EVALUATION OF CASES OF PORTAL HYPERTENSION BY COLOUR DOPPLER AND ULTRASONOGRAPHY

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ABSTRACT

BACKGROUND

In adults, the normal portal venous pressure is 5-10 mmHg. Portal hypertension is defined as portal venous pressure of more than at least 5 mmHg greater than the pressure in the hepatic veins or inferior vena cava.[1] Clinically significant portal hypertension, sufficient to cause serious complications and therefore requiring treatment, is defined as an increase of 12 mmHg.

The objective of the study is to study the role of ultrasound and colour doppler sonography in

1. evaluation of portal hypertension,
2. identifying specific features of portal hypertension on these modalities, that permit its accurate diagnosis and
3. detecting the complications at an early stage.

MATERIALS AND METHODS

Forty adult patients referred to the radiodiagnosis department of Sri Lakshmi Narayana Institute of Medical Sciences with clinical diagnosis of portal hypertension were included in study. All patients included in the study underwent ultrasonography (USG) of abdomen using a curvilinear and a sector probe of 3.5-5.0 MHZ coupled with colour Doppler equipment. Statistical analysis was done using percentage and proportions.

RESULTS

The most common age group presenting with portal hypertension was between 51-65 years. The frequency of portal hypertension was more in males. Diameter of portal vein of >13 mm was seen in 53% and <13 mm was seen in 47% cases. Splenomegaly and ascites were frequently associated with portal hypertension.

Thrombosis of veins was more commonly seen in portal vein. Most frequent collaterals were seen in splenorenal and gastro-renal group. Cirrhosis was the most common aetiology. Eight percent of cases showed less than 20% increase in diameter with deep inspiration.

CONCLUSION

Colour Doppler and USG helps in precise evaluation of vascular anatomy in portal hypertension, in establishment of aetiology, haemodynamic changes and detecting its complications.

KEYWORDS

Colour Doppler, USG, Portal Hypertension.

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BACKGROUND

In adults, the normal portal venous pressure is 5-10 mmHg. Portal blood flow is approximately 1000-1200 ml/min. This portal blood flow contributes 75% of the hepatic blood supply.[2] 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 venacava.[1] Clinically significant portal hypertension, sufficient to cause serious complications and therefore requiring treatment, is defined as an increase of 12 mmHg.

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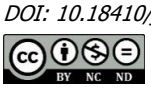

The increase in resistance to portal and splanchnic blood flow contributes to the development of portal hypertension which is a syndrome of various aetiologies, ill-defined pathogenesis, hemodynamic alterations and frequent complications.

Portal hypertension can be sinusoidal, pre-sinusoidal and post sinusoidal. It is a frequent complication and consequence of cirrhosis. 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 oesophageal 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.

In portal hypertension imaging, ultrasound techniques such as duplex doppler or spectral doppler imaging and 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 can permit differentiation of the cause of portal hypertension. They also allow to look for sequelae like portal vein thrombosis, oesophageal varices, other collateral pathways with reasonable accuracy.

Objectives

To study the role of ultrasound and colour doppler sonography in

1. evaluation of portal hypertension
2. identifying specific features of portal hypertension on these modalities, that permit its accurate diagnosis and
3. detecting the complications at an early stage.

MATERIALS AND METHODS

Forty adult patients referred to the radiodiagnosis department of Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry with clinical diagnosis of portal hypertension, from September 2014 to September 2016 were included in this cross-sectional descriptive study. Paediatric, pregnant and traumatic cases were excluded due to some practical and technical difficulties. All patients included in the study underwent USG of abdomen using a curvilinear and a sector probe of 3.5 - 5.0 MHZ coupled with colour Doppler equipment. Philips HD 6 and Philips HD 7 ultrasound machines coupled with colour doppler equipment were used for the study. Statistical analysis was done using percentage and proportions.

RESULTS

The results of this study are presented below in figures and tables.

