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Peripartum Emergency Hysterectomy, Risk Factors and Pregnancy Outcome at Al-Elwiyah Maternity Teaching Hospital

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Abstract: **Background:** Emergency peripartum hysterectomy (EPH) is rather an uncommon surgical procedure performed as a life-saving measure in cases of intractable obstetric bleeding. Although modern obstetrics as part of the technological scientific revolution have shown massive advances both medically and surgically, hemorrhage remains universally to be the leading cause of maternal mortality. A Middle East Region report shows that the percentage of EPH ranges from 0.39 to 5.38 per 1,000 deliveries. Intractable obstetric hemorrhage is a life-threatening condition caused by uterine pathology, uterine atony, uterine rupture and abnormal placentation.

Aim of the study: To determine the risk factors, maternal and neonatal outcomes of cases of EPH at Al-Elwiyah Maternity Teaching Hospital.

Patients and methods: A prospective cross-sectional study that was conducted in the Department of Obstetrics and Gynecology at Al-Elwiyah Maternity Teaching Hospital during a period extending from the 1st of Jan., 2022 to the 31st of Dec., 2022. All pregnant women who required EPH during the study period were included, with interpretation of risk factors, presentations, maternal and neonatal outcomes were insured.

Results: The prevalence of EPH in all hospital deliveries was 0.6%, and 1.51% of all C/S deliveries. Sixty-two cases were undergoing EPH during the study period. Placenta accreta spectrum (PAS) was the cause of EPH in (59.7%), while postpartum hemorrhage (PPH) is the cause in (20.9%). Parity was significantly high in cases of EPH due to PAS and PPH with P value of 0.015, maternal age was significantly high in cases of EPH due to rupture uterus and cervical tear with P value of 0.002. Cases of EPH due to PAS and rupture uterus had significantly higher association P value < 0.0001, with an intensive care unit admission and the need for more blood transfusion than other causes of EPH. While the neonatal outcome was not differed in accordance with the indication of a hysterectomy.

Conclusion: The main causes of peripartum hysterectomy in our hospital were mainly due to PAS followed by PPH. The single independent predictor for requirement of maternal intensive care unit admission was the indication for EPH, while neonatal intensive care unit admission was related mainly to gestational age and maternal hypertension.

1. Introduction

1.1 Background:

Emergency peripartum hysterectomy (EPH) is rather an uncommon surgical procedure performed as a life saving measure in cases of intractable obstetric bleeding. Although, modern obstetrics as part of the technological scientific revolution have showed massive advances both medically and surgically, hemorrhage remains universally to be the leading cause of maternal mortality[1].

Uncontrolled hemorrhage is a leading cause of maternal morbidity and mortality around the globe, particularly in third world countries. Though obstetric hysterectomy was pioneered more than 200 years ago, it still has a pertinent role in the management of PPH, especially in developing countries where interventional radiology is not readily accessible. Lack of infrastructure, delayed referral also plays an important role in an increased trend for obstetric hysterectomy[2].

1.2 Definition:

Peripartum hysterectomy is defined as the removal of uterus at the time of delivery and/or the immediate postpartum period, mostly due to stubborn bleeding[3].

1.3 Epidemiology:

It is estimated that the incidence of EPH is 0.05%, however, this varies across different studies and different countries. This discrepancy may be attributed to many factors inclusive of; obstetric education, adequacy of antenatal care, contraception methods, national awareness programs, development of medical competencies and surgical skills[4].

A Middle East Region report, shows that the percentage of EPH ranging from 0.39 to 5.38 per 1,000 deliveries[5].

1.4 Causes and risk factors:

Intractable obstetric hemorrhage is a life intimidating ailment caused by uterine pathology, uterine atony, uterine rupture and abnormal placentation. Previously, the leading cause of intractable obstetric hemorrhage was uterine atony, whereas recently, reports showed that uterine atony is an uncommon cause of such conditions due to advent in prostaglandins therapy[6].

