Chapter one

Introduction

Chapter one

1.1Introduction

The paranasal sinuses are complex anatomical structures with a significant inter-individual variation. The use of computed tomography (CT) instead of plain radiography in the work-up of parnasal sinus bone.

The frontal sinuses, the second largest sinuses, are paired and are normally located between the tables of the vertical plate of the frontal, (Doyle 1990).

The sinuses often extend beyond the frontal region of the bone, most frequently into the orbital plates. The intersinus septum is usually deviated from the midline; for this reason the frontal sinuses are rarely symmetric. Multiple septa are sometimes present. Like maxillary sinuses, the frontal sinuses drain into the middle nasal meatus. . (Philip and Eguene 1999)

1.2 Problem of the study:

The data are insufficient about normal frontal sinuses measurements in Sudan.

1.3: objectives:

1.3.1 General objectives:

To determine normal frontal sinuses dimensions .

1.3.2 Specific objectives:

To co-relate of normal frontal sinuses measurements among age group, gender.

1.4 Overview of the study:

This study consisted of five chapters, chapter one an introduction which, includes; problem of study also contain general, specific objectives . Chapter two includes back ground and literature review about role of CT images to measurement of frontal sinus. Chapter three describe the methodology . Chapter

four include result of presentation of finding of study; finally chapter five include discussion, conclusion and recommendation

Chapter two
Literature Review

Chapter two

Theoretical background

2.1Anatomy;

2.1.1 The location of frontal sinus:

The frontal sinuses are a part of paranasal sinuses and they located in the frontal bone above each eye (Fig2-1). They make an important contribution to normal forehead and glabellar contour.

2.1.2 The development of frontal sinus:

According to classical knowledge based on x-rays, frontal sinus is not apparent at birth and development begins during the second year of life (Yoshino , 1987).

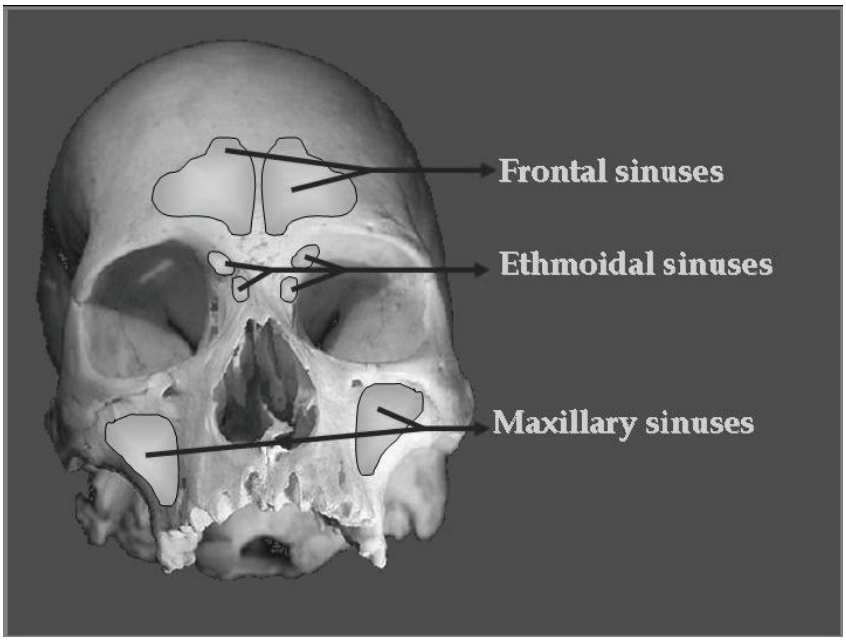


Figure 2-1: shows Location of Paranasal Sinuses

The region of frontal recess of the frontal nasal meatus in a fetus aging 4th months of gestation. In the latter weeks of the fetal life, the frontal recess of the middle nasal meatustransforms upwards into an oval thin-walled space

corresponding to the developing frontal sinus. It adheres to the ethmoidal labyrinth, integrating with it (Miller &Amedee, 1998;). The frontal sinus rarely is visible on radiographs earlier than the second year of life. The sinus invades the frontal bone by about 5 years of age and slowly grows to reach an adult size in late adolescence (Miller &Amedee, 1998).

Whilst it is widely accepted that the development of the frontal sinus is complete by about 20 years of age and remains stable until further enlargement of the chambers can occur from bone reposition during the advanced ages (Yoshino ., 1987; ., 1996;Kirk e., 2002);

2.2.3 Morphological structure of frontal sinus:

The frontal sinus is a triangular, pyramid-shaped (its apex is superior and its base is inferior) cavity extending between the anterior and posterior tables of the ascending portion of the frontal bone (Clemente, 2004). The structure of frontal sinus can be variable from person to person and its sizes might be different in different populations (Miller &Amedee, 1998; Tatlisumak ., 2008). Usually, there was a complete intersinus septum between both frontal sinuses. The anterior wall of frontal sinus is the strongest of the sinus walls and its thickness can reach to 12 mm. In the entire sinus wall, there were diploë, although the dipole is minimal in the posterior wall and floor of sinus (inferior wall). The posterior wall is a plate of thin, compact bone (1-2 mm) whose upper part is vertical. It separates the frontal sinus from the anterior cranial fossa and can extent to lesser wing of sphenoid bone. The floor of the sinus also functions as the supraorbital roof in the lateral side

and naso-etmoid floor in the medial side. The drainage ostium is located in the posteromedial portion of the sinusfloor. The frontal infundibulum is a more narrow area within the sinus that leads to the ostium. The frontal sinus-ostium-frontal recess complex is shaped like an hourglass. The size of the bottom half depends on the dimensions of the frontal recess (Miller &Amedee, 1998; Clemente, 2004).

