بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

قال الله تعالى:

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صدق الله العظيم

Dedication

This thesis is dedicated to my wonderful parents, who have raised me to be the person I am today. They have been with me every step of the way, through good times and bad. They have been a source of encouragement and inspiration to me throughout my life, a very special thank you for the myriad of ways in which, throughout my life, they have actively supported me in my determination to find and realize my potential, and to make this contribution to our world.

Thanks for all the unconditional love, guidance, and support that they have always given me, helping me to succeed and instilling in me the confidence that I am capable of doing anything I put my mind to. Thank you for all my teachers with my love.

Acknowledgement

My acknowledgements and gratefulness at the beginning and at last is to God who gave us the gift of the mind. Profound thanks and gratitude to everyone who encouraged me to complete this thesis. My gratitude is extended to my supervisor **Dr. Caroline Ayad** and co-supervisor **Dr. Bushra Hussein Ahmed,** for their helps. Their works have stimulated and fostered my efforts in producing this research. My gratitude is also extended to **Dr. Elsafi Ahmed Abdulla**, and special thanks to Radiology and Ultrasound Department in Military Hospital for the continuous help and facilitation. My gratitude extends to my Colleagues College of Medical Radiological Sciences, Sudan University of Sciences and Technology Department for their continuous help and support.

Finally I would like to warmly thank of my long-suffering family for never-ending support. May almighty God bless them all

Abstract

Objectives: The Purpose of this study was to characterize the ascites fluid using echo texture and to compare the findings with laboratory results in order to predict the ascites type by imaging method for ascitic patients.

Methods:53 Patients who underwent sonography for ascites between February 2012 and January 2014 were included in the study, the study was implemented in Wad-Medani Military hospital, Alia Specialist Hospital- Wad-Madani.Wad-medani teaching hospital, Nuclearal Cancer Institute- Wad-Madani and Omdurman Military Hospital, gray scale sonography of the abdomen was performed using Aloka SSD-500 and Honda SSD-500 with frequency (3.5 MHz) convex probe, the scanning was done on longitudinal and transverse scan for abdomen and pelvis, the patients ascites echo texture had been evaluated and the findings were correlated with ascites paracentesis results including total protein values ,total albumin, Serum ascites Albumin Gradient (SAAG),ascitis type , liver and spleen texture as well as the ultrasound findings.

Result:

During this period,53patients (31male,22female) underwent sonography for ascitis,5(9.4%)had abdomen tuberculosis,1(1.9%) acute renal failure,2(3.8%)Ca breast,1(1.9%)Ca prostate,1(1.9%) Ca colon, 2(3.8%) Ca ovaries, 3(5.7%) Congestive heart disease, 6(11.3%) Chronic renal failure, 1(1.9%) cystadenocarcinoma, 2(3.8%) hepato cellular carcinoma, 1(1.9%) Hepatitis, 23(43.4%) Liver Cirrhosis, 1(1.9%) lymphoma, 1(1.9%) portal hyper tension, 2(3.8%) pelvis inflammatory diseases, 1(1.9%) Urinary bladder

Schistosomasis. The correlation between the ascitis echo texture with total protein values, total albumin, SAAG, ascites type, ultrasound findings was found to be significant at *p* value 0.05.liver echo texture has significant relation with ascites echo texture and laboratory results but no impact of the spleen texture in the ascites character was noted.

ملخص الدراسة:

الأهداف :كان الغرض من هذه الدراسة العلمية الوصفية لمعرفة وتميز نوع سائل الاستسقاء باستخدام صدى الملمس (الموجات فوق الصوتية) و مقارنها مع النتائج المختبرية من أجل التنبؤ بنوع الاستسقاء ذلك عن طريقة تصوير مرضى الاستسقاء بواسطة الموجات فوق الصوتية .

الأساليب :العينة التى اخذت كانت لعدد(53) مريض و الذين خضعوا الكشف بواسطة بالموجات فوق الصوتية لحالات مرضى الاستسقاء و أجريت هذه الدراسة أثناء الفترة فبرائر 2012 إلى يناير 2014 استمرت لمدة عامين بمستشفى ود مدني العسكري ومستشفى علياء التخصصي ود مدنى ,مستشفى التعليمي ود مدني معهد الطب النوؤى ود مدنى ومستشفى امدرمان العسكري وكان ذلك في أقسام الموجات فوق الصوتية استخدام اجهزة الموجات فوق الصوتية المتحركة مقياس الرمادية - جهاز ألوكا ALOKA SSD- 5 00 وجهاز هوندا HONDA SSD- 500 مع تردد (3.5 ميغاهرتز) مسبار محدب، وقد تم المسح الطولي والعرضي للبطن والحوض لمرضى الاستسقاء.

النتيجة:

فى خلال فترة الدراسة ، خضعوا (53) مريض ،منهم (31) ذكور و (22) إناث وكانت نتائج التصوير بالموجات فوق الصوتية لمرضى الاستسقاء كالأتي : (9.4%) 5 يعانون من السل البطن ، (1.9%) 1 يعانى من الفشل الكلوي الحاد(3.8 %) 2 تعانان من سرطان الثدي ,

(1.9 %) 1 يعانى من سرطان البروستاتا (1.9%) 1 يعاني من سرطان لقولون ، (3.8%) 2 تعانان من سرطان المبايض , (5.7%) 3 يعانون من أمراض القلب ألاحتقاني ، (11.3 %) 6 يعانون من الفشل الكلوي المزمن ، (1.9%) 1 تعانى من سرطانة غدية كيسية, (3.8%) 2 يعانا من سرطان الكبد ، (1.9%) 1 التهاب الكبد الوبائي ، (43.4 %) 23 يعانون من تليف الكبد ، (1.9 %) 1 يعانى سرطان الغدد الليمفاوية ، (1.9 %) 1 يعانى فرط اتساع الوريد البابي، (3.8%) 2 تعانان من أمراض التهاب الحوض ، (1.9 %) 1 يعانى من أمراض البلهارسيا المثانية .

