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ORIGINAL ARTICLE

Association of Preoperative Anemia with Postoperative Outcomes in Patients Undergoing Gastrointestinal Surgery: A Cross-Sectional Study

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ABSTRACT

Background: Preoperative anemia is a common clinical condition in patients undergoing gastrointestinal surgery and is associated with impaired oxygen delivery, reduced immune function, and delayed tissue healing. It is increasingly recognized as a significant predictor of adverse postoperative outcomes, particularly in resource-limited settings such as Pakistan.

Aim: To assess the impact of preoperative anemia on postoperative outcomes in patients with gastrointestinal surgery.

Methods: This cross-sectional study was done at Rawal Institute of Health Sciences and DHQ Teaching Hospital, from May 2022 to May 2023 involving 110 patients undergoing gastrointestinal surgery. Patients were categorized into anemic (Hb <13 g/dL in males, <12 g/dL in females) and non-anemic groups. Data on demographics, comorbidities, type of surgery, and postoperative outcomes—including surgical site infection (SSI), ICU admission, length of hospital stay, and mortality—were collected. Statistical analysis was performed using chi-square and independent t-tests, with $p < 0.05$ considered significant.

Results: Preoperative anemia was present in 52.7% of patients. Postoperative complications were significantly higher in the anemic group, including surgical site infections (36.2% vs 13.5%, p = 0.006), ICU admissions (27.6% vs 9.6%, p = 0.01), and prolonged hospital stay (>7 days) (58.6% vs 28.8%, p = 0.002). The mean hospital stay was also significantly longer in anemic patients (8.9 ± 3.6 days vs 6.1 ± 2.8 days, p = 0.001). Although mortality was higher in anemic patients (8.6% vs 3.8%), it was not statistically significant (p = 0.28).

Conclusion: Gastrointestinal surgery patients with preoperative anemia have higher post-operative morbidity. Intervention to correct anemia early may lead to better outcomes and reduced healthcare costs.

Keywords: Preoperative anemia, gastrointestinal surgery, postoperative complications, surgical site infection, ICU admission, hospital stay.

INTRODUCTION

Anemia is a prevalent hematological disorder seen before surgery in patients undergoing gastrointestinal (GI) surgery, especially in developing countries like Pakistan[1]. It occurs when hemoglobin levels are below the normal range, and is commonly linked to chronic disease, malnutrition, and covert or overt gastrointestinal bleeding. In surgical patients, particularly those with cancers, inflammatory bowel disease, peptic ulcer disease or bowel obstruction, the reported rates of anemia range from 40% to 60%, highlighting it as an important but often overlooked condition[2,3].

Of significance is that hemoglobin is essential in the delivery of oxygen to tissues. Oxygen is crucial for metabolic processes, immune response and wound repair[4]. Anemia reduces the oxygen-carrying capacity of the blood, leading to tissue hypoxia, impaired collagen formation and decreased leukocyte function, thereby affecting the postoperative course. As a result, anemic patients are at greater risk of complications including wound infection, wound healing delay, need for blood transfusion, longer hospital stay and ICU admission[5].

When it comes to gastrointestinal surgery, the impact of preoperative anemia is even more pronounced. Gastrointestinal blood loss, malabsorption, and anemia associated with malignancy play a major role in low hemoglobin concentrations[6]. Additionally, urgent surgical admissions may not allow for optimal preparation, further exacerbating risks. Despite its prevalence and impact on health, anemia is often neglected in the preoperative setting, especially in low- and middle-income countries[7].

Recent studies from abroad indicate that preoperative anemia is not only a reflection of the severity of the underlying disease, but also a predictor of poor post-operative outcomes[8]. It's associated with poor postoperative outcomes, increased hospital costs, and decreased survival. However, there is a lack of regional studies assessing the association of anemia with postoperative outcomes in our local population, where socioeconomic status, dietary patterns and access to health care may play a role in the prevalence and effect of anemia[9].

Therefore, this study aims to investigate the association between preoperative anemia and postoperative outcomes in patients undergoing gastrointestinal surgery. By analyzing key clinical endpoints such as surgical site infections, ICU admission, length of hospital stay, and mortality, this study seeks to provide evidence that may support early identification and targeted management of anemia as a modifiable risk factor in surgical practice[10].

