بِسْمِ ٱللَّهِ ٱلرَّحْمَٰنِ ٱلرَّحِيمِ

كلية الدراسات العليا

Sudan University of Science and Technology

College of Graduate Studies

Assessment of Right Upper Quadrant Pain using Ultrasonography

تقييم الألم في الربع العلوي الأيمن بإستخدام الموجات فوق الصوتية

A Thesis Submitted for Partial Fulfillment of Requirements of M.SC Degree in Medical Diagnostic Ultrasound

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الآيــة

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

قال تعالي :

{ وَعَلَّمَكَ مَا لَمْ تَكُنْ تَعْلَمُ وَكَانَ فَضْلُ اللهِ عَلَيْكَعَظِيماً}

صدق الله العظيم

النساء الآية 113

DEDICATION

I dedicate this thesis to my parents. I hope that this achievement will complete the dream that you had for me all those many years ago when you chose to give me the best education you could.

This humble work is also dedicated to my mother-in-law, Dr. laila Taha whose words of encouragement and push for tenacity ring in my ears. I will always appreciate all you have done and how much you supported me throughout my educational career.

To my beloved sisters, who are always there to help me in order to make this work possible.

To Dr. Marwa , my amazing wife, whose sacrificial care for me and our son made it possible for me to complete this work, and to our son Ahmed.

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Abbreviations

Abbreviation	Stand for
BSP	Brom sulphthalein
CBD	Common bile duct
CD	Common duct
CM	Centimeter.
CNS	Central Nervous System.
CT	Computerized tomography
HCC	Hepatocellular carcinoma
HA	Hepatic artery
IVC	Inferior vena cava
LPV	Left portal vein
M	Mass
MRI	Magnetic resonance imaging
MHz	Mega Hertz.
PH	Pancreas head
PV	Portal vein
SOSS	Statistical Packaged for Social Studies
SGPT	Serum glutamic pyruvic transaminase
RCC	Renal cell carcinoma
RUQ	Right upper quadrant
US	Ultrasound.

Abstract

A descriptive cross–sectional and analytical study was carried at Khartoum state hospitals during the period from June to October 2016.

This study aims to diagnosis of Sudanese patients with right upper quadrant painusing ultrasound technique. The scanning followed international scanning guide lines and protocol to perform ultra sound.

The data analyzed using SPSS.

The U.S. findings of Seventy patients with right upper quadrant pain indicate that 18 (36%) were normal, on the other hand 17 (24%) the pain caused by gall bladder disease, most of them 9(52.9%) with gall bladder stones, 5(29.4%) with acute cholycystitis, while mean one (0.05%) with calculus cholycystitis 2(0.12%) with chronic cholycystitis. U.S. Examination of liver found that 11(15.7%) caused by liver disease 5(0.45%) out of them fatty liver one (0.09%) liver cyst, 2 (0.08%) abscess,1(0.09%) cancerand 2(0.08%) hepatitis.U.S examination also found there were 29(41.4%) out of them with right kidney disease most of them 17(58.6%0 with renal stones while 7(24.1%) with hydronephrosis, on the other hand 3(10%) with acute pylo nephritis and among the rest one(3.4%) with renal cyst and one (3.4%) with chronic pylo nephritis, U.s. examination of colon found that 2(2.8%), one(50%) out of them with gases and the other with trauma

There was a significant correlation between BMI and liver disease ($P \leq 0.05$) .

This study concluded that ultra sound diagnosis is useful diagnostic technique in determination of causes of right upper quadrant pain.

مستخلص الاطروحه

أجريت هذه الدراسة المقطعيه الوصفيه في عدد من مستشفيات الخرطوم في الفترة من يونيو الي اكتوبر 2016 .

تهدف هذه الدراسة تحديد مسببا ت الالم العلوي للجهه اليمنى للمرضى السودانيين باستخدام الموجات الصوتيه .تم المسح بستخدام البرتكول العالمي في الموجات فوق الصوتية .

تم جمع البينات و تحليلها بواسطة برنامج الحزم التحليلي الاحصائي.

تم فحص 70 مريض يعانون من ألم في الجزء الايمن العلوي من البطن باستخدام جهاز الموجات فوق الصوتيه. اظهرت فحص الموجات الصوتية ان هنالك 18(36%) لايعانون من اي امراض بينما 17(24%) يعانون من الم في المرارة معظمهم 9(52.9%)حصوات ،5(29.4%)التهاب حاد في المرارة ،1(0.5%)التهاب مع حصوات ،2(0.12%) التهاب مزمن ،واظهرت في الكبد 11(15.7%) اسبابها 5(0.45%) دهون في الكبد ،واحد (0.09%) تكيس في الكبد ، 2 (0.08) خوراج في الكبد عند التهاب فيروسي ،1(0.09)سرطان ، كما اظهر فحص الموجات فوق الصوتية للكلية اليمنى إن هنالك عدد 29(41.4%) معظمهم 17(58.6%) يعانون من حصوات بالكلية اليمنى ، 7(24.1%) التهاب مع انسداد في الحالب الايمن ، 3(10%) التهاب بكتيري ، منهم حاله واحده (3.4%) التهاب ممن واخرى التهاب حاد بالكليه اليمنى. وعند فحص القولون وجد ان هنالك حالة شرخ في القولون واخرى وجود غازات.

اثبتت هذه الدراسة وجود ارتباط معنوي بين موشر كتلة الجسم وامراض الكبد ($P\leq0.05$)

كما ان هنالك فرق معنوي بين الذكور والاناث بالنسبه لمرض المراره

خلصت هذه الدراسة الي ان الفحص بالموجات فوق الصوتيه له اهميه قصوى لتشخيص مسببات الالم العلوي للجهه اليمنى للمرضى.

CHAPTER ONE

INTRODUCTION

Chapter One
Introduction

1.1 Introduction

Ultrasound is the dominant first line investigation for an enormous variety of abdominal symptoms because of its non invasive and comparatively accessible nature .It is good practice, particularly on the patient's first attendance, to scan the whole of the upper abdomen, focusing particularly on the relevant areas, but also excluding or identifying any other significant pathology. (Jane,2004).

A right upper quadrant (RUQ), is an anatomical area of the human body, this area may also be called the *epigastrium*. The RUQ extends from the median plane to the right of the patient, and from the umbilical plane to the right ribcage. Internal organs of the RUQ The right upper quadrant contains all or part of the following internal organs:(Liver, Gall bladder, Duodenum , Pancreas, Colon and Right kidney. (David's, 2003)

Pain in the right upper quadrant (RUQ) can be caused by a wide variety of conditions. The age, sex and general condition of the patient will influence the likely diagnosis. History and examination will also focus the differential diagnosis. Features such as acute or chronic onset, weight loss, pyrexia, general malaise, and urinary or bowel symptoms may all help point to a diagnosis. It is important to decide if there is an acute abdomen. (Steven ,2011).

The Ultrasonography is technique which answers most of the clinical questions posed in patient with suspected upper right quadrant pathology (Dean , 2005).

1.2 Problems of Study

The problem of the study lied on the fact that the right upper quadrant pain is a common in different age groups, and caused by a different organs in the body so it need accurate diagnoses with cheap cost.

1.3 Objectives

1.3.1 General objectives

To assess the right upper quadrant pain using Ultrasonography.

1.3.2 Specific objectives

- To determine the causes of RUQ pain.
- To compare between prevalence of RUQ pain in both gender.
- To find relationship between the prevalence of RUQ pain and patients age.
- To find relationship between the prevalence of RUQ pain and patients BMI.

CHAPTER TWO

LITRETURE REVIWO

Chapter Two

Literature Review

2.1 Anatomy

2.1.1 Anatomy of the Liver

The liver is the largest internal organ of the body, weighing about kg (3.5-4.0lbs) in an adult. It is positioned immediately beneath the diaphragm in the epigastria and right hypochondriac regions of the abdomen. Its reddish brown color is due to its great vascularity.

The liver has four lobes and two supporting ligaments. Anteriorly, the right lobe is separated from the smaller left lobe by the falciform ligament (Figure 2-1).Inferiorly, the caudate lobe is positioned near the inferior vena cava, and the quadrate lobe is adjacent to the gallbladder. The falciform liga-ment attaches the liver to the anterior abdominal wall and the diaphragm. The ligamentum teres (round ligament) extends from the falciform ligament to the umbilicus. This ligament is the remnant of the umbilical vein of the fetus.(Van ,2001)

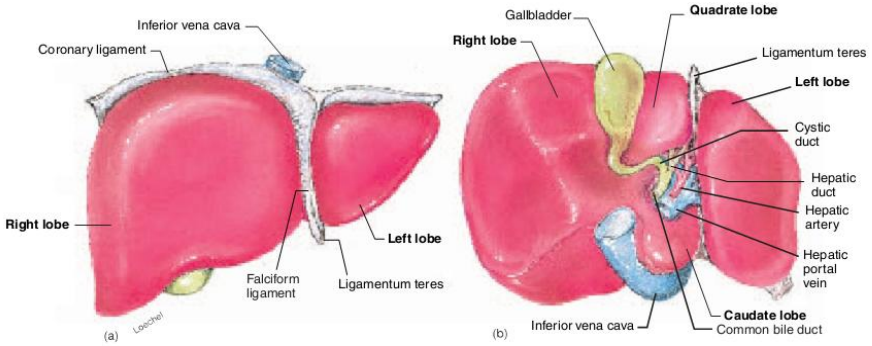

Figure (2-1). The liver and gallbladder. (a) An anterior view and (b) a rotated inferior view. (Steven,2011)

2.1.1.2 Hepatic Circulation

The liver possesses a dual blood supply, with roughly 75% of the blood coming from the portal vein and 25% from the hepatic artery. Both arterial and portal venous vessels branch and divide until they reach the hepatic sinusoids. The portal vein is divided into a right and left branch. The right branch of the portal vein passes transversely within the liver substance for a few centimeters before dividing into anterior and posterior branches, while the left branch curves anteromedially, branching into the parts of the liver it traverses. The hepatic arterial branches follow the same pattern .The hepatic veins (Figure 2-2) include three main veins, the right, middle and left, which drain the hepatic sinusoids of the liver and empty into the upper part of the inferior vena cava. The right hepatic vein runs in the coronal plain and empties separately into the inferior vena cava (IVC). The middle hepatic vein passes from the position of the gallbladder fossa and joins the left hepatic vein to form a short common trunk of approximately one centimeter before entering the anterior aspect of the IVC just below the diaphragm (Svein , 2005)**.**

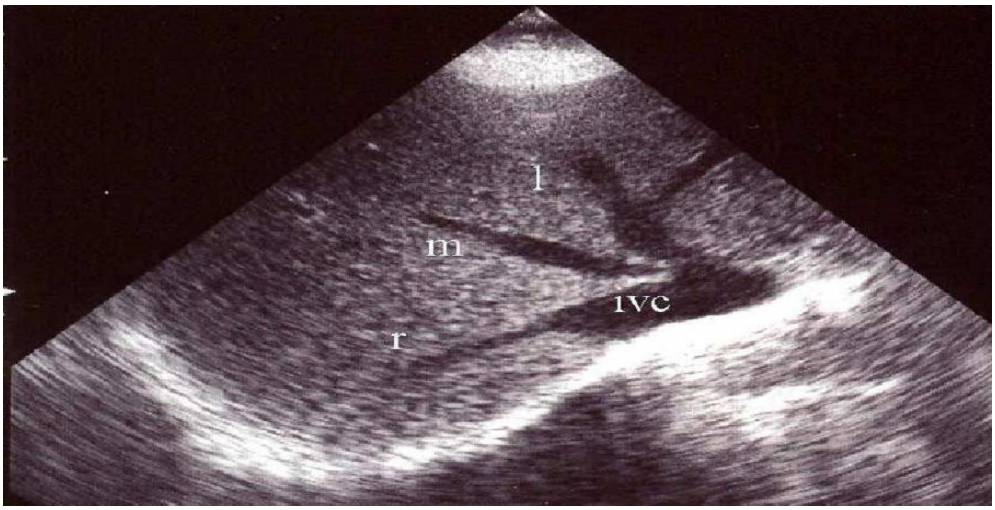

Figure (2-2). Transverse sonogram of the three main hepatic veins, the right (r), middle (m) and left (l), inferior vena cava (ivc).(Steven,2011)

2.1.1.3 External Feature

Hepatic Attachment

The liver is attached to the anterior abdominal wall ,diaphragm and other viscera by several ligaments, which are formed from condensations of the peritoneum as described .

Hepatic surface

The liver possesses three surfaces, viz., and superior, inferior and posterior . A sharp, well-defined margin divides the inferior from the superior in front; the other margins are rounded. The superior surface is attached to the diaphragm and anterior abdominal wall by a triangular or falciform fold of peritoneum, the falciform ligament ,in the free margin of which is a rounded cord, the ligamentum teres (*obliterated umbilical vein*). The line of attachment of the falciform ligament divides the liver into two parts, termed the right and left lobes, the right being much the larger. The inferior and posterior surfaces are divided into four lobes by five fosse, which are arranged in the form of the letter H.

The superior surface (*facies superior*) comprises a part of both lobes, and, as a whole, is convex, and fits under the vault of the diaphragm which in front separates it on the right from the sixth to the tenth ribs and their cartilages, and on the left from the seventh and eighth costal cartilages. Its middle part lies behind the xiphoid process, and, in the angle between the diverging rib cartilage of opposite sides, is in contact with the abdominal wall. Behind this the diaphragm separates the liver from the lower part of the lungs and pleurae , the heart and pericardium and the right costal arches from the seventh to the eleventh inclusive. It is completely covered by peritoneum except along the line of attachment of the falciform ligament.(Steven ,2011).

