


Original Research Article

Study of portal vein diameter by ultrasound and its association with endoscopic findings in patients with liver cirrhosis

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Abstract

Background: The major cause of morbidity and mortality in patients with portal hypertension is due to oesophageal varices. Upper gastrointestinal endoscopy is considered best to detect varices earlier. It's an invasive tool which is expensive and increased financial burden among patients. Hence this study is undertaken to find non-invasive indicators of oesophageal varices in cirrhosis patients with portal hypertension and to establish the role of portal vein diameter determined by ultrasonography in predicting the oesophageal varices.

Aim and objectives: To detect non-invasive indicators of oesophageal varices in chronic liver disease, to determine the relation between oesophageal varices on upper gastrointestinal endoscopy and portal vein diameter, to determine other non-invasive parameters to identify oesophageal varices.

Materials and methods: A cross sectional study on 45 patients, who were diagnosed to have chronic liver disease and are being presented to outpatient department and were admitted in Malla Reddy Institute of Medical Sciences, Suraram over a period of one year under department of general medicine. All the patients with chronic liver disease who underwent upper gastrointestinal endoscopy are included in the study.

Results: 45 patients with cirrhosis of liver were included in the study, among which 32 were males and 13 were females with a mean age group of 46 years. On upper gastrointestinal endoscopy 87% of patients had oesophageal varices while other 13% of patients were normal. Mean portal vein diameter

was 13.8 mm and has a positive linear correlation with $p < 0.01$ and positive predictive value of 95.25%. Majority of patients belonged to the platelet count group of 50,000 to 1lakh and its inversely co related to the severity of varices. Majority of patients with oesophageal varices had moderate splenomegaly.

Conclusion: Ultrasonography of portal vein diameter and spleen size along with thrombocytopenia are reliable, inexpensive and easily reproducible non-invasive tool in predicting the presence of oesophageal varices and hence can identify the patients who require endoscopy on a prophylactic basis.

Key words

Portal vein, Diameter, Ultrasound, Endoscopic findings, Liver cirrhosis.

Introduction

Cirrhosis is characterized by distortion of hepatic architecture causing progressive, diffuse and hepatic fibrosis. The major morbidity from cirrhosis is due to its complications one of which is portal hypertension which is defined as the elevation of the hepatic venous pressure gradient (HVPG) to > 5 mmHg [1].

Portal hypertension is a significant complicating feature combination of two simultaneously occurring hemodynamic processes:

- Increased intrahepatic resistance to the passage of blood flow through the liver due to cirrhosis and regenerative nodules.
- Increased splanchnic blood flow secondary to vasodilation within the splanchnic vascular bed.

The portal vein receives almost from the entire gastrointestinal tract. A varix is formed as an event of worsening portal hypertension because of increase in caliber of splenoportal veins and decompresses itself by opening a shunt into systemic circulation.

The prevalence of varices in patients with cirrhosis is approximately 60-80% and the risk of bleeding is 25-35% [2]. Large oesophageal varices are at a high risk of rupture, thus increasing the risk of morbidity and mortality. While approximately 85% of the individuals with Child-Pugh C cirrhosis have varices, they are usually present in only approximately about 45%

with Child- Pugh A cirrhosis. The mortality rate from variceal bleeding is about 20% when patients are optimally treated in hospital [3].

Even though an elevated hepatic-portal vein pressure gradient of >10 mm of Hg is the single most accurate predictor for development of varices [4]. Its measurement is difficult due to lack of technical expertise and tampered secondary to complications like intraperitoneal bleeding. Repeat endoscopy is recommended at 2-3 years intervals in patients without varices and at 1-2 years interval in-patients with small varices to evaluate the development or progression of varices [5].

