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Radiology

Role of Ultrasound Color Doppler in Portal Hypertension

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Abstract: Portal hypertension is defined as portal venous pressure greater than 12 mmHg. The signs of cirrhosis causes can be divided into presinusoidal, sinusoidal, and post sinusoidal. Pre sinusoidal causes include extrinsic compression of portal vein and schistosomiasis. Sinusoidal causes include cirrhosis Ultrasonography with colour Doppler helps in evaluation of portal hypertension. It can permit differentiation of sinusoidal, pre or post sinusoidal cause of portal hypertension. It also allows to look for sequelae like portal vein thrombosis, oesophagealvarices with reasonable accuracy.Colour Doppler sonography is a non-invasive, cost-effective, require no radiation, it is most rapid, widely available and easy to follow up and presently the initial imaging of choice. Hence purpose of study is to study the role of colour Doppler sonography in portal hypertension.
Keywords: Portal hypertension, cirrhosis, colour doppler.

INTRODUCTION

Portal hypertension is defined as portal venous pressure greater than 12 mmHg. Haematemesis is the commonest presenting symptom. The signs of cirrhosis such as spider naevi, pamar erythema, Jaundice may be present.Causes can be divided into presinusoidal, sinusoidal, and post sinusoidal pre sinusoidal causes include extrinsic compression of portal vein and schistosomiasis. Sinusoidal causes include cirrhosis. Post sinusoidal causes include buddchiari syndrome, hepatoveno occlusive disease and right heart failure or biventricular failure. 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 majority of cases portal hypertension is seen as a major complication of cirrhosis. It can further lead to life threatening complications like variceal bleeding acute or chronic hepatic encephalopathy. So accurate diagnosis helps in timely implementation of surgical and medical management and thus prevents complication. Before the advent of ultrasonography X ray and barium studies are investigations of choice. However these studies are superceded by upper GI endoscopy. In upper GI endoscopy GI varices can be best visualized and grading will be done according to their size. Larger varices are more likely to bleed than smaller varices. Ultrasonography with colour Doppler helps in evaluation of portal hypertension. It can permit differentiation of sinusoidal, pre or post sinusoidal cause of portal hypertension. It also allows looking for sequelae like portal vein thrombosis, oesophageal varices with reasonable accuracy. Colour Doppler sonography is a non-invasive, cost-effective, require no radiation, it is most rapid, widely available and easy to follow up and presently the initial imaging of choice. Hence purpose of study is to study the role of colour Doppler sonography in portal hypertension. CT is done for better visualization of retroperitoneal and mesenteric collaterals and to look for cause of portal hypertension. MR images can show collaterals well as a signal void or flow related enhancement respectively. Spleno-portovenography and trans-hepatic portography are used. These procedures have the disadvantage of being invasive but they are indicated before surgical procedures to correct portal hypertension to provide an anatomical roadmap for the surgery.

AIM AND OBJECTIVES

- 2D ultrasound findings in portal hypertension.
- To know the spectrum of colourdopplersonographic findings in portal hypertension.
- To study flowmetric changes in portal hypertension.

- To look for presence of various portosystemic collaterals.
- To compare with previous studies.

METHODOLOGY

This study was conducted in the Department of Radio-Diagnosis at SreeBalaji Medical College and Hospital, Chrompet, chennai in 50 patients all patients referred to the department of radiodiagnosis with the clinically diagnosed cases of portal hypertension. Duration of study from August 2016 to September 2017. 50 cases of clinically diagnosed portal hypertension cases were included in this study. Cross sectional study was performed.

Inclusion Criteria

All cases with clinical diagnosis of portal hypertension. Adult cases (cases in the age group of 20-65>)

Exclusion criteria

Paediatric age group cases, Pregnantcases, Traumatic cases

Tools used

All patients included in the study underwent ultrasonography of abdomen using a curvilinear probe of 3.5-5.0 MHZ with colour Doppler.

