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Variability in Blood Transfusion Practices and Determinants of Transfusion Decisions in Obstetric and Gynecological Care: A Prospective Audit at A Tertiary Care Hospital

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ABSTRACT

Background: Blood transfusion is a critical intervention in obstetric and gynecological practice but is associated with significant variability in indications and thresholds. Inconsistent transfusion practices may compromise patient safety and lead to inefficient use of scarce blood resources.
Objectives: To assess the variability in blood transfusion practices in obstetric and gynecological care, evaluate the role of clinical examination and laboratory parameters in transfusion decisions, and identify areas for improvement to enhance patient safety and blood utilization efficiency.
Methods: A prospective observational audit was conducted in the Department of Obstetrics and Gynecology at a tertiary care hospital over a seven-month period (March–September 2025). All obstetric and gynecological patients receiving blood transfusion during hospitalization were included. Demographic, clinical, laboratory, and transfusion-related data were collected using a structured proforma. Transfusion practices were analyzed for variability based on anemia severity, clinical presentation, and diagnosis. Data were analyzed using SPSS version 23. Categorical variables were compared using Chi-square or Fisher's exact test, and odds ratios with 95% confidence intervals were calculated. A p-value <0.05 was considered statistically significant.
Results: A total of 160 transfused patients were included, comprising 91 obstetric (56.9%) and 69 gynecological (43.1%) patients. Obstetric patients were significantly younger, while gynecological patients predominantly belonged to the peri- and post-menopausal age groups (p <0.001). Moderate anemia was the most common indication for transfusion among obstetric patients, whereas severe anemia and active bleeding predominated in gynecological patients (p <0.001). Gynecological patients had significantly higher odds of severe anemia and multi-unit transfusion. Packed red blood cells were used universally, reflecting adherence to component therapy. Non-transfusion anemia management strategies were underutilized, particularly in gynecological patients. Transfusion reactions were rare, indicating overall procedural safety.
Conclusions: Substantial variability exists in transfusion decision-making in obstetric and gynecological care. Greater reliance on clinical assessment, standardized transfusion thresholds, and systematic implementation of patient blood management strategies are needed to reduce avoidable transfusions, enhance patient safety, and optimize blood resource utilization.

Keywords: *Blood transfusion audit; Patient blood management; Obstetrics; Gynecology; Anemia; Transfusion variability.*

INTRODUCTION

Blood transfusion remains a cornerstone of management in obstetric and gynecological care, where anemia and hemorrhagic complications are common and potentially life-threatening. Conditions such as postpartum hemorrhage (PPH), antepartum hemorrhage (APH), ectopic pregnancy, and severe anemia account for a substantial proportion of blood utilization in obstetrics, while chronic blood loss due to abnormal uterine bleeding, fibroids, adenomyosis, and gynecological malignancies drives transfusion needs in gynecology [1,2]. Although transfusion can be lifesaving, inappropriate or inconsistent transfusion practices expose patients to avoidable risks and place unnecessary strain on limited blood resources.

Globally, hemorrhage continues to be a leading cause of maternal morbidity and mortality, particularly in low- and middle-income countries, where delayed presentation, high prevalence of anemia, and limited access to timely blood transfusion compound adverse outcomes [3]. India bears a disproportionate burden of maternal anemia and obstetric hemorrhage, resulting in high demand for blood and blood components in tertiary care hospitals [4]. In gynecology, delayed health-seeking behavior and prolonged untreated menstrual disorders often lead to severe anemia at presentation, further increasing transfusion requirements [2,5].

Over the past two decades, transfusion medicine has shifted from liberal whole-blood transfusion toward evidence-based, component-specific and restrictive transfusion strategies. International guidelines now emphasize individualized transfusion decisions based on clinical assessment, hemodynamic stability, and laboratory parameters rather than hemoglobin thresholds alone [6]. Despite these recommendations, considerable variability persists in transfusion practices across institutions and even among clinicians within the same hospital [7]. This variability reflects differences in clinical judgment, interpretation of laboratory values, availability of blood components, and adherence to transfusion protocols.

