Evaluation of portal hypertension by grey scale and colour doppler

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***Abstract*— Portal hypertension is the most common condition affecting the portal venous system in chronic liver disease. The increase in resistance to portal and splanchnic blood flow contributes to the development of portal hypertension which is a syndrome of various etiologies, ill defined pathogenesis, hemodynamic alterations and frequent complications.**

Background: **In adults, the normal portal venous pressure is 5-10mm Hg. Portal hypertension is defined as portal venous pressure of more than at least 5 mm Hg greater than the pressure in the hepatic veins or inferior vena cava. Clinically significant portal hypertension, sufficient to cause serious complications and requiring treatment, is defined as an increase of 12mm Hg. Portal hypertension can be sinusoidal, pre sinusoidal and post sinusoidal. Accurate diagnosis by imaging modality can help in prompt treatment. Many of the most lethal complications of liver disease are directly related to the presence of portal hypertension including ascites, portal systemic encephalopathy and haemorrhage from gastro esophageal varices. In cirrhotic patients with portal hypertension, numerous collaterals develop from high pressure portal system to low pressure systemic circulation, few of which can be lethal causes of gastrointestinal bleeding. So accurate diagnosis helps in timely implementation of surgical and medical management and thus prevents complications.**

***Index Terms*— PV (Portal vein), SPLV (Splenic vein), SMV (Superior mesenteric vein), GB (Gall bladder), USG (ultra sonography), USG (Ultra sonography).**

I. INTRODUCTION

In adults, the normal portal venous pressure is 5-10mm Hg. Portal hypertension is defined as portal venous pressure of more than at least 5 mm Hg greater than the pressure in the hepatic veins or inferior vena cava. Clinically significant portal hypertension, sufficient to cause serious complications and requiring treatment, is defined as an increase of 12mm Hg. It is the most common condition affecting the portal venous system in chronic liver disease. The increase in resistance to portal and splanchnic blood flow contributes to the development of portal hypertension which is a syndrome of various etiologies, ill defined pathogenesis, hemodynamic alterations and frequent complications [1]. Portal hypertension can be sinusoidal, pre sinusoidal and post sinusoidal. Accurate diagnosis by imaging modality can help in prompt treatment. Many of the most lethal complications of liver disease are directly related to the presence of portal hypertension including ascites, portal systemic encephalopathy and haemorrhage from gastro esophageal varices. In cirrhotic patients with portal hypertension, numerous collaterals develop from high pressure portal system to low pressure systemic circulation, few of which can be lethal causes of gastrointestinal bleeding [2]. So accurate diagnosis helps in timely implementation of surgical and medical management and thus prevents complications. In portal hypertension imaging, ultrasound techniques such colour doppler imaging or power doppler imaging are most rapid, non-invasive, cost-effective, require no radiation, widely available and easy to follow up and presently the initial imaging of choice. They also allow to look for sequelae like portal vein thrombosis, oesophageal varices, other collateral pathways with reasonable accuracy [3]. Hence, purpose of the study is to study the role of ultrasound and colour doppler sonography in evaluation of portal hypertension and to look for specific features of portal hypertension on these modalities that permit its accurate diagnosis and to detect the complications at an early stage.

II. MATERIAL AND METHODS

This cross sectional study was carried out on patients of Department of Radiodiagnosis, at Maharaja's Institute of Medical Sciences, Vizianagaram, and Andhra Pradesh from September 2021 to March 2022. Total 40 patients (both male and females of aged 20 to 65 years) referred to department of radiodiagnosis with clinical diagnosis of portal hypertension were studied in this study. In this study pediatric age group, pregnant and traumatic cases are excluded.

III. HOSPITAL PROTOCOL

The patient must fast 8 hours before the USG examination and when patient come will lie on an exam table. Patient move his clothing away from abdomen and then apply gel to the area. The gel will help the transducer make secure contact with the body and eliminate air between the transducer and the skin. Once the imaging is complete, the clear ultrasound gel will be wiped off skin. Any portions that are not wiped off will dry quickly. The ultrasound gel does not usually stain or discolor clothing. The exam usually takes less than 40 minutes.

