Research Article

Prevalence and Risk Factors of Thrombocytopenia in a Medical Intensive Care Unit in Egypt

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Abstract

Background: Thrombocytopenia is a very common complication in the intensive care unit and is considered an important prognostic factor. The important possible mechanisms for thrombocytopenia include disseminated intravascular coagulation, sepsis, massive hemorrhage, the use of heparin and antibiotics.

Aim of Study: This study aimed to determine the prevalence and risk factors of thrombocytopenia in the medical intensive care unit in Zagazig University hospitals in Egypt.

Patients and Methods: This observational, cross-sectional study was conducted on 140 patients (78 males and 62 females) in the medical intensive care unit. Present and past history was taken, and platelets count was estimated every day until discharge to detect thrombocytopenia.

Results: Thrombocytopenia was detected in 94 patients, with a prevalence of 67% (53 males and 41 females). Regarding age, 56% of cases were above the age of 60 years. The main risk factors for development of thrombocytopenia in this study were sepsis, antibiotics, heparin and mechanical ventilation as there was a significant difference between patients with and those without thrombocytopenia regarding these factors. On the other hand, there was no significant difference regarding duration of ICU stay, invasive catheters or coronary artery disease.

Conclusion: Thrombocytopenia is a common complication in ICU patients. The main risk factors are sepsis, antibiotics, heparin and mechanical ventilation.

Keywords: Thrombocytopenia; Intensive Care Unit; Prevalence; Risk Factors

Introduction

Thrombocytopenia is one of the most commonly observed laboratory abnormalities in the intensive care unit (ICU) with incidence ranging from 13% to 44% [1]. Thrombocytopenia is defined as a platelet count less than 150,000/ul [2].

Thrombocytopenia is an important parameter in patients admitted to the ICU. It has been associated with longer ICU stay and worse clinical course; thus, imposing a heavy burden on the patient and the healthcare system [3].

Although there are many known causes of thrombocytopenia, it cannot be clearly identified in more than half of critically ill patients. It develops in the context of infection, inflammation, and depletion of coagulation factors. The unknown etiology of thrombocytopenia

seen in the ICU has been termed as thrombocytopenia in critically ill patients. It is thought to be a poor prognostic indicator [4].

The possible mechanisms leading to thrombocytopenia in critically ill patients could involve the presence of disseminated intravascular coagulation (DIC), sepsis, massive hemorrhage and thrombocytopenia induced by heparin or other drugs [5].

The systemic inflammatory response syndrome (SIRS) and sepsis are among the leading causes of hospitalization and ICU mortality, as are the leading cause of thrombocytopenia in critically ill patients [6].

Patients and Methods

This study was conducted at the medical ICU and Clinical Pathology laboratories at Zagazig University hospitals during a four-month period. This observational, cross-sectional study was aiming to calculate the prevalence of ICU-acquired thrombocytopenia and its associated risk factors. The study was conducted on 140 patients divided into 78 males and 62 females.

Inclusion and exclusion criteria

Patients admitted to the medical ICU during a four-month period were included. Patients were excluded if they had a platelet count less than 150,000/ul on admission, history of platelet disorder, autoimmune disorder, hematological malignancy or splenectomy.

After informed consent was obtained, all the participants were subjected to the following:

Full history taking:

- Personal and family history
- Present and past history of diseases, surgery or drug intake.

Collection of venous blood samples for estimation of platelets count

- Venous blood samples were taken on Ethylene diamine tetra acetic acid (EDTA) vacutainer tube and were processed using Sysmex KX 21. N. cell counter. Also, fresh blood smears were prepared and stained with Leishman's stain to check and confirm platelets count.

- Platelet count was checked every day from ICU admission to ICU discharge.

Data processing and analysis

Statistical analyses were performed using SPSS software version 22.0 (IBM, Armonk, NY, USA), and MedCalc program for Windows. Measures of central tendency and dispersion were used to analyze the numerical variables. The categorical variables were analyzed using the chi-squared test ($\chi 2$ test).

A p-value <0.05 was used as a measure of statistical significance.

