clinically have paranasal sinuses diseases. Undergo the CT examination for paranasal sinus.

The patients were registered (age, sex, CT coronal & axial findings was recording,).

3. 1 patients are females while the -20----- are males and their ages are ranged from 9-69 years.

3-3. Machine used:

For both scanning techniques (axial and coronal), Brilliance CT 64-channel scanner - Philips.

specification of the machine: Brailliance 64-channel scanner- Philips consist of these components:

- Operating station

  The operating station used to operate and monitor the scans being performed which consists of computing system , scan control box , monitor , keyboard and mouse , patient intercom , data storage device , automatic filming control device .

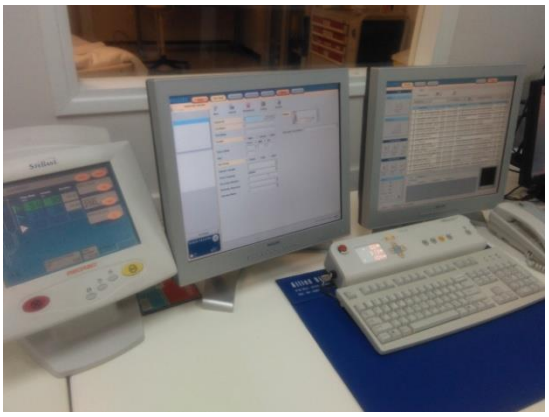


Figure 3.1 CT Scan control box

the box consist of a variety of buttons for controlling and displaying gantry tilt angle and patient table movements.

- Gantry

  The gantry provides and means of rotating the x-ray tube , beam elements , detectors , and front end electronics (FEE). The gantry panels (front and rear) are used to activate the laser marker, tilt the gantry , and control patient table movements.

Figure 3.2CT.Scan gantry

- Patient table

  The patient table moves the patient to the scan position through the use of the gantry control panel.

Figure 3.3 CT.Scan Table

Table 3-1 CT.cscan gantry and table specification

Gantry and table

Gantry

Feature	Specification
X-ray tube and Detectors Architecture	Third generation; Rotate-rotate
Rotation times	0.4*, 0.5, 0.75, 1, 1.5, 2 seconds for full 360° scans 0.28*, 0.33, seconds for partial angle 240° scans
Gantry aperture, mm	700mm
Intercom system	Two-way connection between the gantry and console areas
Gantry tilt, degrees	-30° to +30° with 0.5° increments
Controls located on Gantry (left and right, front and back)	Tilt, Couch In/Out, Couch Up/Down, Emergency Stop, X-Ray Indicator
Controls located at Operator's Console	Tilt, Couch In/Out, Couch Up/Down, Emergency Stop, X-Ray Indicator, Start Scan, Pause
Focus-detector distance	1040mm
Focus-isocenter distance	570mm

Table (3-2) CT.scangenerator specification

Generator

Feature	Specification
Output capacity	60 kW
kV	80, 120, 140 kVp
mA	20-500 mA; 1 mA increments

X-ray Tube

Feature	Specification
Anode storage capacity	8 MHU
Anode max cooling rate	1608 kHU/min
Focal spot (IEC)	Large: 1.0mm x 1.0mm Small: 0.5mm x 1.0mm
Anode diameter	200mm
Anode rotation speed	105 Hz (6300rpm)
Target angle	7°
Maximum On-Time (@ maximum power, 120kV, Large Focal Spot)	23 sec @ 500 mA

PRINTER

Figure 3.4 CT.scan printer

3-4. Technique:

CT scans typically obtained for visualizing the paranasal sinuses should include axial and coronal cuts.

Proper positioning of the patients head is important to obtain symmetrical image for both sides.

3-4-1 Axial View:

A patient was positioned laying supine with the head in axial head holder.

Scan was taken paralled to the orbitomeatal line, scan factors were as follow: 5mm slice thickness and 5mm interspaces, medium mA (77), scan time 4.8 sec, target image reconstruction for paranasal sinus field have been employed. Film and display window setting were paranasal sinuses (window width (ww) 300 Hu, window level (WL) 50 Hu) for evaluation of soft tissue, (window 2000 Hu, level 300 Hu) for evaluation of bone.

3-4-2 coronal view(direct):

Coronal images were obtained directly with the patient supine with the neck in hyperextension (hanging head) position.

The gantry was angled perpendicular to the hard palate. Scan factors were as follow, slice thickness 5mm, interspaces 5mm, medium mA (77), scan time 4.8 sec, image should be obtained at an intermediate setting of about(2000-2500 Hu) window width, (200-350Hu) window level, this provided details of bone and soft tissue.

3-4-3. Contrast:-

The type of contrast media was urographic (20ml) intravenous was injected just prior to scanning, can help defines soft tissue lesion and delineate vascularized structures such as vascular tumors, contrast enhanced CT is particularly useful in evaluating neoplastic and extension of this lesion to the brain and adjacent tissues.

3-4-4. Film evaluation:-

All films (axial and coronal) were evaluated by one radiologist and two technologists, and all patients were evaluated to identify the diseases that affected paranasal sinuses in coronal and axial views (inflammatory, sinonasal polyps, mucocele, fungal sinusitis, tumors of paranasal sinuses).

