بسم الله الرحمن الرحيم

Sudan University of Science and Technology

Collage of Graduate Studies

Study of Fatty Liver in Sudanese using Ultrasonography

دراسة التدهن الكبدي لدى السودانيين بإستخدم الموجات فوق الصوتيه

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

BY

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الآية

أعوذ بالله من الشيطان الرجيم

بسم الله الرحمن الرحيم

لَا تَعْمَلُونَ مِنْ عَمَلٍ إِلَّا كُنَّا عَلَيْكُمْ شُهُودًا إِذْ تُفِيضُونَ فِيهِ)

صدق الله العظيم

سورة يونس الايه 61

Dedication

To:

My parents

My family

My wife

My colleges

& and all my teachers

Acknowledgement

First my acknowledgement and great fullness at the beginning and end to ALLAH

Then, my special gratitude to my supervisor **Dr Mona Ahmed**; who do her best helping and guidance I am very grateful to all my teachers in all educational level.

Finally specially thanks for Dr Ahmed Mustafa, Dr Abdurrahman. M. Nor and Dr Mohammed .M. Omer**.**

List of Abbreviations

Abb	Word
ASH	alcoholic steatohepatitis
FLD	Fatty liver disease
LPV	Left portal vein
NAFLD	Non alcoholic fatty liver disease
NASH	Non alcoholic steatohepatitis
PV	Portal vein
US	Ultra sound
RPV	Right portal vein
NAFLD	Non alcoholic fatty liver disease
NASH	Non alcoholic steatohepatitis
CBD	Common bile duct
MPV	Middle portal vein
US	Ultra sound
DM	Diabetes mellitus
HTN	Hypertension
CL	Caudate Lobe
IVC	Inferior vena cava

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ABSTRACT

The fatty liver is one of diseases that can be discovered when performing routine abdominal ultrasound and noted that its prevalence increased. Although of its wide prevalence and serious prognosis, there was no previous study determined the prevalence of fatty liver in Sudanese.

The main objective of this study was to know the prevalence of fatty liver disease in adult Sudanese using ultrasonography; linking it by obesity. One hundred and fourteen patients aging between 18 to74 years were scanned at the year of 2015 attended to the Ribat Universal Hospital. (Khartoum Sudan) for routine abdominal ultrasound. Coronal, axial and longitudinal scans done to well prepared patients at supine position with hold inspiration using siemnces (Germany) ultrasound machine with 2-5 mega hirz convex probe applying enough capable gel.

This study revealed that 31 (27.2) % patients out of 114 patients showed fatty liver disease; 23patients (77.4) % out of them associated with obesity. The study also revealed that the highest frequency of fatty liver disease among the age group (35-44) years by percentage of 34.6 %. Regarding the gender fatty liver disease was more common in male (29.4) % comparing with female (25.4) %. Four out of four patients (100) % were alcoholic abuser. Six diabetic patients (54.5) % out of 11 was showed fatty liver comparing with five patients (45.5) % none. The high life style patients showing 16 patients with fatty liver out of 42 the percentage was 38% on the other hand the low life style patient's percentage was only 20.8%.

Finally the prevalence of fatty liver disease in this study is 27.2% and has directly link to obesity.

خلاصة البحث

التدهن الكبدي من الامراض التي يتم إكتشافها عند اجراء فحوصات الموجات الصوتيه العادية للبطن وقد لوحظ ازدياد نسبة المصابين بهذا المرض.وبالرقم من إنتشاره وخطورة مئالاته لا توجد دراسه سابقة تحدد نسبة إنتشاره بين السودانيين.

الهدف الاساسي من هذه الدراسه هو معرفه نسبة إنتشار التدهن الكبدي لدى السودانيين البالغين بإستخدام التصوير بالموجات فوق الصوتيه ومدى إرتباط هذا المرض بالسمنة. تم الكشف علي 114 مريض تتراوح أعمارهم مابين (18-74)سنه في العام 2015م حضروا لمستشفى الرباط الجامعي.الخرطوم-السودان لغرض إجراء فحص الموجات الصوتيه العاديه للبطن. تم فحصهم طوليا ومقطعيا وتاجيا –وهم محضرين تحضيرا جيدا لهذا الغرض-في وضعية الإستلقاء علي الظهر مع أخذ نفس عميق وإستخدام كمية جل مناسبه. تم إجراء الفحص بإستخدام جهاز موجات صوتيه ألماني الصنع ماركة (سيمنس) تردمِسبَارِهِ ما بين 2 الى 5 ميقا هيرز.

أظهرت الدراسةأنَّ 31 مريضاً (بنسبة27.2%) من العدد الكلي (114) مصابون بالتدهن الكبدي 23 منهم (بنسبة 77.4%)مصحوباً بالسمنةيأضاً ظأهرت الدراسه أنَّ أعلى تردد لمرض التدهن الكبدي ظهر في الفئة العمريه (35-44)سنة بنسبة 34.6%. إعتباراً للنوع فإنَّ التدهن الكبدي ظهر كأثر شيوعاً عند الذكور(29.4%) منه عند الإناث(25.4%).شملت الدراسة أربعة أشخاص متعاطي كحول جميعهم أظهروا تدهنا في الكبد بنسبة(100%). عدد مرضى السكري الذين شملتهم الدراسه 11 مريض 6 منهم مصابون بالتدهن الكبدي بنسبة (54.5%)مقارنةً بمن ليس لديهم تدهن كبدي (5) مرضى بنسبة (45.5%)0المرضى ذووا المستوى المعيشي العالي, 16مريض منهم أظهر تدهنا في الكبد من ضمن 42 شخص بنسبة (38%) ،في الناحية الاخرى الأشخاص ذووا المستوى المعيشي المتدني بلغت نسبة التدهن الكبدي لديهم فقط (20.8%)0

ختاملاً نسبة إنتشار مرض التدهن الكبدي وفقلاً لهذه الدراسه هي 27.2% وله رابط مباشر مع زيادة الوزن.

CHAPTER ONE

1.1-Introduction

Fatty liver disease (FLD) is characterized by excessive fat accumulation in the liver (steatosis).It is a chronic liver disorder that can progress to hepatic cirrhosis, hepatic failure and even hepatocellular carcinoma. (Berardis et al 2014). The mechanism of FLD is unknown but involves the development of insulin resistant, inflammatory cytokine and oxidative stress .It is associated with obesity, physical inactivity, metabolic syndrome and life style. (Wilkins, et al 2013)

At present, accurate classification of FLD represents a significant challenges, it is an alarming health problem. The aim of the present study is to know the prevalence of the FLD in the Sudanese.

According to the guidelines of the European Association for the Study of Liver disease FLD can be divided into nonalcoholic fatty liver disease (NAFLD) and alcoholic fatty liver disease (AFLD) based of ethanol consumption. The gradually growing prevalence of diabetes mellitus, metabolic syndrome and obesity put the Sudanese population at risk of developing FLD. The diagnosis is usually made when FLD is noted on imaging examination such as ultrasound, computed tomography and magnetic resonance. Because US is noninvasive it plays a greater role on diagnosis. (Wilkins, et al 2013)

American study by Lopez Velazquez, etal.2014 explained that FLD was directly linked to increased obesity.

In this study I will study the target sample to explore the adult prevalence of FLD in Sudanese population by linking it to obesity.

1.2-statements of the problem:-

Fatty liver disease becomes a significant challenge public health which may be progress to cirrhosis, end stage liver disease and even to hepatocellular carcinoma. (Berardis, etal.2014)

1.3- Objectives:-

1.3.1-General objective

-To know the prevalence of FLD in Sudanese people.

1.3.2-specific objectives

-To find out common disorders associated with FLD.

-To know the relationship between FLD and obesity.

1.4-overview of the study

This study will cover five chapters, chapter one the introduction, chapter two the literature review, chapter three the material and methods, chapter four the results, chapter five discussion, conclusion, recommendation, references and appendix.

CHAPTER TWO

2.1-INTRODUCTION

The liver is the largest organ of the abdominal viscera, occupying a substantial portion of the upper abdominal cavity. It occupies the most of the right hypochondrium and epigastrium, and frequently extends into the left hypochondrium as far as the left lateral line (figure2-1). (Susan 2008). Throughout life the liver is reddish brown in colour, although this can vary depending upon the fat contents. Obesity is the most common causes of excess fat in the liver (also known as steatosis): the liver assumes a more yellowish tinge as its fat content increased. The texture is usually soft to firm, although it depends partly on the volume of blood, the liver contains and the fat contents. (Susan 2008).

2.2-LIVER ANATOMY

The liver is the largest gland of the body, weighting of 1200-1600g, it wedge-shape and covered by Gilson's capsule. As the body grow from infancy to adulthood the liver rapidly increases in size. The period of the plateau around 18 years and is followed by a gradual decrease in the liver weight from middle age. (Susan 2008).

The liver is an inter peritoneal structure situated in the right upper quadrant of the abdomen and bounded superiorly by the diaphragm (F2-1). The size and shape of the liver are highly variable. The posterior surface of the right lobe of the liver is indented by the right kidney. The inferior vena cava also lies posterior to the liver substance but frequently has a short intra hepatic course just before the right atrium. The hepatic flexure of the colon lies adjacent to the free margin of the right lobe, but does not indent it. The left lobe is highly variable in size and shape, at time extending well into the left upper quadrant, while in other patients it extends to mid line. The inferior margin lies close to

the body and antrum of the stomach, and frequently lies adjacent to the body of the pancreas, splenic vein and splenic artery.(Rumak et al 2005)

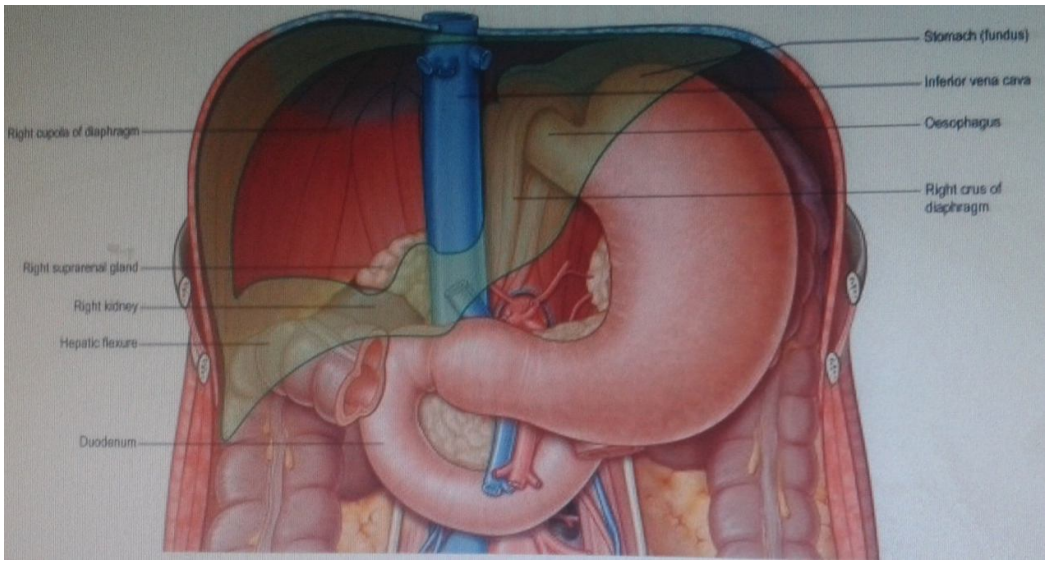


Figure (2-1):The bed of the liver (Susan 2008)

2.2.1-Segmental anatomy of the liver

In traditional segmental anatomy the liver has three Lobes: The right lobe-which is divided into anterior and posterior segments, the left lobe-which has medial and lateral segment and the caudate lobe-which is considered a separate lobe. The key anatomic structures useful in determining the relative positions of the hepatic segments are portal veins, hepatic veins and hepatic ligaments. (Rumak et al 2005)

2.2.1.1-The major hepatic veins and intra hepatic portal structures:-

2.2.1.1.1-The main lobar fissure divides the liver into its true anatomic right and left lobes. This fissure is found in a line joining the gall bladder fossa with the (portal vein) inferior vena cava. Both of these structures are easily seen by ultrasound but determining the plane of line joining them is difficult figure (2-2).

2.2.1.1.2-The middle hepatic vein courses in the cephalic portion of the main lobar fissure. On transverse scans it will be apparent that the main lobar

fissure separates the medial segment of the left lobe from the anterior segment of the right lobe

2.2.1.1.3-The right intersegmental fissure divides the anterior and posterior segments of the right lobe. The anterior and posterior divisions of the right portal vein course centrally within these segments. Along branch of the right hepatic vein which is commonly observed on both transverse and longitudinal sonograms, courses within the right segmental fissure.

2.2.1.1.4-Left inter segmental fissure divides the left lobe into medial and lateral segments. The left segmental fissure can be considered as having cranial, middle and caudal thirds.

2.2.1.1.4.1-cephalic third: The left hepatic veins courses within the cranial aspect of the left inter segmental fissure dividing the cephalic portion of the medial and lateral segments of the left hepatic lobe.