However, routine endoscopy has its own limitations like being an invasive procedure and the cost effectiveness of this particular approach. So, identification of predictors of oesophageal varices which are non-invasive will enable to perform endoscopy in selected group of patients thus reducing the burden of unnecessary intervention and at the same time, no patients will be missed with risk of bleeding. Predicting the grade of varices by non-invasive methods at the time of registration is likely to predict the need for prophylactic β blockers or endoscopic variceal ligation in patients with cirrhosis and portal hypertension.

Materials and methods

Type of study: Cross - sectional study

Place of study: Malla Reddy Institute of Medical Sciences

Source of data: Department of Medicine, Outpatient Department and Inpatients, Malla Reddy Institute of medical Sciences, Hyderabad.

Study period: One year

Study population: 45

Methods of collection of data

All the consecutive patients with chronic liver disease meeting the inclusion criteria admitted in the Department of Medicine and attending outpatient department of Medicine, MRIMS Hospital during the study period were included in the study.

A detailed and thorough clinical history and physical examination was taken, and the relevant investigations were done as per protocol.

Inclusion criteria

All patients >18 years presented to medicine department and diagnosed as chronic liver disease based on clinical, biochemical and ultrasonographic findings.

Exclusion criteria

- Patients on current treatment with beta-blockers
- Patients on treatment with nitrates/diuretics
- Portal vein thrombosis
- Hyper-coagulable states

Investigations

Complete Hemogram

Haemoglobin (g/dL)

MCV (fl)

RBC (millions/Cumm)

Total Count (cells/Cumm)

Platelets (lakhs/Cumm)

Liver Function Tests

Serum Bilirubin

Serum Albumin

Alanine Amino Transferase and Aspartate Amino Transferase

Prothrombin Time and INR

Child Pugh Score

Graded into Class A/ B/ C.

Ultrasound Abdomen

Liver architecture

Portal Vein diameter

Presence of ascites

Spleen size

Upper Gastrointestinal Endoscopy

Presence of oesophageal and gastric varices and grading according to endoscopic grading for oesophageal varices and any other findings were also noted.

Procedure

Forty-five patients with cirrhosis of liver, attending the medical wards and outpatient Medical Department of Malla Reddy Institute of Medical Sciences, Hyderabad during the study period were selected, based on inclusion and exclusion criteria.

All patients included in the study underwent a full clinical evaluation. Clinical history and physical examination findings were noted. All patients were undergone necessary biochemical tests and Child-Pugh score was calculated for all patients. Upper GI endoscopy was done to detect presence of varices and grade them using Olympus which was fibre optic oesophageo gastro duodenal endoscopy.

Oesophageal varices was classified as according to Modified Paquet Classification:

Grade 1: Varices extending just above mucosal level.

Grade 2: Varices projecting by one-third of the luminal diameter that cannot be compressed with air insufflation.

Grade 3: Varices projecting up to 50% of the luminal diameter and in contact with each other.

Results

A total of 45 patients were studied over a period of one year. Among which 32(71%) were males and 13(29%) were females (**Graph – 1**).

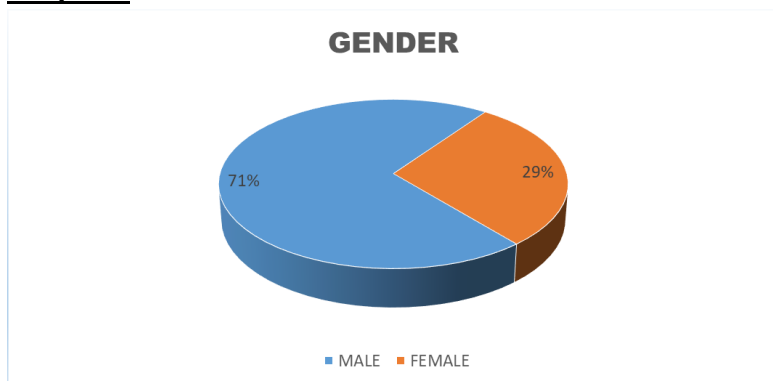
Among 45 patients, the mean age group was 46 years, with majority of patients belonging to the

age group- 41 – 50 years (23) patients contributing up to 51.1% (**Graph – 2**).