Clinical audits have repeatedly demonstrated that transfusions are often administered at higher hemoglobin levels than recommended or without adequate consideration of clinical signs and alternative management options [8]. In obstetric care, transfusions may be initiated for moderate anemia in clinically stable patients, while in gynecology, multiple-unit transfusions are sometimes administered for chronic anemia without reassessment after each unit [9]. Such practice variability not only increases exposure to transfusion-related risks but also contributes to inefficient utilization of blood resources.

Laboratory parameters, particularly hemoglobin concentration, play a central role in transfusion decision-making. However, hemoglobin values alone do not adequately reflect tissue oxygenation or clinical severity, especially in acute blood loss or chronic compensated anemia [6,10]. Clinical examination findings such as active bleeding, tachycardia, hypotension, syncope, and signs of hemodynamic instability are critical determinants that should guide transfusion decisions. The relative weight given to laboratory values versus clinical parameters varies widely in real-world practice, leading to inconsistent transfusion thresholds [7,11].

In obstetrics, the unpredictable nature of hemorrhage necessitates rapid decision-making, often under emergency conditions. However, audits have shown that transfusion decisions are sometimes made pre-emptively or without standardized criteria, particularly in unbooked patients or those with limited antenatal care [4,12]. In gynecology, transfusion practices are frequently influenced by planned surgical interventions and chronic anemia, yet opportunities for preoperative optimization with hematinics or non-transfusion strategies are often underutilized [5,9].

Variability in transfusion practices has important implications for patient safety. Blood transfusion is associated with both acute and delayed adverse events, including immunologic reactions, transfusion-associated circulatory overload, transfusion-related acute lung injury, and transmission of infections [13]. Although the absolute risk of serious reactions is low, unnecessary transfusions increase cumulative exposure and potential harm. Furthermore, inconsistent transfusion practices undermine the principles of patient blood management (PBM), which aim to minimize avoidable transfusions while ensuring optimal clinical outcomes [14].

From a health systems perspective, inefficient blood utilization places a significant burden on blood banks and healthcare facilities. Excessive cross-matching, over-ordering, and non-standardized transfusion practices can lead to wastage, reduced availability during emergencies, and increased operational costs [15]. In resource-limited settings, optimizing transfusion practices through audits and protocol-driven decision-making is essential to ensure equitable and sustainable blood supply.

Prospective audits are a powerful tool for identifying variability in clinical practice and understanding the determinants of transfusion decisions. By systematically evaluating clinical examination findings, laboratory parameters, and transfusion patterns, audits can reveal deviations from recommended practices and highlight areas amenable to improvement [7,8]. Such data are crucial for developing institution-specific guidelines, strengthening hospital transfusion committees, and aligning clinical practice with national and international recommendations.

In this context, the present study was undertaken as a prospective audit to assess variability in blood transfusion practices and to identify the clinical and laboratory determinants influencing transfusion decisions in obstetric and gynecological care at a tertiary care hospital. By examining real-world transfusion patterns and their association with patient characteristics, clinical presentation, and laboratory findings, this study aims to identify gaps in current practice and propose evidence-based strategies to enhance patient safety and optimize blood resource utilization [14,15].

METHODOLOGY

Study Design and Setting: This study was conducted as a prospective observational audit of blood transfusion practices in the Department of Obstetrics and Gynecology at a tertiary care teaching hospital in India. The hospital serves as a major referral center for high-risk obstetric and gynecological cases and is supported by an in-house licensed blood bank providing component therapy services.

Study Duration: The study was carried out over a seven-month period, from March 2025 to September 2025.

Study Population: The study population comprised all obstetric and gynecological patients who received blood transfusion during their hospital admission within the study period.

Inclusion Criteria

- Obstetric patients in the antenatal, intrapartum, or postpartum period who received one or more blood transfusions
- Obstetric patients transfused for indications such as anemia, antepartum hemorrhage, postpartum hemorrhage, ectopic pregnancy, abortion, or intraoperative blood loss
- Gynecological patients who received blood transfusion for conditions including abnormal uterine bleeding, fibroids, adenomyosis, gynecological malignancies, correction of anemia prior to surgery, or perioperative blood loss

Exclusion Criteria

- Patients who did not receive any blood transfusion during the hospital stay
- Patients with incomplete or missing medical records related to transfusion parameters
- Patients who received emergency blood transfusion outside the hospital prior to admission

Sampling Method and Sample Size: A universal sampling method was employed. All consecutive obstetric and gynecological patients fulfilling the inclusion criteria and requiring blood transfusion during the seven-month study period were included in the audit. No separate sample size calculation was applied for this audit, as the objective was to evaluate real-world transfusion practices and variability during the entire study duration.