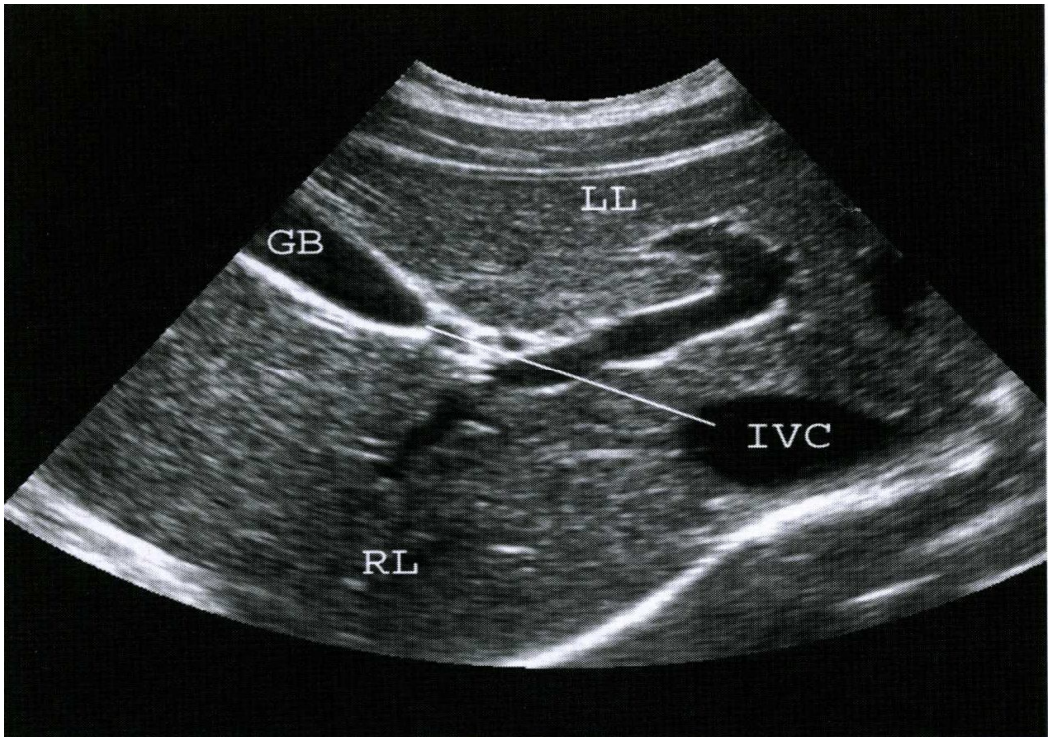


Figure (2-2): Ultrasound image of the main lobar fissure (Rumak et, al2005) (GB= gall bladder, LL= left lobe, RL=right lobe and IVC=inferior vena cava)

2.2.1.1.4.2-cuadal third: the ligamentum teres, hepatic or round ligament of the liver divides the caudal portion of the medial and lateral segments of the

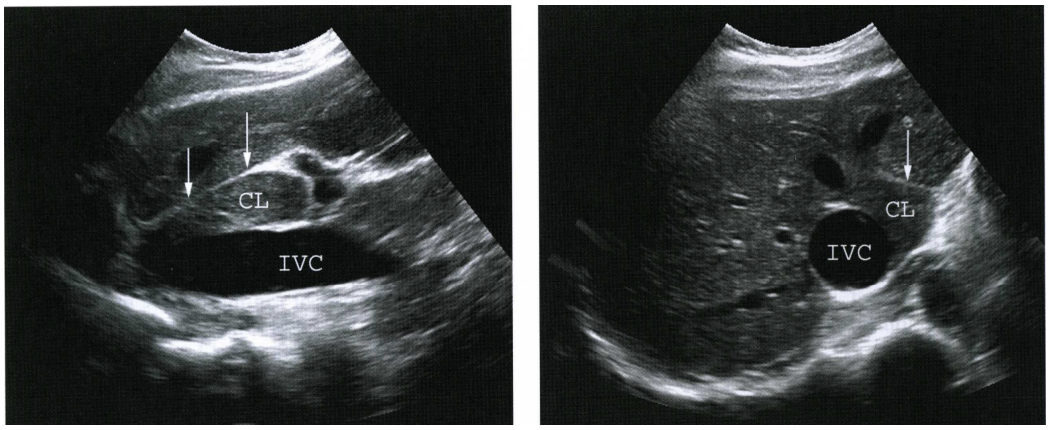
left hepatic lobe. It runs in the inferior or free edge of the falciform ligament, and is frequently noted on the ultrasound scanning. The round ligament is the obliterated left umbilical vein and is seen on transverse scans as a rounded structure generating high amplitude echoes and often has acoustic shadow. This sonographic appearance can readily be mistaken for a highly echogenic tumor nodule, unless one is aware of the typical appearance and location of the round ligament. It can be reliably distinguished from tumor because of its linear shape in longitudinal plane, extending from the anterior inferior surface of the liver posteriorly to the left portal vein at the porta hepatis. (Rumak et, al2005)

2.2.1.1.4.3-The middle third of the left inter segmental fissure can be identified by observing the course of the left portal vein (LPV). The LVP initially courses along the caudate lobe's anterio-inferior surface and generally towards the patient's left. The LPV then makes abrupt anterior run. This portion is the umbilical or ascending of the LPV which end in the bifurcation into medial and lateral branches. This change in course by the ascending segment of the LPV occurs in the left inter segmental fissure and can be used as an indication of the middle third of the fissure that divides the medial and lateral segments of the left lobe. (Rumak et, al2005)

2.2.1.2-The caudate lobe

Is considered a separate lobe since it receives portal venous and hepatic arterial blood from both right and left systems. The caudate lobe veins drain directly into the IVC via several small veins. The caudate lobe is in the posterior portion of the liver lying between the IVC and the fissure of the ligamentum venosum, superior to the level of the porta hepatis. This fissure may normally be seen on both transverse and longitudinal scans. The ligamentum venosum (the remnant of the ductus venosus) is visible. The tissue lying between these fissures and the caval fossa represents the caudal

lobe parenchyma which lies superior to bifurcation of the main portal vein. (Rumak et, al2005)



A B

Figure (2-3): A Longitudinal B Axial ultrasound image of the caudate lobe (Rumak et, al2005) (CL=caudate lobe, IVC=inferior vena cava)

The medial segment of the left lobe represents the quadrate lobe in traditional anatomy.

2.2.2-Couinaud classification

The widely accepted Couinaud system describes liver segment anatomy. This classification, modified by Bismuth (segment IV a, b), is based on eight segments, each of which has its own arterial and portal venous vessel architecture (Glisson's triad) for vascular inflow, outflow and biliary drainage. As a result of this division into self-contained units, each can be resected (alone or in groups) without damaging the remaining segments because the vascular inflow, outflow and biliary drainage are preserved. Depending on the three-dimensional volume orientation of the liver (longitudinal or oblique), the interpretation of the Couinaud classification can be inconsistent in the literature. While the portal vein plane has often been described as transverse, it may also be oblique because the left branch runs superiorly and the right runs inferiorly. In addition to forming an oblique transverse plane between segments, the left and right portal veins branch superiorly and inferiorly to project into the centre of each segment The most

unique of the Couinaud segments is segment I, which is part of the caudate lobe (sometimes called the Spiegel lobe). This segment is located posteriorly and adjacent to segment IV. Its medial and lateral boundaries are defined by the IVC and ligamentum venosum (remnant of duct of Arantii in the foetus), respectively, which runs caudally to the hepatic artery and can be identified in this way. The caudate lobe has a variable vessel anatomy that differs from the rest of the liver; its portal inflow is derived from both the left and right branches of the portal vein, and it has its own short (and usually small) hepatic veins that connect directly to the IVC. Owing to the variable and extensive crossing of vessels, and its position relative to the liver hilum and IVC, segment I is frequently not resected, unless absolutely necessary. A more detailed description can be found in the EFSUMB Course Book on Ultrasound. Surgical resections proceed along the vessels that define the peripheries of the segments. In general, this means resection lines are parallel to the hepatic veins to preserve the hepatic arteries, portal veins and bile ducts that provide vascular inflow and biliary drainage through the centre of the segment. (Rumak et, al2005)

2.2.3-The porta hepatis:-

The entrance of the portal vein, hepatic artery and common bile duct called porta hepatis it represents the hilum of the liver this situation extends to every microscopic unit of the liver. (Rumak et, al2005)

2.3-LIVER VASCULAR SUPPLY

The liver takes blood from portal vein (80%) which comes from digestive system and hepatic artery (20%) which carries oxygenated blood.

The liver gives away the blood by three hepatic veins emptying into the inferior vena cava.

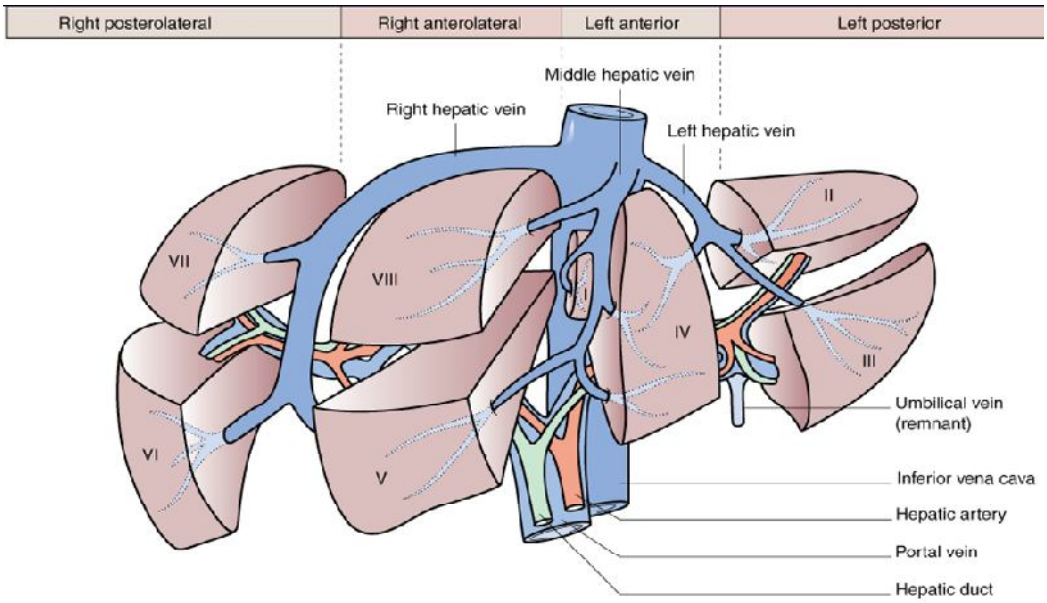


Figure 2-4 Schematic representation of segments of the liver according to vascular anatomy (anterior view) (Tival 2012)

2.3.1-Fundamental vascular rule

Hepatic veins are **inter**segments (between segments).

Portal veins are **intra** segments (within segments). Hepatic artery and bile ducts travel with portal vein forming the portal triads. (Rumak et, al2005)

2.3.2-Liver lobules

Between columns of hepatic cells are irregular shaped vascular channels called sinusoids. Each sinusoid contains about 80% portal venous blood and 20% hepatic arterial blood. The hepatic cells are contact with the sinusoid blood scatter along the column of the liver cells uniformly, but sparsely about the Kupffers cells these are phagocytes cells (i.e. are capable of ingesting foreign materials) that are consider part reticulo endothelial system.

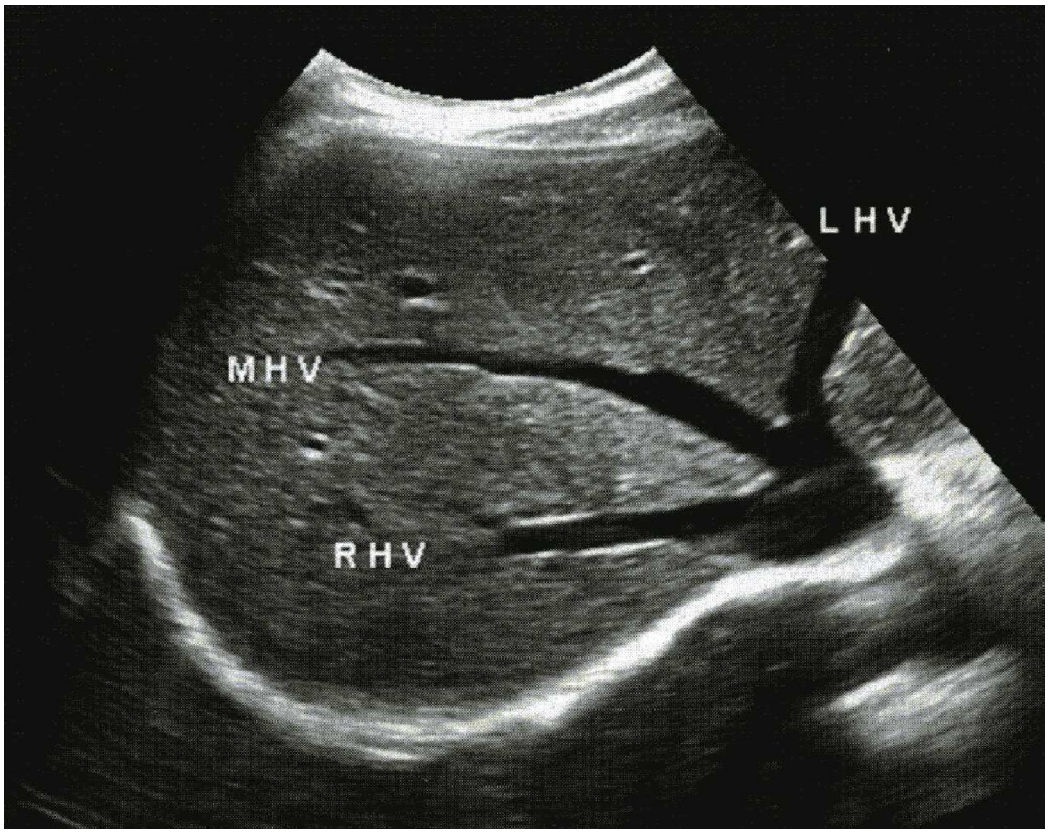


Figure (2-5) ultrasound image of hepatic veins. (Rumak et, al2005)

RHV=right hepatic vein, MHV=middle hepatic vein LHV=left hepatic vein

The bile canaliculi locate between the two layers of the liver cell column. Bile librates from the hepatic cells into the canaliculus and will then flow towards a larger bile duct which is located at the outer edge of the liver lobule. In this manner the bile always is separated by one row of the liver cells from the sinusoid. Also located at the edge of the lobule, beside the bile ducts, are branches of the portal vein and hepatic artery. These three structures are called the portal triads. Many portal triads serve a single lobe.

