

بسم الله الرحمن الرحيم

**Sudan University of Science and Technology**  
**College of Post Graduate and Scientific Research**

# **Characterization of the liver in patient with jaundice by using ultrasound**

**توصيف الكبد لدى مرضى اليرقان باستخدام الموجات فوق الصوتية**

A THESIS SUBMITTED FOR PARTIAL FULFILLMENT OF MSC DEGREE IN MEDICAL ULTRASOUND

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## ***Dedication***

To my parents **MOHAMED ABUTUMA** and **FATIMA MUSA**, who help me to study further about the radiological sciences to help patients in difference ways of life.

To my wife, AISHA for all help, support and mercy that she give to my life.

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## **ABSTRACT**

The liver is largest visceral organ in the body, in the Rt hypochondrium and epigastric region (Rt upper quadrant), extending into the Lt upper quadrant. Divided into three lobes Rt, Lt and caudate lobe, attached to the anterior abdominal wall by the falciform ligament, additional folds of peritoneum connect the liver to the stomach, duodenum and diaphragm. The aim of this study is evaluate the changes occurs to the liver in case of jaundice as a result of different causes, using ultrasound. Thirty patients are included in this study, their ages ranged between (15-75) years old and different genders. Ultrasound machine Esaote my lab and Siemens, with probe 5MHZ are used to measure the liver size, CBD diameter, GB wall thickness, and characterizing the shape and texture of liver. Moreover that CBD, GB stone are identified. The results of the study found that the changes occurs to the liver related to the different causes of jaundice as follows: 36.7% of patients have normal liver size ranged from 10.5-14cm, 56.6% have liver more than 14cm, 6.7% have shrunken liver. 30% of patients have a homogeneous liver texture, 40% hyperechoic, 30% hypoechoic liver texture. 93.3% of patients have normal CBD diameter (4-6mm), 6.7% more than 6mm. 6.7% of patients have CBD stone 93.3% without stone. 73.3% of patients have normal GB wall thickness (2-3mm), 26.7% more than 3mm. 10% of patients have solitary GB stone, 10% multiple stone 80% of them without stone.

## ملخص البحث

الكبد هي أكبر عضو حشوي في جسم الإنسان، تقع في إتجاه الأيمن والشرسوف تمتد إلى الربع الأيسر- العلوى. تنقسم إلى ثلاث فصوص الأيمن، الأيسر- والفص المذنب. مضمومة إلى الجدار البطنى- الأمامى بالرباط المنجلى. طيات البروتون الإضافية تربط الكبد مع المعدة والإثنى عشر والحجاب الحاجز.

الهدف من هذه الدراسة تقييم التغيرات التى تطرأ على الكبد فى حالة مرض اليرقان المرتبط بأسباب متعددة. ثلاثون مريضاً تتراوح أعمارهم ما بين- (15-75 سنة) تم فحصهم بالموجات فوق الصوتية لمعرفة القياس الطولى للكبد. وقياس قناة الصفراء المشتركة، وسمك جدار الحويصلة الصفراوية، بالإضافة إلى تحديد وجود الحساوى فى قناة الصفراء المشتركة والحويصلة الصفراوية

أهم نتائج البحث الآتى:

36.3% من المرضى- لهم قياس للكبد طولى طبيعى (10.5- 14 سم). 56.6% القياس الطولى للكبد أكثر من 14 سم, 6.7% يوجد إنكماش فى الكبد. 30% من المرضى- لهم نسيج كبدى متجانس, 40% فرط فى النسيج و 30% قصور فى النسيج. 93.3% من المرضى لهم قطر طبيعى لقناة الصفراء المشتركة (4-6 ملم), 6.7% أكثر من 6 ملم.

6.7% من المرضى- توجد لديهم حصوة فى قناة الصفراء المشتركة 93.3% لا توجد . 73.3% من المرضى لديهم سمك طبيعى لجدار الحويصلة الصفراء (2-3 ملم), 26.7% أكثر من 3 ملم.

10% من المرضى لهم حصوة واحدة فى الحويصلة الصفراء, 10% لهم عدة حساوى, 80% ليست لديهم حساوى.



**List of abbreviations:**

CBD: Common Bile Duct

GB: Gall Bladder.

RT: Right.

LT: Left.

US: Ultrasound

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## **Chapter One**

### **1.1 Introduction:**

Jaundice or hyperbilirubinaemia, is an elevated level of bilirubin in the blood. It is recognized by a characteristic yellow colouration of the skin and sclera of the eye, often accompanied by itching if prolonged.

Bilirubin is derived from the haem portion of haemoglobin. Red blood cells are broken down in the liver into haem and globin, releasing their bilirubin which is non-soluble. This is termed un conjugated bilirubin. This is taken up by the liver cells and converted to a water-soluble form conjugated bilirubin, which is excreted via the biliary ducts into the duodenum to aid fat digestion .By knowing which of these two types of bilirubin is present in the jaundiced patient, the clinician can narrow down the diagnostic possibilities. Ultrasound then further refines the diagnosis.

Jaundice can fall into of two categories:

Obstructive (sometimes called post hepatic)-in which the bile is prevented from draining out of the liver because of obstruction the biliary duct (s).

Non-obstructive (pre hepatic or hepatic), in which the elevated bilirubin level is due to haemolysis (break-down of the red blood cells) or disturbance in the mechanism of the liver for uptake and storage of bilirubin, such as in inflammatory or metabolic liver disease .(Jane Bates : 2011).

Jaundice: is a term used to describe a yellowish ting to the skin and sclera (white part of the eye).

That is caused by hyperbilirubinaemia (an excess of bilirubin in the blood). Body fluids also be yellow, the color of the skin and sclera varies depending on the level of bilirubin.

Jaundice most often occurs as a result of underlying disorder that either causes tissues to become over saturated with bilirubin or prevent the liver from disposing of bilirubin.

