Results

This study was carried out on 70 sides of dried skulls and 30sides of cadaveric heads after exclusion of specimens which showed any missed parts or destructed parts in the studied regions (lateral nasal wall and orbital cavity).

Conchae: In the present study the following variations were found, in 86 specimens (86%) the number of conchae was 3 (figs.2, 3,4,15) (table 1),in 14 specimens (14%) the number of conchae was 4 with the presecence of supreme concha (fig.1) (table1) which in some specimens was longer than superior concha. **Pneumatized concha:**middle concha was the most common to be pneumatized when this occurs it's called concha bulbsa (Fig.2). This variation was present in 46 specimens(46%) (table1). Superior concha was pneumatized in 30 specimens(30%) (Fig.2) (table1). Pneumatized inferior concha was present in 2 specimens (2%) (Fig.2) (table1). In 22% of specimens, there were no pneumatization of superior, middle or inferior concha.

Paranasal sinuses ostia: In this study the following variations in ostia of paranasal sinues were found.

sphenoid sinus ostium was located in spheno-ethmoid recess in all specimens (100%) (Figs.3,4,13). This ostium was only one ostium for each sinus . Its size was 3$\pm$1mm (2-4mm) The shape of sphenoid sinus ostium was rounded in 70 specimens (70%) and elliptical in 30 specimens (30%).

Frontal sinus ostium:ostium of frontal sinus means the narrow transitional point at the floor of the frontal sinus connecting it with the

frontal recess. In this study, in all specimens (100%) it had one ostium for each sinus .In all specimens (100%) it was located at the floor of the sinus represents the upper end of fronto nasal drainge pathway (FNDP) (Fig. 18) this pathway ends in 80 specimens (80%) posteriorly to uncinate process in hiatus semilunaris (Fig.11) and in 20 specimens (20%) anteriorly to uncinate process directly into middle meatus (Fig. 18)**.**The size of frontal ostium was 5± 1mm (4-6 mm) (Fig.18) .

Ethmoid sinus ostia: The ethmoid sinues were divided by basal lamella of middle turbinate into, anterior and posterior ethmoid sinus. In (100%) of specimens the anterior ethmoid sinus opened into middle meatus (Fig.12) and the Posterior ethmoid sinus in all specimens (100%) opened into superior meatus (Fig.17).

Maxillary sinus ostium: In 30 specimens it was located in the ethmoid infundibulum which was bounded medially by uncinate process and extends from hiatus semilunaris till maxillany sinus. This means that this ostium was hidden by uncinate process (Fig.7). In 19 specimens (63%), the shape of maxillary ostium was oval, in 11 specimens (37%) the shape of this ostium was rounded (Fig.7) .The diameter of maxillary sinus ostium was 4.5± 2.5mm (2-7 mm).The number of maxillary ostium was as follows: in 22 specimens (73%) it was a single ostium (Fig.7) .In 8 specimens (27%) there was an accessory ostium .The accessony ostium was located in anterior fontanelle in 5 specimens (16%) (Fig.8) and located in posterior fontanelle in 3 specimens (11%) (Figs.9,10) the accessory ostium was single in 7 specimens (23%) (Fig.9), double in only one specimen (4%) (Fig.10)

Uncinate process: in the present study there were 2 types of uncinate process according to its shape

1- flattened type: this type was noticed in 45 specimens (45%) due to excessive pneumatization of bulla ethmaidale (Figs.6,7,8).

2- folded type: In this type the upper and lower margins of uncinate process were folded upon each other. This type represents 55% of specimens (Fig.15) . Uncinate process had 4 types of articulation with inferior concha as follows:

Type I: in this type, the postero- inferior end of uncinate process was articulated with inferior concha (Figs. 8,11) this type was present in 40% of specimens.

Type II: in this type the uncinate process was not articulated with inferior concha (fig. 15) .This type was present in 35% of specimens.

