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Frequency of Postpartum Hemorrhage after Elective Cesarean Section and Emergency Cesarean Section

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ABSTRACT

Background: Postpartum hemorrhage is a common cause of both maternal morbidity and mortality worldwide and is frequent following cesarean delivery. Prevalence is affected by both maternal and procedural elements and is often greater with emergency cesarean deliveries. Identification of incidence and determinants of postpartum hemorrhage is of primary importance and guides preventive strategies at the level of clinical practice. **Objective:** To determine the frequency of postpartum hemorrhage after cesarean section and to compare its occurrence between elective and emergency cesarean deliveries. **Study Design:** Cross-sectional study. **Duration and Place of Study:** The study was conducted from June 2024 to November 2024 at the Department of Obstetrics and Gynecology, Mardan Medical Complex, Mardan. **Methodology:** A total of 135 women aged 18–40 years undergoing cesarean delivery were included through non-probability consecutive sampling. Baseline demographic data including maternal age, gestational age, parity, body mass index, socioeconomic status, residence, occupation, and education were recorded. Cesarean sections were performed by obstetricians with at least one year of postgraduate experience. Postpartum hemorrhage was defined as blood loss exceeding 1000 ml within 24 hours, measured using standardized gravimetric methods. **Results:** The mean maternal age was 30.27±6.16 years, and mean gestational age was 38.47±1.74 weeks. Postpartum hemorrhage occurred in 19.3% (26/135) of patients. Elective cesarean section had a lower frequency (8.0%) compared to emergency procedures (25.9%), with statistical significance (p=0.012). Gestational age ≤39 weeks and secondary-level education were also significantly associated with higher rates of postpartum hemorrhage. **Conclusion:** Postpartum hemorrhage is more frequent following emergency cesarean section compared to elective procedures.

INTRODUCTION

Postpartum hemorrhage is a common cause of maternal morbidity and mortality worldwide and is accountable for a high percentage of preventable deaths in both developed and impoverished health care settings.[1] It is generally defined by blood loss of greater than 500 milliliters following vaginal delivery or greater than 1000 milliliters following cesarean section, although clinical-level diagnosis is no less important than quantitative measurement.[2] Its etiology is often multi-factorial and uterine atony is the most frequent cause followed by retained placental tissue, genital tract trauma and coagulopathies.[3] Early identification and prompt treatment are mandatory if hemodynamic instability and life-threatening complications are to be prevented in the mother.[4]

In elective cesarean section patients, postpartum hemorrhage is generally lower compared with emergency surgeries resulting from preplanned surgical scenarios, optimum maternal preparation, and exposure to a controlled operating room.[5] Women arriving for elective surgeries are usually optimized with stabilized hemodynamics, completion of antenatal workup, and preoperative optimization with correction of anemia and control of comorbidities.[6] The surgical team is further optimally prepared with adequate resources available within their reach, and this reduces intraoperative complications and blood loss estimation. Despite these ideal situations, postpartum hemorrhage remains a likely consequence of situations such as placenta previa, multiple gestations, or pre-existing abnormalities of the uterus.[7]

Emergency cesareans have a substantially higher risk of postpartum hemorrhage by virtue of presentation urgency and severity. They are typically undertaken in operability unstable patients, with chorioamnionitis, labor obstruction, abruption or following prolonged oxytocin exposure and these are all risks of hemorrhage and uterine atony.[8] The urgency of surgery itself, the preoperative unpreparedness and greater odds of trauma at operation

largely account for the risks.[9] Also, suboptimal blood product availability and limited time available for optimization of anesthesia may complicate management where available resources are limited.[10] Emergency cesarean section is still a notable promoter of severe postpartum hemorrhage and associated maternal complications.[11,12]

Roshani S. et al. reported that the incidence of postpartum hemorrhage following cesarean section was 22%.[13] Similarly, Sharma A. et al. demonstrated that postpartum hemorrhage occurred in 6.2% of women undergoing elective cesarean section compared to 16.9% in those who had emergency cesarean section.[14]

Conducting this study from Mardan is relevant because postpartum hemorrhage is yet a frequent cause of maternal morbidity and mortality within the region but data relating to local practice are few. Patient demography, available resources and surgical readiness may differ and can influence the outcomes following elective and emergency cesarean deliveries. Producing evidence from Mardan will not only inform us of the prevalence of postpartum hemorrhage from this group of patients but will enable obstetricians and policymakers to take region-specific steps toward reducing maternal complications and improving general quality of care.

