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Original Research Article

Profile of Thrombocytopenia in ICU Patients at a Tertiary Care Hospital in Eastern India

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Conflict of interest: Nil

Abstract:

Introduction: When severely ill patients are admitted to intensive care units (ICUs), thrombocytopenia—defined as a platelet count below 150,000/µL—occurs frequently. Depending on underlying conditions, drugs, and treatments, its frequency among ICU patients varies greatly, ranging from 8.3% to 67.6%.

Aims: To study prevalence, likely aetiologies, pattern among different categories of patients and impact of thrombocytopenia on the 7 days mortality among the critically ill patients in an intensive care unit of a tertiary care hospital in Eastern India.

Materials & Methods: This study is a prospective observational study conducted in a single-center setup at Command Hospital (Eastern Command), Kolkata. The study period extends from 1st October 2022 to 31st March 2024, and a total of 150 consecutive patients admitted to the ICU will be included.

Result: In our study, majority of the patients were male (64.7%) and most of the patients were from age group 61-80 years (46.7%). 79 patients (52.7%) were admitted with pre-existent thrombocytopenia and 43 patients (28.7%) had developed thrombocytopenia during their hospital stay. The platelet trajectory was found to be biphasic with initial thrombocytopenia having nadir at 4-5 days of admission. Thrombocytopenia was found to be associated with baseline liver and kidney dysfunction and along with development of sepsis and overt disseminated intravascular coagulation. Presence of thrombocytopenia was found to be significantly associated with mortality (33.6% vs 3.6%, among those with and without thrombocytopenia respectively). Thrombocytopenia was also found to be associated with requirement of vasopressors support, invasive ventilator support and requirement of dialysis (50.8%, 43.4% and 27.0% respectively in thrombocytopenia group versus 21.4%, 35.7% and 7.1% respectively in non-thrombocytopenia group).

Conclusion: We concluded that thrombocytopenia is encountered frequently among critically ill patients of ICU. It is associated with sepsis and disseminated intravascular coagulation along with requirement of life-supports. It is also associated with higher 07-day mortality among critically ill patients.

Keywords: Thrombocytopenia, ICU, Sepsis, Platelet count, Platelet trajectory, Mortality.

Introduction

Critically sick patients admitted to intensive care units (ICUs) frequently have thrombocytopenia, a hematological disorder characterized by a platelet count below 1,50,000/µL. Depending on underlying conditions, drugs, and therapies, its prevalence at the time of ICU admission can range from 8.3% to 67.6% whereas, the incidence of new-onset thrombocytopenia developing during ICU admission ranges from 14% to 44% [1,2].Along with hematological conditions like megaloblastic anemia and leukemia, infections like dengue, malaria, and enteric fever—especially in areas like Eastern India—are common causes of thrombocytopenia [3].Moreover, thrombocytopenia in critically ill patients is significantly influenced by sepsis and disseminated intravascular

coagulation (DIC) [4]. In intensive care units, thrombocytopenia can present clinically as bleeding tendencies that range from minor ecchymoses and petechiae to major, potentially fatal hemorrhages.

Since severe thrombocytopenia is linked to longer intensive care unit stays, greater rates of morbidity, and higher death rates, early detection and prompt treatment are crucial. Thrombocytopenia in critically unwell individuals has a complex etiology.It is often multifactorial and could be caused by hemodilution, increased platelet consumption or destruction, platelet sequestration in the spleen, or decreased platelet synthesis in the bone marrow [5].

One of the most frequent causes of thrombocytopenia in intensive care unit patients is sepsis. Immune-mediated platelet destruction, platelet consumption in microthrombi, and bone marrow suppression brought on by inflammatory cytokines are some of the mechanisms behind sepsis-associated thrombocytopenia[6]. Other known causes include drug-induced thrombocytopenia, especially when using chemotherapeutic drugs, heparin, and antibiotics often in intensive care units [7,8] Beyond its direct clinical consequences, thrombocytopenia serves as a surrogate marker of disease severity and systemic inflammation among ICU patients [9].

Several studies have also shown that, both the duration and severity of thrombocytopenia, correlate independently with adverse outcomes among critically ill patients [10]. Thrombocytopenia's prevalence and effects have been extensively studied worldwide, yet there is still a dearth of information from Eastern India. In contrast to Western cohorts, where drug-induced and hematological causes are more common, regional studies indicate that infectious etiologies continue to be more common in this population [11]. Knowing the pattern, causes, and consequences of thrombocytopenia is essential for ICU management methods because of the high infection burden and scarce healthcare resources in several eastern Indian locations. This study aimsto study prevalence, likely aetiologies, pattern among different categories of patients and impact of thrombocytopenia on the 7 days mortality among the critically ill patients in an intensive care unit of a tertiary care hospital in Eastern India.