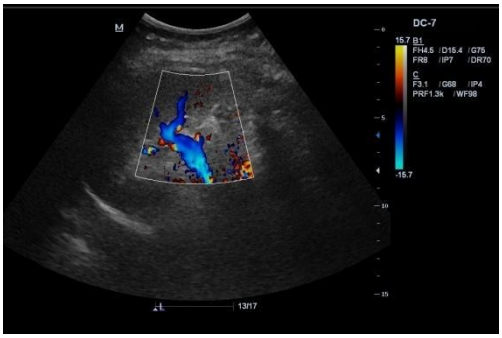
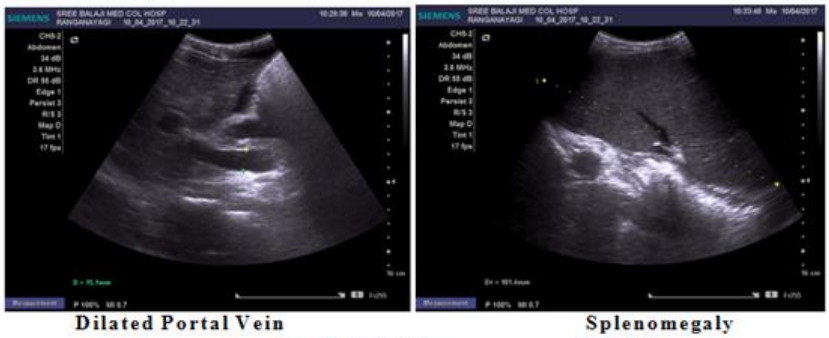
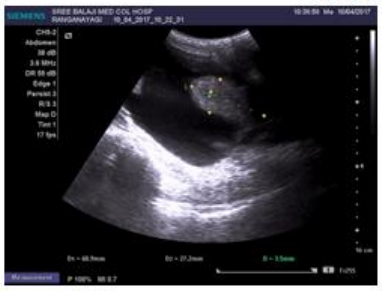


Fig-1: Cavernoma formation- shows multiple tortuous vessels near the hilum



Dilated Portal Vein

Splenomegaly



Ascities

Fig-2

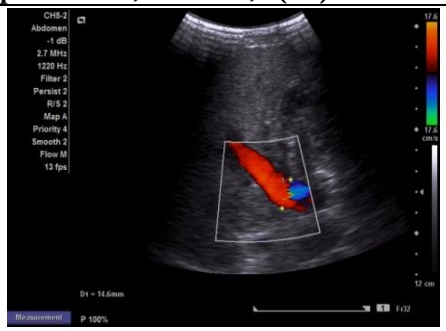


Fig-3: Ascities

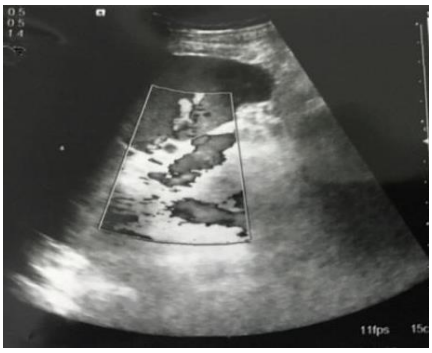


Fig-4: Thrombosed Portal Vein

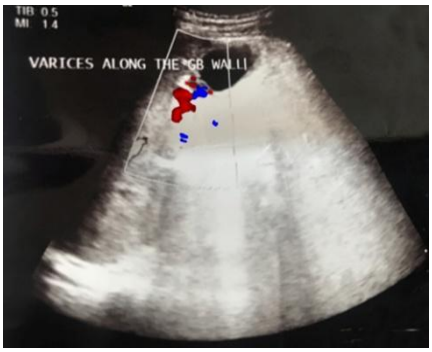


Fig-5: GB Wall Varices

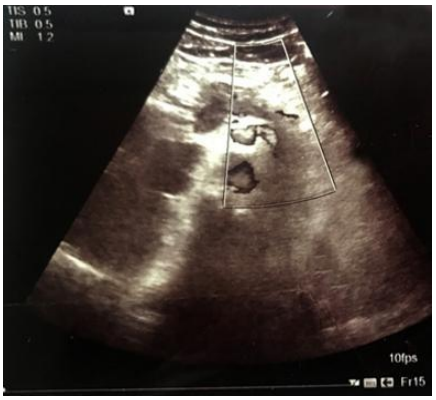


Fig-6 Thrombus seen in distal part of splenic vein and superior mesenteric vein

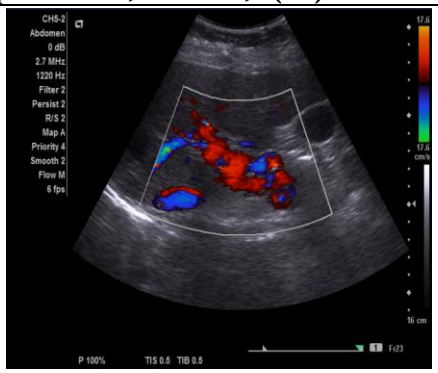


Fig-7: Multiple tortous vessels seen along the portal vein-cavernous malformation