Blood percolates through the liver sinusoid towards the central vein. The hepatic and Kupffur cells extract substances from the blood and liberate substances into the blood. Once the blood reaches the central veinit should be cleansed of toxins and be rich in liver secretions such as heparin, fibrinogen, and prothrombin. Small central hepatic vein coalesce to form larger vessels so that eventually three large hepatic veins drain into the IVC. Bile canaliculi

coalesce to form progressively larger ducts until eventually two main bile ducts (each called a hepatic duct) join together in the porta hepatis area to form the common hepatic duct. The CHD is subsequently joined by the cystic duct from the gallbladder .together they form the common bile duct which drain into duodenum. (Davis 2007)

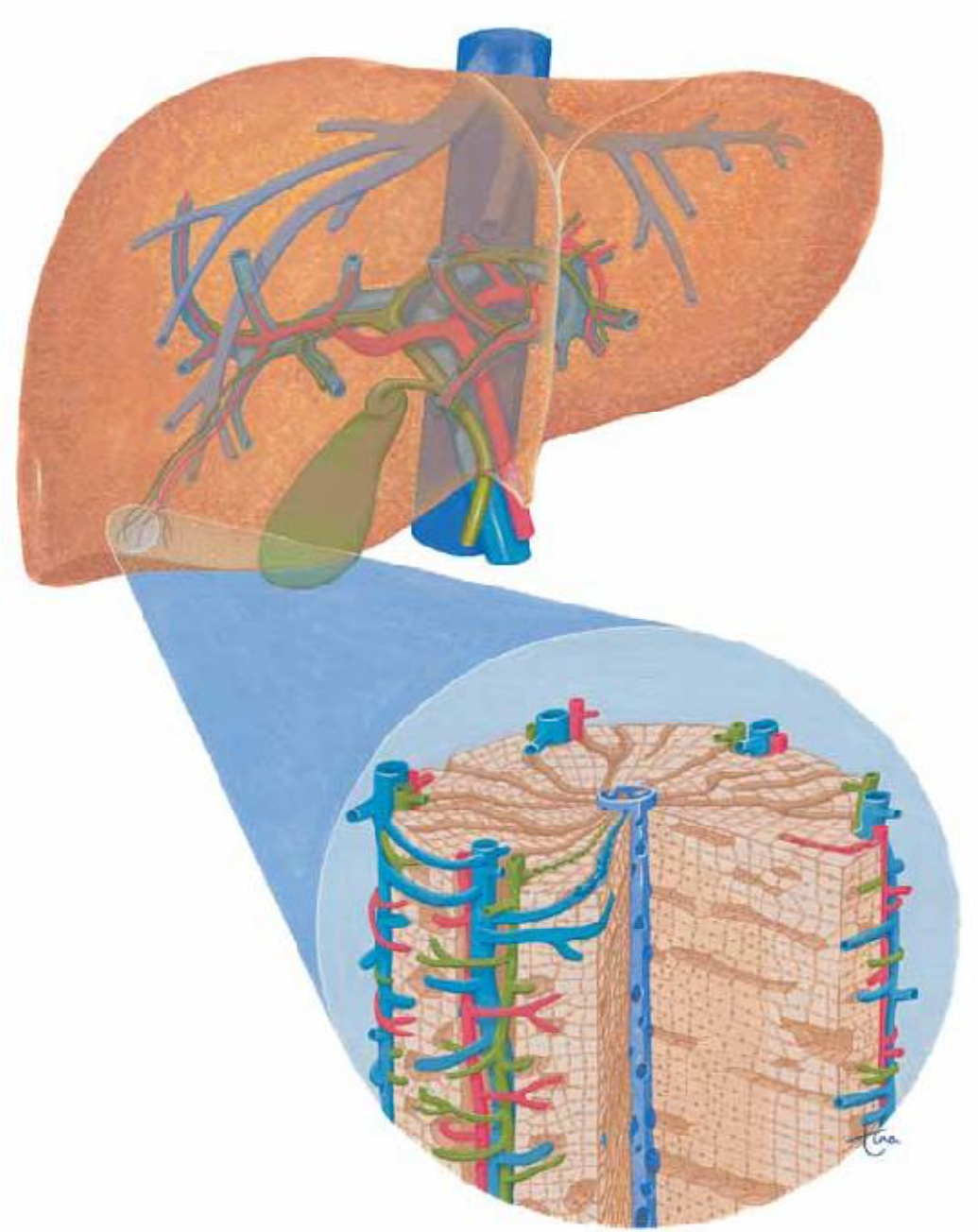


Figure (2-6) magnified view of one liver lobule (The liver and the GB with blood vessels &bile ducts) (Davis 2007)

2.4-Normal liver size and echogenicity

2.4.1-Texture and echogenicity (echo pattern)

The normal echogenicity of the parenchymatous organs in the upper abdomen is something fundamentally different in the different age groups. In young patients, adolescents and also in asthenic patient one sees a tendency of hypoechoic liver and pancreas than in obese and elderly patients. In addition to this weight and age dependence, there are also differences between the various organs. Normally the most echogenic is the spleen, followed by the liver and then the slightly hypoechoic renal cortex, and finally the very hypoechoic renal medulla. Our eyes distinguish relative differences (contrast) between the individual echogenicity but poorly identify its absolute values. Thus a direct measurement of the brightness of the organs in relation to one another in digital images would be advantageous but this is not practical. In conclusion the normal liver parenchyma is of medium homogenous echogenicity. It is usually slightly darker than the spleen and slightly brighter than the renal cortex, independent of age except in childhood. Liver surface and vessel borders are smooth and vascular architecture, with its classic branching dichotomy, is perceived as a harmonic and detailed aspect. The normal parenchyma image varies very little between individuals. (Christopher et al 2013)

2.4.2-Surface, outline

The normal liver surface should be smooth with no protruding lumps or indentations. The inferior liver border in the normal patient should have an acute angled edge**.** (Christopher et al 2013)

The upper border of the liver lies approximately at the level of the fifth intercostal space at the mid clavicular line. The lower border extends to or slightly below the costal margin. An accurate assessment of the liver size is difficult with real-time ultrasound equipments because of the limited field of the view. Gosink proposed measuring of the liver length in the mid hepatic

line. In 75% of the patients with liver length of greater than 15.5cm, Hepatomegaly is present. Measured the liver in longitudinal and anteroposterior diameter in both mid clavicular line and mid line and correlate these findings with gender, age, height, and weight and body surface area. They found that organs size increases with height and body surface area and decreases with age. The longitudinal diameter of the liver in the midclavicular line is 10.5 with 1.5cm (standard deviation).

The normal liver homogeneous, contain fine-level echoes and is either minimally hypoechoic or isoechoic compared to the normal renal cortex. The liver is hypoechoic compare to the spleen. This relationship is evident when the lateral segment of the left lobe is elongated and warps around the spleen. (Rumak et, al2005).

2.4.3-Size& measurement

The liver is very complex constructed and shaped organ. The measurement of the volume of the liver could be done by computed tomography with help of 3 dimensions reconstruction.

Exact measurement only important for scientific purpose the most important question whether there is a significant enlargement, or reduction of the normal liver size; acute liver poisoning, acute hepatitis, fatty liver, alcoholic steatohepatitis (ASH), non alcoholic steatohepatitis(NASH) or amyloidosis can lead to liver enlargement. One measurement of liver size is done in the mid- clavicular line from highest peak of the diaphragm down to the caudal liver end this has a maximum dimension 18 cm. another possibility to measure the liver is in the mid clavicular line to measure ventrodorsal dimension (depth) and cranio-caudal dimension (length). The maximum length is 15 cm and depth 13 cm; maximum for both dimensions together is 28cm (figure7) .in many diseases the caudate lobe larger than the rest. In the liver cross section, measurement of this lobe relative to rest, the quotient

should be normally less than 0.55 [Figure(2-7)&(2-8)] (Christopher et al 2013).

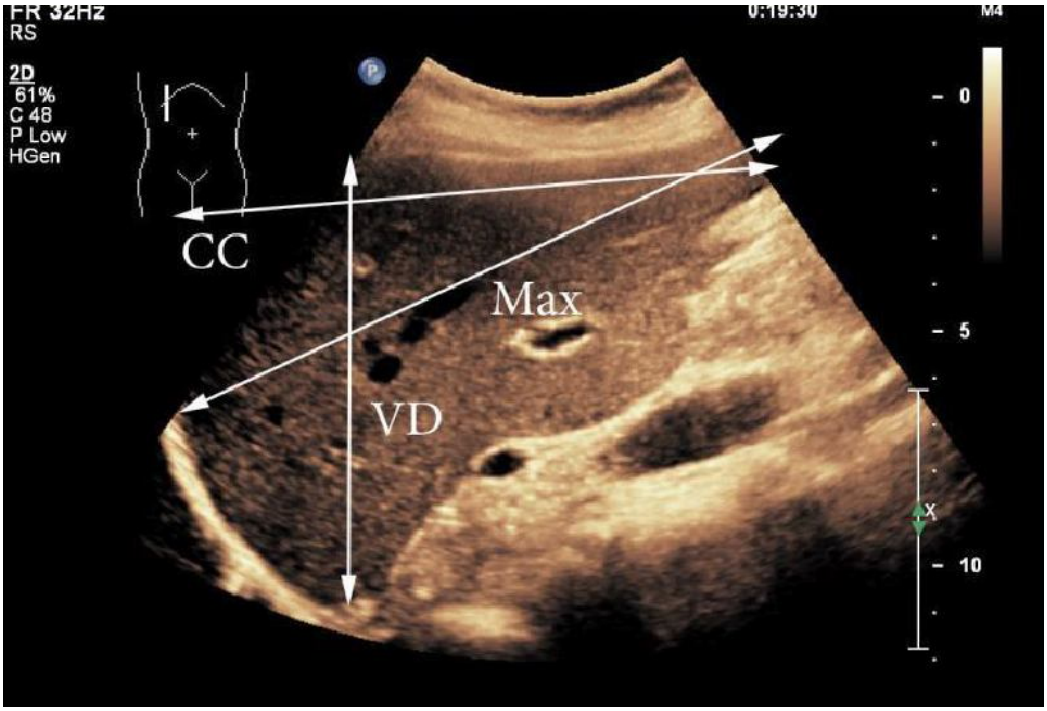


Figure (2-7) Measurement of the over line segments. (Christopher et al 2013)

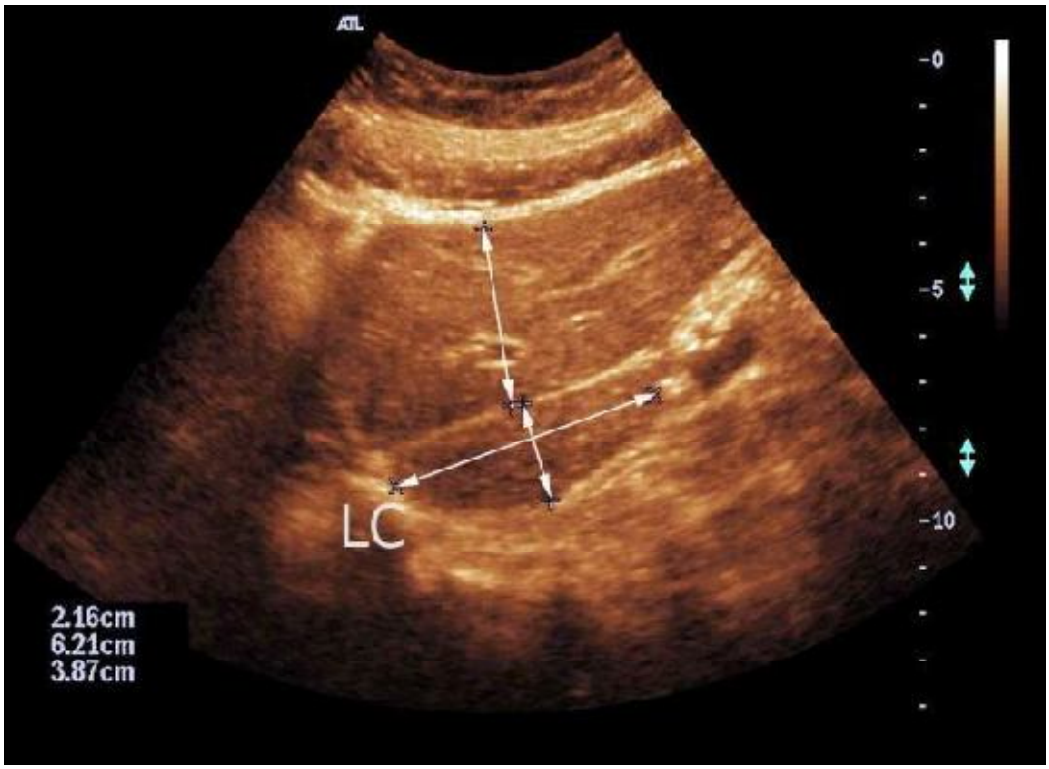


Figure (2-8) Measurement of the caudate lobe (Christopher et al 2013)

2.4.4-Normal variant

Knowledge of the normal ultrasound feature is highly important for a better understanding of the main spectrum of pathologies in which method is valuable (called clinical applications). It must be understood that ultrasound anatomy is only partially superimposed upon "classical anatomy". US can only visualize some anatomical structures; the method is actually a simplified of the reality. For example a number of structures such as the lymph plexuses, nervous plexuses, or structures of microvasculature are not accessible to ultrasound. Echography can visualize vascular and tubular structures only from the level of large and medium divisions, leaving apart those with a small caliper. The confidence when expressing deep located. The examiner's mind must build a virtual, tridimensional "projection" when represents anatomical structures seen on sonographic section. Liver anatomy, in spite of its complexity, can be simplified by using a minimal number of sections that have to be known and can be considered, "fundamental" sections. Once these section can obtained, achievement of intermediary sections, parallel to orthogonal sections together with sections taken under different angles, will lead to an exact understanding of what is , in the end, the sonographic expression of the liver. It is of high importance that the continuity of the identified structures is permanently demonstrated. It is obvious that the process is based on a large number of conducted investigations, accumulated personal experience thus being of critical importance. There for it is easier to use a systematic liver examination following evaluation criteria: position, size, shape and contour, surface (outline), texture and echogenicity (echo pattern), architecture, consistency (elasticity) and vascularity. (Christopher et al 2013).

2.5-FUNCTION OF THE LIVER

The liver performs a wide range of metabolic activities required for homeostasis, nutrition and immune defence. Here I will select some functions related to my study

2.5.1-Metabolic function

2.5.1.1-Fat metabolism: the liver removes fatty acid molecule from the blood and changes them into lipoproteins which are more readily used by the blood. The lipoproteins, which as their name tell us, are molecules of lipids and proteins, for the transport of fats in the blood to other tissues. The liver also synthesizes cholesterol and excretes excess cholesterol into bile to be eliminated in feces. Fatty acids are a potential source of energy, but in order to be used in cell respiration they must be broken down to smaller molecules. In the process of beta-oxidation, the long carbon chains of fatty acids are split into two-carbon molecules called acetyl groups, which are simple carbohydrates. These acetyl groups may be used by the liver cells to produce ATP or may be combined to form ketenes to be transported in the blood to other cells. These other cells then use the ketoses to produce ATP in cell respiration (Davis 2007)

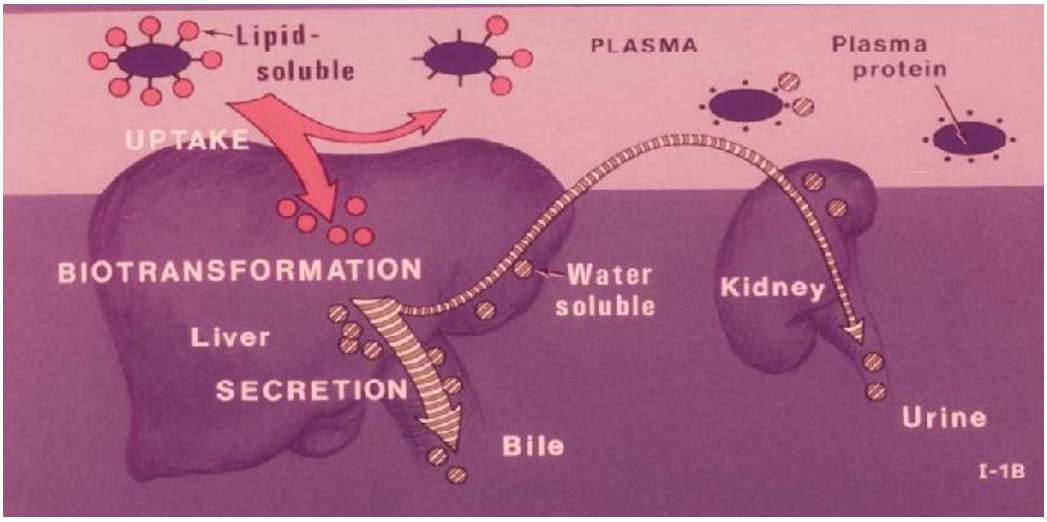


Figure (2-9) Hepatic removal of lipid soluble compound (Tival 2012)

2.5.1.2 Amino Acid synthesis: many of the liver function are achieved throw enzymes which it also manufactures. Enzymes called transaminase are stored in the liver and are used by the liver to move amino groups around from protein to protein as different amino acid are made. A separate aminotransferase (AST) and alanine aminotransferase (ALT) are two important enzymes that will back up into the bloodstream whenever there is acute hepatic cell damage or death. Therefore marked elevation of these transaminase in the serum are indicator of acute hepatic disorder. It is important to note that marked elevation of AST and ALT are nonspecific indictor of an acute hepatic disorder in that these can be elevated for variety of causes.

