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ORIGINAL ARTICLE

Risk Factors for Blood Transfusion during Caesarean Section

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ABSTRACT

Objective: To assess the risk factors and evaluate the association of blood transfusion with neonatal outcomes.
Study Design: Prospective study
Place and Duration of Study: Department of Obstetrics & Gynaecology, Lady Willingdon Hospital, Khairpur Mir's Pakistan from 1st June 2021 to 31st December 2021.
Methodology: Nine hundred and fifty seven women who underwent C-sections were enrolled. The maternal socio-demographics and comorbidities, obstetrics and operative factors, indications for C-section, and neonatal outcomes were recorded.
Results: The results revealed that high maternal weight and age, preoperative anemia, placenta previa or abruption, antepartum hemorrhage, third trimester bleeding, multiparity, assisted reproductive technology (ART), prophylactic anticoagulation, and prolonged labor were significantly associated with transfusion during C-section. However, prior uterine scar or atony, previous C-sections, multiple births, diabetes, fibroids, Human immunodeficiency virus (HIV), type of C-section, the cadre of the lead surgeon, surgery type, failed induction or instrumentation, fetal distress, malpresentation, and adhesions were not significantly associated with blood transfusion. There was no significant difference in birth weights of neonates from the two groups.
Conclusion: Healthcare professionals should stay cautious when dealing with parturients exhibiting such risk factors. Timely arrangement and transfusion of blood in these women can help reduce maternal mortality.
Key words: Caesarean section, Blood transfusion, Risk factors, Postpartum hemorrhage, Antepartum hemorrhage

INTRODUCTION

Caesarean section (C-section) refers to the delivery of a fetus after 24-weeks of gestation via surgical incisions made through the uterine wall and the abdominal wall.[1,2] C-section is one of the most common surgical procedures performed throughout the world, with its rate rangingfrom 17.8% to 31.2% in the tertiary care hospitals of Pakistan.[1,3]

Despite its popularity, caesarean delivery is related to a higher incidence of obstetric complications than vaginal delivery. One such complication is postpartum hemorrhage (PPH).[4] As per a recent report by the World Health Organization (WHO), PPH accounts for 60% of the maternal deaths occurring in developing countries.[5] C-section is a crucial risk factor for PPH and thus a common indication for blood transfusion. Various factors, including maternal age, body mass index (BMI), and comorbidities such as uterine fibroids, can increase blood loss associated with C-section.[6]

Although a life-saving intervention, blood transfusion carriers with it significant short- and long-term risks, including acute or delayed hemolytic transfusion reaction, allergic reaction, and transfusion-related lung injury.[7,8] Moreover, unnecessary cross-matching and reservation of blood is cost-intensive and can cause scarcity of blood in centers with limited blood products.[7] Therefore, in developing countries like Pakistan, where there is no reliable donor base and governance setup, unnecessary ordering and subsequent wastage of blood products can deprive patients in actual need of transfusion.[6] This need for judicious allocation of precious blood reserves became a lot clearer during the coronavirus disease 2019 (COVID-19) pandemic.[9]

Hence, considering the risks associated with unnecessary transfusions and the possible need for blood transfusion as a life-saving intervention in women undergoing caesarean delivery, it is important to highlight the risk factors for caesarean delivery-related transfusion. Therefore, this study aims to assess the risks for blood transfusion in women undergoing C-sections and evaluate the association of blood transfusion with neonatal outcomes.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of Obstetrics and Gynaecology, Lady Willingdon Hospital, Khairpur Medical College, Khairpur Mir's Pakistan. This study included women who either had elective or emergency C-section. All women with missing data regarding blood transfusion and those who had a vaginal delivery were excluded. They were divided in two groups based on the status of blood transfusion: group A (transfused) and group B (non-transfused). The institutional Research and Ethical Review Committee approved the study (Code No. KMC/RERC/49). Data were obtained from medical records, the blood bank database, and surgical notes. For all caesarean deliveries, blood loss was estimated from the bloodstains on the theatre sheets, the number of soaked gauze pads, and by measurement of the volume of blood in the suction device. To maintain accuracy, two independent investigators reviewed the data and filled the questionnaires. Patient privacy and anonymity were ensured throughout the data collection process**.**

All analyses were performed using SPSS-24. The Chi-square test and independent-samples t-test for establishing an association of transfusion status with risk factors and neonatal outcomes were used. However, Fisher's exact test instead of the Chi-square test in cases where the expected cell count was less than five. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Only 5.43% belonged to group A (transfused group), while the remaining 94.56% of the participants belonged to group B (non-transfused group). The mean age of the participants was 28.49±8.94 years, while the mean maternal weight was 65.27±11.69 kg. A vast majority (58.1%) of our study population were para 0-1. The mean of blood units (pints) transfused in our study population was 1.81±0.89 (Fig. 1).

