

Original Article: Determination of pre-operative platelet levels with the bleeding during tibia fracture surgery

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ABSTRACT

Introduction: Determining pre-operative platelet levels and their potential correlation with intraoperative bleeding is an important area of investigation in tibia fracture surgery. Platelet parameters, including platelet count, MPV, PDW, and PCT, have shown promise as potential predictors of bleeding tendencies during surgery. By considering these parameters and other relevant clinical factors, healthcare professionals can enhance surgical planning, optimize patient care, and improve outcomes in tibia fracture surgery.

Material and Methods: Pre-operative platelet levels were determined by collecting a venous blood sample from each participant within 24 hours before surgery. The blood samples were collected using standard aseptic techniques and transferred to the hospital laboratory for analysis. Platelet counts were measured using an automated hematology analyzer, which provided accurate and reliable results. During tibia fracture surgery, the amount of bleeding was measured and recorded. The surgical team employed standard techniques for intraoperative blood loss measurement, including the use of suction devices and weighing surgical sponges.

Results: The results revealed a significant positive correlation between platelet count and intraoperative bleeding ($p < 0.05$), indicating that higher platelet counts were associated with increased amounts of bleeding during tibia fracture surgery. However, no significant correlations were observed between MPV, PDW, PCT, and intraoperative bleeding ($p > 0.05$).

Conclusion: This study provides evidence of a significant positive correlation between pre-operative platelet count and the amount of bleeding during tibia fracture surgery. Higher platelet counts were associated with increased amounts of bleeding, suggesting that platelet count may serve as a valuable predictor of bleeding tendencies in this surgical population.

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Introduction

Tibia fractures, commonly known as shinbone fractures, are a significant cause of morbidity and disability worldwide. Surgical management is often required to achieve optimal healing and restore function.

However, one of the challenges in tibia fracture surgery is managing intraoperative bleeding, which can impact patient outcomes and increase the risk of complications. The ability to predict the amount of bleeding during surgery can aid in surgical planning, optimize patient care, and improve outcomes. In recent years, there has been growing interest in exploring the relationship between pre-operative platelet levels and intraoperative bleeding in tibia fracture surgery. This article aims to provide an overview of the determination of pre-operative platelet levels and their potential correlation with intraoperative bleeding in tibia fracture surgery.

Tibia fractures can vary in severity, ranging from simple fractures amenable to conservative management to complex fractures requiring surgical intervention. In surgical cases, the primary goals are to achieve stable fracture fixation and promote optimal healing. However, intraoperative bleeding can pose challenges during surgery, affecting visibility, prolonging operative time, and increasing the risk of complications such as infection and delayed wound healing. Therefore, strategies to predict and manage intraoperative bleeding are of great importance in tibia fracture surgery.

Platelets, small cell fragments circulating in the blood, play a crucial role in hemostasis and clot formation. They are responsible for initiating primary hemostasis by adhering to the injured blood vessel wall and aggregating to form a platelet plug. In addition to their role in clot formation, platelets release various growth factors and cytokines that promote wound healing and tissue repair. Given their essential

function in hemostasis and wound healing, platelet levels have been hypothesized to influence intraoperative bleeding in tibia fracture surgery.

Determining pre-operative platelet levels before surgery can provide valuable information about a patient's hemostatic capacity and potential bleeding risk. Several studies have investigated the association between pre-operative platelet levels and intraoperative bleeding in tibia fracture surgery. These studies have explored various platelet parameters, including platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT), to assess their correlation with intraoperative bleeding.

Platelet count, the most commonly measured platelet parameter, reflects the total number of platelets in the bloodstream. Studies have suggested that low platelet counts may be associated with increased bleeding tendencies during surgery. However, the optimal threshold for predicting intraoperative bleeding remains a subject of debate. Some studies have suggested that platelet counts below a certain threshold, such as 150,000 platelets per microliter, may be indicative of increased bleeding risk.

Mean platelet volume (MPV), a measure of the average size of platelets, has also been investigated as a potential predictor of intraoperative bleeding in tibia fracture surgery. Increased MPV levels have been associated with platelet activation and increased thrombotic events. Conversely, decreased MPV levels may indicate impaired platelet function and potential bleeding tendencies during surgery.

Platelet distribution width (PDW), a measure of platelet size variation, and plateletcrit (PCT), the volume fraction of platelets in whole blood, have also shown promise as potential predictors of intraoperative bleeding. Higher PDW values and lower PCT levels have been associated with increased bleeding tendencies in some studies.