Abdominal ultrasonography (ultrasound)-uses high frequency sound waves to create a two-dimensional image of the soft tissues inside the human body. It is especially useful in identifying tumors, and dilated bile duct and gallstones (Caroline Gillott: 2013).

### **1.2 Problem of the study:**

Jaundice as a disease has different causes , some of them are simple and other are complicated and may be fatal , so the neglect of the complex one lead to further complication.

### **1.3 Research Objectives:**

#### **1.3.1 General objectives:**

To evaluate the pathological changes of the liver caused by jaundice.

#### **1.3.2 Specific objectives:**

To measure the liver size.

To identify the shape of the liver.

To assess the changes occurs to the texture of the liver.

To measure the CBD diameter.

To measure the GB wall thickness.

To characterize the different causes of the jaundice.

### **1.4 Thesis Overview:**

This study consist of five chapters:

**Chapter one:** Contains introduction and objectives (general and specific).

**Chapter two:** Contains anatomy, physiology and pathology of the liver.

**Chapter three:** Contains technical methods and tools.

**Chapter four:** Contains the result presentation.

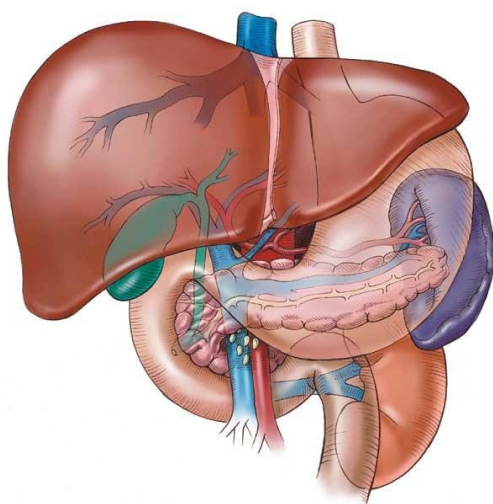
**Chapter five:** Contains discussion, conclusion and recommendations.

## Chapter Two

### Literature Review:

Liver lies in the right upper quadrant of the abdomen, suspended from the right hemidiaphragm. Divided into three lobes-right, left and caudate lobe. The right lobe of the liver can be divided into anterior and posterior segments by intersegmental fissure. The left lobe divided into medial and lateral segments. The caudate lobe is situated on the posterior aspect of the liver.

### 2.1 Anatomy:



**Figure (2.1) Shows anatomy of the liver**

The liver is covered by a thin connective tissue layer called Glisson's capsule. The capsule surrounds the entire liver and is thickest around the inferior vena cava and the porta hepatis, at which the portal vein, the proper hepatic artery, and the common bile duct are contained within the hepatoduodenal ligament. The falciform ligament conducts the umbilical vein to the liver during fetal development, after birth forming the ligamentum teres. The right layer forms the upper layer of the coronary ligament, the left layer forms the upper layer of the triangular ligament.

**Liver Vascular Supply:** The liver receives dual blood supply from both the portal vein and the hepatic artery. Portal vein carries incompletely oxygenated (80%) venous blood from the intestines and spleen , it supplies up to one half the oxygen to hepatocytes.

It divides into two branches the right and left portal veins.

The hepatic veins are divided into three components right, middle and left. The hepatic arteries carry oxygenated blood from the aorta to the liver. ( Rumack – 2005).

## **2.2 Liver Physiology:**

The liver, bile ducts and gall bladder constitute the hepatobiliary system, which performs metabolic and excretory functions essential to physical well being. The liver has many functions, including: metabolism, digestion, storage and detoxification.

Through the process of digestion the liver expels waste products from the body via its excretory product, bile also plays an important role in fat absorption. Bilirubin is a pigment released when the red blood cells are broken down. The liver is storage site for several compounds used in a variety of physiologic activities throughout the body.

The liver is also a center for detoxification. Diseases affecting the liver may be classified as hepato cellular, when the liver cells or hepatocyte are the immediate problem; or obstructive when bile excretion is blocked.

### **2.2.1 Hepatic Metabolic Function:**

Carbohydrates, fats, and amino acids are converted chemically to other compounds or are processed for storage or energy production.

### **2.2.2 Carbohydrates:**

The liver function as a major site for conversion of dietary sugars into glucose, which is released into the blood stream for general use. Excess



sugar is converted by the liver to glycogen (a starch), which may be stored in the liver cells or transported in the blood to distance storage sites.

The liver helps to maintain a steady state of glucose in blood stream. Fats are converted in the hepatocytes to lipo proteins, in which form fats are transported through the body to sites where they are stored or used by other organs. Stored fats may be transported to the liver and converted into energy, yielding glucose or other substances such as cholesterol.

### **2.2.3 Proteins:**

The liver produces a variety of proteins, either in directly from amino acids absorbed from the gut or directly from raw materials stored within the body.

Albumin is produced in great quantities. Albumin function as transport medium for some kinds of molecules, and also helps to maintain oncotic pressure within the vascular system.

The liver is the principal source of proteins necessary for blood coagulation.

Hepatic Enzymes: are protein catalysis used throughout the body in all metabolic processes.

Hepatic detoxification functions: the liver is a major location for detoxification of body waste products, foreign chemicals and drugs, ammonium, a toxic product of nitrogen metabolism, is converted to non toxic urea in the liver, bilirubin, the breakdown product of hemoglobin, is also an important substance detoxified in the liver.

The liver excretes bilirubin into the gut via the biliary tree. Elevation of serum bilirubin results in jaundice, which is a yellow coloration of the skin, sclera, and body secretions.

#### **2.2.4 Hormones and drugs detoxification:**

The liver breaks down several hormones that otherwise would accumulate in the body.

