

Original Article

# Risk Factors Contributing Thrombocytopenia in Cardiac Patients at Tertiary Care Hospital

Alishba Imran<sup>1</sup>, Faizan Hameed<sup>1</sup>, Fizza Shahbaz Ahmad<sup>2</sup>, Farwa Nadeem<sup>1</sup>, Hafiz Ayaz Ahmad<sup>1</sup>, Ijaz Ahmad<sup>1</sup>, Dr Bilal Aslam<sup>3</sup>, Azka Mubeen<sup>1</sup>

<sup>1</sup> Department of Medical Lab Technology, Faculty of Allied Health Sciences, The Superior University, Lahore, Pakistan

<sup>2</sup> Department of Biological Sciences, Faculty of Allied Health Sciences, The Superior University, Lahore, Pakistan

<sup>3</sup> University College of Medicine and Dentistry Lahore, Pakistan

\*Corresponding Author: Azka Mubeen, [azkamubeen786@gmail.com](mailto:azkamubeen786@gmail.com)

**Cite this Article** Received: 08 March 2026; Accepted: 27 April 2026; Published: 14 May 2026

**Author Contributions:** Concept: AI; Design: FH; Data Collection: FNA and HAA; Analysis: IA and BA; Drafting: AM, **Ethical Approval:** Superior University, Lahore, Pakistan. **Informed Consent:** Written informed consent was obtained from all participants; **Conflict of Interest:** The authors declare no conflict of interest. **Funding:** No external funding; **Data Availability:** Available from the corresponding author on reasonable request; **Acknowledgments:** N/A.

## ABSTRACT

**Background:** Thrombocytopenia is a clinically important hematological abnormality in cardiac patients because reduced platelet count may increase bleeding risk and complicate the use of antiplatelet and anticoagulant therapy. **Objective:** This study aimed to determine the frequency of thrombocytopenia and describe associated demographic and hematological patterns among adult cardiac patients admitted to a tertiary-care hospital. **Methods:** A cross-sectional observational study was conducted over four months among 152 cardiac patients aged 40–75 years. Patients were selected using a random sampling technique, and demographic characteristics, clinical information, and hematological parameters were obtained from medical records and laboratory reports. Platelet count, hemoglobin, red blood cell count, white blood cell count, red cell indices, and erythrocyte sedimentation rate were assessed. Data were summarized using frequencies and percentages. **Results:** Among 152 cardiac patients, males represented 58.6% and females 41.4%. The largest age group was 40–49 years, comprising 30.3% of patients. Anemia was the most frequent hematological abnormality, observed in 44.7% of patients, followed by leukocytosis in 20.4% and thrombocytopenia in 19.1%. Leukopenia, polycythemia, and thrombocytosis were observed in 9.9%, 5.3%, and 3.9% of patients, respectively. **Conclusion:** Hematological abnormalities were common among cardiac patients, with thrombocytopenia affecting approximately one-fifth of the cohort. Routine complete blood count assessment and platelet monitoring may support safer cardiovascular management, especially in patients receiving antithrombotic therapy. **Keywords:** Thrombocytopenia, Cardiac Patients, Platelet Count, Cardiovascular Disease, Anemia, Hematological Abnormalities.

## INTRODUCTION

Cardiovascular diseases remain a major cause of morbidity and mortality worldwide, and their clinical management is frequently complicated by hematological abnormalities that influence both prognosis and therapeutic decision-making. Among these abnormalities, thrombocytopenia is particularly important because platelets are essential for primary hemostasis, vascular integrity, thrombus formation, and inflammatory signaling. A reduction in platelet count may increase bleeding risk, alter the safety of antiplatelet and anticoagulant therapy, and serve as a marker of systemic illness severity in hospitalized cardiac patients (1,2). This concern is especially relevant in tertiary-care settings, where patients often present with multiple comorbidities, advanced cardiovascular disease, acute inflammatory states, and exposure to drugs that may affect platelet production, activation, survival, or destruction.