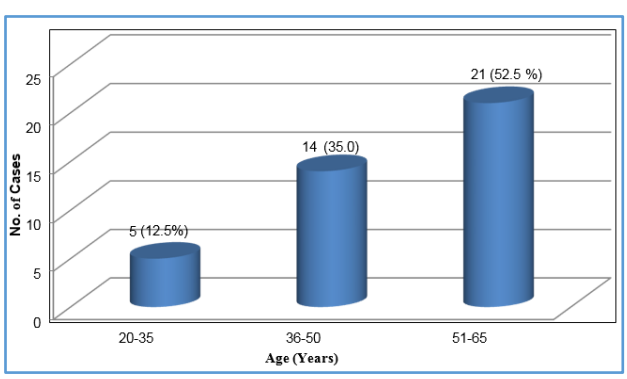

Figure 1. Age Distribution

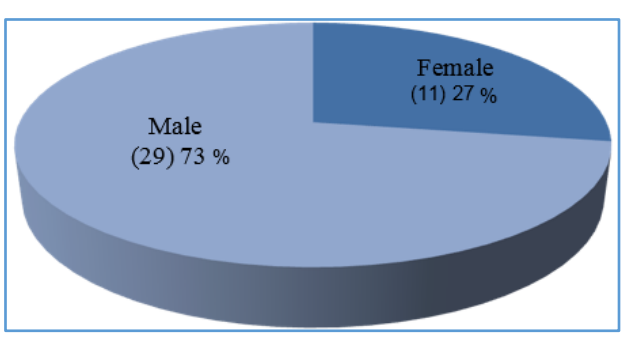

Figure 2. Sex Distribution

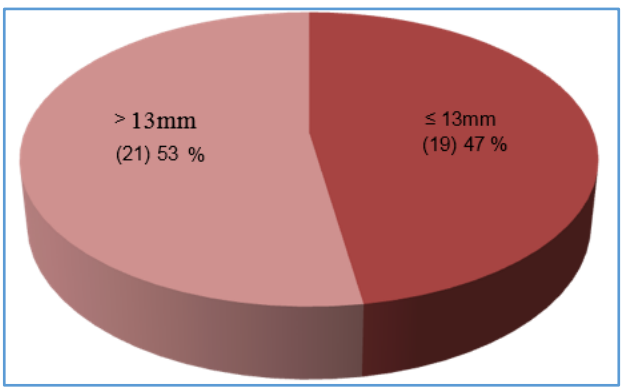

Figure 3. Portal Vein Diameter

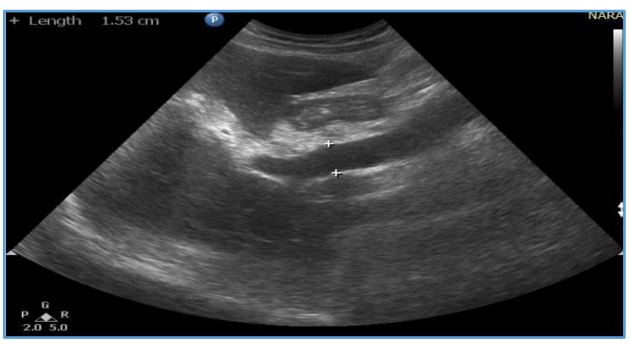

Figure 4. Image of Dilated Portal Vein

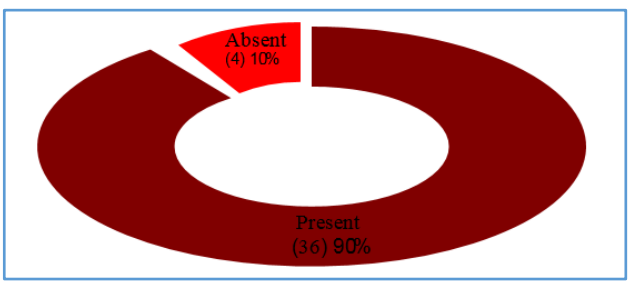

Figure 5. Splenomegaly (>12 cm)

