

Sudan University of Science and Technology
College of Graduate Studies

**Measurements of Normal Maxillary Sinuses Dimensions
Among Sudanese Using Computed Tomography**

قياسات الجيوب الانفية الفكية الطبيعية لدى السودانين باستخدام الاشعة المقطعية
المحوسبة

A Thesis Submitted for Partial Fulfillment for the Requirements of
M.s.c Degree in Diagnostic Radiologic Imaging

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الآية

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال الله تعالى:

وَقُلْ زِدْنِي عِلْمًا

صدق الله العظيم

سورة طه (114)

Dedication

To my father

Who always supported me in every endeavour

To my mother

Who is the reason I am here at all, and made me who I am
today

If I donated to you everything in this world, it is not enough
to give you your rights

Acknowledgement

I would like to express my

deepest appreciation to all those who provided me the possibility to complete this study. A special gratitude I give to supervisor, **Dr. Ahmed Almustafa**, for his kind contribution in stimulating suggestions and encouragement, helped me to coordinate my project especially in writing this report.

Furthermore I would like to thank to thank the participants in this study, who have willingly shared their precious time during the process of interviewing.

I would like to thank my loved ones, who have supported me throughout entire process, both by keeping me harmonious and helping me putting pieces together. I will be grateful forever for your love.

Abstract

The purpose of this study was to estimate the dimensions of maxillary sinus in healthy Sudanese's subjects using CT scan. This study included 50 (28 males and 22 females) Sudanese subjects whom referred for

T sinuses their age ranged from (20-80years), who admitted to spiral CT scan unit in radiology departments of Alamal Hospital to have CT of the brain and paranasal sinuses from October 2017 to march 2018, who had complaints of headaches or with suspicion of sinusitis but without pathological findings in maxillary sinuses. The maxillary sinus dimensions (width, depth, and height) were measured with the help of the computer software in Spiral CT scan system.

The statistical analyses of maxillary sinus measurements showed the mean of the right width 20.56 ± 5.67 mm and left side 20.61 ± 6.04 mm and measure the right depth 34.77 ± 3.15 mm and left side 34.83 ± 3.65 mm and measure of right height 33.25 ± 5.73 mm and left side 33.55 ± 6.31 mm for males and the measure of females were the right width 22.76 ± 4.84 and left 20.18 ± 3.96 mm and right depth 34.46 ± 3.64 mm and left 34.04 ± 3.77 mm and the right height 31.97 ± 5.18 mm and left 32.50 ± 5.74 mm. The dimensions of maxillary sinuses were equals in males and females. and no difference in measurements with the age, in addition the study showed the mean of right width 21.53 ± 5.38 mm and for the left side width 20.42 ± 5.18 mm, measure of right height 33.25 ± 5.56 mm for the left height 33.09 ± 6.03 mm, measure of right depth 34.64 ± 3.34 mm and the left depth 34.48 ± 3.68 mm it is found that there was no significant differences in measurements of maxillary sinuses between tow side. The study provides essential anatomical information for Sudanese subjects and its impact in the clinical surgical practice.

مستخلص البحث

هدفت الدراسة لقياس الابعاد التشريحية الطبيعية باستخدام الاشعة المقطعية واجريت الدراسة على 50 حالة من السودانيين منهم 28 ذكور و22 إناث.

وقد تم التقسيم تبعاً للعمر والجنس الذين اجريت لهم فحوصات للراس والجيوب الانفية باستخدام الاشعة المقطعية والقياسات من المقاطع التاجية والسهمية

وقد عملت الفحوصات في ولاية الخرطوم في الفترة من اكتوبر 2016م الي مارس 2018 بقسم الاشعة بمستشفى الامل الوطنى.

وقد اخذت الابعاد للجيوب الفكية الامامية من عمر 20 عام الى 80 عام .

اظهرت الدراسة من خلال قياسات الجيوب الفكية الامامية للذكور ان متوسط قياس العرض الايمن = **20.56**، متوسط قياس العرض الايسر = **20.61** ملم. ومن قياس الجانب الامامى الخلفى الايمن **34.77** ملم والجانب الامامى الخلفى الايسر = **34.83** ملم ومتوسط القياس الارتفاع الايمن = **3325** ملم وقياس الارتفاع الايسر = **33.25**م.

