

Sudan University of Science & Technology

College of Graduate studies

Research title:

Evaluation of Para-nasal sinuses common pathological

Findings using computed tomography

تقويم امراض الجيوب الأنفية في الأشعة المقطعية

A Thesis submitted in Partial fulfillment of M.Sc. degree in Diagnostic radiology

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م 2014

بسم الله الرحمن الرحيم

(اللَّهُ لَا إِلَهَ إِلَّا هُوَ رَبُّ الْعَرْشِ الْعَظِيمِ (26) قَالَ سَنَنْظُرُ
أُصَدَقْتَ أَمْ كُنْتَ مِنَ الْكَاذِبِينَ (27) اذْهَبْ بِكِتَابِي هَذَا فَأَلْقِهْ
إِلَيْهِمْ ثُمَّ تَوَلَّ عَنْهُمْ فَانْظُرْ مَاذَا يَرْجِعُونَ (28) قَالَتْ يَا أَيُّهَا
الْمَلَأُ إِنِّي أُلْقِيَ إِلَيَّ كِتَابٌ كَرِيمٌ (29) إِنَّهُ مِنْ سُلَيْمَانَ وَإِنَّهُ
بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ (30)

صدق الله العظيم

سورة النمل (25-30)

Dedication

To my father: Mustafa Ahmed, Who supported me
in every endeavor

To my Mother Fatima Ahmed, Who is the reason I
!am here at all and made me who I is am today

Acknowledgement

My deep thanks to my supervisor Dr. Hussein

.Ahmed Hussein

I would like to thank also radiology department

staff member in Antalya diagnostic center

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Abbreviations

Ct	Computed Tomography
P.N.S	Pan nasal sinuses
GE	general electric
KUP	Kilo Voltage peak
MPR	Multi planer Reformation
URI	Upper respiratory inflammation

MRI	Magnetic resonance image
FESS	Functional endoscopic sinus surgery

Abstract

The main objective of this study was to evaluate and assessment of the effectiveness of computed tomography in the diagnosis of para nasal sinuses disease and compared between two images planes (axial and coronal) when they are applied for the same cases. This study consist of Random samples of 100 patients which categorized to (27 males and 73 females) with age between (10 to 60) years old with different symptoms were chosen axial and

coronal cuts done to explain the suitable technique to demonstrate all the para-nasal sinuses disease clearly.

The main observation was excluded that the coronal scan is better than axial scan and more sensitive so the two image planes are perform together and used as essential technique of pns which help to obtain accurate diagnosis and demonstrate any pathological changes that can affect Para nasal sinuses.

الملخص

تهدف هذه الدراسة لتقييم فعالية الأشعة المقطعية في تقييم أمراض الجيوب الأنفية والمقارنة بين وضعي التصوير (المحوري والتاجي) عند إجرائهما معاً لنفس الحالات. هذا البحث يتكون من عينات عشوائية لمائة مريض، 27 ذكر و 73 أنثى بين الأعمار من (10-60) عام. مع أعراض مختلفة لأمراضهم عند اختيار الوضعين المحوري والتاجي لتوضيح الطريقة الأنسب لتشخيص كل أمراض الجيوب الأنفية بصورة دقيقة. وقد استنتجنا أن الوضع المحوري أفضل من التاجي وأكثر حساسية.

من هنا يمكن القول أنه يمكن تشخيص أمراض الجيوب الأنفية
بإجراء الوضعين مع بعضهما البعض للحصول على التشخيص
الدقيق لإظهار التغيرات المرضية.

Chapter One

1-1 Introduction:

Computed tomography has become a 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 multi planar reformation (MPR) recent advance in CT allows the a quoin of high resolution image in many planes. CT now is standard examination techniques in diagnosing and treatment of para nasal sinuses 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 detailes 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 para nasal sinuses 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 para nasal sinuses 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 so the introduction of computed tomography with advance scanning technique and the multi-detector scanning and image processing capabilities that lead to overcome the detection of various type of PNS disease using multi-planner images and image reconstruction with small cuts also the use of the complex 3D techniques.

1-3 Objectives:

1-3-1;General objectives

The aim of this study is to characterize the most common para-nasal sinuses pathology in Sudanese population in order to classify the most common finding of its pathology.

1-3-2 Specific objectives:

To classify most age groups with main sinuses.

To correlate between age and pathological finding.

To correlate between disease and patient sex.

To characterize common lesion by using CT number.

To describe anomalies of para-nasal sinuses.

To evaluated using CT the frequency of P.N.S anomalies in Sudan.

1-4 Significant of this study:

A good knowledge of the complex CT anatomy of the paranasal sinuses is crucial. This knowledge will provide an accurate assessment of the normal variants and pathological changes required for successful FESS. The prominence of this study is to characritise the most common pathological finding in paranasal sinus by using multi-detector CT scanner therefore the classification of Sudanese paranasal sinuses disease according to age and sex is considered more significant issue here.

1-5 Overview of this study:

This study was consist of five chapters, chapter one consist of an introduction; introduce briefly this thesis and it was contain, general introduction about the CT scan of para nasal sinuses, problem of the study, general and specific objectives, significant of the study in addition to the overview of the study. Chapter two was the literature review which contain the general theoretical background and previous studies about detection of these disease during computed tomography scan for PNS. Chapter three describe the methodology (materials and methods) was used in this study. Chapter four was include result of presentation of final finding of study. Chapter five was include discussion, conclusion and recommendations for future scope in addition to references and appendices.

