The National Ribat University

Faculty of Graduate Studies and Scientific Research

Measurement of Normal Common Bile Duct Diameter using Ultrasonography

قياس القطر الطبيعي للقناه الصفراويه باستخدام التصوير بالموجات فوق الصوتية

A thesis submitted for Partial Fulfillment of MS.C Degree in

Medical Diagnostic Ultrasound

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الايـــــة

قال تعالـــى:

(رَبِّ قَدْ آتَيْتَنِي مِنَ الْمُلْكِ وَعَلَّمْتَنِي مِنْ تَأْوِيلِ الْأَحَادِيثِ فَاطِرَ السَّمَاوَاتِ وَالْأَرْضِ أَنْتَ وَلِيِّي فِي الدُّنْيَا وَالْآخِرَةِ تَوَفَّنِي مُسْلِمًا وَأَلْحِقْنِي بِالصَّالِحِينَ).

صدق الله العظيم

سورة يوسف:الاية (101)

Dedication

To my family

To my teachers

To my Friends and colleagues

Acknowledgement

My greatest and all thanks to Allah as he helped me to finish this research . He also gave me strength and good health while doing this work.

Thanks Dr. Ahmed Abdelrahim Mohammed, my supervisor for his kind advice, true guidance and great help.

Thanks also to Dr. Awadia Greeballah Suliman Ali for encouragement and support.

Abstract

This was a descriptive cross sectional study carried out in National Ribat teaching hospital and Al salam clinic in Al haj yousef - Khartoum state - Sudan from December 2017 to April 2018, which aimed to measured normal common bile duct diameter using Ultrasonography.

There were one hundred cases of age ranged from thirteen to eighty seven years, all cases had normal CBD, any patient had CBD disorder was excluded from this study. Transabdominal scanning was done for all cases using Siemens and mindray DP 10 with curvilinear probe of 2 to 6 Megahertz (MHz).

Data collected using special data collection sheet designed to evaluate gender, age, weight, height, BMI and CBD diameter. there analyzed by Statistical Package for Social Sciences (SPSS).

Study resulted that mean of age for cases under study was 35.39 ± 15.05years, the mean of weight 71.39±10.53 kilograms (Kgs), mean of height 169.22± 9.94centimeter, mean of body mass index 24.91± 3.19, while mean common bile diameter 4.0 ± 0.84 mm. Study concluded that there was significant correlation between common bile duct diameter with age, weight and height and significance correlation between common bile duct diameter with body mass index.

The Study concluded that ultrasound loose effective modality in measurement of CBD.

Study recommended that further studies for measurement of the common bile duct in different locations and posture.

مستخلص الدراسة

هذة دراسة وصفية تحليلية اجريت في مستشفي الرباط الوطني وعيادة السلام في الحاج يوسف – الخرطوم السودان في الفترة من ديسمبر 2017 الـــى ابريل2018 , هدفت الدراســـة الى قياس المدى الطبيعـــي لقطـــر القناة الصفراوية المشتركة.

تمت دراسة مائة حالة من عمر13 سنة الى 87 سنة , وكانت كل الحالات ذات قناة صفراوية طبيعية , وتم استبعاد اي حالة ذات اعتلال في القناة الصفراوية. تم استخدام المسح البطني لكل هذه الحالات باستخدام جهاز سيمنس و مندري باستخدام مسبار ذو منحني ذو تردد من 2 الى 6 ميجاهيرز.

تم جمع البيانات باستخدام ورقة تجميع خاصة لتقييم الجنس والعمر والوزن والطول و مؤشر كتلة الجســـم وقطر القناة الصفراوية المشتركة. ولتحليل تم استخدام تحليل الحزم الاحصائية للعلوم الاجتماعية.

وخلصت الدراسة الى ان المتوسط العمري للحالات 35.3+ 15.05سنة, بالاضافة للمتوسط الوزني71.39 ± 10.53كيلو, ومتوسط طولي 169.22± 9.49سم, ومتوسط مؤشر كتلة الجسم 24.91 ± 3.19 , بالاضافة الى متوسط قطر القناة الصفراوية 4.00 ± 0.84مم.

وخلصت الدراسة الي ان هنالك علاقة بين قطر القناة الصفراوية المشتركة وبين العمر والوزن والطول ولا يوجد علاقة بين قطر القناة الصفراوية وبين مؤشر كتلة الجسم.

وخلصت الدراسة الى ان الموجات فوق الصوتية لها تاثير فعال في قياس قطر القناة الصفراوية.

أوصت الدراسة ان يتم قياس قطر القناة الصفراوية المشتركة في اماكن مختلفة بوضعيات جسدية مختلفة.

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List of abbreviations

No	Abbreviation	Full meaning
1	BMI	Body Mass Index
2	CBD	Common Bile Duct
3	CHD	Common Hepatic Duct
4	kHz	Kilohertz
5	MHz	Megahertz
6	US	Ultrasound

Chapter one

1.1 Introduction

Ultrasonography is the diagnostic method of choice for visualization and rational work up of abdominal organs. The size of the common bile duct is a predictor of biliary obstruction and it measurement is therefore an important component in the evaluation of the biliary system. Availability of normal measurements of the common bile duct would help to distinguish obstructive from non-obstructive causes of jaundice.(1)

Ultrasonography is an accurate, safe, non-invasive and inexpensive imaging modality, which is highly sensitive and specific for the detection of many biliary tree diseases. (1)

Ultrasonography is comparable in accuracy to oral cholecystography, radionuclide studies, computed tomography and magnetic resonance imaging, and more cost-effective.(2)

With the development of high resolution scanners, the luminal diameters of the common bile duct can be assessed accurately. The normal internal diameter of the common bile duct on ultrasonography is 6 mm.(3)

