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Cherkes M.B.,
Student V.O.,
Masna Z.Z.
Danylo Halytsky Lviv National Medical University, Lviv, Ukraine, maryana.cherkes@gmail.com

VARIANTS OF THE MAXILLARY SINUS SHAPES DEPENDING ON THE SECTION PLANES OF COMPUTED TOMOGRAPHY

Abstract. *The gold standard to diagnose sinusitis is radiation methods of diagnostics, and Computed Tomography in particular. The objective of the investigation was to study peculiarities of the maxillary sinuses in spatial imaging in adults of different sexes. 20 computed tomograms of the maxillary-facial area were analyzed – 10 obtained from males and 10 those from females, the patients of the 3D Medical Diagnostic Centre undergoing screening CT examination or examination to find pathology not connected with the maxillary sinus. The examination was carried out by means of Point 3D Combi 500. This method enables to visualize minimal changes in the walls and cavities of the maxillary sinuses. Five shapes of the maxillary sinuses were detected: rectangle, trapezoid, round, oval and triangle. In frontal view of men the maxillary sinus is mainly of a rectangle shape, and it is triangle in women; in horizontal view the maxillary sinuses are of a triangle shape both in men and women. Complete symmetry was detected in 20 % of the examined men and in 50% of the examined women.*
Key words: *maxillary sinuses, spiral Computed Tomography.*

Introduction. according to literary scientific data acute and chronic sinusitis of various etiology is one of the serious problems for both ENT specialists and dentists [1-3, 7, 8]. Usually patients with pathology of the maxillary sinus have various complaints: blocked nose, running nose, nasal discharge, unpleasant smell from the nose, headache, fever, intact toothache etc. Objective and clinical methods of diagnostics are used to diagnose pathology of the maxillary sinuses. To choose a right therapeutic tactics on the stage of diagnosing maxillary sinusitis of rhinogenous or odontogenous genesis should be differentiated [1, 3].

While examining the patient and collecting anamnesis it is important to find early signs of development of pathological process. The gold standard to diagnose sinusitis is radiation methods of diagnostics, and Computed Tomography in particular [4-6]. This method enables to visualize minimal changes in the walls and cavities of the maxillary sinuses. To be able to differentiate them the structure of the maxillary sinuses should be perfectly known: peculiarities of their shape, connection with the nasal cavity, contact with dental roots of the maxillary dentition [2, 6].

Objective: to study peculiarities of the maxillary sinuses in spatial imaging in adults of different sexes.

Materials and methods: 20 computed tomograms of the maxillary-facial area were analyzed – 10 obtained from males and 10 those from females, the patients of the 3D Medical Diagnostic Centre undergoing screening CT examination or examination to find pathology not connected with the maxillary sinus. The examination was carried out by means of *Point 3D Combi 500* (Korea). The type of the device: conical-radiation computer scanner (dental scanner). The area of examination/scanning (F.O.V): 9x12 cm. Voxel value/thickness of a section: 0,16 mm. The value of the exposed dose (radiation): 20-100 mc3v. The time of scanning: 19 seconds. Explorer of examination: RealScan. Type of image retention: DICOM-files/sections 445 in amount.

The explorer RealScan is applied to analyze the results of tomographic examination with the use of layered sections of DICOM format. Capabilities of the explorer: 1. Step-by-step view of a scanned area with the thickness of section from 0,16 mm to 30 mm, with possible independent change of the section thickness; 2. The explorer interface is

represented by 4 windows: 3 plane windows (coronary, axial and sagittal) and 3D-reconstruction window of a scanned area; 3. Plane windows are separated by vector lines having 4 mobile points; 4. Accurate measuring of anatomical structures and pathological changes; 5. Transform visualization of the examination: change intensity and contrast.

While analyzing CT the shape of the maxillary sinus was detected in two vies – frontal and horizontal, and they were compared; the level of maximal width and depth of sinuses, the contact with the dental roots of the maxillary dentition, availability of additional septa, cells or inlets in the sinus, availability or obstruction of maxillary outlets into the nasal cavity, symmetry of the shape, size and formations in the cavity and walls of the sinuses were detected.

To unify these data we have elaborated a single standard algorithm to process the results of conical-radiation Computed Tomography essential to minimize some inaccuracy possibly occurring due to individual specifications of patient's position during scanning. In its turn, it affects the obtained results of visual and programmed analysis of the examination data.