The inferior surface (*facies inferior; visceral surface*) is uneven, concave, directed downward, backward, and to the left, and is in relation with the stomach and duodenum, the right colic flexure, and the right kidney and suprarenal gland. The surface is almost completely invested by peritoneum; the only parts devoid of this covering are where the gall-bladder is attached to the liver, and at the porta hepatis where the two layers of the lesser omentum are separated from each other by the blood vessels and ducts of the liver.(Steven ,2011).

The posterior surface (*facies posterior*) is rounded and broad behind the right lobe, but narrow on the left. Over a large part of its extent it is not covered by peritoneum; this uncovered portion is about 7.5 cm. broad at its widest part, and is in direct contact with the diaphragm. It is marked off from the upper surface by the line of reflection of the upper layer of the coronary ligament, and from the under surface by the line of reflection of the lower layer of the coronary ligament. The central part of the posterior surface presents a deep concavity which is moulded on the vertebral column and crura of the diaphragm. To the right of this the inferior vena cava is lodged in its fossa between the uncovered area and the caudate lobe.(Steven,2011).

2.1.1.4 Liver Segments

Because sonography allows evaluation of liver anatomy in multiple planes, the radiologist can precisely localize a lesion to a given segment for the surgeon .This description is based on portal segments and is of both functional and pathologic importance. Each segment has its own blood supply (arterial, portal venous , and hepatic venous), lymphatics, and biliary drainage.

There are eight segments, the right, middle, and left hepatic veins divide the liver is further divided transversely longitudinally into four sections.

Each of these sections by an imaginary plane through the right main and left main portal pedicles.(Sandra , 2012).

The liver is divided into right and left lobes along an imaginary plane extending from thegall bladder fossa to the anterior vena cava. The most commonly used system of classifying different liver segments, the Couinaud classification system (1, 2), divides the right lobe into anterior and posterior segments, each with a superior and inferior sub segment.

The left lobe is divided into medial and lateral segments, each with an inferior and superior sub segment. Each sub segment is given a number from 1 to 8, proceeding in a clock wise direction (Meyer, 1992).

Segment one is the retrocaval portion of the caudate lobe. The other segments are defined craniocaudally by a transverse or axial section through the porta hepatis at the level where the main portal vein divides into right and left portal vein branches (on ultrasonography, this plane is best obtained subcostally in deep inspiration). Moving from right to left, this horizontal plane divides, segment 6 from 7, 5 from 8, 4a from 4b, 2 from 3.

The liver is then divided by longitudinal planes radiating from the IVC in the plane of each of the three hepatic veins. The plane through the right hepatic vein and inferior vena cava divides the right lobe into the posterolateral segments 6 and 7 and the anteromedial segments 5 and 8. The two medial segments of the left lobe, 4a and 4b, are divided from the left lateral segments, 2 and 3 by the left hepatic vein and falciform ligament. The segmental anatomy is thus defined by the major vascular tree and identifies clear surgical planes for resection .The localization of tumors according to this system is fully possible with ultrasound (Smith,1998).

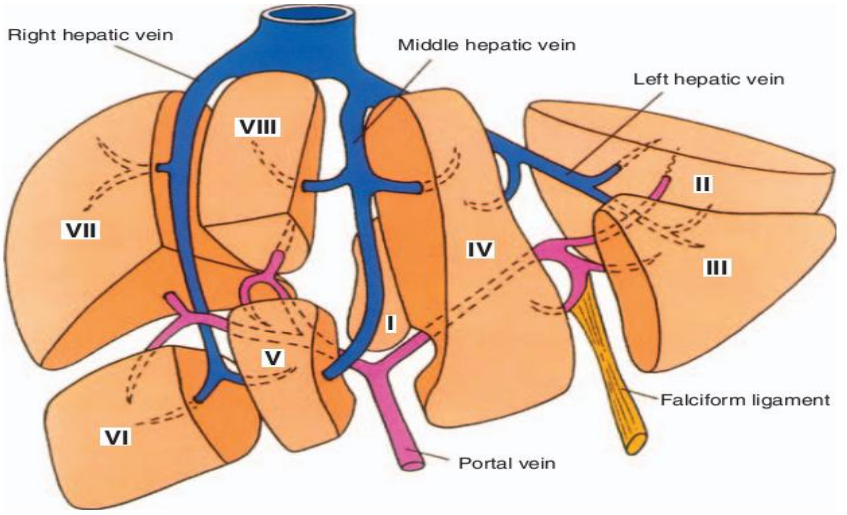

Figure (2-3).The surgical segments of the liver (after Couinaud) (Jane,2004)

2.1.1.5 Ligaments and Fissures of the Liver

Two readily identifiable ligaments may be noted within the normal liver during a sonogram: the ligamentum venosum and the ligamentum teres. The ligamentum venosum, which appears as a hyper echoic linear structure, can be noted anterior to the caudate lobe, between the caudatelobe and left hepatic lobe. The ligamentum teres can be appreciated near the left portal vein in most persons .In the transverse scan plane, it often appears as a hyperechoic, triangular shaped structure between the left and right hepatic lobes.(Steven ,2011).

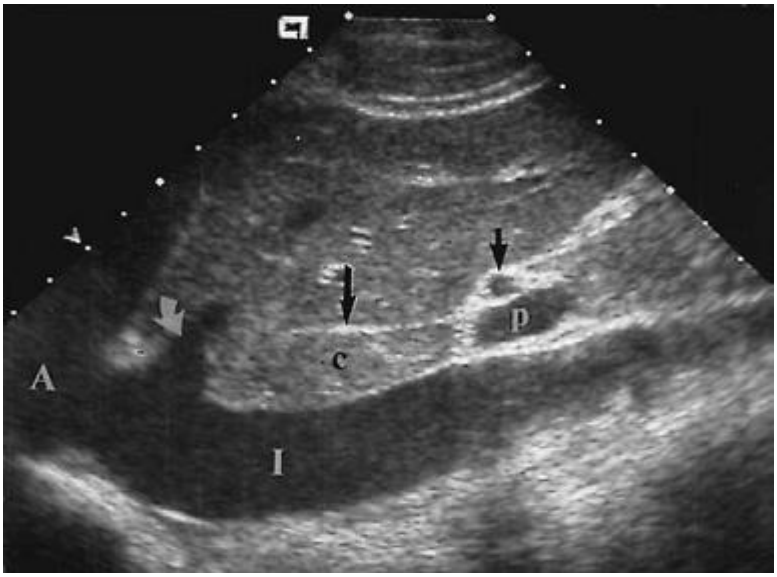

Figure (2-4).Caudate lobe (c) is located between the ligamentum venosum and the infe-rior vena cava (I). (Steven ,2011).

2.1.2 Gall Bladder Anatomy

2.1.2.1 Gross Anatomy

The gallbladder, which is located posterior to the right lobe of the liver within the gallbladder fossa, is considered an intraperitoneal organ. Although the location of the gallbladder relies on the position of the patient, auseful landmark to locate the gallbladder fossa is the main lobar fissure. (Steven ,2011).

2.1.2.2 Gross Structure Gall Bladder

The gallbladder has a neck, body, and fundus. The neck is contiguous with the cysticduct, which connects the gallbladder to the rest of the biliary system at the level of the common hepatic duct. The portion of the biliary tree that lies distal to the union of the cystic duct with the hepatic duct is the common bile duct. The fun-dus is the most dependent portion of the gallbladder and therefore is a common location for gallstones to collect.(Steven ,2011).

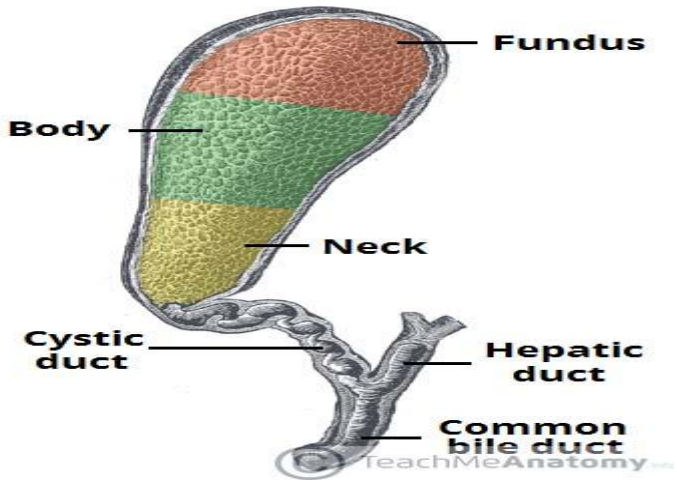

Figure (2-5). Gall bladder and biliary

www.medicinehealthy.com

2.1.2.3 MICROSCOPIC ANATOMY

This pear-shaped sac is used to store and concentrate bile. It has three distinct layers within its walls. The mucosal layer is the innermost layer. It consists of multiple folds and rugae. The middle layer of the wall is the fibromuscular layer, whereas the outer is the serosal layer**.**(Steven ,2011). The common bile duct (CBD) has a fibroelastic wall with no muscle layer except for the submucosal sphincter (of Boyden) around its lower end; it is lined with columnar epithelium, which secretes mucus (this mucus is the 'white' bile present in the CBD in patients with surgical obstructive jaundice SOJ). (Agur ,1999).

2.1.2.4 Vessels and nerves of gall bladder

The gallbladder is supplied with blood from the cystic artery, which branches from the right hepatic artery. Venous blood is returned through the cystic vein, which empties into the hepatic portal vein.

Autonomic innervation of the gallbladder is similar to that of the liver; both receive parasympathetic innervation from the vagus nerves and sympathetic innervation from thoracolumbar nerves through the celiac ganglia.(Van , 2001).

The bile is formed by the hepatocytes and ductal cells lining the hepatic ducts. The hepatocytes, one surface of which is adjacent to the blood sinusoids and other to the biliary canaliculi, pick up some constituents of bile from the blood (e.g. Bilepigments), synthesize some constituents (e.g. Bile salts) and secrete a mixture into the biliary canaliculi.Bile has Digestive function. Bile salts help in the digestion of fats by emulsifying fat drops Absorptive functions. Bile salts help in the absorption of fats and fat soluble vitamins .

-Excretory function.Bile pigments are the major excretory products of the bile,Laxative action. Bile salts increase the gastrointestinal motility and

act as a laxative and Choleretic action, i.e. bile salts stimulates the liver to secrete bile, Maintenance of pH of gastrointestinal tract, Prevention of gall stone formation In the absence of bile salts, the cholesterol precipitates along with lecithin and may form gall stones and Lubricating function. The mucin secreted by the gall bladder mucosa into the bile lubricates the chyme in the intestine.(Indu ,2012)

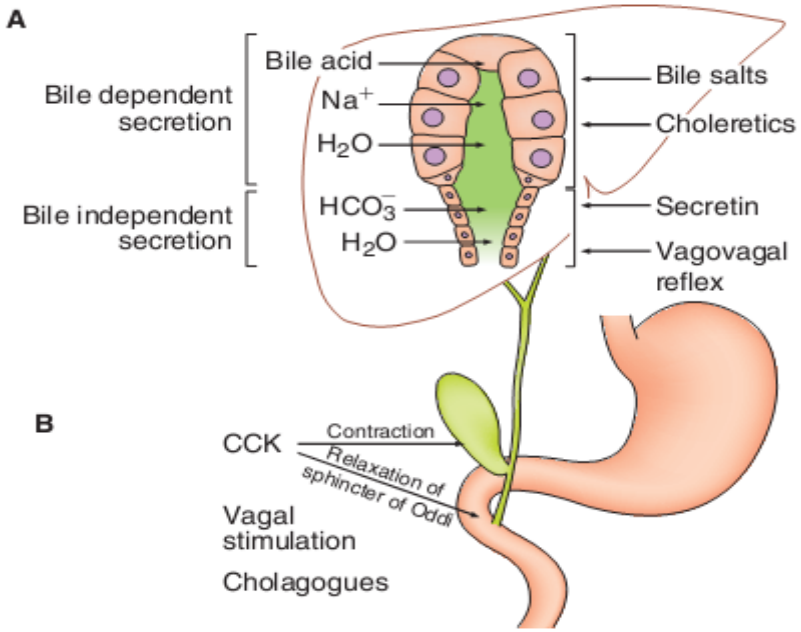

Figure (2-6). (A)Regulation of bile secretion and (B) Release from gall bladder. (Indu ,2012)

2.1.3 Renal anatomy

2.1.3.1 Gross anatomy of the Kidney

The kidney are located in the upper abdominal cavity on either side of the vertebral column, behind the peritoneum (retroperitoneal).(Fig.2-6). They extend from the level of 12th thoracic vertebra to the 3rd lumber vertebra receiving some protection from the lower rib cage. The right kidney is usually slightly lower than left, probably because of the considerable space occupied by the liver (Ross,2009).

The upper pole of the left kidney may overlie the eleventh rib in a radiograph, that of the right kidney seldom ascend so high, though it must be remember that each kidney moves in vertical range of almost 1 inch during full respiratory excursion of the diaphragm. (Last, 1984).

Figure (2-7). position of the kidney

(www.netterimages.com)

2.1.3.2 Gross Structure of kidney

There are three areas of tissue that can be distinguished when a longitudinal section of the kidney is viewed with the naked eye. Fibrous capsule , surrounding the kidney. The cortex, a reddish brown layer of tissue immediately below the capsule and outside the pyramid. Medulla, the innermost layer , consisting of pale conical-shaped striation, the renal pyramids. (Ross , 2006).

