Sudan University of Science and Technology

College of Graduate Studies

Evaluation of Ascites Causes using Computed Tomography

تقويم أسباب الإستسقاء بإستخدام الاشعة المقطعية المحوسبة

A thesis Submitted for Partial Fulfillment of the Requirements of M.Sc. Degree in Diagnostic Radiologic Technology

By:

Eltahir Ahmed ElshreefAlkhider

Supervisor:

Prof. Caroline EdwardAyadKhilla

2020

الآية

بسم الله الرحمن الرحيم

(قَالَ رَبِّ اشْرَحْ لِي صَدْرِي (25) وَيَسِّرْ لِي أَمْرِي (26)

وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي (27) يَفْقَهُوا قَوْلِي)(28)

صدق الله العظيم

سورة طه الآيات (25-28)

Dedication

To My mother

To My father

To My wife

To My daughter

To my brothers

To my sister

To my friends

Acknowledgement

Grateful thanks and grace to Allah, the Almighty for guiding and helping me to finish this research.

I would like also to express sincere thanks and gratitude tomy supervisor **Prof: Caroline Edward** for her supervision, guidance and valuable comments and support from the idea of this research until finishing.

Special thanks to **MilitaryHospital** for agreement to collect the data.

Finally I would like to thanks my friends, teachers and colleges

Abstract

This is discriptive studyit was conducted at Military Hospital during the period extended from January 2019 to September 2019. The objective of the study was to evaluate of ascites causes using computed tomography. The study included fifty patients, 28 were males and 22 were females.

The study showed males (56%) were more affected by ascites than females (44%).The most affected ages were in the age group of (64-80) years.Metastases was the most common diseases that cause ascites (32%), followed by portal hypertension (24%), cirrhosis (18%), hepatocellular carcinoma(4%), then pancreatic cancer (4%), and other causes constituting (6%).

Through these results, it was found that there is a relationship between the main cause of ascites and its grade at (P = 0.011.), andthere were not relationship between ascites causes and pleural effusion at (P = 0.197)

The study concluded that a CT scan can find out the ascites and the underlying cause.

المستخلص

تعتبر هذه الدراسة وصفية وقد تم اجراءها في المستشفي العسكري وجمعت بياناتها في الفترة من يناير 2019 إلي سبتمبر2019 و الهدف الأساسي منها هو تقويم اسباب الاستسقاء البطني بواسطة استخدام الاشعة المقطعية.

وقد شملت هذه الدراسة عدد خمسين مريضا , منهم 28 ذكور و 22 إناث.

خرجت الدراسة بنتائج مفادها أن الامراض التي تسبب الإستسقاء أكثر شيوعاً في الذكور (56%) منه في الإناث (44 %) وكانت أكثر الأعمار إصابة هي في الفئة العمرية (64–80) سنة , و كانت الاورام الخبيثة من أكثر الامراض التي تسبب استسقاء البطن (32%) تليها ارتفاع ضغط الوريد البابي (24%) ثم تليف الكبد (18%) ثم سرطان الكبد(4%) ثم سرطان البنكرياس (4%) ثم مسببات اخري تشكل (6%).

ومن خلال هذه النتائج تبين أن هنالك علاقة مابين السبب الاساسي للاستسقاء وحجمه p = 0.011.كما اتضح من نتائج هذه الدراسة انه لا توجد علاقة بين سبب الإستسقاء والانصباب الرئوي p = 0.197

و قد أظهرت هذه الدراسة أن الأشعة المقطعية هي أفضل وسيله لتشخيص الامراض التي تسبب الاستسقاء البطني لأن لها درجة عالية من الدقة والكفاءة في التشخيص الآمن.

Table of Contents

List of Figures

List of Tables

List of the Abbreviations

AUROCs	area under the receiver operating characteristic curves
Ca	Cancer
CHF	Congestive Heart Failure
CIs	Confidence Intervals
CT	Computed Tomography
GI	Gastrointestinal
HCC	Hepatocellular Carcinoma
HIV	Human Immuno deficiency virus
IV	Intravenous
IVC	Inferior Vena Cava
LLQ	left Lower Quadrant
LUQ	left Upper Quadrant
MELD	Model For End-Stage liver Disease
MRI	Magnetic Resonance Imaging
PE	Pleural Effusion
PHT	Portal Hypertension
RLQ	Right Lower Quadrant
RUQ	Right Upper Quadrant

Chapter one

Introduction

Chapter one

1.1 Introduction:

Ascites is the accumulation of fluid within the peritoneal cavity, is also seen as a result of portal hypertension and the leakage of excessive fluids from the portal capillaries. Much of this excess fluid is composed of hepatic lymph weeping from the liver surface. It is associated with approximately 50% of deaths from cirrhosis.Ascites may also result from chronic hepatitis, congestive heart failure, renal failure, and certain cancers. Abdominal sonography is commonly used in the detection or confirmation of ascites. Diagnostic and therapeutic paracentesis may be conducted with sonographic guidance to locate a site that will allow fluid to be removed and to avoid damage to the floating bowel loops. (Nina K, 2014).

A diagnostic paracentesis involves removal of 50 to 100 mL of peritoneal fluid for analysis. Patients with ascites generally complain of nonspecific abdominal pain and dyspnea. Medical treatment of ascites includes bed rest, dietary restrictions of sodium, use of diuretics to avoid excess fluid accumulation, and treatment of the underlying cause.(Nina K, 2014).

It is important for the radiographer to be aware of the clinical diagnosis of ascites because the fluid accumulation makes it difficult to adequately penetrate the abdomen. An increase in exposure factors is necessary to obtain a diagnostic-quality radiograph. Radiographically, large amounts of ascites fluid give the abdomen a dense, gray, ground-glass appearance. When the patient is in the supine position, fluid accumulates in the pelvis and ascends to either side of the bladder to give it a dog-eared appearance. Gradually, the margins of the liver, spleen, kidneys, and psoas muscles become indistinct as the volume of fluid

increases. Loops of bowel filled with gas float centrally, and a lateral decubitus radiograph demonstrates the fluid descending and the gasfilled loops of bowel floating on top. (Nina K, 2014).

Conventional radiographic signs of cirrhosis are few and not specific. Morphologic changes in the liver from cirrhosis may cause displacement of other abdominal organs such as the stomach, duodenum, colon, gallbladder, and kidney. CT is the primary modality for evaluating the complications arising from cirrhosis. Fatty infiltration of the liver is well visualized by CT. The most characteristic finding in cirrhosis is an increase in the ratio of the caudate lobe and the right lobe. This occurs with cirrhosis because of atrophy of the right lobe and medial segment of the left lobe and hypertrophy of the caudate lobe and the lateral segment of the left lobe. Because of its dual arterial blood supply, the caudate lobe of the liver is usually spared in cirrhosis.(Nina K, 2014.)

Studies show that individuals with cirrhosis have an increased risk of developing hepatic carcinoma, so CT is also of value in assessing the presence of complications of cirrhosis such as ascites and hepatocellular carcinoma.(Nina K, 2014).

Diagnostic medical sonography is helpful in identifying liver cirrhosis and enlargement of the liver and spleen. Doppler is used to detect portal hypertension and evaluate portosystemic collateral circulation. It is used to measure the vessel size of the portal vein, which ranges from 0.64 to 1 cm in a normal adult. A portal vein larger than 1.3 cm in diameter is indicative of portal hypertension.(Nina K, 2014).

Treatment of cirrhosis depends on the extent of liver damage and the involvement of other organs (e.g., the esophagus and stomach).

The primary goal of treatment is to eliminate the underlying causes of the disease and to treat its complications. Surgical treatment of portal hypertension may be achieved by diverting blood from the portocollateral

system into the lowerpressure systemic circulation. This is accomplished by placing a shunt, eliminating the chance of variceal bleeding. A distal splenorenal shunt, in which the splenic vein is divided, with the distal portion anastomosed to the left renal vein, is most commonly used. If the patient is not a candidate for this type of shunt, a total shunt, either portocaval or mesocaval, must be placed.(Nina K, 2014).

Lesions in the liver that have been identified on sonography, MRI, or CT are highly recommended to be further evaluated with MRI of the abdomen, with and without contrast, to conclusively differentiate between benign and malignant lesions. If the patient is unable to tolerateMRI contrast, CT of the abdomen is the next modality recommended to delineate the liver lesion in question.(Nina K, 2014).

If abdominal ascites is suspected in a patient with acute abdominal pain, the use of helical CT is highly recommended to document the presence of free fluid in the abdomen, as it is sensitive andvery cost-effective in evaluating the patient with acute abdominal pain. (Nina K, 2014).

ATreatment depends on the underlying cause of the fluid accumulation. In the case of advanced liver failure or cirrhosis of the liver, there is no cure, but patients must stop all alcohol consumption as well as drugs that damage the liver, such as high doses of Tylenol.There are several treatments that may be administered in combination to reduce the amount of accumulated fluid: Restricting sodium (salt) intake.Diuretic therapy (“water pills”) to increase urine production and help the body excrete extra sodium and water.(Nina K, 2014).

Therapeutic (“large volume”) paracentesis (using a local anesthetic to insert a needle through the abdominal wall) may be used to draw out as much fluid as possible from patients who do not respond adequately to restricted sodium and diuretic therapy. (Nina K, 2014).

Whatever treatment is used, patients will be closely monitored by their physician to track body weight, kidney function and levels of sodium and potassium in the blood. (Nina K, 2014).

Ascites classified to three degrees, grade (1) ascites is mild and can be detected only by an examination such as ultrasound. Grade (2) ascites is moderate and evidenced by moderate distension of the abdomen , and is therefore readily detectable on physical examination. Grade (3) ascites is large with marked distension of the abdomen.

1.2 Statement of problem:

There are many patients came to hospital complain nonspecific abdominal pain, dyspnea and distention. The diagnosis was done clinically which can not show underling cause.

