



RESEARCH ARTICLE

EVALUATION OF PLATELET COUNT AND PLATELET INDICES IN COVID-19 INFECTION

Dr. Gauri S. Metkar and Dr. Mangala Nagare

Manuscript Info

Manuscript History

Received: 05 June 2022

Final Accepted: 09 July 2022

Published: August 2022

Key words:-

COVID-19, Platelet Count, Platelet Indices

Abstract

Background: Covid-19 infection has caused global pandemic. One of the important pathogenic mechanisms of COVID-19 infection is abnormal inflammatory response. Newer studies show that platelets play important role in inflammatory and immune responses. Platelet count and isolated platelet indices have been studied in COVID-19 infections. However comprehensive study of all platelet parameters is lacking. Hence, we analysed platelet count as well as platelet indices in COVID-19 patients in correlation with each-other.

Methods: This is a cross-sectional observational study which included 101 COVID-19 patients whose platelet count and platelet indices were analysed using MINDRAY B-6000 Analyzer.

Results: The study population consisted of 61 males and 40 females, and Maximum patients were in the age group of 61-70 years. 49 (47%) out of 101 patients had normal platelet count. Mild thrombocytopenia was seen in 38 (37.60%) patients. Mean MPV in the present study was 11.4 which is on the higher side of normal range of MPV. Mean PDW, P-LCC and P-LCR were significantly increased. Mean platelet count and PCT were within normal range in the present study.

Conclusions: Platelet parameter derangements can be seen in COVID-19 infection, even in mild cases. Analysis of platelet counts and platelet indices can be used as useful method in monitoring and prognostication of COVID-19 patients. In COVID-19 patients having normal platelet count, platelet indices like PDW, P-LCC and P-LCR can be used for monitoring and evaluating treatment effect.

Copy Right, IJAR, 2022.. All rights reserved.

Introduction:-

COVID-19 infection has caused global pandemic. In India, till now more than 73,07,097 confirmed COVID-19 cases have been reported with number of covid-19 deaths being 1,11,266[1]. The clinical outcome of Covid-19 infection ranges from mild infection of respiratory tract to severe pneumonia with fatal multi organ failure in severe cases[1-6]. One of the important pathogenic mechanisms of COVID-19 infection is abnormal inflammatory response, especially in severe cases[7-8]. Platelets play important role in early clot formation and clot modulation[9]. Newer studies show that platelets play important role in inflammatory and immune responses as well. Platelet granules have many pro-inflammatory mediators which act as direct as well as indirect activators of inflammation[10-14]. Platelets have also been found to perform phagocytic function. Platelet count and isolated platelet indices have been studied in relation to COVID-19 infections. However comprehensive study of all platelet parameters is lacking. Hence, the aim of this study is to evaluate platelet count as well as platelet indices in COVID-19 patients in correlation with each-other.

Aims and Objectives:-

The aim of this study was:

1. To study platelet count in confirmed COVID-19 positive patients.
2. To study following platelet indices in confirmed COVID 19 patients:
3. MPV- mean platelet volume
4. PDW- platelet distribution width
5. PCT- plateletcrit
6. Platelet –large cell ratio

Materials and Methods:-**Study design:**

Cross-sectional observational study.

Study Duration and procedure:

Study was conducted in clinical pathology laboratory of Rural tertiary health care centre, all confirmed COVID-19 positive patients admitted in hospital in 2021. Informed written consent of the patients, for this study, was obtained prior to collection of blood sample. Blood samples from confirmed COVID 19 patients (confirmed by RT PCR) were collected in EDTA vacutainers. These samples were processed for determination of platelet count and platelet indices which was done by using automated cell counter method. The Cell Counter used was MINDRAY BC-6000.

Sample size–

Sample size was calculated as follows:

$$N = \frac{(S.D)^2 \times Z\alpha^2}{(\text{Diff})^2}$$

Mean-190

SD -75.98

At $\alpha = 0.05$

Allowable error = 10%

Sample size = 61.4 = 62

or

At $\alpha = 0.001$

Sample size = 98

For estimation of sample size:

$$N = \frac{P \times Q \times Z\alpha^2}{(\text{Diff})^2}$$

Selection Of Cases-**Inclusion criteria:**

All COVID-19 positive patients admitted to hospital, confirmed by RT-PCR Test.

Exclusion criteria:

Suspected COVID-19 patients, with negative RT-PCR test.

1. Patients admitted for treatment of non - COVID disease.
2. Covid-19 positive patients having other diseases which can affect platelets.
3. Patients who test positive for infections in addition to COVID-19 infection like Dengue fever, malaria.

Statistical analysis:

Data was analyzed using mean, median and standard deviation for each parameter.

All procedures performed in the current study were approved by IRB (IEC/MIMER/2021/757, DATED-31/03/2021) in accordance with the 1964 Helsinki declaration and its later amendments.