Materials and Methods

Type of study: Prospective observational study, in a single centre setup.

Place of study: Command Hospital (Eastern Command), (CHEC) Kolkata.

Study duration: 1st October 2022 and 31st March 2024.

Sample Size: 150 consecutive ICU patients

Inclusion Criteria

- All patients who were admitted in ICU complex of CHEC during the study period.
- All hospitalized patients who were readmitted in/ transferred to ICU complex of CHEC during the study period.

Exclusion Criteria

- Age <12 years
- Patients with a known history of chronic thrombocytopenia prior to ICU admission
- Patients with hematological malignancies such as leukemia or lymphoma causing baseline thrombocytopenia.

Study Variables

- Age
- Gender
- Residence
- Comorbidities
- Platelet count on ICU admission
- Everyday single platelet counts for the first 7 days of ICU admission or till death
- Baseline data on serum hemoglobin, total leukocyte count, serum electrolytes (sodium and potassium), liver function test (serum bilirubin, serum albumin and globulin, alkaline phosphatase, alanine aminotransferase, and aspartate aminotransferase), blood urea, and serum creatinine
- Everyday coagulation profile values (serum prothrombin time (PT), international normalised ratio (INR), activated partial thromboplastin time (aPTT),d-dimer, serum fibrinogen, and fibrin degradation product) for first 7 days of ICU admission or till death

Anemia was considered when serum hemoglobin level was <10 g/dL, irrespective of age and gender. Total leucocyte count > 12000/µL was taken as leucocytosis and a count < 3500/µL was taken as leucopenia. Normal platelet count was taken as 1,50,000 to 4,00,000 per µL. Thrombocytopenia was taken as platelet count < 1,50,000/µL; where as it was further graded to mild, moderate and severe thrombocytopenia when the platelet count was between 1,00,000 to < 1,50,000 per µL, between 50,000 to <1,00,000 per µL and < 50,000/µL respectively. Blood urea level > 50 mg/dL and serum creatinine value > 1.5 mg/dL was considered as renal dysfunction. Serum bilirubin > 2 mg/dL and/or serum transaminases levels >200 u/L have been taken as liver dysfunction. Sepsis was defined as the presence of infection with organ dysfunction on the basis of qSOFA (quick Sepsis related Organ Failure Assessment Score) ≥ 2 – altered mental status (Glasgow coma score <15), respiratory rate >22/min and systolic blood pressure (SBP) < 100

mmHg [12]. Disseminated intravascular coagulation (DIC) was defined as elevated d-dimer level with at-least two of the following: prolonged prothrombin time (PT> 16 sec and/ or INR > 1.5), decreased fibrinogen (<100 mg/dL) and thrombocytopenia (< 1,50,000/µL). Overt and non-overt DIC were further calculated using ISTH scoring system [13].

Statistical Analysis

Data were entered into Excel and analyzed using SPSS and GraphPad Prism. Numerical variables were summarized using means and standard deviations, while categorical variables were described with counts and percentages. Two-sample t-tests were used to compare independent groups, while paired t-tests accounted for correlations in paired data. Chi-square tests (including Fisher's exact test for small sample sizes) were used for categorical data comparisons. P-values ≤ 0.05 were considered statistically significant.

Result

In our study, most patients were aged 61–80 years (70 patients, 46.7%), followed by 41–60 years (43 patients, 28.7%) and 21–40 years (29 patients, 19.3%); and male patients were predominant (97 patients, 64.7%) compared to female patients (53) patients, 35.3%).

Table 1: Distribution of study population as per age

	Frequency	Percent	p- value
<20 years	3	2	< .00001
21-40 years	29	19.3	
41-60 years	43	28.7	
61-80 years	70	46.7	
>80 years	5	3.3	
Total	150	100	

Table 2: Distribution of study population as per gender

	No of patients	Percentage of patients	p- value
Male	97	64.7	< .00001
Female	53	35.3	
Total	150	100	

In our study, 68 patients (45.3%) were hypertensive and 58 patients (38.7%) were diabetic, while 34 patients (22.7%) had chronic kidney disease (CKD), 26 patients (17.3%) had coronary artery disease (CAD), 19 patients (12.7%) had chronic obstructive pulmonary disease (COPD), and 16 patients (10.7%) had chronic liver disease (CLD).

