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Prevalence of Blood Transfusions in Term Pregnancies undergoing Lower Segment Cesarean Section: A Retrospective Study

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Abstract: ***Background: Obstetric hemorrhage is a leading cause of maternal morbidity and mortality worldwide, and caesarean section (CS) is associated with increased risk of significant blood loss, often requiring blood transfusion. Identifying preoperative risk factors associated with blood transfusion may improve maternal outcomes, particularly in resource-limited settings. Aim & Objective: To determine the prevalence of blood transfusion in women undergoing caesarean section and identify associated preoperative risk factors. Methods: A retrospective cross-sectional study was conducted at Cama Albless Hospital, including all consecutive patients undergoing caesarean section from February to October 2024. The primary outcome variable was the prevalence of blood transfusion, and multivariable analysis was performed to identify independent risk factors for blood transfusion. Results: A total of 1008 women were included in the study, of whom 108 (10.7%) received a blood transfusion. Women with a history of previous caesarean section or abdominal surgery had a significantly higher transfusion rate (72.2%) compared to those without a scar (27.7%). The main risk factors for blood transfusion included lower preoperative Hb level (40.7%), higher intraoperative blood loss (35%), hypertensive disorders of pregnancy (9.2%), placenta previa (5%), blood disorders (5%), and multiple gestation (4%). Conclusion: The risk of blood transfusion in caesarean sections is high, particularly in parturients with preoperative maternal anemia, hypertensive disorders of pregnancy, multifetal pregnancies, placenta previa, and blood disorders. Adequate preoperative preparation, including optimizing maternal hemoglobin levels during antenatal care, is essential to reduce the incidence of transfusion-related complications in caesarean deliveries.***

Keywords: Blood transfusion, cesarean section, postpartum hemorrhage, risk factors, anemia, hypertensive disorders, placenta previa, maternal morbidity.

1. Introduction

Maternal mortality, morbidity, and maternal near-miss events in developing countries are predominantly associated with hemorrhage, which remains the leading cause of maternal deaths. Postpartum hemorrhage (PPH) accounts for more than 80% of obstetric hemorrhages and is responsible for 25% of maternal deaths annually. Cesarean section (CS) is a significant contributor to PPH, with the procedure posing a substantial risk for major intraoperative blood loss.

As the frequency of cesarean deliveries increases, so does the complexity of the procedure and the incidence of associated complications, which in turn escalates the demand for blood transfusions. Several factors contribute to blood loss during cesarean sections, including preoperative anemia, hypertensive disorders of pregnancy, placenta previa and acreta spectrum, grand multipara, multifetal pregnancies, and comorbidities such as fibroid uterus, blood disorders, the experience of the surgeon, and the duration of surgery.

Placenta previa and acreta spectrum, a condition in which the placenta is abnormally located over or near the cervix, presents a significant risk during cesarean delivery, leading to higher rates of bleeding and increases prevalence of BT. This condition often requires more complex surgical interventions to control bleeding, further increasing the likelihood of requiring a blood transfusion.

Although blood transfusion remains a life-saving intervention, its use carries inherent risks. Limited availability of blood due to inadequate donor response, anemia, and increasing costs hampers the timely provision of blood and blood products. In settings with constrained blood supply and blood banking services, the judicious utilization of blood is essential to achieve the overarching objective of safe and effective transfusion therapy.

At our institution, it is a standard practice to cross-match two or more units of blood for patients undergoing cesarean section. This practice involves reserving blood for the specific patient, making it unavailable for other potential recipients—a common practice in many healthcare facilities in this region. However, the unnecessary cross-matching and reservation of blood not only incur additional financial costs but also contribute to an artificial scarcity of blood in centers with limited blood supplies. As a result, patients may face difficulty accessing blood during critical, life-threatening situations.

This study seeks to identify prevalence of blood transfusion and evaluate the risk factors associated with the need for blood transfusion in women who undergo cesarean delivery, with the goal of optimizing transfusion practices and improving resource management.

2. Methods

This study is a retrospective analysis conducted at a tertiary care center, focusing on the evaluation of blood transfusion requirements in patients who underwent Lower Segment

Cesarean Section (LSCS) during the study period, over an eight-month period, from February 2024 to October 2024. The study allows for the analysis of existing medical records to identify risk factors and outcomes associated with transfusion during the intraoperative period.

