بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of graduate studies

Estimation of Normal Main Portal Vein Diameter Using Ultrasonography

تقويم قطر الوريد البابي الرئيسي بإستخدام الموجات فوق الصوتية

A these Submitted for Partial Fulfillment For The Requirement Of M.Sc. Degree In Medical Diagnostic ultrasound

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الآيـة

بسم الله الرحمن الرحيم

قـال تعالـى:

فَتَبَسَّمَ ضَاحِكًا مِنْ قَوْلِهَا وَقَالَ رَبِّ أَوْزِعْنِي أَنْ أَشْكُرَ نِعْمَتَكَ الَّتِي أَنْعَمْتَ عَلَيَّ وَعَلَىٰ وَالِدَيَّ وَأَنْ أَعْمَلَ صَالِحًا تَرْضَاهُ وَأَدْخِلْنِي بِرَحْمَتِكَ فِي عِبَادِكَ الصَّالِحِينَ ﴿١٩﴾

صدق الله العظيم
سـورة النمل: الآيـة (19)

Dedication

to all whom I love and respect

My parents who brought me up.

To my teacher

To my brother and my lovely sister

To my husband

And my kids

Acknowledgment

Gratefull thanks and grace to allah for guiding and helping me finishing this research .

Iwould like also to express sincere thanks and gratitude tomy supervisor Dr. Babikerabdelwahab for his keensupervison , guidance , valuable comments and support the idea of this research until finishing .

مستخلص

هذه دراسة وصفية تحليلية اجريت في مستشفي الرباط الوطني التعليمي في الفترة من يناير حتي ابريل من العام 2017 هدفت الدراسة تقدير لقياس القطر الطبيعي للوريد البابي الرئيسي باستخدام الموجات فوق الصوتية

تمت دراسة مائة حالة من عمر 7 سنوات وحتي 74 سنة ,وكانت كل الحلات ذات كبد طبيعي ,وتم استبعاد عمر 80 سنة او أي حالة ذات اعتلال في الوريد البابي او الكبد من الدراسة .

تم استخدام المسح البطني لكل هذه الحلات باستخدام جهاز سيمنس موديل 2011بستخدام مسبار ذو خطوط منحنية ذو تردد من 3.5حتي 5 ميقاهيرز.

تم جمع البيانات باستخدام ورقة تجميع بيانات خاصة لتقيم الجنس والعمر والوزن والطول وقطر الوريد البابي ,وللتحليل تم استخدام تحليل الحزم الإحصائية للعلوم الإجتماعية.

وخلصت الدراسة الي ان متوسط العمري للحلات 29.9سنة بانحراف معياري 15.9سنة ,بالاضافة للمتوسط الوزني 59.6كيلو بانحراف معياري 13.3 كيلو, ومتوسط طولي 1.65متر بانحراف معياري 13.متر ,ومتوسط قطر الوريد البابي 0.98سنتمتر بانحراف معياري 0.01سنتمتر.

وخلصت الدراسة الي ان هنالك علاقة ضعيفة بين قطر الوريد البابي والعمر والطول ,وبينما كانت هنالك علاقة قوية بين قطر الوريد البابيي والوزن وليست هنالك علاقة بين الجنس وقطر الوريد البابي .

اوصت الدراسة بعمل دراسات في المستقبل بزيادة عدد الحلات وادخال فئات عمرية اخري .

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Abstract

This was a descriptive cross sectional study carried out in Ribat teaching hospital - Khartoum state - Sudan from January to April 2017, which aimed to estimate of normal main portal vein diameter using Ultrasonography.

There were one hundred cases of age ranged from seven to seventy four years, all cases had normal liver, any patient had age eighty years old or had any hepatic and portal vein disorder was excluded from this study.

Transabdominal scanning was done for all cases using Siemens with curvilinear probe of 2 to 3.5 Megahertz (MHz).

Data collected using special data collection sheet designed to evaluate geneder age, weight, height and Portal vein. For analyzing of collected data study used Statistical Package for Social Sciences (SPSS).

Study resulted that mean of age for cases under study was 29.9 years with stander deviation 15.9 years, while the mean of weight 59.6 kilograms (Kgs) with stander deviation 13.3 (Kgs), mean of height 1.65 meter with stander deviation 0.13 meter, while mean portal vein diameter 0.98 centimeter with stander deviation 0.01 centimeter.

Study concluded that there was a weak correlation between portal vein diameter with age and height of cases, while there was strong correlation between portal vein diameter with weight The study also concluded that there was no significance correlation between portal vein diameter with gender.

Study recommended that further studies should be done with increased number of sample and introduced other age groups.

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Abbreviation

pv	**Portal vein**
VTE	**Venous thrombus embolism**
V T	**Venous thrombosis**
A P	**Antero - posterior**
P W	**Pulsed wave doppler**
C W	**Continous wave**

Table of contents

ChapterOne

Introduction

1-1Introduction: The portal vein (PV) is a unique vein that drains blood from the capillaries of the intestinal walls and spleen to the capillaries of the hepatic sinusoids. It is less prone to anatomical variation than the hepatic artery and is normally formed posterior to the neck of the pancreas, by the union of the superior mesenteric vein (SMV) and the splenic vein (SV) at the level of the L1/L2 disc space. It runs posterior to the bile duct and the hepatic artery at the porta hepatis, where it divides into right and left branches to supply the right and left lobes of the liver. The PV supplies % of blood flow to the liver, while hepatic artery supplies 20-25%.PV disease is a common clinical presentation of portal venous disease with multiple causes and several sequelae. It is responsible for substantial economic, social, psychologic, and mental burdens; and its causes could either be pre-hepatic, hepatic, or post-hepatic. The most common cause of portal hypertension is cirrhosis of the liver. Cirrhosis results from scarring of the liver, an injury caused by hepatitis, alcoho abuse, schistosomiasis, or other causes of liver damage. Low flow velocity, reversal of flow, high diameter, and area are seen in portal hypertension. High flow velocity, reduced diameter, and area are seen in PV stenosis; while absence flow, high diameter, and area are seen in PV thrombosis. Conventional angiography, computed tomographic angiography (CTA), and magnetic resonance angiography (MRA) can be used to evaluate PV diameter. However, ultrasound (US) is preferred because it is a safe, noninvasive, cheap, and readily available diagnostic tool for evaluating PV diameter.US is a valuable tool for diagnosing abnormalities of the portal venous system, and with real-time grey-scale and Doppler US, evaluation of the PV has become relatively simple and reliable. This takes into account PV dilatation, decreased flow velocity, and flow reversal which are the physiological changes associated with portal hypertension; however, the sensitivity of PV dilatation in the diagnosis of portal hypertension is relatively high. There is a need for alocal ultrasonographic reference value of normal

PV diameter in our environment as most values in the literature are from the Caucasian population**.** Ages is necessary for the detection of abnormal measurement in organs assessment of normal organ measurement at various. The hepatic portal vein is a vessel that moves blood from the spleen and gastrointestinal tract to the liver**.**It is approximately three to four inches in length and is usually formed by the merging of the superior mesenteric and splenic veins behind the upper edge of the head of the pancreas. In some individuals, the inferior mesenteric vein may enter this intersection instead. In most people, the portal vein splits into left and right veins before entering the liver. The right vein then branches off into anterior and superior veins.The portal vein supplies approximately 75 percent of blood flow to the liver. The portal vein is not a true vein, which means it does not drain into the heart. Instead, it brings nutrient-rich blood to the liver from the gastrointestinal tract and spleen.(NJIRM. 2013)

Once there, the liver can process the nutrients from the blood and filter out any toxic substances it contains before the blood goes back into general circulation.Conditions involving the portal vein cause considerable illness and death. An important example of such a condition is elevated blood pressure in the portal vein. This condition, called portal hypertension, is a major complication of cirrhosis.(NJIRM. 2013)

1.2 Objectives:

1.2.1 General objective

To Estimate of normal main portal vein diameter using ultra Sonography

1.2.2Specific objectives:

-To measure normal portal vein diameter

-To correlate portal vein diameter with age, gender, body weight, and body length.

