

## Original Article

### Platelet Count Spleen Diameter Ratio for non invasive Diagnosis of Esophageal Varices

Vinay Wagh<sup>1</sup>, Ashwin Mankoskar<sup>2</sup>

<sup>1</sup>Professor, <sup>2</sup>Postgraduate student, Department of General Medicine, D.Y. Patil Medical College, Kohlapur, Maharashtra, India

#### ABSTRACT:

**Background:** Esophageal varices are the porto-systemic channels that connect the portal and systemic venous circulation preferentially located in the sub mucosa of lower esophagus. They are the most important complication of portal hypertension. UGI scopy is very costly and not available in the peripheral rural areas. Many studies had been conducted for possible way of determining varices by means by using low cost and non-invasive parameters to investigate for varices for the replacement of endoscopy. **Aim of the study:** To prospectively evaluate the validity of platelet count to spleen diameter ratio by comparing it with other noninvasive parameters that can be used to screen for the presence of esophageal varices to reduce the burden of endoscopy. **Materials and methods:** The study was a prospective observational study. The study was conducted over a period of two years from May 2016 to August 2018. It was conducted at Inpatient and outpatient Department of Medicine of D. Y. Patil Medical College and Hospital, Kohlapur, Maharashtra, India. Registration of patients was from May 2016 to August 2018. They were registered and admitted under Medicine Department according to inclusion and exclusion criteria. The sample size selected was 100 patients. **Results:** Based on Conn's Grading, the grading of the varices in study population was done. Grade I varices predominated (28 %), followed by Grade II varices (25 %). Varices were absent in 40 % of the patients. AUROC curve was 0.88 (CI- 0.80-0.95, p value <0.01). From ROC (Figure) obtained threshold value of 111 with sensitivity and specificity 88.3 and 85 respectively. ROC curve and the cut off value for spleen diameter was  $\geq 111$  mm. Area under the curve for ROC curve was 0.85. We have used cut off value 909 for Platelet Count Spleen Diameter Ratio, with this cut off value obtained sensitivity and specificity 81.67% and 82.50% respectively and PPV and NPV of 87.50% and 75% respectively. **Conclusion:** From our study we conclude that platelet count and spleen diameter ratio is useful denominator to predict the presence of higher grades of varices. Hence it can identify the subset of patients who require endoscopy for the prophylactic management of esophageal varices. Therefore reduces the burden on the endoscopy units, avoiding unnecessary screening endoscopies as well. It may reduce the cost of management of bleeding varices.

**Key words:** Esophageal varices, porto-systemic channels, endoscopies.

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**Corresponding author:** Dr. Ashwin Mankoskar, Postgraduate student, Department of General Medicine, D.Y. Patil Medical College, Kohlapur, Maharashtra, India

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#### INTRODUCTION:

Esophageal varices are the porto-systemic channels that connect the portal and systemic venous circulation preferentially located in the sub mucosa of lower esophagus. They are the most important complication of portal hypertension.<sup>1, 2</sup> The frequency varies from 30 to 70% in liver cirrhosis. The break and bleeding from varices are associated with significantly high morbidity and mortality rate. Variceal bleeding is one of the most common causes of death in liver cirrhosis. It accounts for 13-32 % of all upper gastrointestinal bleeding. Mortality during the first episode is estimated to 15–20%. The exact mechanism of variceal rupture has not yet been determined and thus no ideal treatment has been found. The number of

deaths has decreased in the last few decades as a result of modern techniques. As per many studies, like BAVENO VI consensus it is mandatory that all cases of cirrhosis must undergo UGI scopy every year to detect varices, as it is the gold standard investigation, at the earliest to start prophylactic management to prevent bleeding risk.<sup>3, 4</sup> UGI scopy is very costly and not available in the peripheral rural areas. Many studies had been conducted for possible way of determining varices by means by using low cost and non-invasive parameters to investigate for varices for the replacement of endoscopy. The first to propose study for correlating noninvasive parameters with esophageal varices was Giannini in 2003.<sup>5, 6</sup> He proposed that platelet count and spleen diameter ratio is independently associated as the

non-invasive parameter for esophageal varices in the study. They are the best non-invasive parameters developed till date. Similarly, other studies were conducted to correlate non-invasive parameters like prothrombin time, INR, albumin, leucocyte count etc with esophageal varices.<sup>7,8</sup> The present study attempts to prospectively evaluate the validity of platelet count to spleen diameter ratio by comparing it with other noninvasive parameters that can be used to screen for the presence of esophageal varices to reduce the burden of endoscopy.