Chapter Two

Theoretical background

2-1: Anatomy of para nasal sinuses

The par 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 sinus:

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 sinus:

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. (Ameet singh et- al 2013)

2:1:3: Ethmoide Sinuses

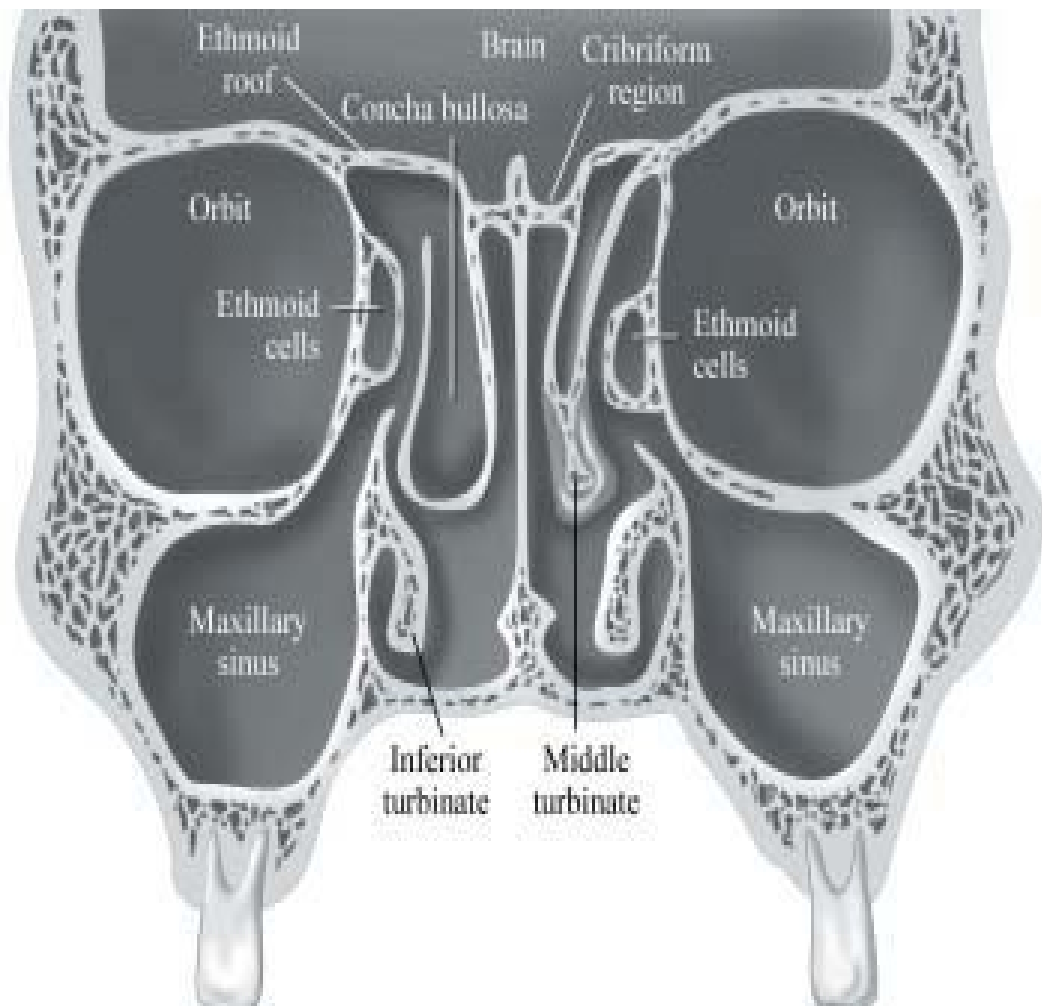
The ethmoide Sinuses forming several distinct air cells between the eyes. The shaped like pyramids and divided by thin septa,

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)

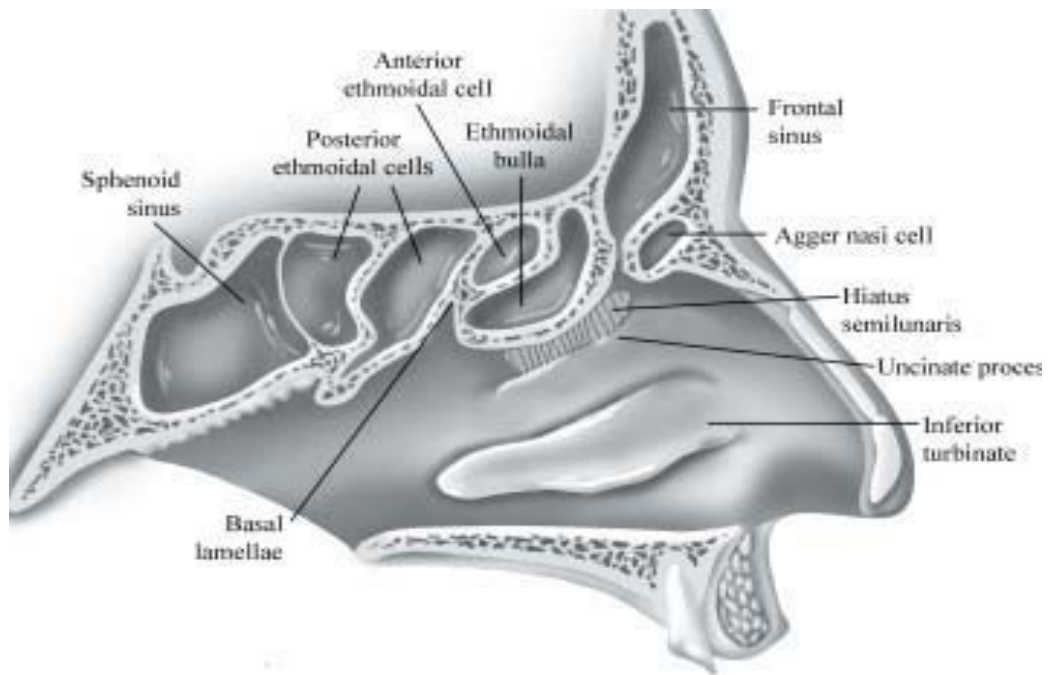
2.1-4:Sphnoid sinus:

Originates in the sphenoid bone it's full size by late ten age years, The thickness of wall variable.It supplied by the sphenopalative artery.