1.3Problem of the study:

Lake study of normal portal vein diameter in Sudanese population .

1.4 Over view of the study:

This study contain five chapters,chapter one deal with the introduction,chapter two include studies, chapter three detailed the material and methods then chapter four present the result and chapter five present the discussion, conclusion and recommendation,references and appendices.

Chapter tow

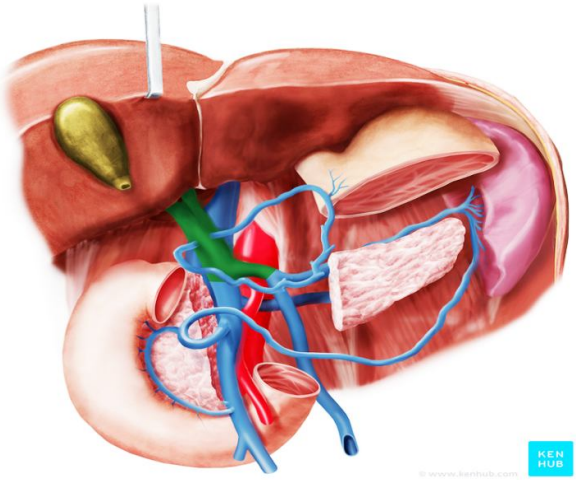
Literature review

Literature review

2-1-1Anatomy of the portal vein:

Formed by the confluens of the splenic and superior mesenteric vein, the portal vein, can be sonographically displayed using scans more or less perpendicular to the lower. costal margin (orientation might be achieved referring from the right shoulder to the umbilicus), preferably in a left decubitus position and in variably deep inspiration. Intrahepatically, the portal vein bifurcates into a main left and right branch . The first (right) portal vein branch splits into an anterior and into a posterior branch, these portal venule branches run alongside hepatic arterioles in the spaces between the liver lobules, and these two vessels, along with a common bile duct, form the hepatic portal triad. These vessels all empty eventually into the hepatic sinusoids.The portal venous system receives blood from the length of gut fromthe lower third of the oesophagus to the upper half of the anal canal aswell as the spleen, pancreas and gall-bladder. It serves to transfer bloodto the liver where the products of digestion can be metabolized andstored. Blood from the liver ultimately gains access to the inferior venacava by way of the hepatic veins. The portal vein is formed behind theneck of the pancreas by the union of the superior mesenteric and splenicveins. It passes behind the first part of the duodenum in front of the inferiorvena cava and enters the free border of the lesser omentum. Thevein then ascends towards the porta hepatis in the anterior margin of theepiploic foramen (of Winslow) in the lesser omentum. At the porta hepatiit divides into right and left branches. The veins that correspond tothe branches of the coeliac and superior mesenteric arteries drain intothe portal vein or one of its tributaries. The inferior mesenteric vein drains into the splenic vein adjacent to the fourth part to the duodenum.(Omar Faiz 2015)

Fig(2-1) showing normal portal vein ultrasound (Oma rfaiz2015)



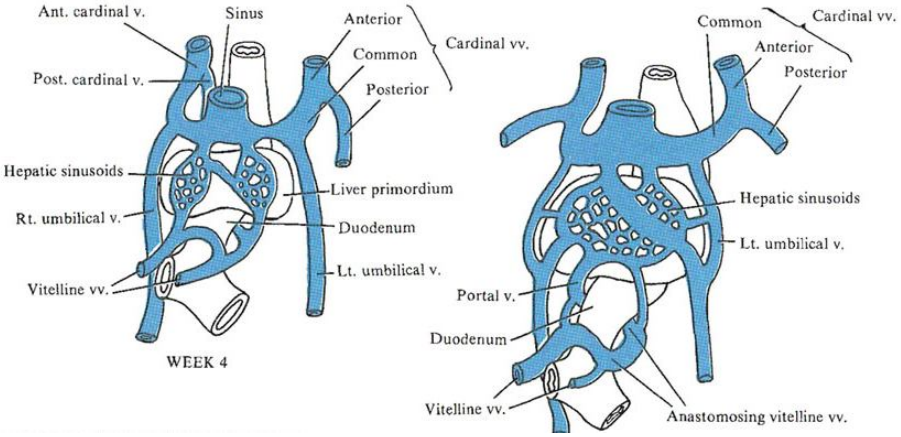
FIG(2-2)show normal portal vein anatomy (wikipedi2016)

2-1-2Accessory hepatic portal veins:

Accessory hepatic portal veins are those veins that drain directly into the liver without joining the hepatic portal vein. These include theparaumbilical veins as well as veins of the lesser omentum, falciform ligament, and those draining the gallbladder wall. (Clin. 2000)

2-1-3 Portal vein embryology:

The portal system: the 3-week-old embryo is characterized by the existence of 3 pairs of veins: the vitelline or omphalomesenteric veins carrying blood from the yolk sac to the heart, the umbilical veins originating in the chorionic villi of the placenta and carrying oxygenated blood to the embryo, and the cardinal veins draining the body of the embryo. The portal system relates to the first 2 The vitelline or omphalomesenteric veins enter the body of the embryo via the yolk sac stalk, form an anastomotic network around the duodenum of the digestive tract, and then enter the septum transversum, which they cross on their way to the heartProliferation of the entodermal liver cords, which form the liver primordium, fragments the vitelline veins to form a vascular labyrinth, the so-called hepatic sinusoids After the yolk sac disappears, the vitelline veins regress almost completely and persist only in their mesenteric branchesCranial to the liver, the vitelline veins open into the right and left horns of the sinus venosus.When the left horn of the sinus venosus disappears, the right vitelline trunk receives the anastomosis of the inferior vena cava and becomes its terminal portion or suprahepatic portion of the inferior vena cavaCaudal to the liver, the vitelline vein anastomotic network around the duodenum fuses to form a single trunk, the portal vein, partly by obliteration and partly by growth of different portionsThe superior mesenteric vein which drains the primitive intestinal loop is considered to be the successor of the right vitelline veinThe distal portion of the left vitelline vein disappears completely.(BenPansky2013).



Figure(2-3) showing development of the portal system

Adapted from(Ben Pansky2013).

2-2The Portal Circulation

The liver is unusual in that it has a double blood supply; the right and left hepatic arteries carry oxygenated blood to the liver, and the portal vein carries venous blood from the GI tract to the liver.The venous blood from the GI tract drains into the superior and inferior mesenteric veins; these two vessels are then joined by the splenic vein just posterior to the neck of the pancreas to form the portal vein. This then splits to form the right and left branches, each supplying about half of the liver.

On entering the liver, the blood drains into the hepatic sinusoids, where it is screened by specialized macrophages (Kupffer cells) to remove any pathogens that manage to get past the GI defences. The plasma is filtered through the endothelial lining of the sinusoids and bathes the hepatocytes; these cells contain vast numbers of enzymes capable of braking down and metabolizing most of what has been absorbed.The portal venous blood contains all of the products of digestion absorbed from the GI tract, so all

useful and non-useful products are processed in the liver before being either released back into the hepatic veins which join the inferior vena cava just inferior to the diaphragm, or stored in the liver for later(pansky2013).