IV. TECHNIQUE

With the patient in the supine position, then applied gel then start scan with the probe in longitudinal plane, the probe orientates cephalic and asking patient holding breath. Then the liver, spleen. Splenic vein, portal vein and rest of the abdomen are assessed.

V. RESULTS

Portal vein diameter >13 mm was seen in 52.5% of cases. Though portal hypertension has PV diameter >13 mm, it is not seen in all cases. Variation of portal vein diameter less than 20% with deep inspiration was seen in 80% cases which correlated well with studies previously done. Most frequent flow type in veins was hepatopetal. 65% of PV, 80% of SPLV and 85% of SMV showed hepatopetal flow. PV, SPLV and SMV showed hepatofugal flow in 10%, 5%, 2.5% cases respectively. Bidirectional flow was least frequent and was seen in 2.5% of cases in all veins .Absent flow seen in PV,SPLV, SMV in 22.5%, 12.5% and 10% respectively due to thrombosed veins. Thrombosis of veins, which was accurately diagnosed using ultrasonography, colour and spectral study, was seen in around 35%, 17.5% and 12.5% cases in PV, SPLV and SMV respectively. Splenomegaly and ascites were seen in most of the cases of portal hypertension. It was seen in 90 % and 85% cases respectively. Splenorenal and gastrorenal groups were the most frequent collateral group and were seen in 92.5% cases. GEJ collaterals are seen in 62.5% and paraumbilical collateral noted in 47.5%. Cavernoma formation was seen in only 10% cases. GB varices were least frequent and were seen in only 7.5% of cases. Least frequent were GB varices, being seen in 7.5% cases. In the present study cirrhosis was the most common cause for portal hypertension. It was seen in 65% of cases. Benign portal venous occlusion was seen in 12.5% case, whereas sinistral / left sided portal hyprtension was seen in 10%, malignancy causing PV thrombosis was seen in 5% and other etiologies were seen in 7.5% each.

Table no 1 : AGE GROUP.

AGE GROUP IN YEARS	Percentage
20 - 35	12.50 %
36 - 50	35.0 %
51 – 65	52.50%

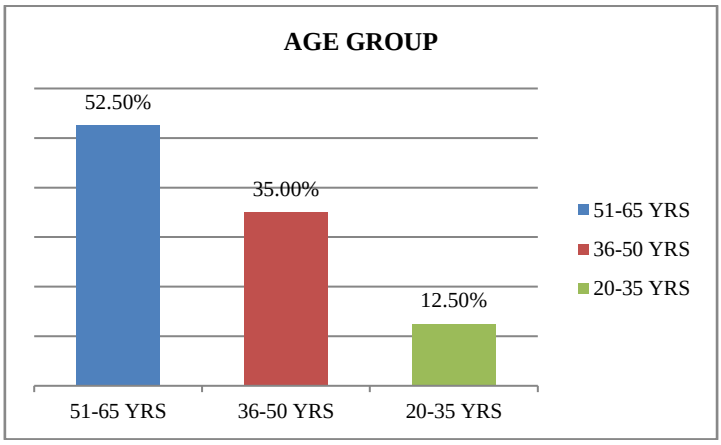


Table no2 : SPECTRUM OF SONOGRPAHIC FINDINGS IN PORTAL HYPERTENSION

FINDINGS	Percentage
Portal vein Diameter > 12	53%
Splenomegaly	90%
Ascites	85%

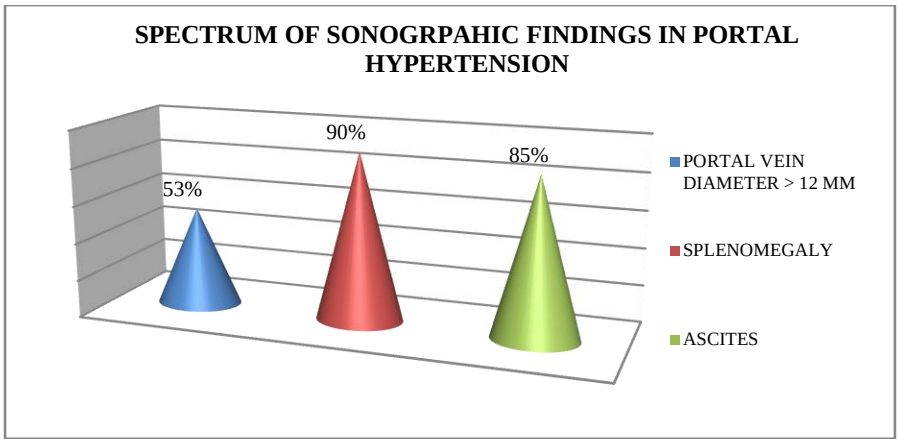


Table no 3 : SHOWS SEX RATIO.

