Sudan University of Science & Technology

College of Graduate studies

Evaluation of Para-nasal Sinuses Common Pathology using Computed Tomography

تقويم أمراض الجيوب الأنفية الشائعة باستخدام الاشعة المقطعية

A Thesis submitted in Partial Fulfillment for M.Sc. Degree in Diagnostic Radiology Technology

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الآيـة

بسم الله الرحمن الرحيم

قال الله تعالى:

(قُلْ لَوْ كَانَ الْبَحْرُ مِدَادًا لِكَلِمَاتِ رَبِّي لَنَفِدَ الْبَحْرُ قَبْلَ أَنْ تَنْفَدَ كَلِمَاتُ رَبِّي وَلَوْ جِئْنَا بِمِثْلِهِ مَدَدًا (*) قُلْ إِنَّمَا أَنَا بَشَرٌ مِثْلُكُمْ يُوحَى إِلَيَّ أَنَّمَا إِلَهُكُمْ إِلَهٌ وَاحِدٌ فَمَنْ كَانَ يَرْجُو لِقَاءَ رَبِّهِ فَلْيَعْمَلْ عَمَلًا صَالِحًا وَلَا يُشْرِكْ بِعِبَادَةِ رَبِّهِ أَحَدًا(*))

صدق الله العظيم

سورة الكهف

Dedication

To my parents To my sisters My brothers

To everyone whom give me a bit of wise advice

Acknowledgment

Grateful thanks and grace to Allah for guiding and helping me finishing this research.

I would like also thanks to Dr. Afraa Siddeg Hassan Omer for her continuously helping, guiding and supervision.

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Abstract

This study was a descriptive analytic study. The main objective of which study was to evaluate of the effectiveness of computed tomography in the diagnosis of para- nasal sinuses diseases.

The study was carried out at the Modern Medical Center and Kuwait Hospital during the period from November 2017 to January 2018, and the data were collected from these two hospitals .CT machine (Optima /GE Health Care) 64- slice was used in obtaining the images. This study included random samples of 100 patients (73 males and 27females) with ages between (20 to 60) years old.

The study has come out with many result including that the incidence of sinus pathology is higher in males(73%) than in females (27%). The most affected age groups were the ages between (51-60) years and pathology was most commonly seen in the maxillary sinuses (46%), ethmoid sinuses (30%) ,frontal sinuses (13%), and sphenoid sinuses (11%) .

The sinusitis was the most frequently observed abnormality in males (58.9%) and in females (55.56%).

The results also showed that using CT technique was highly accurate in the diagnosis of inflammatory conditions and their complications. It is also a very sensitive modality for detection, accurate localization and determination of exact extent of para-nasal sinus neoplasm. Various important anatomical variants can also be easily detected on CT of paranasal sinuses.

مستخلص الدراسة

تعتبر هذه الدراسة وصفية تحليلية وكان الهدف الاساسي منها هو تقييم فعالية الأشعة المقطعية في تشخيص أمراض الجيوب حول الانف.

تم إجراء هذه الدراسة في مركز الطب الحديث والمستشفى الكويتي حلا الفترة من نوفمبر 2017 الي يانير 2018 وقد تم جمع البيانات من هذين المستشفيين وقد تم استخدام جهاز الاشعة المقطعية (اوبتما جي-اي الرعاية الصحية) ونوع الشريحة 64 .شملت هذه الدراسة عينة عشوائية بعدد مائة مريض (73 ذكور و 27إناث)

خرجت الدراسة بنتائج مفادها ان حدوث مرض الجيوب الانفية حول الانف شائع اكثر في الذكور(73%) منه في الاناث (27%) وكانت اكثر الاعمار إصابه هي في الفئه العمرية (60-51سنه) وكانت اكثر الاصابات في جيوب الفك العلوي (46%) تليها اصابات الجيوب الغربالية (30%) ثم اصابات الجيوب الانفية الجبهية (13%) ثم اصابات الجيوب الانفية الوتديه (11%).

وكانت اكثر الاصابات حدوثا عند الذكور هي التهابات الجيوب الانفية (58.9%) وعند الاناث (55.56%) .

أظهرت الدراسة ايضا ان استخدام الأشعة المقطعية هو الأكثر دقة في تشخيص التهابات الجيوب الأنفية ومضاعفاتها وكذلك هي الأكثر حساسية في اكتشاف وتحديد الموقع والامتداد الصحيح لاورام الجيوب الأنفية جوار الانف كما انه يمكن اكتشاف كثير من التغيرات التشريحة في الجيوب الأنفية بسهولة باستخدام الأشعة المقطعية .

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Abbreviation

CT	Computed Tomography
CBCT	Cone-beam computed tomography
LCPL	Lateral Cribriform Plate Lamella
MRI	Magnetic resonance image
MPR	Multi planer Reformation
OMC	Ostiomeatal Complex
PNS	Para-nasal sinuses

Chapter One

Introduction

Chapter One
Introduction

1.1 Introduction

Computed tomography has be method of the choice for many routine and clinical applications, It provides good image quality for body per rotation of 1 to 2 times the X- ray beam collimation, Using (MPR) recent advance in CT allows the a quoin of high resolution image in many planes.

CT now is standard examination techniques in diagnosing of PNS disease, CT scan are special x-ray tests that produce cross sectional images of the body using x-ray and a computer, CT produces a volume of data that can be manipulated through a process known as "windowing" in order to demonstrate various body structures, CT is non invasive, safe, and well to leafed. It provides a highly details look at many different parts of the body. (Kennedy et al 2001)

CT scan are used to evaluate the brain, neck, spine, chest, abdomen , pelvis and sinuses.

The PNS are hollow air filled spaces locates within, the bones of face and surrounding the nasal cavity. And consist of four pains of sinuses There are only two planes are common for imaging the sinuses coronal and axial (Yousem 1993).

Many Sudanese people complain of sinuses diseases routinely sent to CT department and obtain cuts which can diagnosis the PNS disease accurately.

1.2 Research Problem:

Conventional x-ray was more frequently used to detect the bony and PNS disease using more complicated positions than the routine skull x-ray more over it can’t detect the whole changes and all disease of the PNS is difficult to be diagnosed directly using routine x-ray images of PNS.

1.3 Objectives:

1.3.1 General objectives

The aim of this study is to Evaluation of Para-nasal sinuses common pathological Findings using computed tomography.

1.3.2 Specific objectives:

- To evaluate PNS common abnormality using CT scan.
- To correlate between age and pathological finding.
- To correlate between disease and patient gender.
- To characterize common side of pathology by using CT number.

1-4: Overview of this study:

This study was consists of five chapters, chapter one contains general introduction about the CT scan of PNS, problem of the study, general and specific objectives, in addition to overview of the study.

Chapter two includes the literature review which contains the general theoretical background and previous studies about detection of this disease during computed tomography scan for PNS.

Chapter three contains methodology materials and methods.

Chapter four contains result of presentation of final finding of study and chapter five includes discussion, conclusion and recommendations. Finally, there are lists of references and appendices.

Chapter Two

Literature review

Chapter Two

Literature review

2.1 Anatomy of Para nasal sinuses

The para nasal sinuses are air filled spaces located within the bones of the skull & face, they are central on the nasal cavity they are four sets of paired sinuses are:

2.1.1 Maxillary sinuses

The maxillary sinus is the largest P.N.S and found inferior to the eyes in the maxillary bone; it is the first sinus to develop and filled with fluid at birth.

The shape of the sinuses is a pyramid the natural osmium of the maxillary sinuses is located in the superior portion of the medial wall.