Informed consent was obtained from all individual participants included in the study.

Results:-

In total, 101 COVID-19 patients were included in this study. This was cross sectional observation study conducted in clinical pathology laboratory of rural tertiary health care centre in 2021. The study population consisted of 61 males and 40 females, and Maximum patients were in the age group of 61-70 years.[Table no.1, 2]

Table No.1:- Agewise distribution of Covid 19 patients in the study.

Age	Covid-19 cases	Percentage (%)
10 – 20	3	2.90%
21-30	11	10.89%
31- 40	13	13%
41-50	14	14%
51- 60	22	22%
61-70	27	27%
71- 80	10	10%
>81	1	0.99
Total	101	100%

49 (47%) out of 101 patients had normal platelet count. Mild thrombocytopenia was seen in 38 (37.60%) patients [Table no.3]

Table No.2:- Gender Distribution.

Sex	Cases	Percentage (%)
Male	61	60.39
Female	40	39.60
Total	101	100

Table No.3:- Platelet count in the study groups.

Platelet count(lac/cumm)	Total Cases	Percentage (%)
< 0.5	1	1%
0.5-1	13	13%
1-1.5	38	37.60%
1.5-2	21	20.7
>2	28	27.7
Total	101	100

Mean MPV in the present study was 11.4 which is on the higher side of normal range of MPV. Mean PDW, P-LCC and P-LCR were significantly increased. Mean platelet count and PCT were within normal range in the present study. [Table no. 4]

Table No.4:- Platelet counts and platelet indices in COVID 19 patients.

	Platelet(Lac/cumm)	Age years	MPV	PDW	PCT	P-LCC	P-LCR
Normal Range	1.5-4.5(lac/cumm)	10-78 years	7.5-11.5fL	8.3-11.4 fL	0.11-0.29%	12-30 fl	15-35%
Mean	169000	52.44	11.4376	16.76337	1.9933	62.673	36.23
Median	147000	55	11.2	16.7	0.18	55	34.7
SD	76145.87	16.47087	1.494848	0.585273	17.99018	30.0157	10.3211 2

Discussion:-

Role of platelets in various viral infections is well known. In COVID 19 infection also changes in platelet parameters are seen. In present study we have analyzed changes in platelet count and platelet indices in COVID 19 infection. Platelet count changes are found in many infections. Thrombocytopenia or decreased platelet count can be graded into mild, moderate and severe grades which correlates with severity of infection. Maximum patients in our study had mild thrombocytopenia. Mean platelet count in our study was normal. This could be because most of the patients in our study had mild disease [Table 3]. In a study by Bhandary C. P. et al [15], mild thrombocytopenia was most common finding as most of the patients had mild disease.

In addition to platelet count, platelet indices help in assessing platelet abnormalities like variation in size of platelets indicated by PDW and proportion of large platelets indicated by P-LCC and P-LCR. Few of the study like Güçlü E. et al [16,17] explain the increase in platelet indices, like MPV, and PDW in Covid-19 infection. Altered platelet indices are due to increased young platelets which are more active than older platelets [18].

In our study, among platelet indices, mean PDW, P-LCC and P-LCR were significantly increased. [Table 4] This indicates platelet abnormalities like large platelets, presence of immature platelets resulting in increased variation in size of platelets. Bhandary C. P. et al [15], Shankaralingappa A et al [19] and Neslihan Ozcelik [20] found similar results in their studies. In our study, mean PCT was within normal range.

In covid-19 patients, Age and sex act as important prognostic factors. Covid-19 infection can affect any age group, however, advanced age has been observed to be associated with bad prognosis. It has also been observed that males are more commonly affected by COVID 19 infection. Covid-19 associated morbidity and mortality is also more in males. Hence, age and sex should be taken into consideration in prognostication of these patients. In present study, maximum patients were in the age group of 61-70 years. In a study done by Zarir F Udwardia et al [28] maximum patients were in the age group of ≥ 60 years and were males.

Conclusion:-

Platelet parameter derangements can be seen in COVID 19 infection, even in mild cases. With the advent of reliable automated hematology cell counters, analysis of platelet counts and platelet indices can be used as useful cost effective, easily available, reliable, non-invasive and repeatable method in monitoring and prognostication of COVID 19 patients. In COVID 19 patients having normal platelet count, platelet indices like PDW, P-LCC and P-LCR can be used for monitoring and evaluating treatment effect.

Notes:**Ethics Statement**

MIMER Medical College, Talegaon (D) Institutional Review Board issued ethics approval to the present study. (IEC/MIMER/2021/757, DATED- 31/03/2021).

Author Contributions

Conceptualization: GM, MN. Data curation: MN. Methodology: GM. Writing—original draft: GM, MN. Writing—review & editing: GM. Approval of final manuscript: all authors.

