ROLE OF COLOUR DOPPLER ULTRASONOGRAPHY IN THE EVALUATION OF PORTAL VENOUS HYPERTENSION

INTRODUCTION
Portal hypertension is the hemodynamic abnormality frequently associated with serious liver disease, although it is recognized less commonly in a variety of extrahepatic diseases also. 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 gastroesophageal varices.

Portal hypertension can be sinusoidal, pre sinusoidal and post sinusoidal. Accurate diagnosis by imaging modality can help in prompt treatment. 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.

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, 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.

OBJECTIVES
1. To know the spectrum of colour Doppler sonographic findings in portal hypertension.
2. To study flow metric changes in portal hypertension.
3. To look for presence of various portosystemic collaterals.

METHODOLOGY
Study location:
The main source of data for the study are, patients from ASRAM Medical College, Eluru.

Study population:
All patients referred to the department of radio diagnosis with the clinically diagnosed cases of portal hypertension, in a period of 2 years from November 2017 to November 2019 were subjected for the study. 40 cases of portal hypertension were studied.

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METHODS:
Forty portal hypertensive patients were studied using colour Doppler ultrasonogram from ASRAM Medical College, Eluru. Gray scale and colour Doppler along with duplex Doppler was used to study flow metric changes collaterals and other findings.

RESULTS:
Majority of cases were in the age group 51-65 years with males being predominantly affected. Dilated portal vein was seen in 55% of cases. Hepatopetal, hepatofugal and bidirectional flow was seen in 60-85%, 7.5-10% and 2.5% of cases in different veins. 15-30% of veins showed thrombosis. Splenomegaly and ascites were seen in 87.5% and 77.5% respectively. Most frequent collaterals were gastroplenic and splenorenal group. The most common cause of aetiology was cirrhosis.

CONCLUSION:
Colour Doppler ultrasonography detects various findings like dilated portal vein, respiratory variation, flow direction, splenomegaly and ascites accurately. It helps also in identifying the aetiology.

KEYWORDS:
Portal hypertension; Hepatofugal flow; portosystemic collaterals; colour Doppler ultrasound.
Thrombosis of vein was more common in portal vein seen in 30%. Splenic vein showed 22.5% of thrombosis. Thrombosis in SMV was less frequent than above two veins, corresponding to 15%.

Table 2: Distribution of study participants according to ultrasound findings (N=40)

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>No.of cases</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portal vein diameter</td>
<td>&lt;13 mm</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>&gt; 13 mm</td>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>Variation of portal vein</td>
<td>&gt;20%</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>diameter with respiration</td>
<td>&lt;20%</td>
<td>34</td>
<td>85</td>
</tr>
<tr>
<td>Splenomegaly</td>
<td>Present</td>
<td>35</td>
<td>87.5</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>Ascites</td>
<td>Present</td>
<td>31</td>
<td>77.5</td>
</tr>
<tr>
<td></td>
<td>Absent</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td>Thrombosis</td>
<td>Portal vein</td>
<td>12</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Splenic vein</td>
<td>9</td>
<td>22.5</td>
</tr>
<tr>
<td></td>
<td>Superior mesenteric vein</td>
<td>6</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3 represents the direction of flow in portal, splenic and superior mesenteric veins.

**Portal vein:** The flow direction in portal vein is predominantly hepatopetal in 24 patients corresponding to 60% of cases. However 25% patients showed no flow due to complete thrombosed vein. Partially thrombosed / recanalised veins showed peripheral petal flow.

**Splenic vein:** 75% cases showed flow direction towards liver i.e. hepatopetal, 3 cases (7.5%) showed complete hepatofugal flow, whereas 1 case (2.5%) showed to and fro bidirectional flow. However 6 cases (15%) showed no flow due to complete thrombosed vein. Partially thrombosed / recanalised veins showed peripheral petal flow.

**Superior Mesenteric Vein:** In SMV most frequent flow pattern was hepatopetal corresponding to 85%. Bidirectional and hepatofugal flow were detected in one case each. They correspond to 2.5% each. 4 cases (10%) showed no flow.

