VOLUME-6, ISSUE-10, OCTOBER-2017 • ISSN No 2277 - 8160 IF : 4.547 | IC Value 80.26

Original Research Paper Radiology

NORMAL LIVER DIMENSION IN SAUDI ARABIA USING ULTRASONOGRAPHY

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ABSTRACT

Background: To determine liver size sonographically in a randomly selected population. Aims: The aims of this study was to determine a reliable reference range in the Kingdom of Saudi Arabia(KSA) for a normal liver size for adults.

Methods: A prospective study was carried out at King Abdulaziz University Hospital (KAUH)- Saudi Arabia, Jeddah between (11 -30) March 2015, A total of 90 adults subjects (59 females, 31 males; mean age 44.8889 years) underwent sonographic examination of the liver in the midclavicular line (MCL)to determine liver span.

Results: The average liver length in the midclavicular line for the overall collective was 15.00 cm; the average for females was 14.6800 cm and 14.629 cm for males. Liver length exceeded 15 cm in 37.8% of subjects. Results of the multivariate analysis showed that, BMI and weight were the two factors potentially influencing liver span($p<0.000$).While there was no significant differences in liver size were observed, between subjects with sex, body height and age.

Conclusion: The study provides the normal measure of liver size by ultrasonography in healthy Saudi populations.

KEYWORDS : liver size, MCL, sonographic, measurement, liver span.

Introduction:

The liver is the largest gland in the human body in the intra-abdominal cavity. It weighs around 1500g and has higher density among male individual. Its function is to filter and store blood, metabolize carbohydrates, proteins, hormones and strange chemicals; to from bile, store vitamins and iron; and to produce clotting factors1, 3. The liver has two anatomical parts, the right lobe and left lobe separated by an imaginary line that runs from the gallbladder fossa into the inferior vena cava1, 2. Physical examination addresses the liver in a projections surface that covers almost the entire chest wall 4, 5. After inspection, percussion is performed with the aim of determining the liver volume is proportional to body size. The normal adult liver spans 10 to 12 cm for man and 8 to 10 cm for women 6. Generally, it can vary between 6 and 12 cm in all subjects when percussion is performed in the MCL 7. The patient should be positioned supine and the examiner always on his right 7. The last dullness points found on per-cession imaginary line from MCL to craniocaudal direction will determine the liver lower boarder 8, 9. The path joining the two points, the onset on liver dullness being the first and the limit point of dullness at the lower edge the second is the supposedly the real liver size 10. The liver volume can be measured by various techniques such as radiography, scintigraphy, computed tomography, magnetic resonance and ultrasonography 9, 11. Ultrasonography is the first imaging method to assess hepatic affections, which has a number of key advantages, such as low cost, rapid implementation, risk-free, non-invasive, no use of ionizing radiation or sedation that facilitates technical performance, especially when it comes to children 12, 11.

The objective of the present study was to determine liver span sonographically in a randomly selected population sample and identify factors that affect liver size.

Patients and Methods:

Between (11 -30) March 2015, A total of 90 patients with age range between 14-98 years underwent abdominal sonographic examination as part of outpatient scanned in diagnostics radiology department. The selected sample according to their sonographic appointment scheduling. The study included those over fourteen years of age. All patients were informed about the research project and their agreed was taken, in addition to being registered in an inclusion form. Exclusion criteria included patients with any abnormality sonographic findings, as well as those who did not agree to participate in the study. Ultrasonography was performed by good experience sonographers trained in ultrasound technique and the report approval by an expert radiologists. Statistical analyses was performed using SPSS 16.0 software. The BMI was calculated according to recommendations of the World Health Organization 13. The variables were summarized as percentage or average as indicated. Correlation between hepatic measurements undertaken by u/s and several anthropometric factors including age, gender, weight, height and BMI performed on the data to test the statistical significance of the various relationships between liver span as represented by MCL (Figure1).

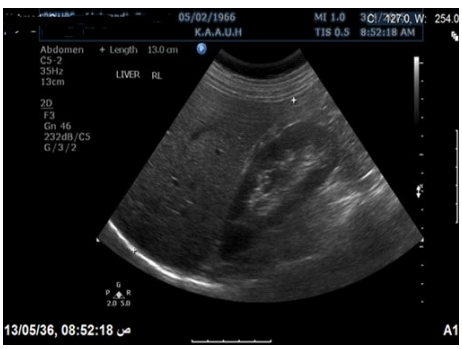

Figure1. Sonogram of normal liver to measurement liver size in the MCL during inspiration in supine position.

Results:

Data were available for a total 90 subjects (59 women, 56.6%; 31 men, 34.4%) Table1. Participants' average age was 44.8889 years, the average maximum liver length measured sonographically along the MCL was 15.00 cm (median, 14.6624; range, 10.50–16.00) cm and mean BMI was *27* ranging between 4.86 and 46.00 kg/m2 Table 2. Liver length showed a statistically significant difference between body weight and BMI as revealed by the Pearson correlation (p-value = 0.000), but it showed no statistical significance difference between genders and liver size in the multivariate correlation analysis (p=0.886) Table 3, where the average of liver length for females was14.6800 and for males14.629 cm Table 4. The analysis showed 62.2% of subjects clarified a liver length ≤15 cm, and 37.8% of subjects illustrated a liver span >15 cm Table 5.