وتوصلت الدراسة من خلال قياسات الجيوب الفكية الامامية للاناث ، ان متوسط قياس العرض الايمن = **22.76**ملم متوسط قياس العرض الايسر = **20.18**ملم وقياس الجانب الامامى الخلفى الايمن = **34.46**ملم والجانب الامامى الخلفى الايسر = **34.54**ملم ومتوسط قياس الارتفاع الايمن = **31.97**ملم وقياس الارتفاع الايسر = **32.50**ملم ومن خلال هذه النتائج توصلت الدراسة الى ان ليس هنالك فرق فى القياسات بين الذكور والاناث.

كما ان ليس هنالك علاقة بين العمر وقياسات الجيوب الفكية الامامية.

ان متوسط قياس العرض الايمن = **21.53**ملم ومتوسط قياس الجانب الايسر = **20.42** ملم وقياس متوسط الارتفاع الايمن = **33.25**ملم ومتوسط قياس الجانب الايسر = **33.09** ملم ومتوسط قياس الحانب الامامى الخلفى الايمن = **34.64**ملم ومتوسط قياس الحانب الامامى الخلفى الايسر = **34.48**ملم وتوصلت الدراسة من خلال القياسات للجنسين معا لا يوجد فرق فى قياسات الجوانب.

بهذا تمنحنا الدراسة معلومات هامة عن الابعاد للجيوب الفكية الامامية الطبيعية لدى السودانيين

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Abbreviation

CTA	Compeuted Tomography Axial
CT	Computed Tomography
PNS	Paranasal sinuses
MDCT	Muti Detcter Computed CT
DAS	Data aquisition system

Chapter One

Introduction

1.1 Introduction:

Since the discovery of x-rays by W C Roentgen in 1895, medical imaging has contributed significantly to progress in medicine. Diagnostic imaging has grown during the last 50 years from a state of infancy to a high level of maturity. And become having an important role in patient management, and especially radiologic diagnosis (Seeram, 2001).

One of these developments in medical imaging is computed tomography (CT) —sometimes called CAT scanning— was discovered independently by a British engineer named Sir Godfrey Hounsfield and Dr. Alan Cormack. It has become a mainstay for diagnosing medical diseases. For their work, Hounsfield and Cormack were jointly awarded the Nobel Prize in 1979. (Seeram, 2001).

CT or CAT scans are special x-ray tests that produce cross-sectional images of the body using x-rays and a computer.

Because of advances in computer technology, CT scanners have vastly improved these improvements have also led to higher-resolution images, which improve the diagnostic capabilities of the test (Seeram, 2001)

CT produces a volume of data that can be manipulated, CT produces a volume of data that can be manipulated,. CT is noninvasive, safe, and well-tolerated. It provides a highly detailed look at many different parts of the body. (Kennedy. et al, 2001)

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

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

of sinuses, each connected to the nasal cavity by small openings. (Paul, 1998)

So CT scanning is the standard imaging in the evaluation of the paranasal sinuses. It is also used as a tool to establish the severity of disease and response to treatment and surgery.

The beauty of CT scans is that they can be artificially “rotated” inside the computer. This gives docs the ability to change the angle of the “slices” through the head – the “plane”. In practical terms, there are only 2 planes that are common for imaging the sinuses: the coronal plane, and the axial plane that can diagnose the PNS diseases more than other modalities. (Yousem, 1993)

Sinus problems and sinus disease are commonly these days.

And demonstrates the anatomical structure of the maxillary sinuses and accuracy of the maxillary sinus dimensions

1.2 The problem of study:

Characterization of maxillary sinuses differs according to many factor including age and gender to confirm this select the CT scan imaging modality as one of the methods which used for measurement of normal or disease of maxillary sinuses on Sudanese population.

1.3 Objectives

1-3-1 General objective:

To determine normal maxillary sinuses dimensions.

1.3-2 specific objective:

- To compare between males and females dimensions.
- To compare between the right side and left side of maxillary sinus.
- To correlate between measurement and age.