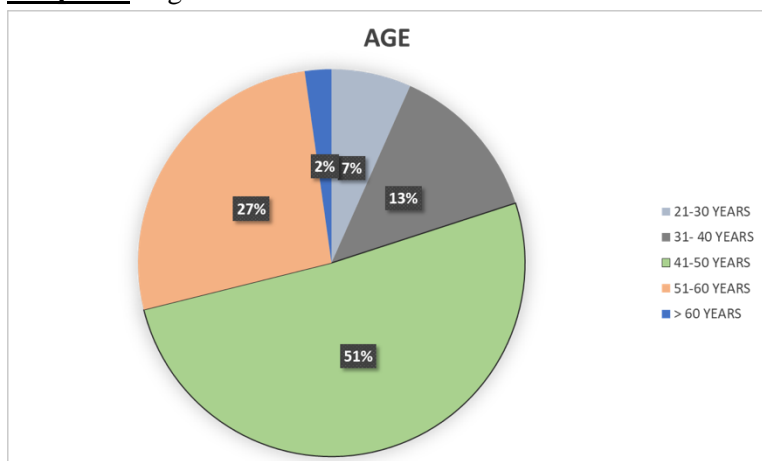
Among the 45 patients, majority of the patients had cirrhosis of liver secondary to consumption of alcohol – total of 33 cases contributing up to

73%. While the second leading cause was hepatitis of which in total of 8 patients (17.7%), 6 patients had hepatitis-B (13.3%) while 1 patient (2.2%) had hepatitis-C and 1 patient had both hepatitis B and C (**Graph – 3**).

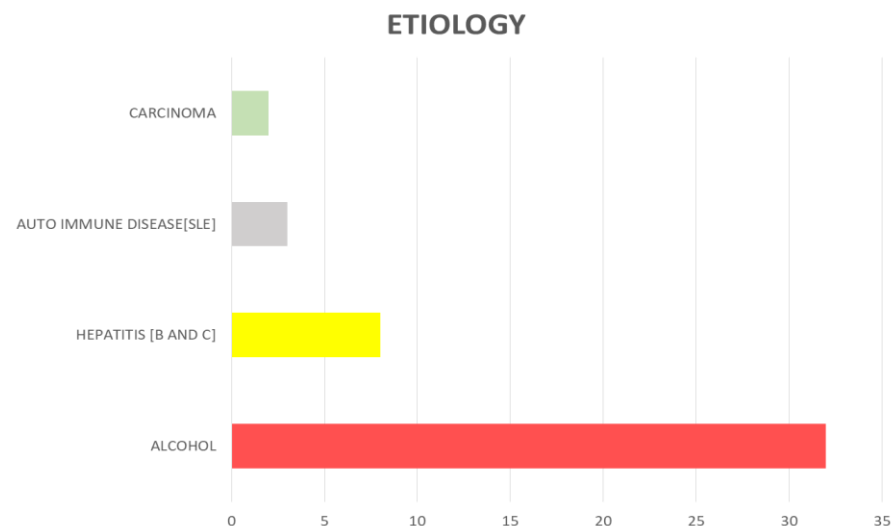
Graph - 1: Gender distribution.



