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Original Research Article

Retrospective Evaluation of Preoperative Anemia Severity and Its Association with Perioperative Transfusion and Postoperative Outcomes

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Abstract

Background: Preoperative anemia is the widespread clinical issue in patients who have to undergo elective surgeries, and it is linked to the higher postoperative morbidity and mortality. The intensity of anemia can have an impact on blood transfusion and postoperative healing.

Purpose: This study aims to evaluate the perioperative blood transfusion and postoperative outcomes of surgical patients in retrospect to assess the severity of preoperative anemia and its relationship with preoperative anemia.

Methods: The proposed study is a retrospective observational study by nature, which takes place in a tertiary care teaching hospital during one year (January 2024 to December 2024). One hundred adult patients who had an elective major surgery were selected. The preoperative hemoglobin levels were categorized in line with the criteria set by the world health organization in mild, moderate and severe anemia. There were data on perioperative transfusion, postoperative complications, intensive care unit (ICU) admission, and length of hospital stay that were collected and analyzed through SPSS software. The statistical significance was determined to be $p < 0.05$.

Findings: Out of 100 patients, 48 percent were identified to be preoperative anaemic. 22% of patients had mild anemia, 18% had moderate anemia and 8% had severe anemia. The proportion of the total population that needed perioperative blood transfusion was 33, and there was a progressive growth in the percentage of transfusion with severity of anemia. Complications occurring after surgery were prevalent in anemic patients than non-anemic people. Mean hospital stay among the patients with moderate and severe anemia was significantly different.

Conclusion: The severity of the preoperative anemia increases greatly with the transfusion requirements, postoperative complications, and prolongs the hospital stay. The preoperative screening and optimization of anemia before elective surgery have the potential to resolve the perioperative results and lower the healthcare costs.

Keywords: Preoperative anemia; Hemoglobin; Blood transfusion; Postoperative complications; Retrospective study.

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Introduction

Preoperative anemia is a hematological disorder that is prevalent in the patients who undergo major and elective surgery [1]. It is marked by the decrease of hemoglobin levels that are below the limits of normal levels, which results in the lower oxygen carrying capacity of blood [2]. The World Health Organization defines anemia as "hemoglobin less than 13g /dL in men and women less than 12g/dL. Magnitude of anemia is further categorized as mild, moderate and severe depending on the level of hemoglobin [3]. Anemia is a major problem in the global population and is specifically widespread in people with chronic illnesses, malnutrition, cancer, kidney diseases, and

inflammatory diseases [4]. In the surgical scenario, the preoperative anemia can be present in the form of underlying pathology or can go undetected until regular pre-surgical screening is conducted. Clinical importance of preoperative anemia is a topic that has become more and more popular in perioperative medicine [5]. Anemia leads to impaired supply of oxygen to tissues that is essential during surgery and post-surgery in wound healing, immune response, and organ functioning. Various researches have shown that anemic patients are more susceptible to blood transfusion during perioperative, extended mechanical ventilated, intensive care unit (ICU), and increased hospital stay [6,7].

Despite the life-saving features, blood transfusion is not completely risk-free, it is linked to transfusion reactions, immunomodulation, transmission of diseases, higher cost of care, and the rise of morbidity and mortality [8]. In addition, perioperative anemia has been singled out as a predictive factor of unfavorable postoperative results, such as surgical site infections, cardiovascular events, renal dysfunction, and higher mortality rates in the short term [9]. In the light of the increasing surgical operations in the world, the untreated or inadequately managed preoperative anemia is a huge burden of healthcare.

Although the literature is increasingly accumulating to demonstrate that anemia and raised surgery outcomes are linked, there are still gaps in knowledge about the effect that the intensity of preoperative anemia has on both perioperative trans fusional demands and postoperative complications. Most research is generally done on existence or lack of anemia without classifying the patients based on the levels of anemia [10]. Also, the study populations, surgical specialties, and transfusion procedures were not similar across the study, thus, complicating the generalization of findings. The information on the severity of anemia and its direct effect on the postoperative outcome in resource-limited settings is scarce. Institutional-based retrospective studies are required to examine actual data and to find out whether the heightened severity of anemia is proportionally related to the poor clinical outcomes.

