Sudan University of Science and Technology

College of Graduate studies

Songraphic Evaluation of Caudate Lobe and Right Lobe Ratio in Normal Sudanese

تقييم نسبة الفص الكبدى الذيلى إلى الفص الكبدى الأيمن لدى السودانين الاصحاء باستخدام الموجات فوق الصوتية

A thesis Submitted for Partial Fulfillment of the requirement of (M.Sc.) Degree in Medical Diagnostic Ultrasound

Presented by:

Elhadi AbdAlla Mostufa Mohammed

Supervisor:

Dr. Afraa Siddig Hassan Omer

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الآية

قال الله تعالي:

(لا يُكَلِّفُ ٱللَّهُ نَفْسًا إِلَّا وُسْعَهَا لَهَا مَاكَسَبَتْ وَعَلَيْهَا مَا ٱكْتَسَبَتْ رَبَّنَا لَا تُؤَاخِذْنَآ إِن نَّسِينَآ أَوْ أَخْطَأْنَا رَبَّنَا وَلَا تَحْمِلْ عَلَيْنَآ إِصْرًا كَمَا حَمَلْتَهُ عَلَى ٱلَّذِينَ مِن قَبْلِنَا رَبَّنَا وَلَا تُحَمِّلْنَا مَالَا طَاقَةَ لَنَا بِهِ وَٱعْفُ عَنَّا وَٱغْفِرْ لَنَا وَٱرْحَمْنَآ أَنتَ مَوْلَانَا فَٱنصُرْنَا عَلَى ٱلْقَوْمِ ٱلْكَافِرِينَ)

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Dedication

To my parents

To my family

To all believers in the world

My friends

To everyone who helped me in my life

Acknowledgement

Praise is to the Alla almighty who blessed me with, knowledge, and spirit to write this thesis. Also deep thanks to my supervisor Dr. Afraa Siddig Hassan and Dr. AwadiaGraeebAllaSuliman who analyze my data. Also thanks to AlZaim Al Azhari Ultrasound Clinic and Omdurman Teaching Hospital.

Abstract

This was a cross sectional study that carried out to evaluate the ratio between the caudate and right liver lobes among normal Sudanese population at hospitals of Omdurman teaching hospital and AlzaiemAlazhari ultrasonic clinic. This study is conducted from December 2016 to march 2017.The problem of the study was that unknown of normal liver size and ideal methods of measurements lead to missed diagnosis. The study aimed to measure the length of right liver lobe, to measure the length of caudate liver lobe, to calculate the ratio of two lobes, to correlate the ratio of two lobes with the participant age, weight and gender and to establish normal ratio in Sudanese. This study applied among 90 participants. The data was collected by data collection sheet which classified and analyzed by using statistical package for social science (SPSS). The study found that the caudate to right liver ratio in Sudanese ranging from 0.3 to 0.6, the maximum and minimum length of caudate lobe obtained was (3cm and 8cm) respectively,the maximum and minimum length of right lobe obtained was (10cm and more than 14cm) respectively, the study found that there were significant correlation between participant age and caudate to right lobes ratio. The study concluded that ultrasound is easy, available, less expensive, non invasive and safe tool in assessing the liver. The study recommended that the use of ultrasound in investigating the liver and floor is open for other investigators to participate.

مستخلص البحث

هذه دراسة مقطعية أجريت لتقييم نسبة الفص الذيلي والفص الأيمن للكبد وسط سودانين أصحاء في كل من مستشفي أم درمان التعليمي وعيادة جامعة الزعيم الأزهري للموجات فوق الصوتية في الفترة مابين ديسمبر 2016 و مارس 2017. وتكمن مشكلة الدراسة في أن عدم معرفة القياسات الطبيعية والطريقة المثلي لإجراء القياسات يؤدي إلي التشخيص الخاطئ.

هدفت الدراسة إلي تحديد دقة الموجات لقياس طول الفص الأيمن والفص الذيلي للكبد، وحساب النسبة بينهما وعلاقتها مع عمر،وزن ونوع المشارك وإنشاء نسبة مرجعية في السودانين. أجريت الدراسة علي 90 مشاركا وتم جمع البيانات عن طريق الإستبيان وصنفت وحللت بواسطة برنامج الحزم الإحصائية للعلوم الإجتماعية. ووجدت الدراسة أن نسبة الفص الذيلي إلي الفص الأيمن تتراوح بين 0.3 إلي 0.6، وكان أطول وأقصر طول للفص الذيلي بين 8سم و3سم وكان أطول وأقصر طول للفص الأيمن بين 10سم واكثر من 14سم. ووجدت الدراسة أن هنالك علاقة قوية بين عمر المشارك والنسبة بين الفصين وليست هناك علاقة بين النسبة ووزن ونوع المشارك. وخلصت الدراسة إلي أن الموجات فوق الصوتية سهلة، رخيصة وآمنة لتقييم الكبد. واوصيت الدراسة بعمل مزيد من الدراسات باستخدام عينات أكبر للدراسة.

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List of abbreviations

AP	Antro-posterior
CL	Caudate lobe
C.B.D	Common bile duct
C.D	Common duct
RL	Right lobe
C/R	Caudate/right
F	Female
I.V.C	Invera vena cava
H.A	Hepatic artery
L.H.A	Left hepatic artery
L.H.V	Left hepatic vein
L. H.D	Left hepatic duct
L.P.V	Left portable vien
M	Male
M.H.V	Middle hepatic vein
Pt	Patient
P.V	Portable vien
LLD	Left lateral decubitus
LPO	Left posterior oblique
R.H.A	hepatic arteryRight
R.H.D	hepatic ductRight
R.H.V	Right hepatic vien
R.P.V	Right portale vein

Chapter one

Chapter One

1.1. Introduction:

Ultrasound is usually the first imaging modality employed inpatients with repeatedly altered liver function tests or clinicallysuspected diffuse liver disease. As well as being able to excludeother conditions such as biliary obstruction, there are a number ofrecognised patterns of altered liver echotexture, contour and shapethat are indicative of certain diffuse liver conditions. These changes,however, are often subtle or even non-detectable; therefore theoperator needs to be extremely familiar with the appearance ofnormal liver on the particular ultrasound system they are using. (Paul L Allan, Grant M. Baxter and Micheal J. Weston 2011)

The assessment of liver parenchymal textureis notoriously subjective, and can give rise to a confusing range ofreporting terminology in both normal and abnormal situations.. The aim inevery department should be to develop agreed standards, both forimaging technique and reporting terminology.The key to ultrasound examination of liver parenchyma is imageoptimisation. Firstly, depth should be adjusted to include only thesection of liver down to its deepest surface, followed by optimization of 2D gain. Time gain compensation should be adjusted toproduce an image that is as uniform as possible from near to farfield. Focus depth is generally positioned at the area of interest, butmay be placed in the far field to improve penetration. Tissueharmonic imaging may be used for baseline scanning or activatedwhen increased tissue contrast is required – this again is a matterof personal preference depending on the system used.High-resolution or ‘read’ zoomshould be used to interrogate areasof interest. ..Since the time gain compensation curves of most scanners areset up using the right lobe of liver as a reference, there should belittle or no appreciable attenuation of echoes when progressingfrom near to far

field in normal circumstances. (Paul L Allan, Grant M. Baxter and Micheal J. Weston 2011)

Ultrasound assessment ofliver size is possible, using linear measurements in standard positions,and these may be useful in specific circumstances.For reference,longitudinal (maximum supero-inferior0 span) measurementsof the left lobe in the midline and right lobe in midclavicular line areMidclavicular longitudinal 10.5 ± 1.5, Midclavicularanteroposterior 8.1 ± 1.9, Midline longitudinal 8.3 ± 1.7 and Midline anteroposterior 5.7 ± 1.5. However, the size of the caudate lobe is relatively easily assessedusing linear ultrasound measurements, and this may be helpful inconfirming enlargement in conditions such as cirrhosis or hepaticvein occlusion (Budd–Chiari syndrome). The transverse diametercan be obtained as shown in, where this diameter at thelevel of the porta can be compared with that of the right lobe. Thenormal caudate lobe should be less than two-thirds the diameter ofthe right lobe.The anteroposterior diameter of the caudate lobecan also be measured and compared with that of the adjacent leftlobe; the normal caudate diameter should be less than half that ofthe left lobe.(Paul L Allan, Grant M. Baxter and Micheal J. Weston 2011).