The study is an attempt to study the ascites and underling cause by using CT Scan. As it is an excellent imaging method to diagnose the entire abdominal organs.

1.3 Objective of study

1.3.1 The general objectives:

ToEvaluationof Ascites Causes using Computed Tomography.

1.3.2 Specific objectives :

2. To evaluate the underling causes of ascites according to gender.
3. To evaluate the underling causes of ascites according to age.
4. To evaluate the commonestunderling causes of ascites.
5. To correlate between grade of ascites and underling cause.
6. To correlate between ascites causesand pleural effusion.

1.4 Overview of the study:

Chapter One is introduction will discuss prelude, problem, objective of study. Chapter two is literature review will discuss background (anatomy, physiology, pathology and previous study), Chapter three is material and methods will discuss the study sample, methods, variables, data collection and data analysis, Chapter four is results will discuss study results, Chapter five is discussion, conclusion and recommendation and references.

Chapter two
Literature review

Chapter two

Literature review

2.1. Anatomy and physiology of the abdominal cavity:

The human abdomen is divided into quadrants and regions by anatomists and physicians for the purposes of study, diagnosis, and treatment. The division into four quadrants allows the localization of pain and tenderness, scars, lumps, and other items of interest, narrowing in on which organs and tissues may be involved. The quadrants are referred to as the left lower quadrant, left upper quadrant, right upper quadrant and right lower quadrant.

(https://en.wikipedia.org/wiki/Quadrants_and_regions_of_abdomen)

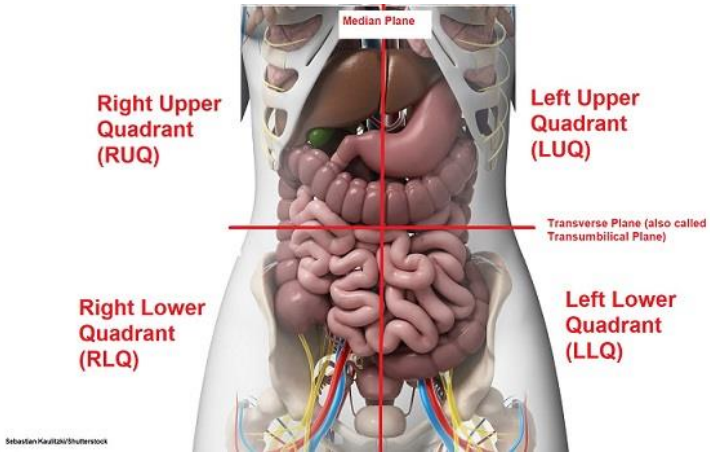

Figure (2. 1) four-quadrant

2.1.1. The left upper quadrant (LUQ) extends from the median plane to the left of the patient, and from the umbilical plane to the left ribcage . Important organs here are:

2.1.1.2 Stomach (The stomach is a muscular, hollow organ in the gastro-intestinal tract of humans) the stomach has three main functions: temporary storage for food, which passes from the esophagus to the stomach where it is held for 2 hours or longer, mixing and breakdown of food by contraction and relaxation of the muscle layers in the stomach.digestion of food.(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.1.3 Spleen (The spleen is an organ found in virtually all vertebrates. Similar in structure to a large lymph node, It is operates as filter for blood. It helps ward off infections and maintains body-fluid balance. .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.1.4 Left lobe of liver (The liver is a large organ that occupies the upper right quadrant of the abdominal cavity, however the left lobe is smaller and more flattened than the right. and situated in the left upper quadrant) Vital Functions of the Liver:Carbohydrate metabolism, Lipid metabolism,Aminoacid metabolism, Removal of waste products, Vitamin and mineral storage, Drug inactivation, Synthesis and secretion of bile. (https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen)

2.1.1.5 Body of pancreas (The pancreas is an organ that in humans lies in the upper left quadrant of the abdomen. In adults, it is about 12–15 centimetres (4.7–5.9 in) long, lobulated, and salmon-coloured in appearance. Anatomically, the pancreas is divided into a head, neck, body, and tail) its function The pancreas is involved in: blood sugar control and metabolism within the body. the secretion of substances (collectively pancreatic juice) which help digestion. These are divided into an "endocrine" role, relating to the secretion of insulin and other substances within pancreatic islets and helping control blood sugar levels and metabolism within the body, and an "exocrine" role, relating to the

secretion of enzymes involved in digesting substances from outside of the body. (https://wikipedia.org/wiki/Quadrants_and_regions_of_abdomen)

2.1.1.6 Left kidney The left kidney lies slightly higher than the right (because the left lobe of the liver is smaller than the right).) The basic functions include: Regulation of extracellular fluid volume, The kidneys work to ensure an adequate quantity of plasma to keep blood flowing to vital organs, Regulation of osmolarity, Regulation of ion concentrations, Regulation of pH, Excretion of wastes and toxinsm, Production of hormones.(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen)

2.1.1.7 Left adrenal gland(The left adrenal gland also known as suprarenal gland is endocrine glands that produce a variety of hormones including adrenaline and the steroids aldosterone and cortisol. It is found above the left kidney) .(https://wikipedia.org/wiki/Quadrants and_regions_of_abdomen).

2.1.1.8 Splenic flexure of colon (The colon is the largest portion of the largeintestine. The colon absorbs vitamins that are created by the colonic bacteria, such as vitamin K It also compacts feces, and stores fecal matter in the rectum until it can be discharged via the anus in defecation (There are two colic flexures, or curvatures in the transverse colon. The one on the left, the left colic flexure is known as the splenic flexure. The one on the right, the right colic flexure is known as the hepatic flexure. (https:/wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.1.9 Parts of transverse and descending colon The transverse colon is the longest and most movable part of the colon. It crosses the abdomen from the ascending colon at the hepatic or right colic flexure with a downward convexity to the descending colon. .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.2 The right upper quadrant (RUQ) extends from the median plane to the right of the patient, and from the umbilical plane to the right ribcage. Important organs here are:

2.1.2.1 Liver (The liver is a large organ that occupies the upper right quadrant of the abdominal cavity).

.(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.2.2 Gall bladder The gallbladder, a digestive organ, is a pearshaped sac located on the undersurface on the right lobe of the liver. Normally, the walls are quite thin, but they often thicken in the presence of inflammation. The sole function of the gallbladder is to store and concentrate bile that has been produced in the liver. The gallbladder receives bile from the liver via the hepatic duct and empties bile into the duodenum to aid the digestion and absorption of fats in the gastrointestinal (GI) system.

.(https:wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.2.3 Duodenum The duodenum is the first section of the small intestineThe duodenum precedes the jejunum and ileum and is the shortest part of the small intestine. In humans, the duodenum is a hollow jointed tube about 25–38 cm (10–15 inches) long. The duodenum is largely responsible for the breakdown of food in the small intestine, using enzymes. The duodenum also regulates the rate of emptying of the stomach via hormonal pathways. Secretin and cholecystokinin are released from cells in the duodenal epithelium..(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.2.4 Head of pancreas The pancreas is an organ that in humans lies in the upper left quadrant of the abdomen. In adults, it is about 12–15 centimetres (4.7–5.9 in) long, lobulated, and salmon-coloured in

appearance. Anatomically, the pancreas is divided into a head lies in the upper right quadrant neck, body, and tail).
(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen)

2.1.2.5 Right kidney. The right kidney lies slightly lower than the left kidney (because the left lobe of the liver is smaller than the right).) The basic functions include: Regulation of extracellular fluid volume, The kidneys work to ensure an adequate quantity of plasma to keep blood flowing to vital organs, Regulation of osmolarity, Regulation of ion concentrations, Regulation of pH, Excretion of wastes and toxinsm, Production of hormones.(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen)

2.1.2.6 Right adrenal gland. (The right adrenal gland also known as suprarenal glandisendocrine glands that produce a variety of hormones including adrenaline and the steroids aldosterone and cortisol. It is found above the right kidney) .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.2.7 Hepatic flexure of colon. (There are two colic flexures, or curvatures in the transverse colon. The one on the left, the left colic flexure is known as the splenic flexure. The one on the right, the right colic flexure is known as the hepatic flexure.(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

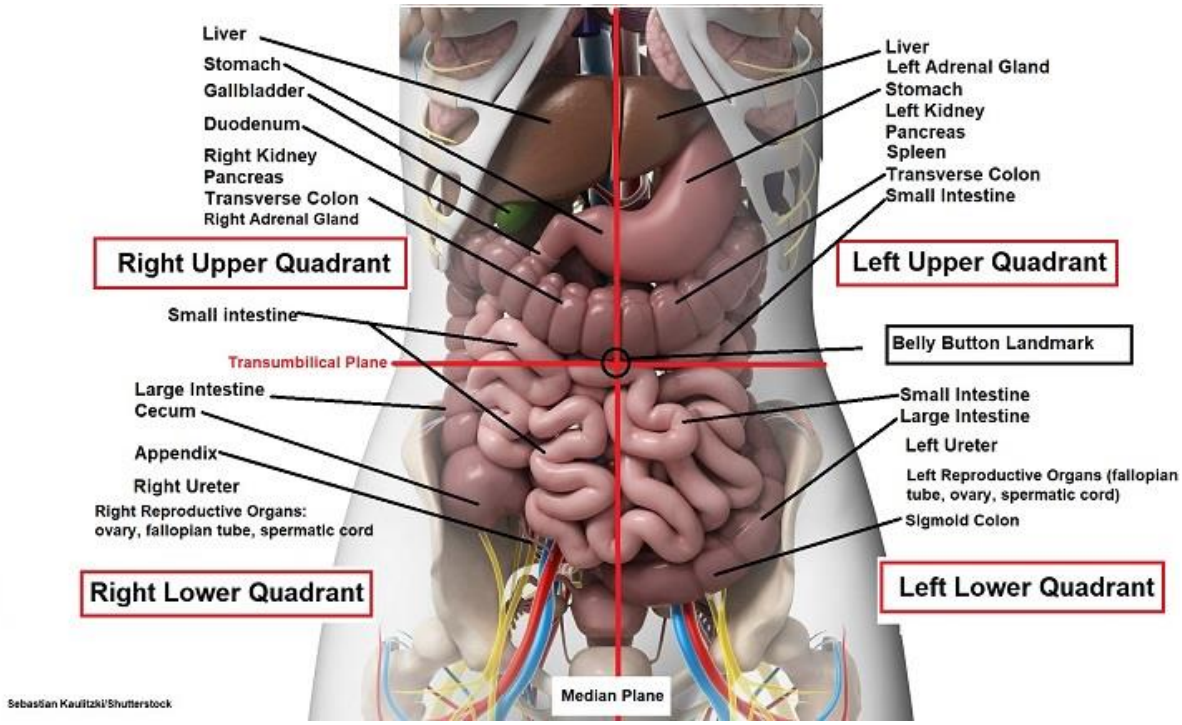

Figure (2. 2) abdominal-quadrants

2.1.3The left lower quadrant (LLQ) of the human abdomen is the area left of the midline and below the umbilicus. The LLQ includes the left iliac fossa and half of the left flank region. Important organs here are:

2.1.3.1 thedescendingcolonis the part of the large intestine from the splenic flexure to the beginning of the sigmoid colon. The function of the descending colon in the digestive system is to store the remains of digested food that will be emptied into the rectum The sigmoid colon (or pelvic colon) is the part of the large intestine that is closest to the rectum and anus. It forms a loop that averages about 35–40 cm (13.78-15.75 in) in length.

(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.3.2The left ovary: the ovary is an organ found in the female reproductive system that produces an ovum. When released, this travels down the fallopian tube into the uterus, where it may become fertilized by a sperm. the function of the ovaries : Gamete production, Hormone

secretion, Ovarian aging .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.3.3 Left fallopian tube: The fallopian tube is composed of four anatomic segments. Beginning laterally near the ovaries proceeding medially toward the uterus these include the infundibulum with its associated fimbriae near the ovary , the ampulla that represent the major portion of the lateral tube , the isthmus which is the narrower part of the tube that links to the uterus. Inside the Fallopian tubes there are hair-like Fallopian cilia which carry the fertilized egg from the ovaries of female mammals to the uterus, via the uterotubal junction it is function is Fertilization..(wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.3.4 The left ureters is tube made of smooth muscle fibers that propel urine from the left kidneys to the urinary bladder. In the adult, the ureters are usually 25–30 cm (10–12 in) long and around 3–4 mm (0.12–0.16 in) in diameter. .(wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.4 The right lower quadrant (RLQ) extends from the median plane to the right of the patient, and from the umbilical plane to the right inguinal ligamentImportant organs here are:

2.1.4.1 The cecum or caecum is a pouch within the peritoneum that is considered to be the beginning of the large intestine. It is typically located on the right side of the body (the same side of the body as the appendix, to which it is joined).

.(.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.4.2 Ascending colon The ascending colon is the part of the colon located between the cecum and the transverse colon. The ascending colon is smaller in calibre than the cecum from where it starts.

2.1.4.3 Appendixis a finger-like, blind-ended tube connected to the cecum, from which it develops in the embryo. The cecum is a pouch-like structure of the colon, located at the junction of the small and the

large intestines. The appendix used to be considered a vestigial organ, but this view has changed over the past decades.

(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.4.4 Right ovary the ovary is an organ found in the female reproductive system that produces an ovum. When released, this travels down the fallopian tube into the uterus, where it may become fertilized by a sperm. the function of the ovaries : Gamete production, Hormone secretion, Ovarian aging .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.4.5 Fallopian tube.The fallopian tube is composed of four anatomic segments. Beginning laterally near the ovaries proceeding medially toward the uterus these include the infundibulum with its associated fimbriae near the ovary , the ampulla that represent the major portion of the lateral tube , the isthmus which is the narrower part of the tube that links to the uterus. Inside the Fallopian tubes there are hair-like Fallopian cilia which carry the fertilized egg from the ovaries of female mammals to the uterus, via the uterotubal junction it is function is Fertilization.

(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.1.4.6 Right ureter is tube made of smooth muscle fibers that propel urine from the right kidneys to the urinary bladder. In the adult, the ureters are usually 25–30 cm (10–12 in) long and around 3–4 mm (0.12–0.16 in) in diameter. .(https://en.wikipedia.org/wiki/Quadrants _and_regions_of_abdomen).

2.2. Intraperitoneal and Retroperitoneal Relationships.

The terms intraperitoneal and retroperitoneal are used to describe the relationship of various organs to their peritoneal covering. An organ is said to be intraperitoneal when it is almost totally covered with visceral peritoneum. The stomach, jejunum, ileum, and spleen are good examples

of intraperitoneal organs. Retroperitoneal organs lie behind the peritoneum and are only partially covered with visceral peritoneum. The pancreas and the ascending and descending parts of the colon are examples of retroperitoneal organs. No organ, however, is actually within the peritoneal cavity. An intraperitoneal organ, such as the stomach, appears to be surrounded by the peritoneal cavity, but it is covered with visceral peritoneum and is attached to other organs by omenta. (Richard s.Snell 2012).

T A B L E(2.1) The List of Intraperitoneal Organs
Gallbladder
Liver (except for bare area)
Ovaries
Spleen (except for the splenic hilum)
Stomach

(Steven M. p,2011)

T A B L E(2.2) The List of Retroperitoneal Organs
Abdominal lymph nodes
Adrenal glands
Aorta
Ascending and descending colon
Duodenum
Inferior vena cava
Kidneys
Pancreas
Prostate gland
Ureters
Urinary bladder
Uterus

(Steven M. p,2011)

2.3 Pathologies Associated with Ascites:

T A B L E(2.3) PathologiesAssociated with Ascites
Cirrhosis Portal hypertension Congestive heart failure Ectopic pregnancy Malignancy Ruptured abdominal aortic aneurysm

(Steven M. p,2011)

2.3.1 Cirrhosis:

Cirrhosis is a devastating liver disorder that is defined as hepatocyte death, fibrosis and necrosis of the liver, and the subsequent development of regenerating nodules. Common sequela of cirrhosis includes portal hypertension, the development of varicosities within the abdomen, portal vein thrombosis, splenomegaly, and HCC. The most common cause of cirrhosis is alcoholism. However, cirrhosis can also be caused by primary biliary cirrhosis, hepatitis, cholangitis, and hemochromatosis. Patients may have normal laboratory findings until cirrhosis advances into end-stage liver disease. However, when laboratory abnormalities are evident, they include elevation in aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase, and bilirubin. Patients may also present with jaundice, fatigue,weight loss, diarrhea, initial hepatomegaly, and ascites.

2.3.2 Clinical findings of cirrhosis:

Ascites, diarrhea, elevated liver function tests,fatigue, hepatomegal (initial) jaundice , splenomegaly and weight loss. (Steven M. p,2011)

2.3.3 Portal Hypertension:

Portal hypertension is the elevation of blood pressure within the portal venous system. The pressure within the portal vein can be altered by several abnormalities. The most common cause of

portal hypertension is cirrhosis. However, portal hypertension can also result from portal vein thrombosis or compression of the portal veins by a tumor in an adjacent organ. The portal vein diameter will exceed 13 mm in the anteroposterior dimension, and the superior mesenteric vein will exceed 10 mm. Interventional treatment for portal hypertension is by means of a transjugular intrahepatic portosystemic shunt (TIPS). This therapy involves the placement of astent between the portal veins and hepatic veins to shunt blood and reduce portal systemic pressure. The right jugular vein is most often used to access the inferior vena cava for stent placement. TIPS is only a temporary treatment for portal hypertension.

2.3.4 Clinical findings of portal hypertension:

Abnormal liver function tests, ascites, Diarrhea, fatigue, hepatomegaly, jaundice, weight loss. (Steven M. p,2011)

2.3.5 Hepatocellular CarcinomaHCC is the most common primary form of liver cancer, although it is not encountered as often as metastatic liver disease. HCC is most often seen in men, and frequently accompanied by cirrhosis or chronic hepatitis.The malignant mass associated with HCC is referred to as a hepatoma. Hepatomas can invade the portal veins or hepatic veins. Narrowing of the hepatic veins, with possible tumor invasion into the inferior vena cava, is termed Budd–Chiari syndrome. (Steven M. p,2011)

2.3.6 Cancer of the Pancreas: The most common pancreatic malignancy is adenocarcinoma (90%) which often is far advanced and has metastasized before it is detected and thus has an extremely poor survival rate. Of these malignancies, 60% occur in the head of the pancreas. Less common pancreatic tumors are hormone-secreting neoplasms of the islet cells of the islets of Langerhans(Steven M. p,2011)

2.3.7 Ca ovaries: The most common malignancies involving the ovaries are metastatic tumors, which arise principally from carcinomas of the breast, colon, and stomach. They are frequently bilateral and often asymptomatic. (Steven M. p,2011)

2.3.8 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. Right upper quadrant pain and leukocytosis are often associated with acute cholecystitis. Other laboratory findings may include an elevation in alkaline phosphatase and aminotransferase. Bilirubin may also be elevated if obstruction to the ducts occurs. Patients will complain of focal tenderness over the gallbladder with transducer pressure when the gallbladder is inflamed. (Steven M. p,2011)

2.4 Computer tomography:

The basic equipment configurations for CT are three major systems:
the imaging system, computer system and image display, recording, storage and communication system.(Moss G,2015)

2.4.1 The three major systems are located in separate rooms as follows:

I. The imaging system is located in the scanner room.

II. The computer system is located in the computer room.

III. The display, recording and storage system is located in the operator's room

2.4.1.1 Imaging system:

2.4.1.1.1 Gantry:

Is amounted frame work that surrounds the patient in vertical plane. It contains a rotating scan frame on to which the x- ray generator, ray tube and other component are mounted.