**Bile:** is the excretory product of the liver, bile is formed continuously by the hepatocytes and transported to the gut via the bile ducts. Components of bile are water, bile salts, and bile pigments. The primary functions of bile are the emulsification of intestinal fat and the removal of waste product excreted by the liver. Prothrombin time is a liver enzyme that is part of the blood clotting mechanism ( Segendo Qazalis:2014).

#### **2.3 Liver Pathology:**

Evaluation of the liver parenchyma includes the assessment of its size, configuration, homogeneity and contour.

The hepatic parenchymal pattern changes with diseases processes. Hepatocellular diseases affect the hepatocytes and interferes with liver function. Cirrhosis, ascites, or fatty liver patterns may be detected with ultra sound examination.

Diffuse hepato cellular disease: affects the hepato cytes and interferes with liver function.

The hepato cyte is a parenchymal liver cell that performs all the functions ascribed to the liver.

##### **2.3.1 Fatty infiltration:**

Implies increased lipid accumulation in the hepato cytes.

Fatty infiltration is a benign process and may be reversible.

The patient is usually asymptomatic, however, some patient may present with jaundice, nausea and vomiting, and abdominal tenderness or pain.

**Common causes of fatty liver:**

Alcoholic liver disease

Diabetes mellitus

Pregnancy

Severe hepatitis

Chronic illness

Steroids

Moderate to severe fatty infiltration shows increased echogenicity on ultra sound.

The portal vein structures may be difficult to visualize because of the increased attenuation of the ultra sound.

The increased attenuation also causes a decrease in penetration of the sound beam.

**Classification of the fatty infiltration:**

Grade1: a slight diffuse increase in fine echoes in the hepatic parenchyma with normal visualization of the diaphragm and intra hepatic vessels borders.

Grade2: a moderate diffuse increase in fine echoes with slightly impaired visualization of the intra hepatic vessels and diaphragm.

Grade3: a marked increased in fine echoes with poor or no visualization of the intra hepatic vessels borders, diaphragm, and posterior portion of the right lobe of the liver. Fatty infiltration is not always uniform through the liver parenchyma. It is not uncommon to see patchy distribution of fat, especially in the right lobe of the liver.

### **2.3.3 Hepatitis:**

Is the general name for inflammatory and infectious disease of the liver, of which there are many causes.

The disease may result from a local infection from an infection elsewhere in the body or from chemical or drug toxicity.

**Viral hepatitis:** is considered to result from infection by a group of viruses that specially target the hepatocytes.

**Type A hepatitis:** is spread primary by fecal contamination, because the virus lives in the alimentary tract.

**Hepatitis B:** Is caused by the type B virus, which exists in the blood stream by transfusions of infected blood or plasma or through the use of contaminated needles.

Hepatitis B is the greatest risk to health care workers because of the nature of transmission.

#### **Acute hepatitis:**

In acute hepatitis, damage to the liver may be range from mild disease to massive necrosis and liver failure.

On ultra sound examination the liver may appear normal, hepatosplenomegally is present, and the gall bladder wall is thickened.

#### **Chronic hepatitis:**

Chronic hepatitis exists when there is clinical or bio chemical evidence of hepatic inflammation for at least 3 to 6 months.

#### **Causes of chronic hepatitis:**

Viral.

Metabolic.

Auto immune.

Drug induce.

Chronic persistent hepatitis is a benign, self limiting process.

Chronic active hepatitis usually progress to cirrhosis and liver failure.

#### **2.3.4 Cirrhosis:**

Is a chronic de generative disease of the liver in which the lobes are covered with fibrous tissues, the parenchyma degenerates, and the lobules are infiltrated with fat.

The essential feature is silmultaneous parenchymal necrosis, regeneration, and diffuse fibrosis resulting in disorganization of lobular architecture.

The process is chronic and progressive, with liver cell failure and portal hypertension at the end stage.

Cirrhosis is most commonly the result of chronic alcohol abuse, but can be the result of nutritional deprivation or hepatitis or other infecton.

#### **Types of cirrhosis:**

Biliary cirrhosis.

Fatty cirrhosis.

Post hepatic cirrhosis.

**Biliary cirrhosis:** (1) obstructed bile damage and destroy liver cells.

(2) lead to inflammation, fibrosis and formation of regenerative nodules.

**Fatty cirrhosis:** most common cause:

alcohol cause metabolic changes in the liver

fatty infiltration of hepatocytes

inflammatory cells infiltrate the liver causing necrosis , fibrosis and destruction of functional liver tissues .

liver shrinks and develops a nodular appearance .

malnutrition commonly accompanies alcoholic cirrhosis.

**Post hepatic cirrhosis:**

result from chronic hepatitis B or C or unknown cause.

liver shrunken and nodular with cell loss and fibrosis.

Patients with acute cirrhosis may seem asymptomatic or may have symptoms that include nausea, flatulence, ascites, light colored stools, weakness, abdominal pain, varicosities, and spider angiomas.

The diagnosis of cirrhosis by ultra sound may be difficult. Specific finding may include coarsening of liver parenchyma secondary to fibrosis and nodularity.

Hepatosplenomegaly may present with ascites surrounding the liver. Chronic cirrhosis may show nodularity of the liver edge, especially if ascites is present. Portal hyper tension may present with or without abnormal Doppler flow patterns.

Patient who have cirrhosis have an increased incidence of hepatoma tumors within the liver parenchyma.

**2.3.5 Glycogen storage disease:**

There are six categories of glycogen storage disease, which are divided on the basis of clinical symptoms and specific enzymatic defects.

The most common is type 1, or voncierkes disease, abnormally large amounts of glycogen are deposited in the liver and kidney, Patients present with hepatomegaly, increased echogenecity, and nodularity increased attenuation.

**2.3.6 Haemochromatosis:**

Is a rare disease of iron metabolism characterized by excess iron deposits in the body that may lead to cirrhosis and portal hypertension.