The roof of the maxillary sinuses is the floor of the orbit. The maxillary sinuses is supplied by branches of the internal maxillary artery which include the infra orbital, alveolar, greater palatine, and spheno palatine arteries. (Ameet Singh et- al 2013)

2.1.2 Frontal sinuses

The frontal sinus is housed in the frontal bone superior to eyes in the forehead. The frontal sinuses are funnel. Shaped structures with Ostia located in the most dependent portion of the cavities, the posterior Wall of the frontal sinus much thinner than the anterior wall. It is supplied by sub orbital and supra orbital and subratrochlear arteries of the ophthalmic artery. (A meet Singh et- al 2013)

2.1.3 Ethmoide Sinuses

The ethmoide Sinuses forming several distinct air cells between the eyes. The shaped like pyramids and divided by thin septa, the ethmoide labyrinth may extend above the orbit, lateral and superior to the sphenoid, above the frontal sinuses and into the roof of the maxillary sinuses and supplied by the anterior and posterior ethmoidal arteries. (Ameet Singh et- al 2013)

2.1.4 : Sphnoid sinus

Originates in the sphenoid bone its full size by late ten age years, the thickness of wall variable. It supplied by the sphenopalative artery.
(A meet Singh et- al 2013).

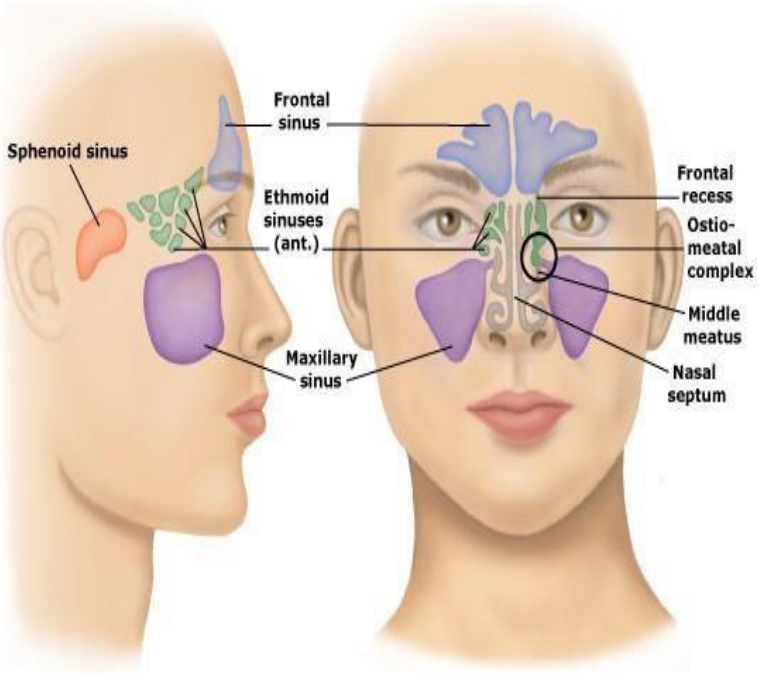

Figure (2-1): Anatomy of Para -nasal sinuses (Zollikofer, 2008)

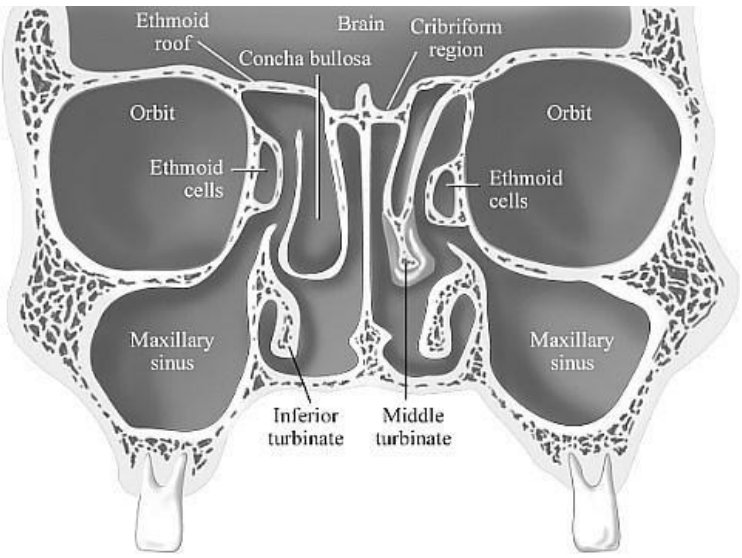

Figure (2.2): Anatomy Coronal views of the Para-Nasal sinuses (Stam et al, 2011)

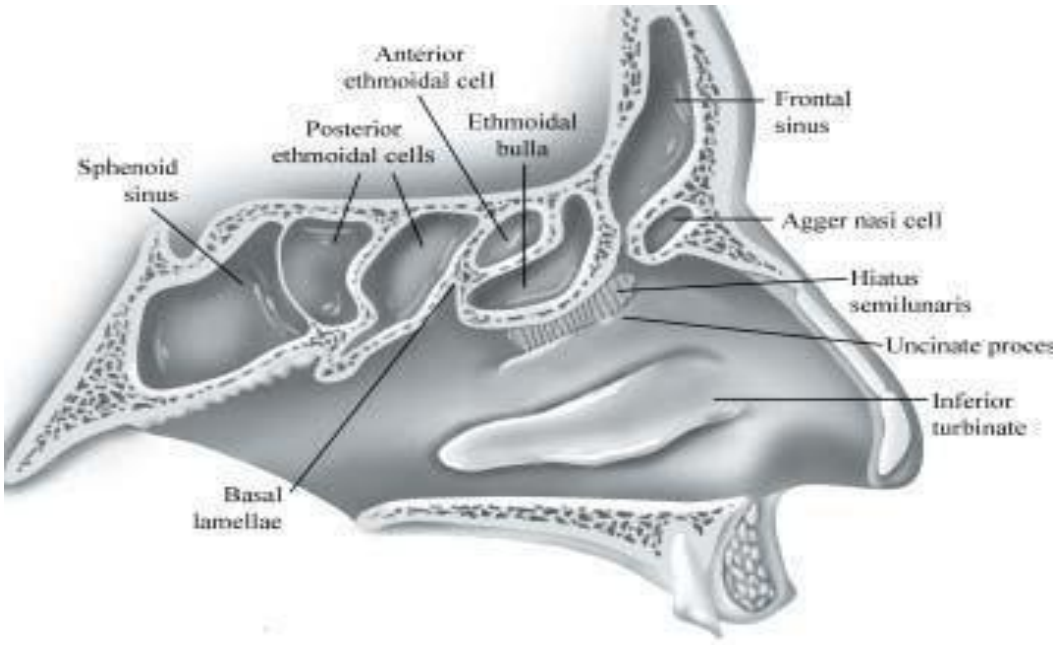

Figure (2.3): Anatomy sagittal views into the Para-Nasal sinuses (Stam et al, 2011)

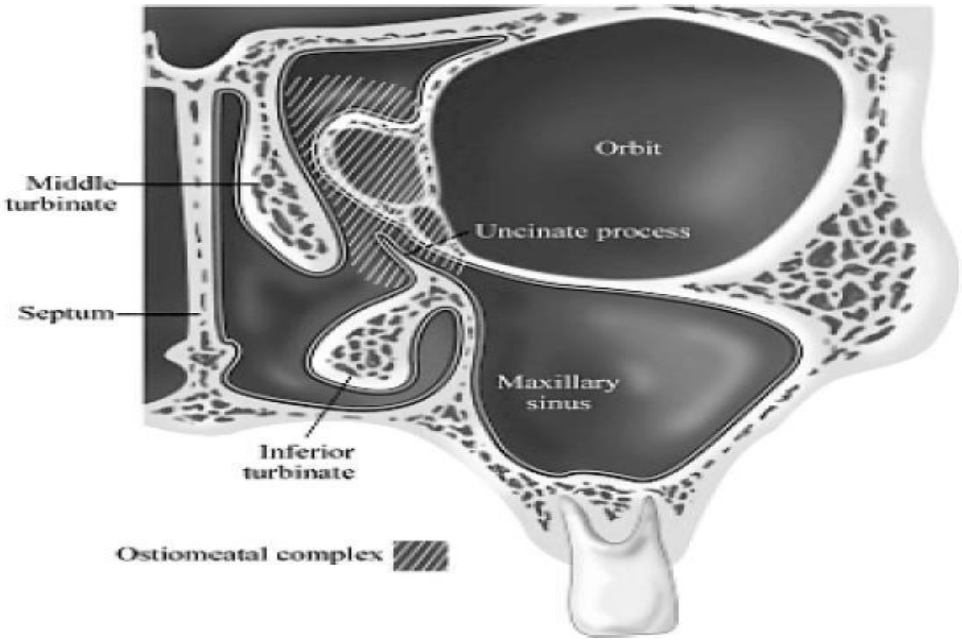

Figure (2.4): The maxillary, frontal, and ethmoid sinuses drain into the middle meatus, which is bordered by the middle turbinate bone. (Stam et al, 2011)

2.2 Gross Anatomy

2.2.1. Ethmoid bone

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

The cribriform plate contains numerous perforations that transmit olfactory fibers to the superior turbinate and the superior portions of the nasal septum and middle turbinate.