The maternal age and weight of the transfused participants were 6.30±1.26 years and 7.48±1.65 kg higher than their counterparts, respectively (p<0.001). We also observed that a significantly higher proportion of multiparous women received blood transfusion than their counterparts (para 0-1) (8.2% vs 3.4%; p=0.001). Our results revealed preoperative anemia to be a significant risk factor for transfusion during C-section; 73.6% participants with preoperative anemia belonged to group A while

26.54% were in group B (p<0.001). On contrary, diabetes, uterine fibroids, and HIV did not show any significant (p>0.05) association with C-section-related blood transfusion (Table 1).

A significant majority of females with placenta previa (77.3% vs. 22.7%; p<0.001) and placental abruption (83.3% vs. 16.7; p<0.001) received C-section- related blood transfusion. Other variables that showed significant association with transfusion were third trimester bleeding (p<0.001), conception through assisted reproductive technology (ART) (p<0.001), and prophylactic anticoagulation during pregnancy (p= 0.003). Around one-fifth of the participants (17.9%) had a history of prior C-section, of which only 4.1% received transfusion. Less than one-tenth of the females (6.3%) had a history of multiple births, all of whom belonged to the non-transfused group. Amongst all the females having a previous uterine scar (15%), only five required blood. Thus, prior uterine scar, prior C-sections, and multiple births were not significantly (p>0.05) associated with blood transfusion (Table 2).

The mean duration of C-section was 29.72±3.49 mins. The results revealed that time interval of surgery was significantly associated with the need of C-section-associated transfusions (31.62±4.86 vs 29.62±3.37 minutes, p<0.001). A significant preponderance of females having an estimated blood loss between 500-1000 ml belonged to the transfused group (63%) (p<0.001). Most of the participants received spinal anesthesia (99.6%), out of which a significant preponderance belonged to the group B (94.9%) (p=0.001). On the other hand, only two participants received epidural anesthesia; however, both of them belonged to group A (p=0.001). Interestingly, type of C-section, the cadre of the lead surgeon, history of uterine atony, surgery type, and adhesions were significantly (p>0.05) different between the transfused and non-transfused groups (Table 3).

Table 1: Socio-demographics and preoperative co-morbidities of the study population

Variable	Group A (N=52)	Group B (N=905)	P value
Maternal age (years)	34.46±7.09	28.16±8.91	0.001
Maternal weight (kgs)	72.35±13.15	64.87±11.47	0.001
Parity			
0 -1	19 (3.4%)	537 (96.6%)	0.001
2 – 9	33 (8.2%)	368 (91.8%)	
Diabetes	4 (6.1)	62 (93.9%)	0.777
HIV	-	14 (100%)	1.000
Uterine fibroids	-	19 (100%)	0.619
Preoperative anemia	39 (73.6)	14 (26.4%)	0.001

Table 2: Comparison of obstetric characteristics between the transfused and non- transfused group of patients

Variable	Group A (N=52)	Group B (N=905)	P value
Gestational age at delivery (weeks)	37.94±2.13	38.348±1.436	0.055
Previous C-section	7 (4.1%)	164 (95.9%)	0.394
Previous uterine scar	5 (3.5%)	139 (96.5%)	0.260
Multiple births	-	60 (100%)	0.070
Conceived through ART	4 (100%)	-	0.001
Prophylactic anticoagulation during pregnancy	2 (100%)	-	0.003
Third trimester bleeding	7 (100%)	-	0.001
Placenta previa	17 (77.3)	5 (22.7%)	0.001
Placental abruption	10 (83.3)	2 (16.7%)	0.001

With 78.9% of the participants with antepartum hemorrhage getting blood transfused, antepartum hemorrhage was one of the strongest significant predictors (p<0.001) of blood transfusion during the procedure among our study population. In contrast, a significant majority of participants having cephalopelvic disproportionation (CPD) (97.8%) did not receive blood transfusions (p<0.001). However, other variables such as failed induction, failed instrumentation, fetal distress, and malpresentation did not show any statistically significant relationship with either group A or group B (p>0.05). Furthermore, the mean birth weight of the neonates of our study participants was 3.58±1.13 kg. There was no significant difference in birth weights of neonates from the two groups (3.57±0.50 kg vs. 3.58±1.15; p>0.05). A preponderance of neonates in our study had a 5-minute Apgar score >7 (95%); amongst them, a vast majority (96.5%) belonged to group B (p<0.001) [Table 4].

