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WHAT ANTHROPOMETRIC PARAMETERS AFFECT THE LINEAR DIMENSIONS OF LEFT LIVER LOBE?

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ABSTRACT — The anthropometric parameters and linear ultrasound diameters of left liver lobe were taken in 212 adult healthy volunteers (90 men and 122 women). In men anthropometric parameters correlate with linear diameters of the left liver lobe much more than in women. Anteroposterior diameter of the left liver lobe increasingly correlates with anthropometric parameters both in men and women.The most significant correlations were detected both in men and women between anteroposterior diameter of the left liver lobe and body weight, body mass index and waist circumference.

KEYWORDS — anthropometric parameters, ultrasound, linear dimensions of the liver, left liver lobe, gender differences.

INTRODUCTION

It is well known that left liver lobe may have different forms ranging from practically non-existent to very short and deep or, on the contrary, very long and flat[1, 2, 3]. Thus, one of the anatomical types of left liver lobe's structures is a so called «beaver's tail» («the beaver tailed liver»): such left liver lobe is elongated and wraps around the spleen [4].

Saritha S. etal. consider that knowledge of the liver anatomy in normal and variable forms provides safety during segmental resections of liver. It also helps to avoid errors in interpretation of different methods of diagnostic visualization[3].

Chapligina E.V. etal. [5] has found that anteroposteriordiameter of the left liver lobe is statistically significantly differ in pyknic and asthenic types (8,19±1,38 cm and 6,36±0,87 cm, respectively). Whereas the left liver lobe craniocaudal diameter doesn't depend on the body type. However, they used abdominal spiral computed tomography for measurement of left liver lobe and said nothing about gender differences. Our previous study has shown[6] that the anteroposterior diameter of left liver lobe in men is larger than in women, but at that study we didn't pay attention to anthropometric parameters. Therefore, it is expediently to identify the relationship between anthropometric parameters and linear diameters of the liver in both genders.

The aim of our study was to determine the correlation between diameters of left liver lobe and anthropometric parameters in men and women, which could be used in clinical practice.

MATERIALS AND METHODS

We have carried out measurements of anthropometric parameters and ultrasound examination of abdominal cavity's organs with determining of linear dimensions of the left liver lobe in 212 healthy volunteers (90 men и 122 women) aged 18 to 69 years.

Height, weight, infrasternal angle, chest circumference (CC) and waist circumference (WC) were measured. The posterior semicircle of CC matches with the line just below the inferior scapula's angle, the anterior semicircle of CC in men crosses the nipples and matches with the line just below mammary gland in women. Waist circumference (WC) was measured at the level of the navel. Thickness of subcutaneous adipose tissue of anterior abdominal wall (SAT of AAW) was measured at 3 cm to the right side from navel with ultrasound linear transducer. Body mass index (BMI) was calculated using standard formula.

Ultrasound examinations of liver were performed with convex transducers using Aixplorer (Supersonic Imagine, France), SonoScapeS6 (China) andMindray-DC-8 (China) ultrasound systems. All patients were investigated in the supine position with the both arms placed above the head, the stretched legs and with quiet breathing.

Leftlobe has been measured either in the median line under xiphisternum or in the right parasternal line due to the anatomical form of left lobe. Transducer was used with no tilt to the right or the left side, so vena cava inferior or aortashould not be visualized on the sonogram. We have measured anteroposterior diameter (AP, depth), craniocaudal diameter (CC, length) and caudate lobe's (CL) thickness (Fig. 1).

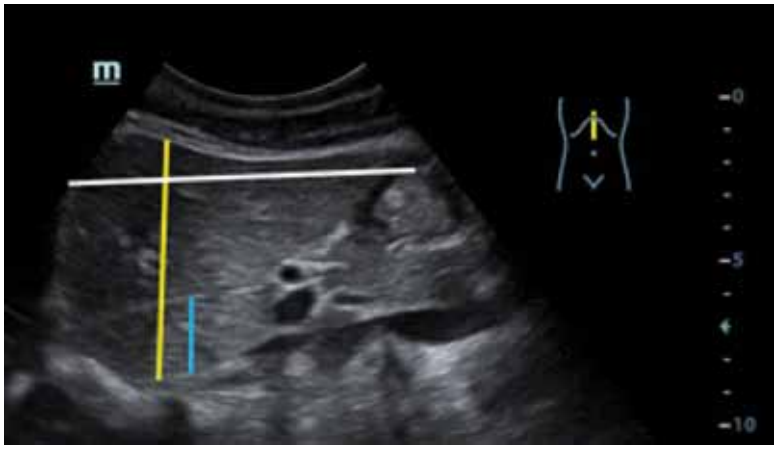

Fig. 1. Ultrasound measurements of the left liver lobe in a volunteer U., 29 years old. Transducer orientated longitudinally in the midline under xiphisternum. Yellow color indicates the anteroposterior diameter of the left lobe, white — the craniocaudal diameter of the left lobe, blue — the thickness of the caudate lobe

All data were analyzed using the Statistical Package for the Social Sciences 23.0 (SPSS) software recommended for analysis of biomedical data. Correlation was assessed using Spearman's rank correlation coefficient. Chaddock`s scale was used for the assessment of correlation [7]. P-values of less than 0.05 were considered statistically significant.

FINDINGS

The correlation and its statistical significance between anthropometric parameters and linear dimensions of the left liver's lobe in men and women are represented in the Table 1.