1-4 Over view of the study:

This study consisted of five chapters’ chapter one an Introduction which includes;

General,specific objectives also contain problem of study. Chapter two includes: literature review.Chapter three describes material and method. Chapter four include result of presentation of finding of study' finally.Chapterfive includediscussion, conclusion and recommendation .

Chapter (Two)

Literature Review

2.1 Anatomy and physiology:

The nasal ssory 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 (C.k Warrick , 1969)

In all, there are eight sinuses they are divided into two groups; the anterior and posterior groups(figure2-1) 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 (C.k Warrick, 1969).

The anterior group drainage into middle meatus which is bordered by the middle turbinate bone and the posterior group drainage into superior meatus (which is a space defined by superior turbinate bone) and the sphenothmoidal 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. et al,1990),(Tasar. et al, 2007), (Eggesbo. et al, 2001),(Kapoor. et al, 2002)

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. et al, 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 Nasal cavities:

The anterior part of the nasal cavity opens inferiorly in the nostril while the nose communicates posteriorly with the rhino pharynx. Usually, authors divide the nasal cavity into three parts: the nasal vestibule, the olfactory region and the respiratory region. The junction of the vestibule with the nasal cavity is called the internal nasal valve. It is situated between the caudal end of the upper alar cartilage laterally, and the septum medially. Its apical angle has angulations of less than **15°**. It is the narrowest site of the nasal cavity, only 0.3 cm² on each side

2.1.2 Nasal septum:

The septum divides the nasal cavity into two halves. Depending on the expansion of the perpendicular plate and the vomer, i.e. the bony parts of the septum, the cartilaginous septum reach adult dimensions at the age of **2** years. The bony part of the septum consists of the perpendicular plate of the ethmoidal bone and the vomer while the cartilaginous part is formed by the quadrilateral cartilage. The anterior part defines the columella and the postero-superior angle has contact with the sphenoid bone. The nasal septum lays in the crista nasalis of the bony palate. (Watelet and Cauwenberge 1999)

2.1.3 Turbinate:

The lateral nasal wall supports the three turbinate (inferior, middle, superior and sometimes there is even a supreme) that divide this lateral wall into three meats (inferior, middle, superior). Before 9 weeks of gestation, three soft tissue elevations (the pre turbinate) can be identified within the nasal cavity; they are orientated both in size and position in a similar way to the inferior, middle and superior turbinate in the adult. The turbinates contain cartilage at 9 weeks of gestation. The inferior turbinate ossification appears to proceed that of the middle turbinate (17 week's vs 19 weeks of gestation). The head of the inferior turbinate interferes directly with the entering airflow and its tail, in case of hypertrophy, can significantly reduce the choanal size. The middle turbinate covers the ostium of the major sinuses medially, while the supreme turbinate is not always present.



Fig 2-1 Coronal CT Image illustrate turbinate and nasal septum (David Sutton 2002)

2.1.4 Histology of the maxillary sinus:

The maxillary sinus is lined with a mucous membrane of the respiratory type however it is somewhat thinner than that lining the nasal cavity. The antral mucous membrane is formed of an epithelial layer resting on a basement membrane and a subepithelial connective tissue layer.

2.1.4.1 The epithelial layer:

The epithelial layer of the maxillary sinus lining is thinner than that of the nasal cavity. Composed predominantly of pseudostratified columnar ciliated cells derived from the olfactory epithelium of the middle nasal meatus, in addition to columnar non ciliated cells, basal cells and mucous producing and secreting goblet cells.

The pseudostratified columnar ciliated epithelial cells have nucleus and electronlucent cytoplasm containing numerous mitochondria, enzyme containing organelles and basal bodies. The latter serve to attach the ciliary microtubules to the apical cell membrane. Structurally the cilia are composed of 9 + 1 pairs of microtubules which provide the mucociliary motile function to the sinus epithelium, which moves the debris, microorganisms, and the mucous film lining the epithelial surface of the sinus into the nasal cavity through the ostium maxillare. The cilia beat automatically; they are not under nervous control.

The goblet cell is a unicellular gland; it is mucous synthesizing and secreting cells. It resembles an inverted wine glass with a short stalk like basal end containing the nucleus and a swollen apical end containing mucin. It is an apocrine gland, i.e. it pours its secretion through rupture of its apical cell membrane that gets regenerated. So it has all the criteria of the synthesizing and secreting cells.