Some authors divide frontal sinus drainage pathway into superior and inferior compartments. The superior compartment is formed by the union of adjacent air spaces at the anteroinferior portion of the ethmoid bone. Its size and shape varies with the variable anatomy of frontal ethmoidal air cells. The superior compartmentcommunicates directly with the inferior compartment. The inferior compartment is a narrow passage way formed by the ethmoidal infundibulum or the middle meatus. If the uncinate process gets attached to the skull base the inferior portion is formed by the ethmoidal infundibulum. On the contrary if the uncinate process gets attached to the lamina papyracea the inferior compartment is formed by the middle meatus.

Frontal recess area: Is anatomically defined as the most anterior and superior part of anterior ethmoidal complex. This is precisely where from the frontal bone gets pneumatized. In the sagittal plane the frontal recess appears like an inverted funnel. It opens superiorly into the frontal sinus ostium. The lateral wall of frontal recess area is formed by lamina papyracea. Its medial wall is formed by the vertical attachment of middle turbinate. Its posterior wall is highly variable, and is formed by the bulla ethmoidalis if it reaches up to the level of

skull base. A large bulla could cause narrowing of this critical area obstructing frontal sinus drainage channel. Any imaging modality should critically examine this area where pathology could lurk. The aggernasi cells and the uncinate process play a role in the formation of the floor of this area.

If the uncinate process is attached to skull base as shown in the figure above the frontal recess drains into the superior end of ethmoidal infundibulum. **(** Balasubramanian 2009)

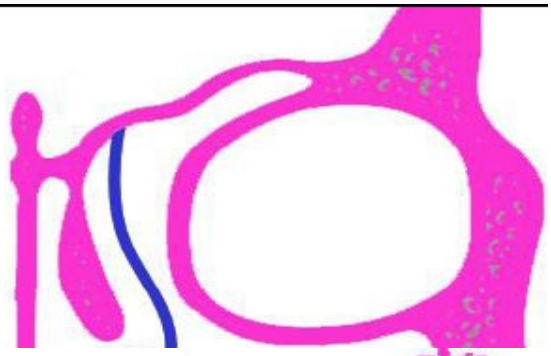


Figure 2-2 shows: sIf the uncinate process is attached to skull base as shown in the figure above the frontal recess drains into the superior end of ethmoidal infundibulum.

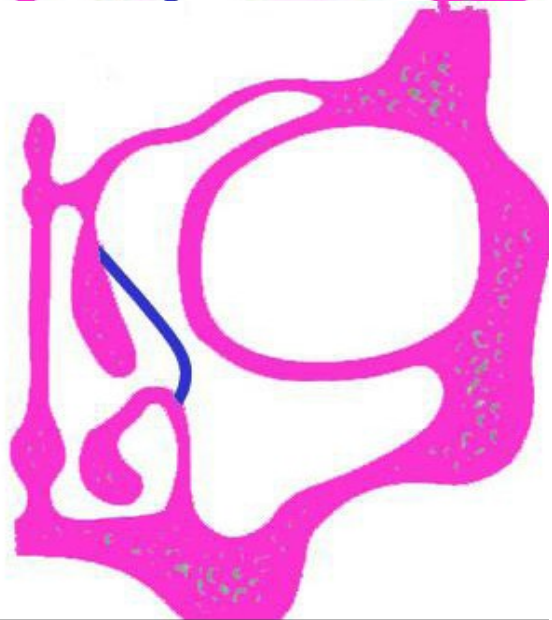


Figure 2-3: showsIf the uncinate process gets attached to the

superior-anterior portion of the middle turbinate as shown in the figure above the frontal recess drains into the superior end of ethmoidal infundibulum.

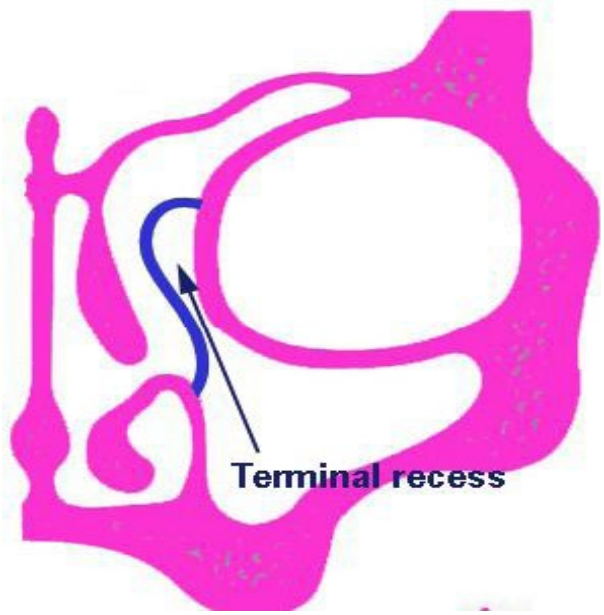


Figure2-4 showing terminal recess If the uncinate process gets attached to lamina papyracea the frontal recess opens directly into the superior aspect of middle meatus. The ethmoidal infundibulum ends directly into a terminal recess.

