

An Observational Cadaveric Study to Evaluate the Measurements of Diameter of Common Bile Duct at Porta Hepatis

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Abstract

Aim: The aim of the present study was to evaluate the measurements of diameter of common bile duct at porta hepatis.

Methods: The present study was conducted in the Department of Anatomy and 100 cases were included in the study group. After examining the abdomen by ultrasound expert, if no hepatobiliary, portal vein pathology is detected then the case is included in the study.

Results: A mean age of 36.96 years was observed, accompanied by a standard deviation of 14.96 years. The age range with a 95% confidence level is 31.96-37.92 years. The calculated mean height was 162.04 cm, accompanied by a standard deviation of 12.88 cm. The height has a 95% confidence limit of 5.13-5.33 ft. The average weight of the participants was 54.66 kg, with a standard deviation of 13.37 kg. The weight has a 95% confidence interval of 49.53 - 54.05 kg.

Conclusion: The utilization of ultrasonic assessment for the common bile duct has significant importance, value, and diagnostic utility in the majority of biliary illnesses, including cholelithiasis and jaundice blockage. The size of the diameter of the common bile duct is not influenced by any parameters such as age, height, or weight.

Keywords: common bile duct, porta hepatis

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Introduction

The common bile duct (CBD) is a component of the biliary tree, a network of structures responsible for the drainage of bile from the liver into the duodenum's second segment. The process commences at the anatomical location where the cystic duct converges with the common hepatic duct (CHD) and subsequently merges distally with the pancreatic duct within a dilated ampulla. In addition to the gall bladder, the biliary tree encompasses the cystic duct, the right and left hepatic ducts, the common hepatic duct, and a collection of microscopic biliary ducts located within the liver. [1]

The measurement of the common bile duct's size is a crucial factor in assessing the biliary system, as it serves as an indicator of potential biliary obstruction. The presence of a reference range would facilitate the differentiation between medical and surgical jaundice. [2]

The utilization of ultrasonographic evaluation of the common bile duct has been employed in the assessment of hepatobiliary disease for a period

exceeding three decades. [3] Although, imaging of the CBD may be conducted with one or a combination of numerous modalities including computed tomography (CT), magnetic resonance pancreatography (MRCP), endoscopic retrograde cholangiopancreatography (ERCP), ultrasonography has remained the imaging method of first choice. The utilization of ultrasonography is easily accessible, non-intrusive, cost-effective, and employs non-ionizing radiation. Ultrasonography can accurately demonstrate extrahepatic biliary obstruction with a high degree of precision, approaching 100%. [4]

The accurate assessment of luminal diameters of the common bile duct has been made possible through the advancement of high-resolution scanners. According to ultrasonography, the typical internal diameter of the common bile duct is measured to be 6 mm. [5] The assessment of adult CBD duct size and its variations with age, [6-9] gender, body mass index (BMI), post cholecystectomy and changes with breathing. [10-12] A common duct bigger than 7 mm in diameter

is conceivable in non-jaundiced individuals with cholelithiasis, pancreatitis or jaundiced patients with common duct blockage by stone or tumor. An obstruction is strongly indicated by a common duct with a diameter exceeding 11 mm.² An upper limit of 8 mm looks suitable beyond the age of 50; and an upper limit of 10 mm is adequate for cholecystectomized persons. [13] Sonographic CBD diameter assessment may be used in every situation where its diameter affects further treatment and prognosis; hence a need to establish CBD reference values for our population using ultrasonography which is a useful non-invasive, readily available and cheap procedure for accurate hepatobiliary and pancreatic assessment. [14]

The purpose of the present study was to analyze the measures of diameter of common bile duct at porta hepatis.

Materials and Methods

The present study was conducted in the Department of Anatomy, Gouri Devi Institute of Medical Sciences and Hospital, Durgapur, West Bengal, India for one year and 100 cases were included in the study group. After examining the abdomen by ultrasound expert, if no hepatobiliary, portal vein pathology is detected then the case is included in the

study. Diameter of common bile duct at porta hepatis is noted in millimetres. Other parameters height in meters and weight in kilogram were noted. And then using the formula given below for Body surface area is calculated: $A = W^{0.425} \times H^{0.725} \times 71.84$ (constant) Sq.m. A is body surface area in square meters, W is weight in kilogram Kg, H is height in meters. All 100 cases were correlated with the parameters such as age, weight and height.

