RESEARCH
O&G Forum 2024; 34 – 3s: 100-104

A STUDY ON PLATELET COUNT TO SPLEEN DIAMETER RATIO TO PREDICT ESOPHAGEAL VARICES IN PATIENTS WITH HEPATIC CIRRHOSIS IN A TERTIARY CARE HOSPITAL

Nawal Mahboob Basha[1], Mohammed Abdul Kabir[2], Syeda Afreen Fatima[3*]
[1,2]Intern, Shadan Institute of Medical Sciences & Hospital, Hyderabad, Telangana.
[*3]Assistant Professor, Department of Obstetrics & Gynaecology, Dr.VRK Women's Medical College Teaching Hospital & Research Center, Hyderabad. Telangana state.

Abstract
Background: Cirrhosis instances can appear with a variety of clinical symptoms [1]. The disease is characterized by significant hepatic fibrosis, irreversible parenchymal damage, and the production of regenerative nodules. Gilbert initially created the term "portal hypertension". Cirrhotic livers can cause increased spontaneous blood flow, vasodilation, and hepatic resistance [2]. Esophageal variceal development is a prominent consequence of portal hypertension (PHT) [3].
OBJECTIVES: To study the value of platelet count to spleen diameter ratio as a non-invasive parameter for diagnosing esophageal varices (EVs) in Liver Cirrhosis.
MATERIAL & METHODS: Study Design: Hospital-based, cross sectional study. Study area: The study was conducted in the Department of General Medicine, Shadan Institute of Medical Sciences & Hospital, Hyderabad, Telangana from September 2022 to February 2023. Study population: Outpatients and Inpatients of both Departments of General Medicine and Gastroenterology. Sample size: Study consisted a total of 100 subjects. Sampling Technique: Simple Random technique. Study tools and Data collection procedure: Hundred patients with cirrhosis of liver, attending the medical and gastroenterology wards and outpatient departments, were selected, based on inclusion and exclusion criteria. All patients in the study underwent a full clinical evaluation. Clinical history and physical examination findings were recorded with particular attention to present or previous hematemesis, malena, bleeding per rectum, bleeding tendencies, alcoholism, blood transfusion, intake of hepatotoxic drugs, exposure to Sexually transmitted diseases, IV drug abuse, jaundice, anemia, edema, stigmata of chronic liver disease, dilated abdominal veins, ascites, splenomegaly andencephalopathy.
Results: Relationship between non-invasive parameters like Serum Bilirubin, Serum albumin, Hemoglobin, Platelet count, spleen Bipolar diameter to presence of varices was studied. Of this only Platelet Count (P=0.0001) and Spleen Bipolar diameter (P=0.0002) had statistical significance.
CONCLUSION: The use of Platelet count/Splenic diameter ratio, non-invasive criteria in appropriate subgroups of cirrhotic patients for esophageal varices screening and follow-up can significantly reduce health-care costs and patient pain, as well as the strain on endoscopy units.
Keywords: esophageal varix; portal hypertension; platelet count; spleen diameter

INTRODUCTION

Cirrhosis instances can appear with a variety of clinical symptoms [1]. The disease is characterized by significant hepatic fibrosis, irreversible parenchymal damage, and the production of regenerative nodules. Gilbert initially created the term "portal hypertension". Cirrhotic livers can cause increased spontaneous blood flow, vasodilation, and hepatic resistance [2]. Esophageal variceal development is a prominent consequence of portal hypertension (PHT) [3].

Approximately one-third of individuals experience gastroesophageal variceal bleed [4]. According to the Baveno VII consensus on PHT, individuals with cirrhosis should undergo an upper gastrointestinal endoscopic (UGI) test to identify oesophageal varices at diagnosis [5]. UGI endoscopy is advised every 1-2 years for patients with minor varices and 2-3 years for those without varices to monitor disease progression [6]. Endoscopy is an invasive and uncomfortable diagnostic procedure that may not be affordable for some due to comorbidities and financial constraints [7]. Non-invasive and easily accessible tools with significant predictive value in esophageal variceal diagnosis are needed. Prior studies have employed non-invasive methods including platelet count/spleen diameter (PC/SD) ratio, fibrotest, and fibroscan test to predict esophageal variceal disease. However, the PC/SD ratio has shown the most promise [8].

