



## RESEARCH ARTICLE

### CORRELATION BETWEEN THE RATIO OF PORTAL VEIN AND SPLENIC VEIN DIAMETER VERSUS GRADING OF ESOPHAGEAL VARICES AND GRADING OF PORTAL HYPERTENSIVE GASTROPATHY IN 50 PATIENTS OF CHRONIC LIVER DISEASE

<sup>1</sup>Dr. Meena, O.P., <sup>2\*</sup>Dr. Ajay Singh, <sup>3</sup>Dr. Gautam Kumar Bunker, <sup>4</sup>Dr. Umesh Meena and <sup>5</sup>Dr. Shekhar Gurjar

<sup>1</sup>Senior Professor & Unit Head, Department of General Medicine, R.N.T. Medical College, Udaipur  
<sup>2,4,5</sup>Resident Doctor, Department of General Medicine, R.N.T. Medical College, Udaipur  
<sup>3</sup>Assistant Professor, General Medicine, R.N.T. Medical College, Udaipur

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\*Corresponding author:  
Dr. Ajay Singh

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## INTRODUCTION

The portal vein (PV) is formed by the union of superior mesenteric and splenic veins posterior to the pancreas. It ascends to the porta hepatis posterior to left common bile duct and the hepatic artery, where it splits into the right and left branches to supply corresponding lobes of the liver. The liver has a dual blood supply, about 70-80% contributed by the PV and the rest by the hepatic artery. Blood from these vessels mixes in the hepatic sinusoids, which are located between cords of hepatocytes and are lined by fenestrated

endothelium. The blood from each hepatic lobule then drains through the hepatic veins and finally into the inferior vena cava<sup>1</sup>. An inevitable complication of most chronic liver disease is the development of portal hypertension. The reason behind its widespread complications of portal hypertension is due to the formation of Porto-systemic collaterals which results in the formation of various other complications in the form of gastro esophageal varices, with or without variceal hemorrhage, ascites, renal dysfunction etc. Gastro Esophageal varices are seen in about 50% of patients with cirrhosis and they invariably correlate with the stage of liver disease. The

#### ABSTRACT

**Background:** Patients with chronic liver disease need to undergo screening with an upper GI endoscopy to detect esophageal varices and to institute prophylactic measures in patients with large esophageal varices at the time of diagnosis and during follow up. This poses social and medical burden due to the greater number of cirrhotic patients and lesser number of endoscopic units. In this study we aim to identify the non invasive predictors of esophageal varices particularly portal vein, splenic vein diameter and portal vein/splenic vein diameter ratio. **Objective:** Assessment of the correlation between the ratio of portal vein and splenic vein diameter with the grading of esophageal varices and portal hypertensive gastropathy in a group of 50 patients diagnosed with chronic liver disease. **Materials and methods:** Observational study of 50 patients of chronic liver disease were included between June 2022 and November 2022. Relevant clinical parameters were assessed which included physical examination, complete hemogram, biochemical workup. upper GI endoscopy for Grading of varices and portal hypertensive gastropathy and ultrasonographic measurement of portal vein diameter and splenic vein diameter. Portal vein/Splenic vein diameter ratio was calculated for all patients. **Results:** Among the 50 patients studied males predominated the study with 80%. Out of the study population 96% of the patients had varices. Higher grades of esophageal varices exists with higher PVD and greater PVD/SVD ratio. In our study we observed that those with Grade 1 esophageal varices had mean PVD/SVD ratio of  $1.37 \pm 0.08$ , those with Grade 2 varices had  $1.45 \pm 0.08$  and cases with grade 3 varices had mean ratio of  $1.55 \pm 0.08$ , p value was  $<0.05$ , which is statistically significant. Moreover we observed that those with mild PHG had mean PVD/SVD ratio of  $1.45 \pm 0.11$ , those with moderate PHG had  $1.47 \pm 0.05$  and cases with severe PHG had mean ratio of  $1.59 \pm 0.07$ , p value was  $<0.05$ , which is statistically significant. **Conclusion:** From our study we conclude that as PVD/SVD ratio increases there is higher chances of esophageal varices and portal hypertensive gastropathy as well hence prediction of esophageal varices by ratio of portal vein Splenic vein diameter via ultrasound reduce the burden on the endoscopy units, avoiding unnecessary screening endoscopies. Apart from being noninvasive, portal vein diameter and Splenic vein diameter ratio count is a relatively inexpensive and easily reproducible.