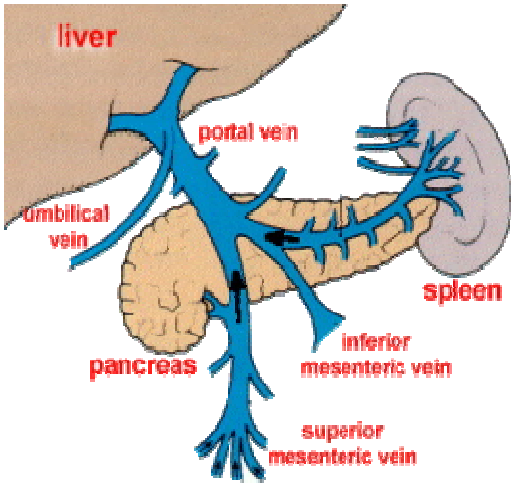


Fig (2-4) showing double portal supply(pansky2013).

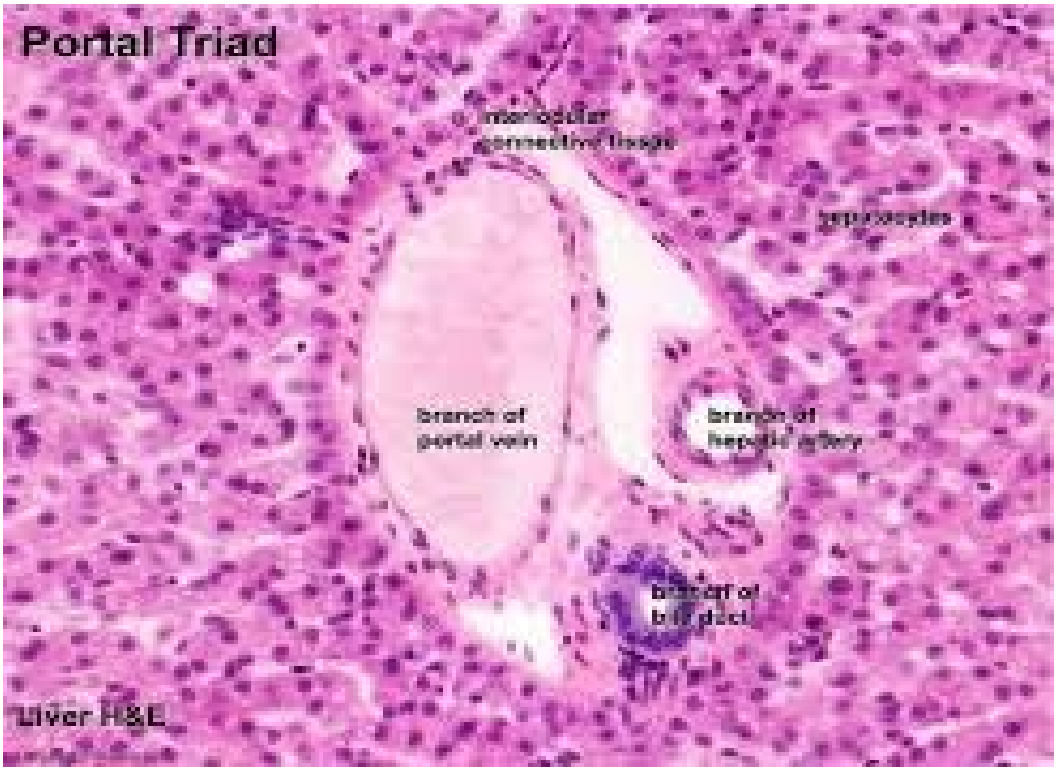
2-3 Portal vein histology

A portal triad (also known as portal field, portal area, or portal tract) is a distinctive arrangement in the liver. It is a component of the hepatic lobule. It consists of the following five structures:

proper hepatic artery, an arteriole branch of the hepatic artery that supplies oxygen,hepatic portal vein, a venule branch of the portal vein, with blood rich in nutrients but low in oxygen,one or two small bile ductules of cuboidal epithelium, branches of the bile conducting system.,lymphaticvessels,branch of the vagus nerve

The misnomer "portal triad" traditionally has included only the first three structures, and was named before lymphatic vessels were discovered in the structure. It can refer both to the largest branch of each of these vessels running inside the hepatoduodenal ligament, and to the smaller branches of these vessels inside the liver.In the smaller portal triads, the four vessels lie in

a network of connective tissue and are surrounded on all sides by hepatocytes. The ring of hepatocytes abutting the.connective tissue of the triad is called the periportal limiting plate.(pubsrsna.2002).



Fig(2-5)histological section through the portal vein(rsna.2002)

2-4 Sonographic finding of normal portal vein

t is generaly accepted that colour Doppler ultrasound enables the detection of the presence and direction of blood flow in the portal venous system. Continuous hepatofugal flow in the portal vein trunk is found with an overall prevalence of 8.3% in patients with liver cirrhosis.Prevalence did not differ in relation to the aetiology of liver cirrhosis..Reversed portal venous blood flow develops when the intrahepatic resistance is greater than the resistance of portosystemic collaterals. It is likely that the increase of intrahepatic resistance owing to structural abnormalities, i.e. hepatic vein sclerosis andhepatocyteenlargement..A possible association has been found between abnormal flow direction and the presence of oesophagealvarices, ascites and

spontaneous portosystemic shunts, with the strongest association being with shunts Analysis of the direction of flow in the portal vein is therefore strongly warranted in assessing portal hypertension.Continuoushepatofugal flow in branches of the portal vein is a specific sign for portal hypertension.Portosystemic collateral blood vessels develop from pre-existing small portal vessels and may lead to portosystemicshunting.Depending on collateral size and amount of blood drainage from the portal venous system, hepatofugal portal venous flow may be found in the portal venous trunk, sections of the portal venous systems or only in small portal venous branches, e.g. left gastric vein.(Wd et al 2003)