(Ameet singh et- al 2013)



A



B

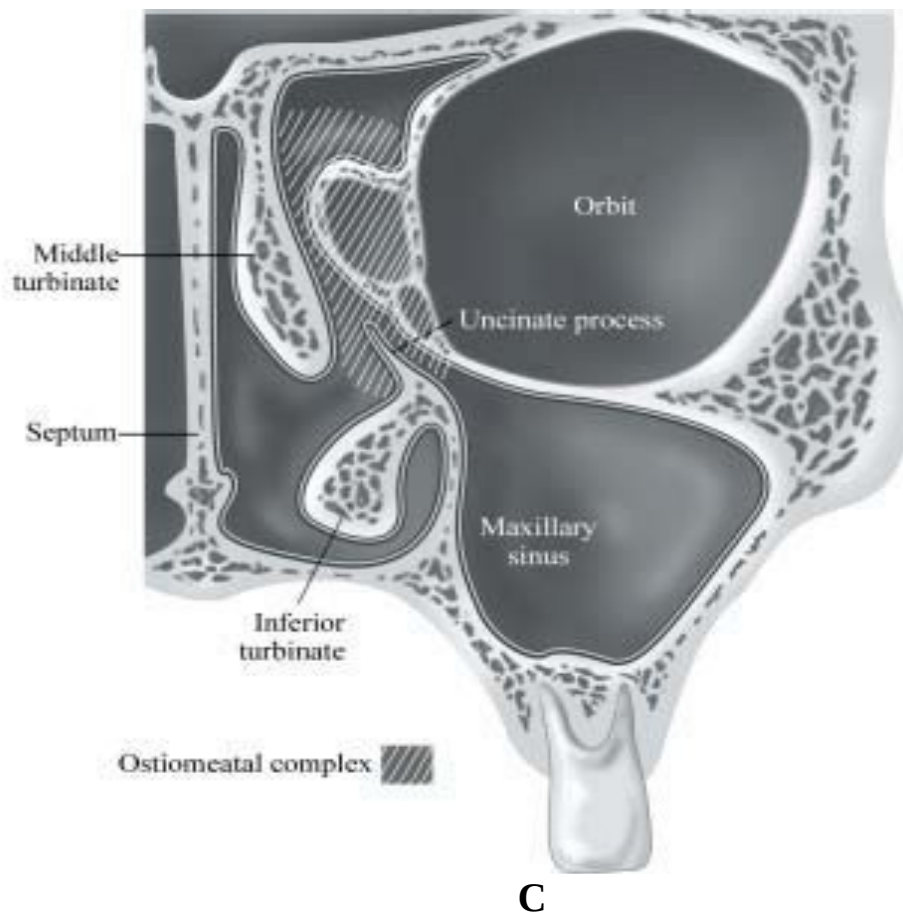


Figure (2.1): anatomy of the para nasal sinuses .

((Stam et al, 2000

.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

:Physiology of para nasal sinuses 2-2

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 feedback..

areas for production of mucus to moisten the nasal chambers and inspired air. (Slide share et – al 2010)

:pathology of Para nasal sinuses are :2:3

: sinusitis :2:3:1

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. (Slide share et – al 2010)

2-3-2: Cancer :

Cancer of Para nasal sinuses relatively un common. These can rang 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.(board 2014)

2-3-3: Rhinitis:

Occurs when you breath in something you are allergic to such as duts-dander or pollen (board 2014)

2-3:4: Polyps :

Are sac-like consisting of inflamed tissue to sinuses. Large polyps can block the sinuses. (Slide share et – al 2010)

2-3-5: - Mucosa thickening:

Is a common occurrence. It suggests mild sinusitis if severe sinusitis can cause headaches. Is a self limiting and non-dangerous condition. (Slide share et – al 2010)

2-4 Computed tomography

Computed tomography is a technology that uses computer processed x- rays to produce homographic images (virtual slices)of specific areas of the scanned object, allowing the user to see inside without cutting.

As x-ray ct the most common form of ct in medicine and various other contexts. ct produces a volume of data that can be manipulated in order to demonstrate various body structures based on their ability to block the x-ray beam. Modern scanners allow this volume to be reformatted in 3D represent structures. The term volume imaging might describe this technology more accurately than the term tomography.

There are some alternative names like CAT Scan.Computed axial tomography C T using in abdomen- Spine. Chest, Brain.- orbital scan and sinuses. The contrast media can be given depends on the type of C T being performed. may be intravenous or by rectum or drink before the scan.(Radiology info-2014)



Figure (2-5) CT scan machine -a and BA- CT scan console B-
CT Gantry and Table

Advantages of CT:

Diagnose an infection.

Guide a surgeon to the right area during a biopsy.

Identify masses and tumors ,including cancer.

Study blood vessels.

Measure bone minimal density for detection of osteoporosis.

Risks of C T are :

Being exposed to radiation.