The relationship between cardiovascular disease and thrombocytopenia is clinically complex. Cardiac patients may develop reduced platelet counts due to drug-related mechanisms, including heparin exposure, antiplatelet agents, glycoprotein IIb/IIIa inhibitors, and anticoagulant therapy, as well as non-drug mechanisms such as inflammation, immune-mediated platelet destruction, endothelial dysfunction, sepsis, renal impairment, liver disease, bone marrow suppression, and consumptive coagulopathy (3,4). In patients with acute coronary syndromes, cardiogenic shock, heart failure, and myocardial infarction, thrombocytopenia has been associated in previous studies with adverse outcomes, including bleeding complications, prolonged hospitalization, and increased mortality risk (5,6). At the same time, cardiovascular patients are often dependent on antithrombotic therapy to prevent ischemic events, creating a difficult clinical balance between thrombosis prevention and bleeding avoidance.

In low- and middle-income healthcare settings, including Pakistan, the burden of cardiovascular disease is substantial, while routine risk stratification for associated hematological abnormalities may be inconsistently performed. Hypertension, ischemic heart disease, heart failure, and other cardiovascular conditions are commonly encountered in adult tertiary-care populations, and these conditions may coexist with anemia, leukocyte abnormalities, inflammatory markers, and platelet-count disturbances. However, local evidence describing the frequency and clinical profile of thrombocytopenia among adult cardiac patients remains limited. Existing literature has largely focused on specific cardiac subgroups, such as patients undergoing cardiac surgery, those with acute coronary syndromes, or critically ill patients, while fewer studies have examined broader hospitalized cardiac populations in routine tertiary-care practice (7,8).

This gap is important because early recognition of thrombocytopenia may influence clinical decisions regarding anticoagulation, antiplatelet therapy, transfusion thresholds, laboratory monitoring, bleeding-risk assessment, and overall patient management. Without clear local data on the distribution of thrombocytopenia and its associated demographic, cardiovascular, and hematological characteristics, clinicians may underestimate platelet abnormalities in cardiac patients or fail to identify patients requiring closer monitoring. A focused evaluation of thrombocytopenia in this population may therefore support safer treatment planning and improve awareness of hematological risk in cardiovascular care.

Therefore, this study was conducted to evaluate thrombocytopenia among adult cardiac patients admitted to a tertiary-care hospital and to identify associated demographic patterns, cardiovascular conditions, and hematological parameters linked with reduced platelet count. The study specifically aimed to determine the frequency of thrombocytopenia in this population and assess whether patient characteristics and clinical profiles suggest potentially important risk factors requiring further investigation.

## **MATERIALS AND METHODS**

A cross-sectional observational study was conducted over a period of four months at a tertiary-care hospital to evaluate thrombocytopenia and associated clinical and hematological factors among adult cardiac patients. The study population consisted of 152 patients aged 40–75 years who were admitted with confirmed cardiovascular disease during the study period. Participants were selected using a random sampling technique from eligible cardiac admissions to minimize selection bias and improve representativeness of the hospital-based cardiac population.

Patients were eligible for inclusion if they were between 40 and 75 years of age, had a documented diagnosis of cardiovascular disease, and had complete hematological laboratory records available, including platelet count. Patients with incomplete demographic or laboratory data, missing platelet-count results, or insufficient clinical documentation for assessment of cardiovascular diagnosis and hematological profile were excluded from analysis (9). Cardiovascular disease status was determined from the clinical diagnosis recorded in the hospital medical record, while hematological abnormalities were assessed using laboratory reports generated during admission.

Data were collected from patient medical records and laboratory reports using a structured data extraction approach. Demographic variables included age and sex. Clinical variables included the documented cardiovascular diagnosis and relevant comorbid conditions recorded in the patient file. Hematological variables included hemoglobin concentration, red blood cell count, white blood cell count, platelet count, mean corpuscular volume, mean corpuscular hemoglobin, mean corpuscular hemoglobin concentration, and erythrocyte sedimentation rate where available. Thrombocytopenia was operationally defined as a platelet count below the lower normal reference threshold, while other hematological abnormalities, including anemia, leukocytosis, leukopenia, polycythemia, and thrombocytosis, were classified according to the laboratory reference ranges used by the hospital diagnostic laboratory.

The primary outcome variable was the presence of thrombocytopenia among cardiac patients. Secondary variables included age group, sex distribution, cardiovascular diagnosis, and associated hematological abnormalities. Age was categorized into four groups: 40–49 years, 50–59 years, 60–69 years, and 70–75 years.

Platelet count was assessed as both a categorical variable, based on thrombocytopenia status, and a hematological parameter interpreted alongside other blood indices. The relationship between thrombocytopenia and demographic, cardiovascular, and hematological characteristics was evaluated to identify clinically relevant patterns among admitted cardiac patients.

