

# Diagnostic Accuracy of Platelet Count to Spleen Size for Prediction of Esophageal Varices in Patients of Liver Cirrhosis

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## ABSTRACT:

**Objective:** To determine the diagnostic accuracy of ratio of platelet count to spleen size for prediction of esophageal varices in patients of liver cirrhosis, keeping upper GI endoscopy as gold standard.

**Materials and Methods:** This cross-sectional validation study was carried out in Radiology Department, Combined Military Hospital, Peshawar from February, 2015 to August, 2015. One hundred and fifty patients of either sex, having liver cirrhosis with no episode of gastrointestinal bleeding, scheduled to undergo upper GI endoscopy were selected. Ultrasound abdomen of these patients was carried out and spleen size was determined in millimeters. Platelet count if already not performed was also carried out. Platelet count was divided by the spleen size to obtain the platelet count to spleen size ratio. Close follow up of the patient was done until he/she underwent upper GI endoscopy for diagnosis of esophageal varices. A correlation was performed between the platelet count to spleen size ratio and findings of upper GI endoscopy.

**Results:** Collected data was analyzed through computer software SPSS11.0. The ratio of platelet count to spleen size as a predictor of esophageal varices in patients of liver cirrhosis demonstrated sensitivity of 92.5 %, specificity of 87.5 %, positive predictive value of 93.3 %, negative predictive value of 86.1 % and diagnostic accuracy of 90.8 %.

**Conclusion:** The ratio of platelet count to spleen size as a predictor of esophageal varices in patients of liver cirrhosis is found to be high

**Keywords:** Diagnostic accuracy, Esophageal varices, Liver cirrhosis, Platelet count, Spleen size, Ratio of platelet count to spleen size

## INTRODUCTION:

Liver cirrhosis is a fatal disease, accounting to one of the leading causes of mortality and morbidity worldwide. It increases the intrahepatic vascular resistance and reduces the systemic and splanchnic resistance, leading to the development of portal hypertension. Portal hypertension results in increase in the porto-systemic gradient and venous collaterals form at various sites in an attempt to decompress the portal system. Varices develop due to enlargement of pre-existing anastomoses between the portal and the systemic venous systems.

The distal esophagus is the site of anastomosis of left gastric (coronary) vein and short gastric veins with the distal esophageal veins and serves as the commonest site of development of varices. The frequency of varices varies from 60 to 80 % in patients of cirrhosis.<sup>1</sup> At the time of diagnosis approximately 30 % of the patients of cirrhosis have esophageal varices, reaching up to approximately 90 % after about ten years.<sup>2</sup> The bleeding resulting from esophageal varices is the most dreadful complication of liver cirrhosis<sup>3</sup> associated with mortality as high as 11- 20 %, within six weeks of bleeding episode<sup>4,5,6,7</sup> and almost 70 % survivors having recurrence within the first year.<sup>8</sup> Hence, it requires constant vigilance, prompt diagnosis and active management to prevent any complications.

Upper GI endoscopy is considered the gold standard for the diagnosis of esophageal varices<sup>9</sup> with most current guidelines recommending all cirrhotic patients to be screened for presence of esophageal varices by upper GI endoscopy at the time of diagnosis.<sup>10,11,12</sup> However, it is an invasive procedure, which has a number of complications with infection, perforation and hemorrhage, being the most noteworthy. Also, it is neither a cost effective investigation nor is easily available. To counter this problem, various non-invasive predictors have been developed which include spleen size, platelet count to spleen size diameter, portal vein diameter, serum albumin count and ultrasound elastography. Among all these non invasive parameters, the platelet count to spleen size ratio has the highest diagnostic accuracy for diagnosis of esophageal varices at a cut off value of 909, having sensitivity of 100 %, specificity of 93 % with positive predictive value of 96 % and 100 %.<sup>13</sup> Congestive splenomegaly is a common finding in portal hypertension<sup>14</sup> and low platelet count serves as an independent risk factor for the development

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of esophageal varices<sup>15</sup>.

