

Sonographic Study of Normal Common Bile Duct Diameter in Saudi Subjects

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Abstract

Background: The aim of this study was to measure the normal parameters of the common bile duct (CBD) in Saudi subjects using ultrasound modality.

Methods and Results: This descriptive cross-sectional study was carried out in Alazhar Medical Group (Alqufoda town, Saudi Arabia) from July 2022 to October 2022. The study included 150 subjects (43 males and 107 females) aged between 10 and 73 years without known biliary/pancreatic disease or surgery. The data was collected using the ultrasound machine Samsung Medison (SonoAce R7) using the lower frequency [2-8 MHz] curvilinear probe. The age, gender, body height, weight, and body mass index (BMI) were also recorded. The mean weight, height, and BMI levels were 71.64 ± 17.32 kg, 165.06 ± 11.7 cm, and 26.19 ± 5.66 kg/m², respectively. The mean CBD diameter was 3.26 ± 0.82 mm, ranging from 1.8 mm to 5.8 mm. There was no statistically significant difference in CBD diameter between male and female subjects. Our study found that the linear regression model partially predicted the value of the CBD diameter with increasing age and weight. Further research on CBD measurement with a larger population sample and using various body positions is needed for more accurate results. (**International Journal of Biomedicine. 2023;13(2):265-268.**)

Keywords: common bile duct • ultrasound • body mass index

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Introduction

Many people worldwide are affected by biliary diseases.

⁽¹⁾ The common bile duct (CBD) size is key in evaluating and assessing the status of the biliary system obstruction.⁽²⁾ Ultrasonography is a reliable, safe, economical, non-invasive imaging technique that can detect a variety of biliary tree illnesses due to its excellent sensitivity and specificity.⁽³⁾ Oral cholecystography, radionuclide investigations, computerized tomography, and MRI are more accurate than ultrasound, but ultrasound is more affordable. With the development of high-resolution ultrasound, the luminal of CBD can be measured

correctly. The CBD diameter can typically range from 2 to 7 mm.^(4,5)

Literature has revealed a variety of viewpoints on the size of the CBD. The CBD may lose some elasticity with aging, and the normal duct may be somewhat extended in an elderly participant due to the loss of elastic recoil. As a rule of thumb, the duct may dilate about only 1mm each decade after age 60. Perret et al.⁽⁶⁾ demonstrated a slight, although statistically significant, increase in the caliber of CBD with increasing age. Although the CBD did increase in size with aging, 98% of all ducts remained below 6 to 7 mm, the commonly accepted upper range of normal.

As is known, variations exist in the anthropometric features of various populations, races, and regions. Despite technological advancements, the association of anthropometric measurements with the CBD diameters has remained controversial.^(7,8)

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The aim of this study was to measure the normal parameters of the CBD in Saudi subjects using ultrasound modality.

Materials and Methods

This descriptive cross-sectional study was carried out in Alazhar Medical Group (Alqunfoda town, Saudi Arabia) from July 2022 to October 2022. The study included 150 subjects (43 males and 107 females) aged between 10 and 73 years without known biliary/pancreatic disease or surgery.

The data was collected using the ultrasound machine Samsung Medison (SonoAce R7) using the lower frequency [2-8 MHz] curvilinear probe. The CBD was identified through its association with the portal vein in the long axis of the gallbladder. At this location, the CBD and hepatic artery appear as two smaller circles anterior to the portal vein, giving an appearance of a face with two ears – also called a “Mickey Mouse” sign. With the indicator directed toward the patient’s right, the right ear is the CBD, and the left ear the hepatic artery. CBD was measured at three locations – at the porta hepatis, in the most distal aspect of the pancreas head, and midway between these points, and the overall mean for all measures was calculated.

The age, gender, body height, weight, and body mass index (BMI) were also recorded.

This study was approved by the Scientific Ethics Committee of the College of Medical Radiological Sciences, Sudan University of Science and Technology (Khartoum, Sudan). Written informed consent was obtained from each patient.

