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A Study on Platelet Count-Splenic Diameter Ratio as a Non-Invasive Predictor of Esophageal Varices in Cirrhosis

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ABSTRACT
Cirrhosis, a chronic liver condition characterized by fibrosis and impaired liver function, is a leading cause of morbidity and mortality worldwide. A major complication of cirrhosis is the development of esophageal varices due to portal hypertension, which significantly increases the risk of upper gastrointestinal bleeding. Traditional diagnostic methods for esophageal varices, like endoscopy, are invasive. Therefore, there is a growing need for non-invasive, cost-effective screening tools, such as the platelet count-splenic diameter (PC-SD) ratio, to predict the presence of esophageal varices. This study aimed to evaluate the efficacy of the platelet count-splenic diameter ratio as a non-invasive predictor for esophageal varices in cirrhotic patients, thereby improving the early detection and management of this complication. A cross-sectional study was conducted from June 2022 to June 2024 at Aarupadai Veedu Medical College, Puducherry. The study included 94 cirrhotic patients who underwent screening endoscopy for esophageal varices. Data collection involved medical history, clinical examination, laboratory tests, endoscopy and ultrasonography. The PC-SD ratio was calculated and analyzed. Statistical analysis was performed using SPSS, with Fisher's exact test to determine the significance of associations. The study found that 66% of participants had esophageal varices. The presence of varices was significantly associated with a spleen diameter greater than 150 mm (p=0.0001), platelet counts of ≤125,000/µL (p=0.0001) and a PC-SD ratio of ≤909 (p=0.0001). These findings suggest that the PC-SD ratio is a reliable non-invasive marker for predicting esophageal varices in cirrhotic patients. The PC-SD ratio is a valuable, non-invasive tool for predicting esophageal varices in patients with cirrhosis. It can potentially reduce the need for invasive procedures like endoscopy, improving patient compliance and reducing healthcare burdens. This study reinforces the need for ongoing research to refine non-invasive screening methods for cirrhosis-related complications.

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Key Words
Cirrhosis, esophageal varices, platelet count, splenic diameter, non-invasive screening, portal hypertension, PC-SD ratio

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INTRODUCTION

One of the leading causes of early death is cirrhosis, a prevalent liver condition with substantial morbidity. It is possible at any age. The most frequent causes worldwide are excessive alcohol intake and viral hepatitis[1]. Cirrhosis, a progressive liver disease characterized by fibrosis and compromised liver function, often leads to serious complications, including esophageal varices. Esophageal varices, which are dilated veins in the esophagus, can result from portal hypertension, a common consequence of cirrhosis. The presence of these varices poses a significant risk of upper gastrointestinal bleeding, a condition associated with high morbidity and mortality. Early detection and monitoring of esophageal varices are crucial for preventing such life-threatening events[2]. Traditional methods for diagnosing esophageal varices, such as endoscopy, are invasive and may not always be readily accessible or feasible. Consequently, there is a need for non-invasive, cost-effective screening tools to identify patients at risk of variceal bleeding. The platelet count-splenic diameter ratio (PC-SD ratio) has emerged as a promising non-invasive predictor in this context. This ratio is derived from simple, readily available clinical parameters: platelet count and splenic diameter, measured via abdominal ultrasound[3,4]. Portal hypertension, the primary consequence of cirrhosis, causes variceal haemorrhage, which accounts for 35-40% of deaths. It is presently advised that all patients with chronic liver disease undergo endoscopic screening for esophageal varices (EV) at the time of cirrhosis diagnosis[5]. The rationale behind using the PC-SD ratio stems from its association with portal hypertension. In cirrhosis, portal hypertension often results in splenomegaly (enlarged spleen) and thrombocytopenia (low platelet count). Invasive techniques to identify the occurrence of esophageal varices need to be avoided in favour of simple, readily accessible and repeatable investigation/screening to increase patient compliance and lessen the workload on doctors and hospitals. By evaluating the PC-SD ratio, clinicians may be able to estimate the severity of portal hypertension and the risk of esophageal varices, potentially offering an alternative to invasive diagnostic procedures[6]. This study aims to investigate the efficacy of the platelet count-splenic diameter ratio as a non-invasive predictor of esophageal varices in patients with cirrhosis. By evaluating this ratio's predictive value, the study seeks to enhance the management of cirrhosis and reduce the reliance on invasive diagnostic methods.