The use of noninvasive methods for prediction of esophageal varices would restrict endoscopic studies to those with high probability of having varices.<sup>16</sup> The study emphasizes upon the diagnostic accuracy of platelet count to spleen size ratio in predicting esophageal varices in patients of liver cirrhosis in our setup and can be used to screen cirrhotic patients for esophageal varices reporting to OPDs.

**MATERIALS AND METHODS:**

The study was conducted in Radiology Department, Combined Military Hospital, Peshawar, from 20<sup>th</sup> February 2015 to 20<sup>th</sup> August 2015. A total of 185 established patients of liver cirrhosis were evaluated. Non-probability, purposive sampling was done. The study was approved by institute’s ethical committee for research and all the procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. Radiologically diagnosed patients of liver cirrhosis, having findings of coarse liver echo texture with irregular margins and dilated portal vein on ultrasound were taken. Early cases diagnosed in the last 6 months, not yet undergone upper gastrointestinal endoscopy were selected. Radiologically diagnosed patients of liver cirrhosis having age between 30 and 70 years and both genders visiting the outpatient department were included in the study sample. Already diagnosed patients of esophageal varices on upper GI endoscopy or patients with history of hematemesis were excluded from the study.

Every patient was explained about the procedure and protocol of the ultrasound examination of the abdomen, and was given related instructions regarding the preparation for the procedure. The patients were examined in the right lateral decubitus position, pillow removed, hands resting by the side, during quiet respiration. Trans-abdominal ultrasound was performed using Toshiba Nemio XG Doppler ultrasound scanner with 4.2 MHz frequency scanner. The curved array transducer was used, placing it in the left lower inter costal spaces, identifying and measuring the spleen at its largest dimension, taking spleen size in millimeters. The upper limit of normal size on ultrasound was taken as 125 mm (12.5 cm). Patients having spleen size more than 125 mm were labeled as having splenomegaly. Platelet counts, if not already performed, will also be undertaken. The ratio of platelet count to spleen size was calculated and documented. The patient was sent to the gastroenterology department for upper GI endoscopy. All relevant information such as name, age, gender and results of platelet count, ultrasound an upper GI endoscopy was recorded in a predesigned performa. A correlation was performed between the platelet count to spleen size ratio and findings of upper GI endoscopy. Collected data was analyzed through computer software SPSS11.

**RESULTS:**

The gender distribution was 109 (58.9 %) males and 76 (41.1 %) females (Table 1 and Figure 1). The mean age of the patients was 58.11 ± 9.71 years with minimum age being 36 years and the maximum age 80 years (Table 2). About 93 (50.3%) patients were found suffering from hepatitis C, while 72 (38.9 %) patients were suffering from hepatitis B. Other less common causes included autoimmune, alcoholic and other causes (Table 3). The most common complaint was anorexia, (33.5 %) followed by abdominal distention (22.1 %) and jaundice (17.8 %) (Figure 2). The mean platelet count of all the patients was 120.97 x 10<sup>3</sup>/mm<sup>3</sup>. The mean spleen size calculated from ultrasound was 138.1 mm. 121 patients were detected having esophageal varices on upper gastrointestinal endoscopy while 64 patients did not have varices. The mean platelet count to spleen size ratio of all the patients was calculated to be 878.57± 121.85. Patients without esophageal varices had a mean platelet count to spleen size ratio of 1012.09 ± 92.02. Patients with esophageal varices had a mean platelet count to spleen size ratio of 806.82 ± 59.57. Taking platelet count to splenic size ratio of more than 909 as normal and comparing it with the upper GI endoscopy findings, the sensitivity was 92.5 %, specificity 87.5 %, positive predictive value 93.3 %, negative predictive value 86.1 % and diagnostic accuracy was 90.8 %.

Table: 1  
Gender wise stratification of groups

Gender	Groups		Total	P-Value
	Cirrhotics with esophageal varices	Cirrhotics without esophageal varices		
Male	73 (39.45%)	36 (19.45%)	109 (58.91%)	*0.866
Female	50 (24.02%)	26 (14.05%)	76 (41.08%)	
Total	123 (66.48%)	62 (33.51%)	185 (100%)	

\*P Value Calculated by Chi Square Test.

