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## Correlation of portal vein diameter, splenomegaly and thrombocytopenia with gastro-esophageal varices in cirrhotic patients

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### Abstract

**Background:** Portal hypertension is one of the complications of chronic liver disease due to cirrhosis liver. Portal vein diameter, Splenomegaly and Thrombocytopenia can be used as Non- Invasive markers for the presence of gastro-esophageal varices in cirrhotic patients. Early detection of gastro-esophageal varices can prevent the UGI variceal bleed in cirrhotic patients. Hence the correlation of portal vein diameter, splenomegaly and thrombocytopenia with Gastro-Esophageal Varices helps in early detection of gastro-esophageal varices.

**Method:** This study was conducted on 100 patients of cirrhosis and investigations for platelet count, ultrasonography for portal vein diameter and upper GI endoscopy for esophageal varices detection were undertaken in all the patients..

**Results:** Our study demonstrated that thrombocytopenia, presence of portal hypertension with splenomegaly and portal vein diameter are strong predictors of developing gastro-esophageal varices in cirrhotic patients.

**Conclusion:** in cirrhotic patients gastro-esophageal varices has direct correlation with Portal hypertension and inverse correlation with platelet count.

**Keywords:** Portal hypertension; Gastro-esophageal varices ; Thrombocytopenia

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### Introduction

Portal hypertension is the consequence of an increase in the splanchnic blood flow secondary to vasodilation and increased resistance to the passage of blood through the cirrhotic liver. Thrombocytopenia and splenomegaly are independent predictors of large

esophageal varices in cirrhosis. There is evidence that with increase in portal vein diameter, splenomegaly, and thrombocytopenia, there are more chances of formation of gastro-esophageal varices. Thus, these can be used as non-invasive predictors of presence of

esophageal varices and guide for selecting patients for endoscopic evaluation. Upper gastrointestinal endoscopy in combination with the clinical data may be utilized to identify the patients at high risk of bleeding.<sup>1</sup>

## Materials and Methods

The study included 100 patients of cirrhosis .Each patient was subjected to investigations which included platelet count, ultrasound to detect portal vein diameter and spleen size and Esophago-Gastro-Duodenoscopy to grade gastric and esophageal varices.

Inclusion criteria: (1) Individuals of age > 18 years (2)Patients of cirrhosis with portal hypertension.

Exclusion criteria:(1)Patients with advanced cirrhosis(Child-Pugh class C) (2)Patients with human immunodeficiency virus (HIV)infection (3)Patients with Hepatocellular carcinoma (4)Patients with portal vein thrombosis,(5)Patients with current alcohol abuse, (6)Previous or current treatment with b-blockers, diuretics and other vasoactive drugs (7)Patients with severe or unstable cardiovascular disease and pulmonary disease (8)Patients with clinically significant renal or hepatic disease or dysfunction (9)Patients with hematological disorders

## Observations

A total of 100 patients were selected for the study. Among them, 74 patients (74%) were males and 26 patients (26%) were females. It was further observed that out of 100 patients 19% patients developed grade-I EV, 29% Grade-II, 27% Grade-III and 25% Grade IV Esophageal Varices. Mean age of the patients with Grade-I, II, III, IV Esophageal Varices were 47.58 , 46.45, 47.56 and 48.72 years ranging from 14 to 85 years as shown in **Table 1**. Statistical analysis applied on patient under study shows a positive correlation between portal vein diameter and grading of the esophageal varices and this correlation was found to be statistically significant ( $p < 0.001$ ) thereby showing that when portal vein diameter increased, esophageal varices also increased in size as shown in **Table 2 & Fig-1**. Regarding correlation of spleen size with the grading of Esophageal Varices (EV), it was observed that the mean spleen size of the patients with Grade-I EV was  $12.05 \pm 0.67$  cm, Grade-II EV was  $14.33 \pm 0.93$  cm, with grade-III EV  $16.35 \pm 1.03$  cm and Grade-IV EV was  $19.10 \pm 1.16$  cm. This correlation was found to be statistically significant ( $p < 0.001$ ) thus depicting that when spleen size increased, Esophageal Varices also increased in size as shown in **Table 3 & Fig 2**.

