Sonographic gallbladder wall thickness in normal adult population in Nigeria

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Abstract

Aim. The aim of the study was to determine the ultrasonic gallbladder wall thickness in normal adult Nigerians so as to create standards for defining gallbladder abnormalities in Nigerians.

Method. Four hundred adults comprising 228 (57%) women and 172 (43%) men aged 16 - 78 years, who had normal clinical history and physical findings, were recruited. The gallbladder wall thickness was obtained in the supine, prone and right anterior oblique positions. Differences in gallbladder wall thickness were determined using the chi-square test, while the relationship between the ultrasound-measured gallbladder wall thickness and the subjects' age, sex, height and weight were analysed using the Pearson product moment correlation. Normal ranges and related statistics were estimated and tabulated according to age group and sex.

Results. The mean age of the subjects was 32±13.2 years. The mean gallbladder wall thickness range was 1.8 - 2.8 mm±0.5mm. The thickness range for females was 1.7 - 2.7 mm±0.5 mm, and that for males was 1.9 - 2.9 mm±0.5 mm. There was a statistically significant difference ($p<0.05$) in the mean wall thickness between males and females. The mean body parameters (height, weight) of males were significantly greater than those of females ($p<0.047$, $p<0.000$ respectively). There was no correlation between gallbladder wall thickness and age and height of subjects ($r=0.34$, $p<0.09$).

Conclusion. Our study was able to establish population-specific ultrasonic values for gallbladder wall thickness in normal adults that can be reliably used as standards to define gallbladder abnormalities in Nigerians.

Introduction

Thickening of the gallbladder wall is a relatively frequent finding in diagnostic imaging studies.[1,2] Historically, a thick-walled gallbladder has been regarded as proof of primary gallbladder disease, and it is a well-known hallmark feature of acute cholecystitis.[3,4] The finding itself, however, is non-specific and can be found in a wide range of gallbladder diseases and extracholecystic pathological conditions.[1,3,5]

Ultrasound (US), computed tomography (CT) and magnetic resonance imaging (MRI) all allow direct visualisation of the normal and thickened gallbladder wall.[5] Traditionally, US is used as the initial imaging technique for evaluating patients with suspected gallbladder disease, because of its high sensitivity in the detection of gallbladder dimensions, real-time character, speed and portability.[6,7]

To establish our own standards and to contribute to the literature on this subject, we sought to evaluate normal gallbladder wall thickness in healthy adults by means of US.

Materials and methods

This was a prospective cross-sectional study that spanned a 2-year period from June 2005 to May 2007, involving 400 adults aged 16 - 78 years, carried out at the University of Maiduguri Teaching Hospital (UMTH) at Maiduguri, Borno State, which is in north-eastern Nigeria. The city has a population of slightly over 1.1 million.[8] The study concerned the clinically normal gallbladder in consenting adults aged ≥16 years. Subjects were recruited consecutively from the neighboring school of nursing and high schools and within the hospital. Excluded from the study were: pregnant women (confirmed by additional pelvic scan because of physiological distension of the gallbladder), volunteers with a past history of gallbladder and liver diseases or chronic alcohol consumption, those who could not fast (such as diabetics and sickle cell patients), and those who were <16 years old. At inclusion, a full history was obtained from each subject, with particular emphasis on demographic characteristics, history of previous jaundice, right hypochondrial pain, and history of upper abdominal surgery or chronic alcohol consumption.

All volunteers gave informed consent but, in addition, a review and authorisation of the study protocols was done by the Ethical Committee of the University of Maiduguri Teaching Hospital. The study subjects were informed of the safety of US. The healthy subjects who voluntarily submitted themselves for routine abdominal US were instructed to fast for 6 - 8 hours prior to the procedure to ensure gallbladder distension and to reduce the amount of gastric and intestinal gas. Subjects were, however, recruited mainly in the afternoon during the Muslim Ramadan period, which assisted in compliance with fasting. The clinical parameters, which included age, sex, height in metres and weight in kilograms, were also recorded for each subject prior to examination.