MATERIALS AND METHODS

The study was hospital-based cross-sectional research conducted from June 2022 to June 2024 for both the outpatient and inpatient departments in the Department of General Medicine, at Aarupadai Veedu Medical College, Puducherry. All the study participants gave written informed consent form before the interview. The ethical committee approval was obtained with ethical approval number (IHEC No. AV/IHEC/2022/087) from the institutional Human Ethics Committee of Aarupadai Veedu Medical College and Hospital in Kirumampakam, Puducherry. It included patients over 18 years old, of both genders, who were either undergoing screening endoscopy for varices at the time of cirrhosis diagnosis or were known cirrhotic patients who had never had such screening, irrespective of cirrhosis etiology. Exclusion criteria included patients with active upper gastrointestinal bleeding, a history of endoscopic sclerotherapy or band ligation of esophageal varices, previous surgery for portal hypertension, or prior beta-blocker treatment. The sampling population comprised all cirrhosis patients attending the OPD and IPD within 48 hours, with a sample size of 94 calculated based on the study conducted by Waghralkar M et al., in the year 2008[7]. Consecutive sampling was employed. Ethical approval was obtained and informed consent was collected from participants. Data collection involved a detailed medical history, clinical examination, laboratory tests, endoscopy to assess esophageal varices and ultrasonography for spleen measurement. The platelet count/spleen diameter ratio was calculated and analyzed, with subgroup analyses conducted for various liver function impairments and disease etiologies. To analyse the data SPSS (IBM SPSS Statistics for Windows, Version 26.0, Armonk, NY: IBM Corp. Released 2019) and Excel Sheet was used to enter the data is used. The Normality tests, Kolmogorov-Smirnov and Shapiro-Wilks tests results revealed that the data follows normal distribution. Therefore, to analyse the data, parametric test was applied. Descriptive statistics determined the frequency, percentage, mean and standard deviation for the variables. Fisher exact test was applied to find the statistical significance difference between the variables. Significance level is fixed as 5% (a=0.05). P-value <0.05 is considered to be statistically significance.

RESULTS AND DISCUSSIONS

In our study, age-wise distribution shows that the participants were predominantly over 50 years of age. Specifically, 31.9% of the participants were aged 40 years or younger, while the largest group, comprising 39.4%, were over 50 years old. The age groups of 41-45 years and 46-50 years were less represented, with 21.3% and 7.4%, respectively. This indicates that the study's sample has a notable concentration of participants at the extremes of the age range, with fewer middle-aged individuals. (Table 2) depicts the gender distribution among the study participants