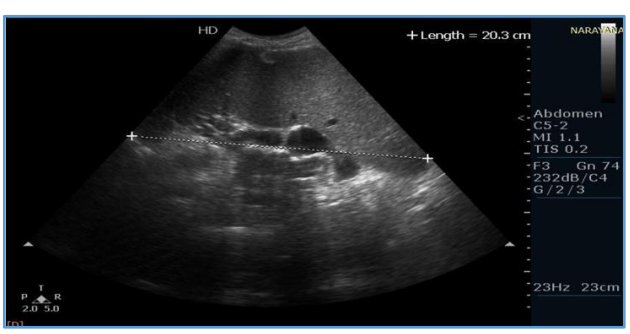

Figure 6. Image of Splenomegaly

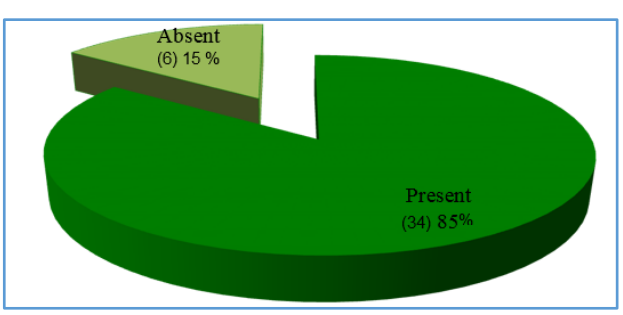

Figure 7. Ascites

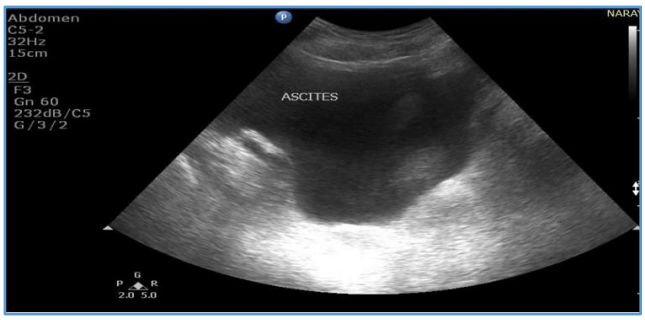

Figure 8. Image of Ascites

Direction of Flow	In Portal Vein	In Splenic Vein	In Superior Mesenteric Vein
	No. of Cases (%)		
Petal	26 (65)	32 (80)	34 (85)
To and Fro	1 (2.5)	1 (2.5)	1 (2.5)
Fugal	4 (10)	2 (5)	1 (2.5)
No flow	9 (22.5)	5 (12.5)	4 (10)

Table 1. Direction of Blood Flow in Various Veins

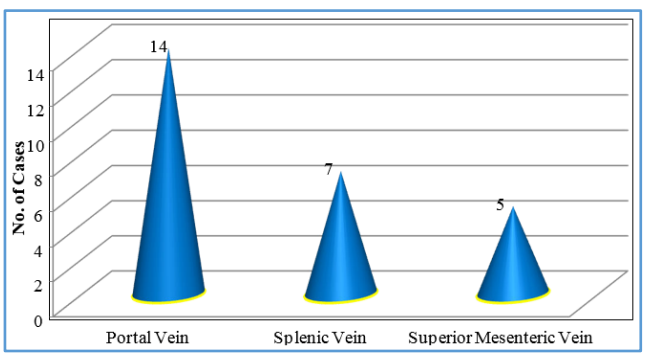

Figure 9. Thrombosis in Veins (n=40)

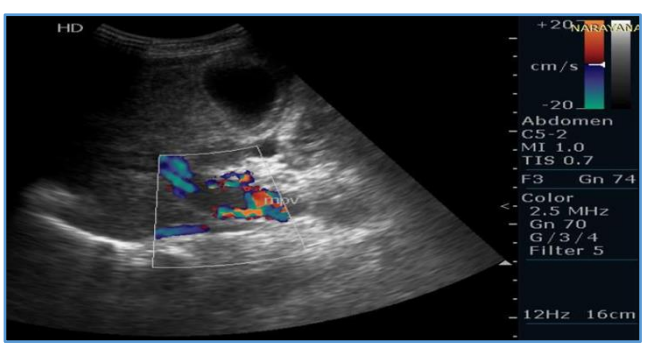

Figure 10. Image of Thrombus in Portal Vein

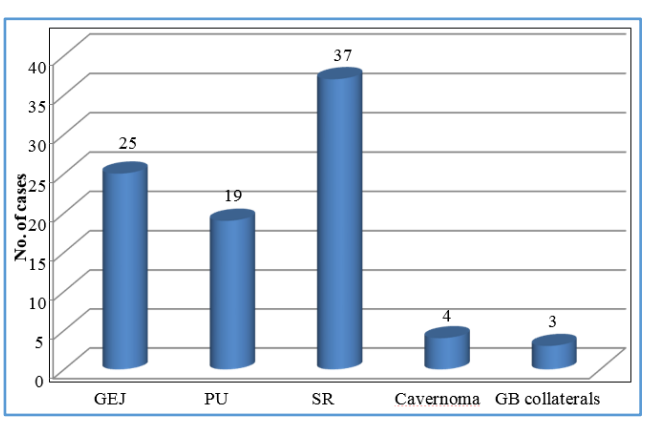

Figure 11. Collateral Veins Seen

GB - Gall Bladder
GES - Gastroesophageal Junction
PU - Paraumbilical Vein
SR - Splenorenal and Gastro Splenic

