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Original Research Article

MATERNAL AND FETAL RISK FACTORS ASSOCIATED WITH EMERGENCY PERIPARTUM HYSTERECTOMY: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Emergency peripartum hysterectomy is a life-saving surgical procedure performed for uncontrollable obstetric haemorrhage when medical and conservative surgical measures fail. It is associated with massive blood loss, intensive care admission, maternal morbidity, permanent loss of fertility and adverse fetal outcomes. Identification of maternal and fetal factors among women undergoing EPH many support antenatal risk stratification, timely referral and improved emergency preparedness. **Aim:** To evaluate the maternal and fetal risk factors and outcomes among women undergoing emergency peripartum hysterectomy.

Materials and Methods: This hospital-based prospective observational study included 38 women who underwent emergency peripartum hysterectomy at a tertiary-care teaching hospital. Maternal demographic characteristics, obstetric history, referral status, previous caesarean delivery, clinical condition, laboratory findings, indications for hysterectomy, operative details and maternal complications were recorded. Pregnancy-related factors and fetal outcomes, including gestational age, fetal presentation, fetal distress, birth weight, Apgar score, NICU admission and perinatal mortality, were evaluated. Categorical variables were presented as frequencies and percentages, while continuous variables were summarized as mean and standard deviation. Chi-square, exact binomial and one-sample t-tests were applied, with $p<0.05$ considered statistically significant.

Results: Among 18,342 deliveries, 38 women underwent EPH, giving a frequency of 2.07 per 1,000 deliveries (95% CI: 1.47-2.84). The mean maternal age was 31.74±4.86 years, mean parity was 2.84±1.36, mean gestational age was 35.82±3.41 weeks and mean admission haemoglobin was 8.42±1.76 g/dL. Previous caesarean delivery was present in 68.4%, anaemia in 76.3%, multiparity in 60.5% and placenta previa in 44.7%. Placenta accreta spectrum was the leading indication for EPH (34.2%), followed by refractory uterine atony (23.7%) and uterine rupture (21.1%). The mean estimated blood loss was 3,420±1,280 mL, and the mean transfusion requirement was 6.74±3.21 units. Blood-component transfusion was required in 94.7%, and 81.6% required ICU admission. Disseminated intravascular coagulation occurred in 31.6%, acute kidney injury in 23.7% and postoperative sepsis in 18.4%. Maternal survival was 89.5%, while maternal mortality was 10.5%. Fetal distress occurred in 55.3%, and 55.3% of pregnancies were preterm. Surviving live births constituted 73.7%, while stillbirth and early neonatal death occurred in 21.1% and 5.3%, respectively. NICU admission and prematurity were each recorded in 55.3%, low birth weight in 57.9%, birth asphyxia in 36.8%, and overall perinatal mortality in 28.9%.

Conclusion: Placenta accreta spectrum, uterine atony and uterine rupture were the principal indications for emergency peripartum hysterectomy. Anaemia, previous caesarean delivery, multiparity, placenta previa and referral after the onset of complications were prominent maternal characteristics. EPH was associated with massive haemorrhage, extensive transfusion requirements, ICU admission and considerable maternal and perinatal morbidity and mortality. Early identification of high-risk pregnancies, correction of anaemia, timely referral and multidisciplinary management with adequate blood-bank and intensive care support may improve maternal and fetal outcomes.
Keywords: Emergency peripartum hysterectomy; Placenta accreta spectrum; Obstetric haemorrhage.

INTRODUCTION

Emergency peripartum hysterectomy (EPH) is the surgical removal of the uterus performed during caesarean delivery or following vaginal or caesarean birth, usually as a life-saving procedure for uncontrollable obstetric haemorrhage. Although relatively uncommon, EPH represents one of the most severe forms of maternal morbidity because it is frequently undertaken under emergency conditions in haemodynamically unstable patients. It may be accompanied by massive blood loss, blood-component transfusion, disseminated intravascular coagulation, urinary tract injury, intensive care admission, prolonged hospitalization and maternal death. In addition to its immediate physical consequences, hysterectomy results in permanent loss of fertility and can cause considerable psychological and social distress.[1,2]

The indications for EPH have changed over time. Uterine atony and uterine rupture were traditionally the major indications, whereas abnormal placentation particularly placenta accreta spectrum associated with placenta previa and previous caesarean delivery has become increasingly important.[2,3] The increasing rate of caesarean delivery has contributed to a larger population of women with uterine scars and a higher risk of placenta previa, placenta accreta spectrum, operative adhesions and uterine rupture in subsequent pregnancies. Other maternal factors associated with EPH include advanced maternal age, multiparity, grand multiparity, anaemia, previous uterine surgery, inadequate antenatal care, referral after the onset of complications, hypertensive disorders, prolonged or obstructed labour and coagulation abnormalities.[1-4]

Fetal and pregnancy-related conditions may also contribute directly or indirectly to EPH. Multiple pregnancy, fetal macrosomia, polyhydramnios and prolonged labour can cause uterine overdistension or exhaustion and increase the risk of uterine atony. Malpresentation, obstructed labour, intrauterine fetal death and placental abruption may be associated with traumatic delivery, uterine rupture, coagulopathy or severe haemorrhage. Adverse fetal outcomes, including prematurity, birth asphyxia, neonatal intensive care admission, stillbirth and early neonatal death, are common when EPH follows placental abruption, uterine rupture, severe maternal shock or an emergency preterm delivery.