Ethical statement

Participation in this study was completely voluntary and a written consent was taken from all patients. The right of withdrawal at any time without giving a reason was preserved. No patients' names were recorded.

Results

We enrolled 140 patients (78 males and 62 females) admitted to the medical ICU of Zagazig University Hospitals during a four-month period.

The participants were selected through systematic random sampling. The age of the study participants ranged between 26 and 75 years, with a mean of 53.65 and standard deviation of 14.4 years.

The baseline characteristics of the sample population are summarized in (Table 1).

Parameter	No. (%) or mean
Age (years)	53.65 ± 14.4
Hypertension	32 (22.8%)
Chronic kidney disease	19 (13.6%)
Diabetes mellitus	17 (12.1%)
Cancer	15 (10.7%)
Cardiovascular disease	12 (8.5%)

Table 1: Baseline characteristics of all patients (No. = 140).

Hypertension was the commonest comorbidity, followed by chronic kidney disease, diabetes mellitus, cancer and cardiovascular disease with 32 (22.8%), 19(13.6%), 17 (12.1%), 15 (10.7%) and 12 (8.6%) cases, respectively.

The mean platelets count at admission was 188,400/ul.

94 patients (67%) developed thrombocytopenia during their ICU stay. Among them, 53 were male and 41 were female. The gender difference was not significant (Table 2).

Gender	No. (%) of thrombocytopenia cases	P-value
Male (Total = 78)	53 (67.9%)	0.82
Female (Total = 62)	41 (66.1%)	

Table 2: Prevalence of thrombocytopenia according to gender.

p-value >0.05: Non significant (NS).

p-value <0.05: Significant (S).*

p-value <0.01: Highly Significant (HS).**

56% of the patients who developed thrombocytopenia were above the age of 60 years. The frequency of thrombocytopenia according to different age groups is presented in (Table 3).

Age group	No. (%) of thrombocytopenia cases
≤40 years	15 (15.9%)
41 - 50 years	14 (14.8%)
51 - 60 years	19 (20.2%)
> 60 years	46 (48.9%)

Table 3: Prevalence of thrombocytopenia according to age groups.

The comparison between patients with and without thrombocytopenia regarding risk factors and co-morbidities is shown in (Table 4). There was a significant difference regarding sepsis, use of antibiotics, use of heparin and mechanical ventilation. While there was no significant difference in the duration of ICU stay, presence of coro nary artery disease and use of invasive catheters.

Risk factor	Patients with thrombocytopenia (94 patients), No. (%)	Patients without thrombocy-topenia (46 patients), No. (%)	P-value
ICU stay (days), mean	7.25	6.4	0.18
Mechanical ventilation	57 (60.6%)	19 (41.3%)	0.031*
Sepsis	65 (69.1%)	22 (47.8%)	0.015*
Invasive catheters	50 (53.1%)	25 (54.3%)	0.897
Coronary artery disease	13 (13.8%)	8 (17.4%)	0.579
Antibiotics	72 (76.6%)	19 (41.3%)	<0.001**
Heparin	51 (54.2%)	15 (32.6%)	0.016*

Table 4: Comparison between patients with and without thrombocytopenia regarding the associated risk factors.

p-value >0.05: Non significant (NS).

p-value <0.05: Significant (S).*

p-value <0.01: Highly Significant (HS).**

Discussion

The many comorbidities in the severely ill patient affect platelet homeostasis, and consequently, thrombocytopenia is very common in critically ill patients treated in the intensive care unit (ICU). Thrombocytopenia is usually defined as a platelet count of less than 150 x 10⁹/L, whereas severe thrombocytopenia is considered as platelet counts less than 50 x 10⁹/L [7].

Platelets play a key role in hemostasis and can be used as a marker of disseminated intravascular coagulation, where a significant decrease in platelet count should be interpreted as a deterioration signal in critically ill patients especially in patients with sepsis or septic shock [8].

Sepsis is a triggering factor of thrombocytopenia, modifying platelets production, increasing their consumption, sequestration

or destruction by the spleen or along the surface of endothelial cells [6].