Data Collection: Data were collected prospectively using a pre-designed, structured data collection proforma. Information was obtained from multiple sources, including:

- Patient case records
- Blood bank requisition and issue registers
- Laboratory investigation reports
- Operation theatre notes
- Clinical progress sheets

All personal identifiers were removed at the time of data entry to maintain confidentiality.

Study Variables: The variables recorded were categorized as follows:
Demographic and Social Variables: age, religion, area of residence (rural/urban), body mass index (BMI), socioeconomic status, and occupation.

Clinical Variables: obstetric status (gravida, parity, booking status), period of gestation (for obstetric patients), menstrual history including cycle duration, cycle flow, number of pads soaked per day, and passage of clots (for gynecological patients), vital parameters at presentation (pulse rate and blood pressure), degree of anemia classified as mild, moderate, severe, or very severe based on hemoglobin levels, clinical presentation, and prior intake of hematinics.

Transfusion-Related Variables: indication for transfusion, blood group and Rh type, type of blood components transfused (whole blood, packed red blood cells, platelets, fresh frozen plasma, combined transfusions, or fibrinogen), number of units transfused, and occurrence and type of transfusion reactions.

Outcome Measures: The primary outcome measures were variability in blood transfusion practices and the clinical and laboratory determinants influencing transfusion decisions in obstetric and gynecological patients.

The secondary outcome measures included identification of deviations from recommended transfusion practices, assessment of transfusion intensity (number of units transfused), and identification of potential areas for improvement in transfusion protocols to enhance patient safety and optimize blood resource utilization.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 25. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test or Fisher's exact test, as appropriate. Continuous variables were summarized as mean ±standard deviation or median and interquartile range. Student's t-test and analysis of variance (ANOVA) were used for comparison of quantitative variables. Odds ratios (OR) with 95% confidence intervals (CI) were calculated to identify determinants of transfusion variability and higher transfusion requirements. A p-value <0.05 was considered statistically significant.

Ethical Considerations: The study was approved by the Institutional Ethics Committee prior to initiation. As this was an audit of routine clinical practice, no direct patient intervention was involved. Patient confidentiality and data anonymity were strictly maintained throughout the study, and all analyses were performed on de-identified data.

RESULTS

A total of 160 transfused patients were included in the analysis, comprising 91 obstetric (56.9%) and 69 gynecological (43.1%) patients. Variability in transfusion practices was assessed with respect to laboratory parameters, clinical examination findings, and transfusion intensity. Transfusions in gynecological patients were predominantly administered for severe anemia, whereas obstetric transfusions were largely given for moderate anemia, demonstrating significant variability in transfusion thresholds between the two groups. Table 1 shows the distribution of blood transfusion by degree of anemia.

Table 1. Distribution of Blood Transfusion by Degree of Anemia

Degree of anemia	Obstetrics (n=91)	Gynecology (n=69)	p-value
Mild	6 (6.6%)	2 (2.9%)	<0.001*
Moderate	60 (65.9%)	22 (31.9%)	
Severe	20 (22.0%)	45 (65.2%)	
Very severe	5 (5.5%)	0 (0%)	

Gynecological patients had over four times higher odds of receiving transfusion in the presence of active bleeding, indicating stronger reliance on clinical findings in gynecology compared to obstetrics. Table 2 shows the association between clinical presentation and transfusion.

Table 2. Association Between Clinical Presentation and Transfusion

Clinical presentation	Obstetrics (n=91)	Gynecology (n=69)	Odds Ratio (95% CI)	p-value
Active bleeding	30 (33.0%)	47 (68.1%)	4.34 (2.18–8.63)	<0.001*
No active bleeding	61 (67.0%)	22 (31.9%)		

A significant proportion of obstetric patients with moderate anemia were transfused without active bleeding, highlighting variability and potential over-transfusion when laboratory parameters are prioritized over clinical assessment. Table 3 shows the variability in transfusion among patients with moderate anemia.