EPH is generally considered only after medical and uterus-preserving interventions such as uterotonics, tranexamic acid, uterine balloon tamponade, compression sutures and devascularization procedures have failed or are considered unsuitable. Nevertheless, hysterectomy should not be delayed when continuing haemorrhage threatens the woman's life. Early recognition of risk factors, antenatal diagnosis of placenta accreta spectrum, timely referral, availability of blood components and coordinated multidisciplinary management may improve maternal and fetal outcomes.[3-5] Therefore, identifying the maternal and fetal factors observed among women undergoing EPH is essential for strengthening antenatal risk stratification, referral systems, emergency preparedness and clinical management at tertiary-care hospitals.

Aim

To evaluate the maternal and fetal risk factors and outcomes among women undergoing emergency peripartum hysterectomy.

Objectives

1. To determine the frequency, clinical indications and maternal risk factors among women undergoing emergency peripartum hysterectomy.
2. To assess the fetal and pregnancy-related factors associated with emergency peripartum hysterectomy.
3. To evaluate the maternal and fetal outcomes following emergency peripartum hysterectomy.

MATERIALS AND METHODS

Source of Data

The study data were obtained prospectively from pregnant or recently delivered women who underwent emergency peripartum hysterectomy at the study hospital during the defined study period. Information was collected from direct clinical assessment, antenatal records, referral documents, labour-room records, operation notes, anaesthesia records, blood-bank records, intensive care records, laboratory reports and neonatal case records.

Study Design

The study was designed as a hospital-based prospective observational study.

Study Location

The study was conducted in the Department of Obstetrics and Gynaecology of a tertiary-care teaching hospital in Central India. The hospital served as a referral centre for high-risk pregnancies and obstetric emergencies from surrounding urban and rural areas.

Study Duration

The study was conducted from 1 December 2022 to 30 December 2024, covering approximately 24 months, including recruitment, clinical follow-up, data verification and analysis.

Study Population

The study population consisted of all women who underwent emergency peripartum hysterectomy following a pregnancy of more than 28 completed weeks and fulfilled the eligibility criteria during the study period.

Sample Size

The sample size was calculated using the formula for estimating a single population proportion:

$$n = \frac{Z_{\alpha/2}^2 \times p \times q}{d^2}$$

Where:

- n= required sample size
- $Z_{\alpha/2}$= 1.96 at a 95% confidence level
- p= anticipated proportion of the principal risk factor, taken as 50% because reliable local estimates were unavailable
- $q = 1 - p = 50\%$
- d= absolute precision, taken as 16%

$$n = \frac{(1.96)^2 \times 0.50 \times 0.50}{(0.16)^2}$$

$$n = \frac{3.8416 \times 0.25}{0.0256} = 37.52$$

Thus, the minimum required sample size was rounded to 38 participants. Consecutive sampling was used, and all 38 eligible cases encountered during the study period were included.

Inclusion Criteria

- Women who underwent emergency peripartum hysterectomy during or after vaginal or caesarean delivery.
- Women with a gestational age of more than 28 completed weeks.
- Hysterectomy performed during delivery or within 42 days following termination of pregnancy for an obstetric indication.
- Women managed primarily at the study hospital or referred after delivery or an obstetric complication.
- Women whose clinical, operative and outcome records were sufficiently complete for analysis.
- Women or legally authorized representatives who provided informed consent for participation and use of clinical data, wherever applicable.

Exclusion Criteria

- Hysterectomy performed before 28 completed weeks of gestation.
- Elective hysterectomy planned for a non-obstetric indication.
- Hysterectomy performed for gynaecological malignancy, benign gynaecological disease or chronic pelvic pathology unrelated to pregnancy.
- Women who underwent conservative surgical management without removal of the uterus.
- Cases with insufficient clinical or operative information for determining the indication and outcomes.
- Women who declined participation or use of their clinical data.

Procedure and Methodology

Approval was obtained from the Institutional Ethics Committee before commencement of the study. Eligible women were enrolled consecutively. Informed consent was obtained from the patient; when the patient was critically ill or unconscious, consent was obtained from a legally authorized representative according to institutional policy. Emergency treatment was not delayed for research-related procedures.

Demographic characteristics, including age, residence, socioeconomic status, booking status and referral status, were recorded. A detailed obstetric history was obtained, including gravidity, parity, gestational age, previous caesarean deliveries, previous uterine surgery, history of postpartum haemorrhage, abortions, antenatal complications and current pregnancy characteristics.

Maternal risk factors assessed included advanced maternal age, multiparity, grand multiparity, anaemia, previous caesarean delivery, placenta previa, placenta accreta spectrum, placental abruption, hypertensive disorders, prolonged or obstructed labour, uterine rupture, uterine atony, coagulation abnormalities, sepsis, traumatic delivery and delay in referral.

Pregnancy-related and fetal factors included multiple pregnancy, fetal macrosomia, polyhydramnios, malpresentation, fetal distress, prematurity, intrauterine fetal death and birth asphyxia. Fetal or neonatal outcomes included live birth, stillbirth, birth weight, Apgar scores, requirement for resuscitation, neonatal intensive care admission and early neonatal death.

At admission, the woman's pulse, blood pressure, respiratory rate, oxygen saturation, temperature, consciousness level, capillary refill time and presence of haemorrhagic shock were documented. General, systemic and obstetric examinations were performed. Relevant ultrasound and Doppler findings were recorded when available.

The indication for hysterectomy, mode of delivery, conservative measures attempted before hysterectomy, type of hysterectomy, surgical approach, operative duration, estimated blood loss,

blood-component requirement, intraoperative complications and additional surgical procedures were documented. Conservative measures included uterotonics, tranexamic acid, uterine massage, balloon tamponade, uterine compression sutures and uterine or internal iliac artery ligation, as clinically appropriate.

Postoperatively, the women were followed until discharge or death. Intensive care admission, ventilatory or vasopressor support, disseminated intravascular coagulation, acute kidney injury, febrile morbidity, sepsis, wound complications, urinary tract injury, re-exploration, length of hospital stay and maternal mortality were recorded.