Ultrasound scan: The patient had to fast a minimum of eight hours before the examination so that bowel gas get limited and gall bladder was not contracted. The examination of abdomen was done in supine and in oblique position with the transducer of 3.5 MHz. To conduct the proper ultrasound without any fallacy of abdomen, the patients were called in the morning on empty stomach. Because bowels are relatively empty. History, clinical examination was correlated with the ultrasound observation. As per standard procedure, scan was undertaken in supine position from midline from above downwards and left to right. Particular site of interest can be seen by real time sonography. Standard oblique view was taken of liver, pancreas, etc. Porta hepatis is viewed in longitudinal scan and diameter of common bile duct is measured.

Results

Table 1: Demographic data

Variable	Mean	Std. Deviation	95% C.I.
Age	36.96 years	14.96 years	31.96-37.92 yrs
Height	162.04 cm	12.88 cm	156.36 - 162.45 cm
Weight	54.66 kg	13.37 kg	49.53-54.05 kg
Body surface area	1.7 Sq.m.	0.36 Sq.m.	1.29 - 1.73 Sq.m.
Common Bile Duct	3.36 mm	0.64 mm	3.21. - 3.49 mm

The mean age was 36.96 years with standard deviation of 14.96 years. 95% Confidence limit of age are 31.96-37.92 yrs. The mean height was 162.04 cm with standard deviation of 12.88 cm. 95% Confidence limit of height are 5.13-5.33 feet. The mean weight was 54.66 kg with standard deviation of 13.37 kg. 95% Confidence limit of weight are 49.53 - 54.05Kg.

Table 2: Mean measurements of the diameter of common bile at porta hepatis in different age group

Age group in years	N	%	CBD in mm
18-30	45	45	3.3
31-40	25	25	3.6
41-50	15	15	3.5
51-60	8	8	3.8
61-70	2	2	3.0
71-80	5	5	4.0

Mean Diameter of portal vein in age group 18-30 years (45 cases) was found to be 3.3 mm, Mean Diameter of portal vein in age group 31-40 years (25 cases) was found to be 3.6 mm, Mean Diameter of portal vein in age group 41-50 years (15 cases) was found to be 3.5 mm, Mean Diameter of portal

vein in age group 51-60 years (8 cases) was found to be 3.8 mm, Mean Diameter of portal vein in age group 61-70 years (2 cases) was found to be 3.0 mm, Mean Diameter of portal vein in age group 71-80 years (5) cases was found to be 4.0 mm.

Table 3: Correlation of measurements of diameter of common bile duct with height and weight

Height	N	%	CBD in mm
120-135	3	3	3.1
136-150	22	22	3.2
151-165	52	52	3.5
166-180	23	23	3.6
Weight			
31-40	20	20	3.3
41-50	32	32	3.6
51-60	28	28	3.4
61-70	12	12	3.4
71-80	6	6	3.8
81-90	2	2	3.2

Mean measurement of diameter of common bile duct in the group of 120-135 cm (cases 3) was 3.1 mm, Mean measurement of diameter of common bile duct in the group of 136-150 cm (cases 22) was 3.2 mm, Mean measurement of diameter of common bile duct in the group of 151-165 cm (cases 52) was 3.5 mm, Mean measurement of diameter of common bile duct in the group of 166-180 cm (cases 23) was 3.6 mm. Mean measurement of diameter of common bile duct in the group of

31-40 kg (cases 20) was 3.3 mm, Mean measurement of diameter of common bile duct in the group of 41-50 kg (cases 32) was 3.6 mm, Mean measurement of diameter of common bile duct in the group of 51-60 kg (cases 28) was 3.4 mm, Mean measurement of diameter of common bile duct in the group of 61-70 kg (cases 12) was 3.4 mm, Mean measurement of diameter of common bile duct in the group of 71-80 kg (cases 6) was 3.8 mm.

Table 4: Correlation of Mean measurements of common bile duct with body surface area

Age group in years	N	%	CBD in mm
1.00-1.15	3	3	3.4
1.16-1.30	12	12	3.4
1.31-1.45	28	28	3.5
1.46-1.60	27	27	3.3
1.61-1.75	20	20	3.6
1.76-1.90	10	10	3.7

Mean measurement of diameter of common bile duct in the group 1.16-1.30 sq.m (cases 12) was 3.4 mm, Mean measurement of diameter of common bile duct in the group 1.31-1.45 sq.m (cases 28) was 3.5 mm, Mean measurement of diameter of common bile duct in the group 1.46-1.60 sq.m (cases 27) was 3.3 mm, Mean measurement of diameter of common bile duct in the group 1.61-1.75 sq.m (cases 20) was 3.6 mm, Mean measurement of diameter of common bile duct in the group 1.76-1.90 sq.m (cases 10) was 3.7 mm.

