Sudan University of Science and Technology

College of Graduate Studies

Study of Normal Maxillary Sinuses Dimensions Among Sudanese using CT

دراسة الجيوب الانفية الفكية الامامية الطبيعية لدى السودانيين باستخذام الاشعة المقطعية المحوسبة

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

By:

Ahmed Ali Ahmed Ibrahim

Supervisor:

Dr. Asma Ibrahim Ahmed Elamin

2020

الآية

قال تعالى:

(وقل ربي زدني علما)

صدق الله العظيم

(طه الآية 114)

DEDICATION

To my Family

To My Colleague & Teacher

To Everyone help to Complete This Thesis

ACKNOWLEDGEMENT

I would like to express my grateful to my main supervisor Dr.Assma Ibrahim Ahmed Elamin for her close supervision guidance , encouragement to Complete and understanding of the Subject

Abstract

Descriptive study, done in Alsaha Specialist Hospital , using Newsoft machine 16 slice . 50 subject with no any pathological condition ,22 male and 28 female ranged between (21-81) years, CT scan were obtained using CT machine with 120 kvp and , measurement of maxillary sinuses was taken in mms for both genders.

The maxillary sinuses dimensions (width, length) were measured with the help of the computer software in spiral ct system ,data collection sheet used in collect date and the date analysis using SPSS ,The statistical analysis of maxillary sinuses measurement show the mean of the right width 27.206+_7.06mm and left side 27.21+_7.62 mm and right length 37.73+_5.188 mm and left length 38.48=_5.65 mm

The result showed that there was relation between maxillary sinueis measyrement and theage ,we found that there is a negative correlation between the age and the length RT length R = 0.0054 . Also there is a negative between the age and the Lt length R =0.0038 ,also we found a positive correlation between the age and the width RT width R =0.036 (scatter plot 4-4) LT width R = 0.0103 (scatter plot 4-5).in the present study was found no different between males and females.

Concluded that ceramal CT scan had value in chanactinztion of maxillary sinuses and sudaneses have different measurement from the other population .

مستخلص البحث

هدفت هذه الدراسة لقياس الأبعاد التشريحية الطبيعية بأستخدام الأشعة المقطعية وأجريت هذه الدراسى على 50 حالة من السودانيين 22 ذكثر 28 اناث

وقد تقسيم الحالات تبعا للعمر والجنس واجريت لهم الأشعة المقطعية واستخدام المحمور الأفقي لأخذ القياسات

أجريت هذه الفحوصات في ولاية الخرطوم من الفترة اغسطس 2019 الي أكتوبر 2019 بقسم الأشعة مستشفى الساحة

وقد اخذت الابعاد للجيوب الفكية الامامية للحالات من عمر 21 الى 80

اظهرت الدراسة من خلال قياسات الجيوب الفكية الامامية ان متوسط قياس العرض الأيمن 27.20 ملم ومتوسط قياس العرض الأيسر27.21 ملم ومتوسط قياس الارتفاع الأيمن 34.73 ملم ومتوسط قياس الارتفاع الأيسر 35.48

ومن خلال هذه النتائج توصلت الدراسة بأن ليس هناك علاقة بين العمر وقياسات الجيوب الفكية الأمامية

وصلت الدراسة الى معلومات هامة حول قياسات الجيوب الفكية الامامية لدى السودانيين ,كما اوضحت الدراسة وجود علاقة بين القياسات والعمر وعرض الوجه ,كما توصلت الى ان السودانيين لهم قياسات مختلفة مقارنة بالشعوب الاخرى .

List of Contents

Chapter One

Introduction

Chapter Two

Background and Literature Review

Chapter Three

Materials and Methods

Chapter Four

Results

Chapter Five

Discussion, Conclusion and Recommendation

List of Figure

Abbreviation

SPSS	Statistical packages of social sciences
MDCT	Multi Detector Computed CT
PNS	Par nasal sinuses
CT	computed tomography
DAS	Data aquision system

CHAPTER ONE

INTRODUCTION

Chapter One

1.1Introduction

Maxillary sinuses is at the cross roads of dentistry and otorhino-larynologist occupies a straight position connected directly to nasal cavity and related indirectly to the oral cavity and maxillary alveolus it there for imperative that even the oral maxillofacial radiologist has to be well versed with pathologies of maxillary sinus and there can be no escape from this additional responsibility (Bahskar k battle 2010) .

The first modern and accurate descriptions of the paranasal sinuses can be traced to the works of the late 19th century Austrian anatomist Emil Zuckerkandl. His detailed study and illustrations of the paranasal sinuses set the standard for generations of anatomists and physicians. Countless 19th and 20th century anatomists, radiologists and surgeons have further contributed to advancing the knowledge of sinus anatomy. The introduction of computed tomography (CT) and the wider use of it in the last 20 years have further contributed to the physician's ability to appreciate nuances of paranasal sinus anatomy and accurate disease correlation. The introduction of head and neck CT imaging and the current wider use of this modality have undoubtedly helped the clinician. CT has become a useful diagnostic modality in the evaluation of the paranasal sinuses and an integral part of surgical planning. It is also used to create intraoperative road maps. Today, CT.is the radiologic examination of choice in evaluating the paranasal sinuses of patient with sinusitis (Bell 2013). The use of CT scanning combined with functional endoscopic sinus surgery (FESS) has empowered the modern sinus surgeon to treat patients more effectively, facilitating reduce morbidity and complications. Physicians who are interested in treating patients with sinus disease must be able to read and interpret sinus CT.Scan. Mastery of sinus anatomy and its variant features form the basis from which radiologic interpretation begins. Familiarization with the radiologic landmarks and cross-sectional anatomy on patient CT scans, along with clinical correlation, can further enhance the reader’s ability to understand sinus CT findings (Bilaniuk 1982). With experience, CT findings can be accurately correlated with the anatomic and clinical realities of the particular patient. As in all radiologic surveys, sinus CT scans must be read with systemic approach. In addition to reviewing the scan to determine the presence of disease, CT.Scan of sinuses can also be reviewed to evaluate potential areas of occlusion and variations of the patient’s sinus anatomy is the setting of surgical planning (June et al 1984)

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)

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)

1.2The Problem of Study

There was no reference of the maxillary sinuses in the axial section .

1.3. Objectives

1.3.1. General objective

- To measurement maxillary Sinuses in normal Sudanese’s population

1.3.2 Specific objectives

-To correlate between Rt and Lt

- To compare between males and female

-To correlate the length with age

-To correlate the width with age

-To find out and index for Sudanese population

1.4 the scope of the study

The study consist five chapters, chapter one consist of introduction , problems of the study and objectives of the study chapter two includes the literature review and previous studies . Chapter three describe the material and method .chapter four includes the results, lastly chapter five includes the discussion.