The primary preparation of the examination for the following analysis consisted of a spatial orientation of the plane axes to steady anatomical formations: 1. In the window of frontal (coronary) view the axial line is positioned parallel to the hard palate or sagittal line is positioned along the longitudinal axis (parallel) to the nasal septum (Fig. 1); 2. In the window of horizontal (axial) view the sagittal line is accurately positioned parallel to the nasal septum (Fig. 2); 3. In the window of sagittal (lateral) view the horizontal line should be positioned along the plane of the hard palate (Fig. 3).

Results and discussion: the results of the studies conducted were indicative of the availability of 5 shapes of the maxillary sinus among the randomized sampling of patients visualized in the frontal and horizontal planes: rectangle, trapezoid, round, oval and triangle. (Tables 1, 2).

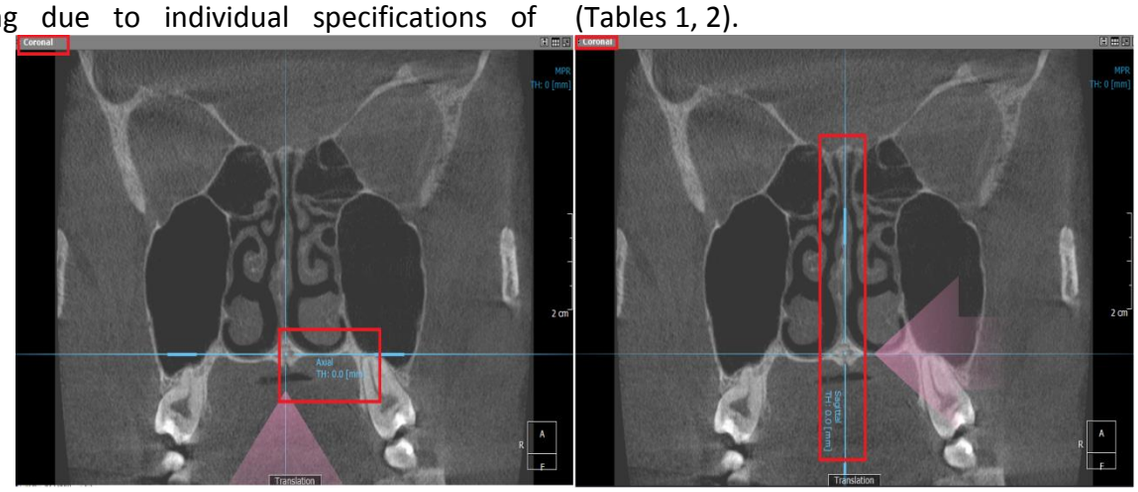

Figure 1: Windows of frontal view; А. Position of the axial line parallel to the hard palate Б. Position of the sagittal line parallel to the nasal septum

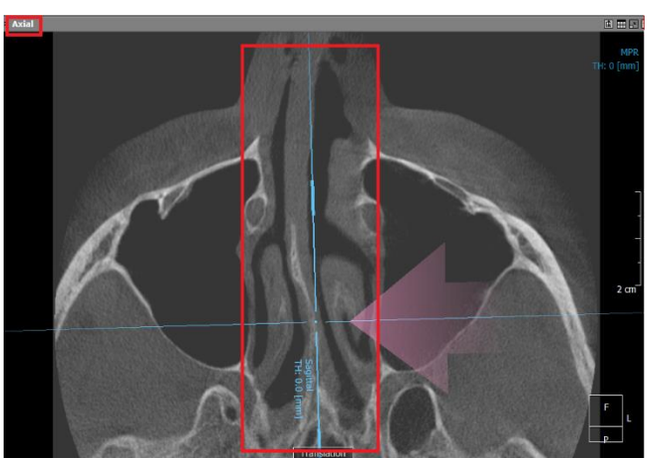

Figure 2: Window of horizontal view – position of the sagittal line parallel to the nasal septum

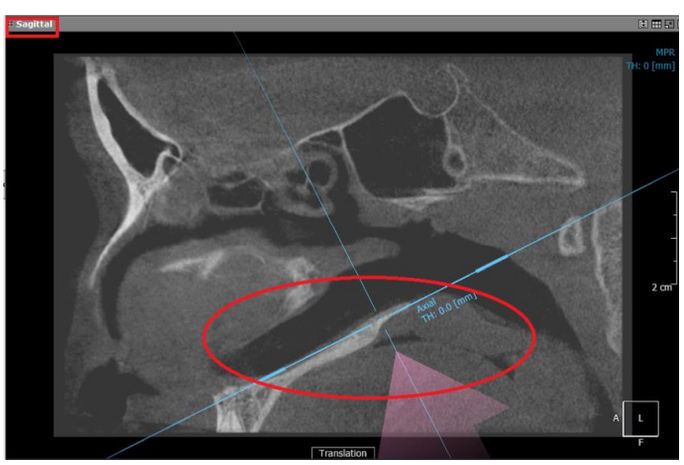

Figure 3: Window of sagittal view – position of the horizontal line parallel to the plane of the hard palate

Table 1

Quantitative ratio of the variability of the maxillary sinus shapes in men and women in frontal view.

