

Frequency of Thrombocytopenia in Patients with COVID-19

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ABSTRACT

Objective: To determine the frequency of thrombocytopenia in patients with COVID-19.

Study Design: Cross sectional study.

Place and Duration of Study: Combined Military Hospital, Quetta Pakistan, from Apr 2021 to Mar 2022.

Methodology: A total of 225 patients with COVID-19 were selected using non-probability, consecutive sampling. After ethical approval, informed consent platelet count was studied in 2 weeks of hospital admission fulfilling inclusion and exclusion criteria.

Results: Two hundred and twenty-five patients, with age ranging from 30 to 60 years and mean 44.89 ± 5.42 years were included in this study, in which 95 patients were COVID-19 survivors and 130 were non-survivors. Blood samples of all patients was collected, and platelet count was studied and categorized into [0-50], [50-100], [100-150], and 150 or more by using unit ($\times 10^9/L$). 2321 tests of platelet count were done, that shows $50 \times 10^9/L$ was the lower limit of normal range of platelets. Overall mortality rate per 1000 is 77 out of which was survival rate is 93.4% and death rate (6.6%), moreover mortality rate in patient with platelet [0-50] is (38.80%), [50-100] (25.70%), [100-150] (23.60%), and >150 group (11.70%) respectively.

Conclusion: Thrombocytopenia was common in patients with corona virus and platelet count was relatively lower in severe COVID-19 infection and analyzing the gradual decrease in platelet counts may be useful in the prognosis of patients with COVID-19.

Keywords: COVID-19, SARS-CoV-2, Thrombocytopenia.

How to Cite This Article: Khan Z, Fazal N, Iqbal R, Ikhlaq A, Zafar N. Frequency of Thrombocytopenia in Patients with COVID-19. Pak Armed Forces Med J 2026; 76(Suppl-9): S1417-S1421. DOI: <https://doi.org/10.51253/pafmj.v76iSUPPL-9.8833>

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INTRODUCTION

In Wuhan, China, the first cases of infection with a novel human microbe, now formally known as severe acute respiratory syndrome corona virus 2 (SARS-CoV-2), was reported in December 2019.¹ Infection with SARS-CoV-2 causes thrombosis and inflammation, Prophylactic dosages of low molecular weight heparin (LMWH) may be justified in hospitalized COVID-19 patients because of the significant thrombotic risk, and anticoagulant medication may improve their prognosis.² Thrombocytopenia appeared to be associated with severe COVID-19 disease. The Multiple Organ Dysfunction Score (MODS), Simplified Acute Physiology Score (SAPS) II, and Acute Physiology and Chronic Health Evaluation (APACHE) II all correlate with a low platelet count.³ A national study in China reported platelet count less than $150 \times 10^9/L$ happened with 36.2% in all COVID-19 patients,⁴ 31.6% in less severe and 57.7% in severe patients, while another

study showed the frequency of thrombocytopenia was 12%.^{5,6} Even the most seriously sick COVID-19 individuals, had relatively moderate thrombocytopenia. Only 5% of patients had platelet counts of $100 \times 10^9/L$ in one case study (n 14 62),⁷ while 69 patients from Singapore had platelet counts of $100 \times 10^9/L$ upon admission.⁸

The present study was planned to see frequency of thrombocytopenia in diagnosed patients of covid 19 to ensure early management, which can decrease disease burden and reduce morbidity in society.

METHODOLOGY

A cross sectional study was conducted at the Department of Medicine, CMH Quetta Pakistan from April 2021 to March 2022 on patients diagnosed or deceased with COVID-19 infection. Sample size was calculated using WHO sample size calculator taking confidence interval 95%, margin of error 5%, and reported prevalence of COVID-19 infection of 17.81%.⁹ The estimated sample size came out to be 225 patients. The participants in the study were recruited using non probability, consecutive sampling. Ethical approval was obtained from institutional review board (Ref# CMH-QTA-IRB/036).