The examination was performed using a high-resolution real-time Doppler US scanner (Aloka, SSD-3500) equipped with 3.5 MHz and 5.0 MHz curved linear array transducers. A 3.5 MHz curved linear array transducer generally provides optimum resolution while maintaining

adequate depth penetration, and is suitable for obese subjects. A 5.0 MHz curved linear array transducer provides greater resolution for slender subjects.

Subjects were scanned in the supine, prone and right anterior oblique positions. The transducer was placed in the right hypochondrial area, in the mid clavicular line and cephalad angled in both longitudinal and transverse planes, to obtain a full view of the gallbladder.

Scanning in the prone position was also adopted as the gallbladder was difficult to visualise otherwise in some of the subjects. For prone scanning, the subjects were placed in the prone position, and then the gallbladder was scanned intercostally or subcostally with the subject positioned prone oblique and right side elevated sufficiently to allow transducer contact at about the midclavicular line. Scanning continued as the subject was rolled slowly into a left lateral decubitus position and then laid supine again. In each separate position, the fluid-filled gallbladder was assessed in the longitudinal scans and sometimes zoomed, to obtain maximum gallbladder wall thickness in millimetres (Fig. 1).

Data from the structured data collection sheet were entered into a computer to generate a data base for subsequent analysis. For all the observed measurements, the data were initially summarised into frequency distribution tables. From these tables, the percentages of age, sex distributions and mean height and weights were calculated.

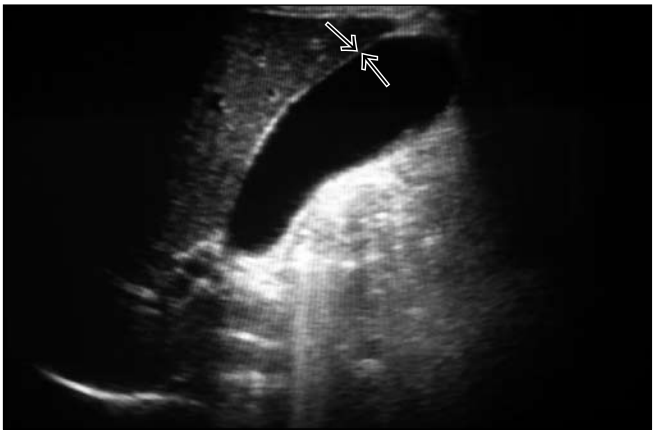

Fig. 1. Longitudinal US image showing site of measurement of gallbladder wall thickness (arrows).

Table I. Age distribution of mean gallbladder wall thickness in the study population

Age group (Years) (*N*)	Wall thickness (mm) Mean	Range	Std
16 - 25 (148)	2.20	1.0 - 3.3	0.56
26 - 35 (142)	2.36	1.0 - 4.0	0.51
36 - 45 (58)	2.37	1.1 - 3.4	0.52
46 - 55 (22)	2.29	1.6 - 2.9	0.38
56 - 65 (16)	2.28	1.7 - 3.0	0.44
66 - 75 (6)	2.57	1.9 - 2.9	0.41
76 - 85 (8)	2.15	1.0 - 3.0	0.71
400			

Table II. Correlation between mean gallbladder wall thickness and body parameters of the population

	Age (years)	Height (m)	Weight (kg)	MI
Wall thickness (mm)	0.048	0.042	0.168†	0.153†
p value	0.341	0.405	0.001	0.002

†Correlations were significant at the 0.01 level (2-tailed)
BMI=body mass index

Results were expressed as the mean±standard deviation (SD). Categorical differences were analysed using the chi-square test of independence. An independent Student's *t*-test was done to study the group difference for continuous variables. Chi-square and Student's *t*-tests were applied for univariate analysis. Multivariate regression analysis with logistic regression using the SPSS 11.0 package (SPSS Inc., Chicago, IL, USA) was applied to evaluate the effect of the various factors on gallbladder wall thickness; a p-value <0.05 was considered to be significant.

Results

The sample population comprised 400 healthy subjects made up of 228 (57%) females and 172 (43%) males (ratio of 1.3:1). Their ages ranged from 16 - 78 years, with mean age and SD of 32±13.2 years.

One hundred and forty-eight subjects in the sample population were in the age group 16 - 25 years, representing 37% of the population. The age group of 66 - 75 years was the smallest (1.5%) of the population, and had equal numbers of men and women at 3 (0.75%) each (Table I).