The perpendicular plate of the ethmoid connects with the quadrangular cartilage anteroinferiorly and the vomer posteroinferiorly to form the nasal septum (Weissman, 2008).

2.2.2 Ethmoid roof (fovea ethmoidalis)

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

The fovea ethmoidalis slopes inferiorly when travelling in an anteriorto-posterior or lateral-to-medial direction along the skull base.

Understanding this orientation is important for preventing inadvertent entry into the skull base during endoscopic sinonasal procedures.

The roof of the ethmoid is composed of a thicker horizontal portion, called the orbital plate of the frontal bone, and a thinner vertical portion, called the lateral cribriform plate lamella (LCPL). The orbital plate comprises most of the ethmoid roof, with the LCPL forming a small medial portion. The height of the LCPL defines the depth of the olfactory cleft, where dura is

closely adherent to the bone. The bony thickness of the LCPL ranges from 0.05 mm to 0.2 mm and provides little resistance to injury (Weissman, 2008).

2.2.3 Lateral nasal wall

2.2.3.1 Turbinates

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

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

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

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

Preserving the anterior buttress, posterior buttresses, and vertical lamella of the turbinate during surgery is important to prevent lateralization of the turbinate and consequent obstruction of outflow. Preservation of the inferior

portion of the horizontal lamella further decreases the risk of turbinate lateralization (JOHN, 2008)

2.2.3.2 Uncinate process and ethmoid infundibulum

The Uncinate process is a saber-shaped ethmoid bone that attaches to the lateral nasal wall through multiple bony and fibrous attachments.

The Uncinate lies lateral to the middle turbinate and has a free edge that runs from the maxillary sinus ostium inferiorly to below the frontal recess superiorly. The Uncinate forms the medial wall of the ethmoid infundibulum, a 3 dimensional space that accepts drainage from the maxillary, frontal, and anterior ethmoid sinuses.

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

The uncinate process usually attaches to the medial orbital wall superiorly but may attach to the skull base or the middle turbinate.

The site of attachment of the uncinate influences the drainage pattern of the frontal sinus. When attached to the medial orbital wall, the frontal sinus drains into the middle meatus, defined by the space under the middle turbinate. If the uncinate process is attached to the skull base or the middle turbinate superiorly, the frontal sinus drains directly into the infundibulum (Bodino C, 2004).

2.2.3.3 Ethmoid bulla and semi lunar hiatus

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

The space between the lateral/inferior surface of the ethmoidal bulla and the superior surface of the Uncinate process is called the hiatus semilunaris

(semi lunar hiatus). This 2-dimensional space connects the infundibulum to the middle meatus.

If the ethmoidal bulla has a posterior surface, the space between the bulla and the basal lamella is called the retrobullar recess or sinus lateralis. The 2-dimensional opening into the retrobullar recess is called the hiatus semilunaris posterior (posterior semi lunar hiatus).

The retrobullar recess may communicate with the suprabullar recess, which is a cleft that forms between the superior surface of the ethmoidal bulla and the fovea ethmoidalis.

The basal lamella represents the division between the anterior and posterior ethmoidal cells. Anterior ethmoidal cells drain into the middle meatus via the ethmoid infundibulum. Posterior ethmoidal cells, which are fewer in number, drain into the superior meatus (.(Bodino C, 2004).

2.2.3.4 Ostiomeatal complex

The Ostiomeatal complex represents a 3-dimensional space that is bordered by the lamina papyracea laterally, the middle turbinate medially, the frontal recess superiorly, and the maxillary sinus ostium inferiorly. This space includes the Uncinate process, ethmoid infundibulum, semi lunar hiatus, and clefts between Uncinate and middle turbinate and between ethmoid bulla and middle turbinate. Chronic inflammation and edema of the OMC causes anatomic and functional obstruction, leading to chronic inflammation of sinuses draining into the area (Bent J etal , 2015)

2.2.3.5 Haller cell (infraorbital ethmoid cell)

The Haller cell, or infraorbital cell, is an anterior ethmoidal cell that pneumatizes into the maxillary sinus ostium just below the inferior orbital wall. The presence of a Haller cell may contribute to persistent maxillary sinus disease in some cases of chronic sinusitis. This is typically secondary to mucosal inflammation of the common wall between the Haller cell and the maxillary sinus ostium (Bent J etal, 2015)

2.2.3.6 Accessory Ostia

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

2.2.4 Frontal recess (sinus)

In broad anatomic terms, the frontal recess is bordered posteriorly by the sloping anterior skull base and anteriorly by the beak of the frontal process. Its anatomy is made complex by the wide variety of anterior ethmoidal cells that populate the space.

Some of the more common frontal recess cells include the agger nasi cell, supraorbital ethmoid cell, interfrontal sinus septal cell, frontal bulla cell, suprabullar cell, and 4 types of frontal cells (types I-IV). The most prominent cells include the agger nasi cell, supraorbital cell, and 4 types of frontal cells.

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

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

2.2.5 Agger nasi cell

The agger nasi cell is the most anterior of all the ethmoidal cells found in the lacrimal bone anterior and superior to the anterior buttress of the middle

turbinate. It is also the most prominent and constantethmoidal cell, characterized as the bulge in the lateral nasal wall and found in over 90% of computed tomography (CT) scans. It is the first anterior ethmoidal cell to undergo pneumatization.

The medial and posterior walls of the agger nasi cell often lie in close association with the vertical lamella of the middle turbinate and the skull base, respectively. The posterior wall usually represents the anterior face of the frontal recess. The superior surface (or cap) of the agger nasi cell, if left in place during frontal recess surgery, may contribute to iatrogenic frontal sinus obstruction (Bolger WE, 2014).

2.2.6 Supraorbital ethmoid cell

The supraorbital ethmoid cell is an anterior ethmoidal cell that pneumatizes into the orbital plate of the frontal bone. This cell extends over the orbit and sometimes pneumatizes all the way to the lateral wall. When extensively pneumatized, this cell may be mistaken for the frontal sinus or a septate frontal sinus. Often, this cell may be completely missed by the endoscopic sinus surgeon, especially when it is hidden behind the bulla lamella (Bolger WE,2014).

2.2.7 Frontal sinus cells

Four types of frontal cells pneumatize above the agger nasi cell, thereby contributing to the complexity of frontal recess anatomy. A type I frontal sinus cell lies above the agger nasi cell. A type II frontal sinus cell is a configuration of 2 cells stacked above the agger nasi cell. A type III cell is a large frontal sinus cell that pneumatizes into the frontal sinus and occupies nearly 50% of the sinus. Finally, a type IV frontal sinus cell is a single isolated cell that exists completely withinthe frontal sinus and has no connection to the frontal recess (Bolger WE,2014).