The renal pelvis is a funnel shaped structure that acts as receptor for urine formed by the kidney; it has a number of distal branches called calyces, each of which surrounds the apex of a renal pyramids. The hilum is the concave medial border of the right kidney where the renal blood and lymph-vessels, the ureter and nerves enter (Figure 2.8). (R.J, 1984).

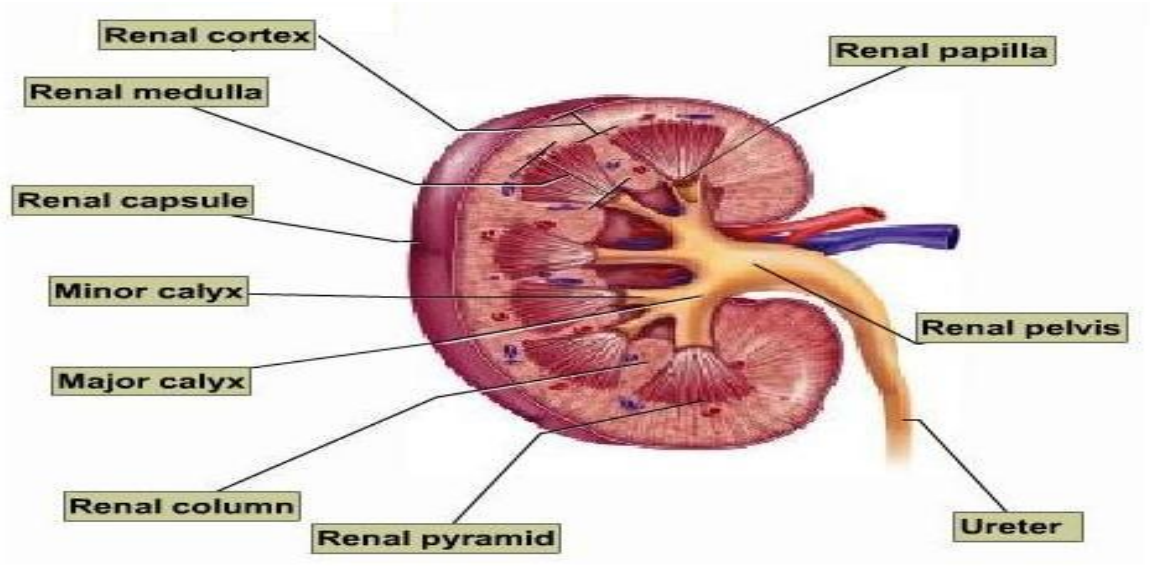

Figure (2-8) .gross structure of the right kidney

(www.infovisual.info)

2.1.3.3 Microscopic structure of the kidney

The kidney is composed of about I million functional units, the nephron, and a smaller number of collecting ducts. It is in the nephron, with their associated blood vessels, that urine is formed. The collecting ducts transport urine through the pyramids to the renal pelvis, giving them heir striped appearance.The tubules are supported by a small amount of connective tissue, containing blood vessels, nerves, nerves and lymph vessels. (Ross ,2009).

2.1.3.4 Vascular anatomy of the kidney

The renal arteries are branches of the abdominal aorta that are located just below the level of the superior mesenteric artery. Oxygenated blood travels through the renal arteries, which enter the renal hilum, and then into the segmental branches and subsequently into the interlobar arteries, which can be noted traveling between the renal pyramids . The interlobar arteries branch into the much smaller arcuate arteries at the base of the pyramids.

The arcuate arteries then branch into the interlobular arteries, and into the afferent arterioles, which carry blood into the glomerulus for filtration. The renal veins exit the kidneys at their respective renal hilums and connect to the lateral aspects of the inferior vena cava. The right renal artery travels posterior to the inferior vena cava. It is longer than the left renal artery. (Steven, 2011).

2.2 Physiology

2.2.1 Physiology of liver

The fact that mitochondria are maximally present in the liver emphasizes that liver is involved in many biochemical functions. Although details of the various functions per-formed by liver are discussed under their respective places, they are summarized here briefly.

Liver cells act as an exocrine gland and continuously secrete bile, which is important for digestion and absorption of fats. Liver is the key organ and the principal site where the metabolism of carbohydrates, lipids and proteins takes place. Liver is also involved in the metabolism of vitamins and minerals to certain extent.

Liver stores glucose (in the form of glycogen), vitamin B12and vitamin A. It stores 60% of excess of iron mainly in the form of ferr itin and partly as haemosiderin.

Certain exogenous dyes like bromsulphthalein (BSP) and rosebengal dye are exclusively excreted through the liver cells.

2.2.2 Physiology of gall bladder and billary

FUNCTIONS OF GALL BLADDER

Gall bladder subserves following functions:

- Storage of bile. The bile secreted during interdigestive period is stored in the gall bladder. The gall bladder, typically stores 30–50 mL of bile.
- Concentration of bile. The mucosa of gall bladder is extensively folded and can actively absorb fluid and electrolytes.

- Effect on the pH of bile. In the gall bladder, due to rapid absorption of HCO_3^- (mainly), Na^+ and Cl^-, the pH of bile is decreased.

- Secretion of mucous. Gall bladder secretes mucin, which is added to the bile stored in it.

2.2.3 Physiology of the Kidney

- Excretion of Metabolic Waste Products, Foreign Chemicals, Drugs, and Hormone Metabolites.
- Regulation of Water and Electrolyte Balances.
- Regulation of Arterial Pressure.
- Regulation of Acid-Base Balance.
- Regulation of Erythrocyte Production. The kidneys secrete *erythropoietin,* which stimulates the production of red blood cells. One important stimulus for erythropoietin secretion by the kidneys is *hypoxia.*
- Regulation of 1,25–Dihydroxyvitamin D3 Production.
- Glucose Synthesis. The kidneys synthesize glucose from amino acids and other precursors during prolonged fasting, a process referred to as *gluconeogenesis.* (Arthur, 2006).

2.3 Sonographeric Appearance

2.3.1 Sonography of the Liver

A sonogram of the liver can be ordered for several reasons. Patient preparation should be at least 4 hours, al-though a period of 8 hours is optimal if the entire right upper quadrant is to be evaluated. The normal liver is homogenous. Its echogenicity is either equal to or slightly greater than the parenchyma of the normal right kidney, and slightly less echogenic than the normal spleen. Also, when compared with the pancreas, the liver is slightly less echogenic in an adult.

The liver measures approximately 13 to 15 cm in length in an adult. Although many authors disagree, hepatomegaly is often suspected if the liver measures greater than 15.5 cm in the mid-hepatic line. (Steven,2011).

Figure (2-9).Transverse section (TS) through the liver, above the confluence of the hepatic veins.

Figure (2-10). LS, midline, through the left lobe, angled right towards the IVC. LPV = left portal vein; HA = hepatic(Jane . 2004)

2.3.2.1 Sonographic view of the porta hepatis

The best view of the porta hepatis is often obtained through one of the right lateral inter-costal spaces, either with the patient in a left lateral decubitus position or standing.With the patient in one of these positions the liver is shifted downwards and medially providing a better ultrasonic window for obtaining a view of the porta hepatis, gallbladder (GB) and

pancreas. In this scanning plane, the portal vein (PV) is usually visualized in a longitudinal section. The common duct (CD) is also visualized in a longitudinal fashion where the common hepatic duct crosses the right branch of the PV (Figure. 2.10)

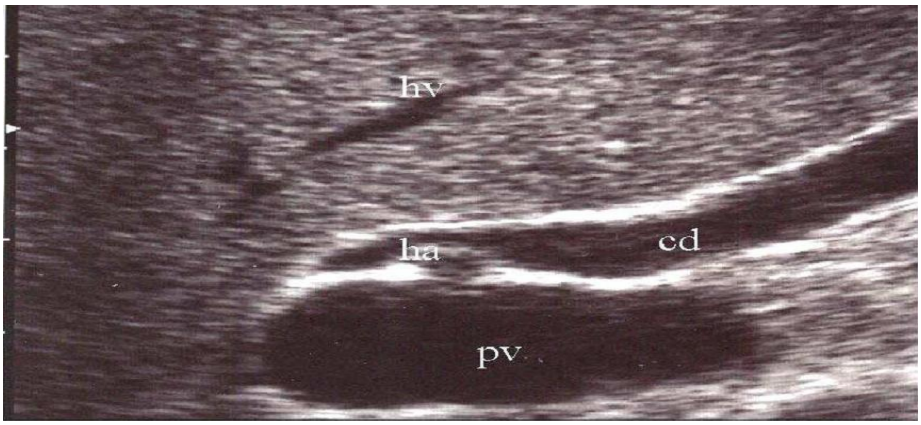

Figure (2-11).Oblique view of the porta hepatis where the common duct (cd) crosses the right branch of the portal vein (pv) with the hepatic artery (ha) in between.(hv) hepatic vein. (Jane . 2004)

2.3.2Sonography of Gall Bladder

The sonographic examination of the GB should ideally be performed after a night's fast because in the non-fasted state the normal gallbladder is contracted and thick-walled, similar to a pathologically contracted GB. The thickness of the gallbladder wall is usually measured in the transverse section with the beam perpendicular to the long axis of the GB because oblique sections may give a false impression of wall thickening. The gallbladder must be examined in both longitudinal and transverse sections.

The posterior wall of the GB is often located adjacent to the duodenum, which may cause acoustic shadowing that can be difficult to differentiate from that of GB pathology. In these cases a drink of water, which outlines the duodenum, may help rule out shadowing caused by multiple small stones**.**(Steven .2011).

Figure (2-12). Longitudinal scan. Normal Gallbladder

2.3.3Sonography of the Right kidney

2.3.3.1 Renal Shape and Position

The sonographic appearance of the kidney differs with age. And multiple variants may be noted with sonography. Neonatal and pediatric kidneys may appear lobulated, have prominent renal pyramids, and/or have subtle sonographic distinctions between the renal cortex and renal sinus. Normal adult kidneys are elliptical in shape in the longitudinal plane and rounded in the transverse plane.(Steven . 2011).

2.3.3.2 Normal Renal Measurements

The size of the kidneys is affected by age, sex (greater in men than in women), and body size; furthermore, the left kidney is slightly larger than the right in most individuals. The normal adult kidney measures 9 to 12 cm in length, 4 to 5 cm in width, and 2.5 to 3 cm in thickness. Cortical thickness is 11-18 mm in the male and 11-16 mm in the female**.** (Jane Bates, 2004).

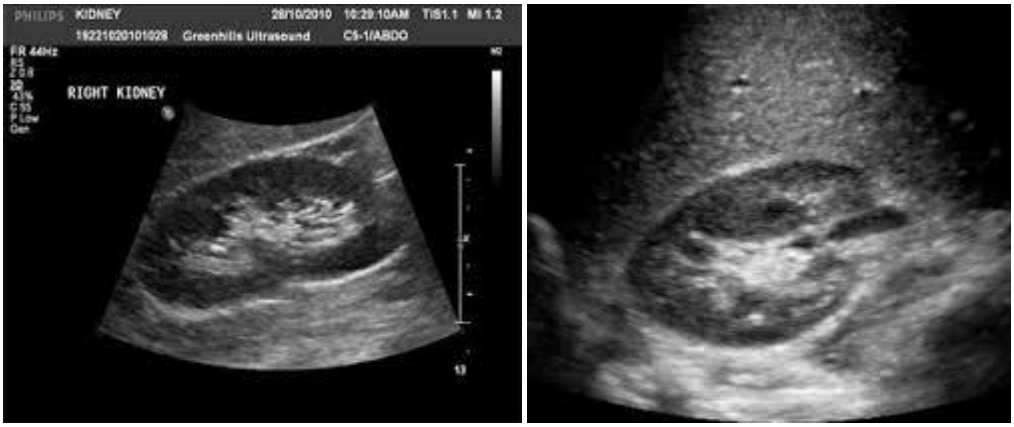

Figure (2-13).Longitudinal and transverse views of the normal right kidney. (www.ultrasoundpaedia.com)

2.4 Pathology

2.4.1 Pathology of the Liver

2.4.1.1 Focal Liver Disease

Liver Hepatitis

Hepatitis is inflammation of the liver, which can ultimately lead to cirrhosis, portal hypert come in many forms, including hepatitis A, B, C, D, E, and ension, and hepatocellular carcinoma (HCC). Hepatitis can be acute or chronic, and G. The two most common forms are hepatitis A and B**.**(Henningsen, 2004).

- The clinical findings of hepatitis is dark urine, elevated liver function tests, fever, hepatosplenomegaly ,and jaundice. (Steven ,2011)
- The sonographic findings of hepatitis is normal liver, enlarged, hypoechoic liver , periportal cuffing with "starry sky" ,and gallbladder wall thickening.(Steven ,2011)

Figure (2-14).Acute hepatitis.shows the “starry sky” appearance of the portal triads.(Brant,2001.)

2.4.1.2Diffuse Liver Disease

●Fatty Liver Disease

Fatty liver is a reversible disease characterized by deposits of fat within the hepatocytes**.** Fatty changes within the liver can be diffuse or focal. Diffuse infiltration will cause the liver to appear diffusely echogenic and it will be more difficult to penetrate . Both focal fatty infiltration and focal fatty sparing occur in essentially the same places. It is much more likely that signs of sparing and infiltration are seen adjacent to the gallbladder, near the porta hepatis, and the left medial segment. Although both of these abnormalities may mimic solid masses, they will not produce mass effect and therefore will not distort adjacent anatomy. (Kawamura, 1997)

- The clinical of fatty liver disease is Alcohol abuse, Obesity Chemotherapy , and Diabetes mellitus .