The study was carried out in a tertiary care hospital, which has an established and well-maintained medical record system. The hospital's medical records provided comprehensive data on patient demographics, clinical details, operative interventions, and transfusion requirements.

Inclusion Criteria

- Women who underwent LSCS during the study period (Emergency and Elective).
- Women undergoing LSCS who received a blood transfusion either in the form of whole blood, packed red blood cells (PRBCs), or blood products such as random/single donor platelets during the intraoperative period. These patients were identified based on the recorded transfusion data in the medical records.

Exclusion Criteria:

- Women with ongoing blood transfusion, underwent vaginal delivery or any other non-LSCS obstetric procedures during the study period.

Post-operative blood transfusions: Women who required blood transfusions for reasons other than those directly related to obstetric complications during the intraoperative period (e.g., post-operative complications like infections, etc.) were excluded.

The study aims to identify preoperative, intraoperative, and patient-related factors that may predict the need for blood transfusions during LSCS and to establish clinical guidelines for transfusion management in this patient group.

3. Results

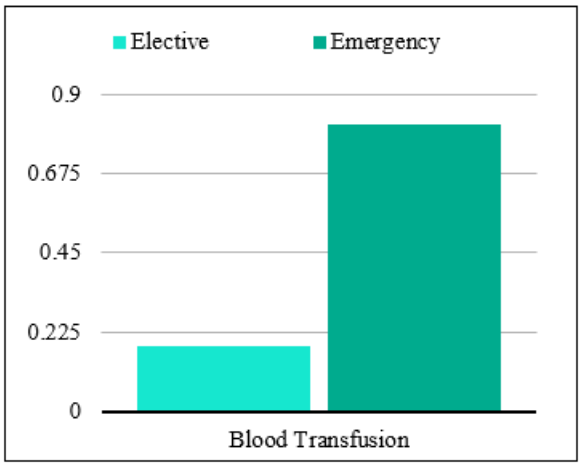
The study analyzed data from 1,008 term antenatal women who underwent lower segment cesarean section (LSCS). Of these, 108 participants (10.7%) required blood transfusion during the procedure.

1) Prevalence of Blood Transfusion

The prevalence of blood transfusion during LSCS was 10.7%, reflecting a significant portion of participants, who experienced complications requiring blood and blood product support.

2) Type of LSCS and Blood Transfusion

The study analyzed the distribution of cases based on the type of cesarean section—elective or emergency and their association with blood transfusion requirements. Among the 108 women who required transfusions:
82% were Emergency LSCS
18% were Elective LSCS



3) Emergency LSCS and Blood Transfusion

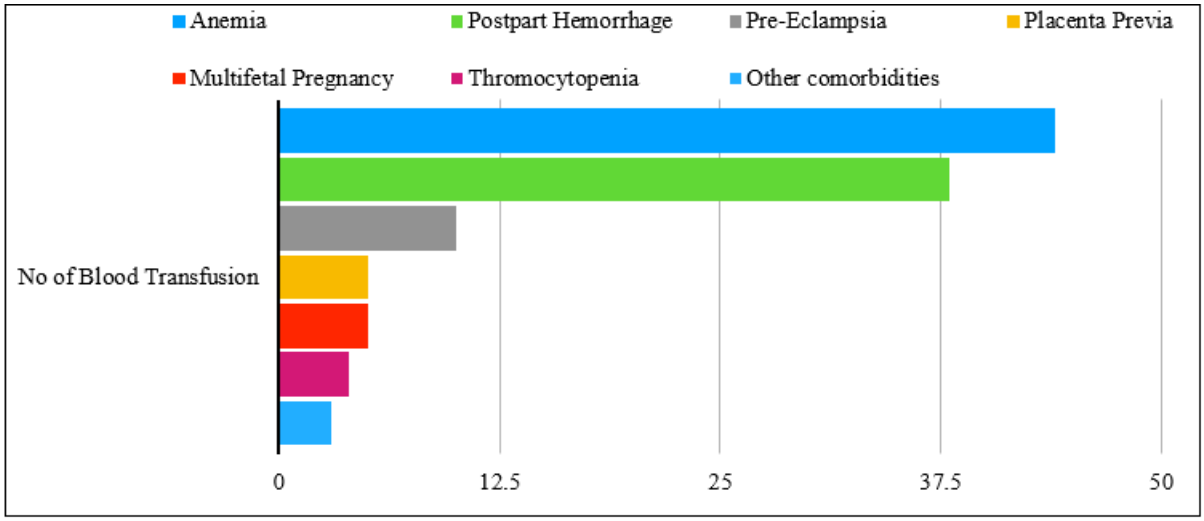
- Higher rates of complications such as uterine atony, placental abruption, and unexpected intraoperative hemorrhage in emergency scenarios.
- Less opportunity for pre-surgical optimization or blood banking, increasing reliance on transfusions.