2.2.8 Sphenoid bone

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

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

2.2.9 Sphenoid sinus

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

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

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

2.2. 10 Pneumatization patterns

Pneumatization of the sphenoid sinus is highly variable and can extend as far as the clivus inferiorly, the sphenoid wings laterally, and the foramen magnum inferiorly. Pneumatization of the vast majority of sinuses reaches the sella turcica by age 7. Three majorpneumatization patterns for sphenoid sinus have been noted: sellar (80%), presellar (17%), and conchal (3%).

A sellar sphenoid sinus has pneumatization anterior and inferior to the sellar prominence. A presellar sphenoid sinus has pneumatization only anterior to the sella. A conchal sphenoid sinus has minimal to no

pneumatization. A conchal configuration poses the greatest anatomic challenge to the endoscopic management of sphenoid, pituitary, or anterior skull base pathology.

There is 1 more pattern that is sometimes seen, the postsellar pattern.

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

2.2.11 Onodi cell

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

Recognizing the presence of this cell before and during endoscopic sinus or skull base surgery is important. An Onodi cell may often encompass the optic nerve laterally in the posterior ethmoid sinus, making it potentially vulnerable to injury. Also, the presence of an Onodi cell places the sphenoid sinus in a more medial and inferior position, thereby increasing the risk of intracranial penetration if the surgeon expects the sinus to be behind the last posterior ethmoid cell (Chan R,2006).

2.3. Physiology of Para nasal sinuses

Air conditioning, pressure dumping, heat in solution, reduction of skull

weight, flotation of skull in water, Increasing the olfactory area.

Mechanical rigidity, vocal resonance and diminution of auditory fed back.

Areas for production of mucus to moisten the nasal chambers and inspired air. (Margaret S, Brand, 2016)

2.4 pathology of Para nasal sinuses are 2.4.1 sinusitis

It is inflammatory condition of the mucous membrane lining of the sinuses. It may progress to pus formation. May be acute and chronic and

may be primary or secondary. Primary are appear as result of trauma or allergy. But usually infection from other focuses. There are 3 main factors lead to sinusitis development. Opening of sinus hole may be blocked and may be an anomaly of anatomical structures. The retain of secret decrease the pressure of oxygen contribute the bacteria multiplication. (Margaret S, 2016)

2.4.2 Cancer

Cancer of Para nasal sinuses relatively un common. These can range from benign and low grade malignant that can be removed via a minimally in naive endoscopic approach to tumors that are extremely aggressive and require removal of most or all of the entire cheek bone (maxilla) and occasionally the base of the skull and eye as well. .(steven etal, 2014)

2.4.3 Rhinitis

Inflammation of the nasal mucous membrane is called rhinitis. The symptoms include sneezing and runny and/or itchy nose, caused by irritation and congestion in the nose.

Occurs when you breath in something you are allergic to such as dust-dander or pollen (steven etal, 2014)

2.4.4 Polyps

Are sac-like consisting of inflamed tissue to sinuses. Large polyps can block the sinuses (Margaret S Brand, 2016).

2.4.5 Mucosa thickening

Is a common occurrence It suggests mild sinusitis if sever sinusitis can cause headaches. Is a self limiting and non- dangerous condition. (MargaretS,Brand,2016)

2.5 Computed Tomography

CT scanning sometimes called CAT scanning is noninvasive medical test that helps physicians diagnose and treat medical conditions.

CT scanning combines special x-ray equipment with sophisticated computers to produce multiple images or pictures of the inside of the body. These cross-sectional images of the area being studied can then be examined on a computer monitor, printed or transferred to a CD.

CT scans of internal organs, bones, soft tissue and blood vessels provide greater clarity and reveal more details than regular x-ray exams.

A CT scan of the face produces images that also show a patient's para- nasal sinus cavities. (RadiologyInfo.org, 2014)

Figure (2-5) CT scan machine. (RadiologyInfo.org, 2014)

2.5.1 CT of the sinuses primarily is used to

- Detect the presence of inflammatory diseases.
- Plan for surgery by defining anatomy or giving further information about
- Tumors of the nasal cavity and sinuses.
- Evaluate sinuses that are filled with fluid or thickened sinus membranes.
- Help diagnose sinusitis.(RadiologyInfo.org, 2014)

2.5.2 Benefits of CT

- A CT scan is one of the safest means of studying the head.
- CT is the most reliable imaging technique for determining if the sinuses are obstructed. It is the best imaging modality for sinusitis.
- CT of the sinuses is now widely available and is performed in a relatively short time, especially when compared to magnetic resonance imaging (MRI).
- CT scanning is painless, noninvasive and accurate.
- A major advantage of CT is its ability to image bone, soft tissue and blood vessels all at the same time.
- Unlike conventional x-rays, CT scanning provides very detailed images of many types of tissue as well as the lungs, bones, and blood vessels.
- CT examinations are fast and simple; in emergency cases, they can reveal internal injuries and bleeding quickly enough to help save lives.
- CT has been shown to be a cost-effective imaging tool for a wide range of clinical problems.
- CT is less sensitive to patient movement than MRI.
- CT can be performed if you have an implanted medical device of any kind, unlike MRI.
- CT imaging provides real-time imaging, making it a good tool for

guiding minimally invasive procedures such as needle biopsies and needle aspirations of many areas of the body, particularly the lungs, abdomen, pelvis and bones.

- A diagnosis determined by CT scanning may eliminate the need for exploratory surgery and surgical biopsy.
- No radiation remains in a patient's body after a CT examination.
- X-rays used in CT scans usually have no immediate side effects.(RadiologyInfo.org, 2014)

2.5.3 Risks of CT

- There is always a slight chance of cancer from excessive exposure to radiation. However, the benefit of an accurate diagnosis far outweighs the risk.
- CT scanning is, in general, not recommended for pregnant women unless medically necessary because of potential risk to the baby.
- The risk of serious allergic reaction to contrast materials that contain iodine is extremely rare, and radiology departments are well-equipped to deal with them.
- Because children are more sensitive to radiation, they should have a CT study only if it is essential for making a diagnosis and should not have repeated CT studies unless absolutely necessary. (RadiologyInfo.org, 2014).

2.5.4 The limitations of CT:

- Soft tissue of brain internal pelvic organs and joints can be better by MRI.
- In pregnant woman use MRI and ultrasound safely more than CT.
- The patient who is very long not fit into the opening of conventional CT scanner or may be over the weight limit 450 pounds. (Radiology info- 2014).

2.6 Previous studies:

- (Rege etal 2012) Studied occurrence of maxillary CT in a symptomatic patients and result that abnormalities were diagnosed in 68.2% of cases. There was a significant difference between genders and there was no difference in age groups, mucosal thickening was most prevalent (66%) followed by retention cysts (10.1%) and opacification (7.8%).
- (olackan – 2013) studies incidental P.N.S. abnormality on coronal CT in a valerian population and result that
- Total of 100 Pt consist of 63 males and 37 females with age range of 11-
- 76 years mucosal abnormality was commonest in anterior ethnocide (34%), Maxillary antrum (30%) frontal sinuses (13%) posterior ethomide(12%) and in sphenoid sinuses (11%)
- (Dr Rajesh Bhalse etal 2015) CT evaluation of diseases of Para-nasal sinuses & histopathological studies result that
- A total of 50 patients satisfying the inclusion criteria were include in the study, A descriptive comparative analysis of imaging findings was compared, and results were derived. Majority of case were found in age group 21-30 and 41-50 years age. Incidence of para-nasal sinus disease was more in male (80%) as compared to female (20%).The Female: Male ratio is 1:4. Predominant symptoms in study group were headache in 29 patients (58%) followed in decreasing order by facial pain & swelling in 19 patients (38%) and nasal obstruction in 8 patients (16%).
- (Esin Bozdemir etal 2016)The aim of this study was to investigate para-nasal sinus pathology detected on cone-beam computed tomography (CBCT) in an adult population result that: the age of the patients ranged from 18 to 85 years there were 172 (48.7%) females and 181 (51.3%) males. There was a significant difference between the genders (p=0.02), with males (53.5%) having more sinus pathology than females (46.5%).

