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Sonographic Measurement of Normal Gallbladder Sizes in Adult Nigeria Population

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ABSTRACT

The length, height and wall thickness of the gallbladder of 400 healthy subjects, comprising, 206 males and 194 females, were measured in fasted subjects using 2-dimensimal (2D) ultrasound to establish the range and mean of normal gallbladder sizes in an adult Nigeria population. The gallbladder volume was calculated from measured values using the ellipsoid equation. Two tailed parametric tests were done to determine any differences in the mean values of the gallbladder volume (GBV) and gallbladder wall thickness (GBWT). The gallbladder dimensions range from 41-96mm (mean=67.42±12.22mm) for the length, 16-44mm (mean = 28.77+ 6.08mm) for the width, 16-44mm (mean = 27.89+5.36mm) for the height and 1-3.10mm (mean =2.30 + 0.54mm) for the wall thickness. The mean GBV was 31.43cm^3 and 22.60cm3 for males and females respectively compared with 50cm3 but no statistically significant difference was noted between the sexes. A nomogram of gallbladder dimensions has been obtained from this study and the volume calculated indicate a statistically significant difference in the GBV of the population compared with that of the Caucasians.

Keywords: Gallbladder sizes, sonography, Nigerian.

Assessment of the gallbladder disorders. The first choice in the assessment of the gallbladder is sonography because both structural and functional alterations can be detected" (Lamb 2000, Mittal and Liu, 2002). The measurement of gallbladder sizes is useful in the diagnosis of hydrops while GBWT is used in the assessment of cholocystitis. A previous study noted an increased gallbladder volume in fasted non-insulin dependent diabetes mellitus patients (Guliter and Karakan,2003). A positive correlation between GBV in fasted subjects on one hand and body weight and height on the other has been noted (sari et al 1998, Yoo et al 2003).

In sonography, the GBV is estimated by the ellipsoid equation if the length, width and height are measured from 2D images (Zimmermann et al, 1993). From the available literature and to the best of our knowledge. There is no report of gallbladder sizes in normal subjects in the locality and Caucasians values are adopted in the assessment of normalcy or otherwise. This study is therefore aimed at producing a normogram of gallbladder dimensions in the locality to provide a more accurate evaluation of normality.

MATERIALS AND METHODS

400 healthy subjects who had no history of gallbladder disease were enlisted into the study as volunteers. Subjects, with diabetes, or family history of diabetes, previous gallbladder surgery and other conditions affecting the biliary tree were excluded. All the subjects were informed of the nature of the procedure and they willingly provided informed consent to participate. In addition, approval was obtained from the research ethics committee for the research protocol and consequently, all the rules regarding the use of humans for research were strictly complied with.

Real-time sonographic examination of the gallbladder of each subject was performed using a Siemens Medical ultrasound unit Model S-LI manufactured by Siemens, USA which is equipped with a 3.5 MH, linear transducer. Each subject was scanned after an overnight fasting and in the supine position according to Romanki 2003. After visualization of the maximum gallbladder longitudinal outline, the length and maximum height were taken at right angles to each other. Measurements were taken from outer to outer hypoerechoic walls. The probe was then rotated through 900 in order to

Table 1: Age and sex distribution of gallbladder dimensions.

Age (Years)	Length (mm) Mean ± SD		Width (mm) Mean ± SD		Height (mm) Mean ± SD	
	Males	Females	Males	Females	Males	Females
18-28	69.59±12.37	64.31±16.7b	27.93±5.70	28.21±5.61	29.07±3.40	27.23±5.0
29-39	66.80	64.13 ± 6.54	29.53 ± 7.92	28.90±6.54	29.77±8.50	26.23±6.90
40-70	70.52±4.60	69.17±5.56	31.56±5.83	26.50±0.54	29.19±4.31	25.83±3.25
Mean	68.97±11.05	65.87±13.84	29.67±6.56	27.87±5.60	29.34±5.25	26.43±5.47

Table 2

Age and sex distribution of gallbladder volume

	Male		Females	
Age range	No of subjects (% age of total)	Mean GBV±SD	No of subjects (% age of total)	Mean GBV±SD
18 – 28	92 (44.66)	30.33±1.88	122 (62.89)	28.51±2.29
29 – 39	60 (29.13)	30.19±4.21	60 (30.92)	26.50±2.16
40 – 70	54 (26.21)	34.71±1.81	12(6.19)	23.80±0.70
Total	206 (100)	31.43	194 (100)	27.6±16.13

Table 3: large and mean of all measured parameters

	Males		Females	
Variable (unit)	Range	Mean ± SD	Range	Mean ± SD
Age (years)	18-63	34.17±12.3	20-43	27.77±5.49
Subject Height (m)	1.57-1.44	1.75±0.07	1.49-1.8	1.61±0.01
Weight (kg)	57-90	72.39±9.20	39-75	57.92±10.21
Gallbladder Length (mm)	47-91	68.97±11.05	41-96	65.87±13.84
Gallbladder width (mm)	16-44	29.67±6.56	16-39	27.87±5.60
Gallbladder height (mm)	16-43	29.34±5.25	16-37	26.43±5.47
Gallbladder wall thickness (mm)	1.4-3.3	2.45±0.57	1-3.10	2.14±16.13
Gallbladder volume (cm^3)	7.26-75.65	31.43±15.45	7.77-69.02	27.60±16.13
BMI (kg/m^2)	19.02-30.1	23.74±3.11	14.51-30.66	22.1±3.48