Ultrasound does not show specific finding other than hepatomegaly and cirrhotic change.

### **2.3.7 Diffuse abnormalities of the liver parenchyma:**

Biliary obstruction, common bile ducts stones and stricture, passive hepatic congestion, extra hepatic mass, proximal biliary obstruction proximal to the cystic duct can be caused by gall stones, carcinoma of the common bile duct , or metastatic tumor invasion of the portahepatis.

Clinically the patient may be jaundiced and have pruritus (itching). Sonographically, carcinoma of the common bile duct shows as tubular branching with dilated intrahepatic ducts. Gallbladder is of normal size, even after a fatty meal is administered .

#### **Distal biliary obstruction:**

Stone in the common bile duct, an extra hepatic mass, stricture of the common bile duct.

Clinically, common bile duct stone cause right upper quadrant pain, jaundice and pruritus, as well as an increase in direct bilirubin and alkaline phosphate.

#### **Extra hepatic mass:**

Cause the same clinical signs as in biliary obstruction, there is intra hepatic ductal dilatation, with hydrobic gall bladder, the lesion may arise from the lymph nodes, pancreatitis. Pseudo cyst. Or carcinoma in the head of pancreas.

**Common duct stricture:**

Clinically the patient is jaundice and has had a previous cholecystectomy, is present dilated intra hepatic duct with absence of mass in the porta hepatis.

**Massive hepatic congestion:**

Develops as secondary to congestive heart failure with sign of hepatomegaly, on ultra sound examination, dilatation of the inferior vena cava, superior mesenteric, hepatic, and splenic veins are noted.

**Focal hepatic disease:**

Very few hepatic lesion have specific sonographic feature. Intrahepatic masses may cause displacement of the hepatic vascular radicles, external bulging of the liver capsule, or posterior shift of the inferior vena cava.

**2.3.8Cystic lesions:**

Usually refers to solitary non parasitic cyst of the liver. The cyst may be congenital or acquired, solitary or multiple. When the cysts become large, pain may develop as the lesion compress the hepatic vasculature or ductal system.

**Cystic lesions within the liver include the following:**

Simple

Congenital

Traumatic cyst

Parasitic cyst

Inflammatory cyst

Pseudocysts



**Simple hepatic cysts:**

The sonographic finding of simple hepatic is usually incidental because most patients are asymptomatic.

Hepatic cysts occur more often in females than in males, the cyst walls are thin, with well-defined borders, and an echoic, enhancement.

**Congenital hepatic cysts:**

Is rare and usually is an incidental lesion ,this abnormality arises from developmental defects in the formation of bile ducts ,the mass is usually solitary and may vary in size from tiny to as large as 20 cm.

**Poly cystic liver disease:**

Is autosomal dominant and affects 1 person in 500, at least 25 to 50% of patients with polycystic renal disease have one to several hepatic cyst, on ultrasound examination, the cysts generally present as an echoic well-defined borders with acoustic enhancement.

**2.3.9 Inflammatory disease of the liver:**

Hepatic abscesses occur most often as of complications biliary tract disease, surgery, or trauma.

**Basic types of liver abscess:**

Intrahepatic

Subhepatic

Subphrenic

Generally, the patient present with fever, elevated white blood counts, and right upper quadrant pain. The search for an abscess must be made to locate solitary or multiple lesions within the liver or abnormal fluid collections.

**Infectious processes:**

Pyogenic abscess

Hepatic candidiasis

Chronic granulomatous disease

Echinococcal disease

**Pyogenic abscess: is (pus-forming abscess).**

Clinically the patient present with fever, pain, pleuritis, nausea, vomiting, diarrhea. The abscess may be hypo echoic with round or ovoid margins and acoustic enhancement, or it may be complex, with debris along the posterior margin and irregular walls. If gas is present it can be hyper echoic with dirty shadowing.

**Hepatic candidiasis:**

It usually occurs in immune compromised hosts and is caused by a species of candida. Clinically the patient may present with non specific findings, such as fever and localized pain, the liver may present as multiple small hypo echoic masses with echogenic central cores, referred to as bull s-eye or target lesions.

**Chronic granulomatous disease:**

Congenital defect in the leukocytes that is able to ingest but not kill certain bacteria. On ultrasound a poorly marginated, hypo echoic mass is seen with posterior enhancement.

**Amebic abscess:** is a collection of pus formed by disintegrated tissue caused by protozoan parasite *Entamoeba histolytica*. The infection is primarily is a disease of the colon, patient may be asymptomatic or may show the gastrointestinal symptoms of abdominal pain, diarrhea, leukocytosis, and low fever.

The lesion is hypo echoic compared with normal liver parenchyma, with low level echos.

**Echinococcal cyst:**

Hepatic echinococcal is an infectious cystic disease common in sheep-herding areas of the world. The echinococcal is a tape worm that infects human as the intermediate host. The echinococcal has two layers: the inner layer and outer, or inflammatory reaction. Daughter cyst may develop from the inner layer, the cysts may enlarge and rupture and may also lead to vascular thrombosis and infarction.

On ultrasound, several patterns may occur, from a simple cyst to a complex mass.

If a daughter cyst is found, it is specific for echinococcal disease.

**2.3.10 Benign hepatic tumors:****2.3.10-1 Cavernous hemangioma:**

A hemangioma is a benign, congenital tumor consisting of large, blood-filled cystic spaces.

Cavernous hemangioma is the most common benign tumor of the liver. Patients are usually asymptomatic and is more frequently in females, a small percentage may bleed causing right upper quadrant pain.

Hemangiomas enlarge slowly and undergo degeneration, fibrosis, and calcification.

They are round, oval, or lobulated with well-defined borders, hyperechoic with acoustic enhancement. The large hemangioma may have a mixed pattern resulting from necrosis.

They may also project with calcification or a complex or anechoic echo pattern.

