ORIGINAL RESEARCH

To evaluate the hematological problems in individuals who have different orthopedic operations in a hospital setting

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ABSTRACT
Aim: To evaluate the hematological problems in individuals who have different orthopedic operations in a hospital setting. **Material and methods**: A total of 50 patients who were scheduled for elective and emergency orthopedic surgeries were enrolled in the study.Postoperative hematological evaluations were performed on postoperative days 1, 3, and 7. These evaluations included repeat CBC and coagulation profile tests to monitor changes in hematological parameters. Postoperative complications, such as deep vein thrombosis (DVT), pulmonary embolism (PE), and bleeding, were recorded. All patients were monitored closely during their hospital stay and were followed up for 30 days post-surgery to assess any delayed hematological complications. **Results**: On postoperative day 1, the mean hemoglobin level decreased to 12.0 g/dL, reflecting blood loss during surgery. By day 7, hemoglobin levels had begun to recover, reaching 13.2 g/dL. WBC counts increased to 10.0 ×10^9/L on day 1, likely due to the surgical stress response, but decreased to 7.5 ×10^9/L by day 7. The postoperative outcomes show that the majority of patients had a hospital stay of less than 7 days (70%), while 30% stayed for 7 days or more. ICU admission was required for 10% of the patients, reflecting the severity or complications associated with their surgeries. Postoperative complications were observed in 20% of the patients, which included issues like infections and delayed recovery. The readmission rate within 30 days was 10%, indicating that a small proportion of patients experienced late-onset complications requiring further medical attention. The significant hematological complications observed post-surgery include deep vein thrombosis (DVT) in 6% of patients, pulmonary embolism (PE) in 4%, and prolonged bleeding in 10%. **Conclusion**: We concluded that while orthopedic surgeries are generally safe, it can lead to transient changes in liver function tests and hematological parameters. Monitoring these parameters closely in the immediate postoperative period is crucial to ensure patient safety and prompt management of any complications that may arise.
Keywords- orthopedic surgery, haematology, complications

INTRODUCTION

Orthopedic surgeries encompass a wide range of procedures aimed at correcting injuries, deformities, and diseases of the bones, joints, and associated structures. These surgeries, while often life-enhancing or life-saving, come with a host of potential complications, among which hematological complications are particularly significant. Understanding these complications is crucial for improving patient outcomes, optimizing surgical techniques, and developing preventive measures.Hematological complications refer to disorders related to the blood that may arise during or after surgery. These can include anemia, thrombocytopenia, coagulopathies, and thromboembolic events, among others. These complications can significantly impact the recovery process, prolong hospital stays, increase the need for additional treatments, and in severe cases, pose a threat to life.[1]One of the most common hematological complications following orthopedic surgery is anemia. Anemia in the postoperative period is usually due to blood loss during surgery. Orthopedic surgeries, particularly those involving large bones like hip and knee replacements, can result in significant blood loss. The body's ability to compensate for this loss can be compromised, especially in patients who are already anaemic or have other comorbid conditions. Anemia can lead to symptoms such as fatigue, weakness, and delayed wound healing, thereby affecting the overall recovery process. In severe cases, it might necessitate blood transfusions, which come with their own risks,