Chapter Four

Results

4.1Results

Table 4.1 show statistical parameters for patient age

	N	Minimum	Maximum	Mean	Std. Deviation
Age	51	8.0	65.0	34.529	14.0575

Table 4.2 shows frequency distribution for age group

Age group	Frequency	Percent
0-9	1	2.0
10-19	7	13.7
20-29	12	23.5
30-39	14	27.5
40-49	9	17.6
50-59	5	9.8
60-69	3	5.9
Total	51	100.0

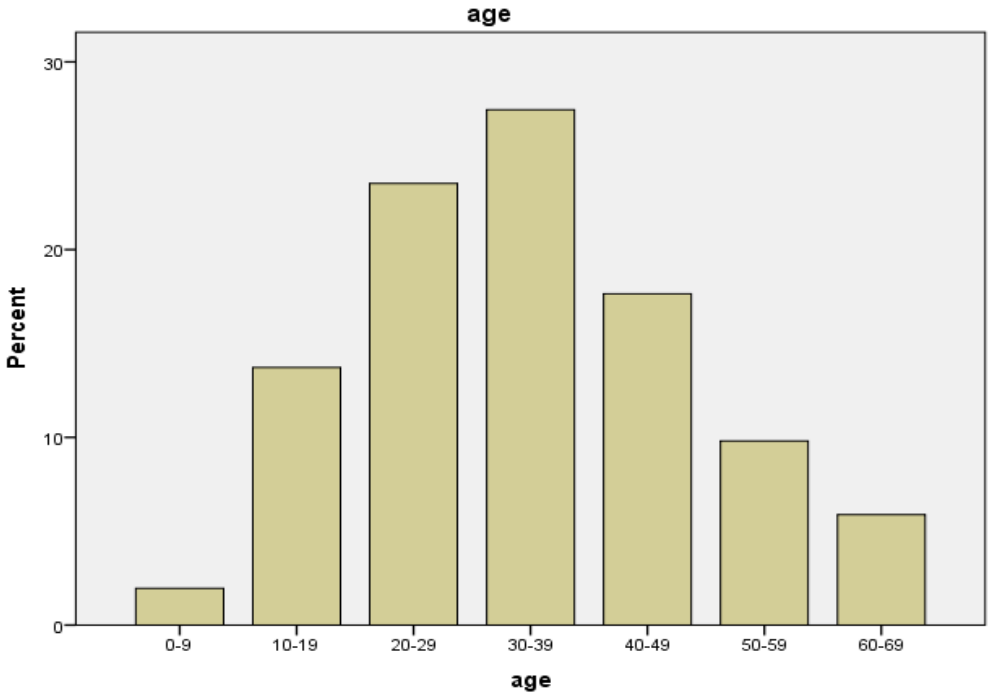


Figure 4.1 show frequency distribution of age

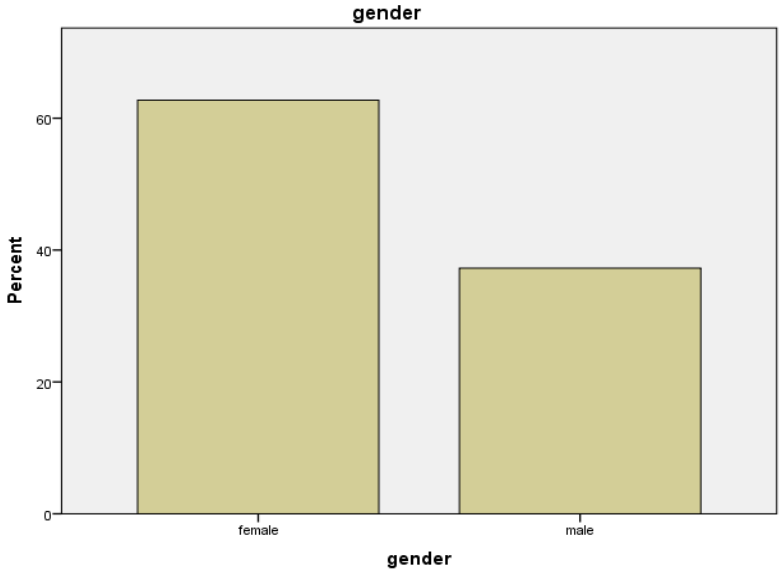


Figure 4.2 show frequency distribution of gender

Table 4.3 shows frequency distribution of CT result

CT result	Frequency	Percent
normal result	3	5.9
mild Mucosal line thickening	24	47.1
diffuse polyp	10	19.6
OMC occlusion	6	11.8
sever Mucosal line thickening	3	5.9
mild polyp	2	3.9
hypertrophy	2	3.9
cyst	1	2.0
Total	51	100.0