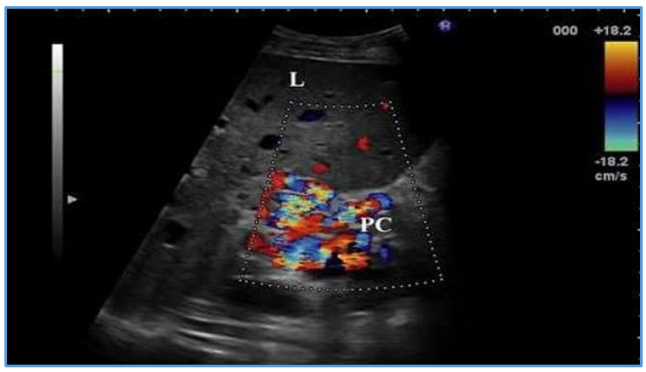

Figure 12. Image of Portal Cavernoma

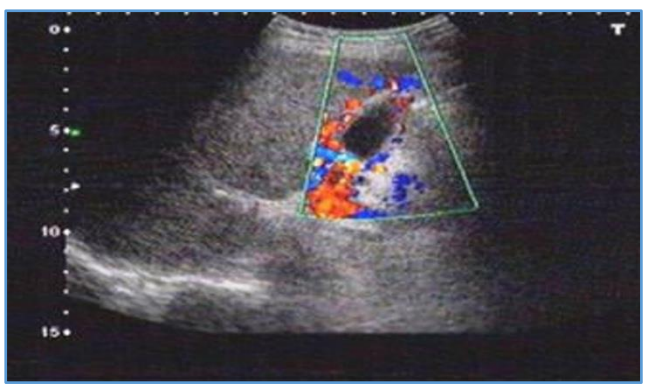

Figure 13. Image of Gall Bladder Collaterals

Aetiology	No. of Cases	Percentage
Cirrhosis (Alcoholic, Viral & other)	26	65.0
Portal vein occlusion	5	12.5
Sinister PHT	4	10.0
Malignancy	2	5.0
Others	3	7.5

Table 2. Aetiology of Portal Hypertension

Sinister Portal Hypertension

Portal hypertension that occurs in occlusion of the splenic vein.

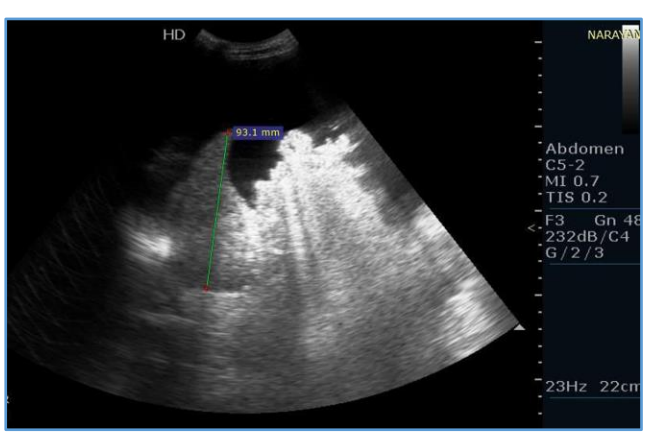

Figure 14. Image of Cirrhosis of Liver

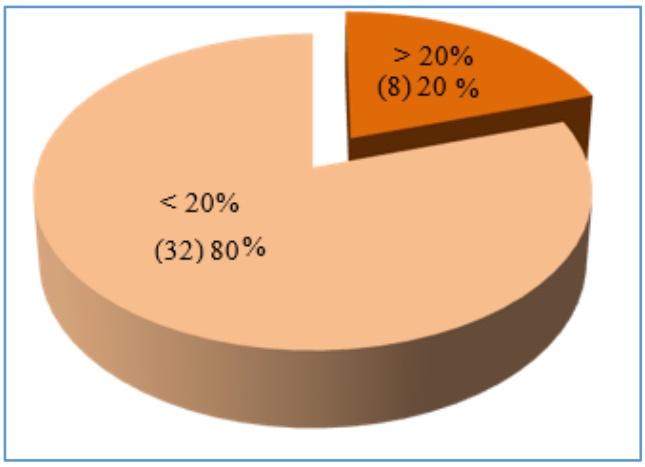

Figure 15. Variation of Portal Vein Diameter with Respiration

DISCUSSION

Portal hypertension is the hemodynamic abnormality frequently associated with serious liver disease, although it is recognized less commonly in a variety of extra hepatic diseases also. Colour doppler and USG being non-invasive, reliable and widely available, is the initial tool for evaluation and diagnosis of portal hypertension, identifying the aetiology and complications. Duplex pulsed doppler is a very versatile modality, which can be used to investigate portal vein abnormalities in a non-invasive manner. The portal vein, hepatic veins and hepatic artery can be easily identified by their Doppler signatures. Portal flow is a low velocity flow, which changes slightly with respiration. If audible signals are recorded, they typically have a "windstorm" sound.

