

ORIGINAL ARTICLE

Impact of Preoperative Anemia on Postoperative Outcomes in General Surgery and Gynecology patients

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ABSTRACT

Background: Anemia is a common clinical condition in surgical patients and can decrease tissue oxygen delivery, increase perioperative transfusion needs and negatively impact postoperative recovery. This investigation evaluated the effects of preoperative anemia on the postoperative results of patients who underwent general surgical and gynecological operations.

Methods: This prospective comparative observational study was conducted at Qazi Hussain Ahmad Medical Complex, Nowshera, and Timergara Medical College and DHQ Teaching Hospital from March 2023 to August 2023. Patients were randomly selected by consecutive sampling for total 82 patients undergoing general surgical or gynecological procedure were recruited. Patients were divided into two groups: an anemic group (preoperative hemoglobin level < 12 g/dl) and a non-anemic group (preoperative hemoglobin level ≥ 12 g/dl). Demographic, clinical, hematological, operative and postoperative data were recorded. Appropriate statistical tests were used to compare outcomes, and multivariable logistic regression to determine the independent predictors of postoperative complications. A p value < 0.05 was deemed as significant.

Results: Preoperative anemia was identified in 34 (41.5%) patients, while 48 (58.5%) had normal hemoglobin levels. Overall postoperative complications occurred more frequently among anemic than non-anemic patients (52.9% versus 20.8%, p = 0.003). Anemic patients had higher rates of postoperative blood transfusion (41.2% versus 10.4%, p = 0.001) and prolonged hospitalization (44.1% versus 16.7%, p = 0.006). Their mean hospital stay was also longer (6.8 ± 3.1 versus 4.2 ± 2.0 days, p < 0.001). Moderate or severe anemia was associated with poorer outcomes than mild anemia. After adjustment for potential confounders, preoperative anemia remained an independent predictor of postoperative complications (adjusted OR: 3.61; 95% CI: 1.25–10.41; p = 0.018).

Conclusion: Preoperative anemia was common and was independently associated with increased postoperative complications, blood transfusion requirements, and prolonged hospitalization. Early detection, investigation, and appropriate management of anemia before surgery may improve postoperative recovery and reduce perioperative morbidity.

Keywords: Preoperative anemia; postoperative complications; blood transfusion; general surgery; gynecology; length of hospital stay.

INTRODUCTION

Anemia is the condition of having a lower-than-normal amount of blood hemoglobin. Anemia is a condition in which there is less haemoglobin in the blood than is needed to supply the body's oxygen needs. It occurs commonly with those who are going to have surgery, and can occur due to iron deficiency, nutritional deficiency, chronic inflammation, renal failure, malignancy or continued blood loss. A decrease in the concentration of hemoglobin in surgical patients restricts the transport of oxygen in the blood and can make these patients more sensitive to the effects of anaesthesia, operative stress and blood loss. International guidelines for surgery therefore stress the need to screen surgical patients for anemia long before the surgery, so that the cause of anemia can be identified and treated^[1-3].

Anemia before surgery is seen as a significant perioperative risk factor. The previous studies have linked it to an increase in the morbidity and mortality rate in the postoperative period, as well as to intensive care admission, blood transfusion and longer hospital stay. A meta-analysis of patients undergoing surgery found poorer outcomes in the presence of anemia and a significantly higher rate of red-cell transfusion, but the differences between procedures and patients were large. Non-cardiac surgical evidence has also been more recent and has shown that patients with anemia face an increased risk following surgery compared to patients with normal levels of hemoglobin prior to surgery^[4-6].

The association between anemia and unfavorable outcomes may be explained through several mechanisms. Poor oxygen transport may slow healing of tissue, make the heart work harder and lower the reserve of the heart during surgery. Anemic patients will also be more likely to need red-cell transfusion perioperatively, especially if the procedure is long or there is significant blood loss.

While transfusion can save lives, additional exposures to blood products can cause adverse events and thereby drive up health care use. Preoperative anemia has been reported as being correlated with greater transfusion use, postoperative complications and morbidity, longer hospital stays, and higher treatment costs, in gynecological surgery. These concerns justify the incorporation of anemia assessment and treatment into patient blood-management programmes^[7-9].

