International Journal of Research in Medical Sciences
Gurler M et al. Int J Res Med Sci. 2016 Jan;4(1):1-4
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20160001

Review Article

A review of the association of mean platelet volume and red cell distribution width in inflammation

Mujgan Gurler[1], Gulali Aktas[2]*

[1]Department of Internal Medicine, Baltalimani Education and Training Hospital, Istanbul, Turkey
[2]Department of Internal Medicine, Abant Izzet Baysal University, Bolu, Turkey

Received: 08 November 2015
Accepted: 17 December 2015

***Correspondence:**
Dr. Gulali Aktas,
E-mail: draliaktas@yahoo.com

ABSTRACT

Simple hemogram parameters have been proposed as novel markers of inflammation recently. Two of these parameters are red cell distribution width (RDW) and mean platelet volume (MPV). Both MPV and RDW have been shown to be associated with inflammatory diseases. In this review, we aimed to discuss the clinical significance of these hemogram parameters in inflammatory states by reviewing the related studies in literature.

Keywords: Hemogram parameters, Mean platelet volume, Red cell distribution width, Inflammation

INTRODUCTION

Hemogram parameters have been recently proposed as markers of inflammation in various studies from different parts of the world. Beside their importance in homeostasis, authors have implied them showroom of the inflammatory burden. Two of these hemogram parameters are red cell distribution width (RDW) and mean platelet volume (MPV). Literature is full of data about the association between inflammation and RDW[1-4] and MPV.[4-8] Although they are both inexpensive and easy to access tests, clinical usefulness of these parameters are controversial. In this review, we aimed to show the clinical significance of these hemogram parameters in inflammatory states by reviewing the related studies in literature.

Red cell distribution width

Red cell distribution width is a hemogram parameter refers the size variation of erythrocytes. It is usually increased in iron deficiency anemia whereas it is quite in normal range in thalassemias thus, it helps to distinguish iron deficiency anemia from haemoglobinopathies. Recent studies have showed that, beside iron deficiency anemia, RDW also increases in certain conditions that associated with overt or evident inflammation. Demir et al studied RDW and its relation with cerebral venous sinus thrombosis in 138 subjects and found increased RDW in patients with cerebral venous sinus thrombosis compared to healthy controls.[9] The hemoglobin levels of the subjects were not significantly different from controls in their study and thus iron deficiency anemia, a possible confounder was ruled out. In another study in literature, authors found that systemic lupus erythematosus patients had increased RDW compared to healthy individuals.[10] In this study, there was no information about the hemoglobin levels of the study and control groups, however, authors declared a positive correlation between RDW and c-reactive protein, a well-known inflammatory marker. Another study about RDW and SLE by Vaya et al revealed that patients with SLE had higher RDW compared to controls.[11] However, patients with SLE had lower hemoglobin levels than that of the control subjects in that study. Ramirez Moreno et al showed that patients with higher RDW are more likely to develop stroke than that of the patients with lower RDW.[12] Sadaka et al reported that RDW was a strong predictor of outcome in patients with septic shock.[13] Consequently, their results have been suggested by a Korean study which indicated higher RDW was associated with greater mortality rate in patients with sepsis and septic shock.[14] It is important to

note that there was no difference in hematocrit values of the survivors and non survivors in that study. Another Korean study showed prognostic value of RDW in community acquired pneumonia[15] and Ozsu et al reported mortal pulmonary embolism had greater RDW compared to non-mortal pulmonary embolism cases.[16] However, hemoglobin levels were significantly different between study groups in these two studies. It is well established that, RDW is correlated with hemoglobin levels. In another study by Senol et al reported that RDW could determine the prognosis of patients with acute pancreatitis.[17] However, their report was lack of information about hemoglobin levels of the study population. Moreover, it has been supposed that RDW could be a novel biomarker of activation of breast cancers.[18] Similarly, some reports suggest that RDW may increase diagnostic accuracy in colon cancer.[19,20] There are also more studies in literature pointed out elevated RDW in malignancies.[21-23] The possible mechanism between RDW and inflammation could be that inflammatory cytokines may interfere in erythropoesis in bone marrow resulting production of red blood cells of different sizes.