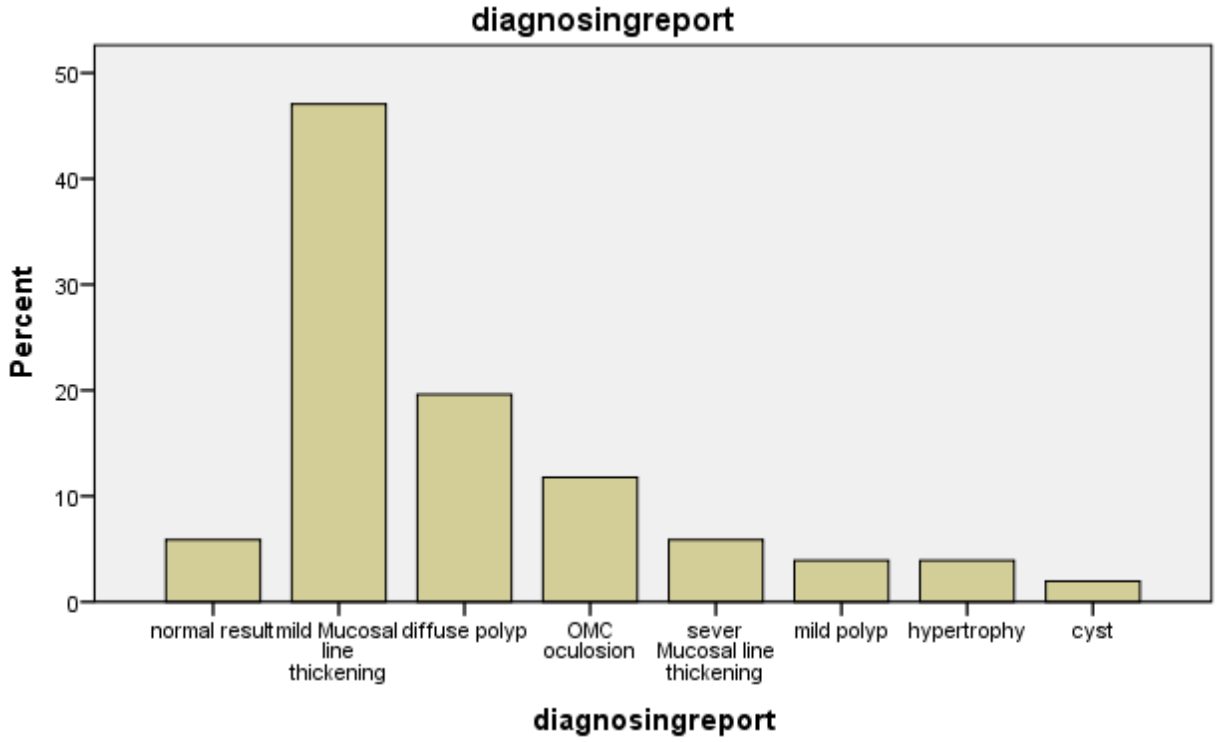


Figure 4.3 show frequency distribution of diagnostic report

Table 4.4 frequency distribution of Site of disease

Site of disease	Frequency	Percent
all PNS	16	31.4
both maxillary	11	21.6
RT maxillary	9	17.6
LT maxillary	2	3.9
frontal and maxillary	4	7.8
maxillary and ethimoidal	3	5.9
nasal area	4	7.8
sphinoid	2	3.9
Total	51	100.0