METHODOLOGY

This cross-sectional study was undertaken in the Department of Obstetrics and Gynecology at Mardan Medical Complex, Mardan, over a six-month period from June 2024 to November 2024. A total of 135 participants were enrolled. The sample size was calculated using the World Health Organization sample size software, with a 95% confidence level, a 7% margin of error, and an expected frequency of postpartum hemorrhage of 22% following cesarean section.[13]

Prior to study initiation, formal approval was obtained from the institutional ethics committee. Women between 18 and 40 years of age, with a singleton pregnancy confirmed on ultrasound, gestational age greater than 36 weeks by last menstrual period, and scheduled for cesarean delivery, either elective or emergency, were considered eligible. Elective cesarean delivery was defined as a procedure scheduled before the estimated due date, with the decision taken more than 24 hours before delivery. Emergency cesarean delivery was defined as any non-planned cesarean procedure performed due to immediate maternal or fetal indications. Women were excluded if they had preoperative hemoglobin levels at or below 10 g/dl, a history of antepartum hemorrhage, abnormal placentation on ultrasound, severe pre-eclampsia or eclampsia, diabetes mellitus, or chronic hypertension. Written informed consent was obtained from each participant, ensuring confidentiality and voluntary participation. Demographic details such as maternal age, gestational age, parity, body mass index, socioeconomic class, monthly income, occupation, educational attainment, place of residence, and type of cesarean section were recorded. Obstetric history and complete clinical assessment were carried out before surgery. All procedures were performed by obstetricians who had completed at least one year of postgraduate training and independently conducted a minimum of 25 cesarean deliveries prior to the study. The primary outcome of interest was postpartum hemorrhage, defined as blood loss greater than 1000 milliliters within 24 hours of cesarean delivery. Blood loss was assessed by weighing soaked pads, gauzes, and clots, subtracting dry weight, and calculating total loss, with one gram equated to one milliliter.

All data were entered into a structured proforma prepared for this study. Statistical analysis was conducted using IBM SPSS version 26. Quantitative data were presented as mean with standard deviation or median with interquartile range depending on distribution, assessed using the Shapiro–Wilk test. Categorical data were expressed as frequencies and percentages. Comparisons of postpartum hemorrhage between elective and emergency cesarean groups were made using the chi-square test, with a p-value of ≤0.05 considered statistically significant. To account for effect modifiers, stratification was performed for age, gestational age, parity, body mass index, socioeconomic status, residence, occupation, and education, followed by post-stratification chi-square analysis.

RESULTS

The study population comprised 135 patients with a mean age of 30.27±6.16 years, mean gestational age of 38.47±1.74 weeks, mean parity of 3.14±1.92, and mean BMI of 27.80±3.83 kg/m^2 (as shown in Table-I). The mean blood loss was 835.56±243.67 ml across all patients. Regarding residential distribution, 70 patients (51.9%) were from rural areas while 65 patients (48.1%) were from urban areas. Socioeconomic status analysis revealed that 57 patients (42.2%) belonged to low socioeconomic status, 64 patients (47.4%) to middle class, and 14 patients (10.4%) to high socioeconomic status. The majority of patients were housewives comprising 130 patients (96.3%), with only 5 patients (3.7%) being employed. Educational background showed that 37 patients (27.4%) were uneducated, 49 patients (36.3%) had primary education, 41 patients (30.4%) had secondary education, and 8 patients (5.9%) had higher education. The cesarean section distribution demonstrated that 50 patients (37.0%) underwent elective procedures while 85 patients (63.0%) required emergency cesarean sections (as shown in Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD
Age (years)	30.27±6.16
Gestational Age (weeks)	38.47±1.74
Parity	3.14±1.92
BMI (Kg/m^2)	27.80±3.83
Blood loss (ml)	835.56±243.67
Residential Status	
Rural n (%)	70 (51.9%)
Urban n (%)	65 (48.1%)
Socioeconomic Status	
Low n (%)	57 (42.2%)
Middle n (%)	64 (47.4%)
High n (%)	14 (10.4%)
Profession	
Housewife n (%)	130 (96.3%)
Job n (%)	5 (3.7%)
Education Level	

Uneducated n (%)	37 (27.4%)
Primary n (%)	49 (36.3%)
Secondary n (%)	41 (30.4%)
Higher n (%)	8 (5.9%)
Type of C-section	
Elective n (%)	50 (37.0%)
Emergency n (%)	85 (63.0%)

The overall frequency of postpartum hemorrhage was 26 cases (19.3%) out of 135 total deliveries, while 109 patients (80.7%) did not experience postpartum hemorrhage (as shown in Table-II).

Table II

Frequency of Postpartum Hemorrhage

Postpartum Hemorrhage	Frequency	%age
Yes	26	19.30%
No	109	80.70%
Total	135	100%

The comparison between cesarean section types revealed a statistically significant difference in postpartum hemorrhage rates, with elective cesarean sections showing 4 cases (8.0%) compared to emergency cesarean sections with 22 cases (25.9%), yielding a p-value of 0.012 using Fischer Exact Test (as shown in Table-III).