Cakal et al introduced RDW as a marker of activity in inflammatory bowel disease[24] and afterwards, it has been supposed to be usefull in differentiating Crohn's disease from ulcerative colitis.[25]

Conversely, some authors supposed that RDW alone might not have diagnostic importance about inflammatory status and prognostic value.[26,27]

Although large amount of data suggested RDW as an inflammatory marker, difficulties to standardize blood counting tests prohibit the world wide acceptance it as a novel inflammatory marker.

Mean platelet volume

MPV is a surrogate marker of platelet activation and likewise the mean corpuscular volume of erythrocytes; it refers the mean size of platelets. Beside their role in homeostasis, platelets also interact as inflammatory cells.[28] In respond to inflammatory stimuli, platelets become activated and activated platelets tend to be larger than reposed platelets. MPV reflects activation and production rate of the platelets.[29,30]

Various studies in literature reported decreased MPV associated with inflammatory diseases. In a study about ulcerative colitis, authors found an association between the disease and lower MPV.[31] Similar results have been published in two reports showed decreased MPV in patients with inflammatory bowel disease compared to healthy subjects.[32,33] Afterwards, relation of decreased MPV with inflammation has been shown in different inflammatory conditions such as rheumatoid arthritis,[34] and nasal polyp.[7]

In contrast, some authors reported elevated MPV in inflammatory conditions. For example, Shin et al showed that MPV increased in patients with hepatosteatosis.[35] Another report has been suggested their findings.[36] MPV has been reported to be increased in infectious conditions; such as chronic prostatitis,[6] hepatic[5] and pulmonary[37] hydatid cyst disease.

Either increase or decrease in MPV in inflammatory conditions should be the result of the effects of inflammatory cytokines in bone marrow. Activated platelets become larger in these conditions and cause an elevation in MPV values in hemogram tests. However, at an uncertain level, MPV tend to be decreased after utilization of these activated larger platelets in inflammatory processes thus, remaining smaller platelets lead a decrease in MPV in blood count tests.

On the contrary, some authors have not found a relation between platelet indices and platelet aggregation.[38]

Standardization of mean platelet volume assay is difficult, in fact mostly considered impossible due to many factors interfere with measurement including; environmental conditions at the time of blood sampling, interval between blood drawning and laboratory assessment, amount and type of the anticoagulant in test tubes, type and calibration of the analyzer device.[39] A study in literature revealed that both EDTA and citrate can be used for accurately measurement of MPV.[40]

Another issue is that, same as RDW, standardizing blood count tests is difficult and the prolongation of the time between blood sampling and assay may cause swelling of the platelets which may mislead increased MPV measurement.

CONCLUSION

Both MPV and RDW could pose as novel biomarkers of inflammation in certain diseases due to their inexpensive and easy to access nature, however, standardization problems of the measurement assays are still important issues which need to be resolved. They could act as strong biomarkers of inflammatory conditions after standardization of measurement assays.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

REFERENCES

1. Aktas G, Alcelik A, Tekce BK, Tekelioglu V, Sit M, Savli H. Red cell distribution width and mean platelet volume in patients with irritable bowel syndrome. Przeglad gastroenterologiczny. 2014;9(3):160-3.
2. Aktas G, Alcelik A, Tekce BK, Sit M, Savli H, Tekce H, et al. Could Mean Platelet Volume and