Figure: 1  
Gender distribution of patients

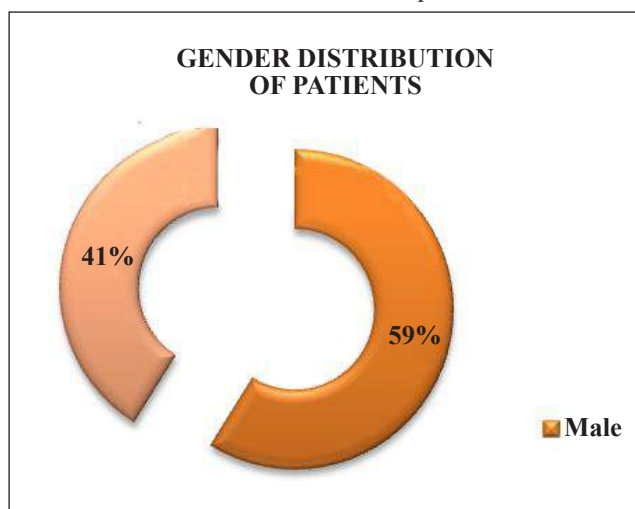


Table: 2  
Age wise stratification of groups

Age group	Groups		Total	P-Value
	Cirrhotics with esophageal varices	Cirrhotics without esophageal varices		
30-39	0 (0%)	7 (3.78%)	7 (3.78%)	*0.000
40-49	3 (1.62%)	28 (15.13%)	31 (16.75%)	
50-59	34 (18.37%)	27 (14.49%)	61 (32.97%)	
60-69	59 (31.89%)	3 (1.62%)	62 (33.51%)	
70-79	21 (11.35%)	2 (1.08%)	23 (12.43%)	
80-89	1 (0.54%)	0 (0%)	1 (0.54%)	
Total	118 (63.78%)	67 (36.21%)	185 (100%)	

\*P Value Calculated by Chi Square Test.

Figure: 2  
Frequency of distribution of clinical symptoms

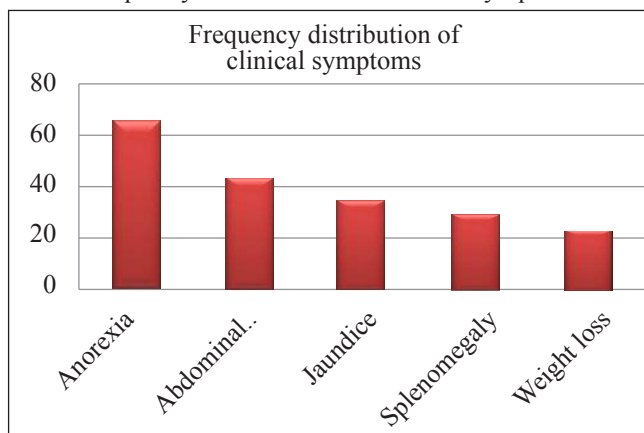


Table: 3  
Frequency and percentage distribution of etiology of cirrhosis

Variables	Number	Percentage
Hepatitis C	93	50.3 %
Hepatitis B	72	38.9 %
Autoimmune	4	2.1%
Alcoholic	3	1.6 %
Others	13	7.3 %
Total	185	

**DISCUSSION:**

Liver cirrhosis results from a long pathologic process initiated by chronic infection with hepatitis B virus or hepatitis C virus, excessive alcohol consumption, accumulation of fat in liver cells or other metabolic alterations.<sup>17</sup> Architectural changes caused by progressive hepatic fibrosis lead to the development of portal hypertension,<sup>18</sup> which results in formation of esophageal varices. Esophageal varices are a fatal complication, associated with high mortality and morbidity rates due to life threatening hemorrhages. Almost 4 % patients bleed per year, increasing to 15 % per year in patients with medium or large varices.<sup>19</sup> It also carries the threat of subsequent re-bleed, which can not only prove to be