Discussion

The common bile duct is created from the merging of the common hepatic duct and cystic duct, located directly below the porta hepatis. Bile ducts often open at the main papilla, which is located on the posteromedial wall of the duodenum. [15] The common bile duct undergoes dilation in instances of cholelithiasis and jaundice accompanied by blockage. [16] Various radiographic methods can be used to assess the common bile duct. Ultrasound is considered a safe and straightforward non-invasive modality for the first assessment of hepatobiliary disorders. [17] Ultrasound is the

primary modality employed in the identification of biliary tract illness in individuals with jaundice, enabling the differentiation between dilated and non-dilated biliary ducts. The measurement of the diameter of common bile is a significant ultrasonic modality for assessing hepatobiliary diseases. [18]

The average age of the participants was 36.96 years, with a standard deviation of 14.96 years. The 95% confidence interval for the age range is 31.96-37.92 years. A mean height of 162.04 cm was observed, accompanied by a standard deviation of 12.88 cm. There is a 95% confidence interval for the height range of 5.13-5.33 ft. A mean weight of 54.66 kg was observed, accompanied by a standard deviation of 13.37 kg. There is a 95% confidence interval for the weight range of 49.53 - 54.05 kg. Mean Diameter of portal vein in age group 18-30 years (45 cases) was found to be 3.3 mm, Mean Diameter of portal vein in age group 31-40 years (25 cases) was found to be 3.6 mm, Mean Diameter of portal vein in age group 41-50 years (15 cases) was found to be 3.5 mm, Mean Diameter of portal vein in age group 51-60 years (8 cases) was found to be 3.8 mm, Mean Diameter of portal vein in age group 61-70 years (2 cases) was found to be 3.0

mm, Mean Diameter of portal vein in age group 71-80 years (5) cases was found to be 4.0 mm. The abnormal confluence of the cystic duct with the common bile duct may induce stasis of bile. [19] The presence of anatomical variations in the cystic duct, such as the cystic junction radial orientation variant, can potentially lead to surgical complications if left unidentified. [20] Low junction individuals with a short CBD have many difficulties, including congenital dilatation of the cystic duct. [19] Choledochocoele is a cystic or diverticular dilation of the lower bile duct and is sometimes linked with cholangitis or pancreatitis. [21]

Mean measurement of diameter of common bile duct in the group of 120-135 cm (cases 3) was 3.1 mm, Mean measurement of diameter of common bile duct in the group of 136-150 cm (cases 22) was 3.2 mm, Mean measurement of diameter of common bile duct in the group of 151-165 cm (cases 52) was 3.5 mm, Mean measurement of diameter of common bile duct in the group of 166-180 cm (cases 23) was 3.6 mm. Mean measurement of diameter of common bile duct in the group of 120-135 cm (cases 3) was 3.1 mm, Mean measurement of diameter of common bile duct in the group of 136-150 cm (cases 22) was 3.2 mm, Mean measurement of diameter of common bile duct in the group of 151-165 cm (cases 52) was 3.5 mm, Mean measurement of diameter of common bile duct in the group of 166-180 cm (cases 23) was 3.6 mm. Mean measurement of diameter of common bile duct in the group of 31-40 kg (cases 20) was 3.3 mm, Mean measurement of diameter of common bile duct in the group of 41-50 kg (cases 32) was 3.6 mm, Mean measurement of diameter of common bile duct in the group of 51-60 kg (cases 28) was 3.4 mm, Mean measurement of diameter of common bile duct in the group of 61-70 kg (cases 12) was 3.4 mm, Mean measurement of diameter of common bile duct in the group of 71-80 kg (cases 6) was 3.8 mm. In a study by Bachar et al [22] on the effect of aging on the adult extra-hepatic bile ducts using ultrasonography. They found significant correlation between CBD size and age.

Mean measurement of diameter of common bile duct in the group 1.16-1.30 sq.m (cases 12) was 3.4 mm, Mean measurement of diameter of common bile duct in the group 1.31-1.45 sq.m (cases 28) was 3.5 mm, Mean measurement of diameter of common bile duct in the group 1.46-1.60 sq.m (cases 27) was 3.3 mm, Mean measurement of diameter of common bile duct in the group 1.61-1.75 sq.m (cases 20) was 3.6 mm, Mean measurement of diameter of common bile duct in the group 1.76-1.90 sq.m (cases 10) was 3.7 mm.

Conclusion

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In the majority of biliary illnesses, such as cholelithiasis and blockage in jaundice, the ultrasound examination of the common bile duct is essential, beneficial, and diagnostic. There are no factors that have any influence on the size of the diameter of the common bile duct, such as age, height, or weight.