such as transfusion reactions and infections.[2]Another critical haematological issue is thrombocytopenia, a condition characterized by an abnormally low number of platelets in the blood. Platelets are essential for normal blood clotting, and their deficiency can lead to excessive bleeding. This can be particularly problematic in the surgical setting where bleeding needs to be controlled to ensure patient safety and successful outcomes. Thrombocytopenia can be caused by various factors, including surgical trauma, hemodilution from fluid administration, or pre-existing conditions that affect platelet production.[3]Coagulopathies, or disorders of blood clotting, also present significant challenges in the postoperative period. These can be inherent, such as hemophilia, or acquired due to surgery or medications. Coagulopathies can lead to either excessive bleeding or an increased risk of clot formation, both of which can complicate recovery. Managing patients with coagulopathies requires careful preoperative planning, intraoperative management, and postoperative monitoring to balance the risks of bleeding and thrombosis.[4]Thromboembolic events, including deep vein thrombosis (DVT) and pulmonary embolism (PE), are among the most serious hematological complications following orthopedic surgery. The immobility associated with surgery, combined with an increased tendency for blood to clot postoperatively, significantly raises the risk of these events. DVT occurs when a blood clot forms in a deep vein, usually in the legs, which can cause pain, swelling, and redness. If a part of this clot breaks off and travels to the lungs, it results in a pulmonary embolism, a potentially life-threatening condition characterized by sudden shortness of breath, chest pain, and hypoxia. Preventive measures such as anticoagulant medications, mechanical compression devices, and early mobilization are critical in mitigating these risks.Moreover, orthopedic patients are often older adults who may have multiple comorbidities such as cardiovascular disease, diabetes, or chronic kidney disease, which can further predispose them to hematological complications. These conditions not only increase the risk but also complicate the management of these patients. For instance, managing anticoagulation in a patient with atrial fibrillation undergoing hip replacement requires a delicate balance to prevent both bleeding and thromboembolic events.[5]In addition to patient-specific factors, surgical factors also play a significant role in the incidence of hematological complications. The type of surgery, duration of the procedure, and surgical technique can influence the extent of blood loss and the likelihood of complications. For example, minimally invasive techniques such as arthroscopy generally have lower rates of blood loss and complications compared to open surgeries. However, complex reconstructive surgeries or those involving multiple procedures in a single session may pose higher risks.[6]Preoperative assessment and optimization are critical in minimizing the risk of hematological complications. This includes thorough evaluation of the patient's medical history, current medications, and baseline hematological status. Preoperative optimization might involve correcting anemia with iron supplements or erythropoietin, adjusting medications that affect coagulation, and planning for perioperative anticoagulation in patients at risk for thromboembolic events.Intraoperative management focuses on minimizing blood loss through meticulous surgical techniques, employing blood conservation strategies such as controlled hypotension and the use of hemostatic agents, and ensuring adequate hemodynamic monitoring. The use of cell salvage techniques, where the patient's own blood lost during surgery is collected, processed, and reinfused, can also reduce the need for allogeneic blood transfusions.[7]Postoperative care involves close monitoring for signs of hematological complications, timely laboratory evaluations, and appropriate interventions. Early mobilization, use of mechanical prophylaxis, and anticoagulant therapy are standard practices to prevent thromboembolic events. Patient education on recognizing symptoms of complications and the importance of follow-up care is also essential.

MATERIALS AND METHODS

This hospital-based prospective study was conducted to assess the hematological complications among patients undergoing various orthopedic surgeries. The study was carried out at a tertiary care hospital over a period of six months. A total of 50 patients who were scheduled for elective and emergency orthopedic surgeries were enrolled in the study.

Inclusion criteria

1. Patients aged 18 years and older.
2. Patients scheduled for various orthopedic surgeries, including but not limited to, fracture fixation, joint replacement, and spine surgeries.
3. Patients who provided written informed consent to participate in the study.

Exclusion criteria

1. Patients with pre-existing hematological disorders, such as hemophilia, thrombocytopenia, or anemia.
2. Patients undergoing revision surgeries.
3. Patients with incomplete medical records.
4. Patients who were pregnant or lactating.

Preoperative assessment included a thorough medical history, physical examination, and baseline hematological tests, which comprised complete blood count (CBC), coagulation profile (prothrombin time, activated partial thromboplastin time), and blood grouping and cross-matching. These tests were conducted using standard laboratory techniques.Intraoperative data collected included the type of orthopedic surgery performed, duration of

surgery, intraoperative blood loss (measured using the gravimetric method), and the requirement for blood transfusions. Details of any intraoperative complications were also documented.Postoperative hematological evaluations were performed on postoperative days 1, 3, and 7. These evaluations included repeat CBC and coagulation profile tests to monitor changes in hematological parameters. Postoperative complications, such as deep vein thrombosis (DVT), pulmonary embolism (PE), and bleeding, were recorded.All patients were monitored closely during their hospital stay and were followed up for 30 days post-surgery to assess any delayed hematological complications. Patients were advised to report any symptoms suggestive of hematological issues, such as unexplained bruising, prolonged bleeding, or signs of thrombosis.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics were used to summarize the demographic and clinical characteristics of the patients. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. The incidence of hematological complications was calculated, and potential risk factors were identified using logistic regression analysis, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Table 1: Demographic Characteristics of Patients

The demographic characteristics of the 50 patients who underwent various orthopedic surgeries show a balanced distribution across different age groups and a higher prevalence of male patients. Specifically, the age distribution reveals that the majority of patients were between 31-50 years old, with 24% in the 31-40 years group and 30% in the 41-50 years group. This indicates that middle-aged individuals are more frequently undergoing orthopedic surgeries, possibly due to the higher incidence of musculoskeletal issues in this age bracket. The gender distribution shows that 60% of the patients were male and 40% were female, which could reflect the demographic trends in orthopedic surgery patients or a higher incidence of orthopedic conditions in males.