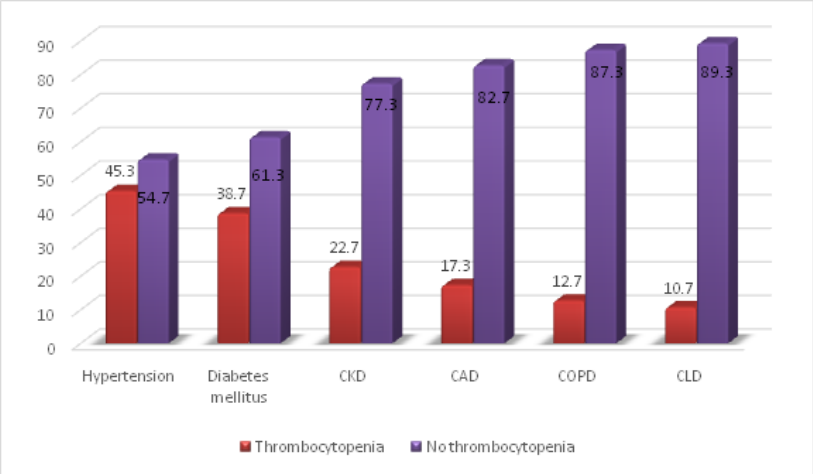

Figure 1: Association of thrombocytopenia with co-morbid conditions (in percentage)

In our cohort, 122 patients (81.3%) had thrombocytopenia during the course of our study period. Among them 79 patients (52.7%) were admitted in ICU with thrombocytopenia and 43 patients (28.7%) subsequently developed thrombocytopenia during their ICU stay.

Among those already with thrombocytopenia, 36 patients (45.6%) had mild (platelet 1,00,000 to <1,50,000 per µL), 26 patients (32.9%) had moderate (50,000 to < 1,00,000 per µL) and 17 patients (21.5%) had severe (<50,000 per µL) thrombocytopenia.

Table 3: Thrombocytopenia during course of illness

	No of patients	Percentage of patients
Pre-existent thrombocytopenia	79	52.7
New-onset thrombocytopenia	43	28.7
No thrombocytopenia	28	18.6
Total	150	100

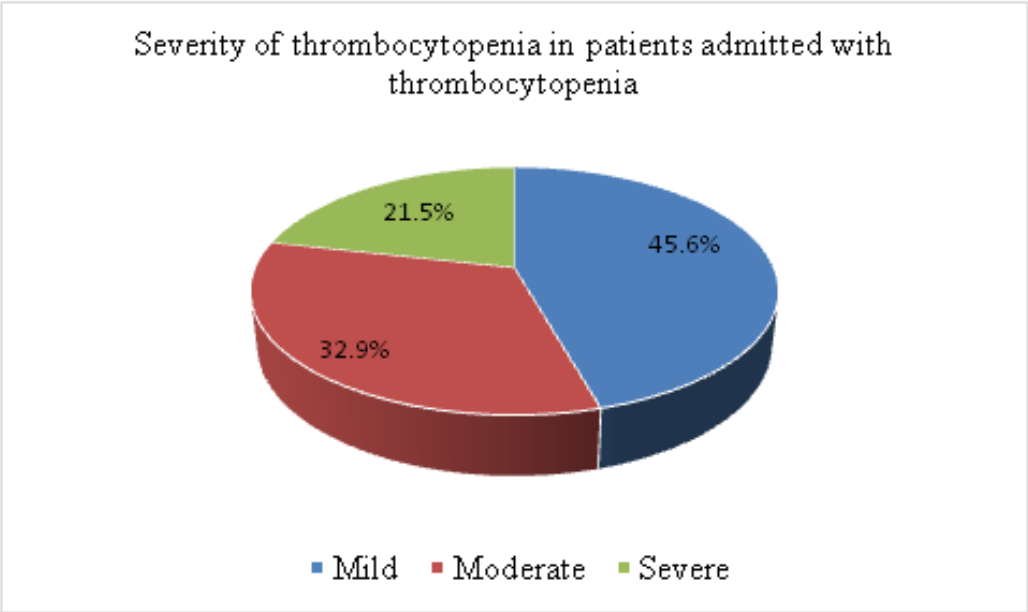

Figure 2: Severity of thrombocytopenia among those admitted with low platelet count

Using the third International Consensus Definitions for sepsis [14],we found out 64 patients (42.7%) in our study population had sepsis, and among them 55 patients (36.7%) had thrombocytopenia. In this population, 36 patients had been admitted with pre-existing thrombocytopenia (at admission platelet count <1,50,000/µL) and 19 patients had developed new-onset thrombocytopenia during their hospital stay.