Sample Processing

Venous blood samples collected as part of routine clinical management were processed in the hospital laboratory. Blood collected in ethylenediaminetetraacetic acid tubes was used for haemoglobin, total leukocyte count and platelet count. Citrated blood was used for prothrombin time, international normalized ratio, activated partial thromboplastin time and fibrinogen estimation when indicated. Serum samples were used for renal and liver function tests and electrolyte estimation.

Blood grouping and cross-matching were performed through the hospital blood bank. Samples were labelled with unique identification numbers and transported according to institutional biosafety protocols. No additional invasive sample was collected solely for this observational study. Laboratory results obtained nearest to admission and before major transfusion, whenever available, were used as baseline findings.

Data Collection

Data were collected using a predesigned, pretested case-record form. The form included:

- Demographic and socioeconomic characteristics
- Booking and referral details
- Medical, surgical and obstetric history
- Maternal and fetal risk factors
- Clinical condition at admission
- Laboratory and imaging findings
- Indication for hysterectomy
- Conservative measures attempted
- Operative and anaesthetic details
- Blood and blood-component transfusion
- Intraoperative and postoperative complications
- Maternal outcome
- Fetal and neonatal outcomes

Each form was checked for completeness. Participant identity was replaced by a unique study code, and the data were stored securely with access limited to the investigators.

Statistical Methods

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 20.0 or a later available version. Categorical variables were summarized as frequencies and percentages. Continuous variables were presented as mean with standard deviation when normally distributed and as median with interquartile range when non-normally distributed. The Shapiro-Wilk test and graphical methods were used to assess normality.

Associations between categorical variables were assessed using the chi-square test or Fisher's exact test when expected cell frequencies were small. Continuous variables were compared using the independent-samples *t*-test or Mann-Whitney U test, as appropriate. Effect estimates were presented as odds ratios with 95% confidence intervals.

Variables clinically relevant or associated at $p < 0.20$in univariable analysis were considered for multivariable logistic regression, subject to the number of observed outcome events. Adjusted odds ratios with 95% confidence intervals were reported. Because the sample contained only 38 cases, the number of predictors entered into a multivariable model was restricted to avoid model overfitting. All tests were two-tailed, and $p < 0.05$was considered statistically significant.

RESULTS

Table 1: Overall maternal and fetal risk-factor and outcome profile of women undergoing emergency peripartum hysterectomy (N=38)

Study parameter	n (%) or Mean (SD)	95% CI	Test statistic	p-value
Maternal age, years	31.74 (4.86)	30.14-33.34	t=2.21†	0.033
Parity	2.84 (1.36)	2.39-3.29	t=3.81†	<0.001
Gestational age, weeks	35.82 (3.41)	34.70-36.94	t=−2.13†	0.040
Admission haemoglobin, g/dL	8.42 (1.76)	7.84-9.00	t=−9.03†	<0.001
Booked pregnancy	31 (81.6)	66.6-90.8	Exact binomial	<0.001
Referred from another facility	27 (71.1)	55.2-83.0	Exact binomial	0.014
Previous caesarean delivery	26 (68.4)	52.5-80.9	Exact binomial	0.034
Multiparity, parity ≥3	23 (60.5)	44.7-74.4	Exact binomial	0.256
Haemorrhagic shock at admission	24 (63.2)	47.3-76.6	Exact binomial	0.143
Preterm pregnancy, <37 weeks	21 (55.3)	39.7-69.9	Exact binomial	0.627
Fetal distress	21 (55.3)	39.7-69.9	Exact binomial	0.627
Live birth	28 (73.7)	58.0-85.0	Exact binomial	0.005
Maternal ICU admission	31 (81.6)	66.6-90.8	Exact binomial	<0.001
Maternal survival	34 (89.5)	75.9-95.8	Exact binomial	<0.001

†One-sample *t*-test against reference values: maternal age=30 years, parity=2, gestational age=37 weeks and haemoglobin=11 g/dL. Exact binomial tests compared the observed proportion with 50%.

Table 1 presents the overall maternal and fetal risk-factor and outcome profile of 38 women who underwent emergency peripartum hysterectomy. The mean maternal age was 31.74±4.86 years (95% CI: 30.14-33.34), which was significantly higher than the reference age of 30 years (t=2.21, p=0.033). The mean parity was 2.84±1.36 (95% CI: 2.39-3.29) and was significantly higher than the reference value of two (t=3.81, p<0.001). The mean gestational age was 35.82±3.41 weeks (95% CI: 34.70-36.94), which was significantly lower than 37 weeks (t=−2.13, p=0.040). The mean admission haemoglobin was 8.42±1.76 g/dL (95% CI: 7.84-9.00), indicating significant maternal anaemia compared with the reference value of 11 g/dL (t=−9.03, p<0.001). Most pregnancies were booked (81.6%, p<0.001), while 71.1% of women were referred from another facility (p=0.014). A previous caesarean delivery was reported in 68.4% of cases (p=0.034), and 60.5% were multiparous, although the latter proportion was not statistically significant (p=0.256). Haemorrhagic shock was present in 63.2% of women at admission. Preterm pregnancy and fetal distress were each observed in 55.3% of cases; these proportions were not significantly different from 50% (p=0.627). A live birth was recorded in 73.7% of cases (95% CI: 58.0-85.0; p=0.005). ICU admission was required in 81.6% of women (p<0.001), reflecting the severity of their clinical condition. Nevertheless, maternal survival was 89.5% (95% CI: 75.9-95.8; p<0.001).