Ethmoidal infundibulum: This is a three dimensional space bounded by:

. Laterally – By lamina papyracea

. Anteromedially – By uncinate process

. Posteriorly – By Bulla ethmoidalis

Frontal sinus drainage can occur via ethmoidal infundibulum if the uncinate process doesn’t get attached to the lamina papyracea. **(** Balasubramanian 2009)

Figure 2-5: Coronal CT showing uncinate process attached to skull base. The frontal recess is seen between the aggernasi and uncinate process

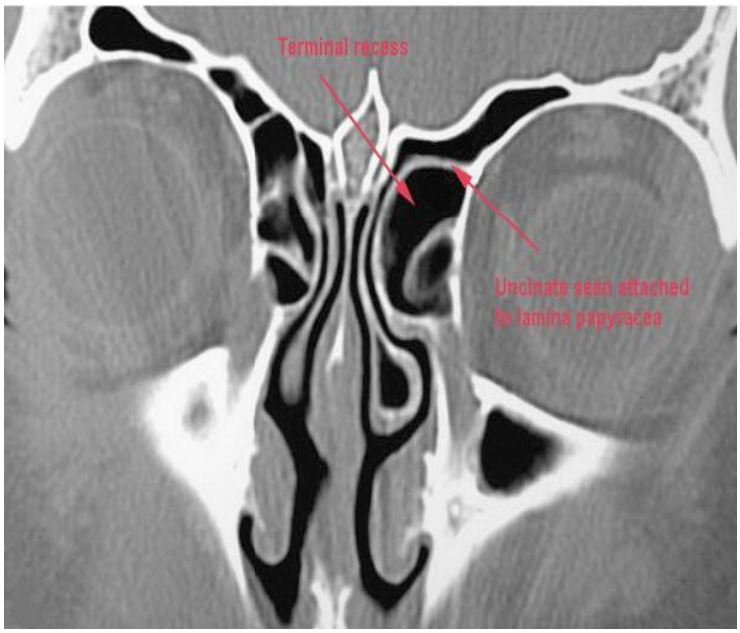


Figure 2-5 Coronal CT scan showing uncinate process being attached to lamina papyracea. This causes terminal recess to form. Frontal sinus drains directly into middle meatus

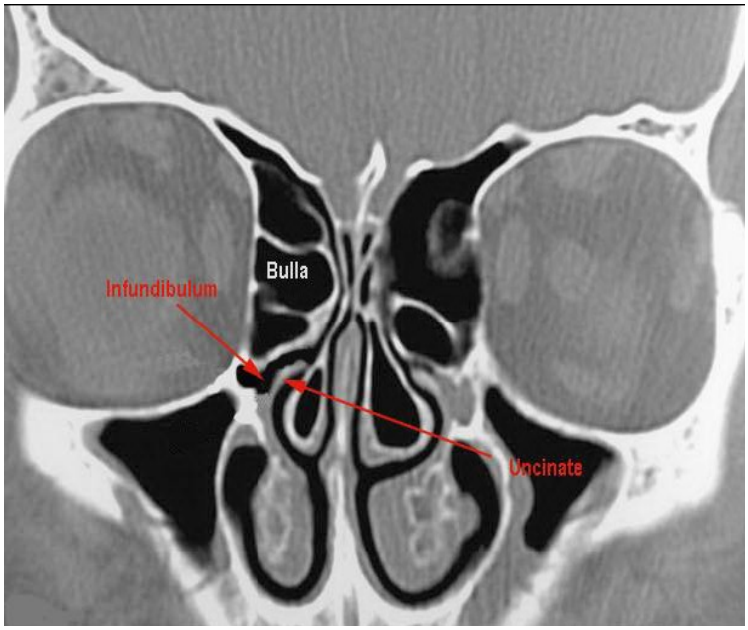


Figure 2-6 This coronal CT scan shows the uncinate process being attached to the middle turbinate. Note the presence of infundibulum between the bulla and the uncinate process. Frontal sinus is seen opening into the infundibulum. Note also the fairly deep olfactory fosse.

2.1.4 Anatomic variants of frontal sinuses:

Frontal cells: These are rare anatomic variants that involve ethmoidal pneumatization that impinge on the frontal recess area. These cells may also extend to involve the lumen of frontal ostium. According to Bent there are four types of frontal cells.

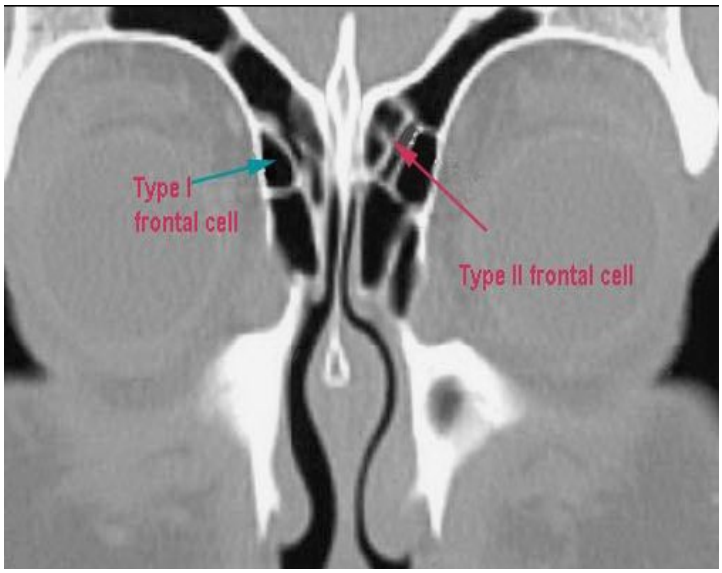
Bent's classification of frontal cells:

Type I frontal cells: This is a single frontal recess cell above the aggernasi.

Type II frontal cells: This is a tier of cells above aggernasi, projecting within the frontal recess

Type III frontal cell: This is a single and massive cell arising above the aggernasi. The pneumatization occurs in a cephalic direction in to the frontal sinus.(. Balasubramanian 2009).

Type IV frontal cell: This is a single isolated cell within the frontal sinus. This cell is sometimes difficult to visualize due to its very thin walls.