23 patients (15.3%) in our study populationhad developed overt disseminated intravascular coagulation (DIC) in our study (as calculated by ISTH scoring), among whom 19patients had pre-existing thrombocytopenia, and 03 patients had developed new-onset thrombocytopenia. However, the association with thrombocytopenia with both sepsis and DIC could not be measured due to presence of confounding factors.

We also had 09 patients (06%) of dengue fever in our study group, out of whom 07 patients had been admitted in ICU with thrombocytopenia while 02 patients had developed thrombocytopenia during their hospital stay. We had 28 patients (18.7%) with chronic liver disease (CLD) and66 patients (44%) with chronic kidney disease (CKD) in our study population. In this subset, 26 patients (92.8% of those with CLD), and 60 patients (90.9% of those with CKD) were associated with thrombocytopenia respectively.

However, as both these diseases are associated with chronic baseline thrombocytopenia, the significance of their association with thrombocytopenia were disregarded.

Our study had 113 patients (75.3%) with anemia, 62 patients (41.3%) with leukocytosis and 28 patients (18.7%) with leukopenia. Within this cohort, 92 patients (81.4% of those with anemia), 50 patients (80.6% of those with leukocytosis), and all patients with leukopenia were associated with thrombocytopenia respectively. However, this result was associated with confounding factors of associated co-morbid conditions, development of sepsis and/ or DIC and usage of different antibiotics. Our study had 63 patients (42%) who required invasive ventilatory support, out of whom 53 patients (84.1%) had thrombocytopenia. Among the 87 patients (58%) not requiring invasive ventilation, 69 patients (79.3%) had thrombocytopenia. We also had 35 patients (23.3%) requiring dialysis support and 68 patients (45.3%) requiring vasopressors support during our study period.

We found 33 patients of those requiring dialysis (94.3%) and 62 patients of those requiring vasopressors support (91.2%) had associated thrombocytopenia. However, the significance was these associations were overlooked in view of presence of confounding variables.

Table 4: Association of thrombocytopenia with life-support requirements

	Thrombocytopenia present	No thrombocytopenia
Invasive ventilator requirement	53/122 (43.4%)	10/28 (35.7%)
Dialysis requirement	33/122 (27.0%)	02/28 (07.1%)
Inotrope requirement	62/122 (50.8%)	06/28 (21.4%)

While calculating 07-day mortality, it was found that, out of 42 patients who succumbedin our study population, 41 patients (97.6%) had thrombocytopenia, which was statistically significant.

Table 5: Outcome association with thrombocytopenia (p = 0.013)

			Thrombocytopenia			Total
			Pre-existing	New onset	No thrombocytopenia	
Outcome after 7 days	Death	Frequency	32	9	1	42
	Survival	Frequency	47	34	27	108
Total		Frequency	79	43	28	150

Among those who died, 38 patients (90.5%), 32 patients (76.2%), and 17 patients (40.5%) had required inotrope support, ventilator support, and dialysis support respectively.

However, due to presence of confounding variables, statistical association could not be measured. Among those who succumbed, 33 patients (78.6%) had sepsis and 15 patients (7.4%) had overt DIC. The significance could not be calculated as we could not eliminate various confounding factors.

While studying the platelet kinetics we found a biphasic course of platelet trajectory over seven days. There was gradual decline in platelet count after ICU admission till day 4-5 of admission, followed by gradual rise in platelet count.