The C T scanner is typically a large box, like machine with a hole or short tunnel table that slides in or out the tunnel. X-ray tube and detectors located opposite each other in ring called a gantry, Computer workstation located in semantic control room. In C T scanner the technologist begins by positioning you on the C T table. On your back. Next the table will move to determine the correct starting position. You may be asked to hold your breath and stop any motion can lead to artifacts on the images. The C T examination is usually completed within 30 minutes (Radiology info- 2014)

The limitations of C T:

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 C T scanner or may be over the weight limit 450 pounds. .(

Radiology info- 2014)

Previous studies:

- Fujimoto et.al (1999) they studied: patient with total blindness caused by P.N.S disease have rarely been reported. During the past ten years they are identical 17 patient with optic nerve disease and posterior P.N.S disease, 7 of 17 had no light perception . 5 of these 7 had a final visual acuity of 20/200 or better, 2patient showed dramatic visual improvement after end nasal surgery C T should be done at the patient first visit

- (M. pifferi,2011) Had studied agenesis of P.N.S nitric oxide in primary ciliary skinesia (P C d)

The results were : out of 86 (42 males) and 46 children) age between (8 – 17 years) and 40 adults (18 - 58 years) immunological abnormalities

Were excluded in all patient. No subject had CF or C T gene mutations (The 33 most common mutations in the populations were sought) and careful examination of swallowing problems and spurious phenyl complication of gastro. Esophageal reflux.

- Laryngoscope 1991) studied C T analysis for para nasal sinuses bone anatomic variation and mucosal abnormalities and result that : coronal plane C T scanning has aromatically

improved the imagery of P.N.S anatomy as compared to sinus radiographies.

- AJNR 1986: Studied incidental P.N.S abnormalities on C T of children , and result that the P.N.S were prospectively evaluated by C T clinical history and physical examination in infants having cranial CT for indications unrelated to upper respiration inflammation (URI).

18% of patient older the 1 year without signs or symptoms.

The incidence of abnormalities was 31% maxillary antral were not identifiable on were pacifically in 72% of all infants under 1 year old.

- (J F Linn el al 2007) Studied prospective analysis of incidental P.N.S a abnormalities on C T scans and result that : he correlated with symptomatic assessment- 27% has sinuses opacification.

The study illustrates the importance of careful clinical correlation when interpreting C T scan of P.N.S.

- (Rege etal 2012) Studied occurrence of maxillary C T in a symptomatic patients and result that abnormalities were diagnosed in 68.2% of cases.

There was a significant difference between genders

($P \leq 0.001$) and there was no difference in age groups, mucosal thickening was most prevalent (66%) followed by retention cysts (10.1%) and opacification (7.8%).

- (J. Pediatr 2011) Studied the clinical progression of incidental tomography finding in P.N.S of a symptomatic individuals and result that (56%) of the 106 Pt enrolled in the study had opacity, the majority due mucosal thickening intense opacification was found (suspected) score ≥ 15 and patient in this subset had a greaten risk of developing symptoms during follow up (oddsratio = 2.74. 95% ci 1.10 – 6.83) compared to those with no findings on discrete findings.
- (olackan – 2013) studies incidental P.N.S. abnormality on coronal C T in a valerian population and result that : Total of 100 P t 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%)

Chapter three

Methodology

2-1: Material

3.1.1 Machine used; GE Toshiba 8 slice multi detector CT machine

3.1.2 study sample; the study sample consist of 100 patient 27 male and 73 female with different age

3.1.3 study duration

This study conducted from may 2014 until December 2014

3.2 Method;

3.2.1 Techniques used

The technologist begins by positioning the patient on CT examination table for scan the sinuses.

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

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

Some patients require injection of contrast material to enhance the visibility of certain tissues or blood vessels.

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 per formed , depending on the type of CT scan .

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

3.2.2Area of the study

This study conducted at Khartoum state hospital mostly at antalya medical diagnostic

3,2.3Image interperaion

The patient data clinical information where obtain all the axial and coronal image

Must by applicated to identify the pathological change

The radiologist reported were collected all this information were analyzed and presented in the graphs and tables

3-2-4 Ethical issue:

Should be take agreement when obtain any data from each patient

No patient data will published

Chapter Four

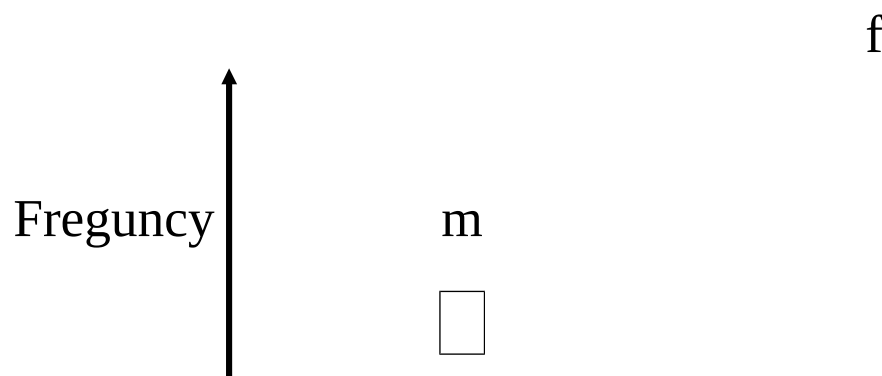
The Results

The study carried in 100 patients age between (x – y) years old, when under went CT scan the data collected by the following tables and graphs.

Table 4-1 Showed the study gruop

Gender	Frequency	Percentage
male	27	27%
Female	73	73%

Note the female are more than males.



→

Gendar

Figure 4-1 showed of the study group .