Sex	Percentage
Males	63 %
Females	37 %

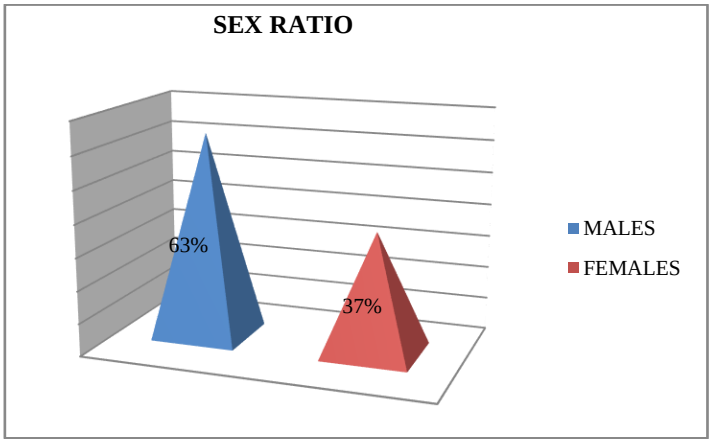


Table no 4 : SHOWS HEPATOPETAL FLOW PATTERN IN VEINS.

Veins	Percentage
Portal veins	65 %
Splenic veins	80 %
Superior mesenteric vein	85 %

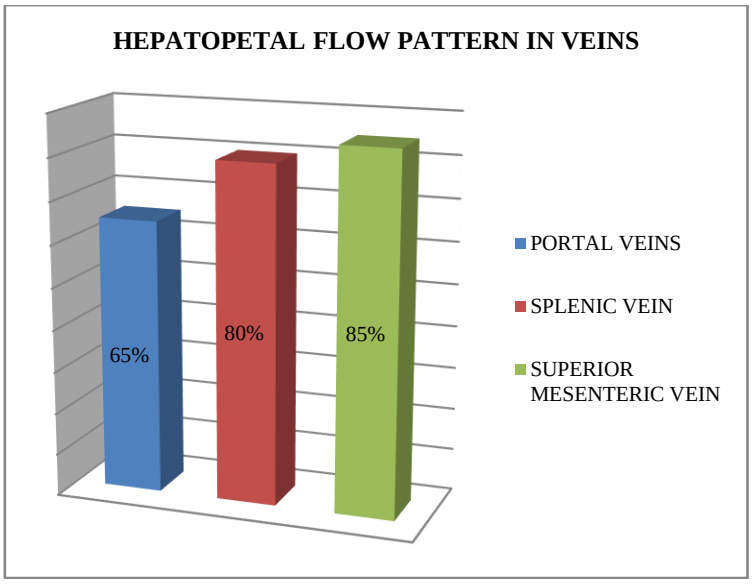


Table no 5: SHOWS HEPATOFUGAL FLOW PATTERN IN VEINS.

Veins	Percentage
Portal veins	65 %
Splenic veins	80 %
Superior mesenteric vein	85 %