2.4.1.1.2 Patient couch:

The patient couch or table provides a plate from on which the patient lies during examination. The couch should be strong and rigid to support the weight of the patient, additionally it should provide for safety and comfort of the patient during examination. (Moss G,2015)

2.4.2.1 The computer system:

The computer system in CT belongs to class of minicomputers. The two most important characteristics of the CT computer system are a large strong capacity and fast and efficient processing of various kinds of data. .(Moss G,2015)

2.4.2.1.1 Imaging display, storage, recording and communication:

2.4.2.1.2 Image display:

A display device for CT generally a black and white or color monitor, where as images are usually displayed in gray scale.The features of the image display are display matrix, pixel, size, bit depth, CT value scale image monitor and number of lines, and selectable window width and window center. (Moss-G,2015)

2.4.2.1.3 Image storage:

Data are stored in digital form to preserve the wide dynamic range of image processing and intensity transformation and to decrease the possibility of lost records and reduce the space needed for archiving. (Moss-G. 2015)

2.4.2.1.4 Laser recording system:

The requirements for hard copy recording of CT images are stringent because these images are used for diagnostic interpretation. (Moss-G. 2015)

The steps in the laser printing film are:

When the appropriate command from the operator is received an unexposed film is transported to the exposure area of the printer.

I. In the exposure area, the film is scanned systematically line by line. The laser received its signal from computer to produce a latent image.
II. Depending on the printer, the laser. Scanned film is sent to the receiver or a chemical processor attached to the printer for development.
III. The result is a laser printed film ready for viewing.

Figure (2. 3)CT machine (64-slice) (Moss-G. 2015)

2.4.3 Technique and strategies of computed tomography examination:

The diagnostic methodology is part of diagnostic strategy and includes patient preparation, examination parameters and administration of contrast media.

2.4.4 Patient preparation:

When patient presents for abdominal computed tomography the radiologist should assess the clinical problem and review previous imaging studies. Assess medical history, including the current indication for study, contrast allergies, renal impairment, past abdominal surgeries, radiation therapy...etc. (Moss-G. 2015)

Brief physiological examination is helpful if there is suspected of an abdominal mass. Decision to be made to individualize the examination includes:

- Oral Contrast 45 minutes before scan to opacity GIT trac.
- Area scanned, anatomic land marks.
- Scan parameter, thickness, spacing, field of view, filters, dose and angulations.

The radiologist should review the scan before patient leave. The patients were examined after 8 hours of fasting

2.4.5 Technical parameter:

Slice thickness (5-10) mm is sufficient for most application of abdominal computed tomography. Most scan are performed using contiguous slice (10mm-thick at 10mm interval) ,Scan time of 1-2 second used to a dimnish motion artifact from peristalsis and pulsating blood vessels. Contiguous section must be scanned when second image reconstruction (reformatting) to be performed.

A reduction in slice thickness will lead to increase noise if the reduction dose per slice is not increase correspondingly.

The number of slices to be scanned determine the total scans time. Depending on the slice thickness and size of the computer matrix, the selected dose per slice determines the degree of spatial and contrast resolution. (Moss-G,2015)

2.5 Previous Studies:

In study done by (AyantundeAA,et al 2007).entitled Pattern and prognostic factors in patients with malignant ascites, they mentioned the malignant ascites is a manifestation of end stage events in a variety of cancers and associated with a poor prognosis. They evaluated the pattern of cancers causing malignant ascites and factors affecting survival.

They showed in their study that there were 209 patients (140 females and 69 males), median age being 67 (30–98) years. The commonest cancer was ovarian followed by gastrointestinal (GI) cancers. Fifty-eight percent of the patients had symptoms related to the ascites. Liver metastases were significantly commoner in the GI cancers (P = 0.0001). Fifty-four per cent of their patients presented with ascites at the initial diagnosis of their cancer. Paracentesis was given to 112, diuretics to 70 and chemotherapy to 103 patients. The median survival following diagnosis of ascites was 5.7 months. Ovarian cancer favoured longer survival while low serum albumin, low serum protein and liver metastases adversely affected survival. The independent prognostic factors for survival were cancer type, liver metastases and serum albumin.

In their conclusion they was identified independent prognostic factors should be used to select patients for multimodality therapy for adequate palliation.

Another study done by(Mohammadi A, et al 2011), entitled differentiation of benign from malignant induced ascites by measuring gallbladder wall thickness.Ascites showedthattheir study is multiple causes for ascites and conventional diagnostic method for most of them is paracentesis. This method is invasive and time consuming. The aim of thier study is to survey the reliability of measuring gallbladder wall thickness to discriminate between cirrhotic and malignant ascites.

In their study they measured the gallbladder wall thickness by ultrasonography in 100 consecutive patients with portal hypertension induced ascites and in 100 consecutive patients with peritoneal carcinomatosis induced ascites

The mean Gallbladder wall thickness was 3.94±0.69 mm in cirrhotic patients and 2.26±0.62 mm in patients with peritoneal carcinomatosis. Gallbladder wall thickening in cirrhotic patients was significantly more compared to patients with peritoneal carcinomatosis (p-value=0.001).

They was showed in their study that the thickened gallbladder wall in patients with ascites is highly predictive for diagnosis of portal hypertension induced ascites.

In the other study published by (XiaozhongX ,et al 2017), entitled Quantification of ascites based on abdomino-pelvic computed tomography scans for predicting the in-hospital mortality of liver cirrhosis. Showed that ascites is the most common complications of liver cirrhosis and is associated with a high mortality rate. The present retrospective study aimed to evaluate the potential correlation between in-hospital mortality of liver cirrhosis and volume of ascites.

Their results showed the data of 177 patients was reviewed in the their study. A total of 109 (61.58%) patients were male and 68 (38.42%) were female. The mean age of patients was 59.37±12.05 years. Ascites was confirmed by CT scans in 117 (61.10%) patients, among them, 27 patients presented with ascites, but the volume of ascites could not be evaluated according to five-point method.

During hospitalization, the mortality rate of patients was 4.5% (8/177). Hepatitis B virus and alcohol abuse were the two major causes of cirrhosis. Founded quantification of ascites may aid to predict the in-hospital mortality rate of cirrhotic patients.

Another discriptive cross sectional study done by (Mahmood G, et al 2009). On 100 consecutive adult cases of ascites showed incidence of underlying causes, diagnosis of ascites was based on history, clinical examination & USG examination. Among the 100 cases, male were 68 & female were 32, age range was 13-61 years. Causes of ascites were cirrhosis of liver 68%, tubercular peritonitis 9%, hepatocellular carcinoma 8%, congestive cardiac failure 6%, malignancy 4%, nephrotic syndrome 3%, lymphoma 2% and others 4%. Cirrhosis of liver is the major cause of ascites in thier study.

Many of the patients with cirrhosis & hepatocellular carcinoma were positive for HBs Ag & anti HCV implying that hepatitis B & C viruses play a positive role in this condition.

Chapter Three

Materials and Methods

CHAPTER THREE

Materials and Methods

3-1 Materials:

3.1.1 Patients:

The entire population of this study were 50 patients with nonspecific abdominal pain, dyspnea and distention (28males and 22females) with ages range between (13-90) years. They referred to CT center for CT examination of the abdomen. some patients suspected they have abdominal ascites according to the clinical signs and symptoms.

3.1.2 Machine Used:

CT scannar used was 64 slice scanner (Toshiba) to acquire images of the abdominopelvic in a caudocranial direction.

3-2 Methods:

3.2.1 Method of Data collection:

Data collected by data collected sheet.

3.2.2 Methods of data analysis:

The data were analyzed through statistical package for social science.

3.2.3 Area and duration of the study:

The study has been carried out during the period from January 2019 up to September 2019 in Military hospital.

3.2.4 Technique Used:

- The patients were fasting for 8 to 12 hours.
- oral and intravenous contrast (omnipaque), introduced of an 20 ml of contrast mixed with 600 ml of water and given to the patient to drink 400 ml one hour before scan, 200 ml just before scan.
- Patients position supine and feet first.

- The abdomen field of view is the from lung bases -to- Symphisis pubis.
- Slice thickness 5 — 10mm.
- Intravenous contrast was injected 1.5 to 2 ml/sec, 1.5 ml/kg.

3.2.5 Interpretation and results:

A radiologist, a physician specifically trained to supervise and interpret radiology examinations,they diagnose the images and send assigned report to primary care or referring physician.

Data were collected from image reports that demonstrate volume, underling cause.