When the left and right sinuses were considered together, pathology were most commonly seen in the maxillary sinuses (57.1%), followed by the ethmoid (53.7 %), frontal (22.6%), and sphenoid sinuses (15.8%). Mucosal thickening was the most frequently observed abnormality (51.7%), followed by hypoplasia (17.5%) and sinusitis (17.3%).

Chapter Three

Material and Methods

Chapter Three

Material and Methods

3.1 Materials

3.1.1 Inclusion criteria

Study sample consists of 100 patients with age range between (20-60) Years old with different number of 73 male and 27 female. Data were collected in the period from November 2017 to January 2018

3-1-2Exclusion criteria

In this study I excluded all normal cases.

3-1-3Machine used

Optima /GE Health Care 64 slice (Modern Medicine Center) and Optima /GE Health Care 64 slices (Kuwait Hospital).

3-2 Method

3-2-1 Techniques used

The patient is positioned lying flat on the back and may be also positioned face down with the chin elevated (head first).

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

Next ,the table will move quickly through the scanner to determine the correct starting position for the scan, then the table will move slowly through is performed.

The actual CT scan takes less than a minute and the entire process is usually completed within ten minutes.

The data of all patients viewed two plans axial and coronal images.

3.3 Data analysis

The data collected by using data collecting sheets which including gender, age, pathology, and site of sinuses diseases.

The all data was analysis using Microsoft Excel and statistical package for social sciences.

3.4 Ethical issue

In this study the data was collected by complete agreement of patient.

Chapter Four

Results

Chapter Four

Results

The study carried in 100 patient's age between (20-60) years old, when underwent CT scan the data collected by the following tables and figures.

Table 4-1 showed the study group:

Gender	**Frequency**	**Percentage**
Male	73	73%
Female	27	27%
Total	**100**	**100%**

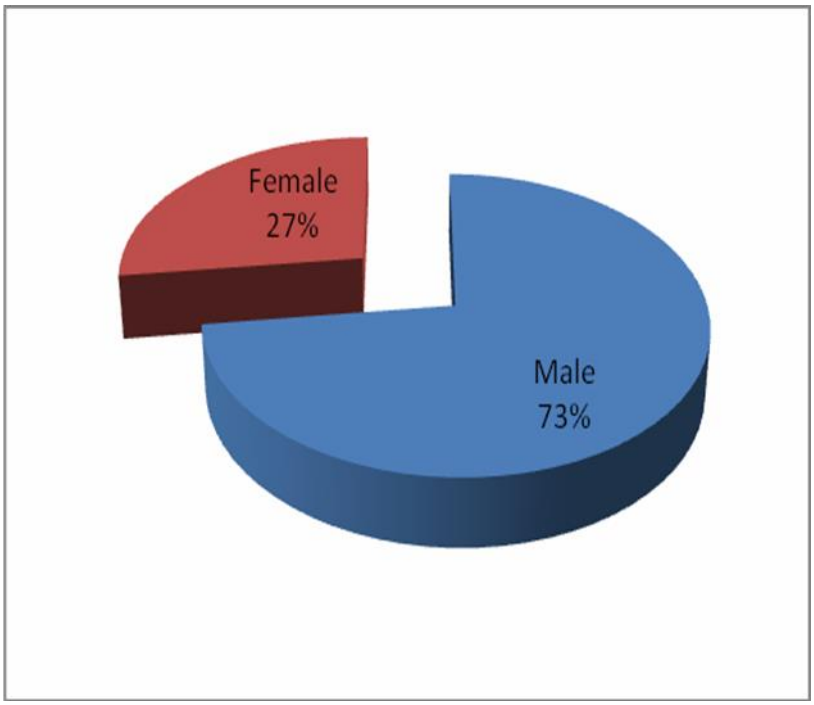

Figure 4-1 showed the study group

Table 4-2 showed age distribution of study group:

Range of patient age*(in years)*	**Frequency**	**Percentage**
20 – 30 years	13	13%
31 – 40 years	24	24%
41 – 50 years	33	33%
51 – 60 years	30	30%
Total	**100**	**100%**

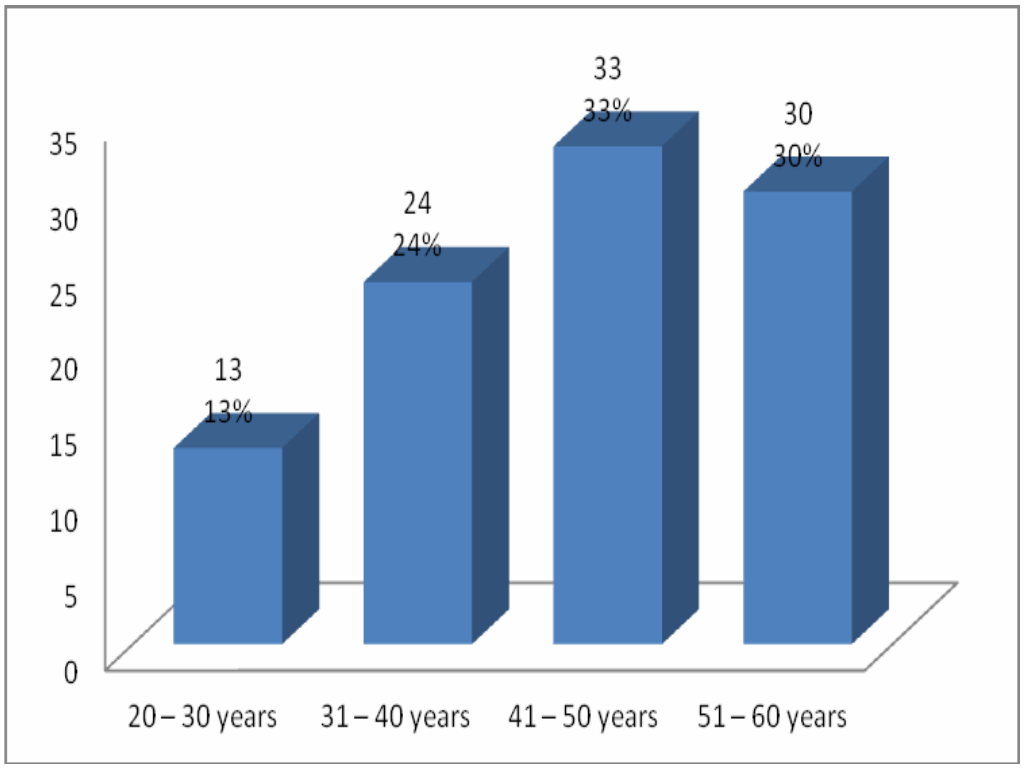

Figure 4-2 showed age distribution of study group

Table (4 – 3) showed the sinuses pathology in male group:

Disease	Frequency	Percentage
Sinusitis	43	58.90%
Polyp	17	23.29%
Rhinitis sinusitis	12	16.44%
Mass	1	1.37%
Total	**73**	**100%**