CT scan Figure 2-7: Coronalshowing type I and type II frontal cells

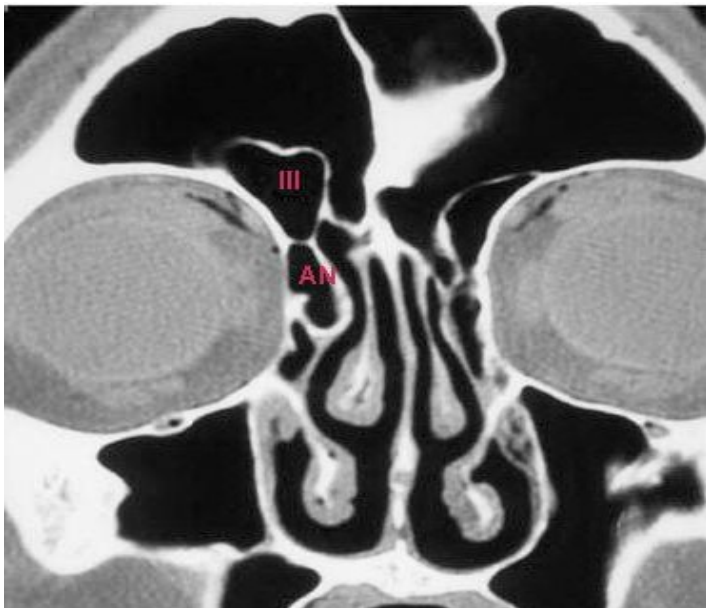


Figure 2-8: Coronal CT showing Type III frontal cell

Figure 2-9:: Coronal CT showing type IV frontal cell

Supraorbital ethmoidal air cell:

These cells are caused by pneumatization of orbital plate of frontal bone posterior to the frontal recess and lateral to the frontal sinus. Sometimes these supraorbital air cells can reach up to the anterior margin of the orbital plate mimicking a frontal sinus.

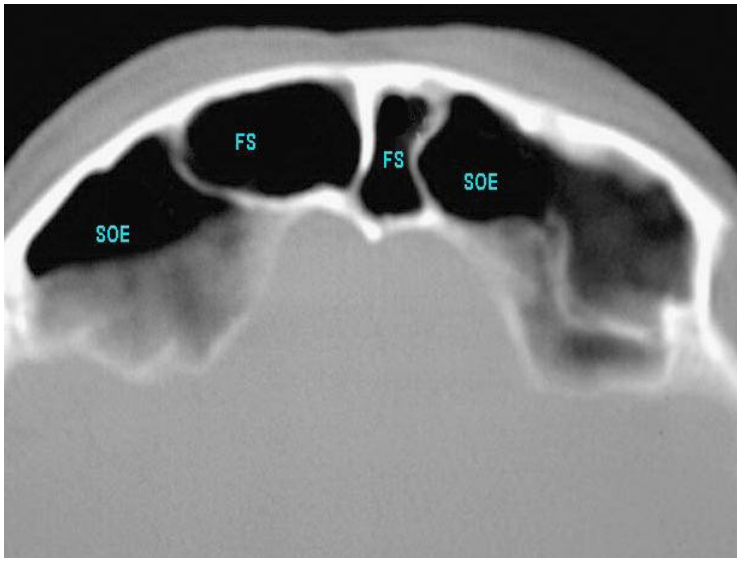


Figure 2-10: Axial CT showing supraorbital cell

2.2 Physiology;

2.2.1Funcation of frontal sinus:

The functions of frontal sinuses which are a part of paranasal sinuses greatly resemble to paranasal sinus functions. The functional significance of paranasal sinuses remains largely unknown. The sinuses have been believed to play numerous roles, but no substantive laboratory studies have confirmed any of these hypothetical functions (Miller & Amedee, 1998). Prevailing theories suggest that the paranasal sinuses perform: (a) humidifying and warming inspired air, (b) assisting in regulation of intranasal pressure, (c) increasing the surface area of the olfactory membranes, (d) lightening the skull to maintain proper headbalance or assist in flotation, (e) imparting resonance to the voice, (f) absorbing shock to the head, (g) contributing to facial growth, (h) existing as evolutionary remains of useless air spaces, (i) secreting of immunoglobulin, interferon and lysozyme (Miller &Amedee, 1998;e,). Also, described a role of frontal sinus in nitric oxide output (Qian et al, 2005).

The complete function of the paranasal sinuses is probably not described by a single theorybut is instead most likely a combination of several of the foregoing theories (Miller &Amedee, 1998).

2.3 pathology

2.3.1Pathology of frontal sinus

The frontal sinus is also often thought of as a more“symptomatic sinus” because of the difficulties encountered in frontal sinusitis and maintaining a patent frontal sinusostium in patients with difficult to treat frontal rhino sinusitis.

However, as indicated by the current data, many patients with a completely opacified frontal sinus are not necessarily more significantly negatively affected in terms of symptom scores by their frontal sinus disease. This may be caused by several factors such as patients adapting or accommodating

To painful symptoms of frontal sinusitis, other symptoms such as rhinorrhea or nasal obstruction overshadowing the frontal sinus symptoms or other factors yet to be elucidated.

As an example, chronic rhino sinusitis may have symptom manifestation leading to headache, facial pain and facial discomfort. It would appear intuitively likely that patients with higher radiographic volumes of disease would manifest more severe symptom scores and greater disease volumes would carry with them potentially more deleterious effects on quality of life (bhattacharyya, 2005).

