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SPATIAL TOPOGRAPHY OF THE DIAPHRAGM IN THE SAGITTAL PLANE IN WOMEN

Abstract. *Individual spatial topography of the patient diaphragm is of certain importance for diagnostic and therapeutic manipulations. The study to determine individual characteristics of the spatial topography of the human diaphragm in sagittal plane based on SCT-data considering sex, age and somatotype has been conducted. The material for the study was the data after examination of 75 patients with different diseases of the abdominal and thoracic cavities. Measuring of the diaphragm attachment angles in the sagittal plane was made on the vertebral, paravertebral, scapular and posterior axillary lines on both sides (front and back values). Statistical analysis of the measurements revealed little correlation between the age and angle of diaphragm attachment in female. Other parameters were not correlated with the studied values (sex and type of the body structure).*
Key words. *Individual spatial topography, attachment angle of the diaphragm.*

Introduction. Individual spatial topography of the diaphragm is of a great importance for understanding the structural organization of this organ in every particular clinical case [1]. To conduct diagnostic and especially therapeutic manipulations the awareness of individual peculiarities of every patients is compulsory. This knowledge enables to avoid damage of the internal organs of the abdomen and thorax in case of their puncture (catheterization), to determine localization of a pathological process more precisely, and to choose the method of further surgery or conservative treatment [2, 3].

Objective of our study was to find individual peculiarities of the spatial topography of the human diaphragm in two vertical planes – sagittal and frontal on the bases of spiral computed tomography (SCT) examination considering sex, age and somatic type [4, 5].

On the basis of the results of the obtained findings availability (or absence) of relations between individual peculiarities of spatial topography and sex, age and somatic type has been planned to find. The data obtained were used to develop 3D program of an individual modeling of the human diaphragm [6, 7].

Materials and methods. The data of 75 patients examined during the last 2 years concerning various diseases of the abdominal and thoracic organs were used in the investigation. There was no any diaphragmatic pathology found. The analysis and processing of the images obtained were conducted on the working station “HP-Z820” with application of the specialized program “Vitrea 2”.

There were 61 men and 14 women involved in the study. Their age ranged from 26 to 82. According to the body or somatic type the following proportions were found: male hypersthenic persons – 35%, normosthenic – 60%, asthenic – 15%; among women this proportion was the following: 30%, 50% and 20% respectively. The body constitutional type was determined according to Pinje index. Due to limited possibilities we will not present all the data obtained, but will show only minimal and maximal values. The article presents the findings obtained in the investigation of the attachment angles of the diaphragm to the sagittal pane in women. The data obtained will be presented in the following succession: the values of the angles of the diaphragm attachment to the vertebral line (vl), paravertebral line (pvl), scapular line (sl) and posterior axillary line (pal) in the left, and the same examinations (except vertebral line) in the right.

Figure presents the screenshot of the measurement of the human diaphragm

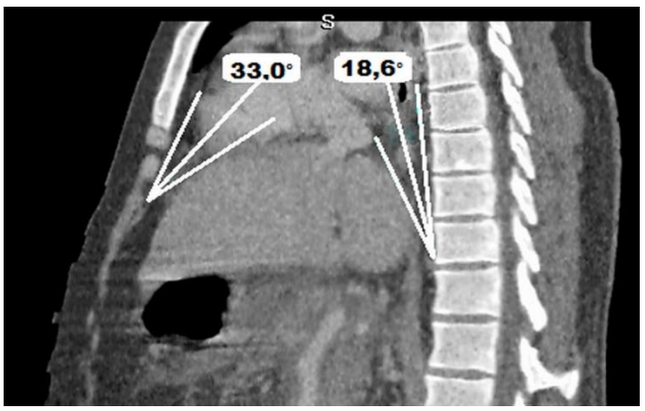

Figure. The angles of human diaphragm attachment along the vertebral line in the frontal plane.

attachment angles along the vertebral line in the frontal plane. The figure demonstrates that these investigations will present two values: the first value – the angle of the diaphragm attachment along the anterior surface (as – sternal line), and the second value – the angle of the diaphragm attachment along the posterior surface (ps – the vertebral line proper).

Results and discussion. The data characterizing minimal and maximal values of the diaphragm attachment in women are presented in Table 1. The biggest number of values of the diaphragm

Table 1

Minimal and maximal values of the diaphragm attachment in women in the sagittal plane

		asthenic		Normosthenic		hypersthanic	
		min	max	min	max	min	max
vl	as	26,4°	58,6°	33,6°	95,4°	29,6°	60,0°
	ps	5,2°	40,2°	10,0°	43,4°	9,2°	48,4°
Left pvl	as	35,7°	91,0°	27,7°	89,2°	15,0°	102,8°
	ps	20,5°	75,0°	23,3°	76,5°	17,1°	80,6°
Left sl	as	27,2°	83,5°	38,4°	106,0°	41,5°	101,8°
	ps	27,1°	75,6°	23,3°	66,1°	24,0°	69,1°
Left pal	as	27,2°	92,6°	38,4°	106,0°	41,5°	101,8°
	ps	24,0°	75,5°	16,1°	54,1°	23,1°	51,7°
Right pvl	as	32,6°	74,4°	16,1°	73,5°	42,4°	85,3°
	ps	32,9°	80,5°	24,1°	76,1°	17,5°	72,5°
Right sl	as	28,2°	66,0°	21,7°	65,2°	36,3°	75,7°
	ps	24,1°	69,7°	21,5°	70,4°	29,7°	74,5°
Right pal	as	22,1°	46,0°	16,6°	68,5°	19,5°	76,6°
	ps	20,4°	63,0°	21,5°	81,7°	24,8°	75,5°

attachment along the vertebral line (anterior surface) is found within the interval from 70° to 80°. There were 4 such cases (28,6%). 3 cases (21,4%) were found within the range from 50^0 to 60°. Therefore, 50,0% of cases were within the range from 50 to 60 and 70 – 80°.