Chapter Two

Background and Literature Review

Chapter Two

Background and Literature Review

2.1 Theoretical background

2.1.1 Anatomy of paranasal sinuses

par nasal sinuses are a group of four paired air-filled spaces that surround the nasal cavity. The maxillary sinuses are located under the eyes; the frontal sinuses are above the eyes; the ethmoidal sinuses are between the eyes and the sphenoidal sinuses are behind the eyes. The sinuses are named for the facial bones in which they are located . (Dr.T.Balasubramanian .M.S.D.L.O)

The function of the sinuses is not clear. It is thought that they may contribute to the humidifying of the inspired air. They also reduce the weight of the skull.

Sinuses are formed in childhood by the nasal cavity eroding into surrounding bone. As they are outgrowths of the nasal cavity, they all drain back into it – opening**s** to the paranasal sinuses are found on the roof and lateral walls of the nasal cavity. The inner surface is lined by a respiratory mucosa. (Dr.T.Balasubramanian .M.S.D.L.O)

Paranasal sinuses form developmentally through excavation of bone by air-filled sacs (pneumatic diverticula) from the nasal cavity. This process begins prenatally (intrauterine life), and it continues through the course of an organism's lifetime.

The results of experimental studies suggest that the natural ventilation rate of a sinus with a single sinus ostium (opening) is extremely slow. Such limited ventilation may be protective for the sinus, as it would help prevent drying of its mucosal surface and maintain a near-sterile environment with high carbon dioxide concentrations and minimal pathogen access. Thus composition of gas content in the maxillary sinus is similar to venous blood, with high carbon dioxide and lower oxygen levels compared to breathing air. (Courty of susan Standring 2008)

At birth only the maxillary sinus and the ethmoid sinus are developed but not yet pneumatized; only by the age of seven they are fully aerated. The sphenoid sinus appears at the age of three, and the frontal sinuses first appear at the age of six, and fully develop during adulthood (J.scott (1982)

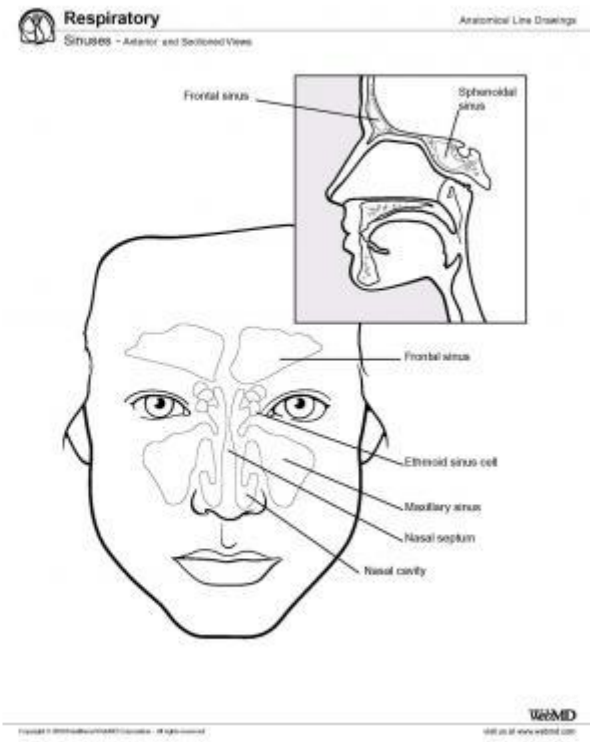

Fig2-1 show paranasal sinuses (en.wikipedia.org/wiki/Maxillary sinus)

2.1.1.2 Maxillary sinus

The maxillary sinus is one of the four paranasal sinuses, which are sinuses located near the nose. The maxillary sinus is the largest of the paranasal sinuses. The two maxillary sinuses are located below the cheeks, above the teeth and on the sides of the nose.

The maxillary sinuses are shaped like a pyramid and each contain three cavities, which point sideways, inwards, and downwards. The sinuses are small air-filled holes found in the bones of the face. They reduce skull weight, produce mucus, and affect the tone quality of a person's voice. J.scott (1982)

The maxillary sinus drains into the nose through a hole called the **ostia**. When the ostia becomes clogged, sinusitis can occur. The ostia of the maxillary sinus .

2.1.1.3 Frontal sinus

The is frontal one of several pranasel sinuses of the cranium. It is located in the frontal bone and completes growth by around the 20th year. Frontal sinuses are highly variable in size and shape, permanent after development is complete, and easily visualized using radiology (including X-rays, computed tomography scan, and magnetic resonance imaging). These features make frontal sinuses ideal structures for personal identification of human remains in cases where ante mortem records depicting the frontal sinuses are available for comparison. Frontal sinuses were first used in identification in 1925 and have since been widely studied by forensic anthropologists and radiologists including the development of methods to codify and quantify frontal sinus size and shape. Recent advances include studies on improving comparison methods through standardization, quantification, and automation, as well as improved imaging of frontal sinuses due to advances in forensic radiology. The successful admission of a frontal sinus-based identification following an admissibility hearing further supports the acceptance of frontal sinuses as a reliable and valid method of personal identification. J.scott (1982)

2.1.1.4 Sphenoid sinus

The sphenoid sinuses are located in the sphenoid bone near the optic nerve and the pituitary gland on the side of the skull. There are seven bones that form the orbit (eye socket), and the sphenoid is one of these bones. The pituitary gland, which produces many different hormones that control other glands, is housed in the sphenoid bone. It is also housed in the sella turcica. J.scott (1982)

Like the nasal cavity, the sinuses are all lined with mucus. The mucus secretions produced in the sinuses are continually being swept into the nose by the hair-like structures on the surface of the respiratory membrane (lung lining tissues). This serves to moisten the air we breathe through our noses. The hollow sinuses also act to lighten the bones of the skull and serve as resonating chambers for speech. (Courty of susan Standring 2008)

The paired and often asymmetrical sinuses are small or rudimentary at birth but grow as the skull grows. They are fairly well developed by age 7 to 8, but don't reach their maximum size until after puberty. In adults, the sinuses vary considerably in size and shape.