وقد أجرى تقييم المرضى الاستسقاء بواسطة صدى الملمس (الموجات فوق الصوتية) وتم العثور على علاقة كانت مرنبطة مع نوع الاستسقاء نتائج مجموع القيم البروتين ، ومجموع الزلال ، SAAG،ارتباطا قوية بقيمة P تقدر 0.05 وايضا ووجدت علاقة ارتباط قوية مع نسيج الكبد ونوع الاستسقاء ولكن لا تأثير لوحظ فى نسيج الطحال مع نوع استسقاء.

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List Abbreviations

1	ARF	Acute renal failure
2	**B-** Mode	Brightness mode
	CNNA	Culture-negative neutrocytic ascites
4	CRF	Chronic renal failure
5	CSF	Cerebrospinal fluid
6	CUP	Central processing unit
7	HCC	Hepatocellular carcinoma
8	MCL	Medoclaviclar line
9	MHz	Megahertz
10	NAFLD	Non-alcoholic fatty liver disease
11	PC	Personal computer
12	RCC	Renal cell carcinoma
13	SAAG	Serum ascites albumin gradient
14	SPSS	Statistic package for social studeis `
15	SBP	Spontaneous bacterial peritonitis
16	TEAA	Total stimulated abdominal
17	TIPS	Transjugular intrahepatic portosystemic shunts
18	TP	Total protein

Chapter One

1.1 Prelude

Ascites is defined as the accumulation of fluids in the peritoneal cavity *(Runyon BA. 1989)*. Two important factors that control the balance exchange of fluids in the body, these including the plasma colloid osmotic pressure and the portal venous pressure; its disturbance may cause ascites. *(Cattau El, et al. 1982, Goldberg BB, et al. 1970, Sherlock S., et al. 1981)*.

The most common cause of ascites from Western Europe and North America is cirrhosis, which records about 80% of the cases, the other common causes are malignancy (10%), cardiac failure (5%) and tuberculosis and other causes. *(Runyon BA. 2004, Moore KP, et al. 2006)*. The differentiation between ascites causes is important for diagnostic and therapeutic purposes. *(Anita R. Bijoor, et al. 2001)*. Diagnostic abdominal paracentesis is considered as an essential investigation for differential diagnoses in all patients with clinically noticed ascites. *(Hoefs JC. 1990)*.

Clinically; ascites is detected by the presence of flank dullness to percussion, (*Cattau El, et al. 1982),* in recent years ultrasound has been proven an accurate and reliable method of detecting abdominal fluid, determining its site *(Goldberg BB: 1976)*, but questions have been raised about its capability to differentiate the ascites of transudates concept from inflammatory or malignant exudates. Assessment of the ascites is necessary in monitoring the progress of the disease and in selecting appropriate methods of treatment. *(Szkodziak P. R, et al. 2010)*. Radiologic evaluation of the abdomen was helpful in confirming the presence of fluid computed axial tomography are considered quite sensitive in detection of ascitic fluid physical examination findings are consistent with the diagnosis of an

intra-abdominal fluid accumulation; but its sensitivity yields varying results. *(Goldberg BB, et al. 1970)*. To evaluate the reflection of ascites echo texture related the fluid composition; we correlated the ultrasound findings with patient history, clinical findings of proven ascites cases and laboratory findings including total protein, total albumin and the serum ascites albumin gradient (SAAG).

The onset of ascites makes a turning point in the prognosis of cirrhotic patients with mortality rate of (50%) *(Sherlock S. et al. 1981)*, within two to five years its first appearance *(Runyon BA. 2004)*, Patients with ascites usually present with increase abdominal girth ,nausea, anorexia and they may have shortness of breath due to elevation of diaphragm or pleural effusion, tense ascites can causes pain.

Abdominal ultrasound imaging is the gold standard for detection underlying causes of ascites and confirming the peritoneal fluid as low as 100 ml, that cannot usually detected on physical examination, according to the quantity of ascites, the ultrasound is widely available, and easy-to-use and less expensive than other imaging methods ,ultrasound image can gives a clear picture of fluid than do not show upon x-ray images, ultrasound images cannot causes breath problem and may be repeated as often as is necessary, it provide real–time imaging, making it a good tool for guiding minimally invasive procedure such as needle biopsies (parcentasis) *(Moore KP, et al. 2006)* and needle aspiration, physical examination may suggest of the presence of ascites by shifting dullness or by demonstration of fluid thrill or wave, the patients with ascites usually have addition stigmata of chronic liver disease such as co-etaneous collection of abdomen, vascular spiders, and splenomegaly. In patients with large amount of ascites the nutritional status is often poor, umbilical hernia and incisional hernia are particularly frequent. The hyper dynamic circulation and raised cardiac output are evidenced by a normal /

low blood pressure and tachycardia an ejection systolic murmur may be present. Leg oedema is variably found.

Through microspores in diaphragm may also be present, in about (80%) Anita R. Bijoor, et al. 2001, *http://www.ncbi.nlm.nih.gov/pmc/articles/ PMC1435346/- b1*of cases the effusions are right-sided.