Table 2: Preoperative Baseline Hematological Tests

The baseline hematological tests for the patients show that their hematological parameters were within the normal range before surgery. The mean hemoglobin level was 13.5 g/dL, within the normal range of 12-16 g/dL, indicating that the patients did not have pre-existing anemia. The white blood cell (WBC) count averaged 7.2 ×10^9/L, within the normal range of 4-11 ×10^9/L, suggesting no underlying infection or inflammation. Platelet counts were also normal, with a mean of 250 ×10^9/L, ensuring adequate clotting ability. Prothrombin time (PT) and activated partial thromboplastin time (APTT) were within normal limits, indicating normal blood clotting function.

Table 3: Intraoperative Data

Intraoperative data highlights the types of surgeries performed and the intraoperative conditions. The majority of surgeries were fracture fixations (40%) and joint replacements (30%), with spine surgeries accounting for 20%. Most surgeries (60%) were completed in less than 2 hours, while 40% took longer, indicating that a significant number of procedures were complex. Intraoperative blood loss was less than 500 mL for 70% of the patients, while 30% experienced blood loss of 500 mL or more. Blood transfusions were required in 20% of the cases, reflecting the extent of blood loss during surgery.

Table 4: Postoperative Hematological Tests

Postoperative hematological tests reveal changes in hematological parameters over time. On postoperative day 1, the mean hemoglobin level decreased to 12.0 g/dL, reflecting blood loss during surgery. By day 7, hemoglobin levels had begun to recover, reaching 13.2 g/dL. WBC counts increased to 10.0 ×10^9/L on day 1, likely due to the surgical stress response, but decreased to 7.5 ×10^9/L by day 7. Platelet counts showed a slight decrease initially but remained within the normal range throughout the postoperative period. PT and APTT values were slightly elevated on day 1 but normalized by day 7, indicating a transient impact on clotting function.

Table 5: Postoperative Outcomes

The postoperative outcomes show that the majority of patients had a hospital stay of less than 7 days (70%), while 30% stayed for 7 days or more. ICU admission was required for 10% of the patients, reflecting the severity or complications associated with their surgeries. Postoperative complications were observed in 20% of the patients, which included issues like infections and delayed recovery. The readmission rate within 30 days was 10%, indicating that a small proportion of patients experienced late-onset complications requiring further medical attention.

Table 6: Significant Hematological Complications Post-Surgery

The significant hematological complications observed post-surgery include deep vein thrombosis (DVT) in 6% of patients, pulmonary embolism (PE) in 4%, and prolonged bleeding in 10%. These complications highlight the importance of monitoring and managing hematological parameters closely in the postoperative period to prevent and address potential issues promptly. The incidence of DVT and PE, although relatively low, underscores the need for prophylactic measures and vigilant observation in orthopedic surgery patients.

Table 1: Demographic Characteristics of Patients

Variable	Frequency (n=50)	Percentage (%)
Age (years)		
18-30	10	20%
31-40	12	24%
41-50	15	30%
51-60	8	16%
>60	5	10%
Gender		
Male	30	60%
Female	20	40%

Table 2: Preoperative Baseline Hematological Tests

LFT Parameter	Mean ± SD	Normal Range
Hemoglobin (g/dL)	13.5 ± 1.2	12-16
WBC (×10^9/L)	7.2 ± 2.1	4-11
Platelets (×10^9/L)	250 ± 60	150-400
PT (seconds)	12.5 ± 1.2	11-15
APTT (seconds)	32.0 ± 4.5	25-35

Table 3: Intraoperative Data

Variable	Frequency (n=50)	Percentage (%)
Type of Surgery		
Fracture Fixation	20	40%
Joint Replacement	15	30%
Spine Surgery	10	20%
Others	5	10%
Duration of Surgery		
<2 hours	30	60%
≥2 hours	20	40%
Intraoperative Blood Loss		
<500 mL	35	70%
≥500 mL	15	30%
Blood Transfusion Required		
Yes	10	20%
No	40	80%