The midclavicular line is the simplest measurement and is considered theliver length. Normal liver length is in the range of 10.5 cm (plus or minus 1.5 cm), with 13cm considered a highly reliable cut-off for normal livers.It is also possible to use the midclavicular plane to measure anteroposteriorly. At the thickestpoint the normal range is 8.1 cm (plus or minus 1.9 cm).(Brwin 1 module2)

1.2. Problem of the study:

The ratio of caudate to the right lobe affected by many diseases there for affected by many features.

1.3.Objectives:

1.3.1. General objective

To evaluate the ratio of caudate lobe to right liver lobe in normal Sudanese population.

1.3.2. Specific objectives

1. To measure the length of right liver lobe.
2. To measure the length of caudate liver lobe.
3. To calculate the ratio of two lobes.
4. To correlate the ratio of two lobes with the patient age, weight and gender.
5. To establish normal Ratio in Sudanese.

1.4. Study Outline:

- Chapter one: Introduction.
- Chapter Two: Background study.
- Chapter Three: Material and methods.
- Chapter Four: Results.
- Chapter Five: Discussion, Conclusion and Recommondations.

Chapter two

Chapter Two

Background Study

2.1 U/S Physics:

2.1.1 Definition:

Ultrasound is a high frequency sound, exceeding the upper limit of human hearing – 20.000 cycles per second (20 KHz). Knowledge of basic ultrasound physics is essential for understanding image formation, echo machine settings optimization, advantages and limitations of the technique. (medcastle.com, 2009).

2.1.2 General principles:

Sound is a longitudinal mechanical wave transmitted through the medium by local displacement of particles within the medium. The displacement of the particle from their equilibrium position produces changes in the medium density (areas of compression/rarefaction). Ultrasound is defined as sound with frequencies above the human audible range between 20 Hz and 20.000 Hz. Diagnostic medical ultrasound uses frequencies from 1.000.000 to 40.000.000 Hz = 1 to 40 megahertz (MHz). The ultrasound wave is often graphically displayed as a sine wave in which the peaks and nadirs represent the areas of compression and rare faction respectively. (medcastle.com, 2009).

2.1.3 Properties of sound waves:

Sound waves are characterized by the following parameters:

Frequency - The frequency of the sound wave is the number of oscillations per unit of time.

Amplitude - The magnitude of the pressure changes, i.e. the difference between the pressure peaks and pressure nadirs (The strength of the wave, loudness of the sound). Amplitude is measured in decibels, a logarithmic unit that relates acoustic pressure to some reference value. The primary advantage of using a logarithmic scale to display amplitude is that a very

wide range of values can be accommodated and weak signals can be displayed alongside much stronger signals. There are some other logarithmic variables used in clinical practice (e.g. pH). Since sound waves are mechanical waves, they are further characterized by the following additional parameters which depend on the medium in which the wave propagates: Wavelength - The length of one period of the wave; e.g. from one pressure peak to the next. The wavelength depends on the frequency and the medium in which the sound wave propagates.(medcastle.com, 2009).

Velocity - The speed at which sound propagates through a given medium. Velocity through a given medium is inversely related to the density and directly related to stiffness of that medium. Ultrasound waves travel faster through a stiff medium, such as bone. In echocardiography, the velocity of sound is assumed to be approximately 1,540 m/sec (or 1.54 m/msec). Sound waves travel through the air with speed of 330 m/s. The typical velocities for different tissues are provided in table 1.

The wave equation: product of wavelength (λ) and frequency (f) represents the velocity (c) of the sound wave. $c = \lambda f$.(medcastle.com, 2009).

Velocity through soft tissue is assumed to be constant (1540 m/s) hence there is an inverse relationship between frequency and wavelength:

Attenuation

Attenuation is a measure of the rate at which the intensity of the ultrasound beam diminishes as it penetrates the tissue. Attenuation always increases with depth and the higher the frequency of ultrasound is, the more rapidly it will attenuate (medcastle.com, 2009).

2.2 Surface Anatomy:

2.2.1 The Liver:

The liver, the largest gland in the body, has both external and internal secretions, which are formed in the hepatic cells. Its external secretion, the bile, is collected after passing through the bile capillaries by the bile ducts, which join like the twigs and branches of a tree to form two large ducts that unite to form the hepatic duct. The bile is either carried to the gall-bladder by the cystic duct or poured directly into the duodenum by the common bile duct where it aids in digestion. The internal secretions are concerned with the metabolism of both nitrogenous and carbohydrate materials absorbed from the intestine and carried to the liver by the portal vein. The carbohydrates are stored in the hepatic cells in the form of glycogen which is secreted in the form of sugar directly into the blood stream. Some of the cells lining the blood capillaries of the liver are concerned in the destruction of red blood corpuscles. It is situated in the upper and right parts of the abdominal cavity, occupying almost the whole of the right hypochondrium, the greater part of the epigastrium, and not uncommonly extending into the left hypochondrium as far as the mammillary line (Snell, 2004).

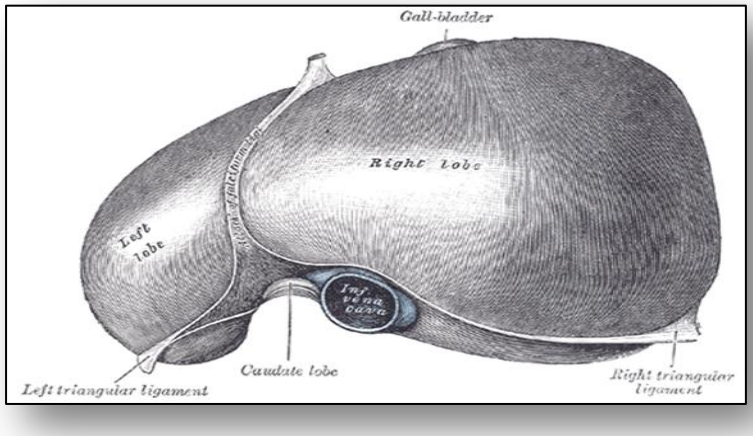


Figure (2.1) the superior surface of the liver (Snell, 2004)

2.2.2 Peritoneal ligaments:

Peritoneal ligaments are folds of peritoneum that are used to connect viscera to viscera or the abdominal wall.

There are multiple named ligaments that usually are named in accordance with what they are.

•Gastrocolicligament, connects the stomach and the colon.

•Splenocolicligament, connects the spleen and the colon.

•Round ligament

•Triangular ligament

The liver is unique among organs in that it receives blood via two distinct circulatory routes: systemic circulation and hepatic portal circulation. Each of these routes provides blood of differing compositions that allow the liver to perform its unique and vital digestive and metabolic functions (Snell, 2004).

2.2.3 Liver Lobes:

The right lobe (lobushepatisdexter) is much larger than the left; the proportion between them being as six to one. It occupies the right hypochondrium, and is separated from the left lobe on its upper surface by the falciform ligament; on its under and posterior surfaces by the left sagittal fossa; and in front by the umbilical notch. It is of a somewhat quadrilateral form, its under and posterior surfaces being marked by three fossæ: the porta and the fossæ for the gall-bladder and inferior vena cava, which separate its left part into two smaller lobes; the quadrate and caudate lobes. The impressions on the right lobe have already been described(Snell, 2004).

The quadrate lobe (lobusquadratus) is situated on the under surface of the right lobe, bounded in front by the anterior margin of the liver; behind by the porta; on the right, by the fossa for the gall-bladder; and on the left, by thefossa for the umbilical vein. It is oblong in shape, itsantero-

posterior diameter being greater than its transverse.Thecaudate lobe (lobuscaudatus; Spigelian lobe) is situated upon the posterior surface of the right lobe of the liver, opposite the tenthand eleventh thoracic vertebræ. It is bounded, below, by the porta; on the right, by the fossa for the inferior vena cava; and, on the left, by the fossafor the ductusvenosus. It looks backward, being nearly vertical in position; it is longer from above downward than from side to side, and is somewhat concave inthe transverse direction. The caudate process is a small elevation of the hepatic substance extending obliquely lateralward, from the lower extremity of the caudate lobe to the under surface of the right lobe. It is situated behind the porta, and separates the fossa for the gall-bladder from the commencement of the fossa for the inferior vena cava.(Wick et al, 2005).