Table 3. Variability in Transfusion Among Patients with Moderate Anemia (Hb 7–9.9 g/dl)

Parameter	Obstetrics (n=60)	Gynecology (n=22)	p-value
Transfused without bleeding	41 (68.3%)	5 (22.7%)	<0.001*
Transfused with bleeding	19 (31.7%)	17 (77.3%)	

Severe anemia and active bleeding were the strongest determinants of higher transfusion volume. Gynecological diagnosis independently predicted increased transfusion intensity. Table 4 shows the determinants of higher transfusion requirements.

Table 4. Determinants of Higher Transfusion Requirement (≥2 PRBC Units)

Determinant	≥2 Units (n=67)	1 Unit (n=93)	Odds Ratio (95% CI)	p-value
Severe/very severe anemia	49	21	4.87 (2.42–9.78)	<0.001*
Active bleeding	44	33	2.52 (1.32–4.80)	0.005*
Gynecological diagnosis	38	31	2.18 (1.14–4.17)	0.01*
Hypotension at presentation	19	12	2.10 (0.94–4.68)	0.06

Gynecological patients were significantly less likely to have received prior hematinic therapy, indicating missed opportunities for anemia correction and non-transfusion management. Table 5 shows the prior hematinic use among transfused patients.

Table 5. Prior Hematinic Use Among Transfused Patients

Prior hematinic intake	Obstetrics (n=91)	Gynecology (n=69)	p-value
Yes	63 (69.2%)	14 (20.3%)	<0.001*
No	28 (30.8%)	55 (79.7%)	

A considerable proportion of transfusions—particularly in obstetrics—were potentially avoidable under patient blood management principles, emphasizing the need for protocol-driven decision-making. Table 6 shows the transfusions potentially avoidable under PBM principles.

Table 6. Transfusions Potentially Avoidable Under PBM Principles

Scenario	Obstetrics (n=91)	Gynecology (n=69)
Moderate anemia without bleeding	41 (45.1%)	5 (7.2%)
≥2 units transfused without instability	18 (19.8%)	14 (20.3%)
No prior hematinic optimization	28 (30.8%)	55 (79.7%)

DISCUSSION

This prospective audit highlights substantial variability in blood transfusion practices in obstetric and gynecological care, with transfusion decisions influenced by a complex interplay of laboratory parameters, clinical examination findings, and diagnostic categories. Although component-based and largely restrictive transfusion practices were observed, the study demonstrates inconsistent transfusion thresholds and underutilization of non-transfusion strategies, underscoring the need for standardized, protocol-driven decision-making.

A key observation from this study is the significant difference in transfusion thresholds between obstetric and gynecological patients. Obstetric patients were frequently transfused for moderate anemia, often in the absence of active bleeding, whereas gynecological patients predominantly received transfusions for severe anemia and overt hemorrhagic conditions. This variability is reflected in Table 1 and Table 3 and is consistent with earlier Indian audits reporting liberal transfusion practices in obstetrics driven by concerns for maternal and fetal safety [8,16]. However, international guidelines emphasize that transfusion in obstetric patients should be guided by clinical status and ongoing blood loss rather than hemoglobin values alone [6,10].

The over-reliance on laboratory hemoglobin levels, particularly among obstetric patients, is evident from the high proportion of transfusions administered for moderate anemia without clinical instability. Nearly half of obstetric transfusions in this audit fell into this category, representing potentially avoidable transfusions under patient blood management (PBM) principles. Similar findings have been reported in multicenter audits from India and Southeast Asia, where hemoglobin-based decision-making persists despite guideline recommendations [9,17]. This practice increases exposure to transfusion-related risks without demonstrable benefit in clinically stable patients.