Type III: In this type the uncinate process was articulated to bulla ethmoidalis and inferior concha by its postero-superior angle and antero-inferior angle respectively (Fig.18).This type was present in 15% of specimens.

Type IV: in this type the uncinate process was articulated with inferior concha by whole its inferior aspect (fig.14).this type repressent 10% of specimens. In this study the variations in the length of articulation of uncinate process to infenior concha were recorded as follows, the mean lengh of this articulation was 3.5$\pm$ 1.5 mm (2-5 mm) (fig.11) (table 4).

Nasal fontanelle

nasal fontanelle is the area devoid of bone in lateral wall of nasal cavity, closed by mucous membrane. The nasal fontanelle has the following boundaries. **Anteriorly**: lacrimal bone, **posteriorly:** perpendicular plate of palatine bone,**superiorly:** in anterior 1/5 orbital

floor ,in middle 3/5 bulla ethmoidalis and in posterior 1/5 ground lamella of middle turbinate and **Inferiorly:** inferior turbinate (fig.18).

In the present study the following points of nasal fontanelle were studied.

1- shape: 3 type of nasal fontanelle were discovered A-triangular shape: In this type, the posterior margin was longer than anterior margin. This type was present in 60% of specimens. (Figs. 18,19). B-Pencil-like: In this type, the posterior margin equal in length to anterior margin.This type was present in 23% of specimens. (Figs.11,12). C-oval type: in this type the mid portion was the highest than anterior and posterior margins. This type was present in 17% of specimens (Fig.15).
2- The vertical diameter of whole fontenelle was 12± 2 mm (10-14mm) (Fig.18) (table2).
3- The antero posterior diameter of whole nasal fontanelle was 32± 4 mm (28-36mm) (Fig.18) (table2). In 40% of specimens the uncinate process divided the nasal fontanelle into anterior fontanelle (antero-inferior to uncinate process) and posterior fontanelle (postero-superior to uncinate process (fig.13).The diameters of both fontanelles were recorded as follows, the vertical diameter of anterior nasal fontanelle was 11± 2mm (9-13mm) and its antero-posterior diameter was 18± 1.25mm (16.75-19.25mm) (fig.13) (table2). The vertical diameter of posterior nasal fontanelle was 11± 1.5mm(9.5-12.5mm) and its antero-posterior diameter was 17± 3mm(14-20mm) (fig.13) (table2).
4- **Anterior nasal spine as a landmark for sinus endoscopy:**

The anterior nasal spine was used as an important land mark in sinus endoscopy so, the following distances were measured.1-The

distance between the anterior nasal spine and postero inferior end of uncinate process was 38± 4mm (34-42mm) (Figs.13,15) (table3). 2-The distance between the anterior nasal spine and anterior edge of nasal fontanelle was 12.5±4.5mm (8-17mm) (Figs.13,15,18) (table 3). 3-The distance between the anterior nasal spine and posterior margin of nasal fortanelle was 35±14 mm (21-49mm) (Figs.13,15,18) (table 3).

4-The distance between the anterior nasal spine and the center of maxillary ostium was 38.5± 8.5mm (30-47mm) (Fig.7) (table3).

Posterior margin of nasal fontanelle as a landmark:

The posterior margin of nasal fontanlle was used as a landmark for endoscopic sinus surgery so, the following distances were measured. The distance between the posterior margin of nasal fontanelle and sphenopalatine foramen was 6± 2mm (4 -8mm) (table 4). 2- The distance between the posterior margin of nasal fontanelle and optic formaen was 47± 10mm (37-57mm) (table 4). 3-The distance between the posterior margin of nasal fontanelle and anterior end of cavernous sinus was 49.5± 10.5mm (39-60mm) (table 4).