Table 3: Distribution of study participants according to flow metric patterns in veins (N=40)

<table>
<thead>
<tr>
<th>Direction Of Flow</th>
<th>Portal Vein</th>
<th>Splenic Vein</th>
<th>Superior Mesenteric Vein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Petal</td>
<td>24 (60)</td>
<td>30 (75)</td>
<td>34 (85)</td>
</tr>
<tr>
<td>To and fro</td>
<td>1 (2.5)</td>
<td>1 (2.5)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Fugal</td>
<td>5 (12.5)</td>
<td>3 (7.5)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>No flow</td>
<td>10 (25)</td>
<td>6 (15)</td>
<td>4 (10)</td>
</tr>
</tbody>
</table>

*Note: Numbers within brackets indicate percentages*

Most frequent collateral were seen in splenorenal and gastro renal group in 90% cases. Coronary vein and GEJ collaterals corresponded to 60% and Paraumbilical vein was seen in 50% cases. Gallbladder varices noted in 12.5%. Least frequent was cavernoma seen in 7.5% cases. (Fig.1)

In our study, most common aetiology was cirrhosis seen in 23 cases (57.5%). Portal vein occlusion of benign aetiology was seen in 12.5% cases. Sinistral portal hypertension, malignancy causing venous occlusion were seen in 10% cases each. Other rare causes seen in 10% cases. (Fig 2)

**DISCUSSION**

Portal hypertension is one of serious and debilitating condition. It results from various causes, but cirrhosis being most frequent of all. It leads to various haemodynamic alterations in body especially abdomen. Colour Doppler ultrasonography being non-invasive reliable and widely available, is initial tool for evaluation and diagnosis of portal hypertension, finding out etiology and looking for its complications.
We studied 40 patients, who were clinically diagnosed as portal hypertensive and confirmed on ultrasound and Doppler study.

Age and sex distribution
Majority of cases were in the age group of 51-65 years i.e. 47.5%. Next frequency was 37.5% in 36-50 years age. Males were affected more than females, 77.5% males as against 22.5% females. This may be due to the higher incidence of alcohol consumption leading to cirrhosis and portal hypertension.

Portal vein diameter
In the present study portal vein diameter above 13mm was seen in 55% of cases. Similar findings were found in studies done in southwest Ethiopia and New York that portal vein diameter >13 mm can be considered fairly characteristic sign of portal hypertension.2

A study done by Ditchfield et al.3 found that portal vein diameter of 13mm was seen in 42% and >13mm in 59% of patients diagnosed as portal hypertension using endoscopy, sonography and Doppler signs. Demosthenes D et al are of the opinion that the portal vein diameter >13mm is indicative of portal hypertension with specificity of 100% and sensitivity of 45-50%.4 Diameter of <13mm was probably due to, development of portosystemic collateral decompressing portal venous pressure; and cases where portal vein was chronically thrombosed.

Flow direction
Ditchfield et al studied 118 cases of portal hypertension diagnosed using specific endoscopic sonographic and Doppler signs. They found that reversed flow in portal vein was seen in 3.4 – 5.3% cases.5 Another study done by Alexandra von et al found direction of portal vein flow was normal in 73%, hepatofugal in 9% and bidirectional in 6% patients.6

Burchardt F et al found that 14.8% of patients had total hepatofugal blood flow which is similar to our findings. In the present study, the direction of flow in portal vein is hepatopetal in 60%, bidirectional in 2.5% and hepatofugal in 12.5%.

The discrepancies with first two studies may be due to differences in the proportion of patients with advanced disease and limited sample size.

Variation in vein diameter with respiration
According to study conducted by Bolondi et al an increase of <20% in diameter of portal vein with deep inspiration indicates portal hypertension with sensitivity of 80% and specificity of 100%.7 RokniYazeli et al found that reduced respiratory changes in diameter <20% for portal vein had higher sensitivity of 89% and specificity of 89%.8 In our study we had 85% of cases which showed diameter change of <20%. Our study correlates with above studies.

Splenomegaly
Among portal hypertension patients, Gibson et al found that sonographically 52% of patients had large spleen, 35% with spleen <1 standard deviation from normal and 13% with equivocal splenomegaly. They concluded that splenomegaly is an intensive sign of portal hypertension.9

According to Demosthenes et al, mild to moderate splenomegaly (>13cm) is a common finding in portal hypertension.10 In our study we had 87.5% of cases showing splenomegaly and 12.5% did not show enlarged spleen.

Collaterals
Kadir et al studied diagnostic value of real time sonography for portal hypertension in 38 patients. The frequency of detection of collaterals compared to percutaneous transhepatic portography, sonography was 85% for coronary (GEJ),100% for paraumbilical and 10% for short gastric vein.11

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.12

Subranyam et al studied 40 cases with portal hypertension and collateral, were seen in 88% of cases and GEJ collateral, seen in 64% cases.13

REFERENCES