Table 4-2 showed age distribution of study group

Range of patient age _(in years)	Frequency	Percentage
20 – 30	13	13%
31 – 40	24	24%
41 – 50	66	33%
51 – 60	30	30%
Total	100	100%

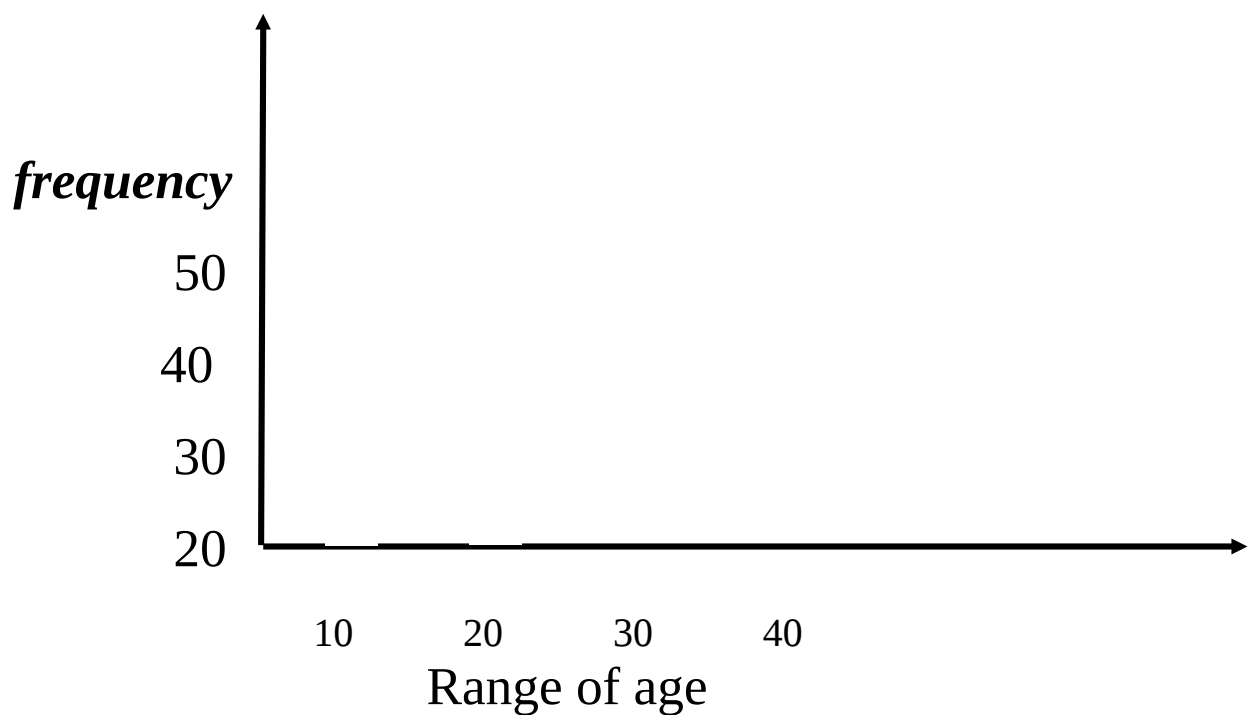


Figure (4 – 2) showed the age distribution of study group

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

Frequency	Disease	Percentage
41	Sinusitis	41%
17	Polyp	17%
9	Rhinitis sinusitis	9%
1	Mass	1%
5	Rhinitis	5%