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MATERIALS AND METHODS

This cross-sectional study was conducted at Rawal Institute of Health Sciences and DHQ Teaching Hospital over a duration of one year, from May 2022 to May 2023. We recruited 110 patients who underwent gastrointestinal (GI) surgeries using non-probability consecutive sampling.

The study included patients aged 18-70 years undergoing elective and emergency gastrointestinal surgical procedures such as appendicitis, intestinal obstruction, gastrointestinal perforation, hernias and gastrointestinal cancers. Those with a history of hematological diseases, chronic kidney disease, blood transfusion in the past two weeks, or receiving chemotherapy were excluded to avoid factors that could affect the hemoglobin level and postoperative complications.

The study involved a comprehensive history, physical examination and routine laboratory work-up in the preoperative period. Blood hemoglobin concentration was measured 24 hours before surgery, using automated hematology analyzers. Based on World Health Organization (WHO) criteria, patients were categorized into two groups: anemic (hemoglobin <13 g/dL in males and <12 g/dL in females) and non-anemic (hemoglobin ≥13 g/dL in males and ≥12 g/dL in females).

Age, sex, co-morbidities (such as diabetes and hypertension), surgical procedure and urgency of surgery (elective or emergency) and intraoperative findings were documented in a proforma.

Outcomes of interest were the incidence of surgical site infections (SSI), requirement for intensive care unit (ICU) care, length of stay and in-hospital death. Wound infections were defined as redness, pus discharge, swelling and wound opening.

Patients were followed until death or discharge. Data were entered and analysed in SPSS 26. Categorical variables were reported as number (percentage), and continuous variables as mean ± standard deviation. Chi-square test was used to determine the association between preoperative anemia and categorical postoperative outcomes and independent t-test for continuous variables. A p-value of <0.05 was considered statistically significant.

The study received ethical clearance from the institutional review boards of both hospitals, and informed consent was obtained from all patients before they were enrolled in the study.

RESULTS

The study recruited 110 patients who had gastrointestinal surgical operations. The mean age of the participants was 44.8 ± 13.2 years, with a male predominance (62 males, 56.4%) compared to females (48 females, 43.6%). Based on preoperative hemoglobin levels, 58 patients (52.7%) were classified as anemic, while 52 patients (47.3%) were non-anemic. The distribution of baseline characteristics between the two groups showed no statistically significant difference in terms of age and gender (p > 0.05), indicating comparability between groups. The number of patients with diabetes, hypertension and other co-morbidities was higher among the anemic group, although the difference was not statistically significant. Likewise, there was no significant difference in the number of emergency and elective surgeries between the two groups. These data indicate the two groups were similar at baseline, enabling a valid comparison of post-surgery outcomes (Table 1).

Preoperative anemia was significantly associated with occurrence of postoperative complications. Surgical site infections (SSI) were reported in 21 patients (36.2%) in the anemic group compared to 7 patients (13.5%) in the non-anemic group, demonstrating a statistically significant association (p = 0.006). Similarly, ICU admission was required in 16 anemic patients (27.6%) compared to 5 non-anemic patients (9.6%), which was also statistically significant (p = 0.01). Prolonged hospital stay (>7 days) was observed in 34 patients (58.6%) in the anemic group, significantly higher than 15 patients (28.8%) in the non-anemic group (p = 0.002). Although postoperative mortality was higher in anemic patients (5 patients, 8.6%) compared to non-anemic patients (2 patients, 3.8%), this difference did not reach statistical significance (p = 0.28). These results clearly show that preoperative anemia is a predictor of postoperative complications in patients undergoing gastrointestinal surgery (Table 2).

Overall, the combined results demonstrate that preoperative anemia is significantly associated with higher rates of postoperative complications, increased ICU admissions, and prolonged hospital stay, establishing it as an important and modifiable risk factor in gastrointestinal surgical practice.

Further evaluation of continuous variables demonstrated that the mean duration of hospital stay was significantly longer in anemic patients (8.9 ± 3.6 days) compared to non-anemic patients (6.1 ± 2.8 days, p = 0.001). This observation also supports a link between pre-operative anemia and a prolonged post-operative recovery period, signifying a greater health care burden and costs (Table 3).