To reduce information bias, data were extracted from standardized hospital records and laboratory reports rather than patient recall. Laboratory parameters were recorded from documented reports generated through routine hospital diagnostic procedures. Data entries were reviewed for completeness and internal consistency before analysis. Patients with missing key variables were excluded to maintain the reliability of the final dataset. Potential confounding by age and sex was addressed by stratifying results according to demographic categories and comparing clinical and hematological distributions across relevant patient groups.

The sample size comprised all eligible patients fulfilling the study criteria during the four-month data-collection period, resulting in a final sample of 152 cardiac patients. Data were entered, cleaned, coded, and analyzed using statistical software. Descriptive statistics were used to summarize demographic, clinical, and hematological characteristics.

Categorical variables were presented as frequencies and percentages, while continuous hematological variables were summarized using appropriate measures of central tendency and dispersion. Associations between thrombocytopenia and categorical variables were assessed using the chi-square test or Fisher's exact test where expected cell counts were small. For continuous variables, independent-sample t-tests or non-parametric alternatives were applied according to data distribution. A p-value of less than 0.05 was considered statistically significant.

Data integrity was maintained through systematic coding, duplicate checking, correction of inconsistent entries, and review of extreme laboratory values against source records. Patient confidentiality was preserved by anonymizing all extracted data before analysis, and no personally identifiable information was included in the dataset used for statistical evaluation. The study was conducted in accordance with ethical principles for human-subject research, with institutional permission obtained before data collection and all patient information handled confidentially throughout the research process.

## RESULTS

A total of 152 cardiac patients aged 40–75 years were included in the analysis. The largest proportion of patients belonged to the 40–49-year age group, followed by the 60–69-year, 50–59-year, and 70–75-year age groups. When recalculated against the total sample of 152 patients, the 40–49-year group represented 30.3% of the study population, while patients aged 70–75 years accounted for 17.1%. Male

patients were more frequent than female patients, with 89 males and 63 females, corresponding to 58.6% and 41.4%, respectively.

**Table 1. Demographic Distribution of Cardiac Patients**

Variable	Category	Frequency (n)	Percentage (%)
Age group	40–49 years	46	30.3
	50–59 years	38	25.0
	60–69 years	42	27.6
	70–75 years	26	17.1
	Total	152	100.0
Gender	Male	89	58.6
	Female	63	41.4
	Total	152	100.0

The hematological diagnostic profile showed that anemia was the most frequently observed abnormality among cardiac patients, affecting 68 patients, which represented 44.7% of the sample. Leukocytosis was observed in 31 patients, corresponding to 20.4%, while thrombocytopenia was identified in 29 patients, giving a thrombocytopenia frequency of 19.1%. Leukopenia was present in 15 patients, and 14 patients had hematological values within the normal range. Polycythemia and thrombocytosis were less frequent, affecting 8 and 6 patients, respectively. Because these hematological categories may coexist within the same patient, the cumulative frequency exceeds the total sample size.

**Table 2. Distribution of Hematological Abnormalities Among Cardiac Patients**

Hematological Finding	Frequency (n)	Percentage of Total Sample (%)
Anemia / low hemoglobin	68	44.7
Leukocytosis / high WBC count	31	20.4
Thrombocytopenia / low platelet count	29	19.1
Leukopenia / low WBC count	15	9.9
Normal / within reference range	14	9.2
Polycythemia / high RBC or hemoglobin	8	5.3
Thrombocytosis / high platelet count	6	3.9

Among the reported hematological abnormalities, anemia had the highest burden, occurring in nearly half of the cardiac patients. Thrombocytopenia was the third most frequent hematological abnormality, affecting approximately one in five patients. The combined presence of anemia, leukocyte abnormalities, and platelet-count disturbances suggests that hematological alterations were common in this cardiac population and were not limited to platelet reduction alone.