Table 2: Frequency, clinical indications and maternal risk factors among women undergoing emergency peripartum hysterectomy

A. Frequency of emergency peripartum hysterectomy

Parameter	Value	95% CI	Test statistic	p-value
Total deliveries during study period	18,342			
Emergency peripartum hysterectomies	38			
Frequency per 1,000 deliveries	2.07	1.47-2.84	z=4.60†	<0.001

†One-sample proportion test against a reference frequency of 1 EPH per 1,000 deliveries.

B. Clinical indications for emergency peripartum hysterectomy (N=38)

Clinical indication	n (%)	95% CI	Test statistic	p-value
Placenta accreta spectrum	13 (34.2)	21.2-50.1	χ^2=15.68	0.008
Refractory uterine atony	9 (23.7)	13.0-39.2		
Uterine rupture	8 (21.1)	11.1-36.3		
Placental abruption with uncontrolled haemorrhage	4 (10.5)	4.2-24.1		
Traumatic obstetric haemorrhage	3 (7.9)	2.7-20.8		
Other indications	1 (2.6)	0.5-13.5		

The chi-square goodness-of-fit test assessed the overall distribution of indications.

C. Maternal risk factors (N=38)

Maternal risk factor	n (%)	95% CI	Test statistic	p-value
Previous caesarean delivery	26 (68.4)	52.5-80.9	Exact binomial	0.034
Anaemia at admission, Hb <10 g/dL	29 (76.3)	60.8-87.0	Exact binomial	0.002
Multiparity, parity ≥3	23 (60.5)	44.7-74.4	Exact binomial	0.256
Maternal age ≥30 years	22 (57.9)	42.2-72.1	Exact binomial	0.418
Placenta previa	17 (44.7)	30.1-60.3	Exact binomial	0.627
Inadequate antenatal visits	16 (42.1)	27.9-57.8	Exact binomial	0.418
Hypertensive disorder of pregnancy	12 (31.6)	19.1-47.5	Exact binomial	0.034
Prolonged or obstructed labour	11 (28.9)	17.0-44.8	Exact binomial	0.014
Previous dilatation and curettage	9 (23.7)	13.0-39.2	Exact binomial	0.002
Previous postpartum haemorrhage	7 (18.4)	9.2-33.4	Exact binomial	<0.001
Known coagulation abnormality	4 (10.5)	4.2-24.1	Exact binomial	<0.001

Exact binomial tests compared the proportion with and without each risk factor.

During the study period, 18,342 deliveries were recorded, of which 38 required emergency peripartum hysterectomy. The frequency of EPH was therefore 2.07 per 1,000 deliveries (95% CI: 1.47-2.84), which was significantly higher than the reference frequency of one per 1,000 deliveries (z=4.60, p<0.001). Placenta accreta spectrum was the leading clinical indication, accounting for 34.2% of procedures, followed by refractory uterine atony in 23.7% and uterine rupture in 21.1%. Placental abruption with uncontrolled haemorrhage accounted for 10.5%, traumatic obstetric haemorrhage for 7.9%, and other indications for 2.6%. The overall distribution of clinical indications differed significantly (χ^2=15.68, p=0.008), demonstrating that placenta accreta spectrum, uterine atony and uterine rupture collectively represented the predominant indications for EPH.

Anaemia at admission was the most frequent maternal risk factor and was present in 76.3% of women (95% CI: 60.8-87.0; p=0.002). Previous caesarean delivery was reported in 68.4% (p=0.034), while 60.5% were multiparous and 57.9% were aged 30 years or older. Placenta previa was present in 44.7%, and 42.1% of women had received inadequate antenatal care. Hypertensive disorders of

pregnancy were documented in 31.6% (p=0.034), whereas prolonged or obstructed labour was found in 28.9% (p=0.014). Previous dilatation and curettage was reported in 23.7%, previous postpartum haemorrhage in 18.4%, and a known coagulation abnormality in 10.5%.

Table 3: Fetal and pregnancy-related factors among women undergoing emergency peripartum hysterectomy (N=38)

Fetal or pregnancy-related factor	n (%) or Mean (SD)	95% CI	Test statistic	p-value
Gestational age, weeks	35.82 (3.41)	34.70-36.94	t=−2.13†	0.040
Estimated fetal weight, kg	2.42 (0.76)	2.17-2.67	t=−0.65†	0.520
Gestational-age category			χ^2=12.32	0.006
<34 weeks	17 (44.7)	30.1-60.3		
34-36 weeks	12 (31.6)	19.1-47.5		
37-39 weeks	6 (15.8)	7.4-30.4		
≥40 weeks	3 (7.9)	2.7-20.8		
Fetal presentation			χ^2=23.89	<0.001
Cephalic	22 (57.9)	42.2-72.1		
Breech	8 (21.1)	11.1-36.3		
Transverse/oblique lie	6 (15.8)	7.4-30.4		
Other presentation	2 (5.3)	1.5-17.3		
Fetal distress	21 (55.3)	39.7-69.9	Exact binomial	0.627
Oligohydramnios	11 (28.9)	17.0-44.8	Exact binomial	0.014
Intrauterine fetal death at admission	9 (23.7)	13.0-39.2	Exact binomial	0.002
Placental abruption	8 (21.1)	11.1-36.3	Exact binomial	<0.001
Fetal growth restriction	7 (18.4)	9.2-33.4	Exact binomial	<0.001
Fetal macrosomia, ≥4 kg	6 (15.8)	7.4-30.4	Exact binomial	<0.001
Multiple pregnancy	4 (10.5)	4.2-24.1	Exact binomial	<0.001
Polyhydramnios	3 (7.9)	2.7-20.8	Exact binomial	<0.001

†One-sample *t*-test against reference values of 37 weeks for gestational age and 2.5 kg for estimated fetal weight. Chi-square tests assessed the overall distributions of gestational age and fetal presentation. Exact binomial tests used an expected proportion of 50%.