2.1.4.2. The subepithelial connective tissue layer (lamina propria):

The lamina propria of the maxillary sinus lining is much thinner than that of the nasal mucosa.

It is formed of connective tissue cells, and intercellular substance of collagen bundles and few elastic fibers. It is moderately vascular. The lamina propria contains subepithelial antral glands composed of mixed glands formed of serous and mucous acini or seromucous acini as well as myoepithelial cells. The antral glands are more concentrated in the lamina propria located around

the ostium maxillare. The mixed secretory products of the antral glands reach the sinus cavity through their excretory duct .

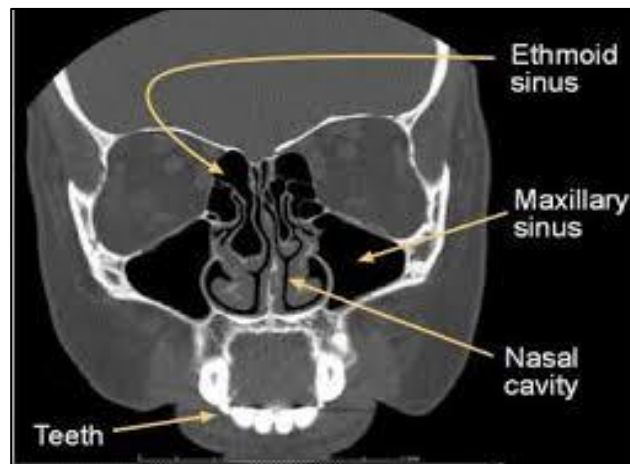


Fig 2.2 coronal CT image illustrate paranasal sinuses.(snell 2000)

2.1.5 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 pneumatization of the maxilla. They are more or less shaped like a pyramid. The capacity of the maxillary sinus is roughly 1 fluid ounce (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 (Snell 2000)

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(Snell 2000)

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.

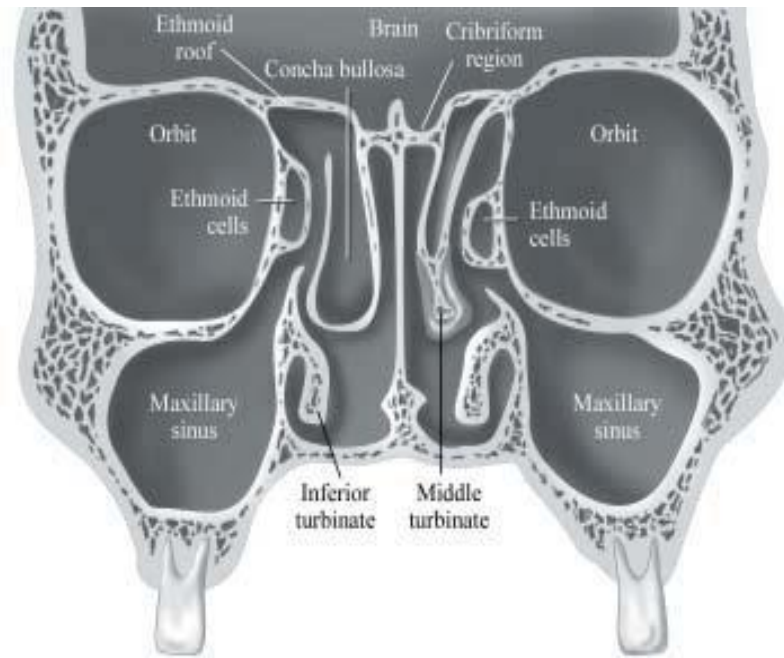


Figure 2-3: Show anatomy of paranasal sinuse(Snell 2000)

2 -1-6 Developments:

The maxillary sinuses are the only sizeable sinuses present at birth they have the size of a small lima bean measuring about 8x4mm; and are situated with their longer dimension directed anteriorly and posteriorly.