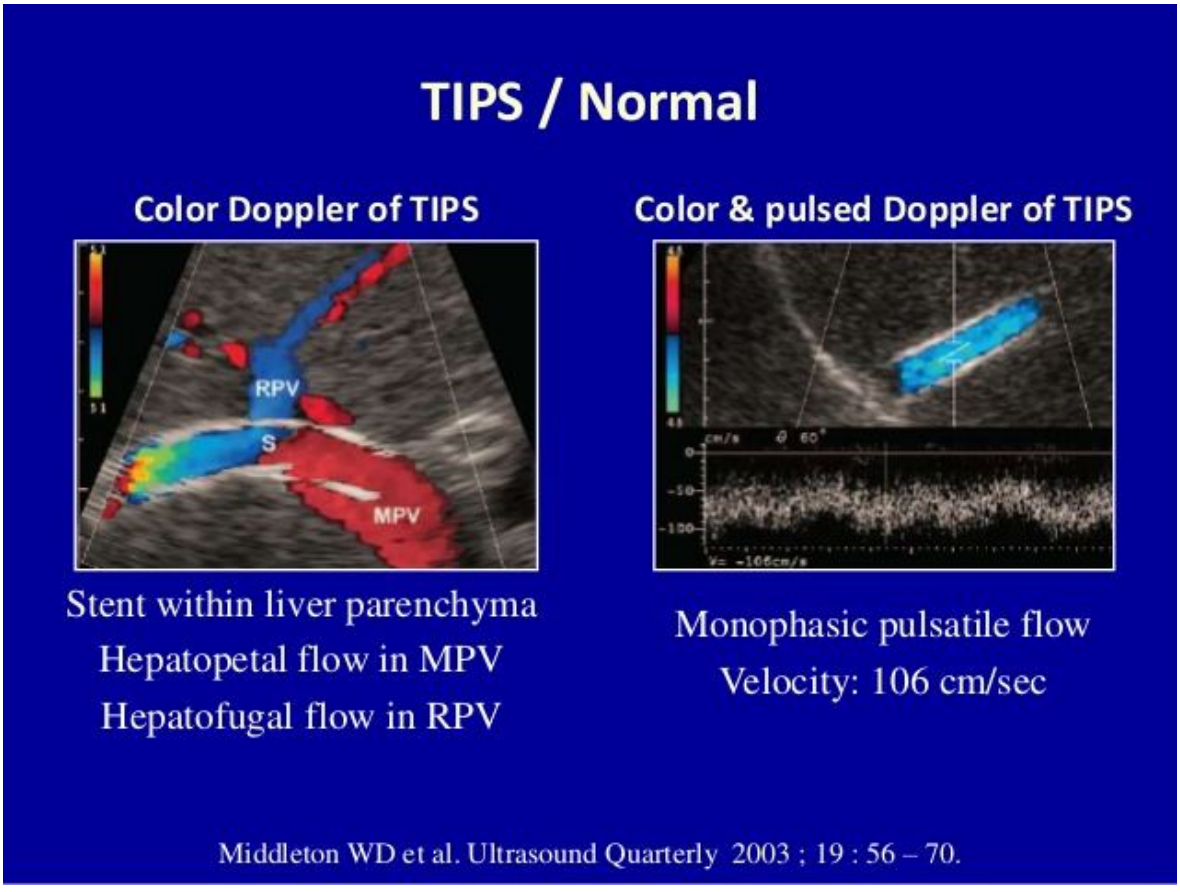
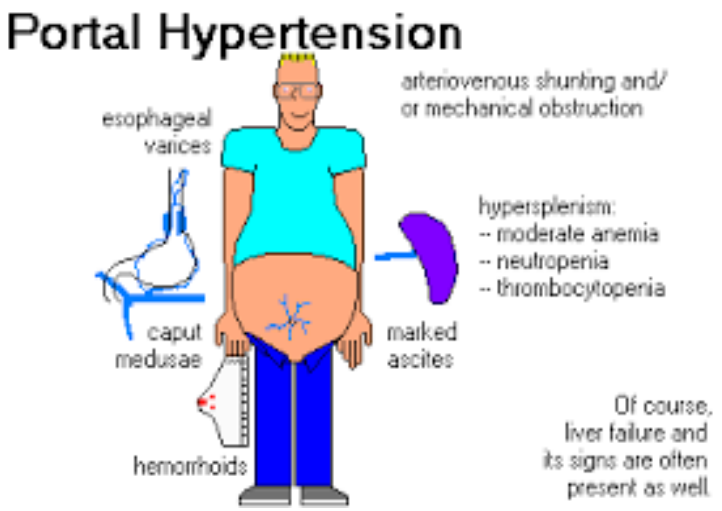


Fig (2-6)doppler of normal vein portal.(Wd et al 2003)

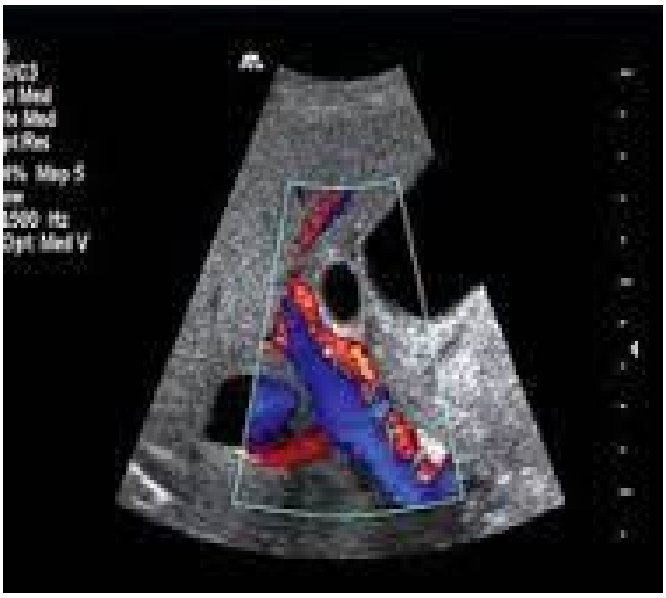
2-5 Pathology:

2-5-1 Portal hypertension:

Portal hypertension is hypertension (high blood pressure) in the hepatic portal system, which are the portal vein and its branches, which drain from most of the intestines to the liver. Portal hypertension is defined as a hepatic venous pressure gradient equal to or greater than 6 mmHg. Cirrhosis (a form of chronic liver failure) is the most common cause of portal hypertension; other, less frequent causes are therefore grouped as non-cirrhotic portal hypertension. When it becomes severe enough to cause symptoms or complications, treatment may be given to decrease portal hypertension itself or to manage its complications.(Wikipedia2016)



Fig(2-7) showing portal hypertentionsymptom.(Wikipedia 2016)



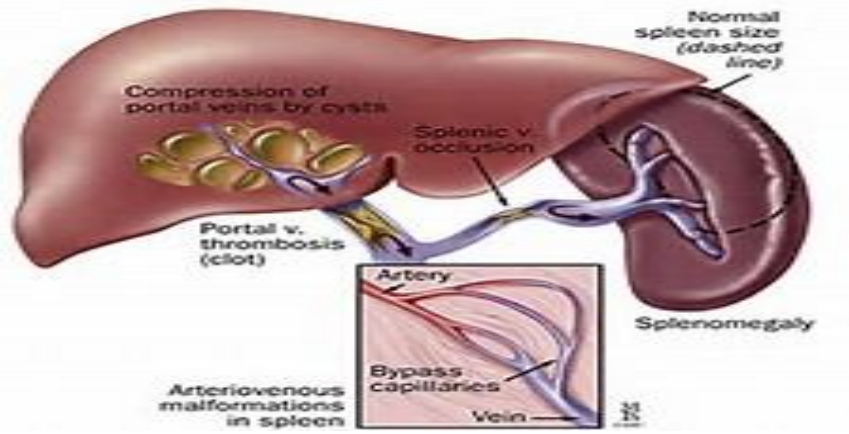
Fig(2-8)color doppler marked portal vein hypertention.(Wikipedia 2016)

2-4-2 Portal thrombosis

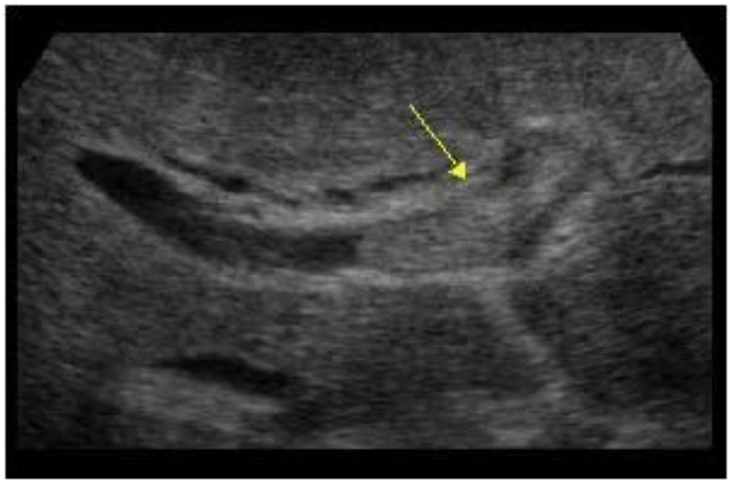
Thrombosis is the formation of a blood clot inside a blood vessel, obstructing the flow of blood through the circulatory system. When a blood vessel is injured, the body uses platelets (thrombocytes) and fibrin to form a blood clot to prevent blood loss. Even when a blood vessel is not injured, blood clots may form in the body under certain conditions. A clot, or a piece of the clot, that breaks free and begins to travel around the body is known as an embolus.