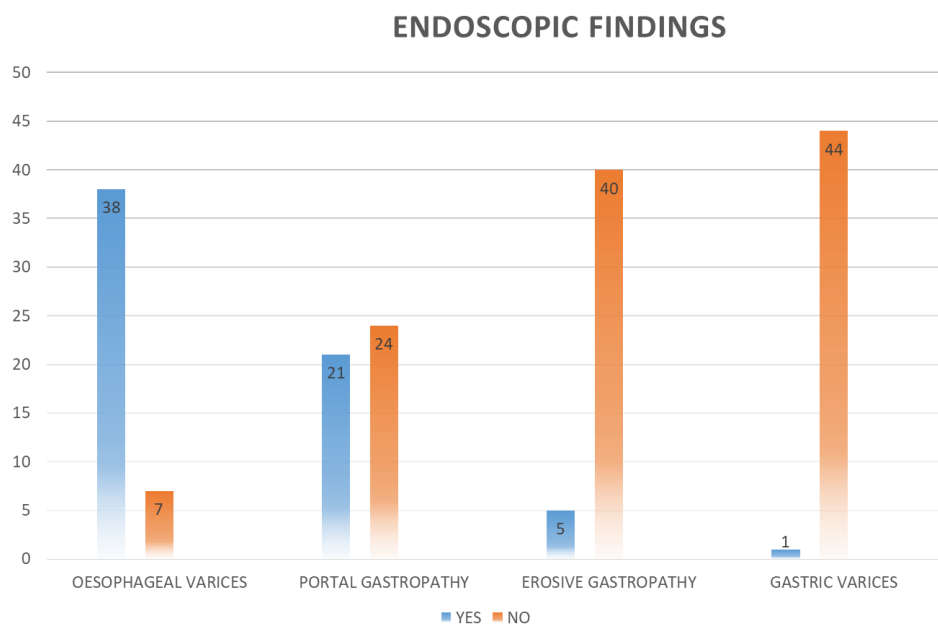
Graph - 2: Age distribution.



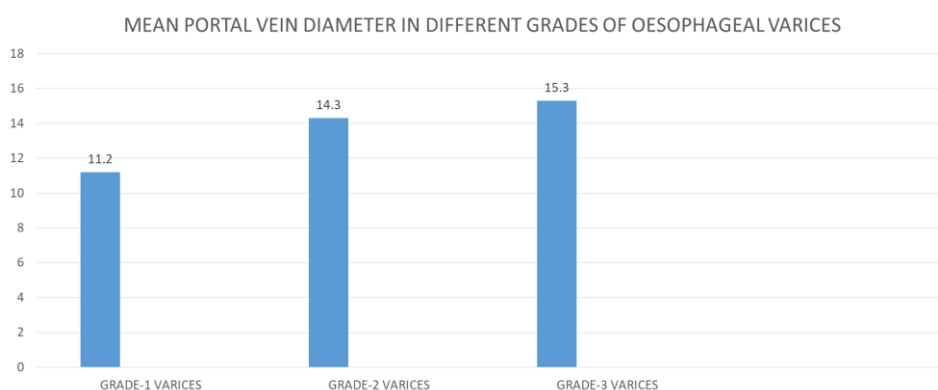
Graph - 3: Distribution based on etiology of cirrhosis.



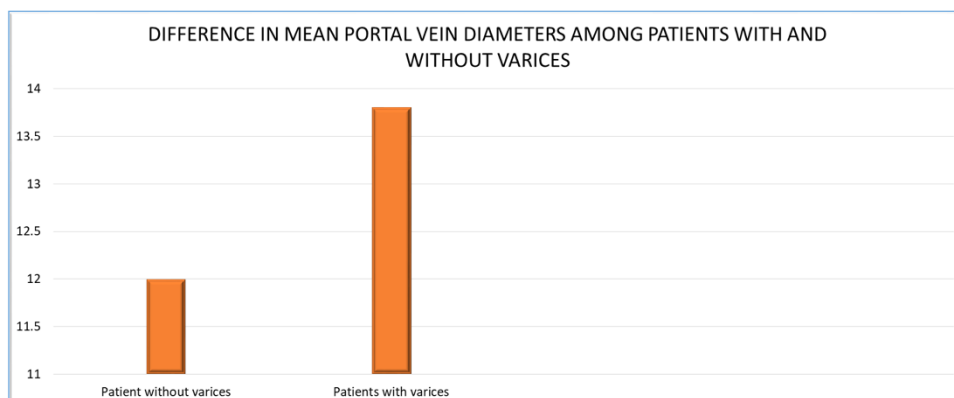
Graph - 4: Endoscopic findings in the study subjects.