- Sonographic findings of diffuse fatty liver is Diffusely echogenic liver ,increased attenuation of the sound beam, and walls of the hepatic

vasculature and diaphragm will not be easily imaged. (Steven ,2011)

- The sonographic findings of focal fatty infiltration and focal fatty sparing is hyperechoic area adjacent to the gallbladder, near the porta hepatis, or the entire medial segment of the left lobe may appear echogenic , and Can appear much like pericholecystic fluid when seen adjacent to the gallbladder.(Steven,2011)

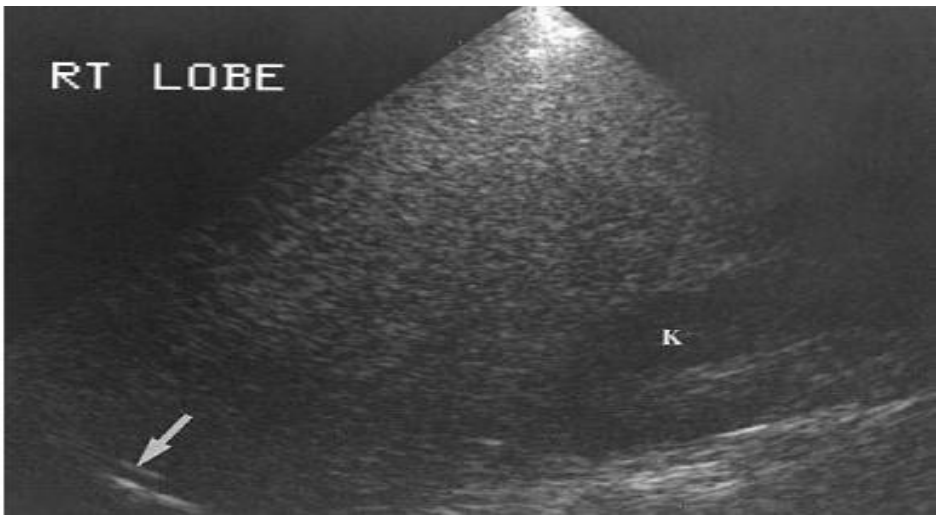

Figure (2-15).Fatty liver. The liver is diffusely echogenic and difficult to penetrate. **(**Brant,2001)

2.4.1.3 Budd–Chiari Syndrome

Budd–Chiari syndrome is described as the occlusion of the hepatic veins, with possible co-existing occlusion of the inferior vena cava can be seen secondary to a congenital webbing disordercoagulation abnormalities, tumor invasion from HCC, thrombosisoral contraceptive use, pregnancy, and trauma**.(Rumack ,2005).**

- The clinical of budd–chiari syndrome is ascites, elevated liver function test, hepatomegaly, and right upper quadrant pain.

- The sonographic findings of budd–chiari syndrome is nonvisualization or reduced visualization of the hepatic veins, thrombus within the hepatic veins, enlarged caudate lobe, and narrowing of the inferior vena cava.(Steven,2011).

2.4.1.4 Hepatic cysts

Ultrasound is highly accurate in the demonstration of liver cysts including features like cyst smoothness and regularity, septa, fluid levels and possible internal echoes and posterior acoustic enhancement.

Simple hepatic cysts may be primary or secondary. Primary liver cysts are congenital and arise from developmental defects in the formation of bile ducts. They have an average size of 3 cm and are rarely palpable and usually do not cause liver enlargement.(Roemer, 1981).

Acquired cysts are usually secondary to trauma, inflammation or parasitic infection and are often indistinguishable from primary cysts on ultrasound.The differential diagnosis includes a necrotic metastasis, hydatid cyst, hepatic cystadenocarcinoma, haematoma or abscess.(Larssen,1997).

Multiple cysts in the liver occasionally occur as an isolated phenomenon; however, they are most commonly seen in patients with underlying adult polycystic liver disease. Polycystic liver disease is more likely to be symptomatic than single cysts, the most common presentation being hepatomegaly.(Larssen,1997).

- The clinical of hepatic cysts is asymptomatic, normal liver function tests, and polycystic kidney disease. (Steven, 2011).

- The sonographic findings of hepatic cysts is anechoic mass or masses with smooth walls and posterior enhancement, and may have irregular shapes.(Steven, 2011).

Figure (2-16).Typical simple liver cyst demonstrating a band of posterior enhancement.(Jane, 2004)

Echinococcal cysts (hydatid disease)

A hydatid liver cyst may also be referred to as an echinococcal cyst These cysts develop most com-monly from a parasite referred to as Echinococcus granulosus . This parasite is a tapeworm that lives in dog feces. Food contaminated by the infected feces is consumed indirectly by sheep, cattle, goat, and possibly humans.(Rumack ,2005).

- The clinical findings of a hydatid liver cyst is obstructive jaundice, and right upper quadrant tenderness

- The sonographic findings of hydatid liver cyst is anechoic mass containing some debris (hydatid sand),"water lily" sign-wall of the endocyst seen floating within the pericyst , and "mother" cyst containing one or more smaller "daughter" cyst.(Steve, 2011).

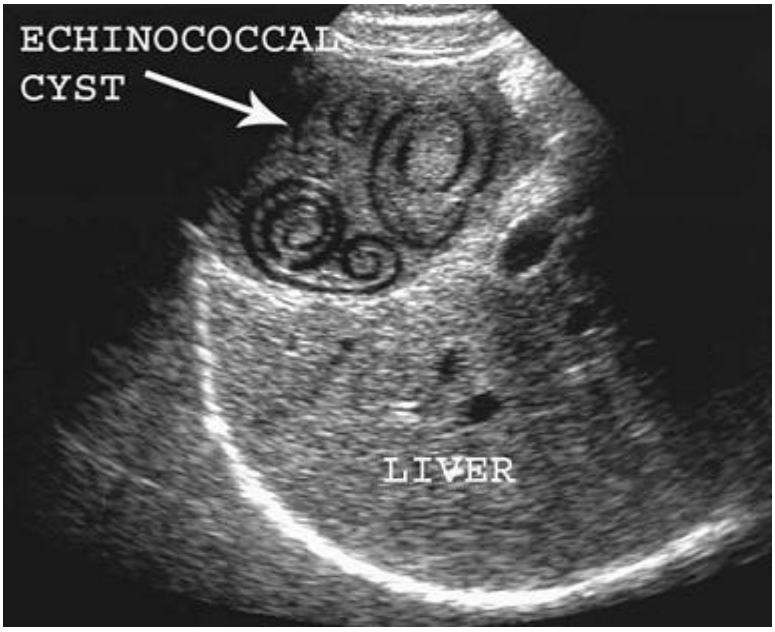

Figure (2-17). Hydatid cyst.echonococcal granulosus infection within the liver. (Brant W 2001).

2.4.1.5 Hepatic Abscess

Pyogenic hepatic abscess

A pyogenic hepatic abscess can result from the spread of infection from inflammatory conditions such as appendicitis, diverticulitis, cholecystitis, cholangitis, and endocarditis. The bacteria enter the liver through the portal vein, hepatic artery, biliary tree, or from an operative procedure.(Steven , 2011).

- The clinical of a pyogenic hepatic abscess is hepatomegaly,possible abnormal liver function tests,and right upper quadrant pain.

- The sonographic findings of a pyogenic hepatic abscess is complex cyst with thick walls, mass may contain debris, septations, and/or gas ,and shadowing or ring down artifact.(Steven, 2011).

Figure (2-18).Early stages of a pyogenic abscess in a transplanted liver (Brant, 2001)

● **Amebic Hepatic Abscess**

Anamebic hepatic abscesscomes from a parasite that grows in the colon and invades the liver via the portal vein.1 It is typically transmitted through contaminated water found in places like Mexico, Central America, South America, India, and Africa.**(**Bates,2004).

- The clinical of an amebichepatic abscess is hepatomegaly, right upper quadrant or general abdominal pain, and mild anemia.

- The sonographic findings of an amebic hepatic abscess is round, hypoechoic or anechoic mass or masses, may contain debris, and acoustic enhancement. (Steven,2011).

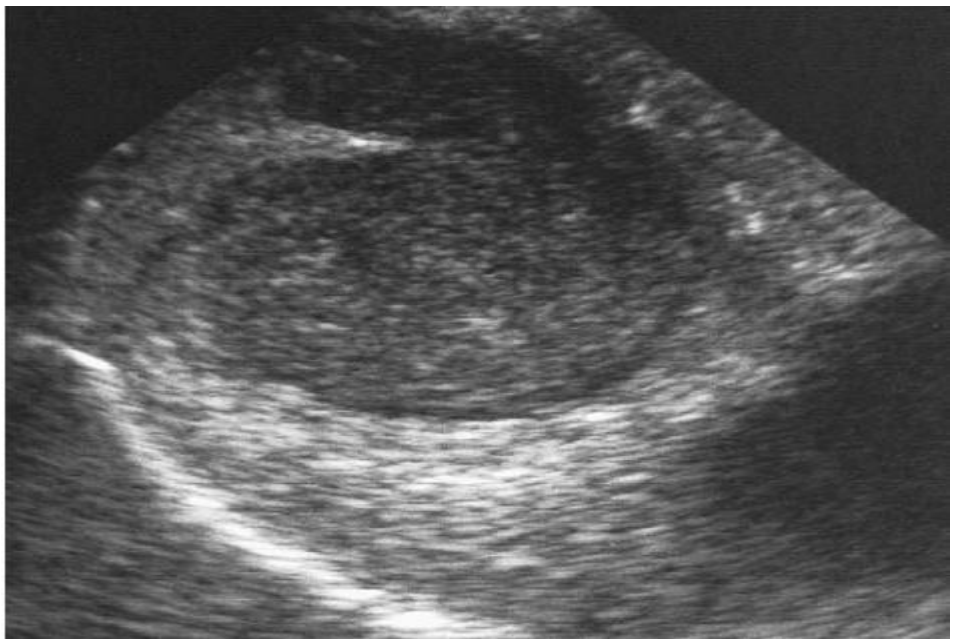

Figure (2-19). Amebic abscess. (Brant, 2001)

2.4.1.6 Hepatic Candidiasis

Patients who are immune compromised can develop hepatic candidiasis. The Candidiasis results from the spread of fungus, namely Candida albicans, in the blood.

- The clinical of hepatic candidiasis is right upper quadrant pain ,and fever hepatomegaly.

- The sonographic findings of hepatic candidiasis is multiple hyperechoic masses with hypoechoic halos ("halo" or"bull's-eye" lesions). (Steven, 2011)**.**

Figure (2-20).Hepatic Candidiasis (Brant,2001)

2.4.1.7 Hepatic Metastasis

The liver is a common location for metastatic disease to manifest. Metastatic liver disease is much more common than primary liver cancer. The malignant cells from other sites enter the liver through the portal veins or lymphatic channels. Primary cancers that metastasize to the liver include the gallbladder, colon, stomach, pan-creas, breast, and lung, with the latter being the most common primary source**.**(Rumack , 2005).

- The clinical of hepatic metastasis weight loss,jaundice, right upper quadrant pain, hepatomegaly, and ascites (abdominal swelling). (Steven , 2011)

- The sonographic findings of hepatic metastasis is hypoechoic masses may be from the breast, lung, or lymphoma , hyperechoic masses may be from the kidney and also pancreas, and "target" or "bull's-eye" lesion may be from lung or colon.(Steven ,2011).

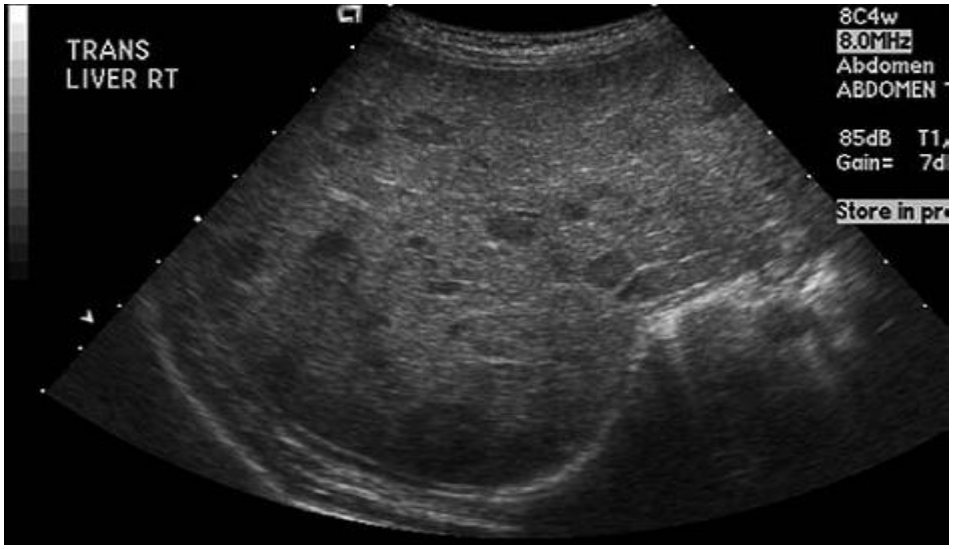

Figure (2-21). Metastatic liver disease. (Steven, 2011).