Thrombosis may occur in veins (venous thrombosis) or in arteries. Venous thrombosis leads to congestion of the affected part of the body, while arterial thrombosis (and rarely severe venous thrombosis) affects the blood supply and leads to damage of the tissue supplied by that artery (ischemia and necrosis). A piece of either an arterial or a venous thrombus can break off as an embolus which can travel through the circulation and lodge somewhere else as an embolism. This type of embolism is known as a thromboembolism. Complications can arise when a venous thrombusembolism (commonly called a VTE) lodges in the lung as a pulmonary embolism. An arterial embolus

may travel further down the affected blood vessel where it can lodge as an embolism(.wikipedia2015)



Fig(2-9) show portal vein Thrombous(wikipeadia2015)



Fig(2-10)ultrasound image shows portal vein thrombus(weikepaedia2015)

2-5 Ultrasound Technique

The PV ultrasound examination was explained to each subject and a brief history obtained. Biodata, which include age and sex was recorded for each patient.

Prior to the examination patients were asked to fast for at least 6-8 h. This reduces excess bowel gas that may obscure the main PV and distends the biliary ducts. The examination was performed using a high-resolution real-time Doppler ultrasound scanne equipped with 3.5 MHz curvilinear transducer. This transducer provides excellent resolution for deep abdominal

visceral organs such as the liver.The ultrasound examination was conducted in the supine position. Ultrasound gel was applied, and transducer placed in the epigastrium in both transverse and longitudinal planes to evaluate the main PV, and right hypochondria region to evaluate the right and left PVs. The intrahepatic PVs in some patients were also examined in sub-coastal or inter-coastal approach with the patient either in supine, right anterior oblique or left posterior oblique as needed. In patients with excess gas in the duodenum and antrum that obscured the distal extrahepatic PV, they were placed in an erect right anterior oblique position to displace the air.The PVs were identified using color Doppler, which differentiates them from the adjacent hepatic arteries and bile ducts. Antero-posterior (AP) and transverse diameter of the main PV were measured at its midpoint (A to B), while the values for right PV (C to D) and left PV (E to F) were measured at the level of their bifurcation and. The AP diameter from proximal to distal wall was obtained using the longitudinal view while the transverse diameter from the medial to lateral wall was obtained from the transverse view.

(au/members2003).

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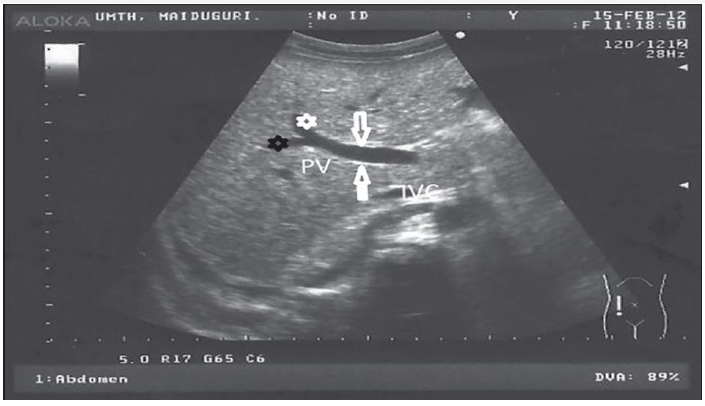


Fig (2-11) shows normal portal vein ultrasound (au/members2003)

Fig (2-12)showing scanplaneintercostal of liver from(Wikipedia2016)

2-6 History

The potential of ultrasound as an imaging modality was realized as early as the late 1940s when, utilizing sonar and radar technology developed during World War II, several groups of investigators around the world started exploring diagnostic capabilities of ultrasound (Goldberg and Kimmelman, 1988). In the early1950s, John Wild and John Reid in Minnesota developed a prototype B-mode ultrasonic imaging instrument and were able to demonstrate the capability of ultrasound for imaging and characterization of cancerous tissues at frequencies as high as 15 Mhz. John Wild's pioneering effort and accomplishment were recognized with the Japan Prize in 1991. At the same time, apparently unaware of the effort by Wild and Reid, Douglas Howry and Joseph Holms at the University of Colorado at Denver also built

an ultrasonic imaging device with which they produced cross-sectional images of the arm and leg.Starting in the late 1940s, medical applications of ultrasound in Japan were explored by Kenji Tanaka and Toshio Wagai. Two Japanese investigators, Shigeo Satomura and YasuharaNimura, were credited with the earliest development of ultrasonic Doppler devices for monitoring tissue motion and blood flow in 1955.Virtually simultaneously with the work going on in Japan and in the U.S., IngeEdler and Hellmuth Hertz at the University of Lund in Sweden worked on echocardiography, an ultrasound imaging technique for imaging cardiac structures and monitoring cardiac functions. In parallel with these developments on the diagnostic front, William Fry and his colleagues at the University of Illinois at Urbana worked on using high-intensity ultrasound beams to treat neurological disorders in the brain.The primary form of ultrasonic imaging to date has been that of a pulse–echo mode. The principle is very similar to that of sonar and radar. In essence, followingan ultrasonic pulse transmission, echoes from the medium being interrogated aredetected and used to form an image. Much of the terminology used in ultrasoundwas imported from the field of sonar and radar. Although pulse–echo ultrasound hadbeen used to diagnose a variety of medical problems since the 1950s, it did notbecome a widely accepted diagnostic tool until the early 1970s when gray-scaleultrasound with nonlinear echo amplitude to gray level mapping was introduced.Continuous wave (CW) and pulsed wave Doppler (PW) ultrasound devices formeasuring blood flow also became available during that time. Duplex ultrasoundscanners that combined both functions, thus allowing the imaging of anatomy andthe measurement of blood flow with one single instrument, soon followed. Today,ultrasound is the second most utilized diagnostic imaging modality in medicine,second only to conventional x-ray, and is a critically important diagnostic tool ofany medical facility.(diagnostic ultrasound Imaging and blood flow Measurements(K. Kirk Shung © 2006).

2-7Previous studies:

Aminu Umar Usman et, al 2015 aimed to assess of portal vein (PV) diameter in adult patients using ultrasonography. Their study was aimed at determining the mean and range of PV diameter in normal adults in northeastern Nigeria.

This cross-sectional prospective study was carried out at the University of Maiduguri Teaching Hospital between January and June, 2013. Two hundred and fifty normal adult male and female patients aged 18 years and above underwent abdominal ultrasonography for measurement of their main, right, and left PV diameter in both inspiration and expiration. The relationship between the PV diameter and age was correlated using Pearson's correlation test. While the difference between the two sexes and phases of respiration were compared using Student'st-test.Study resulted that there were 187 (74.8%) males and 63 (25.2%) females aged between 19 and 77 years, mean 43.78 ± 12.97 years. The mean diameter of the main PV was 10.87 mm ± 0.81. The mean diameter of the right and left PVs were 4.35 mm ± 0.52 and 4.12 mm ± 0.52, respectively. The PV diameter correlated with age and respiratory phases ($P < 0.05$). There was statistically significant difference in PV diameter between males and females ($P < 0.05$) with values higher in females.They concluded that; the mean PV diameter in normal adults has been established in northeastern Nigeria. The diameter correlated with age and showed significant difference between the two sexes and respiratory phases.