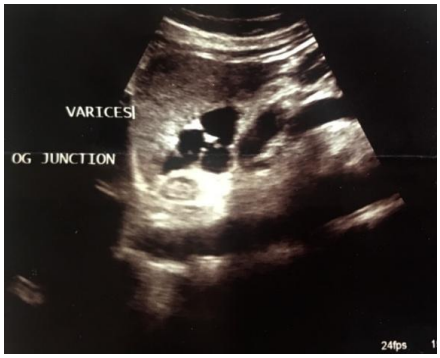


Fig-8: Multiple Varices Noted in Periesophageal Junction

Statistical test used

Statistical analysis was done using percentage and proportions.

OBSERVATIONS AND RESULTS

Table-1: Age distribution

Age	No of Persons	%
20-35	9	18
36-50	20	40
51-65>	21	42
Total	50	100

50 cases were studied. The most common age group presenting with portal hypertension was between 51-65> years 42%. Patients under 36-50 years age group were 40% and only 18% were presented in age group 20-35 years.

The frequency of portal hypertensive patients was more in males. Males accounted for 74% as compared to 26% of female patients (Table-2).

Diameter of portal vein of > 13mm was seen in 60% cases. Less than 13mm was seen in 40% cases (Table-3).

Table-2: Sex distribution

Gender	No of Persons	%
Female	13	26
Male	37	74
Total	50	100

Table-3: Portal vein diameter

Diameter	No of Persons	%
<13mm	20	40
>13mm	30	60
Total	50	100

Table-4: Splenomegaly

Splenomegaly	No of Persons	%
Present	39	78
Absent	11	22
Total	50	100

In this study splenomegaly was frequently associated with portal hypertension. Splenomegaly > 13cm was 78% of individuals (Table-4).

Ascites is a frequent finding in portal hypertension. It is seen in 86% of cases (Table-5).

Out of 50 cases 37 cases i.e 74% showed centripetal flow, 3 cases showed centrifugal flow i.e 6%, 1 case showed to and fro flow i.e 2% No flow in 9 cases i.e 18% (Table-5).

Table-5: Ascites

Ascites	No of Persons	%
Present	43	86
Absent	7	14
Total	50	100

Table-6: Flow in portal vein

Flow in portal vein	No of Persons	%
Petal	37	74
To and fro	1	2
Fugal	3	6
No flow	9	18
Total	50	100

Table-7: Flow in splenic vein

Flow in splenic vein	No of Persons	%
Petal	44	88
To and fro	1	2
Fugal	1	2
No flow	4	8
Total	50	100

44 cases out of 50 cases showed flow direction towards liver i.ehepatopetal flow (88%), 1 case (2%) showed hepatofugal flow, 1 case (2%) showed to and fro bidirectional flow. However 4 cases (8%) showed no flow due to thrombosed vein (Table-7).

Table-8: Direction of flow in superior mesenteric vein

Flow	No of Persons	%
Petal	46	92
To and fro	1	2
Fugal	1	2
No flow	2	4
Total	50	100

In SMV most frequent flow pattern was hepatopetal corresponding to 92%. Bidirectional and hepatofugal flow were detected in one case each. They correspond to 2%, 2%, and 4% show no flow (Table-8).

Thrombosis of vein was more common in portal vein seen in 28%. Splenic vein showed 8% of thrombosis. Thrombosis in SMV was less frequent than above two veins, corresponding to 4% (Table-9).

Table-9: Thrombosis in veins

Thrombosis in Veins	No of Persons	%
Portal vein	14	28
Splenic vein	4	8
Superior mesentric	2	4

Table-10: Thrombosis in veins

Collaterals	No of Persons	%
GEJ	22	44
PU	20	40
SR	38	76
Cavernoma	3	6
GB	5	10

Most frequent collateral were seen in splenorenal group in 76% cases. GEJ collaterals corresponded to 44% and Gallbladder varices noted in 10% Least frequent was cavernoma seen 6% cases.