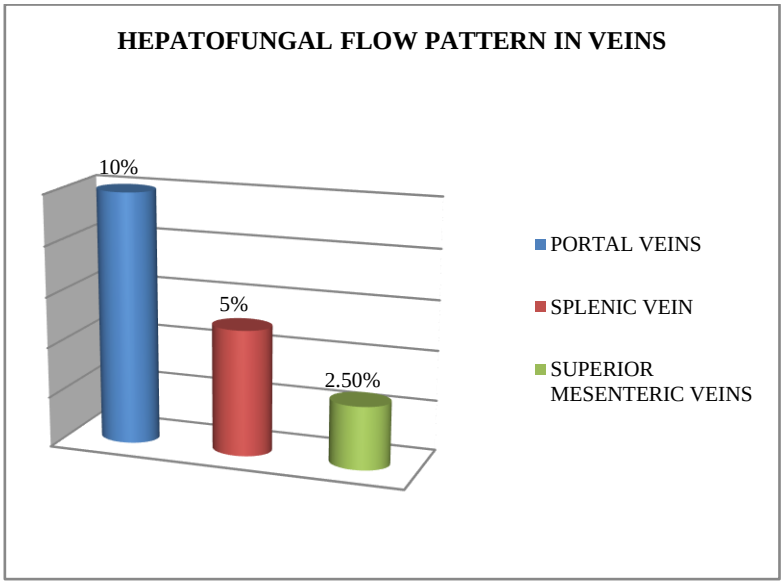


Table no 6 : SHOWS THROMBUS / ABSENT FLOW.

Veins	Percentage %
Portal veins	22.50 %
Splenic veins	12.50 %
Superior mesenteric vein	10 %

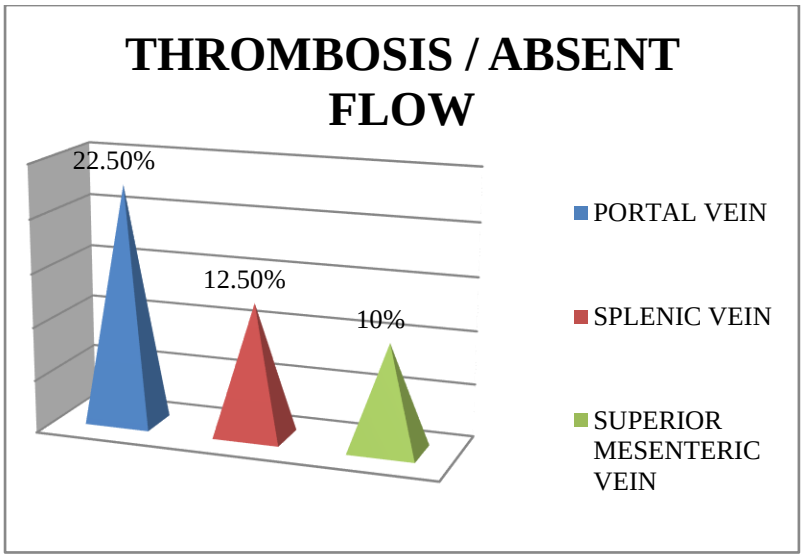


Table no 7 : SHOWS THROMBUS / ABSENT FLOW.

Collaterals	Percentage %
Splenorenal and gastrorenal collaterals	92.50 %
Coronary vein and gastrooesophageal collaterals	62.50 %
Para umbilical collaterals	47.50 %
Cavernoma	10 %
Gall bladder varices	7.50 %

