GMR
The Original

CORRELATION BETWEEN SPLENOMEGALY AND PRESENCE OF ESOPHAGEAL VARICES IN PEDIATRICS CHRONIC LIVER DISEASE (CLD) PATIENTS

Hanif Ullah[1*], Shamama Hasan[2], Saba Idrees[3], Adnan[4], Naurin Ali[5], Khaista Rehman[6]

[1,2,3,4,5,6] Department of Pediatric Gastroenterology, Combined Military Hospital, Rawalpindi, Pakistan
[*]Corresponding Author: Hanif Ullah, Email: hanifullah46@gmail.com

ABSTRACT
Objective: To determine the correlation between the degree of splenomegaly and the presence of esophageal varices in pediatric patients with chronic liver disease.
Study Design: Cross-sectional study.
Place and Duration of Study: Department of Pediatric Gastroenterology, Combined Military Hospital, Rawalpindi, Pakistan, from 10 October, 2025 to 10 April, 2026.
Methodology: The study included 23 children aged 1–12 years diagnosed with chronic liver disease and ultrasound-documented splenomegaly. Patients were categorized into three groups based on the severity of splenomegaly: Group 1 (1–2.9 SD), Group 2 (3–5.9 SD), and Group 3 (≥6 SD). All patients underwent esophagogastroduodenoscopy (EGD) to identify esophageal varices. Statistical analysis was performed using chi-square and Pearson's correlation to assess the relationship between varices and clinical markers including spleen size, platelet count, and platelet count to splenic diameter (PC/SD) ratio ($p<0.05$ significant).
Results: Mean age was 6 years ± 3 Standard deviation. 60.9% were male. Esophageal varices were present in 78.2% (n=18) of the total population. Varices were identified in 71.4% of Group 1, 80% of Group 2, and 83.3% of Group 3 patients. There was no statistically significant correlation between the degree of splenomegaly and the presence of varices ($p=0.618$). Furthermore, no significant associations were found for Child-Pugh class ($p=0.914$), platelet count ($p=0.822$), or the PC/SD ratio ($p=0.474$).
Conclusion: Splenomegaly and associated non-invasive hematological markers are not reliable predictors for the presence of esophageal varices in children. Routine surveillance endoscopy remains necessary for accurate diagnosis in pediatric chronic liver disease.

KEYWORDS: Chronic liver disease, Esophageal varices, Pediatric, Portal hypertension, Splenomegaly.

INTRODUCTION:

Chronic liver disease in children with various underlying causes has significantly increased its burden in terms of prevalence[1.]

Once end-stage liver disease occurs, the implications of portal hypertension hit. Bleeding from esophageal varices is a regular sequalae of portal hypertension and should be anticipated in all the children with portal hypertension. It remains a significant cause of mortality and morbidity in pediatrics population[2,4]. Early identification usually paves the path for timely intervention in the form of primary prevention, which may include the use of beta blockers or the banding of esophageal varices.[5]

A baseline surveillance esophagogastroduodenoscopy (EGD) is conventionally performed to assess the risk of variceal bleeding and remains the most reliable diagnostic tool for identifying esophageal varices[3]

The invasive nature of esophagogastroduodenoscopy, the limited available facilities of endoscopy especially in resource limited countries combined with the additional anxiety of parents and patients due to invasiveness warrants that endoscopy for esophageal varices be only performed once esophageal varices are present and amenable to intervention and not for routine surveillance.

To identify clinical indicators of esophageal varices prior to the onset of hematemesis, it is essential to evaluate alternative parameters of portal hypertension. Congestive splenomegaly, a well-recognized hallmark of portal hypertension, may serve as a potential indicator. Splenomegaly is mainly caused by elevated portal venous pressure and the resultant impaired splenic venous flow. It occurs in a substantial proportion of pediatric cirrhotic as well as non-cirrhotic patients with portal hypertension.[6] The splenic index including the three dimensions of spleen (anteroposterior, transverse and cephalocaudal) has been studied previously as well for its correlation with the severity of cirrhosis and the esophageal varices.[7]

The other commonly reported parameters for assessing the severity of cirrhosis as well as for development of esophageal varices include platelets count, the platelet to spleen diameter ratio and the heavily used Child Pugh score system.[8]

This study aims to elucidate the role of splenomegaly in the development of gastroesophageal varices by evaluating its association with non-invasive parameters, with the goal of establishing practical guidelines for early detection and preventive management of gastrointestinal bleeding in cirrhotic patients.