The left lobe (lobushepatis sinister) is smaller and more flattened than the right. It is situated in the epigastric and left hypochondriac regions. Its upper surface is slightly convex and is moulded on to the diaphragm; its under surface presents the gastric impression and omental tuberosity (Wick et al, 2005).

2.2.4 Liver Blood Flow:

Oxygenated blood leaving the heart first passes through the aorta, which descends from the thorax into the abdomen as the abdominal aorta.

The celiac trunk branches from the abdominal aorta and splits into three major branches, one of which, the common hepatic artery, supplies blood to the liver and gallbladder along with the stomach, small intestine, and pancreas. The common hepatic artery further divides into three more branches, with the proper hepatic artery supplying blood to the liver, gallbladder, and part of the stomach. The common hepatic artery further bifurcates into the left and right hepatic arteries to deliver blood the left and right sides of the liver. As the right hepatic artery approachesthe

gallbladder, it branches off to form the cystic artery, which supplies the gallbladder and cystic duct with oxygenated blood. These arteries further branch off into many smaller arteries and arterioles and, finally,capillariesto provide oxygen and nutrients to allof the tissues of the liver and gallbladder(Snell, 2004).

The hepatic portal vein provides the liver's tissues with deoxygenated blood that has passed through the tissues of the stomach, pancreas, spleen, and intestine. This blood is rich in dissolved nutrients absorbed from digested food, as well as any toxins or medications consumed by the body. Before this material can reach the other tissues of the body, it passes through the hepatic portal vein and enters the liver, wherein it is divided among many specialized capillaries, known as sinusoids. In the sinusoid, the deoxygenated blood is processed by hepatocytes, which can absorb or release nutrients as needed and metabolize dangerous chemicals before they can affect the rest of the body (Snell, 2004).

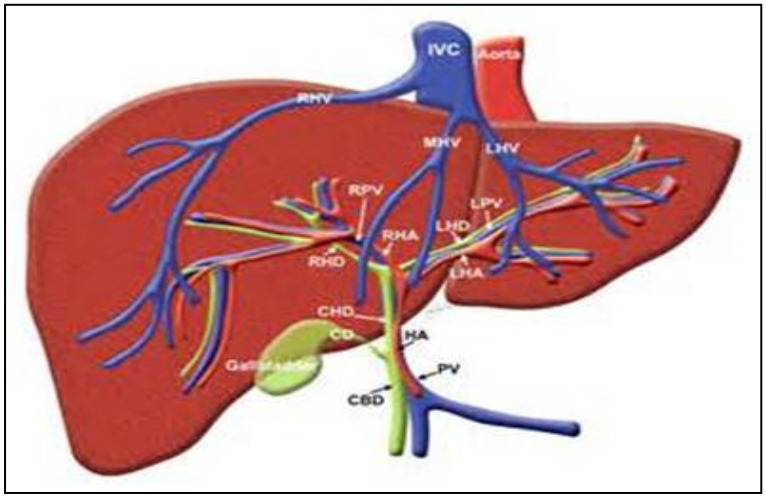


Figure (2.2) liver blood flow (Snell, 2004)

2.2.5 Liver Billiary Flow*:*

The gallbladder is a small, pear-shaped, muscular storage sac that holds bile. Bile is a greenish yellow, thick, sticky fluid. It consists of bile salts, electrolytes(dissolved charged particles, such as sodium and bicarbonate), bile pigments, cholesterol, and other fats (lipids). Bile has two main functions: aiding in digestion and eliminating certain waste products (mainly hemoglobin and excess cholesterol) from the body. Bile salts aid in digestion by making cholesterol, fats, and fat-soluble vitamins easier to absorb from the intestine. The main pigment in bile, bilirubin, is a waste product that is formed from hemoglobin (the protein that carries oxygen in the blood) and is excreted in bile. Hemoglobin is released when old or damaged red blood cells are destroyed.(Snell, 2004)..

Bile flows out of the liver through the left and right hepatic ducts, which come together to form the common hepatic duct. This duct then joins with a duct connected to the gallbladder, called the cystic duct, to form the common bile duct. The common bile duct enters the small intestine at the sphincter ofOddi(a ring-shapedmuscle), located a few inches below the stomach.(Snell, 2004).

About half the bile secreted between meals flows directly through the common bile duct into the small intestine the rest of the bile is diverted through the cystic duct into the gallbladder to be stored. In the gallbladder, up to 90% of the water in bile is absorbed into the bloodstream, making the remaining bile very concentrated. When food enters the small intestine, a series of hormonal and nerve signals triggers the gallbladder to contract and the sphincter of Oddi to relax and open. Bile then flows from the gallbladder into the small intestine to mix with food contents and perform its digestive functions(Snell, 2004).

After bile enters and passes down the small intestine, about 90% of bile salts are reabsorbed into the bloodstream through the wall of the lower

small intestine. The liver extracts these bile salts from the blood and re-secretes them back into the bile. Bile salts go through this cycle about 10 to 12 times a day.Eachtime, small amounts of bile salts escape absorption and reach the large intestine, where they are broken down by bacteria. Some bile salts are reabsorbed in the large intestine. The rest are excreted in the stool (Snell, 2004).

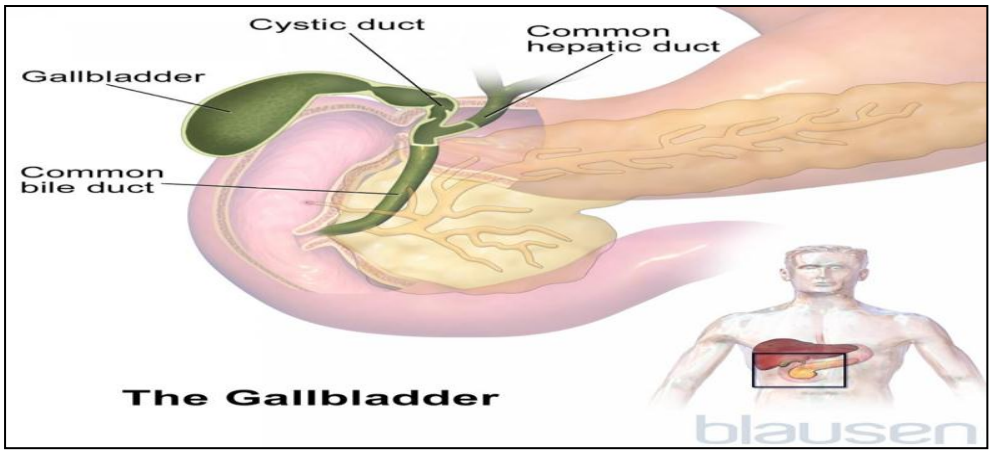


Figure (2.3) Liver Billiary System (Snell, 2004)

2.2.6 Liver Ultrasonography:

Role of Ultrasound is to assess the:

• Size

• Capsular contour (smooth, coarse, lobulated)

• Parenchymal echogenicity

• Vascularity

• Biliary tree

• Masses or collections(Hogen, 2002).

LimitationsObesity and patients with severe cases of metabolic disorders such as haemochromatosis andfatty infiltration will reduce detail and the diagnostic yield of the scan(Hogen, 2002).

Preparation:

• Ideally, fast the patient for 6hours to reduce bowel gas and prevent gall bladder contraction(Hogen, 2002).

Equipment Selection:

• Depending on the size of the patient a curved linear array 2-6MHz.

• If there is nodularity of the liver border then a linear array with a 7-12MHz frequency will better appreciate this. Good color/ power/ Doppler capabilities when assessing vessels or vascularity of a structure.

• Be prepared to change focal zone position and frequency output of probe (or probes) to adequately assess both superficial and deeper structures (Hogen, 2002).