Relations of the maxillary sinus walls to the orbital floor:

There is a close relationship between maxillary sinus and orbit ,to clarify these relations the following points were studied .In all specimens the orbital apex extended beyond posterior wall of maxillary sinus by adistance about 6.5± 3.5mm (3-10mm) (Figs.20, 21) (table 4). The Distance between superior margin of nasal fontanelle and orbital floor was as follows . The orbital floor was in 53 speciemens (53%) lower than superior margin of nasal fontanelle as in (Fig.20) by a distance about 2mm ,but in 47 speciemens it was higher than superior margin of nasal fontenelle by a distance about 2mm (Fig.21) (table4) .

Fig.1: A photograph of right lateral wall of nasal cavity showing: four conchae: supreme concha (1), superior concha (S.C), middle concha (M.C) and inferior concha (I.C). Notice superior meatus (S.M), middle meatus (M.M) and hard palate (H.P).

Fig.2: A photograph of right lateral wall of nasal cavity showing: superior concha (S.C.), middle concha (M.C.) and inferior concha (I.C.). Notice concha bullosa (pneumatized middle concha) (C.B.) in the middle part of middle concha. Also notice slight pneumatization of superior and inferior conchae (blue arrows). Also notice sphenoid sinus (sph.s.) and posterior part of nasal septum (N.S.).

Fig.3: A photograph of right lateral wall of nasal cavity showing: the opening of sphenoid sinus in the sphenoethmoid recess. Notice superior concha (S.C.), middle concha (M.C.), Inferior concha (I.C.), hard palate (H.P.) also notice a green wire in the sphenoid opening into the spheno ethmoidal recess (S.E.R.)

Fig.4: A photograph of right lateral wall of nasal cavity showing: The site of opening of sphenoid sinus in spheno ethmoidal recess(S.E.R.). Notice frontal sinus (F.S.), sphenoid sinus (S.S.), superior concha (S.C.), middle concha (M.C.), Inferior concha (I.C.) and tubal elevation (T.E.).

Figu. 5: A photograph of left lateral wall of nasal cavity showing: a white wire represents the passage of drainge of frontal sinus into the middle meatus. Notice frontal sinus (F.S.), superior concha (S.C.), middle concha (M.C.) and middle meatus (M.M.).

Figu.6: A photograph of right lateral wall of nasal cavity showing: The features of middle meatus which consisting of bulla ethmoidalis (B.E.), hiatus semilunaris (H.S.), uncinate process (U.P.), mucous memberane convering anterior fontanelle (A.F.) "anteroinferior to uncinate process" mucous memberane covering the posterior fontanelle (P.F.) "postero superior to uncinate process". Notice the middle concha (M.C.) was "reflected" upwards. Also notice the inferior concha (I.C.).

Fig.7: A photograph of the previous section showing: The following features in the middle meatus : bulla ethmoidalis (B.E.), uncinate process (U.P.) "reflected", maxillary ostium (M.O.) and posterior nasal fontanelle (P.N.F.). Notice the distance between anterior nasal spine (A.N.S.) and the anterior edge of maxillary ostium. Also notice inferior concha (I.C.) and middle concha (M.C.) reflected upwards.

Fig.8: A photograph of right lateral wall of nasal cavity showing: a single accessory maxillary ostium (A.M.O.) located in anterior fontanelle (A.F.). Notice bulla ethmoidalis (B.E.), sphenoid sinus (S.S.), inferior concha (I.C.), middle concha (M.C.) "reflected" uncinate process (U.P.) and hiatus semilunaris (H.S.).

Fig.9: A photograph of right lateral wall of nasal cavity showing: a single accessory maxillary ostium located in posterior nasal fontanelle ((P.N.F.). Notice middle concha (M.C.) "reflected" posterior nasal fontanelle (P.N.F.), accessory maxillary ostium (A.M.O.), Inferior concha (I.C.) and hard palate (H.P.).

Fig.10: A photograph of right lateral wall of nasal cavity showing: double accessory maxillary ostia (A.M.O.) are located in the posterior nasal fontanelle (P.N.F.). uncinate process (U.P.), Inferior concha (I.C.), hard palate (H.P.), tongue (T.) and anterior nasal fontanelle (A.N.F.).

