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SPATIAL TOPOGRAPHY OF MALE DIAPHRAGM IN THE SAGITTAL PLANE

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Introduction. Individual spatial topography of the diaphragm is of great importance for understanding the organization of the body in a particular clinical case [5]. For

diagnostic and particularly therapeutic manipulation knowledge of the individual characteristics of each patient is required. This knowledge allows you to avoid damage to the internal organs of the abdominal and thoracic cavities when they puncture (catheterization) and more accurately determine the localization of the pathological process, choose the method further surgical or conservative treatment [6,7].

Objectives. The purpose of our research was determination of the individual characteristics of the spatial topography of the human diaphragm in two vertical planes — sagittal and frontal based on SCT-research depending on gender, age and somatotype [1,2].

According to the results of the measurements reveal the presence (or absence) of the relationship between individual characteristics and spatial topography of gender, age and the type of body structure. The resulting data were also used to make individual 3D modeling programs for human diaphragm [3,4].

Material and methods. Material the data of 75 patients surveyed in the last 2 years about various diseases of the abdominal and thoracic cavities. Any diaphragm with pathology was excluded. Analysis and image processing

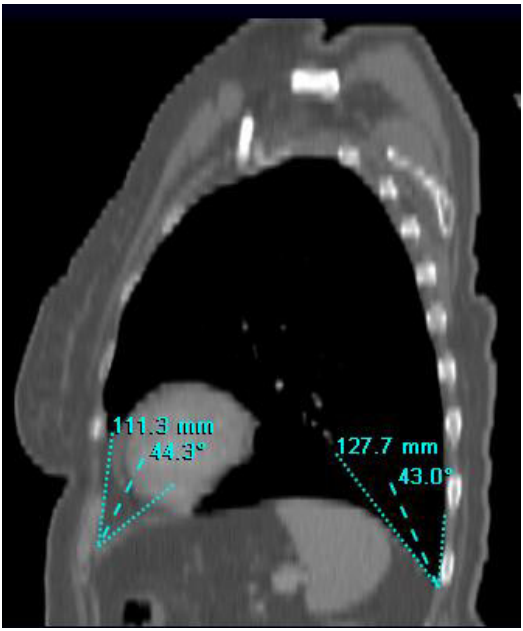
were performed on a workstation "HP-Z820" c using the specialized program "Vitrea 2".

Gender-based cases were: male – 61 and female – 14 cases. Age interval from 26 to 82 years old, according to the type of the structure revealed the following relationships — male hypersthenics — 35%, normosthenics — 60%, asthenics — 15%; for female following ratio was 30%, 50% and 20% resp. Type of body structure was determined by the index of Pinue. Due to the limited amount of messages we do not give all the findings are limited to the minimum and maximum values.

The height of the cupola of a diaphragm and angles of its attachment in the sagittal plane have been calculated.

The study of angles of attachment of the human diaphragm in the sagittal plane was made along next lines: vertebral (vl), paravertebral (pvl), scapular (sl) and posterior axillary (pal) lines for left side and the same lines except vertebral line for right side of body.

Presentation data show values of 2 angles of attachment of the human diaphragm in the sagittal plane in male on indicated lines: for the anterior (as) and posterior (ps) surfaces (pict.1).



Picture 1. Angles of attachment of the human diaphragm in the sagittal plane on the level of left scapular line.

Results and discussion. The data of the minimum and maximum values of the angle of attachment of the diaphragm in males are given in table 1.

Some values of the attachment of the diaphragm along the vertebral line (anterior surface) were met repeatedly. Thus, the value of 50.0° — three cases (46 years old, asthenic, 37 years old, normosthenic and 73 years old, hypersthenic), 52.3° — three cases (80 years old, hypersthenic, 69 years old, hypersthenic and 76 years old, normosthenic), 65.0° — two cases (79 years old, normosthenic and 80 years old,

asthenic), 71.6° — three cases (43 years old, normosthenic, 63 years old, hypersthenic and 75 years old, normosthenic), 72.1° — four cases (74 years old, hypersthenic, 71 years old, normosthenic, 38 and 63 years old, asthenics), 76.0° — three observations (60 years old, asthenic, 66 and 53 years old, hypersthenics).

Table 1.

Minimum and maximum values of the angle of attachment of the diaphragm for male in the sagittal plane

line		Asthenics		Normosthenics		Hypersthenics	
		min	max	min	max	min	max
vl (grad.)	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 (grad.)	as	35,7°	91,0°	27,7°	89,2°	15,0°	02,8°
	ps	20,5°	75,0°	23,3°	76,5°	17,	80,6

						1°	°
Left sl (grad.)	as	27,2°	83,5°	38,4°	106,0°	41, 5°	01,8 °
	ps	27,1°	75,6°	23,3°	66,1°	24, 0°	69,1 °
Left pal (grad.)	as	27,2°	92,6°	38,4°	106,0°	41, 5°	01,8 °
	ps	24,0°	75,5°	16,1°	54,1°	23, 1°	51,7 °
Right pvl (grad.)	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 (grad.)	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 (grad.)	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 °

The greatest number of values is noted in the range from 70° to 80°. Such cases were 17° (28.3%). In the range from 50° to 60°, 14 (23.3%) cases were detected. Thus, 51.6% of observations were found in the range from 50° to 60° and 70° to 80°.