Different opinions regarding the size of the common bile duct have been revealed in literature. It is an established fact that variations exist in the anthropometric features of various populations and regions Studies have suggested correlation between different kinds of body builds and diseases. However, despite technological advancements, the association of anthropometric measurements with the diameters of common bile duct has remained controversial.(4)

study done in Tikur Anbessa Hospital, Department of Radiology, Addis Ababa University, Medical Faculty, Addis Ababa, Ethiopia by Admassie D, the result

found to be the mean diameter of the common bile duct diameter was found to be 3.9 mm; measured diameter ranged from 2.1 to 6mm.[5]

There was also a positive correlation between the common bile duct diameter with age and weight. No significant difference was noted between the two sexes and common bile duct diameter. No association was observed with height and common bile duct diameter.[5]

Another Study done in Radiology. 1979 Dec by Parulekar SG , the result found The mean diameter of the normal common duct was 4.1 mm. [6]

The aim of this study to obtain data on sonographically measuring diameters of common bile duct in a series of normal population and to measure its correlation with age, sex and anthropometry.

In this study the common problems for data collection are measuring CBD in obese patient , not good patient preparation in most of hospital & can not known the correct age for some patients.

1.2 Problem of the study

Changes in caliber of the CBD related to various factors including Hepatobiliary disease this study tries to assess the range of normal measurements in relation with age, sex and anthropometry.

1.3 Objectives

1.3.1 General objective

The aim of this studies to measure the normal common bile duct diameter using ultrasonography.

1.3.2 Specific objectives

1) To determine the association of CBD diameter with age.
2) To estimate the association of CBD diameter with sex.

3) To correlate the association of CBD diameter with physical measurements (height, weight & BMI).

1.4 Overview of the study

This study consisted of five chapters, chapter one is an introduction, which introduce briefly this thesis and contained (general introduction, problem of study also contains general, specific objectives). Chapter two was literature review which contains (anatomy and physiology , Common bile duct ultrasound measurements and previous study). Chapter three was describe the methodology (material, method) used in this study. Chapter four includes results presentation of study finding, chapter five included discussion, conclusion and recommendation for future scope in addition to references and appendices.

Chapter Two

2. Anatomy and normal variant

The smallest biliary vessels are microscopic canaliculi as described under "Microscopic Anatomy of the Liver" in the previous Module. These canaliculi anastomose to form lobular bile ducts that are part of the portal triad. Eventually these small ducts anastomose to form left and right hepatic ducts which in turn join to form the common hepatic duct (CHD) The CHD is approximately 3 cm long.[7]

It lies anterior to the main portal vein and lateral to the hepatic artery (proper) These three structures travel in the free edge of the lesser omentum (the hepatoduodenal ligament portion). The common hepatic duct is known as the common bile duct (CBD) once it has joined the cystic duct from the gallbladder.The CBD is approximately 7 cm long.5 It leaves the lesser omentum and passes posterior to the first part of the duodenum and then grooves or penetrates the posterior part of the head of the pancreas .Within the lateral aspect of the pancreatic head it is joined by the pancreatic duct (of Wirsung) which together empty into the duodenum through the lumen of the duodenal papilla, controlled by a sphincter (of Oddi). The CBD enters the duodenum opposite the uncinate process of the pancreas. This is the narrowest part of the biliary tract. The area where the pancreatic duct joins the CBD is the ampulla (of Vater).[7]

The cystic duct joins the common bile duct at variable levels, usually 2-3 cm. below the porta hepatis. It can join as high up as the porta or as low as within the pancreatic head. Sometimes the cystic duct will run parallel with the common hepatic duct before joining it. Many authors refer to both the common hepatic duct and the common bile duct as the common duct because the cystic duct is rarely

visualized sonographically to define the specific level at which the CHD ends and the CBD begins. The common duct would then be a total of 10 cm in length.[7]

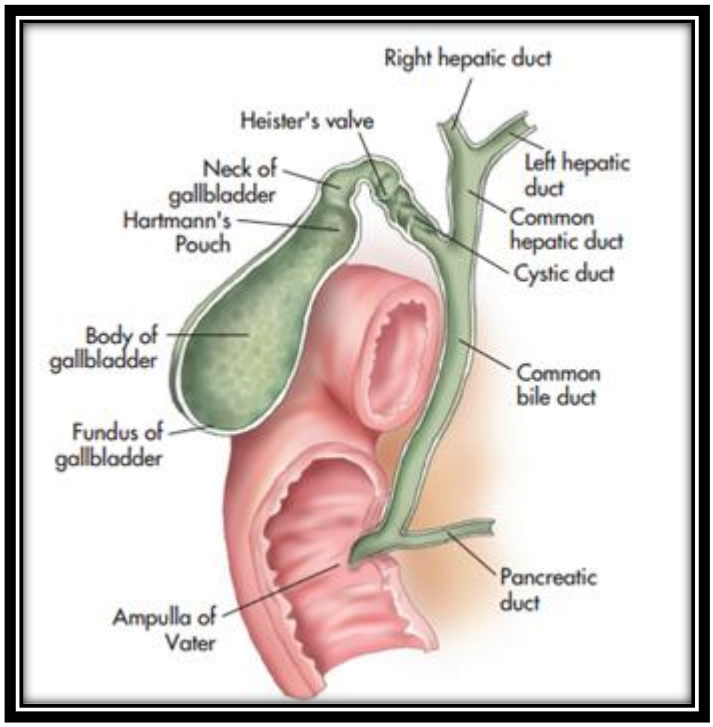


Figure (2:1) show biliary system and Gallbladder.[8]

2.1 physiology

The primary functions of the extrahepatic biliary tract are (1) the transportation of bile from the liver to the intestine and (2) the regulation of its flow. This is an important function as the liver secretes approximately 1 to 2 liters of bile per day.[8]