Fig.11: A photograph of right lateral wall of nasal cavity showing: the flat uncinate process (U.P.) is attached by its postero-inferior end to inferior concha separating the anterior fontanelle (A.F.) from posterior fontanelle (P.F.). Notice the opening of fronto- nasal canal (F.N.D.) into the hiatus semilunaris (H.S.), sphenoid sinus (S.S.), bulla ethmoidalis (B.E.), inferior concha (I.C.), anterior nasal spine (A.N.S.) and line of fusion of uncinate process with inferior concha (blue arrow).

Fig.12: A photograph of the previous section showing: The blue wire indicating the passage of opening of anterior ethmoid sinus into middle meatus. Notice the pencil like nasal fontanelle, sphenoid sinus (S.S.), bulla ethmoidalis (B.E.) and hiatus semilunaris (H.S.),uncinate process (U.P.),inferior concha (I.C.).

Fig.13: A photograph of right lateral wall of nasal cavity showing: the flat uncinate process (U.P.) dividing pencil like nasal fontanelle into the anterior fontanelle (A.F.) and posterior fontanelle (P.F.) by attachement of its postero- inferior end to inferior concha (I.C.). Notice the opening of sphenoid sinus (S.S.), into spheno ethmoid recess (S.E.R.) and the distances between anterior nasal spine (A.N.S.) and anterior margin, posterior margin of nasal fontanelle and end of uncinate process. Notice also superior concha (S.C.) and middle concha (M.C.) "Cut".

Fig.14: A photograph of right lateral wall of nasal cavity showing: the uncinate process (U.P.) is attached to inferior concha (I.C.) by whole its antero- inferior margin(dotted white line). Notice maxillary sinus (M.S.).

Fig.15: A photograph of right lateral wall of nasal cavity showing: folded uncinate process (U.P.) with free prstero- inferior end where the anterior fontanelle (A.F.) communicating with the posterior fontanelle (P.F.). Notice the distance between anterior nasal spine (A.N.S.) and anterior (1) & posterior (2) margins of nasal fontanelle and lower free end (3) of unicate process. Notice also middle concha (M.C.) and inferior concha (I.C.).

Fig.16: A photograph of the previous section after cutting the superior concha showing:The posterior ethmoid sinus (P.E.S.) opens in superior meatus (S.M.) . Notice inferior concha (I.C.), midle concha (M.C.) ,nasal fontanelle (N.F.) and uncinate process (U.P.).

Fig.17: A photograph of left lateral wall of nasal cavity showing: the posterior angle (P.A.) of uncinate process (U.P.) fusing with bulla ethmoidalis (B.E.), while postero- inferior margin of uncinate process is free producing one large nasal fontanelle (N.F.). Notice inferior concha (I.C.) and spheno- palatine foramen (S.P.F.).

Fig.18: A photograph of left lateral wall of nasal cavity showing: the antero inferior (A.I.) angle of uncinate process(U.P.) fusing with inferior concha (I.C.) while its postero-superior angle (P.I.) is fused with the bulla ethmoidalis (B.E). Notice the diminsions of the triangular nasal fontanelle (N.F.) and the distance between anterior nasal spine (A.N.S.) and anterior & posterior margins of nasal fontanelle. Also notice frontal sinus (F.S.), with its opening at the beginning of frontonasal duct, ethmoid sinuses (E.S.), spheno palatine foramen (S.P.F.), hard palate (H.P.), lacrimal bone (L.B), perpendicular plate of palatine bone (P.P.P) and medial pterygoid plate (M.P.P.).

Fig.19: A photograph of left lateral wall of nasal cavity showing: large triangular nasal fontanelle (N.F.) extending in front, below and behind the bulla ethmoidalis (B.E.). Notice the distance between anterior nasal spine (A.N.S.) and both anterior & posterior margins of nasal fontanelle. Notice also inferior concha (I.C.), hard palate (H.P.) and blue arrow represents inferior concha spike.