Figure (2. 4) U/S: Normal Liver (Hogen, 2002)

2.3. Liver Physiology:

Every day, your liver helps your body by providing it with energy, fighting off infections and toxins, helping clot the blood, regulating hormones and much, much more. To give you an idea of the liver's critical roles, here is a partial list ofits functions:

1. Cleanses blood:Metabolizing alcohol and other drugs and chemicals, Neutralizing and destroying poisonous substances.

2. Regulates the supply of body fuel: producing, storing and supplying quick energy (glucose) to keep the mind alert and the body active, Producing, storing and exporting fat. Manufactures many essential
3. Body proteins involved in:Transporting substances in the blood, clotting of blood, providing resistance to infection.
4. Regulates the balance of many hormones:Sex hormones, Thyroid hormones, Cortisone and other adrenal hormones.
5. Regulates body cholesterolProduces cholesterol, excretes and converts it to other essential substances.
6. Regulates the supply of essential vitamins and minerals such as iron and copper.
7. Produces bile which eliminates toxic substances from the body and aids digestion (Hogen, 2002).

2.4. Liver Pathology:

1. Benign focal liver lesions such Simple cysts, Complex cysts, Polycystic liver, Hydatid cyst, Abscesses, Haematoma, Haemangioma, Adenoma, Focal fatty change, Focal nodular hyperplasia, Granuloma, Hepatic calcification.

2. Malignant focal liver lesions such as Metastases, Hepatocellular carcinoma, Cholangiocarcinoma.

3. Diffuse liver conditions such as Fatty infiltration, Cirrhosis, Portal hypertension, Hepatitis, Primary sclerosing cholangitis, Budd–Chiari syndrome, Cystic fibrosis, Congestive cardiac disease.**(reference)**

4. Liver conditions in pregnancy.

5. Liver transplants. **(Jane A. Bates 2004)**

2.5. Previous Studies:

A many of studies were conducted to show the use of U/S in liver cirrhosis. U/S was used to demonstrate clearly liver cirrhosis and complication like spleenomegaly, PVH, Ascites, etc.

2.5.1.Study done byWidanagama, M.A., L.B.L. Prabodha, K.N. Palahepitiya, B.G. Nanayakkara under the title of Anatomical dimension of the caudate lobe of the liver in Sri Lankan.2011:

A total of 26 apparently healthy livers obtained from formalin fixed cadavers were studied. The Caudate lobe was measured along its maximum antero-posterior and transverse diameters using a sliding caliper capable of measuring to the nearest 0.01 mm. Maximum transverse diameter of the right lobe of the liver was taken to compare the ratio between the right lobe and the Caudate lobe.

The mean maximum antero-posterior and transverse diameters of the caudate lobe was 51.6 ± 4.6 mm and 27.6 ± 4.5 mm respectively. The transverse diameter of the right lobe was 85.05± 13.2 mm. The mean ratio of the transverse diameter of the caudate lobe to that of the right lobe was found to be 0.32 ± .06.

The results of the study demonstrate the anatomical dimensions established for the caudate lobe for a group of adult Sri Lankan population. These data will facilitate in improving the outcome of surgical procedures of the liver.

2.5.2.Another study done by Chavan NN*, Wabale RN. Under the title of Morphological study of caudate lobe of liver in Indian 2014:

Abstract:

Introduction: Caudate lobe is a well demarcated anatomic segment of liver that has independent vessels in the form of portalvenousand hepatic arterial branches. Taking into consideration clinical importance of this lobe in metastasis, cirrhosis andhepatic resections a morphological study was carried out on caudate lobe of fifty liver specimens. The present study was plannedto assess the anatomical independence of caudate lobe from rest of the liver and its importance in calculating the ratio forcirrhosis.

Material and methods: All parameters of caudate lobe such as size, transverse diameter were measured using vernier caliperand surface area was calculated using butter paper. Biliary drainage and venous supply were noted by gross dissection.

Observations and results: Portal venous supply only from left portal vein was found in 25/50 (50%) cases, from both right aswell as left vein was found in 14/50(28%) cases, from both left portal vein and junction of two veins in 5/50(10%) cases, onlyfrom right portal vein in 3/50 (6%) cases, from the junction of two veins in 1/50(2%) cases, from left portal vein, right portal veinand also from junction of two in 1/50(2%) cases and from main portal trunk in 1/50(2%) cases.

Conclusion: The degree of anatomical independence of caudate lobe was assessed and reaffirmed. Its importance in calculating the ratio for cirrhosis on USG was reviewed.

2.5.3. Another study done byNeel Kamal Arora1, Stuti Srivastava2, Mahboobul Haque3, AbeerZubair Khan2, Karamvir Singh2 under the title of Morphometric Study of Caudate Lobe of Liver at 2016:

ABSTRACT

Background: To study the morphology of the caudate lobe of liver. The caudate lobe is visible on the posterior surface,bounded on the left by the fissure for the ligamentumvenosum, below by the portahepatis and on the right by thegroove for the inferior vena cava. Above, it continues into the superior surface on the right of the upper end of thefissure for the ligamentumvenosum. Below and to the right, it is connected to the right lobe by a narrow caudateprocess, which is immediately behind the portahepatis and above the epiploic foramen. Below and to the left, thecaudate lobe has a small rounded papillary process. Taking into consideration clinical importance of this lobe inmetastasis, cirrhosis and hepatic resections a morphological study was carried out on caudate lobe.

Methods. This Study was undertaken on 36 cadaveric livers available in the Department of Anatomy of Shri Ram MurtiSmarak Instituteof Medical Sciences, Bareilly to study the morphometery of caudate lobe of liver using vernier caliper.

Results: Various

Shapes of the caudate lobe were observed, rectangular being the commonest. **Conclusion:** Knowledge of variations ofCaudate lobe may be important to anatomists and morphologists for new variant, embryologists for new developmentaldefect, clinicians for diseases, surgeons for planning surgery involving liver, and imagery specialists for avoidingmisinterpretation of CT and MRI.

2.5.4. Another study done by Alsafi Ahmed AbdallaBalla , Mohammed Abdallaabdoand Caroline .E.ayad. under thetitle of Evaluation of Caudate and Right Hepatic Lobes Ratio in Patients withSchistosomaMansoniusing Ultrasound in Al-fao area. Sudan 2013.

Abstract:

Caudate-right lobe ratio is used to assess the liver, usually in the setting of cirrhosis, caused by chronic liver disease, inwhich there is atrophy of the right lobe with hypertrophy of the caudate lobe. The study was done to assess the caudate to righthepatic lobe ratios in diagnosing cases with schistosomiasis. It was carried on 50 adult patients of known cases of schistosomiasis inAl-Fao area and 20 adult volunteers from the same area as control group, all were surveyed by ultrasound .Abdominal scanningwas carried out; measurements were done for liver caudate right lobe ratio, portal vein wall thickness, portal vein caliber andspleen size following the international guide line for measurement, scanning and protocol. The study showed that the male wereaffected more than female with incidences 62%, 38% respectively. It also showed that the most affected patients were farmerworker with high incidence 64 %. The study noticed the most affected patient were those in the age ranging between (31 -50) yearswith incidence 58 %. The study concluded that Caudate /right lobe ratio has ability to detected change in the liver size, texture andcomplication caused by schistosomiasis, the ratio has proportional relation to the portal vein wall thickness, the portal vein caliberand the spleen size and has reversal relation to the liver size. The Caudate /right lobe ratio in coarse liver is more than 0.64% and incomplication is more than 0.7%. Measuring the caudate and right hepatic lobes ratio using ultrasound appear to have a great value indiagnosis patients with liver cirrhosis.

2.5.5. Study done by G. Stefano etalunder the title of search the value of U/S in diagnosis of liver cirrhosis.

The ratio of transverse caudate lobe width to Rt lobe width (C/RL) was determined with U/S in 25 healthy subject and 15-6 consecutive Pt with chronic persistent or chronic active hepatitis or liver cirrhosis the C/RL ratio had sensitivity of 43% a specificity of 100% and accuracy of 79% in cirrhosis. The sensitivity was very low in alcoholic cirrhosis low in cryptogenic and cirrhosis high in hepatitis-B virus related cirrhosis in spite of its fairly low overall sensitivity. The C/RL ratio is a useful measurement in assessing chronic liver disease because of its high specificity in cirrhosis (Gon, 2006).

Chapter three

Chapter three

Materials and Methods

3.1. Study type:

This was a cross sectional study was carried out in the area of the study. Each participant was scanned,list the findings in details according to the study variables recorded in the data collecting sheets.