During the fasting state, very little bile flows into the duodenum. Stimulation produced by the influence of food causes the gallbladder to contract, resulting in an outpouring of bile into the duodenum. When the stomach is emptied, duodenal peristalsis diminishes, the gallbladder relaxes, the tonus of the sphincter of Oddi increases slightly, and thus very little bile passes into the duodenum. Small amounts of bile secreted by the liver are retained in the common duct and forced

into the gallbladder. The contracted gallbladder appears as a thick-walled structure with a slit for the bile. It is nearly impossible to see luminal or wall abnormalities when the gallbladder is contracted. [8]

2.2 Ultrasound (U/S)

Ultrasounds are sound waves with frequencies higher than the upper audible limit of human hearing. Ultrasound is no different from 'normal' (audible) sound in its physical properties, except in that humans cannot hear it. This limit varies from person to person and is approximately 20 kilohertz (20,000 hertz) in healthy, young adults. Ultrasound devices operate with frequencies from 20 kHz up to several gigahertz. [9]

Ultrasound is used in many different fields. Ultrasonic devices are used to detect objects and measure distances. Ultrasound imaging or sonography is often used in medicine. In the nondestructive testing of products and structures, ultrasound is used to detect invisible flaws. Industrially, ultrasound is used for cleaning, mixing, and to accelerate chemical processes. Animals such as bats and porpoises use ultrasound for locating prey and obstacles. [9]

2.2.1 Sonographic Technique

Our technique for assessment of the intrahepatic ducts includes a routine scan, as would be performed for liver evaluation, including both sagittal and transverse scans. In addition, we perform a focused scan to assess the porta hepatis, recognizing that its orientation requires an oblique plane to show the length of the right and left hepatic ducts in a single image. For this we utilize a subcostal oblique view with the left edge of the transducer more cephalad than the right edge. The face of the transducer is directed toward the right shoulder. With a full suspended

inspiration, a sweep of the transducer from the shoulder to the umbilical region will show the middle hepatic vein, then the long axis of the right and left hepatic ducts at the porta hepatis, followed by the common duct in cross section. By rotating the transducer 90 degrees to this plane, a second suspended inspiration will allow for a long axis view of the CHD and CBD at the porta hepatis.[10]

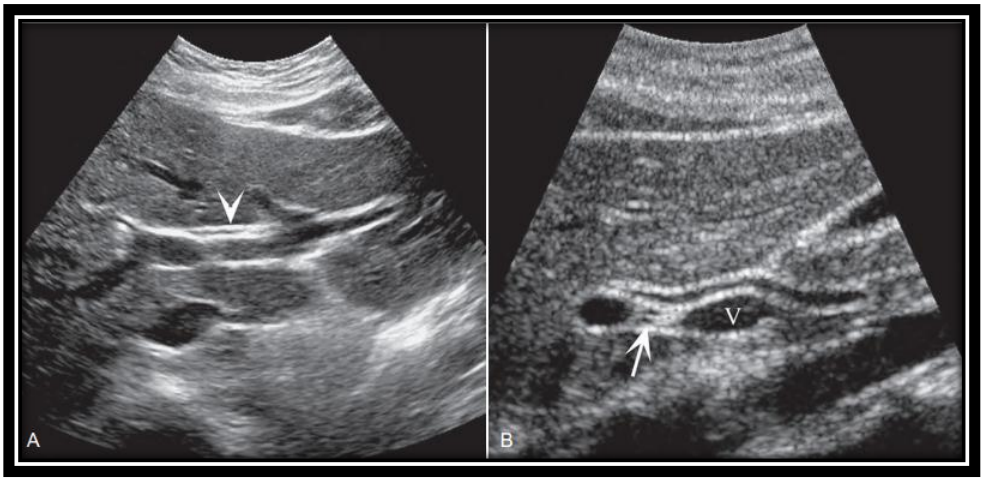
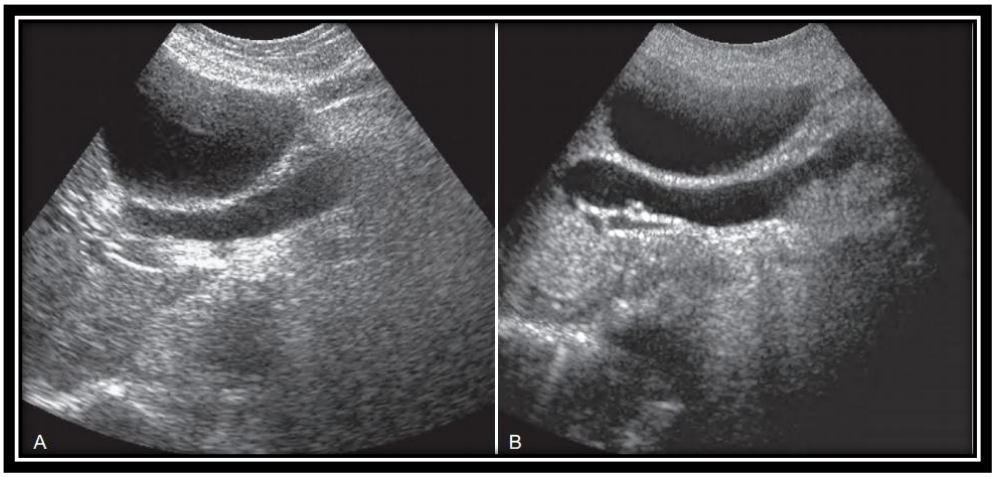


Figure (2.2) show normal bile ducts. A, Right and left hepatic ducts *(arrowhead)* are normally seen lying anterior to the portal veins. **B,** Common hepatic/common bile ducts of normal caliber in sagittal view lying in the typical position anterior to the portal vein *(V)* and hepatic artery *(arrow).*[10]

Harmonic imaging allows for improved contrast between the ducts and adjacent tissues, leading to improved visualization of the duct, its luminal contents, and wall .[10]

Tissue harmonic imaging must be used to assessment of biliary tree in specific scanning technique for assessment of cholangitis and Cholangiocarcinoma.