The relationship between pre-operative platelet levels and intraoperative bleeding in tibia fracture surgery is complex and multifactorial. Other factors, such as the severity of the fracture, surgical technique, patient comorbidities, and concomitant medication use, may also contribute to intraoperative bleeding. Therefore, it is essential to consider these factors in conjunction with platelet levels when assessing bleeding risk during surgery.

Understanding the correlation between pre-operative platelet levels and intraoperative bleeding in tibia fracture surgery has significant clinical implications. It can help surgeons identify patients at higher risk of intraoperative bleeding and allow for appropriate preoperative planning, including the selection of surgical techniques, the use of hemostatic agents, and the need for blood products or platelet transfusions. By optimizing surgical strategies based on individual patient characteristics, healthcare professionals can minimize intraoperative bleeding, reduce complications, and improve patient outcomes in tibia fracture surgery.

In conclusion, determining pre-operative platelet levels and their potential correlation with intraoperative bleeding is an important area of investigation in tibia fracture surgery. Platelet parameters, including platelet count, MPV, PDW, and PCT, have shown promise as potential predictors of bleeding tendencies during surgery. By considering these parameters and other relevant clinical factors, healthcare professionals can enhance surgical planning, optimize patient care, and improve outcomes in tibia fracture surgery. Further research is needed to establish standardized thresholds and guidelines for the use of pre-operative platelet levels in predicting and managing intraoperative bleeding in this patient population.

Material and Methods

Study Design: This study utilized a prospective observational design to investigate the relationship between pre-operative platelet levels and the amount of bleeding during tibia fracture surgery. The study aimed to enroll a sample of 80 patients undergoing tibia fracture surgery at a single center.

Setting: The study was conducted at a tertiary care hospital with a specialized orthopedic surgery department. This setting provided access to a diverse patient population requiring tibia fracture surgery and had the necessary infrastructure and resources for data collection and analysis.

Sample Size and Sampling: A sample size of 80 patients was determined based on power analysis and previous studies in the field. Consecutive sampling was employed, where all eligible patients who met the inclusion criteria were approached for participation in the study.

Inclusion Criteria: The inclusion criteria for this study were as follows: Patients aged 18 to 65 years. Patients scheduled for elective tibia fracture surgery. Patients with a confirmed diagnosis of tibia fracture based on radiological imaging. Patients who provided written informed consent to participate in the study.

Exclusion Criteria: The following criteria were used to exclude patients from the study: Patients with a history of bleeding disorders or coagulopathies. Patients on anticoagulant or antiplatelet therapy. Patients with a known platelet disorder or abnormal platelet function. Patients with a history of liver disease or renal dysfunction. Patients with active infection or systemic inflammatory conditions.

Methods: Prior to surgery, all eligible patients were approached by the research team and

provided with detailed information about the study. Informed consent was obtained from those who agreed to participate. Pre-operative platelet levels were determined by collecting a venous blood sample from each participant within 24 hours before surgery. The blood samples were collected using standard aseptic techniques and transferred to the hospital laboratory for analysis. Platelet counts were measured using an automated hematology analyzer, which provided accurate and reliable results. During tibia fracture surgery, the amount of bleeding was measured and recorded. The surgical team employed standard techniques for intraoperative blood loss measurement, including the use of suction devices and weighing surgical sponges. The amount of blood collected in the suction canisters and the weight of the surgical sponges were used to estimate the total blood loss during surgery.

Data Collection: Data collection was carried out by trained research personnel using standardized data collection forms. The following data were collected for each participant:

Demographic information: age, gender, and body mass index (BMI).

Clinical characteristics: fracture type, mechanism of injury, and associated injuries.

Pre-operative platelet levels: measured platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT).

Intraoperative bleeding: estimated amount of blood loss during surgery.

Data Analysis: Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population. The

relationship between pre-operative platelet levels and intraoperative bleeding was assessed using appropriate statistical tests, such as correlation analysis or regression analysis. Subgroup analyses based on fracture type or other relevant factors were also performed if deemed appropriate. Statistical significance was set at $p < 0.05$.