This paper will seek to retrospectively assess the intensity of preoperative anemia and its correlation with perioperative transfusion and post-surgical outcome in 100 patients in a period of one year. Through the assessment of clinical records, this study aims at identifying the importance of higher grades of anemia in terms of increased transfusion, post-operative complications, ICU admissions, and extending hospitalization. The research results of this study can be applied to the enhancement of the risk stratification during the perioperative period and to the enforcement of the necessity to diagnose and optimize the state of anemia at a pre-surgical stage.

Methodology

Study Design: This research was done in a form of retrospective observational research. The study was a review of already recorded medical records of the patients undergoing elective major surgeries. Since it was a retrospective analysis, there was no direct intervention done to any patient and all the information retrieved was through hospital medical records and electronic databases.

Study Setting: The analysis was conducted in a teaching hospital which a tertiary care institution is offering multispecialty surgical care. The facility serves a wide range of patients and conducts a substantial number of elective and major surgery cases per year, and thus is a suitable location to assess the clinical outcomes of perioperative units.

Study Duration: The research took place within the area of one year (between January 2024 and December 2024). All the eligible patients who had gone through surgery between this periods and were able to meet the inclusion criteria were put under analysis.

Sample Size: The study population was 100 patients. The sample included adult patients who had elective major surgery operations between the study periods and had ready preoperative and postoperative records that were reviewed.

Inclusion Criteria

The following criteria were used to include patients in the study:

- Adults-Patients over 18 years old.
- Patients that had undergone elective major procedures.
- Access to documented levels of preoperative hemoglobin within seven days of surgery.
- Full perioperative and postoperative medical records.

Exclusion Criteria

The patients were not allowed in the study in case they belonged to any of the following categories:

- Surgical procedures in case of emergency.
- Active intraoperative massive bleeding not associated with preoperative anemia.
- Latent hematological malignancies or bleeding disorders.
- Nondisclosed or lost medical records.
- Pediatric patients under the age of 18 years.

Data Collection: The retrospective collection of data was done using patient case records, laboratory reports, anesthesia records and discharge summaries. The demographic information involved age and gender. The clinical variables were type of

surgery done, comorbidity cases like diabetes mellitus and hypertension, and America society of anesthesiologists (ASA) physical status. The values of laboratories were based on the preoperative levels of hemoglobin measured within seven days of surgery. The outcome measures were perioperative blood transfusion (transfusion number of units), postoperative complications, need of admission to intensive care unit (ICU), and length of stay being hospitalized in days.

Definitions: Anemia was described and categorized in line with the descriptions set by the world health organization. Adult males were classified to be anaemic when hemoglobin is below 13 g/dL and adult females when hemoglobin is below 12 g/dl.

Severity was described as mild anemia (hemoglobin 11 to 12.9g/dl in men and 11 to 11.9g/dl in women), moderate anemia (hemoglobin 8 to 10.9g/dl) and severe anemia (hemoglobin less than 8g/dl). The patients were clustered so as to be analyzed in comparison.

Outcome Measures: The main finding of the research was the need of perioperative blood transfusion, which was considered to be the administration of packed red blood cells during surgery or the 48 hours after the surgery. Secondary outcomes were the presence of postoperative complications (surgical site infection, respiratory complications, cardiovascular events); admission to the intensive care unit; and the length of stay in the hospital, admission to discharge.