Figure(2.3) show Harmonic imaging of biliary tree. A, Longitudinal view of the CBD with fundamental frequencies and B, with harmonic imaging. There is increased contrast to noise with harmonic imaging, effectively clearing the artifactual, low-level echoes over the fluid-filled duct.[10]

2.2.2 Measurement of the Common Duct (CD)

The lumen of the CD is measured directly anterior to the hepatic artery and right portal vein. Please note, this portion of the duct is actually the common hepatic duct but is called the common duct by convention. The wall of the bile duct is composed mainly of fibroelastic tissue, with the stretch potential of the elastic fibers permitting duct dilatation, while the elastic recoil of the fibers allows for return of the duct to normal size following ductal emptying or after relief of obstruction. The bile duct may lose some of its elasticity with aging and the normal duct may be somewhat ectatic in an elderly patient due to the loss of elastic recoil. As a rule of thumb the duct may dilate about 1 mm for each decade after the age of 60. For example, in a 70 year old patient, 7 mm may be normal in the absence of biliary symptoms. The majority of older patients have ducts which measure the same as the younger population. (4 mm or less). The normal right and left hepatic ducts are visualized adjacent to the proximal left and right portal

veins within the porta hepatis. The normal cystic duct lies posterior to the CBD, has an average diameter of slightly less than 2 mm, and is visible in approximately 50% of patients. The normal upper limit for the common duct is 6-7 mm.[7]

A recent study evaluated the CD in asymptomatic people aged 60 and over. "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 view of this data, it seems prudent that we reevaluate use of the often quoted rule of thumb of 'adding 1 mm per decade after the age of 60 years to the upper range of duct size in determining a normal diameter.' The data from the present study clearly show that in the overwhelming majority of patients 60 years of age or older the mean diameter of the CBD remained 'normal', being less than 6 mm in 98% of patients (1000 of 1018) and less than 7 mm in 99% (1015 of 1018) of the patients we surveyed.[7]

2.3 Previous studies

Study done by **Nidhi Lal in December 2014** to obtain data on sonographically measured diameters of common bile duct in series of normal Rajasthani population and to measure its correlation with age, sex and anthropometry. The study include 200 participants with equal proportion belonging to either sex. CBD measured at three location at the porta hepatis in the most distal aspect of the head of pancreas and midway between these points. Anthropometric measurements including height, weight, chest circumference, circumference at the transpyloric plane, circumference at umbilicus and circumference at the hip were obtained using standard procedure. The results revealed that Mean age of study subjects was 34.5 years (Range 18-85 years). mean diameters of the common bile duct in the three locations were: proximal, 4.0 mm (SD 1.02 mm); middle, 4.1 mm (SD 1.01 mm);

and distal, 4.2 mm (SD 1.01 mm) and overall mean for all measures 4.1 mm (SD 1.01 mm). Average diameter ranged from 2.0 mm to 7.9 mm, with 95 percent of the subjects having a diameter of less than 6 mm. The study observed a statistically significant relation of common bile duct with age, along with a linear trend. There was no statistically significant difference in common bile duct diameter between male and female subjects. The diameter did not show any statistically significant correlation with any of the anthropometric measurements.[11]

Another study done in Oct 2008, Tikur Anbessa Hospital, Department of Radiology, Addis Ababa University by **Admassie D**, the result found to be the mean diameter of the common bile duct diameter was found to be 3.9 mm; measured diameter ranged from 2.1mm to 6mm. There was also a positive correlation between the common bile duct diameter with age and weight. No significant difference was noted between the two sexes and common bile duct diameter. No association was observed with height and common bile duct diameter.[12]

Another study done by **Perret R** aimed to evaluate the Common bile duct measurements in an elderly population done in 1,018 patients between the ages of 60 to 96 periods to determine if there is a significant change in its size with aging. All of the patients included in the study were being evaluated primarily for carotid or peripheral vascular disease. Any patients with a history of biliary disease (i.e. bilirubin level greater than 1.5 mg/ml, cholecystectomy, or cholelithiasis) were excluded. Ultrasonography of the common bile duct was performed only in those patients with no subjective abdominal pain or icterus. Our results demonstrated a small although statistically significant increase in the caliber of the common bile duct with increasing age (60 years old or less, mean diameter 3.6 mm +/- 0.2mm,

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.[13]

Another Study done by **Parulekar SG** in Dec 1979, A new sonographic technique for demonstration of the common bile duct is described in a prospective study of 200 patients. The mean diameter of the normal common duct was 4.1 mm. A common duct greater than 7 mm in diameter can be seen in (a) nonjaundiced patients with gallstones and/or pancreatitis, or (b) jaundiced patients with common duct obstruction by stone or tumor. A common duct greater than 11 mm in diameter is strongly suggestive of obstruction by stone or tumor.[6]

Another Study done by **Mohammad H, Achinge G I, Eke B A, Mbaave T P, Okwori G, Ojobi J E, Shaahu V N and Bitto T T** in September and December 2011, North Central Nigeria, the result found The range of CBD diameter in this apparently normal population seeking health in our centre was 2- 9mm. More than 50% of both male and female participants in this study had a CBD diameter of 5-7mm. BMI did not appear to influence CBD diameter in this study. [14]

Another study done by **Atoosa Adibi and Behrooz Givechian** in 2007, This was a cross-sectional study on 375 patients (>16 years old) including 219 females and 156 males. They had no evident hepatobiliary or pancreatic disease and underwent abdominopelvic ultrasonography for measurement of their CBD diameter. The result found the mean CBD diameter (1 standard deviation), in proximal and distal parts were 3.64 mm (±1.2) and 3.72 mm (±1.2), respectively. The CBD diameters (proximal and distal) were significantly ($P<0.05$) correlated with age ($r = 0.55$ and 0.54, respectively), BMI ($r = 0.25$ and 0.27, respectively) and portal vein diameter

(r = 0.24 and 0.22, respectively). Distal diameter of CBD was significantly larger in opium addicts (5.66 ± 2.65) in comparison with non addicts (3.68 ± 1.17, P = 0.04). [15]

Chapter Three

3.1 Design of the study

A cross section study design was used For this study.