Red Cell Distribution Width Predict Vitamin B12 Deficiency? British Journal of Medicine and Medical Research. 2014;4(31):4965.
3. Aktas G, Sit M, Dikbas O, Tekce BK, Savli H, Tekce H, et al. Could Red Cell Distribution Width be a Marker in Hashimoto's Thyroiditis? Exp Clin Endocr Diab. 2014;122(10):572-4.
4. Aktas G, Alcelik A, Tekce BK, Savlı H, Uyeturk U, Kurt M et al. Mean Platelet Volume and Red Cell distribution width in Hepatosteatosis. National journal of medical research. 2013;3(3):264-6.
5. Sit M, Aktas G, Yilmaz EE, Hakyemez IN, Alcelik A, Kucukbayrak A. Platelet parameters in hepatic hydatid cysts. International journal of inflammation. 2013:593273.
6. Aktas G, Cakiroglu B, Sit M, Uyeturk U, Alcelik A, Savli H, et al. Mean Platelet Volume: A Simple Indicator of Chronic Prostatitis. Acta Medica Mediterr. 2013;29(3):551-4.
7. Aktas G, Sit M, Tekce H, Alcelik A, Savli H, Simsek T, et al. Mean platelet volume in nasal polyps. The West Indian medical journal. 2013;62(6):515-8.
8. Cakir L, Aktas G, Enginyurt O, Cakir SA. Mean Platelet Volume Increases in Type 2 Diabetes Mellitus Independent of Hba1c Level. Acta Medica Mediterr. 2014;30(2):425-8.
9. Demir R, Saritemur M, Ozel L, Ozdemir G, Emet M, Ulvi H. Red Cell Distribution Width Identifies Cerebral Venous Sinus Thrombosis in Patients With Headache. Clin Appl Thromb-Hem. 2015;21(4):354-8.
10. Hu ZD, Chen Y, Zhang L, Sun Y, Huang YL, Wang QQ. Red blood cell distribution width is a potential index to assess the disease activity of systemic lupus erythematosus. Clin Chim Acta. 2013;425:202-5.
11. Vaya A, Alis R, Hernandez JL, Calvo J, Mico L, Romagnoli M. RDW in patients with systemic lupus erythematosus. Influence of anaemia and inflammatory markers. Clin Hemorheol Micro. 2013;54(3):333-9.
12. Ramirez-Moreno JM, Gonzalez-Gomez M, Ollero-Ortiz A, Roa-Montero AM, Gomez-Baquero MJ, Constantino-Silva AB. Relation between red blood cell distribution width and ischemic stroke: a case-control study. Int J Stroke. 2013;8(6):E36.
13. Sadaka F, O'Brien J, Prakash S. Red cell distribution width and outcome in patients with septic shock. Journal of intensive care medicine. 2013;28(5):307-13.
14. Jo YH, Kim K, Lee JH, Kang C, Kim T, Park HM, et al. Red cell distribution width is a prognostic factor in severe sepsis and septic shock. Am J Emerg Med. 2013;31(3):545-8.
15. Lee JH, Chung HJ, Kim K, Jo YH, Rhee JE, Kim YJ, et al. Red cell distribution width as a prognostic marker in patients with community-acquired pneumonia. Am J Emerg Med. 2013;31(1):72-9.
16. Ozsu S, Abul Y, Gunaydin S, Orem A, Ozlu T. Prognostic Value of Red Cell Distribution Width in Patients With Pulmonary Embolism. Clin Appl Thromb-Hem. 2014;20(4):365-70.
17. Senol K, Saylam B, Kocaay F, Tez M. Red cell distribution width as a predictor of mortality in acute pancreatitis. Am J Emerg Med. 2013;31(4):687-9.
18. Seretis C, Seretis F, Lagoudianakis E, Gemenetzis G, Salemis NS. Is red cell distribution width a novel biomarker of breast cancer activity? Data from a pilot study. Journal of clinical medicine research. 2013;5(2):121.
19. Spell DW, Jones DV, Harper WF, Bessman DJ. The value of a complete blood count in predicting cancer of the colon. Cancer detection and prevention. 2004;28(1):37-42.
20. Speights VO, Johnson MW, Stoltenberg PH, Rappaport ES, Helbert B, Riggs MW. Complete blood count indices in colorectal carcinoma. Archives of pathology & laboratory medicine. 1992;116(3):258-60.
21. Baicus C, Caraiola S, Rimbas M, Patrascu R, Baicus A. Utility of routine hematological and inflammation parameters for the diagnosis of cancer in involuntary weight loss. Journal of investigative medicine: the official publication of the American Federation for Clinical Research. 2011;59(6):951-5.
22. Ozkalemkas F, Ali R, Ozkocaman V, Ozcelik T, Ozan U, Ozturk H, et al. The bone marrow aspirate and biopsy in the diagnosis of unsuspected nonhematologic malignancy: A clinical study of 19 cases. Bmc Cancer. 2005:5.
23. Seitanides B, Giakoumakis G, Tsakona C. Increased Red-Cell Volume Distribution Width in Patients with Bone-Marrow Metastases. J Clin Pathol. 1988;41(11):1246.
24. Cakal B, Akoz AG, Ustundag Y, Yalinkilic M, Ulker A, Ankarali H. Red Cell Distribution Width for Assessment of Activity of Inflammatory Bowel Disease. Digest Dis Sci. 2009:54(4):842-7.
25. Farkas K, Papp M, Nyári T, Nagy F, Szepes Z, Wittmann T, et al. Red blood cell distribution width in combination with serological markers can help in the differentiation between Crohn's disease and ulcerative colitis. Open Gastroenterology Journal. 2010;4:1-4.
26. Balta S, Demirkol S, Hatipoglu M, Ardic S, Aydogan M, Celik T. Other inflammatory indicators should be kept in mind when assessing red cell distribution width in patients with pneumonia. Am J Emerg Med. 2013;31(7):1144-5.
27. Cakar M, Balta S, Demirkol S, Kurt O, Unlu M, Akhan M. Red Cell Distribution Width Should Be Assessed together with Other Inflammatory Markers in Daily Clinical Practice. Cardiology. 2013;124(1):60.
28. Bazzoni G, Dejana E, Delmaschio A. Platelet-Neutrophil Interactions - Possible Relevance in the Pathogenesis of Thrombosis and Inflammation. Haematologica. 1991;76(6):491-9.