2.5.1.3 Protein metabolism: ammonia is formed from breakdown of protein; the liver removes this from the blood, and it then becomes a principle part of urea which excretes back to the blood. The kidneys remove urea from the blood and excrete it as part of urine.

2.5.1.4 Albumin synthesis: the liver manufacture albumin which is a large molecule found in the blood. Its role is to remain within capillary and attract back into the vessel. The same amount of fluid that left the vessel. Therefore the plasma leaves the capillary to become interstitial fluid. The albumin will attract into the vessel the correct amount of interstitial fluid to replenish the plasma lost. Albumin plays a significant role in maintaining the body's fluid balance.

Figure (2-10) Normal liver function-Tival 2012

Correct fluid balance means the total amount of body fluid it correct and it is distributed through the body's fluid compartments in the correct amount; the cytoplasm of the cell, the interstitial fluid and the blood plasma are the three fluid compartments. If the hepatic cells secrete too little amount of albumin the fluids will collect outside the vessels resulting in ascites, edema or plural effusion.

2.5.1.5 Fibrinogen, prothrombin and heparin synthesis: the liver manufactures the clot proteins fibrinogen and prothrombin and also the anticoagulant heparin.

2.5.1.6 Carbohydrate metabolism: the pancreatic hormones insulin and glucagon work in conjunction with glucose regulation by liver.

2.5.2- Production of bile

Bile is a fluid that contains bile salts cholesterol and small amount of bilirubin – waste products from destruction of the red blood cells. Mature RBC have a 120 days then engulfed by phagocytes in the spleen and liver. The iron in the heme is stored in the liver, the globin is broke down into

amino acid and reused and the pigment part of heme will be excreted by the liver as part of bile. Bile makes the duodenal contents alkaline so that the pancreatic enzymes will be efficient it also mix with the feces and will ultimately be eliminated from the body. Bilirubin obtained from the breakdown of RBCs by the spleen and called indirect or fat soluble. It is taken to the liver where along the liver bilirubin converted to the direct or water soluble. In this situation bilirubin work with bile salts and enables absorption of fat.

2.5.3-storege

The liver stores glycogen, fat, iron and several vitamins (A, D, B complex and k). The liver utilizes vitamin K to form prothrombin therefore people with liver disease will have longer clotting time.

2.5.4-detoxification of blood

The liver detoxified alcohol, drugs and steroid hormones therefore prolong abuse of alcohol and certain drugs can eventually destroy the hepatic cells. (Davis 2007)

2.6-PATHOLOGY

The pathology of the liver includes the following:-

2.6.1-Diffuse Liver Disease

These are changes which involve the entire liver producing an overall change in echogenicity and liver size. The most common abnormality observed is a generalized increase in the echogenicity of the liver parenchyma.

This appearance is typical of fatty infiltration or cirrhosis, a less common diffuse involvement of the liver is an overall decrease in echogenicity .Multiple hypo echoic poorly attenuating masses may be seen with primary non-Hodgkin’s lymphoma of the liver or lymphoma associated with AIDS. (Rumak et, al2005)

2.6.2-Infectous diseases:

2.6.2-1-Viral hepatitis These are viral diseases that affect the liver.

2.6.2-1.1-Hepatitis A -This is a common virus found in blood and feces during theacute stage. It is passed to another person on contaminated foods, fluids,utensils via the fecal/oral route. The incubation period is 2 to 6 weeks.

2.6.2-1.2-Hepatitis B - Hepatitis B is currently the world's most common cause of hepatitis1 Hepatitis B is spread via the body fluids, including blood, saliva, semen, vaginal fluid and tears, of a person with hepatitis B or a carrier of the virus. It is very much more infectious than AIDS, though it is passed on in the same way: by intimate body contact, including sexual intercourse (especially without a condom); by injecting drug-users sharing needles and other equipment; by tattooing, acupuncture or ear-piercing with unsterilized equipments and by accidental contact with spilled infected blood. The incubation period before symptoms appear is from 4 to 26 weeks. During this period it is highly infectious.

2.6.2-1.2.1-The acute form can cause weakness, fatigue, fever, and vomiting - as well as Jaundice. A small number become carriers who are asymptomatic and may have progressive subclinical disease.

2.6.2-1.2.2-The chronic form of hepatitis B presents a very different and much more dangerous situation. With chronic hepatitis B, the symptoms may be hidden and go unnoticed for years. The patient feels nothing; nevertheless, the hepatitis B virus will be in the body and may be slowly destroying the liver. Chronic hepatitis B can lead to death through cirrhosis or cancer of the liver. And once the process has started, it cannot be stopped. The disease is incurable.

2.6.2.1.3-Hepatitis C - This is a major cause of liver disease worldwide. It is present in the blood of infected individuals and passed on by contact with the blood of infected persons through inoculations and blood transfusions. All

blood, for transfusion purposes, is now tested for this virus. Half of the infected people have a short illness and heal completely.

2.6.2.1.4-Hepatitis D - This is also called the hepatitis delta virus. In order to be infected with hepatitis D, the patient must either be a hepatitis B carrier (Co infection) or already have the hepatitis B infection (super infection).

2.6.2.1.5-Hepatitis E - Hepatitis E is a water-borne infection occurring primarily in young to middle aged adults. It has the clinical characteristics of hepatitis A infection and is not associated with carriers, progression to chronic hepatitis or hepatocellular carcinoma**.**

2.6.3-Liver cyst

A liver cyst is defined as a fluid –filled space with an epithelial lining. The frequent presence of columnar epithelium within the simple cyst suggest they have a ductal origin ,although their precise cause is unclear. On sonographic examination benign hepatic cysts are anechoic, with a thin well demarcated wall and posterior acoustic enhancement .occasionally the patient may deceloped pain and fever secondary to cyst hemorrhage or infection . In these patients the cyst may contain internal echoes and septation, may have a thickened wall ,or may appear solid .

2.6.4-Hepatic masses:

Focal liver masses include a variety of malignant and benign neoplasm, as well as masses with developmental, inflammatory, and traumatic causes. In cross sectional imaging. Hemangiomas, focal nodular hyperplasia, and adenoma are the benign neoplasm typically encountered in the liver, where as hepato cellular carcinoma and metastases account for majority of malignant tumors. (Rumak et, al2005)

2.6.4.1-Benign liver tumors:

They generally develop on normal or fatty liver, are single or multiple, have distinct delineation, with increased echogenicity [hemangioma, benign focal nodular hyperplasia, or absent, with posterior acoustic enhancement

effect[cysts], as tumors often asymptomatic, being incidentally discovered . (Rumak et, al2005).

C2.6.4.2-cavernous hemangioma

Cavernous hemangiomas are the most common benign tumors of the liver they occur in all age grouped but are more common in adult particularly in women. The vast majority of hemangiomas is small, asymptomatic, and discovered incidentally. Histoligically: Hemangiomas consist of multiple vascular channels that lined by a single layer of endothelium and separated and supported by fibrous septa. Sonographically cavernous hemangioma appears small lesion in size less than 3cm in diameter, well defined, homogeneous and hyper echoic. (Rumak et, al2005)

2.6.4.3-Focal nodular hyperplasia :

Focal nodular hyperplasia(FNH) is the second most benign liver mass after hemangioms. It is typically, a solitary, well-circumscribed mass with a central scar . most lesion are less than 5cm in diameter .although usually single , multiple FNH masses have been reported .Sonographically : FNH is often a subtle liver mass that difficult to differentiate in echogenicity from the adjacent liver parenchyma .it appear as a subtle liver isoechoic mass with central hypoechoic , linear or satellite area within the central portion of the mass. (Rumak et, al2005)

2.6.4.4-Adenoma:

It is a benign tumor, much less common than FNH more common on women that used oral contraceptive. It may be a symptomatic. Adenoma is usually solitary. Sonographic appearance is no specific, the echogenicity may by hyper echoic, hypo echoic, isoechoic or mixed .with hemorrhage, a fluid component maybe evident within or around the mass, and free intra peritoneal blood maybe seen .sonographic changes depend on the duration and amount of hemorrhage . (Rumak et, al2005)

2.6.4.5-Fatty tumor of the liver

2.6.4.5.1-Hepatic lipomas and angiomyolipoma

Hepatic lipomas are extremely rare, and only isolated cases have been reported in the radiologic literature. There is an association between hepatic lipomas and angiomyolipomas tuberous sclerosis. The lesions are asymptomatic. Ultrasound demonstrates a well-defined echogenic mass, indistinguishable from a hemangioma, echogenic metastasis, or focal fat unless the mass is large and near the diaphragm in which case differential sound transmission through the fatty mass will produce a discontinuous or broken diaphragm echo. The diagnosis is confirmed using CT scanning, which reveals the fatty nature of the mass by the negative Hounsfield units (-30 HU). Angiomyolipomas, by comparison, may also appear echogenic on sonography, although they may have insufficient fat to consistently appear of fatty attenuation on CT scan making confirmation of their diagnosis more difficult without biopsy. (Rumak et, al2005)

2.6.5-Cirrhosis:

It is one of fatty liver prognosis. It is a diffuse process characterized by fibrosis and conversion of normal liver architecture into structurally abnormal nodules three major pathologic mechanism which in combination create cirrhosis: cell death, fibrosis and regeneration. Cirrhosis has been classified as micro nodular, in which nodules are 0.1 to1cm in diameter, and macro nodular, characterized by nodules of varying size, up to 5cm in diameter alcohol consumption is the most common cause of micro nodular cirrhosis, and chronic hepatitis is the most frequently cause of macro nodular cirrhosis, other etiologies is biliary cirrhosis, Wilsons disease, primary sclerosing cholangitis, and hemochromatosis. The sonographic features associated with cirrhosis include the following:-Enlarged liver in early stage where as in advanced stage the liver is small in size with relative enlargement of caudate lobe, left lobe or both compared to the right lobe

-Increased echogenicity

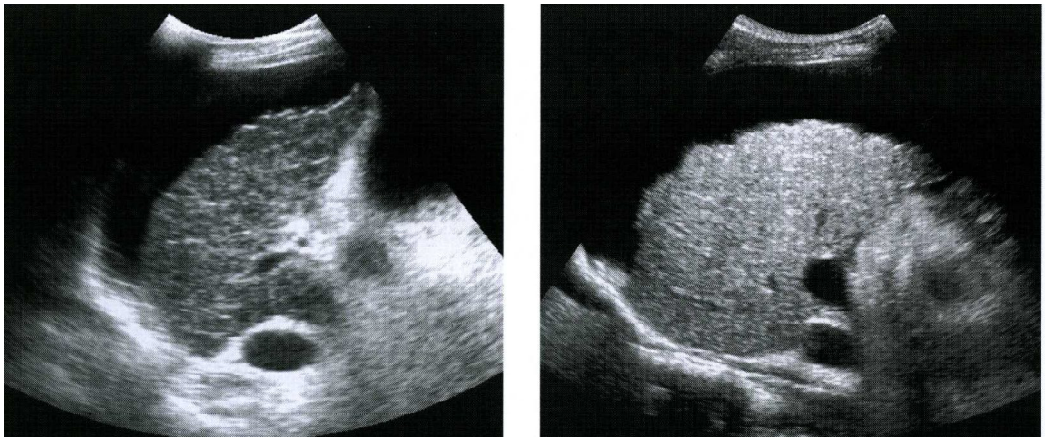
-coarse echo texture

-Irregularity of liver surface with presence of ascites

-Presence of regenerating nodules and fibrosis: these regenerating hepatocytes are surrounded by fibrotic changes. It tends to be isoechoic hypoechoic with a thin, echogenic border that corresponds to fibro fatty connective tissue.