They develop at the third month of intrauterine life; in the place existing between the oral cavity and the floor of the orbit (snell 2000)

They develop as an evagination of mucous membrane of the lateral wall of the nasal cavity at the level of the middle nasal meatus forming a minute space that expands in an inferior direction into the primordium of the maxilla(Snell2000)

Growth of the maxillary sinus is determined by a process of bone remodeling referred to as pneumatization which is carried out by resorption of the internal wall (except the medial wall) at a rate that slightly exceeds growth of the maxilla

In young age 'sinus growth by pneumatization is proportional to the growth of the maxilla. However with the advance of age pneumatization exceeds

maxillary growth .thus the anturm will expand at the expense of the maxillary process.

2- 1-7 Function of the maxillary sinus;

Lightening the weight of the skull

Resonance of voice olfactory and respiratory modulation through regulation of the air pressure within the sinus during respiration .

Inspired air condition.

Crainofacial protection against mechanical trauma.

Production of the bacterial enzyme (lysozyme) which may be significant in protection against bacterial infection of the nasal mucosa.

2- 1-8Anatomical variation of maxillary:

The maxillary sinus can exhibit anatomic variations such as :

Mxillary sinus pneumatization.

Maxillary sinus hypo plasia. Maxillary sinus septa and Accessory maxillary sinuses ostia

2.2 Computed tomography (CT scan):



Fig 2-4 illustrate CT machine

Helical scanning in the late 1980s, helical CT has revolutionized clinical imaging. Also called spiral (or continuous acquisition) scanning, helical scanning brought dramatic improvement in scanning speed by eliminating the interscan delay. There are three basic ingredients that define a helical

scan process: a continually rotating x-ray tube, constant x-ray output, and uninterrupted table movement. Increasing the scan speed results in improved image resolution owing to the ability to obtain images with Improved iodinated contrast concentration, decreased respiratory and Cardiac motion artifact, and superior multiplanar and three dimensional(3-D) reformation capabilities. In addition to improved diagnostic Accuracy, the speed associated with helical scanning is also beneficial in Regards to patient comfort and department productivity. (Lois E.2011).

Helical scanners were constructed with a single row of detectors. Since Then, MDCT systems with as many as 64 detector rows have been Introduced. By further improving scan speed, these systems have made Clinical applications, such as CT angiography (CTA). (Lois E.2011).

2.2-1 CT Machine Equipment:

The rotating part of the system consists of the X-ray tube, High voltage Generator, Detectors and Data acquisition system (DAS). The stationary Part consists of the front-end memory and computer and the first stage High voltage component. The X-ray tube and detectors rotate continuously during data collection because the cable wraparound³⁰

Problem has been eliminated by slip ring technology. Because large amounts of projection data are collected very quickly, increased storage is Needed. This accommodated by the front-end memory fast solid state, and magnetic disk storage. In spiral CT scanners, the X-ray tube is energized for longer periods of time compared with conventional CT tubes. This character requires X- ray tubes that are physically larger than conventional X-ray tubes and has heat unit's capacities greater than 3 Million heat units (MHU) and anode cooling rates of (1 MHU) per minute. X-ray detectors for single slice spiral CT scanning are one dimensional (ID) array and should be solid state because their overall efficiency is greater than gas ionization detectors.

The high voltage generator for spiral CT scanner is a high frequency generator with high power output. The high voltage generator is mounted on the rotating frame of the CT gantry and positioned close to the X-ray tube. X-ray tubes operate at high voltages (about 80 to 140 kVp) to produce X-rays with the intensity needed for CT scanning. At such high voltages, arcing between the brushes and rings of the gantry may occur during scanning. To solve this problem, one approach (high voltage SR) is to divide the power supply into a first stage on the stationary part of the scanner, where the voltage is increased to an intermediate level and a second stage on the rotating part of the scanner, where the voltage is increased to the required high voltages needed for X-ray production and finally rectified to direct current potential. Another approach passes a low voltage across the brushes to the slip rings, the high voltage generator and then the X-ray tube. In both designs, only a low to intermediate voltage is applied to the brush / slip ring interface, thus decreasing the

2-3 Previous study:

The study conducted by Pawarively et al (2010) at Mumbai. The aim of the study was to estimate dimensions of the maxillary sinuses on CT scan to compare the data gender wise and side wise. It was found that the mean depth, the width, and the height of the maxillary sinus in males on both right and left sides as (38, 38) (27, 26) and (34, 33) mm respectively. In females (37, 36) (27, 26) and (34, 33) mm respectively.