When in doubt about the etiology of ascites diagnosis paracentasis is indicated in recent years the transudate-exudates concept has been replaced by a classification based on the serum ascites albumin gradient (SAAG) of > 11g/l (low gradient) is indicative for hepatic causes of ascites albumin gradient of <11g/l (high gradient) is indicative for infection peritoneal carcinomatous ,in addition to the albumin concentration in ascites,other useful laboratory investigation may be the recommended determination *(Goldberg BB: 1979)*.

1.2 Problem of the study

The Purpose of this study was to characterize the ascites fluid using echo texture and to compare the findings with laboratory results in order to predict the ascites type by imaging method for ascitic patients. And also there is no specific characterization of the volume of the ascites related to different abdominal visceral diseases so this study is obtains to correlate the changes of fluid volume (mild–moderate and severe) with types of the diseases.

1.3 The objectives

1.3.1 The main Objectives of study

The main objective of study is capability of ultrasound images for detecting underlying causes of the ascites.

1.3.2 The specific Objectives of study

To evaluate the causes of ascites in many sources such as liver disease, cancers, congestive heart failure, renal failure and tuberculosis.

- To confirm the presence, location, and volume of ascites.
- To describe scanning techniques for detecting the ascites.
- To identify the relationships between types of ascites and laboratory investigation.

1.4 Overview of study

This thesis will includes five chapters

Chapter one: is general introduction which include .problem of study, objective, significant of the study, Chapter two will include a comprehensive literature review about the previous study concerning the diagnosis of underlying causing using ultrasound. Chapter three will provide detailed material and method use to collect the data as well as the general method used to analyze the data by using SPSS method and ANOVA independent

Value. Chapter four will include the data presentation and finally Chapter five will include discussion, recommendation and conclusion

Chapter Two

Literature Review

2.1Ultrasound Machine used in abdominal scanning

Ultrasonic waves travel through various tissues with different ultrasonic proprieties, waves are reflected. The reflected waves can be received by the same ultrasonic transducer that functions as the emitter of the ultrasound pulse. Reflected waves are depicted on a cathode ray tube. Earlier ultrasonic equipment produced static images of the area being examined, but newer (real time image) equipment shows the dynamics of ongoing movements. A recent development uses the Doppler effect to evaluate blood flow in larger vessels, but current technology lacks the degree of resolution that would make Doppler ultrasonography a true alternative to arteriography studies in the renal artery. Real-time ultrasonography can also be used to guide renal biopsy needles or fine needle insertion into the renal pelvis. The major advantages of ultrasonography over conventional radiography are its noninvasive nature, potential viability at the bedside, and low cost, as well as absence of ionizing radiation and potentially harmful contrast materials. Shortcomings are inferior resolution and greater dependence on experience and talent of the operator.

A basic ultrasound machine has the following parts: Transducer probe - probe that sends and receives the sound waves, central processing unit (CPU) - computer that does all of the calculations and contains the electrical power supplies for itself and the transducer probe .transducer pulse controls - changes the amplitude, frequency and duration of the pulses emitted from the transducer probe .display - displays the image from the ultrasound data processed by the CPU keyboard/cursor- inputs data and takes measurements from the display, disk storage device (hard, floppy, CD) -

stores the acquired images .Printer - prints the image from the displayed data [Figure 2-1].

Figure 2-1. Shows Ultrasound machine (Kountouras J, et al. 1993)

2.1.1Transducer

The transducer probe is the main part of the ultrasound machine. The transducer probe makes the sound waves and receives the echoes. It is, so to speak, the mouth and ears of the ultrasound machine. The transducer probe generates and receives sound waves using a principle called the piezoelectric (pressure electricity) effect, which was discovered by Pierre and Jacques Curie in 1880. In the probe, there is one or more quartz crystals called (piezoelectric crystals).

When an electric current is applied to these crystals, they change shape rapidly. The rapid shape changes, or vibrations, of the crystals produce sound waves that travel outward. Conversely, when sound or pressure waves hit the crystals, they emit electrical currents.

Therefore, the same crystals can be used to send and receive sound waves. The probe also has a sound absorbing substance to eliminate back reflections from the probe itself, and an acoustic lens to help focus the emitted sound waves. Transducer probes come in many shapes and sizes, as shown in the photo above. The shape of the probe determines its field of view, and the frequency of emitted sound waves determines how deep the sound waves penetrate and the resolution of the image. Transducer probes may contain one or more crystal elements; in multiple-element probes, each crystal has its own circuit. Multiple-element probes have the advantage that the ultrasound beam can be "steered" by changing the timing in which each element gets pulsed; steering the beam is especially important for cardiac ultrasound. In addition to probes that can be moved across the surface of the body, some probes are designed to be inserted through various openings of the body (vagina, rectum, esophagus) so that they can get closer to the organ being examined (uterus, prostate gland, stomach); getting closer to the organ can allow for more detailed views.

The U/S transducer is the most sensitive and expensive part of the system. It converts the electrical energy to U/S energy and vice versa. Transducer consists of three layers. The piezoelectric layer which convert the electrical energy to U/S and vice versa. The second layer is matching layer is commonly placed on transducer element and tissue, it reduce the reflection of U/S at the transducer element surface, so improve sound transmission. The third layer is the damping layer is

attached to rare face of the transducer element to reduce pulse duration and spatial pulse length and improve resolution [Figure 2-2].