**MATERIALS AND METHODS:**

The study was a prospective observational study. The study was conducted over a period of two years from May 2016 to August 2018. It was conducted at Inpatient and outpatient Department of Medicine of D. Y. Patil Medical College and Hospital, Kolhapur, Maharashtra, India. Registration of patients was from May 2016 to August 2018. They were registered and admitted under Medicine Department according to inclusion and exclusion criteria. The sample size selected was 100 patients.

**DATA COLLECTION:**

- All patients were classified according to criteria.
- A detailed informed consent was taken of every patient in their language prior to study.
- A detailed history was taken along with clinical examination.
- The biological parameters were evaluated and ultrasound was used to measure the longest diameter of the spleen as well as portal vein diameter. Child Pugh score was calculated of all patients.
- The platelet count /spleen diameter ratio was calculated and analyzed to determine whether it could predict the presence of esophageal varices.
- Upper GI scopy was used as the gold standard investigation.

**INCLUSION CRITERIA:**

- All patients above 18 years
- All patients with: 1. Thrombocytopenia  
2. Portal hypertension  
a) PV diameter>14mm  
b) Splenomegaly

**EXCLUSION CRITERIA:**

- Active upper GI bleeding at admission
- Megaloblastic anemia
- Hematological malignancies

- Aplastic anemia
- Myelofibrosis
- History of band ligation or sclerotherapy for varices
- Patients on drugs which cause thrombocytopenia

**STATISTICAL ANALYSIS:**

Statistical analysis was done using SPSS 20. Data was presented using frequency, percentage, mean, and standard deviation. Association between two variables using chi-square and Fischer exact test wherever necessary. Comparison between two continuous variables was done using unpaired t test. Test was considered significant if p value is less than 0.05.

**RESULTS:**

Table 1 and Fig 1 shows the distribution of patients based on grade of varices. Based on Conn’s Grading, the grading of the varices in study population was done. Grade I varices predominated (28 %), followed by Grade II varices (25 %). Varices were absent in 40 % of the patients.

**Spleen Diameter**

To find out threshold value of SD for presence of varices we have used ROC curve (Graph 1). AUROC curve was 0.88 (CI- 0.80-0.95, p value <0.01). From ROC (Figure) obtained threshold value of 111 with sensitivity and specificity 88.3 and 85 respectively. Table 2 shows the role of spleen diameter ratio in predicting varices. Cut off value for spleen diameter was obtained by used ROC curve and the cut off value for spleen diameter was ≥111mm. Area under the curve for ROC curve was 0.88 (CI- 0.80-0.95, p value <0.01) with sensitivity and specificity 88.3% and 85% respectively and positive predictive value and negative predictive value 89.83% and 82.93% respectively. (Table 2)

**Platelet Count**

To find out cut off value for platelet count for presence of varices we have used ROC curve. Area under the curve for ROC curve was 0.85 (CI- 0.77-0.83, p value <0.01). From ROC (Graph 2) obtained cut off was 168500 with sensitivity and specificity 80% and 88.3% respectively. (Table 3)

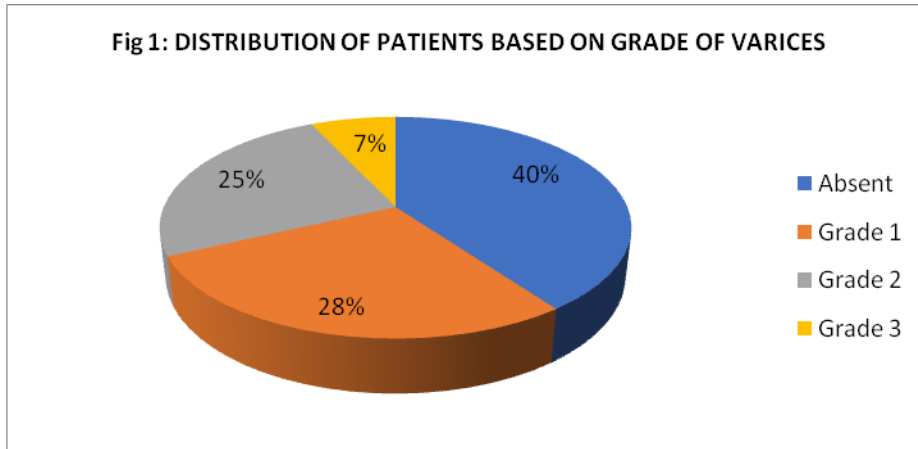
**Platelet Count Spleen Diameter Ratio**