2.2 previous Studies:

Study by Matthew cranioplastyK.lee , and Jeffery K.speigle , in united states (2008) They found by using CT imaging for forehead and frontal sinus dimensions have been described.Generally, males had grater Frontal sinus dimensions in , kantidevi dental college in India (2015) by using digital radiographic images, the mean values of the frontal sinus Height, width and area are greater in males. Right frontal sinus is larger than left frontal sinus in both the sex.

Mahima, and Karthikeya Patil, india s , radiographs taken by cadwell techniques , they found the frontal sinuses are bigger in males than in females

Study by saraSaedi, Saeed Reza Motamedian, and Kimia Rohani, Iran (2015, they found in most cases (97%) of the study population. There was a significant correlation between various dimensions of this structure, and it is relatively larger in size in males than females. In addition, the morphology of the frontal sinus is different between females and males.

Sahlstrand-Johnson1, Magnus Jannert, Anita Strömbeck and KasimAbul-Kasim, Sweden (2011 they found the volume and the craniocaudal and anteroposterior diameter of the frontal sinus of male patients were significantly greater than the corresponding values for female patients

Sahlstrand-Johnson1, Magnus Jannert, Anita Strömbeck and KasimAbul-Kasim, Sweden (2011) , , the frontal sinus had the left cavity larger or equal to the right one and the age

group differences was not significant regarding the size of the frontal sinus.

Study showed Cristiana Regina Ruiz and Nader , Wafae,brazil (2004),, the frontal sinus is a constantstructure in the human being, but its shape and dimensions may vary among individuals

Neha Patil, Freny R. Karjodkar, SubodhSontakke, KaustubhSansare and Rohini Salvi , India (2012) study Comparison among each of the frontal sinuses of the 100 people in the sample revealed that no two sinuses are the same, that is, the sinus is unique to each individual.

Chapter Three
Materials and Methods

Chapter three

Materials and Methods

The study was carried out in Khartoum state, Sudan in radiological departments ofAlamal national hospital, Sudan diagnostic center, Almudres medical center **3.1Materials:**

3.1.1 Equipments:

CT scans of frontal sinus have conventionally being performed with continuous 2mm coronal and axial slices. High resolution multiplanar scanners have made reformatted images a possibility. These scanners enable imaging in three planes.

The study was carried out in different machine multislice CT scan:

1. Toshiba,64 slice made by Toshiba medical system corporation in Japan 2007

Kv: 120 mAs: 150

2mm reconstructed slice thickness , bone window

2. General electric,2 slice made by general electric corporation in USA 2001

Kv: 120 mAs: 200

2 mm reconstructed slice thickness , bone window

3. Siemens,16 slice made by Siemens corporation in Italy 2005

Kv: 120 mAs :360

2 mm reconstructed slice thickness , bone window

3.1.2 Study population sampling:

Patients were randomly selected including asymptomatic subjects It was done on 94 subjects

Subjects were diagnosed as normal sinus. Patients having pathological changes as, sinusitis, any congenital abnormalities in frontal sinuses and subjects younger less than 20 years excluded.

3.2Method:

. The sample comprised of 94 Sudanese subjects attended for CT scanning forsinuses and CT head 57(60.6%) males and 37(39.4%) females. The age ranging between 20 to99 years.
58(56%) were males and 37(44%) were females and with ages ranging between (20-99) years.
Scan the subjects in ct head in supine and for sinuses scan in prone in often
Multi slice CT scanner Toshiba Aquilion 64, Siemenssomatom 16and general electric dual, CT scanners were used. Axial Paranasal sinus CT, were obtained inparallel projection to the orbitomeatal line, with a (1 mm) slice thickness and a (0.6 mm) reconstruction interval.

Reconstruction of the axial images using slice thickness equal to
(0.5mm). the measurements were performed on axial and coronal images

3.2.1 Technique used:

Frontal sinus dimensions measurements were taken at midline to the left and right of midline width, height and anteroposterior ` by using coronal and axial sections images.

Figure (3-2-11): show Coronal image demonstrates right and left width measure and right and left height measures

Figure (3-2-12) show axial image demonstrates right and left anteroposterior measures

3.2.2image interpretation:

Interpretation by Radiological technologist: and radiologist

3.2.3 Method of data collection:

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

3.2.4 Data analysis:

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

Chapter four

Results

Chapter four

Results

The 94 Subjects studied consist of 57(60.6%) males and 37(39.4%) females. The mean age of the subjects was 47.8years old ranging between 20 and 99 years.

MLW:measure of left width , MRW :measure of right width , MRH :measure of right height MLH :measure of left height , MRAP: measure of right anteropostrior, MLAP:measure of leftAnteroposteriorData was presented in tables and figures.

Table (4-1): shows distribution of age and gander

	Minimum	Maximum	Mean	Std. Deviation
AGE	1.00	8.00	3.2198	2.00999
GANDER	1.00	5.00	1.4659	.72633
MlRW	.00	54.50	21.5681	9.17754
MLW	1.06	52.60	22.7180	8.49110
MLH	.00	47.60	15.4805	8.08209
MRH	.00	38.40	14.8112	7.32385
MRAP	.00	13.30	7.7365	2.66543
MLAP	3.10	12.20	8.0622	2.23562
Valid N (listwise)				

Table (4-2) :show distribution of age classes

AGE

classes	Frequency	Percent	Valid Percent	Cumulative Percent
20-29	27	28.7	28.7	28.7
30-39	17	18.1	18.1	46.8
40-49	13	13.8	13.8	60.6
50-59	6	6.4	6.4	67.0
60-69	15	16.0	16.0	83.0
70-79	12	12.8	12.8	95.7
80-89	3	3.2	3.2	98.9
90-99	1	1.1	1.1	100.0
Total	94	100.0	100.0	