GemechuGeleto, WondimGetnet, and TsegayeTewelde were aimed assess of normal mean portal vein diameter among patients referred to The Department of Radiology in Jimma University Hospital using ultrasonography.This was a cross-sectional study was conducted from November to December 2014 at Jimma University Hospital on a total of 195 clients. Data about portal vein

diameter for eligible clients were collected by radiologists using Sonography. Data were edited manually, entered and analyzed using SPSS version 16.Data were collected from a total of 195 participants. Among these, 121(62.1%) were males and the median age of the participants was 35 years. The study revealed a normal mean portal vein diameter of 10.6 mm ±1.8 SD with a respirophasic variation of 25.6%. Likewise, the normal mean portal vein diameter seemed to have varied significantly by age and sex.The study revealed a normal mean portal vein diameter ranging below 13 mm. Hence, decisions made in clinical settings should base on these findings. Besides, there is a need for large scale study to determine portal vein diameter variation by age and sex, controlling other confounders.

Other study done by 2-7-4 (G Geleto - 2011), the aim of t sthat study was sonographic assessment of normal mean portal vein diameter among patients referred to The Department of Radiology in Jimma University Hospital.

A facility based cross-sectional study was conducted from November to December 2014 at Jimma University Hospital on a total of 195 clients. Data about portal vein diameter for eligible clients were collected by radiologists using Sonography. Data were edited manually, entered and analyzed using SPSS version 16.Data were collected from a total of 195 participants. Among these, 121(62.1%) were males and the median age of the participants was 35 years.That study revealed a normal mean portal vein diameter of 10.6 mm ±1.8 SD with a respirophasic variation of 25.6%. Likewise, the normal mean portal vein diameter seemed to have varied significantly by age and sex.

The study revealed a normal mean portal vein diameter ranging below 13 mm.

2-7 – 2(YHawaz D AdmassieVol 17, No 1 (2012)**):**That was a prospective cross-sectional study done at TikurAnbessa Specialized Hospital to sonographically determine the normal portal vein diameter. Data was

collected from 502 patients on consecutive bases from May – September 2010. This includes 190 males and 312 females The mean portal vein diameter was 7.9 + 2mm with an increase in diameter with increase in age of the subject. Our study also revealed 21.5% increase in portal vein diameter with the phases of inspiration.That study has comparable results with studies done elsewhere so that it can be used as a baseline for future population based studies and clinical decision making.

Chapter Three

Material and method

3-1Type of the study

This is prospection study deal with the normal measurement of portal vein of Sudanesepopulationandcorrelationitwithsex,age ,height, and bodyweight.

3-2Population of the study

Sudanesepopulation in Khartoumstate.

3-3 Study sample

Onehandarednormal Sudanesepopulation 43male57female.

3-4 Inclusion criteria

HealthySudanese population withnormal portal veinmeasurement.

3-5Excuiusioncritera

Patient withportal vein pathology.thesonographic examination performedwithlowfrequencyreal time scanner with 3.5 Mhzcovextransuducer.

3-6Method

The ultrasound examination was conducted in the supine position

Ultrasound gel was applied, and transducer placed in the epigastrium in both transverse and longitudinal planes to evaluate the main PV, and right hypochondria region to evaluate the right and left PVs. The intrahepatic PVs in some patients were also examined in sub-coastal or inter-coastal approach with the patient either in supine, right anterior oblique or left posterior oblique as needed. In patients with excess gas in the duodenum and antrum that obscured the distal extrahepatic PV, they were placed in an erect right anterior oblique position to displace the air. The measurement ofportal vein made during deep inspiration.

3-7Duration of the study

This study was done from(January ----april 2017)

3-8Data collection:

Thedata was collected by master data sheet,using the flowing variable age ,gender,body height and body weightto measurement of portalvein.

3-9 Materials:

- Ultrasound system with 3.5MHz and 5MHz curvetransducer.
- Gel.
- Computerize reporting system

3-10 Data analysis:

The relationship of alldimensionwith gender,age, bodyheight and body weight.

Using computer stasticprocedure in analysisof data wellperformet it, number of handeredSudanese population for abdominalinvestigationin ultra sound department withdefferentageinrubat hospitalin Khartoum state.

3-11 Datastorage:

The datawasstored:-

1/personalcomputer

2/patient datacollection sheet

3-12 Equipment used:

The researcher used sonoscape ultrasound machine modle-- Siemens.

The features of the machine are superior contrast, high resolution transducer (3.5 to 5 MHz)

3-13 Ethical consideration:

Justice and human dignity was observed by treating selected patients equally when telling them to participate in the research as sample of this Study. The patients were free to decide whether to participate or not.

No identification or individual details were published.

Chapter four

Results

Results:

Table (4.1) frequency distribution of gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
female	57	57.0	57.0	57.0
male	43	43.0	43.0	100.0
Total	100	100.0	100.0	

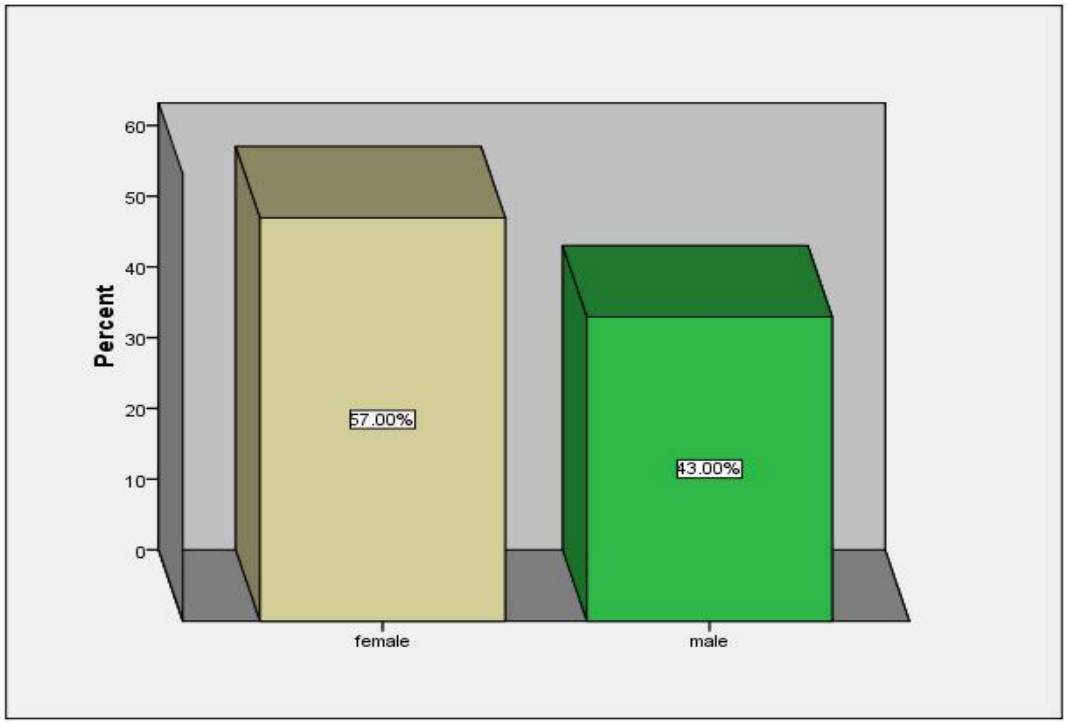


Figure (4.1) shows frequency distribution of gender

Table (4.2) descriptive statistic minimum, maximum and means of age , weight ,height of individual and PV measurement