Table 1.Distribution by gender.

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Men	31	34.4	34.4	34.4
	Wome	59	65.6	65.6	100.0
	Total	90	100.0	100.0	

Table 2. Descriptive Statistics.

	N	Minimum	Maximum	Mean	Std. Deviation
AGE	90	14.00	98.00	44.8889	18.02648
Weight	90	37.00	131.00	73.1756	17.41314
Height	90	142.00	180.00	160.5167	8.12465
BMI	90	4.86	46.00	27.4490	6.82832
Liver length	90	10.50	16.00	14.6624	1.58840
Valid N (Total)	90				

Table 3.Findings of Multivariate Analysis.

		SEX	AGE	weight	height	BMI
liver length	Pearson Correlation	.015	-.090-	.498**	.174	.391**
	P value	.886	.397	.000	.102	.000
	N	90	90	90	90	90
**. Correlation is significant at the 0.01 level (2-tailed).						

Table 4. Findings of Multivariate Analysis.

	SEX	N	Mean	Std. Deviation	t	p-value
AGE	males	31	46.0323	16.66630	.434	.665
	females	59	44.2881	18.81219		
weight	m	31	75.9355	15.49319	1.091	.278
	females	59	71.7254	18.30065		
height	m	31	165.0548	8.08413	4.182	.000
	females	59	158.1322	7.12014		
BMI	m	31	27.3340	4.50330	-.115-	.909
	females	59	27.5095	7.81322		
lever	m	31	14.6290	1.43531	-.144-	.886
	females	59	14.6800	1.67483		

Table 5. Study results by liver size.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10-12	2	2.2	2.2	
	13-15	54	60.0	60.0	62.2
	16-18	33	36.7	36.7	37.8
	18-20	1	1.1	1.1	100.0
	Total	90	100.0	100.0	

Discussion

Ultrasound is a cornerstone imaging method to evaluate the liver simply because it is easy to use, inexpensive, and quick. It provides real time images and doesn't require anesthesia or utilize ionizing radiation. Unfortunately, in kingdom of Saudi Arabia to the best of our knowledge, no published studies have examined liver diameter at MCL and its potential influence parameters and we rely on normal range published in Western literature. This will lead to miscalling a normal liver as enlarged resulting to increase an unnecessary investigations for the patient by increasing cost and wasting the resources.

The importance of this research in the fact is to create a reliable reference range in KSA for the liver size by ultrasound. In this study, we used liver ultrasonography measurement parameter in the longitudinal length of liver in the MCL. This has become affirmed in routine use and demonstrate an upper limit of the reference range [13, 15,16,17,18.] The autopsy study of Gosink and Leymaster found a good correlation between sonographic measurements of the liver taken in the right MCL and the size of the liver determined at autopsy [18.] Average liver length in the present study for the overall collective was 15.00 cm compared to10.5 cm in Niederau et al.'s a prospective study conducted inGermany on a large group of adult healthy [19.] This difference may be attributed to the higher values of mean weights (73 kg compared to 71 kgs) in their sample. We could find only two published study that discussed this subject in the Arab World, the first came from Egypt by El Sharkawy et al. [20] They found that average right hepatic lobe diameter at MCL sagittal plane was 14.6 cm in a 77 adult subjects; near to our figure, while the second one from Jordan by Emad S. Tarawneh et al they concluded that the average of liver length was 12.3 cm less than our measure. Possibly, this may be due to the fact that our study was conducted on a limited number and in a very limited geographic area and this consider to be a limitation on this study.

Factors such as body weight or body height may exert an influence on liver size and should be considered at the time of the sonographic examination.[21,22]However, Zeeh and Platt showed that both liver weight and liver volume decrease with advancing age.[23]Chouke`r et al. found a reduction in liver weight beginning after age 50 years.[24] Studies by Urata et al. and Vauthey et al., which were conducted with the purpose of establishing a formula for determining liver volume, reported only a slight correlation between patient age and liver volume.[25,26] but our study showed that only a statistically significant difference between body weight and BMI and there is no statistically significant difference between genders and liver size, this results were partially disagree with Singh K et al. and Toukan et al. as both studies are similar to the study done in Jordanian adults by Emad S. Tarawneh et al, which have concluded that height is a major determinant of liver span, however, when liver span was correlated with weight, Emad S. Tarawneh et al didn't agree with Toukan et al.'s; as they concluded a positive correlation in-line with other studies. [27,28,29,30] and this agree with the present study.

Conclusion:

At the end, a very important aspect must be stressed is the fact that our average measured liver diameter seem close enough to 15 cm or less, it is recommended that further studies must be conducted to provide a more accurate assessment of liver size in adults.

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