**Table – 1 Age distribution with the grading of esophageal varices**

Grade of Esophageal Varices	Number of Patients	Range (years)	Mean Age (years) (Mean $\pm$ SD)	Significance (p value)
I	19	30-65	47.58 $\pm$ 11.44	p=0.937 (NS)
II	29	25-75	46.45 $\pm$ 11.44	
III	27	25-82	47.56 $\pm$ 13.12	
IV	25	14-85	48.72 $\pm$ 15.13	

**Table-2 Correlation of mean portal vein diameter with grading of esophageal varices**

Grade of Esophageal Varices	Number of Patients	Range (in mm)	Mean Portal Vein Diameter (mm) Mean $\pm$ SD	Correlation Coefficient (r)	Significance (p value)
I	19	12.0-14.0	13.16 $\pm$ 0.61	0.953	p<0.001 (HS)
II	29	13.6-16.0	14.59 $\pm$ 0.56		
III	27	15.0-17.5	16.39 $\pm$ 0.69		
IV	25	17.0-21.0	19.02 $\pm$ 0.99		

Fig-1

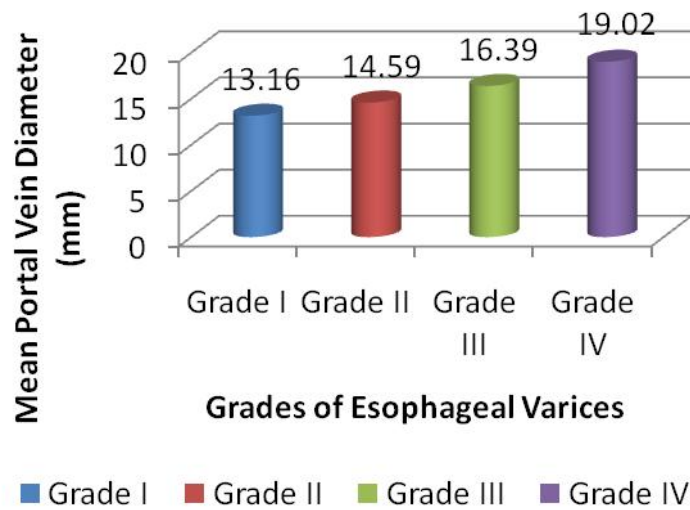
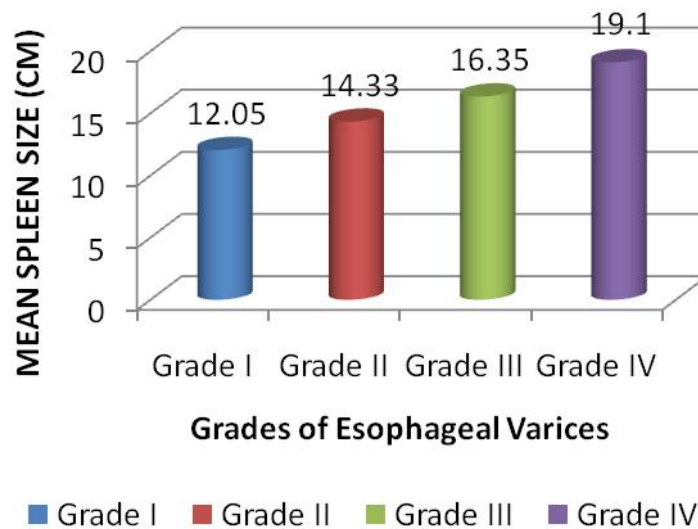


Table 3 Correlation of mean spleen size with grading of esophageal varices

Grade of Esophageal Varices	Number of Patients	Range (in cm)	Mean Spleen Size (cm) Mean±SD	Correlation Coefficient (r)	Significant (p value)
I	19	11.0-13.0	12.05±0.67	0.941	p<0.001 (S)
II	29	12.0-16.0	14.33±0.93		
III	27	14.5-20.0	16.35±1.03		
IV	25	17.0-21.0	19.10±1.16		