Graph (4-2) show distribution of age classes

Table (4-3): show distribution of gander

GANDER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	57	60.6	60.6	60.6
	FEMALE	37	39.4	39.4	100.0
	Total	94	100.0	100.0	

Graph (4-3) show distribution of gander

Table (4-11): show distributions female measurement of frontal sinus

	Minimum	Maximum	Mean	Std. Deviation
AGE	1.00	8.00	3.2198	2.00999
GANDER	1.00	5.00	1.4659	.72633
MlRW	.00	45.50	19.5681	6.17754
MLW	1.06	48.60	21.7180	7.49110
MLH	.00	45.60	13.4805	7.08209
MRH	.00	32.40	12.8112	6.32385
MRAP	.00	13.30	6.7365	1.66543
MLAP	3.10	12.20	7.9718	1.23562
Valid N (listwise)				

Table (4-12): show Distribution male measurement of frontal sinus

	Minimum	Maximum	Mean	Std. Deviation
AGE	1.00	8.00	3.2198	2.00999
GANDER	1.00	5.00	1.4659	2.72633
MlRW	.00	48.50	20.7685	7.17754
MLW	2.30	50.60	23.4367	8.9865
MLH	1.00	47.60	15.4805	8.08209

MRH	1.00	42.40	13.8765	7.32385
MRAP	.00	15.60	7.9856	1.66543
MLAP	3.10	13.20	8.9876	1.23562
Valid N (listwise)				

(4-13): show Distribution of age classes (20-29)

Age (20-29)	Minimum	Maximum	Mean	Std. Deviation
MlRW	8.1	29.7	18.9	6.17754
MLW	14.1	31.5	22.8	7.49110
MLH	18.8	27.2	23	7.08209
MRH	10.1	24.4	17.25	6.32385
MRAP	6.6	11.3	8.95	1.66543
MLAP	3.2	13.2	8.2	1.23562
Valid N (listwise)				

(4-14) Distribution of age classes (30-39)

Age (30-39)	Minimum	Maximum	Mean	Std. Deviation
MlRW	13.6	25.1	19.35	6.17754
MLW	10.8	34.1	22.45	7.49110
MLH	8.9	33	6.1	7.08209
MRH	11.4	27	15.7	6.32385
MRAP	6.6	11.7	9.15	1.66543
MLAP	7	11.8	9.9	1.23562
Valid N (listwise)				

(4-15) : show Distribution of age classes (40-49)

Age (40-49)	Minimum	Maximum	Mean	Std. Deviation
MlRW	17.3	29.9	18.55	6.17754
MLW	19.5	27.2	23.35	7.49110
MLH	3	24.5	13.75	7.08209
MRH	6.4	25	15.7	6.32385
MRAP	6.8	10.8	8.8	1.66543
MLAP	3.4	9.9	6.65	1.23562
Valid N (listwise)				

(4-16): show Distribution of age classes (50-59)

Age (50-59)	Minimum	Maximum	Mean	Std. Deviation
MlRW	8.6	27.6	18.1	6.17754
MLW	24.4	38.8	31.6	7.49110
MLH	7.3	48.6	27.95	7.08209
MRH	5.2	47.9	26.55	6.32385
MRAP	3.6	5.5	4.55	1.66543
MLAP	7.5	8.5	8	1.23562
Valid N (listwise)				

(4-17): show Distribution of age classes (60-69)

Age (60-69)	Minimum	Maximum	Mean	Std. Deviation
MlRW	16.4	41.7	29	6.17754
MLW	17.7	52.6	35.15	7.49110
MLH	11.8	28.6	20.2	7.08209
MRH	11.8	30.4	21.1	6.32385
MRAP	7	12.5	9.75	1.66543
MLAP	6	10.2	8.2	1.23562
Valid N (listwise)				

(4-18): show Distribution of age classes (70-79)

Age (70-79)	Minimum	Maximum	Mean	Std. Deviation
MlRW	5.5	27.2	11.35	6.17754
MLW	10.3	27.9	19.1	7.49110
MLH	8.8	21.9	15.85	7.08209
MRH	4.6	22.3	13.45	6.32385
MRAP	7.9	11.5	9.7	1.66543
MLAP	6.3	8.5	7.4	1.23562
Valid N (listwise)				

(4-19): show Distribution of age classes (80-89)

Age (80-89)	Minimum	Maximum	Mean	Std. Deviation
MlRW	23	25	24	6.17754
MLW	21.8	22.6	22.2	7.49110
MLH	12	22.4	17.2	7.08209
MRH	15.2	24.9	20.02	6.32385
MRAP	7.4	8.7	8.02	1.66543
MLAP	8.2	10.3	9.25	1.23562
Valid N (list wise)				

Chapter five
Discussion, Conclusion & Recommendations

Chapter five

5.1 Discussion

The bilateral frontal sinus was absent in 4% of the caseas against 89% (94 persons) that showed bilateral presence of the frontal sinus. Unilateral absenceof a frontal sinus occurred in1% of the cases, the left frontal sinus absent in one case. The study found for both genders the left side of frontal sinuses is greater than the right one table (4-1) showed the differences between MRW, MLW, MRH, MLH and MRAP, MLAP.