Sinuses are susceptible to infection. Sinusitis is inflammation of a sinus caused by a bacterial infection that can follow a viral infection. This causes pus and mucus to accumulate within the sinus. Symptoms can include fever, headache, sinus pain, stuffy nose, and impaired sense of smell. (Courty of susan Standring 2008)

2.1.1.5 Ethmoid sinus

The ethmoid sinus (one of six sets of sinuses) is part of the paranasal sinus system and is located between the nose and eyes. It is very small at birth and becomes walnut-sized during puberty. The primary function of the ethmoid sinus, like all the sinus cavities in the skull, is to provide lubrication (mucus) to the inner nose. In addition to creating mucus, the sinuses — including the ethmoid sinus — reduce the skull's overall weight and make one's voice more resonant as they grow in size during puberty. (Courty of susan Standring 2008)

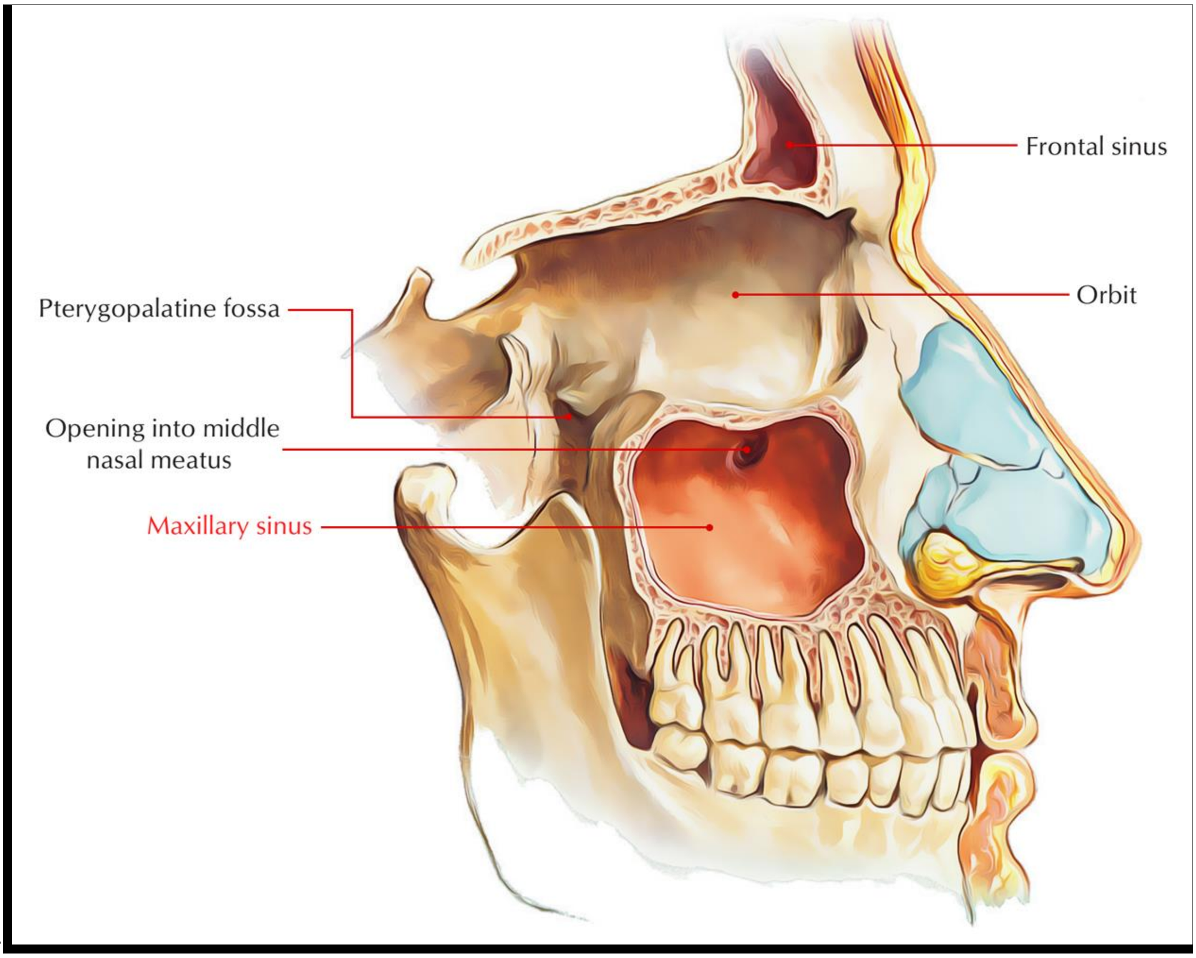

Fig 2.2 Maxillary sinuses (en.wikipedia.org/wiki/Maxillary sinus)

2.1.2 Gross Anatomy

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).

2.1.2.1 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).

In addition, increasing depths of the olfactory cleft correlate with a greater risk of inadvertent injury during surgery. Injury may often result in a cerebrospinal fluid leak, pneumocephalus, or intracranial bleeding. The Keros classification divides the ethmoid roof into 3 configurations: shallow type I (1-3 mm), medium type II (4-7 mm), and deep type III (8-16 mm). The type III configuration, being the deepest, is at greatest risk for complications during endoscopic endonasal surgery. One additional anatomic variant exists in which the orbital plate is thinner and the LCPL runs in a more horizontal direction. An even greater risk of inadvertent injury exists if the surgeon perceives the thinner orbital plate to be part of a superior ethmoid cell, rather than the actual skull base (Weissman, 2008).

2.1. 2.2 vascular supply

The nose and the paranasal sinuses are supplied by the internal and external carotid arterial system. The anterior ethmoidal artery (AEA) and posterior ethmoidal artery (PEA) arise from the ophthalmic artery, the first branch of the supraclinoid internal carotid artery. These ethmoidal arteries traverse the orbit and pierce the lamina papyracea to supply the nose and paranasal sinuses. The AEA crosses the medial rectus, penetrates the lamina papyracea, and runs across the anterior fovea ethmoidalis before branching and supplying the cribriform plate and anterior and superior nasal septum. The AEA runs at a 45 º angle from lateral to medial along the skull base. It usually travels at the base of the frontal recess or behind the ethmoid bulla. If the bulla lamella (attachment of the ethmoidal bulla to the skull base) exists, the AEA runs in it or just posterior to it. Usually the AEA is flush with the skull base, but 14-43% of the time it lies in a mesentery hanging from the skull base, thereby exposing it to a greater risk of injury during surgery. The PEA crosses the medial rectus, penetrates the lamina papyracea, and courses through the posterior ethmoid cells near the anterior face of the sphenoid in close association with the skull base. This artery supplies the posterior ethmoidal sinuses, superior posterior septum, and portions of the superior and middle turbinates. The location of the posterior ethmoidal artery is parallel to the optic nerve near the orbital vertex. Either the AEA or the PEA may be dehiscent, and caution is necessary to prevent injury and retraction of these arteries into the orbit, resulting in an orbital hematoma and potential visual loss. (Weissman, 2008).

The sphenopalatine artery, a terminal branch of the internal maxillary artery, provides blood to the posterior nasal cavity, as well as to portions of the maxillary, ethmoid, and sphenoid sinuses. It passes through the pterygopalatine fossa through the sphenopalatine foramen and branches into the posterior septal artery and the posterior lateral nasal artery. The sphenopalatine artery is located at the posterior edge of the maxillary sinus ostium and is transmitted between the orbital processes of the palatine bone. It is visualized after reflection of the mucosa of the maxillary sinus laterally and the nasal mucosa medially. Removal of the bone that remains leads to the pterygopalatine and infratemporal fossa (Graney DO, 1998).