3.2. StudyArea:

The study was conducted in khartoum state, in the ultrasound departments of :

1. Omdurman Teaching Hosppital.
2. AlzaiemAlazhariUniversity ultrasound clinic –Khartoum North.

3.3. Study Duration:

From December 2016 to march 2017.

3.4. study population:

Health 90 male and female as well living in Khartoum state was scanned by ultrasound.

3.5. Sample Size:

90 who came to the ultrasound department.

3.6. Sampling:

The study was conducted on volunteers and normal sample of patient with normal liver findings, selection of participants through simple random sampling, and then the data was collected from the participants.

3.7. Study variables:

The study population were assessed against the following variables:

- Age.
- Gender.
- weigh.
- Ultrasound findingsincluding**:** the length of right liver lobe, the length of caudate liver lobe and the ratio of two lobes.

3.8. Data collection and Instrumentation:

Data collection was done by using 90 samples of volunteers in the area and duration of the study.

3.8.1. Source of date collection:

1. The participant history.

2.The data collecting sheet which designed specially for the study.

3.8.2. Ultrasound technique:

A 3.5 to 5 MHz curve linear array, electronically focused transducer which is the best available forAbdominal ultrasonography.

The patient was placed in the supine, left posterior oblique (LPD) or left lateral decubitus (LLD)position. Scans were done in longitudinal and transverse or transverse-oblique planes.The transducer was placed in a subcostal location and scanning is usually performed with thepatient in deep suspended inspiration in order to lower the liver. The best images of thediaphragmatic portion of the liver are usually obtained with steep cephalad angulation of thetransducer.

Intercostal scanning may be necessary if the patient is too full of gas or if the liver is smalland too high for adequate subcostal scanning. Moving the patient from the supine into theLPO or LLD positions may cause the liver to fall to a lower position and it often rearrangesthe gas thereby

enhancing the scanning procedure. Intercostal scanning provides scans inthe coronal plane.

A real time transducer with a small foot print and a wide field of view is generally thepreferred equipment. This enables easy subcostal and intercostal scanning. As the liver isa large organ, the optimal transducer should provide focusing from near to far field (Brwin reference name).

3.8.3. Equipment used for the data collection:

An U/S machine , having the same probe (curve linear array) with the same frequency (3.5 to 5MHz):

1 - Snoace x4.

2-Toshiba, Xario200.

3.9. Data analysis:

After collecting , the data sheets was coded, classified and analyzed by statistical package for social sciences program of computer (SPSS). The complex tables was used in the analysis, the frequences was calculated and was carried out the relationship between different variables and the important statistical indicators were drawn from the study.

3.10. Ethical considerations:

No part of this study relies on data which normaly be collected from routine scaning. All patients are informed,both by the researcher and by their referring physician,that the result of examination will form part of research project. no patient identification or individual patient detail will bublished,and all specific information relating to patient's identities will be protected in the same way.

3.11. Inclusion and Exclusion Criteria:

3.11.1.Inclusion Criteria:

1. normal patient with normal liver findings**.**

2. Volunteerwith normal liver findings**.**

3.11.2.Exclusion Criteria:

1. Patient with abnormal liver findings.

Chapter four

Chapter Four

The Results

Table (4.1) frequency distribution of age:

Age group	Frequency	Percent	Valid Percent	Cumulative Percent
5-15 years	6	6.7	6.7	6.7
16-25 years	24	26.7	26.7	33.3
26-35 years	17	18.9	18.9	52.2
36-45 years	12	13.3	13.3	65.6
46-55 years	3	3.3	3.3	68.9
56-65 years	11	12.2	12.2	81.1
66-75 years	4	4.4	4.4	85.6
more than 75 years	13	14.4	14.4	100.0
Total	90	100.0	100.0	

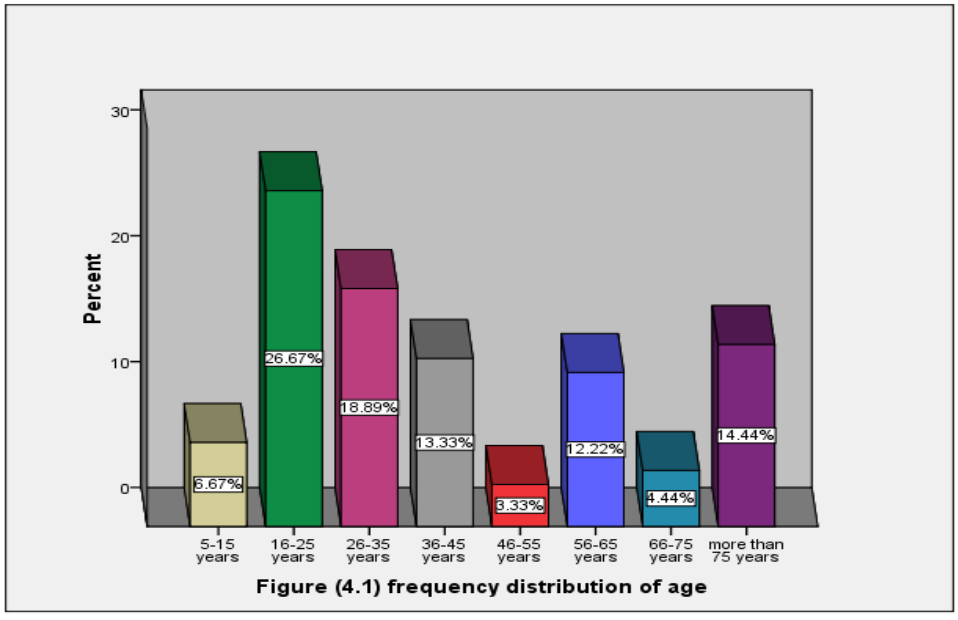


Figure (4.1) frequency distribution of age

Table (4.2): frequency distribution of gender:

	Frequency	Percent	Valid Percent	Cumulative Percent
Female	45	50.0	50.0	50.0
Male	45	50.0	50.0	100.0
Total	90	100.0	100.0	

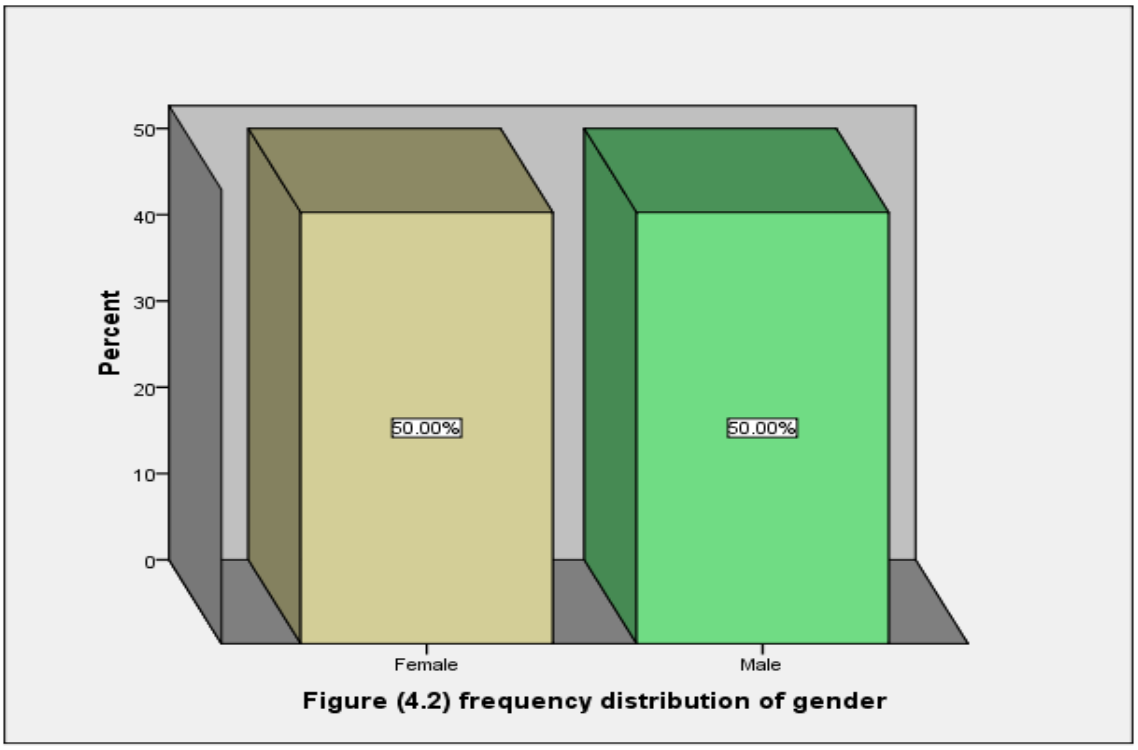


Figure (4.2) frequency distribution of gender

Table (4.3) frequency distribution of weight:

Weight	Frequency	Percent	Valid Percent	Cumulative Percent
20- 40 kg	3	3.3	3.3	3.3
41-60 kg	25	27.8	27.8	31.1
61-80 kg	50	55.6	55.6	86.7
81-100 kg	12	13.3	13.3	100.0
Total	90	100.0	100.0	

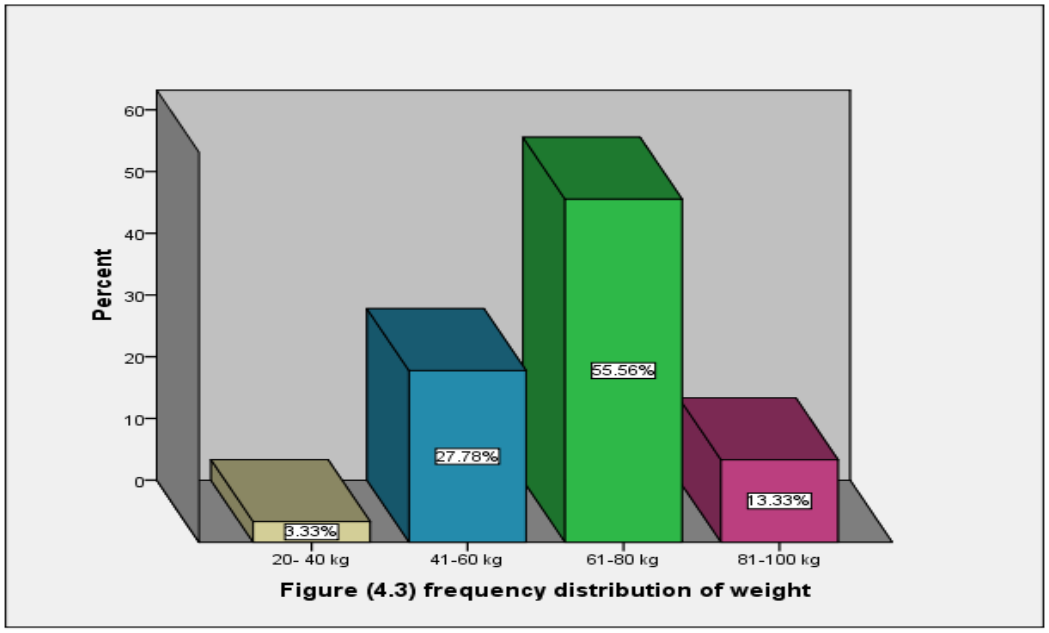


Figure (4.3) frequency distribution of weight

Table (4.4) frequency distribution of caudate lobe measurement:

Caudate measurement	Frequency	Percent	Valid Percent	Cumulative Percent
3-4cm	4	4.4	4.4	4.4
4.01-5.0 cm	42	46.7	46.7	51.1
5.01-6.0 cm	36	40.0	40.0	91.1
6.01-8.0 cm	8	8.9	8.9	100.0
Total	90	100.0	100.0	

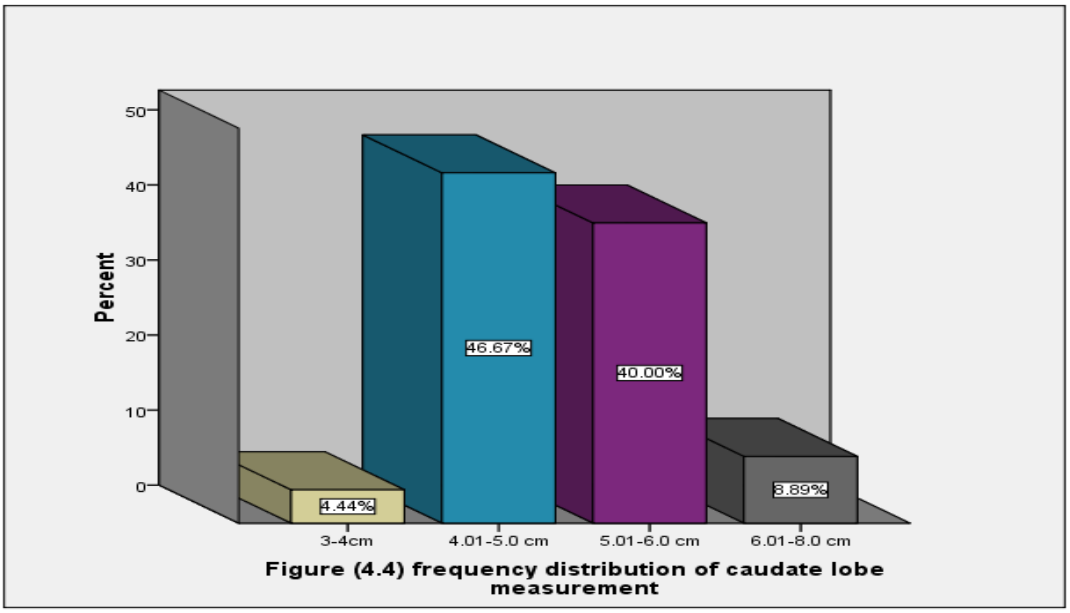


Figure (4.4) frequency distribution of caudate lobe measurement

Table (4.5) frequency distribution of right lobe measurement

RLL measurement	Frequency	Percent	Valid Percent	Cumulative Percent
10-12 cm	12	13.3	13.3	13.3
12.1 -14 cm	74	82.2	82.2	95.6
more than 14 cm	4	4.4	4.4	100.0
Total	90	100.0	100.0	

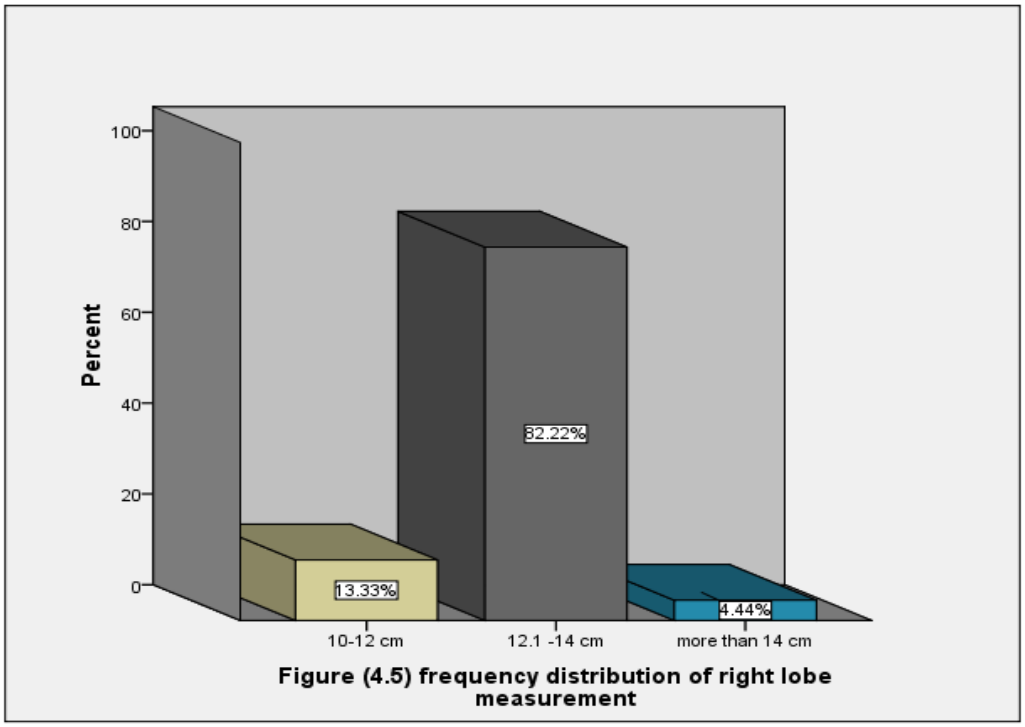


Figure (4.5) frequency distribution of right lobe measurement

Table (4.6) frequency distribution of caudate to right lobe ratio:

CL\RL ratio	Frequency	Percent	Valid Percent	Cumulative Percent
0.3-0.4	51	56.7	56.7	56.7
0.41-0.5	35	38.9	38.9	95.6
0.51-0.6	4	4.4	4.4	100.0
Total	90	100.0	100.0	

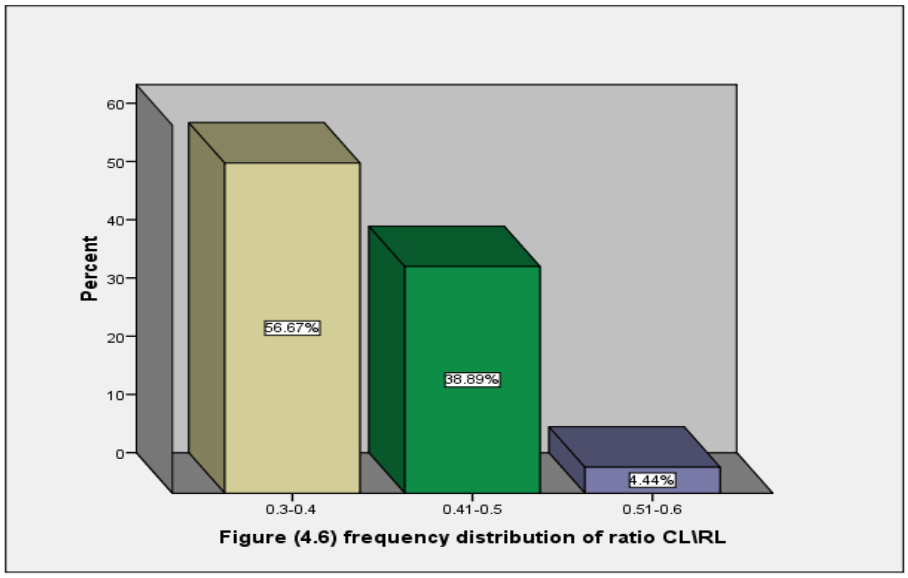


Figure (4.6) frequency distribution of ratio CL\RL

Table (4.7) Descriptive Statistics, minimum, maximum,means, std. Deviations for age, weight and measurement of right,caudate and caudate to right lobe ratio

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	90	7.00	92.00	42.1222	23.87271
Weight	90	20.00	98.00	65.6222	13.85525
Caudate lobe\cm	90	3.90	6.66	4.9480	.75072
Right lobe \cm	90	10.00	14.60	12.8002	.83618
CL\RL ratio	90	.31	.58	.3880	.06400
Valid N (listwise)	90				

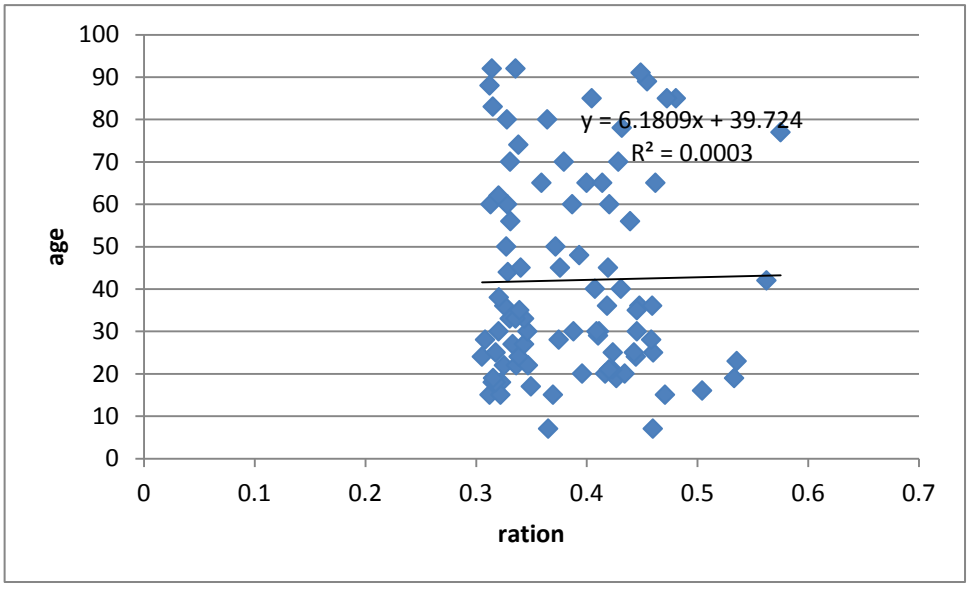


Figure (4.7) scatter plot for prediction of relationship between age and ratio

Table (4.8)correlation between age ,weight and measurement of right ,caudate and caudate to right lobe ratio

		Age	weight	Caudate	Right	Ratio
Age	Pearson Correlation	1	.535**	.044	.066	.017
	Sig. (2-tailed)		.000	.684	.536	.877
	N	90	90	90	90	90
Weight	Pearson Correlation	.535**	1	.196	.373**	.023
	Sig. (2-tailed)	.000		.064	.000	.832
	N	90	90	90	90	90
Caudate	Pearson Correlation	.044	.196	1	.109	.886**
	Sig. (2-tailed)	.684	.064		.306	.000
	N	90	90	90	90	90
Right	Pearson Correlation	.066	.373**	.109	1	-.361**
	Sig. (2-tailed)	.536	.000	.306		.000
	N	90	90	90	90	90
Ratio	Pearson Correlation	.017	.023	.886**	-.361**	1
	Sig. (2-tailed)	.877	.832	.000	.000	
	N	90	90	90	90	90
**. Correlation is significant at the 0.01 level (2-tailed).						

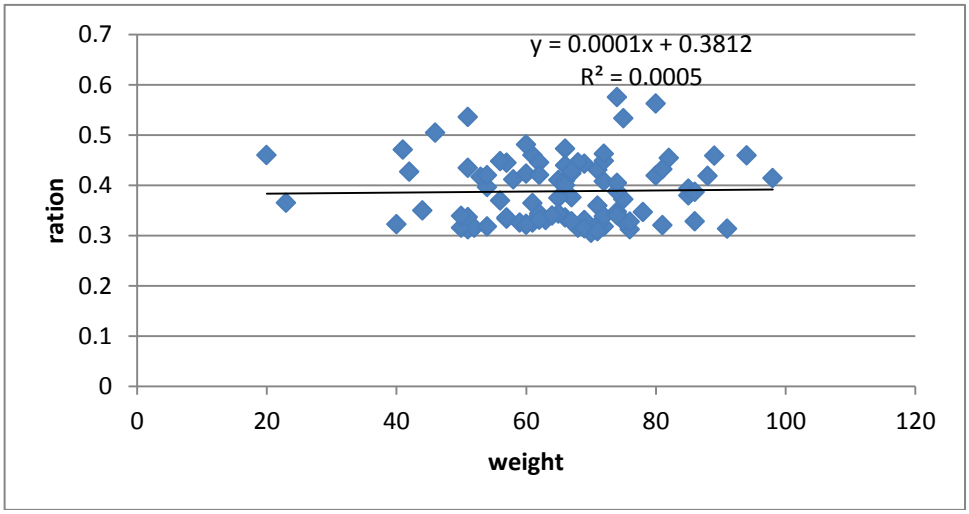


Figure (4.8) scatter plot for prediction of relationship between weight and ratio

Table (4.9) Descriptive Statistics, minimum, maximum, means, std. Deviations for age, weight and measurement of right, caudate and caudate to right lobe ratio for male:

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Age	45	15	92	48.47	26.475
Weight	45	42.00	98.00	67.2889	11.46858
Caudate \cm	45	4.00	6.66	4.9393	.80547
Right \cm	45	10.40	14.47	12.8249	.79062
Ratio CL\RL	45	.31	.58	.3866	.06826
Valid N (listwise)	45				