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Received: 06 Jun 2022; revision received: 13 Mar 2023; accepted: 18 Apr 2023

Inclusion Criteria: Patients between age 30-60 years, with the clinical diagnosis of COVID-19 infection and disease duration of more than 02 months were included in the study.

Exclusion Criteria: Patient those COVID-19 PCR was negative, other co morbidities like diabetes mellitus, hypertension, Ischemic heart disease, and those who refuse to participate in study.

The diagnosis of COVID-19 infection was done according to WHO guidelines and confirmed by amplification of RNA of SARS-CoV-2. The main objective of study was to determine the prevalence of thrombocytopenia in COVID-19 according to its severity. A local server was used to store data regarding COVID-19 patients. Log files of hospitals and lab numbers were also consulted. All such data was unique and reflected the actual data of patients. At admission test of blood complete count, including platelet count was done, repeated on choice of treating physician. The platelet counts from the participants were categorized into (0-50), (50-100), (100-150) and (150 or more) groups, using the unit ($\times 10^9/L$).

The raw data were analyzed using Statistical Package for Social Sciences (version 26) software. The response variables were platelet count (in $\times 10^9/L$) and age (in years), which are both quantitative variables. The independent variables were gender, which is a nominal variable with two groups – Male and Female; and COVID-19 cases, which is also a nominal variable with two groups – Survivors and Non-survivors. Independent samples t-test was used to evaluate if there was a difference in platelet counts as well as age among the survivors and non-survivors of COVID-19. The *p*-value approach to hypothesis testing was utilized, with level of significance set to 0.05.

RESULTS

A total of 225 patients were included in the study. 155(68.9%) were males while 70(31.1%) were females. The mean age of the participants was 44.89 ± 5.42 years. Respondents with platelet count of 150 ($\times 10^9/L$) or more were the highest in number, with a frequency of 87(38.7%), while those falling in the platelet count category of 100-150 ($\times 10^9/L$) had the least frequency (18(8.0%)). COVID-19 non-survivors were the highest in number, with a frequency of 130(57.8%), while survivors were the least in number with a frequency of 95(42.2%) (Table-I).

An Independent samples t-test was conducted in order to determine whether there was a difference in platelet counts among the survivors and non-

survivors of COVID-19. The results indicated that mean platelet count for the non-survivors (66.59 ± 37.81) was significantly lower than that of the survivors (149.98 ± 29.60), $p < .001$ (Table-II). This means that Thrombocytopenia occurred more in COVID-19 non-survivors than in the survivors.

Table-I: Descriptive Statistics of Demographic and Study Variables (n=225)

Study Parameter(s)	Values
Age (Mean $\pm$ SD)	44.89 $\pm$ 5.42 years
Platelet count (Mean $\pm$ SD)	101.80 $\pm$ 53.81 ($\times 10^9 /L$)
Gender	
Male	155(68.9%)
Female	70(31.1%)
Platelet count category ($\times 10^9 /L$)	
0-50	72(32.0%)
50-100	48(21.3%)
100-150	18(8.0%)
150 or more	87(38.7%)
COVID-19 Cases	
Survivors	95(42.2%)
Non-survivors	130(57.8%)

Table-II: Age Comparison Between Survivors and Non-Survivors (n=225)

Variable(s)	Survivor (n=95)	Non-survivor (n=130)	<i>p</i> -value
Platelet count ($\times 10^9 /L$) (Mean $\pm$ SD)	149.98 $\pm$ 29.60	66.59 $\pm$ 37.81	<0.001
Age in years (mean $\pm$ SD)	43.15 $\pm$ 4.90	46.17 $\pm$ 5.45	<0.001

Another Independent samples t-test was conducted to examine whether there was a difference in age among the survivors and non-survivors of COVID-19. The results revealed that the mean age (in years) of the survivors (43.15 ± 4.90) was significantly lower than that of the non-survivors (46.17 ± 5.45), $p < 0.001$ (Table-II). This shows that the non-survivors were older than the survivors.