2.4.2Gallbladder and Biliary System pathology

2.4.2.1 Cholelithiasis or Gallbladder stones

Biliary stones that form within the gallbladder are called gallstones, or cholelithiasis. Gallstones typically consist of a mixture of cholesterol, calcium bilirubinate, and calcium carbonate. Gallstones are more commonly seen in female patients. Moreover, patients who are fat,female, fertile, flatulent, fair, and forty have been shown to have higher incidence of gallstones. Pediatric patients who have hemolytic anemia, such as sickle cell disease, and those with Crohn's disease have an increased risk for developing gallstones. (Steven ,2011).

- The clinical of cholelithiasis is epigastric pain,nausea and vomiting,and pain that radiates to the shoulders. (Steven,2011)

- The sonographic findings of cholelithiasis is echogenic, mobile, shadowing structure(s) within the lumen of the gallbladder ,and stones that lodge within the cystic duct or neck of the gallbladder may not move. (Steven,2011)

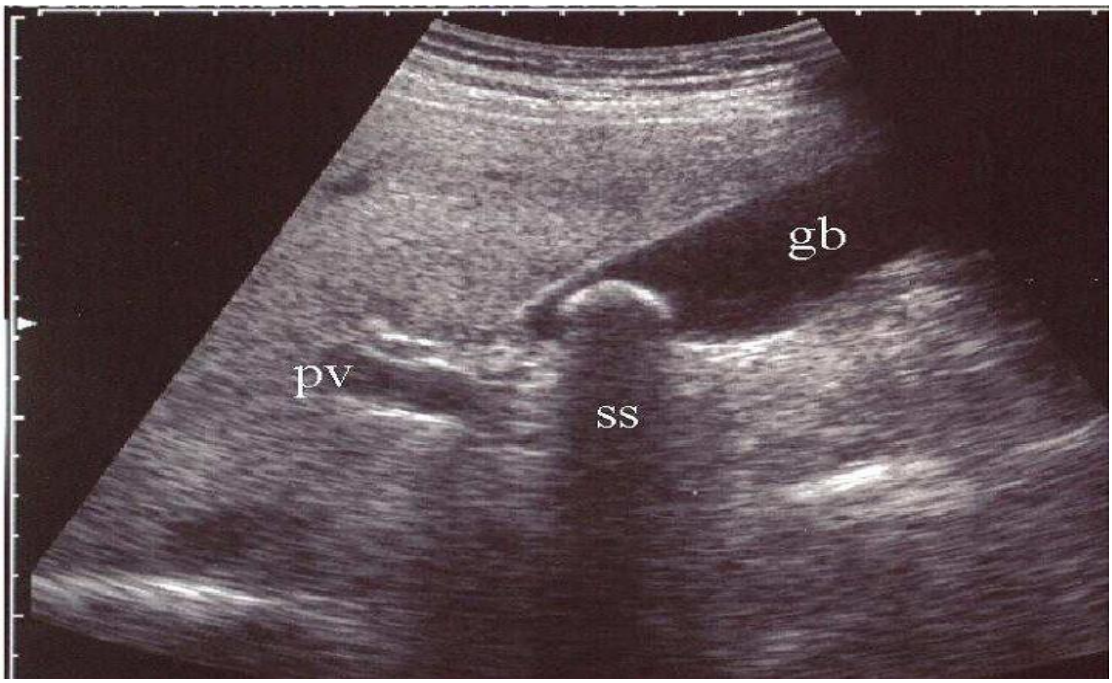

Figure (2-22). Gall bladder stone .(Highly reflective gallstone located near the neck of the GB. (Odegaard,2005)

2.4.2.2 Inflammatory gallbladder disease

Acute cholecystitis

The sudden onset of gallbladder inflammation is referred to as acute cholecystitis. The most common cause of acute cholecystitis is a gallstone that has become lodged in the cystic duct or neck of the gallbladder**.**(Rumack,2005) .Right upper quadrant pain and leukocytosis are often associated with acute cholecystitis.Other laboratory findings mayinclude an elevation in alkaline phosphatase and amino transferase. Bilirubin may also be elevated if obstruction to the ducts occurs**.** (Steven,2011).

- The clinical findings of acute cholecystitis is right upper quadrant tenderness, epigastric or abdominal pain, leukocytosis,and pain that radiates to the shoulders. (Steven,2011).

- The sonographic findings of acute cholecystitis is gallstones and sludge,positive sonographic murphy'ssign,gallbladder wall thickening,and pericholecystic fluid. (Steven,2011).

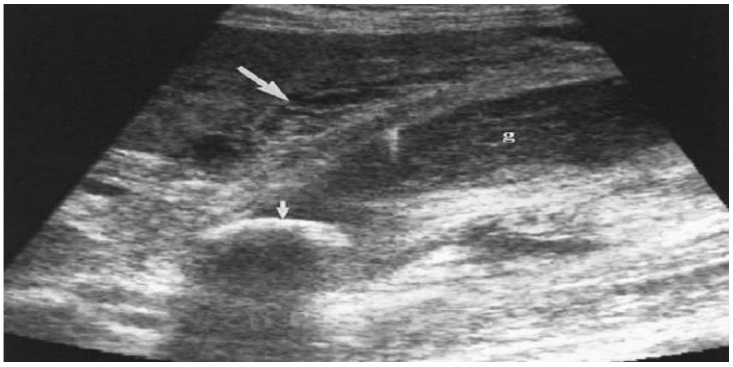

Figure (2-23).Acute cholecystitis. The gallbladder filled with sludge and a gallstone. (Brant,2001).

Chronic cholecystitis

Usually associated with gallstones, chronic cholecystitis presents with lower-grade, recurring right upper quadrant pain. The action of stones on the wall causes it to become fibrosed and irregularly thickened, frequently appearing hyperechoic (Figure 2-24).The gallbladder is often shrunken and contracted, having little or no recognizable lumen around the stones.(Bates,2004).

- the clinical of chornic cholecystitis is intolerance to fatty foods, nausea, and belching. .(Steven ,2011)

- The sonographic findings of chronic cholecystitis is gallstones,and possible gallbladder wall thickening.(Steven ,2011)

Figure (2-24).Chronic cholecystitis. A hyperechoic irregular, thickened wall. The gallbladder contains a small stone.(Bates,2004)

Acalculous Cholecystitis

Acalculous cholecystitispresents with all of the symp-toms and sonographic findings of cholecystitis except no gallstones are present (Figure 2-25). This form of acute cholecystitis is more commonly found in children, recently hospitalized patients, or those who are immunocompromised. (Brant , 2001).

- The clinical of acalculous cholecystitis is right upper quadrant tenderness, epigastric or abdominal pain, and leukocytosis.(Steven ,2011)

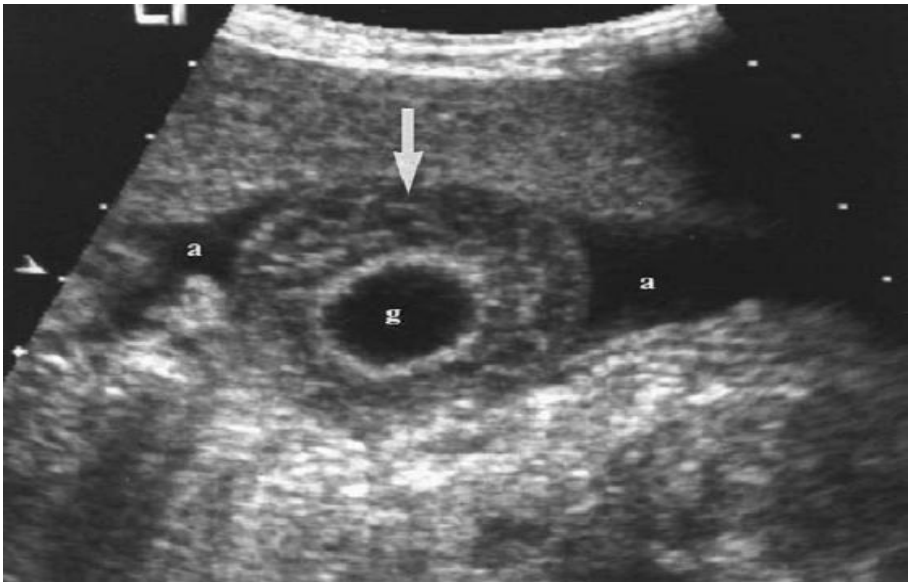

Figure (2-25).Transverse image of the gallbladder (g) shows Acalculous cholecystitis. (Brant,2001)

2.4.2.3 Carcinoma of the Gallbladder

Gallbladder carcinoma is rare, although it is the most common cancer of the biliary tract. **(Rumack, 2005).**Over 90% of gallbladder carcinomas are adenocarcinomas and advanced local and regional disease is usually present at the time of diagnosis. It affects females four times as commonly as males; its prevalence increases with age. Chronic cholecystitis, choledochal cysts and significantly high body mass index are associated risk factors. Overall, the curative resection rates for gallbladder carcinoma range from 10% to 30%.(Levin, 1999).

- The clinical of gallbladder carcinoma is weight loss,right upper quadrant pain, jaundice, and hepatomegaly. (Steven,2011).
- The sonographic findings of gallbladder carcinoma is nonmobile mass within the gallbladder lumen gallstones that measures >2 cm,diffuse or focal gallbladder wall thickening ,and irregular mass that may completely fill the gall bladder fossa. (Steven,2011).

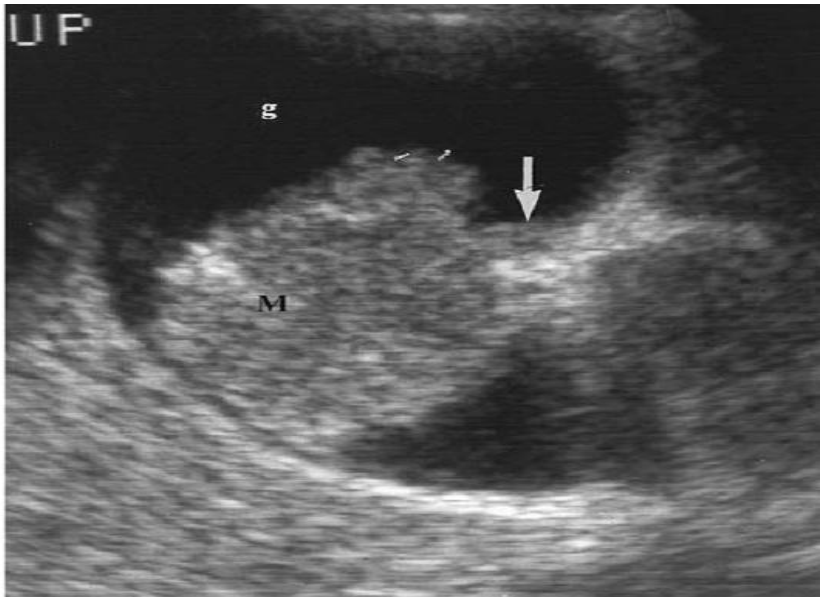

Figure (2-26).Gallbladder carcinoma. (Bates,2004).

2.4.3 Pathology of the Right Kidney

2.4.3.1 Renal Infection

● Acute Pyelonephritis

Acute pyelonephritis is a tubuointerstitial inflammation of the kidney. Two routes may lead to inflammation: Bacteria can spread to the kidney through the bloodstream or, more commonly, from the lower urinary tract .The infection begins in the bladder and refluxes up through the ureters and into the kidney.

-The clinical of acute pyelonephritis is flank pain,bacteriuria, leukocytosis, and dysuria. . (Steven,2011).

- The sonographic findings of acute pyelonephritis is may appear normal ,renal enlargement, focal areas of altered echotexture compression of the renal sinus. (Steven, 2011).

Figure (2-27) Acute pyelonephritis: Hypoechoic kidney with an obliterated sinus echo and a rim of fluid in the renal pelvis. (Schmidt, 2011).

●Pyonephrosis

Pyonephrosis describes the condition of having pus, also referred to as purulent material, within the collecting system of the kidney. The accumulation of pus is most likely caused by some obstructive process or infection that leads to urinary stasis, as seen in many cases of pyelonephritis. (Steven , 2011).

- The clinical of pyonephrosis is flank pain, pyuria, bacteruria, fever ,and leukocytosis. . (Steven,2011).

- The sonographic findings of pyonephrosis is hydronephrosis,pus and debris appear as internal ,layering, and low level echoes within the dilated collecting system.(Steven , 2011).

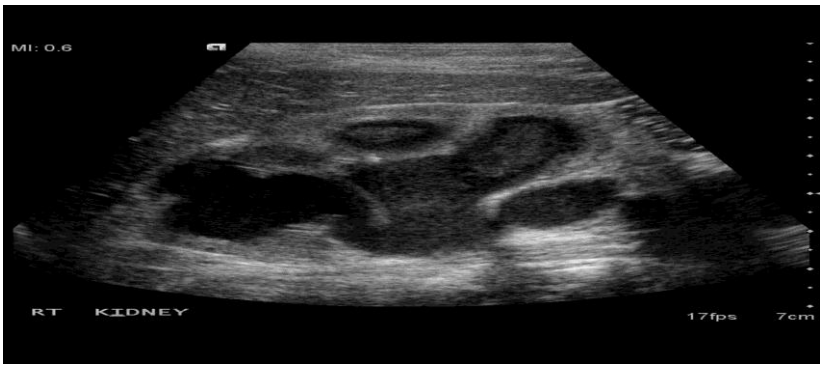

Figure (2-28). Pyonephrosis. (http://www.ajronline.org).