shows a significant imbalance. Males comprise the vast majority, with 82 participants, accounting for 87.2% of the total sample. In contrast, females are markedly under represented, with only 12 participants, making up just 12.8% of the total. This disparity suggests that the study's findings may be heavily influenced by male perspectives and experiences, potentially limiting the generalizability of the results to the broader population, especially to females. (Table 3) depicts the distribution of alcohol consumption among the study participants indicates that a substantial majority, 86.2%, are classified as alcoholics, with 81 individuals reporting alcohol use. In contrast, only 13 participants, or 13.8%, do not consume alcohol. This significant difference highlights a strong prevalence of alcohol use within the study group, which could have implications for the study's findings and interpretations, especially if alcohol consumption is a relevant factor in the research context. The (table 4) provides descriptive statistics, including mean and standard deviation, for various measurable variables among the study participants. The mean age of participants is 46.08 years, with a standard deviation of 8.36, indicating a moderate spread in ages. Hemoglobin (HB) levels range from 9.10-13.10, with a mean of 10.97 and a standard deviation of 0.93, suggesting relatively consistent HB levels across participants. Serum bilirubin levels average 2.23 with a standard deviation of 0.52, while serum protein levels are quite stable, with a mean of 6.28 and a standard deviation of 0.33. Albumin levels show a mean of 2.58 and a standard deviation of 0.41. Prothrombin time (PT) averages 21.48 seconds, with a standard deviation of 3.03 and platelet counts vary widely, with a mean of 121,265.95 and a standard deviation of 17,351.62. Other variables include spleen diameter, with a mean of 157.25 and standard deviation of 12.95 and the ratio, averaging 778.51 with a standard deviation of 159.05. Specific subgroups of 40 participants each are reported for RI (mean 0.67, SD 0.08), BWT (mean 2.75, SD 0.60), gestational age at delivery (mean 38.45 weeks, SD 1.81), APG (mean 8.37, SD 2.03) and stay duration (mean 7.66 days, SD 8.55). This data provides a detailed overview of the health and demographic characteristics of the study population. The data in (Table 5) explores the relationship between spleen diameter and the presence of esophageal varices (OGV) among study participants. Among those with a spleen diameter of 150mm or less, only 4.3% tested positive for OGV, while 21.3% tested negative. In contrast, for participants with a spleen diameter greater than 150 mm, a significant 61.7% tested positive for OGV, while only 12.8% tested negative. Overall, 66.0% of the study participants had a positive OGV status, compared to 34.0% with a negative status. The association between larger spleen diameter and the presence of OGV is statistically significant, as indicated by the Fisher's Exact test value of 34.873 and a p-value of 0.0001, suggesting a strong correlation between increased spleen size and the occurrence of esophageal varices. (Table 6) shows the association between platelet count and the presence of esophageal varices (OGV) among the study participants. In the group with platelet counts of 125,000 or fewer, a high percentage, 62.8%, tested positive for OGV, while only 3.2% tested negative. Conversely, in the group with platelet counts above 125,000, only 3.2% tested positive for OGV, while 30.9% tested negative. Overall, 66.0% of participants had a positive OGV status, compared to 34.0% with a negative status. The Fisher's Exact test value of 69.177 and the p-value of 0.0001 indicate a statistically significant association, suggesting that lower platelet counts are strongly correlated with the presence of esophageal varices. (Table 7) examines the association between a specific ratio (presumably a clinical parameter) and the presence of esophageal varices (OGV) among the study participants. In participants with a ratio of 909 or less, a substantial 63.8% tested positive for OGV, while only 8.5% tested negative. In contrast, among those with a ratio greater than 909, only 2.1% tested positive for OGV, while 25.5% tested negative. Overall, 66.0% of the participants had a positive OGV status, compared to 34.0% with a negative status. The statistical analysis, indicated by a Fisher's Exact test value of 54.341 and a p-value of 0.0001, demonstrates a significant association between the lower ratio and the presence of OGV. This suggests that a ratio of 909 or less is strongly correlated with the presence of esophageal varices, while higher ratios are more often associated with the absence of OGV.

Table 1: Age-Wise Group Distribution Among the Study Participants

Age Distribution	Frequency	Percentage
≤40 years	30	31.9
41-45 years	20	21.3
46-50 years	7	7.4
>50 years	37	39.4

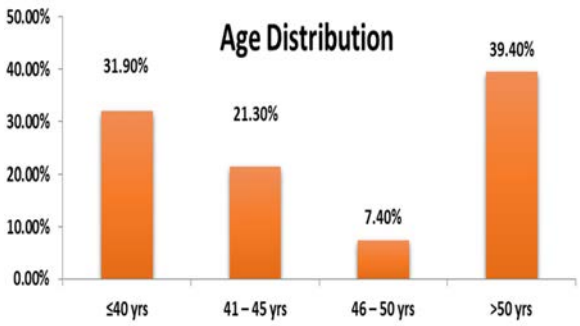

Fig 1: Age Group Distribution of the Study Participants

In present study majority (39.4%) of the patients were between 50-60 years of age. It is noted that overall 31.9% of patients were <40 years of age and very few patients (7.4%) were between 46-50 years of age.