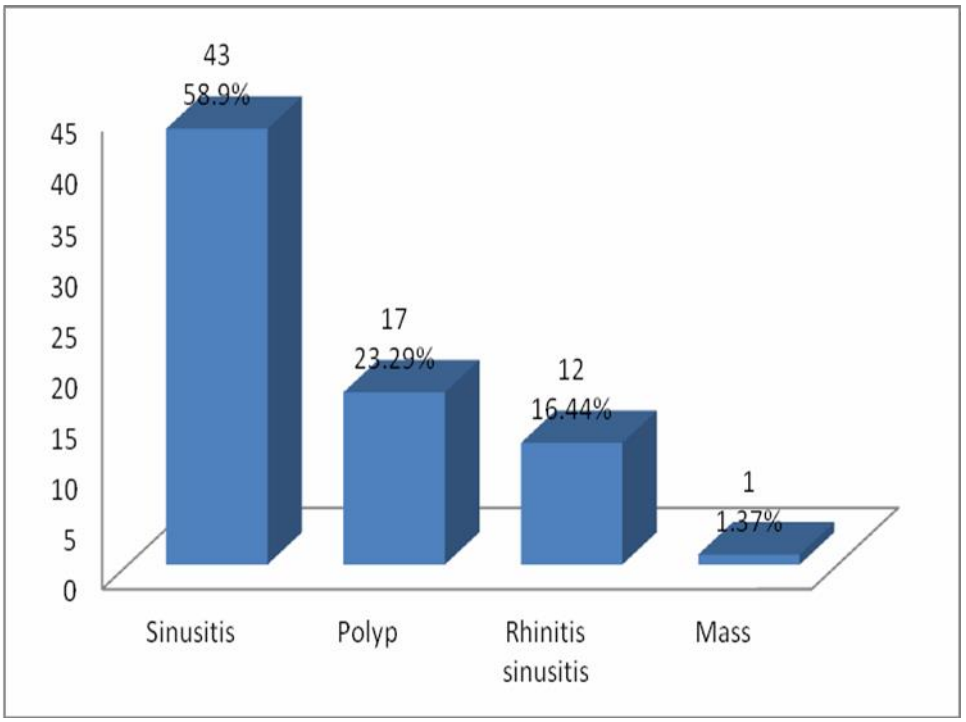

Figure (4 – 3) showed the sinuses pathology in male group

Table (4 – 4) showed: sinuses pathology in female group

Disease	Frequency	Percentage
Sinusitis	15	55.56%
Polyp	4	14.81%
Rhinitis-Sinusitis	8	29.63%
Total	**27**	**100%**

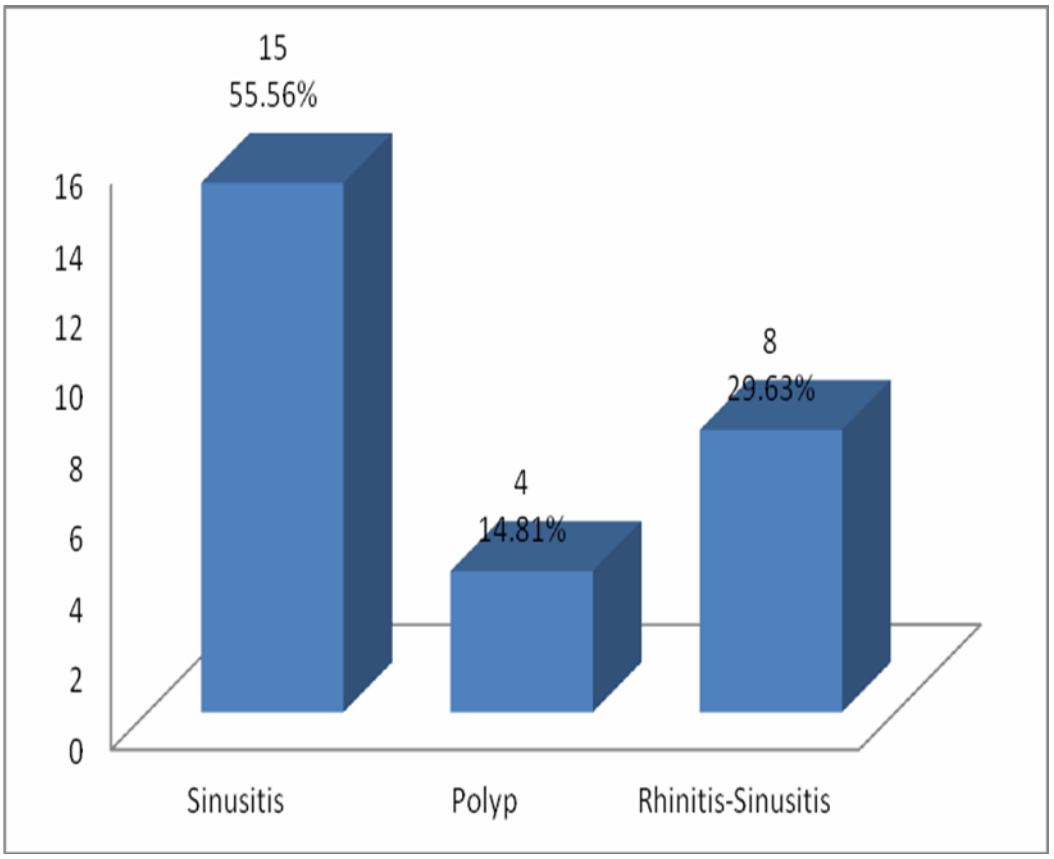

Figure (4 – 4) showed: sinuses pathology in female group

Table (4-5) showed distribution of sinuses pathology with respect to age

Age group		Sinusitis	Polyp	Rhinos-sinuses	Total
20 - 30 years	Frequency	6	3	3	**12**
	Percentage	50%	25%	25%	**100%**
31 - 40 years	Frequency	8	20	1	**29**
	Percentage	27.59%	68.97%	3.44%	**100%**
41- 50 years	Frequency	11	12	4	**27**
	Percentage	40.74%	44.44%	14.82%	**100%**
51 - 60 years	Frequency	22	5	5	**32**
	Percentage	68.74%	15.63%	15.63%	**100%**

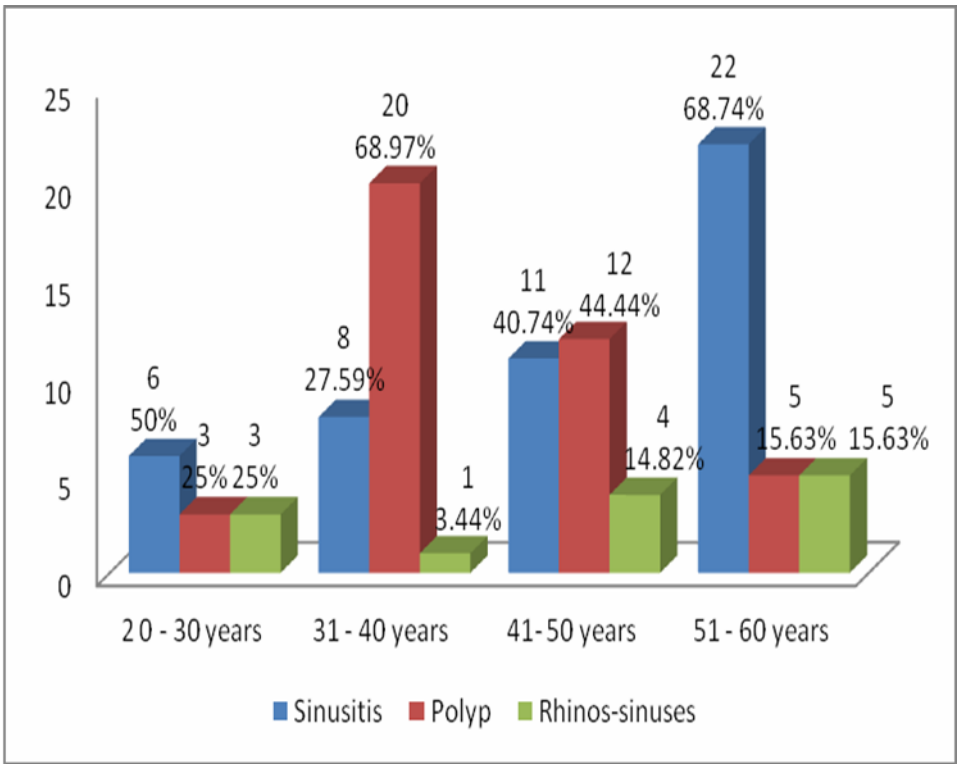

Figure (4-5) showed distribution of sinuses pathology with respect to age

Table 4-6 showed various sinuses involved

Site	Frequency	Percentage
Maxillary	46	46%
Ethmoid	30	30%
Frontal	13	13%
Sphenoid	11	11%
Total	**100**	**100%**