The second value of the attachment of the diaphragm along the vertebral line (posterior surface) for male had the following values: several times, the values of 9.2° were repeated — two cases (44 years old, asthenic and 66 years old, hypersthenic), 13.1° — two cases (59 years old, hypersthenic and 58 years old, asthenic), 24.6° — two cases (59 years old, hypersthenic and 66 years old, normosthenic), 25.5° — two cases (43 and 67 years old, hypersthenics).

The most frequent values were in the interval from 10° to 20° — 21 cases, which was 35% and in the interval from 20° to 30° — 13 cases (21.6%). Thus, in the range from 10° to 30° — 56.6% of all cases were notated.

It was impossible determine the angle of attachment along the back surface in some observations. This is due to the individual features of the location of the aorta relative to the vertebral column.

The order of presentation of the data — the first measurement of the angle of contiguity along the anterior

surface (parasternal line), the second measurement — on the posterior surface (paravertebral line).

There were the same values — 64.3° — two cases (80 years old, asthenic and 38 years old, asthenic), 67.5° — two cases (59 years old, hypersthenic and 49 years old, hypersthenic).

Some cases were found in the interval from 60° to 70° — 11 cases (18.3%). In the interval from 70° to 90° there were 16 cases (26.6%). Thus, 44.9% of observations were in the range from 60° to 90°. A total 42 measurements in male were made. The remaining measurements are not made, which is due to the individual features of the location of internal organs.

The second values for male along the left paravertebral line are the next: several values were repeated. This is 40.0° — two cases (72 years old, hypersthenic and 63 years old, asthenic) and 75.0° — two cases (50 years old, asthenic and 64 years old, normosthenic).

Values in the range from 40° to 50° were more common. There were 13, which was 28.88%. The remaining values were evenly distributed over all intervals. In this field, as well, it was not possible to obtain some values in the studied patients. This is due to the individual features of the location of the aorta relative to the vertebral column.

Angles of attaching the diaphragm along the left scapular line.

For male the first value of the angle of attachment of the diaphragm was: several identical values were found. This is 53.2° — two cases (58 years old, asthenic and 26 years old, asthenic), 56.0° — two cases (46 years old, asthenic and 76 years old, normosthenic), 61.2° — two cases (36 years old, normosthenic and 53 years old, hypersthenic), 71.0° — two cases (80 years old, hypersthenic and 66 years old, asthenic). The values in the interval from 50° to 60° were encountered more often. There were 15 observations (25%). In the range from 60° to 80° 41.6% of all observations were encountered. Thus, in the range from 50° to 80° 66.6% of all observations were contained.

The second values of the angles of attachment of the diaphragm for male were: several times the same values were encountered. It was 33.5° — three cases (53 years old and 62 years old, both hypersthenics and 79 years old, normosthenic), 52.2° — three cases (74, 72 and 69 years old, hypersthenics), 60.0° — two cases (71 and 76 years old, normosthenics).

Values in the range from 30° to 40° were encountered the most often — 21 observations, which accounted for 35% of

all observations. Another 14 values were found in the range from 40° to 50° — 23.3%. Thus, 58.3% is detected in the range from 30° to 50°.

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

The first values (anterior surface) of the attachment of the diaphragm for male were next: several times the same values were met — 34.2° — two cases (62 and 34 years old, both hypersthenics), 36.9° — two cases (47 and 76 years old, normosthenics), 47.0° — two cases (66 years old, hypersthenic and 80 years old, asthenic), 55.0° — four cases (79 years old, hypersthenic, 75, 43 and 66 years old, normosthenics), 56.6° — two cases (50 years old, asthenic and 77 years old, hypersthenic), 57.5° — two cases (66 and 53 years old, hypersthenics).

The most often cases were encountered in the interval from 30° to 40° — 25 observations (41.6%) and from 50° to 60° — 15 observations (25%). Another 10 cases (16.6%) occurred in the range from 40° to 50°. Thus, in the interval from 30° to 60°, 83.2% of all observations were found.

Second values (posterior surface) of diaphragm attachment in the posterior axillary line for male are represented by the next: the same values were observed — 30.5° — two cases

(37 years old, normosthenic and 69 years old, hypersthenic), 36.0° — two cases (62 years old, hypersthenic and 76 years old, normosthenic), 36.9° — two cases (37 and 53 years old, hypersthenics), 39.4° — two cases (80 years old, asthenic and 82 years old, normosthenic), 45.5° — two cases (74 and 72 years old, hypersthenics), 45.9° — two cases (58 and 71 years old, normosthenics).