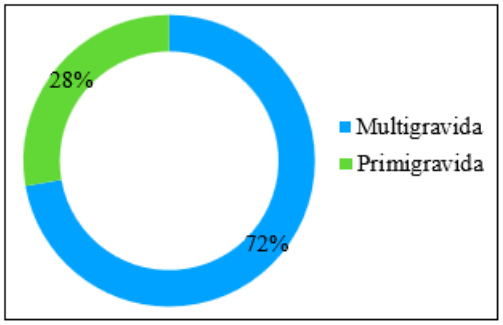
4) Elective LSCS and Blood Transfusion

- Elective LSCS accounted for a smaller proportion of transfusion cases. This aligns with the fact that elective procedures:
- Allow for better preoperative preparation, including correction of anemia and comprehensive risk assessment.
- Tend to have fewer unexpected complications due to thorough planning and stable clinical conditions of the patients.

5) Gravidity and Blood Transfusion

Among the 108 women who required transfusions:
72.2% were multigravida (women with two or more pregnancies).





27.8% were primigravida (first-time pregnancies).

This indicates that multigravida women are at a higher risk of requiring blood transfusions during LSCS. The increased risk is linked to:

- Anemia due to multiple pregnancies.
- Uterine scarring and complications from prior cesarean sections or deliveries, such as uterine atony and placenta Previn and acreta spectrum.

Comorbidities and Risk Factors Associated with Transfusions

1) **Anemia**

- The most common comorbidity, seen in 40.7% of women requiring transfusion.
- Anemia predisposes women to:
- Lower baseline hemoglobin levels, reducing their ability to tolerate blood loss during surgery. Increased risk of severe postpartum complications requiring transfusions, The prevalence of anemia in multigravida women underscores the need for early screening and intervention during antenatal care.

2) Postpartum Hemorrhage (PPH)

- Identified in 35.2% of transfusion cases, making it the second most common reason for transfusion.
- PPH is a major contributor to maternal morbidity and mortality and can occur due to:
- Uterine atony (failure of the uterus to contract after delivery), Placenta previa (abnormal location of the placenta near the cervix), Retained placental fragments or uterine rupture in cases with prior cesarean sections.

3) Pre-eclampsia

- Hypertensive disorders of pregnancy contributed to 9.3% of transfusion cases.
- Pre-eclampsia can lead to severe bleeding complications such as:
  Placental abruption., Eclampsia (seizures in pregnancy).

4) Thrombocytopenia and Multifetal Pregnancies

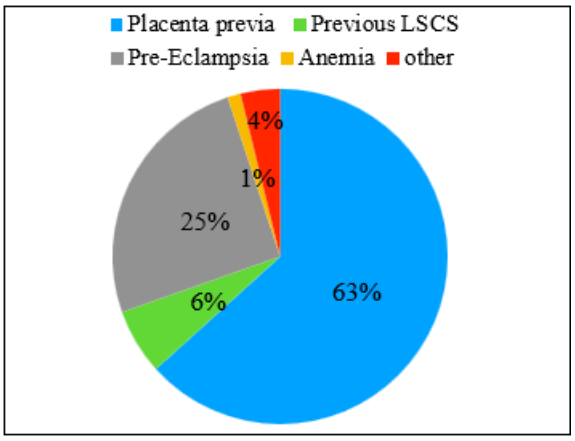
- Thrombocytopenia (low platelet count) was observed in 4.6% of cases, increasing the risk of prolonged bleeding.
- Multifetal pregnancies accounted for 3.7% of cases. These pregnancies pose challenges such as:
  Preterm labor, Increased incidence of PPH due to overdistension of the uterus.