●Chronic Pyelonephritis

Recurrent kidney infections or chronic obstruction may lead to scarring of the calices and renal pelvis. This is referred to as chronic pyelonephritis. Chronic pyelonephritis can lead to xanthogranulomatous pyelonephritis and end stage renal disease. (Steven , 2011).

- The clinical of chronic pyelonephritis is flank pain, bacteruria, pyuria, leukocytosis, dysuria ,and urinary frequency.
- The Sonographic findings of chronic pyelonephritis is Small, echogenic kidneys that have lobulated borders. (Steven , 2011).

Figure (2-29).Chronic pyelonepheritis, decreased renal size in pyelonephritis (83.9mm, cursors). (Schmidt, 2011).

2.4.3.2 Renal or Perinephric Abscess

A renal abscess can occur in regions of the kidney affected by pyelonephritis or be located adjacent to the kidney. A perinephric abscess is a collection of purulent material that has leaked through the capsule into the tissue surrounding the kidney.(Figure 2-30). (Barton Dudlick, 2006).

- The Clinical of a renal or perinephric abscess is Symptom of pyelonephritis , High fever, Flank pain ,and Leukocytosis. (Steven, 2011).

- The sonographic findings of renal or perinephric abscess is can appear anechoic, hypoechoic, or complex, depending on its contents ,and gas shadows or dirty shadowing may be present within the mass. (Steven, 2011).

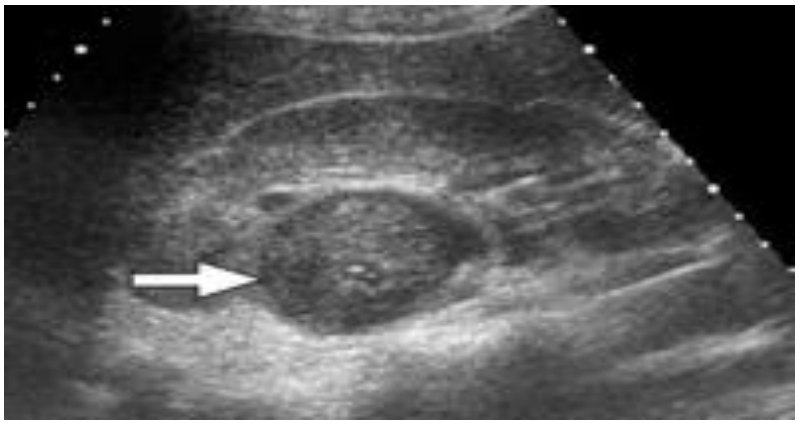

Figure (2.30).Renal abscess. (http://www.ajronline.org)

2.4.3.3 Renal stones

Renal calculi are a common finding on ultrasound. They may be an accidental discovery in an asymptomatic patient; alternatively they may be present in patients with acute renal colic and complete or partial obstruction of the ipsilateral renal tract. They may be the cause of haematuria and can also be associated with urinary tract infections.

The composition of calculi can vary. The common types include:

- Calcium stonesare the most common type and are frequently associated with patients who have abnormal calcium metabolism.
- Struvite (triple phosphate) stoneshave a different composition of salts and are associated with urinary tract infections. They may form large, staghorn calculi.
- Uric acid stonesare rare, and tend to be associated with gout.
- Cystine stonesare the rarest of all and result from a disorder of amino acid metabolism cystinuria.

Most renal calculi are calcified foci located in the collecting system of the kidney. Careful scanning with modern equipment can identify over

90% of these.16 most stones are highly reflective structures which display distal shadowing .The shadowing may, however, be difficult to demonstrate due to the proximity of hyperechoic sinus echoes distal to the stone, or due to the relatively small size of the stone compared to the beam width.

Ultrasound still has a major role, however, not just in calculus detection but in identifying the secondary effects, that is, hydronephrosis, and where necessary, guiding renal drainage.

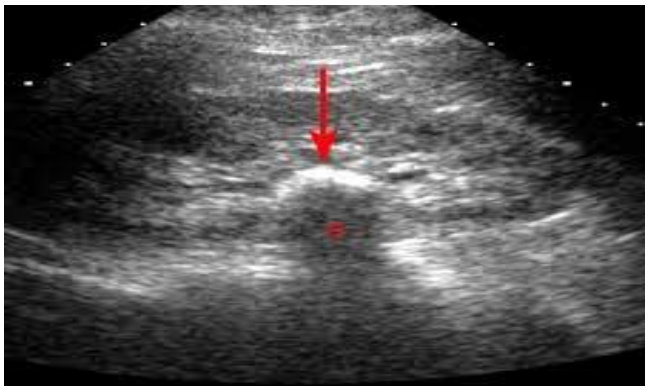

Figure (2-31). Renal stones. (www.urologystone.com)

2.4.3.4 Hydronephrosis and Renal Obstruction

Hydronephrosis is dilation of the calices, infundibula, and renal pelvis. Hydronephrosis may also be referred to as pyelocaliectasis, and described more specifically according to which part of the kidney is dilated.It may also be described as mild, moderate, and severe or marked. (Jane Bates, 2004).

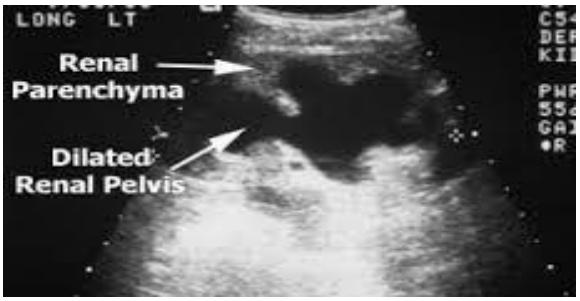

Figure (2-32). Hydronephrosis. (www.meddean.luc.edu.com)

Irregularities that lead to renal obstruction that are located inside of the urinary tract are called intrinsic causes of hydronephrosis, and

abnormalities that are located outside of the urinary tract that lead to renal obstructionare referred to as extrinsic causes of hydronephrosis (table 2-1) . (Steven, 2011).

Figure (2-33) obstructing stone. (www.ultrasound-images.com)

Table (2-1) causes of hydronephrosis

Intrinsic Causes of Hydronephrosis
Urolithiasis Congenital abnormality (vesicoureteral reflux, posterior urethral valves, and ureterovesicular junction obstruction) Hematoma (blood clot) Neoplasm Ureteropelvic junction obstruction or ureteral stricture Ureterocele
Extrinsic Causes of Hydronephrosis
Benign prostatic hypertrophy Neurogenic bladder Pelvic masses (uterine leiomyoma, ovarian masses. Tubo-ovarian abscess and bowel masses) Pregnancy

Traum

2.4.3.5 Malignant Renal Masses

Renal cell carcinoma (RCC) may also be referred to as a hypernephroma or adenocarcinoma of the kidney. It is a primary form of renal cancer. Smoking, hypertension, obesity, and tuberous sclerosis increased risk for developing RCC. Also, there seems to be a strong association between RCC and von Hippel–Lindau disease. The tumor can spread into the renal vein and inferior vena cava. (Figure 2-34**). (Barton Dudlick, 2006).**

- The clinical of renal cell carcinoma is anorexia, flank pain ,gross hematuria ,hypertension ,palpable mass, and weight loss. . (Steven,2011).
- The sonographic findings of renal cell carcinoma is hypoechoic or isoechoic solid mass on the kidney. (Steven , 2011).

Figure (2-34). RCC.a hyperechoic mass (M) arising from the lower pole with areas of intra tumoral cystic changes. (Barton, 2006).

2.5 Right Upper Quadrant Imaging

2.5.1Conventional Radiology

X-ray machines have been used to diagnose diseases for about 100 years. Conventional x rays do involve some exposure to ionizing

radiation that is strong enough to damage some cells. Plain abdominal X-rays, erect and supine, may show abnormal bowel patterns, fluid levels or gas or fluid under the diaphragm. 70% of renal stones and 30% of gallstones are radio-opaque .Two common x-ray procedures include the injection of a special dye, called contrast medium, which shows the shape of the urinary tract. **(Emilio ,2014).**

2.5.2 CT Scans

Computerized tomography scans use a combination of x rays and computer technology to create three dimensional (3-D) images. A CT scan may include the injection of contrast medium. CT scans require the person to lie on a table that slides into a tunnel-shaped device where the x rays are taken. The procedure is performed in an outpatient center or hospital by a specially trained technician, and the images are interpreted by a radiologist; anesthesia is not needed. CT scans can show stones in the urinary tract, obstructions, infections, cysts, tumors, and traumatic injuries. (Emilio ,2014)

2.5.3 MRI

Magnetic resonance imaging is a test that takes pictures of the body's internal organs and soft tissues without using x rays. MRI machines use radio waves and magnets to produce detailed pictures of the body's internal organs and soft tissues. An MRI may include the injection of contrast medium. With most MRI machines, the person lies on a table that slides into a tunnel-shaped device where the images are taken. The device may be open ended or closed at one end; some newer machines are designed to allow the person to lie in a more open space. (Emilio ,2014).

MRI is diagnosing gallstones, gallbladder wall thickening, pericholecystic fluid, and acute cholecystitis in patients presenting with symptoms of acute right upper quadrant pain.Especially in

sonographically challenging patients, limited MRI may provide a faster, easier method of diagnosis**.**(Oh KY,2003)

2.5.4 Ultrasonography

Ultrasound represent a first line imaging technique in the assessment of the kidney , and it present several advantage over the other imaging technique including, low financial cost ,portability ,availability, lack or restrictions in performing frequent serial examination in short intervals, and absence of exposure to radiation or nuclear traces. (Emilio ,2014).

Ultrasound is useful in assessment of the renal tract for stones or dilatation. It is the best way to detect gallstones. It can also be used to check the liver for enlargement and establish if it has a homogeneous pattern or areas of different echo density. (Miller ,2006).

2.5.5 Doppler ultrasound

Analysis of RUQP vessels has to be performed after conventional gray scale ultrasound examination since it allows functional evaluation of the (Rt kidney,Liver, GB,and Pancreas) . (Emilio ,2014).

2-6 Previous Study

Study done by (FC. Laing, et al, 1981) titled: Ultrasonic evaluation of patients with acute right upper quadrant pain, was performed on 52 patients having clinically suspected acute cholecystitis. Ultrasonographic determination of acute or chronic cholecystitis, or diagnosis of a normal gallbladder, was based on analysis of location of tenderness, calculi, sludge, and wall thickness. The diagnosis of acute cholecystitis (34.6% of patients) was based on the highly significant observations of focal gallbladder tenderness and calculi. Sludge and wall thickening were also statistically significant, but to a lesser degree. Cholelithiasis allowed differentiation of patients with chronic cholecystitis (32.7%) from

patients with normal gallbladders (32.7%). Neither of these two groups had significant focal gallbladder tenderness, sludge, or thickened walls. Because acute cholecystitis is found in the minority of patients with acute right upper quadrant pain, and because ultrasound is rapid, accurate, and noninvasive, it should be the initial modality used to evaluate these patients.

Study done by (TH.Philbricket al, 1981) titled: Abdominal ultrasound in patients with acute right upper quadrant pain, was performed as the first imaging procedure in 100 patients who presented with acute right upper quadrant pain suggestive of cholecystitis or cholelithiasis. In the final analysis 46 patients were found to have gallbladder disease (40 patients with cholelithiasis, 5 with acalculouscholecystitis, and 1 with a cholesterol polyp in the gallbladder). In 22 of 54 patients with a normal gallbladder, other abdominal disease was found. The error rate for ultrasound was 5%, and in 4 patients ultrasound was not the suitable procedure for the diagnosis. In 91 patients the ultrasonographic diagnosis was correct.

Study done by (sabina imran ,2003) titled**:** Causes of upper abdominal pain, 500 cases with upper abdominal pain ,248 patients had positive findings on ultrasound. This comes to slightly less than 50%. Bulk of positive cases had liver, renal pathology and biliary tree, all roughly with equal numbers. The final outcome of negative cases justified the failure of ultrasound 157 of them were later found to have gastrointestinal problems like gastritis, uncomplicated peptic ulcer disease, worm infestation and intestinal tuberculosis. Eighteen patients had problems upper diaphragm like basal pemumonitis , and myocardial infarction . Fifteen patients had urinary tract infection .The cause of uuper abdominal pain was not clear in 62 patients but themhowever, responded well to ordinary analgesics and smooth muscle relax.

Study done by (EnasAlhashme, 2014) titled: Ultrasonic Finding of patients with Right upper quadrant pain.found that Of the total 100 patients the result found that the female (72%)and male (28%), most affected age group was in less than 30 years(29%).The Ultrasonography found that most of the patients with RUQ Pain diagnosis had gall bladder stone (42%), with (19%)h ad gaseous bowel ,with (9%) acalculs cholecystitis, (6%) had calculs cholecysitis ,(3%) had cystic liver lesion and the rest (6%)had other which included one case (1%) of the following (solid liver lesion with distal obstruction ,calculus cholecysitis puls cirrhosis puls ascites ,liver congestion and common bile duct stone.

CHAPTER THREE

MATERIAL& METHODS

Chapter Three

Material& Methods

3.1 Materials

This is descriptive, cross-sectional study deal with ultrasound findings in patients with right upper quadrant pain.

3.1.1patients

Seventy patients aged (5-70 years) , Females were 41 (59%) and males were 29 (41%).The study was conducted in Khartoum different hospitals (Academic Hospital, Haji Safi Hospital and Chinese friendship hospital Omdurman) and private clinic centers in sudan .