Fig-2



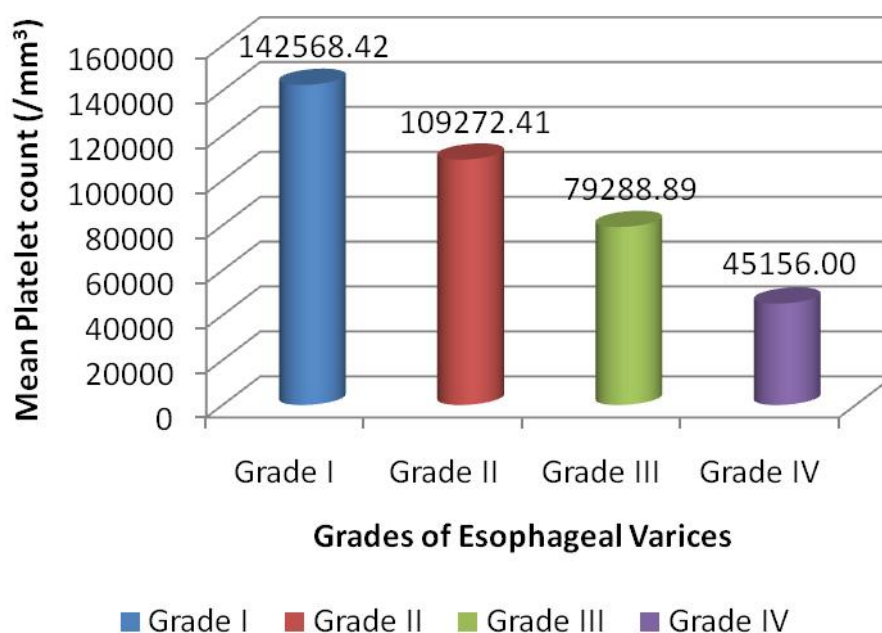
In our study, statistical analysis showed an inverse relation between the platelet count and grading of Esophageal Varices (EV). It was a statistically significant correlation with p-value<0.001. It also

suggested that as the platelet count decreased, grading of Esophageal Varices increased as shown in **Table- 4 & Fig 3**.

**Table 4 Correlation of mean platelet count with grades of esophageal varices**

Grade of Esophageal Varices	Number of Patients	Range (in/mm <sup>3</sup> )	Mean Platelet Count (/mm <sup>3</sup> ) Mean±SD	Correlation Coefficient (r)	Significant (p value)
I	19	120000-152000	142568.42±6640.37	-0.961	p<0.001(S)
II	29	80000-129000	109272.41±9567.16		
III	27	70000-90000	79288.89±5506.94		
IV	25	36000-58000	45156.00±7032.43		

**Fig-3**



**Discussion**

Cirrhosis is the most advanced form of liver disease and variceal haemorrhage is one of its lethal complications. Cirrhotic patients with large esophageal varices (EV) are at a high risk for bleeding, so efforts should be made to identify cirrhotic patients with large varices.<sup>2</sup>

The present study was done to find out the correlation of portal vein diameter, splenomegaly, and thrombocytopenia with gastro-esophageal varices in cirrhotic patients. 100 patients were enrolled for this study & it was observed that 19% patients developed grade I EV , 29% grade II EV, 27% grade III EV and 25% patients developed grade IV EV . Two patients developed gastric varices . A similar study was done by Abbasi et al<sup>3</sup> in 102 patients to find out the

correlation of thrombocytopenia with Grading of EV in Chronic Liver Disease Patients. Out of 102 patients, seven patients had EV grade I, 24 had grade II, 35 had grade III, and 36 had grade IV. Gastric Varices were detected only in 2 patients. Our Study demonstrated that thrombocytopenia, presence of portal hypertension with splenomegaly and portal vein diameter are strong predictors of developing gastro-esophageal varices in cirrhotic patients.

Earlier, the pathophysiology of thrombocytopenia in liver disease was linked to the presence of hypersplenism, but now it has been discovered that thrombopoietin production is dependent on functioning liver cell mass and is responsible for reduced thrombopoiesis and consequently peripheral

thrombocytopenia. In patients with liver cirrhosis the presence of decreased platelet count can be associated with several factors such as shortened platelets mean half life, decreased thrombopoietin production or myelotoxic effects of alcohol. On the other hand, the presence of splenomegaly in cirrhotic patients is likely the result of vascular disturbance that are mainly linked to portal hypertension.<sup>2,4</sup>