Graph - 5: Mean portal vein diameter in different grades of oesophageal varices.



Graph - 6: Difference in mean portal vein diameter among patients with and without oesophageal varices.



Among 45 patients, 38 patients (84.4%) had oesophageal varices while 7 patients (15.6%) had portal hypertensive gastropathy. Only 1 (2.25%) patient had gastric varices and 5 patients (11.11%) had erosive gastropathy (**Graph - 4**).

Mean portal vein diameter increases as severity of oesophageal varices was increasing. In patients with grade-1 varices, mean portal vein diameter was about 11.2 ± 1.04 mm, while in patients with grade-2 oesophageal varices, mean portal vein diameter was about 14.3 ± 0.91 mm. In patients with grade-3 oesophageal varices, mean portal vein diameter was 15.3 ± 1.11 mm. It showed that as the severity of varices increases, the mean portal vein diameter was increased showing a positive linear co relation with p value of <0.01 (**Graph – 5**).

Patients with oesophageal varices had a mean portal vein diameter of $13.8 \text{ mm} \pm 1.82 \text{ mm}$ with a positive predictive value of 96.54%. Patients without oesophageal varices have a mean portal vein diameter of $11.9 \pm 1.27 \text{ mm}$ (**Graph – 6**).

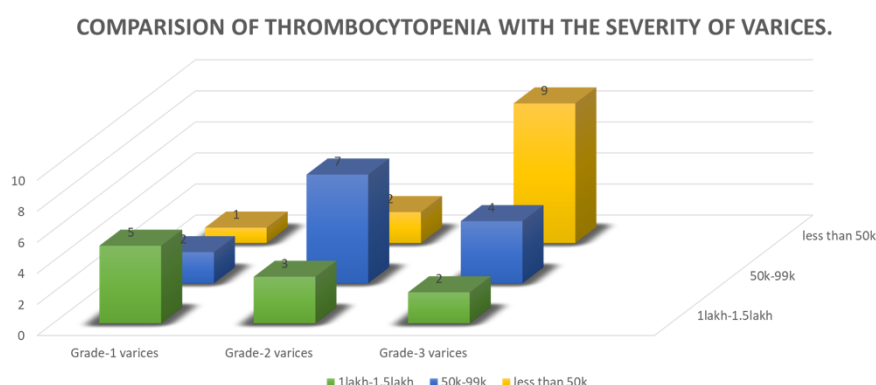
Among 45 patients, splenomegaly was present in 2 (4.44%) patients without varices while 27 (60%) patients had splenomegaly with varices. Thus, proving splenomegaly can be used as a marker for oesophageal varices (**Graph – 7**).

Among 45 patients, 35 patients had thrombocytopenia, mild thrombocytopenia (1 lakh - 1.5 lakh) was present in 10 patients seen predominantly in patients with grade-1 varices- 5 patients (50%). Moderate thrombocytopenia (50k-99k) seen in about 13 patients which predominantly included patients with grade 2 varices- 7 patients (53.8%). Severe thrombocytopenia less than 50k was seen in 12 patients, predominantly seen in patients with grade 3 varices -9 (75%) (**Graph – 8**).

Graph - 7: Splenomegaly among patients with and without oesophageal varices.



Graph - 8: Comparison of thrombocytopenia with the severity of oesophageal varices.



Discussion

In this study, a total of 45 patients with cirrhosis of liver presenting to the in-patient and out-patient department in Malla Reddy were

undertaken and were evaluated for presence of oesophageal varices and establish the role of portal vein diameter and splenomegaly in identifying the varices.