Statistical Analysis: The analysis was carried out by use of Statistical Package of the Social Sciences (SPSS) software version 25.0. Variables that are continuous were indicated as mean standard deviation and those that were categorical indicated frequencies and percentages. The Chi-square test was applied to evaluate the relationship between the severity of anemia (against categorical outcome variables) transfusion requirement and postoperative complications. The comparison between mean stay at hospital was performed by using the independent t -test. The p-value used was less than 0.05 which was taken to be significant.

Results

Demographic Data: The number of patients used in the study was 100. The average age of the population sample was 52.414.2. Most of the patients were aged 41-60 years. The respondents were divided into 58 (58) males and 42 (42) females.

Table 1: Baseline Characteristics (n = 100)

Variable	Value
Mean Age (years)	52.4 ± 14.2
Age Group 18–40 years	24 (24%)
Age Group 41–60 years	46 (46%)
Age Group >60 years	30 (30%)
Male	58 (58%)
Female	42 (42%)

Prevalence of Anemia: Four8 (48) patients out of 100 (48) were diagnosed with preoperative anemia. Two out of every five were mildly anaemic (22), one was slightly anaemic (18) and the remaining 8 were severely anaemic (8). One-third (52) of the patients were non-anemic.

Table 2: Severity of Preoperative Anemia Distribution

Anemia Status	Number of Patients	Percentage (%)
Non-anemic	52	52%
Mild anemia	22	22%
Moderate anemia	18	18%
Severe anemia	8	8%
Total	**100**	**100%**

Transfusion Requirement: In general, 34 (34%) patients needed blood transfusion during the operation. The requirement of transfusion was reported in 5 (9.6) non-anemic patients, 8 (36.4) patients with mild anemia, 12 (66.7) patients with moderate anemia and 8 (100) patients with severe anemia.

Table 3: Perioperative Blood Transfusion According to Anemia Severity

Anemia Status	Total Patients	Patients Transfused	Percentage (%)
Non-anemic	52	5	9.6%
Mild anemia	22	8	36.4%
Moderate anemia	18	12	66.7%
Severe anemia	8	8	100%
Total	**100**	**33**	**33%**

Postoperative Complications: In 22 (22) patients, postoperative complications were found. Out of the non-anemic patients, 6 (11.5) acquired complications. In the mild anemia, 5 (22.7) patients acquired complications. In moderate anemia group, there were complications developed in 7 (38.9) patients, and 4 (50) patients in the severe anemia group developed complications. Frequent complications were surgical site infection (12 percent), respiratory (6 percent), and cardiovascular (4 percent) complications. The number of patients who had to be admitted to the ICU was 15 (15%).

Table 4: Postoperative Outcomes According to Anemia Severity

Outcome	Non-anemic (n=52)	Mild (n=22)	Moderate (n=18)	Severe (n=8)	Total (%)
Postoperative complications	6 (11.5%)	5 (22.7%)	7 (38.9%)	4 (50%)	22%
ICU admission	4 (7.7%)	3 (13.6%)	5 (27.8%)	3 (37.5%)	15%
Surgical site infection	4	3	3	2	12%
Respiratory complications	2	1	2	1	6%
Cardiovascular complications	0	1	2	1	4%

Length of Hospital Stay: The mean average length of stay was 8.1 days with a standard deviation of 3.4. The average days of stay in non anemic patients were 6.2 2.1 days, in mildly anemic patients were 7.8 2.4 days, in moderate anemia patients were 9.5 3.2 days and in severe anemia patients were 12.1 4.3 days.

Discussion

The current retrospective research considered the linkage between the severity of preoperative anemia and the requirements of perioperative transfusion and the postoperative outcomes in a sample of 100 patients during a time span of one year. The results showed 48 percent of the patients were anaemic preoperative with different magnitudes of anaemia severity. It was found that a gradual rise in the perioperative blood transfusion requirement was associated with the severity of anemia up to 100 percent in severe anemia group. Anemic patients experienced more postoperative complications such as surgical site infection, respiratory complications, and stay in the ICU than non-anemic patients. In addition, the average duration of stay in hospital was proportional to the level of anemia. These results suggest that there is a close correlation between the severity of anemia and poor surgical outcome.