Table 2: Frequency and Percentage Distribution of Gender Distribution Among the Study Participants

Gender	Frequency	Percentage
Male	82	87.2
Female	12	12.8

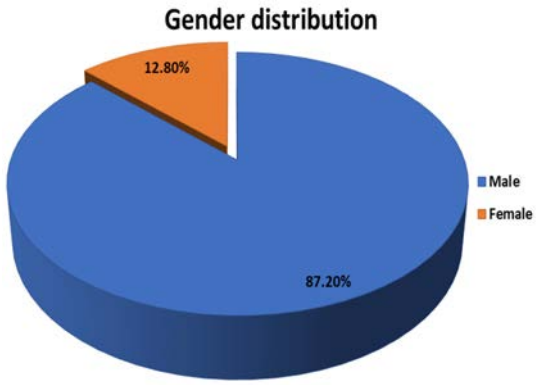

Fig 2: Gender Distribution of the Study Participants

In our study males constituted 87.20% and females constituted 12.80%. In our population males predominated the study.

Table 3: Frequency and Percentage Distribution of Alcoholic Distribution Among the Study Participants

Alcoholic	Frequency	Percentage
Yes	81	86.2
No	13	13.8

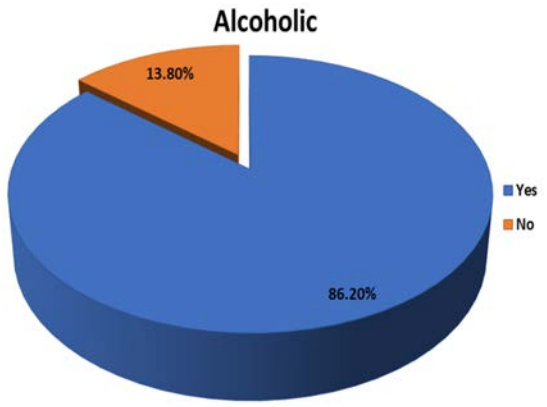

Fig 3: Frequency and Percentage Distribution of Alcoholic Distribution of the Study Participants

In our study alcoholics constituted 86.20% of the total cirrhotic cohort, with 13.20% being non-alcoholics.

Table 4: Mean and Standard Deviation of All Measurable Variables

Variable	Minimum	Maximum	Mean±SD
Age	29.00	59.00	46.08±8.36
HB	9.10	13.10	10.97±0.93
Serum Billirubin	1.30	3.60	2.23±0.52
Serum Protein	5.50	7.00	6.28±0.33
Albumin	1.80	3.90	2.58±0.41
PT	15.00	29.00	21.48±3.03
Platelet Count	92000.00	167000	121265.95±17351.62
Spleen Diameter	125.00	181.00	157.25±12.95
Ratio	519.33	1118.85	778.51±159.05

Table 5: Association Between Spleen Diameters and OGV Among the Study Participants

Spleen diameter	OGV				
	Positive	%	Negative	%	Total
≤150	4	4.3%	20	21.3%	24 (25.5%)
>150	58	61.7%	12	12.8%	70 (74.5%)
Total	62	66.0%	32	34.0%	94 (100%)
Fisher's Exact test value		34.873	P value		0.0001*

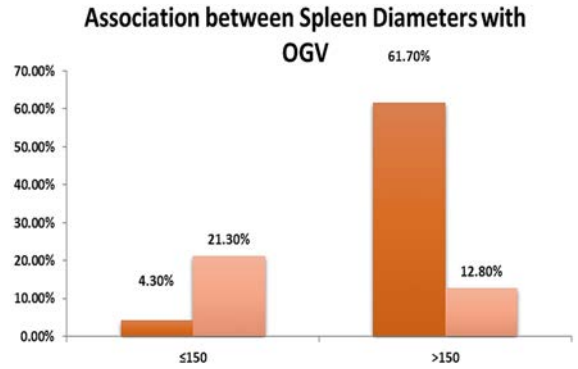

Fig 4: Association Between Spleen Diameters and OGV Among the Study Participants

In our study, a spleen diameter greater than 150 mm was strongly associated with the presence of Esophageal Varices.