3.2 Area and duration of the study

This study will carry out in National Ribat teaching hospital and Al salam clinic in Al haj yousef in the period from December 2017 to April 2018.

3.3 Materials

The data of this study was collected using DP 10 and Siemens with curve linear low frequency transducer (2-6 MHz).

3.4 Population of the study

Healthy adult male and female with normal common bile duct that showed no sign of abnormality.

3.5 Sample size

One hundred normal population from December 2017 to March 2018.

3.5.1 Inclusion criteria

Healthy Population with normal common bile duct measurement.

3.5.2 Exclusion criteria

People with common bile duct pathology & people with cholecystectomy or any Gallbladder pathology that may effect CBD.

3.6 Method of data collection

Verbal explanation of the nature and aim of the study will perform to the subject and sonographic staff. All the individuals were examined in the supine position used a convex probe low frequency (2-6 MHZ in ultrasound machine. The area for evaluation was fixed and skin adequately lubricated to facilitate ultrasound transmission. The transducer was gently applied and longitudinal scan was taken.

3.7Technique

The scan include sonographic information at the mid clavicular line. at this location the common bile duct 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 36 directed toward the patient's right, the right ear is the common bile duct and the left ear is the hepatic artery. The normal caliber of the CBD in patients without history of biliary disease is up to 6 mm in most studies (Carol M. Rumack).

3.8 Variables of the study

Dependant variable (common bile duct diameter) and Independent variables (age, gender, height , weight & MBI)**.**

3.9 Method of data analysis

Data was collected randomly using data collection sheet and statistical analysis was performed Statistical Package for Social Sciences (SPSS) version 16 and EXCEL 2010.

3.10 Ethical approval

Ethical consideration prior to this study, verbal consent approval will obtain from each participating the subject prior to his/her inclusion into the study. Clarification of the nature and purpose of the study was done on the interview with each the subject, the investigator emphasized participation is absolutely voluntary and confidential. Anonymity, privacy, safety and confidentiality was absolutely assured throughout the whole study and the right to withdraw.

3.11 Budged

The budget of this study was consumed around 50$.

3.12 Time frame

Data collection from December 2017 to March 2018 (3months). Data analysis and discussion about one month.

Chapter Four

Table (4.1) frequency distribution of gender.

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Female	50	50.0	50.0	50.0
Male	50	50.0	50.0	100.0
Total	100	100.0	100.0	

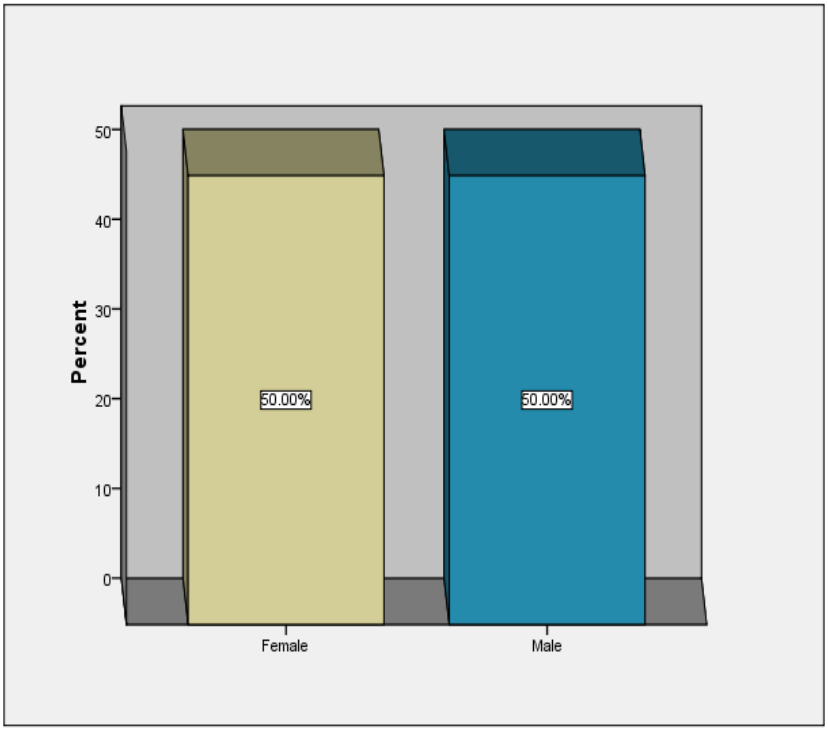


Figure (4.1) frequency distribution of gender.

Table (4.2) frequency distribution of age group.

age	Frequency	Percent	Valid Percent	Cumulative Percent
13-17 years	3	3.0	3.0	3.0
18-38 years	62	62.0	62.0	65.0
39-59 years	28	28.0	28.0	93.0
60-80 years	5	5.0	5.0	98.0
more than 80 years	2	2.0	2.0	100.0
Total	100	100.0	100.0	