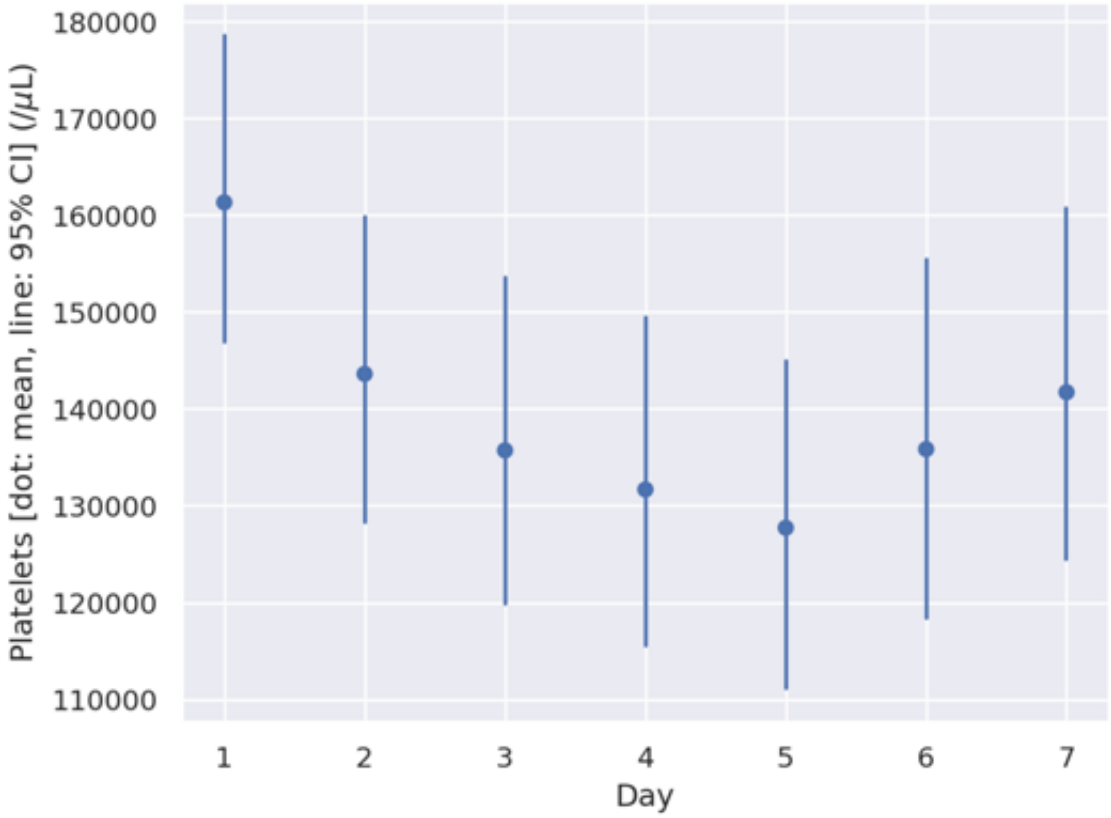

Figure 3: Biphasic course of platelet trajectory among ICU patients

We also found, that the patients who had sepsis and overt DIC, had lower platelet count compared to those without sepsis and/ or overt DIC. The trajectory clearly noted that those who had succumbed had lower platelet count compared to those who survived their ICU stay within the first seven days of admission.