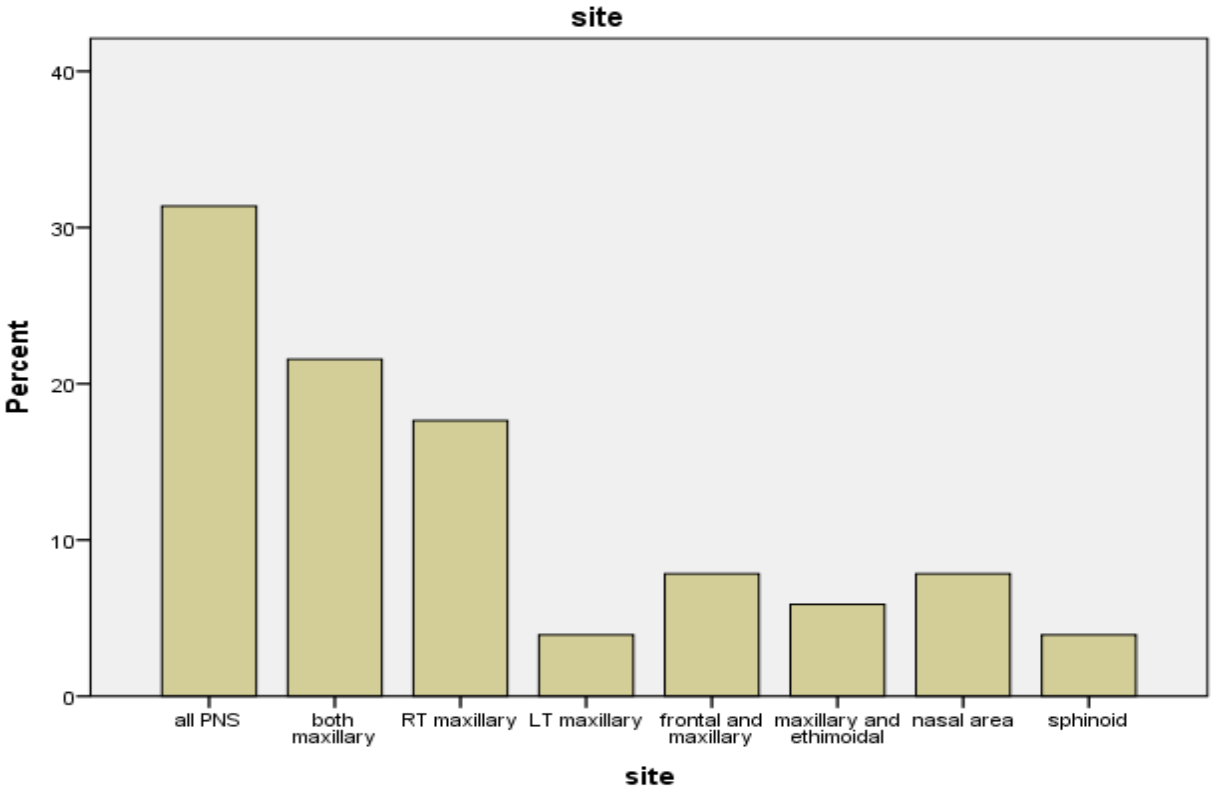


Figure 4.4 show frequency distribution of site

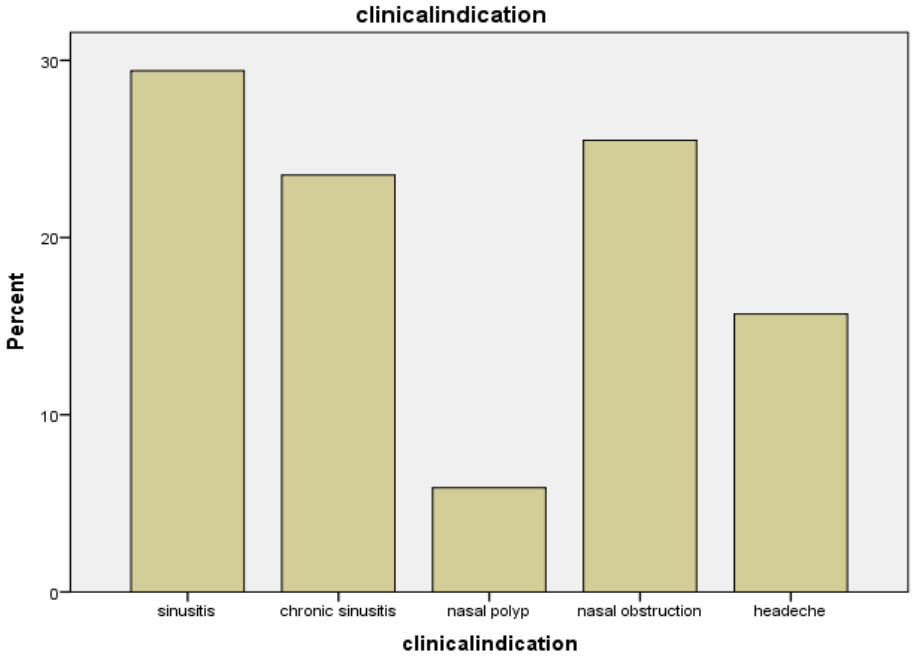


Figure 4.5 show frequency distribution of clinical indication

Table 4.6 shows the patient's gender in frequency and percentage

Gender vs findings	Gender		Total
	Female	Male	
normal result	3	0	3
mild Mucosal line thickening	18	6	24
diffuse polyp	4	6	10
OMC occlusion	2	4	6
sever Mucosal line thickening	3	0	3
mild polyp	1	1	2
Hypertrophy	1	1	2
Cyst	0	1	1
Total	32	19	51
Correlation were significant at $p<0.05$, $p=0.118$			

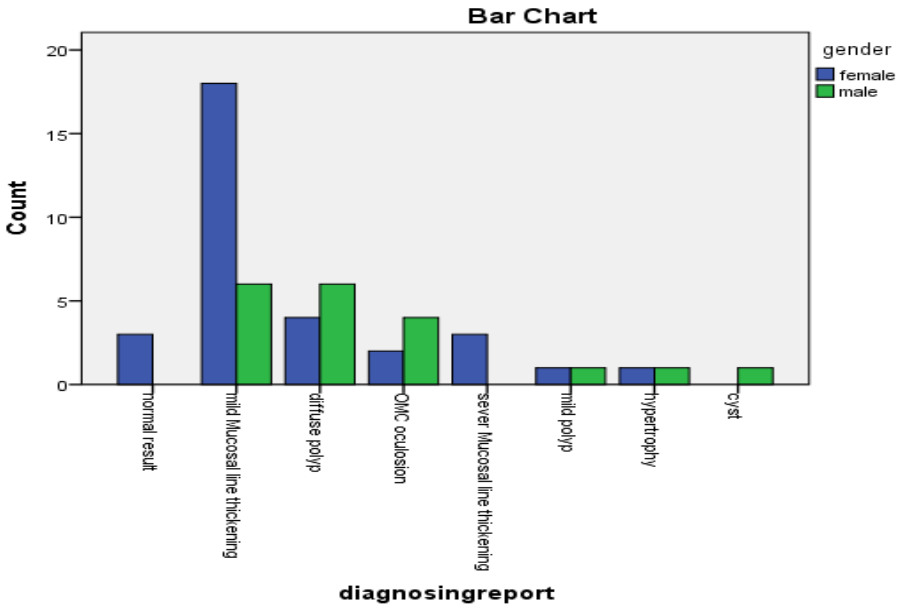


Figure 4.6 show correlation between the diagnostic report with gender

Table **4.7** Shows the frequency and percentage of affected side.

Site vs report	site								Total
	PNS	both maxillary	RT maxillary	LT maxillary	ntal and maxillary	Eth&max	sal area	henoid	
normal result	2	0	0	0	1	3	0	0	3
d Mucosal line thickening	9	7	2	1	1	24	2	1	24
liffuse polyp	1	2	4	1	0	10	0	1	10
MC oculosion	3	0	1	0	0	6	2	0	6
er Mucosal line thickening	0	1	1	0	0	3	0	0	3
mild polyp	0	0	0	0	2	2	0	0	2
Hypertrophy	0	1	1	0	0	2	0	0	2
Cyst	1	0	0	0	0	1	0	0	1
Total	16	11	9	2	4	51	4	2	51
Correlation were significant at p<0.05, p=0.147									