General surgery and gynecology include a broad range of procedures with differing levels of operative complexity, anticipated blood loss, and postoperative risk. Nevertheless, evidence directly comparing the effect of anemia across these two patient groups remains limited, particularly in local healthcare settings. Determining its relationship with postoperative complications may support improved preoperative risk assessment and more effective use of limited blood-bank and hospital resources. Therefore, the present study was conducted to determine the frequency and severity of preoperative anemia and to evaluate its association with postoperative complications, perioperative blood transfusion, intensive care admission, and length of hospital stay among general surgery and gynecology patients treated at Qazi Hussain Ahmad Medical Complex, Nowshera, and Timergara Medical College and DHQ Teaching Hospital.

MATERIAL AND METHODS

This prospective comparative observational study was conducted at two tertiary-care hospitals: Qazi Hussain Ahmad Medical Complex, Nowshera, and Timergara Medical College and DHQ Teaching Hospital. The study was carried out over a six-month period from March 2023 to August 2023. The primary objective was to evaluate the impact of preoperative anemia on postoperative outcomes among patients undergoing general surgical and gynecological procedures. A total of 82 eligible patients were enrolled using a consecutive non-probability

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sampling technique. Patients were divided into anemic and non-anemic groups according to their preoperative hemoglobin levels.

Eligible patients were adult (age 18 or above) who were admitted for elective or emergency general surgical or gynecological procedures. Patients who were either male or female who were undergoing general or regional anesthesia for a major or intermediate procedure were included. Patients with incomplete clinical records, known hematological malignancy, active major bleeding prior to surgery, recent blood transfusion within 4 weeks, obstetric procedures related to pregnancy, and severe chronic illness which was likely to have an independent effect on the outcomes after surgery were excluded. Those who were not consented or surgery was cancelled were not included in the final analysis.

Demographic and clinical data were collected on a standardized data form after enrollment. The factors collected were: age, sex, BMI, type of admission, surgical specialty, comorbidities, ASA physical status classification, type of surgical procedure, approach and duration of surgery. Laboratory pre-operative tests performed were hemoglobin concentration, hematocrit level, mean corpuscular volume, mean corpuscular hemoglobin, total leucocyte count, and platelet count. Anemia was considered as hemoglobin < 13 g/dl in men and < 12 g/dl in women. Anemia was also defined as mild, moderate, or severe based on measured hemoglobin concentration.

Operative and postoperative data was collected prospectively. Anesthetic, surgical time, blood loss, complications during surgery, and transfusion of blood were the operative variables. Patients were followed during their hospital stay and for 30 days after surgery, if possible. The primary postoperative outcomes were the development of any postoperative complication, postoperative blood transfusion, surgical-site infection, wound dehiscence, other surgical-site hemorrhage, admission to the intensive care unit, reoperation, prolonged hospitalization, in-hospital readmission, and in-hospital death. The length of hospital stay was determined as the duration between surgery and discharge. All patients were routinely treated perioperatively and postoperatively, as per the protocols of the different surgical units.

The data were entered and analyzed using IBM SPSS Statistics. The quantitative data like age, Hb level, operation duration, EBL and hospital stay were reported as mean and SD or median and IQR depending upon the distribution of data. Frequencies and percentages were used to summarize categorical variables. Continuous and categorical variables were compared by the independent-samples t-test or the Mann-Whitney U test, respectively, and the chi-square test or Fisher's exact test was used. Logistic regression was used to determine independent risk factors for postoperative complications after adjustment for relevant confounding factors. Odds ratios with 95% confidence intervals were presented and a p value of less than 0.05 was deemed significant.

RESULTS

A total of 82 patients under general surgery and gynecological surgeries were studied. The mean age of the subjects was 44.6 ± 13.2 years (range 19 – 72 years). Of the total participants, 28 (34.1%) were male and 54 (65.9%) were female. Forty-five patients (54.9%) had undergone general surgical procedures and 37 patients (45.1%) had undergone gynecological procedures. In 34 patients (41.5%), an anemia was identified before surgery and 48 patients (58.5%) had a normal hemoglobin level preoperatively. Among the anemic patients, 19 (55.9%) had mild anemia, 12 (35.3%) had moderate anemia, and 3 (8.8%) had severe anemia. Patients with anemia had significantly lower mean Hb levels than those without anemia (10.2 ± 1.1 g/dL vs 13.4 ± 0.9 g/dL; $p < 0.001$).

Anemia was associated with patients having significantly higher age and ASA class than non-anemic patients. Similarly, anemic patients were more likely to have emergency surgery,

diabetes and hypertension, but the differences were not statistically significant.