Variables	N	Minimum	Maximum	Mean	Std. Deviation
age	100	7	74	33.08	14.816
weight	100	18	95	63.12	13.754
Height	100	120	190	165.48	10.507
PV diameter	100	.80	1.20	.9836	.11375
Valid N (listwise)	100				

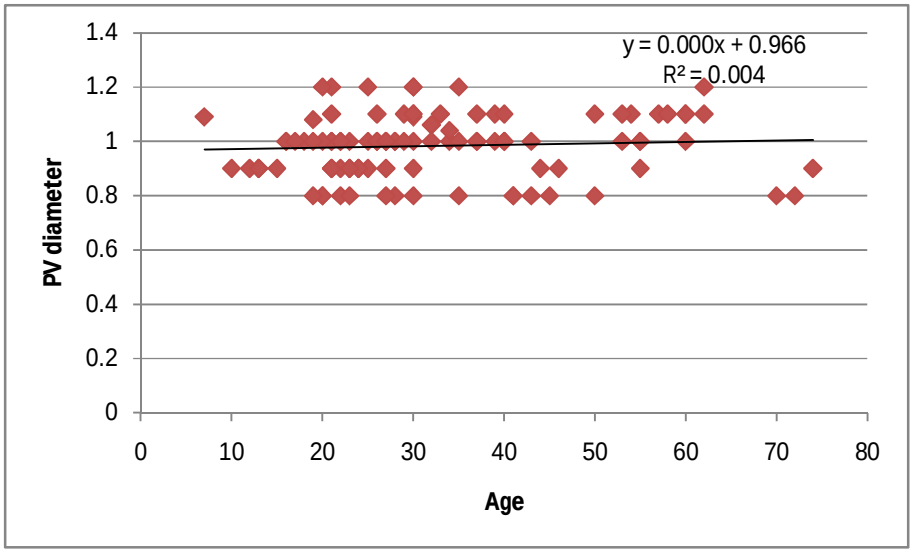


Figure (4.2) scatter plot shows relationship between age and PV diameter

Table (4.3) correlation between age, weight, height and PV diameter

		age	Height	Weight	PV diameter
age	Pearson Correlation	1	.101	.438**	.069
	Sig. (2-tailed)		.318	.000	.496
	N	100	100	100	100
Height	Pearson Correlation	.101	1	.268**	.105
	Sig. (2-tailed)	.318		.007	.297
	N	100	100	100	100
Weight	Pearson Correlation	.438**	.268**	1	.272**
	Sig. (2-tailed)	.000	.007		.006
	N	100	100	100	100
PV diameter	Pearson Correlation	.069	.105	.272**	1
	Sig. (2-tailed)	.496	.297	.006	
	N	100	100	100	100
**. Correlation is significant at the 0.01 level (2-tailed).					

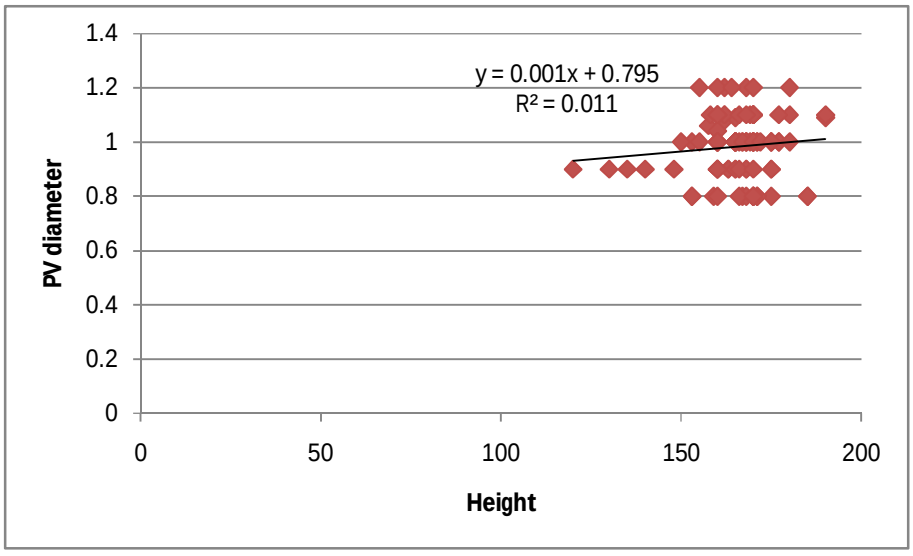


Figure (4.3) scatter plot shows relationship between height and PV diameter

Table (4.4) descriptive statistic minimum, maximum and means of age , weight ,height of individual and PV measurement for male

Variables	N	Minimum	Maximum	Mean	Std. Deviation
age	43	7	72	29.91	15.986
weight	43	18	85	59.65	13.356
Height	43	120	190	165.56	13.247
PV diameter	43	.80	1.20	.9874	.09950
Valid N (listwise)	43				

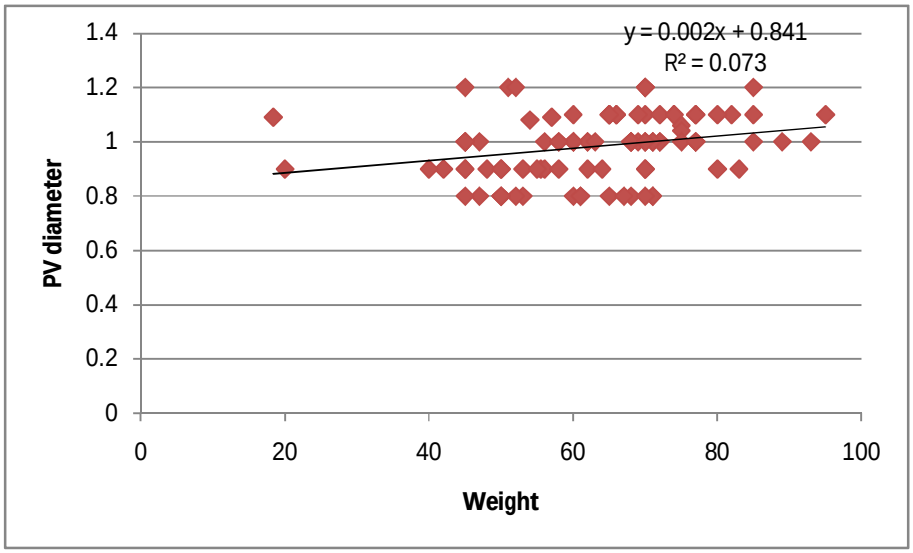


Figure (4.4) scatter plot shows relationship between weight and PV diameter

Table (4.5) correlation between age, weight, height and PV diameter in male

		age	Length	Weight	PV diameter
Age	Pearson Correlation	1	.203	.500**	.003
	Sig. (2-tailed)		.193	.001	.985
	N	43	43	43	43
Height	Pearson Correlation	.203	1	.432**	.300
	Sig. (2-tailed)	.193		.004	.051
	N	43	43	43	43
Weight	Pearson Correlation	.500**	.432**	1	.213
	Sig. (2-tailed)	.001	.004		.171
	N	43	43	43	43
PV diameter	Pearson Correlation	.003	.300	.213	1
	Sig. (2-tailed)	.985	.051	.171	
	N	43	43	43	43
**. Correlation is significant at the 0.01 level (2-tailed).					