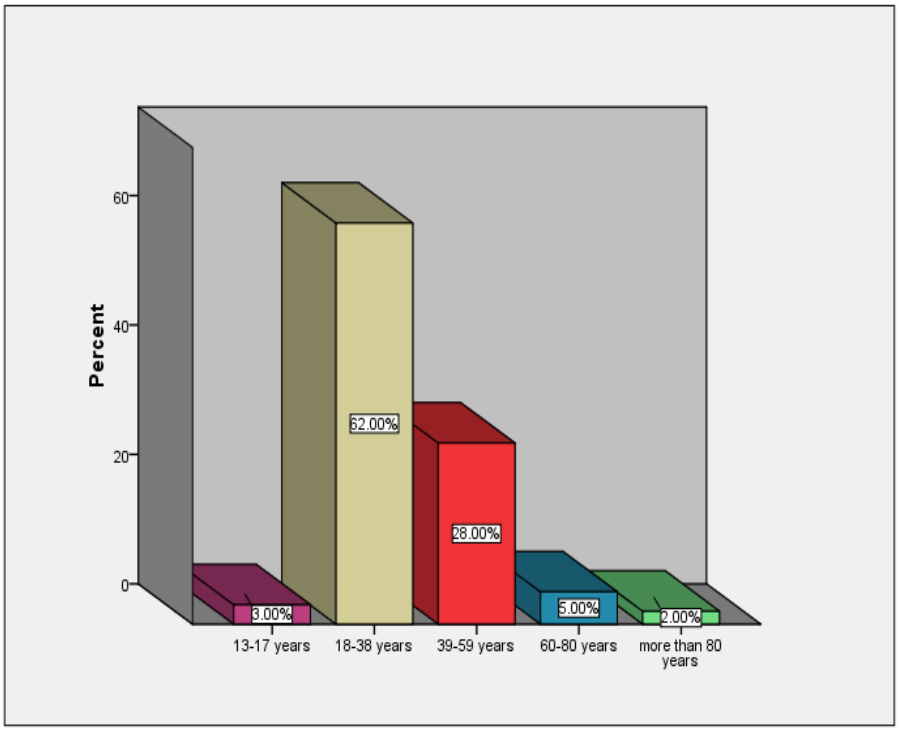


Figure (4.2) frequency distribution of age group.

Table (4.3) descriptive statistic for age ,weight, BMI and CBD measurement.

	N	Minimum	Maximum	Mean	Std. Deviation
Age	100	13	87	35.39	15.05
Weight	100	35	94	71.39	10.53
Height	100	130	187	169.22	9.49
BMI	100	17.9	34.9	24.91	3.19
CBD measurement	100	1.9	6.1	4.00	.84
Valid N (listwise)	100				

Table (4.4) compares means of CBD measurement with gender.

Gender	Mean	N	Std. Deviation	Maximum	Minimum
Female	3.60	50	.75	5.6	1.9
Male	4.39	50	.75	6.1	2.1
Total	4.00	100	.84	6.1	1.9

Table (4.5) compares means of CBD measurement with gender.

Age group	Mean	N	Std. Deviation	Maximum	Minimum
13-17 years	2.30	3	.53	2.9	1.9
18-38 years	3.86	62	.72	5.1	2.3
39-59 years	4.13	28	.72	4.9	2.3
60-80 years	5.20	5	.27	5.6	4.9
more than 80 years	5.75	2	.50	6.1	5.4
Total	4.00	100	.84	6.1	1.9

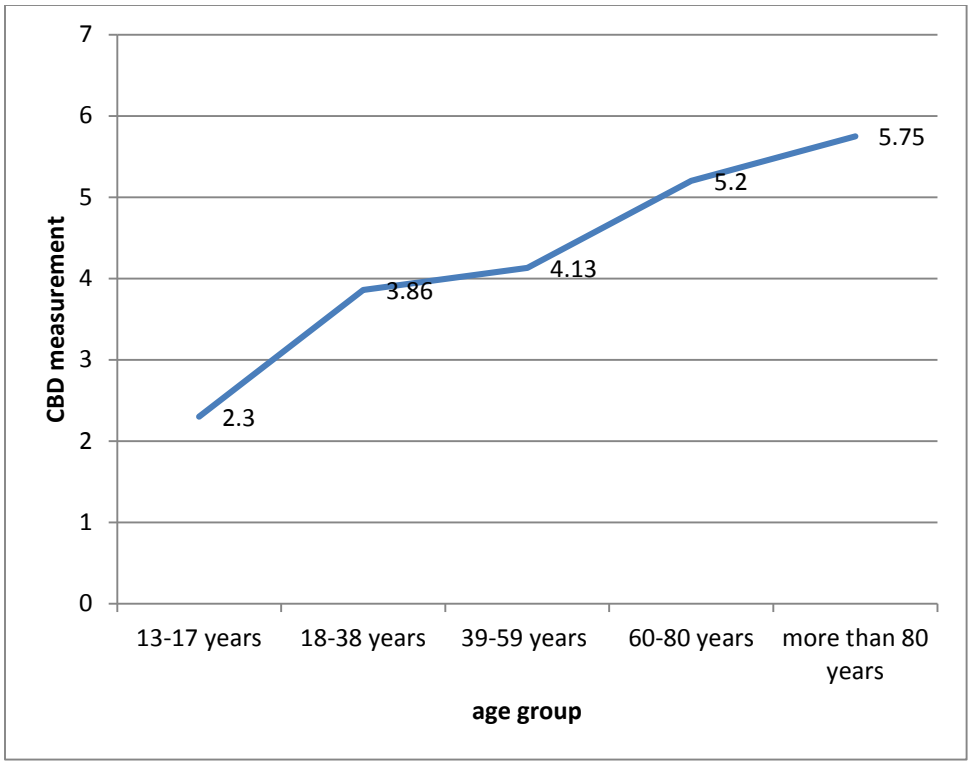


Figure (4.3) shows relation of means CBD with different age group.

Table (4.6) correlation (Pearson) between age , weight, height ,BMI and CBD measurement.

		Age	Wight	Height	BMI	CBD \mm
CBD measurement	Pearson Correlation	.561**	.392**	.465**	.084	1
	Sig. (2-tailed)	.000	.000	.000	.407	
	N	100	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).						