We have used cut off value 909 for Platelet Count Spleen Diameter Ratio, with this cut off value obtained sensitivity and specificity 81.67% and 82.50% respectively and PPV and NPV of 87.50% and 75% respectively. (Table 4)

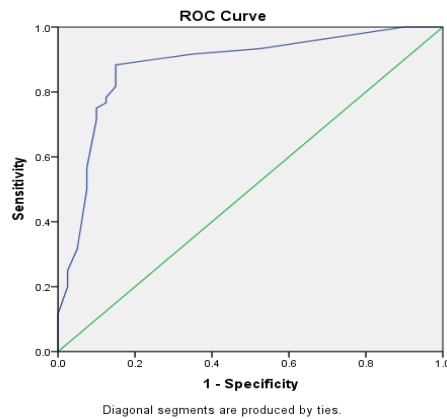
**Table 1: Distribution of patients based on grade of varices**

Grades of Varices	No of Patients	Percentage
Absent	40	40%
Grade 1	28	28%
Grade 2	25	25%

Grade 3	7	7%
Total	100	100%



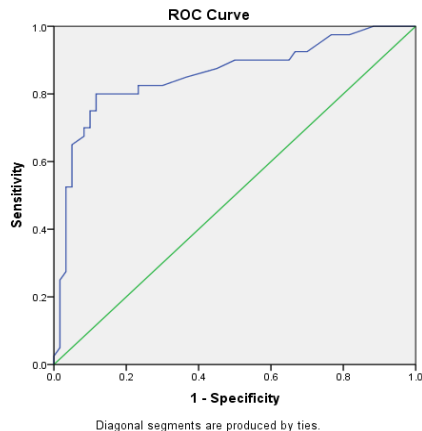
**Graph 1: ROC curve for spleen diameter**



**Table 2: Role of spleen diameter ratio in predicting varices**

Spleen diameter	Varices		Total	p-value
	Present	Absent		
≥111	53	6	59	<0.01
<111	7	34	<b>41</b>	
Total	60	40	<b>100</b>	

**Graph 2: ROC curve for platelet count**



**Table 3: Role of platelet count ratio in predicting varices**

Platelet Diameter	Varices		Total	p-value
	Present	Absent		
<168500	53	8	61	<0.01
>=168500	7	32	39	
Total	60	40	100	

**Table 4: Role of PC/SD ratio in predicting varices**

PC/SD	Varices		Total	p-value
	Present	Absent		
<909	49	7	56	<0.01
>=909	11	33	44	
Total	60	40	100	

**DISCUSSION:**

Variceal bleeding is the most important complication of cirrhosis. The first crucial step in prevention is the identification of patients who are at risk of bleeding by the use of OGD scopy and to subject them for prophylactic therapy. Since a variable proportion of patients will not have varices, screening of all patients with cirrhosis with upper GI endoscopy implies a number of unwanted OGD scopies, which increase the work load of endoscopy units. In addition, recommendations are limited on the compliance with endoscopic screening. Prediction of the presence of varices by noninvasive mode would allow us to restrict the use of endoscopy to those patients with a high probability of having the varices. We studied total 100 patients; out of them esophageal varices were present in 60 %patients and absent in 40% patients. We also studied the frequency of distribution based on Conn’s grading of varices and found that Grade I predominated (28 %). (Table 1; Figure 1).Rajesh Wadhwa et al (2014)<sup>9</sup> studied 111 patients, out of them EVs were present in 68 (61.3%) patients and absent in 43 (38.7%) patients. The similar percentages of EV were observed in our present study. Study done by Mahafuzzaman M et al (2018)<sup>10</sup> included 64 patients; out of them 54 (84.4% ) patients detected with EV. Angelo Zambam de mattos et al(2017)<sup>11</sup> study includes 164 cirrhotics, out of them EV were present in 72.56% patients. Prathish Kumar et al(2017)<sup>12</sup> conducted study to

identify non-invasive predictors of EV. EV were detected in 69 (69%) patients and absent in 31(31%) patients. Vijant Singh Chandail et al(2017)<sup>13</sup> carried out study in 51 patients, EV were seen in 34 (66.67%) patients and absent in 17 (33.33%) patients.