In our study, it was observed that mean platelet count in grade-I EV was  $142568.42 \pm 6640.369/\text{mm}^3$ , in grade-II EV as  $109272.41 \pm 9567.16/\text{mm}^3$ , in grade III EV was  $79288.89 \pm 5506.94/\text{mm}^3$ , and in grade-IV EV was  $45156.00 \pm 7032.43/\text{mm}^3$ . Platelet count showed a highly statistical significant inverse correlation with the grading of esophageal varices, which is in agreement with Thomopoulos et al.<sup>5</sup> Esophageal varices were graded according to **Paquet**<sup>6</sup>. Grading System and Gastric varices were graded according to **Sarin et al**<sup>7</sup>.

A longitudinal study by **Qamar et al**<sup>8</sup> of 213 patients, with compensated cirrhosis with portal hypertension but without varices, demonstrated that the median platelet count at the time of occurrence of varices was  $91,000/\text{mm}^3$ . However, no platelet count could be identified that accurately predicted the presence of esophageal varices, and they, therefore, concluded that platelet count is an inadequate noninvasive marker for prediction of the presence of esophageal varices.

**Giannini et al**<sup>9</sup> proposed platelet count/splenic diameter ratio as a non-invasive marker for predicting esophageal varices in patients with liver cirrhosis. Parameters directly or indirectly linked to portal hypertension, such as splenomegaly and decreased platelet count, were predictors of the presence of esophageal varices.

**Hong Wan-dong et al**<sup>10</sup> conducted a study to develop a decision model based on classification and regression tree analysis for the prediction of large esophageal varices in cirrhotic patients. 309 cirrhotic patients (training sample, 187 patients; test sample 122 patients) were included. Within the training sample, the classification and regression tree analysis was used to identify predictors and prediction model of large esophageal varices. The prediction model was then further evaluated in the test sample and different Child-Pugh classes. The prevalence of large esophageal varices in cirrhotic patients was 50.8%. A tree model consisting of spleen width, portal vein

diameter and prothrombin time was developed by classification and regression tree analysis achieved a diagnostic accuracy of 84% for prediction of large esophageal varices. When reconstructed into two groups, the rate of varices was 83.2% for high-risk group and 15.2% for low-risk group. Accuracy of the tree model was maintained in the test sample and different Child-Pugh classes. Thus the study showed that spleen width, portal vein diameter and prothrombin time may be useful for prediction of large esophageal varices in cirrhotic patients.

**Baig et al**<sup>11</sup> in their study of 150 patients of cirrhosis evaluated laboratory and ultrasonographic variables prospectively. Only stable patients were included in the study. Patients with active gastrointestinal bleeding at the time of admission were excluded. All patients underwent screening upper gastrointestinal endoscopy. The platelet count, spleen diameter and platelet count to spleen diameter ratio in patients with esophageal varices were significantly different from patients without esophageal varices. The platelet count to spleen diameter ratio had the highest accuracy among the three parameters. By applying receiver operating characteristic curves, a platelet count to spleen diameter 58 ratio cut-off value of 1014 was obtained, which gave positive and negative predictive values of 95.4% and 95.1%, respectively. The accuracy of this cut-off value as evaluated by applying receiver operating characteristic curves was 0.942 (95% CI 0.890 to 0.995).

Splenomegaly and portal vein diameter are also reliable predictors of the presence of Esophageal Varices. In our study, the mean spleen size of the patients with grade-I EV was  $12.05 \pm 0.67$  cm, grade-II EV was  $14.33 \pm 0.93$  cm, grade-III EV was  $16.35 \pm 1.03$  cm and with grade-IV EV was  $19.10 \pm 1.16$  cm which showed a statistical significant direct correlation with the presence of reported that splenomegaly is recognized as one of the diagnostic signs of cirrhosis and portal hypertension and was in accordance with a study carried out by **Mandal et al**<sup>12</sup> **Sharma and Agarwal**<sup>13</sup> in their study had noted that clinically palpable spleen was associated with high grade varices however they did not measure the splenic size radiologically. **Farooqi et al**<sup>1</sup> also found out that platelet count of  $<65 \times 10^3/\mu\text{L}$ , serum albumin  $<2.2$  g/dl and portal vein diameter of  $>13$  mm are independent and significant predictors of esophageal varices on endoscopy.



