Research Article

Prevalence and Indications of Blood And Blood Component Transfusion Among Obstetric Patients in A Tertiary Care Hospital: A Cross-Sectional Study

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Abstract

Background: Blood transfusion is a critical component of obstetric care, particularly in the management of postpartum haemorrhage (PPH), anaemia, and other causes of significant maternal blood loss. Despite advances in obstetric care, the requirement for blood and blood components remains an important indicator of severe obstetric morbidity. Identification of clinical factors associated with increased transfusion requirements may facilitate early risk stratification and improve transfusion preparedness.

Objective: To determine the indications and patterns of blood and blood component transfusion among obstetric patients and to identify factors independently associated with massive transfusion in a tertiary care hospital.

Methods: This hospital-based cross-sectional observational study was conducted in the Department of Obstetrics and Gynaecology at Sree Balaji Medical College and Hospital, Chennai, over a period of six months from September 2025 to February 2026. A total of 120 obstetric patients who received blood or blood component transfusion during hospital admission were included using consecutive sampling. Demographic characteristics, obstetric profile, indications for transfusion, blood component utilization, clinical characteristics, and maternal and neonatal outcomes were recorded using a structured proforma. Written informed consent was obtained from all participants before enrolment, and confidentiality of patient information was maintained. Data were analysed using IBM SPSS version 26. Categorical variables were analysed using the chi-square test or Fisher's exact test, while appropriate tests were used for continuous variables. Multivariate logistic regression was performed to identify independent predictors of massive transfusion, defined as administration of ≥4 units of PRBCs. A p-value <0.05 was considered statistically significant.

Results: The majority of patients were aged 21–30 years (65.0%) and were multigravida (56.7%). Antenatal anaemia was present in 85.0% of patients, with 75.0% having mild-to-moderate anaemia and 10.0% having severe anaemia. Postpartum haemorrhage was the most common indication for transfusion (37.5%), followed by postpartum anaemia (16.7%) and antenatal anaemia (16.7%). Antepartum haemorrhage accounted for 4.2% of transfusion indications. Packed red blood cells were administered to all patients (100%), while fresh frozen plasma was administered to 51.7%, platelets to 23.3%, cryoprecipitate to 10.0%, and whole blood to 15.0%. Massive transfusion was required in 20.0% of patients. On multivariate analysis, obesity (AOR 4.12, 95% CI: 1.24–13.74; p=0.021), severe antenatal anaemia (AOR 4.22, 95% CI: 1.10–16.10; p=0.036), PPH (AOR 3.89, 95% CI: 1.42–10.60; p=0.008), and hypertension (AOR 2.76, 95% CI: 1.01–7.52; p=0.047) were identified as independent predictors of massive transfusion.

Conclusion: Postpartum haemorrhage and anaemia were the predominant indications for blood and blood component transfusion among obstetric patients. The substantial requirement for multiple blood components and massive transfusion reflects the severity of obstetric complications encountered in this population. Obesity, severe antenatal anaemia, PPH, and hypertension were independent predictors of massive transfusion, highlighting the importance of early risk identification and preparedness for major obstetric haemorrhage. Strengthening antenatal anaemia screening and treatment, timely recognition and management of PPH, and implementation of standardized patient standardized transfusion practices strategies may help optimize transfusion practices and improve maternal outcomes.

Keywords: Obstetric transfusion; postpartum haemorrhage; antenatal anaemia; blood components; massive transfusion; standardized transfusion practices.

Introduction

Blood transfusion is a critical component of emergency obstetric care and plays a vital role in reducing maternal morbidity and mortality, particularly in cases of postpartum hemorrhage and severe anemia. Postpartum hemorrhage remains the leading direct cause of maternal death globally, contributing to nearly 25–30% of all maternal deaths despite the availability of effective preventive strategies [1]. Globally, an estimated 287,000 maternal deaths occur each year, with a maternal mortality ratio of approximately 223 per 100,000 live births, and nearly 95% of these deaths occur in low- and middle-income countries, reflecting disparities in access to quality obstetric and transfusion services [2]. Clinical guidelines emphasize that early recognition of hemorrhage and timely administration of blood and blood components are essential in preventing adverse maternal outcomes [3].

Blood transfusion in obstetrics is commonly indicated in postpartum hemorrhage, antepartum hemorrhage, ruptured ectopic pregnancy, placental abnormalities, and severe anemia complicating pregnancy [4]. In addition to its therapeutic role, transfusion has emerged as a key indicator of severe maternal morbidity, accounting for more than 40% of such cases, thereby reflecting the burden of critical obstetric complications within healthcare systems [5]. Over recent years, there has been increasing emphasis on patient standardized transfusion practice strategies, which focus on optimizing hemoglobin levels, minimizing blood loss, and promoting rational use of blood products in obstetric care [6].