- Presence of dysplastic nodules: these are larger than regenerating nodules and are considered premalignant .they contain well differentiated hepatocytes, a portal venous blood supply and atypical or frankly malignant cells

- Portal hypertension, ascites, splenomegaly and varices. (Rumak et, al2005)



A B

Figure (2-11)showing ultrasound immage of liver cirrhosis (A axial &B Sagittal view) (Rumak et, al2005)

2.6.6-HEPATOCELLULAR CARCINOMA:

Hepatocellular carcinoma (HCC) is the one of the most common malignant tumors. HCC occurs predominantly in men. Etiologic factor depend on geographic distribution. Also occur in association with underlying liver problems, like viral hepatitis, cirrhosis or fatty liver disease. The clinical presentation is often delayed until the tumor reaches advanced stage .HCC

pathologically occur in the following form solitary, multiple nodules and diffuse infiltration. . Typically HCC invades liver vessels, primarily the portal veins but also the hepatic veins. (Rumak et, al2005)

The sonographic appearance is variable the mass may be hypoechoic , complex or echogenic .Most small (less than 5cm) HCC masses are hypoechoic with a thin peripheral hypoechoic halo sign , which corresponds to a fibrous capsule , this situation seen most often in small HCCs. With time and increasing size, the masses tend to become more complex and inhomogeneous as a result of necrosis and fibrosis. Small tumor may appear diffusely hyper echoic, secondary to fatty metamorphosis or sinusoidal dilation. (Rumak et, al2005)

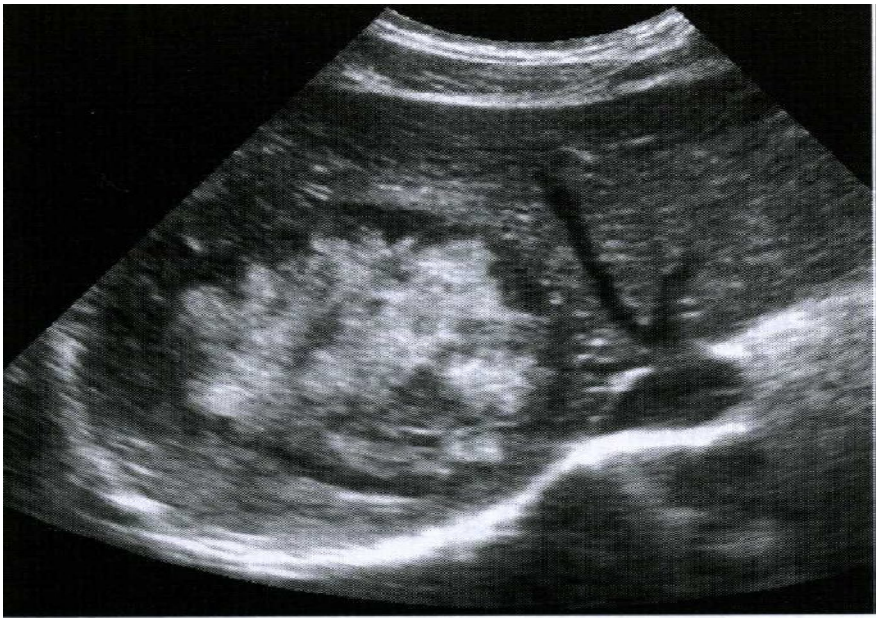


Figure (2-12) hepatocellular carcinoma (Rumak et, al2005)

2.6.7-Fatty liver disease

Fatty liver disease(FLD) can range from fatty liver alone (steatosis) to fatty liver associated with inflammation (steatohepatitis) this condition can occur with use of alcohol (alcohol-related fatty liver) or in the absence of alcohol; non alcoholic fatty liver disease abbreviated as NAFLD. If steatohepatitis is present in non alcoholic patient the condition is termed non alcoholic

steatohepatitis (NASH). Fatty change in the liver results from excessive accumulation of lipids within hepatocytes; when the amount of fat exceeds 5-10% of liver weight then we use the term of fatty liver. The simple fatty liver is believed to be benign but NASH can progress to cirrhosis and can be associated with hepatocellular carcinoma. (Rumak et, al 2005)

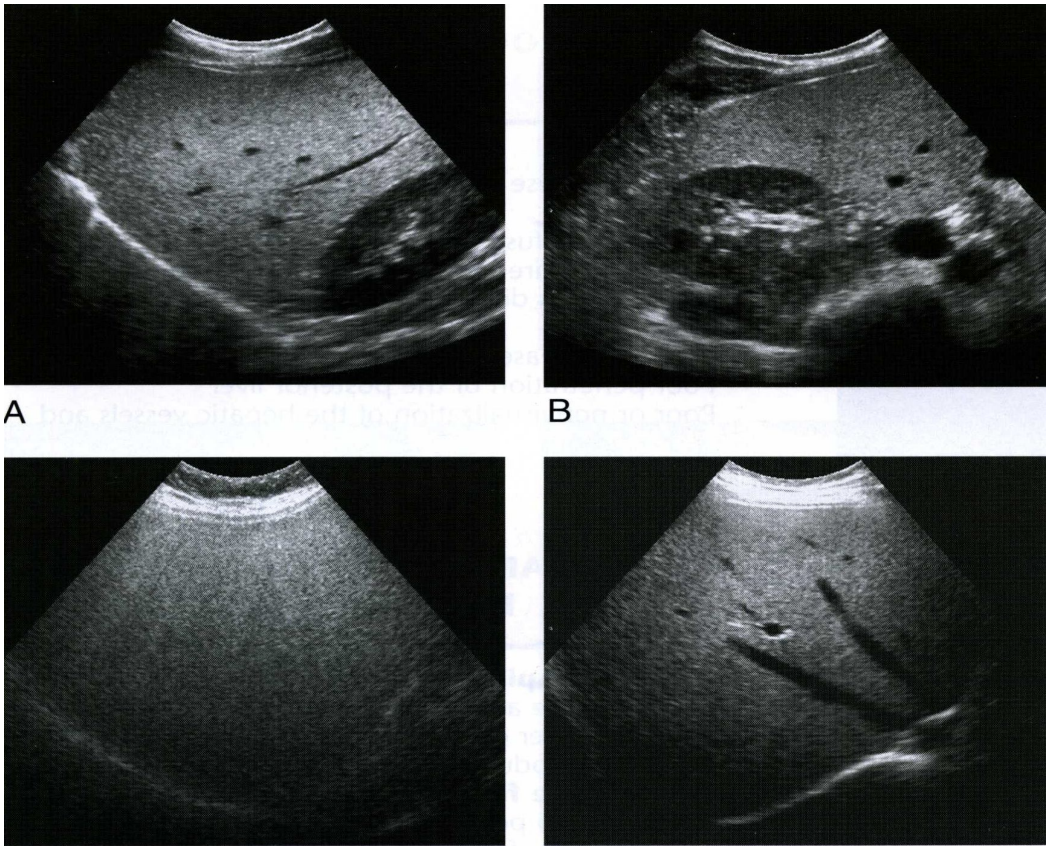


Figure (2-13)A,B,C&D showing ultrasound images of diffuse fat–spectrum of appearance (Rumak et, al 2005)

Fatty liver is accumulation of triglycerides and other fats in liver cells. In some patients this may be accompanies by hepatic inflammation and liver cell death (steatohepatitis). (Rumak et, al 2005)

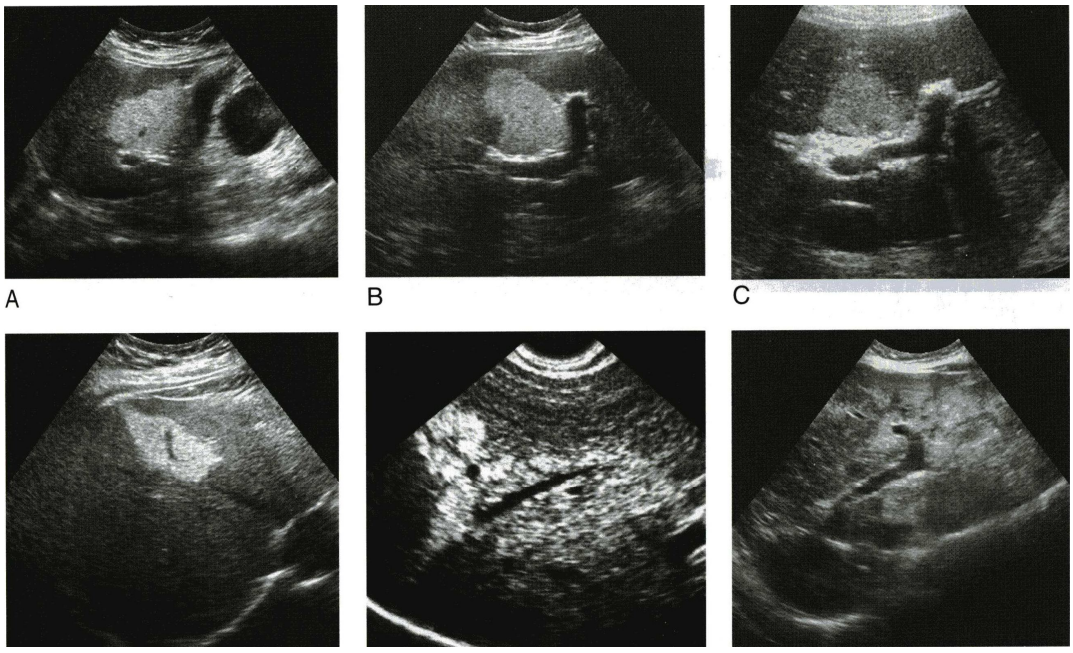


Figure (2-14) A,B,C,D,E&F showing ultrasound images of focal fat- spectrum of appearance (Rumak et al 2005)

2.6.7.1-Potential pathophysiological mechanism includes:-

2.6.7.1.1- Decreased mitochondrial fatty acid beta-oxidation

2.6.7.1.2-Increased endogenous fatty acid synthesis or enhanced delivery of fatty acid to liver and

2.6.7.1.3 Deficient incorporation or export of triglycerides as a very low density lipoprotein. (Rumak et, al2005)

Most people who do not abuse alcohol and have fatty liver are obese. Steatosis and steatohepatitis can be caused by alcohol, some drugs and sometimes occur in patient with diabetes mellitus. Steatohepatitis not caused by alcohol named non alcoholic steatohepatitis (NASH).The factor that determined who will develop fatty liver is unknown, some mildly obese and occasionally non obese patients will developed fatty liver while some severely obese will not. Patients with fatty liver or steatohepatitis usually present to physician with unexplained elevations in the serum aminotransferase activities. Serum alkaline phosphates and gamma-glutamyltranspeptidase activities can also be elevated. (Rumak et, al2005)

The diagnosis is usually suspected after exclusion of other causes of hepatitis. Sometimes, patient with fatty liver or steatohepatitis will have elevated serum triglyceride concentrations; however, this is not always the cause. If patient has elevation in serum aminotransferase activities for longer than six months, liver biopsy must be done to make the diagnosis of fatty liver or steatohepatitis. (Rumak et, al2005)

The microscopic section is divided histologically into lobules. The center of the lobule is the central vein; at the periphery of the lobule are portal triads. Functionally the liver can be divided into three zones based upon oxygen supply. Zone 1 encircles the portal tracts where the oxygenated blood from hepatic arteries enters. Zone 3 is located around central veins where oxygenation is poor. Zone 2 is located in between. (Rumak et, al2005)

Steatohepatitis can progress to cirrhosis treatment may stop this progression .steatosis and steatohepatitis will often improve with weight loss, preferably to near patient's ideal body weight. Avoidance of alcohol and potentially hepatotoxic drugs may also be beneficial. (Rumak et, al2005)

2.6.7.2-CLINICAL HISTORY

Most patients with fatty liver are a symptomatic. However, more than 50% of patients or NASH report persistent fatigue, malaise, or upper abdominal discomfort. Symptoms of liver disease, such as ascites, edema, jaundice and fever may arise in patients with cirrhosis due to progressive NASH. (Rumak et, al2005)

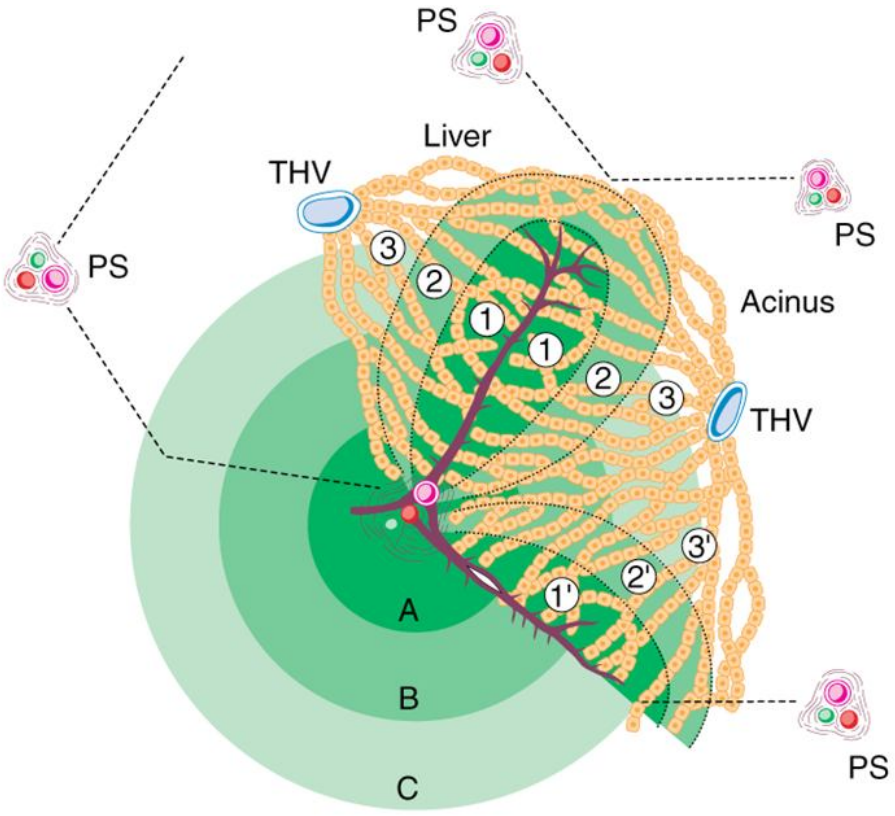


Figure (2-15) Blood supply of one simple liver acinnus and the zonal arrangement of cells. (Tival 2012)

2.6.7.3-PHYSICAL HITORY OF FLD

-Hepatomegaly is common

-splenomegaly and stigmata of portal hypertension (ascites, edema, spider angiomas, gynecomastia and menstrual disorders) may occur in patient with cirrhosis.

-patient with drug-induced fatty liver may present with rapid fulmination liver failure

-Patient who abuse alcohol extra hepatic effects such as skeletal muscle wasting, cardiomyopathy, pancreatitis or peripheral neuropathy may present.