Table-11: etiology

Etiology	No of Persons	%
Cirrhosis (alcoholic, Viral & others)	35	70
Portal vein occlusion	5	10
Sinister PHT	2	4
Malignancy	3	6
Others	5	10
Total	50	100

In this study, most common etiology was cirrhosis seen in 35 cases 70%. Portal vein occlusion of benign etiology was seen in 10% cases. Sinistral portal Hypertension 4%, malignancy causing venous occlusion were seen in 6%. Other rare causes seen in 10% cases.

Table-12: Variation in pv diameter

Variation In PV Diameter	No of Persons	%
>20%	10	20
<20%	40	80
Total	50	100

Variation with respiration of portal vein was studied. 80% of cases showed less than 20% increase in diameter with deep inspiration. Only 20% cases had respiratory increased diameter greater than 20% .

DISCUSSION

Portal hypertension is one of serious and debilitating condition. It results from various causes, but cirrhosis being most frequent of all. Colour Doppler ultrasonography being noninvasive reliable and widely available, is initial tool for evaluation and diagnosis of portal hypertension, finding out etiology and its complications.

Splenomegaly and ascites are associated with portal hypertension. Portosystemic collateral, are almost always associated with portal hypertension. Lienorenal and gastro renal, GEJ and paraumbilical veins were more frequent. Cirrhosis is by far the most common cause for portal hypertension. Hence colourdoppler ultrasonography is non investigation tool which shows various spectrums of findings, flow metric changes and collaterals accurately in portal hypertension.

In this study, we studied 50 patients, who were clinically diagnosed as portal hypertensive and confirmed on ultrasound and Doppler study and studied flow patterns in portal vein and collaterals.

Age and sex distribution

Majority of cases were in the age group of 51-65 tears i.e. 52.5%. Next frequency was 35.5% in 36-50 years age. Males were affected more than females, alcohol consumption leading to cirrhosis and portal hypertension.

Portal vein

Normal portal vein diameter is 13mm. Portal vein diameter over 13mm is indicative of portal hypertension in 60-70% cases. Portal vein show >20-30% increase in diameter with food and inspiration. In portal hypertension variation with respiration will be <20%.

Bolondi *et al.* an increase or less than 20% diameter of portal vein with deep inspiration indicates portal hypertension with sensitivity of 80% and specificity of 100%. In this study we had 80% of cases which showed diameter change of less than 20%. Our study correlates with above studies[1]. The velocity in the portal vein is approximately 15-18 cm/sec with a lot of variation in the range. Portal flow velocity varies with the cardiac activity and respiration giving the portal waveform an undulating appearance.

Bradley Koslin in his series of 50 cirrhotics and 25 controls found the normal velocities ranging from 8-18 cm/sec in adults and 10-30 cm/sec in

children. With the development of portal hypertension the flow decreases and the velocity fluctuations disappear (i.e., flow becomes continuous. The velocity decreases in cases where there is increased resistance to the portal blood flow as postulated by Patriquin and Bradley Koslin[2].

Increased pulsatailty of portal vein i.e exaggerated pulsatality with minimum velocity below base line is seen in portal hypertension, tricuspid regurgitation and right heart failure. Reversal of flow pattern seen in advanced portal hypertension, portosystemic shunt. Ditchfield *et al.* studied 118 cases of portal hypertension that were diagnosed using specific endoscopic sonographic and Doppler signs. They found that reversed flow in portal vein was seen in 3.4-7.3% cases. In this study Hepatofugal flow was seen in 7.5% which is correlating with this study [3].

HEPATIC VEIN

Normal hepatic veins- wave form is triphasic and. Contain 3wave form- atrial systole, ventricular systole, and atrial diastole. Ventricualr systole will be greater than atrial diastole. Dampening index of hepatic vein waveform is less than 0.6 and in portal hypertension more than 0.6.

Biphasic flow in buddchiarri syndrome, cirroshis, ascites, metastases and healthy individuals and monophasic flow in buddchiari syndrome, cirrhosis.

HEPATIC ARTERY

Meaurement of hepatic artery should be taken from 2 cms distal to its origin from celiac trunk. Normal hepatic artery show low resistance flow and in end stage liver disease reversal or decrease diastolic flow is seen. According to Chawla *et al*. reversal of flow seen in hepatic artery in end stage liver disease [4].

Splenomegaly

Ultrasonography shows upto 95% sensitivity and upto 98% specificity in measuring spleen. Gibson *et al*. studied 111 patients of portal hypertension. They found that sonographically 70-80% of patients had definitely large spleen and 15-20% cases spleen less than one standard deviation from normal. They concluded that splenomegaly is an intensive sign of portal hypertension [5]. In this study we had 85% of cases showing splenomegaly and 15% did not show enlarged spleen which is correlating with this study.