The mean hemoglobin, hematocrit, mean corpuscular volume, and mean corpuscular hemoglobin levels were significantly reduced in anemic patients. No significant difference was seen in platelet count or total leukocyte count.

The blood loss estimated during surgery was significantly higher in anemic patients, as was also the duration of the surgery. The number of anemic patients who needed intraoperative blood transfusion was 32.4% versus 8.3% of non-anemic patients.

Overall, 28 patients (34.1%) experienced postoperative complications. Anemic patients had a significantly higher rate of complications compared to non-anemic patients (52.9% vs 20.8%, $p = 0.003$). The anemia group were also more likely to have had blood transfusion in the postoperative period and to be hospitalized for a longer duration. Anemic patients had a significantly longer hospital stay, at 6.8 ± 3.1 days, than non-anemic patients, 4.2 ± 2.0 days.

Moderate and severe anemia groups had significantly higher number of overall postoperative complications, number of blood transfusion and longer hospital stay than mild anemia group. They also had a much longer mean hospital stay.

The frequency of anemia was slightly higher among gynecology patients than among general surgery patients. However, no statistically significant differences were observed between the two specialties regarding complications, transfusion, ICU admission, or prolonged hospitalization.

After adjustment for age, emergency surgery, ASA class, operative duration, and blood loss, preoperative anemia remained independently associated with postoperative complications. Anemic patients had approximately 3.6 times higher odds of developing postoperative complications than non-anemic patients. Estimated blood loss of 300 mL or more was also identified as an independent predictor of adverse postoperative outcomes.

Table 1: Demographic and clinical characteristics according to preoperative anemia status

Variable	Anemic patients n=34	Non-anemic patients n=48	Total n=82	p-value
Age, years, mean $\pm$ SD	48.1 $\pm$ 12.7	42.1 $\pm$ 13.0	44.6 $\pm$ 13.2	0.041
Male sex	10 (29.4%)	18 (37.5%)	28 (34.1%)	0.449
Female sex	24 (70.6%)	30 (62.5%)	54 (65.9%)	
BMI, kg/m ² , mean $\pm$ SD	27.1 $\pm$ 4.2	26.3 $\pm$ 3.9	26.6 $\pm$ 4.0	0.374
General surgery	17 (50.0%)	28 (58.3%)	45 (54.9%)	0.456
Gynecology	17 (50.0%)	20 (41.7%)	37 (45.1%)	
Emergency surgery	12 (35.3%)	8 (16.7%)	20 (24.4%)	0.051
Diabetes mellitus	9 (26.5%)	7 (14.6%)	16 (19.5%)	0.181
Hypertension	13 (38.2%)	11 (22.9%)	24 (29.3%)	0.132
ASA class III or IV	10 (29.4%)	5 (10.4%)	15 (18.3%)	0.027

Table 2: Preoperative hematological findings

Hematological variable	Anemic patients n=34	Non-anemic patients n=48	p-value
Hemoglobin, g/dL	10.2 $\pm$ 1.1	13.4 $\pm$ 0.9	<0.001
Hematocrit, %	31.8 $\pm$ 3.7	40.2 $\pm$ 3.4	<0.001
Mean corpuscular volume, fL	78.9 $\pm$ 8.6	85.4 $\pm$ 6.9	<0.001
Mean corpuscular hemoglobin, pg	25.7 $\pm$ 3.2	28.9 $\pm$ 2.5	<0.001
Platelet count, $\times 10^9$ /L	286.4 $\pm$ 82.7	271.8 $\pm$ 69.5	0.386
Total leukocyte count, $\times 10^9$ /L	8.3 $\pm$ 2.4	7.8 $\pm$ 2.1	0.317

Table 3: Operative characteristics according to anemia status

Operative variable	Anemic patients n=34	Non-anemic patients n=48	p-value
Major surgery	24 (70.6%)	25 (52.1%)	0.092
Open surgery	23 (67.6%)	23 (47.9%)	0.077
General anesthesia	27 (79.4%)	34 (70.8%)	0.380
Operative duration, minutes	111.5 $\pm$ 33.8	92.6 $\pm$ 28.7	0.008
Estimated blood loss, mL	318.2 $\pm$ 176.5	201.4 $\pm$ 128.3	0.001
Intraoperative transfusion	11 (32.4%)	4 (8.3%)	0.005
Intraoperative complication	6 (17.6%)	3 (6.3%)	0.103