The results of measurements right width minimum =0.00 mm and maximum width =54.50 mm ,mean=21.56 mm and stdev=9.17mm.Measure of left width minimum 1.06 mm , maximum width 52.60mm ,mean =22.71mm stdev =8.91mm.Measure of right height minimum = 0.00 mm maximum= 38.40 mm, mean = 14.81mm stdev=7.32 mm.Left height minimum=0.00 , maximum = 47,60 mm, mean=15.40 m, stdev= 8.08Right anteroposterior measure minimum=0.00 , maximum =13.30 , mean=7.73 , stdev 2.66mm Left anteroposterior measure minimum=3.06, mm maximum =12.20mm, mean=8.06mm.
(Mathew k.lee 2011) study showed Mean anterior table thickness ranged from 2.6 to 4.1 mm and was thinnest at10 mm left and right of midline (2.9 and 2.6 mm). Mean anteroposterior depthof the frontal sinus ranged from 8.0 to 9.3 mm and did not vary significantly at any distance from midline. Frontal sinus height was greatest at midline (mean = 24.5 mm) and progressively lessened at lateral distances. Mean total

width at the level of the supraorbital ridge was 52.2 mm. For all measurements, I agree.

Table (4-5) Study found in MLW the greater percent 3.7% in measure 28.90mm.Table (4-6) MRW greater percent 3.7% measure 19.50mm. table(4-7) In MLH the greater percent 3.8% in measure 21.20mm table(4-8) and found in MRH the greater percent 3.7% in measure 19.50mm table(4-9) Study found in MRAP the greater percent 6.2% in measure 8.20mm table(4-10) Study found in MLW the greater percent 5% in measure 9.60mm The Study showed the left side is greater than right side Gulisanoet.(1978) observed that the left sinus tends to be larger than the right. .Iagree.. Rubira-Bullen, IRF, Rubira, CMF., Sarmento, VA. AndAzevedo, RA. (2010) they found There is a great anatomical variety of frontal sinus in this population. The left cavity of frontal sinus is larger or equal to the right one.

In table (4-11) for female distribution the mean of right width= 19.56 mm less than the left width =21.71mm.mean of right height= 12.81 mm less than the left height=13.48 mm. The anteropostrior measure of right side mean =6. 73 mm less than left7.97mm.In table (4-12) for male distribution the mean of right width= 20.76 mm less than the left width =23.4mm mean of right height= 13.87 mm less than the left height=15.48 mm.

The anteropostrior measure of right side mean =7.98 mm less than left=8.98 Pondé found measures of 58.3 mm and 46.9 mm in males and females respectively, but without statistical

significance (p< 0.10) . Harris et al. (1987) have found a height of 30.1 mm in males against 26.0 mm in females.

Sahlstrand-Johnson1, Magnus Jannert, Anita Strömbeck and KasimAbul-Kasim, Sweden (2011) study Computed tomography measurements of different dimensions of maxillary and frontal sinuses, they found the volume and the craniocaudal and anteroposterior diameter of the frontal sinus of male patients were significantly greater than the corresponding values for female patients Azita Tehranchi1, Sara Saedi, Saeed Reza Motamedian and Kimia Rohani, iran (2015) ,they found in most cases (97%) of the study population. There was a significant correlation between various dimensions of this structure, and it is relatively larger in size in males than females. In addition, the morphology of the frontal sinus is different between females and males. Magnus Jannert, Anita Strömbeck and KasimAbul-Kasim, Sweden (2011), they found the volume and the craniocaudal and anteroposterior diameter of the frontal sinus of male patients were significantly greater than the corresponding valuesforfemale.

From tables (4-12) to (4-19) the ages distribution classes the greater mean of frontal sinus resulted between ages (50-59) and (60-69) this yields also proved the frontal sinuses continued expand after 40 years.

Tatlisumak et al., reported that, the highest values of measurements of frontal sinus were at the 31–40 age group in both sexes and there were a tendency to decrease with aging I disagree.

McLaughlin et al., suggested that the frontal sinus continued to expand until the age of 40 years because of mechanical stresses of mastication and growth hormone..I agree.

The results observed in this studies the male have grater in frontal sinus than female and deals with other studies but indivsuals some females have grater frontal sinus than males but in general males are graters.

5.2Conclusion

Sudanese population frontal sinuses a measurement differs from other comparing populations and also the differences take place between males and females.

The study demonstrates the left frontal sinus is greater than the right one.

And also demonstrates the male have grater frontal sinus more than females

.

5-3 Recommendations:

1- Usage of CT images in forensic sciences, morphological structure of frontal sinus, usability of CT images of frontal sinus in forensic personal identification.

2- Anatomic differences of the frontal sinus between genders should be taken into consideration during surgery.

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Appendices

Appendix (1)

Data collections sheet

…… :Serial no

Age: 1.20-29 ( ) 2.30-39 ( ) 3. 40-49 ( )
5.50-59 ( ) 6.60-69 ( ) 7.70-79 ( ) 8. 80-89 (
( )) 9. 90-99

( ) Gender: Male ( ) Female

Table of measurements

measure	right	Left	Total
width			

height

A -P

Appendix (2)