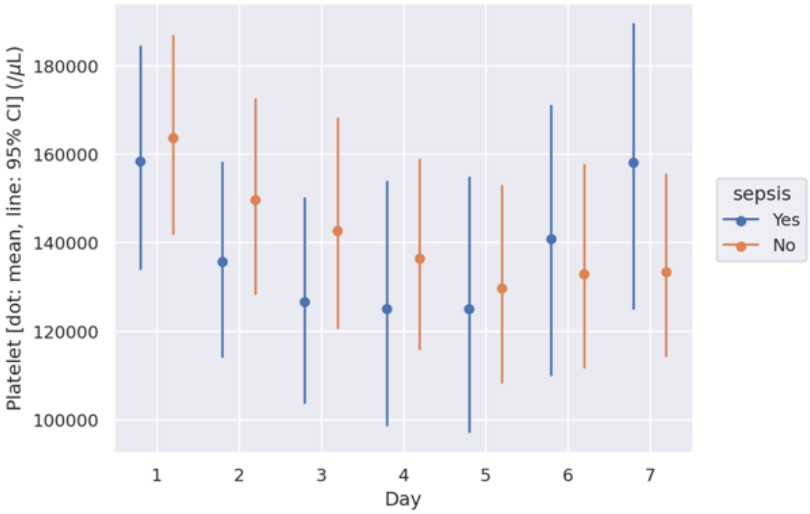

Figure 4: Platelet kinetics in those patients who had sepsis

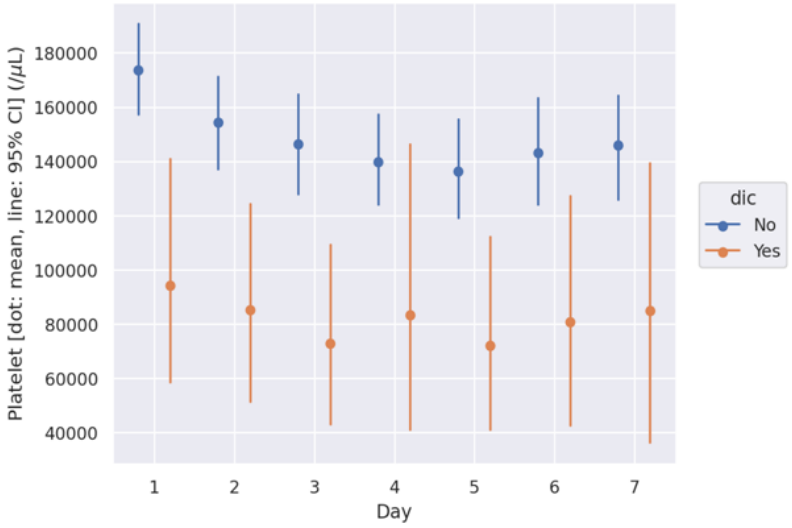

Figure 5: Platelet kinetics in those patients who had overt DIC

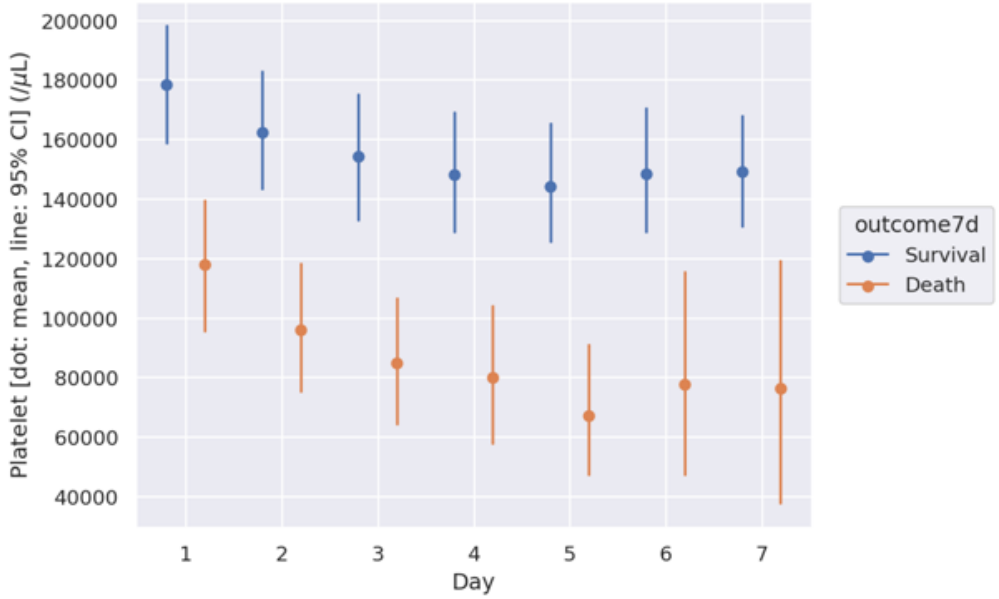

Figure 6: Platelet kinetics with mortality

Discussion

Thrombocytopenia, a frequent finding encountered in ICU patients, is regarded as a poor prognostic marker to patient-outcome. It is very commonly associated with multi-organ dysfunction, rendering the management complicated [15]. The patients admitted in ICU can manifest either with existing thrombocytopenia, or they can develop new-onset thrombocytopenia. This new-onset thrombocytopenia in an ICU setting often indicates disease progression or development of complications (sepsis, liver impairment, renal impairment, DIC, etc), which are evolving or worsening, making it clinically significant [1].

In our study, out of 150 patients,majority were 61-80 years old [70 (46.7%)] and most of the patients were male[97 (64.7%)] which was statistically significant ($p< 0.00001$). In a prospective cohort study done in 1166 patients in 52 ICUs across 10 countries by Anthon CT et al (2023)the median age was 63 years and 60.5% were males [16]. Another retrospective data analysis by Serife Bayraktar Y et al (2023) among 299 ICU patients found median age to be 68 years and 62.9% of study population were males [17].