The highest mean weight (72.14 kg) in the study population was in the age group 46 - 55 years, which correspondingly reflected the highest body mass index (BMI). The lowest body parameters (height 1.60 m, weight 49.13 kg and BMI 19.13) were in the 76 - 85 years age group. Women showed lower mean body parameters than men in the study (p<0.05). However, the mean total BMI was higher for women (23.66) than men (22.99).

Gallbladder wall thickness fond in the study ranged from 1.7 mm - 2.7 mm. There was no correlation between gallbladder wall thickness and subject's age and height (p<0.05) (Table II), although the highest mean wall thickness (2.57±0.41 mm) was observed in the 66 - 75 years age group. However, there was a strong positive correlation between gallbladder wall thickness and BMI (r=0.153, p<0.002)(Table II).

The average gallbladder wall thickness was significantly higher in men than in women (p<0.000), and the differences in body parameter were statistically significant in both sexes (p<0.047) (Table III).

Discussion

The study group comprised 228 (57%) women and 172 (43%) men. The female dominance in our study population was probably due to the greater willingness of women to be recruited and, secondly, that most of the volunteers came from a nursing school and therefore were predominanatly female.

The study population's age ranged from 16 - 78 years, with a mean age and SD of 32±13.2 years. The age parameter was unevenly distributed

Table III. Comparison of the mean gallbladder wall thickness and body parameters in the different sexes

Sex (*N*)		Wall thickness (mm)	Height (m)	Weight (kg)
F (228)	Mean	2.196	1.61	60.93
	Std	±0.504	±0.07	±14.50
M (172)	Mean	2.432	1.72	67.70
	Std	±0.524	±0.08	±12.36
p value:		0.000*	0.047*	0.000*
Total	Mean	2.298	1.654	63.84
	Std	±0.525	±0.925	±14.01

*Significant at $p<0.05$

with many (37%) of the volunteers fallingin the age group of 16 - 25 years, and 35% in the 26 - 35 years group (Table I). The age groups of 66 - 75 years and 76 - 85 years had the least representation (1.5 - 2.0%). The unevenness of our population was a result of the randomised selection process, which unfortunately might affect the accuracy of the age influence on our measurement parameters.

We observed in the study that most of the gallbladder wall thicknesses measured were greater in men than in women. There was also a statistically significant difference between the mean gallbladder wall thickness of women and of men at $p<0.001$ (Table III), which is in line with the fact that organ sizes in men are generally larger than those in women. This finding is in agreement with Caroli-Bosc *et al.*[6]

There have been few studies of normal gallbladders in adults, and the resulting dearth of information regarding standard reference measurements can make decisions about the presence or absence of gallbladder disease difficult. In our study, the average gallbladder wall thickness ranged from 1.7 - 2.7 mm, which is lower than figures reported by Wolson *et al.* [7] and Cooperberg *et al.*,[9] who reported in separate studies that gallbladder wall thickness measured 2 – 3 mm and ≤3 mm respectively, though it is known that greater gallbladder wall thickness may be a non-specific finding.[10,11] However, in adults as well as in children, an increase in thickness may result from a large spectrum of pathological conditions.

In our study, gallbladder wall thickness showed no significant correlation with subjects' age and height (Table II), unlike the observations reported by McGahan *et al.*[12] in a similar study on children.

Graphing gallbladder wall thickness against age showed a sinusoidal incremental pattern with plateau and peak levels at 26 - 35, 36 - 45 and 66 - 75 years (Fig. 2), which cannot be explained by this study. However, the peak value of gallbladder wall thickness noted in the 66 - 75 years age group could represent the age at which the organ thickness is highest before involution begins to occur.

Our study also showed a strong positive correlation between gallbladder wall thickness and BMI of subjects (Table II).