2.1.3 Physiology of Maxillry sinuses

1. speech and voice resonance
2. Reduce or lighten the weight of the skull
3. Warmth inhaled oxygen
4. Contributes to facial growth
5. Increase surface area for olfaction
6. Regulation of intra nasal pressure
7. Humidity for inspires air
8. Immunological Barrier (body defence)
9. Filtration of inspired air
10. Act as a shock absorber

    (Courty of susan Standring 2008)

2.1.4 Pathology of Paranasal Sinuses

2.1.4.1 Sinusitis

The primary CT findings in the sinus cavities are relatively uniform mucosal thickening of the at least 6 mm.(6) As an intermediate stage, an air fluid level may be observed before the destructed sinus becomes totally opacified. The mucosal thickening of infective sinusitis shows contrast enhancement on CT and where the secretions are retained, multiple concentric rings appear in the affected sinus.(courtesy of killey et al 1975)

Fig2-3 Acute sinusitis. Coronal CT image show mucosal thickening and opacification of left maxillary sinus (en.wikipedia.org/wiki/Maxillary sinus disease)

Clinically and radiographically, both allergic and bacterial sinusitis should show some improvement (documented by CT) after 2-3 weeks of conservative medical therapy.(7)

2.1.4.2 sino nasal polyps

Sino-nasal polyps are soft tissue pedunculated masses of oedematous hyperplastic upper respiratory mucosa. Commonest site is ethmoids followed by maxillary antra and then sphenoid sinus. Inflammatory polyps are indistinguishable from allergic polyp on imaging. CT displays homogenous soft tissue characteristics with smooth, convex borders.(8) Multiple polyps in the ethmoid sinuses can be differentiated from tumour by demonstrating intact bony septa and a thin rim of mucoid material separating the polypoid masses. .(courtesy of killey et al 1975)

The antrochoanal polyp originates from maxillary antrum and extends through the ostium to the nasal cavity and nasopharynx. These solitary, unilateral lesions accounts for 4-6% of all nasal polyps. CT imaging in coronal plane is best for delineating the size and location of such polyps. .(courtesy of killey et al 1975)

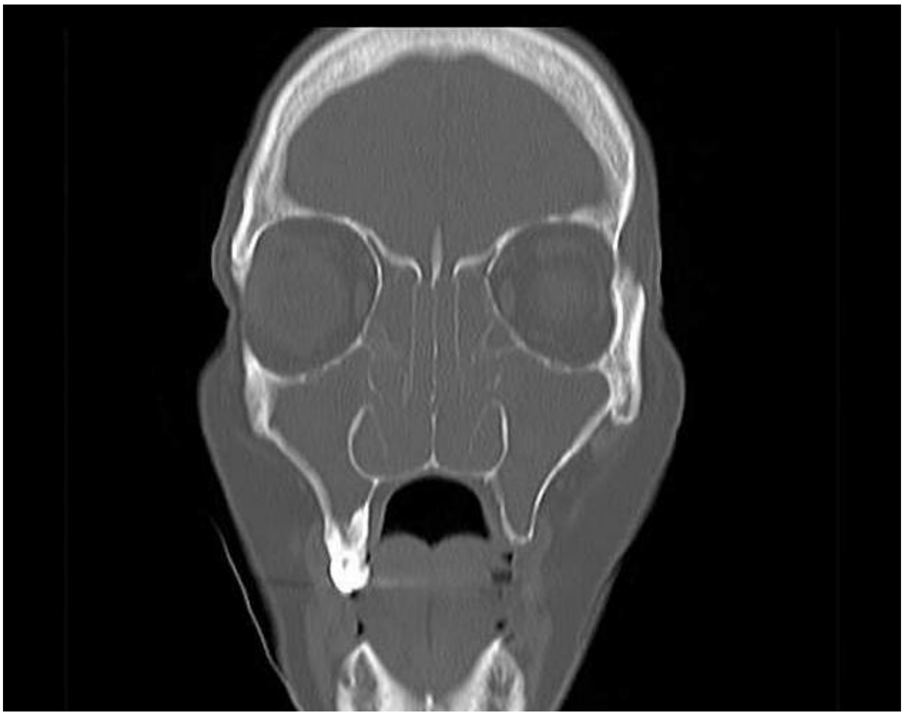

Fig.2-4 :- Sino-nasal polyposis. Coronal CT image shows diffuse, extensive, mucosal thickening and soft tissue pacification of bilateral maxillary, ethmoid, frontal sinuses. The lesion merges with nasal turbinate's (en.wikipedia.org/wiki/Maxillary sinus disease)

2.1.4.3 Mucocoeles

Mucocoeles of the paranasal sinuses are benign, expansile paranasal sinus masses, with time they slowly enlarge to expand and erode bony structures. These lesions have been most commonly reported in the frontal (66%) and ethmoid sinuses (25%) and 10% in maxillary sinuses (10%). Mucocoele of sphenoid sinus is rare.

The majority of mucocoeles have a homogenous appearance on CT, and in general the lesions do not enhance with contrast infusion. These are most often isodense relative to brain tissue, but this may vary, depending on whether they contain clear mucous or thick viscous material of a pyocele.(9) Both transverse and coronal CT are essential for adequate evaluation. .(courtesy of killey et al 1975)

Specific CT signs for mucocoel is described as an isodense mass with clear cut margins on orbital and cranial sides without signs of infiltration. A peripheral shell-like calcification is considered to be a remodeled bone or result of repeated attacks of infection in the mucocoel

2.1.4.4 Benign tumor

Fibro-osseous lesions are very common incidental finding of the craniofacial bones are a challenging group of condition that is difficult to classify and treat. Conventional radiography and CT scanning show thickening of the facial skeleton with encroachment on the lumen of the maxillary sinus. CT characteristics of fibrous dysplasia include expansion of the involved bone with heterogeneous pattern of densities associated with scattered or confluent islands of bone formation.(11) Involvement of optic canals, fissures and osteomeatal complex have been best evaluated by CT. .(courtesy of killey et al 1975)

