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Original Research Article

Impact of Preoperative Anemia on Postoperative Outcomes in Abdominal Surgery

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Abstract:

Background: Preoperative anemia is a frequent clinical issue in surgical patients, especially those requiring abdominal surgery. It decreases the capacity of blood to carry oxygen and consequently compromises tissue perfusion, wound healing, and immunity. It puts patients at risk for increased morbidity, more extended hospital stays, and mortality. Assessing its effect is crucial for enhancing perioperative management.

Objectives: The current investigation was designed to evaluate the impact of preoperative anemia on abdominal surgery postoperative outcomes, particularly complications, hospital stay, transfusion needs, and early mortality.

Materials and Methods: The study was an observational cohort study done over a period of one year in a tertiary care center. 194 adult patients having elective and emergency abdominal surgeries were enrolled. The patients were stratified into anemic and non-anemic categories according to WHO hemoglobin standards. Demographic information, comorbidities, perioperative complications after surgery, need for transfusion, and 30-day outcomes were noted. Statistical analysis was done using chi-square test, Student's t-test, and multivariate logistic regression, and $p<0.05$ was taken as significant.

Results: Preoperative anemia was seen in 78 of 194 patients (40.2%). Anemic patients had increased rates of surgical site infection (18% vs. 9%, p=0.04), pulmonary complications (14% vs. 7%, p=0.03), and ileus (12% vs. 5%, p=0.05). Hospital stay was significantly more extended for the anemic group (10.2 ± 3.8 vs. 7.4 ± 2.9 days, p=0.001). The need for transfusions was substantially greater among anemic patients (35% vs. 10%, p=0.001). Thirty-day mortality was also elevated in the anemic group (6.5% vs. 2.1%, p=0.04).

Conclusion: Preoperative anemia is a potent predictor of postoperative complications following abdominal surgery, resulting in increased complication rates, more extended hospital stays, increased requirements for transfusions, and increased mortality. Systematic screening and early correction of anemia should be included in perioperative care to maximize surgical results and decrease morbidity.

Keywords: Preoperative Anemia, Abdominal Surgery, Postoperative Outcomes, Morbidity, Mortality, Blood Transfusion, Hospital Stay.

Introduction

Anemia is the most frequent medical condition seen among surgical patients, with a frequency of 20–40% among those undergoing significant abdominal surgery. According to the World Health Organization (WHO), anemia is classified as a hemoglobin level of less than 13 g/dL in men and 12 g/dL in women, indicating a decreased capacity of blood to carry oxygen [1]. During the perioperative period, the condition is challenging as effective oxygen delivery is crucial for wound healing, immune protection, and organ function maintenance. In suboptimal hemoglobin levels, the physiological reserve is impaired, predisposing to tissue hypoxia and subsequent postoperative morbidity [2].

During abdominal surgery, the impact of anemia is especially problematic because of the intrusiveness and complexity of these operations. Patients who are undergoing gastrointestinal resections, hepatobiliary procedures, or emergency laparotomies tend to present with anemia secondary to chronic blood loss, nutritional deficiency, malignancy, or systemic disease [3]. Furthermore, intraoperative blood loss from surgery can worsen anemia, which requires perioperative blood transfusion with risks of transfusion reactions, immunosuppression, and susceptibility to infections. Therefore, preoperative anemia not only represents disease burden but also serves as an independent risk factor for adverse surgical outcomes [4].

Several studies have confirmed that preoperative anemia patients are at increased risk of postoperative morbidity, such as surgical site infections, delayed wound healing, pulmonary complications, and cardiovascular complications. In addition, these patients tend to have more extended hospital stays, higher healthcare expenditures, and higher rates of intensive care unit admission [5]. What is critically important is that anemia has also been found to be associated with higher short- and long-term mortality rates in cases of major abdominal surgery. Although perioperative blood transfusion is a usual redressing approach, it does not eliminate the risks and can itself lead to harmful results, reinforcing the necessity of preoperative optimization [6].

Despite increased awareness of its significance, preoperative anemia is underdiagnosed and undertreated in surgical care, especially in the resource-deprived environment [7]. Prompt detection and management by iron replacement, erythropoiesis-stimulating agents, or nutritional deficiency correction could potentially enhance outcomes, but the implementation is not regularized. This underscores the need to study the interaction between preoperative anemia and postoperative results rigorously and with a method to inform evidence-based perioperative care [8].