Esophageal varices often occur when the hepatic venous pressure gradient (HVPG) exceeds 10 Hg. The size of the variceal wall rises by 5-10% per year, which might cause rupture and hemorrhage [9]. Using noninvasive parameters, UGI endoscopy can be avoided in cases with low risk of high-grade

esophageal varices, reducing patient discomfort and financial burden [10]. Platelet count < 88,000/cc mm accurately predicts the existence of big oesophageal varices (OR = 5.5, 95% CI = 1.4-23) and stomach varices (OR = 5, 95% CI = 1.4-23) [11].
This study aimed to investigate the correlation between platelet count, spleen diameter, and ratio with the existence of oesophageal varices in cirrhotic individuals.
OBJECTIVES: To study the value of platelet count to spleen diameter ratio as a non-invasive parameter for diagnosing esophageal varices (EVs) in Liver Cirrhosis.

MATERIAL & METHODS:
Study Design: Hospital-based, cross-sectional study.
Study area: The study was conducted in the Department of General Medicine, Shadan Institute of Medical Sciences & Hospital, Hyderabad, Telangana from September 2022 to February 2023.
Study population: Outpatients and Inpatients of both Departments of General Medicine and Gastroenterology.
Sample size: Study consisted a total of 100 subjects.
Sampling Technique: Simple Random technique.
Inclusion Criteria: All diagnosed, previously or newly, cases of cirrhosis of liver, based on physical examination, biochemical parameters, ultrasound abdomen and upper GI endoscopy.
Exclusion criteria:

- Patients on medication for primary prophylaxis of varices,
- Those with varices/variceal bleed, Unstable patients, with encephalopathy, hepatorenal syndrome, sepsis,
- History of ligation/sclerotherapy.
- Patients with hepatocellular carcinoma Portal vein thrombosis
- Previous or current treatment with β blockers, diuretics or other vasoactive drugs.
- Budd Chiari Syndrome.

Study tools and Data collection procedure:
Hundred patients with cirrhosis of liver, attending the medical and gastroenterology wards and outpatient departments, were selected, based on inclusion and exclusion criteria. All patients in the study underwent a full clinical evaluation. Clinical history and physical examination findings were recorded with particular attention to present or previous hematemesis, malena, bleeding per rectum, bleeding tendencies, alcoholism, blood transfusion, intake of hepatotoxic drugs, exposure to Sexually transmitted diseases, IV drug abuse, jaundice, anemia, edema, stigmata of chronic liver disease, dilated abdominal veins, ascites, splenomegaly and encephalopathy.
All patients underwent biochemical tests, like liver function tests, complete blood counts, renal function tests, prothrombin time, ultrasonography of the abdomen to confirm the presence of cirrhosis and to record the spleen bipolar diameter, portal vein size, ascites and presence of collaterals and Ascitic fluid analysis in patients with ascites. Upper GI endoscopy was done in all patients to confirm the presence of varices and also to grade them.
Statistical analysis:
The data has been entered into MS-Excel and statistical analysis has been done by using IBM SPSS Version 25.0. For categorical variables, the data values are represented in terms of numbers and percentages. The chi-square test was used to assess group association. For continuous variables, mean and standard deviation of the data are displayed. The student's t-test was used to compare the mean differences between the two groups. All p values less than 0.05 are regarded as statistically significant.

OBSERVATIONS & RESULTS:
Table 1: Relationship Between Age of the Study Population and Grade of Varices

Varices	age group							Total
		<20	21-30	31-40	41-50	51-60	>60	
Grade of varices	I	1	4	6	7	4	1	23
	II	2	3	4	7	5	2	23
	III	0	5	6	7	7	2	27
	IV	0	0	0	7	3	0	10
	0	4	2	3	2	4	2	17
Total		7	14	19	30	23	7	100

χ^2 = 7.96 P=0.94 NS

Mean age of the patients in the study was 42.69. SD = 12.62. Distribution of grade of varices was studied in various age groups and no significant correlation was detected.

Table 2: Distribution Based on Sex

Varices		Sex		Total
		Male	Female	
Grade of Varices	I	14	9	23
	II	16	7	23
	III	13	14	27
	IV	5	5	10
	0	12	5	17
Total		60	40	100

χ^2 = 3.67 P= 0.45 NS

No significant gender difference in the distribution of grade of varices was found in our study.

Table 3: Distribution Based on Grade of Varices

Varices		Frequency	Percent
Grade of Varices	I	23	23.0
	II	23	23.0
	III	27	27.0
	IV	10	10.0
	0	17	17.0
	Total	100	100.0

Based on Conn's Grading, the grading of the varices in study population was done. Grade III varices predominated (27 %). Varices were absent (Grade 0) in 17 % of the patients.