Table 6: Association Between Platelet Count and OGV Among the Study Participants

Platelet count	OGV				
	Positive	%	Negative	%	Total
≤125000	59	62.8%	3	3.2%	62 (66.0%)
>125000	3	3.2%	29	30.9%	32 (34.0%)
Total	62	66.0%	32	34.0%	94 (100%)
Fisher's Exact test value		69.177	P value		0.0001*

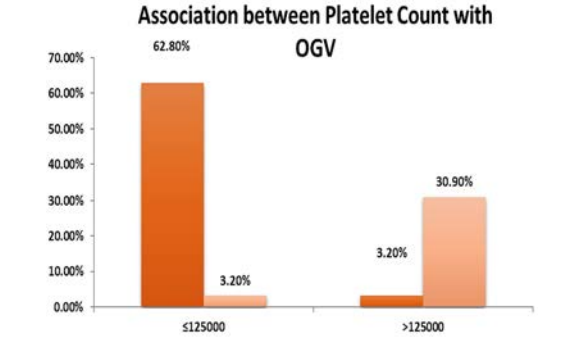

Fig 5: Association between Platelet Count and OGV of the study participants

Lower platelet counts (≤125,000/µL) were significantly associated with the presence of Esophageal Varices.

Table 7: Association Between Ratio and OGV Among the Study Participants

Ratio	OGV				
	Positive	%	Negative	%	Total
≤909	60	63.8%	8	8.5%	68 (72.3%)
>909	2	2.1%	24	25.5%	26 (27.7%)
Total	62	66.0%	32	34.0%	94 (100%)
Fisher's Exact test value		54.341	P value		0.0001*

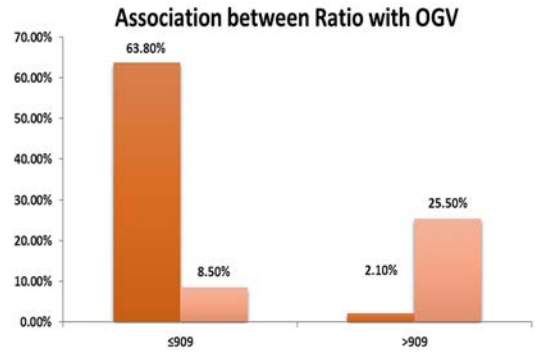

Fig 6: Association Between Ratio and OGV Among the Study Participants

A lower PDR (≤909) was strongly associated with the presence of Esophageal Varices.