esophageal or gastric varices progress at a rate of 5% per year, which are even more prevalent in patients who continue to consume alcohol or with a patient whose liver functions keep deteriorating<sup>2</sup>. An HVPG of at least 10-12 mm Hg is needed for the esophageal varices to form early diagnosis and treatment of gastro esophageal varices to prevent the further complications. The most vital part is if the varices can be diagnosed early and much before the varices bleed initially. It's essential because the studies of primary prophylaxis clearly show that the risk of variceal hemorrhage can be reduced significantly from 50 % chances for bleeding to about or even less than 15% for large esophageal varices<sup>3,4</sup>. Endoscopy is a gold standard method to assess the presence of gastro esophageal varices and allows assessing risk factors if any such like any varices which are large (more than 5mm in diameter) and those with presence of red color signs, (venules or any formation of red spots on varices) these factors if seen has a high propensity for bleeding. The available guidelines recommend that all patients with cirrhosis of liver should be screened for any gastroesophageal varices at the time of diagnosis and also these patients should be followed up regularly, if possible at every 2-3 years in patients without varices (in regard with the severity of liver disease) and follow up every 1-2 years in patients with small varices, to assess for enlargement of varices and to decide on the need for prophylactic treatment and every one year for those with decompensated disease with or without varices<sup>5,6</sup>. Transabdominal ultrasound (B-Mode) is used to measure the diameter of portal vein and splenic vein.

McCormick et al classification systems for portal hypertensive gastropathy <sup>7</sup> .	
Mild	Mosaic or snake skin appearance
Moderate	Presence of erythema
Severe	Presence of erosions or hemorrhagic gastritis

Paquet's classification of esophageal varices <sup>8</sup>	
Grade 0	No varices
Grade I	Varices disappearing with insufflation
Grade II	Larger, clearly visible, usually straight varices, not disappearing with insufflation
Grade III	More Prominent varices, Locally coil shaped and partly occupying the lumen
Grade IV	Tortuous Sometime grape like varices occupying the oesophageal lumen

Oesophageal varices develop as a result of portal hypertension in patients of chronic liver disease. The incidence of oesophageal varices is around 7% per year. Size of oesophageal varices increases in linear fashion with increasing duration and severity of liver disease<sup>9</sup>. Large sized oesophageal varices and presence of red wale mark predict the greater risk of upper gastrointestinal bleeding from varices<sup>4</sup> which is associated with nearly 20% mortality<sup>10</sup>. Portal hypertensive gastropathy develops in 8-90% of patients of chronic liver disease. Portal hypertension leads to regurgitation of portal blood in the stomach vascular bed resulting in changes in gastric mucosal friability and dilated blood vessels<sup>11</sup>. The mechanism of PHG is not fully understood and involves interplay of various gastric growth factors like epidermal growth factor, and cytokines like tumour necrosis factor, nitric oxide and prostaglandins<sup>12</sup>. The significance of PHG lies mainly as a focus of acute and chronic upper gastrointestinal bleeding which can be very severe and fatal occasionally. The relationship between oesophageal varices and portal hypertensive gastropathy is not fully clear. While presence of oesophageal varices has been linked to the increasing frequency of portal hypertensive gastropathy<sup>13</sup>, endoscopic therapy of grade 3 and 4 oesophageal varices has been found to be associated with increasing severity of portal hypertensive gastropathy<sup>14</sup>.