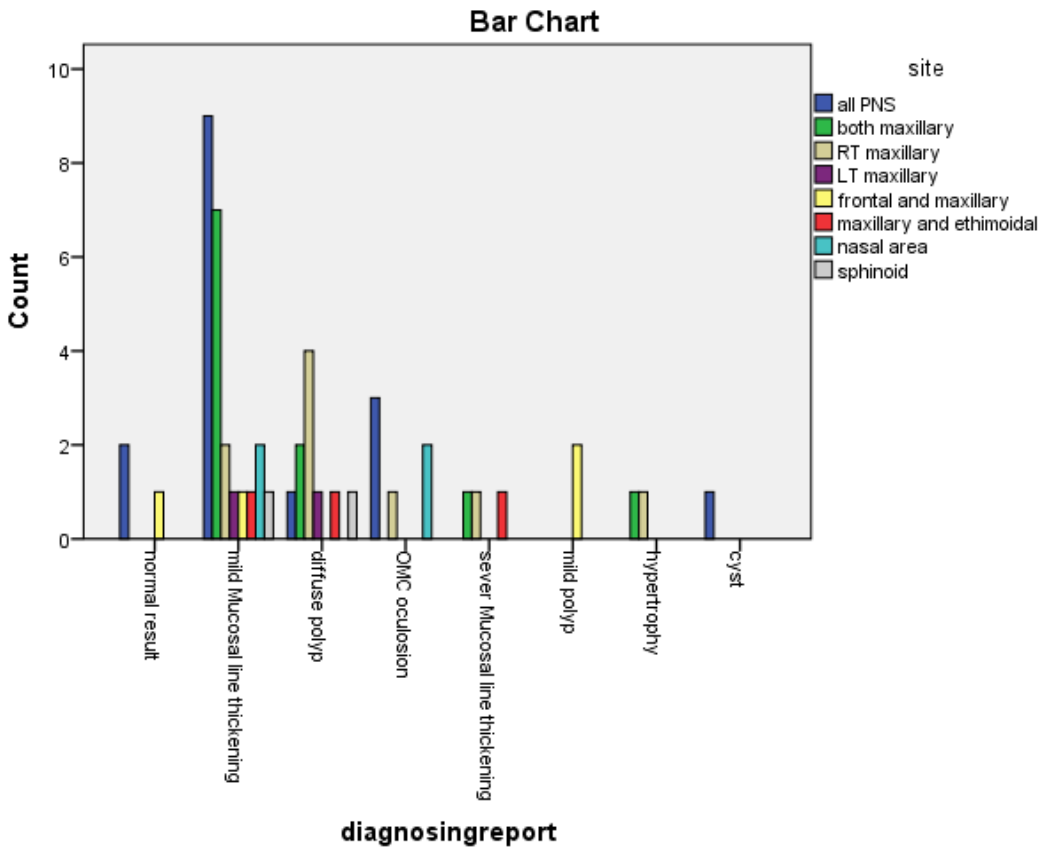


Figure 4.7 show correlation between the diagnostic report with site

Table **4.8** Shows the frequency and percentage of the clinical indications in the patients with sinuses diseases.

Clinical indication vs result	Clinical indication					Total
	sinusitis	chronic sinus	nasal poly	nasal obst	Headache	
normal result	1	0	0	0	2	3
mild Mucosal line thickening	5	7	1	7	4	24
diffuse polyp	4	1	0	4	1	10

OMC oculosion	2	2	1	1	0	6
sever Mucosal line thickening	2	0	1	0	0	3
mild polyp	0	0	0	1	1	2
Hypertrophy	1	1	0	0	0	2
Cyst	0	1	0	0	0	1
Total	15	12	3	13	8	51
Correlation were significant at p<0.05, p=0.432						

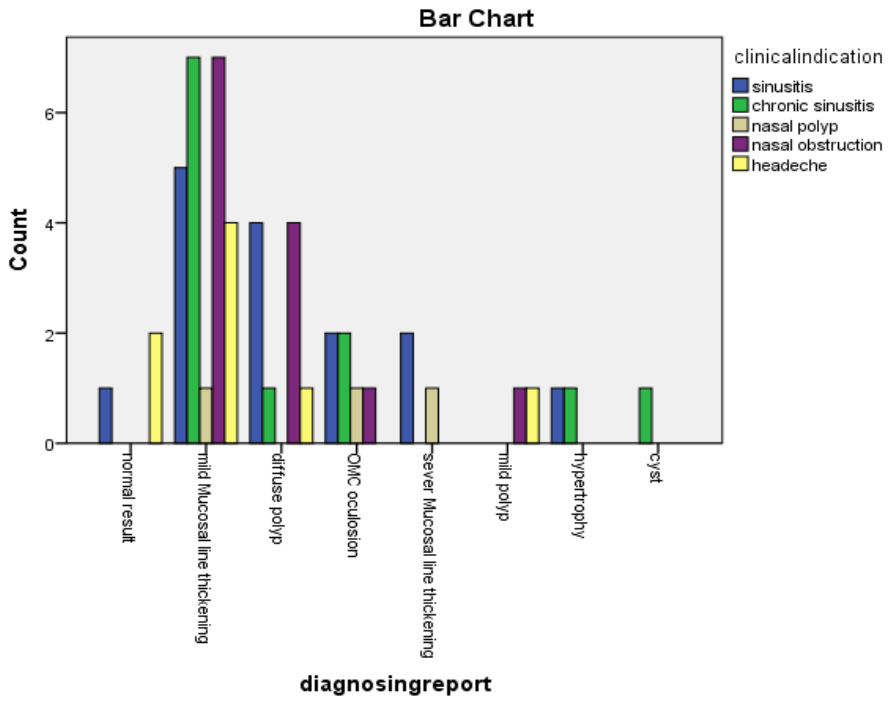


Figure 4.8 show correlation between the diagnostic report with clinical indication

Table **4.10** Shows a comparison between patient's ages and the sinuses diseases,

Age vs report	Age							Total
	)-9	10-19	0-29	0-39	0-49	0-59	0-69	
normal result	0	0	1	1	0	1	0	3
mild Mucosal line thickening	0	3	4	8	3	3		24
diffuse polyp	0	1	2	4	3	0	0	10
OMC oculosion	0	2	3	0	1	0	0	6
ever Mucosal line thickening	0	0	2	1	0	0	0	3
mild polyp	1	0	0	0	1	0	0	2
hypertrophy	0	1	0	0	0	1	0	2
Cyst	0	0	0	0	1	0	0	1
Total	1	7	12	14	9	5	3	51
Correlation were significant at $p<0.05$, $p=0.053$								