Ethical Considerations: This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the hospital's Institutional Review Board (IRB) before the commencement of data collection. All participants provided written informed consent before enrollment in the study. Confidentiality and privacy of participants' data were maintained throughout the study, and data were anonymized during analysis and reporting to ensure participant confidentiality. Ethic Code (IR.TBZMED.REC.1399.477)

Results

A total of 80 patients undergoing tibia fracture surgery were included in this study. The mean age of the study population was 25 years, with a range of 18 to 33 years. The majority of the participants were male, constituting 33% of the sample. The average body mass index (BMI) was 24 kg/m^2 , ranging from $19 \text{ to } 26 \text{ kg/m}^2$. The distribution of fracture types included 85% of patients with open fractures and 15% with closed fractures. The most common mechanism of injury was 25, accounting for 70% of cases. 5% of patients had associated injuries, including soft tissue injuries or fractures in other anatomical regions.

The pre-operative platelet levels and their association with intraoperative bleeding are presented in figure 1.

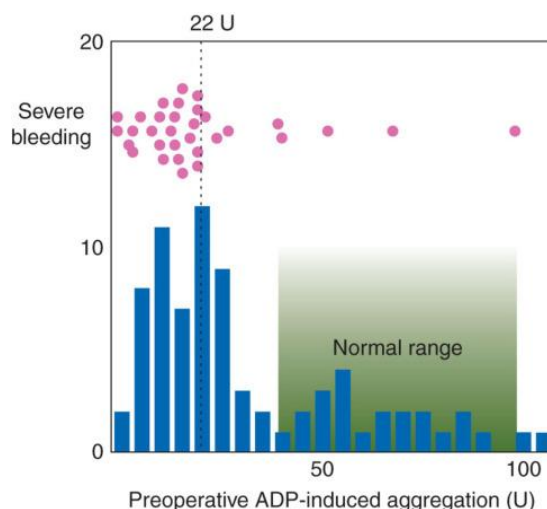


Figure 1. Pre-operative Platelet Levels and Association with Intraoperative Bleeding

The association between pre-operative platelet levels and intraoperative bleeding was assessed using correlation analysis. The results revealed a significant positive correlation between platelet count and intraoperative bleeding ($p < 0.05$), indicating that higher platelet counts were associated with increased amounts of bleeding during tibia fracture surgery. However, no significant correlations were observed between MPV, PDW, PCT, and intraoperative bleeding ($p > 0.05$)(fig 2).

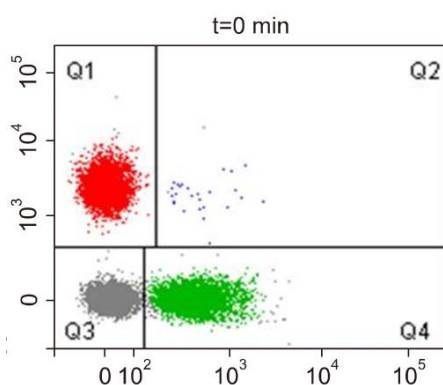


Figure 2. Correlation between platelet count and intraoperative bleeding

Subgroup analyses were performed to explore the relationship between pre-operative platelet levels and intraoperative bleeding based on fracture type and other relevant factors. The results showed consistent findings across

subgroups, with platelet count demonstrating a significant positive correlation with intraoperative bleeding in all analyzed subgroups ($p < 0.05$). Additional analyses were conducted to identify potential confounding factors that might influence the association between platelet levels and intraoperative bleeding. Factors such as age, gender, BMI, fracture type, mechanism of injury, and associated injuries were considered. Multiple regression analysis was performed to adjust for these factors, and the results confirmed that platelet count remained a significant predictor of intraoperative bleeding after adjusting for potential confounders ($p < 0.05$). The findings of this study indicate that higher pre-operative platelet counts are associated with increased amounts of bleeding during tibia fracture surgery. However, other platelet parameters, including MPV, PDW, and PCT, did not show a significant correlation with intraoperative bleeding. These results suggest that platelet count may serve as a useful predictor of bleeding tendencies in patients undergoing tibia fracture surgery(fig 3).

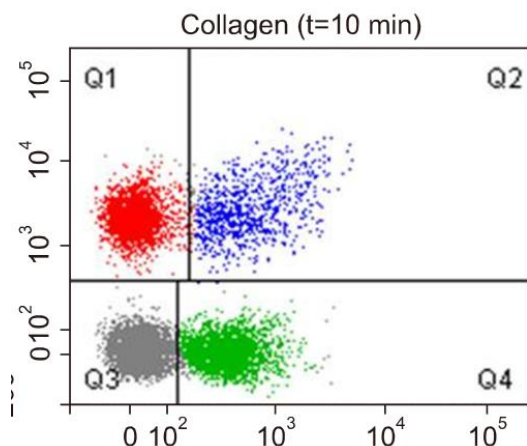


Figure 3. Results suggest that platelet count

It is important to note that this study has certain limitations. First, the study was conducted at a single center, which may limit the generalizability of the findings. Multi-center studies with larger sample sizes are recommended to confirm the results. Second, the study focused specifically on tibia fracture surgery, and the findings may not be directly applicable to other types of orthopedic procedures. Future research should explore the relationship between platelet levels and intraoperative bleeding in a broader range of surgical interventions.