Conflicts of Interest

The authors declare that they have no potential conflicts of interest.

Funding Statement

No funding to declare.

Sources of support if any:

No

Acknowledgment if any:

NA.

References:-

1. Kumar SU, Kumar DT, Christopher BP, Doss C. The rise and impact of COVID-19 in India. *Frontiers in medicine*. 2020 May 22;7:250.
2. Chen N, Zhou M, Dong X, Qu J, Gong F, Han Y, Qiu Y, Wang J, Liu Y, Wei Y, Yu T. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. *The lancet*. 2020 Feb 15;395(10223):507-13.
3. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, Cheng Z. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *The lancet*. 2020 Feb 15;395(10223):497-506.
4. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, Wang B, Xiang H, Cheng Z, Xiong Y, Zhao Y. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus–infected pneumonia in Wuhan, China. *Jama*. 2020 Mar 17;323(11):1061-9.
5. Mehra MR, Desai SS, Kuy S, Henry TD, Patel AN. Cardiovascular disease, drug therapy, and mortality in Covid-19. *New England Journal of Medicine*. 2020 Jun 18;382(25):e102.
6. Cohen A, Harari E, Cipok M, Laish-Farkash A, Bryk G, Yahud E, Sela Y, Lador NK, Mann T, Mayo A, Lev EI. Immature platelets in patients hospitalized with Covid-19. *Journal of thrombosis and thrombolysis*. 2020 Sep 30:1-9.
7. Weyrich AS, Elstad MR, McEver RP, McIntyre TM, Moore KL, Morrissey JH, Prescott SM, Zimmerman GA. Activated platelets signal chemokine synthesis by human monocytes. *The Journal of clinical investigation*. 1996 Mar 15;97(6):1525-34.
8. Klein F, Soriano JC, Anfuso MB, Ruiz V, Perazzo M, Paladini H, Vigliano A, Ossés J, Lowenstein P, Vigliano C, Cánova J. Transbronchial biopsies' histopathological findings leading to successful late steroid therapy in Covid-19 acute respiratory failure. *VirchowsArchiv*. 2021 Jan 7:1-7.
9. Sonmez O, Sonmez M. Role of platelets in immune system and inflammation. *Porto biomedical journal*. 2017 Nov 1;2(6):311-4.
10. Morrell CN, Aggrey AA, Chapman LM, Modjeski KL. Emerging roles for platelets as immune and inflammatory cells. *Blood, The Journal of the American Society of Hematology*. 2014 May 1;123(18):2759-67.
11. Elzey BD, Tian J, Jensen RJ, Swanson AK, Lees JR, Lentz SR, Stein CS, Nieswandt B, Wang Y, Davidson BL, Ratliff TL. Platelet-mediated modulation of adaptive immunity: a communication link between innate and adaptive immune compartments. *Immunity*. 2003 Jul 1;19(1):9-19.
12. Semple JW, Italiano JE, Freedman J. Platelets and the immune continuum. *Nature Reviews Immunology*. 2011 Apr;11(4):264-74.
13. Watson SP, Morgan NV, Harrison P. The vascular function of platelets. *Postgraduate Haematology*. 2015 Dec 14:699-714.
14. Salamanna F, Maglio M, Landini MP, Fini M. Platelet functions and activities as potential hematologic parameters related to Coronavirus Disease 2019 (Covid-19). *Platelets*. 2020 Jul 3;31(5):627-32.

15. Bhandary CP, Agarkar PL, Manivannan P, Kar R, Basu D. Hematological parameters in covid-19 illness: Emphasis on platelet indices as a marker of severity of disease. *Indian Journal of Hematology and Blood Transfusion*. 2020:S128-.
16. Güçlü E, Kocayığit H, Okan HD, Erkorkmaz U, Yürümez Y, Yaylacı S, Koroglu M, Uzun C, Karabay O. Effect of COVID-19 on platelet count and its indices. *Revista da Associação Médica Brasileira*. 2020 Sep 11;66:1122-7
17. Karabay O, Güçlü E. The effect of severe sepsis on platelet count and their indices.
18. Sadler JE. What's new in the diagnosis and pathophysiology of thromboticthrombocytopenic purpura. *Hematology Am SocHematolEduc Program*.2015;2015:631-636.
19. Shankaralingappa A, Tummidi S, ArunBabu T. Diagnostic value of platelet indices in COVID 19 infection: a case-control study from a single tertiary care center. *The Egyptian Journal of Internal Medicine*. 2022 Dec;34(1):1-5.
20. Ozcelik N, Ozyurt S, Yilmaz Kara B, Gumus A, Sahin U. The value of the platelet count and platelet indices in differentiation of COVID-19 and influenza pneumonia. *Journal of Medical Virology*. 2021 Apr;93(4):2221-6.