Table 3: Comparison of operative factors between the transfused and non-transfused group of patients

Variable	Group A (N=52)	Group B (N=905)	P value
Type of C-section			
Low transverse	52 (5.4)	903 (94.6%)	1.000
Vertical	-	2 (100%)	
Cesarean hysterectomy	-	-	
Surgery Type			
Elective	51 (5.4%)	899 (94.6%)	0.325
Emergency	1 (14.3%)	6 (85.7%)	
Anesthesia			
Spinal	49 (5.1%)	904 (94.9%)	0.001
General	1 (50%)	1 (50%)	
Epidural	2 (100%)	-)	
Adhesions			
No/mild	50 (5.3%)	899 (94.7%)	0.066
Moderate	2 (25%)	6 (75%)	
Severe	-	-	
Uterine atony	-	2 (100%)	1.000
Years of experience of lead surgeon			
Less than 4 years	-	5 (100%)	1.000
Greater than 4 years	52 (5.5%)	900 (94.5%)	
Mean duration of surgery (mins)	31.62±4.86	29.62±3.37	0.001
Estimated blood loss			
<500 ml	35 (3.8%)	894 (96.2%)	0.001
500-1000 ml	17 (63%)	10 (37%)	
>1000 ml	-	1 (100%)	

Table 4: Indications for Cesarean section and neonatal outcomes in blood transfused versus non-transfused patients.

Indications	Group A (N=52)	Group B (N=905)	P value
Repeat cesarean section		1 (100%)	1.000
Cephalopelvic disproportionation	14(2.2%)	633 (97.8%)	<0.001
Malpresentation	6 (6.9%)	81 (93.1%)	0.701
Fetal distress	2 (1.85)	108 (98.2%)	0.115
Antepartum hemorrhage	30 (78.9%)	8 (21.1%)	<0.001
Failed induction	-	44 (100%)	0.165
Failed instrumentation	-	30 (100%)	0.402
Neonatal outcomes			
Birth weight (kgs)	3.57±0.50	3.58±1.15	0.912
5-minute Apgar score >7	32 (3.5%)	877 (96.5%)	<0.001

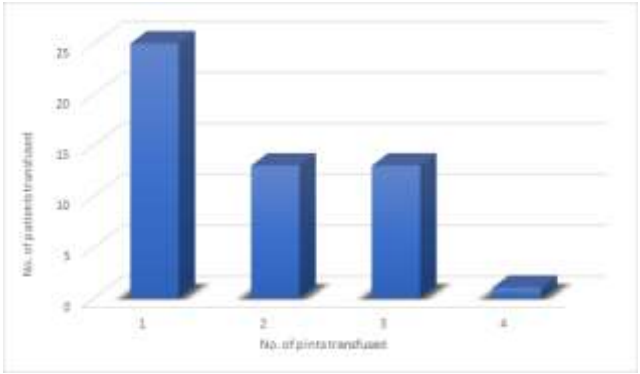

Figure 1: Frequency of units of blood transfused

DISCUSSION

The rate of the C-section has increased globally, with the highest rates quoted for the developed world. Secondary assessment of data from the Pakistan Demographic and Health Surveys (1990–

2018) showed a significant increase in caesarean births among Pakistani women, from 3.2% in 1990 to 19.6% in 2018.[10] The ubiquity of this procedure has spurred a large amount of research dedicated to its implications.

Many obstetric complications, including obstetric hemorrhage, are far more common after caesarean delivery than after vaginal delivery. Many of the risk factors for a C-section are themselves risk factors for obstetric hemorrhage.[11] As the complexity and complications during a C-section increase, the need for blood transfusion also increases, making C-section an essential indicator for blood transfusion.

In the present study, approximately 5.43% of the participants received blood transfusion; this rate was drastically lower than the reported rate from other resource-poor countries, which averaged around 12.5 and 22.5.[12,13] The reason for this could be the increased proportion of elective C-sections in our study population. Data suggests that elective C-sections have less risk of requiring blood transfusion.[14] Furthermore, the variance in the transfusion rate could also be due to the resource-limited situation of the hospital, which ensured effective blood reserve utilization.

The link between maternal age and body weight and unfavorable pregnancy outcomes.[15,16] Similarly, we also found a significantly increased risk of transfusion in women with greater maternal age and weight; this could be due to the growing incidence of miscarriages, placenta previa, chronic hypertension, gestational diabetes, and macrosomic newborn in this group.[15,16] However, further probing is required to establish a causal relationship.