In our study the mean portal vein diameter of the patients with Grade-I,II,III &IV EV were  $13.16\pm 0.61$  m,  $14.59\pm 0.56$  mm,  $16.39\pm 0.69$  mm and  $19.02\pm 0.99$  mm respectively, which shows a statistical significant direct correlation between Portal vein diameter and the presence of Esophageal Varices which is in accordance with the study done by Sarwar et al<sup>14</sup> who postulated that portal vein diameter more than 11 mm on ultrasonography is independently associated with the presence of esophageal varices.

## Conclusion

It is concluded from our study that:

1. Portal vein diameter increases with development of gastro-esophageal varices.
2. Spleen size increases with formation of gastro-esophageal varices.
3. Platelet count decreases with the development of gastro-esophageal varices.
4. There is a positive correlation between portal vein diameter and splenomegaly with gastro-esophageal varices, and an inverse relationship between thrombocytopenia and gastro-esophageal varices.

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**Conflict of interest:** None declared

## References

1. Farooqi JI, Ahmed H, Ikramullah Q, Ahmed F, Masood-ur-Rehman. Predictors of Esophageal Varices in Patients of Liver Cirrhosis. JPMI 2007; 21(01): 60-4.
2. Zaman A, Becker T, Lpidus J. Risk factors for the presence of varices in cirrhotic patients without a history of variceal hemorrhage. Archives of Internal Medicine 2001; 161: 2564-70.
3. Abbasi A, Butt N, Bhutto AR, Munir SM. Correlation of Thrombocytopenia with Grading of Esophageal Varices in Chronic Liver Disease Patients. Journal of the College of Physicians and Surgeons Pakistan 2010; 20(6): 369-72.
4. Gue CS, Yap CK, Ng HS. The Correlation Between Cytopenia and Esophageal Varices in Patients With Liver Cirrhosis. Med J Malaysia 2004; 59(5): 604-9.
5. Thomopoulos KC, Labropoulou-Karatza C, Mimidis KP, Katsakoulis E C, Iconomou G, Nikolopoulou VN: Non-invasive predictors of the presence of large esophageal varices in patients with cirrhosis. Digestive and Liver Disease 2003; 35(7): 473-8.
6. Paquet KJ. Prophylactic endoscopic sclerosing treatment of esophageal wall in varices: A prospective controlled trial. Endoscopy 1982; 14: 4-5.
7. Sarin SK, Preimignani M, Agarwal Sr. Gastric Varices. In: Defranchis R, ed. Portal Hypertension, Proceeding of the third Baveno International Consensus Workshop on definitions, methodology and therapeutic strategies. Oxford: Blackwell Science, 2001, p. 576-9.
8. Qamar AA, Grace ND. Abnormal hematological indices in cirrhosis. Can J Gastroenterol 2009; 23(6): 441-5.
9. Giannini EG, Botta F, Borro P. Application of the platelet count/spleen diameter ratio to rule out the presence of esophageal varices in patients with cirrhosis: A validation study based on follow-up. Digestive and Liver Disease 2005; 37; 779-82.
10. Hong WD, Dong IL, Jiang IZ, Zhu IIQ, Jinl IS. Prediction of large esophageal varices in cirrhotic patients using classification and regression tree analysis. Clinics 2011; 66(1): 119-24.
11. Baig WW, Nagaraja MV, Varma M, Prabhu R. Platelet count to spleen diameter ratio for the diagnosis of esophageal varices: Is it feasible? Can J Gastroenterol 2008; 22(10): 825-8.
12. Mandal L, Mandal SK, BAndyopadhyay D, Datta S. Correlation of portal vein diameter and splenic size with gastro-oesophageal varices in cirrhosis of liver. JIACM 2011; 12(4): 266-70.
13. Sharma SK, Aggarwal R. Prediction of large oesophageal varices in patients with cirrhosis of the liver using clinical, laboratory and imaging parameters. J. Gastroenterol Hepatol. 2007 Nov; 22(11): 1909-15.

14. Sarwar S, Khan AA, Alam A. Non-endoscopic prediction of presence of oesophageal varices in cirrhosis. J Coll Physicians Surg Pak 2005; 15(9): 528-31.

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