The differential consideration for hemangioma should include metastases, hepatoma, focal nodular hyperplasia, and adenoma.

#### **2.3.10.2.1 Liver cell adenoma:**

Consist of normal or slightly atypical hepatocytes with areas of bile stasis and focal hemorrhage or necrosis.

The lesion is found in women and has been related to oral contraceptive usage.

Patients may present with right upper quadrant pain secondary to rupture with bleeding into the tumor.

It is hyper echoic with a central hypo echoic area caused by hemorrhage and it may be solitary or multiple.

#### **2.3.10.2.2 Hepatic cyst adenoma:**

This is a rare neoplasm occurring in middle age women that contain cystic structures with the lesion.

#### **2.3.10-3 Focal nodular hyperplasia:**

Is the second most common benign liver mass after hemangioma and it is found in women under 40 years age. The lesion occur more in the right lobe of the liver, and the patient is asymptomatic, there may be more than mass, many are located along subcapsular area of the liver, some are pedunculated, and may have a central scar.

The lesion appear well defined with hyper echoic to iso echoic patterns compared with liver.

#### **2.3.11 Malignant disease:**

Primary malignant tumors are relatively rare in the liver. The most common tumor is hepatocellular carcinoma, developing in cirrhotic liver.

Symptoms include nausea and vomiting, and hepatomegaly, portal hypertension and splenomegaly are common.

### **2.3.11-1 Hepatocellular carcinoma:**

Is the most common primary malignant neoplasm, the prevalence varies, depending on predisposing factors such as hepatitis B and aflatoxin exposures.

The pathogenesis of hepatocellular carcinoma is related to cirrhosis, chronic hepatitis and hepatocarcinogens in food.

The tumor occur more frequently in men. Clinically, patient with HCC usually present with a previous history of cirrhosis, a palpable mass, hepatomegaly, appetite disorders, and fever.

The carcinoma may present in one of three patterns = Solitary massive tumor. Multiple nodules. Diffuse infiltrative masses.

A variable appearance is noted with discrete lesions hypoechoic or hyper echoic. The carcinoma can be very invasive and has been known to invade hepatic veins to produce Budd-chari syndrome .The lesion may be isoechoic, and halo may surround the lesion.

Another pattern presents as diffuse involvement with in homogeneity. The last pattern is a combination of discrete and diffuse echoes. Hepatocellular carcinoma cannot be differentiated from metastasis on ultrasound.

### **2.3.11-2 Metastatic disease:**

Is the most common form of neoplastic involvement of liver. The majority of metastases arise from a primary colonic malignancy, breast and lung are also common.

Metastatic spread occurs through the lymphatic stream or through the blood stream. The ultrasound patterns is multiple through both lobes of the liver.

**Three specific patterns has been described:**

A well defined hypoechoic mass.

A well defined echogenic mass.

Diffuse distortion of the normal homogeneous parenchymal pattern. Target types of metastases or bull s eye patterns are the result of edema around the tumor or necrosis or hemorrhage within the tumor.

The lesion may be solitary or multiple, be variable in size and shape and have sharp or ill defined margins.

( Segendao Qazalis- 2014).

**2 .3.11-3 Lymphoma:**

Are malignant neoplasms involving lymphocyte proliferation in the lymph nodes. The two main disorders:

Hodgkins lymphoma.

non-hodgkins lymphoma.

The patient may present with enlarged non tender lymph nodes, fever, fatigue, night sweats, bone pain, or an abdominal mass.

The presence of splenomegaly or retroperitoneal nodes may help confirm the diagnosis of lymphadenopathy.

**2 .3.12 Hepatic trauma:**

This is the third most common organ injured in the abdomen after the spleen and kidney. Computerized tomography is used more often than ultrasound to localized the extend of the laceration with the liver and surrounding areas.

Septation and internal echoes develop 1 to 4 weeks after the trauma.

**2.3.13 Liver transplantation:**

Is performed to eliminate irreversible disease when more conservative medical and surgical treatments have failed.

**Common indication:**

Cirrhosis.

Fulminant active hepatitis.

Congenital metabolic disorders.

Sclerosing cholangitis.

Budd chiari syndrome.

Un resectable hepatoma.

Ultrasound can play an important role in the operative and post operative evaluation the hepatic transplantation.

**2.3.14 Portal venous hypertension:**

Exists when the portal venous pressure is above 10 mm Hg.

Acute or chronic hepatocellular disease can block the flow of blood throughout the liver, causing it to back up into the hepatic portal vein.

In an effort to relieve the pressure, collateral veins are formed that connect to the systemic veins. These are known as varicose veins and occur most frequently in the area of the esophagus, stomach, and rectum. Rupture of these veins can cause massive bleeding that may result in death.

Portal hypertension may also develop when hepatopedal flow (toward the liver) is impeded by thrombus or tumor invasion.

The most common mechanism for increased resistance to flow occurs in patients with cirrhosis.

Collateral circulation develops when the normal venous channels obstructed. This diverted blood flow causes embryonic channels to reopen, blood flow hepatofugal (away from the liver) and is diverted into collateral vessels.

The most common collateral pathways are through the coronary and esophageal veins.

The umbilical vein may become recanalized secondary to portal hypertension. The invasion of the portal system with tumor or thrombosis may cause portal hypertension if the vessel is significantly occluded.

Portal vein thrombosis may develop secondary to trauma, sepsis, cirrhosis or hepatocellular carcinoma.

### **2.3.15 Budd chiari syndrome:**

Is an uncommon, often dramatic illness caused by thrombosis of the hepatic veins or inferior vena cava.

Symptoms are abdominal pain, hepatosplenomegaly, jaundice and diarrhea.

Ultrasound is useful in imaging patient with hepatic vein thrombosis and has proven to be diagnostic in 87% of cases.