Several risk factors significantly increase the likelihood of transfusion in obstetric patients, including uterine atony, placenta previa and accreta spectrum, hypertensive disorders, operative delivery, and pre-existing anemia [7]. Anemia remains a major global public health problem, affecting approximately 36–40% of pregnant women worldwide, particularly in low-resource settings, thereby increasing vulnerability to hemorrhage and the need for transfusion [8]. Contemporary guidelines recommend the use of blood component therapy, including packed red blood cells, fresh frozen plasma, and platelets, rather than whole blood, to improve clinical outcomes and reduce complications [9].

Recent studies have demonstrated considerable variability in transfusion practices across institutions, with transfusion rates ranging from 2% to 10% of obstetric admissions depending on case mix, resource availability, and clinical protocols [10]. National health systems have increasingly advocated for standardized patient standardized transfusion

protocols to ensure appropriate utilization of blood products and to reduce unnecessary transfusions [11]. Postpartum hemorrhage is clinically defined as blood loss exceeding 500 mL following vaginal delivery and 1000 mL following cesarean section, with severe hemorrhage involving blood loss greater than 1500 mL or the requirement of four or more units of blood transfusion [12].

Massive obstetric hemorrhage requires rapid, multidisciplinary management, including prompt transfusion support, to prevent progression to shock and organ failure [13]. Despite improvements in transfusion safety, complications such as transfusion reactions and transfusion-related acute lung injury occur in approximately 1–3% of cases, necessitating careful monitoring and adherence to safety protocols [14]. Furthermore, maternal anemia continues to contribute significantly to transfusion requirements and adverse outcomes, particularly in low-resource settings where nutritional deficiencies and inadequate antenatal care remain prevalent [15].

In this context, evaluating the prevalence, indications, and patterns of blood and blood component transfusion among obstetric patients in a tertiary care hospital is essential for improving clinical decision-making, optimizing blood utilization, and enhancing maternal healthcare outcomes.

METHODOLOGY

This study was designed as a hospital-based cross-sectional observational study conducted in the Department of Obstetrics and Gynaecology at Sree Balaji Medical College and Hospital, Chennai, a tertiary care teaching institution with comprehensive obstetric services and an established blood bank facility. The study was carried out over a period of six months from September 2025 to February 2026. The study population included all obstetric patients, both antenatal and postnatal, who were admitted to the department and received blood or blood component transfusion during their hospital stay within the study period.

The sample size was calculated using Dobson's formula for prevalence studies, considering a confidence level of 95%, an assumed prevalence of 50% to obtain the maximum sample size, and a precision of 9%. Based on this

calculation, the required sample size was approximately 118.6, which was rounded off to 120 participants to ensure adequate statistical power. A consecutive sampling technique was employed, wherein all eligible patients meeting the inclusion criteria were enrolled until the desired sample size was achieved.

Inclusion criteria comprised all obstetric patients who required blood or blood component transfusion during their hospital admission and provided informed consent to participate in the study. Patients who had received transfusion outside the hospital or those who were unwilling or unable to provide consent were excluded from the study. Written informed consent was obtained from all participants prior to inclusion, and confidentiality of patient information was strictly maintained throughout the study.

Data collection was carried out using a structured and predesigned proforma. Relevant information including demographic details such as age, parity, and socioeconomic status, along with obstetric history, clinical diagnosis, and indication for transfusion, was recorded. Detailed transfusion-related data were collected, including the type and quantity of blood components administered, such as packed red blood cells, fresh frozen plasma, platelets, cryoprecipitate, or whole blood where applicable. Clinical parameters at the time of transfusion decision, including vital signs, obstetric shock index, and Modified Early Obstetric Warning Score, were documented. Laboratory investigations, including hemoglobin levels, hematocrit, platelet count, coagulation profile, and fibrinogen levels, were recorded both before transfusion and within 6–24 hours after transfusion to assess response.

Additional data regarding obstetric complications, estimated blood loss, classification of postpartum hemorrhage, and interventions such as use of uterotonics, tranexamic acid, or surgical procedures were also documented. Blood bank-related parameters including cross-match details, time from requisition to issue of blood, and component utilization ratios were collected to evaluate transfusion practices. Outcomes were assessed in terms of hemodynamic stabilization, hemoglobin increment, need for intensive care unit admission, duration of hospital stay, maternal complications, and neonatal outcomes where applicable. Transfusion-related adverse events were monitored and categorized based on standard definitions, including febrile non-hemolytic reactions, allergic reactions, hemolytic reactions, transfusion-associated circulatory overload, and transfusion-related acute lung injury.

All collected data were cross-verified using patient case records and blood bank registers to ensure accuracy and completeness. Data entry was performed using Microsoft Excel, and statistical analysis was carried out using IBM SPSS software version 26. Descriptive statistics were used to summarize the data, with continuous variables expressed as mean ± standard deviation and categorical variables presented as frequencies and percentages. Inferential statistical tests such as the chi-square test or Fisher's exact test were applied for categorical variables, while independent t-test or Mann–Whitney U test was used for continuous variables as appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Human Ethics Committee prior to commencement. The study was purely observational in nature, with no intervention or alteration in standard patient care. All procedures adhered to ethical principles, and participants were assured that their decision to participate or withdraw would not affect their treatment in any manner.