Given the rising global burden of abdominal surgeries and the significant prevalence of anemia in surgical populations, there is an urgent need to evaluate its implications on postoperative recovery and survival [9]. This study aims to assess the impact of preoperative anemia on postoperative morbidity and mortality in patients undergoing abdominal surgery, with a focus on complications, hospital stay, transfusion requirements, and short-term survival. In this way, it aims to be a part of the enlarging database supporting preoperative anemia screening and optimization as necessary parts of surgical care.

Methodology

Study Design: A hospital-based observational cohort study was employed to evaluate the impact of preoperative anemia on postoperative outcomes in patients undergoing abdominal surgery.

Study Setting: The study was performed in the Department of General Surgery of a tertiary care hospital, which provides services for elective and emergency surgical cases.

Study Population: All adult patients undergoing elective or emergency abdominal surgery during the study period were found to be eligible for inclusion.

Study Duration: The research was carried out for a period of 1 year.

Sample Size: A total of 194 patients were enrolled in the study, based on the inclusion and exclusion criteria.

Inclusion Criteria

- Adult patients (≥18 years) undergoing elective or emergency surgery of the abdomen.
- Patients with available complete preoperative hemoglobin reports.
- Patients who gave informed consent for enrollment.

Exclusion Criteria

- Patients with pre-existing hematological disorders (e.g., thalassemia, sickle cell disease).
- Patients with incomplete clinical or laboratory records.
- Previous abdominal surgery or reoperations within 30 days.

Sampling Technique: The Consecutive sampling technique was used, whereby all eligible patients who presented during the study duration were sampled until the desired sample size was reached.

Data Collection: Information was obtained on a structured proforma that encompassed patient demographics, comorbidities, surgery type, preoperative hemoglobin values, intraoperative information, postoperative complications, hospital stay days, need for blood transfusion, and 30-day mortality. Anemia was staged based on WHO criteria.

Study Procedure: Patients were categorized into two groups—preoperative anemia and non-preoperative anemia. Both groups were prospectively followed from the operative day through discharge and again for 30-day postoperative outcomes. All complications, including surgical site infection, pulmonary complications, cardiovascular complications, prolonged ileus, and death, were recorded.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed with SPSS version 25. Baseline characteristics were analyzed using descriptive statistics. Continuous data were presented as mean ± standard deviation, whereas categorical data were summarized as frequencies and percentages. Student's t-test and chi-square test were employed to test differences between groups. Multivariate logistic regression was used to account for confounding variables. A p-value of less than 0.05 was regarded as statistically significant.

Results

Table 1 showed that the baseline profiles between the anemic and non-anemic cohorts were generally similar, and there were no statistically significant differences in Age, sex allocation, or surgical procedure. Diabetes mellitus and hypertension

comorbidities occurred slightly more frequently among anemic patients, but not significantly. This supports that both cohorts were generally similar at baseline. Thus, differences in outcomes are likely to be due to preoperative anemia rather than confounding baseline variables.

Table 1: Baseline Characteristics of Study Population (n=194)

Parameter	Non-Anemic (n=116)	Anemic (n=78)	p-value
Mean Age (years)	46.8 ± 12.3	49.2 ± 13.1	0.21
Male: Female Ratio	1.4: 1	1.1: 1	0.34
Elective Surgeries (%)	68 (59%)	40 (51%)	0.28
Emergency Surgeries (%)	48 (41%)	38 (49%)	0.18
Diabetes Mellitus (%)	22 (19%)	20 (26%)	0.19
Hypertension (%)	28 (24%)	21 (27%)	0.42

Figure 1 shows that postoperative morbidity was significantly increased in anemic patients (44%) versus non-anemic patients (21%). This illustrates that preoperative anemia almost doubles the risk of a negative surgical outcome. The results emphasize anemia as a significant modifiable predictor of postoperative morbidity in abdominal surgery.