Table 3 summarizes the fetal and pregnancy-related factors among the 38 women who underwent EPH. The mean gestational age was 35.82±3.41 weeks (95% CI: 34.70-36.94), which was significantly lower than the reference value of 37 weeks (t=−2.13, p=0.040). The mean estimated fetal weight was 2.42±0.76 kg (95% CI: 2.17-2.67) and did not differ significantly from 2.5 kg (t=−0.65, p=0.520). Regarding gestational-age distribution, 44.7% of pregnancies were below 34 weeks, 31.6% were between 34 and 36 weeks, 15.8% were between 37 and 39 weeks, and 7.9% were at or beyond 40 weeks. This distribution was statistically significant (χ^2=12.32, p=0.006), with approximately three-fourths of the pregnancies being preterm.

Cephalic presentation was the most common fetal presentation and was observed in 57.9% of cases. Breech presentation was noted in 21.1%, transverse or oblique lie in 15.8%, and other presentations in 5.3%. The distribution of fetal presentations was statistically significant (χ^2=23.89, p<0.001). Fetal distress was observed in 55.3% of pregnancies. Oligohydramnios was present in 28.9%, while 23.7% of fetuses had already experienced intrauterine death at admission. Placental abruption was recorded in 21.1%, fetal growth restriction in 18.4%, fetal macrosomia in 15.8%, multiple pregnancy in 10.5%, and polyhydramnios in 7.9%.

Table 4: Maternal and fetal outcomes following emergency peripartum hysterectomy (N=38)

A. Maternal outcomes

Maternal outcome	n (%) or Mean (SD)	95% CI	Test statistic	p-value
Estimated blood loss, mL	3,420 (1,280)	2,999-3,841	t=6.84†	<0.001
Blood components transfused, units	6.74 (3.21)	5.68-7.80	t=5.26†	<0.001
Length of hospital stay, days	9.63 (4.82)	8.05-11.21	t=3.37†	0.002
Required blood-component transfusion	36 (94.7)	82.7-98.5	Exact binomial	<0.001
ICU admission	31 (81.6)	66.6-90.8	Exact binomial	<0.001
Vasopressor support	24 (63.2)	47.3-76.6	Exact binomial	0.143
Mechanical ventilation	18 (47.4)	32.5-62.7	Exact binomial	0.871
Disseminated intravascular coagulation	12 (31.6)	19.1-47.5	Exact binomial	0.034
Acute kidney injury	9 (23.7)	13.0-39.2	Exact binomial	0.002
Postoperative sepsis	7 (18.4)	9.2-33.4	Exact binomial	<0.001
Urinary bladder injury	4 (10.5)	4.2-24.1	Exact binomial	<0.001
Surgical re-exploration	3 (7.9)	2.7-20.8	Exact binomial	<0.001
Maternal survival	34 (89.5)	75.9-95.8	Exact binomial	<0.001
Maternal mortality	4 (10.5)	4.2-24.1	Exact binomial	<0.001

†One-sample *t*-test against reference values of 2,000 mL blood loss, 4 transfused units and 7 days of hospitalization.

Table 4A presents the maternal outcomes following emergency peripartum hysterectomy. The mean estimated blood loss was 3,420±1,280 mL (95% CI: 2,999-3,841), which was significantly higher than the reference value of 2,000 mL (t=6.84, p<0.001). The women received a mean of 6.74±3.21 units of blood components (95% CI: 5.68-7.80), significantly exceeding the reference value of four units (t=5.26, p<0.001). The mean duration of hospital stay was 9.63±4.82 days (95% CI: 8.05-11.21), which was significantly longer than seven days (t=3.37, p=0.002).

Blood-component transfusion was required in 94.7% of women, and 81.6% required ICU admission; both findings were statistically significant (p<0.001). Vasopressor support was required in 63.2%, while 47.4% required mechanical ventilation. Disseminated intravascular coagulation developed in 31.6% (p=0.034), and acute kidney injury occurred in 23.7% (p=0.002). Postoperative sepsis was reported in 18.4%, urinary bladder injury in 10.5%, and surgical re-exploration in 7.9%. Overall, 34 women survived, giving a maternal survival rate of 89.5% (95% CI: 75.9-95.8), while four women died, resulting in a maternal mortality rate of 10.5%.

B. Fetal and neonatal outcomes

Fetal/neonatal outcome	n (%) or Mean (SD)	95% CI	Test statistic	p-value
Birth weight, kg	2.31 (0.71)	2.08-2.54	t=−1.65†	0.108
Five-minute Apgar score	6.84 (2.13)	6.14-7.54	t=−3.36†	0.002
Final fetal/neonatal status			χ^2=28.00	<0.001
Surviving live birth	28 (73.7)	58.0-85.0		
Stillbirth	8 (21.1)	11.1-36.3		
Early neonatal death	2 (5.3)	1.5-17.3		
Required neonatal resuscitation	23 (60.5)	44.7-74.4	Exact binomial	0.256
NICU admission	21 (55.3)	39.7-69.9	Exact binomial	0.627
Prematurity	21 (55.3)	39.7-69.9	Exact binomial	0.627
Low birth weight, <2.5 kg	22 (57.9)	42.2-72.1	Exact binomial	0.418
Birth asphyxia	14 (36.8)	23.4-52.7	Exact binomial	0.143
Overall perinatal mortality	11 (28.9)	17.0-44.8	Exact binomial	0.014

†One-sample *t*-test against reference values of 2.5 kg for birth weight and an Apgar score of 8. The chi-square test assessed the overall distribution of final fetal/neonatal status.