**AIMS AND OBJECTIVES:** Estimation of Portal vein and splenic vein diameter by ultrasound. To measure the grade of esophageal varices along with Grade of portal hypertensive gastropathy by upper GI endoscopy. To calculate the ratio of portal vein and splenic vein. To find correlation between the ratio of portal vein and splenic vein diameter versus grading of esophageal varices and portal hypertensive gastropathy.

## MATERIAL AND METHODS

**Study Site:** Departments of Medicine and Gastroenterology, RNT Medical College, Udaipur.

**Study Design:** Hospital based cross-sectional observational study.

**Study Period:** 50 cases of Chronic liver disease admitted in wards of RNT Medical College and Govt. M.B. Hospital, Udaipur were studied from June 2022 to November 2022.

**Study Population:** All the patient of chronic liver disease admitted to IPD for various complaints like hematemesis, ascites etc.

### Inclusion criteria

All patients above 18 yrs presenting to General Medicine Department who are either proved or newly diagnosed with chronic livers disease based on clinical, biological, ultrasonographic findings.

### Exclusion criteria

- Patients with active upper gastrointestinal bleeding
- Bleeding disorders apart from liver disease.
- Patients who have already received endoscopic or surgical intervention for portal hypertension previously.
- Patients with evidence of hepatocellular carcinoma.

**Study method:** Patients admitted in the Medicine and Gastroenterology IPD department, who are known cases of chronic liver disease irrespective of aetiology, who full-fill the inclusion and exclusion criteria are included in the study after obtaining informed consent from the patients. Blood samples from these patients are taken and sent for routine investigations and then measure the portal vein and splenic vein diameter by ultrasound and upper GI endoscopy to see the esophageal varices and grade them using Paquet classification system and also look for portal hypertensive gastropathy changes by using McCormick et al classification system. Then analysed to establish a clinical significance among them.

**Statistical analysis:** Summary statistics will be done by proportions, mean, median, and standard deviation. The inferential statistics will be done by, ANOVA and Pearson's correlation. All measurements will be done using SPSS version 21.0 'p' value < 0.05 will be considered as statistically significant.

**OBSERVATIONS:** Among 50 patients studied, There were 40 (80%) males and 10 (20%) females in our study, showing a male predominance and cause of CLD was found to be alcoholism in 80% and non-alcoholic in 20%. Out of 50 patients, 48 (96%) cases had esophageal varices while 2 (4%) cases had no esophageal varices.

**Table 1. Portal vein diameter in ultrasound**

S.No.	Portal vein diameter (in mm)	No. of cases	Percentage
1.	10-10.9	2	4.0
2.	11-11.9	15	30.0
3.	12-12.9	18	36.0
4.	13-13.9	10	20.0
5.	14-14.9	3	6.0
6.	15-15.9	2	4.0
	Total	50	100.0

Majority of the patients in ultrasound showed portal vein diameter within 12-12.9 mm constituting 36% of cases and next being between 11-11.9 mm. Maximum portal vein diameter among our cases was 15 mm. Majority of the patients in ultrasound showed splenic vein diameter within 8-8.9 mm constituting 60% of cases and next being between 9-9.9 mm. Maximum splenic vein diameter among our cases was 10 mm.

**Table 2. Splenic vein diameter in ultrasound**

S.No.	Splenic vein diameter (in mm)	No. of patients	Percentage (%)
1	6-6.9	2	4.0
2	7-7.9	1	2.0
3	8-8.9	30	60.0
4	9-9.9	16	32.0
5	10-10.9	1	2.0
	Total	50	100.0

**Table 3. Grading of esophageal varices**

S.No.	Grading of esophageal varices	No. of cases	Percentage (%)
1	Grade 1	11	22.0
2	Grade 2	26	52.0
3	Grade 3	11	22.0

Based on endoscopic grading, the grading of the varices in study population was done. Incidence of grade 2 was high among variceal cases with 52%.

**Table 4. Severity of Portal hypertensive gastropathy**

S.No.	Portal hypertensive Gastropathy	No. of cases	Percentage (%)
1	Mild PHG	39	78.0
2	Moderate PHG	8	16.0
3	Severe PHG	3	6.0

Patients were grouped according to severity of portal hypertensive gastropathy. Majority of study group patients had Mild PHG (78%) followed by Moderate PHG (16%).