Chapter Four

Results

Chapter Four

Results

Table (4.1) frequency distribution of gender

		Frequency	Percent
Valid	female	22	44.%
	male	28	56.%
	Total	50	100.%

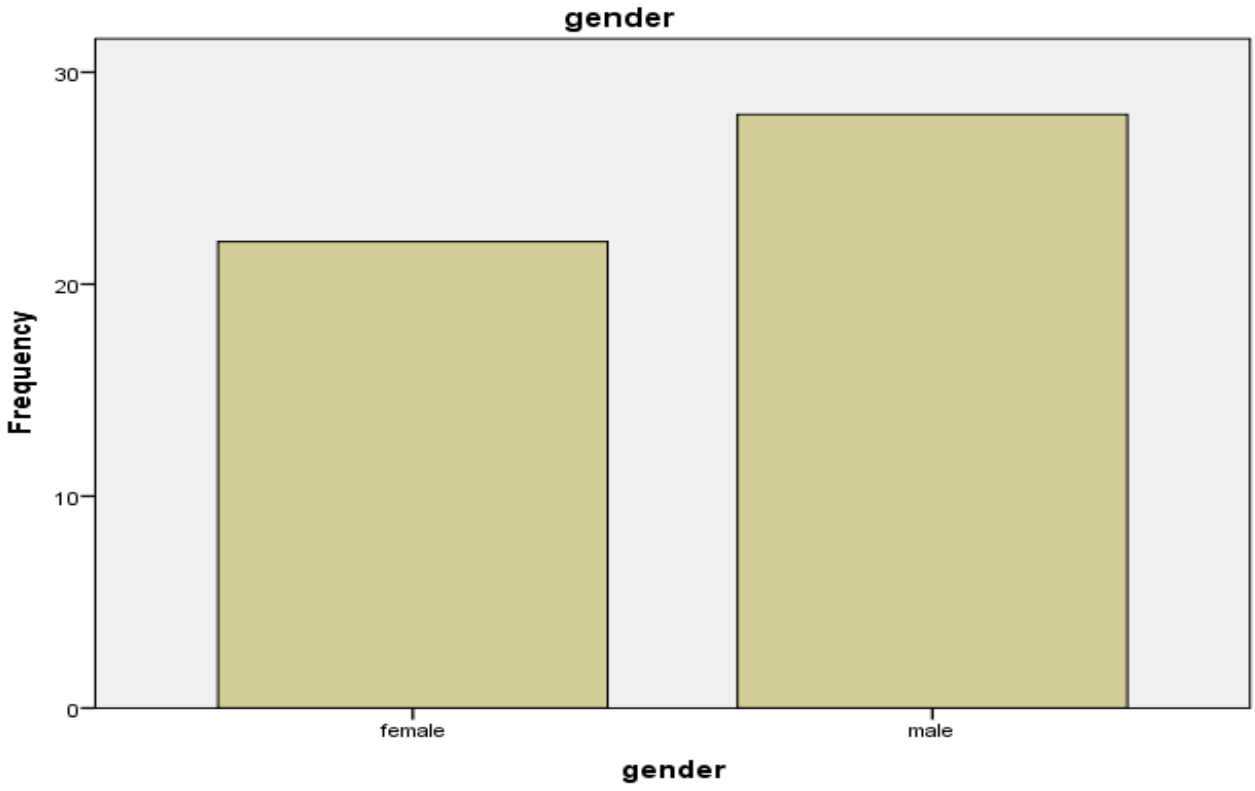

Figure (4.1) frequency distribution of gender

Table (4.2) frequency distribution of age

Range of age	Frequency	Percent
13 ___ 29	4	8.%
30 ___46	10	20.%
47___ 63	14	28.%
64 ___ 80	19	38.%
81 ___ 97	3	6.%
Total	50	100.%

The median age = 61.00

The mean age = 58.30

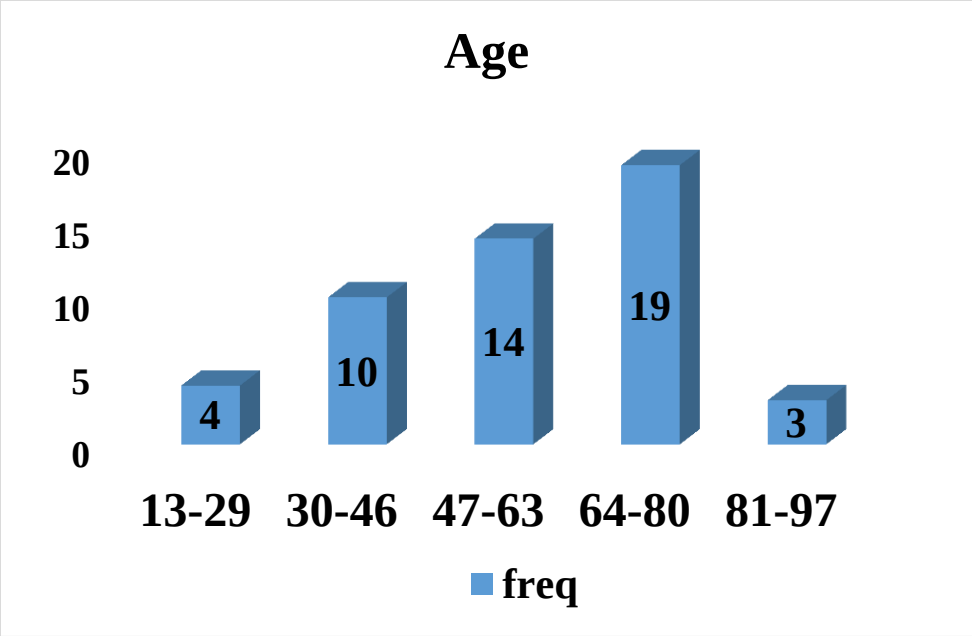

Figure (4.2) frequency distribution of age

Table (4.3) frequency distribution of underling causes of ascites

		Frequency	Percent
Valid	acute choleycystits	3	6.%
	metastases	16	32.%
	cirrhosis	9	18.%
	HCC	2	4.%
	Portal hypertension	12	24.%
	Ca pancreas	2	4.%
	Other*	6	12.%
	Total	50	100.%

*Other (hepatomegaly, Ca ovaries, CHF, Ca endometrium, cardiomegaly, splenomegaly)

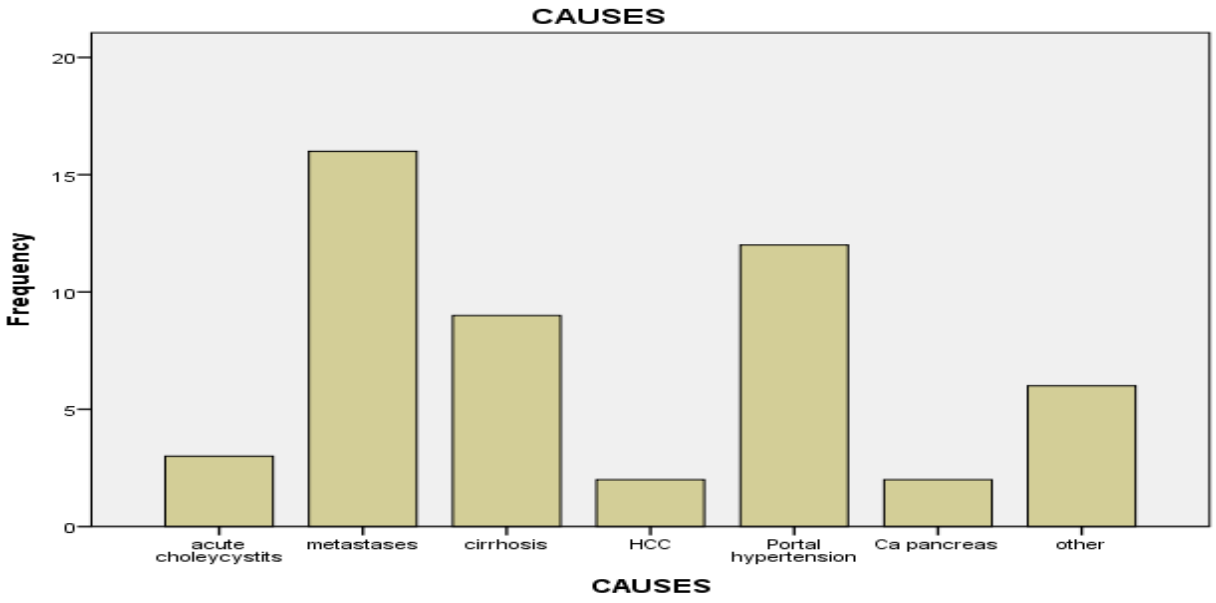

Figure (4.3) frequency distribution underling causes of ascites

Table (4.4) frequency distribution of grade of ascites

		Frequency	Percent
Valid	mild	19	38.%
	moderate	20	40.%
	severe	11	22.%
	Total	50	100.%