The mean neonatal birth weight was 2.31±0.71 kg (95% CI: 2.08-2.54), which was not significantly different from the reference weight of 2.5 kg (t=−1.65, p=0.108). The mean five-minute Apgar score was 6.84±2.13 (95% CI: 6.14-7.54), which was significantly lower than the reference score of eight (t=−3.36, p=0.002). A total of 28 surviving live births (73.7%), eight stillbirths (21.1%) and two early neonatal deaths (5.3%) were recorded. The distribution of final fetal and neonatal status was statistically significant (χ^2=28.00, p<0.001).

Neonatal resuscitation was required in 60.5% of newborns, while NICU admission and prematurity were each observed in 55.3%. Low birth weight was present in 57.9%, and birth asphyxia occurred in 36.8% of cases. Overall perinatal mortality, comprising stillbirths and early neonatal deaths, was reported in 28.9% of pregnancies (95% CI: 17.0-44.8; p=0.014). Thus, although nearly three-fourths of pregnancies resulted in surviving live births, the high frequencies of neonatal resuscitation, prematurity, low birth weight, NICU admission and perinatal mortality demonstrated substantial fetal and neonatal morbidity among EPH cases.

DISCUSSION

The present prospective observational study evaluated 38 women who underwent emergency peripartum hysterectomy (EPH). The findings demonstrated that EPH remained an uncommon but critical life-saving intervention associated with major blood loss, frequent blood-component transfusion, intensive care admission, maternal morbidity and adverse perinatal outcomes. The observed pattern of previous caesarean delivery, anaemia, multiparity, abnormal placentation, uterine atony and uterine rupture was consistent with the recognised epidemiological transition in EPH from obstructed labour and uterine rupture toward placenta accreta spectrum secondary to increasing caesarean delivery rates.

Overall maternal and fetal profile

The mean maternal age was 31.74±4.86 years, significantly higher than the reference age of 30 years. This was slightly higher than the mean ages reported by Sharma et al. (2017),[4], Singla et al. (2017),[5] and Tahmina et al. (2017),[6] which were approximately 28-30 years. Tamrakar et al. (2019),[8] reported a mean age of approximately 26.5 years. The relatively higher maternal age in the present study could be related to delayed childbearing, increasing parity and accumulation of previous caesarean deliveries. The systematic review by van den Akker et al. (2016),[2] identified advanced maternal age as an important risk indicator for EPH, particularly in high-income settings where abnormal placentation constituted a major indication.

The mean parity was 2.84±1.36, and 60.5% of women were multiparous. This agreed with Tahmina et al. (2017),[6] who found that approximately 83% of EPH cases were multiparous,

and Tamrakar et al. (2019),[8] who reported multigravidity in approximately 85% of cases. Satia and More (2016),[3] similarly observed that 23 of their 25 women were multiparous. Repeated pregnancies increase the probability of uterine atony, previous uterine surgery, abnormal placentation and obstetric trauma. However, because the present study included only women who underwent EPH, multiparity should be interpreted as a frequent characteristic rather than an independently established causal risk factor.

The mean gestational age was 35.82±3.41 weeks, and 55.3% of pregnancies were preterm. Tahmina et al. (2017),[6] reported a comparable mean gestational age of approximately 36.7 weeks. Sharma et al. (2017),[4] also observed that most hysterectomies occurred after 34 weeks. The high frequency of preterm delivery in the present study may be explained by placenta accreta spectrum, placenta previa, placental abruption, maternal shock and fetal distress, all of which may necessitate emergency delivery before term.

The mean admission haemoglobin was only 8.42±1.76 g/dL, while 76.3% of women had haemoglobin below 10 g/dL. This finding demonstrated that many women entered the obstetric emergency with inadequate haematological reserve. Chawla et al. (2015),[1] Sharma et al. (2017)[4] and Verma et al. (2020),[10] similarly reported anaemia as a frequent clinical problem among EPH cases. Pre-existing anaemia magnifies the consequences of acute obstetric haemorrhage and increases the likelihood of massive transfusion, haemodynamic instability, organ dysfunction and intensive care admission.

Although 81.6% of pregnancies were booked, 71.1% of women were referred from another facility. This differed from Sharma et al. (2017),[4] and Singla et al. (2017)[5], who reported that approximately 92-95% of their patients were unbooked or referred. Verma et al. (2020),[10] also observed a predominance of unbooked women. The high booking rate in the present study might indicate greater antenatal-care utilization; however, the high referral rate suggests that many complications exceeded the capacity of peripheral facilities or were recognised only after substantial haemorrhage or clinical deterioration had occurred.

Frequency and clinical indications

The frequency of EPH was 2.07 per 1,000 deliveries, significantly higher than the selected reference frequency of one per 1,000 deliveries. Chawla et al. (2015),[1] reported an incidence of approximately 2.6 per 1,000 deliveries at a teaching hospital in North India. Sharma et al. (2017),[4] reported approximately 2.2 hysterectomies per 1,000 deliveries, whereas Singla et al. (2017),[5] observed a lower incidence of approximately 1.06 per 1,000 deliveries. Chaudhary et al. (2021),[11] also demonstrated that the incidence varied considerably according to referral status, caesarean delivery frequency and the complexity of cases managed by the institution. The international review by van den Akker et al. (2016),[2] found marked geographical variation, with a substantially greater burden in low- and middle-income settings. Therefore, the relatively high frequency in the present study was probably related to the tertiary referral status of the hospital and its management of severe obstetric emergencies.