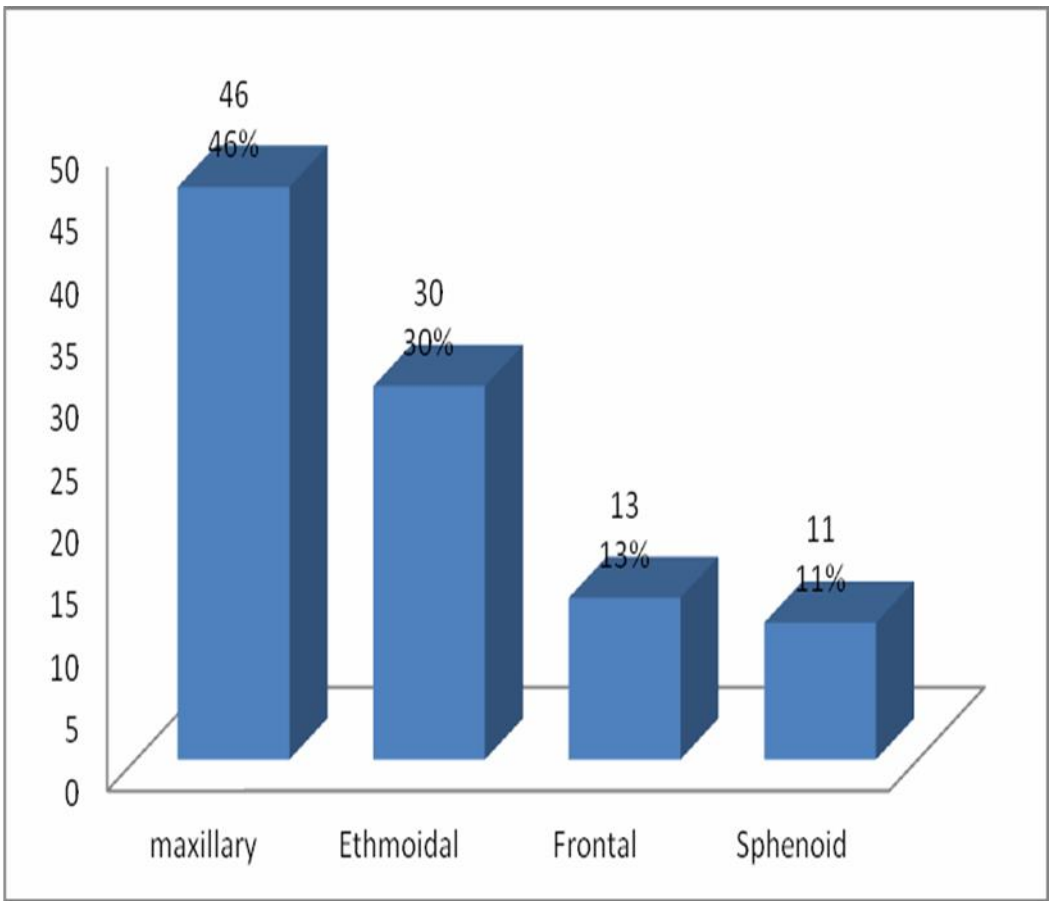

Figure 4-6 showed: various sinuses involved

Table 4-7 sinuses involved in various pathologies

Sinuses Involved		Sinusitis	Polyp	Rhinosinsitis	Total
Maxillary	**N**	25	6	15	**46**
	%	54.34%	13.04%	32.62%*	**100%**
Ethmoid	**N**	15	10	5	**30**
	%	50%	33.33%	16.67%	**100%**
Frontal	**N**	10	0	3	**13**
	%	76.92%	0	23.08%	**100%**
Sphenoid	**N**	11	0	0	**11**
	%	100%	0	0	**100%**

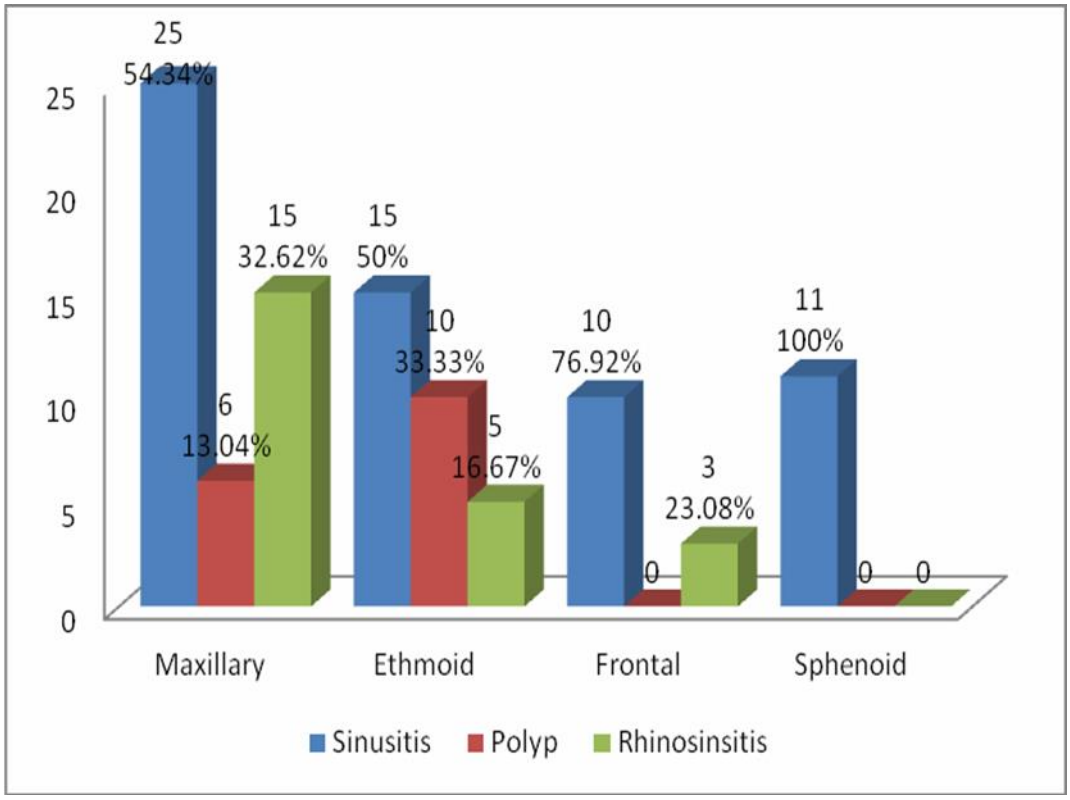

Figure 4-7 sinuses involved in various pathologies

Chapter Five

Discussion, Conclusion and Recommendations

Chapter Five

Discussion, Conclusion and Recommendations

5.1 Discussion

The objective of this descriptive study was to evaluation of para-nasal sinuses common pathology by using CT scan.

In the present study, 100 patients were evaluated for various symptoms with different gander 73male and 27 female (Table 4-1) the result agree with previous (Rege etal 2012).

The sample was classified according to age starting from 20-60 this was present in table 4-2.

Table 4-3 distribution sinuses pathology in male group was found sinusitis (58.90%), polyp (23.29%), rhinitis –sinusitis (16.44%), and
mass (1.37).

Table 4-4 distribution sinuses pathology in female group was found sinusitis (55.66%), polyp (14.81%), and rhinitis- sinusitis (29.63%) Table 4-5 distribution of sinuses pathology with respect to age, (51-60) years is most effected age for PNS pathology.

Table 4-6 various sinuses involved maxillary sinuses (46%), ethmoid sinuses (30%), frontal sinuses (13%), and sphenoid sinuses (11%) the result agree with Esin Bozemir etal 2016.