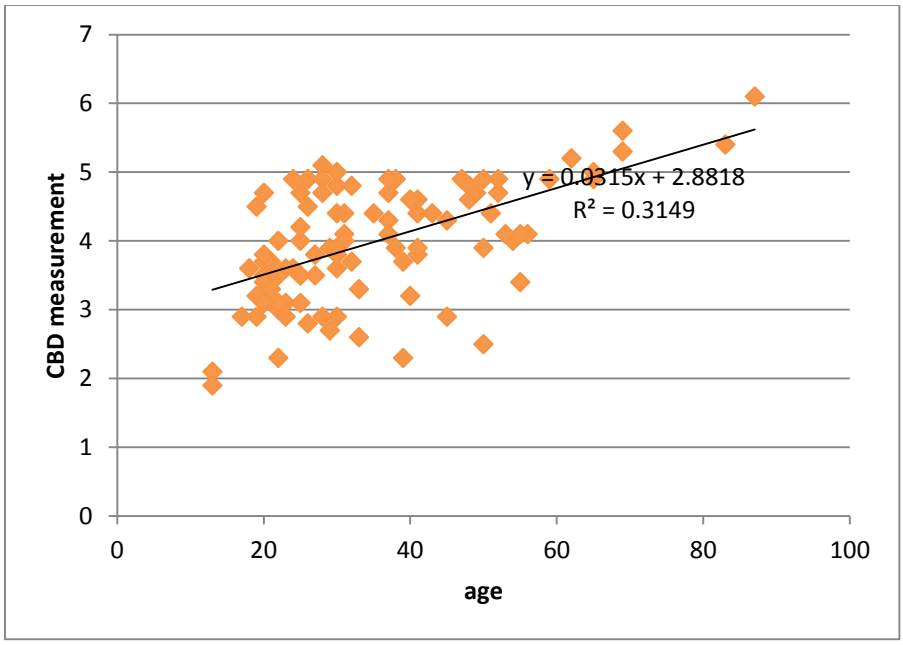


Figure (4.4) scatter plot shows correlation between age and CBD measurement \mm.

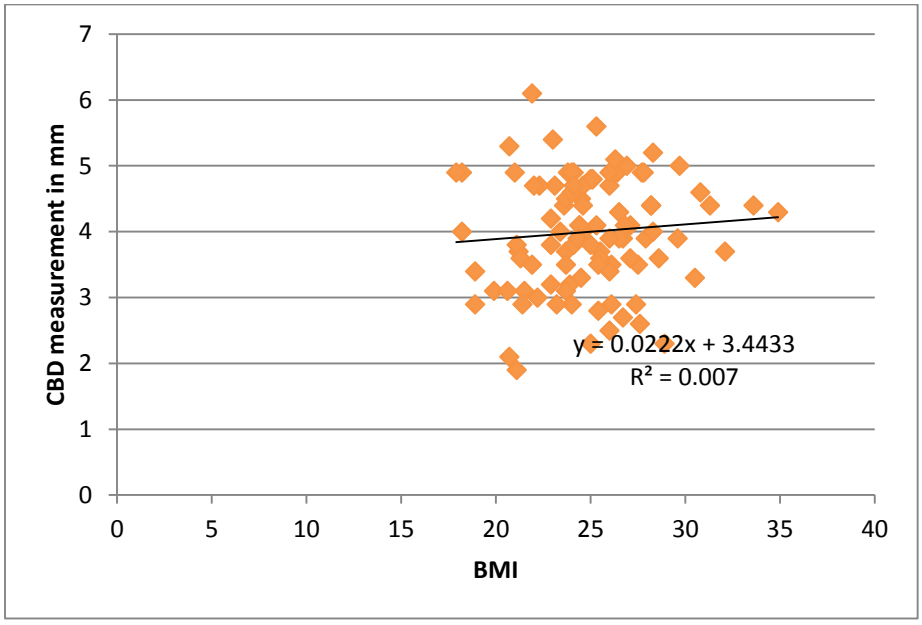


Figure (4.5) scatter plot shows correlation between BMI and CBD measurement \mm.

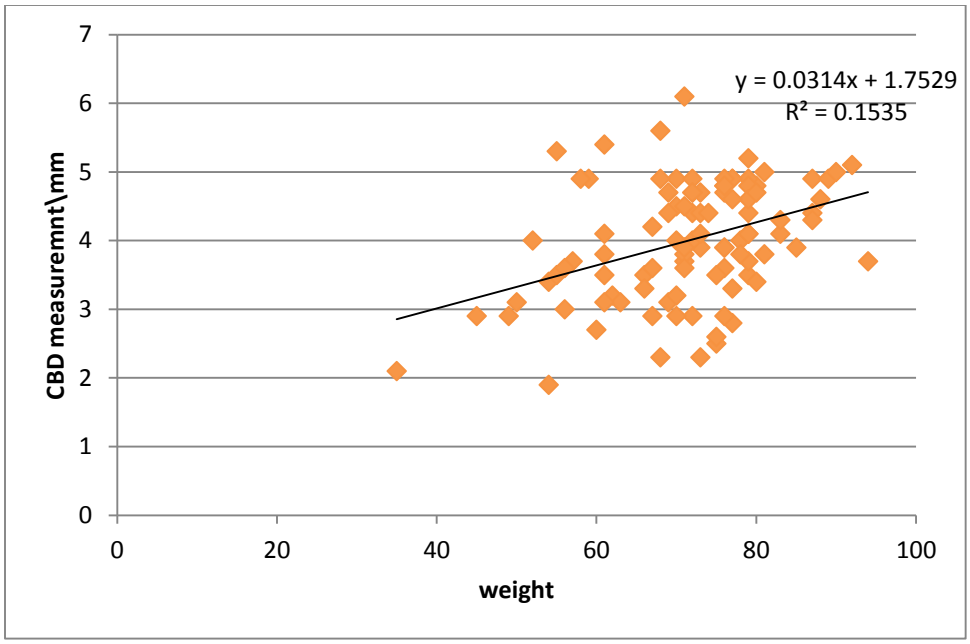


Figure (4.6) scatter plot shows correlation between weight and CBD measurement \mm.