Table 4: Postoperative Hematological Tests

LFT Parameter	Postoperative Day 1	Postoperative Day 3	Postoperative Day 7
Hemoglobin (g/dL)	12.0 ± 1.3	12.8 ± 1.1	13.2 ± 1.0
WBC (×10^9/L)	10.0 ± 3.0	8.5 ± 2.5	7.5 ± 2.0
Platelets (×10^9/L)	230 ± 55	240 ± 60	245 ± 50
PT (seconds)	13.5 ± 1.5	13.0 ± 1.3	12.8 ± 1.2
APTT (seconds)	34.0 ± 4.8	33.0 ± 4.5	32.5 ± 4.0

Table 5: Postoperative Outcomes

Variable	Frequency (n=50)	Percentage (%)
Length of Hospital Stay		
<7 days	35	70%
≥7 days	15	30%
ICU Admission		
Yes	5	10%
No	45	90%
Postoperative Complications		
Yes	10	20%
No	40	80%

Table 6: Significant Hematological Complications Post-Surgery

Hematological Complication	Frequency (n=50)	Percentage (%)
Deep Vein Thrombosis (DVT)	3	6%
Pulmonary Embolism (PE)	2	4%
Prolonged Bleeding	5	10%

DISCUSSION

The demographic data from this study shows that the majority of patients undergoing orthopedic surgeries are within the 31-50 years age group, with a higher prevalence of males. This trend is consistent with other studies that have reported similar age distributions for orthopedic surgery patients. For instance, a study by Kim et al.[8] found that the mean age of patients undergoing total knee arthroplasty was around 65 years, with a significant proportion being male. Similarly, McGrory et al.[9] reported that males tend to undergo hip and knee replacements at a younger age compared to females. The higher prevalence of males in our study could be reflective of the greater incidence of trauma and degenerative joint diseases in men.The baseline hematological parameters in our study were within normal ranges, indicating that the patients were generally healthy before surgery. This is crucial as pre-existing hematological abnormalities can complicate surgery and recovery. Studies by Harris et al.[10] and Musallam et al.[11] have highlighted the importance of normal preoperative hematological parameters in reducing postoperative complications. Our findings align with these studies, suggesting that careful preoperative screening is essential for optimal surgical outcomes.Intraoperative data revealed that most surgeries were fracture fixations and joint replacements, with a significant number taking less than 2 hours. This is in line with findings by Lee et al.[12]and Bhandari et al.[13], who reported that the majority of orthopedic procedures, especially minimally invasive ones, are completed within a short duration, reducing the risk of intraoperative complications. However, blood loss and the need for transfusions in our study were notable, with 30% of patients experiencing significant blood loss, similar to findings by Hooper et al.[14] who emphasized the risks associated with orthopedic surgeries and the importance of blood management strategies.The postoperative hematological tests showed a transient decrease in hemoglobin levels and an increase in WBC counts, which is typical following major surgeries due to surgical stress and blood loss. By day 7, these parameters began to normalize, indicating recovery. These trends are consistent with the findings of studies by Newman et al.[15]and Andersen et al.[16], which documented similar hematological changes post-surgery and emphasized the need for monitoring to prevent complications such as anemia or infection.Postoperative outcomes in our study showed that most patients had a hospital stay of less than 7 days, with a low ICU admission rate. This reflects effective perioperative care and quick recovery, which is comparable to findings by Kurtz et al.[17] and Bozic et al.[18], who reported that advancements in surgical techniques and postoperative care have significantly reduced hospital stays and improved recovery times. However, the 20% complication rate in our study, including infections and delayed recovery, highlights the ongoing challenges in postoperative management, as noted by Patel et al.[19]The incidence of significant hematological complications such as DVT (6%), PE (4%), and prolonged bleeding (10%) underscores the need for vigilant postoperative monitoring and prophylactic measures. These rates are consistent with the findings of Falck-Ytter et al.[20] and Geerts et al.[21], who emphasized the high risk of thromboembolic events following orthopedic surgeries and the importance of thromboprophylaxis. The relatively low incidence of these complications in our study suggests that effective prophylactic strategies were employed, but continuous vigilance is required to further reduce these risks.

CONCLUSION

In summary, the results indicate that while orthopedic surgeries is generally safe, it can lead to transient changes in liver function tests and hematological parameters. Monitoring these parameters closely in the immediate postoperative period is crucial to ensure patient safety and prompt management of any complications that may arise.

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