METHODOLOGY

This cross-sectional study was conducted from 10 October, 2025 to 10 April, 2026 in Pediatric ward of Combined Military hospital Rawalpindi. Ethical approval was sought from IRB/Ethical committee of the same hospital (Serial number: 917). Parents or guardian of the child were informed about the nature and importance of this Research study. The methodology which was to be utilized was also explained to them. After appropriate counselling, consent was taken.

- The study included children aged 1 to 12 years with cirrhosis. The criteria for cirrhosis was decided based on clinical, radiological and/or histological evidence [9] [10]. All the patients underwent clinical evaluation, laboratory tests (Complete blood count, Liver function tests, Prothrombin and activated prothrombin time) and ultrasound imaging to measure spleen size.

Inclusion Criteria: Only patients who had splenomegaly were included in the study. Splenomegaly was defined by a splenic length greater than 97th percentile for the child's height or length as measured on ultrasound.[11]

Exclusion Criteria: Patients who did not undergo endoscopy, those with previous history of esophageal bleed or ligation/sclerotherapy were excluded from the study. Children with underlying storage disorders were also excluded due to the correlation of splenomegaly with infiltration apart from hypersplenism in these patients.

Data were collected using a proforma including demographic information (age, gender), clinical features (history of ascites, encephalopathy, etc.), splenic size, and endoscopic findings of gastroesophageal varices. Endoscopic findings were classified into no varices, small varices, and large varices based on the modified Paquet classification. The Child-Pugh classification was used to assess the severity of cirrhosis, and patients were categorized as Child-Pugh class A, B, or C.

The relationship between splenomegaly and the presence of gastroesophageal varices was assessed using chi-square tests for categorical variables and t-tests for continuous variables. The correlation between spleen size and the presence of varices was evaluated using Pearson's correlation coefficient. Multivariate logistic regression was used to identify independent predictors of GEVs in cirrhotic patients. A p-value < 0.05 was considered statistically significant. All statistical analyses were performed using SPSS version 27.

RESULTS

A total number of 23 pediatric patients with cirrhosis were included in the study. Out of them males were 61% and 9% were females. Children with ages 1 year to 12 years were included in the study. Mean age was 6 years ± 3 Standard deviation. (**Table I)**

Table I: Baseline Demographics and Clinical Characteristics. (n=23)

Gender	Total n (%)	Varices present n (%)	Varices absent n (%)
Males	14 (61%)	10 (71%)	4 (29%)
Females	9 (39%)	8 (89%)	1 (11%)

Average spleen size for each age was taken and for each patient standard deviation (SD) of their spleen size was calculated.[12] Spleen sizes were divided into 3 groups based on Standard deviations. Children with spleen size 1 to 2.9 SD were categorized into Group 1, those with spleen size 3 to 5.9 SD into Group 2 and those with above 6 SD were placed into Group 3. Varices were found in 72%,80%,83% of Group 1, Group 2 and Group 3 patients respectively. P value for the correlation between esophageal varices and spleen size was found to be 0.618 which is not significant. (**Table II).**

Table II: Frequency of Esophageal Varices by Splenic size (n=23)

Spleen size	Varices present n (%)	Varices absent n (%)
Group 1 (1 to 2.9 SD)	5 (72%)	2 (28%)
Group 2 (3 to 5.9 SD)	8 (80%)	2 (20%)
Group 3 (>6 SD)	5 (83%)	1 (17%)

p-value: 0.618

Child-Pugh class categorization was done for all patients to determine the severity of their cirrhosis. The presence or absence of esophageal varices was considered for each. A total of 78% of patients with Child-Pugh class A had esophageal varices while 75% in Child-Pugh class C had them which again shows poor correlation between these two parameters in our study. p-value for this correlation was 0.914 (**Table III).**

Table III: Distribution of Gastroesophageal Varices by Child-Pugh Class (n=23)

Cirrhosis severity	Varices present n(%)	Varices absent n (%)
Child-Pugh Class A	11 (78%)	3 (22%)

Child-Pugh Class B	4 (80%)	1 (20%)
Child-Pugh Class C	3 (75%)	1 (25%)

p-value: 0.914

Platelets count of each patient were placed into 3 groups according to platelets count. 1st group had patients with >150,000 count, 2nd group included a count of 100,000 to 150,000 and 3rd group had a platelet count of less than 100,000. Finally, a correlation between Platelets count and esophageal varices was determined. 80% of the patients with platelet count >150,000 had esophageal varices while 75% of those with platelet count <100,000 had esophageal varices showing inconsistent relationship between the two factors.
Platelet count to Splenic diameter was calculated by dividing number of platelets per mm3 to splenic diameter in the maximum axis in millimeter. The presence of varices was considered for each. A p value of 0.882 was found showing poor correlation between the two. (**Table IV)**

Table IV: Association of Platelet count and Esophageal varices.