Table 4: Postoperative outcomes according to preoperative anemia status

Postoperative outcome	Anemic patients n=34	Non-anemic patients n=48	p-value
Any postoperative complication	18 (52.9%)	10 (20.8%)	0.003
Postoperative blood transfusion	14 (41.2%)	5 (10.4%)	0.001
Surgical-site infection	8 (23.5%)	4 (8.3%)	0.054
Postoperative hemorrhage	5 (14.7%)	2 (4.2%)	0.124
Wound dehiscence	4 (11.8%)	1 (2.1%)	0.153
ICU admission	7 (20.6%)	3 (6.3%)	0.055
Reoperation	4 (11.8%)	2 (4.2%)	0.226
Prolonged hospital stay	15 (44.1%)	8 (16.7%)	0.006
Readmission within 30 days	5 (14.7%)	2 (4.2%)	0.124
In-hospital mortality	2 (5.9%)	0 (0.0%)	0.169
Length of stay, days	6.8 ± 3.1	4.2 ± 2.0	<0.001

Table 5: Postoperative outcomes according to severity of anemia

Outcome	Mild anemia n=19	Moderate/severe anemia n=15	p-value
Any postoperative complication	7 (36.8%)	11 (73.3%)	0.034
Blood transfusion	5 (26.3%)	9 (60.0%)	0.047
Surgical-site infection	3 (15.8%)	5 (33.3%)	0.267
ICU admission	2 (10.5%)	5 (33.3%)	0.115
Prolonged hospital stay	5 (26.3%)	10 (66.7%)	0.018
Length of stay, days	5.6 ± 2.4	8.3 ± 3.3	0.009

Table 6: Comparison of postoperative outcomes between surgical specialties

Outcome	General surgery n=45	Gynecology n=37	p-value
Preoperative anemia	17 (37.8%)	17 (45.9%)	0.456
Any postoperative complication	16 (35.6%)	12 (32.4%)	0.764
Blood transfusion	10 (22.2%)	9 (24.3%)	0.822
Surgical-site infection	8 (17.8%)	4 (10.8%)	0.374
ICU admission	6 (13.3%)	4 (10.8%)	0.729
Prolonged hospital stay	13 (28.9%)	10 (27.0%)	0.852
Length of stay, days	5.4 ± 2.9	5.1 ± 2.8	0.640

Table 7: Logistic regression analysis for predictors of postoperative complications

Predictor	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Preoperative anemia	4.28 (1.64–11.18)	3.61 (1.25–10.41)	0.018
Age ≥50 years	2.24 (0.89–5.65)	1.72 (0.60–4.93)	0.312
Emergency surgery	3.14 (1.12–8.80)	2.46 (0.78–7.73)	0.124
ASA class III–IV	3.48 (1.08–11.19)	2.21 (0.60–8.14)	0.233
Operative duration >120 minutes	3.06 (1.14–8.20)	2.68 (0.91–7.91)	0.074
Blood loss ≥300 mL	4.02 (1.48–10.93)	3.29 (1.08–10.02)	0.036

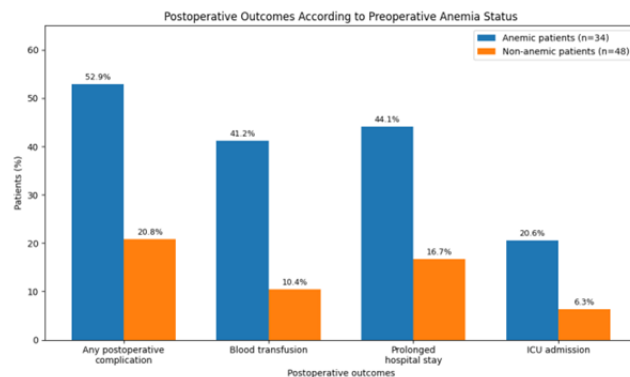


Figure 1: Comparison of postoperative outcomes between patients with and without preoperative anemia. Anemic patients had higher frequencies of postoperative complications, blood transfusion, prolonged hospital stay, and ICU admission.

Overall, the findings demonstrated that preoperative anemia was associated with increased blood transfusion requirements, longer hospitalization, and a greater frequency of postoperative complications. The adverse effect was more pronounced among patients with moderate or severe anemia.