References

1. Farate A, Umar UH, Ahmadu MS, Mustapha Z, Ahidjo A, Tahir A. Sonographic evaluation of the common bile duct size in normal adults at university of maiduguri teaching hospital, Nigeria.
2. Parulekar SG. Ultrasound evaluation of common bile duct size. *Radiology*. 1979 Dec; 133 (3):703-7.
3. Adibi A, Givechian B. Diameter of common bile duct: what are the predicting factors? *JRMS* 2007; 12 (3): 121-124.
4. Lokich JJ, Kane RA, Harrison DA, McDermott WV. Biliary tract obstruction secondary to cancer: management guidelines and selected literature. *JCO* 1987; 5 (6): 969-981.
5. Decker GAG. Editor: Lee McGregor's synopsis of surgical anatomy, John Wright & Sons Ltd. 1986.
6. Bachar GN, Cohen M, Belenky A, Atar E, Gideon S. Effect of aging on the adult extrahepatic bile duct: a sonographic study. *Journal of ultrasound in medicine*. 2003 Sep;22(9):879-82.
7. Horrow MM, Horrow JCH, Niakosari A, Kirby CL, Rosenberg HK. Is age associated with size of adult extrahepatic bile duct: sonographic study. *Radiology* 2001; 221(2):411-414.
8. Adibi A, Givechian B. Diameter of common bile duct: what are the predicting factors? *JRMS* 2007; 12(3): 121-124.
9. Daradkeh S, Tarwneh E, Al-Hadidy A. Factors affecting common bile duct diameter. *Hepato-gastroenterology* 2005; 52(66): 1659-1661.
10. Kusak D, Bieganski T. Common bile duct diameter in patients with cholelithiasis and/or portcholecystectomy: ultrasound evaluation of 1436 subjects. *Pol J Radiol* 2005; 70(4): 79-86.
11. Csendes P, Csendes A, Burgos AM, Burdiles P. Bile duct diameter before and 12 years after cholecystectomy. *Rev Med Chile* 2007; 135: 735-742.
12. Skalicky M, Dajcman D, Hojs R. Effect of cholecystectomy for gallstones on the surface of the papilla of Vater and the diameter of the common bile duct. *Eur J Gastroenterol Hepatol* 2002; 14(4): 399-404.
13. Senturk S., Miroglu T.C., Bilici A., Gumus H., Tekin R.C., Ekici F., Tekbas G., Diameters of the common bile duct in adults and postcholecystectomy patients: A study with 64-slice CT.

- European Journal of Radiology. 2012; 81 (1):39-42.
14. Akochi SJ, Ugwu AC, Otuh I. Sonographic measurement of common bile duct diameter in apparently healthy adults in Abakaliki metropolis. *International Journal of Sciences & Applied Research*. 2018;5(8):01-8.
 15. *Grays anatomy: Churchill Livingstone Elsevier* 40th edition Editor-in- Chief Susan Standring Page No. 1170-1171.
 16. Sherlock S, Dooley J: *Diseases of the liver and biliary system*. Blackwell Scientific Publication, Oxford, 9 edition 1993: 17-26, 146-147, 173-178.
 17. Sarti DA, Sample WF, *Diagnostic ultrasound Text and cases*. G. K. Hall Medical Publishers, Boston, Massachusetts, 1977: 62-63.
 18. Decker GAG, editor Lee McGregor's *Synopsis of Surgical Anatomy*. John Wright and Sons Ltd. 1986.
 19. Uetsuji S, Okuda Y, Komada H, Yamamura M, Kamiyama Y. Clinical evaluation of a low junction of the cystic duct. *Scandinavian journal of gastroenterology*. 1993 Jan 1;28(1):85-8.
 20. Tsitouridis I, Lazaraki G, Papastergiou C, Pagalos E, Germanidis G. Low conjunction of the cystic duct with the common bile duct: does it correlate with the formation of common bile duct stones?. *Surgical endoscopy*. 2007 Jan;21: 48-52.
 21. Kamisawa T, Yoshiike M, Egawa N, Tsuruta K, Okamoto A, Matsukawa M. Classification of choledochocoele. *Hepato-gastroenterology*. 2005 Jan 1;52(61):29-32.
 22. Bachar GN, Cohen M, Belenky A, Atar E, Gideon S. Effect of aging on the adult extrahepatic bile duct: a sonographic study. *Journal of ultrasound in medicine*. 2003 Sep;22(9):879-82.