Table III

Comparison of C-section Type with Postpartum Hemorrhage

C-section Type	Postpartum Hemorrhage		P-value
	Yes n(%)	No n(%)	
Elective	4 (8.0%)	46 (92.0%)	0.012*
Emergency	22 (25.9%)	63 (74.1%)	

***Fischer Exact Test**

Age stratification into ≤30 years and >30 years groups showed 15 cases (21.7%) and 11 cases (16.7%) respectively, with no statistical significance (p=0.455). Gestational age analysis revealed a significant association (p=0.018) with patients ≤39 weeks experiencing 23 cases (25.0%) of hemorrhage compared to 3 cases (7.0%) in patients >39 weeks. Parity groups showed 18 cases (23.4%) in patients with ≤3 pregnancies versus 8 cases (13.8%) in those with >3 pregnancies, without statistical significance (p=0.162). BMI stratification demonstrated 9 cases (22.5%) in patients with BMI ≤25 kg/m^2 and 17 cases (17.9%) in those with BMI >25 kg/m^2, showing no significant difference (p=0.536). Residential status comparison revealed 9 cases (12.9%) in rural patients versus 17 cases (26.2%) in urban patients, approaching statistical significance (p=0.050). Socioeconomic status analysis showed 8 cases (14.0%) in low status, 16 cases (25.0%) in middle status, and 2 cases (14.3%) in high status groups, without statistical significance (p=0.286). Professional status demonstrated 26 cases (20.0%) among housewives and 0 cases (0.0%) among employed women, showing no statistical significance (p=0.583). Education level analysis revealed significant associations (p=0.009) with uneducated patients showing 8 cases (21.6%), primary education 3 cases (6.1%), secondary education 14 cases (34.1%), and higher education 1 case (12.5%) of postpartum hemorrhage (as shown in Table-IV).

Table IV

Association of Demographic Factors with Postpartum Hemorrhage

Demographic Factors	Groups	Postpartum Hemorrhage		p-value
		Yes n(%)	No n(%)	
Age (years)	≤30	15 (21.7%)	54 (78.3%)	0.455
	>30	11 (16.7%)	55 (83.3%)	
Gestational Age (weeks)	≤39	23 (25.0%)	69 (75.0%)	0.018*
	>39	3 (7.0%)	40 (93.0%)	
Parity	≤3	18 (23.4%)	59 (76.6%)	0.162
	>3	8 (13.8%)	50 (86.2%)	
BMI (Kg/m^2)	≤25	9 (22.5%)	31 (77.5%)	0.536
	>25	17 (17.9%)	78 (82.1%)	
Residential Status	Rural	9 (12.9%)	61 (87.1%)	0.050
	Urban	17 (26.2%)	48 (73.8%)	
Socioeconomic Status	Low	8 (14.0%)	49 (86.0%)	0.286
	Middle	16 (25.0%)	48 (75.0%)	
	High	2 (14.3%)	12 (85.7%)	
Profession	Housewife	26 (20.0%)	104 (80.0%)	0.583*
	Job	0 (0.0%)	5 (100.0%)	
Education Level	Uneducated	8 (21.6%)	29 (78.4%)	0.009*
	Primary	3 (6.1%)	46 (93.9%)	
	Secondary	14 (34.1%)	27 (65.9%)	
	Higher	1 (12.5%)	7 (87.5%)	

***Fischer Exact Test**

DISCUSSION

This study investigated the incidence and contributing factors of postpartum hemorrhage following cesarean section deliveries, with particular attention paid to elective and emergency cesarean sections. We identified that postpartum hemorrhage was substantially higher after emergency cesarean sections (25.9%) than after elective sections (8.0%), both corresponding to a hemorrhage incidence of 19.3% in this study sample.

Three times elevated hemorrhage risk of emergency cesarean deliveries may be attributable both to physiological and clinical features. Emergency cesarean deliveries have a tendency to occur under the circumstances of prolonged labor or fetal or maternal complications making feasible the uterine atony and contractility impairment. Further, emergency cesarean deliveries cannot offer sufficient surgical preparation, control of hemostasis and preemption and control of potential bleeding complications. Emergency conditions involve stress reaction resulting in coagulopathy due to activation of inflammatory cascades and consumption of coagulation factors.