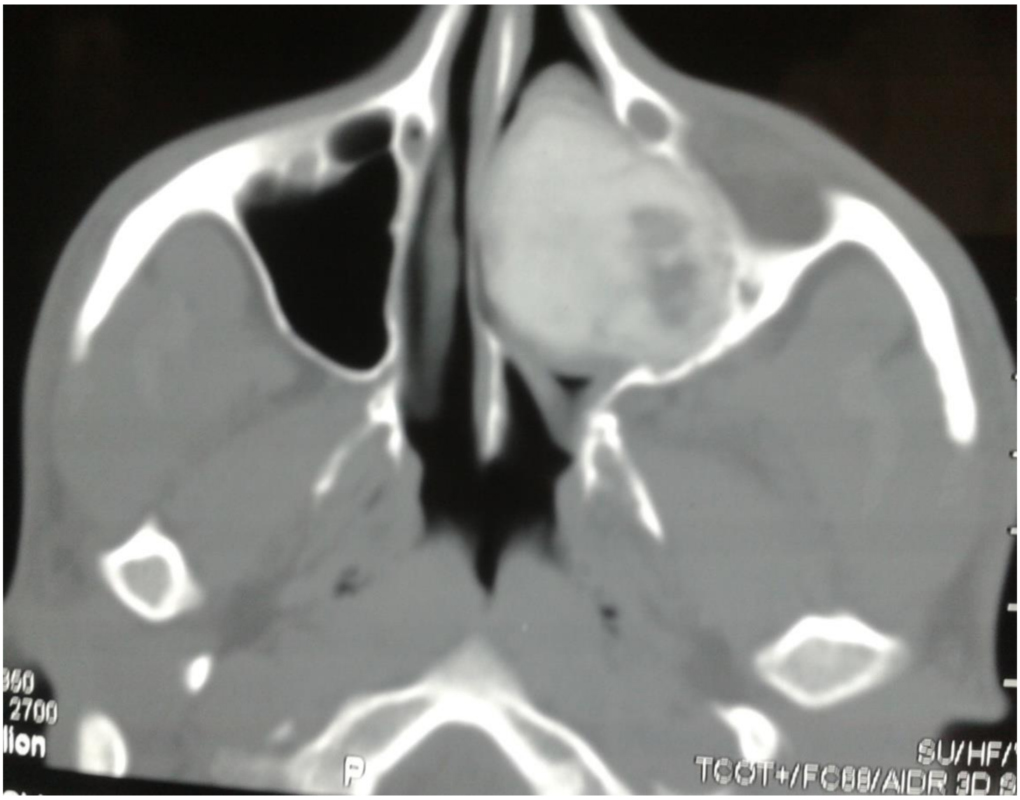

Fig 2-5 Fibrous dysplasia. Axial CT image in bone window shows hyperdense bony lesion seen in left m axillary sinus. (en.wikipedia.org/wiki/Maxillary sinus disease)

2.1.4.5Angiofibroma

is a benign, highly vascular, non-encapsulated neoplasm that occurs exclusively in male adolescents, with intracranial involvement in 20 to 36% of patients.

CT is believed as better option to reveal the gross anatomy of these lesions than other imaging techniques. The geographic of the tumour is usually obvious even without contrast injection; however enhanced scan should always be obtained, on which the angiofibroma will demonstrate intense staining relative to the adjacent muscle. If diagnosis of juvenile angiofibroma is suspected then CT is usually the initial investigation in assessing the extent of tumour in the pterygoid fossa with resultant anterior bowing of posterior wall of the maxillary sinus. It becomes desirable prior to biopsy, which may result in extensive bleeding. .(courtesy of killey et al 1975)

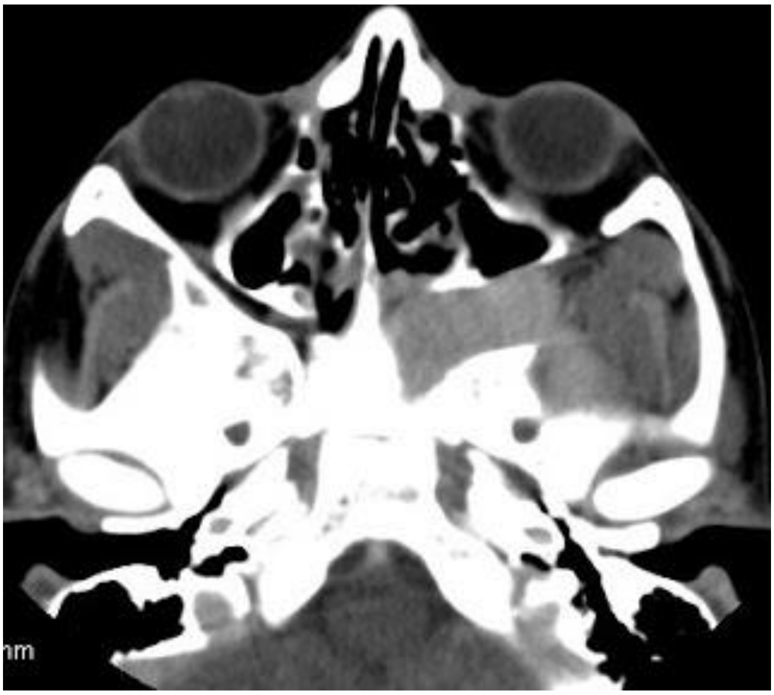

Fig. 2-6. Juvenile Nasopharyngeal Angiofibroma. Axial CT scan of paranasal sinus show enhanced soft tissue lesion in roof of left side of nose involving sphenopalatine fossa extending superiorly to involving pterygopalatine fossa causing widening of it and anterior bowing of posterior wall left maxillary sinus. The lesion also involve left temporal fossa (en.wikipedia.org/wiki/Maxillary sinus disease)

2.1.5 computed tomography (CT scan)

A CT scan or computed tomography scan (formerly computerized axial tomography scan or CAT scan) makes use of computer-processed combinations of many X-ray measurements taken from different angles to produce cross-sectional (tomographic) images (virtual "slices") of specific areas of a scanned object, allowing the user to see inside the object without cutting. The 1979 Nobel Prize in Physiology or Medicine was awarded jointly to Allan M. Cormack and Godfrey N. Hounsfield "for the development of computer assisted tomography. (Springer, 2009)

Fig 2-4.1 Modern CT scanner(en.wikipedia.org/wiki/Computed tomography)

The term "computed tomography" (CT) is often used to refer to X-ray CT, because it is the most commonly known form. But, many other types of CT exist, such as positron emission tomography (PET) and single-photon emission computed tomography (SPECT). X-ray tomography, a predecessor of CT, is one form of radiography, along with many other forms of tomographic and non-tomographic radiography. (Springer, 2009)

CT produces data that can be manipulated in order to demonstrate various bodily structures based on their ability to absorb the X-ray beam. Although, historically, the images generated were in the axial or transverse plane, perpendicular to the long axis of the body, modern scanners allow this volume of data to be reformatted in various planes or even as volumetric (3D) representations of structures. Although most common in medicine, CT is also used in other fields, such as nondestructive materials testing. Another example is archaeological uses such as imaging the contents of sarcophagi or ceramics. Individuals responsible for performing CT exams are called radiographers or radiologic technologists (ARRT 2014)

2.1.5.1 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 energizedfor 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 3Million 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 are 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 second stage on the rotating part of the scanner, where the voltage is increased to the requirement high voltages needed for X-ray production. (Springer, 2009)

