Clin. Lab. 2025;71:XXX-XXX

SHORT COMMUNICATION

Mean Platelet Volume/Platelet Count Ratio is Markedly Increased in Liver Cirrhosis Compared to Hepatitis

Ha-Eun Cho [1, 2, *], Jae Joon Lee [3, *], Sun Young Cho [1, 2], Woo-In Lee [1, 4]

** These two authors are equally contributed as the first author*
[1] Department of Laboratory Medicine, College of Medicine, Kyung Hee University, Seoul, South Korea
[2] Department of Laboratory Medicine, Kyung Hee Medical Center, Seoul, South Korea
[3] Department of Laboratory Medicine, Seegene Medical Foundation, Seoul, South Korea
[4] Department of Laboratory Medicine, Kyung Hee University Hospital at Gangdong, Seoul, South Korea

SUMMARY

Background: **The mean platelet volume to platelet count ratio (MPV/PC) is a potential non-invasive marker of liver fibrosis in chronic liver diseases.**
Methods: **A total of 232 patients with chronic hepatitis B (CHB), chronic hepatitis C (CHC), non-alcoholic liver cirrhosis (NALC), and alcoholic liver cirrhosis (ALC), along with 143 healthy controls, were analyzed. MPV and PC were measured within 2 hours using an ADVIA 2120 analyzer. ANOVA and ROC analyses evaluated group differences and diagnostic performance.**
Results: **MPV/PC was significantly elevated in NALC and ALC compared to CHB, CHC, and controls ($p < 0.001$). ROC analysis for cirrhosis showed 88.3% sensitivity and 94.4% specificity (AUC = 0.946).**
Conclusions: **MPV/PC is significantly increased in liver cirrhosis regardless of etiology, suggesting disrupted platelet homeostasis. It may serve as a sensitive, non-invasive marker for fibrosis. Further validation incorporating fibrosis biomarkers is recommended.**
(Clin. Lab. 2025;71:xx-xx. DOI: 10.7754/Clin.Lab.2025.250456)

Correspondence:
Sun Young Cho, MD, PhD
Department of Laboratory Medicine
College of Medicine
Kyung Hee University
Kyungheedae-ro 23
Dongdaemun-gu, Seoul, 02447
Republic of Korea
Phone: +82 2-958-8674
Fax: +82 2-958-8609
Email: untoyou@hanmail.net

Short Communication accepted April 30, 2025

KEYWORDS

mean platelet volume (MPV), platelet, hepatitis, liver cirrhosis

INTRODUCTION

Mean platelet volume (MPV) is a routinely measured platelet index that reflects platelet size and serves as a surrogate marker of platelet activation [1]. Platelet count (PC) is a hematological parameter used in clinical practice to assess the absolute number of circulating platelets and their changes. MPV and PC maintain a reciprocal relationship as part of a homeostatic mechanism to preserve overall platelet mass under normal physiological conditions [2]. The liver plays a crucial role in producing thrombopoietin (TPO), a hormone that regulates platelet production and maturation in the bone marrow. In liver disease, reduced TPO synthesis leads to decreased platelet production, which may trigger re-

active thrombopoiesis and an increase in the proportion of larger platelets, resulting in elevated MPV levels [3, 4]. MPV is also influenced by inflammatory cytokines released during systemic inflammatory responses [1,2]. In this study, we investigated the changes in the MPV to PC ratio (MPV/PC) in patients with chronic inflammatory liver diseases, including chronic hepatitis B (CHB), chronic hepatitis C (CHC), non-alcoholic liver cirrhosis (NALC), and alcoholic liver cirrhosis (ALC).

MATERIALS AND METHODS

This study included 81 patients with CHB, 23 with CHC, 98 with NALC, and 30 with ALC. Diagnoses were confirmed through a retrospective review of medical records. The control group consisted of 143 individuals who underwent routine medical check-ups at the same hospital and had also been used as controls in previous studies.

MPV and PC were measured within 2 hours of venous blood sampling using an ADVIA 2120 hematology analyzer (Siemens Healthcare Diagnostics, Tarrytown, NY, USA). Differences among groups were analyzed using one-way analysis of variance (ANOVA). Receiver operating characteristic (ROC) curve analysis was performed to assess the diagnostic performance of the MPV/PC ratio. All statistical analyses were conducted using Med Calc version 11.6 (MedCalc Software, Mariakerke, Belgium) and Microsoft Excel 2007 (Microsoft Corporation, Redmond, WA, USA). A p-value < 0.05 was considered statistically significant.