(Segendao Qazalis- 2014)





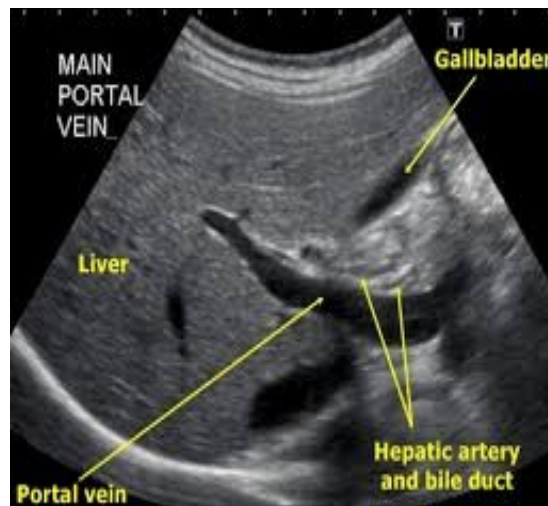
**Figure (2.2) shows normal liver texture**



**Figure (2.3) shows normal liver and hepatic veins**



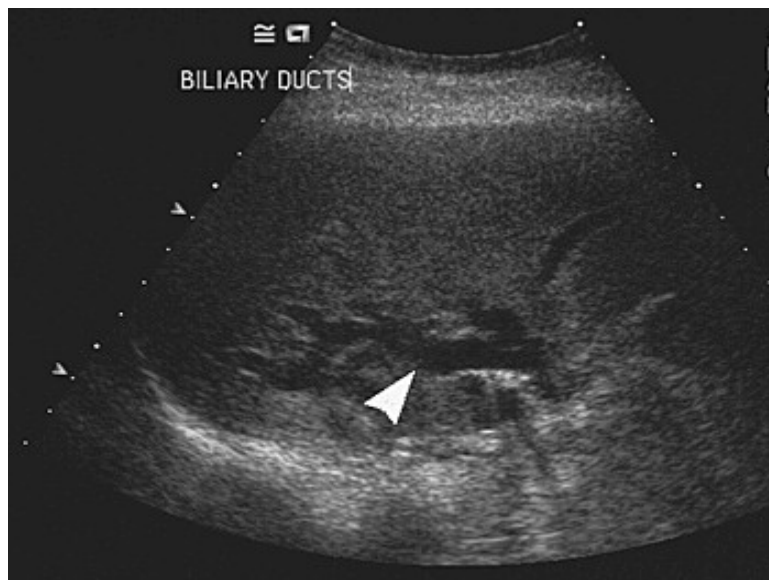
**Figure (2.4) shows the normal right lobe of the liver**



**Figure (2.5) shows the Normal portal vein**



**Figure (2.6) shows liver with multiple cysts**



**Figure (2.7) shows dilated biliary ducts**

## **Chapter Three**

### **3.1 Material**

#### **3.1.1. Patients**

Preparation of the patient: the patient should take nothing by mouth for 8 hours preceding the examination, if fluid is needed only water should be given. If symptoms are acute precede with the examination, infants should be given nothing by mouth for 3 hours preceding the examination.

#### **Position of the patient**

We start with patient lying supine, and later we turn the patient on to the left side or examined erect on hands and knees.

Apply coupling agent to the right upper quadrant or abdomen, later cover the left upper quadrant of the abdomen also.

Perform the scans with patient holding the breath in or with abdomen pushed out in full expiration.

#### **3.1.2 Machine**

US machine Esaote my lab and Siemens of 3.5MHZ probe for adults and 5MHZ Probe for thin adults and children.

Setting the correct gain placing the transducer centrally at the top of the abdomen (the xiphoid angle).

Angle the beam to the right side of the patient to image the liver.

### **3.2 Methods**

#### **3.2.1 Technique**

We start with longitudinal scan ,then transverse scan, and intercostals scan if needed, then turn the patient on to the left side and make oblique scan at different angles, if there is an excessive gas in the bowel the patient must be examined standing erect.

The hands/ knees position can be used to demonstrate gall stone more clearly allowing the stone to move anteriorly.

**Setting the correct gain:**

The gain should allow the diaphragm to be clearly seen , the liver when normal appear homogeneous through its depth .(P.E.S.Palmer:2002).

Supine longitudinal scan plane: the longitudinal or sagittal scan offers an excellent window to visualise the hepatic structure sweep under the costal margin (with slight to medium pressure) to record the liver parenchyma from the anterior abdominal wall to the diaphragm. As one moves midline or slightly to the right of the midline, a larger segment of the left lobe and the inferior vena cava may be seen posteriorly. In this view, it is useful to record the inferior vena cava as it is dilated near the end of inspiration .The left or middle hepatic vein may be imaged as it drains into the inferior vena cava near the level of the diaphragm.

The area of porta hepatis is shown anterior to the inferior vena cava as the superior mesenteric vein. The common bile duct may be seen just inferior to the main portal vein. The last scan is usually made to show the right kidney and the lateral segment of the right lobe of the liver.

The liver texture is compared to the renal parenchyma .The normal liver parenchyma should have a softer, more homogeneous texture than the dense medulla and hypoechoic renal cortex.(Sandal : 1975).

The normal sonographic appearance of the liver: the liver is a homogeneous, mid-gray organ on ultrasound .It has the same, or slightly increased echogenecity when compared to the cortex of the right kidney. Its outline is smooth, the inferior margin coming to a point anteriorly. The liver is surrounded by a thin, hyperechoic capsule, which difficult to see on ultrasound unless outlined by fluid.(Jane Bates :2011)

### **3.2.2 Measurements :**

The normal size of liver in adults: range from 10.5-14cm .

The normal GB wall thickness is range from 2-3mm.

The normal internal diameter of the CBD in adults is range from 4-6mm.

(Carol et al., 1993 ).