5) Placenta Previa and acreta spectrum

Placenta previa occurs when the placenta is abnormally positioned over or near the cervix, making vaginal delivery unsafe due to the risk of catastrophic hemorrhage. cesarean section is a preferred mode of delivery. The abnormal location of the placenta can lead to more difficult surgical procedures, such as the need for a hysterectomy or more extensive uterine repair. The increased blood loss and the need for complex surgical interventions make blood transfusions more likely in these cases. Additionally, as placenta previa is commonly associated with previous cesarean sections, Placenta Accreta Spectrum (PAS) is a group of conditions where the placenta abnormally adheres to or invades the uterine wall, which can occur in cases of placenta previa, especially when there are previous cesarean deliveries. The spectrum includes placenta accreta, placenta increta', and placenta percreta each varying in the degree of invasion into the uterine wall. These conditions are associated with significant maternal morbidity, including severe postpartum hemorrhage (PPH), in cases of PAS, there is an increased risk of massive blood loss due to the difficulty in separating the placenta from the uterine wall. obstetrics hysterectomy or other complex surgeries is frequently required in severe cases

The relationship between these placental abnormalities and blood transfusion needs underscores the importance of careful prenatal monitoring and timely interventions to manage the risks of severe hemorrhage.

In our study, Total 5 patients of placental previa with acreta spectrum, all required more than 1unit of blood and blood products



This Pie chart shows requirements >1 Blood and blood products during LSCS in 108 traget population

4. Discussion

The findings of our study underscore the critical role of intraoperative blood transfusion during Lower Segment Cesarean Section (LSCS) in managing complications arising from excessive blood loss. With a prevalence of 10.7% for blood transfusions in the studied cohort, the results align with existing literature emphasizing the growing complexity of cesarean deliveries and the associated risks of hemorrhage and maternal morbidity.

Prevalence and Risk Factors for Transfusion
The high prevalence of blood transfusion observed in our study highlights the need for targeted interventions. Among the 108 women who required transfusion, multigravida women constituted a significant proportion (72.2%). This finding correlates with prior research indicating that repeated pregnancies and prior cesarean deliveries predispose women to complications such as uterine atony, placenta previa, and adhesions, all of which contribute to significant intraoperative blood loss.

Additionally, our study identified several key risk factors for transfusion, including anemia, postpartum hemorrhage (PPH), hypertensive disorders, and placental abnormalities. Anemia was the most common comorbidity, present in 40.7% of cases requiring transfusion. Women with preexisting anemia have reduced tolerance for blood loss, exacerbating their vulnerability during surgical procedures. This highlights the critical need for early identification and management of anemia during antenatal care, including iron supplementation and possibly erythropoietin therapy to optimize hemoglobin levels before delivery.

Placental Abnormalities and Hemorrhagic Risk
Placenta previa and Placenta Accreta Spectrum (PAS) emerged as significant contributors to the increased demand for blood transfusion. In our cohort, all patients with placenta previa and PAS required more than one unit of blood or blood products during surgery. These conditions are associated with abnormal placental adherence and invasion, making surgical intervention complex and increasing the likelihood of catastrophic hemorrhage. Studies have consistently demonstrated that PAS conditions such as placenta increta and percreta require advanced surgical techniques, including hysterectomy, to control bleeding, further elevating the demand for blood products.

Postpartum Hemorrhage and Hypertensive Disorders
Postpartum hemorrhage, identified in 35.2% of transfusion cases, remains a major contributor to maternal morbidity. The leading causes of PPH in our cohort included uterine atony, retained placental fragments, and complications from prior uterine surgeries. These findings highlight the importance of active management of the third stage of labor and early surgical intervention to address uterine atony and other causes of PPH.

Hypertensive disorders of pregnancy, such as pre-eclampsia, were observed in 9.3% of cases. These conditions predispose women to complications like placental abruption and coagulopathies, increasing the risk of severe intraoperative hemorrhage. This reinforces the importance of close monitoring and timely intervention in patients with hypertensive disorders to prevent adverse maternal outcomes.

Implications for Blood Management
Given the risks associated with blood transfusions, including limited availability, increased costs, and the potential for transfusion-related complications, optimizing blood utilization is essential. At our institution, the standard practice of cross-matching two or more units of blood for LSCS patients often results in over-reservation of blood, contributing to artificial scarcity. This practice underscores the need for evidence-based guidelines to ensure that blood is reserved only when clinically indicated.

Emerging techniques such as intraoperative cell salvage, which allows the collection and reinfusion of autologous blood, can play a pivotal role in reducing reliance on donor blood. Similarly, point-of-care testing for coagulation parameters and the use of tranexamic acid to reduce blood loss during surgery are promising strategies to optimize blood management.