RESULTS

MPV/PC is quantified as 0.03209 within the control cohort, 0.05709 among individuals diagnosed with CHB and CHC, 0.1037 for patients suffering from NALC, and 0.1071 for those with ALC, respectively (Figure 1). A statistically significant elevation in MPV/PC was observed in patients with liver cirrhosis when compared to both chronic hepatitis patients and the control group ($p < 0.001$). NALC and ALC presented no significant difference. In the comparative analysis between the control cohort and patients diagnosed with liver cirrhosis, ROC analysis yielded a sensitivity of 88.3% and a specificity of 94.4% at the threshold criterion of MPV/PC > 0.044 (AUC = 0.946, $p < 0.001$) (Figure 2).

DISCUSSION

Larger platelets are more reactive and reach activation more rapidly than smaller ones, as they are newly formed and contain more granules and adhesion molecules [5]. Therefore, in acute inflammatory states, the demand for large platelets that actively release proinflammatory agents increases, resulting in elevated MPV levels [3,6-7]. However, excessive production of cytokines and acute-phase reactants can impair megakaryopoiesis, potentially leading to an increased proportion of smaller platelets and a decrease in MPV [8]. Some studies have consequently reported no significant difference in MPV between patients with acute inflammation and healthy controls [9]. In contrast, diseases associated with chronic inflammation, such as chronic hepatitis B and C, have shown increased MPV levels, with some studies suggesting a link between inflammation-induced fibrosis and MPV elevation [10,11]. Additionally, chronic liver disease is associated with a shortened platelet lifespan, which may stimulate compensatory thrombopoiesis and increase the proportion of large platelets [12].

In the present study, the MPV/PC ratio was significantly elevated in patients with liver cirrhosis, irrespective of its underlying etiology. This elevation indicates an increase in platelet size that exceeds the expected compensatory response to declining platelet counts, suggesting disruption of normal homeostatic mechanisms. Previous studies have reported increased MPV and MPV/PC ratios in both alcoholic liver disease (ALD) and metabolic dysfunction-associated steatotic liver disease (MASLD) [13,14]. Although positive associations between MPV/PC and fibrosis severity - measured by the Child-Pugh score in ALD and disease activity in MASLD - have been proposed, few investigations have explored MPV/PC specifically in cirrhosis stratified by etiology [13-17].

However, this study has limitations, including a relatively small sample size and unequal distribution of participants across disease subgroups. These factors highlight the need for future large-scale cohort studies with balanced patient populations for each liver disease etiology. Although our findings showed a significant increase in MPV/PC in patients with liver cirrhosis based on diagnostic classification, further studies incorporating blood-based biomarkers of liver fibrosis may provide deeper insights into the progression from inflammation to cirrhosis. Commonly used markers such as the AST-to-platelet ratio index (APRI) and fibrosis-4 (FIB-4) score have demonstrated limited accuracy compared to ultrasound elastography, with indeterminate cases reported in 20 - 60% of evaluations [18]. Similarly, the enhanced liver fibrosis (ELF) score, which includes hyaluronic acid, procollagen III N-terminal peptide, and TIMP-1, has shown up to 40% indeterminate cases [18]. Emerging biomarkers like propeptides of type III collagen (PRO-C3) and high mobility group proteins 2 (HMGB2) have shown promise for fibrosis assessment [19,20]. Incorporating these biomarkers in future research may further validate and enhance the diagnostic utility of MPV/PC in liver cirrhosis.

Our findings suggest that the compensatory mechanism of increasing platelet size in response to reduced platelet counts is exaggerated in liver cirrhosis, indicating a disruption of normal homeostasis. As a non-invasive marker, the MPV/PC ratio demonstrated excellent sensitivity