Placenta accreta spectrum was the leading indication, accounting for 34.2% of hysterectomies. It was followed by refractory uterine atony in 23.7%, uterine rupture in 21.1%, placental abruption in 10.5% and traumatic obstetric haemorrhage in 7.9%. Sharma et al. (2017),[4] reported placenta accreta in approximately 60% and uterine atony in 27.5% of cases. Chaudhary et al. (2021),[11] similarly found morbidly adherent placenta in approximately 62% of cases. Verma et al. (2020),[10] reported abnormal placentation in 38%, uterine rupture in 33.3% and atonic postpartum haemorrhage in 28.5%. In contrast, Singla et al. (2017),[5] identified atonic postpartum haemorrhage as the leading indication, followed by unscarred uterine rupture and morbidly adherent placenta.

These variations demonstrate the changing spectrum of EPH. Uterine rupture continues to be important in locations where obstructed labour, delayed referral and inadequate intrapartum monitoring remain prevalent. In tertiary institutions managing women with multiple previous caesarean deliveries, placenta accreta spectrum has increasingly become the predominant indication. The ACOG and Society for Maternal-Fetal Medicine guidance (2018),[7] identifies previous caesarean delivery, particularly in combination with placenta previa, as the major risk factor for placenta accreta spectrum. Antenatal recognition and planned delivery in a multidisciplinary centre are consequently essential for reducing uncontrolled haemorrhage and emergency surgery.

Maternal risk factors

Previous caesarean delivery was documented in 68.4% of women, while placenta previa was found in 44.7%. These findings support the close relationship among caesarean scar, placenta previa, placenta accreta spectrum and EPH. Sharma et al. (2017),[4] and Chaudhary et al. (2021),[11] similarly reported a strong predominance of previous caesarean delivery among women undergoing EPH. Chaudhary et al. found that peripartum hysterectomy was markedly more frequent following caesarean than vaginal delivery. Kallianidis et al. (2020),[9] in a multicountry European analysis, also identified previous caesarean delivery and abnormal placentation as major determinants of EPH. These observations highlight the need for evidence-based selection of primary caesarean delivery and targeted antenatal screening for placenta accreta spectrum in women with both placenta previa and a uterine scar.

Hypertensive disorders were present in 31.6% of cases, and placental abruption was recorded in

21.1%. Hypertensive disease can contribute to placental abruption, coagulopathy, fetal compromise and medically indicated preterm delivery. Prolonged or obstructed labour occurred in 28.9% and may have contributed to uterine exhaustion, atony, uterine rupture and traumatic haemorrhage. Previous dilatation and curettage was reported in 23.7%, which could be relevant because prior endometrial or uterine instrumentation may disturb the normal decidua and predispose to abnormal placental implantation. However, the observed proportions should not be interpreted as measures of increased risk without comparison with women who delivered without EPH.

Fetal and pregnancy-related factors

Approximately 76.3% of women delivered before 37 weeks, including 44.7% before 34 weeks. This high prematurity burden was consistent with the high prevalence of abnormal placentation, placental abruption, fetal distress and maternal haemodynamic instability. Tahmina et al. (2017),[6] and Sharma et al. (2017),[4] likewise reported that EPH frequently occurred at late-preterm or near-term gestation. The mean estimated fetal weight of 2.42±0.76 kg was not significantly different from the selected reference value of 2.5 kg, although fetal growth restriction was recorded in 18.4%.

Cephalic presentation was most common, but 42.1% of fetuses had a non-cephalic or other abnormal presentation. Breech presentation accounted for 21.1%, and transverse or oblique lie accounted for 15.8%. Abnormal lie and presentation may be associated with placenta previa, prematurity, multiple pregnancy and uterine structural abnormalities. They may also increase the complexity of delivery and the likelihood of operative intervention.

Fetal distress was observed in 55.3% of pregnancies, while 23.7% had intrauterine fetal death at admission. Placental abruption was present in 21.1%, oligohydramnios in 28.9%, and fetal growth restriction in 18.4%. These findings indicated that fetal compromise frequently accompanied the severe maternal condition leading to EPH. The fetal problems were probably consequences of the primary obstetric catastrophe such as placental separation, uterine rupture, maternal hypotension or severe haemorrhage rather than direct consequences of hysterectomy itself.

Maternal outcomes

The mean estimated blood loss was 3,420±1,280 mL, significantly exceeding the reference value of 2,000 mL. Blood-component transfusion was required in 94.7% of women, with a mean requirement of 6.74±3.21 units. Tahmina et al. (2017),[6] reported an average transfusion requirement of approximately 7.6 units. Sharma et al. (2017),[4] found that more than half of the women required over five units, with some receiving up to 12 units. Satia and More (2016),[3] also reported that virtually all women undergoing obstetric hysterectomy required transfusion. These comparisons confirm that massive haemorrhage and extensive transfusion support are central features of EPH. Current FIGO recommendations emphasize early quantification of blood loss, rapid administration of uterotonics and tranexamic acid, activation of a massive-transfusion protocol when indicated and timely progression to surgical haemostasis when conservative treatment fails.[12]

ICU admission was required in 81.6% of women. This was higher than the approximately 39% reported by Singla et al. (2017),[5] and the 42.5% reported by Sharma et al. (2017).[4] The high ICU-admission rate might reflect greater illness severity, frequent shock, extensive transfusion requirements or a lower institutional threshold for postoperative critical-care monitoring. Vasopressor support was required in 63.2%, and mechanical ventilation was required in 47.4%, further demonstrating the physiological consequences of major obstetric haemorrhage.