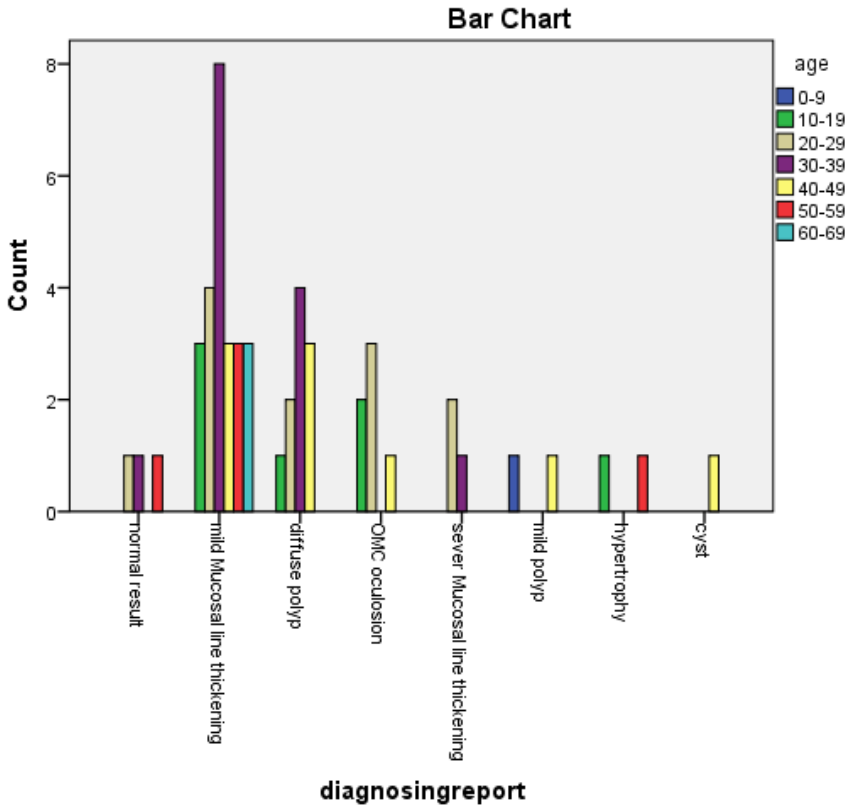


Figure 4.9 show correlation between the diagnostic report with Age

5.1 Discussion:

Table 4.1 show statistical parameters for the age for all patients as mean ± standard deviation, and it was 34.53 ± 14.06. table 4.2 show frequency of age group distribution for all patients, were the patients from 30-39 years was more frequently 14 times, the patients from 20-29 years repeated 12 times. As shown in fig 4.1.

Figure 4.2 show gender distribution for all patients shows as frequency and percentage.

CT results as frequency distribution for all patients in table 4.3. and fig 4.3 show the frequency distribution of diagnostic reports for all patients.

Table 4.4 show frequency distribution of disease site for all patients as shown in fig 4.4.

Figure 4.5 frequency distribution for clinical indication for all patients.

Correlation between the gender and finding shows that the patients with mild mucosal line thickening was more frequently for the gender (18 female and 6 male) in table 4.6 and fig 4.6.

Table 4.7 show that the correlation between the site of disease with report were the patients with mild mucosal was more frequently in all sites.

Table 4.8 show correlation between the clinical indication with results were the mild mucosal was higher indication among other clinical indication fig as 4.8.

5.2Conclusion:

CT SCAN is playing important role in diagnostic of sinusitis (acute& chronic) ,mycocele , osteomyelitis , etc. 1% of carcinoma disease of sphenoid and frontal sinuses can be shown. MRI is more sensitive than CT. in detecting fungal infection .

The flexible fiberopticrhinoscope allows direct visualization of the nasal passages and sinus drainage areas (ostiomeatal complex) and is complementary to CT. The research show that female patient percentage in sinusis disease more than male. Study show ethmoidal sinusitis more affected than other.

Chronic sinusitis is the highest percentage in clinical indication among the patient in studies sample. The most affected age among the patient is 0-39 y about 27.5% .

5.3 Recommendations:

The study end within the following recommendations:

- Two images planes (axial, coronal) should be perform together for any patients complain of paranasal sinuses problem.
- Direct Coronal view should be performs as an essential view to give accurate diagnosis.
- Well trained radiologist and technologist are important for well medical service management.
- Further studies could be made to compare between CT scan technique and other modalities to explain the suitable technique that produce highly quality image and more diagnosable.

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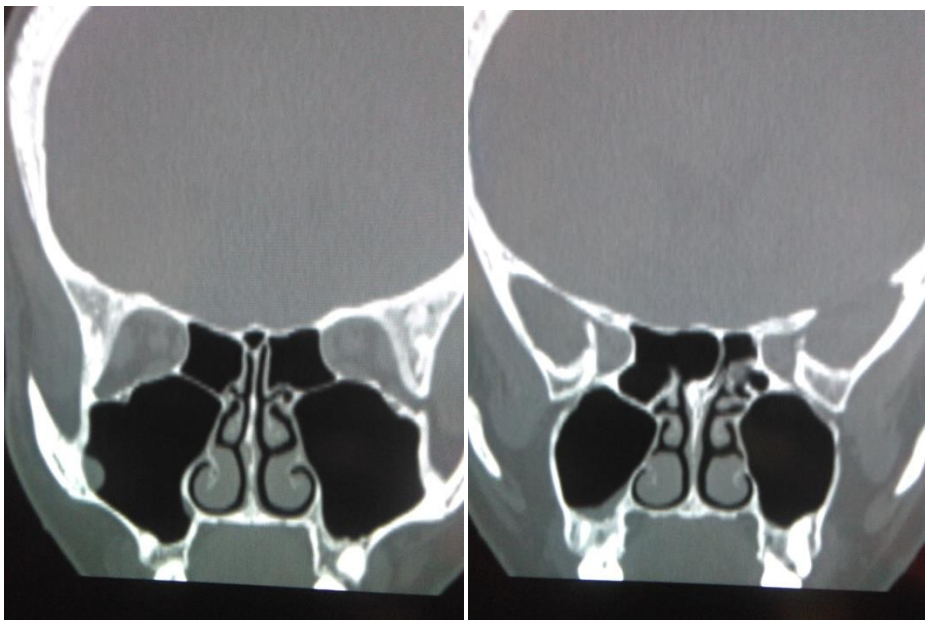
Appendices



Name: khulood karim

Age:34y

Sex : female

Diagnosis: soft tissue polypoidal mucosal thickenings are seen in RT maxillary suggestive of sinusitis. Mucosal hypertrophy of both inferior nasal turbinates more evident on Rt side.