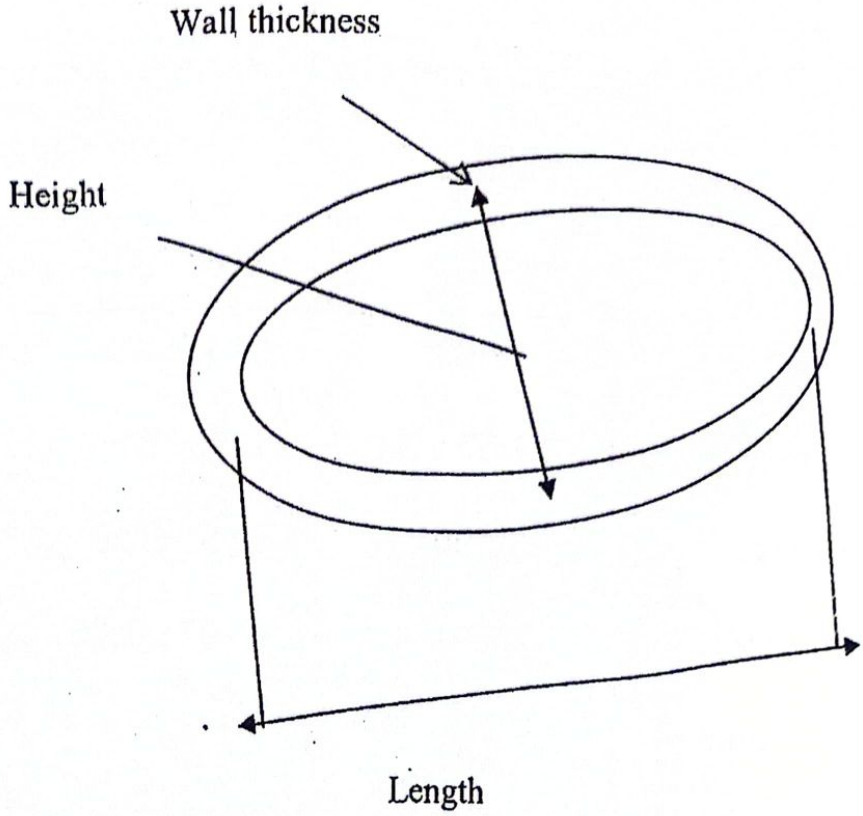

Fig 1a: A line drawing showing a longitudinal section of the gallbladder.

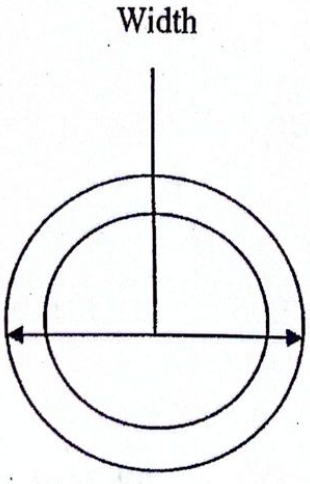

Fig 1b: A line drawing showing a transverse section of the gallbladder.

measure the width in a transverse section. These three measurements are shown in fig 1a and 1b. The GBWT was measured from outer to inner surface of the hyperechoic wall at the anterior mid-body of each gallbladder. All the measurements were made in triplicate and the mean value adopted.

The subjects' weight were obtained after the ultrasound procedure using a bathroom scale Model H89 I.T Blue manufactured by Hanson Co Ltd China while the height was measured from a calibrated wall in metres. The body mass index

(BMI) and the GBV were calculated according to Zimmermann et al (1993) and Vitti et al (1994). All statistical analysis were performed using Microsoft Excel office 2000 Software. The relationship between GBV and some anthropometric variables were investigated using Pearson Moment Correlation and interpreted according to Portney and Watkins (2000)

. Parametric tests were done to determine any statistically significant differences between the GBV and GBWT in males and females.

RESULTS

The age and sex distribution of measured gallbladder dimensions are shown in Table1. The mean of the gallbladder length was 68.97+ 11.05mm and 65.87+13.84mm for males and females respectively while the width was 29.67+6.56mm and 27.87+5.60mm for males and females respectively. The gallbladder height was 29.34±5.25mm and 26.43±5.47mm for the males and females respectively and the GBWT was 2.45±0.57mm and 2.14±0.51mm also for the males and females respectively.

Table 3 presents a summary of the values obtained together with the standard deviation for various parameters. There were no statistically significant differences in the measured dimensions between the sexes. No significant correlation was noted between the GBV and the anthropometric variables ($p > 0.05$).

DISCUSSION

Establishing normal values of gallbladder dimensions is helpful in eliminating the errors of subjectivity in describing the gallbladder as either normal or diseased. Subjective sonographyic or clinical evaluation are associated with poor reprochicibility and wide inter observer variations. The use of non-specific population normogram as is the practice presently in the locality may result in errors in predicting abnormality of the gallbladder. From this study, the range of normal gallbladder length in the locality is 41-96mm.(mean = 67.42±112.2mm) as shown in Table 1 against values of 80-100mm for the caucasians as reported by krebs et al 1993. Similarly the width of normal gallbladder obtained from this study is 16-44mm (Mean= 28.77+6.08) as against 30-50mm for the caucasians as also noted by Krebs et al 1993). The result of this study also shows that the mean GBV is 31.43 and 27.60cm in males and calculated corresponding volumes show statistically significant difference $p < 0.05$. This justifies the use of population specific normogram in assessing the gallbladder if errors in predicting abnormality are to be avoided. The GBV did not show any correlation with age, height, weight and BMI.

However, it should be noted that the volume of the gallbladder was calculated using the ellipsoid equation despite differences in gallbladder contour and shapes observed. It has been suggested that other models, like sphere, cone, cylinder (Krebs et al 1993)should be adopted when the contour is better described by the appropriate shape. The effect this has or the values obtained, was not investigated. It should therefore be noted that errors higher than those recorded may be present. Three dimensional (3D) sonography is fast becoming available at most centres and may well be the appropriate technology in future studies.

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