Here, it is also imperative to mention that, while diabetes is known to induce poor pregnancy outcomes, we did not observe any association of diabetes with an increased risk of transfusion; a Finnish study also showed similar results.[17] In line with existing literature[6], a higher risk of transfusion with greater parity in our study could be attributed to the increased risk of uterine atony. Al-Zirki et al[18] identified uterine atony as a leading cause of severe obstetric hemorrhage in a large birth registry cohort from Norway. However, surprisingly, we found no link of uterine atony with blood transfusion. We hypothesize that this discrepancy is due to the bias caused by a small sample size of uterine atony patients. Our findings also revealed that blood transfusion constituted a significant risk in pregnancies conceived using ART. This is attributable to the fact that the average age of mothers undergoing these treatments is older. Also, techniques like IVF raise the chance of placenta previa, which necessitates transfusions.[19]

According to a study conducted by Abbas et al[6] the risk of transfusion was dramatically enhanced in the presence of adhesions. While the authors revealed that the presence of adhesions leads to prolonged surgery, they also identified protracted surgery as an independent risk factor for transfusion. Our study failed to make any significant correlation with adhesions. However, we did witness an appreciable increase in the risk of transfusion with the prolonged duration of the procedure. Lengthy operations can be an indicator of a complicated pregnancy, thus requiring a transfusion.

In line with the findings from other investigators, we witnessed an expected increased risk of transfusion with antepartum hemorrhage, specifically in women with placenta previa and placental abruptions.[6,14,20,21] Additionally, placenta previa was recognized as one of the risk factors for PPH and peripartum hysterectomy as, alongside placental implantation, it can result in a delayed placental expulsion which can lead to contraction failure causing severe bleeding.[21] Furthermore, in conformity with Spiegelman's work, we also observed that the use of anticoagulants during the antepartum period is a major risk factor for an increased rate of transfusion.[4]

Preoperative anemia was one of the biggest risk factors for transfusion. In other studies, where this finding was further analyzed, it was observed that preoperative anemia may be caused due to severe blood loss through antepartum hemorrhage or from pre-existing anemia in pregnant women which could be a result of nutritional deficiency, hemoglobinopathies, parasitic infestations, or HIV infections.[17,21-23] Despite being a major risk factor for anemia, HIV itself was not directly associated with an increased risk of transfusion. Similar findings were indicated in a study by Eyelade et al[20], however, HIV was found to be a major risk factor in a case-control study from South Africa conducted by Bloch et al.[23] These findings indicate a need for care providers to improve the nutritional status of young women to reduce instances of preoperative anemia.

While our study did not assess the amount of antenatal care or the number of antenatal visits the patients had, several other studies have revealed the importance of these visits showing an increased risk of transfusion in patients who had no antenatal visits. A viable explanation for this finding is that these women are more likely to present in emergency and undergo a C-section and hence more likely to require blood.[3,20] Chua et al[24] identified the emergency C-section as a key risk factor for transfusion. Likewise, we found that emergency C-section patients (14.3%) were more liable to be transfused than elective C-section patients (5.4%); the results were, however, statistically insignificant. This suggests a need for further development in the primary healthcare sector to increase antenatal screening and decrease the likelihood of women presenting in an emergency.

Although general anesthesia is known to increase the risk of transfusion[6], we noticed that the risk of transfusion was elevated in persons who received epidural anesthesia. However, due to the small sample size in this group, no definitive evidence could be drawn.

Lastly, we compared the neonatal outcomes such as birth weight and the 5-minute Apgar scores between the two groups. Birth weight was pretty constant across the charts; hence, no positive association was discovered. The 5-minute Apgar score, on the other hand, varied between the groups and was generally higher than 7 in the non-transfused group. In a comparable study by Spiegelman et al[4] reported the 1-minute Apgar score to be a more accurate predictor of intrapartum transfusion than the 5-minute Apgar score. However, Apgar scores were found to be unrelated to a blood transfusion during C-sections in a study by Abbas et al.[6]

CONCLUSION

This study identified potential risk factors for blood transfusion in women undergoing caesarean section. Higher maternal age and weight, conception through ART, prophylactic anticoagulation during pregnancy, preoperative anemia, placenta previa, placental abruption, antepartum hemorrhage, and prolonged duration of labor significantly increased the risk of blood transfusion. Healthcare professionals should stay cautious when dealing with parturients exhibiting such risk factors. Timely arrangement and transfusion of blood in these women can help reduce maternal mortality.

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