29. Briggs C. Quality counts: new parameters in blood cell counting. International journal of laboratory hematology. 2009;31(3):277-97.
30. Bath PM, Butterworth RJ. Platelet size: measurement, physiology and vascular disease. Blood coagulation & fibrinolysis: an international journal in haemostasis and thrombosis. 1996;7(2):157-61.
31. Polinska B, Matowicka-Karna J, Kemona H. Assessment of the influence of the inflammatory process on the activation of blood platelets and morphological parameters in patients with ulcerative colitis (colitis ulcerosa). Folia histochemica et cytobiologica / Polish Academy of Sciences, Polish Histochemical and Cytochemical Society. 2011;49(1):119-24.
32. Yuksel O, Helvaci K, Basar O, Koklu S, Caner S, Helvaci N et al. An overlooked indicator of disease activity in ulcerative colitis: mean platelet volume. Platelets. 2009;20(4):277-81.
33. Kapsoritakis AN, Koukourakis MI, Sfiridaki A, Potamianos SP, Kosmadaki MG, Koutroubakis IE et al. Mean platelet volume: A useful marker of inflammatory bowel disease activity. Am J Gastroenterol. 2001;96(3):776-81.
34. Kisacik B, Tufan A, Kalyoncu U, Karadag O, Akdogan A, Ozturk MA, et al. Mean platelet volume (MPV) as an inflammatory marker in ankylosing spondylitis and rheumatoid arthritis. Joint Bone Spine. 2008;75(3):291-4.
35. Shin WY, Jung DH, Shim JY, Lee HR. The association between non-alcoholic hepatic steatosis and mean platelet volume in an obese Korean population. Platelets. 2011;22(6):442-6.
36. Ozhan H, Aydin M, Yazici M, Yazgan O, Basar C, Gungor A et al. Mean platelet volume in patients with non-alcoholic fatty liver disease. Platelets. 2010;21(1):29-32.
37. Kucukbayrak A, Oz G, Findik G, Karaoglanoglu N, Kaya S, Tastepe I et al. Evaluation of platelet parameters in patients with pulmonary hydatid cyst. Mediterranean journal of hematology and infectious diseases. 2010;2(1):e2010006.
38. Beyan C, Kaptan K, Ifran A. Platelet count, mean platelet volume, platelet distribution width, and plateletcrit do not correlate with optical platelet aggegation responses in healthy volunteers. J Thromb Thrombolys. 2006;22(3):161-4.
39. Vizioli L, Muscari S, Muscari A. The relationship of mean platelet volume with the risk and prognosis of cardiovascular diseases. Int J Clin Pract. 2009;63(10):1509-15.
40. Dastjerdi MS, Emami T, Najafian A, Amini M. Mean platelet volume measurement, EDTA or citrate? Hematology. 2006;11(5):317-9.

Cite this article as: Gurler M, Aktas G. A review of the association of mean platelet volume and red cell distribution width in inflammation. Int J Res Med Sci 2016;4:1-4.