There is robust association of gestational age ≤39 weeks and elevated hemorrhage risk with preterm deliveries' immature uterine contractility and suboptimal

hemostasis. Preterm delivering uteri exhibit low density of myometrial fibers and dysfunctional adaptation of vessels leading to inefficienct spiral artery compression after delivering. Educational level association, particularly greater hemorrhage prevalence at secondary education level (34.1%), may reflect underlying multifaceted sociodemographic determinants of attitudes toward healthcare seeking, antenatal care seeking and nutrition status but requires more study to establish causality.

Our findings align with several international studies demonstrating significantly higher postpartum hemorrhage rates in emergency compared to elective cesarean sections. Pandey S, et al. [15] reported a 9.2% hemorrhage rate in emergency cesarean sections, which is considerably lower than our emergency group rate of 25.9%, possibly reflecting differences in study populations, hemorrhage definitions, or institutional protocols.[16] Similarly, Sharma A, et al. [14] found postpartum hemorrhage rates of 16.9% in emergency versus 6.2% in elective cesarean sections, demonstrating a comparable pattern to our study though with lower absolute rates. The disparity in hemorrhage frequencies across studies may be attributed to variations in patient demographics, with Pandey S, et al. [15] reporting 59.2% rural patients compared to our 51.9%, and differences in clinical management protocols between institutions.

The demographic profile of our study population shows similarities with existing literature, particularly regarding maternal age and gestational parameters. Our mean maternal age of 30.27±6.16 years is comparable to El Abdeen EZ, et al. [17] who reported 29.7±6.3 years for carbetocin group and 29.6±6.2 years for oxytocin group, and Mostafayi M, et al. [18] with 28.1±5.1 versus 28.7±4.5 years for elective and emergency groups respectively. However, our study population demonstrated higher BMI values (27.80±3.83 kg/m^2) compared to El Abdeen EZ, et al. [17] who reported 25.3±3.4 versus 25.2±3.3 kg/m^2, suggesting regional nutritional differences or varying obesity prevalence that may influence hemorrhage risk through altered uterine contractility and surgical complexity.

Our finding of significantly increased hemorrhage risk with gestational age ≤39 weeks (25.0% versus 7.0%, p=0.018) contradicts the gestational age findings of El Abdeen EZ, et al. [17] who reported similar gestational ages (38.6±1.1 versus 38.3±1.1 weeks) between groups without significant hemorrhage differences. This discrepancy may reflect our study's broader gestational age range and different cutoff criteria, as earlier gestational ages are associated with incomplete uterine maturation and suboptimal hemostatic mechanisms. The residential status association approaching significance (p=0.050) with higher urban hemorrhage rates (26.2% versus 12.9%) differs from Pandey S, et al. [15] who found higher complication rates in rural populations, possibly reflecting urbanization-related lifestyle factors, delayed presentation patterns, or healthcare accessibility differences in our Pakistani population.

The blood loss patterns in our study (mean 835.56±243.67 ml) demonstrate intermediate values compared to international data, with El Abdeen EZ, et al. [17] reporting lower blood loss (448.5±85.1 ml in carbetocin group versus 505.1±111.1 ml in oxytocin group) and Mostafayi M, et al. [18] showing higher intraoperative bleeding (753±112 ml versus 800±110 ml for elective and emergency respectively). These variations likely reflect differences in hemorrhage measurement techniques, prophylactic uterotonic protocols, and surgical expertise, as Fenn MG, et al. [19] reported mean blood loss of 860 ml versus 1400 ml for vaginal versus cesarean deliveries, emphasizing the inherently higher bleeding risk associated with surgical delivery. The educational level association we observed, particularly the elevated hemorrhage rate in secondary education patients (34.1%), has not been consistently reported in comparable studies, suggesting this relationship may be specific to our population's socioeconomic and healthcare access patterns rather than a universal demographic risk factor.

Several limitations must be acknowledged when interpreting our findings. This retrospective study at one center limits generalizability of results to other health care facilities with diverse patient populations, surgical practice, and available resources. Data collection being cross-sectional might have introduced temporal bias and potential misclassification of hemorrhage severity or demographic variables. Confounding variables such as anesthetic practice, expertise of the surgeon, prophylactic uterotonic practice, or individual emergency cesarean section indications were not controlled for within our study and may critically influence hemorrhage outcomes. Sample size was quite small with limited power within particular demographic subgroups such as higher education status or employed women where cases may have been few. Study period and institutional practice may not reflect up-to-date evidence-based practice or newer therapeutic strategies that may alter hemorrhage risk profiles.

CONCLUSION

Our study has identified that postpartum hemorrhage is far more likely after emergency cesareans than after elective cesareans and has identified the urgency and timing of surgical intervention as the defining factor of maternal bleeding complications. It identified gestational age and education status as significant demographic predictors of hemorrhage incidence and found no significant associations involving other parameters of maternal age, parity, BMI, living status, socioeconomic status, and occupation.

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