A Chi-Square test of independence was conducted to examine whether there exists an association between gender and Thrombocytopenia. The results revealed that there is a significant association between the two variables ($p < 0.001$). Based on the cross tabulation results (Table-III), 67(43.2%) of the males had platelet counts falling in the category 0-50 ($\times 10^9/L$) as compared to the 7.1% of the females. Similarly, 27.1% of the males had their platelet counts falling in the category 50-100 ($\times 10^9/L$) as compared to the 8.6% of the females. Therefore, it can be concluded that the males are more affected by Thrombocytopenia than females. The tabulation results show that only 19.4% of the males have platelet counts in the category 150

($\times 10^9/L$) and over as compared to the 81.4% of the females.

Table-III: Cross Tabulation between Gender and Platelet count (n=225)

Gender	Category of Platelet count ($\times 10^9/L$)				p-value
	0-50	50-100	100-150	150 or more	
Male	67(43.2%)	42(27.1%)	16(10.3%)	30(19.4%)	<0.001
Female	5(7.1%)	6(8.6%)	2(2.9%)	57(81.4%)	

The bar chart in Figure below shows a visualization of the counts of non-survivors for each category of platelet count. From the graph, it can be seen that mortality was highest among the patients with platelet counts in the group 0-50 ($\times 10^9/L$), followed by those in the group 50-100 ($\times 10^9/L$), then those in the group 100-150 ($\times 10^9/L$), and lastly, those with platelet counts of 150 ($\times 10^9/L$) and more.

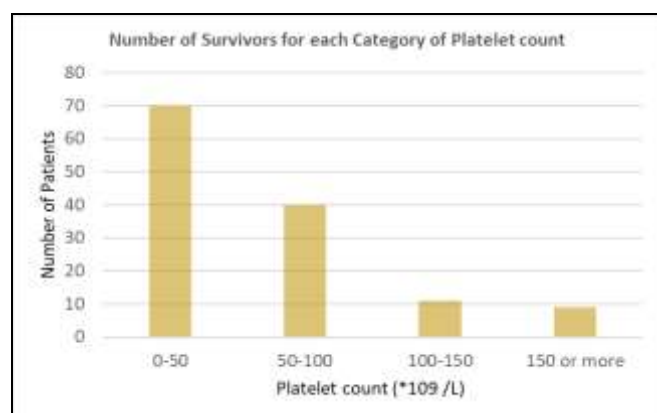


Figure: Bar chart showing the number of non-survivors (mortality) for each category of Platelet count (n=130)

DISCUSSION

The results of our study found that Thrombocytopenia is common in patients with COVID-19, it occurred in severe disease with higher risk of mortality in hospital patients. Because of the fast emergence of new infections and the current era of medicine, biomarkers are needed to predict disease severity and prognosis and to guide therapeutic therapy. Thrombocytopenia is a common finding in infectious disorders, and the most prevalent pathogens that cause thrombocytopenia are viruses (28%) and bacteria (14%). Fungi came in second (28%), followed by bacteria (15%).¹⁰ A distinguishing aspect of COVID-19 is the wide range of illness severity observed among infected individuals, with clinical manifestations ranging from completely asymptomatic infection to mild, moderate, severe, and critical disease. Some individuals may remain asymptomatic or develop only minor symptoms, such as fever,

cough, fatigue, or loss of taste and smell, while others may progress to severe respiratory illness requiring hospitalization and advanced supportive care. In critically ill patients, the disease may be complicated by acute respiratory distress, hypoxemia, systemic inflammation, thrombotic complications, and multiorgan dysfunction. This considerable variability in clinical presentation may be influenced by factors such as age, underlying medical conditions, immune response, and other patient-related characteristics. Understanding this broad spectrum of disease severity is important for early risk assessment, appropriate clinical monitoring, and timely intervention, particularly in patients who are at greater risk of progressing from mild or moderate illness to severe or critical disease.¹¹⁻¹³