Fig.20: A photograph of midorbital section of right side of the skull showing: the nasal fontanelle (N.F.) from the lateral aspect to define the extent of apex of orbit (3) in relation to posterior wall of maxillary sinus (4). Also define the relation of orbital floor (2) to superior margin of nasal fontanelle (1). Notice optic canal (O.C.), medial wall of orbit (M.O.W.), anterior ethmoid foramen (A.E.F.) posterior ethmoid foramen (P.E.F.), frontal sinus (F.S.), line of superior margin of nasal fontanelle (1), line of level of orbital floor (2), line of orbital apex (3), line of posterior wall of maxillary sinu (4) and pterygo palatine fossa (P.P.F.).

Fig.21: A photograph of midorbital section of left side of the skull showing: the nasal fontanelle (N.F.) from the lateral aspect to define the extent of orbital apex (3) in relation to posterior wall of maxillary sinus (4), also define the relation between orbital floor (1) and superior margin of nasal fontanelle (2). Notice optic canal (O.C.), medial orbital wall (M.O.W.), maxillary sinus cavity (M.S.).

Table (1): Shows the number, the incidences and pneumatization of conchae in 100 specimens (70 dried skulls and 30cadavers).

	No. of conchae		Incidence
Conchae	3 in 86 specimens 4 in 14 specimens		86% 14%
Pneumatization of conchae	Superior concha	30 specimens	30%
	Middle concha	46 specimens	46%
	Inferior concha	2 specimens	2%

Table (2): Shows the diameters of the nasal fontanelles (anterior nasal fontanelle (A.N.F.), posterior nasal fontanelle (P.N.F.) and the whole nasal fontanelle (N.F.).

	Vertical diameter				Antero posterior diameter			
	Mean (mm)	**±SD**	**Minimum**	**Maximum**	**Mean (mm)**	**±SD**	**Minimum**	**Maximum**
A.N.F.	11	± 2	9	13	18	± 1.25	16.75	19.25
P.N.F.	11	± 1.5	9.5	12.5	17	± 3	14	20
N.F.	12	± 2	10	14	32	± 4	28	36

Table (3): shows the distances between the anterior nasal spine (A.N.S.) and the following parts: anterior margin of nasal fontanelle (ANF1), posterior margin of nasal fontanelle (ANF2), postero inferior end of uncinate process (U.P.) and maxillary ostium (M.O.).

		Mean (mm)	**± SD**	**Minimum**	**Maximun**
1	Distance between ANS and ANF1	12.5	± 4.5	8	17
2	Distence between ANS and ANF2	35	± 14	21	49
3	Distane between ANS and posteroinferior end of U.P	38	± 4	34	42
4	Distance between ANS and M.O.	38.5	± 8.5	30	47

Table (4): shows the distances between posterior margin of nasal fontanelle (NF1) and spheno palatine foramen (SPF), optic foramen (O.F.) and cavernous sinus (C.S.). Also shows the distance between posterior wall of maxillary sinus (M.S.) and orbital apex (O.A) and the distance between superior margin of nasal fontanelle (NF2) and orbital floor (O.F.). Also shows the length of attachement of uncinate process (U.P.) to inferior concha (I.C.).

		Mean (mm)	**± SD**	**Minimum**	**Maximun**
1	Distance between NF1 and S.P.F	6	± 2	4	8
2	Distance between NF1 and O.F.	47	± 10	37	57
3	Distance between NF1 and C.S.	49.5	± 10.5	39	60
4	Distance between NF2 and O.F.	0.0 m	± 2	2mm below O.F.	2 mm above O.F.
5	Distance between M.S. and O.A.	6.5	± 3.5	3	10
6	Length of attachemet of U.P to I.C.	3.5	± 1.5	2	5