2.1.6 Previous study

The study conducted in 2018 by Alsir The purpose of this study was to estimate the dimensions of maxillary sinus in healthy Sudanese‘s subjects using CT scan in both axial and coronal section. This study included 50 (28 males and 22 females) Sudanese subjects whom referred for their age ranged from (20-80years), 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+_3.15mm and left side 34.83+_3.65mm and measure of right height 33.25+_5.73mm and left side 33.55+_6.31mm for males and the measure of females were the right width 22.76+_4.84 and left 20.18+_3.96mm and right depth34.46+_3.64mmand left 34.04+_3.77mmand the right height 31.97+_5.18mm and left 32.50+_5.74mm. 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 width21.53+_5.38mm and for the left side width 20.42+_5.18 mm, measure of right height 33.25 +_5.56mm for the left height 33.09+_6.03mm,measure of right depth 34.64 +_3.34mm and the left depth 34.48+_3.68mm 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. A second study done by Abdullah in Sudan (2013).The aim of the study to characterize the the maxillary sinuses in 49 patient with normal maxillary sinuses The study showed 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 was found the left width of maxillary sinus (23.12+_4.54)mm and the right side width (23.01+_4.59).Al so (Nihon Jibiin kokaGakkaikaiho 1996) in their study done as a volumetric measurement

Chapter Three

Materials and Methods

Chapter Three

Materials and Methods

3.1 Materials:

3.1.1 Study sample

I carried out a study for 50 scans of paranasal sinuses of subjects of both genders. Study cases were (50 patients)

(28 female)(22 male) average age ranging from (21-82) Patients were randomly selected including asymptomatic subjects . Subjects were diagnosed as normal sinus. Patient having pathological changes as sinusitis, any congenital abnormalities in maxillary sinuses and subjects younger less than 19 years were exclude.

3.1.2 Area and duration of the study

The study has been carried ut during the period from August to October in A-lsaha Hospital and Alamal diagnostic center

3.1.3 Machine used

-Newsoft

Kvp120 16 slice Alsaha hospital

-Toshiba spiral

Kv 120 MA 64 slice Almal medical center

3.2 Methods

All Axial scams obtained from coronal by recomstructed image with slices thickness between (5-2)

3.2.1 Image interpretations

All axial image were evaluated by measuring length and width of maxillary sinues

3.2.2 methods of measurement

Measurement taken from the distance between two further ponts on the center of the maxillary sinus (right and left)

3.3.3 Data collection

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

3.3.4 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

Chapter Four

Results

4.1Results

The following figures and tables presented the data obtained from 50 patient were examined for CT sinuses. Demographic data were presented as age , gender , as well as maxillary sinuses length , width

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

Gender	Frequency	Percent
Female	28	56.0
Male	22	44.0
Total	50	100.0

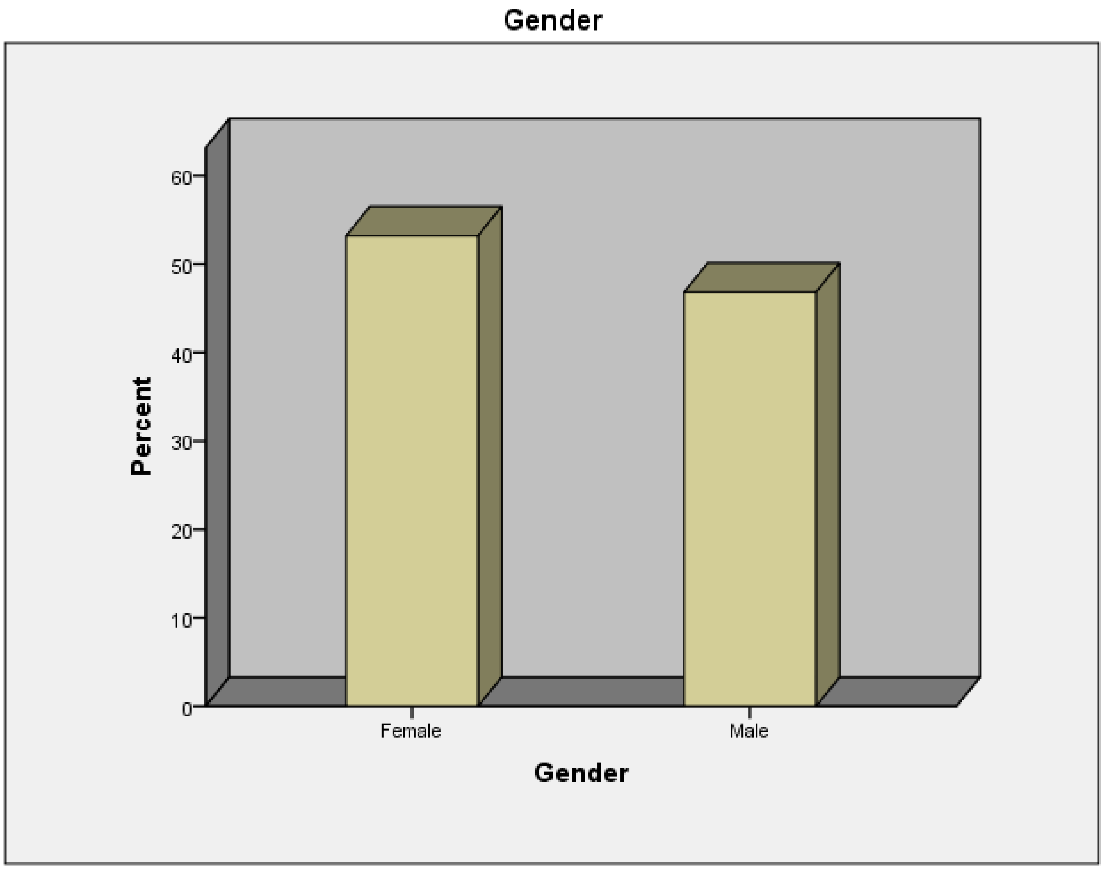

Figure 4-1 Percentage of patient's gender

Table 4.2 Descriptive Statistics of Variables

	Mean	Std. Deviation	Minimum	Maximum
AGE	43.02	17.940	20	85
RT width	27.206	7.0672	12.5	38.9
LT Width	27.219	7.6206	12.3	45.9
RT Length	34.732	5.1833	24.7	48.2
LT Length	35.481	5.6519	24.7	48.1