The study involved 94 participants diagnosed with cirrhosis, predominantly male (87.2%), with a mean age of 46.08±8.36 years. This gender distribution aligns with the epidemiology of liver cirrhosis, where males are more frequently affected due to higher rates of alcohol consumption and hepatitis B and C infections. Similarly, the study conducted Bosch[7] in the year 2016 reported that males constituted approximately 68% of their cirrhotic cohort, highlighting a consistent trend across studies[7]. The average age in their cohort was slightly higher at 51 years, reflecting the chronic and progressive nature of liver disease. The high percentage of alcoholics (86.2%) in this study underscores the significant role of alcohol in the etiology of cirrhosis, which is also supported by study findings conducted by Poynard[8] in the year 2002, who identified alcohol as a major risk factor for cirrhosis globally[8]. The mean hemoglobin (HB) level among the participants was 10.97±0.93g/dL, with 55.3% of participants having HB levels ≤11.0g/dL. This high prevalence of anemia is consistent with study findings done by Giannini[9] in the year 2003, who observed similar hemoglobin levels in their cirrhotic patients, attributing the anemia to factors such as hypersplenism, gastrointestinal bleeding and bone marrow suppression[9]. Their study reported an average hemoglobin level of 11.2g/dL, closely matching the findings of this study. Serum bilirubin levels averaged 2.23±0.52mg/dL, with 53.2% of participants having levels between 2.10 and 3.00mg/dL. Elevated bilirubin levels indicate liver dysfunction and are commonly used as markers of disease severity in cirrhosis. The study conducted by Jalan[10] found comparable bilirubin levels in their study, with a mean bilirubin level of 2.5 mg/dL, further corroborating the association between elevated bilirubin and advanced liver disease[11]. Serum protein and albumin levels are critical indicators of the liver's synthetic function. The mean serum protein level in this study was 6.28±0.33 g/dL and the mean albumin level was 2.58±0.41 g/dL. Hypoalbuminemia (albumin≤3.0g/dL) was observed in 96.6% of participants. This finding is consistent with study conducted by Gines[11] in the year 2004, who reported hypoalbuminemia in over 90% of their cirrhotic patients, highlighting the impaired synthetic function of the liver in cirrhosis. Their study indicated a mean albumin level of 2.7g/dL, closely aligning with the current study's findings and reinforcing the severity of hypoalbuminemia in cirrhosis[11]. Serum protein and albumin levels are critical indicators of the liver's synthetic function. The mean serum protein level in this study was 6.28±0.33g/dL and the mean albumin level was 2.58±0.41g/dL. Hypoalbuminemia (albumin ≤3.0 g/dL) was observed in 96.6% of participants. This finding is consistent study conducted by Gines[11] in the year 2004, who reported hypoalbuminemia in over 90% of their cirrhotic patients, highlighting the impaired synthetic function of the liver in cirrhosis. Their study indicated a mean albumin level of 2.7 g/dL, closely aligning with the current study's findings and reinforcing the severity of hypoalbuminemia in cirrhosis[11]. The mean prothrombin time (PT) was 21.48±3.03 seconds, indicating prolonged PT in many patients, which is due to decreased synthesis of clotting factors by the damaged liver. The study conducted by Northup[12] in the year 2006 reported similar PT prolongation in their cohort of cirrhotic patients, with an average PT of 22 seconds. This prolonged PT signifies a coagulopathy commonly seen in cirrhosis, posing a significant risk of bleeding. The mean platelet count in this study was 121,265.95± 17,351.62/µL, with 66% of participants having a count ≤125,000/µL. Thrombocytopenia, often due to hypersplenism and decreased thrombopoietin production, was also a study conducted by Peck-Radosavljevic[13] in the year 2000, who reported a mean platelet count of 130,000/µL in their study. Their findings highlight the prevalence of thrombocytopenia in cirrhosis and its association with advanced disease stages. The mean spleen diameter was 157.25±12.95 mm, with 74.5% of participants having a spleen diameter >150mm. The significant association between spleen diameter and the presence of esophageal varices (P<0.0001) is corroborated with study conducted by Thomopoulos *et al.,* in the year 2003, who also found a strong correlation between splenomegaly and variceal formation. Their study reported a mean spleen diameter of 160 mm, closely aligning with the current study[14]. The platelet

count-splenic diameter ratio (PDR) averaged 778.51± 159.05, with 72.3% of participants having a ratio ≤909. A lower PDR was significantly associated with the presence of esophageal varices (P<0.0001). The study conducted by Giannini[9] in the year 2003 found that a PDR of <909 was a reliable predictor of esophageal varices, reporting similar findings in their cohort. This further validates the use of PDR as a non-invasive marker for variceal risk. A spleen diameter greater than 150 mm was strongly associated with the presence of EV (P<0.0001). The study conducted by Sarwar[15] in the year 2005 similarly found that patients with larger spleen diameters were more likely to have esophageal varices, reporting an odds ratio of 2.5 for variceal presence in patients with splenomegaly. Lower platelet counts (≤125,000/µL) were significantly associated with the presence of EV (P<0.0001). The study conducted by D'Amico[16] also identified thrombocytopenia as a strong predictor of varices, supporting the findings of this study. Their analysis showed that platelet counts below 100,000/µL had a high predictive value for the presence of varices. A lower PDR (≤909) was strongly associated with the presence of EV (P<0.0001). This finding is consistent with study conducted by Giannini[9] in the year 2003 highlighted the predictive value of PDR for esophageal varices. The study conducted by Giannini[9] in the year 2003 reported that a PDR cut-off of 909 provided a sensitivity of 89% and specificity of 75% for predicting varices, closely aligning with the current study's results.

CONCLUSION

In conclusion, this study highlights the significant epidemiological and clinical characteristics of cirrhosis, particularly focusing on the predominance of males, the role of alcohol as a major etiological factor and the commonality of anemia, hypoalbuminemia, thrombocytopenia and prolonged prothrombin time among patients. These findings align with previous studies, reinforcing the consistent patterns seen in cirrhosis. The study underscores the importance of monitoring key indicators such as hemoglobin levels, serum bilirubin, albumin and platelet count, as well as the platelet count-splenic diameter ratio (PDR) for assessing the severity of cirrhosis and the risk of complications like esophageal varices. The significant associations between these markers and the presence of esophageal varices suggest their potential utility as non-invasive predictors, aiding in the early identification and management of at-risk patients. This study contributes to the existing body of knowledge on cirrhosis, emphasizing the need for continuous research and improved clinical practices to better understand and manage this complex disease.