Thrombocytopenia appears to be associated with increased disease severity in patients with COVID-19 and has been reported in approximately 5% to 40% of affected individuals.¹⁴ The presence and degree of thrombocytopenia may vary according to the severity of infection, underlying comorbidities, and the stage of disease. Several mechanisms have been proposed to explain the reduction in platelet count during COVID-19, including impaired platelet production, increased platelet destruction, consumption of platelets during systemic inflammation and coagulation, and abnormalities associated with severe infection.¹² A markedly reduced platelet count may therefore serve as an important clinical and laboratory indicator of disease progression. Patients with severe COVID-19 may require closer monitoring of platelet counts, particularly when thrombocytopenia is accompanied by other markers of inflammation, coagulation abnormalities, or organ dysfunction. Consequently, assessment of platelet levels may contribute to early risk stratification and identification of patients who are more likely to develop severe complications and poorer clinical outcomes.

Yang *et al.*,¹² investigated the mechanisms of thrombocytopenia in COVID-19 infection and discovered that the virus has a direct effect on hematopoiesis and megakaryocytes maturation, as well as increased platelet adhesion and activation and subsequent platelet consumption in the microcirculation of injured lung tissue. Platelet activation in the pulmonary microcirculation not only increased procoagulant activity in COVID-19 patients, but it also induced lung parenchymal damage, leading to respiratory distress and the need for frequent mechanical ventilation, a symptom of severe COVID-

19.¹⁵ A low grade DIC has also been linked to a reduced platelet count in SARS patients. However, as the World Health Organization (WHO) points out, there are substantial variations between SARS and COVID-19.⁷ Elevated blood levels of ferritin, interleukin-6, and other proinflammatory cytokines have been documented and associated to a poorer outcome in COVID-19, suggesting that hyper inflammation is a key hallmark of severe SARS.¹⁶⁻¹⁸

The platelet count was considerably lower in individuals with more severe COVID-19 (WMD -31 109/L; 95 % Confidence interval, -35 to -29 109/L) according to the findings of nine investigations. There was a lot of heterogeneity (I², 92 percent; $p=0.001$). In patients with more severe COVID-19, the platelet count remained considerably lower (WMD, -22 109/L; 95 % Confidence interval, -26 to -16 109/L; I², 91 percent; $p=0.001$).¹⁹

Most patients with mild to moderate disease have satisfactory treatment outcomes; however, patients with severe or critical COVID-19 may experience poor clinical outcomes and a substantially increased risk of mortality. Severe disease is often associated with complications such as respiratory distress, hypoxemia, pneumonia, systemic inflammation, and multiorgan dysfunction, which can rapidly worsen without appropriate medical intervention. Therefore, early identification of patients who are at increased risk of disease progression is essential for timely clinical management. Close monitoring of vital signs, oxygen saturation, laboratory parameters, and other relevant clinical indicators can help healthcare professionals recognize deterioration at an early stage. Prompt initiation of appropriate supportive and therapeutic measures in patients with severe COVID-19 can improve clinical outcomes and potentially reduce complications and mortality. Consequently, early detection, risk stratification, and timely treatment remain crucial components in the effective management of severe COVID-19 and in reducing preventable deaths.

LIMITATION OF STUDY

First, the tests on platelet count for each patient required different time interval. Second, this study was focusing on only thrombocytopenia, so data on other organ dysfunction were not mentioned. Third, the medical resource was relative short in COVID-19 outbreak so further studies are needed to confirm our findings.

CONCLUSION

Thrombocytopenia is common in patient with COVID-19, occurred in severe disease with higher risk of mortality

in hospital patients. Early diagnosis, active monitoring and thromboprophylaxis can help improve the outcome for those not contraindicated for the treatment.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

ZK & NF: Data acquisition, data analysis, critical review, approval of the final version to be published.

RI & AI: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

NZ: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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