Table 4-7 sinuses involved in various pathologies; in maxillary sinuses: the sinusitis (54.34%), polyp (13.04%), and rhino-sinusitis (32.62%).

Ethmoid sinuses: sinusitis (50%), polyp (33.33%), and rhino-sinusitis (16.67%).

Frontal sinuses: sinusitis (76.92%), polyp (0%), rhino-sinusitis (23.08%).

Sphenoid sinuses: sinusitis (100%), polyp (0%), rhino-sinusitis (0%).

5.2 Conclusion

As conclusions the study found that the paranasal sinuses pathology is higher in males than in females, The most effected age groups were the ages between 51-60 years and pathology was most commonly seen in maxillary sinuses, the sinusitis was the most frequently observed abnormality.

Also concluded that using CT technique was highly accurate in diagnosis of paranasal diseases.

5.3 Recommendations

- Further study with larger sample volume to be done in PNS pathology to give more accuracy result.
- In future studies will do with data collecting sheet contains the types of work.
- Two images planes (axial – coronal) should be perform together for patients complain of P.N.S problem.
- Go to hospital and doctor early with any small problem to avoid complications.

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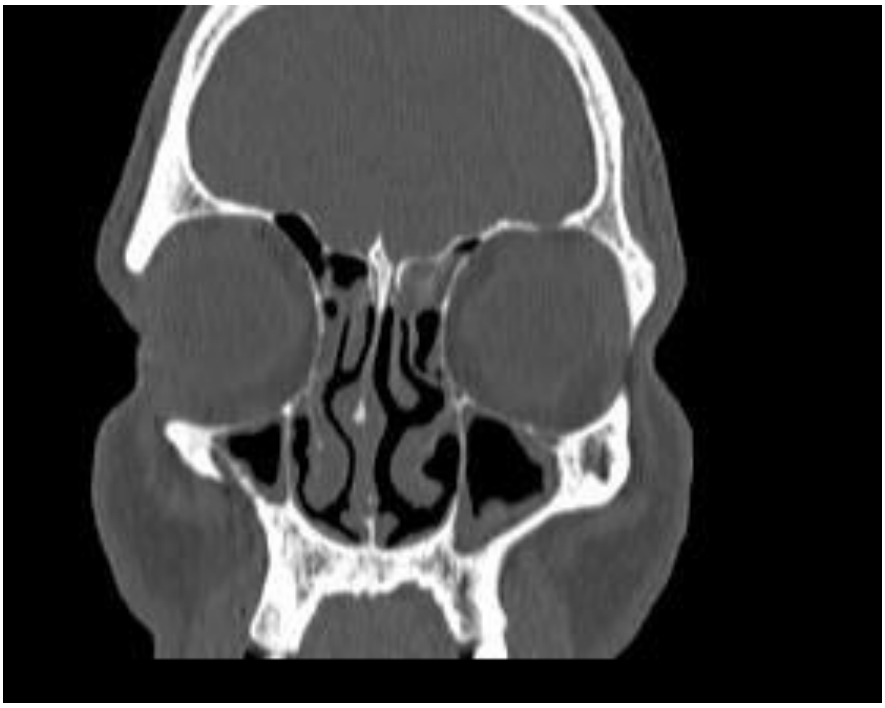
Appendices

Sudan University of Science & Technology College of Graduate studies

DATA SHEET

Patient No	Gender	Age	Pathology	Site of pathology



A: Image (1) A 49 years old male coronal CT image demonstrating chronic sinusitis in both site of maxillary sinuses

B: A 49 years old male axial CT image demonstrating chronic sinusitis in both site of maxillary sinuses

Image (2): 36 years old male coronal CT demonstrating rhinosinusitis

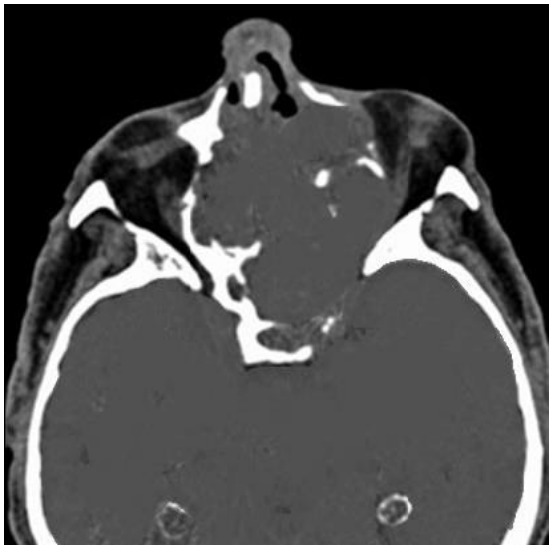
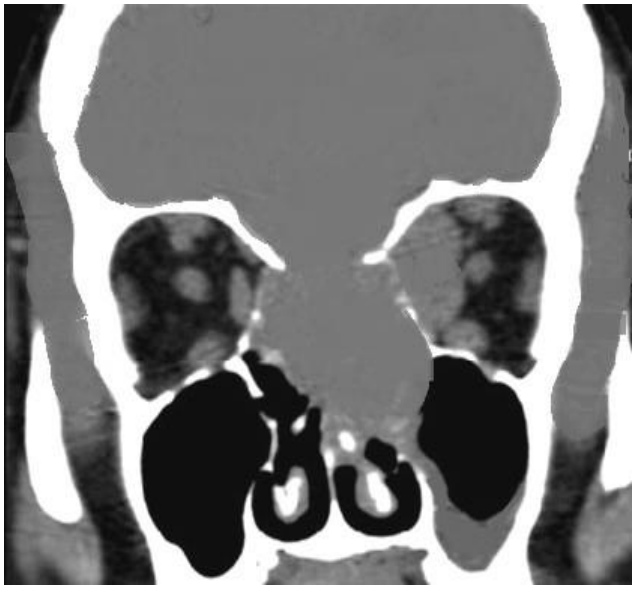
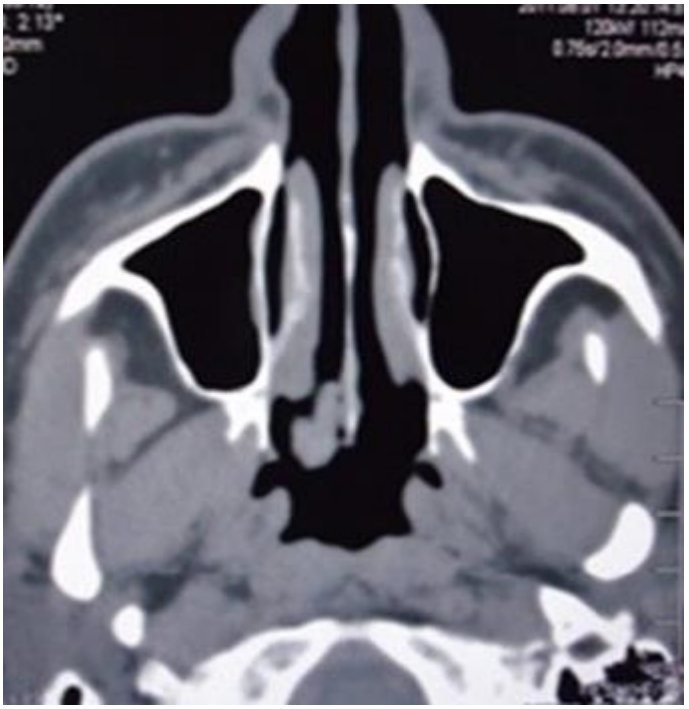


Image (3):A: axial CT demonstrate Adenocarcinoma in male 58 years



B: coronal CT demonstrate Adenocarcinoma in male 58 years

Image 4:A: coronal CT image demonstrate acute sinusitis in a 45 years old female



B: axial CT image demonstrate acute sinusitis in a 45 years old female