**Table 5. PVD/SVD ratio**

S.No.	PVD/SVD ratio	No. of cases	Percentage (%)
1	1.20-1.29	2	4.0
2	1.30-1.39	15	30.0
3	1.40-1.49	7	14.0
4	1.50-1.59	19	38.0
5	1.60-1.69	7	14.0
	Total	50	100.0

In our study we calculated ratio of portal vein diameter to splenic vein diameter. Out of 50 cases, 38% had PVD/SVD ratio between 1.50-1.59 followed by 30% who had PVD/SVD ratio between 1.30-1.39.

**Table 6. Correlation of Portal hypertensive gastropathy with Grade of varices**

Portal hypertensive gastropathy	Grade of esophageal varices			
	Nil (n=2)	Grade 1 (n=11)	Grade 2 (n=26)	Grade 3 (n=11)
Mild PHG	2	11	23	3
Moderate PHG	0	0	3	5
Severe PHG	0	0	0	3

In our study we found that there was no significant correlation between grade of esophageal varices with severity of portal hypertensive gastropathy.

**Table 7: Correlation of PVD with grade of esophageal varices**

Portal vein diameter (in mm)	Grade of esophageal varices			
	Nil(n-2)	Grade 1 (n=11)	Grade 2 (n=26)	Grade 3 (n=11)
10-10.9	2	0	0	0
11-11.9	0	11	4	0
12-12.9	0	0	18	0
13-13.9	0	0	4	6
14-14.9	0	0	0	3
15-15.9	0	0	0	2
Total	2	11	26	11

Out of 50 patients, all the patients with grade 1 esophageal varices had PVD 11-11.9 mm. Majority of patients with grade 2 esophageal varices had PVD 12-12.9 mm. And similarly majority of patients with grade 3 esophageal varices had PVD 13-13.9 mm. So we can conclude that grade of esophageal varices increases with increased portal vein diameter.

**Table 8. Correlation of PVD with severity of PHG**

Portal vein diameter (in mm)	Portal hypertensive gastropathy		
	Mild	Moderate	Severe
10.-10.9	2	0	0
11-11.9	15	0	0
12-12.9	18	0	0
13-13.9	4	6	0
14-14.9	0	2	1
15-15.9	0	0	2
Total	39	8	3

From the above table we can see that majority of patients with Mild PHG had portal vein diameter 12-12.9 mm. Moreover majority patients with Moderate PHG had portal vein diameter >13 mm and those with severe PHG had portal vein diameter >14mm.

**Table 9. Correlation of SVD with grade of esophageal varices**

Splenic vein diameter (in mm)	Grade of esophageal varices			
	Nil (n-2)	Grade 1 (n-11)	Grade 2 (n-26)	Grade 3 (n-11)
6-6.9	2	0	0	0
7-7.9	0	1	0	0
8-8.9	0	9	18	3
9-9.9	0	1	8	7
10-10.9	0	0	0	1
Total	2	11	26	11

From the above table we can conclude that esophageal varices were observed only when splenic vein diameter was more than 8 mm. Only 1 patient had esophageal varices grade 1 with Splenic vein diameter <8mm.

**Table 10. Correlation of SVD with severity of PHG**

Splenic vein diameter (mm)	Portal hypertensive gastropathy		
	Mild	Mild	Mild
6-6.9	2	0	0
7-7.9	1	0	0
8-8.9	30	0	0
9-9.9	6	8	2
10-10.9	0	0	1
Total	39	8	3

From the above table we can see that majority of patients with Mild PHG had splenic vein diameter 8-8.9 mm (76%). However all patients with Moderate PHG had splenic vein diameter 9-9.9 mm. And patients with SVD >9 mm had severe PHG.