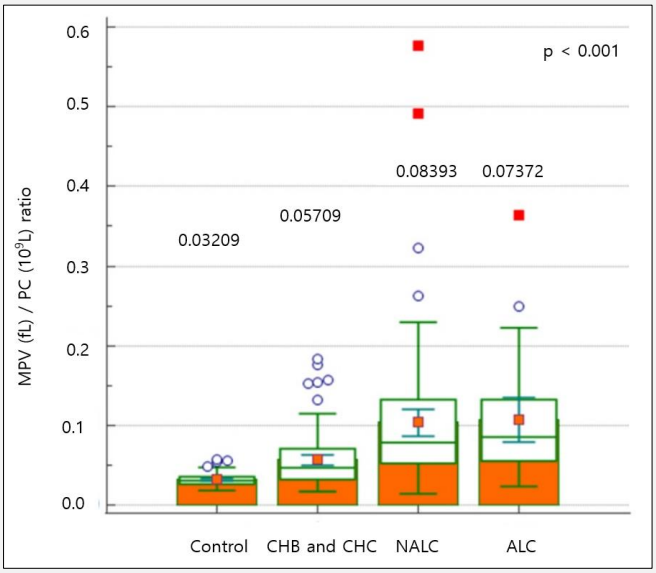

Figure 1. MPV to PC ratio in patients with chronic hepatitis B and chronic hepatitis C (CHB and CHC), non-alcoholic liver cirrhosis (NALC) and alcoholic liver cirrhosis (ALC), compared with the control group.

MPV/PC is 0.03209 in control group, 0.05709 in chronic hepatitis B and chronic hepatitis C patients, 0.1037 in non-alcoholic liver cirrhosis patients and 0.1071 in alcoholic liver cirrhosis patients, respectively. MPV/PC showed the significant increase in liver cirrhosis patients compared with chronic hepatitis patients and control group ($p < 0.001$).
MPV - mean platelet volume, PC - platelet count, CHB - chronic hepatitis B, CHC - chronic hepatitis C, NALC - non-alcoholic liver cirrhosis, ALC - alcoholic liver cirrhosis.

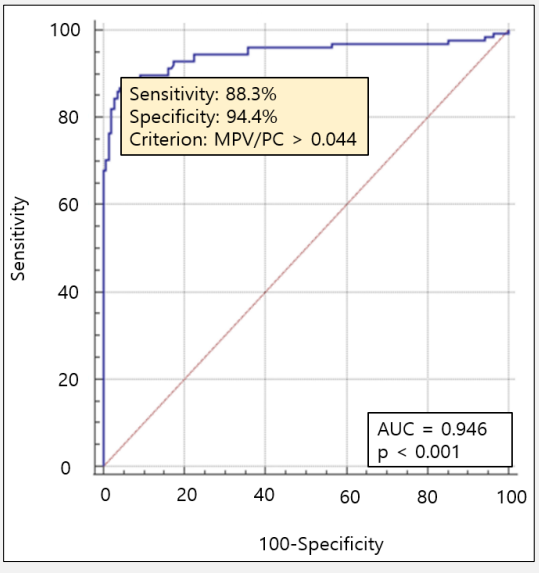

Figure 2. The ROC curve analysis of MPV to PC ratio for comparing liver cirrhosis patients and control group.

Comparing control group and liver cirrhosis patient, ROC analysis showed 88.3% sensitivity and 94.4% specificity at criterion of MPV/PC > 0.044 (AUC = 0.946, $p < 0.001$). ROC - receiver operating characteristic, MPV - mean platelet volume, PC - platelet count.

and specificity for detecting liver fibrosis associated with chronic inflammation. Further large-scale studies are needed to validate its clinical utility across different etiologies of liver cirrhosis.

Declaration of Interest:
The authors declared that there were no conflicts of interest that could influence the study.

References:

1. Ntolios P, Papanas N, Nena E et al. Mean Platelet Volume as a Surrogate Marker for Platelet Activation in Patients With Idiopathic Pulmonary Fibrosis. Clin Appl Thromb Hemost 2016 May; 22(4):346-50. (PMID: 26659450)

2. Korniluk A, Koper-Lenkiewicz OM, Kaminska J, Kemona H, Dymicka-Piekarska V. Mean Platelet Volume (MPV): New Perspectives for an Old Marker in the Course and Prognosis of Inflammatory Conditions. Mediators Inflamm 2019 Apr 17;2019: 9213074. (PMID: 31148950)

3. Cho HE, Ham H, Cho SY, Kim YJ, Park KS, Park TS. Mean Platelet Volume in Acute Hepatitis A. Clin Lab 2025 Mar 1; 71(3). (PMID: 40066542)

4. Clerici B, Scavone M, Urtis C et al. Mean Platelet Volume in Patients with Liver Cirrhosis and Chronic Liver Disease: A Case-Control Study. Blood 2024;144:1182. (https://doi.org/10.1182/blood-2024-207607)