Various studies were done to demonstrate the relation between portal vein diameter, spleen size and oesophageal varices. 45 cirrhotic patients consisting of 32 males (71%) and 13 females (29%) with mean age group of 46 years with majority of patients belonging to the age group 41-50 years (51.1%) were enrolled in our study. In study done by Sharma and Agarwal [6] median age was 45 years, 87(86.1%) were male. In another study by Mandal, et al. [7] 82 patients were selected out of which 56 were males, and the mean age group was 40 years ranging between 19 to 64 years.

In our study alcohol consumption accounted for up to major cause of cirrhosis, total of 33 cases (73%), and second leading cause was hepatitis- 8 patients (17.7%). In a study by Bhattarai S, et al. [8] among 150 patients, chronic alcohol consumption accounted up to 120(80%) of total cases.

Mean portal vein diameter in a patient with varices is 13.8 ± 1.82 mm, in patients without oesophageal varices, the mean portal vein diameter is 11.9 ± 1.27 mm. Patients with grade 1 varices have mean portal vein diameter of 11.2 ± 1.04 mm, while patients with grade 2 varices have 14.3 ± 0.91 mm and grade 3 varices have 15.3 ± 1.11 mm. As the severity of varices increases the mean portal vein diameter is increasing showing a linear correlation with significant p value of <0.01 . In a study by Bhattarai S, et al. [8], average portal vein diameter in patients without varices was 11.545 ± 1.514 mm and with varices was 13.998 ± 1.123 mm.

Shanker, et al. [9] reported portal vein diameter of > 12.20 mm was a predictor of oesophageal varices with sensitivity of 80% and specificity of 80%. In studies by Prihatini, et al. [10] and Cherian, et al. [11] found portal vein diameter of 15 mm and 13 mm respectively to be predictive for detection of varices in patients with cirrhosis.

In our study, among 45 patients, splenomegaly was present in 2 (4.44%) patients without varices

while 27[60%] patients had splenomegaly with varices. Study conducted by Lipp, et al. [12], on patients with CLD revealed that portal vein diameter and average spleen size and platelet count have a significant association with variceal bleeding. Their results strengthened our findings as more than 70% of patients with varices had portal vein diameter above 13 mm. The size of the portal vein also determined the size of varices in this study.

Sudha, et al. [13] concluded that cut-off value is usually 13mm and diameter more than this predicts variceal bleeding. Groszman, et al. [14] in their analysis, concluded that increased size of portal vein and splenomegaly have been associated with severe varices and can be used as non- invasive indicators for oesophageal varices.

Lopamudra, et al. [15] concluded in their study that gastroesophageal varices developed when P diameter was > 11.5 mm and spleen size was > 13.1 cm. In the study by Prihatini, et al. [16], portal vein diameter 11.5 mm and spleen size of 10.3 cm were predictive factors for oesophageal varices in liver cirrhosis with a sensitivity of 75% and a specificity of 54.5%.

In our study, among 45 patients, 35 patients had thrombocytopenia, mild thrombocytopenia was seen predominantly in patients with grade-1 varices- 5 patients (50%). Moderate thrombocytopenia seen predominantly in patients with grade 2 varices- 7 patients (53.8%). Severe thrombocytopenia was predominantly seen in patients with grade 3 varices -9 (75%). Dr. K.V.L. Sudha Rani, et al. [13] suggested cut-off of <1.14 L/Cumm; sensitivity - 83% and Prihatini J, et al. [16] suggested $<88,000$ cells (sensitivity-90.0%; specificity- 41%).

Conclusion

In our study 45 patients, with newly diagnosed cirrhosis were included in the study, the role of portal vein size for predicting oesophageal varices in cirrhotic patients. Splenomegaly and thrombocytopenia also have a significant role in

predicting varices. In this study, portal vein diameter more than 13.8 mm have significance in predicting varices.

Ultrasonography of portal vein diameter and spleen size along with thrombocytopenia are reliable, inexpensive and easily reproducible non-invasive tool in predicting the presence of oesophageal varices and hence can identify the patients who require endoscopy on a prophylactic basis.

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