Statistical analysis was performed using the statistical software package SPSS version 23.0 (SPSS Inc, Armonk, NY: IBM Corp). For data with normal distribution, inter-group comparisons were performed using Student’s t-test. Minimum, maximum, and mean ± SD were used for summarizing the data. A scatterplot was used to show the relationship between two quantitative variables measured for the same individuals. A probability value of $P < 0.05$ was considered statistically significant.

Results

The mean age of participants was 33.37 ± 9.26 years, and the majority (65.3%) were in the age range from 26 to 41 years (Table 1). The mean weight, height, and BMI levels were 71.64 ± 17.32 kg, 165.06 ± 11.7 cm, and 26.19 ± 5.66 kg/m², respectively.

The mean CBD diameter was 3.26 ± 0.82 mm, ranging from 1.8 mm to 5.8 mm (Table 2). There was no statistically significant difference in CBD diameter between male and female subjects (Table 3).

The scatter plots (Figures 1 and 2) show the correlation between the CBD diameter and corresponding weight and age. The CBD increased by 0.0015 cm and 0.0012 cm, respectively, when age increased by a year and weight increased by one kg. Our study found that the linear regression model partially predicted the value of the CBD diameter with increasing age and weight.

Table 1.
Gender and age groups of the study participants.

Gender / Age groups	n	%
Female	43	28.7
Male	107	71.3
Age, years		
10-25	28	18.7%
26-41	98	65.3%
42-57	21	14%
58-73	3	2%

Table 2.
Anthropometric characteristics and CBD diameter in the study participants.

Variable	Mean	Maximum	Minimum	SD
Age, years	33.37	71	11	9.26
Weight, kg	71.64	120	35	17.32
Height, cm	165.06	193	130	11.70
BMI, kg/m ²	26.19	46	16	5.66
CBD diameter, mm	3.26	5.8	1.8	0.82

Table 3.
CBD diameter in males and females.

	Gender	n	Mean	Std. Error Mean	SD
CBD diameter, mm	Male	107	3.3	0.07	0.74
	Female	43	3.1	0.15	0.97
$P = 0.1746$					

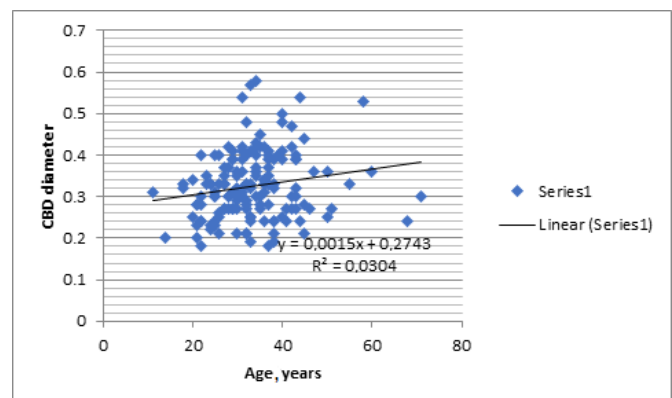


Fig. 1. Scatter plots for CBD diameters (cm) by age (years) with linear regression.

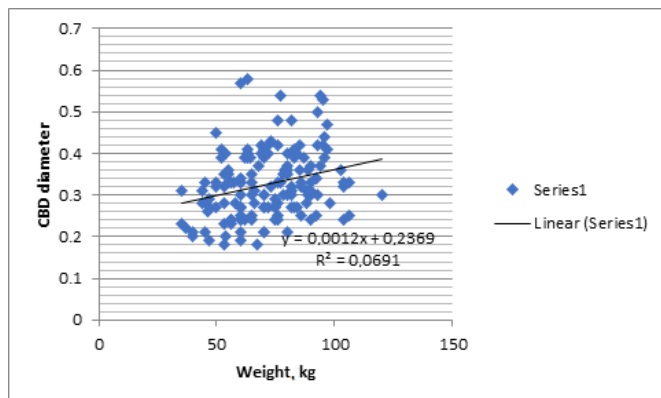


Fig. 2. Scatter plots for CBD diameters (cm) by weight (kg) with linear regression.