Platelet count(10^3/uL)	Varices present n (%)	Varices absent n(%)
>150	4 (80%)	1 (20%)
100-150	8 (80%)	2 (20%)
<100	6 (75%)	2 (25%)

p-value: 0.882

DISCUSSION

Multiple studies have been carried out in adult population determining different parameters which could possibly highlight non-invasive methods to detect esophageal varices in their early stages. Pediatrics studies are also available but they are scarce in number.
We carried out this study with the same intent to detect correlation between the Spleen size with esophageal varices. Our study found no significant correlation between the two parameters. While comparing the result with previous studies we found that while preponderance of adult studies do find a statistically significant association between spleen measures and esophageal varices, [13,14,15] the results of Pediatric cohorts was heterogenous with some studies showing a positive correlation with Esophageal varices and others showing no independent relation between the two.
The result of our study regarding no significant correlation between splenic size and esophageal varices is consistent with the study by *Suttorp M. et al.* who highlighted *that* splenomegaly is not predictive for varices in pediatric populations.[16]
Sezer OB et al. carried out a study in Turkey in 2016 and found the similar results that spleen diameter did not correlate significantly with the presence of varices. His study also showed that even Platelet count to Splenic diameter ratio (PC/SD) is unreliable in pediatric case.[17]
Rahmani P. et al. in his study regarding "Noninvasive markers for esophageal varices in children with cirrhosis" found that Splenomegaly and spleen size were more common in children with varices on univariate testing, but spleen size was not an independent predictor on logistic regression (i.e., no independent positive correlation when accounting for other factors); platelet count, PC/spleen ratio performed better.[18]
Regarding PC/Spleen diameter ratio, many single-center validations, and pooled meta-analysis do find a statistically significant association between a low PC/SD ratio and the presence (or high risk) of esophageal varices in adults. The PC/SD ratio is widely validated as a useful noninvasive screening tool in adults.[15,19,20] In Pediatric population the data is somewhat scarce but Sezer OB et al. negated any significant correlation. [17]
We also analyzed the relationship between Platelet count to Splenic diameter ratio and with a p value of 0.474 it was also negated. Hence as per our study no significant correlation was found between the two. The preponderance of adult literature—including Giannini's original 2003 study, many single-center validations, and pooled meta-analysis—finds a statistically significant association between a low PC/SD ratio and the presence (or high risk) of esophageal varices. The PC/SD ratio is widely validated as a useful noninvasive screening tool in adults.[18,19]
In children, some pediatric cohorts and prediction rules report significant associations (PC/SD or related platelet/spleen metrics)[18], but multiple pediatric studies (notably Sezer et al., 2016) report poor performance of PC/SD — i.e., no reliable or significant correlation in their samples[17,]. Overall, pediatric data are inconsistent and less robust than adult data.
There have been few previous studies regarding the Child-Pugh score relation with Esophageal varices as well in children. In 2020, Rehmani et al. reviewed multiple pediatric studies and found that Child–Pugh score was listed among variables associated with Esophageal varices in several studies but results across pediatric cohorts were mainly heterogeneous and some studies found no correlation between the two.[18]
Most adult studies report a significant positive correlation between Child–Pugh class and both the presence and grade of esophageal varices — patients in Child Pugh class B and C have higher prevalence and larger varices compared with Child Pugh class A.[21,22] Pediatric literature is heterogeneous: several cohorts and reviews report Child Pugh class (or its components) correlates with varices, but smaller samples, differing etiologies and variable multivariate results make the association less consistent than in adults.

Additionally Platelet count (or thrombocytopenia) in our study did not appear to be a promising non-invasive predictor of esophageal varices in children with portal hypertension /chronic liver disease. This result is similar to those determined by Sansotta N. who found a weak correlation between the platelets and esophageal varices in both native livers and transplanted livers studied. [23]Rehmani et. Al was of the same view that the platelet count alone may not reliably predict Esophageal varices when adjusting for other factors (age, spleen size, etiology, etc).[18]

The possible explanation behind this difference between adult and pediatric populations could be due to the children's body size and proportions as they change significantly during growth as well as the different set of etiologies of cirrhosis in the two populations. But this remains to be accurately established. Further research and more studies are needed and would be beneficial to clarify this distinction.