In our study 52.7% patients had pre-existing thrombocytopenia and 28.7% patients had developed new-onset thrombocytopenia. The study performed by Hui P et al (2011)[2]found the incidence of thrombocytopenia developing during ICU admissions ranging from 14% to 44%, while the study by Williamson DR et al (2013) [1] showed prevalence of thrombocytopenia at the time of ICU admission ranging from 8.3% to 67.6%. The recently concluded, large prospective study by Anthon CT et al (2023) found the frequency of thrombocytopenia to be 43.2%, with 23.4% patients having baseline thrombocytopenia and 19.8% patients developing in-hospital thrombocytopenia [16].

In our population, 64 patients (42.7%) patients had sepsis and 23 patients (15.3%) had overt DIC. Out of them, 55 patients (85.9% of those with sepsis) and 22 patients (95.6% of those with overt DIC) had thrombocytopenia respectively. Across different studies, it has been shown that thrombocytopenia can be found in 37.5% to 83.5% of those with sepsis [18].

A recent study by Shitalben P et al (2025)showed presence of septic shock in 94.7% ICU patients who had thrombocytopenia [19]. Sivula M et al (2005)found in their prospective cohort study of 494 unselected medical and surgical ICU patients, that DIC was present in 19% ICU population [20]. Levi M et al (2009) reported that thrombocytopenia can be found in upto 98% of patients with DIC [21]. These were comparable with our population.

Our study also showed92.8% patients having chronic liver disease and 90.9% patients having chronic kidney disease were associated with thrombocytopenia. Thrombocytopenia is the commonest and the first hematological index abnormality in patients with chronic liver disease and can be found in 64% to 84% patients with cirrhosis [22]. Giannini EG (2006) reported 76% patients with chronic liver disease to have thrombocytopenia [23]. Thrombocytopenia also serves as an independent marker for renal dysfunction and a marker for disease severity. A cohort study by Guru PK et al (2016), found that among 541 patients with renal dysfunction, 350 patients (65%) had thrombocytopenia prior to initiation of continuous renal replacement therapy (CRRT), while 107 patients (20%) had developed it after initiation of CRRT [24].

Our study showed also showed, amongthose who had thrombocytopenia, 50.8% patients, 43.4% patients and 27.0% patients had required vasopressors support, invasive ventilator support and dialysis support respectively. In a 10-country inception cohort [PILOT-ICU study], ICU patients with thrombocytopenia required vasopressors in 73%, invasive ventilator support in 63.3% and renal replacement therapy in 25%, versus 45.8%, 44.6% and 5.3% respectively in patients without thrombocytopenia [16]. Our study also showed a mortality rate of 33.6% in patients with thrombocytopenia (41 patients among 122) and 3.6% in patients with out thrombocytopenia (01 patient among 28) (p value 0.03). Serife Bayraktar Y et al (2023)showed a mortality rate of 52.7% in patients with thrombocytopenia and 37.6% in those without (p value 0.011) [17]. In another retrospective cohort study, Ilkhan G et al (2021) showed 69.7% mortality among thrombocytopenic patients compared to 45.1% mortality among non-thrombocytopenic patients [6]. The platelet trajectory in our study showed a biphasic course with an initial decrease to a platelet nadir 4 to 5 days after ICU admission, followed by recovery to higher values likely due to reactive thrombocytosis. In a prospective, multicenter, observational cohort analysis, Akca S et al (2002)also showed a typical biphasic trajectory of platelet counts among critically ill patients [25].

Conclusion

Platelet count shows a biphasic course among critically ill patients with initial thrombocytopenia and later reactionary thrombocytosis. Thrombocytopenia is common among ICU patients and often reflects significant morbidity and disease complications. It is a marker of disease severity and is associated with sepsis and disseminated intravascular coagulation. It is also associated with requirement of vasopressor support, invasive

ventilator support, and requirement of dialysis; and is significantly associated with higher mortality.

Limitations

Despite showing association with low platelet count, presence of co-morbid conditions, associations of sepsis and DIC; organ dysfunctions and requirement of life-support mechanisms, individual strength association could not be done due to presence of confounding factors. The different causes for drug-induced and heparin-induced thrombocytopenia could not be evaluated due to lack of testing kits and methods. Our study also reflected hospital bias, representing a single centre. The study was exclusively done among serving armed forces personnels and their family members. So, the data may not accurately reflect the general population.

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