RESULTS

Table 1. Baseline Demographic and Obstetric Characteristics

Category	Frequency (n) (n=120)	Percentage (%)
Age		
≤20	14	11.7
21–30	78	65.0
>30	28	23.3
Residence		

Urban	73	60.8
Rural	47	39.2
Gravidity		
Primigravida	52	43.3
Multigravida	68	56.7
Mode of Delivery		
Vaginal Delivery	42	35.0
LSCS	60	58.3
Instrumental Delivery	18	6.7
Onset of Labour		
Spontaneous labour	78	65.0
Induced labour	42	35.0
BMI		
Normal	63	52.5
Overweight	34	28.3
Obese	23	19.2
Medical Comorbidities		
None	69	57.5
Hypertension	24	20.0
Diabetes mellitus	16	13.3
Hypothyroidism	11	9.2
Antenatal Anemia		
No anemia	18	15.0
Mild–Moderate	90	75.0
Severe	12	10.0

Table 1 presents the baseline demographic and obstetric characteristics of the 120 obstetric patients who received blood or blood component transfusion. Most women were aged 21–30 years (65.0%), resided in urban areas (60.8%), and were multigravida (56.7%). LSCS was the most common mode of delivery (58.3%), followed by vaginal delivery

(35.0%), while spontaneous labour occurred in 65.0% of patients. More than half of the women had a normal BMI (52.5%), and hypertension (20.0%) was the most common medical comorbidity. Antenatal anaemia was highly prevalent, with 75.0% having mild-to-moderate anaemia and 10.0% having severe anaemia, while only 15.0% had no anaemia, indicating that anaemia was a major clinical characteristic among transfused obstetric patients.

Table 2. Indications for Blood/Component Transfusion

Indication	Frequency	%
Postpartum haemorrhage	45	37.5
Postpartum anaemia	20	16.7
Antenatal anaemia	20	16.7
Antepartum haemorrhage	5	4.2
Placenta previa	10	8.3
Placenta accreta spectrum	3	2.5
Intraoperative blood loss	7	5.8
DIC / Coagulopathy	4	3.3
Thrombocytopenia	3	2.5
Abortion-related haemorrhage	2	1.7
Others	1	0.8
Total	**120**	**100**

Table 2 shows the indications for blood and blood component transfusion among the 120 obstetric patients. Postpartum haemorrhage was the most common indication, accounting for 37.5% of transfusions, followed by postpartum anaemia (16.7%) and antenatal anaemia (16.7%). Placenta previa contributed to 8.3% of transfusions, while intraoperative blood loss accounted for 5.8% and antepartum haemorrhage for 4.2%. Less common indications included DIC/coagulopathy (3.3%), placenta accreta spectrum (2.5%), thrombocytopenia (2.5%), abortion-related haemorrhage (1.7%), and other causes (0.8%). Overall, obstetric haemorrhage and anaemia were the predominant indications for blood and blood component transfusion in the study population.

Table 2A. Causes of Antepartum Harmorrhage (n=10)

Cause	Frequency	%
Placenta previa	5	50
Placental abruption	3	30
Vasa previa	1	10
Others	1	10

Table 2A presents the causes of antepartum haemorrhage (APH) among the 10 patients with APH. Placenta previa was the most common cause, accounting for 50.0% of cases, followed by placental abruption (30.0%). Vasa previa and other causes each contributed 10.0% of APH cases. These findings indicate that placental disorders, particularly placenta previa, were the leading causes of antepartum haemorrhage among transfused obstetric patients in the present study.

Table 3. Components and Quantity of Transfusion

Component	Median Units (IQR)	Patients Receiving n (%)
PRBC	2 (1–3)	120 (100%)
FFP	2 (0–4)	62 (51.7%)
Platelets	4 RDP equivalents	28 (23.3%)
Cryoprecipitate	6 (4–10)	12 (10%)
Whole Blood	1 (1–1)	18 (15%)

Table 3 summarizes the blood components administered to the study participants. Packed red blood cells (PRBCs) were transfused to all patients (100%), with a median of 2 units (IQR: 1–3), making them the most commonly used blood component. Fresh frozen plasma (FFP) was administered to 51.7% of patients with a median of 2 units, while platelet transfusions were required in 23.3% of cases, with a median of 4 random donor platelet (RDP) equivalents. Cryoprecipitate was transfused to 10.0% of patients, with a median of 6 units, and whole blood was administered to 15.0% of patients, usually as a single unit. These findings indicate that although PRBC transfusion was universal, a substantial proportion of patients also required additional blood components for the management of obstetric haemorrhage and coagulation abnormalities.

Figure 1: Proportion of obstetric patients requiring massive transfusion (≥4 units of packed red blood cells). Twenty percent (20%) of patients required massive transfusion, while 80% did not require massive transfusion.