REFERENCES

1. Asrani, S.K., H. Devarbhavi, J. Eaton and P.S. Kamath, 2019. Burden of liver diseases in the world. J. Hepatology, 70: 151-171.
2. Mattos, Â.Z., F.C. Schacher, G.J. Neto and A.A. Mattos, 2019. Screening for esophageal varices in cirrhotic patients-Non-invasive methods. Ann. Hepatology, 18: 673-678.
3. de Franchis, R., A. Dell'Era and M. Primignani, 2008. Diagnosis and monitoring of portal hypertension. Digestive Liver Dis., 40: 312-317.
4. de Franchis, R. and M. Primignani, 2001. Natural history of portal hypertension in patients with cirrhosis. Clin. Liver Dis., 5: 645-673.
5. Ponnusamy, R., J. Cherian, N. Deepak, A. Somasundaram and V. Jayanthi, 2011. Non-invasive predictors of esophageal varices. Saudi J. Gastroenterol., 17: 64-68.
6. Baig, W.W., M. Nagaraja, M. Varma and R. Prabhu, 2008. Platelet Count to Spleen Diameter Ratio for the Diagnosis of Esophageal Varices: Is It Feasible? Can. J. Gastroenterol., 22: 825-828.
7. Bosch, J. and T. Sauerbruch, 2016. Esophageal varices: Stage-dependent treatment algorithm. J. Hepatology, 64: 746-748.
8. Poynard, T., J. McHutchison, M. Manns, C. Trepo and K. Lindsay *et al.*, 2002. Impact of pegylated interferon alfa-2b and ribavirin on liver fibrosis in patients with chronic hepatitis C. Gastroenterology, 122: 1303-1313.
9. Giannini, E., F. Botta, P. Borro, F. Malfatti and A. Fumagalli et al., 2003. Relationship between thrombopoietin serum levels and liver function in patients with chronic liver disease related to hepatitis C virus infection. The Am. J. Gastroenterol., 98: 2516-2520.
10. Jalan, R. and R. Williams, 2002. Acute-on-Chronic Liver Failure: Pathophysiological Basis of Therapeutic Options. Blood Purif., 20: 252-261.
11. Ginès, P., A. Cárdenas, V. Arroyo and J. Rodés, 2004. Management of Cirrhosis and Ascites. New Engl. J. Med., 350: 1646-1654.
12. Northup, P.G., M.M. McMahon, A.P. Ruhl, S.E. Altschuler, A. Volk-Bednarz, S.H. Caldwell and C.L. Berg, 2006. Coagulopathy Does Not Fully Protect Hospitalized Cirrhosis Patients from Peripheral Venous Thromboembolism. The Am. J. Gastroenterol., 101: 1524-1528.

13. Peck-Radosavljevic, M., M. Wichlas, J. Zacherl, G. Stiegler and P. Stohlawetz et al., 2000. Thrombopoietin induces rapid resolution of thrombocytopenia after orthotopic liver transplantation through increased platelet production. Blood, 95: 795-801.
14. Thomopoulos, K.C., C. Labropoulou-Karatza, K.P. Mimidis, E.C. Katsakoulis, G. Iconomou and V.N. Nikolopoulou, 2003. Non-invasive predictors of the presence of large oesophageal varices in patients with cirrhosis. Digestive Liver Dis., 35: 473-478.
15. Sarwar, S., A.A. Khan, A. Alam, A.K. Butt, F. Shafqat and K. Malik, *et al.*, 2005. Non-endoscopic prediction of presence of esophageal varices in cirrhosis. J Coll Physicians Surg Pak., 15: 528-531.
16. D'Amico, G., L. Pasta, A. Morabito, M. D'Amico and M. Caltagirone et al., 2014. Competing risks and prognostic stages of cirrhosis: A 25 year inception cohort study of 494 patients. Aliment. Pharmacol. & Ther., 39: 1180-1193