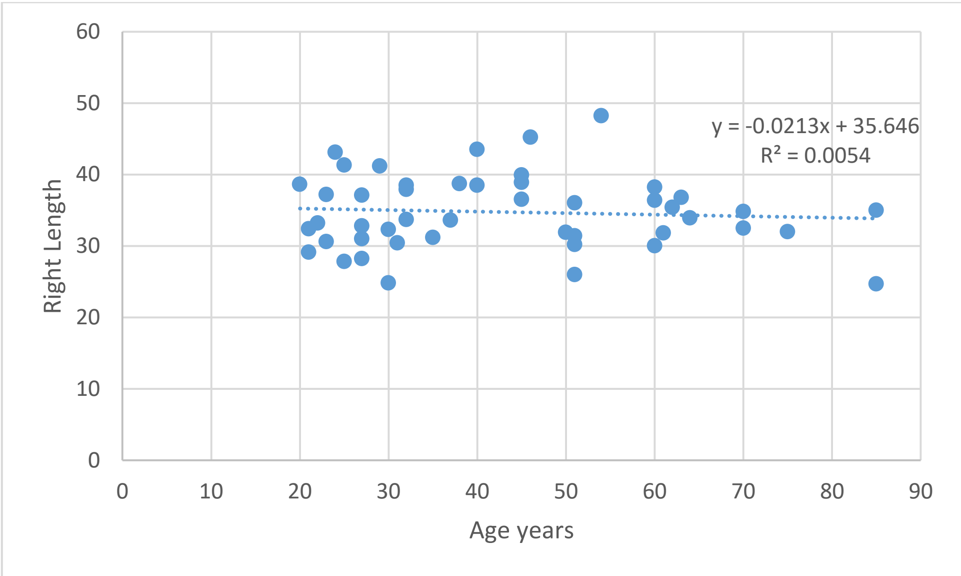

Figure 4-2 scatter plot show line negative correlate between LT length and age

R= 0.0054

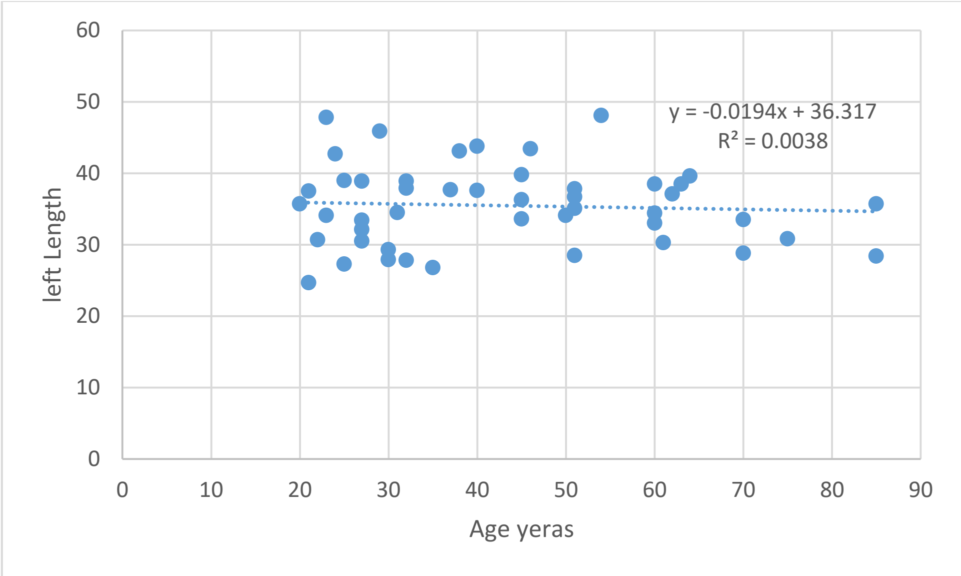

Figure 4-3 scatter plot show negative correlate between Lt length and age R= 0.0103

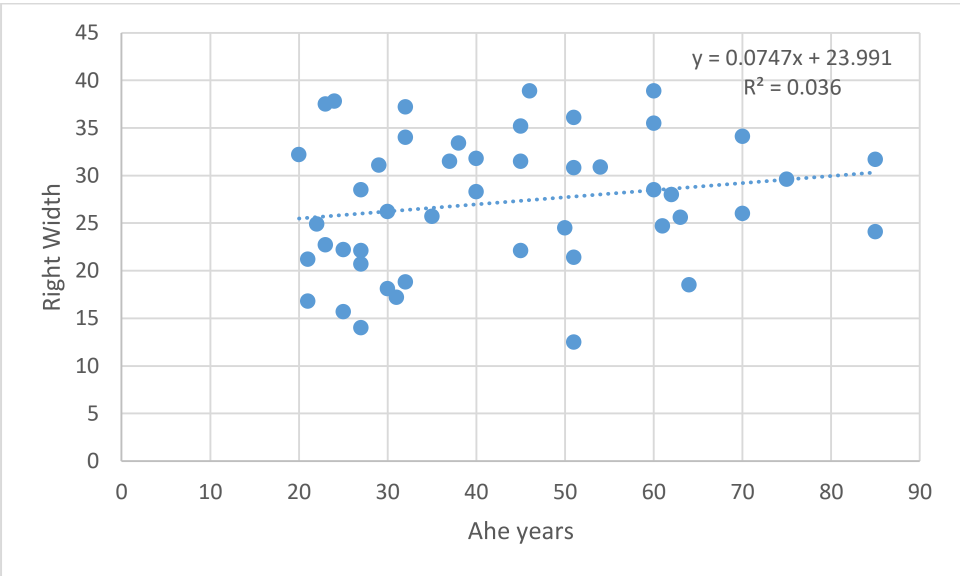

Figure 4-4 scatter plot show positive correlate between Rt width and age R=0.036

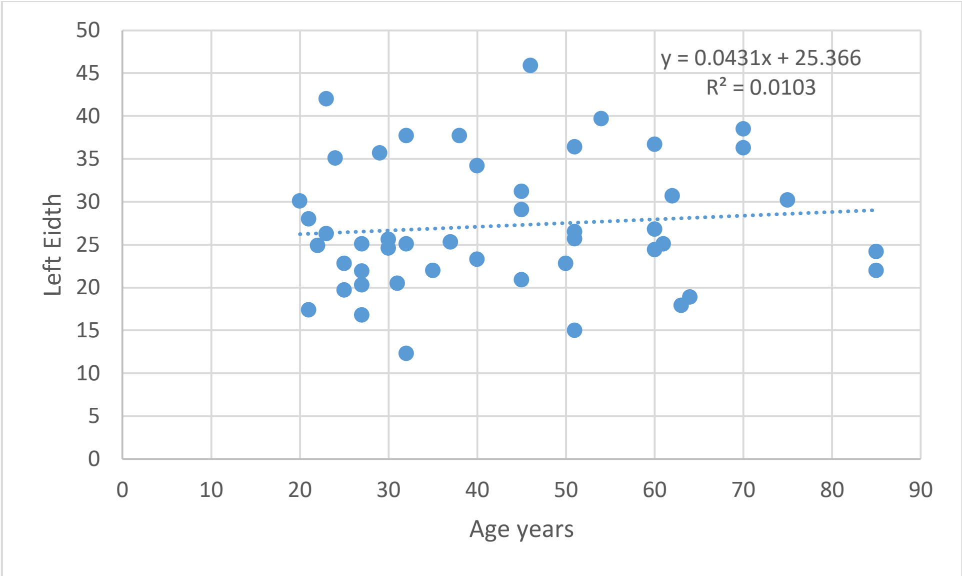

Figure 4-5 scatter plot show positive correlate between Lt width and age

R=0.0103

Chapter Five

Discussion, Conclusion and Recommendation

Chapter Five

Discussion, Conclusion and Recommendation

5.1 Discussion:

This study done in 50 subject with 22 male and 28 female, with no symptomatic or any pathology .