**Table 3. Hematological Parameter Profile in Cardiac Patients**

Parameter	Low / Abnormal Range Reported	Normal / Reference Range Reported
Hemoglobin	8–11 g/dL	12–16 g/dL
RBC count	2.5–3.5 million/ $\mu$ L	4.0–6.0 million/ $\mu$ L
Platelet count	$<1.5 \times 10^5/\mu$ L	$>1.5\text{--}4.5 \times 10^5/\mu$ L
WBC count	3,000–5,000 cells/ $\mu$ L	6,000–10,000 cells/ $\mu$ L
MCV	$<80$ fL	80–100 fL
MCH	$<26$ pg	27–32 pg
MCHC	$<30$ g/dL	31–36 g/dL
ESR	$>20$ mm/hr	12–16 mm/hr

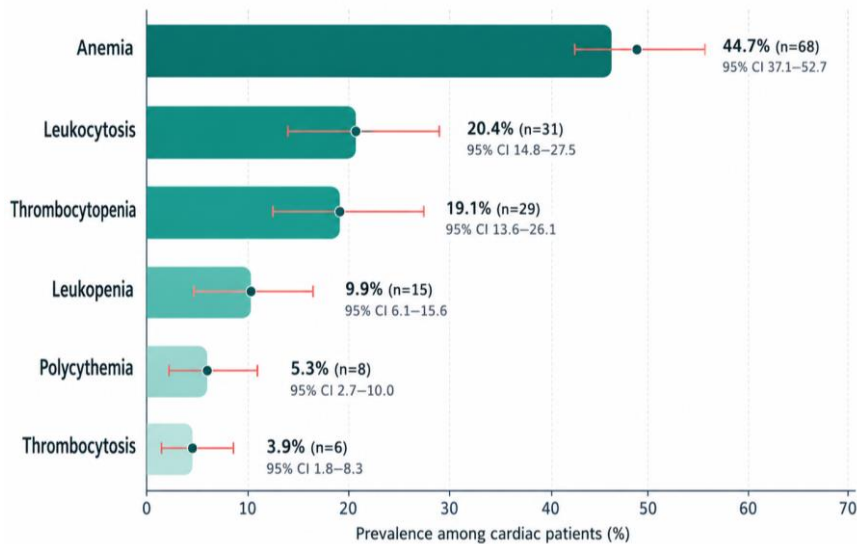
The hematological profile demonstrated reduced hemoglobin, RBC count, platelet count, WBC count, MCV, MCH, and MCHC among affected patients, while ESR was elevated. Hemoglobin values ranged from 8–11 g/dL in the low group compared with a reported reference range of 12–16 g/dL. Platelet values below  $1.5 \times 10^5/\mu$ L were classified as thrombocytopenic, while normal platelet values were reported above  $1.5\text{--}4.5 \times 10^5/\mu$ L. ESR values above 20 mm/hr indicated an inflammatory component among affected cardiac patients.

**Table 4. Relative Burden of Major Hematological Findings**

Rank	Hematological Finding	Frequency (n)	Percentage (%)
1	Anemia / low hemoglobin	68	44.7
2	Leukocytosis / high WBC count	31	20.4
3	Thrombocytopenia / low platelet count	29	19.1
4	Leukopenia / low WBC count	15	9.9
5	Normal / within reference range	14	9.2

6	Polycythemia / high RBC or hemoglobin	8	5.3
7	Thrombocytosis / high platelet count	6	3.9

Overall, the results indicate that hematological abnormalities were common among cardiac patients admitted to the tertiary-care hospital. Anemia represented the dominant abnormality, while thrombocytopenia was present in 19.1% of patients. The demographic distribution showed a male predominance and a higher concentration of cases in the 40–49-year age group. The hematological findings collectively suggest that platelet-count reduction occurred alongside broader blood-profile disturbances, particularly low hemoglobin, altered leukocyte counts, and elevated ESR.



**Figure 1: Burden of Major Hematological Abnormalities Among Cardiac Patients**

Figure Description: The figure presents the prevalence of major hematological abnormalities among 152 cardiac patients, with 95% confidence intervals for each abnormality. Anemia was the most frequent finding, affecting 44.7% of patients (n=68; 95% CI: 37.1–52.7), followed by leukocytosis in 20.4% (n=31; 95% CI: 14.8–27.5) and thrombocytopenia in 19.1% (n=29; 95% CI: 13.6–26.1). Less frequent abnormalities included leukopenia in 9.9% (n=15), polycythemia in 5.3% (n=8), and thrombocytosis in 3.9% (n=6). The distribution indicates that anemia represented the dominant hematological burden in this cardiac cohort, while thrombocytopenia affected approximately one-fifth of patients, supporting the clinical importance of routine platelet and complete blood count monitoring in cardiac admissions. Percentages are based on the full study cohort, and categories may overlap across patients.