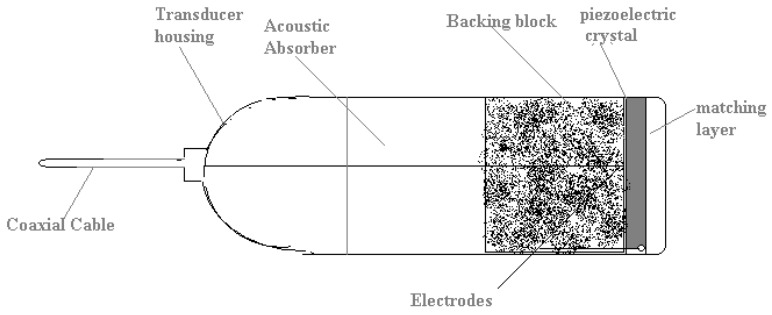

Figure 2.2. Shows Transducer

There are three types of transducer*:*

Linear probe: it is multi small transducer elements electrically coordinated to produce a rectangular image.

Curved array: linear array transducer with a curved head and focusing

Sector: small transducer head that produce a pie-shape image.

2.1.2. Ultrasound resolutions

Resolution is ability of u\s equipment to show the image .It divided in to two parts, Contrast resolution which is the ability of the equipment to differentiate between anatomical structure having similar tissue characteristics, second part is special resolution, which is ability of u\s to show the smallest size of an object in a high contrast. The resolution is proportionally related to frequency as the frequency increase, the resolution increases.

2.1.3 Display modes

A-mode

A-mode produces a one-dimensional image displaying the amplitude strength of the. Returning echo signals along the vertical axis. The amplitude display represents the tire or distance it take the bean to strike an interface and return the signal to transducer. The greater the reflection at the interface, the taller the amplitude spike will appear.

B-mode

The B-mode, method displays the intensity (amplitude) of an each by varying the brightness of a dot to correspond to each strength. Gray scale refers to condition of assigning each level of amplitude a particular shade of gray. The B-mode is basis for all real times imagining in ultrasound.

M-mode:

M-mode displays time along the horizontal axis and depth along the vertical axis to depict movement especially in cardiac structure.

Real time*:*

Real time imaging provides a dynamic presentation of multiple image frame rate is dependent on the frequency, depth of transducer and section depth *(Goldberg BB, et al. 1970)*.

2.1.4. Doppler Ultrasound

The Doppler principal refers to a change in frequency when the motion of laminar or turbulent flow is detected with in a vascular structure. In the medical application of the Doppler principle the sound wave is bounced off a moving red blood cell. if

the cell moves along the line of ultrasound bean(parallel to flow), the Doppler shift is directly proportional to the velocity of the red cell. If the cell moves away from the transducer in the plane of the beam, the fall in frequency is directly proportional to the velocity and direction of the red blood cell movement.

Doppler ultrasound is based upon the Doppler Effect. When the object reflecting the ultrasound waves is moving, it changes the frequency of the echoes, creating a higher frequency if it is moving toward the probe and a lower frequency if it is moving away from the probe. How much the frequency is changed depends upon how fast the object is moving.

Doppler ultrasound measures the change in frequency of the echoes to calculate how fast an object is moving. Doppler ultrasound has been used mostly to measure the rate of blood flow through the heart and major arteries

2.1.5 Color flow Doppler

Allocating a pixel to flow toward the transducer and flow away from the transducer quantities velocities. Each velocity frequency change is allocated color. Color maps may be adjusted to obtain different color assignments for the velocity level, usually red is assigned to flow toward the transducer and blue away from transducer.

2.1.6 Central Processing Unit (CPU)

The CPU is the brain of the ultrasound machine. The CPU is basically a computer that contains the microprocessor, memory amplifiers and power supplies for the microprocessor and transducer probe. The CPU sends electrical currents to the transducer probe to emit sound waves, and also receives the electrical pulses from the probes that were created from the returning echoes. The CPU does all of the

calculations involved in processing the data. Once the raw data are processed, the CPU forms the image on the monitor. The CPU can also store the processed data and/or image on disk.

2.1.7. Transducer Pulse Controls

The transducer pulse controls allow the operator, called the ultrasonographer to set and change the frequency and duration of the ultrasound pulses, as well as the scan mode of the machine. The commands from the operator are translated into changing electric currents that are applied to the piezoelectric crystals in the transducer probe.

2.1.8 Display

The display is a computer monitor that shows the processed data from the CPU. Displays can be black-and-white or color, depending upon the model of the ultrasound machine.

2.1.9 Keyboard/Cursor

Ultrasound machines have a keyboard and a cursor, such as a trackball, built in. These devices allow the operator to add notes to and take measurements from the data.

2.1.10. Disk Storage

The processed data and/ or images can be stored on disk. The disks can be hard disks floppy disks hard discs (CDs) or digital video discs (DVDs). Typically, a patient's ultrasound scans are stored on a floppy disk and archived with the patient's medical records.

2.1.11. Printers

Ultrasound machines have thermal printers that can be used too many capture a hard copy of the image from the display.

2.1.12. Different Types of Ultrasound

The ultrasound that we have described so far presents a two dimensional image, or "slice," of a three dimensional object (fetus, organs).

Two other types of ultrasound are currently in use, 3D ultrasound imaging and Doppler ultrasound.

2.1.15 Scanning protocols &techniques

The scanning protocol for sonography of the peritoneal cavity varies, depending on the patients clinical symptoms and the differential clinical diagnosis, when evaluating for fluid in the peritoneal cavity, be it serous or haemorrhagic, and the following potential spaces should be evaluated in both transverse and longitudinal scanning planes: Hepatic recesses & around the peripheral hepatic borders.Splenic recesses & around the peripheral splenic borders. Right sub-phrenic space. Left sub-phrenic space. Subhepatic space (Morrison`s pouch)

2.2 Technique and protocols to study of patients with ascites

No patients preparation required. Transducer: 3.5-5 MHZ curveted sector transducer is used. Patients position: Patients scanned in supine position. In right lateral decubitus in left lateral decubitus.