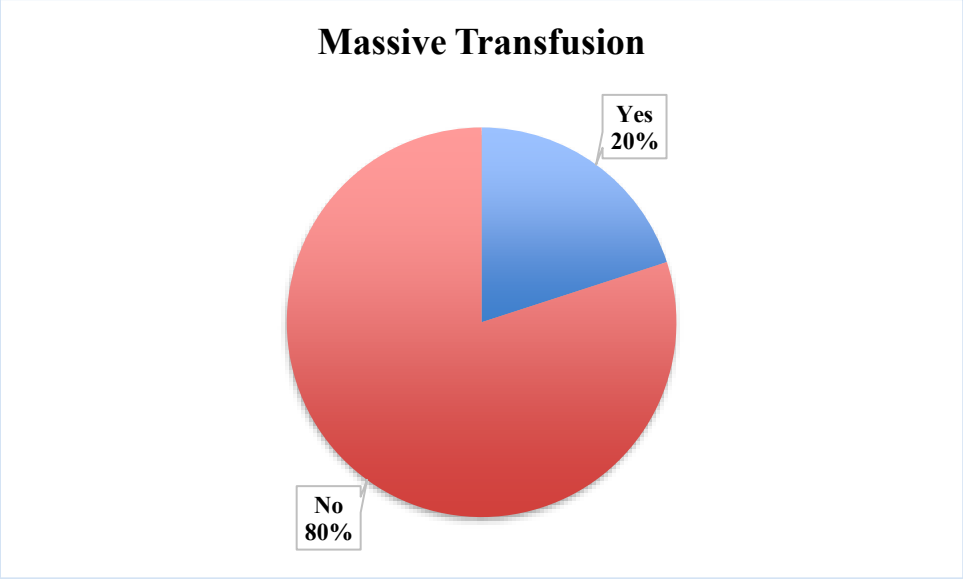


Figure 1 illustrates the proportion of obstetric patients who required massive transfusion, defined as the administration of ≥4 units of PRBCs. In the present study, 20% of patients underwent massive transfusion, while the remaining 80% did not require such high-volume blood replacement.

This distribution indicates that although most obstetric patients received limited transfusion support, a significant

subset — one in five — experienced hemorrhage or clinical instability severe enough to necessitate large-volume transfusion. The 20% massive transfusion rate underscores the critical burden of severe obstetric hemorrhage and highlights the need for rapid blood bank responsiveness, multidisciplinary teamwork, and early recognition of patients at risk.

Table 4. Univariate Analysis

Category	Massive Transfusion YES (n=24) n (%)	Massive Transfusion NO (n=96) n (%)	OR (95% CI)	p-value
BMI				
Normal	6 (9.5)	57 (90.5)	Reference	—
Overweight	8 (23.5)	26 (76.5)	2.92 (0.91-9.35)	0.071
Obese	10 (43.5)	13 (56.5)	7.31 (2.24-23.86)	0.001
Antenatal Anaemia				
None	1 (5.5%)	17 (94.5%)	Reference	—
Mild–Moderate	10 (16.1%)	52 (83.9%)	3.33 (0.40–27.2)	0.263
Severe	13 (32.5%)	27 (67.5%)	8.80 (1.10–69.6)	0.04
PPH				
No	6 (8.8%)	62 (91.2%)	Reference	—
Yes	18 (34.6%)	34 (65.4%)	5.64 (2.18–14.5)	<0.001
APH				
No	16 (15.7%)	86 (84.3%)	Reference	—
Yes	8 (44.4%)	10 (55.6%)	4.22 (1.43–12.4)	0.009
Mode of Delivery				
Vaginal	5 (20.8)	37 (38.5)	Reference	—
LSCS	17 (70.8)	43 (44.8)	2.38 (0.82–6.93)	0.11
Instrumental	2 (8.3)	16 (16.7)	2.47 (0.39–15.40)	0.332

Onset of Labour				
Spontaneous	12 (50.0)	66 (68.8)	Reference	—
Induced	12 (50.0)	30 (31.2)	2.20 (0.90–5.34)	0.083
Hypertension				
No	14 (58.3)	82 (85.4)	Reference	—
Yes	10 (41.7)	14 (14.6)	4.18 (1.56–11.20)	0.004
Diabetes Mellitus				
No	18 (75.0)	86 (89.6)	Reference	—
Yes	6 (25.0)	10 (10.4)	2.87 (0.93–8.84)	0.067
Hypothyroidism				
No	20 (83.3)	89 (92.7)	Reference	—
Yes	4 (16.7)	7 (7.3)	2.54 (0.70–9.18)	0.157

Table 4 presents the univariate analysis of factors associated with the requirement for massive transfusion (≥4 units of PRBC). A significant association was observed between BMI and massive transfusion, with obese women having more than sevenfold higher odds of requiring massive transfusion compared with women with normal BMI (OR: 7.31, 95% CI: 2.24–23.86; p = 0.001), while the association for overweight women was not statistically significant (p = 0.071).

Women with severe antenatal anaemia were significantly more likely to require massive transfusion than those without anaemia (OR: 8.80, 95% CI: 1.10–69.60; p = 0.040), whereas mild-to-moderate anaemia was not significantly associated. Postpartum haemorrhage (PPH) was a strong predictor of massive transfusion, increasing the odds by more than fivefold (OR: 5.64, 95% CI: 2.18–14.50; p < 0.001). Similarly, antepartum haemorrhage (APH) was significantly associated with massive transfusion (OR: 4.22, 95% CI: 1.43–12.40; p = 0.009).