Emergency Versus Elective Cesarean Deliveries
Our findings also highlight the higher risk of transfusion in emergency cesarean sections compared to elective procedures. Emergency surgeries are often associated with unanticipated complications, such as placental abruption or uterine rupture, which can result in massive hemorrhage. In contrast, elective surgeries allow for better preoperative preparation, including the correction of anemia and planning for potential complications. This underscores the importance of antenatal care in identifying high-risk patients and scheduling elective deliveries when possible.

5. Recommendations for Future Practice

The results of this study point to several actionable strategies for improving outcomes in women undergoing LSCS:

1) **Enhanced Antenatal Care:** Early identification and management of anemia and other risk factors during antenatal visits can significantly reduce the risk of

transfusion during cesarean deliveries. Universal screening for anemia and the provision of iron supplementation or erythropoietin should be prioritized.

2) **Judicious Blood Reservation:** Developing institution-specific protocols for blood cross-matching based on risk stratification can minimize unnecessary reservations and ensure timely access to blood for critically ill patients.
3) **Training and Surgical Planning:** Surgeons should be trained in advanced techniques for managing conditions like PAS and uterine atony. Multidisciplinary teams, including obstetricians, anesthesiologists, and hematologists, should be involved in the care of high-risk patients.
4) **Adoption of Blood Conservation Techniques:** Intraoperative cell salvage and the use of antifibrinolytics like tranexamic acid should be integrated into routine practice to reduce dependence on donor blood.
5) **Emergency Preparedness**:** Strengthening the capacity to handle obstetric emergencies, including the availability of blood products and skilled personnel, can improve outcomes in high-risk cases.

6. Limitations and Future Research

While our study provides valuable insights, it is limited by its retrospective design and single-center setting. Future prospective studies across multiple centers are needed to validate our findings and develop comprehensive guidelines for transfusion management in LSCS patients. Additionally, research on the cost-effectiveness and feasibility of blood conservation techniques in resource-limited settings would further inform practice.

7. Conclusion

Cesarean sections (CS) remain a significant contributor to maternal morbidity and mortality, particularly due to the high incidence of postpartum hemorrhage (PPH), which is one of the leading causes of maternal deaths worldwide, especially in developing countries. As the rates of cesarean deliveries increase, so does the complexity of the procedure, leading to a greater risk of complications, including substantial blood loss. This, in turn, results in an increased demand for blood transfusions, which may not always be readily available in resource-limited settings.

Our study highlights several key factors that contribute to the need for blood transfusion during Lower Segment Cesarean Sections (LSCS). Preoperative anemia, hypertensive disorders of pregnancy, and placental abnormalities, particularly placenta previa and placenta accreta spectrum, were found to be significant risk factors for requiring blood products. Women with comorbid conditions such as fibroid uterus, thrombocytopenia, and those undergoing multiple cesarean deliveries also faced higher risks of excessive bleeding and the associated need for transfusions. The findings suggest that careful preoperative screening, particularly for anemia and hypertensive disorders, could play a crucial role in minimizing the risk of severe blood loss during surgery.

Moreover, the study underscores the importance of effective blood management strategies, such as optimizing preoperative care and utilizing advanced techniques like intraoperative cell salvage, to reduce the reliance on allogeneic blood transfusions. These strategies not only help in improving patient outcomes but also address the challenges posed by the limited availability of blood in many healthcare settings. By implementing these strategies, healthcare institutions can enhance the safety of cesarean deliveries, reduce the associated morbidity and mortality, and optimize the use of scarce blood resources.

The study also highlights the need for careful surgical planning, particularly in high-risk cases, such as those with placenta previa or placenta accreta spectrum, where the complexity of the surgery and the risk of hemorrhage are significantly elevated. Timely interventions and the availability of trained personnel and adequate surgical support are crucial in managing these high-risk cases and ensuring favorable outcomes for both the mother and the infant.

In conclusion, while blood transfusion remains a life-saving intervention for managing excessive blood loss during cesarean deliveries, the judicious use of blood products, coupled with proactive preoperative screening and surgical planning, is essential for improving maternal health outcomes. Optimizing transfusion practices and improving resource management are critical to ensuring that blood products are available when needed most, particularly in settings with limited blood supplies. By identifying and addressing the risk factors for blood transfusion, we can not only enhance patient safety but also contribute to the broader goal of reducing maternal morbidity and mortality related to cesarean deliveries.

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