3.1.2 Machine:

Ultrasound machine (mindary),and(Alpinion,Ecube 7 with multifrequncy curvilinear probe (3.5-5 MHZ)which has variable focal zone and frequency capability) had been used in this study.

3.1.3 Study Duration:

The study with conducted from June to September 2016.

3.1.4 Sampling and simple size:

Seventy patients who complained from right upper quadrant pain included in this study.

3.1.5 Included criteria:

All patients who complain from right upper quadrant pain.

3.1.6 Excluded criteria:

Patients who already diagnosed and pregnant women were excluded from this study.

3.1.7 Data collection:

The data was collected by using data sheet, which included all variables such as patient's age, gender, body mass index, duration of pain and symptoms in addition to other complains to satisfy the study.

3.2 Methods

3.2.1 Technique

Investigation protocols:

The following technique was applied to allow visualization of RUQ.

●Patient preparation:

Adult patients were fasted for 8 hours (3 hours for children), preceeding the examination. IV fluid is essential to prevent dehydration, only water should be given . If the patient was eaten and was done the exam after taken 2-4 cups of water or noncarbonated drink because stomach in this case act as window for the sound beam.

●Transducer: curved low frequency transducer 3.5MHZ.

Patient positioning: supine, left lateral oblique, left lateral decubitus, and Prone position was sometimes applied to thin patients.

Initial approach for liver and biliary trect , longitudinal section pt. supine transducer position directly perpendicular at the mid line of the body just inferior to the xiphoid process .

While viewing the left lobe, use sub costal angles and move the transducer to the patient’s left, lateral and inferior along the costal margin until you are beyond the left lobe.

Right kidney, longitudinal section pt. supine transducer position directly below the costal margin in the midclavicular line, beams pointing slightly cephalic.

Respiratory maneuver: deep inspiration protrusion of anterior abdominal wall.

Second approach:

Transverse section for liver and biliary trect : Began with the transducer perpendicular and locate the distal long axis portion of the IVC where it passes through the liver. Move inferiorly middle locate the head of pancreas immediately anterior to it, the pancreas head lies between the IVC and liver.

Transverse section for right kidney : Angulation and position of the transducer in long section. Transducer rotated 90, maintaining angulations.

3.2.2 Data analysis

The data will be analyzed by using Statistical Packaged for Social Studies (SPSS) using Excel analysis and statistical analysis correlation between variables.

3.2.3 Ethical consideration

Ethical concept had been taken before examination

Chapter Four

Results

Table (4.1): Distribution of cases under study according to gender

Groups	No.	%
Males	29	41%
Females	41	59%
Total	70	100

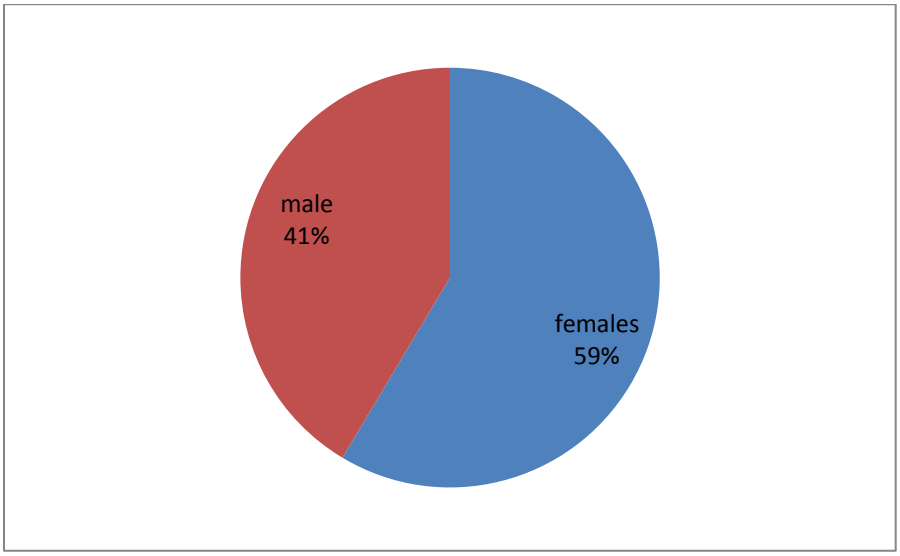

Figure (4.1): Distribution of cases under study according to gender

Table (4.2): Distribution of cases under study according to age

Groups	N0.	%
0-15	2	2%
16-30	17	24%
31-45	26	37%
>45	25	36%
T0tal	70	100

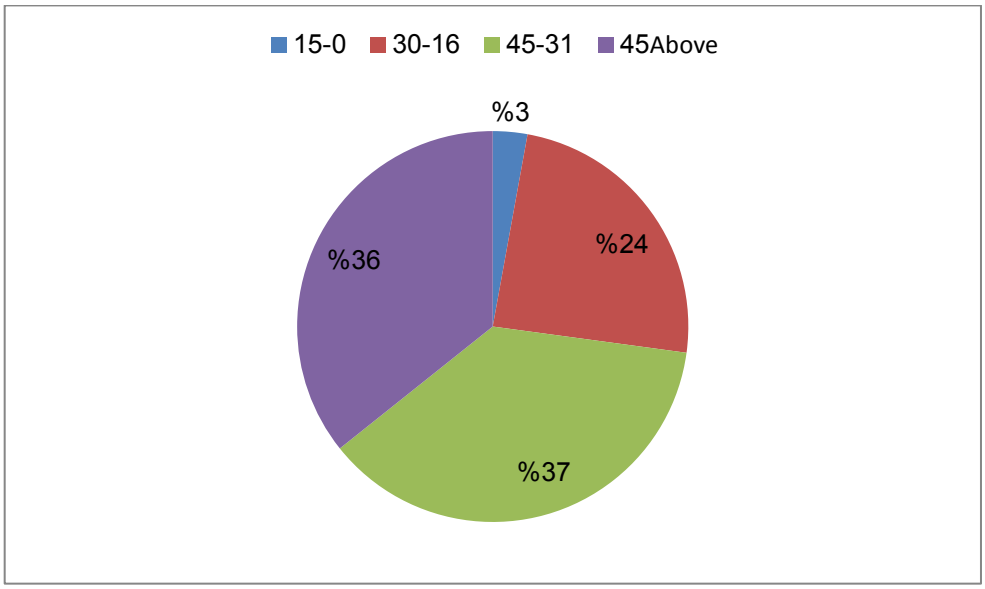

Figure (4.2): Distribution of cases under study according to age

Table (4.3): Distribution of cases under study according to their Body mass Index

Groups	No	%
0-15	3	4
16-30	58	83%
31-45	9	13%
Total	70	100%

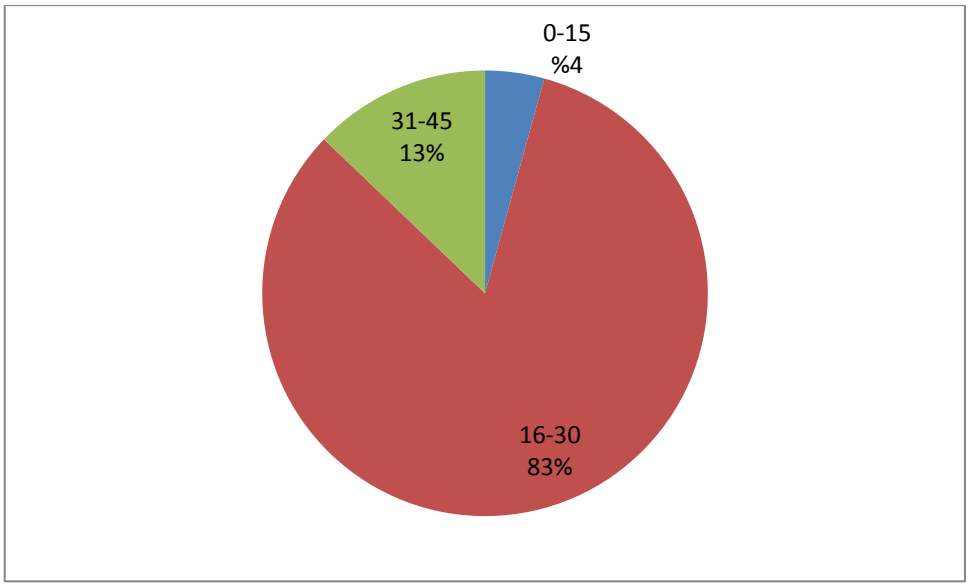

Figure (4.3): Distribution of cases under study according to Body mass Index

Table (4.4): Distribution of cases under study according to Duration of pain

Groups	No	%
≥1month	**40**	**57%**
≥6month	**15**	**22%**
≥12month	**10**	**14%**
≤12month	**5**	**7%**
Tatal	**70**	**100%**

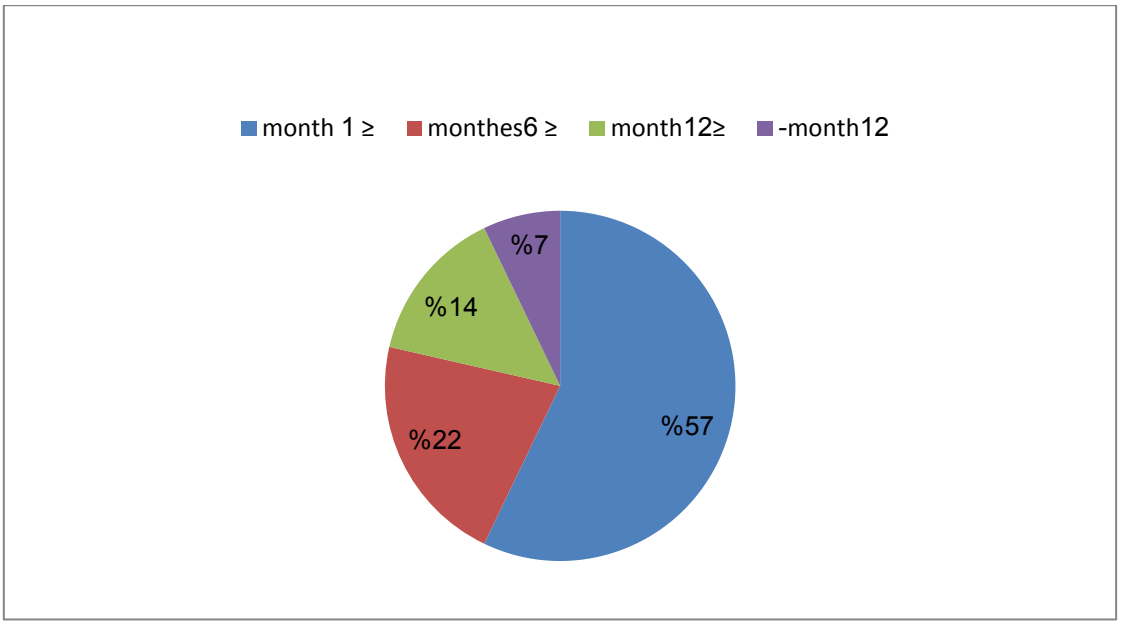

Figure (4.4): Distribution of cases under study according to Duration of pain.

Table (4.5): U/S findings of under study cases

Parameters	groups	N	Mean±. Std. Deviation	P-value
Liver	female	41	.19±.40	
	male	29	.07±.26	0.11
GB	female	41	.37±.49	
	male	29	.14±.36	0.02*
Pa	female	41	.00±00	
	male	29	.00±00	
RTK	female	41	.34±.49	
	male	29	.51±.50	0.15
ID	female	41	.00±00	
	male	29	.034±.19	0.32
None	female	41	.21±.41	
	male	29	.31±.48	0.40

Values obtain as Mean±. Std. Deviation; *significant at (P≤0.o5)

Table (4.6): Cross tabulation between cases under study * Age

Count		Cases		Total
		+ve	Normal	
Age	0-15 years	0	2	2
	16-30 years	11	5	16
	31-45 years	20	6	26
	>45 years	21	5	26
Total		52	18	70

Table (4.7): Cross tabulation between cases with Liver disease * Age

Count		Liver		Total
		-ve	+ve	
Age	0-15 years	2	0	2
	16-30 years	14	2	16
	31-45 years	21	5	26
	>45 years	23	3	26
Total		60	10	70

Table (4.8): Cross tabulation between cases with gall bladder disease * Age

Count		Gall bladder		Total
		-ve	+ve	
Age	0-15 years	2	0	2
	16-30 years	13	3	16
	31-45 years	18	8	26
	>45 years	18	8	26
Total		51	19	70

Table (4.9): Cross tabulation between cases with right kidney disease * Age

Count		Right kidney		Total
		-ve	+ve	
Age	0-15 years	1	1	2
	16-30 years	6	10	16
	31-45 years	17	9	26
	>45 years	17	9	26
Total		41	29	70

Table (4.10): Cross tabulation between cases * gender

Count		Cases		Total
		+ve	Normal	
Gender	F	32	9	41
	M	20	9	29
Total		52	18	70

Table (4.11): Cross tabulation between cases with liver disease * gender

Count		Liver		Total
		-ve	+ve	
Gender	F	33	8	41
	M	27	2	29
Total		60	10	70

Table (4.12): Cross tabulation between cases with gall bladder disease * gender

Count		Gall bladder		Total
		-ve	+ve	
Gender	F	26	15	41
	M	25	4	29
Total		51	19	70

Table (4.13): Cross tabulation between cases with right kidney disease * gender

Count		Right kidney		Total
		-ve	+ve	
Gender	F	27	14	41
	M	14	15	29
Total		41	29	70

Table (4.14): Cross tabulation between cases with Intestinal disorders * gender

Count		Intestinal disorders		Total
		-ve	+ve	
Gender	F	40	1	41
	M	28	1	29
Total		68	2	70

Chapter Five

Discussion & Recommendations

5.1 Discussion

This study had been conducted in Academic Khartoum hospital, Hajj Alsafi Hospital and Chinese friendship hospital Omdurman on seventy patients 41(59%) out of them were females and 29 (41%) were males (Table4-1), presented with right upper quadrant pain and they were investigated using ultrasound scanning. According to their ages as shown in (Table 4-2), they classified into four groups; patients ages of (< 15 years), (16 - 30 years), (31-45 years) and (≥46 years). The most affected age whose age was (< 15 years), this forms prevalence of about (3%). This was due to small sample size.