Among delivery characteristics, women who underwent LSCS had higher odds of requiring massive transfusion than those who had vaginal delivery, although the association was not statistically significant (p = 0.110). Induced labour also showed a non-significant increase in the likelihood of massive transfusion (OR: 2.20, p = 0.083). Hypertension was significantly associated with massive transfusion (OR: 4.18, 95% CI: 1.56–11.20; p = 0.004), whereas diabetes mellitus (p = 0.067) and hypothyroidism (p = 0.157) were not significantly associated. Overall, obesity, severe antenatal anaemia, postpartum haemorrhage, antepartum haemorrhage, and hypertension emerged as significant factors associated with massive transfusion on univariate analysis.

Table 5. Multivariate Logistic Regression

Category	AOR (95% CI)	p-value

BMI		
Normal	Reference	—
Overweight	1.68 (0.54-5.28)	0.370
Obese	4.12 (1.24-13.74)	0.021
Antenatal Anaemia		
None	Reference	—
Mild–Moderate	1.68 (0.31-8.94)	0.541
Severe	4.22 (1.10-16.1)	0.036
PPH		
No	Reference	—
Yes	3.89 (1.42-10.6)	0.008
APH		
No	Reference	—
Yes	2.14 (0.71-6.39)	0.171
Mode of Delivery		
Vaginal Delivery	Ref	-
LSCS	1.81 (0.66-4.96)	0.248
Instrumental Delivery	1.39 (0.22-8.72)	0.723
Onset of Labour		
Spontaneous labour	Ref	-
Induced labour	1.72 (0.69-4.33)	0.249
Medical Comorbidities		
None	Ref	
Hypertension	2.76 (1.01-7.52)	0.047

Diabetes mellitus	1.89 (0.58-6.15)	0.291
Hypothyroidism	1.67 (0.42-6.58)	0.463

Table 5 presents the multivariate logistic regression analysis identifying independent predictors of massive transfusion after adjusting for potential confounding factors. Among the maternal characteristics, obesity remained an independent predictor**,** with obese women having more than fourfold higher odds of requiring massive transfusion compared with women having a normal BMI (AOR: 4.12, 95% CI: 1.24–13.74; p = 0.021), whereas overweight was not significantly associated (p = 0.370).

Similarly, severe antenatal anaemia was independently associated with massive transfusion (AOR: 4.22, 95% CI: 1.10–16.10; p = 0.036), while mild-to-moderate anaemia was not statistically significant. Postpartum haemorrhage (PPH) also remained a significant independent predictor, increasing the odds of massive transfusion by nearly fourfold (AOR: 3.89, 95% CI: 1.42–10.60; p = 0.008). Although antepartum haemorrhage (APH) showed increased adjusted odds, the association was not statistically significant (p = 0.171).

Regarding obstetric characteristics, neither mode of delivery nor onset of labour was independently associated with massive transfusion after adjustment. Women undergoing LSCS had higher adjusted odds than those with vaginal delivery, but the association was not statistically significant (AOR: 1.81, p = 0.248). Likewise, induced labour did not significantly increase the likelihood of massive transfusion (AOR: 1.72, p = 0.249).

Among the medical comorbidities, hypertension emerged as an independent predictor of massive transfusion (AOR: 2.76, 95% CI: 1.01–7.52; p = 0.047). In contrast, diabetes mellitus and hypothyroidism were not independently associated with massive transfusion after adjustment. Overall, obesity, severe antenatal anaemia, postpartum haemorrhage, and hypertension were identified as independent predictors of massive transfusion in the study population.

Table 6. Maternal Outcomes Following Blood Transfusion (N=120)

Outcome	Frequency	%
ICU admission	18	15
Mechanical ventilation	6	5
Obstetric hysterectomy	7	5.8
DIC	4	3.3
Acute kidney injury	3	2.5
Maternal shock	12	10
Maternal mortality	**0**	**0**

Table 6 summarizes the maternal outcomes following blood transfusion among the 120 obstetric patients. Intensive care unit (ICU) admission was required in 15.0% of patients, while 10.0% developed maternal shock. Obstetric hysterectomy was performed in 5.8% of women, and 5.0% required mechanical ventilation. Disseminated intravascular coagulation (DIC) and acute kidney injury occurred in 3.3% and 2.5% of patients, respectively. Importantly, no maternal deaths were recorded during the study period, indicating favorable maternal survival despite the high burden of obstetric hemorrhage and transfusion requirements.