In the present study; 40 patients were studied, who were clinically diagnosed as portal hypertension. First, B mode ultrasound was used to look for sonographic changes in the cases such as liver architecture, splenomegaly, presence of ascites, presence of collaterals, thrombosis of any vessels as well as complications, if any. Then, colour and spectral doppler was done in these cases to identify the portal venous anatomy, its diameter, respiratory variations, to confirm various collaterals, and other hemodynamic changes.

Ditchfield et al 2008, studied 118 patients diagnosed as portal hypertension using endoscopy, sonography and Doppler signs. They found that portal vein diameter of ≤13mm was seen in 42% patients and >13 mm in 59%.[3] Our study results of portal vein diameter correlate with the Ditchfield et al 2008. Other workers such as Zoli et al 1985 and Kurol et al 1986, all found in their respective studies that an enlarged portal vein was present in cases of portal hypertension.[4,5] The average sensitivity of all these studies ranged from 60-80%. Chronic thrombosis of portal vein; and development of portosystemic collateral decompressing portal venous pressure may be the reasons for diameter of less than 13mm.

Alexandra von et al 2000, had studied 67 men and 42 women. In this study of 109 cases, 79 cases (73%) showed hepatopetal flow, 10 cases (9%) showed hepatofugal flow, 6 cases (6%) showed bidirectional flow and no flow was detected in 14 cases (12%).[6] The mild discrepancies between our study and Alexandra von et al 2000 may be due to differences in the proportion of patients with advanced disease and limited sample size.

According to a study conducted by Bolondi et al 1984, an increase of less than 20% in diameter of portal vein with deep inspiration indicates portal hypertension with sensitivity of 80% and specificity of 100%.[7] The present study results of increase in portal vein diameter with deep inspiration correlates with Bolondi et al 1984.

Gibson et al 1990, studied 111 patients of portal hypertension. They found that sonographically 52% of patients had large spleen and 35% a spleen less than one standard deviation from normal, while further 13% had equivocal splenomegaly. They concluded that splenomegaly is an indirect sign of portal hypertension.[8] In our study and Gibson et al 1990, splenomegaly is a very common finding in portal hypertension.

In study conducted by Kadir et al 1981, in 38 cases, 32 cases (85%) showed gastroesophageal junction (GEJ) collaterals, 38 cases (100%) showed para umbilical vein and 3 cases (10%) showed short gastric collaterals.[9] Our study findings correlate with Kadir et al 1981.

According to the study in 63 patients by Nanjaraj et al 2016, ascites was seen in 55 (87.3%) out of 63 cases and 8 (12.7) out of 63 cases did not show ascites.[10] In our study, 85% of cases had ascites and 15% of cases did not have ascites. The above results showed that there is close correlation in both the studies. Thus, ascites is a significant finding in portal hypertension.

According to the study by Nanjaraj et al 2016, in 63 cases; 48 cases of cirrhosis, 12 cases of portal vein occlusion and 2 cases of malignancy were the case of portal hypertension.[10] Our study findings regarding the aetiologies of portal hypertension correlate with Nanjaraj et al 2016. In the present study, Cirrhosis was the most frequent cause, which was seen in 65% cases.

Nanjaraj et al 2016, studied 63 cases with different forms of portal hypertension. In this study, majority of the cases were in the age group of 40-49 years (46%). Next common age group was 50-59 years with 30% of cases under this age group. 16% of cases were more than 60 years of age. Least common age group was 30-39 years with 8% of cases in this age group.[10] It is observed that in our study, portal hypertension is more common in the elderly age group of above 45 yrs. of age and less common in age group of <40 years which correlates with Nanjaraj et al 2016 study.

In a study of 82 patients with cirrhosis of liver by Lopamudra et al. It was observed that 68% were males and the rest 32% were females.[11] In our study, it is seen that 73% were males and 27% were female patients. Higher incidence of alcohol consumption in males leading to cirrhosis, which is the most common cause of portal hypertension in both the studies.

CONCLUSION

Ultrasound is a well-established, non-invasive, highly reproducible and cost-effective diagnostic modality for

assessment of portal hypertension. Addition of colour and spectral doppler of portal venous system reveals various hemodynamic changes with accuracy. It also helps in precise evaluation of vascular anatomy in portal hypertension, in establishment of aetiology, hemodynamic changes and detecting its complications early.

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