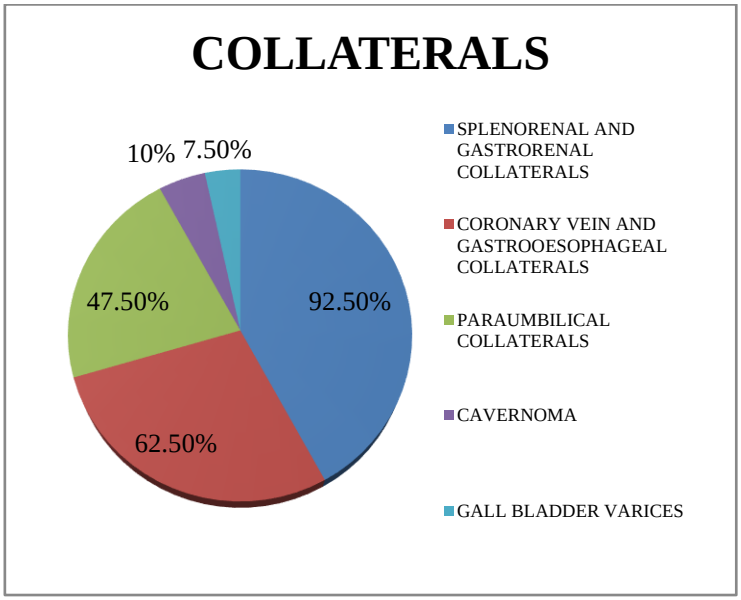
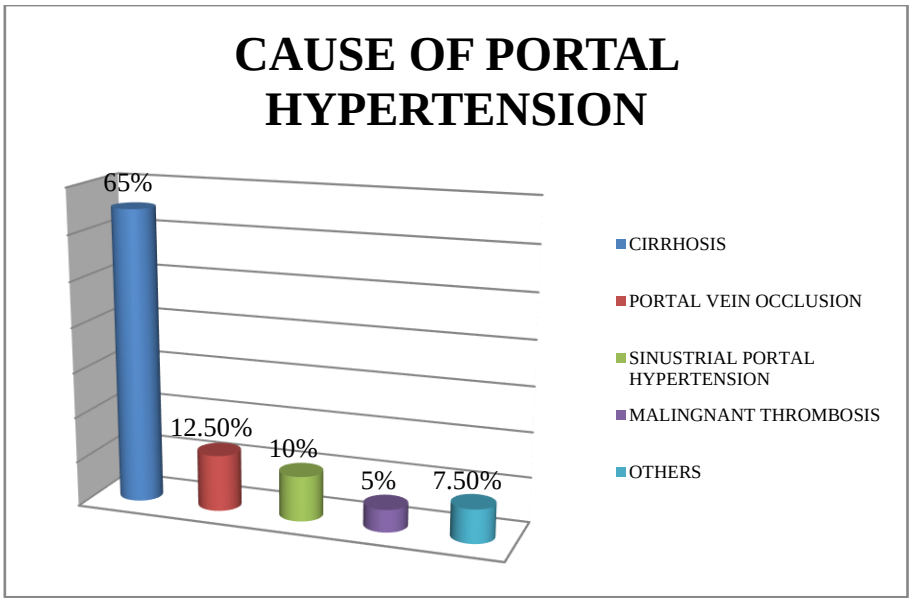


Table no 8 : SHOWS CAUSES OF PORTAL HYPERTENSION.

Collaterals	Percentage %
Cirrhosis	65 %
Portal vein occlusion	12.50 %
Sinustrial portal hypertension	10 %
Malignant thrombosis	5 %
Others	7.50 %