## Chapter Four:

### Results

The data was collected from the random patients admitted in the Omdurman Military Hospital and the Ribat University Hospital during the period from the first April 2015 to thirty September 2015, and it is analyzed using the statistical package for social science-SPSS version 16.

The following pages discuss the results of the analysis.

**Table (4.1) Gender distribution**

	Frequency	Percent	Valid percent	Cumulative Percent
Male	22	73.3	73.3	73.3
Female	8	26.7	26.7	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

The table (4-1) above shows that the gender of patients surveyed in this study is distributed 73.3% males and 26.7% females.

**Table (4.2): Age distribution**

	Frequency	Percent	Valid percent	Cumulative Percent
30 Years and less	6	20	20	20
31 – 40 years	10	33.3	33.3	53.3
41 – 50 Years	6	20	20	73.3
51 – 60 Years	3	10	10	83.3
60 Years and more	5	16.7	16.7	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

The table (4.2) above shows the patients in this study aged between 31-40 years with a percentage 33.3% .The age class 30 years and less and

41-50 years 20% for all. The age class 60 years and more 16.7%. The age class 51-60 10%.



**Table (4.3): Liver Size**

	Frequency	Percent	Valid percent	Cumulative Percent
10cm and less	2	6.7	6.7	6.7
10.5-14cm	11	36.7	36.7	43.3
More than 14cm	17	56.6	56.6	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.3): above indicates that the majority of patients in this study have liver size more than 14cm 56.6% while those how have liver size 10.5-14cm are 36.7 % other who have liver size 10cm and less are 6.7%.

**Table (4.4): Liver Texture**

	Frequency	Percent	Valid percent	Cumulative Percent
Hypoechoic	9	30	30	30
Hyperechoic	12	40	40	70
Homogeneous	9	30	30	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.4) above illustrates that the patients in this study are have hyperechoic liver texture 40%. While that who have hypoechoic liver texture are 30% .Others of homogeneous liver texture are 30% also.

**Table (4.5): Liver Shape**

	Frequency	Percent	Valid percent	Cumulative Percent
Smooth	24	80	80	80
Irregular	6	20	20	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.5) above shows that the majority of patients in this study have smooth liver shape are 80%, while those who have irregular liver shape are 20% .

**Table (4.6): GB Wall thickness**

	Frequency	Percent	Valid percent	Cumulative Percent
2-3mm	22	73.3	73.3	73.3
More than 3mm	8	26.7	26.7	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.6) shows that patients have GB wall thickness 2-3mm are 73.3% , and the other who have more than 3mm are 26.7% in this study.

**Table (4.7): GB Stone**

	Frequency	Percent	Valid percent	Cumulative Percent
Solitary	3	10	10	10
Multiple	3	10	10	20
Normal	24	80	80	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.7) above indicates the majority of patients in this study have no GB stone are 80%, and that who have solitary & multiple stones are 10% percentage respectively.

**Table (4.8): CBD diameter**

	Frequency	Percent	Valid percent	Cumulative Percent
4-6 mm	28	93.3	93.3	93.3
More than 6mm	2	6.7	6.7	100.0

<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	
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Table (4.8) present majority patients have CBD diameter range from 4-6mm are 93.3% while those who have CBD diameter more than 6mm are 6.7% percentage.

**Table (4.9): CBD Stone**

	<b>Frequency</b>	<b>Percent</b>	<b>Valid percent</b>	<b>Cumulative Percent</b>
Yes	2	6.7	6.7	6.7
No stone	28	93.3	93.3	100.0
<b>Total</b>	<b>30</b>	<b>100.0</b>	<b>100.0</b>	

Table (4.9) above reveal that 93.3% percentage of in this study have no CBD stone while that who have are 6.7 percentage.



## **Chapter five**

### **Discussion, Conclusion and Recommendation**

#### **5.1 Discussion:**

The study was conducted in Omdurman Military Hospital and El Ribat university Hospital- ultrasoud department , 30 –thirty patients were enrolled in the study .

The result of the study showed that the patients with jaundice having a liver size more than 14cm are 56.6% as in table (4.3), indicate hepatomegaly and may be due to mass or hydatid cyst , while those that who have a liver size less than 10cm are 6.7% that mean shrunken liver ,and this is consistent with study of factors which affecting the liver size in case of jaundice related to alcohol consumption , which lead to liver cirrhosis .

Table (4.4) illustrates the liver echogenicity, 40% of these patients in the study having a liver with hyper echoic texture, and 30% of patients have a liver with hypo echoic texture , while 30% of patients have a normal liver echo texture , but in mind that the normal sonographic appearance of the liver in ultrasound is homogeneous compared with the cortex of the right kidney. The changes that occurs to the liver echogenicity may be due to severe inflammatory condition as in HIV virus or opportunistic organism. Table (4.5) shows that the patients with jaundice in this study having irregular liver shape are 20% percentage.

As we know on ultrasound the liver shape is smooth out line, the reason that alter the shape to be irregular associated with different causes of jaundice, related to severe inflammatory condition occurs to the liver such as hepatitis or HIV. Table (4.6) present the jaundice patients in this study having a GB wall thickness more than 3mm are 26.7% percentage, this indicate that there is cholecystitis, which may be acute or chronic and finally

it leads to jaundice, or fungating intraluminal mass, this is consistent with study of ultrasonography in obstructive jaundice –A pictorial Essay. Table (4.7) shows the jaundiced patients in this study having gall stone 20% percentage, and this may be due to bile stasis as a result of inflammation of the gallbladder. Table (4-8) reveal 6.7% percentage of the jaundice patients in this study having CBD diameter more than 6mm, due to obstructive jaundice that occurs as result of different causes such as complex mass, hydatid cyst or stone block intra hepatic or extra hepatic ducts, . In table (4.9) we found that 6.7% percentage of jaundiced patients in this study with CBD stone, and may be primary resulting from bile stasis and infection or secondary from gallbladder, and this consistent with the study in ultrasonography in obstructive jaundice –A pictorial Essay.