The definition of abnormal gallbladder wall thickness measurements of adult subjects has received very little attention. Indeed, the fairly uniform agreement to use 3 mm as the upper limit for normal gallbladder wall thickness also applies to children.[13,14] We would say that normal gallbladder wall thickness for most adults is ≤3 mm. Occasionally, even

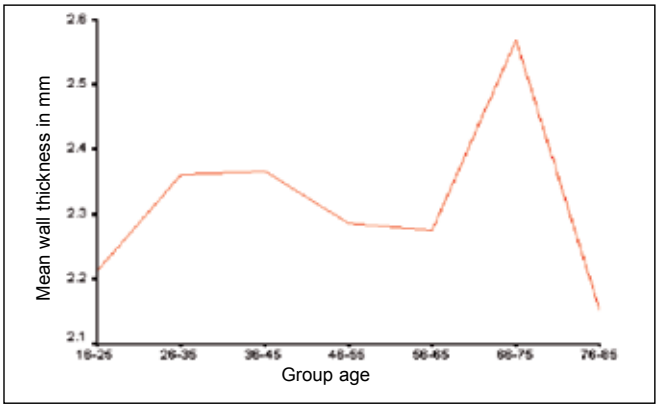

Fig. 2. Graph of gallbladder wall thickness versus age group.

in normal subjects, the wall cannot be adequately measured, which may simply be due to the superficially located gallbladder being out of the focal zone of the transducer, but this can be corrected by adjusting the focal zone and gain.

Conclusion

US can be used to reliably measure the thickness of the gallbladder wall, as was attested to by this study. In addition, this study enabled the establishing of a population-based US gallbladder wall thickness so that a gallbladder wall >3 mm thick will suggest an abnormality in most patients, whereas a thickness <3 mm will suggest normalcy but cannot be used to rule out gallbladder diseases.

Statistically significant differences between gallbladder wall thickness and height and weight of each sex have been established by the study. The established normogram can be used as both a complementary modality in clinical evaluation as well as a more sensitive means of evaluating patients for gallbladder disorder.

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Uraemic tumoral calcinosis in patients on haemodialysis in the renal unit at Dr George Mukhari Hospital, Pretoria

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Abstract

Objective. Uraemic tumoral calcinosis refers to metastatic calcifications that occur rarely on the extensor surfaces of joints in patients undergoing long-term haemodialysis. The aim of the study was to assess the incidence of uraemic tumoral calcinosis in participants undergoing haemodialysis and to investigate any relationship that might exist between the development of uraemic tumoral calcinosis and the length of time on dialysis.

Design. Twenty-four of the 25 patients on haemodialysis at the time of the study underwent radiographs of their shoulders and hips to look for calcinosis, which were then read by the researcher and two independent readers to assess for calcinosis.

Study setting. Dr George Mukhari Hospital, Pretoria.

Results. Eight per cent (*N*=2) of participants were found to have asymptomatic calcinosis of the hips. No relationship to length of time on dialysis was found.

Conclusions. The study was constrained by a small sample size but the presence of calcinosis in 8% of the participants indicates that an extensive study of a larger sample could prove to be useful in determining the true incidence of uraemic tumoral calcinosis in the region. Long-term follow-up could provide more information on the development of calcinosis and length of time on dialysis.

Introduction

Tumoral calcinosis may be defined as metastatic peri-articular calcifications that can be found in a wide variety of conditions such as primary hyperthyroidism and connective tissue diseases, as well as an idiopathic form.[1]

Uraemic tumoral calcinosis is an uncommon occurrence in patients with chronic renal failure who are on long-term haemodialysis therapy, and falls within the broad definition of tumoral calcinosis.[1]

The disease is usually asymptomatic but can present with complications such as impairment of mobility, nerve compression, ulceration of the overlying skin and bony erosion.[1]

If the radiologist is unfamiliar with the radiological patterns of tumoral calcinosis or disease processes that mimic the condition, then diagnosis and treatment might be delayed or the patient may be subjected to unwarranted invasive procedures.[2]

Literature review

Metastatic calcifications may have benign or malignant causes.[3] Uraemic tumoral calcinosis is known to occur in patients with chronic renal failure undergoing haemodialysis and is the most common cause of metastatic peri-articular calcifications.[3] The aetiology is multifactorial and awareness is important since the condition is progressive.[1] The disease is uncommon and current prevalence is not well known but a frequency range of 0.5 - 3% has been reported.[4]

The pathogenesis is not fully understood but significant disturbances of calcium and phosphate homoeostasis can result from chronic renal disease. Among these disturbances are decreased phosphate excretion,