It has been notied that CT paranasal sinuses examinations were increased in females 28 (56%) than males 22(44%)

The mean on the left maxillary length(35.4 +/-5.1) bigger than the right one (34.4+/-5.6) as presented on (table 4.1) also the mean of the left maxillary width (27.+/-7.0) bigger than the right one (27.19+/-17.9) as presented on (table 4.1) (DrBIJU Thomas 2010) (AL.elsheikh hm,alathelms 1992) their study showed significant correlation between all measurement for the entire sample and our showed finding

It has been noticed that the high frequency of cases in the study were aged from 21-28 years old where as low frequency oh them had aged over 66 (Nihon JibiinkokaGakkaikaiho 1996) .Found that in their study age from 20-29 years old had the largest volume .And I agree with them

We found that there is a negative correlation between the age and the length RT length R = 0.0054 scatter plot (4-2)therefor the length decreasing as the age increasing . Also there is a negative between the age and the Lt length R =0.0038

Also we found a positive correlation between the age and the width RT width R therefore the width increasing as the age increasing =0.036 (scatter plot 4-4) LT width R = 0.0103 (scatter plot 4-5)

In the present study was found no different between males and females

5.2 Conclusion

the study conclude that there no different between the male and female , also we found a negative correlation between the length and the age ,the length decreasing with the age according to the negative correlation R=0.0054 .there is a positive correlation between the width and the age ,the width increasing with age according the positive correlation R= 0.0036 .

5.3 Recommendation

-further investigation of the maxillary sinusesuse other image modality in measurement of sinuses

- Further investigation with wider sample size with different state

-Further investigation of the maxillary sinuses measurement of dimension in younger age

- Measure the maxillary for infant

- Study the effect of the pathological conduction on the maxillary sinuses

References

Dr .t.balasubramanian m.s.d.io 2006

(en.wikipedia.org/wiki/Maxillary sinus)

- Towbin, Richard; Dunbar, J. Scott (1982). "The paranasal sinuses in childhood".

- Lloyd et al., : CT of paranasal sinus and FESS : A critical analysis of , 1991
- Eggesbo HB , Soviks,Dolviks, et al 2001 ,

Kennedy DW,Bolger WE,ZinreichSJ,2001 .Diseases of the sinuses Diagnosis and Management ,Hamilton ,canda .

Kuinay ,Ramzis,R.STANLEYL. 1997 Basis pathology ,byWB sanders company 6th edation 1316 -1320

Yousem DM 1993 imaging of sinonasal inflammatory disease Radiology 2.188 -195 .

Warrick 1969 basic anatomy &physiology 3rd edtion publisher by Edward 107-110 .

www. Boimedcentral.com /1471-2342/11/8

www. Slidesheshare,net /yanimo/maxillary sinus

Appendices

Appendix 1

Data collection sheet

PT Number	PT Age	Lt side		Right side	
		width	lenght	width	lenght

Appendix 2

Measurement taken from the distance between further points of the maxillary sinuses

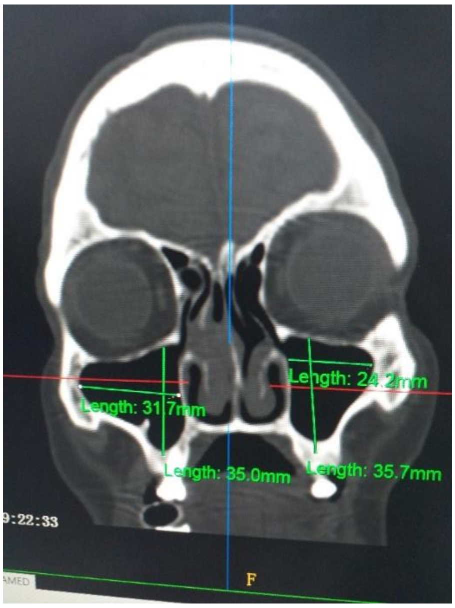

IMAGE 1:Show 40 years old man with normal maxillary sinuses by cornal ct scan

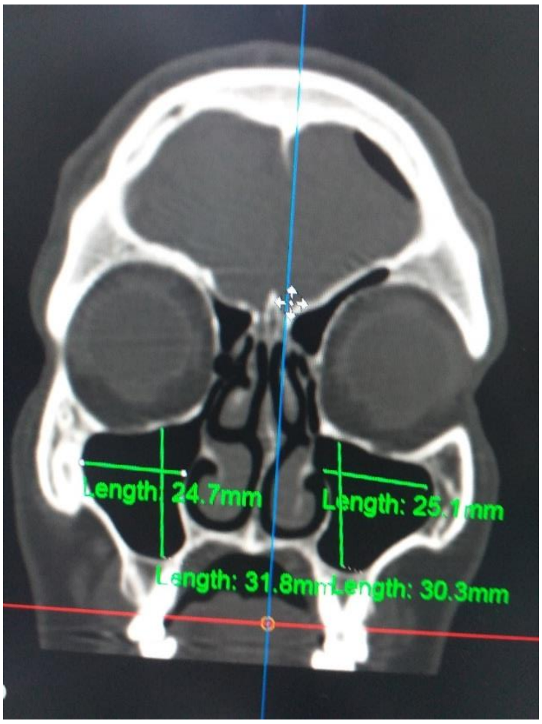

IMAGE 2: Show 2 old years woman with normal maxillary sinuses by cornal ct

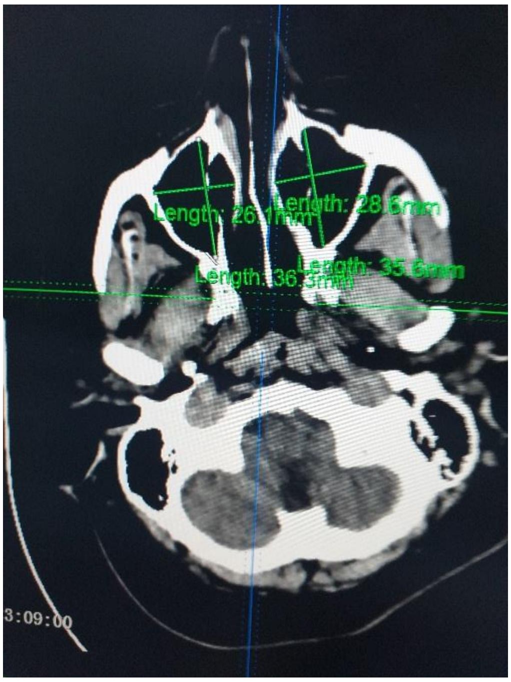

IMAGE 3: Show 30 old years man with normal maxillary sinues by axial ct scan

IMAGE 4: Show 20 old years man with normal maxillary sinuses by axial ct scan