Disseminated intravascular coagulation occurred in 31.6%, acute kidney injury in 23.7%, postoperative sepsis in 18.4%, bladder injury in 10.5% and re-exploration in 7.9%. Sharma et al. (2017),[4] reported DIC in 12.5% and bladder injury in 20%, whereas Singla et al. (2017),[5] reported DIC in approximately 9.8%, bladder injury in 6.7% and relaparotomy in 11.3%. Satia and More (2016),[3] documented bladder injury, DIC, sepsis and acute renal failure in approximately 8-12% of cases. The somewhat higher rates of DIC and acute kidney injury in the present study may be related to the high prevalence of shock and delayed referral.

Maternal survival was 89.5%, giving a mortality rate of 10.5%. This was comparable with the 10% maternal mortality reported by Sharma et al. (2017),[4] and the approximately 11% reported by Verma et al. (2020)[10], but higher than the 4% reported by Chaudhary et al. (2021),[11] and the 7.2% reported by Singla et al. (2017).[5] The observed mortality underscores that EPH is life-saving but does not completely eliminate the risk caused by catastrophic haemorrhage, coagulopathy, shock and multiorgan dysfunction. The WHO consolidated postpartum-haemorrhage guideline (2025),[13] stresses early diagnosis, immediate bundled treatment, timely escalation and coordinated referral to reduce preventable morbidity and mortality.

Fetal and neonatal outcomes

A surviving live birth was recorded in 73.7% of pregnancies, while stillbirth and early neonatal death occurred in 21.1% and 5.3%, respectively. The overall perinatal mortality was therefore 28.9%. Singla et al. (2017),[5] reported approximately 58.3% live births and 41.7% stillbirths, indicating poorer fetal survival than in the present study. Chaudhary et al. (2021),[11] reported a stillbirth rate of approximately 16%, while Tahmina et al. (2017),[6] documented lower perinatal mortality. Differences among studies may reflect gestational age, incidence of uterine rupture and placental abruption, severity

of maternal shock, referral delay and availability of neonatal intensive care.

The mean birth weight was 2.31±0.71 kg, and 57.9% of neonates had low birth weight. Prematurity and NICU admission were each recorded in 55.3%. NICU admission was higher than the approximately 22-23% reported by Sharma et al. (2017),[4] and Singla et al. (2017),[5] and the approximately 33% reported by Tahmina et al. (2017).[6] Neonatal resuscitation was required in 60.5%, birth asphyxia was observed in 36.8%, and the mean five-minute Apgar score was significantly below the reference score of eight. These adverse outcomes were consistent with the high frequency of prematurity, fetal distress, placental abruption, maternal hypotension and emergency operative delivery.

Overall, the study confirmed that EPH remained a marker of severe maternal and perinatal compromise. Previous caesarean delivery, abnormal placentation, anaemia, multiparity, uterine atony, uterine rupture and referral after the onset of complications were prominent characteristics. Strengthening antenatal detection of placenta accreta spectrum, correcting maternal anaemia, ensuring timely referral, maintaining blood-component availability and adopting a multidisciplinary haemorrhage protocol may improve outcomes.

CONCLUSION

Emergency peripartum hysterectomy was an uncommon but essential life-saving procedure, occurring at a frequency of 2.07 per 1,000 deliveries. Placenta accreta spectrum was the leading indication, followed by refractory uterine atony and uterine rupture. Anaemia, previous caesarean delivery, multiparity, placenta previa, inadequate antenatal care and referral from another facility were prominent maternal characteristics. Prematurity, fetal distress, abnormal fetal presentation, oligohydramnios, placental abruption and intrauterine fetal death were important fetal and pregnancy-related factors.

EPH was associated with massive blood loss, extensive blood-component transfusion, frequent ICU admission, disseminated intravascular coagulation, acute kidney injury and postoperative sepsis. Maternal survival was 89.5%; however, maternal mortality remained substantial at 10.5%. Although 73.7% of pregnancies resulted in surviving live births, prematurity, low birth weight, NICU admission, birth asphyxia and perinatal mortality were frequent.

Early antenatal identification of abnormal placentation, correction of maternal anaemia, careful management of women with previous caesarean deliveries, timely referral and ready availability of multidisciplinary surgical, anaesthetic, blood-bank and neonatal intensive care services may reduce maternal and fetal morbidity and mortality associated with EPH.

Limitations

1. The study was conducted at a single tertiary-care referral hospital; therefore, the findings may not be generalizable to primary, secondary or non-referral healthcare settings.
2. The sample size was limited to 38 women because EPH is a relatively uncommon obstetric procedure. This resulted in wide confidence intervals and restricted the precision of subgroup estimates.
3. The study included only women who underwent EPH and did not include a comparison group of women who delivered without hysterectomy. Consequently, the study described the frequency of risk factors among EPH cases but could not establish whether these factors independently increased the risk of EPH.
4. The exact binomial tests compared observed proportions with an arbitrary value of 50%. These p-values reflected differences from that reference proportion and should not be interpreted as evidence of causal association.
5. Reliable multivariable logistic regression could not be performed because of the small number of cases and outcome events. Potential confounding factors could therefore not be adequately controlled.
6. As the hospital was a tertiary referral centre, the sample may have contained a disproportionate number of critically ill women, leading to referral or severity bias.
7. Some referred women had already received treatment, blood transfusion or surgical intervention before admission. This might have affected admission haemoglobin, coagulation parameters, estimated blood loss and clinical severity.
8. Estimation of intraoperative blood loss might have been affected by mixing of blood with amniotic fluid, surgical irrigation fluid and incomplete measurement of blood absorbed by operative materials.
9. Certain pregnancy-related factors, such as fetal distress, prematurity and low birth weight, could have been consequences of the underlying obstetric emergency rather than independent risk factors for hysterectomy.
10. Long-term physical, reproductive, psychological, sexual and socioeconomic consequences of EPH were not assessed because follow-up was limited mainly to the hospital stay and early postnatal period.

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