Table 4: Relationship Between Lab Parameters and Presence of Varices

Parameter	Varices	N	Mean	Std. Deviation	Student t-test
Serum Bilirubin	Present	83	3.831	2.0062	t= 0.13 P= 0.89
	Absent	17	3.764	1.6116	
	Total	100	3.864	3.7869	
Serum Albumin	Present	83	2.883	.6337	t=1.07 P=0.285
	Absent	17	2.711	.3924	
	Total	100	2.854	.603	
Hemoglobin	Present	83	10.409	2.4099	t=1.26 P=0.20
	Absent	17	11.235	2.6685	
	Total	100	10.55	6.1275	
Platelet Count	Present	83	121084.33	23784.273	t=5.83 P=0.0001
	Absent	17	158235.29	24551.337	
	Total	100	127400.00	27690.07 04	
Spleen Bipolar Diameter	Present	83	140.90	10.316	t=3.87 P=0.0002
	Absent	17	128.70	17.682	
	Total	100	138.83	12.746	

Relationship between non-invasive parameters like Serum Bilirubin, Serum albumin, Hemoglobin, Platelet count, spleen Bipolar diameter to presence of varices was studied. Of this only Platelet Count (P=0.0001) and Spleen Bipolar diameter (P=0.0002) had statistical significance.

Table 5: Relationship Between Portal Vein Size and Presence of Varices

Parameter	Varices	N	Mean	Std. Deviation	Student t-test
Portal Vein Size	Present	83	14.361	1.3315	t=5.58 P=0.01
	Absent	17	12.352	1.4528	

Significance was noted between Portal vein size(cm) and presence of Varices in the study group.

Table 6: Association Between Pc/Sd Ratio and Presence of Varices

		Varices
PC/SD ratio	**Pearson Correlation**	**-.2741**
	Sig. (2-tailed)	**.000**
	N	**100**

**** Correlation is significant at the 0.01 level (2-tailed).**

There was statistically significant correlation between presence of varices and a platelet count/ splenic bipolar diameter ratio of ≤1014. 0-0.2 poor correlation,0.2-0.4 fair,0.4-0.6 moderate,0.6-0.8 good, 0.8- 1.0 Very good.

Table 7: Relationship Between PC/SD Ratio and Grade of Varices

		PC/SD RATIO		Total
		≤1014	>1014	
Grade of Varices	I	21	2	23
	II	20	3	23
	III	26	1	27
	IV	10	0	10
	0	6	11	17
Total		83	17	100

χ^2 = 31.1 P=0.0001 S

Patients were categorized in to two groups based on cut off value of 1014 for Platelet count / splenic diameter ratio. It's relation to the grade of varices was studied. A significant difference between the presence or absence of esophageal varices and platelet count to spleen diameter ratio of ≤1014 was observed.

Table 8: Role of PC/SD Ratio In Predicting Varices

		Varices		Total
		Present	Absent	
PC/SD RATIO	**≤1014**	**77**	**6**	**83**
	>1014	**6**	**11**	**17**
Total		**83**	**17**	**100**

	Value in %	95 % CI
Sensitivity	92.77	84.9-97.3
Specificity	64.71	38.33-85.8
Positive Likelihood ratio	2.63	1.38-5.02
Negative Likelihood ratio	0.11	0.05-0.26
Positive Predictive Value	92.77	87.05-96.08
Negative Predictive Value	64.71	44.01-81.05

The sensitivity of PC/SD Ratio of ≤ 1014 in predicting presence of esophageal varices was 92.77 %. Its positive predictive value is 92.77 %.

DISCUSSION:

A total of hundred patients who met the inclusion criteria, were included in the study. Among whom sixty were male and forty were female. The mean age was 42.69. (SD = 12.62).

Comparison Between Present Study and Study By Giannini et.al.[12],

S. no	Parameter	Present study	Giannini et. al.,
1	Place	Hyderabad	Multicenter, International.
2	Sample size	100	218
3	PC/SD Ratio Cutoff	1014	909
4	Prevalence of Varices	83%	54.1%
5	Sensitivity	92.77%	91.5%
6	Specificity	64.71%	67.0%
7	Positive predictive value	92.77%	76.6%

8	Negative predictive value	64.71%	87.0%
9	Positive likelihood ratio	2.63	2.77
10	Negative likelihood ratio	0.11	0.13

Distribution of grade of varices was studied in various age groups and no significant correlation was detected. No significant gender difference in the distribution of grade of varices was found in our study. We studied the frequency of distribution based on Conn's grading of varices and found that Grade III predominated (27 %). 17 % of the study population did not have varices. Relationship between noninvasive parameters like Serum Bilirubin, Serum albumin, Hemoglobin, Platelet count, spleen Bipolar diameter to presence of varices was studied. Among these only Platelet Count (P=0.0001) and Spleen Bipolar diameter (P=0.0002) had statistical significance. The results indicating the relevance of platelet count are on par with studies by Thomopolos et al.[13], Madhotra et al.[14], Pilette et al.[15], state that splenomegaly is an independent predictor of presence of varices. Significance was noted between portal vein size (cm) and presence of varices. Similar results were obtained in study by D'Amico et al.[9].