Another study done by Nahid Abdalla in Sudan (2013). The aim of the study was to characterize the maxillary sinuses in 49 patients with normal maxillary sinuses. The study showed the height of the left maxillary sinus (29.1 ± 4.24) mm and the height of the right side (29.04 ± 4.99). Also, the study found the left width of maxillary sinus (23.12 ± 4.54) mm and the right side width (23.01 ± 4.59).

Also the study done by Dr /N.K.Y.ManjmathuKumaravel in Tamil Nadu(2016) in 200 patient ,the aim of the study to estimate dimensions of maxillary sinuses on CT Scan to difference between males and females and to compare side wise .was found the mean of the right and left sides depth, width and height for males (34.48+_0.75 , 34.47+_75) (24.31+_0.30 ,24.31+_0.31) and of maxillary sinuses depth,width and height for females (32.95 +_0.53 ,32.84+_1.04)(23.07+_0.62 ,23.60+_1.08)and(33.14+_3.17 ,33.31+_2.82) and it was found in the comparison between the right side of maxillary sinuses and left side

the mean right side depth,width and height for males (33.7+_1 , 33.65+_1.22) (23.69+_0.78 ,23.96 +_0.86)and (34/66 +_2.71 , 34.74+_2.48) respectively .

The study conducted by Sharma el al (2014) in Gwalior (India)region on comparison of dimension s between males and females ,there was equal dimensions in height , width and depth of the maxillary sinuses for males and females but the depth of maxillary sinus different for males .

Chapter Three

Materials & Methods

3.1 Subjects

The study was carried out in Khartoum State, Sudan in Alamal diagnostic center ,from October2017 to March 2018. Patients were randomly selected including asymptomatic subjects it was done on 50 subjects. Subjects were diagnosed as normal sinus. Patient having pathological changes as sinusitis, any congenital abnormalities in maxillary sinuses and subjects younger less than 20 years were exclude.

3.2 Machine used:

CT scan of maxillary sinuses has conventionally being performed with continuous 3mm coronal and axial slices. High resolution multiplaner scanners have made reformatted images apossibility.These scanners enable imaging in three planes ,the study was carried out in Toshiba,64 slice made by Toshiba medical system corporation in Japan 2007.

3.3 Technique used:

CT head was performed in supine multislice CT scanner Toshiba Aquillion 64, is used Axial paranasal sinus were obtained in parallel projection on to the orbitomeatal line ,with a(0.5 mm)slice thickness and a (0.6 mm) reconstruction interval . Reconstruction of the Axial images using slice thickness equal to (3mm), the measurement were performed on coronal and sagittal images. Maxillary sinuses dimensions measurements were taken as follows:

1-Height was measured on coronal reconstructed image between the lowest point of the sinus floor to the highest point of the sinus roof .2-The maximal width was measured on coronal reconstructed image between medial walls of sinus to the outermost point of lateral wall of sinus. 3-The maximal depth was measured on sagittal reconstructed image between the most anterior point to the most posterior point of the sinus.

3.4 Image interpretation:

Interpretation by radiological Technologist and radiologist.

3.5 Data collection:

All subjects were examined by multislice CT scanner of adult Sudanese population and data collected on data collecting sheets.

3.6 Data analysis:

Data was analysed using statistics package for social sciences (SPSS) to identify normal measurement range and frequency distribution for all variable.

Chapter Four

Results

4.1 Results:

Table 4-1 Shows the patients gender in frequency and percentage

	Frequency	Percent	Valid Percent	Cumulative Percent
Male	28	56.0 %	56.0	56.0
Valid Female	22	44.0 %	44.0	100.0
Total	50	100.0 %	100.0	