Nasal septum is minimally convex deviated to Rt side at upper part.

Name : mohammad Hassan

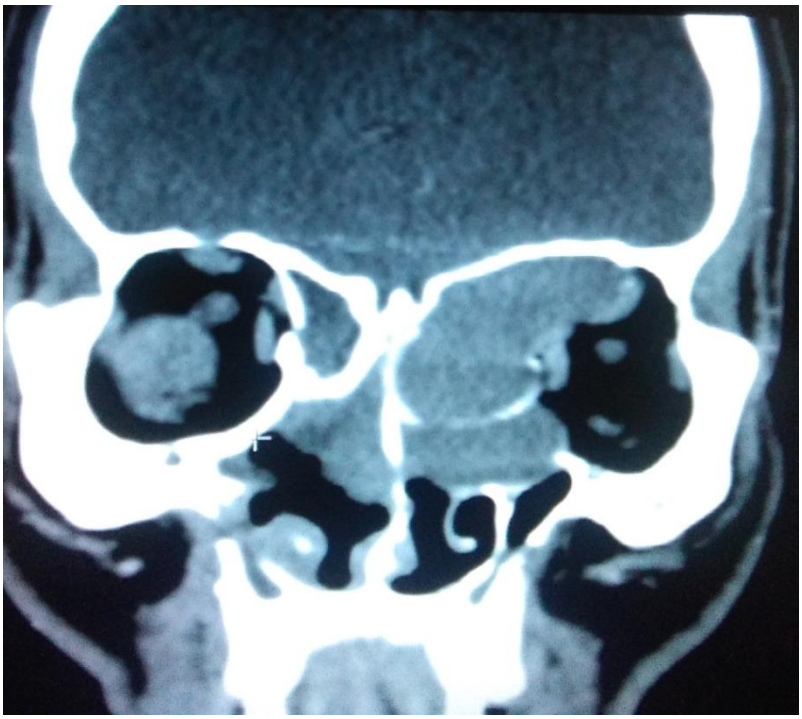
Age : 59 years

Sex : male

Diagnosis : irregular hyper atrophied nasal turbinates seen with thickened nasal turbinates , wavy nasal septum. Patent OMC.

Mild mucosal thickening noticed at maxillary, frontal sinus.

Changes of chronic sinu rhinitis .



Name : nabel bahari

Age : 49 years.

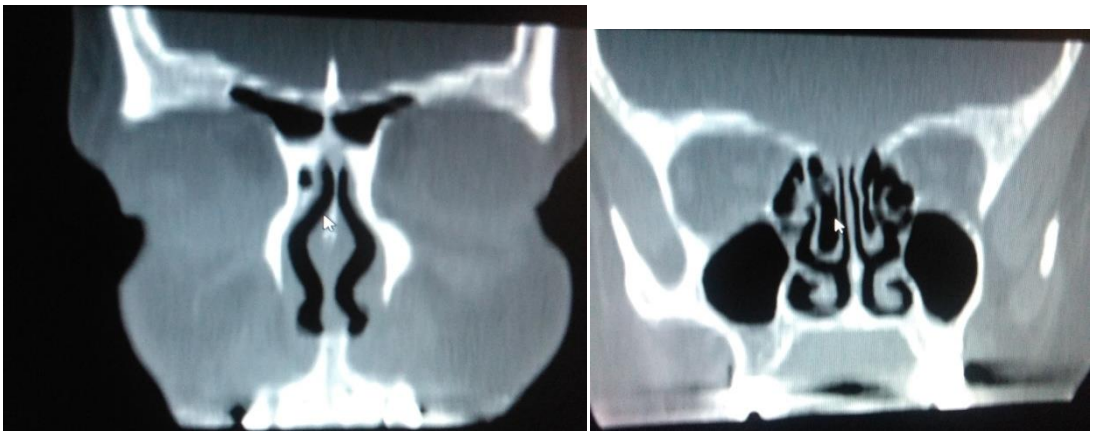
Sex : male

Diagnosis :

Generalized polypoid mucosal thickening of paranasal sinuses more sever at Lt.ethmoid sinus,expanding the sinus cavity eroding the lamina papyracea protruding to the Lt. orbit displacing the orbital content anterolaterally .

The Lt. frontal sinus also expand by the thickened mucosa.

Loss of the medial wall of the RT. Maxillary antrum (previous surgery ?? erosion).