The most frequent values of the diaphragm attachment along the vertebral line (posterior surface) in women were found within the range from 10° to 20° – 6 cases (42,9%) and within the range from 20° to 30° – 4 cases (28,6%). Therefore, within the range from 10° to 30° there were 71,5% of all cases found.

The angle of attachment along the posterior surface was not determined in all the cases. It is connected with individual peculiarities of the aorta location concerning the vertebral column.

The angles of the diaphragm attachment along the left paravertebral line in the sagittal plane in women were measured anteriorly and posteriorly; the order of the data presented is: the first measurement – the angle of attachment along the anterior surface (parasternal line), the second measurement – along the posterior surface (paravertebral line).

The cases within the range from 60° to70° (4 cases) were found most frequently (28,6%). 3 cases (21,4%) were found within the rage from 70° to 90°. Therefore, 50,0% of cases were within the range from 60 to 90°. The rest of the measurements were not conducted due to individual peculiarities of the internal organs location.

The second value in women along the paravertebral line in the left looked like the following: the values within the range from 40° to

50° were found more frequently. There were 5 of them (35,7%). The rest of values were evenly distributed in all the intervals. It should be noted that all the values were not able to be obtained in the patients examined. It is associated with individual peculiarities of the aorta location concerning the vertebral column.

The first value of the angles of the diaphragm attachment along the scapular line in the left in women was the following: most frequent values were within the interval from 50° to 60°. There were 5 such cases (35,7%). Within the interval from 60° to 80° there were 42,8% of all the cases. Therefore, within the range from 50° to 80° there were 78,5% of all the cases.

The second value of the angles of the diaphragm attachment in women was the following: most frequent values were within the interval from 30° to 40° – 5 cases (35,7%). 3 more cases were found within the range from 40° to 50° (21,4%). Therefore, 57,1% of cases were found within the intervals from 30° to 50°.

The next line examined in the sagittal plane in the left is the posterior axillary line.

The first value (along the anterior surface) of the diaphragm attachment in women was the following: most frequent values were found within the interval from 30° to 40° – 6 cases (42,8%) and from 50° to 60° – 4 cases (28,8%). 2 mores cases (14,3%) were within the range from 40° to 50°. Therefore, within the interval from 30° to 60° there were 85,9% of all cases.

The second value (posterior surface) of the diaphragm attachment along the posterior axillary line in women was the following: most frequent values were found within the interval from 30° to 40°. There were 6 such cases (42,8%). There were 5 values (35,7%) within the interval from 40° to 50°. Therefore, within the interval from 30° to 50° there were 11 cases (78,6%).

Then the angles of the diaphragm attachment in the sagittal plane in the right side of the thorax along the similar lines were studied.

In women the first value of the angles of the diaphragm attachment was the following: most frequent values were found within the interval from 50° to 60°. There were 5 values (35,7%). 3 more cases were found within the range from 40° to 50° (21,4%). Therefore, 57,1% of cases were within the range from 40° to 60°.

The second value (posterior surface) of the diaphragm attachment along the paravertebral line in the left in women was the following: most frequent values were found within the interval from 40° to 50°. There were 5 values (35,7%). 2 mores cases (14,3%) were within the range from 30° to 40°. Therefore, 50% of all the cases were within these ranges.

The right scapular line was studied in the sagittal plane. In women the first value of the angles of the diaphragm attachment was the following: most frequent values were found within the interval from 50° to 60°. There were 4 such cases (28,5%). Within the ranges from 30° to 40° and from 60° to 70° there were 3 cases (21,4%). Therefore, within the interval from 30° to 70° there were 71,4% of all the cases.

The second value (posterior surface) of the diaphragm attachment along the scapular line in the right in women was the following: most frequent values were found within the interval from 30° to 40°. There were 6 such cases (42,8%). Within the interval from 40° to 50° there were 4 cases 28,5%). Therefore, within the interval from 30° to 50° there were 71,4% cases.

The measurement along the posterior axillary line in the right of the diaphragm attachment angle in the sagittal plane was the last.

In women the first value of the diaphragm attachment angles was the following: most frequent values were found within the interval from 30° to 40°. There were 5 of them (35,7%). 4 more cases were found within the range from 20° to 30° (28,5%). Therefore, within the range from 20° to 40° there were 64,3% of all cases.

The second value (posterior surface) of the diaphragm attachment along the posterior axillary line in the right in women was the following: most frequent values were found within the interval from 30° to 40° and from 40° to 50°. There were 5 and 4 such cases respectively, constituting 35,7% and 28,5% accordingly. Therefore, within the interval from 30° to 50° there were 64,3% of all the cases.

Conclusions. 1. Individual spatial topography of the diaphragm is very variable and practically does not depend on the sex, age and body constitution type. 2. In certain cases (16%) in individuals of both sexes the height of the location of the left cupola of diaphragm is longer in the left than in

the right, which is explained by a high position of the spleen. 3. The data obtained should be considered while interpreting X-ray images and performing thoracocentesis in the left.

Prospects of further studies. To advance knowledge concerning the spatial topography of the human diaphragm further studies in different planes and projections should be conducted considering the sex, age and somatic type.

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