## DISCUSSION

The present study demonstrates that hematological abnormalities were common among adult cardiac patients admitted to a tertiary-care hospital, with anemia representing the most frequent abnormality and thrombocytopenia affecting 19.1% of the study population. This finding is clinically important because platelet-count reduction in cardiac patients can influence therapeutic decisions, particularly when antiplatelet agents, anticoagulants, or invasive cardiovascular interventions are required. Although anemia showed the highest burden at 44.7%, the presence of thrombocytopenia in nearly one-fifth of patients suggests that platelet monitoring should remain an integral component of routine hematological assessment in cardiac admissions. The coexistence of anemia, leukocyte abnormalities, and platelet-count disturbances also indicates that hematological changes in cardiac patients may reflect broader systemic illness, inflammatory activity, medication exposure, or comorbid disease burden rather than an isolated platelet disorder.

The observed frequency of thrombocytopenia is consistent with the clinical understanding that cardiac patients are vulnerable to platelet-count alterations through multiple mechanisms. Cardiovascular disease is commonly associated with endothelial dysfunction, systemic inflammation, platelet activation,

and thrombo-inflammatory pathways, all of which may contribute to altered platelet consumption or survival. In hospitalized cardiac patients, additional factors such as heparin exposure, antiplatelet therapy, anticoagulant use, renal dysfunction, hepatic impairment, infection, and bone marrow suppression may further increase the likelihood of thrombocytopenia (10,11). This is especially relevant in patients with ischemic heart disease, heart failure, acute coronary syndromes, and cardiogenic shock, where antithrombotic therapy is frequently required but may become more complex when platelet counts are reduced (12).

The age distribution showed that the highest proportion of patients belonged to the 40–49-year age group, followed by patients aged 60–69 years and 50–59 years. This pattern may reflect the increasing burden of cardiovascular risk factors in relatively younger and middle-aged adults in the local population, including hypertension, unhealthy dietary habits, sedentary lifestyle, psychological stress, tobacco exposure, and metabolic risk. However, because the analysis was based on frequency distribution rather than age-stratified risk estimation, the higher number of patients in the 40–49-year group should be interpreted as a description of the study cohort rather than proof that this age group has the greatest biological risk of thrombocytopenia (13,14). Future analytical work comparing thrombocytopenia prevalence across age categories with adjustment for comorbidities and medication exposure would provide stronger evidence regarding age-related risk.

Male patients represented 58.6% of the study population, indicating a modest male predominance among cardiac admissions. This distribution is consistent with the broader pattern of higher cardiovascular disease burden among men in many clinical settings. Male predominance may be influenced by behavioral, metabolic, occupational, and healthcare-access factors, including higher prevalence of smoking, delayed health-seeking behavior, dietary risk, hypertension, and ischemic heart disease in some populations. In the context of thrombocytopenia, sex-based interpretation requires caution because the present data describe overall cardiac admissions rather than thrombocytopenia-specific risk by sex. A more informative analysis would compare the proportion of thrombocytopenia among male and female patients and estimate whether sex remains independently associated with low platelet count after accounting for age, diagnosis, comorbidities, and treatment exposure (15,16).

Anemia was the most common hematological abnormality, affecting nearly half of the patients. This finding has practical importance because anemia in cardiac patients can worsen myocardial oxygen delivery, aggravate ischemic symptoms, reduce exercise tolerance, and contribute to poor functional status. The coexistence of anemia and thrombocytopenia may also indicate chronic inflammation, nutritional deficiency, renal disease, occult blood loss, bone marrow suppression, or drug-related hematological effects. In cardiovascular care, the combined burden of low hemoglobin and low platelet count may complicate decisions regarding anticoagulation, antiplatelet therapy, transfusion, and invasive procedures (17). Therefore, cardiac patients with multiple hematological abnormalities may require closer clinical monitoring than those with isolated laboratory changes.

Leukocytosis was the second most common abnormality, observed in 20.4% of patients, while leukopenia was identified in 9.9%. These findings suggest that inflammatory and immune-related processes may have contributed to the hematological profile of the cohort. Leukocytosis in cardiac patients may reflect acute inflammation, infection, stress response, myocardial injury, or systemic vascular inflammation. Conversely, leukopenia may occur in association with viral illness, marrow suppression, medication effects, or chronic systemic disease (18). The simultaneous presence of leukocyte abnormalities and thrombocytopenia supports the possibility that platelet reduction may not be purely medication-related in all patients, but may also reflect systemic inflammatory or marrow-related pathways. Elevated ESR values in the hematological profile further support the presence of inflammatory activity among affected patients.