*Gender V/s Grades of varices:*

Our sample size consisted of 100 patients of whom 84 (84%) were male and 16 (16%) were female. Distribution of grades of varices was studied with gender (Table 2; Figure 2) and no significant correlation was found between grades of varices and gender. Mohammed Aslam C et al(2017)<sup>14</sup> conducted study in 100 patients with chronic liver disease of whom 67 patients were males and 33 patients were female, as our present study shown in this study also no any significance observed between gender and grades of varices. Enayet Hossain et al(2018)<sup>15</sup> carried out study, also had similar percentages of male (84%) and female (16%) as observed in our study. Debashis Kumar Sarkar et al(2018)<sup>16</sup> conducted study which included 65 cirrhotic patients, among them 66.2 % were male. In Mahafuzzaman M et al (2018)<sup>10</sup> study they had included 64 patients out of that 48 (75%) were male and 16 (25%) were female.

Observed spleen diameter (mm) in our study was 143.55 ± 21.77 in presence of varices and 107.40±17.03 in absence of varices. Significant difference was observed between

presence of varices and spleen diameter. Dipendra Khadka et al(2017)<sup>17</sup> observed spleen diameter in presence of varices was  $144.21 \pm 10.71$  and  $127 \pm 21.24$  in absence of varices and significant difference was observed between presence of varices and spleen diameter. Vijant Singh Chandail et al(2017)<sup>13</sup>, observed spleen diameter in presence of varices was  $122.24 \pm 13.57$  and  $108.25 \pm 14.23$  in absence of varices and Significant difference was observed between presence of varices and spleen diameter. Dharmendra Tiwari et al(2016)<sup>17</sup> observed spleen diameter in presence of varices was  $153.3 \pm 18$  in presence of varices and  $137.7 \pm 14$  in absence of varices and Significant difference was observed between presence of varices and spleen diameter. Mahafuzzaman M et al(2018)<sup>10</sup> observed spleen diameter in presence of varices was  $127.94 \pm 15.14$  in presence of varices and  $110.3 \pm 13.2$  in absence of varices and Significant difference was observed between presence of varices and spleen diameter. Observed PVD (mm) in our study was  $15.82 \pm 0.66$  in presence of varices and  $14.31 \pm 0.21$  in absence of varices. Significant difference was observed between presence of varices and PVD. Vijant Singh Chandail et al (2017)<sup>13</sup> study observed PVD of  $14.48 \pm 1.08$  in presence of varices and  $13.30 \pm 0.32$  in absence of varices and significant difference was observed between presence of varices and PVD. Observed PC/SD ratio in our study was  $793.83 \pm 454.77$  in presence of varices and  $1878.79 \pm 650.76$  in absence of varices. Significant difference was observed between presence of varices and PC/SD ratio. Vijant Singh Chandail et al (2017)<sup>13</sup> observed PC/ SD ratio was  $783.83 \pm 354.77$  in the presence of varices and  $1426 \pm 318.16$  in absence of varices and Significant difference was observed between presence of varices and PC/SD ratio. Dharmendra Tiwari et al (2016)<sup>17</sup> observed PC/ SD ratio was  $712 \pm 253$  in presence of varices and  $1318 \pm 248$  in absence of varices and significant difference was observed between presence of varices and PC/SD ratio. Mahafuzzaman M et al (2018)<sup>10</sup> observed PC/ SD ratio was  $688 \pm 227$  in presence of varices and  $1570 \pm 494$  in absence of varices and significant difference was observed between presence of varices and PC/SD ratio.

#### *Correlation analysis of non-invasive parameters:*

We studied the correlation between presence and absence of varices with non-invasive parameters like spleen diameter, platelet count, and portal vein diameter and platelet count spleen diameter ratio. Positive correlation (0.650, p value <0.01) was observed between spleen diameter and esophageal varices, which shows that with increase in spleen diameter esophageal varices also increases. Negative correlation (-0.605, p value <0.01) was observed between platelet count and esophageal varices, which shows that with decrease in platelet count notes increase in esophageal varices. Positive correlation (0.624, p value <0.01) was observed between portal vein diameter and esophageal varices, which shows that with increase in

portal vein diameter esophageal varices also increases. Negative correlation (-0.655, p value <0.01) was observed between platelet count spleen diameter ratio and esophageal varices, which shows that with decrease in platelet count spleen diameter ratio notes increase in esophageal varices. The same results were observed in Prathish Kumar et al (2017)<sup>12</sup>. The study showed that portal vein ( $r=0.595$ ,  $p<0.00001$ ) and spleen diameter ( $r=0.562$ ,  $p<0.00001$ ) showed statistically significant positive correlation and platelet count ( $r= -0.599$ ,  $p<0.00001$ ) and platelet count/spleen diameter (PC/SD) ratio ( $r= -0.693$ ,  $p<0.00001$ ) showed statistically significant negative correlation with the presence of esophageal varices.