Maxillary sinus shape	Men		Women	
	Left	Right	Left	Right
Rectangle	4	4	2	2
Trapezoid	5	2	1	4
Round	1	1	-	-
Oval	-	2	-	1
Triangle	-	1	7	3

Table 2

Quantitative ratio of the variability of the maxillary sinus shapes in men and women in horizontal view.

Maxillary sinus shape	Men		Women	
	Left	Right	Left	Right
Rectangle	1	3	1	1
Trapezoid	1	1	-	-
Round	-	-	1	-
Oval	1	1	2	1
Triangle	7	5	6	8

Analysis of CT images in the frontal view enabled to establish that in men the maxillary sinus is most frequently of a rectangle shape (4 cases of the left maxillary sinus and 4 cases of the right one), less often – of a trapezoid shape (5 cases of the left maxillary sinus and 2 cases of the right one). In certain cases the sinuses are of a round shape (1 case of the left maxillary sinus and 1 case of the right one), an oval (2 cases of the right maxillary sinus) or a triangle (1 case of the right maxillary sinus) shape (Table 1).

In horizontal view of CT the maxillary sinus is most often of a triangle shape (7 cases of the left maxillary sinus and 5 cases of the right one), less often – of a rectangle shape (1 case of the left maxillary sinus and 3 cases of the right one), and in single cases – a trapezoid shape (1 case of the left maxillary sinus and 1 case of the right one) or an oval one (1 case of the left maxillary sinus and 1 case of the right one) (Table 2).

In women CT conducted in the frontal view demonstrated that maxillary sinuses are of a triangle shape most often (7 cases of the left maxillary sinus and 3 cases of the right one), less often – a trapezoid shape (1 case of the left maxillary sinus and 4 cases of the right one) or a rectangle shape (2 cases of the left maxillary sinus and 2 cases of the right one) and only in one case it was oval among all the examined women (Table 1).

On CT scanning carried out in the horizontal view the maxillary sinuses of women are of a triangle shape most often (6 cases of the left maxillary sinus and 8 cases of the right one), less often – an oval shape (1 case of the left maxillary sinus and 1 case of the right one) and a rectangle shape (1 case of the left maxillary sinus and 1 case of the right one), and only in one case among all the examined women it was round (Table 2).

One more peculiarity of the maxillary sinuses considered during CT examinations of patients is their symmetry and correlation of the shape in the frontal and horizontal planes (Tables 3, 4).

Table 3

Shapes of the maxillary sinuses in the frontal and horizontal view in men

№	Left sinus		Right sinus	
	Frontal (coronal) view	Horizontal (axial) view	Frontal (coronal) view	Horizontal (axial) view
1	Rectangle	Triangle	Rectangle	Triangle
2	Rectangle	Triangle	Oval	Triangle
3	Trapezoid	Oval	Triangle	Oval
4	Trapezoid	Triangle	Trapezoid	Triangle
5	Rectangle	Triangle	Rectangle	Rectangle
6	Trapezoid	Triangle	Trapezoid	Trapezoid
7	Round	Triangle	Rectangle	Triangle
8	Trapezoid	Trapezoid	Rectangle	Rectangle
9	Rectangle	Rectangle	Round	Rectangle
10	Trapezoid	Triangle	Oval	Triangle

Table 4

Shapes of the maxillary sinuses in the frontal and horizontal view in women

№	Left sinus		Right sinus	
	Frontal (coronal) view	Horizontal (axial) view	Frontal (coronal) view	Horizontal (axial) view
1	Trapezoid	Triangle	Trapezoid	Triangle
2	Triangle	Triangle	Triangle	Triangle
3	Triangle	Oval	Trapezoid	Triangle
4	Triangle	Oval	Oval	Oval
5	Triangle	Triangle	Triangle	Triangle
6	Triangle	Triangle	Trapezoid	Triangle
7	Triangle	Triangle	Trapezoid	Triangle
8	Rectangle	Round	Rectangle	Triangle
9	Rectangle	Rectangle	Rectangle	Rectangle
10	Triangle	Triangle	Triangle	Triangle

In the examined men a complete symmetry, that is, correlation of maxillary shapes in the frontal and horizontal planes was found only in two persons (20% of all the examined men). A partial symmetry (only in one plane) was found in 7 men (70% of all the examined men) including 5 men in the horizontal plane (50%), and 2 – in the frontal plane (20%) (Table 3).