Thrombocytopenia has particular relevance in cardiovascular medicine because many cardiac patients require drugs that affect platelet function or coagulation. A reduced platelet count may increase

bleeding tendency, especially when combined with aspirin, clopidogrel, anticoagulants, thrombolytics, heparin, or glycoprotein IIb/IIIa inhibitors. At the same time, withholding antithrombotic therapy in high-risk cardiac patients may increase thrombotic risk. This creates a clinically challenging balance between preventing ischemic events and avoiding bleeding complications. Previous literature has reported that thrombocytopenia in acute coronary syndromes and cardiogenic shock may be associated with worse outcomes, but the degree of risk depends on severity of thrombocytopenia, underlying diagnosis, medication exposure, and comorbid illness (19).

The lower frequency of polycythemia and thrombocytosis indicates that reduced or deficient hematological states were more prominent than elevated cell-count states in this cohort. Polycythemia was reported in 5.3% of patients, while thrombocytosis was present in 3.9%. Although less common, these abnormalities remain clinically relevant in cardiac patients because increased red cell mass or elevated platelet count may contribute to blood viscosity, thrombosis risk, and vascular complications. Their relatively low frequency compared with anemia and thrombocytopenia suggests that the dominant hematological concern in this population was cytopenia rather than excessive cell production.

The findings of this study reinforce the need for complete blood count assessment as part of routine cardiac evaluation. Platelet count should not be interpreted in isolation; rather, it should be assessed alongside hemoglobin, red cell indices, leukocyte count, inflammatory markers, clinical diagnosis, medication history, and comorbid conditions. A cardiac patient with thrombocytopenia and anemia may require different monitoring and treatment decisions than a patient with isolated mild thrombocytopenia. Similarly, thrombocytopenia accompanied by leukocytosis and elevated ESR may suggest an inflammatory or infective contribution, while thrombocytopenia occurring after anticoagulant exposure may raise concern for drug-induced mechanisms, including heparin-associated platelet decline.

This study has several limitations that should be considered when interpreting the findings. The hospital-based, single-center design limits generalizability to other populations and healthcare settings. The available results are primarily descriptive, so causal relationships and independent predictors of thrombocytopenia cannot be established. Medication exposure, severity of cardiovascular disease, renal and hepatic function, bleeding outcomes, transfusion requirement, length of hospital stay, and mortality were not analyzed as comparative outcome variables. In addition, hematological categories may overlap across patients, meaning that the reported frequencies describe the burden of abnormalities rather than mutually exclusive diagnostic groups. Despite these limitations, the study provides useful local evidence that thrombocytopenia and other hematological abnormalities are frequent among cardiac patients and deserve routine clinical attention.

Overall, the study highlights that thrombocytopenia is a meaningful hematological abnormality in cardiac patients, occurring alongside a broader pattern of anemia, leukocyte disturbance, and inflammatory activity. The results support routine monitoring of platelet counts and complete blood profiles in cardiac admissions, especially in patients receiving antiplatelet or anticoagulant therapy. Integrating hematological assessment into cardiovascular management may help clinicians identify patients at increased risk of bleeding, treatment complications, or systemic illness and may contribute to safer individualized care.

## CONCLUSION

This study concludes that hematological abnormalities are frequent among adult cardiac patients admitted to a tertiary-care hospital, with anemia being the most common finding and thrombocytopenia present in approximately one-fifth of the study population. The occurrence of thrombocytopenia in 19.1% of patients highlights its clinical relevance in cardiovascular care, particularly because reduced platelet count may complicate decisions regarding antiplatelet therapy, anticoagulation, bleeding-risk assessment, and invasive cardiac management. The coexistence of thrombocytopenia with other blood-

profile disturbances, including low hemoglobin, altered leukocyte counts, and elevated inflammatory markers, suggests that platelet reduction in cardiac patients should be interpreted as part of a broader hematological and clinical profile rather than as an isolated laboratory abnormality. Routine complete blood count evaluation, early identification of platelet-count abnormalities, and careful monitoring of patients receiving antithrombotic therapy may support safer treatment planning and improve clinical management in tertiary-care cardiac settings.