As a result, according to the discussion above, it reveal that there is a relationship between the jaundice that associated with different causes and the changes that occurs to the liver in its shape, size and texture.

## **5.2 Conclusion:**

This study was conducted in Omdurman Military Hospital-ultra sound department and El Ribat university Hospital-ultrasound department Khartoum State, in the period from the first of April 2015 to thirty of September 2015 for 30 jaundice patients 73.3% male, 26.7% female, the aim of the study is to evaluate the pathological changes that occurs to the liver caused by jaundice using ultrasound. The result conclude that there are changes in the liver size, shape and echogenicity due to different causes of jaundice as severe inflammatory condition, neoplasm and other pathological problems.

Ultrasonography is important to diagnose any changes occurs to the liver in case of jaundice to control the complications.

### **5.3 Recommendation:**

After the result that obtained in this thesis there are some concepts available to recommended as follow:

Ultrasonography must be used as a routine to scan jaundice patients. Ultrasonography is very important to differentiate obstructive jaundice from non obstructive one , and help further to diagnose complex masses in the liver .

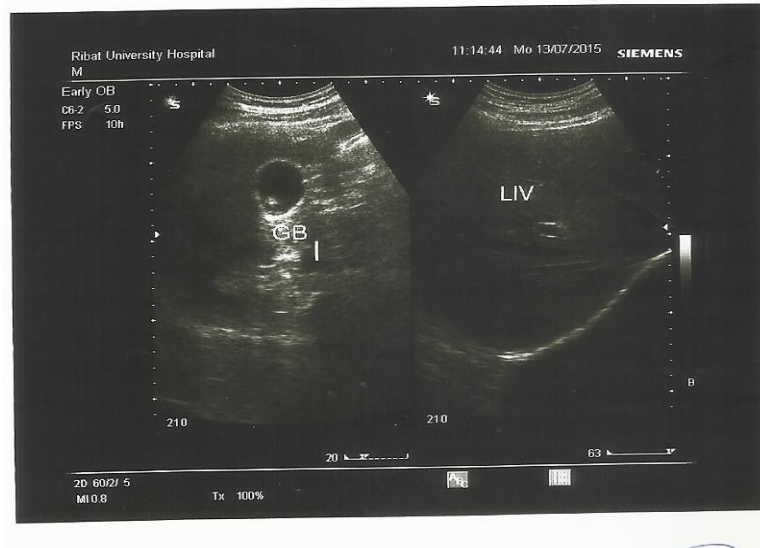
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## **Appendix**

## Appendix (1)



Sonographic Image of Jaundice Patient in the study:

Male: 40 years old.

Liver size: 13.7 cm

Liver shape: smooth

Liver texture: normal.

GB. Wall thickness: 4 mm.

## Appendix (2)

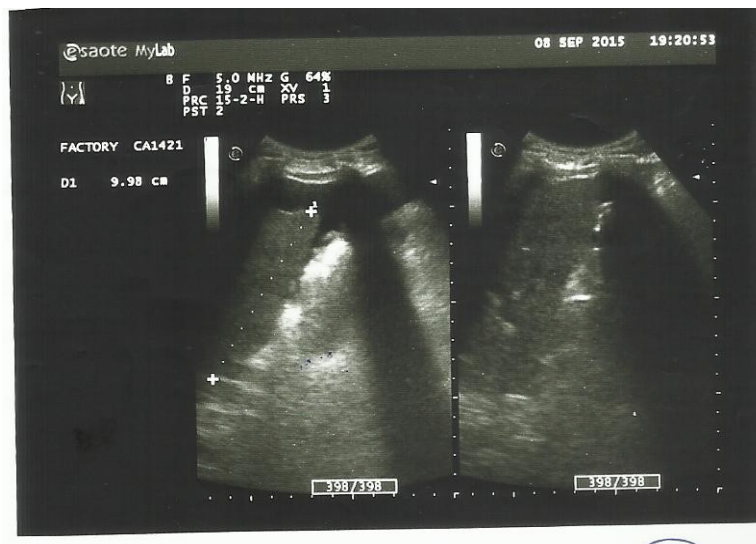


Image of patient.

Male: 65 years old.

Shows shrunken liver.

Liver shape irregular.

### Appendix (3)

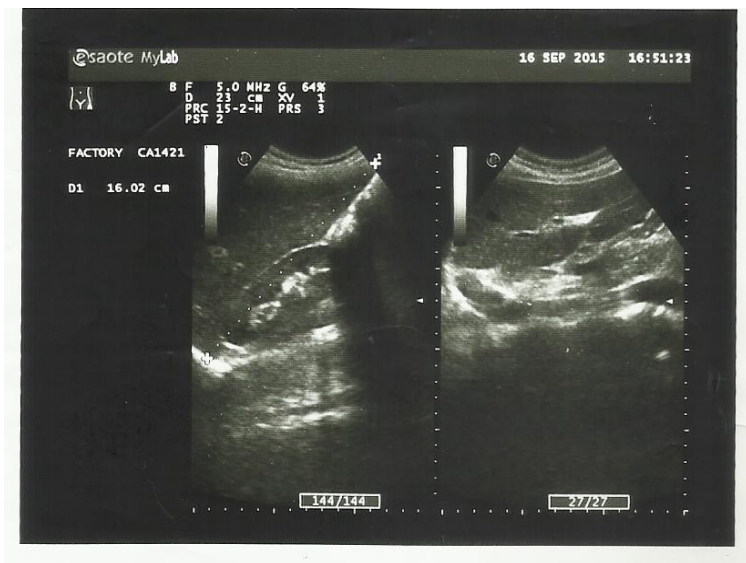


Image of patient.

Female: 23 years old.

Show hepatomegaly.

Liver size: 16.02 cm.