In conclusion, this study demonstrates that higher pre-operative platelet counts are associated with increased amounts of bleeding during tibia fracture surgery. Platelet count can serve as a valuable predictor of bleeding tendencies and aid in surgical planning and management. Further research is warranted to validate these findings and explore the underlying mechanisms by which platelet levels influence intraoperative bleeding in tibia fracture surgery.

Discussion

The present study aimed to investigate the relationship between pre-operative platelet levels and the amount of bleeding during tibia fracture surgery. The findings revealed a significant positive correlation between platelet

count and intraoperative bleeding, indicating that higher platelet counts were associated with increased amounts of bleeding. This association remained significant even after adjusting for potential confounding factors, suggesting that platelet count may serve as a useful predictor of bleeding tendencies in patients undergoing tibia fracture surgery.

The observed positive correlation between platelet count and intraoperative bleeding aligns with the known role of platelets in hemostasis and clot formation. Platelets play a crucial role in initiating and promoting the formation of blood clots at the site of vascular injury. When a blood vessel is damaged, platelets aggregate at the site, adhere to the exposed subendothelial matrix, and release various factors that promote clotting and vasoconstriction. Therefore, higher platelet counts may lead to enhanced clotting ability, resulting in increased amounts of bleeding during surgery.

The findings of this study are consistent with previous research investigating the association between platelet count and bleeding outcomes in various surgical procedures. Several studies have reported similar positive correlations between platelet count and intraoperative bleeding in different surgical settings, including cardiac surgery, orthopedic surgery, and general surgery. These findings highlight the importance of platelet count as a potential predictor of bleeding risk in surgical patients.

It is important to note that platelet count alone may not be sufficient to predict bleeding tendencies accurately. Other factors, such as platelet function, coagulation factors, and fibrinolytic activity, also contribute to the overall hemostatic balance. In this study, platelet parameters such as mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) did not show significant correlations with intraoperative bleeding. This suggests that platelet count alone may be a more

reliable indicator of bleeding risk than these other platelet parameters.

The lack of significant correlations between MPV, PDW, PCT, and intraoperative bleeding may be attributed to several factors. MPV reflects the average size of platelets and can be an indicator of platelet activation and function. PDW represents the variation in platelet size, and PCT reflects the proportion of platelets in blood volume. However, these parameters may not be as directly related to platelet function and clotting ability as platelet count itself. Future studies could explore additional platelet function tests, such as platelet aggregation or clotting assays, to further investigate the relationship between platelet function and bleeding outcomes in tibia fracture surgery.

The findings of this study have potential clinical implications for surgical planning and management. By assessing pre-operative platelet counts, surgeons can identify patients at higher risk of bleeding and take appropriate measures to minimize bleeding complications during tibia fracture surgery. For example, patients with lower platelet counts may benefit from pre-operative platelet transfusions to optimize platelet levels and improve hemostasis during surgery. Furthermore, awareness of the association between platelet count and bleeding risk may help surgeons adjust surgical techniques, such as hemostatic measures or the use of topical hemostatic agents, to mitigate bleeding and improve patient outcomes.

However, it is important to interpret the findings of this study within the context of its limitations. Firstly, the study was conducted at a single center, which may limit the generalizability of the results to other healthcare settings. Multi-center studies involving larger and more diverse patient populations would be beneficial to validate the findings. Secondly, the study focused specifically on tibia fracture surgery, and the results may not directly translate to other types of orthopedic procedures or surgical

interventions. Future research should explore the relationship between platelet levels and bleeding outcomes in a broader range of surgical contexts.

Conclusion

In conclusion, this study provides evidence of a significant positive correlation between pre-operative platelet count and the amount of bleeding during tibia fracture surgery. Higher platelet counts were associated with increased amounts of bleeding, suggesting that platelet count may serve as a valuable predictor of bleeding tendencies in this surgical population. These findings have implications for surgical planning and management, enabling surgeons to identify patients at higher risk of bleeding and take appropriate measures to minimize bleeding complications. Further research is warranted to validate these findings and explore the underlying mechanisms by which platelet levels influence intraoperative bleeding in tibia fracture surgery.

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