DISCUSSION

The present study examined the effect of preoperative anemia on postoperative outcomes among 82 patients undergoing general surgical and gynecological procedures. Preoperative anemia was observed in 34 patients, representing 41.5% of the study population. Patients with anemia experienced a significantly higher frequency of overall postoperative complications than patients with normal hemoglobin levels. They also required more perioperative blood transfusions and had longer hospital stays. These findings indicate that preoperative anemia is an important and potentially modifiable factor associated with unfavorable surgical outcomes. Studies of non-cardiac surgical patients reported a comparable anemia prevalence of approximately 43.7% and found poorer postoperative outcomes among anemic patients^[10-12].

There was an overall postoperative complication rate of 52.9% in anemic patients, but 20.8% in non-anemic patients. Preoperative anemia was independently associated with postoperative morbidity with an adjusted odds ratio of 3.61 after adjustments for age, emergency surgery, ASA status, operative time, and blood loss. This is corroborated by earlier studies which reported that preoperative anemia was an independent predictor of composite postoperative morbidity despite accounting for the following clinical and surgical factors. Anemic patients might also have lower oxygen carrying capacity, which can affect their body's ability to oxygenate tissues, heal wounds and tolerate operative blood loss and surgical stress^[6,13-15].

Need for post-operative blood transfusion was significantly greater in anemic patients compared to non anemic patients. Intraoperative transfusion was required in 32.4% of anemic patients vs 8.3% of non-anemic patients and postoperative transfusion was required in 41.2% and 10.4% respectively. These findings are similar to the findings of others who have found low levels of hemoglobin prior to surgery to be a robust predictor of red-cell transfusion in the perioperative period. Research among inpatients with gynecological diseases very recently revealed a correlation between increased transfusion needs, higher complication rates, higher hospital charges and longer hospital stays, respectively, and preoperative anemia. Transfusion may be needed in patients with severe anemia or large blood loss during the operation, but may also lead to transfusion reactions, fluid overload, risk of infection, and need for additional resources. Identification and treatment of anemia prior to elective surgery, therefore, should help minimize unnecessary blood transfusion^[16-18].

The mean hospital stay was significantly longer for anemic patients (6.8 ± 3.1 days) than for non-anemic patients (4.2 ± 2.0 days) in the present study. The number of hospitalised patients was significantly higher in the anemic group (44.1%) than in the non-anemic group (16.7%). This could be attributed to a higher rate of complications, delayed recovery, higher transfusion requirements, and the need for more intensive post-operative care. Elective gynecological surgery also revealed that women with anemia prior to surgery had higher use of health care resources and higher costs of treatment. In the current study, there was no significant difference between the prevalence of anemia and the rates of postoperative complications among the general surgery and the gynecology groups, indicating that the negative effect of anemia might not be limited to a specific group of surgical procedures^[19,20].

The severity of anemia was also related to postoperative outcome. The frequencies of complications, transfusion and prolonged hospitalization were higher in patients with moderate and severe anemia compared to those with mild anemia. This dose-response trend supports the hypothesis that there is a

relationship between lower hemoglobin and higher perioperative risk. However, the results must be taken into account with certain limitations in mind. The study was conducted at 2 hospitals and comprised a relatively small number of studies, and the six-month time frame may restrict the generalizability of the study results. The procedures ranged in surgical complexity, blood loss, and recovery, some of which were general surgical and others gynecological. Not all participants received iron studies or other tests needed to find out what is causing their anemia. Moreover, because the study was statistically adjusted, some other unmeasured factors like urgency of surgery, nutritional status, inflammation, and malignancy could have affected results. Structured anemia screening and treatment programs need to be assessed in larger multicenter prospective studies to determine if the program can decrease complications, transfusion needs, and hospital days. There is current evidence for the importance of early diagnosis and active management of pre-operative anemia, but it is unclear which strategies of anemia optimization are beneficial between patients groups and more research is needed.

CONCLUSION

Preoperative anemia was common among general surgery and gynecology patients and was significantly associated with adverse postoperative outcomes. Anemic patients experienced more postoperative complications, greater perioperative blood transfusion requirements, increased operative blood loss, and longer hospitalization than non-anemic patients. Moderate or severe anemia was associated with worse outcomes than mild anemia. Preoperative anemia remained an independent predictor of postoperative complications after adjustment for major clinical and operative factors. Routine preoperative hemoglobin assessment, investigation of the underlying cause of anemia, and timely correction before elective surgery may help improve surgical recovery and reduce avoidable complications and transfusions. Patients requiring emergency surgery or those whose anemia cannot be fully corrected should receive individualized perioperative planning, careful blood-conservation measures, and close postoperative monitoring.

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