Discussion

The mean CBD diameter obtained in our study (3.26±0.82 mm with range from 1.8 mm to 5.8 mm) differed from data in a study by Lal et al.,⁽¹⁾ who conducted sonographic measurements of CBD diameters in healthy Rajasthani residents (n=200) and found that the average diameter ranged from 2.0 mm to 7.9 mm, with a mean level of 4.1 mm (SD 1.01 mm).

In a study by Admassie⁽²⁾ involving 293 adult patients without known biliary disease, pancreatic disease, or surgery, the mean CBD diameter was found to be 3.9 mm with a range from 2.1 to 6 mm, and there was also a positive correlation between the CBD diameter and age and weight.

In a study by Kratzer et al.,⁽⁹⁾ the average maximum diameter of the CBD amounted to 5.3±3.0 mm, and there was a positive correlation between age and CBD diameter. Our study found the linear regression model partially predicts the value of CBD diameter with increasing age and weight.

Lal et al.⁽¹⁾ applied a test for linear trend on the age-wise distribution of CBD diameter. This was found to be statistically significant ($P=0.003$). The diameter increased progressively from 3.9 mm among those aged 18-25 years to 4.7 mm among those aged more than 55 years. In contrast, CBD was not observed to have a statistically significant correlation with weight and height.

Perret et al.⁽¹⁰⁾ prospectively evaluated the CBD diameter in 1,018 patients without a history of biliary disease aged 60 to 96 over four years to determine if there was a significant change in CBD with aging (60 years old or less, mean diameter 3.6 mm +/- 0.2 mm, versus over 85 years old, mean diameter 4 mm +/- 0.2 mm, $P=0.009$). Although the common bile duct did increase in size with aging, 98% of all ducts remained below 6 to 7 mm, the commonly accepted upper range of normal.

In a study by Akochi et al.,⁽¹¹⁾ there was also a statistically significant positive correlation between CBD diameter and age of males and females ($r=0.804$ and $r=0.706$ respectively; $P=0.001$) but a mild positive correlation with weight and BMI ($r<0.35$).

In a study by Adibi and Givechian⁽¹²⁾ involving 375 patients (>16 years) with no evident hepatobiliary or

pancreatic disease in abdominopelvic ultrasonography, the mean CBD diameters (proximal and distal) were significantly ($P<0.05$) correlated with age ($r=0.55$ and $r=0.54$, respectively) and BMI ($r=0.25$ and $r=0.27$, respectively).

Worku et al.⁽¹³⁾ performed a cross-sectional study on 206 subjects without any history of hepatobiliary abnormality. The CBD measured at the proximal part just caudal to the porta hepatis. The mean age of the study participants was 39.4 (range 18-87) and the mean diameter of the CBD was 3.64 mm (range 1.8-5.9 mm). The diameter of CBD was significantly associated with age with a linear trend.

The EUS study⁽¹⁴⁾ showed that the CBD dilates significantly after the age of 70 years, but even in most elderly patients, with an intact gallbladder, the normal CBD does not exceed 7.6 mm, thus a wider CBD warrants further investigation.

Conclusion

In Saudi subjects, the mean diameter of the normal CBD was 3.26±0.82 mm, ranging from 1.8 mm to 5.8 mm. There was no statistically significant difference in CBD diameter between male and female subjects. CBD diameter has a slight positive correlation with increasing age and weight. Our study found that the linear regression model partially predicted the value of the CBD diameter with increasing age and weight.

Further research on CBD measurement with a larger population sample and using various body positions is needed for more accurate results.

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Competing Interests

The authors declare that they have no competing interests.

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