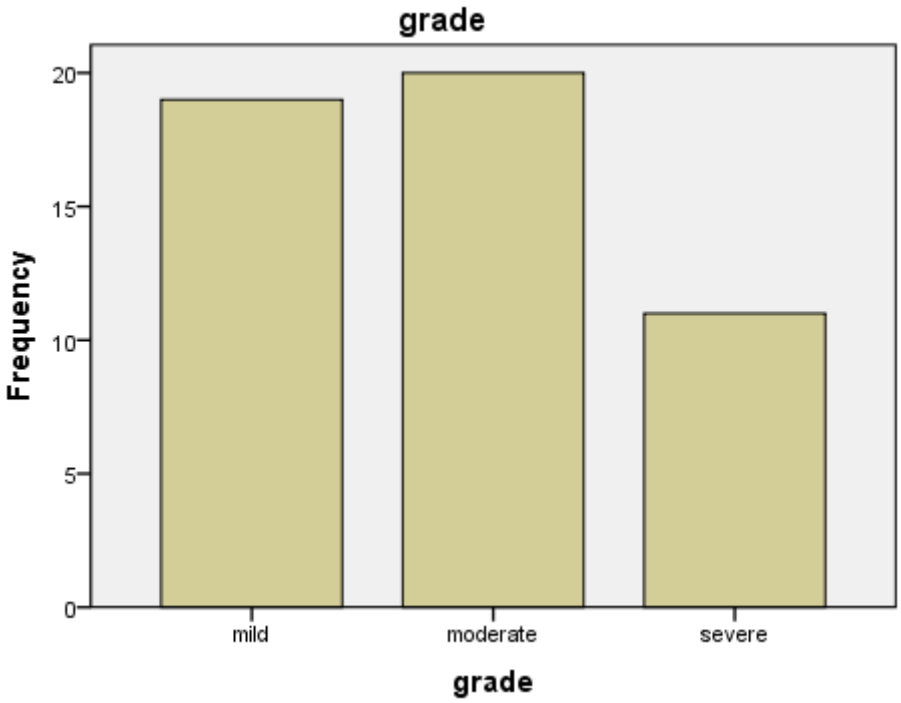

Figure (4.4) frequency distribution of grade of ascites

Table (4.5) frequency distribution of cases associated with pleural effusion

		Frequency	Percent
Valid	without	29	58.%
	with	21	42.%
	Total	50	100.%

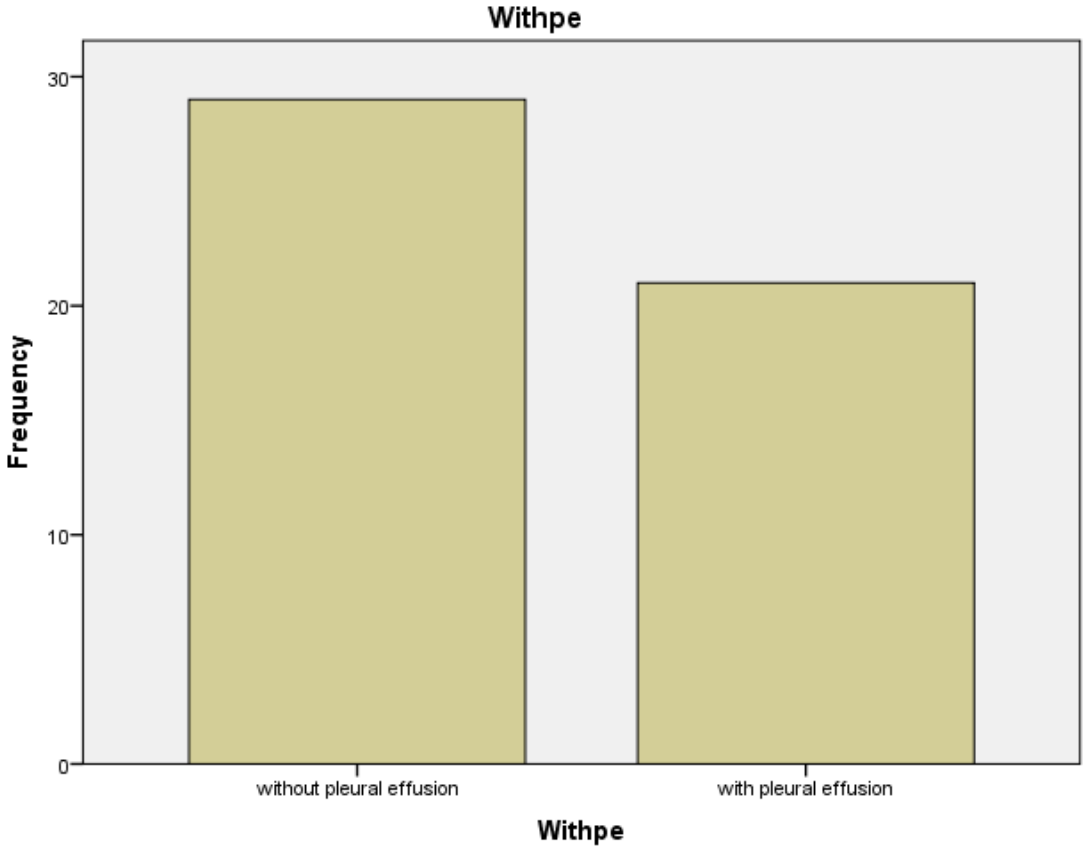

Figure (4.5) frequency distribution of cases associated with pleural effusion

Table (4.6) frequency distribution of volume * causes crosstabulation

		CAUSES							Total
		acute choleycystitis	metastases	cirrhosis	HCC	Portal hypertension	Ca pancreas	other	
Grade	mild	1	8	2	0	2	0	6	19
	moderate	0	6	3	2	8	1	0	20
	severe	2	2	4	0	2	1	0	11
Total		3	16	9	2	12	2	6	50

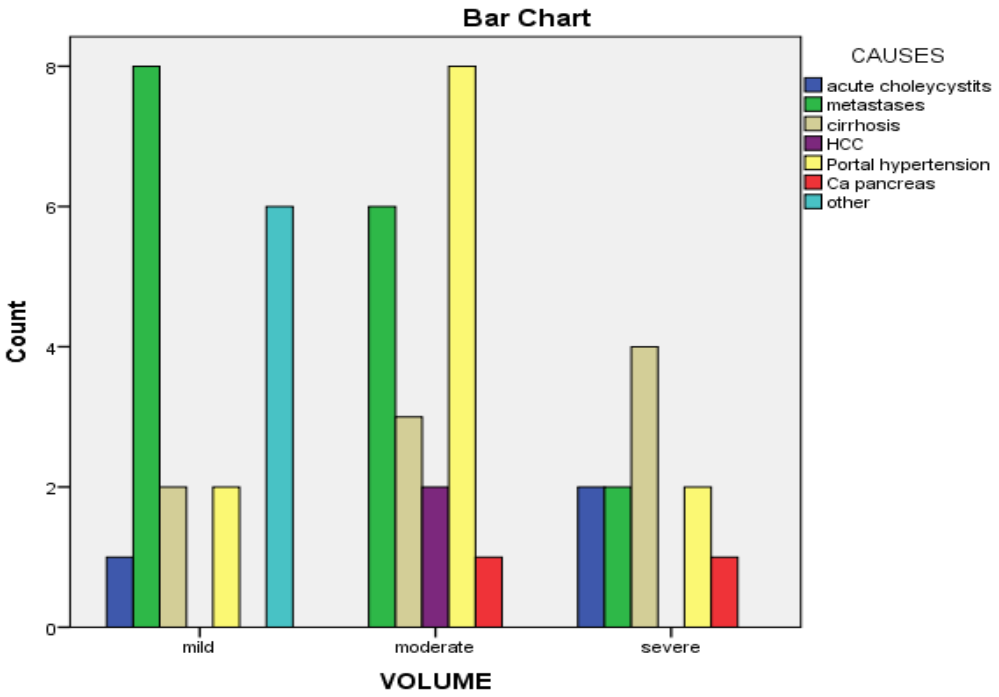

Figure (4.6) frequency distribution of volume * causes crosstabulation

Table (4.7) showing the value of the Chi- square test for grade and causes

Chi-Square Tests

	Value	D f	Asymptotic Significance (2-sided)
Pearson Chi-Square	26.014a	12	.011
Likelihood Ratio	29.044	12	.004
Linear-by-Linear Association	1.350	1	.245

19 cells (90.5%) have expected count less than 5. The minimum expected count is .44

From the above table, we notice that the statistical value of the Chi-Square is equal to 0.011, which means that there is a relationship between the volume of ascites and the cause

Table (4.8) frequency distribution causes* with pleural effusion Crosstabulation

		pleural effusion		Total
		without	with	
CAUSES	acute choleycystits	2	1	3
	metastases	10	6	16
	cirrhosis	3	6	9
	HCC	0	2	2
	Portal hypertension	10	2	12
	Ca pancreas	1	1	2
	other	3	3	6
Total		29	21	50

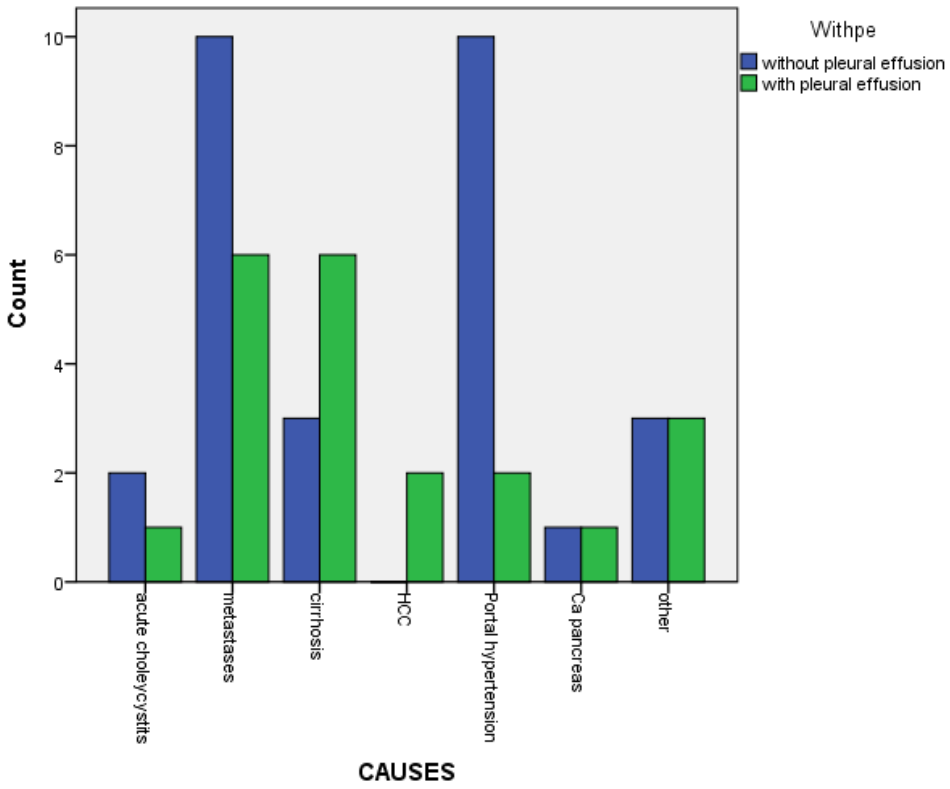

Figure (4.7) frequency distribution of causes * pleural effusion crosstabulation

Table (4.9) showing the value of the Chi- square test for causes and pleural effusion

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	8.607a	6	.197
Likelihood Ratio	9.679	6	.139
Linear-by-Linear Association	.039	1	.843
N of Valid Cases	50		

a. 9 cells (64.3%) have expected count less than 5. The minimum expected count is .84.