5. Braekkan SK, Mathiesen EB, Njolstad I, Wilsgaard T, Stormer J, Hansen JB. Mean platelet volume is a risk factor for venous thromboembolism: the Tromsø Study, Tromsø, Norway. J Thromb Haemost 2010 Jan;8(1):157-62. (PMID: 19496920)

6. Mete E, Akelma AZ, Cizmeci MN, Bozkaya D, Kanburoglu MK. Decreased mean platelet volume in children with acute rotavirus gastroenteritis. Platelets 2014;25(1):51-4. (PMID: 23402274)

7. Renshaw AA, Drago B, Toraya N, Gould EW. Respiratory syncytial virus infection is strongly correlated with decreased mean platelet volume. Int J Infect Dis 2013 Sep;17(9):e678-80. (PMID: 23485431)

8. Bath PM, Butterworth RJ. Platelet size: measurement, physiology and vascular disease. Blood Coagul Fibrinolysis 1996 Mar;7(2): 157-61. (PMID: 8735807)

9. Hu Y, Lou Y, Chen Y, Mao W. Evaluation of mean platelet volume in patients with hepatitis B virus infection. Int J Clin Exp Med 2014 Nov 15;7(11):4207-13. (PMID: 25550932)

10. Ekiz F, Yuksel O, Kocak E et al. Mean platelet volume as a fibrosis marker in patients with chronic hepatitis B. J Clin Lab Anal 2011;25(3):162-5. (PMID: 21567462)

11. Purnak T, Olmez S, Torun S et al. Mean platelet volume is increased in chronic hepatitis C patients with advanced fibrosis. Clin Res Hepatol Gastroenterol 2013 Feb;37(1):41-6. (PMID: 22572524)

12. Ceylan B, Fincanci M, Yardimci C et al. Can mean platelet volume determine the severity of liver fibrosis or inflammation in patients with chronic hepatitis B? Eur J Gastroenterol Hepatol 2013 May;25(5):606-12. (PMID: 23325286)

13. Sharma D, Mangal AK, Fageria N, Kumar P, Nagar GL. To Study Platelet Indices in Alcoholic Liver Disease (ALD) Patients and to Correlate MPV to Platelet Count Ratio with Child Pugh Score to Predict the Severity. J Indian Med Assoc 2024;122(2): 34-8. (https://onlinejima.com/journals_doc/download-journals/2024/february/34-38.pdf)

14. Saremi Z, Rastgoo M, Mohammadifard M, Bijari B, Akbari E. Comparison of platelet number and function between nonalcoholic fatty liver disease and normal individuals. J Res Med Sci 2017 Jun 21;22:75. (PMID: 28717372)

15. Peng Y, Qi X, Guo X. Child-Pugh Versus MELD Score for the Assessment of Prognosis in Liver Cirrhosis: A Systematic Review and Meta-Analysis of Observational Studies. Medicine (Baltimore) 2016 Feb;95(8):e2877. (PMID: 26937922)

16. Parola M, Pinzani M. Liver fibrosis in NAFLD/NASH: from pathophysiology towards diagnostic and therapeutic strategies. Mol Aspects Med 2024 Feb;95:101231. (PMID: 38056058)

17. Chan WK, Chuah KH, Rajaram RB, Lim LL, Ratnasingam J, Vethakkan SR. Metabolic Dysfunction-Associated Steatotic Liver Disease (MASLD): A State-of-the-Art Review. J Obes Metab Syndr 2023 Sep 30;32(3):197-213. (PMID: 37700494)

18. Loomba R, Adams LA. Advances in non-invasive assessment of hepatic fibrosis. Gut 2020 Jul;69(7):1343-52. (PMID: 32066623)

19. Liu M, Qiu H, Zhang W, et al. Evaluation of blood-based PRO-C3 testing as a diagnostic marker for staging liver fibrosis: A systematic review and meta-analysis. J Gastroenterol Hepatol 2023 Jul;38(7):1018-27. (PMID: 37287367)

20. Huang Y, Liangpunsakul S, Rudraiah, S et al. HMGB2 is a potential diagnostic marker and therapeutic target for liver fibrosis and cirrhosis. Hepatol Commun 2023 Nov 6;7(11):e0299. (PMID: 37930124)