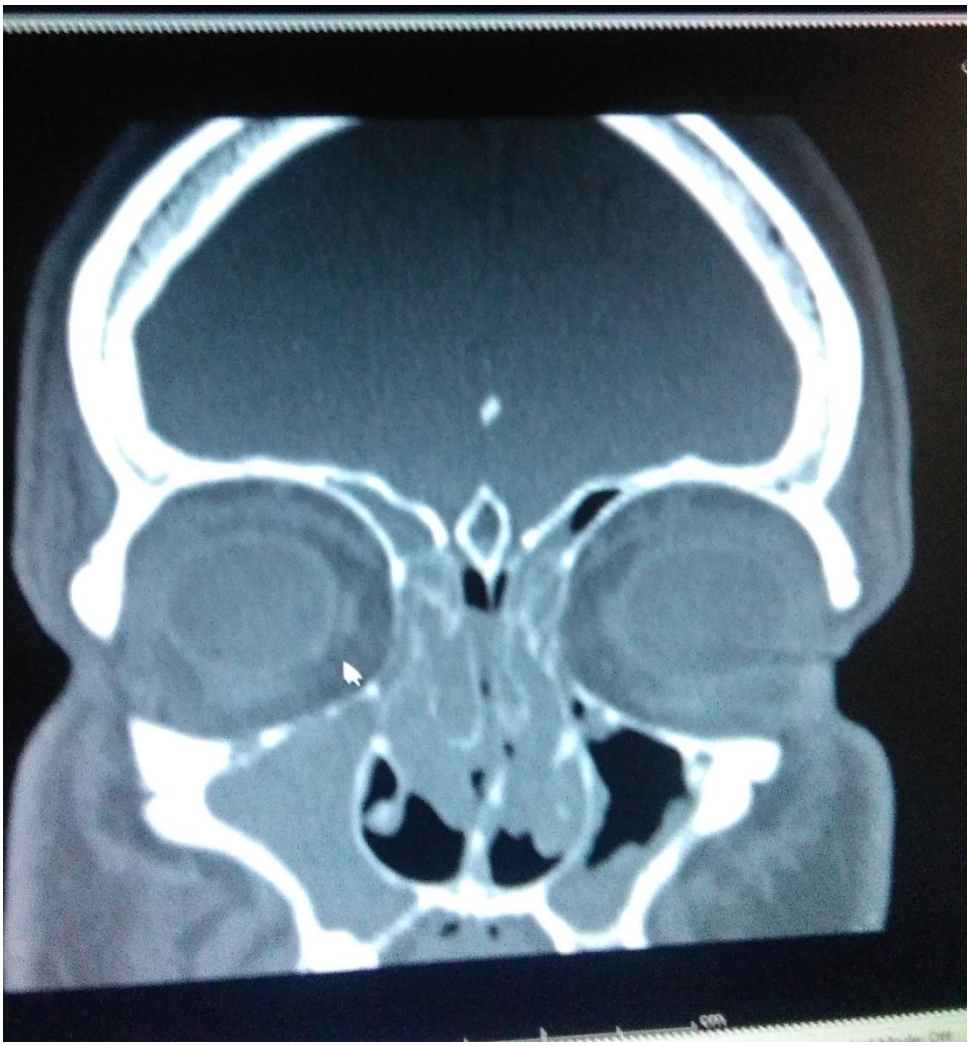
Name : amna ahmes

Age : 58 years

Sex : female

Diagnosis :

Normal CT. appearance & average normal aeration of the examined paranasal sinuses .they display intact bony & mucosal outlines.no evidence of intra-antral masses,polypes or fluid were detected.



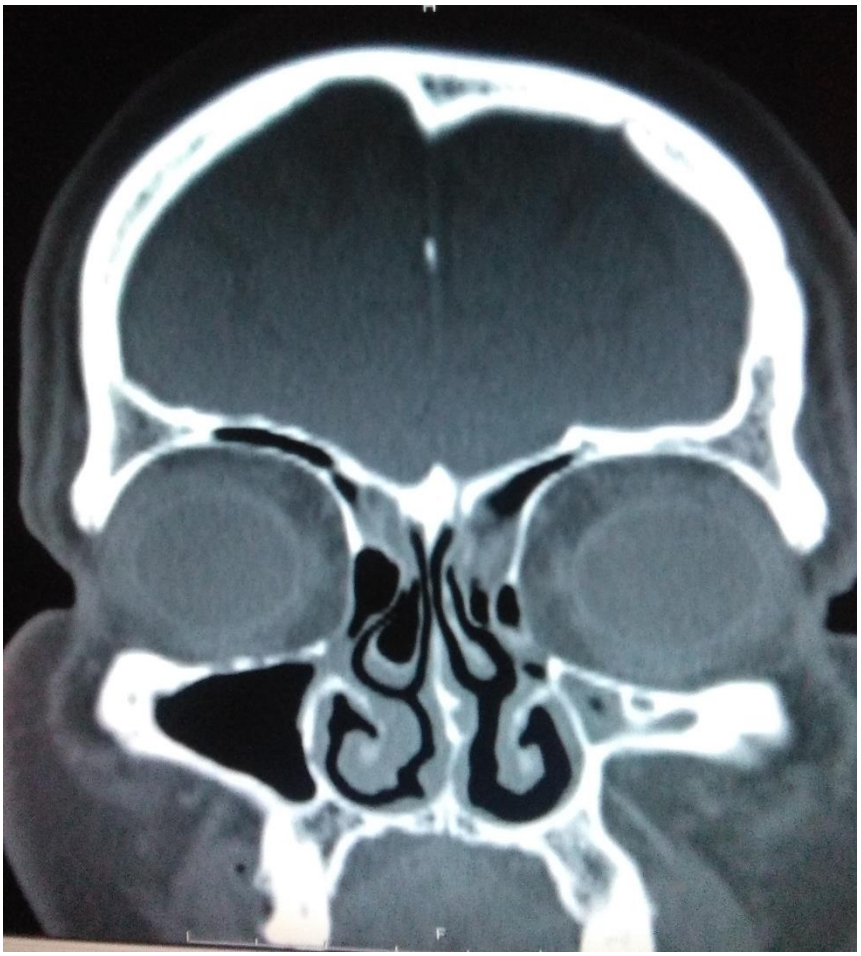
Name :khaled nor

Age : 29 years

Sex: male

Diagnosis : extensive soft tissue mucosal polyposis are seen involving both maxillary, both ethmoidal & both sphenoidal sinuses

Obliterating nasal cavity & paranasal sinuses , opacification of both frontal sinuses., lobulated soft density mass protruding into lower nasal cavity .



Name : taleb mohammed

Age : 65 years

Sex : male

Diagnosis : mild peripheral mucosal thickening at both frontal , ethmoids and left maxillary sinuses with nasal septal deviation to the left and left small nasal spur .