We have found that correlation has significant differences between men and women.

A noticeable positive correlation (0,5–0,7) between anteroposterior diameter and such parameters as body weight, BMI, CC and WC and thickness of SAT of AAW was found in men. A noticeable positive correlation (0,5–0,7) between anteroposterior diameter and such parameters as body weight, BMI and WCwas also found in women. A moderate positive correlation (0,3–0,5) was determined between anteroposterior diameter and such parameters as infrasternal angle, CC and thickness of SAT of AAW in women.

No significant correlation between craniocaudal diameter and antropometric parameters was detected either in men or in women. Moderate positive correlation (0,3–0,5) between craniocaudal diameter with BMI, thickness of SAT of AAW, WC and CC was noticed in men. It is possible to suggest that correlation coefficients between thickness of CL andanthropometric parameters are too minor to be used for practical purposes.

CONCLUSION

Anthropometric parameters in men are more consistent with the linear diameters of left liver lobe than in women.

Thus, the anteroposterior diameter is the most reproducible ultrasound linear dimension of left liver lobe[8, 9] as well as that it is the one which correlates very good with

Table 1. Correlation coefficients of anthropometric parameters and linear diameters of the left liver's lobe in men and women.

Anthropo-metric parameters	AP		CC		CL	
	men (n=90)	women (n=122)	men (n=90)	women (n=122)	men (n=90)	women (n=122)
height	0,132 (p = 0,216)	-0,103 (p = 0,259)	0,259 (p = 0,014)	0,058 (p = 0,529)	0,077 (p = 0,470)	-0,150 (p = 0,099)
weight	0,617 (p < 0,001)	0,534 (p < 0,001)	-0,160 (p = 0,132)	-0,091 (p = 0,317)	0,270 (p = 0,010)	0,121 (p = 0,184)
BMI	0,643 (p < 0,001)	0,563 (p < 0,001)	-0,407 (p < 0,001)	-0,142 (p = 0,118)	0,272 (p = 0,009)	0,200 (p = 0,027)
infrasternal angle	0,281 (p = 0,007)	0,417 (p <0,001)	- 0,113 (p = 0,288)	-0,024 (p = 0,795)	0,096 (p = 0,369)	0,176 (p = 0,053)
CC	0,669 (p < 0,001)	0,438 (p <0,001)	-0,397 (p <0,001)	-0,117 (p = 0,198)	0,225 (p = 0,033)	0,101 (p = 0,270)
WC	0,674 (p < 0,001)	0,507 (p < 0,001)	-0,345 (p = 0,001)	-0,097 (p = 0,287)	0,302 (p = 0,004)	0,136 (p = 0,134)
thickness of SAT of AAW	0,518 (p < 0,001)	0,411 (p < 0,001)	-0,446 (p < 0,001)	-0,286 (p = 0,001)	0, 220 (p = 0,037)	0,097 (p = 0,288)

anthropometric parameters both in men and women. The noticeable positive correlations were detected in men and women between anteroposterior diameter of the left liver lobe and body weight, body mass index and waist circumference. These parameters could be used for assessment of ultrasound liver's dimensions.

REFERENCES

1. **Dietrich, C.F., Tuma, J.,&Badea, R.** (2013). Ultrasound of the liver. EFSUMB – European Course Book. Student Edition. 64 p.
2. **Netter, F. H.** Atlas of human anatomy. Third edition. (2003). 627 p.
3. **Saritha, S., Usha rani, Gayatri, Peter, Anjum, A.,&Himabindu., N.** (2016). A Spectrum of Morphological Variations in the human liver lobes and its Clinical importance; a Cadaveric Study. Journal of Medical Science and Clinical Research. 4(1), 8818–8827. https://doi.org/10.18535/jmscr/v4il.06
4. **Xiang, H., Han, J., Ridley, W. E., & Ridley, L. J.** (2018). Beaver tail liver: Anatomic variant. Journal of medical imaging and radiation oncology, 62 Suppl. 1, 57. https://doi.org/10.1111/1754-9485.05_12784
5. **Chaplygina, E. V., &Gubar, A. S.** (2014). Connection linear parameters of liver with individual somatotype. Morphology, 9(4), 356–358. https://doi.org/10.14300/mnnc.2014.09099.
6. **Stepanyan, I., Izranov, V., Gordova, V., Rohwein, R., &Stepanyan, S.** (2020) Magnetic resonance and ultrasound imaging: do the linear liver measurements differ in men and women? ArchivEuromedica,10(3), 48–50. https://doi.org/10.35630/2199-885X/2020/10/3.11
7. **Chaddock, R.E.** (1925). Principles and methods of statistics. Boston: Houghton Miffin Company, The Riverside Press, Cambridge, 471 p.
8. **Childs, J.T., Esterman, A.J., &Thoirs, K.A.** (2014). Ultrasound measurements of the liver: an intra and inter-rater reliability study. Australasian journal of ultrasound in medicine, 17(3), 113–119. https://doi.org/10.1002/j.2205-0140.2014.tb00026.x
9. **Stepanyan, I.A., Izranov, V.A., Gordova, V.S., Beleckaya, M.A., &Stepanyan, S.A.** (2020) Intra- and inter-research reproducibility of linear liver measurements by ultrasound examination. Diagnostic radiology and radiotherapy. Vol. 11(3), 73–81, https://doi.org/10.22328/2079-5343-2020-11-3-73-81.