**Table 11 Correlation of PVD/SVD ratio with grading of esophageal varices**

Esophageal Varices	No. of patients	Range of (PVD/SVD) ratio	Mean ±SD (mm)	ANOVA F value	ANOVA. P value
Grade 1	11	1.22-1.57	1.37±0.08	13.677	0.000023
Grade 2	26	1.22-1.50	1.45±0.08		
Grade 3	11	1.44-1.66	1.55±0.08		

The mean PVD/SVD ratio of patients with grade 1 esophageal varices was 1.37 ± 0.08, grade 2 esophageal varices was 1.45 ± 0.08 and with grade 3 esophageal varices was 1.55 ± 0.08. The mean PVD/SVD ratio increased with grade of esophageal varices.

**Table 12. Correlation of PVD/SVD ratio with Severity of Portal Hypertensive Gastropathy**

Esophageal Varices	No. of patients	Range of (PVD/SVD) ratio	Mean $\pm$ SD (mm)	ANOVA F value	ANOVA. P value
Mild	39	1.22-1.46	1.45 $\pm$ 0.11	7.856	0.0010
Moderate	8	1.44-1.55	1.47 $\pm$ 0.05		
Severe	3	1.50-1.66	1.59 $\pm$ 0.07		

The mean PVD/SVD ratio of patients with mild PHG was  $1.45 \pm 0.11$ , moderate PHG was  $1.47 \pm 0.05$  and with severe PHG was  $1.59 \pm 0.07$ . The mean PVD/SVD ratio increased with severity of portal hypertensive gastropathy.

## DISCUSSION

Portal hypertension is the most common complication and also one of the important causes of death in chronic liver diseases. Increased resistance to portal blood flow due to alteration of the hepatic architecture leads to dilatation of portal vein, splenomegaly, and formation of esophageal and gastric varices, variceal haemorrhage, ascites, hypersplenism, encephalopathy, etc. Esophageal variceal bleeding is one of the most dreaded complications of CLD because of its high mortality. The prevalence of varices in patients with CLD is approximately 60-80% and the risk of bleeding is 25- 35%. Despite the advantages of endoscopy, it is still an unpleasant and expensive invasive method. It also carries the risk of bleeding due to manipulation, especially in patients with large varices. Therefore, there is a particular need for a non invasive predictor for the presence of EVs to ease the medical, social and economic burden of the disease. Identification of such noninvasive predictors of esophageal varices will allow upper endoscopy to be carried out only in a selected group of patients, thus avoiding unnecessary intervention. Many previous studies have documented good predictive value of various non endoscopic variables for the presence or absence of varices. In present study we considered only simple, commonly available, reproducible parameter. Monitoring of portal vein size by ultrasonography offers an easy, frequently available, non-invasive yet reliable and cost effective way to evaluate the patients with chronic liver disease for the risk of variceal bleeding. It can be used for diagnosis as well as clinical monitoring of patients with portal hypertension, which is very important for the follow-up of these patients. Variceal bleeding due to portal hypertension develops in 30-40% of patients with chronic liver disease. With the growing number of chronic liver disease in the world, the likelihood of patients presenting with gastrointestinal bleeding will increase associated with the concurrent increase in the screening procedures for varices. Non invasive screening for identifying patients with high risk varices will definitely be of help by means of reducing the cost and improve patient's tolerability.

In present study, we tried to find correlation between the ratio of portal vein and splenic vein diameter versus grading of esophageal varices and severity of portal hypertensive gastropathy. In present study, there was preponderance of male (40) as compared to female (10). This was expected as the most common cause of chronic liver disease was alcohol (63.4%) and alcohol consumption was common in males. In present study, we found maximum portal vein diameter was 15 mm i.e in 2 patients and minimum PVD of 10 mm. Similarly, maximum splenic vein diameter was 10 mm and minimum SVD of 6 mm. In present study, patients were grouped according to severity of portal hypertensive gastropathy. Majority of study group patients had Mild PHG (78%) followed by moderate PHG (16%) followed by severe PHG (6%). In our study, out of 50 chronic liver disease patients upper gastrointestinal endoscopy showed esophageal varices in 48 while only 2 had no varices. Based on endoscopy, the grading of esophageal varices in study population was done Incidence of grade 2 was highest among variceal cases i.e., 52%. Average portal vein diameter of patients without gastro-oesophageal varices was  $10.5 \pm 0.5$  mm and of patients with varices was  $13 \pm 2$  mm. The difference was statistically significant ( $p < 0.05$ ). This is consistent with Bhattarai S Study (2014)<sup>15</sup> of Portal Vein Diameter and Spleen Size by