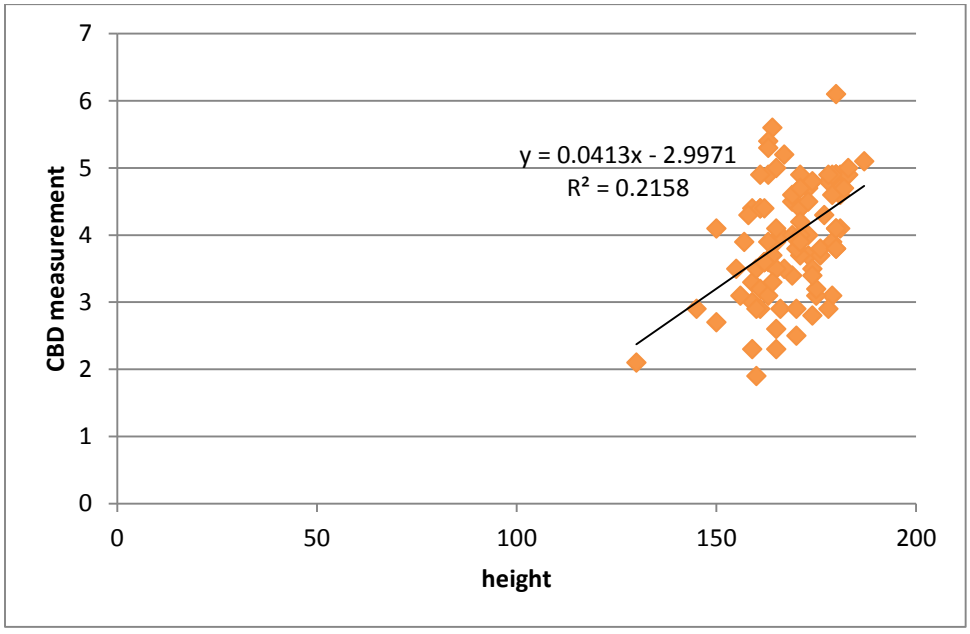


Figure (4.7) scatter plot shows correlation between height and CBD measurement \mm.

Chapter Five

Discussion, conclusion and recommendations

5.1 Discussion

This study was conducted among 100 cases normal subjects belonging to the state of Khartoum. An equal number of males and females in the age group 13-87 years of age. The mean age was 35.39 years (SD 15.05 years) as mentioned in table (4.3). A majority of the participants belonged to the age group18-38 years (frequency 62). As recorded in table (4.5), were included in the study. The subjects underwent ultrasonography measurements of common bile duct diameters in the National Ribat teaching hospital and Al Salam clinic in al haj yousef in Khartoum. In addition, anthropometric data on weight, height and MBI were obtained for each of the study subjects.

The mean diameter of the CBD observed in our study was 4.00 mm with a standard deviation (SD of .84mm) and the average diameter ranged from (1.9 mm - 6.1mm).This was not similar to that reported by Nidhi Lal in his study on 200 normal subjects which reported that the mean equal to 4.1 mm with SD equal to 1.01mm, Average diameter ranged from 2.0 mm to 7.9 mm. This was not similar to that reported by Admassie D in study which observed the mean diameter was 3.9mm and range from 2.1mm to 6.0mm.

From Table (4.3), the mean weight (71.39kg) with (SD=10.53 kg) the mean of height (169.22cm) and the (SD=9.49cm),BMI was calculated from the height and weight measuring the mean of the BMI was (24.91) and the (SD=3.19).

In accordance with previous results correlation was done to find out the relation between the different variables, the result revealed out that there is significant

correlation at the 0.01 level between the age and the CBD diameter as recorded in table (4.6) and figure (4.4) a scatter plot diagram show no linear relation ship between age and CBD diameter.CBD increase 0.03mm per one years. This agrees with the study done by Nidhi Lal which observed a statistically significant relation of common bile duct with age, along with a linear trend and agree with the study done by Admassie D which revealed that the factor found to be significantly affecting the diameter of the common bile duct was age, and agrees with the study done by Perret R which found that there is significant change in size with age and agrees with the study done by Adibi and Givechian which found the CBD diameters were significantly correlated with age.

In order to assess the association between common bile duct diameter and weight , there is significant correlation recorded in table (4.6) and figure (4.6) scatter plot shows no linear relation ship between weight and CBD measurement.CBD increase 0.03 That agree with study done by Admassie D and contradicts the study done by Nidhi Lal which observed a non significant relation of common bile duct with weight.

The correlation between CBD and height show positive relation recorded in table (4.6) and figure (4.7) scatter plot shows no linear relation ship for 1cm jeight increased by 0.04 between height and CBD measurement. That contradicts the study done by Nidhi Lal and study done by A dmassie D.

The correlation between CBD and BMI show no significant recorded in table (4.6) and figure (4.5) scatter plot shows no linear relation ship between BMI and CBD measurement.CBD increased 0.022 for BMI. That agree with study done by Nidhi Lal and study done by Mohammad H, This correlation contradicts with study done

by Adibi and Givechian which observed a significant relation between common bile duct and BMI.

The common bile duct diameter has positive relationship with age (increase with increasing age), height and weight.

The common bile duct caliber has no significant correlation with the body mass index.

CBD for female men was 3.6 ± 0.75 and for male 4.39 ± 0.75.

5.2Conclusion

The study concluded the average of normal main common bile duct diameter was 4.0 ±0.84 mm with minimum 1.9mm and maximum 6.1mm. The age, body height and weight has significant correlation with common bile duct diameter.

The study found no significant association between common bile duct diameter and BMI. The male CBD diameter ws more than female. the mean diameter for male (4.39±0.75) and for female (3.9±0.75).

5.3 Recommendations

- Further studies in measurement of common bile duct in different locations with larger sample of population for more accurate results.
- Measurement with different patient body posture for more accuracy and to have limits of normal diameter according to the position of the patient.
- Further studies should be done with more body characteristic.
- Educating and training technologists to perform optimum examination and correct measurements to CBD.
- The most profound limitation of the study was the small sample size. so we recommend further studies with larger sample size be considered.

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