Patients were categorized in to two groups based on cut off value of 1014 for Platelet count / splenic diameter ratio. It's relation to the grade of varices was studied. A significant difference between the presence or absence of esophageal varices and platelet count to spleen diameter ratio of 1014 was observed. (P= 0.0001). This finding is in agreement with study by Giannini et al.[12].The use of Platelet count/ splenic diameter ratio overcomes the fallacy of using Platelet count alone in predicting esophageal varices for the reason that platelet count may decrease in chronic liver disease due to several other factors. This ratio is introduced to take in to consideration the decrease in platelet count which most likely depends on hypersplenism caused by portal hypertension. Performing unnecessary endoscopy in all patients can be avoided if we take a platelet count/ splenic diameter ratio cut off > 1014, without running the risk of missing cases with esophageal varices.

The two groups showed statistically significant difference (P= 0.0001) based on presence and absence of varices. This is consistent with studies by Gurubacharya et al.[16], Dittrich et al.[17]. The sensitivity of PC/SD Ratio of ≤1014 in predicting presence of esophageal varices was 92.77% with 95 % CI 84.9-97.3% It's positive predictive value is 92.77 % with 95 % CI 87.05-96.08% (Table 8). However, study by Gianni et al.[12] brought out a sensitivity of 100 % and specificity of 93 % if Platelet count /Splenic diameter ratio was used in predicting varices. Even though, in our study the sensitivity of the ratio was only 92.77%, it would still be a very good tool for screening since we cater to a bigger patient population and have restricted resources. Since Cirrhotic patients need regular follow up with repeated endoscopies, using PC/SD ratio cut off of 1014 would help reduce the burden.

Thus use of these parameters may help identify patients with a low probability of esophageal varices who may not need endoscopy. This may help reduce costs and discomfort for these patients and the burden on endoscopy units. These parameters could be used to distinguish between high- and low-risk patients; the high-risk patients could then be followed up with endoscopic examinations. The principal noninvasive predictor of esophageal varices may be the PC/SD ratio because it has high sensitivity and specificity in patients with hepatic cirrhosis. This ratio could represent an acceptable parameter of clinical relevance in patients with portal hypertension.

The cutoff point for the PC/SD ratio in our study was higher than that reported by Giannini et al (< 1014 and< 909, respectively). This difference is probably influenced by racial characteristics. The lower values in the study by Giannini et al.[12] were obtained from studies of a principally Caucasian population; the patients were taller than in our population and therefore had larger internal organs. The patient population included in our study is representative of the population with hepatic cirrhosis who have signs of portal hypertension seen in clinical practice.

Thrombocytopenia can be caused by splenic sequestration or by a decrease in hepatic production of thrombopoietin caused by a failing liver and antibody platelet destruction. Some authors who have evaluated noninvasive parameters in the diagnosis of esophageal varices have found that splenomegaly can have a high sensitivity but a low specificity, whereas thrombocytopenia shows the opposite, that is, a low sensitivity and intermediate specificity. In the study by Chalasani et al.[18], the PC and splenomegaly independently predicted the presence of esophageal varices. In the study by Madhotra et al [14], 32% of the patients had a PC < 68000/μL without splenomegaly. These differences may reflect differences in the etiology of cirrhosis, action of immunological mediators, or reduction in thrombopoietin and not just splenic sequestration.

The positive predictive value (or the proportion of patients with a positive test result who have the disease) was 92.77%, but the negative predictor value (or the proportion of people with a negative test results who do not have the disease) was 64.71% as a reflection of our specificity (64.71%), the prevalence of esophageal varices in patients in cirrhosis and the different etiologies of the chronic liver diseases.

The use of the PC/SD ratio will help create a lower cost and more effective method to identify esophageal varices in patients with portal hypertension. The ideal tool should have high sensitivity and specificity as close as possible to 100% to obtain an accurate profile a high security profile and to avoid the need for endoscopy in patients without esophageal varices. The PC/SD ratio should be considered when identifying patients with a high risk of developing esophageal varices.

CONCLUSION:

The use of Platelet count/Splenic diameter ratio, non-invasive criteria in appropriate subgroups of cirrhotic patients for esophageal varices screening and follow-up can significantly reduce health-care costs and patient pain, as well as the strain on endoscopy units.

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