2.6.7.4-CAUSES

The most common association with fatty liver disease is metabolic syndrome. This includes carrying the diagnosis of type II diabetes, obesity and/or hyper

triglyceride. Other factors such as drugs, nutritional status or other health problems may contribute to fatty liver disease in healthy subjects. Five percent of the liver weight consists of lipids mostly being phospholipids, triglyceride and other lipids fractions. However lipids contents especially triglycerides may increase up to 40-45% in liver steatosis. Lipid accumulation may occur either in micro vascular or macro vascular form. Steatosis may involve all of hepatocytes and liver weight could reach 6000 grams in sever case. The most common case of steatosis is macro vascular fatty accumulation. Diabetes mellitus and chronic alcoholism are most common predisposing condition. The amount of alcohol is important as the duration of abuse. Fatty infiltration occur in zone 2-3 in addition to collagen accumulation in zone 3 phlebitis and gradually obliteration in the terminal hepatic and sub lobular veins; in 25% of cases serum bilirubin and transaminase level are increased. On the other hand liver histology in diabetes mellitus is similar to that of chronic alcoholism except for vascularization in hepatocytes nuclei and periportal lesions. Fatty liver is predominant in type II diabetes mellitus, whereas minimal fatty accumulation involving mostly zone 1 occur in type I diabetes mellitus. Other common reason for macro vascular fatty infiltration is kwashiorkor disease, inflammatory bowel disease, pancreatic disease and intestinal by-pass operations. Microvascular fatty infiltration occurs in zone 3 and accompanies center zonal necrosis. The most common causes of microvascular infiltration are acute lipid metamorphosis of pregnancy, Reye syndrome and tetracycline and calicylate toxicities. Steatosis or fatty changes occur universally in response to a hepatocellular toxic reaction or injury. Fatty change is effectively evident when there is increased production, excessive mobilization or decreased hepatic clearance of fatty acids. Causes include alcohol abuse, obesity, diabetes mellitus, hepatitis, drugs (i.e., steroids) and liver transplantation. This generally a reversible change, but it is often

undetectable at clinical or laboratory examination. In ultrasound, hepatic steatosis is characterized by increased echogenicity, which is often compared with spleen or kidney parenchyma at the same depth. (Davis 2007)

2.6.7.5-Examination Technique

The liver best examined with real-time sonography, ideally following a six hours fast so that bowel gas limited and gallbladder not contracted. Both supine and right anterior oblique views should be obtained if the patient can move or be moved. Because many patients have liver that tucked beneath the lower right rib a transducer with small scanning face, allowing an intercostal approach, is available. Suspended inspiration enable examination of the dome of the liver frequently an ultrasound blind spot. Sagittal, transverse, coronal and subcostal oblique views are required. (Rumak et al2005)

2.6.7.5.1-patient preparation

In general, there are no specific preconditions to do an ultrasound evaluation of the liver. However, it is recommended that patients undergo a period of fasting prior to upper abdominal imaging in order to maximize the distension of the gallbladder and reduce food residue and gas in the upper gastrointestinal tract, which may reduce image quality. This essential for complete imaging of the liver and related biliary tree, but may not be required in an acute situation such as trauma, where immediate imaging of the gallbladder is not essential. (Christopher et al 2013)

2.6.7.5.2- patient position and systemic liver examination

The patient should be examined first in the supine position. Sagittal and subcostal transducer positions allow representation of segments I-VI and intercostal transducer positions are complimented with an optimal representation of segments VI, VII and VIII.

For the last mentioned, the transducer position is used slightly oblique to the patient's position with right arm above the head and the right leg stretched. The consistency (elasticity) of the liver is assessed using the sonographic

palpation. Examination in the standing position is also helpful owing to the liver moving caudally with gravity. Scanning from the sub- or inter costal probe positions (depending on individual anatomy) avoid interposed lung, which can occur in the right posteriolateral (superficial) part of the liver when using the intercostal approach. (Christopher et al 2013)

2.6.7.5.3- transducer selection

The transducer recommended for the examination of the liver is the convex one, with 1-8 MHz For obese patients and very large persons we use lowest possible frequency, for slim person or children higher frequencies. For very difficult cases sector transducer could be used. For imaging of the near field (surface) in patient with suspected liver cirrhosis and superficially liver nodules, high frequency transducers are recommended. (Christophe et al 2013)

Figure (2-16) Ultrasound probes for optimal liver investigation:

Convex probe (C5-1) is commonly used. Sector probe (S5-1) maybe beneficial in obese patients. Linear probe (L12-5) is used to assess the liver surface.

(Christopher et al 2013)

2.6.7.6-Sonographic appearance of fatty liver

May be varies depended of the amount of fat and whether deposits are diffuse or focal figure (2-10) & (2-11).

2.6.7.6.1-Diffuse steatosis may be:

2.6.7.6.1.1-Mild diffuse steatosis: minimal diffuse increase in hepatic echogenicity; normal visualization of diaphragm and hepatic vessels borders.

2.6.7.6.1.2-Moderate diffuse steatosis: moderate diffuse increase in hepatic echogenicity; slightly impaired visualization of the intra hepatic vessels and the diaphragm.

2.6.7.6.1.3-Severe diffuse steatosis: marked increase echogenicity; poor penetration of the posterior segment of the right lobe of the liver and poor visualization of the hepatic vessels and diaphragm.

2.6.7.6.2-Focal fatty infiltration and **Focal fatty sparing:** may mimic neoplastic involvement. In focal fatty infiltration, region of increased echogenicity are present within a background of normal liver parenchyma. Conversely, islands of normal liver parenchyma may appear as a hypoechoic masses within a dense, fatty infiltrated liver. (Rumak et al2005)

2.6.7.6.3-Feature of fatty changes includes**:-**

2.6.7.6.3.1-Focal fatty sparing and focal fatty liver

Both most commonly involve the periportal region of the medial segment of the left lobe (segment IV). Sparing also commonly by the gallbladder fossa and along the liver margins. Focal sub capsular fat may occur in diabetics receiving insulin in peritoneal dialysate. (Rumak et al2005)

2.6.7.6.3.2-Lack of mass effect hepatic vessels as a role are not displaced, a recent report however, has demonstrate the presence of traversing vessels in metastasis.

2.6.7.6.3.3-Geometric margin are present, although focal fat may appear round, nodular or interdigitated with normal tissue.

2.6.7.6.3.4-Rapid change with time fatty infiltration may resolve as early as within 6 days. (Rumak et al2005)

2.7-PREVIOUS STUDIES

Mariana Lazo and others used ultrasonography data from 12454 adults in United States from 1988 to 1994 they found people with diabetes and obesity are the most affected groups and the prevalence of FLD of 21.4%.FLD was more common in Mexican Americans (24.1%) compared with non-Hispanic whites (17.8%) and non-Hispanic blacks (13.5%) ($P = 0.001$) and in men (20.2%) compared with women (15.8%) ($P < 0.001$). Hepatic steatosis and NAFLD were also independently associated with diabetes, with insulin resistance among people without diabetes, with dyslipidemia, and with obesity. Our results extend previous national estimates of the prevalence of NAFLD in the US population and highlight the burden of this disease. Men, Mexican Americans, and people with diabetes and obesity are the most affected groups.

Study done by LIN-zhou zhu and et al (July 2014) revealed that the weighted mean prevalence of FLD in mainland China was 16.73% and the prevalence will stably increase at a rate of 0.594% per year to 20.21% by 2020. In conclusion study reveals a correlation between the economy and the prevalence of FLD in mainland China.

ZHOU YJ; et al work in random sampling of inhabitants over 7 years old was performed in six urban and rural areas of Guangdong province, China using ultrasonography among the 3543 subjects 609 (17.2%) were diagnose having FLD. The overall prevalence increased with age in both gender to the beak of **27.4%** in the group of subjects at the age of 60-70 years.

Shao-Jun Xiao and others were collected data from check-up center at the 1st Affiliated Hospital of Chongqing Medical University in 2011. They analyzed 18 676 subjects (mean age 40.55 ± 9.94 ranging from 18 to 59). The prevalence of fatty liver disease was 22.0% and increased along with age, body mass index, and the presence and severity of metabolic syndrome

Obesity was the most important factors. There conclusion that the Fatty liver disease was prevalent in young and middle-aged population and mainly associated to multiple metabolic disorders.

Vernon and others revealed that an estimate of the worldwide prevalence of NAFLD ranges from 6.3 to 33 %, with a median of 20 % in the general population, based on a variety of assessment methods. (Vernon G et al 2011).

CHAPTER THREE

Material and methods

3.1-material

3.1.1-Area of the study

The Ribat universal hospital –Khartoum Sudan; The ultrasound department where received patients from all Sudanese states.

3.1.2-study group

Patients who had referred to the ultrasound department for abdominal ultrasound scan; there were 114 patients which referred to department for abdominal ultrasound. Inclusion criteria involve all patient between18-74 years. Exclusion criteria pregnant ladies and patients aging below 18 years

3.1.3- Machine used

The ultrasound machine using during this study was a mobile unit called siemnce – Germany having 3 probes convex, linear and transvaginal probes. This machine has many options colour and spectral doppler in addition to fetal cardiograph. A thermal printer SONNY model (Japan) have been link with the machine

3.1.4- Scale: to get patient's weight in kilograms.

3.1.4- Meter: to get patient's length.

3.2- Methods

3.2.1- Technique

Permission is taken from each patient for research purpose. All patients prepared with full bladder and fasting for 8 hours; they were laying supine; couple of gel is applied to the patient for better resolution. Axial, transverse and coronal planes were used to visualize the liver. The data of each patient is recorded immediately after finishing the exam. The data was tabulated for analysis and results.

3.2.2- Variables of the study:

-patients age

-gender

-Body mass index

-associations disorder

-life style

-alcoholic abuser

3.2.3-Data collection:

3.2.3.1- Data collection sheet

3.2.3.1- Image interpretation: -appearance and echo texture

CHAPTER FOUR

Table No.(4-1)- showing the distribution of fatty liver

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NOT FATTY	83	72.8	72.8	72.8
	FATTY	31	27.2	27.2	100.0
	Total	114	100.0	100.0	

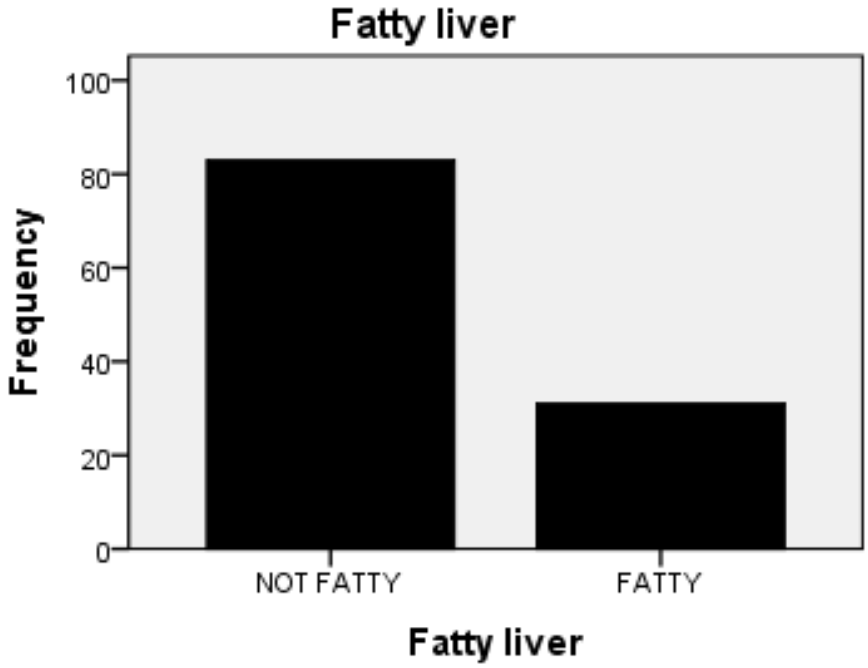


Figure (4-1) showing the distribution of fatty liver disease

Table No. (4-2)- showing cress tabulation of Age *fatty liver

		Fatty liver		Total	% of FL	
		NOT FATTY	FATTY		In group	in sample
Age Group	15-24	14	1	15	20.0%	3.3%
	25-34	17	7	24	29.2%	22.6%
	35-44	17	9	26	34.6%	29.0%
	45-54	16	7	23	30.4%	22.6%
	55-64	15	5	20	25.0%	16.1%
	65-74	4	2	6	33.3%	6.5%
Total		83	31	114	27.2%	100%

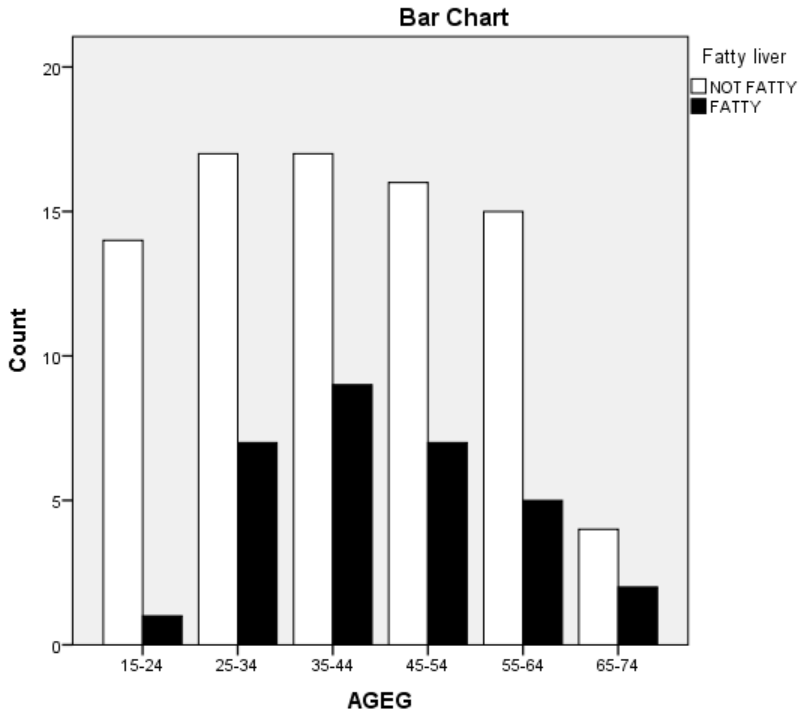


Figure No. (4-2)- showing cress tabulation of Age *fatty liver

Table No.(4-3)-showing the distribution of gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	M	51	44.7	44.7	44.7
	F	63	55.3	55.3	100.0
	Total	114	100.0	100.0	

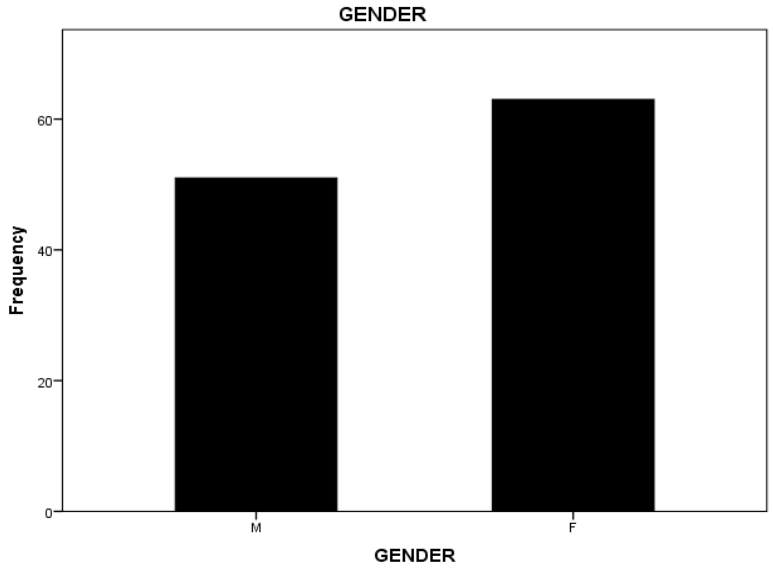


Figure (4-3) **showing the distribution of gender**

Table No. (4-4)- Gender *FLD **Crosstab**

		Fatty liver		Total	% of FL	
		NOT FATTY	FATTY		In group	in sample
GENDER	M	36	15	51	29.4%	48.3%
	F	47	16	63	25.4%	51.7%
Total		83	31	114	27.2%	100%