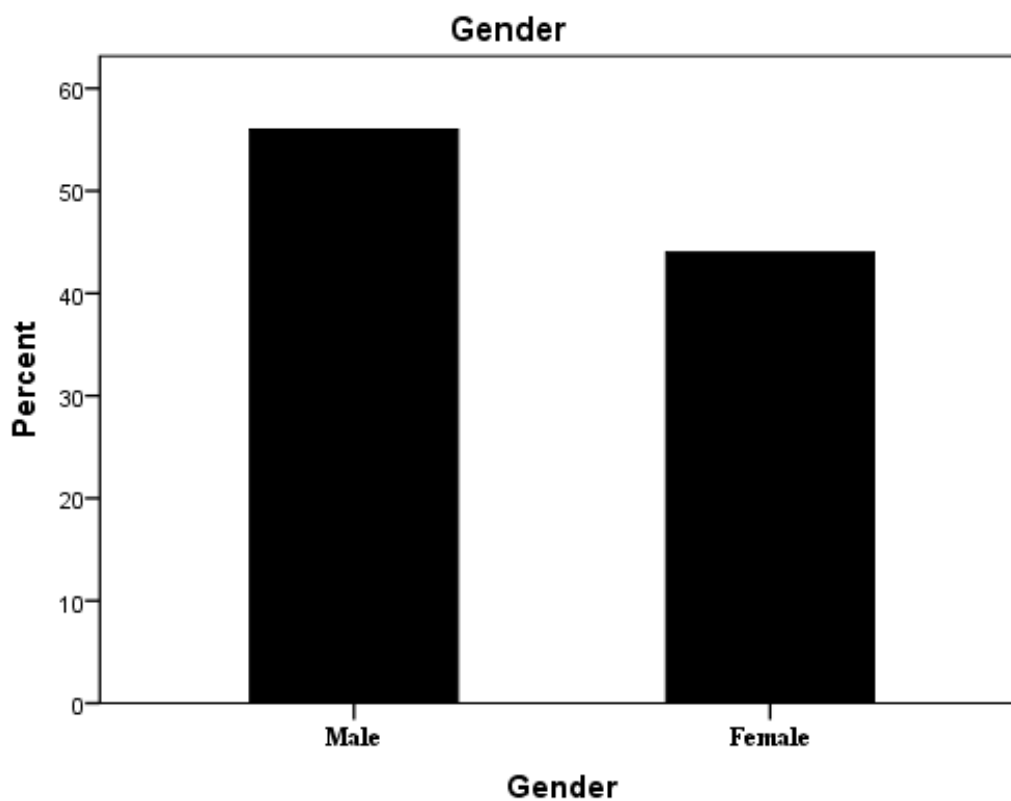


Figure 4-1 Percentage of patient's gender

Table 4.2 Descriptive Statistics of Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Age	50	22	80	42.76	16.205
Rt Maxillary Sinus Height	50	18.8	49.5	33.250	5.5614
Rt Maxillary Sinus Width	50	11.2	36.0	21.530	5.3868
Rt Maxillary Sinus Depth	50	28.2	39.9	34.642	3.3429
Lt Maxillary Sinus Height	50	21.1	46.4	33.090	6.0324
Lt Maxillary Sinus Width	50	12.4	34.5	20.424	5.1864
Lt Maxillary Sinus Depth	50	25.7	41.1	34.488	3.6898

Table 4.3 Comparison of right side and left side maxillary sinus dimensions in (mm) between males and females.

Group Statistics					
	Gender	N	Mean	Std. Deviation	Std. Error Mean
Rt Maxillary Sinus Height	Male	28	34.254	5.7345	1.0837
	Female	22	31.973	5.1803	1.1044
Rt Maxillary Sinus Width	Male	28	20.561	5.6732	1.0721
	Female	22	22.764	4.8457	1.0331
Rt Maxillary Sinus Depth	Male	28	34.779	3.1511	.5955
	Female	22	34.468	3.6403	.7761
Lt Maxillary Sinus Height	Male	28	33.554	6.3118	1.1928
	Female	22	32.500	5.7478	1.2254
Lt Maxillary Sinus Width	Male	28	20.611	6.0432	1.1421
	Female	22	20.186	3.9627	.8449
Lt Maxillary Sinus Depth	Male	28	34.839	3.6553	.6908
	Female	22	34.041	3.7703	.8038

There is no statistical significant difference between Male and Female measurement ($p > 0.05$)

Table 4-4 comparison between right and left sides maxillary sinus.