Table 1: Baseline Demographic and Clinical Characteristics

Variable	Anemic (n=58)	Non-Anemic (n=52)	p-value
Mean Age (years)	45.6 ± 12.9	43.9 ± 13.6	0.48
Male	34 (58.6%)	28 (53.8%)	0.61
Female	24 (41.4%)	24 (46.2%)	—
Diabetes Mellitus	18 (31.0%)	11 (21.2%)	0.24
Hypertension	16 (27.6%)	10 (19.2%)	0.29
Emergency Surgeries	30 (51.7%)	22 (42.3%)	0.32
Elective Surgeries	28 (48.3%)	30 (57.7%)	—

Table 2: Postoperative Outcomes in Anemic vs Non-Anemic Patients

Outcome	Anemic (n=58)	Non-Anemic (n=52)	p-value
Surgical Site Infection	21 (36.2%)	7 (13.5%)	0.006
ICU Admission	16 (27.6%)	5 (9.6%)	0.01
Hospital Stay >7 days	34 (58.6%)	15 (28.8%)	0.002
Mortality	5 (8.6%)	2 (3.8%)	0.28

Table 3: Comparison of Continuous Outcome Variable

Variable	Anemic (n=58)	Non-Anemic (n=52)	p-value
Mean Hospital Stay (days)	8.9 ± 3.6	6.1 ± 2.8	0.001

DISCUSSION

This study shows that preoperative anemia is a predictor of poorer surgical outcomes in patients with gastrointestinal surgery[7]. More than half of the study population (52.7%) was found to be anemic, which is consistent with data reported from developing countries such as Pakistan, where nutritional deficiencies, chronic infections, and delayed healthcare access contribute to a higher burden of anemia. This supports the notion that anemia is not only prevalent but also of clinical importance in surgical patients[8].

A significant finding of this study is the higher rate of surgical site infections (SSI) in anemic patients. This may be due to oxygen transport by hemoglobin[8]. Oxygen is a critical substrate for collagen formation, new blood vessel formation and bacterial killing by white blood cells. Anemia decreases the oxygen supply to these functions, leading to wound infections and slow healing. This finding has been reported in foreign studies, which have shown that anemia is an independent risk factor for post-operative infection[9].

The research also report a higher incidence of ICU admissions in patients with anemia[10]. This is due to the decreased physiologic reserve in such patients, predisposing them to peri-operative hemodynamic instability and organ failure. Perioperatively, anemic patients have a reduced capacity to adapt to the stress of surgery due to reduced oxygen-carrying capacity, which may lead to complications requiring intensive care[11].

Another significant aspect of this study is the increased hospital stay of anemic patients. The anemic group had a longer mean hospital stay, possibly due to more complications, impaired wound healing and a prolonged recovery period. A longer hospital stay can lead to higher health care costs, as well as higher risk of hospital infections and deep vein thrombosis[12,13].

While the mortality rate was greater in anemic patients than in non-anemic patients, this was not significant. This could be because of the small sample size of the study, which results in reduced statistical power to observe differences in rare events such as death. However, the trend remains clinically significant and consistent with other evidence that anemia is a risk factor for mortality after surgery[14,15].

From a clinical standpoint, the study highlights that preoperative anemia is not just a lab finding, but a risk factor. Timely diagnosis through screening and appropriate management, such as iron supplements, nutritional support and addressing underlying causes, may impact surgical outcomes. For elective surgery, preoperative optimization of anemia should be encouraged, whereas in the acute setting, risk stratification and perioperative care are important[16-18].

This study has certain limitations. The study is cross-sectional, and therefore shows association but not cause and effect. This study also did not look at the severity or nature of the anemia which may have affected the results. However, it adds to the local evidence and highlights the need to focus on anemia in the surgical patient[19,20].

CONCLUSION

A high proportion of patients scheduled for gastrointestinal surgery have preoperative anemia, which is linked to greater post-surgical complications, such as surgical site infections, ICU admissions and longer hospital stays. While not statistically significant, the trend towards increased mortality is suggesting a meaningful effect.

Preoperative evaluation and early treatment of anemia should be considered as part of routine surgical practice. Considering anemia as a modifiable risk factor may lead to better postoperative outcomes, lower health-care costs and better quality of life in gastrointestinal surgical patients.

Availability of Data and Materials: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Authors' Contributions: M. A. Qureshi[1] conceptualized and designed the study. A. ur Rehman[2] and S. I. Alam[6] were responsible for data collection and patient recruitment. T. Hamid[3] performed statistical analysis and interpretation of results. R. Khan[4] contributed to manuscript drafting and literature review. R. Malik[5] critically reviewed and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

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