In the examined women a complete symmetry of the maxillary sinuses was found in the frontal and horizontal planes in 5 persons (50% of all the examined women). A partial symmetry was found in 4 women (40% of all the examined women), including 3 persons in the horizontal plane (30%) and in the frontal plane – only in one person (10%) (Table 4).

While analyzing the variants of the maxillary sinus shapes on CT images in the horizontal and frontal panes we have found that a rectangle shape in the frontal view is more often combined with a triangle shape in the horizontal view (4 men and 1 woman), and a trapezoid shape in the frontal view with a triangle shape in the horizontal view (3 men and 4 women). It is interesting to note that the analysis of CT images obtained are indicative of a combination of a triangle shape of the maxillary sinuses (3 women) and a rectangle shape (1 woman) in the frontal and horizontal planes (Tables 3,4).

Conclusions: 1. To choose a right therapeutic tactics on the stage of diagnosing maxillary sinusitis of rhinogenous or odontogenous genesis should be differentiated;

2. Computed Tomography is a gold standard to diagnose rhinosinusitis;

3. The results of analysis of 20 CT images enabled to detect five shapes of the maxillary sinuses visualized in the frontal and horizontal planes: rectangle, trapezoid, round, oval and triangle;

4. Analysis of CT images in the frontal plane enabled to detect that the maxillary sinus shape in men is most often rectangle, and in women it is triangle. On CT images in the horizontal view the maxillary sinuses are most often of a triangle shape both in men and women;

5. Complete symmetry, that is, correlation of the maxillary shapes in the frontal and horizontal planes, was detected in 20% of the examined men and in 50% of the examined women.

Prospects of further studies: in our further studies we are planning to investigate in detail the contact of the maxillary sinuses with the dental roots, condition of the maxillary outlets, which will enable to improve the methods of early diagnostics and prevention of sinusitis as well as the methods of their treatment.

References:

1. Андрейчин Ю.М. Морфологічні критерії хронічних синуситів / Ю.М. Андрейчин, Я.П. Нагірний // Шпитальна хірургія. – 2008. – №1. – с.78-81.

2. Барсуков М.П. Морфоклінічні аспекти верхньощелепних пазух/ М.П. Барсуков// Клінічна анатомія та оперативна хірургія. – 2013 . – Т.12, №3. – с. 64-69.

3. Дудій П.Ф. СКТ-діагностика ускладнень хронічних синуситів/ П.Ф. Дудій// Клінічна анатомія та оперативна хірургія. – 2012 . – Т.11, №4. – с. 29-33.

4. Дудій П.Ф. Спіральна комп'ютерна томографія в діагностиці захворювань кісток та порожнин лицевого черепа: автореф. дис. на здобуття наук. ступеня доктора.мед.наук:спец. 14.01.23 "Променева діагностика, променева терапія" / Дудій П.Ф. – Івано-Франківськ, 2010. – 27 с.

5. Лазарева А.Ю. Возможности КТ исследования в диагностике полипозного риносинусита / А.Ю. Лазарева // Вестник оториноларингологии. – 2008 . – №1. – с. 37-38.

6. Computed tomography measurements of different dimensions of maxillary and frontal sinuses / P. Sahlstrand-Johnson, M. Jannert, A. Strömbeck, K. Abul-Kasim // BMC Medical Imaging. – 2011. – Vol. 11:8.

7. Dunnenbier E.A. Imaging for otolaryngologists/ Erwin A.Dunenbier. – New York: Thieme, 2007. – 346 p.

8. Dammann F. Imaging of paranasal sinuses today/ Dammann F. // Radiologe. – 2007. – Vol.47. – P. 576-583.

9. Leunig A. Endoscopic surgery of the lateral nasal wall, paranasal sinuses and anterior skull base/ A.Leunig. – Tuttlingen.: Endo:Press, 2011. – 230p.

Multiparametric statistical correlations between paranasal sinus anatomic variations and chronic rhinosinusitis/ G.L. Fadda, S. Rosso, S. Aversa, A. Petrelli [et al] // Acta otorhinolaryngologica italica. – 2012– Vol.32. – P. 244-251.