From the above table, we note that the statistical value of the Chi-Square is greater than 0.05 equals 0.197, which means that there is no relationship between the cause of ascitesand pleural effusion (correlation) independence

Chapter Five

Discussion, Conclusion And Recommendations

Chapter Five

Discussion, Conclusion And Recommendations

5.1 Discussion

This study carried out at Military Hospital during the period from January 2019 up to September 2019 in to evaluation of ascites causes using computed tomography. Twenty- two percent of the patients had symptoms related to the ascites, here below the findings of the presentstudy.

50 patients were included: 28 patients (56 %) were males while 22 patients (44%) were females in the table and figure.(4.1), according to this result ascites is more common in males than females patients this was in agreement with Xiaozhong X ,et al 2017, who had mentioned in his study that 109 (61.58%) patients were males and 68 (38.42%) were female and disagree with AyantundeAA,et al 2007, who found that ascites affected (140 females and 69 males).

In the table and figure.(4.2) median age being 61years (13 - 97) years, showed 4 patients (8%) their age range (13-29) years,10 patients (20%) their age range (30 - 46) years. 14 patients (28%) their age range (47- 63) years, 19 patients(38%) their range (64- 80) years, 3 patients(6%) their age range (81 -97) years according to this results, most common age groups with ascites were 64 to 80 years old that means thatwas ascites was more common in elder patients than youth patients. This result was agreement with the results of AyantundeAA,et al 2007, who mentioned that the main age groups was being 67 (30–98) years .

According the table and figure.(4.3) the most common underling cause of ascites was metastases (32%) 16 patients, followed by Portal hypertension (24%) 12 patients, followed by cirrhosis (18%) 9 patients, followed by acute choleycystits(6%) 3 patients, followed by HCC (4%) 2 patients, followed by Ca pancreas about (4%,) 2 patients and other

diseases(hepatomegaly, Ca ovaries, CHF, Ca endometrium, cardiomeg,alsplenomegaly), these findings disagree with study done by AyantundeAA,et al 2007.

In table and figure.(4.4) showed the degree of ascites, the moderate ascites more common so that form about (40%) 20 patients, while the mild (38%) 19 patients, while the severe constitutes (22%) 11 patients.

Table and figure (4.5) showed those cases that are related to pleural effusion (42%) 21 patients suffer from pleural effusion and that (58%) 29 patients were not suffering from pleural effusion.

Table and figure.(4.6) present study showed that mild ascites is predominant in metastases and moderate ascites in the Portal hypertension while the severe ascites in liver cirrhosis, on the other side absence of the Hepatocellular Carcinomain the mild and severe grade. And absence moderate and severe in other cases.

Table (4.7) showed the statisticalvalue of Chi- square test for grade and causeswas equal 0.011, which means therewas a relationship between the grade of ascites and its cause.

Table, figure.(4.8) and table (4.9) showed the statistical value of Chi-Square testfor causes and pleural effusionwas greater than 0.05 equals 0.197, which means that there is no relationship between the cause of ascitesand pleural effusion .

5.2 Conclusion:

Ascites is a sign and complications of many diseaseoccurs in young people but more occur in the elderly. The objective of this study is evaluation of ascites causes using computed tomography.

The study included fifty patients, 28 were males and 22 were females.

The study showed males (56%) were more affected by ascites than females (44%).The most affected ages were in the age group of (64-80) years.Metastases was the most common diseases that cause ascites (32%), followed by portal hypertension (24%), cirrhosis (18%), hepatocellular carcinoma (4%), then pancreatic cancer (4%), and other causes constituting (6%).

Through these results, it was found that there is a relationship between the main cause of ascites and its grade at ($P = 0.011$.)

Regarding of the findings of the study, it was found there were not relationship between ascites causes and pleural effusion at ($P = 0.197$)

The study included that a CT scan can find out the ascites and the underlying cause.

CT is important imaging technology for demonstrating main causes of ascites and its volume.

5.3 Recommendations:

- Clinical assessment should be done for patient suspected of having ascites before the CT examination.
- Other investigations must be done before CT as US.
- unknown cause of ascites there should be imaging in by CT scan.

References

- Nina Kowalczyk, Radiographic pathology for technologists ,2014, Sixth edition, Elsevier Inc.
- https://en.wikipedia.org/wiki/Quadrants_and_regions_of_abdomen
- Richard S. Snell ,Clinical anatomy by regions,2012,Ninth Edition, Lippincott Williams & Wilkins.
- Steven M. Penny, Examination review for ultrasound: abdomen & obstetrics and gynecology, 2011, First Edition, Lippincott Williams & Wilkins.
- Moss-Gamsu-Genant-(2015). computed tomography of the body with magnetic resonance imaging, sixth edition.
- AyantundeAA,et al, Pattern and prognostic factors in patients with malignant ascites, 2007, Oxford University.
- Xiaozhong X ,et al, Quantification of ascites based on abdomino-pelvic computed tomography scans for predicting the in-hospital mortality of liver cirrhosis, 2017.
- Mohammadi A, et al, Differentiation of benign from malignant induced ascites by measuring gallbladder wall thickness, 2011.
- Mahmood G, et al 2009
-

Appendices

Appendix (A)

SUDAN UNIVERSITY OF SCIENCE & TECHNOLOGY

COLLEGE OF GRADUATE STUDIES

DATA COLLECTION

FORM

- Pt Gender:
- Pt Age:
- Date of Examination:
- Clinical Sign & Symptoms:
- Clinical Diagnosis:
- CT Finding:
- Grade of of ascites
- Other Finding:
- Pleura Effusion