Collaterals

Chawla *et al.* studied one hundred and two patients with different forms of portal hypertension and found that frequency of gallbladder varices was between 13-24% in different forms of portal hypertension [4]. And Subrananyam *et al.* studied 40 cases with portal hypertension splenorenal collaterals were seen in 88% of cases and GEJ collateral, seen in 64% cases[6]

In this study various collateral, were seen GEJ (gastroesophagealvarices and coronary vein) collateral seen in 55% cases, SR (splenorenal and gastro renal) seen in 95% cases, Cavernoma formation was seen in 7.5% cases and 12.5% cases showing gall bladder varices which is correlating with the studies.

Etiology

In this study the most frequent etiology was cirrhosis, which was seen in 62.5% cases. It included alcoholic, viral and other rms cirrhosis. Next frequent cause was portal vein occlusion (12.5%) Malignancies, like HCC and pancreatic carcinoma arecausing thrombosis of portal vein, SMV and SPLV in 7.5%, of cases. 5% of cases were having isolated left sided, sinistral portal hypertension.

CONCLUSIONS AND SUMMARY

- Colour Doppler is best noninvasive test to assess portal hypertension to diagnose and to find out etiology.
- 50 cases of portal hypertension were studied using colour Doppler ultrasonography. Various parameters of portal hypertension were observed spectrum of sonographic and colour Doppler findings, flow metric changes and collateral, were assessed.
- Portal vein diameter >13 mm was seen in 60% of cases. Though portal hypertension has PV diameter >13 mm, its 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
- Splenomegaly and ascites are most of time associated with portal hypertension. It was seen in 78% and 86% cases respectively.
- Most frequent flow type in veins was hepatopetal 74% of PV flow, 88% of SPLV and 92% of SMV showed hepatopetal flow.
- Hepatofugal flow was seen in 6%, 2%, 2% cases in PV, SPLV and SMV respectively.
- Bidirectional flow was least frequent and was seen in 2% of cases in all veins.
- Absent flow seen in 18% of PV, 8% SPLV and 4% SMV due to thrombosed veins.
- Thrombosis of veins, which was accurately diagnosed using ultrasonographic, colour and spectral study, was seen in around 28%, 8% and 4% cases in PV, SPLV and SMV respectively.
- Most frequent collateral group was splenorenal and gastrorenal group in 76% cases. GEJ collaterals seen in 44% and paraumbilical collateral noted in 40%. GB varices, were less frequent being seen in 10% cases, However least frequent was cavernoma formation seen in only 6% cases.
- In this study cirrhosis was most common cause for portal hypertension. It was seen in 70% cases being portal venous occlusion was seen in 10% case, whereas sinistral / left sided portal hyprtension 4%,

malignancy 6% causing PV thrombosis and other etiology were seen in 10%.

- Cirrhosis is by far the most common cause for portal hypertension. Hence colour doppler ultrasonography is noninvasive investigation tool which shows various spectrum of findings, flow metric changes and collaterals accurately in portal hypertension.

REFERENCES

1. Bolondl L, Mazziotti A, Arienti V. Ultrasonographic study of portal venous system in portal hypertension and after portosystemic shunt operations. Surg 1984;95:261.
2. Koslin B. Duplex Doppler in portal hypertension. Semin - Ultrasound and CT, MR 1992;13:22-33.
3. Ditchfield MR, Gibson RN, Donlan JD, Gibson PR. Duplex Doppler ultrasound signs of portal hypertension: relative diagnostic value of examination of paraumbilical vein, portal vein and spleen. Journal of Medical Imaging and Radiation Oncology. 1992 May 1;36(2):102-5.
4. Chawla A, Dewan R, Sarin SK. The frequency and influence of gallbladder varices on gallbladder functions in patients with portal hypertension. American Journal of Gastroenterology. 1995 Nov 1;90(11).
5. Gibson PR, Gibson RN, Ditchfield MR, Donlan JD. Splenomegaly-an insensitive sign of portal hypertension. Aust NZ J Med 1990 Dec.;20(6):77
6. Subramanyam BR, Balthazar EJ, Madamba MR, Raghavendra BN, Horii SC, Lefleur RS. Sonography of portosystemic venous collaterals in portal hypertension. Radiol 1983;146:161-166.