Ultrasonography and Their Association with Gastro-esophageal Varices states that Average portal vein diameter of patients without gastro-esophageal varices was  $10.800 \pm 1.1402$  mm, while it was  $13.731 \pm 1.061$ mm in patients with varices ( $p < 0.001$ ). There was 92.72% sensitivity and 90% specificity for prediction for presence of esophageal varices when the cutoff value for portal vein diameter was 12.25 mm. In present study we found that minimum portal vein diameter in patients with grade 1 esophageal varices was 11mm, in majority of patients with grade 2 esophageal varices was 12 mm and grade 3 varices were observed with portal vein diameter  $> 13$  mm. So we concluded that grade of esophageal varices increases with increase in portal vein diameter. As found in study conducted by Dr. Lopamudra Mandal (2011)<sup>16</sup> about Correlation of portal vein diameter and splenic size with gastro-oesophageal varices in cirrhosis of liver. In that study it was found that twenty patients had no varices (grade 0) and the rest sixty-two patients developed varices. Average portal vein diameter of patients without gastro-oesophageal varices was  $11,545 \pm 1.514$  mm and of patients with varices  $13.998 \pm 1.123$  mm. The difference was statistically significant ( $p < 0.05$ ). There was a positive correlation between grading of oesophageal varices and portal vein diameter ( $p < 0.001$ ). Uppalapati S study (2018)<sup>17</sup> on Correlation of portal vein diameter with the presence of oesophageal varices in chronic liver disease: a prospective study states that Out of the study population 70% of the patients had Oesophageal varices Ultrasonography abdomen showed portal vein dilatation ( $> 13$ mm) in 66.6% cases. The mean portal vein diameter in the study group was 13.1 mm and majority of patients had portal vein between 13-13.9 mm (43.3%). A cut-off point of more than 13 mm had a strong significant relationship ( $p < 0.01$ ) with the presence of esophageal varices (sensitivity of 100%, specificity of 90% and positive predictive value of 95.24%). Higher grades of esophageal varices exist with larger portal vein size.

Shanker R et al (2016)<sup>18</sup> conducted a study on 50 patients with cirrhosis of liver admitted in SMS Hospital, Jaipur. Out of 50 patients 40 (80%) had oesophageal varices at the time of presentation. The average portal vein diameter of patients in nonvariceal group was  $11.78 \pm 1.58$  mm and that of patients with varices  $14.05 \pm 2.26$  mm,  $p < 0.01$ . There was a positive correlation between Portal vein Diameter and grades of oesophageal varices  $p < 0.01$ . Hence from the present study it can be concluded that as the Grades of Varices increases with increase in Portal Vein Diameter. For various studies the cut off portal vein size for prediction has varied. From our study, we can state that portal vein diameter more than 11 mm has strong prediction of presence of varices though grading based on portal vein size has been difficult. However, from table 1 we can say that larger portal vein sizes are associated with high grade varices.

Various studies and their portal vein diameter (PVD) & Cut-Off for presence of esophageal varices.