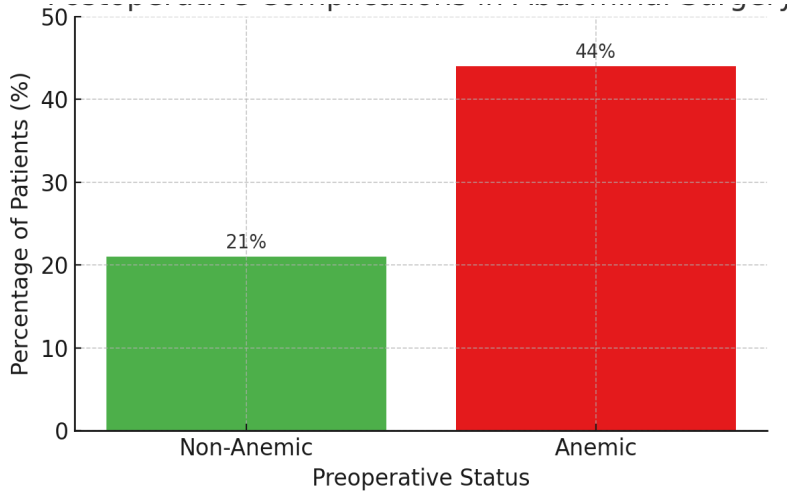

Figure 1: Postoperative complications in Abdominal surgery

Table 2 demonstrates that anemic patients also had a significantly higher incidence of surgical site infections and pulmonary complications than non-anemic patients. Prolonged ileus and cardiovascular complications were more common in the anemic group, although with borderline significance. Reoperation rates were also increased in the anemic patients, but this increase was not statistically significant. Notably, 30-day mortality was significantly higher in the anemic group, highlighting the adverse effect of preoperative anemia on survival.

Table 2: Postoperative Complications in Relation to Preoperative Anemia

Complication	Non-Anemic (n=116)	Anemic (n=78)	p-value
Surgical Site Infection	10 (9%)	14 (18%)	0.04*
Pulmonary Complications	8 (7%)	11 (14%)	0.03*
Prolonged Ileus	6 (5%)	9 (12%)	0.05
Cardiovascular Events	3 (3%)	7 (9%)	0.06
Reoperation	2 (2%)	5 (6%)	0.08
30-Day Mortality	2 (2.1%)	5 (6.5%)	0.04*

Figure 2 shows that the mean hospital length of stay was significantly longer in the anemic group (10.2 days) than in the non-anemic group (7.4 days). This indicates that anemia before surgery is a cause of prolonged recovery and higher use of healthcare. The more extended hospitalization is the result of greater rates of complications and the requirement for subsequent interventions. Shortening hospital stay and enhancing the efficiency of care may be achieved by correcting anemia before surgery.

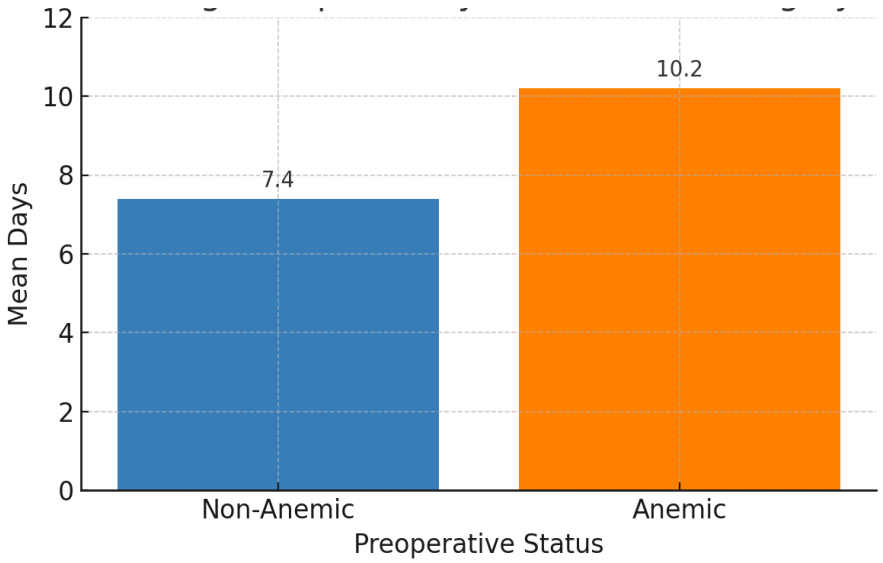

Figure 2: Average Hospital Stay in Abdominal Surgery

Table 3 demonstrates that anemic patients experienced much greater blood loss, need for transfusions, extended hospitalization, and increased ICU admission compared to non-anemic patients. While operative time was minimally longer in the anemic population, the difference was not significant. These results demonstrate that preoperative anemia significantly worsens perioperative resource use and outcomes.