More often values were encountered in the interval from 30° to 40°. There were 27 cases (45%). In the interval from 40° to 50° there were 19 cases (31.6%). Thus, in the range from 30° to 50° there were 46 observations (76.6%).

Next, we studied angles of attachment of the diaphragm in the sagittal plane of the right side of the thorax along the same lines.

For male, the first value of the joining angle were as follows: quite often met the same value — 32.9° — two cases (47 years old, normosthenic, 46 years old, asthenic), 48.3° — three cases (66 years old, hypersthenics , 58 years old, asthenic and 74 years old, hypersthenics), 58.2° — four cases (43, 77, 80 years old — hypersthenics and 54 years old, normosthenic), 59.7° — two cases (59 years old, hypersthenic and 63 years old, asthenic), 60.6° — three cases (76 years old, normosthenic, 67 years old,

hypersthenics and 64 years old, normosthenic), 74.0° — two cases (80 years old, asthenic and 82 years old, normosthenic), 85.3° — two cases (72 and 53 years old, hypersthenics).

Values in the range from 50° to 60° were encountered more often. There were 20 (33.33%). Also, 14 cases were found in the range from 40° to 50° (23.3%). Thus, 56.6% was in the range from 40° to 60°.

The second value (posterior surface) of the diaphragm angle joining on the left paravertebral line represented by the following: met the same value — 43.0° — two cases (59 years old, hypersthenic and 58 years old, asthenic), 46.2° — three cases (47 and 75 years old, normosthenics and 26 years old, asthenic). Values in the range from 40° to 50° were encountered more often. There were 22 observations (36.66%). Another 9 observations were detected in the interval from 30° to 40° (15%). Thus, in these intervals 51.66% of all cases were detected.

The next studied line in the sagittal plane was right scapular line. For male, first values of the angle of attachment of the diaphragm in degrees were as follow: more often the same values were met — 34.1° — two cases (80 years old, asthenic and 44 years old, hypersthenic), 37.0° — two cases

(63 years old, hypersthenic and 75 years old, normosthenic), 44.3° — two casess (33 years old, normosthenic and 75 years old, hypersthenic), 53,6° — two cases (58 years old, asthenic and 71 years old, asthenic).

Values in the range from 50° to 60° were encountered more often. There were 17 observations (28.33%). In the intervals from 30° to 40° and from 60° to 70° there were 14 cases (23.33%). Thus, in the range from 30° to 70° over 75% of all observations was occurred.

The second values (posterior surface) of the diaphragm joining angle on the right scapular line for male are represented by the following: the same values — 31.3° — two cases (66 years old, hypersthenic and 51 years old, normosthenic), 35.9° — two cases (26 years old, asthenic and 75 years old, normosthenic), 43.9° — two cases (50 years old, asthenic and 54 years old, normosthenic), 47.0° — two cases (75 years old, normosthenic and 76 years old, normosthenic).

The values in the range from 30° to 40° were more common. There were 24 cases (40%). In the interval from 40° to 50° 16 cases (26.6%) were detected. Thus, in the interval from 30° to 50° — 66.6% of all observations were detected.

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

For male, the first values of the angle of attachment of the diaphragm were next: one repeated value was found — 36.4° — two cases (74 and 80 years old, hypersthenics).

The values in the interval from 30° to 40° were more common. There were 23 cases (38.33%). Another 16 cases were detected in the range from 20° to 30° (26.66%). Thus, in the range from 20° to 40° 64.99% of all observations were contained.

The second values (posterior surface) of the diaphragm attachment along the right posterior axillary line for male are represented by the following: the same values were met several times — 36.4° — two cases (75 and 73 years old, hypersthenics), 36.5° — two cases (62 years old, hypersthenic and 28 years old, asthenic), 43.1° — two cases (74 and 66 years old, hypersthenics), 46.0° — two cases (26 years old, asthenic and 36 years old, normosthenic), 51.4° — two cases (60 years old, asthenic and 45 years old, hypersthenic).

More often values were found in the range of 30° to 40° and 40° to 50°. This were 20 (33.3%) and 19 (31.7%)

observations respectively. Thus, in the interval from 30° to 50° — 65% of all observations were detected.

Statistical analysis of the measurements revealed little correlation between the age and height of diaphragmatic cupolas in male. Other parameters were not correlated with the studied values (sex and type of body structure).

Conclusion

1. Individual spatial topography of the diaphragm is highly variable and is practically independent of sex, age and type of body structure.

2. In some cases (10%) in both sexes the height of the cupola of the diaphragm more on the left side than the right.

3. Obtained data should be taken into account in the interpretation of X-ray research data and performing thoracentesis left.

Prospects for further research. For increase knowledge about the spatial topography of the human diaphragm further studies in other planes and projections relatively with sex, age and type of body structure are needed.

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