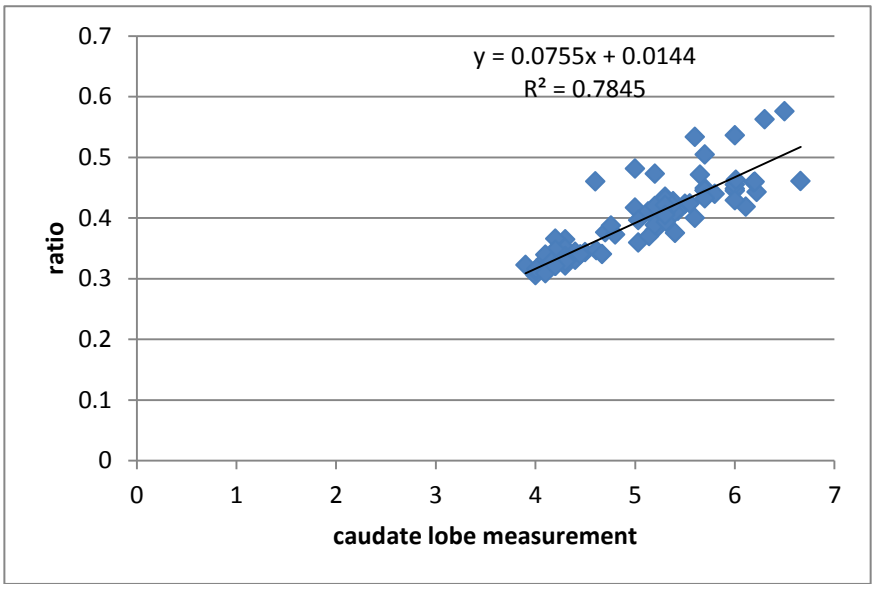


Figure (4.9) scatter plot for prediction of relationship between caudate lobe measurement and ratio

Table (4.10) Descriptive Statistics, minimum, maximum, means, std. Deviations for age, weight and measurement of right,caudate and caudate to right lobe ratio for female:

Variables	N	Minimum	Maximum	Mean	Std. Deviation
Age	45	7	85	35.78	19.222
Weight	45	20.00	94.00	63.9556	15.84578
Caudate \cm	45	3.90	6.20	4.9567	.70073
Right \cm	45	10.00	14.60	12.7756	.88767
Ratio CL\RL	45	.31	.54	.3895	.06018
Valid N (listwise)	45				

Chapter Five

Chapter Five

Discussion, Conclusion, Recommendations:

5.1. Discussion:

This was a cross sectional study that carried out to assess the ratio between the caudate and right liver lobes sonographicallyamong normal Sudanese population at hospitals of Omdurman teaching hospital and AlzaiemAlazhari ultrasonic clinic.This study applied among 90 participants.

The participant's age are ranged from 7 to 92 years with the mean age 49.5 years.

In this study, the reference curves of the ratio between the length of right and caudate lobes of liver was generated. This curves showed that there is no relation between participant age and caudate to right lobes ratio and no significant relation with participant weight and gender.

These results are in line with the study conducted by Widanagama, M.A., L.B.L. Prabodha, K.N. Palahepitiya, B.G. Nanayakkara and concluded that there was a strong relation between participant age and caudate to right lobes ratio.

The study found that the caudate to right liver ratio in Sudanese ranging from 0.31 to 0.58 with the mean of 0.38+or – 0.064 according to the study, the maximum and minimum length of caudate lobe obtained was (3cm and 8cm) with average 5.5cm respectively,the maximum and minimum length of right lobe obtained was (10cm and 14.6cm) with average of 12.8cm respectively,these results are in line with study conducted by Neel Kamal Arora1, StutiSrivastava, MahboobulHaque, AbeerZubairKha, Karamvir Singh which concluded that Vertical length of caudate lobe 3.38 - 7.03 cm average 5.03 cm, Vertical length of right lobe 9.52 - 13.63 average cm 7.79 cm Ratio of caudate to right lobe 0.07-0.29 average 0.16.

5.2. Conclusion:

Reference range for caudate lobe length was 3-8 cm, right lobe length was 10-14.6 cm and the ratio between the two lobes has been generated as 0.31 to 0.58 with mean of 0.388 + or - 0.06. The study found that there was no relation between participant age and caudate to right lobes ratio and no significant relation with participant weight and gender

3.5. Recommendations:

- Further study should be done to take portal vein flow, measurement and direction in addition to other variable also branches of portal vein.

References:

David Waul. MD FACP 12/2004.

Guyton and Hiel – Textbook of Medical Physiology 10th ed. W .B. Saunders Company 2004.

Harsh Mohan – Textbook of Medical Physiology 4th ed. 2007.

http://medcastle.com 24.10.2009.

Michel A. Gon et al. 2006. Caudate Rt Lobe Ratio in Diagnosis with Ultrasound in schistosomamansoni.

Mohamed A. Allah Abdo.2011 (MSc.) Sudan University. Evaluation of caudate lobe and Rt hepatic lobe ratio in Pt with schistosomamansoni.

Palmers – P .E.D .Manual of Diagnostic Ultrasound 3rd ed.1999.

Richard S. snell. Clinical Anatomy 7th ed. 8 Lippicott Williams and wilkins ,AwoltersKluwe Company 2004.

Richard S. snell. Clinical Anatomy 7th ed. 8 Lippicott Williams and wilkins ,AwoltersKluwe Company 2004.

Robbin'sCoton. Pathology Basis of Disease 7th ed. International edition 2004.

Roger War Wick. Peter. L. Gray 35th ed. International edition 2005.

Sandra. Hogen – Ansert. Textbook Diagnostic Ultrasonography 5th ed. 2002.

U/S Atlas of Disease Processes.By Caroln. Krebs, Vishant. Cigananal ,Ronald. Eisenbeny.

WHO Report 5/2014.

Appendix A

Sudan University of Science and Technology

College of Graduate studies

Sonographic Evaluation of Caudate Lobe and Ratio in Normal Sudanese Right Lobe

Data Collection Sheets

- Age ( )
- Gender Male ( ) Female ( )
- Weight ( )
- Caudate Lobe Size ( )
- Right Liver Lobe Size ( )
- Ratio ( )

Appendix B

Image1

Sagital scan Female 25 years

Show CL5.6cm RL13.1cm

Craniocaudal

Image 2

Sagital scan female 65years

Show CL5.03cm RL 14cm

Craniocaudal

Image 3

Sagital scan Female 19Years

Show CL5.4cm RL12.6cm

Craniocaudal

Image.4

Sagital scan female 15years

Show CL5.6cm RL12cm

Craniocaudal

Image 5

Sgital scan female 65years

Show CL 6cm RL 13.8 cm

Craniocaudal

Image 6

Sagital scan male 65years

Show CL5.4cm RL 12.4cm

Craniocaudal

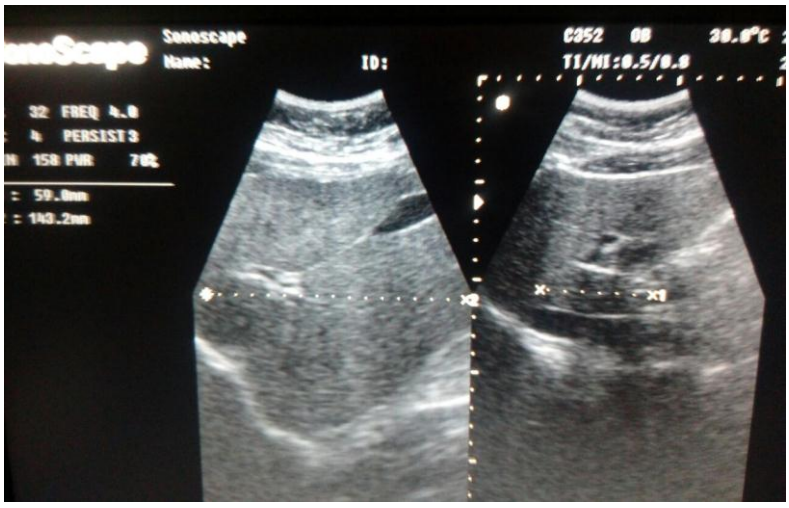
Image 7

Sagital scan male 65years

Show CL 5.3cm RL 12.6cm

Craniocaudal

Image 8



Sagital scan female 36years

Show CL 5.9cm RC14.3cm

Craniocaudal