2.2.1 Transverse section

Transducer is positioned directly under the xiphisternum, angled cephalic: Sweep transducer beam through the liver, and then move distally to umbilicus, applying

graded compression, observing lesser sac (around the pancreas) and transverse mesocolon. Please the transducer directly below the right cosal margin and repeat the scan, observing all peritoneal spaces. Place transducer directly below the left costal margin and repeat. Mover transducer, in the transverse plane, throughout the remainder of the abdomen. It may be necessary to make multiple repetitions of this step to cover the entire abdomen.

2.2.2 Longitudinal section

Place transducer below the xiphisternum, tipped cephalic: Sweep across the abdomen from left to right. Move transducer along right costal margin, angling towards the right lateral border of the liver. Repeat this process to the lateral border of the spleen. Perform longitudinal scans throughout the remaining abdomen, observing all spaces.

2.2.3 Problem solving

Can`t see Morrison`s pouch, right subphrenic or subhepatic spaces Roll patients into decubitus position. Use intercostals approach. Use anterior approach with left lobe of the liver as the window. Use coronal approach.Change respiratory manoeuvres. Can`t see left sub-phrenic or peri-nephric spaces. Roll patients to decubitus position and scan from an anterior approach, using spleen or left lobe of liver as window.

2.3 History

The history can help to elucidate the cause of ascites formation. Increasing abdominal girth as a result of ascites may be part of the initial presentation of patients with alcoholic liver disease; however, the laxity of the abdominal wall and the severity of underlying liver disease suggest that the condition can be present for some time before it is recognized. Patients who consume

ethanol only intermittently may report cyclic ascites, whereas patients with nonalcoholic disease usually have persistent ascites. Other risk factors for viral liver disease should be ascertained (i.e., drug abuse, sexual exposure, blood transfusions, and tattoos). A positive family history of liver disease raises the possibility of a heritable condition (e.g., Wilson's disease, hemochromatosis, or a1-antitrypsin deficiency) that might also present with symptoms referable to other organ systems (diabetes, cardiac disease, joint problems, and hyperpigmentation with hemochromatosis; neurologic disease with Wilson's disease; pulmonary complaints with a1-antitrypsin deficiency). Patients with cirrhotic ascites may report other complications of liver disease including jaundice, pedal edema, gastrointestinal hemorrhage, or encephalopathy. The patient with long-standing stable cirrhosis who abruptly develops ascites should be evaluated for possible HCC.

Information concerning possible nonhepatic disease should be obtained. Weight loss or a prior history of cancer suggests possible malignant ascites, which may be painful and produce rapid increases in abdominal girth. A history of heart disease raises the possibility of cardiac causes of ascites. Some alcoholics with ascites have alcoholic cardiomyopathy rather than liver dysfunction. Obesity, diabetes, and hyperlipidemia are all risk factors for non-alcoholic fatty liver disease (NAFLD), which can cause cirrhosis on its own or act synergistically with other insults (e.g.,

alcohol, Hepatitis C). Tuberculous peritonitis usually presents with fever and abdominal discomfort. Patients with nephrotic syndrome usually have anasarca. Patients with rheumatologic disease may have serositis. Patients with ascites associated with lethargy, cold intolerance, and voice and skin changes should be evaluated for hypothyroidism.

2.3.1 Physical Examination

Ascites should be distinguished from panniculus, massive hepatomegaly, gaseous overdistention, intra-abdominal masses, and pregnancy. Percussion of the flanks can be used to rapidly determine if the patient has ascites. The absence of flank dullness excludes ascites with 90% accuracy. If dullness is found, the patient should be rolled into a partial decubitus position to test if the air-fluid interface determined by percussion shifts (shifting dullness). The fluid wave has less value in the detection of ascites. The puddle sign detects as little as 120 ml of ascitic fluid, but mandates that the patient assume a hands-knees position for several minutes, and is also less useful than flank dullness. The physical examination can help in determining the cause of ascites. Palmar erythema, abdominal wall collateral veins, spider angiomas, splenomegaly, and jaundice are consistent with liver disease. Large veins on the flanks and back indicate blockage of the inferior vena cava that is caused by webs or malignancy. Masses or lymphadenopathy (e.g. Sister Mary Joseph’s nodule, Virchow’s node for upper abdominal malignancies) suggest underlying malignancy. Distended neck veins, cardiomegaly, and auscultation of an S3 or pericardial rub suggest cardiac causes of ascites, where as anasarca may be observed with nephrotic syndrome.

2.4 Anatomy

Both the thoracic and abdominal cavities are lined with thin serous membranes, which are composed with two layers: A parietal layer lines the internal surface of the body. A visceral layer covers the external surface of the organs (viscera) within the cavity.