CONCLUSION

These results suggest that, in the pediatric population, spleen size alone may not be a reliable non-invasive predictor for the presence of esophageal varices.

This contrasts with findings in adult literature and highlights a potential difference in the pathophysiology or presentation of portal hypertension in children.

LIMITATIONS OF STUDY

The study was conducted at a single center. The sample size, while adequate for other parameters, might have been underpowered to detect a subtle association. Future research should focus on larger multi-center studies to validate these findings across diverse pediatric populations and various etiologies of cirrhosis.

RECOMMENDATIONS

The findings of this study underscore the complexity of portal hypertension in pediatric cirrhosis and indicate that spleen alone is insufficient for risk stratification of esophageal varices. This study emphasizes the ongoing need for robust, non-invasive screening tools specifically tailored for the pediatric population to guide timely and appropriate clinical management.

ACKNOWLEDGMENT

The authors would like to thank the staff and administration of CMH Rawalpindi for their support during data collection. We also extend our gratitude to the participating children and their families for their cooperation throughout the study.

CONFLICT OF INTREST: None.

FUNDING SOURCE: None.

AUTHORS CONTRIBUTION

HU conceived and designed the study, supervised the project, participated in data collection, and coordinated the manuscript writing and submission. SI contributed to data collection, and supported data analysis. A participated in data collection and initial drafting of the manuscript. SH provided expert supervision, and critically reviewed the manuscript for intellectual content. . KR assisted in literature review and proofreading of the manuscript. SAS contributed to data collection and assisted in manuscript proofreading.

REFERRENCES:

1. Zhang C, Liu Y, Zhao H, Wang G. Global, regional, and national burdens of cirrhosis in children and adolescents aged under 19 years from 1990 to 2019. Hepatol Int. 2024 Feb;18(1):238-53.
2. https://doi.org/10.1007/s12072-023-10582-7
3. Molleston JP, Bennett Jr WE. Mortality, risk factors and disparities associated with esophageal variceal bleeding in children's hospitals in the US. J Pediatr. 2021 May 1;232:176-82.
4. https://doi.org/10.1016/j.jpeds.2021.01.026
5. Ling SC. Portal hypertension in children. Clin Liver Dis (Hoboken). 2012 Nov;1(5):139-42. https://doi.org/10.1002/cld.93
6. Carneiro de Moura M, Chen S, Kamath BM, Ng VL, Ling SC. Acute variceal bleeding causes significant morbidity. J Pediatr Gastroenterol Nutr. 2018 Sep;67(3):371-6. https://doi.org/10.1097/MPG.0000000000001994
7. Roccarina D, Best LM, Freeman SC, Roberts D, Cooper NJ, Sutton AJ, et al. Primary prevention of variceal bleeding in people with oesophageal varices due to liver cirrhosis: a network meta-analysis. Cochrane Database Syst Rev. 2021(4):CD013121. https://doi.org/10.1002/14651858.CD013121.pub2
8. Yoshida H, Shimizu T, Yoshioka M, Matsushita A, Kawano Y, Ueda J, et al. The role of the spleen in portal hypertension. J Nippon Med Sch. 2023 Feb 25;90(1):20-5. https://doi.org/10.1272/jnms.JNMS.2023_90-104
9. Katwal S, Ansari MA, Suwal S, Rayamajhi S, Ghimire P, Ghimire A. Measurement of portal vein indices and splenic index by ultrasound and their association with gastroesophageal varices in cirrhosis of liver. Ann Med Surg (Lond). 2023 Dec 1;85(12):5926-31. https://doi.org/10.1097/MS9.0000000000001404