#### *Spleen Diameter*

In our study to find out cut off value for spleen diameter we have used ROC curve and the cut off value for spleen diameter was  $\geq 111$ mm. Area under the curve for ROC curve was 0.88 (CI- 0.80-0.95, p value <0.01) with sensitivity and specificity 88.3% and 85% respectively and positive predictive value and negative predictive value 89.83% and 82.93% respectively. Esmat and Rashid et al(2011)<sup>19</sup>, studied 20 cases and found cut off for spleen diameter found was  $\geq 125$  mm, with sensitivity and specificity 100% and 77% respectively. G. Chandra Shekar et al(2016)<sup>20</sup>, obtained cut off value for spleen diameter was  $\geq 154$  mm with sensitivity and specificity 75% and 69.23% respectively and PPV and NPV 52.84% and 47.85% respectively. Zubia Jamil et al (2017)<sup>21</sup> obtained cutoff point of splenic diameter for detecting EV was  $>110$  mm with sensitivity of 83.75%; specificity of 64.29%; +LR, 2.35; -LR, 0.25; +PV, 20.7; -PV, 97.3).

#### *PC/SD ratio*

In our study to find we have used cut off value  $\leq 909$  as suggested by Giannini et al<sup>4</sup> with this cut off obtained sensitivity and specificity was 81.67% and 82.50% respectively and PPV and NPV of 87.50% and 75% respectively. Giannini et al (2006)<sup>4</sup> reported the results of a multicentre study to validate the use of PC/SD in the prediction of EV and obtained a cut-off value of 909, with the sensitivity of 92%, and the specificity of 67%. Esmat et al (2012)<sup>19</sup> obtained cut-off value of 1326.58 for the PC/SD with a resulting 96.34% of sensitivity, 83.33% specificity and 94% accuracy. G. Chandra Shekar et al(2016)<sup>20</sup>, obtained cut-off value of 815 for the PC/SD with a resulting 88% sensitivity, 65% specificity, PPV 58.36% and NPV 42.28% Dharmendra Tiwari et al (2016)<sup>18</sup>, concluded that a used cut-off value of 909 for the PC/SD gave a resulting 81.8% sensitivity, 100% specificity, PPV 100% and NPV 73.91%. Zubia Jamil et al (2017)<sup>21</sup> carried out study obtained cut off point for PC/SD of  $\leq 1077.42$  with sensitivity of 88.75%; specificity, 81.43%; +LR, 4.78; -LR, 0.14; PPV, 34.7; NPV, 98.5. Suresh Raghavan et al (2017)<sup>22</sup> obtained cut off value 919 for PC/ SD using ROC curve and had AUC 0.908 with sensitivity of 74 % and specificity of 88% which is statistically significant with a p

value <.001. Ender Gunes Yegin et al (2017)<sup>23</sup> obtained optimal PC/SD ratio cut-off level was determined using ROC curve which was 731, and had its sensitivity, specificity, PPV, and NPV were 77.1%, 71.9%, 75.8%, and 70.6%, respectively. Mohammed Aslam et al(2017)<sup>24</sup>, Patients were categorized into two groups based on cut off value of 909 for PC/SD and its relation to the grade of varices was studied. A significant difference between the presence or absence of esophageal varices and PC/SD of 909 was observed (p = 0.001). Our study does not demonstrate a statistically significant correlation between presence and grade of varices and ascites. The sensitivity of PC/SD ratio of  $\leq 909$  in predicting presence of EV was 88% with 95% CI (79-94%). Its PPV is 93% with 95% CI (84-97%). SaifAlam et al (2018)<sup>25</sup> obtained a cut off value  $\leq 903$ , with sensitivity of 85% and specificity of 77%.

### CONCLUSION:

From our study we conclude that platelet count and spleen diameter ratio' is useful denominator to predict the presence of higher grades of varices. Hence it can identify the subset of patients who require endoscopy for the prophylactic management of esophageal varices. Therefore reduces the burden on the endoscopy units, avoiding unnecessary screening endoscopies as well. It may reduce the cost of management of bleeding varices. Apart from being noninvasive, platelet count, spleen bipolar diameter and the PC/SD ratio is a relatively inexpensive test as platelet counts and abdominal ultrasounds would be obtained on all cirrhotic patients routinely as part of their clinical workup.

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