Between the parietal and serous membrane is thin serous cavity, actually a "potential space, "containing a lubricating film of serous fluid that secreted by cells of the serous membrane. Serous fluid has the consistency of oil, and serves as a lubricant, in a living human, the organs (e.g., heart lungs stomach, and intestines) are moving and rubbing against each other and the body wall, this constant movement causes friction, the serous fluid's lubricant properties reduce this friction and help the organs move smoothly against both one another and the body wall. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College.)*

2.4.1 Thoracic cavity

The median space in thoracic cavity is called the mediastinum [figure 2.1] .it contains the heart, thymus, esophagus, trachea and main blood vassals that connect to the heart. Within the mediastiunm, the heart is enclosed by a two layered serous membrane called pericardium the parietal pericardium there is the outermost layer and forms the sac around the heart; the visceral pericardium, also called pericardium form the heart external surface. The pericardial cavity is the potential space between the partial and the visceral pericardia, it contains serous fluid. The right and left sides of the thoracic cavity contain the lungs; they are lines by two-layered serous membrane called the pleural. The outer layer of this serous is parietal pleura; it lines the internal surface of the thoracic wall, the inner layer of

this serous membrane is the visceral pleura. It covers the external surface of the lungs. The narrow, most potential space between the partial and visceral pleurae called the pleural cavity, and is the location of the lubricating serous fluid. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

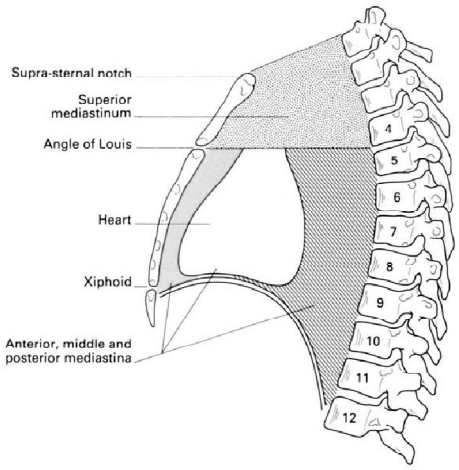

Figure (2.3) the thoracic cavity of mediastinum

2.4.2 Abdominoplevic cavity

The abdominal and pelvic cavity consists of abdominal cavity, which is superior to an imaginary line draw between the superior aspects of the hip bones, and a pelvic cavity that is inferior to this imaginary line.

The abdominal cavity contains most of the organs of the digestive system, as well as the kidney and the ureters of the urinary system. The organs of the pelvic cavity consist of the distal part of the large intestine, the urinary bladder and the urethra, and the internal productive organs. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.4.2.1 The peritoneum

Is the largest serous membrane of the body; it consists of a layer of simple squamous epithelium with underlying supporting layer of areolar connective tissue. The peritoneum is divided into the parietal peritoneum, which lines the wall of abdominopelvic cavity and visceral peritoneum, which covers some organs in the cavity and it their serosa most two layered serous membrane that lines the abdominopelvic cavity, the parietal peritoneum, the outer layer of this serous membrane, the inner the internal walls of the abdominopelvic cavity, whereas the visceral peritoneum, the inner layer of this serous membrane, ensheathes the external surfaces of most digestive organs The slim space containing lubricating serous fluid that is between the parietal portions of the peritoneum is called the peritoneal cavity, in certain diseases, the peritoneal cavity may become distended by the accumulation of several liters of fluid, a condition called ascites. Some organs lie on the posterior abdominal cavity and are covered by peritoneum only on their anterior surfaces; they are not in the peritoneal cavity. Such organs, including the kidneys, ascending and descending colons of large intestine, duodenum of the small intestine, and pancreas, are said to be retroperitoneal.

The pericardium and pleurae, which smoothly cover the heart and the lungs, the peritoneum contain large folds that weave between the viscera, the folds bind the organs to one another and the walls of the abdominal cavity, they also contain blood vessels, lymphatic vessels, and nerves that supply the abdominal organs, there are five major peritoneal folds; the greater omentum, calceiform ligament, lesser omentum, mesentery and mesocolon(*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College).*

2.4.2.2 The greater omentum,

The largest peritoneal fold, drapes over transverse colon and coils of the small intestine like "fatty apron" [figure 2-2]. The greater omentum is double sheet that folds back on itself, giving it a total of four layers, from attachment along the stomach and duodenum the greater omentum extends downward anterior to the small intestine then turns and extends upward and attaches to transverse colon, the greater omentum normally contains a considerable amount of adipose tissue. Its adipose tissue content can greatly expand with weight gain, giving rise to the characteristic “beer belly” seen in some overweight individuals. The many lymph nodes of the greater omentum contribute macrophages and antibody producing plasma cells that help combat and contain infections of the GI tract. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.4.2.3 The falciform ligament

Aattaches the liver to the anterior abdominal wall and diaphragm [figure 2-1]. The liver is the only digestive organ that is attached to the anterior abdominal wall.

2.4.2.4 The lesser omentum

Aarises as an anterior fold in the serosa of the stomach and the duodenum, and it suspends the stomach and duodenum from the liver [figure 2-1]. It the pathway for blood vessels entering the liver and contains the hepatic portal vein, common hepatic artery, and common bile ducts, along with some lymph nodes. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.4.2.5 The mesentery

A fan-shape fold of the peritoneum binds the jejunum and ileum of the small intestine to the posterior wall [figure 2-2]. It extends from the posterior abdominal wall to the wrap around the small intestine and then returns to its origin, forming double-layered structure, between the two layers are blood and lymphatic vessels and lymph nodes.