Paired Samples Statistics					
		Mean	N	Std. Deviation	Sig. (2-tailed)
Pair 1	Rt Maxillary Sinus Height	33.250	50	5.5614	0.75
	Lt Maxillary Sinus Height	33.090	50	6.0324	0.75
Pair 2	Rt Maxillary Sinus Width	21.530	50	5.3868	0.03
	Lt Maxillary Sinus Width	20.424	50	5.1864	0.03
Pair 3 r	Rt Maxillary Sinus Depth	34.642	50	3.3429	0.73
	Lt Maxillary Sinus Depth	34.488	50	3.6898	0.73

Table 4-5 Show relation between age and dimensions.

Correlations								
		Age	Rt Maxillary Sinus Height	Rt Maxillary Sinus Width	Rt Maxillary Sinus Depth	Lt Maxillary Sinus Height	Lt Maxillary Sinus Width	Lt Maxillary Sinus Depth
Age	Pearson Correlation	1	-.142	.017	-.174	-.124	.047	.090
	Sig. (2-tailed)		.325	.908	.228	.390	.744	.535
	N	50	50	50	50	50	50	50

Chapter Five

Discussion, Conclusion and Recommendation

5.1 Discussion:

In this study conducted by Pawar et al (2010) at Mumbai it was found that the mean the depth, the width and the height of maxillary sinus in males on both the right and the left sides as ((38 ,38) (27 , 26) and (34 , 33)mm respectively

But in females (37,37) (27 , 26)and (34 , 33)mm respectively , in this study the average height and width Of the maxillary sinuses are equal in both gender ,

In the present study was found the depth ,the width and height of the maxillary sinus in males on both the right and the left sides as (34.77 ,+_3.15 / 34.83+_3.65) (20.56+_5.67 ,20.61+_6.04)and (33.25+_5.73 ,33.55+_6.31)mm respectively, in female was found (34.46+_3.64 ,34.04 +_3.77) (22.76+_4.84 ,20.18+_3.96)and (31.97++_5.18 ,32.50 +_5.74)mm respectively. Therewere all dimensions found no significant difference P value (>0.05).

In study done by Nahid Abdalla in Sudan (2013) in 49 patients with normal maxillary sinuses,the study showed the height of left maxillary sinus was (29.04+_4.24)mm bigger than the the right of maxillary sinus (29.04 +_4.99)

Also the study found the left side width of maxillary sinus (23.12 +_4.54)mm bigger than the right side width ((23.01+_4.50),but in the present study was found no significant difference of the height and depth ,but the width of the right side (21.53+_5.38)mm is bigar than that of the left side (20.42 +_5.18)mm.

The study done by Dr/N.muthuKumaravelk.y.manjunath in Tamil Nadu(2016) in 200 pateint (100 males)(100 females) ,the study was found the mean of the depth ,height and the width of the maxillary sinus of both the right and left side were comparatively less in females than the males , and the difference was found to be statistically significant ($P < 0.0001$).

On comparison between the sides of maxillary sinus did not show any significant difference in the measurement of the depth and height($P > 0.05$) .whereas the width of the left side (23.96 mm) was higher than that of the right side (23.69) and the difference was found to be statistically significant ($P < 0.05$).

In the present study was found no different between males and females,also was found on comparison between the sides of the maxillary sinus did not show any significant difference in measurements.

In the study conducted by (Sharma et al, 2014)in Gwalior India region. On comparison of dimensions between males and females, the mean values of the height and width of the maxillary sinuses had no statistically significant difference P value (> 0.05), but the depth of the maxillary sinus had statistically significant difference for the males.

In the present study the mean values of the all the three dimensions (width ,height and depth) had no statistically significant difference .

5.2 Conclusion:

Sudanese population maxillary sinuses measurement difference from other comparing populations and also there no differences in measurements between males and females and no difference between right and left sides. Also there no relation between age and measurement of dimensions.

5.3 Recommendation:

CT is more valuable tool in the imaging of maxillary sinus .CT scans also detects the anatomic variation that may place the patient at an increased risk for intraoperative complications.

- Further studies of the maxillary sinuses measurement in different tribe in Sudan using CT.
- Further studies of the maxillary sinuses measurement of dimension in axial view
- Further studies of the maxillary sinuses measurement of dimensions using large sample.

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