## REFERENCES

1. Rodgers GM. Thrombocytopenia, pathophysiology and classification. In: Wintrobe's Clinical Hematology. 2009. p. 1289–1291.
2. Means RT Jr, et al. Wintrobe's Clinical Hematology. Philadelphia: Lippincott Williams & Wilkins; 2023.
3. Posch F, Gebhart J, Rand JH, Koder S, Quehenberger P, Perkmann T, et al. Cardiovascular risk factors are major determinants of thrombotic risk in patients with the lupus anticoagulant. *BMC Med.* 2017;15(1):54.
4. Mensah GA, Fuster V, Murray CJL, Roth GA; Global Burden of Cardiovascular Diseases and Risks Collaborators. Global burden of cardiovascular diseases and risks, 1990–2022. *J Am Coll Cardiol.* 2023;82(25):2350–2473.
5. Anees Ur Rehman M, et al. Prevalence and role of risk factors for hypertension in 18–70 years of age in rural and urban areas of District Sahiwal, Punjab Pakistan. *Pak J Health Sci.* 2022;3(04):175–178. doi:10.54393/pjhs.v3i04.114.
6. Lee HH, Hong SJ. Clinical implications of thrombocytopenia at cardiogenic shock presentation: data from a multicenter registry. *Yonsei Med J.* 2020;61(10):851–859. doi:10.3349/ymj.2020.61.10.851.
7. Rasheed H, et al. Role of dietary patterns in the progression and management of heart failure in Pakistani patients: a multicenter study. *Cureus.* 2024;16(9).
8. Aslam MR, Muhammad Asif H, Ahmad K, Jabbar S, Hayee A, Sagheer R, et al. Global impact and contributing factors in varicose vein disease development. *SAGE Open Med.* 2022;10:20503121221118992.
9. Matthai WH Jr. Thrombocytopenia in cardiovascular patients: diagnosis and management. *Chest.* 2005;127(2 Suppl):46S–52S. doi:10.1378/chest.127.2\_suppl.46S.
10. Yan S, Zhao Y, Zhang Y, Wang X, Zhou Y, Wang Y, et al. Risk factors of thrombocytopenia after cardiac surgery with cardiopulmonary bypass. *Braz J Cardiovasc Surg.* 2023;38(3):389–397. doi:10.21470/1678-9741-2021-0356.
11. Saluk J, Bijak M, Wachowicz B. The formation, metabolism and the evolution of blood platelets. *Postepy Hig Med Dosw.* 2014.
12. Matthai WH Jr. Thrombocytopenia in cardiovascular patients: diagnosis and management. *Chest.* 2005;127(2):46S–52S.
13. Gresele P, Marcucci R, Migliacci R, et al. Low platelet count at admission has an adverse impact on outcome in patients with acute coronary syndromes: from the START Antiplatelet Registry. *Sci Rep.* 2024;14(1):14516. doi:10.1038/s41598-024-64113-5.
14. Wang J, et al. Impact of heart failure and preoperative platelet count on the postoperative short-term outcome in infective endocarditis patients. *Clin Cardiol.* 2024;47(1):e24171. doi:10.1002/clc.24171.

15. Alnardod ZA, Sam KG. Prevalence, risk factors, characteristics, and clinical outcomes of thrombocytopenia in the intensive care unit: a prospective single-center cohort study. *Crit Care Res Pract.* 2026;2026:4492230. doi:10.1155/ccrp/4492230.
16. Cheng JJ, Liufu R. Risk factors of sepsis-associated thrombocytopenia among patients with sepsis-induced coagulopathy. *Clin Appl Thromb Hemost.* 2024;30:10760296241283166. doi:10.1177/10760296241283166.
17. Discepola V, Kheiri B, Naderi S, et al. Clinical importance of thrombocytopenia in patients with acute coronary syndromes: a systematic review and meta-analysis. *Platelets.* 2019;30(7):817–827. doi:10.1080/09537104.2018.1528348.
18. Martínez-Quintana E, Rodríguez-González F. Thrombocytopenia in congenital heart disease patients. *Platelets.* 2015;26(5):432–436. doi:10.3109/09537104.2014.925104.
19. Rubinfeld GD, Smilowitz NR, Berger JS, et al. Association of thrombocytopenia, revascularization, and in-hospital outcomes in patients with acute myocardial infarction. *Am J Med.* 2019;132(8):942–948.e5.