10. Rizvi SR, Wallam MD, Siddiqui AR, Haqqi SA, Farrukh ZU, Niaz SK, et al. Platelet count to prothrombin time: a noninvasive predictor of esophageal varices in patients with chronic liver disease. Cureus. 2024 May 4;16(5):e59633. https://doi.org/10.7759/cureus.59633
11. Hussain SI, Seerani NL, Qureshi AR, Soomro U, Samejo KH, Baig MS. Association of Child Pugh Class with Esophageal Varices and Portal Hypertensive Gastropathy in Patients with Cirrhosis. Pak J Health Sci. 2025 Mar 31;6(03):265-9. https://doi.org/10.54393/pjhs.v6i03.2662
12. Tapper EB, Parikh ND. Diagnosis and management of cirrhosis and its complications: a review. JAMA. 2023 May 9;329(18):1589-602. https://doi.org/10.1001/jama.2023.5997
13. Pelizzo G, Guazzotti M, Klersy C, Nakib G, Costanzo F, Andreatta E, et al. Spleen size evaluation in children: time to define splenomegaly for pediatric surgeons and pediatricians. PLoS One. 2018 Aug 23;13(8):e0202741. https://doi.org/10.1371/journal.pone.0202741
14. Megremis SD, Vlachonikolis IG, Tsilimigaki AM. Spleen length in childhood with US: normal values based on age, sex, and somatometric parameters. Radiology. 2004 Apr;231(1):129-34. https://doi.org/10.1148/radiol.2311020963
15. Zaman S, Gilani SA, Bacha R, Manzoor I, Hasan ZU. Correlation between portal vein diameter and craniocaudal length of the spleen. J Ultrason. 2019 Dec 31;19(79):276-80. https://doi.org/10.15557/JoU.2019.0041
16. Bhattarai S, Gyawali M, Dewan KR, Shrestha G, Patowary BS, Sharma P. Study of portal vein diameter and spleen size by ultrasonography and their association with gastro-esophageal varices. Nepalese J Radiol. 2014;4(2):6-14. https://doi.org/10.3126/njr.v4i2.11977
17. Giannini E, Botta F, Borro P, Risso D, Romagnoli P, Fasoli A, et al. Platelet count/spleen diameter ratio: proposal and validation of a non-invasive parameter to predict the presence of oesophageal varices in patients with liver cirrhosis. Gut. 2003 Aug 1;52(8):1200-5. https://doi.org/10.1136/gut.52.8.1200
18. Suttorp M, Classen CF. Splenomegaly in children and adolescents. Front Pediatr. 2021 Jul 9;9:704635. https://doi.org/10.3389/fped.2021.704635
19. Sezer OB, Çelik D, Tutar N, Özçay F. Can platelet count/spleen diameter ratio be used for cirrhotic children to predict esophageal varices? World J Hepatol. 2016 Nov 28;8(33):1466-70. https://doi.org/10.4254/wjh.v8.i33.1466
20. Rahmani P, Farahmand F, Heidari G, Sayarifard A. Noninvasive markers for esophageal varices in children with cirrhosis. Clin Exp Pediatr. 2021 Jan;64(1):31-6. https://doi.org/10.3345/cep.2019.01633
21. Chen R, Deng H, Ding X, Xie C, Wang W, Shen Q. Platelet count to spleen diameter ratio for the diagnosis of gastroesophageal varices in liver cirrhosis: a systematic review and meta-analysis. Gastroenterol Res Pract. 2017;2017:7407506. https://doi.org/10.1155/2017/7407506
22. Mossie GY, Nur AM, Ayalew ZS, Azibte GT, Berhane KA. Platelet counts to spleen diameter ratio: A promising noninvasive tool for predicting esophageal varices in cirrhosis patients. World J Hepatol. 2024 Oct 27;16(10):1177-85. https://doi.org/10.4254/wjh.v16.i10.1177
23. Kraja B, Mone I, Akshija I, Koçollari A, Prifti S, Burazeri G. Predictors of esophageal varices and first variceal bleeding in liver cirrhosis patients. World J Gastroenterol. 2017 Jul 14;23(26):4806-14. https://doi.org/10.3748/wjg.v23.i26.4806
24. Sumon SM, Sutradhar SR, Chowdhury M, Khan NA, Uddin MZ, Hasan MI, et al. Relation of different grades of esophageal varices with Child-Pugh classes in cirrhosis of liver. Mymensingh Med J. 2013 Jan;22(1):37-41. PMID: 23416548.
25. Sansotta N, Di Giorgio A, Colusso MM, Salvi M, Marra P, Pinelli D, et al. Distinctive Clinical Features of Portal Hypertension in Children with Portal Vein Thrombosis Following Liver Transplantation. Biomedicines. 2025 Aug 24;13(9):2061. https://doi.org/10.3390/biomedicines13092061
26. Gana JC, Turner D, Mieli–Vergani G, Davenport M, Miloh T, Avitzur Y, et al. A clinical prediction rule and platelet count predict esophageal varices in children. Gastroenterology. 2011 Dec 1;141(6):2009-16. https://doi.org/10.1053/j.gastro.2011.08.049