lethal, but also compromises the quality of patient’s life. Upper gastrointestinal endoscopy is considered the gold standard for the diagnosis and grading of esophageal varices. However, it is an invasive procedure with limited availability. If all patients of liver cirrhosis had to undergo periodic screening with upper gastrointestinal endoscopies, this would put a tremendous financial burden on our health system and would lead to saturation of our health resources. Therefore, it is extremely important to devise noninvasive predictors of esophageal varices that would not rely upon upper gastrointestinal endoscopy for diagnosis. A lot of effort and research has been done in this regard and various parameters have been explored. Some of the parameters which have achieved reasonable success include spleen size, platelet count to spleen size ratio, portal vein diameter and Doppler studies of hepatic veins. These parameters require basic investigations like ultrasound and blood counts, which are performed routinely and therefore, do not exert any extra burden on the patient or the health system.

In our study, the ratio of platelet count to spleen size is calculated and its diagnostic accuracy as a predictor of esophageal varices in cirrhotic patients has been determined. In cirrhosis, the scarring and fibrosis leads to increased hepatic vascular resistance causing splenic congestion and splenomegaly. This is also the mechanism for development of portal hypertension and esophageal varices. Therefore, in patients of liver cirrhosis, the platelet count to spleen size ratio is generally reduced as compared to normal individuals. This usually correlates with the duration and severity of the disease and can thus be used to predict the presence of esophageal varices in a noninvasive manner.

Ratio of platelet count to spleen size is easy to perform, widely available and cost-effective parameter for the diagnosis of esophageal varices in patients suffering from liver cirrhosis. The same has been established by our study that all the patients who developed esophageal varices, as proved on upper GI endoscopy, had low values of ratio of platelet count to spleen size compared to those who had not developed esophageal varices as yet. The reliability is also evident by the high sensitivity and specificity, as well as other parameters like positive predictive value and negative predictive value. The diagnostic accuracy was calculated to be 90.67 %. Comparing the results of our study with other local, regional and international studies, it becomes clear that ratio of platelet count to spleen size is a safe, effective and reliable predictor of esophageal varices in patients of liver cirrhosis. Giannini<sup>13</sup> carried out a study in Italy, highlighting the significance of ratio of platelet count to spleen size as a noninvasive predictor of esophageal varices in patients of liver cirrhosis. A cut off of 909 showed sensitivity of 100 % and specificity of 93 % with positive predictive value of 96 % and 100 %. Abu El Makarem<sup>20</sup> conducted a study in Egypt, taking the ratio of platelet count to bipolar spleen diameter ratio for prediction of esophageal varices. A cut-off value of 939.7 gave sensitivity of 100%, specificity of 86.3 %,

positive predictive value of 95.6 % and negative predictive value of 100 %.

A study was published by Baig in India<sup>21</sup>, has revealed that platelet count to spleen size ratio had highest accuracy for the diagnosis of esophageal varices when the three parameters that is platelet count, spleen size and ratio of platelet count to spleen size were compared with a sensitivity of 98.1 % and specificity of 88.6 %. Local studies<sup>22,23</sup> have documented that platelet count to spleen size ratio is a simple and reproducible means for noninvasive diagnosis of esophageal varices, with sensitivity of 96.07 %, specificity of 93.75 %, and positive predictive value of 97.02 % and negative predictive value to 91.83 %. Other studies have also documented similar findings.<sup>24,25,26</sup> The results of all these studies were comparable to our study. There were minor differences with the above mentioned studies which may be due to difference in sample size and population, regional and ethnical differences in the population studies and human errors during the investigation of platelet count in laboratory, spleen size on ultrasound and identification of esophageal varices during upper GI endoscopy.

#### CONCLUSION:

Platelet count to spleen size ratio is a reliable non-invasive predictor of esophageal varices in patients of liver cirrhosis due to its high diagnostic accuracy. It can be used as a primary investigation for identifying patients at a higher risk of developing esophageal varices before subjecting them to upper GI endoscopy, thus reducing the number of unnecessary upper GI endoscopies.

#### Conflict of interest:

This study has no conflict of interest to declare by any author.

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