Table 7. Neonatal Outcomes (n=119 Live Deliveries)

Outcome	Frequency	%

Live birth	114	95.8
Stillbirth	5	4.2
NICU admission	24	20.2
Preterm birth	18	15.1
Low birth weight	22	18.5
Neonatal mortality	0	0

Among the 119 live deliveries, the majority resulted in favorable neonatal outcomes. NICU admission was required for 24 neonates (20.2%), indicating that approximately one-fifth of newborns required specialized neonatal care. Low birth weight was observed in 22 neonates (18.5%), while 18 neonates (15.1%) were born preterm. There were no cases of neonatal mortality (0%) among the live-born infants during the study period. Additionally, 5 pregnancies (4.2%) resulted in stillbirths, while 114 (95.8%) resulted in live births. Overall, although a notable proportion of neonates experienced adverse outcomes such as NICU admission, low birth weight, and prematurity, the absence of neonatal mortality suggests favorable immediate survival among live-born infants.

DISCUSSION

In the present study of 120 obstetric patients who received blood or blood component transfusion, the majority were aged 21–30 years (65.0%) and were multigravida (56.7%). LSCS was the most common mode of delivery (58.3%), while spontaneous onset of labour was observed in 65.0% of patients. Antenatal anaemia was highly prevalent, affecting 85.0% of the study population, with 75.0% having mild-to-moderate anaemia and 10.0% having severe anaemia. Postpartum haemorrhage (PPH) was the leading indication for transfusion (37.5%), followed by postpartum anaemia (16.7%) and antenatal anaemia (16.7%). Antepartum haemorrhage accounted for 4.2% of transfusions. Packed red blood cells were administered to all patients (100%), while fresh frozen plasma was used in 51.7%, platelets in 23.3%, cryoprecipitate in 10.0%, and whole blood in 15.0%. Massive transfusion, defined as administration of ≥4 units of PRBCs, was required in 20.0% of patients. These findings demonstrate that haemorrhage and anaemia remain the principal clinical conditions contributing to transfusion requirements among obstetric patients.

Mohanty et al. [16] reported that obstetric haemorrhage, particularly PPH, accounted for the majority of transfusion indications in emergency obstetric settings. This finding is comparable with the present study, in which PPH was the most common indication for transfusion, accounting for 37.5% of cases. However, the proportion observed in the present study was somewhat lower than that reported by Mohanty et al. This difference may be explained by variation in study population and case mix, as the present study included both antenatal and postnatal obstetric patients rather than exclusively emergency admissions. The predominance of PPH in both studies nevertheless emphasizes the continuing importance of obstetric haemorrhage as a major driver of blood utilization.

Similarly, Begum et al. [17] identified PPH as the most common indication for blood transfusion among obstetric patients, accounting for more than half of transfusion episodes in their cohort. In the present study, PPH accounted for 37.5% of transfusions and remained the single most frequent indication. The relatively lower proportion may reflect the broader spectrum of indications included in the present study, particularly postpartum anaemia and antenatal anaemia, each of which accounted for 16.7% of transfusions. Despite these differences, both studies demonstrate that haemorrhage remains a predominant indication for transfusion in obstetric practice.

Sharma et al. [18] observed that both anaemia and haemorrhage contributed substantially to blood utilization in obstetric patients over an extended study period. The findings of the present study support this observation, as anaemia was present in 85.0% of transfused patients, with 75.0% having mild-to-moderate anaemia and 10.0% having severe anaemia. Furthermore, postpartum and antenatal anaemia each accounted for 16.7% of transfusion indications. The high prevalence of anaemia among transfused women highlights the importance of antenatal detection and correction of anaemia before the occurrence of obstetric haemorrhage.

Lew et al. [19] reported that red blood cell transfusion was primarily associated with acute blood loss and anaemia, with relatively lower utilization of additional blood components. In the present study, PRBCs were universally

administered (100%), with a median requirement of 2 units (IQR 1–3). However, additional component therapy was also frequently required, with FFP administered to 51.7% and platelets to 23.3% of patients. Cryoprecipitate was used in 10.0% of patients. This pattern indicates that a substantial proportion of transfused women required management beyond isolated red-cell replacement, particularly in the setting of significant haemorrhage and coagulation abnormalities.

Kandasamy et al. [20] demonstrated that structured audits and educational interventions can improve the appropriateness of blood transfusion practices and reduce unnecessary utilization. In the present study, the universal use of PRBCs and substantial use of FFP and platelets indicate considerable reliance on component therapy. However, whole blood was still administered to 15.0% of patients. Although the present study did not evaluate the appropriateness of individual transfusion decisions, these findings suggest an opportunity for continued strengthening of standardized patient standardized transfusion protocols and regular transfusion audits.

Sandham et al. [21] emphasized the potential risks associated with blood transfusion, including immunological and transfusion-related complications, and highlighted the importance of judicious transfusion practices. In the present study, the need for multiple blood components and massive transfusion in a substantial proportion of patients reflects the severity of the underlying obstetric conditions. Twenty percent of women required massive transfusion, indicating that one in five transfused patients experienced sufficiently severe haemorrhage or clinical instability to require ≥4 units of PRBCs. This emphasizes the need to balance transfusion-related risks against the urgent requirement for haemodynamic stabilization in severe obstetric emergencies.