According to their body mass index they classified into three groups BMI (0 -15) were (29%), (16 - 30) were (63%) and (31 – 40) were (8%) (Table 4-2).

Patients were classified upon their duration of pain into four groups, group (1) who felt the pain for (≤ one month), group (2) for (1-6 months), group (3) for (6-12 months) and group (4) for (more than 12 months). (Table 4-4).

The Ultra Sound findings indicate that 52(74.3%) were +ve and the rest 18(25.7%) were normal. The positive cases were distributed as follow, the pain in 10(14.2%) caused by liver disease (8 were females and 2 were males), 19(27.1%) by gall bladder disease (15 females and 4 males) 29(41.4%) by Rt. Kidney disease (14 females and 15 males) and 2(2.8%) by intestinal disorders. the more affected group 0f (31-45) in age.

There was a significant difference between males and females in patients with gall bladder disease ($p \leq 0.05$) as shown in (Table 4-5) so the most

affected group was females (78%), also There was a positive correlation between right kidney disease and age while mean the most affected group of age (16-30 years).

The results of this study disagreed with previous study in Pakistan done by (Sabina; 2003) who represents that there were (50%) of cases under study with liver disease, this difference may be due to the difference in the environment and other factors, while the study results were very closed with previous study done in Sudan by (Anas: 2014) who found that there were (9%) of cases under study had liver disease

This study disagreed with (Philip; 1981) and his colleges who found that (46%) out of patients with RUQP had Gall Bladder disease while our study agreed with (Anas 2014) who represents that the most of RUQP patients who had gall bladder disease were had stones.

5.2 Conclusion

This study done in Khartoum state hospital and private clinic center in 70 patients presented with Right upper quadrant pain.The goal of this research was to RUQ organs, and most likely cause of pain, using ultrasound imaging.

This study found statistically correlation between finding and gander, females more finding than males, pain most with gradual was gall bladder stones ,renal stones and normal finding . The other finding included liver disease and rest others which tow case of colon , with one patient gases and the other with trauma.

5.3 Recommendation

After the enumeration of the results that related to the following thesis, there are some ideas which could help in more proper management of patient with RUQ Pain and better to be recommended as follows:

1. Good preparation is necessary to avoid obscure organs by gas.
2. Governmental hospital and private centers should be encouraged provide an excellent advanced machine supplied with Doppler system whenever possible .
3. Further studies should be done to evaluate the accuracy of ultrasound in detecting the causes as well as complications of RUQP, and include more sample data for precise and accurate results.
4. International scanning guidelines and protocol should be used for scanning RUQ to reduce misdiagnosis.

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Appendices

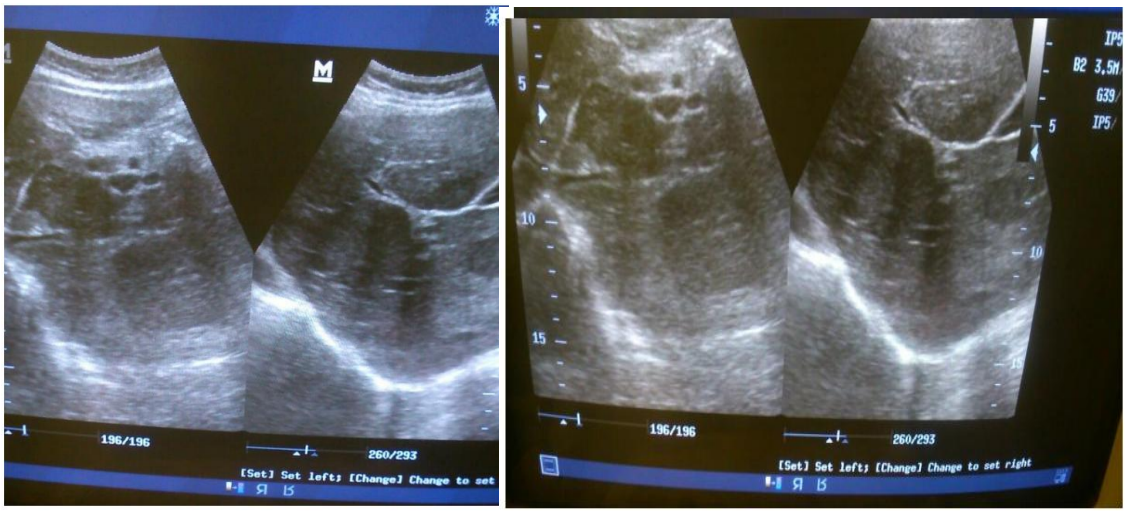
Appendix A: Data collection sheet.

No	Gender	Age	BMI	D of D	1.Liver	2.GB	3.Pa	4.Rt K	5.I.D	6.Normal
1.	F	48	21.8	3 days	+ve	+ve	-	-	-	-
2.	M	50	27	2 days	-	-	-	+ve	-	-
3.	F	20	17.6	5months	-	-	-	+ve	-	-
4.	F	56	25.6	7days	-	-	-	+ve	-	-
5.	M	58	39.7	3days	-	-	-	+ve	-	-
6.	M	23	16.7	1 month	-	-	-	+ve	-	-
7.	F	24	22	2months	-	+ve	-	+ve	-	-
8.	M	45	21.6	3 days	-	-	-	-	-	+ve
9.	M	50	17.5	8 days	-	+ve	-	-	-	-
10.	F	28	24.3	14days	-	+ve	-	-	-	-
11.	M	55	21.2	7days	-	-	-	-	-	+ve
12.	F	50	26.6	3months	-	-	-	+ve	-	-
13.	F	45	25.9	10days	-	-	-	+ve	-	-
14.	F	46	25	2days	-	-	-	-	-	+ve
15.	M	17	15.2	21days	-	-	-	+ve	-	-
16.	M	40	20	2months	-	-	-	+ve	-	-
17.	F	35	18.1	1year	-	+ve	-	-	-	-
18.	M	22	24.3	40days	-	-	-	-	-	+ve
19.	F	55	26.6	1day	-	-	-	-	-	+ve
20.	M	7	8.3	4months	-	-	-	+ve	-	-
21.	F	35	20.8	3days	-	-	-	+ve	-	-
22.	M	34	23.3	1year	-	-	-	+ve	-	-
23.	F	38	27.3	8months	-	+ve	-	-	-	-
24.	F	40	25	7days	-	-	-	-	-	-
25.	F	60	31.6	1year	+ve	+ve	-	-	-	-

26.	F	30	19.3	3years	-	-	-	+ve	-	-
27.	F	37	18.2	5days	-	-	-	+ve	-	-
28.	F	55	17.6	1year	-	-	-	-	-	-
29.	F	40	23.4	6months	-	-	-	+ve	-	-
30.	F	19	20.3	7days	-	-	-	+ve	-	-
31.	M	46	21.8	4years	-	-	-	+ve	-	-
32.	M	21	19.1	2days	-	-	-	+ve	-	-
33.	M	34	21.6	2days	-	-	-	+ve	-	-
34.	F	45	26.2	1months	-	-	-	+ve	-	-
35.	M	27	18	1day	-	-	-	+ve	-	-
36.	M	30	19.4	7months	+ve	-	-	+ve	-	-
37.	M	77	21.8	1year	-	+ve	-	-	-	-
38.	M	35	15	3days	-	-	-	-	-	+ve
39.	F	18	20.8	1day	-	-	-	-	-	+ve
40.	F	55	33.3	3months	+ve	-	-	+ve	-	-
41.	F	40	26.3	1year	+ve	+ve	-	-	-	-
42.	M	36	22	4days	-	+ve	-	-	-	-
43.	F	45	35	2years	-	+ve	-	-	-	-
44.	F	80	33.9	4years	-	-	-	-	-	+ve
45.	M	23	20.8	18days	-	-	-	+ve	-	-
46.	F	42	19.3	2months	-	+ve	-	-	-	-
47.	M	50	25	5years	-	-	-	+ve	-	-
48.	F	23	23.3	3days	-	-	-	+ve	-	-
49.	F	28	22.5	7days	-	-	-	-	-	+ve
50.	F	39	22	20days	-	-	-	-	-	-

D of D = Duration of Disease
Pa = Pancreas
ID= Intestinal Disorders

Appendix B: Images



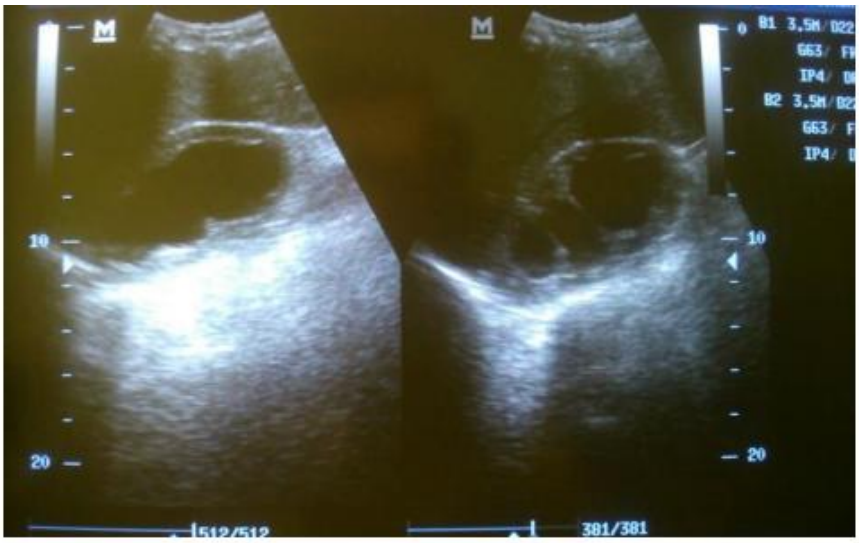
Appendix B-1: Image of live of 55 years old male shows multiple hepatic masugs (metastasis).

Appendix B-2: U/S Image of liver of 42 years old female shows multiple liver irregular masses.

Appendix B-3:U/S Image of GB of 24 years old female shows acute cholycystitis.

Appendix B-4: U/S Image of hepatic flexure of the colon of 15 years old male shows rutycel viscus…Rt trauma.

Appendix B-5: U/S Image of kidney of 26 years old female shows abdominal ascites with slightly small Rt kidney.

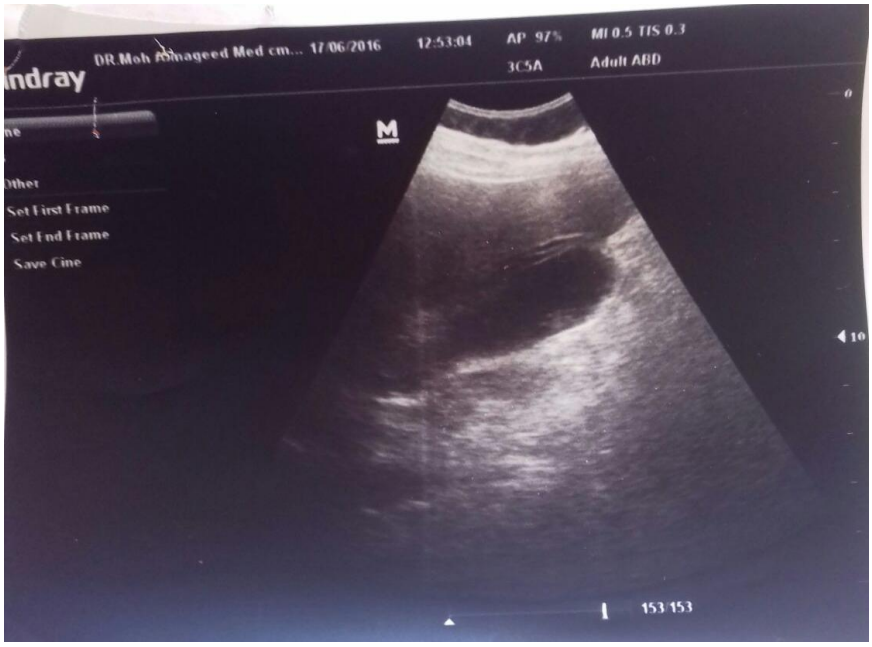


Appendix B-6: U/S Image of kidney of 33 years old female shows Rt kidney sever hydronephrosis, no intra-renal stone detected.

Appendix B-7: U/S Image of Rt kidney of 19 years old male shows mild hydronephrosis, no intra-renal stone detected.

Appendix B-8: U/S Image of kidney of 30 years old female shows normal right kidney volume measuring (131cc)

Appendix B-9: U/S Image of GB of 48 years old female shows multiple gall bladder stone.



Appendix B-10: U/S Image of GB of 42 years old female shows acute cholycystitis.

Appendix B-11: U/S Image of liver of 38 years old female shows fatty liver.

Appendix B-12: U/S Image of GB of 31 years old female shows solitary gall bladder stone.