Comparison to Past Research: Findings of this study are in line with the international literature that has been published before. The high-scale studies have proven that preoperative anemia is a risk that is independent of morbidity and mortality of the perioperative. A historic study in The Lancet found that anemia in the pre-operative phase is an important predictor of postoperative complications and transfusion in the patients of non-cardiac surgery [11]. On the same note, meta-analyses written in the British Journal of Surgery have indicated that anemic patients are likely to be at risk of increased hospitalization and ICU stay [12]. These observations agree with our findings especially on how we have shown a graded relationship between the severity of anemia and adverse consequences. Most of the past researches were mainly interested in the existence of anemia, but this study highlights the effect of stratified levels of severity thus contributing to practical use of perioperative risk assessment.

Clinical Explanation: It is possible to explain the pathophysiological foundation of the observed results by the fact that oxygen delivery to tissues is impaired. Hemoglobin is important in the process of the transportation of oxygen to the outskirts of the body. One consequence of low hemoglobin concentration in anaemic patients is the impairment in the oxygen-carrying capacity which could jeopardize wound healing and organ functions during the perioperative process. Surgical stress also enhances the metabolic demand, therefore sufficient oxygen supply is crucial. Also, anemia can weaken the immune system, making a person prone to infections. A higher transfusion demand in patients with anaemia can also cause problems related to transfusion-associated immunomodulation and inflammatory reactions and possible overload of the volume. A combination of the effect of anemia and risks associated with transfusions is probably the reason behind the increased complication rates and longer hospitalization identified among patients with moderate and severe anemia.

Clinical Implications: The results of this paper highlight the significance of preoperative screening of anemia and early optimization prior to scheduled surgery. Early detection of anemia in the process of pre-anesthetic assessment gives a chance of managing the condition by iron supplementation, treatment of the underlying causes, erythropoiesis-stimulating agents, or delaying elective surgeries in case of necessity. A perioperative management of anemia can be included in the care pathways to decrease transfusion and enhance postoperative outcomes. Patient blood management (PBM) strategies would also lead to a better patient safety and cost-improvement in healthcare.

Limitations: There are some limitations of this study. To begin with, with the retrospective design, there is a lack of capability to determine causal relation. Second, the study sample was 100 patients, which might limit the extrapolability of the results. Third, since the research was carried out in one tertiary care setting, there was no consideration of differences in surgical procedures and transfusion regimens among different hospitals. Further larger prospective multicenter studies are also suggested to confirm these findings and support evidence-based practices in dealing with perioperative anemia.

Conclusion

Conclusively, this retrospective study reveals that preoperative anemia is very common in surgical patients and is very strongly linked with the requirement of increased perioperative blood transfusion, higher rates of complication, high admission to the intensive care and long hospitalization. The results have shown that there is a graded relationship between the severity of anemia and adverse surgical outcomes, with the moderate and severe anemia having the highest risk. These findings demonstrate the fact that the early monitoring of anemia and its proper treatment is crucial in the preoperative stage. Screening of hemoglobin levels and correcting them timely with iron therapy or nutritional optimization or any other evidence-based intervention must become part of regular perioperative care protocols. It is possible to implement structured patient blood management strategies, which could assist in reducing the reliance on transfusion and the overall result of surgery. It is suggested that future prospective multicenter research employing larger sample sizes would support these findings in more detail and set some standard guidelines on how to optimize perioperative anemia.

Ethical Consideration

The research was done after consent of the Institutional Ethics Committee of the teaching hospital of tertiary care had been obtained before data collection. Since this study was a retrospective observational study, informed consent was not provided as per institutional policies. The data of all patients were treated with utmost confidentiality and data extracted and analyzed anonymously. The research was conducted in ethical practices of medical research on human subjects and the standard of patient privacy and data protection was observed throughout the research period.

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