Alipour et al. [22] identified haemorrhage as an important contributor to maternal mortality globally. The present study similarly demonstrates the clinical significance of obstetric haemorrhage, with PPH being the most common indication for transfusion and an important predictor of massive transfusion. On univariate analysis, women with PPH had more than fivefold higher odds of massive transfusion (OR 5.64, 95% CI: 2.18–14.50; p<0.001). Importantly, this association remained statistically significant after adjustment, with PPH independently increasing the odds of massive transfusion nearly fourfold (AOR 3.89, 95% CI: 1.42–10.60; p=0.008).

Meh et al. [23] reported persistent maternal mortality related to haemorrhage and anaemia in India. The present findings reinforce the continuing clinical importance of these conditions, particularly because 85.0% of transfused women had antenatal anaemia and 20.0% required massive transfusion. Severe antenatal anaemia was independently associated with massive transfusion, with affected women having more than fourfold higher adjusted odds compared with women without anaemia (AOR 4.22, 95% CI: 1.10–16.10; p=0.036). This finding emphasizes the importance of identifying and treating severe anaemia during pregnancy before the onset of acute obstetric blood loss.

Amadi et al. [24] reported that anaemia and obstetric bleeding were major determinants of transfusion requirements. The present study strongly supports these observations. Anaemia was present in 85.0% of the study population, while PPH, APH, intraoperative blood loss, and other haemorrhagic indications together represented a substantial proportion of transfusion indications. PPH alone accounted for 37.5% of cases, while APH accounted for 4.2%. The high prevalence of anaemia in the present cohort further highlights the contribution of underlying maternal haematological vulnerability to transfusion requirements.

Gulucu et al. [25] observed that a considerable proportion of obstetric patients required multiple blood components, particularly in severe clinical conditions. This is consistent with the present findings, where 51.7% of patients received FFP, 23.3% received platelets, and 10.0% received cryoprecipitate in addition to universal PRBC transfusion. The requirement for multiple components was particularly relevant in the context of massive obstetric haemorrhage and coagulation abnormalities. The use of multiple component products therefore reflects the complexity of transfusion support required in a subset of critically ill obstetric patients.

Afrin et al. [26] identified anaemia and haemorrhage as major indications for blood transfusion in obstetric patients. The present study demonstrated a similar pattern, with PPH being the leading indication and anaemia collectively accounting for a substantial proportion of transfusions. Notably, 10.0% of women had severe antenatal anaemia, while 75.0% had mild-to-moderate anaemia. The association between severe anaemia and massive transfusion further suggests that the severity of anaemia, rather than merely its presence, may be clinically important in determining subsequent transfusion requirements.

Vinayagam et al. [27] emphasized the importance of perioperative standardized transfusion practices in reducing unnecessary transfusion requirements. In the present study, however, the transfusion burden remained substantial, with 20.0% of patients requiring massive transfusion. Multivariate analysis demonstrated that obesity, severe

antenatal anaemia, PPH, and hypertension were independent predictors of massive transfusion. Obese women had more than fourfold higher adjusted odds of massive transfusion compared with women with normal BMI (AOR 4.12, 95% CI: 1.24–13.74; p=0.021). These findings suggest that risk stratification based on maternal characteristics and obstetric factors may help identify patients who require closer surveillance and early preparation for major haemorrhage.

Feyisa et al. [28] highlighted concerns regarding the appropriateness of blood transfusion, including both overuse and underuse of blood products. Although appropriateness of transfusion was not directly assessed in the present study, the findings provide useful information regarding transfusion patterns. PRBC use was universal, while FFP, platelets, cryoprecipitate, and whole blood were used in varying proportions. The continued use of whole blood in 15.0% of patients indicates variability in transfusion practice and supports the need for periodic audit against standardized patient blood management recommendations.

Escobar et al. [29] recommended early recognition and aggressive management of PPH to reduce maternal morbidity and mortality. The present study reinforces the importance of this approach, as PPH was the leading indication for transfusion and an independent predictor of massive transfusion. Overall, 20.0% of women required ≥4 units of PRBCs, highlighting the potential for obstetric haemorrhage to rapidly progress to a high-volume transfusion requirement. Early identification of women at increased risk of major haemorrhage, rapid availability of blood components, and multidisciplinary management are therefore essential components of obstetric transfusion care.

Akter et al. [30] identified gaps in knowledge and practice related to recognition and management of PPH, particularly in resource-limited settings. The findings of the present study further demonstrate the clinical burden associated with severe obstetric complications. In addition to PPH, severe antenatal anaemia and hypertension were independently associated with massive transfusion. Hypertension was associated with a nearly threefold increase in the adjusted odds of massive transfusion (AOR 2.76, 95% CI: 1.01–7.52; p=0.047). These findings suggest that massive transfusion risk is influenced not only by acute haemorrhage but also by underlying maternal and medical characteristics.