Table 3: Perioperative Outcomes in Anemic vs Non-Anemic Patients

Outcome	Non-Anemic (n=116)	Anemic (n=78)	p-value
Mean Operative Time (min)	124 ± 25	131 ± 29	0.09
Mean Blood Loss (mL)	320 ± 80	410 ± 95	0.01*
Transfusion Requirement (%)	12 (10%)	27 (35%)	0.001*
Mean Hospital Stay (days)	7.4 ± 2.9	10.2 ± 3.8	0.001*
ICU Admission (%)	9 (8%)	15 (19%)	0.02*

Discussion

The current study proves that preoperative anemia is strongly correlated with poor postoperative outcomes in patients who are undergoing abdominal surgery. Anemic individuals had increased rates of surgical site infections, respiratory complications, longer ileus, and higher 30-day mortality rates compared to non-anemic individuals. In addition, perioperative events such as increased blood loss, increased transfusion needs, more extended hospital stay, and higher ICU admissions were more common in the anemic group. These results support the preoperative anemia as an independent predictor of adverse surgical outcomes. Our findings agree with the previous study, which found that preoperative anemia, even if mild, had a higher risk of morbidity and mortality following major non-cardiac surgery [10]. In the same vein, one study identified that anemic surgical patients had poorer short-term outcomes and higher healthcare costs. It proposed that anemia is not only a physiological burden but also a marker of susceptibility in surgical populations [11].

Past studies have all highlighted the connection between anemia and greater transfusion needs, a result supported in this study, wherein 35% of anemic patients received transfusions as opposed to merely 10% of non-anemic patients. This is important clinically because perioperative transfusions themselves are associated with immunomodulation, risk of infection, and worse recovery. The previous studies pointed out that anemic patients are often placed in a "vicious cycle" in which anemia results in transfusions, which further expose patients to other complications, thus multiplying morbidity and resource use [12,13] Our finding of extended hospital stays in anemic patients (10.2 compared with 7.4 days) corroborates the findings of the study, who characterized anemia as a worldwide public health issue with significant effects on recovery time and overall surgical effectiveness. This indicates that anemia not only aggravates clinical outcomes but also adds to enhanced healthcare burden and expense [14].

Notably, this work contributes to a growing body of evidence suggesting that preoperative anemia should be considered a modifiable risk factor, rather than a non-modifiable surgical comorbidity. Perioperative optimization with evidence-based interventions, including iron treatment,

erythropoiesis-stimulating agents, and nutritional support, has been promising in enhancing outcomes. One study indicated that intravenous iron therapy before surgery decreased transfusions and enhanced hemoglobin recovery postoperatively in patients undergoing major abdominal surgery [15]. Similarly, a previous study highlighted that preoperative anemia optimization programs are effective in reducing complications and improving survival [16]. Our research, by highlighting a distinct correlation between preoperative anemia and increased surgical adverse outcomes, points to the increased need for standard anemia screening and optimization procedures in surgical practice, particularly within limited resource settings.

Conclusion

The research concluded that preoperative anemia is a significant predictor of postoperative complications in abdominal surgery. Anemic subjects had increased complication rates, more transfusion requirements, longer postoperative stay, and higher mortality than their non-anemic counterparts. These results suggest that anemia cannot be overlooked as a benign preoperative finding, but rather should be recognized as a modifiable risk factor. Preoperative early detection and prompt correction through focused interventions, such as iron supplementation, nutritional therapy, and patient blood management measures, can significantly enhance surgical outcomes. Anemia optimization must be included in perioperative care protocols to minimize morbidity and optimize recovery.

Limitations

This research was conducted at a single tertiary care facility, which has a small sample size, and may limit generalizability. It did not account for all possible confounding variables, such as nutritional status or the severity of comorbidities. Long-term outcomes, measured after more than 30 days, were not evaluated.

Recommendations

Preoperative screening for anemia as a routine procedure should be incorporated into surgical practice. Early treatment by iron supplementation, nutritional support, and patient blood management protocols is advised. Large cohort multicenter studies with long-term follow-up are required to formulate standardized guidelines for the correction of anemia before abdominal surgery.

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