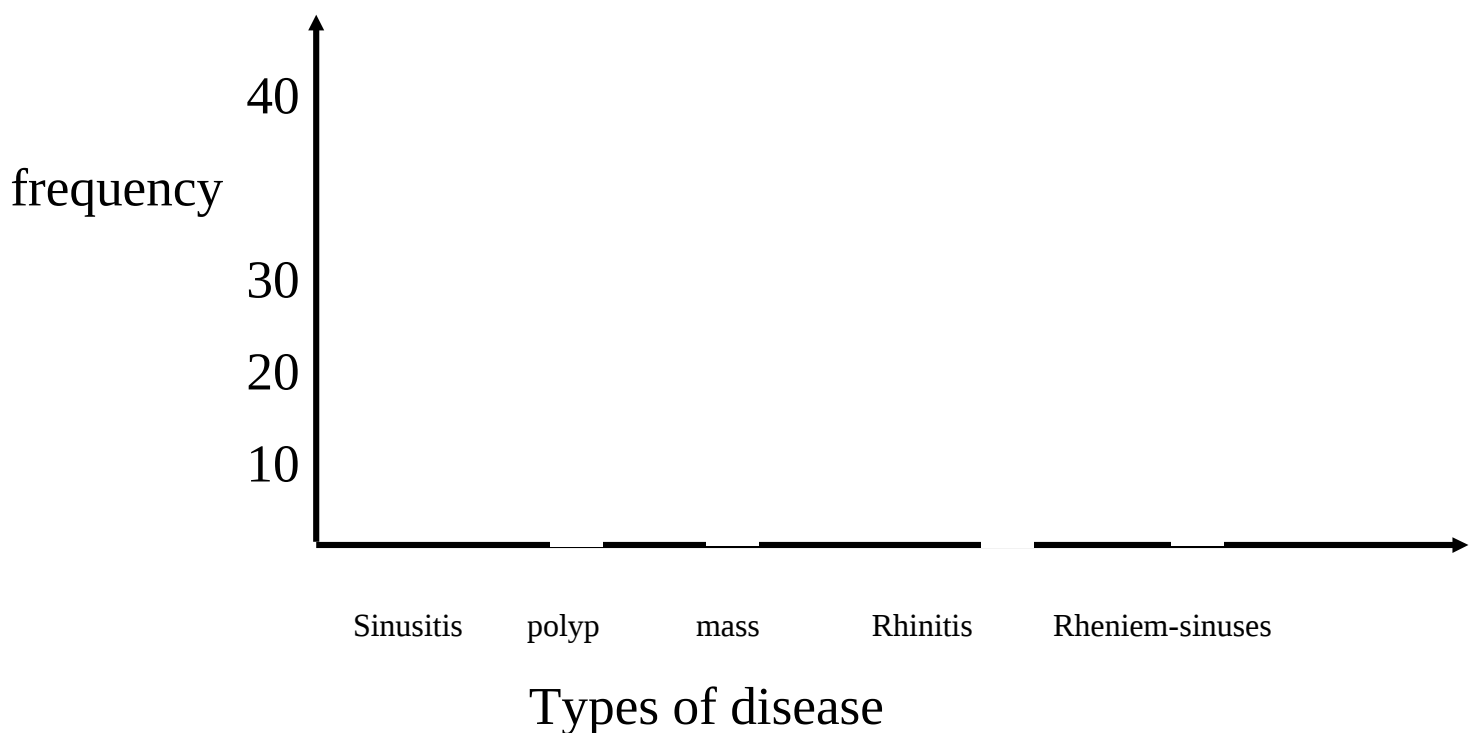


Figure (4 – 3) showed the sinuses pathology in female group

Table (4 – 4) showed sinuses pathology in male group

Frequency	Disease	Percentage
11	Sinusitis	11%
4	Polyp	4%
7	Rhinitis – Sinusitis	7%
5	Rhinitis	5%