The activation, consumption and destruction of platelets may occur in endothelial surface as a result of extensive interaction of platelets with the endothelial cells that occurs in sepsis contributing to multiple organ dysfunctions seen in these patients [9].

Thrombocytopenia is common in ICU patients during the first 4 days and is correlated with the severity of the underlying illness or tissue damage. A poor prognosis is indicated by platelet counts that do not recover or that show a progressive decrease 5 days after admission [10].

In the present study which has been conducted in the medical ICU, 94 patients (67%) developed thrombocytopenia. In the study of Sara Rahama., *et al.* [13], the incidence was 70% in a medical ICU in a tertiary care hospital in Sudan.

Vanderschueren., *et al.* [9] detected that 41% of the patients admitted to medical ICU developed thrombocytopenia (platelet count less than 150 x 10^9/L) during their ICU stay at least once.

In another study done in Morocco, the incidence of thrombocytopenia among patients admitted to a surgical ICU was recorded at 36.6% [11].

Based on these findings from different studies, we can report that there is a considerable variation in the prevalence of thrombocytopenia among ICU patients which is affected by many factors such as the underlying cause for admission, drugs used and other associated risk factors.

Regarding age, 48.9% of the patients who developed thrombocytopenia were aged over 60 years which is in agreement with the results of the studies of Strauss., *et al.* [12] and Sara Rahama., *et al.* [13].

No significant association between development of thrombocytopenia and gender was found in our study, a finding which has been also reported in the study of Sara Rahama., *et al.* [13].

We studied the association between the development of thrombocytopenia in ICU patients and presence of some risk factors.

Sepsis was one of the risk factors and therefore an implicated cause as there was a significant difference between patients with and without thrombocytopenia as regard the presence of sepsis. This finding was consistent with that of C Mehta., *et al.* [14] and So Yeon Lim., *et al.* [15].

The association of thrombocytopenia with sepsis can be explained on the basis of an underlying DIC process, immune-mediated platelet destruction and haemophagocytic syndrome [16,17].

Another important risk factor in our study is the use of antibiotics, as we found a significant difference between patients with and without thrombocytopenia. This finding was also reported by Sara Rahama., *et al.* [13], C Mehta., *et al.* [14], So Yeon Lim., *et al.* [15], and Hanai., *et al.* [18].

In the present study, we also found that the use of heparin is a significant risk factor for thrombocytopenia in ICU patients, which had been also found in the studies of C Mehta., *et al.* [14], So Yeon Lim., *et al.* [15] and Williamson., *et al.* [19].

Heparin-induced thrombocytopenia is a well-described complication of heparin therapy with an incidence of 1-5% when unfractionated heparin (UFH) is used, but less than 1% with low molecular weight heparin (LMWH) [20].

Mechanical ventilation is another risk factor detected in our study where there was a significant difference between patients with and those without thrombocytopenia. This point agrees with the studies of Sara Rahama., *et al.* [13] and C Mehta., *et al.* [14] but does not agree with that of So Yeon Lim., *et al.* [15] who reported mechanical ventilation as a non-significant risk factor.

On the other hand, there was no significant difference regarding duration of ICU stay or the use of invasive catheters, this agrees with the study of C Mehta., *et al.* [14]. Also, there was no significant difference regarding coronary artery disease, but this does not agree with the study of C Mehta., *et al.* [14] and they suggested that the pathophysiology of this association may be explained by the use of antiplatelet drugs in those patients but this needs further investigation for more clarification.

According to all these findings, there is some variation in different risk factors and their significance in the development

of thrombocytopenia in ICU patients. This can be affected by the already present morbidities and chronic diseases, the sample size and the strategy of management of ICU patients in different places.

Conclusion

Thrombocytopenia is a common complication in ICU patients. It can be considered an indicator of the severity of patient's illness and also as an important prognostic factor. There is a considerable variation in the prevalence of thrombocytopenia among ICU patients in different localities. The main risk factors are sepsis, antibiotics, heparin and mechanical ventilation.

Systematic and extensive investigations are required to establish the cause of thrombocytopenia in ICU as there are many possible causes and mechanisms.

Conflict of Interest

None.

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