2.4.2.6 The mesocolon

Two separate folds of peritoneum, called mesocolon, bind transverse colon and sigmoid colon of large intestine to posterior abdominal wall [figure 2-2]. It also carries the blood and lymphatic vessels to the intestines, together mesentery and mesocolon hold the intestines loosely in place, allowing movement as muscular contraction max and move the luminal contents along the GI tract. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College*

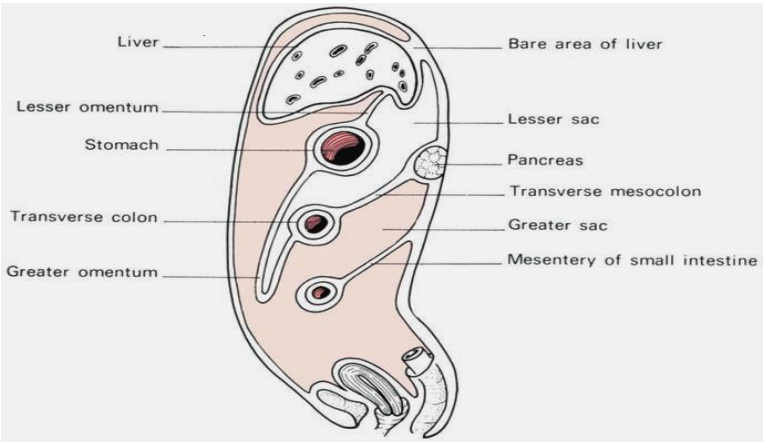

Figure (2.4) the peritoneum cavity

2.5 Liver

Is the heaviest gland of body, weighting about 1.4 kg in an average adult. Of the all organs of the body. The liver inferior to the diaphragm and occupies most of the right hypochondriac and part of epigastric regions of the abdominopelvic cavity [figure 2-2]. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.5.1 The gall bladder

Is a pear -shaped sac that is located in depression of the posterior surface of the liver. It is (10-7) cm long and typically hangs from the anterior margin of liver.

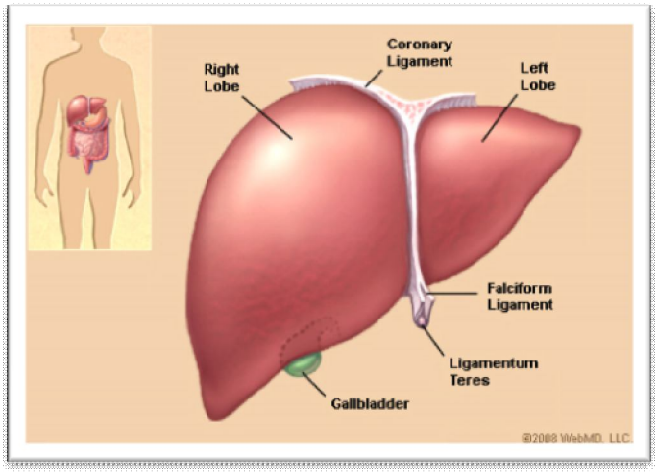

Figure (2.5) Anatomy of liver and gall bladder

The liver is almost completely covered visceral peritoneum and completely covered by a dense irregular connective tissue layer that lies deep to the peritoneum, the liver is divided into two principle lobes-a large right lobe and a smaller left lobe by falicifrom ligament a fold of the mesentery (figure 2-5). Although the right lobe is considered by many anatomists to include an inferior quadrate lobe and a posterior caudate lobe, based on internal morphology, the quadrate and caudate lobes more appropriately belong to the left lobe. The falciform ligament extends from the undersurface of the diaphragm between the two principal lobes of the liver to the superior surface of the liver, helping to

suspend the liver in the abdominal cavity .in the free border of the falciform ligament is the ligamentum teres, remnant of the umbilical vein of the fetus, the fibrous cord extends from the liver to the umbilicus. The right and left coronary ligaments are narrow extensions of the parietal peritoneum that suspend the liver from the diaphragm.

The parts of the gallbladder include the broad fundus, which projects inferiorly beyond the inferior border of the liver, the body, the central protion; and the neck the tapered portion. The body and the neck project superiorly. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.5.2 Blood supply of the liver

The liver receives blood from two sources. From the hepatic artery it obtains oxygenated blood, and form hepatic portal vein it receives deoxygenated blood containing newly absorbed nutrients, drugs, and possibly microbes and the toxins from the gastrointestinal tract, the branches of both the hepatic artery and the hepatic portal veins carry blood into liver sinusoids, where oxygen most of the nutrients and certain toxic substances are taken up by nutrients needed by other cells are secreted back into the blood which then drain into the central vein and eventually passes into a hepatic vein, because blood from gastrointestinal tract passes through the liver as part of hepatic portal circulation, the liver often a site for metastasis of cancer that originates in the gastrointestinal tract. (*Principles of Anatomy and Physiology 12th Edition Gerard J.Tortora Bergen Community College)*

2.6 Pancreas

The pancreas retroperitoneal gland that is about (12-15) cm long and 2.5cm thick, lies posterior to the greater curvature of the stomach, the pancreas consists of the head, a body, and a tail and is usually connected to duodenum by two ducts (figure 2.6). The head is expanded portion of the organ near the curve of duodenum; super to and to the left of the head are the central body and the tapering tail.

Pancreatic juices are secreted by exocrine cell into small ducts that ultimately unite to form two layers ducts, the pancreas ducts and accessory duct. These in turn convey the secretions into the small intestine. The pancreatic duct is the larger of two ducts. In most people, the pancreatic duct joins the common bile duct from the liver and gall bladder and enters the duodenum as dilated common duct called the hepatopancreatic ampulla (amplulla of vater), the amplulla open on an elevation of the duodenal mucosa known as the major duodenal papilla, which lies about 10 cm inferior to the pyloric sphincter of the stomach, the passage of pancreatic juice and the bile through the hepatopancreatic ampulla into the small intestine is regulated by amass of smooth muscle known as the sphincter of the hepatopancreatic ampulla. The other major duct of the pancreas, the accessory duct, leads from the pancreas and empties into the duodenum about 2.5 cm superior to the hepatopancreastic ampulla.