Appendix (B)imges

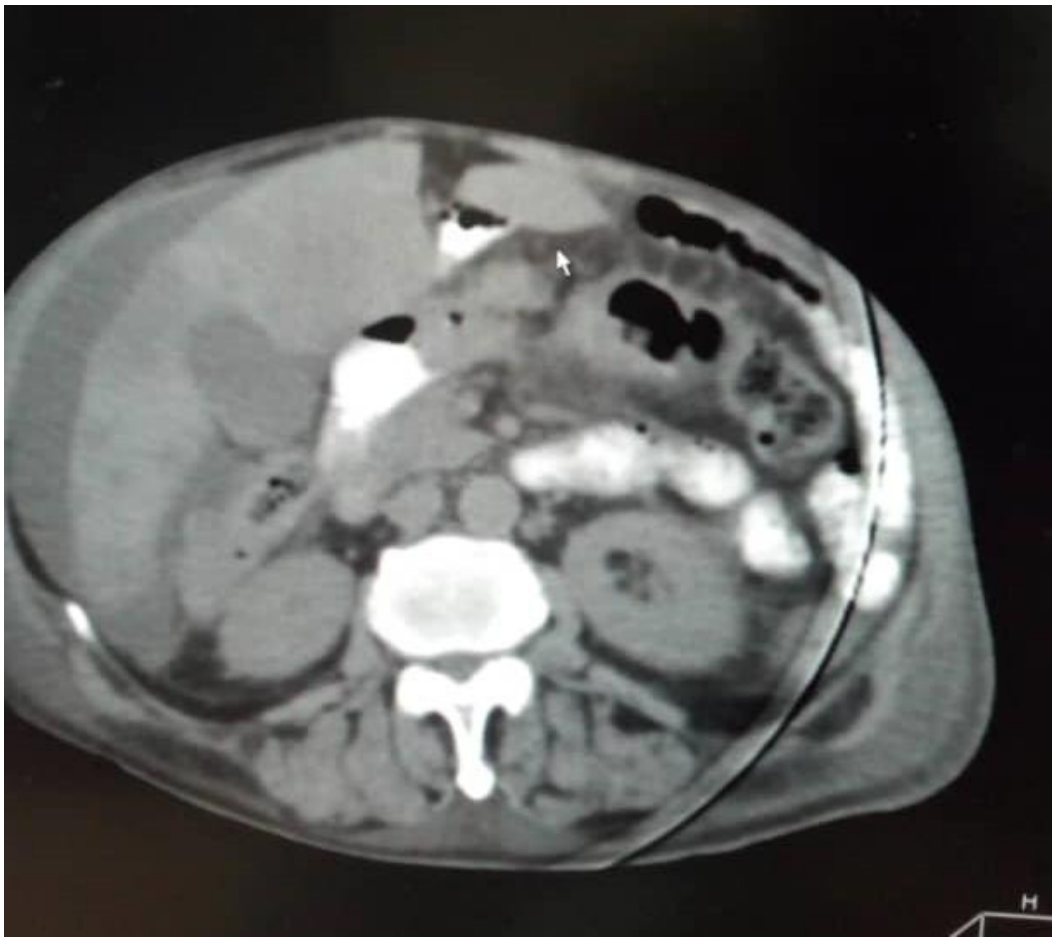

Image (1) axial CT image of abdomen demonstrating mild ascites

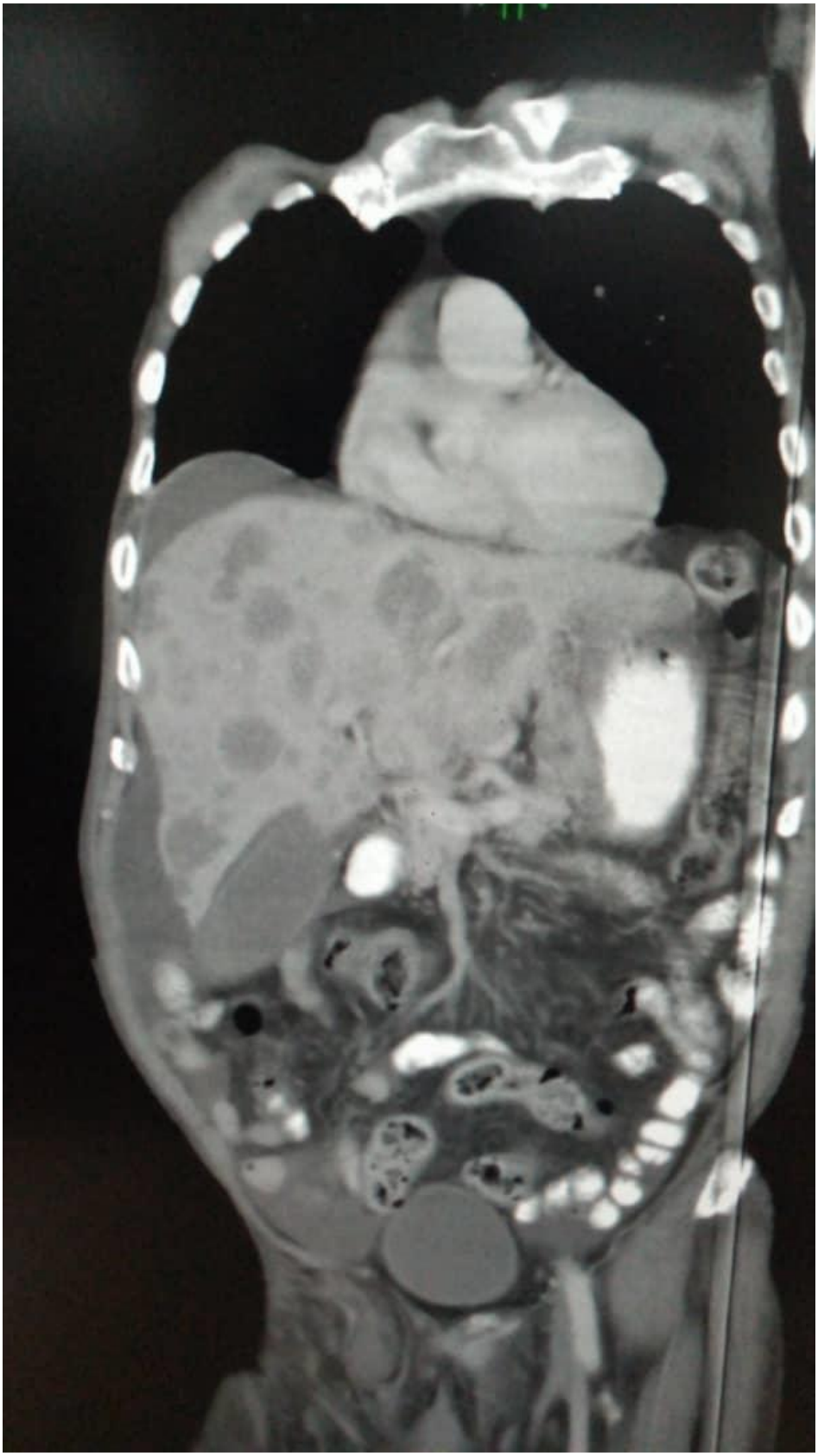

Image (2) coronal CT image of abdomen demonstrating mild ascites with liver metastases

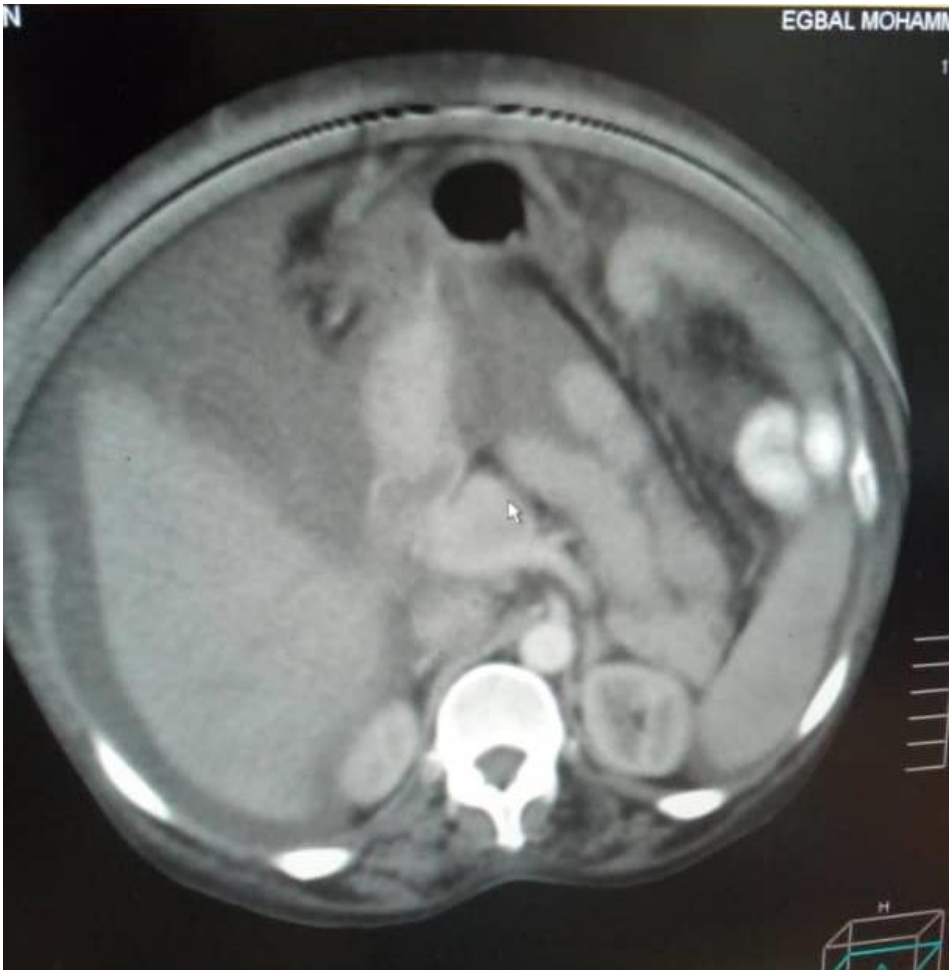

Image (3) axial CT image of the abdomen demonstrating moderate ascites

Image (4) coronal CT image of the abdomen demonstrating moderate ascites

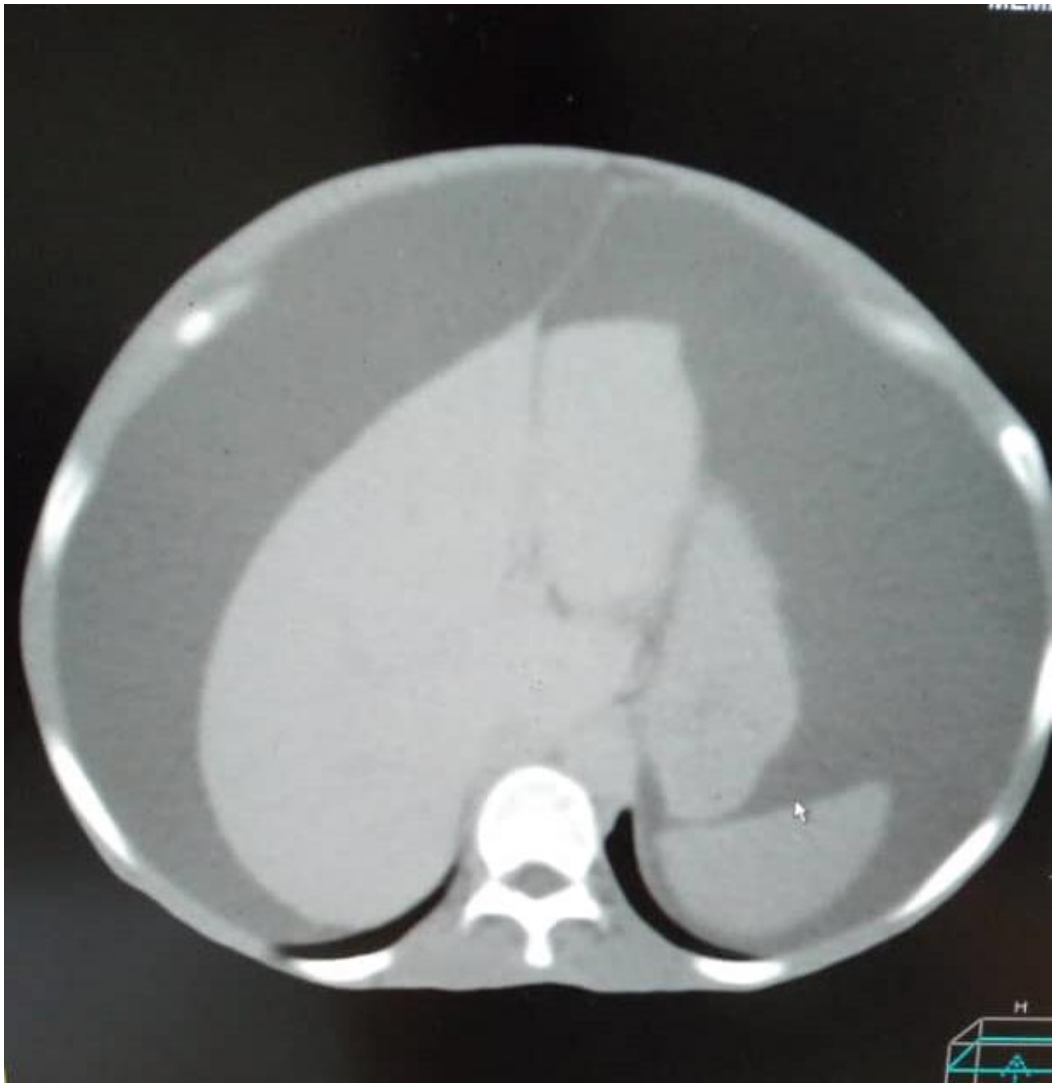

Image (5) axial CT image of the abdomen demonstrating severe ascites

Image (6) coronal CT image of the abdomen demonstrating severe ascites