IMAGES

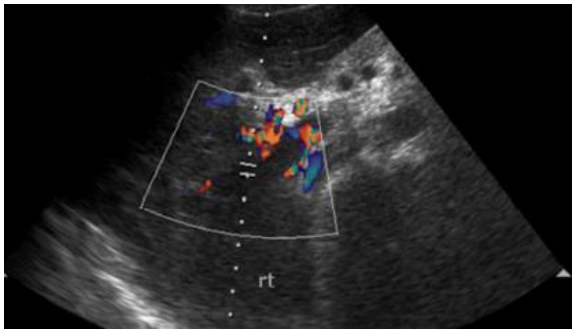


Figure :- 1. Thrombus in right branch of portal vein

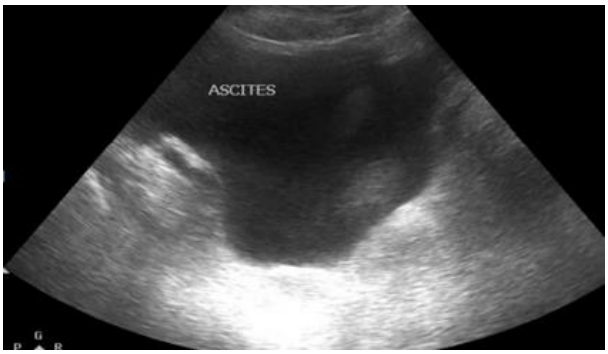


Figure :- 2. Ascites

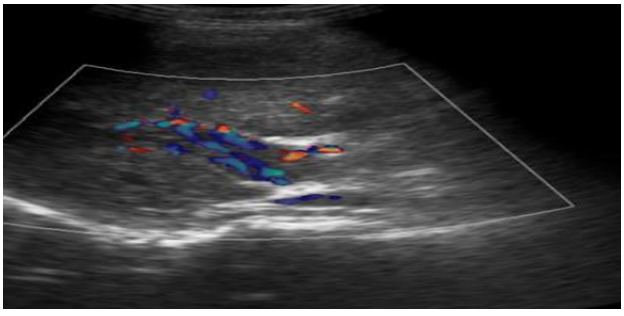


Figure :- 3. Recanalised thrombus in portal vein

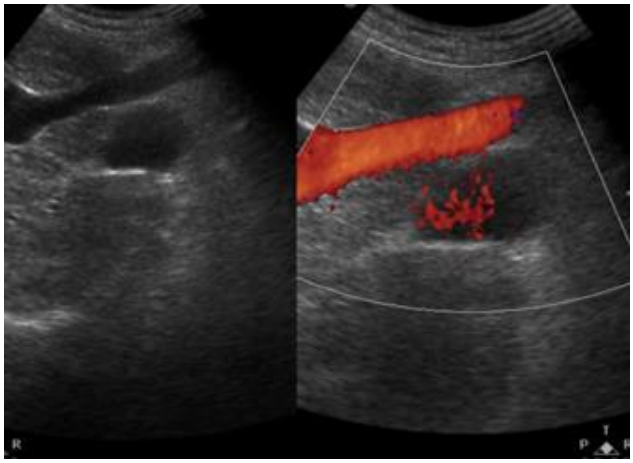


Figure :- 4. Recanalised umbilical vein

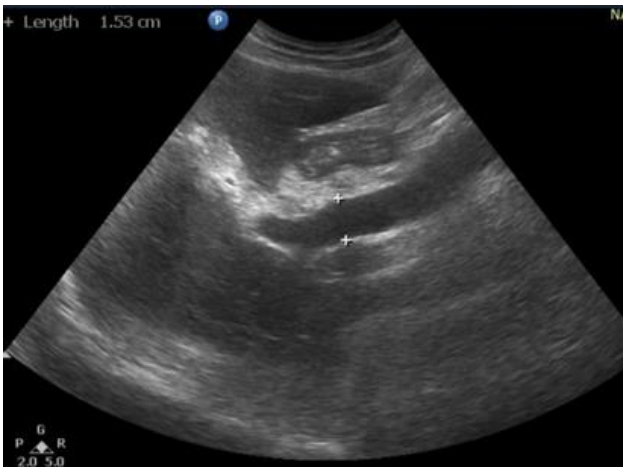


Figure :- 5. Dilated portal vein

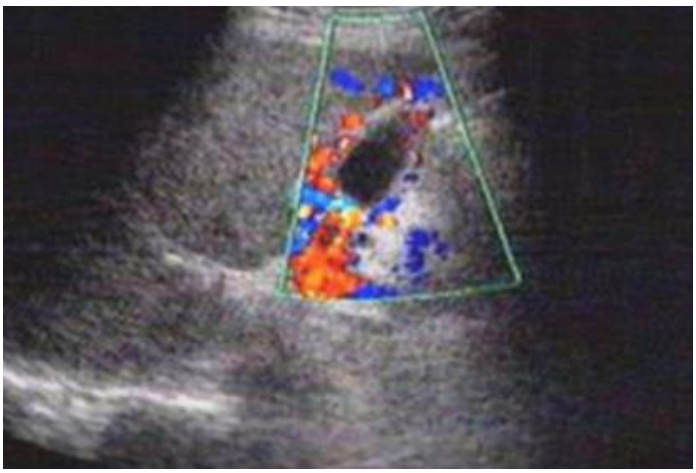


Figure :- 6. Gall bladder collaterals

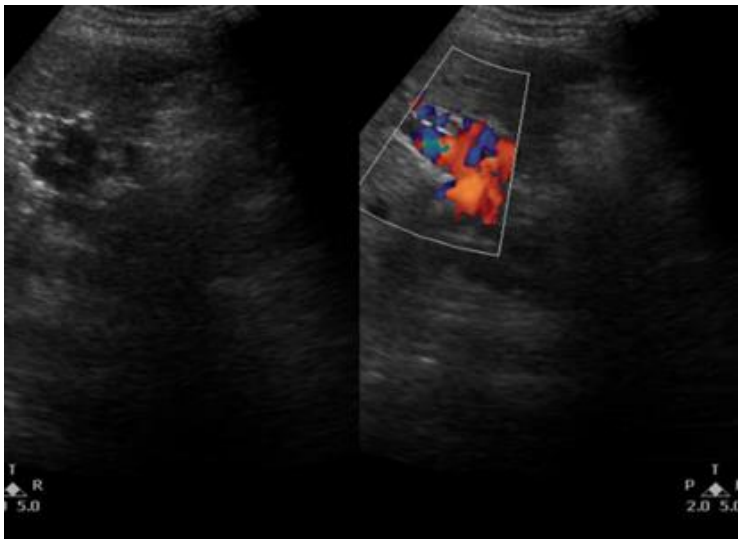


Figure :- 7. Peri portal collaterals

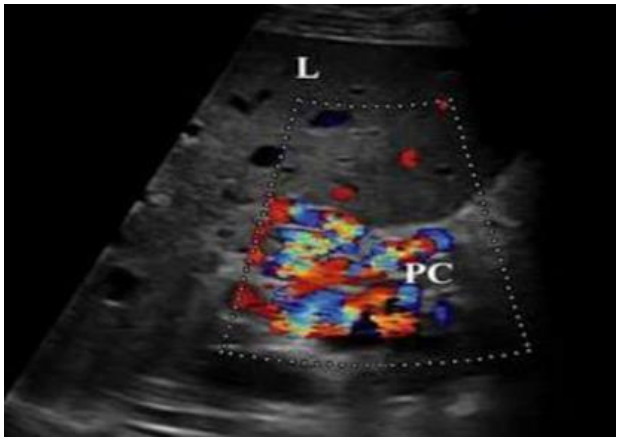


Figure :- 8. Portal cavernoma

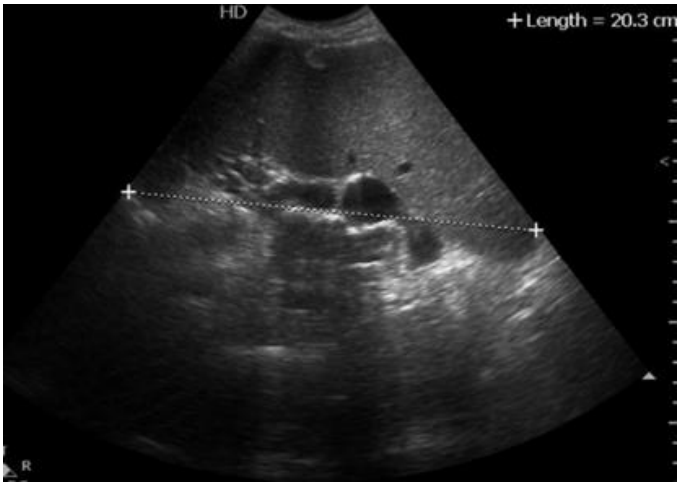


Figure :- 9. Splenomegaly

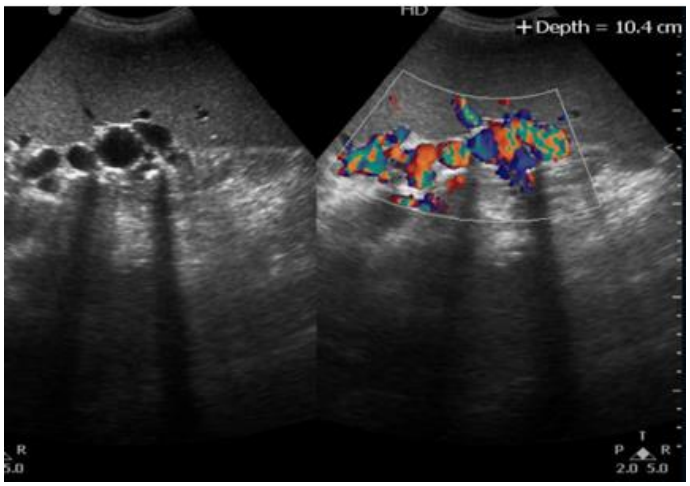


Figure :- 10. Splenic hilar collaterals

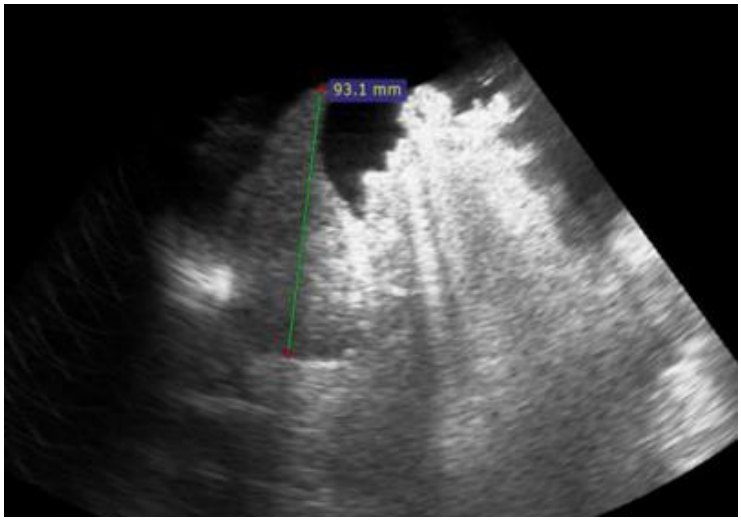


Figure :- 11. Shrunken liver with coarse echotexture with surface irregularity - Cirrhosis

VI. DISCUSSION

The typical portal venous pressure in humans is 5–10 mm Hg. A portal venous pressure of at least 5 mm Hg higher than the pressure in the hepatic veins or inferior vena cava is referred to as portal hypertension. An elevation of 12 mm Hg is considered clinically significant portal hypertension, meaning it is severe enough to create difficulties and require treatment. In chronic liver disease, it is the most prevalent disorder