Portal vein diameter	(cut off)
Devarajini et al (2009) <sup>23</sup>	14mm
Prihatini et al (2005) <sup>24</sup>	11.5mm
Plestina et al (2005) <sup>25</sup>	15mm
Schepis et al (2001) <sup>26</sup>	13mm
Lopamudra et al (2011) <sup>16</sup>	11.5mm
Sarwar et al (2005) <sup>27</sup>	11mm
Present study	11mm

From the above table we can see that portal vein size is varying in different study populations conducted all over the world. It may be due to differences in study sample, race and sex distribution. In present study patients with Chronic liver disease having oesophageal varices were assessed for severity of portal hypertensive gastropathy. Results showed that Mild Portal Hypertensive Gastropathy was observed in 39 (78%), moderate in 8 (16%) and severe in 3 (6%) patients. Grade 1 Oesophageal Varices were present in 11 (22%). patients, grade 2 in 26 (52%) patients, grade 3 in 11 (22%). No significant correlation was observed between grades of gastropathy and size of varices. Thus we concluded Severity of gastropathy is not related to the grade or size of oesophageal varices. This is consistent with study conducted by Saleem K et al (2018)<sup>19</sup> to determine the

relationship between severity of Portal hypertensive gastropathy and size of oesophageal varices. They also found that no significant correlation was observed between grades of gastropathy and size of varices. Similarly Aslam MS et al (2017)<sup>20</sup> done a study to find out the prevalence of portal hypertensive gastropathy among patients of viral cirrhosis undergoing endoscopy and to determine its association with esophageal varices in patients of cirrhosis. Non-significant association was found between portal hypertensive gastropathy and esophageal varices (p-value 0.364). Tiwari PS et al (2019)<sup>21</sup> studied the prevalence of portal hypertensive gastropathy (PHG) in chronic liver disease (CLD) patients and to determine its association with esophageal varices (EV) and the severity of the liver disease. A total of 404 patients with CLD of various etiology enrolling in the study. All patients underwent EGD, and the findings related to EV and PHG were noted. The severity of PHG was graded according to the McCormack classification and EV were graded according to the American Association for the study of liver diseases guideline. No significant association was observed between grades of gastropathy and size of varices (p=0.36). In present study we observed that those with Grade I esophageal varices had mean PVD/SVD ratio of  $1.37 \pm 0.08$ , those with Grade 2 varices had  $1.45 \pm 0.08$  and cases with grade 3 varices had mean ratio of  $1.55 \pm 0.08$ , p value was  $<0.05$ , which is statistically significant. Hence we concluded that as PVD/SVD ratio increases grade of esophageal varices also increased. Gadupati V et al (2015)<sup>22</sup> study which revealed that both venous diameter ratio (portal vein size/splenic vein size) and venous diameter gradient in mm (portal vein size-splenic vein size) calculated from CTs of the abdomen were good predictors of presence of esophageal varices. These parameters might be useful in stratifying patients at risk of developing esophageal varices who are poor candidates for endoscopic evaluation. In our study we observed that those with mild PHG had mean PVD/SVD ratio of  $1.45 \pm 0.11$ , those with Moderate PHG had  $1.47 \pm 0.05$  and cases with Severe PHG had mean ratio of  $1.59 \pm 0.07$ , p value was  $<0.05$ , which is statistically significant. Hence we concluded that as PVD/SVD ratio increases severity of Portal hypertensive gastropathy also increased.

## CONCLUSION

Higher grades of esophageal varices exist with larger portal vein diameter, Portal vein diameter measured using simple ultrasonography can be used as a simple tool for assessing bleeding risk in a CLD patient. Monitoring of portal vein size by ultrasonography offers an easy, frequently available, non-invasive yet reliable and cost effective way to evaluate the CLD patients for the risk of variceal bleeding. It can be used for diagnosis as well as long-term clinical monitoring of patients with portal hypertension. From our study we concluded that as PVD/SVD ratio increases grade of esophageal varices to be found in patients would be high. Similarly severity of portal hypertensive gastropathy also increased with increased PVD/SVD ratio. However, all these non-invasive parameters are not so significantly high as to replace the esophagogastroduodenoscopy (EGD) as a screening tool for the presence of esophageal varices.

## LIMITATIONS

- Small sample size.
- Prospective studies were not done to validate the role of predictive parameters.
- Studies on a large scale are needed before applying these parameters as predictors of esophageal varices.

Disclosure statement: All authors have not declared any conflict of interest relevant to this study.

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