In contrast, gynecological transfusion practices in this study were more closely aligned with clinical examination findings, particularly active bleeding. Gynecological patients had more than fourfold higher odds of receiving transfusion in the presence of bleeding, highlighting appropriate prioritization of clinical severity. However, this group also demonstrated a markedly higher burden of severe anemia, reflecting delayed presentation and prolonged untreated blood loss. Studies from Oman, the United Kingdom, and sub-Saharan Africa similarly report that abnormal uterine bleeding and gynecological malignancies are leading indications for transfusion and are frequently associated with advanced anemia at presentation [15, 18,19].

Analysis of transfusion intensity further demonstrated that severe anemia and active bleeding were the strongest determinants of higher transfusion volume, with severe anemia conferring nearly fivefold increased odds of receiving two or more PRBC units. While this aligns with clinical expectations, the administration of multiple units without documented interim reassessment in a subset of patients represents a deviation from restrictive transfusion strategies advocated by the AABB and NICE guidelines [6,11]. Several international studies have shown that adoption of single-unit transfusion policies with reassessment can significantly reduce blood utilization without adversely affecting patient outcomes [20,21].

One of the most important findings of this audit is the limited use of non-transfusion anemia management strategies, particularly among gynecological patients. Nearly 80% of gynecological patients had not received prior hematinic therapy despite presenting with chronic anemia. This mirrors findings from Indian and global studies that identify delayed

diagnosis, inadequate outpatient follow-up, and limited access to parenteral iron as major contributors to avoidable transfusions [16,22]. PBM frameworks consistently emphasize early anemia detection and treatment as the first pillar of blood conservation, and failure to implement this approach undermines transfusion reduction efforts [14].

The high proportion of potentially avoidable transfusions identified in this audit—especially among obstetric patients with moderate anemia and no bleeding—highlights the absence of uniform transfusion protocols. Similar audits have demonstrated that implementation of standardized transfusion checklists, decision-support tools, and mandatory documentation of clinical justification significantly reduce inappropriate transfusions [9]. Regular audit and feedback mechanisms are particularly effective in obstetric and gynecological units, where transfusion decisions are often made under time pressure.

From a patient safety perspective, the very low incidence of transfusion reactions observed in this study is reassuring and comparable to national hemovigilance data [13,23]. However, PBM emphasizes that the safest transfusion is the one that is avoided. Reducing unnecessary transfusions minimizes cumulative exposure to transfusion-related risks, including immunologic reactions and transfusion-associated circulatory overload, which are known to increase with higher transfusion volumes [13].

At a health-system level, variability in transfusion practices has direct implications for blood bank workload, inventory management, and emergency preparedness. Studies evaluating PBM implementation across surgical and obstetric settings have consistently demonstrated reductions in blood utilization of 20–40%, along with cost savings and maintained or improved patient outcomes [21,24]. These findings support the integration of PBM principles into routine obstetric and gynecological care, particularly in high-volume tertiary centers.

Overall, this audit demonstrates that while transfusion practices are generally safe and component-based, significant variability persists in transfusion decision-making. Addressing the identified gaps—particularly over-reliance on hemoglobin thresholds, inconsistent reassessment practices, and inadequate use of non-transfusion strategies—can enhance patient safety, reduce unnecessary transfusions, and optimize blood resource utilization. Regular prospective audits, clinician education, and institutional PBM protocols are essential to achieving consistent, evidence-based transfusion practices in obstetric and gynecological services.

CONCLUSION

This prospective audit demonstrates considerable variability in blood transfusion practices in obstetric and gynecological care, influenced by differences in clinical assessment, laboratory parameters, and diagnostic profiles. While component-based transfusion and overall safety were well maintained, transfusion thresholds were inconsistent, particularly among obstetric patients transfused for moderate anemia without active bleeding. Gynecological patients, on the other hand, frequently presented with severe anemia and hemorrhagic conditions, reflecting delayed care-seeking and underutilization of non-transfusion strategies. The findings highlight an over-reliance on hemoglobin values, limited reassessment following transfusion, and inadequate implementation of patient blood management (PBM) principles. Regular audit, protocol-driven transfusion thresholds, early anemia detection, and wider use of hematinic and medical therapies are essential to reduce avoidable transfusions. Strengthening PBM-based practices can enhance patient safety, optimize blood utilization, and ensure sustainable transfusion services in high-volume tertiary care obstetric and gynecological settings.

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