Overall, the present study demonstrates that postpartum haemorrhage and anaemia remain the major indications for blood and blood component transfusion among obstetric patients. Antenatal anaemia was present in 85.0% of transfused women, with 10.0% having severe anaemia, highlighting the substantial burden of maternal anaemia in this population. Severe antenatal anaemia was independently associated with massive transfusion, emphasizing the importance of early detection and correction of anaemia during pregnancy. PPH was the most common indication for transfusion and remained an independent predictor of massive transfusion after adjustment. Multivariate analysis further identified obesity, severe antenatal anaemia, PPH, and hypertension as independent predictors of massive transfusion, whereas APH, mode of delivery, onset of labour, diabetes mellitus, and hypothyroidism were not independently associated with massive transfusion.

The maternal outcome findings further demonstrate the clinical severity of the obstetric conditions encountered in this cohort. ICU admission was required in 15.0% of patients, maternal shock occurred in 10.0%, obstetric hysterectomy was performed in 5.8%, mechanical ventilation was required in 5.0%, DIC occurred in 3.3%, and acute kidney injury occurred in 2.5%. Importantly, no maternal deaths were recorded during the study period. Among the 119 deliveries, 114 (95.8%) resulted in live births and 5 (4.2%) were stillbirths. Among the live births, NICU admission occurred in 20.2%, preterm birth in 15.1%, and low birth weight in 18.5%, while no neonatal deaths were recorded. Taken together, these findings emphasize that obstetric transfusion should be considered as an important component of patient standardized transfusion practices, extending beyond the immediate treatment of acute blood loss. Strengthening antenatal screening and treatment of anaemia, early recognition of women at risk of PPH, appropriate preparation for major obstetric haemorrhage, timely availability of blood components, and identification of high-risk characteristics such as obesity and hypertension may help reduce the severity of transfusion requirements and associated maternal morbidity. Continued institutional transfusion audits and implementation of standardized patient standardized transfusion practices protocols may further promote rational blood utilization and improve the quality and safety of obstetric care.

LIMITATIONS

This study has certain limitations that should be considered while interpreting the findings. Firstly, it was conducted at a single tertiary care hospital, which may limit the generalizability of the findings to other healthcare settings, particularly primary and secondary care institutions with different patient profiles, referral patterns, and transfusion

resources. Secondly, the cross-sectional study design limits the ability to establish temporal or causal relationships between factors such as anaemia, obesity, hypertension, and haemorrhage and the requirement for massive transfusion. Thirdly, although the study included 120 transfused obstetric patients, the relatively modest sample size may have limited the statistical power for subgroup analyses and resulted in relatively wide confidence intervals for some associations.

Additionally, the study included only obstetric patients who received blood or blood components and did not include a non-transfused comparison group. Therefore, the findings should not be interpreted as predictors of whether an obstetric patient will require transfusion in the general obstetric population; rather, they identify factors associated with massive transfusion among patients who had already received transfusion. Furthermore, although maternal and neonatal outcomes were documented, long-term maternal and neonatal outcomes were not assessed. Transfusion-related adverse reactions were also not comprehensively evaluated.

The study did not formally assess the appropriateness of individual transfusion decisions against standardized patient standardized transfusion practices guidelines, and therefore the observed utilization patterns cannot be interpreted as evidence of appropriate or inappropriate transfusion practice. Finally, differences in clinical decision-making, availability of blood components, emergency response, and institutional transfusion protocols may have influenced transfusion practices and introduced potential practice-related bias.

CONCLUSION

The present study demonstrates a substantial burden of blood and blood component transfusion among obstetric patients in a tertiary care setting, with postpartum haemorrhage and anaemia emerging as the predominant indications. Antenatal anaemia was highly prevalent, affecting 85.0% of transfused women, while PPH accounted for 37.5% of transfusion indications. Packed red blood cells were administered to all patients, while more than half required FFP and nearly one-fourth required platelet transfusion. Importantly, 20.0% of patients required massive transfusion, reflecting the severity of obstetric haemorrhage and other complications encountered in this population.

Multivariate analysis identified obesity, severe antenatal anaemia, postpartum haemorrhage, and hypertension as independent predictors of massive transfusion. Obesity was associated with more than fourfold higher adjusted odds of massive transfusion (AOR 4.12), while severe antenatal anaemia was associated with an AOR of 4.22. PPH was associated with nearly fourfold higher adjusted odds (AOR 3.89), and hypertension was also independently associated with massive transfusion (AOR 2.76). These findings highlight the importance of early identification and risk stratification of obstetric patients who may require major transfusion support.

The maternal outcome profile further emphasizes the clinical severity of this cohort, with ICU admission, maternal shock, obstetric hysterectomy, mechanical ventilation, DIC, and acute kidney injury occurring in a proportion of patients. However, no maternal or neonatal deaths were recorded among the study population during the study period.

Therefore, strengthening antenatal anaemia prevention and treatment, early recognition and aggressive management of PPH, identification of patients at risk for massive transfusion, rapid access to appropriate blood components, and implementation of standardized patient standardized transfusion practices protocols should be prioritized. Regular transfusion audits and protocol-based component therapy may further improve rational blood utilization. Overall, the findings support a proactive approach to obstetric transfusion management aimed at reducing preventable transfusion burden while ensuring timely and adequate treatment of women with life-threatening obstetric complications.

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