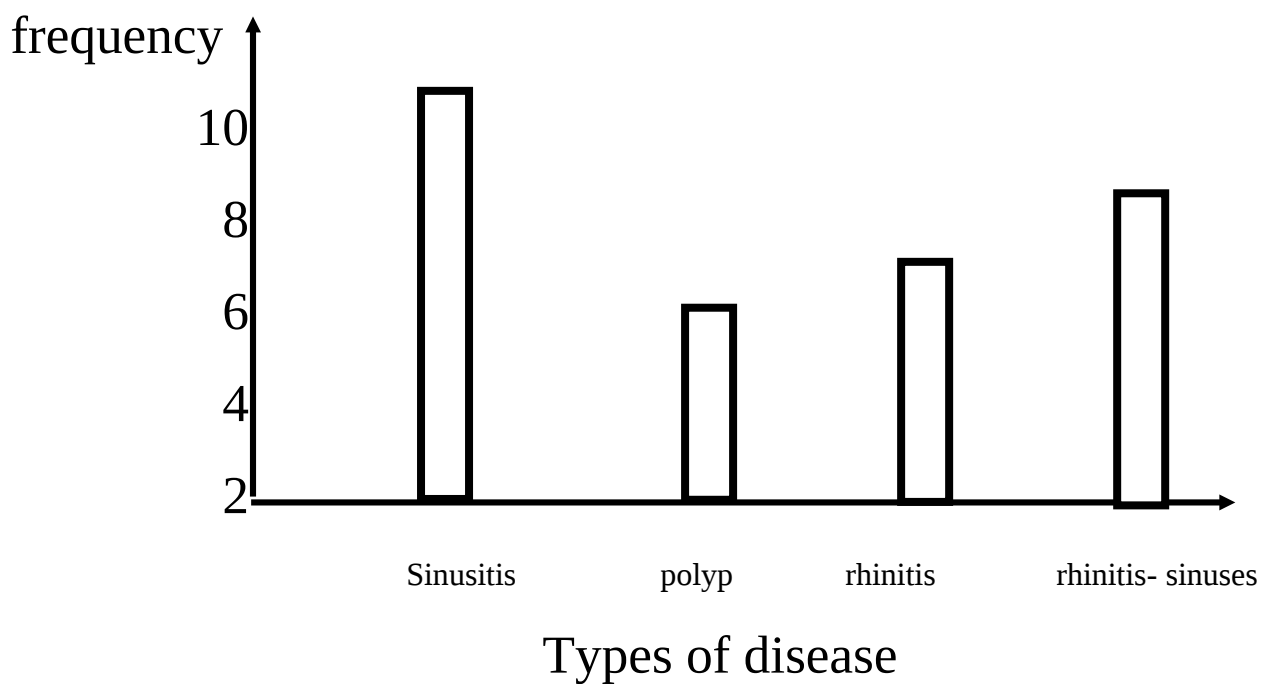


Figure (4 – 4) showed sinuses pathology in male group

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

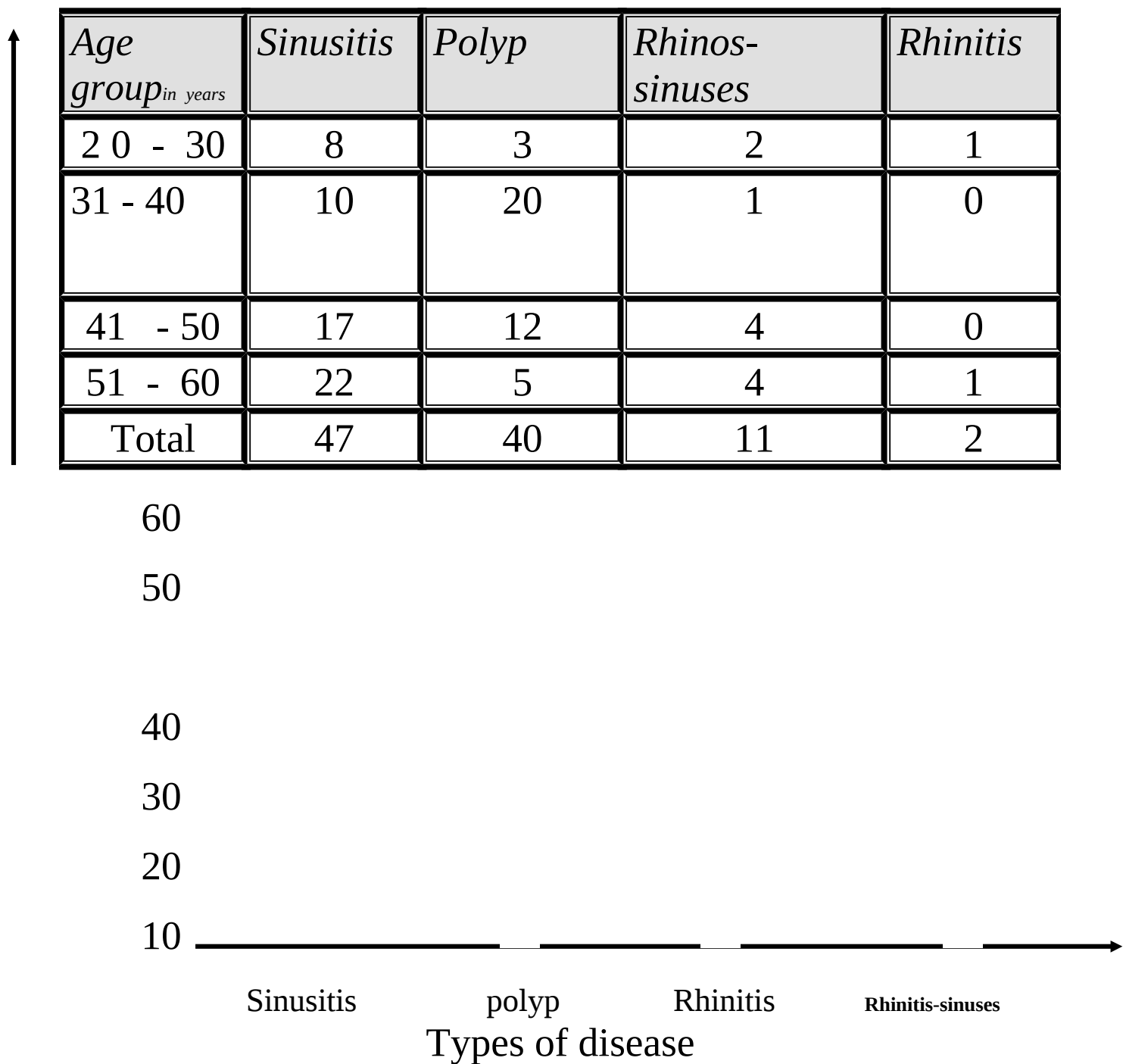


Figure (4 – 5) showed distribution of sinuses pathology with patient age

Chapter five

Discussion , conclusion & recommendation

5-1 Discussion:

CT scanning of P.N.S. is the non invasive, Safe and good protocol, and provide greater details than regular x ray exams

The study showed the female were affected by pathological change of sinuses than male

The study showed the pathology of PNS with different age and showed all types of PNS diseases and analyzed this types compared with sex group and showed the sinusitis high rate than other type of daises

5-2: Conclusion:

The computed Tomography CT best modality in diagnoses of Para nasal sinuses disease

CT is the image modality of choice two planes (axial , coronal) to evaluate the p.n.s and excellent detail is available regarding to the anatomy , pathology and early diagnosis of p.n.s very important factor in the disease management.

Coronal section used ideally for full evaluation of p.n.s diseases.

Axial view also necessary to determines posterior and anterior extension of the disease.

5-3: Recommendations:

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 spread

Well trained radiologist and technologist are important for well medical service management.

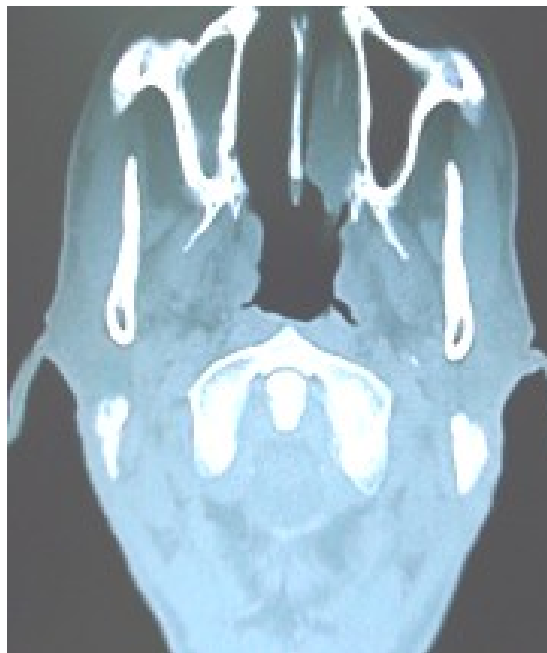
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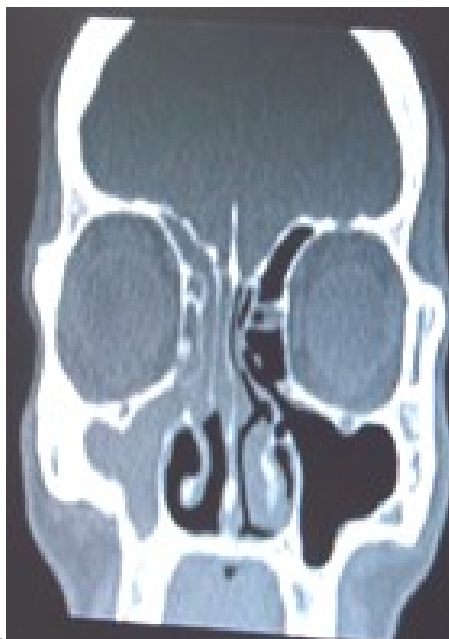
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- Seeram Euclid , computed tomography : 2001.
- Yousem DM , imaging of Sino nasal inflammatory disease radiology. Auf 1993.