that affects the portal venous system. The development of portal hypertension, a syndrome with several aetiologies, ill-defined pathophysiology, hemodynamic changes, and frequent consequences, is influenced by the rise in resistance to portal and splanchnic blood flow. Sinusoidal, pre-sinusoidal, and post-sinusoidal portal hypertension are all possible. Using an imaging modality to provide an accurate diagnosis can aid in quick treatment. Ascites, portal systemic encephalopathy, and haemorrhage from gastroesophageal varices are three of the most deadly consequences of liver disease that are directly linked to portal hypertension. Numerous collaterals from the high-pressure portal system to the low-pressure systemic circulation form in cirrhotic individuals with portal hypertension, but only a small number of them can result in fatal gastrointestinal bleeding [4]. Therefore, rapid execution of surgical and medical therapy and the prevention of complications are made possible by precise diagnosis. Ultrasound techniques, such as colour doppler imaging or power doppler imaging, are currently the first imaging method of choice for portal hypertension since they are the fastest, least invasive, most expensive, radiation-free, widely available, and easiest to monitor. They also make it possible to accurately search for sequelae such portal vein thrombosis, oesophageal varices, and other collateral channels [5]. Therefore, the goal of the study is to examine the function of ultrasound and colour doppler sonography in the evaluation of portal hypertension and to search for particular features of portal hypertension on these modalities that allow for an accurate diagnosis and the early detection of problems.Portal hypertension is the hemodynamic abnormality frequently associated with serious liver disease. Most lethal complications of liver disease are directly related to it including ascites, portal systemic encephalopathy, haemorrhage (gastro esophageal varices). Thus, duplex ultrasound is an accurate, non-invasive means of assessing its etiology, severity and complications [6].

VII. CONSCLUSION

Portal hypertension is a commonly encountered clinical condition with multiple causes and several sequelae. Study of portal hypertension is important to determine the cause, the severity and possible complications and to decide therapeutic measures. Direct measurement of portal vein pressure is an invasive procedure and may result in complications. Ultrasound Doppler is a non-invasive, highly reproducible and cost effective method for the evaluation of portal hemodynamics. Thus, colour Doppler is best non invasive test to assess portal hypertension, to diagnose and to find out the etiology.

VIII. REFERENCES

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