Table (4.6) descriptive statistic minimum, maximum and means of age ,weight ,height of individual and PV measurement for female

Variables	N	Minimum	Maximum	Mean	Std. Deviation
age	57	13	74	35.47	13.521
Height	57	148	185	165.43	7.971
PV diameter	57	.80	1.20	.9807	.12421
Valid N (listwise)	57				

Table (4.7) correlation between age,weight, height and PV diameter in female .

		age	Height	Weight	PV diameter
age	Pearson Correlation	1	-.038-	.343**	.130
	Sig. (2-tailed)		.778	.009	.336
	N	57	57	57	57
Height	Pearson Correlation	-.038-	1	.106	-.075-
	Sig. (2-tailed)	.778		.432	.578
	N	57	57	57	57
Weight	Pearson Correlation	.343**	.106	1	.330*
	Sig. (2-tailed)	.009	.432		.012
	N	57	57	57	57
PV diameter	Pearson Correlation	.130	-.075-	.330*	1
	Sig. (2-tailed)	.336	.578	.012	
	N	57	57	57	57

Chapter five

Discussion, ConcolutionandRecommendation

Discussion, ConcolutionandRecommendations

5.1 Discussion:

Portal vein measurement by sonography are important in study portal vein disorder ,which offershe advantage of anon –invasive method.

The study was performed on 100 consenting normal Sudanese population , 43 (43%) were males while 57 (57%) were females table(4-1).

Descriptive statistic minimum, maximum and means of age , weight ,height of individual and PV measurement.The mean of age was 33 year with standered deviation 14.8, mean of weight was 63.12 with standereddeivation 13.75.,mean of height was 165.4 with standered deviation10.50 and mean of p v diameter was .98cm with standeredveivation .1137cm.(table4-2)

Scatter polt showing no significant between age and portal vein diameter showing in figure(4-2) .

The correlation between age ,weight ,height and portal vein diameter,show strong positive correlation between portal vein and body weight. A weak correlation between portal vein diameter with age and height of cases, but there was no significance correlation between portal vein diameter with gender see in table(4-3).

This finding is in agreement with Hawaz et al. who reported an increase in diameter of PV with increase in weight in normal individuals which is also consistent with the finding of Anakwue et al. Similar findings were also found no significant correlation between PV diameter and age.

The statistic minimum, maximum and means of age was 29year , mean of weight was 59kg , mean of height was165cm and mean of portal vein measurement was 1.2cm for male seein table(4-4)

The correlation between age, weight, height and PV diameter in male, but there was no significance correlation between portal vein diameter with gender in table(4-5) .

The statistic means of age in female group was 35year , mean of weight was 65kg , mean of height was165cm and mean of portal vein measurement was .98cm seein table(4-6).

The correlation between age, weight, height and PV diameter in female, but there was no significance correlation between portal vein diameter with gender in table(4-7) which is disagreement with other studies done in USA , Nigeria , and Kolkata .

5-2 conclusion :

The study concludedthe average of normal main portal vein diameter was 1±.2cm The age ,body height weak significant correlation with portal vein diameter ,the body weight has strong significant correlation with portal vein diameter and there is no significant between gender and portal vein diameter.

5-3 Recommendations:

● People were advised to do U/S scanning routinely to exclude the presence of portal vein disorder, because U/S is a cheap, safe and reliable.

●If there is any indication of liver disorder appears in U/S scanning, the portal vein diameter should be measured.

●Study recommends that the Government should introduce the modern ultrasound machines and increase the training institutes of ultrasound and computer programs for increasing the sonologists skills and experiences.

● According to the high cost of scientific research which the researcher was faced, the government should appeal universities in Sudan and companies to support the researchers in order to improve plans of treating and management of such diseases.

● Further studies should be carried out in this field on many aspects such as increasing the number of patients, to show the relation between normal portal vein diameter with patient age and weight, comparing between the role of U/S scanning and other diagnostic tools, using color Doppler, Computer Tomography and Magnetic Resonance Imaging.

Reference

1-Aminu Umar Usman2015.et/al. Determination of normal portal vein diameter on ultrasound scan among adults in northeastern Nigeria.

2-Gemechu Geleto2016,et/al. Mean Normal Portal Vein Diameter Using Sonography among Coming to Radiology Department of Jimma University Hospital, Southwest Ethiopia.

3- .et/alSonographic2009 Evaluation of Normal Portal Vein Diameter in Nigerians

4- Y Hawaz,2012,et/al Ultrasound Assessment of Normal Portal Vein Diameter in Ethiopians Done at TikurAnbessa Specialized Hosp

5- Octa Journal of Environmental Research.Sept, 2013. Jayanta Bhattacharya et /al.sonographic assessment of portal vein diameter in northernpart of west Bengal,india

6-2015;volume=2 by Kolkata . AU Usman - 2015. Ultrasound Determination of Portal Vein Diameter in Adult Patients

7-/iosrjdms/papers/Vol1Anakwueet al4issue12.Portal vein diameter in a tertiary care centre in North.

8- examination review for ultrasound2011 Lippincott Williams & Wilkins

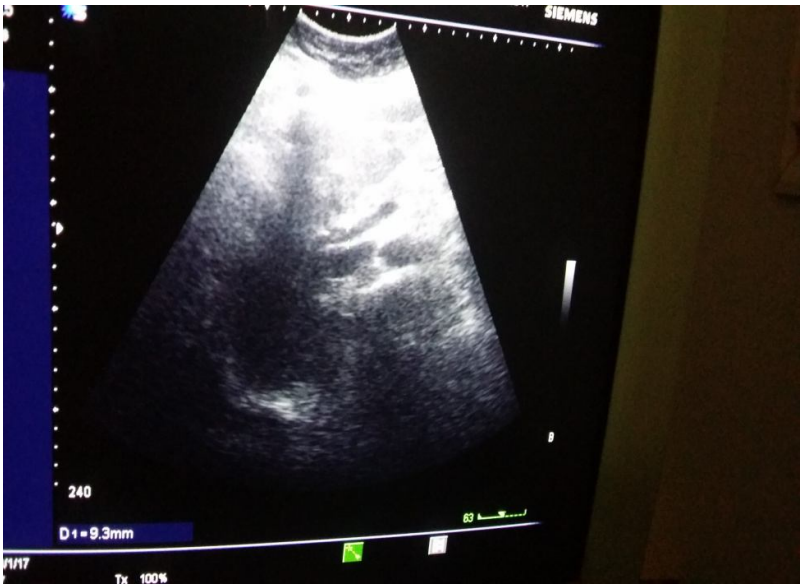
9-Ohmae H, Tanaka M, Hayashi M, et al. Improvement of ultrasonographic and serologic changein Schistosomajaponicum-infected patients after treatment with praziq. 1992

10-Ekta G, Nema U, Gupta A. Sonographic Evaluation Of Portal Vein Diameter In North Indian Population. NJIRM. 2013

Appendices (A):ultra sound images :

Appendix (A-1): Ultrasound image shows normal main portal vein malediameter (1.1cm) 30year

Appendix (A-2): Ultrasound image shows normal main portal vein femal diameter(.98cm)23year.



Appendix (A-3): Ultrasound image(3)normal main portal vein diameter (1cm) male54year

Appendix (A-4): Ultrasound image shows nomal main portal vein diameter(.98cm) female30 year

Appendix B:

Data sheet

subject	age	gender	height	weight	Portal vein diameter
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					