APPENDICS

Appendix (a): axial and coronal CT images demonstrate chronic
:sinusitis disease in a 36 years old man

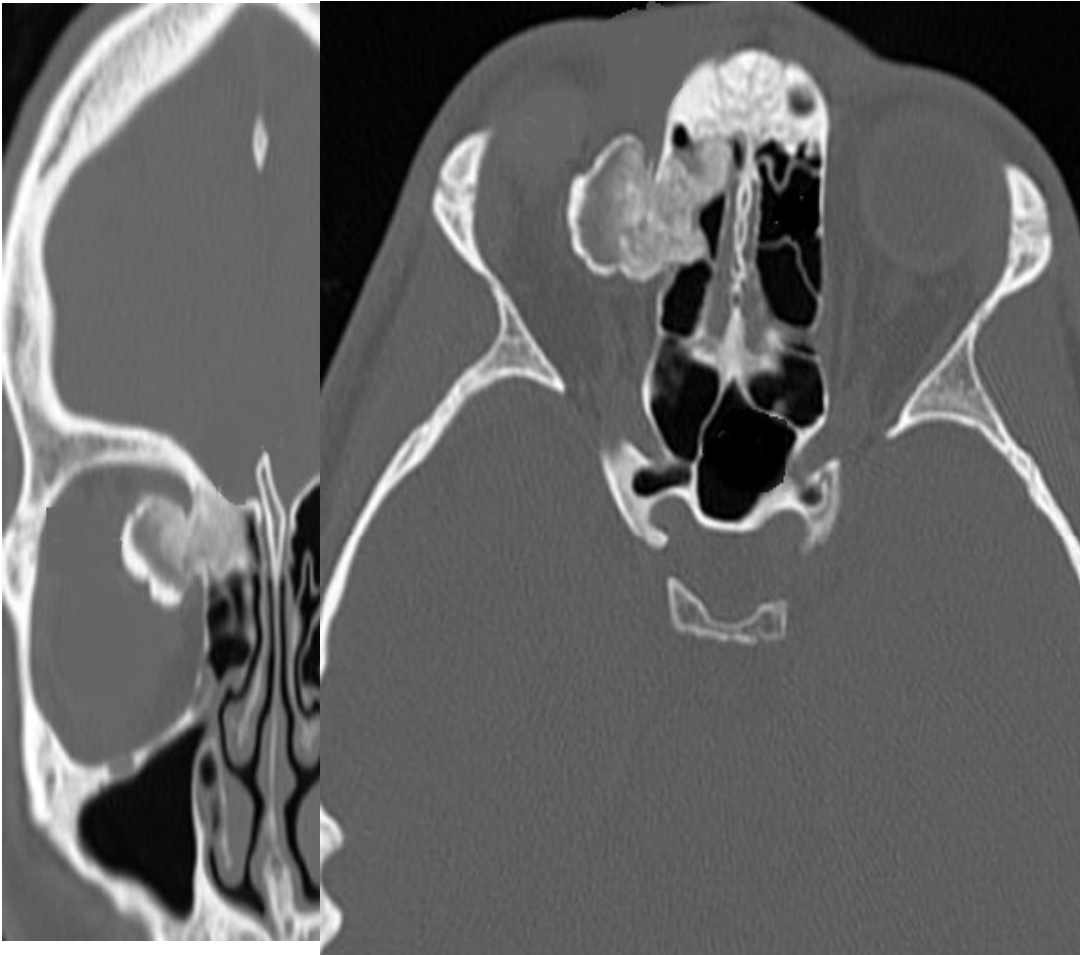


a: an axial section



b. Coronal Section

Appendix (b): axial and coronal CT images demonstrate benign
osteoma in a 17 years old man

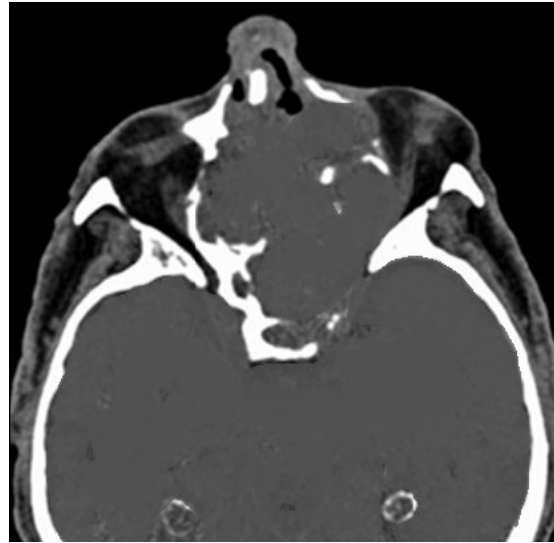


a. Coronal Section

b. Axial Section

Appendix (c): axial and coronal CT images demonstrate Adenocarcinoma in a 58 years old man:

a: an axial section



b. Coronal Section

Appendix (d): axial and coronal CT images demonstrate acute sinusitis in a 45 years old female:

a. an axial section



b. Coronal Section