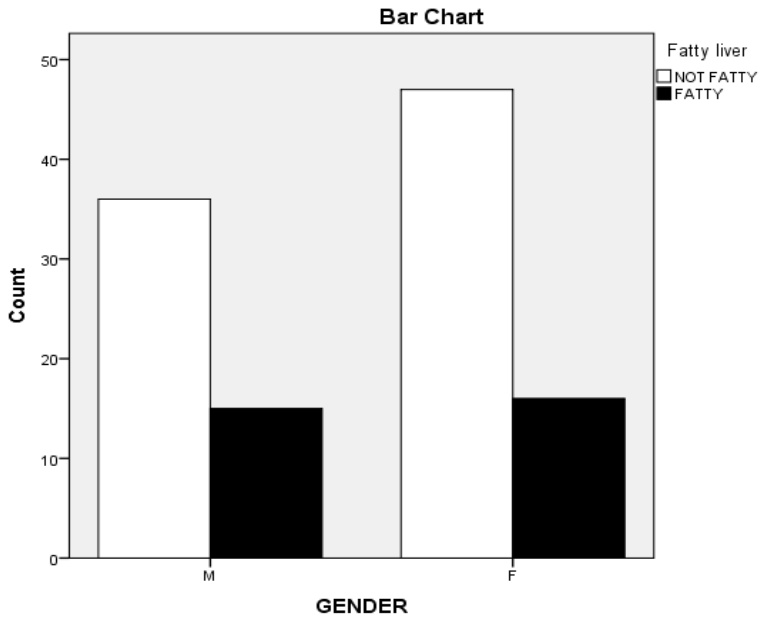


Figure (4-4) FLD*GENDER Crosstab

Table No. (4-5)- Association Disorder * Fatty liver Crosstab

		Fatty liver		Total	%of FLD	
		NOT FATTY	FATTY		In group	in sample
Association Disorder	DM	5	6	11	54.5%	19.4%
	HTN	7	2	9	22.2%	6.5%
	BOTH	6	2	8	25.0%	6.5%
	None	65	21	86	24.4%	67.7%
Total		83	31	114	27.2%	100%

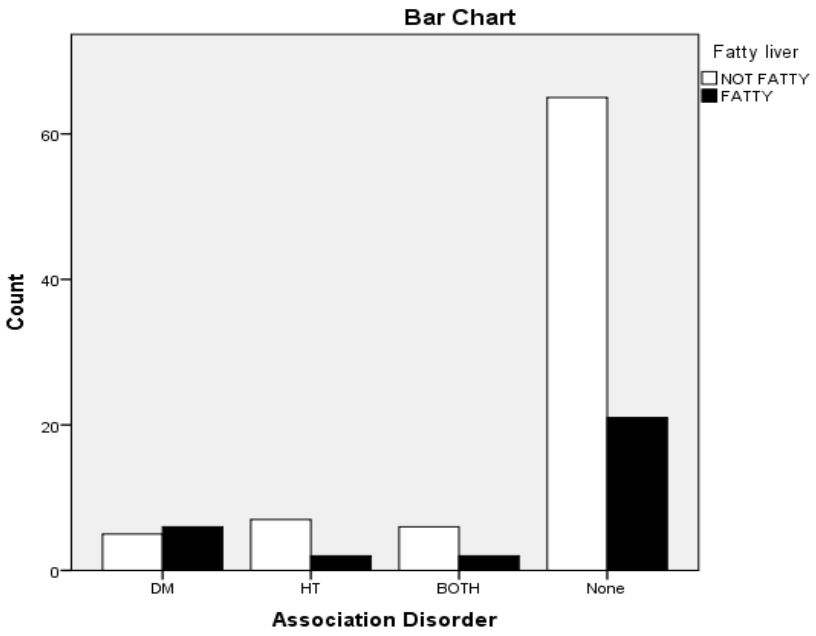


Figure No (4-5) - Association Disorder * Fatty liver Crosstab

Table No. (4-6)- Life style * Fatty liver Crosstab

		Fatty liver		Total	% of FLD	
		NOT FATTY	FATTY		In group	in sample
life style	high	26	16	42	38%	51.6%
	low	57	15	72	20.8%	48.4%
Total		83	31	114	27.2%	100%

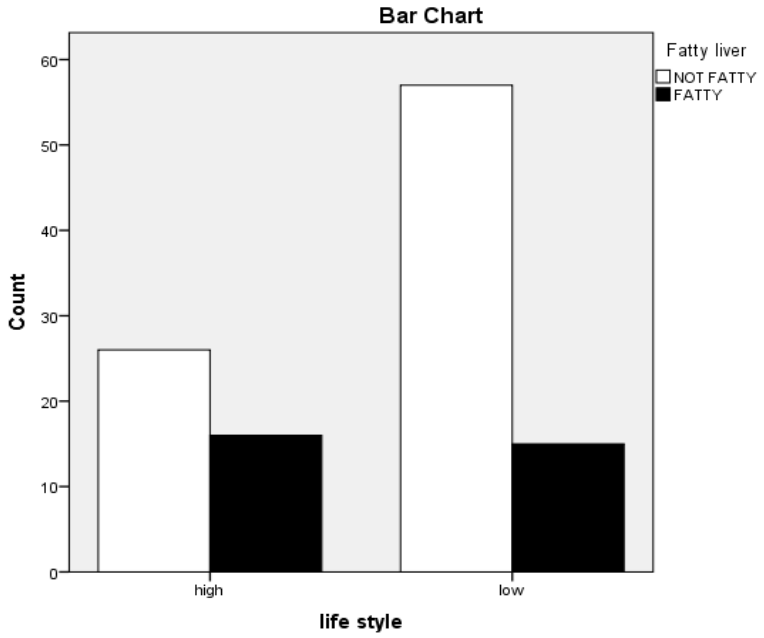


Figure No (4-6)- Life style * Fatty liver Crosstab

Table No (4-7) Crosstab Alcoholic * Fatty liver

		Fatty liver		Total	% OF FLD	
		NOT FATTY	FATTY		In group	in sample
alcoholic	No	83	27	110	24.5%	87.1%
	YES	0	4	4	100%	12.9%
Total		83	31	114	27.2	100%

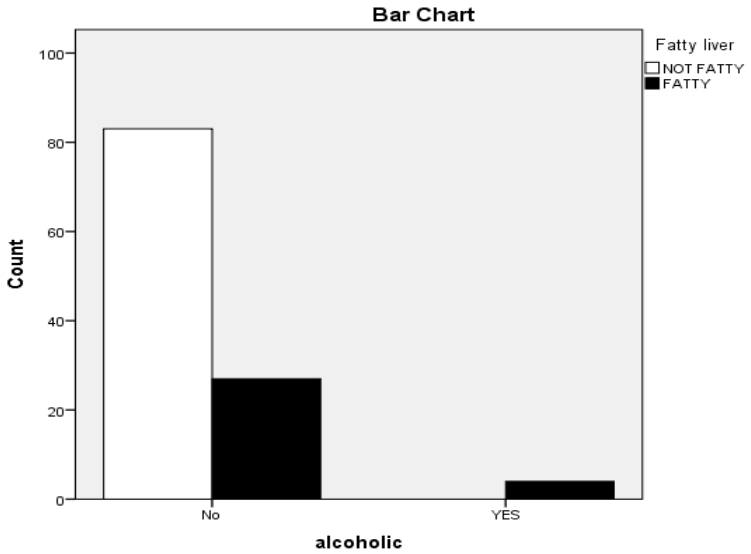


Figure No (4-7) Crosstab Alcoholic * Fatty liver

Table No (4-8) obesity * fatty liver Cross tabulation

Count

		fatty liver		Total	%OF FLD	
		not fatty	fatty		In group	In sample
obesity	obese	30	24	54	44.4%	77.4%
	not obese	53	7	60	11.7%	22.6%
Total		83	31	114	27.2%	100%

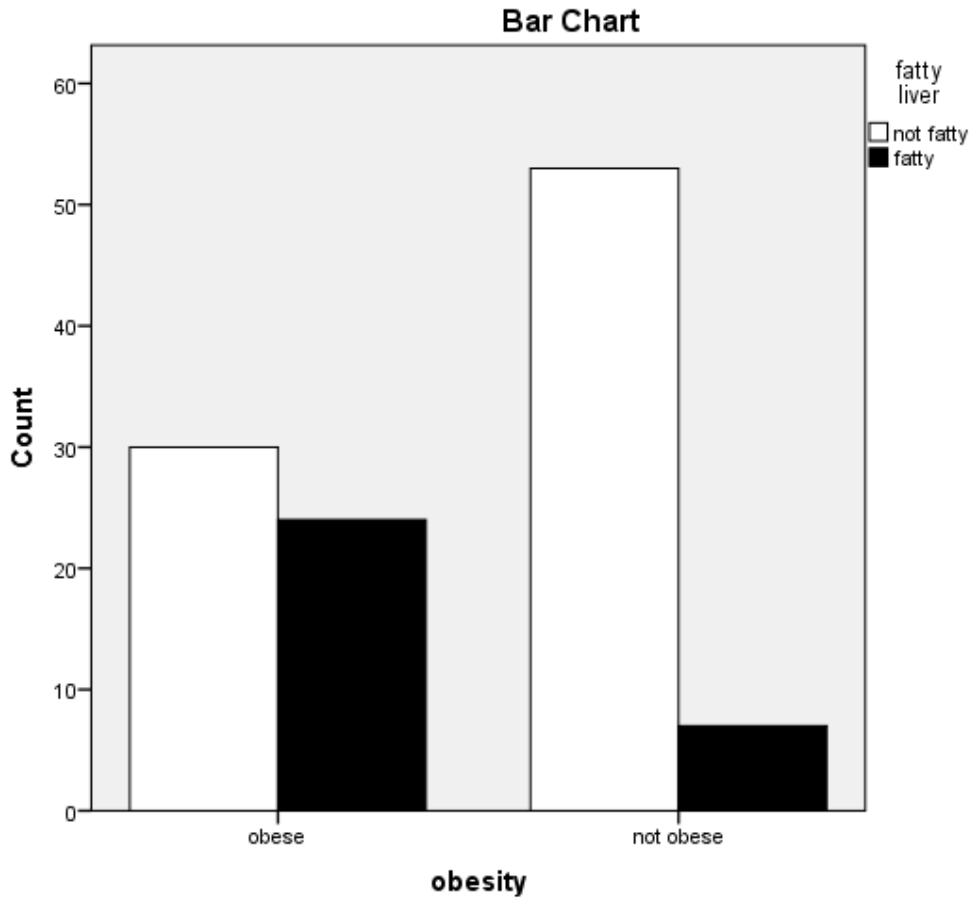


Figure No (4-8) obesity * fatty liver Cross tabulation

CHAPTER FIVE

Discussion, conclusion and recommendation

5.1-Discussion

this study includes 114 patents of the age between 18-74 years attended to ultrasound department for routine abdominal ultrasound regarding to the age the group between (35-44) year display the highest percentage 34.6% that mean the people in middle age were more affected; people like that often obese, diabetic or have high cholesterol ; agree with Shao-Jun Xiao et al-2011. Table No (4-1).

We found the prevalence of fatty liver disease more common in male than female. 51 male 15 of them were register fatty liver with percentage of 29.4% while women percentage of 25.4 % it may be tend to run in family (genetic factor) ; this result is the same as Mariana Lazo et al-2007. Table No (4-4)

In this study the obesity appeared as the main effective factor of the fatty liver disease; I think the increasing endogenous fatty acid synthesis and the enhanced delivery of fatty acid to liver representing the mean reason of persisting FLD in the obese people; there were 54 obese patients (BMI>25); 24 of them were showed fatty liver represented 77.4% of all patients with fatty liver agree with Mariana Lazo et al-2007, lin –zhou zhu et al-2014 and Shao-Jun Xiao et al-2011. Table No (4-8)

Among this study 11 patients with DM have been scanned; 6 patients of them showed fatty liver percentage =54.5% may be due to deficient incorporation or export of triglycerides as a very low density lipoprotein. The result above consistent with Mariana Lazo et al-2007 Table No (4-5)

The high life style patients showing 16 patients with fatty liver out of 42 the percentage was 38%; on the other hand the low life style percentage was only 20.8% this result may due to decreased mitochondrial fatty acid beta-oxidation

because high economic status people always having obesity, no heavy duty or low exercise. Agree with Lin-zhou zhu et al 2014. Table No (4-6)

5.2-Conclusion:

The prevalence of fatty liver in general was 27.2% in the year of 2015. The obese people were the most affected group (77.4%), then the diabetic patients (54.5%), the high life style patients 38%, the middle age people 34.6%, and lastly the male group 29.4%.

This study reveals a correlation between obesity and the prevalence of fatty liver disease in Sudan

5.3-Recommendation:

-People with obesity should be considered annual fatty liver screening by ultrasound to avoid its prognosis

- Diabetic patients should be control their blood glucose to avoid fatty liver disease.

- High life style people should be changes their life habits and be wary about obesity and fatty liver disease.

-On future the studies of the prevalence of fatty liver disease must be consider large sample volume, laboratory investigation (liver enzymes) and ultrasound modalities.

- On future the studies of the prevalence of fatty liver disease must be create an ultrasound number like computed tomography number(CT-Number) to standardize the normal liver echotexture.