Multislice CT scan machines

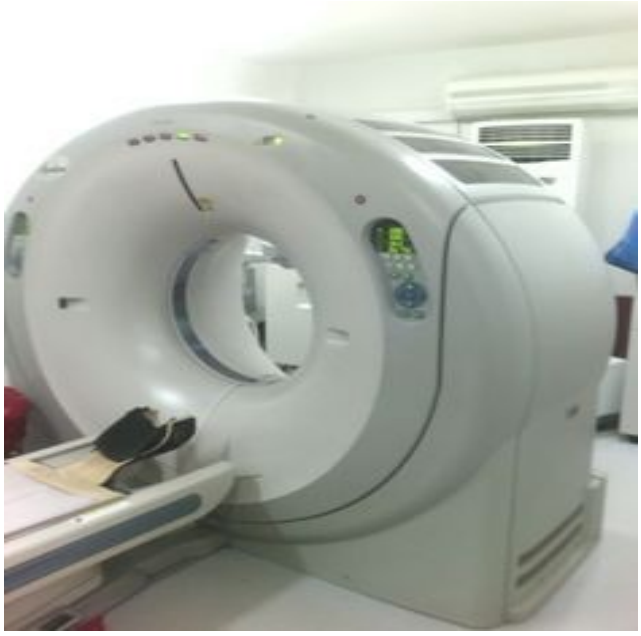

Figure (13): show Toshiba Aquiliuon 64 slice ,alamal national hospital

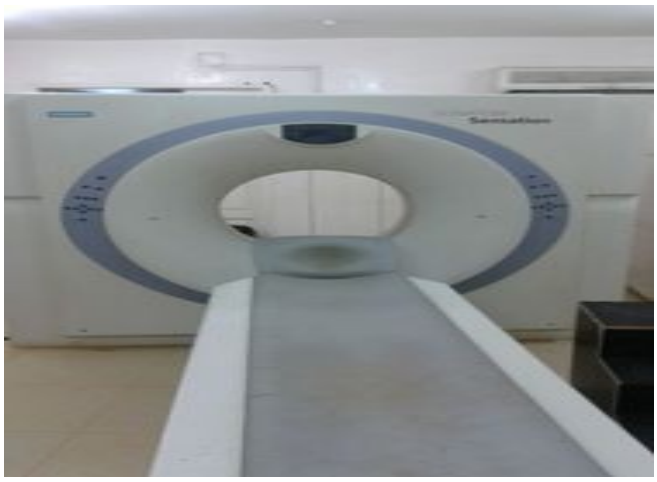

Figure (14) Siemens somatom sensation 16slice, Sudan diagnostic center

Appendix (3)

Cases

Figure (15), show coronal section, male, 60 years demonstrates right and left width measures and right left height measures of frontal sinus

Figure (16) show, axial section of frontal sinus, male, 60 years demonstrates right and left anteroposterior measures

Figure (17), show coronal section, male, 65 years demonstrates right and left width measures and right left height measures of frontal sinus

Figure (18) show, axial section of frontal sinus, male, 60 years demonstrates right and left anteroposterior measures

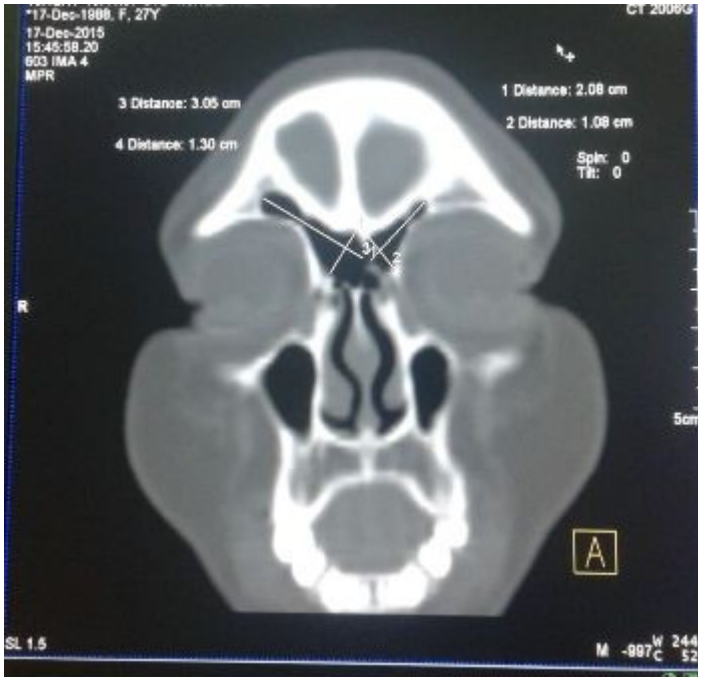

Figure (19), show coronal section, female, 27years demonstrates right and left width measures and right left height measures of frontal sinus

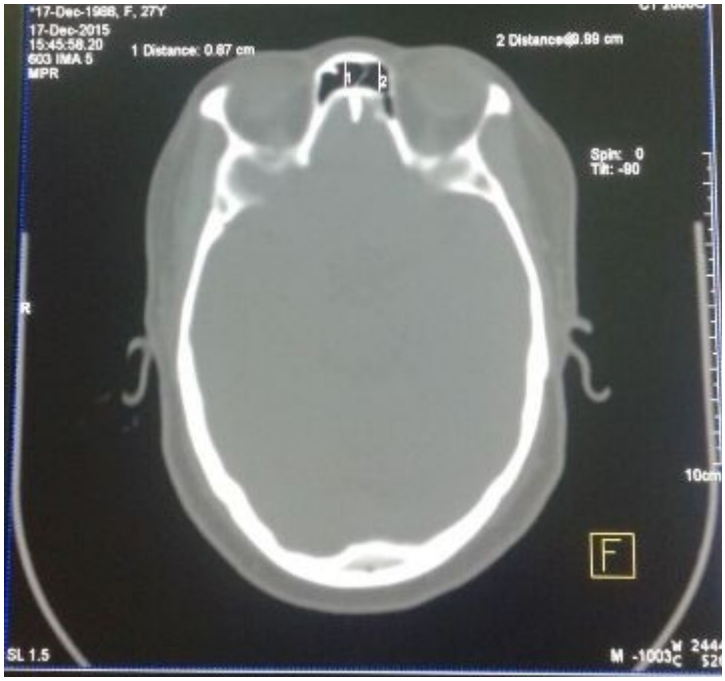

Figure (20) show, axial section of frontal sinus, male, 60 years demonstrates right and left anteroposterior measures