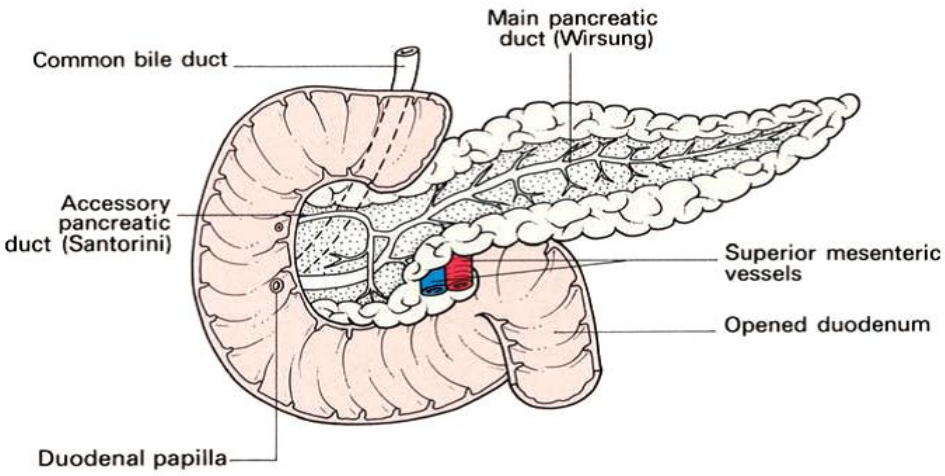

Figure (2.6): Anatomy of the pancreas

2.7 The spleen

The spleen is about the size of the cupped hand. If forms the left lateral extremity of the lesser sac. Passing from it are the gastrosplenic ligament to the greater curvature of stomach (carrying the short gastric and left gastroepiploic vessels) and the lienorenal ligament to the posterior abdominal wall (carrying the splenic vessels and tail of the pancreas). Relations [Fig. 2.7]. (Applied anatomy for students and junior doctors
Harold Ellis 7th Edition)

- Posteriorly—the left diaphragm, separating it from the pleura, left lung
- And the 9th, 10th and 11th ribs.
- Anteriorly—the stomach.
- Inferiorly—the splenic flexure of the colon.
- Medially—the left kidney.

The tail of the pancreas abuts against the hilum of the spleen through,which vessels and nerves enter and leave this organ. (Applied anatomy for students and junior doctors
Harold Ellis 7th Edition)

2.7.1 Blood supply

The splenic artery is one of the three main branches of the coeliac axis. The splenic vein is joined by the superior mesenteric to form the portal vein.
(Note that the splenic vessels also provide the principal blood supply of the Pancreas). (Applied anatomy for students and junior doctors
Harold Ellis 7th Edition)

2.7.2 Structure of spleen.

The spleen represents the largest reticulo-endothelial accumulation. The spleen and its immediate relations body. It has a thin fibrous capsule, to which the peritoneum adheres intimately. The fibrous tissue of the capsule extends into the spleen to form a series of trabeculae between which lies the splenic pulp. (Applied anatomy for students and junior doctors
Harold Ellis 7th Edition)

2.7.3 Clinical features

- In performing a splenectomy the close relation of the pancreatic tail to the hilum and splenic pedicle must be remembered; it is easily wounded.
- Note the close proximity of the lower ribs, lowest part of the left lung and pleural cavity, left diaphragm, left kidney and the spleen; injuries to the left upper abdomen may damage any combination of these structures. Similarly, a

stab wound of the posterior left chest may penetrate the diaphragm and tear the spleen. The spleen, with its thin tense capsule, is the commonest intra-abdominal viscus to be ruptured by blunt trauma.

- Accessory spleens (one or more) may occur most commonly near the hilum, but also in the tail of pancreas, the mesentery of the spleen, the omentum, small bowel mesentery, ovary and even testis.
- They occur in about one in ten subjects and, if left behind, may result in persistence of symptoms following splenectomy for congenital acholuric jaundice or thrombocytopenic purpura. (Applied anatomy for students and junior doctors Harold Ellis 7th Edition)

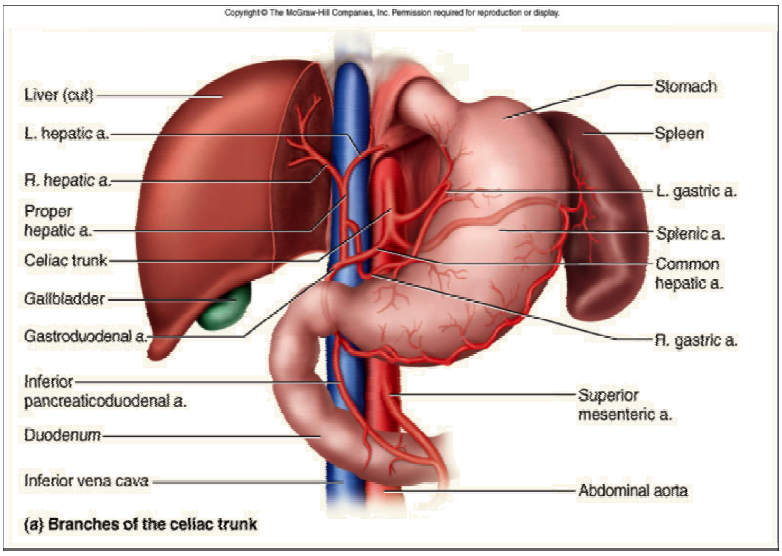

Figure (2.7) Anatomy of the Spleen

2.8 Anatomy of the kidneys

The paired kidneys are reddish, kidney–bean-shaped organs located just above the waist between peritoneum and posterior wall of the abdomen .because their position is the posterior to the peritoneum of the abdominal cavity, they are said to