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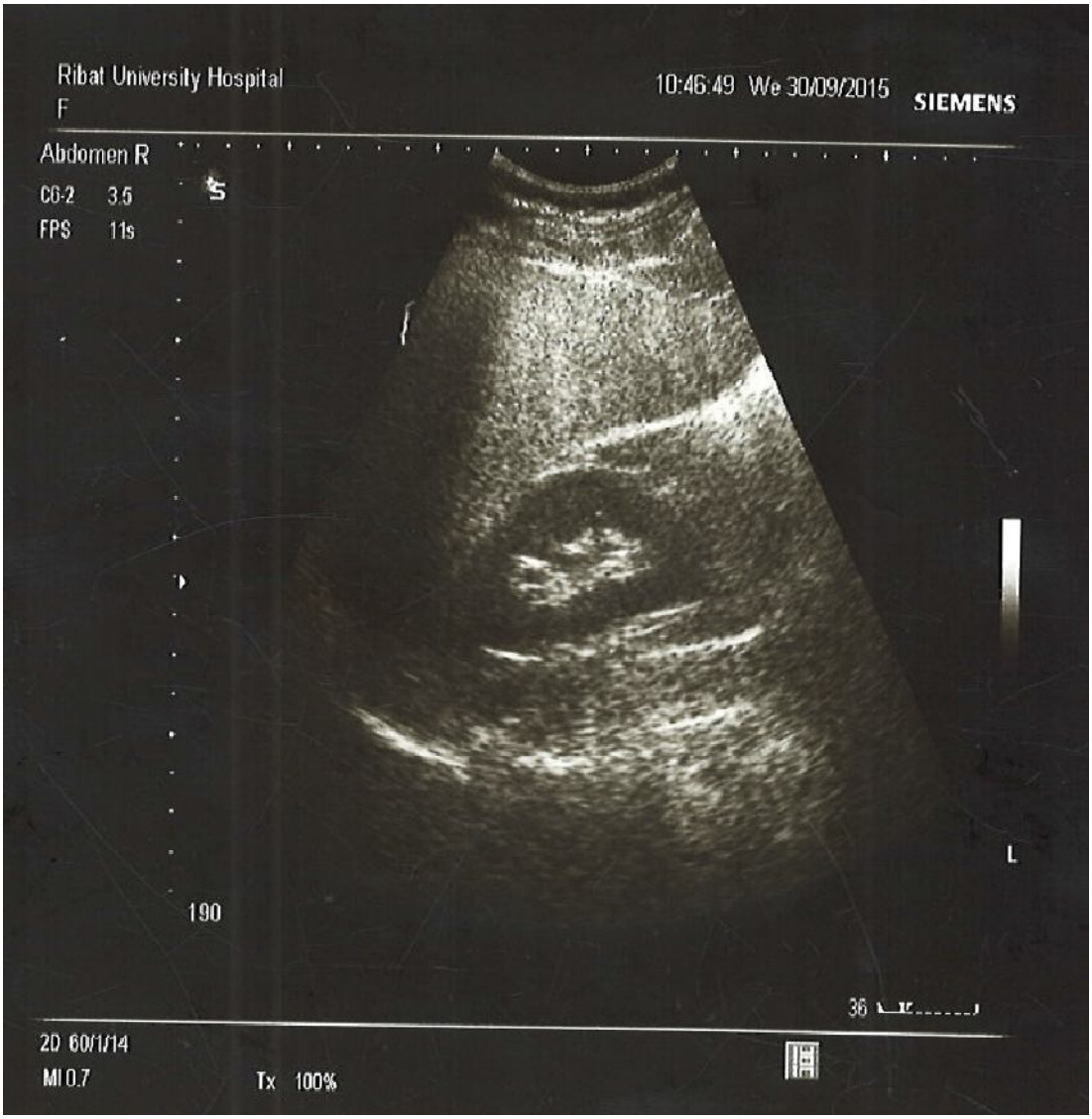
APPENICES

Demographic sheet

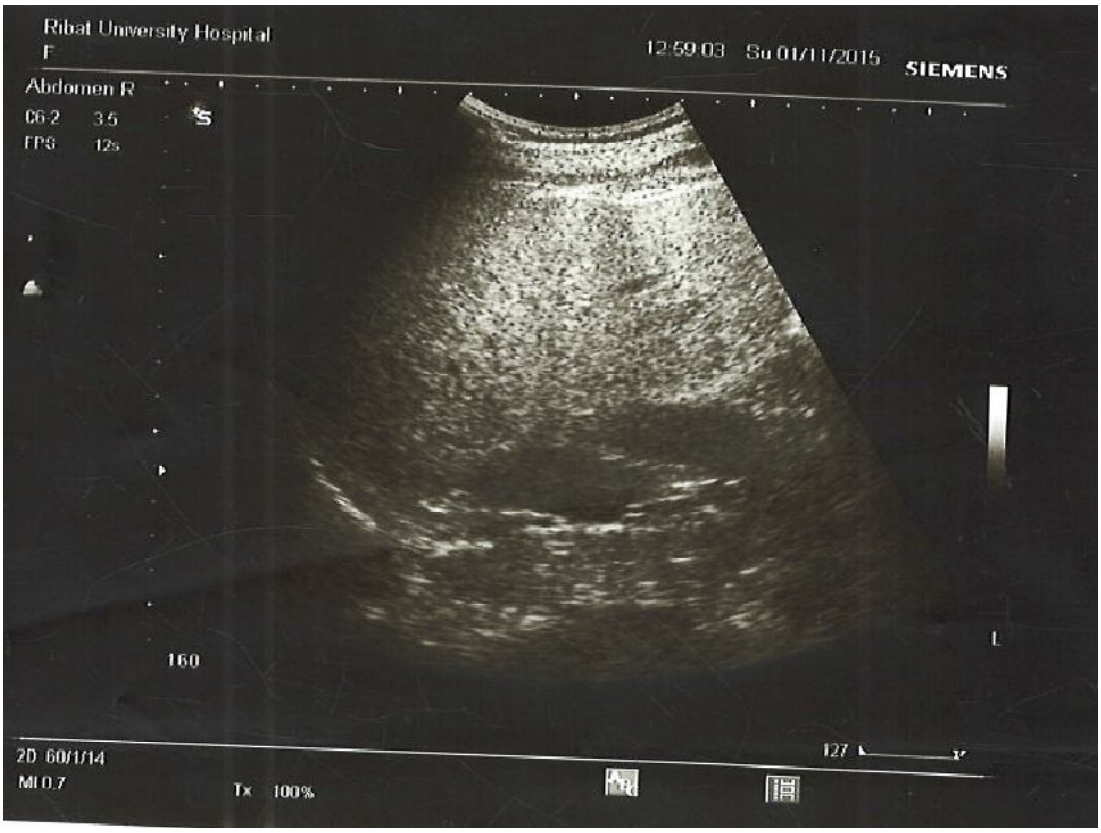
البيانات	البند
	الاسم
	النوع
	العمر
Obese ☐ not obese ☐ BMI	الطول / الوزن
DM ☐ HTN ☐ Anemic ☐	Associations disorder
High ☐ low ☐	LIFESTYLE
Alcoholic ☐ nonalcoholic ☐	Alcohol

RESULT =	FL	Not FL

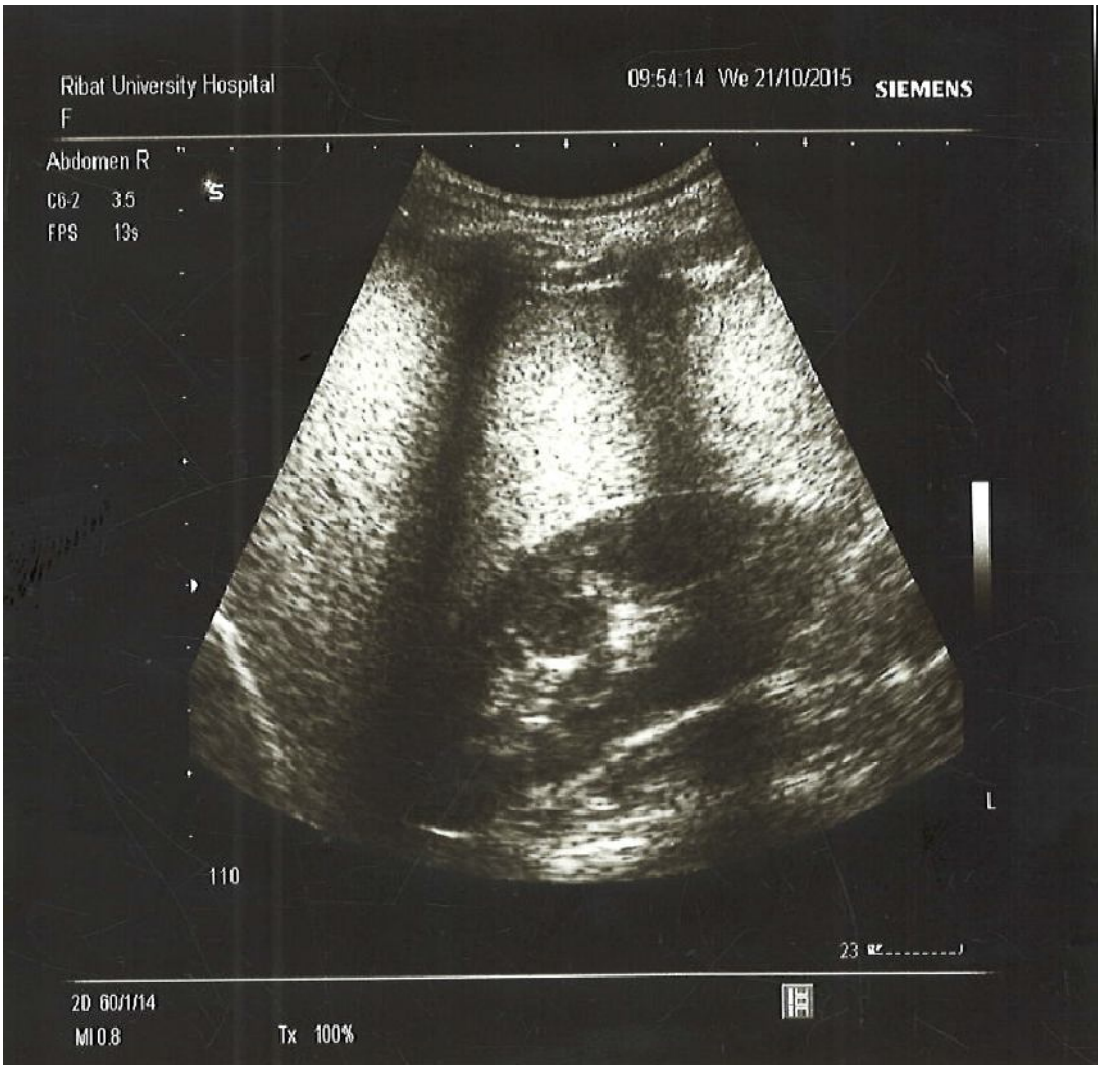
SOME ULTRASOUND IMMAGES



Liver U/S image for obese female of 43year with DM



Liver U/S image for 34year, male (alcoholic abuser)



Liver U/S image for male of 29 year (high life style phenomena)

Data of sample(the master sheet)

NO	GENDER	ADGE	BMI	AD	LS	ALCOH	FAT	Age-group	BMI-group	OBESTY
1	1	21	19.4	4	2	1	1	1	2	2
2	2	43	35.5	1	2	1	2	3	5	1
3	1	56	28.7	4	1	1	2	5	3	1
4	1	26	20	4	1	1	1	2	2	2
5	2	18	25	4	1	1	1	1	3	2
6	2	25	26.2	4	2	1	1	2	3	1
7	2	22	25.7	4	1	1	1	1	3	1
8	2	26	24.1	4	2	1	1	2	3	2
9	1	46	20.7	4	1	1	1	4	2	2
10	2	24	31.3	4	1	1	1	1	4	1
11	2	35	27.3	4	2	1	1	3	3	1
12	2	19	29	4	1	1	1	1	3	1
13	1	25	22.2	4	2	1	1	2	2	2
14	2	50	22.9	2	2	1	1	4	2	2
15	1	32	27.3	4	1	1	1	2	3	1
16	2	35	19.5	4	2	1	1	3	2	2
17	1	56	23.8	4	2	1	1	5	2	2
18	1	70	25.4	4	2	1	2	6	3	1
19	1	38	27	4	1	1	1	3	3	1
20	2	27	18	4	2	1	1	2	1	2
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22	2	26	19	4	2	1	1	2	1	2
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27	2	40	26.4	4	2	1	1	3	3	1

28	2	55	25.5	4	2	1	1	5	3	1
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34	2	47	33.3	4	1	1	2	4	4	1
35	1	38	28.3	1	2	1	2	3	3	1
36	2	34	39	4	1	1	2	2	5	1
37	2	52	32.4	4	2	1	2	4	4	1
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49	1	56	30.8	1	2	1	2	5	4	1
50	2	38	37.6	2	1	1	2	3	5	1
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59	2	37	20.8	4	1	1	2	3	2	2
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67	2	46	23.2	4	2	1	1	4	2	2
68	2	24	20.4	4	1	1	1	1	2	2
69	2	41	31.3	1	2	1	1	3	4	1
70	2	44	29.4	4	2	1	1	3	4	1
71	2	55	35.4	3	1	1	1	5	5	1
72	1	43	29	4	1	1	1	3	3	1
73	1	57	30.9	2	1	1	1	5	4	1
74	1	64	21.7	4	2	1	1	5	2	2
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111	1	22	20.2	4	2	1	1	1	2	2
112	1	56	20	4	2	1	1	5	2	2
113	1	31	24.2	4	2	1	1	2	3	2
114	2	65	37.5	3	2	1	1	6	5	1

Data of FL patients (master sheet)

obesity	MBI-G	age G	LS	COHOLIC	BOTH	HTN	DM	BMI	AGE	Gender	
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1	3	6	2	2	2	2	2	25.4	70	1	3
1	3	5	1	2	2	2	2	29	60	1	4
1	4	4	1	2	2	2	2	33.3	47	2	5
1	3	3	2	2	2	2	1	28.3	38	1	6
1	5	2	1	2	2	2	4	39	34	2	7
1	4	4	2	2	2	2	4	32.4	52	2	8
1	5	2	2	2	2	2	4	38.5	30	2	9
1	3	4	1	2	2	2	1	28.4	50	1	10
1	4	4	1	2	2	2	4	31.3	45	2	11
1	4	5	2	2	2	1	2	31.3	60	2	12
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1	5	4	1	2	2	2	4	35.8	45	1	14
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1	4	2	2	2	2	2	4	33.9	29	1	19
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1	3	3	2	2	2	2	4	26.1	37	2	29
2	2	3	1	2	2	2	4	20.8	37	2	30
2	1	4	1	2	1	2	3	17.3	52	2	31

The code of master data sheet

gender	
Male	1
Female	2

age	group
15-24	1
25- 34	2
35-44	3
45 -54	4
55 -64	5
65 -74	6

BMI	groups
15 -19	1
20 -24	2
25 -29	3
30 -34	4
35 -39	5

obesity	
obese	1
not obese	2

Association disorder	
DM	1
HTN	2
Both	3
None	4

Life style	
High L.S	1
Low L.S	2

Alcoholic abuser	
alcoholism	1
none	2

Fatty texture	
not fatty	1
fatty	2