On the other hand, in modern obstetrics, the leading cause of life-threatening obstetric hemorrhage is abnormal placentation. Not only has a flawless connection between abnormal placentation and cesarean sections (CSs) been demonstrated by multiple reports, but also a strong overtone between repeated cesarean deliveries and abnormal placental location [7]. To illustrate, the incidence of placenta previa was found to be 1.9/1000 after one previous CS, and 91/1000 in women with four previous CS, implying a 47-fold increase, which is alarming to the EPH[1]. Of note, the need for EPH in women having placenta previa accreta was substantially higher than those diagnosed with placenta previa per se [7].

Other risk factors in the occurrence of abnormal placentation includes advanced maternal age, previous uterine curettage and high parity as well[8].

1.4.1 Abnormal placentation:

1.4.1.1 Placenta previa:

Placenta previa is the complete or partial covering of the internal os of the cervix with the placenta. It is a major risk factor for postpartum hemorrhage and can lead to morbidity and mortality of the mother and neonate[9]. This situation prevents a safe vaginal delivery and requires the delivery of the neonate to be via cesarean delivery. Most cases are diagnosed early in pregnancy via sonography and others may present to the emergency room with painless vaginal bleeding in the second or third trimester of pregnancy. The presence of placenta previa can also increase a woman's risk for PAS. This spectrum of conditions includes placenta accreta, increta and percreta.

Uncontrolled postpartum hemorrhage from placenta previa or PAS may necessitate a blood transfusion, hysterectomy thus leaving the patient infertile, admission to the intensive care unit (ICU) or even death[10].

Epidemiology:

Placenta previa complicates 0.3-0.5% of all pregnancies and is a leading cause of third trimester hemorrhage. It accounts for one third of cases of antepartum hemorrhage (APH). The incidence of placenta previa is around 1 in 300 deliveries. The incidence of placenta previa has been increasing over the years. This could be in part due to increased incidence of certain risk factors associated with the condition and partly due to increased antenatal diagnosis at 18 to 20 weeks by ultrasonography which can detect even minor degree of placenta previa[11].

Treatment / Management:

At times the massive hemorrhage may not be controlled with conservative measures and a hysterectomy is necessary If the placenta does not detach or partially detaches then the patient has PAS and the placenta should remain in situ, the uterine incision closed and a cesarean hysterectomy should follow. If there is high suspicion for PAS, then a cesarean section should be performed without manipulation of the placenta[12].

1.4.1.2 Placenta accreta:

PAS is one of the most dangerous conditions associated with pregnancy because hemorrhage may result in multisystem organ failure, disseminated intravascular coagulation, need for admission to an intensive care unit, hysterectomy and even death[13].

Outcomes are generally improved with antepartum diagnosis and care by a multidisciplinary team with expertise in the condition. Morbidity is high; more than half of women receive transfusions of blood products and a third have incidental cystotomy in association with surgical management. Ureteral injury, vesicovaginal fistula and the occurrence of reoperation are less frequent complications[14].

PAS is considered a high-risk condition with serious associated morbidities; therefore, ACOG and the Society for Maternal–Fetal Medicine recommend these patients receive level III (subspecialty) or higher care center[15].

Epidemiology:

As the rate of caesarean delivery is increasing globally, the rates of PAS are increasing.

In Iraq the rate of CS was nearly half the deliveries (49.5%)[16], this goes with increasing prevalence of PAS disorders in Iraq, as it was 162.4 per 100,000 women in 2014, 266.7 in 2015, 382.3 in 2016, and 191.5 per 100 000 women in 2017[17].

Risk factors:

Previous cesarean delivery:

Given that cesarean deliveries are a common source of scarring in the myometrium and endometrium, this common procedure has been associated with the development of PAS in subsequent pregnancies. This is particularly likely when the patient develops a subsequent previa, with the placenta implanted over the lower segment scar. Multiple studies have shown a linear increase in PAS risk correlating with the number of previous cesareans, both with and without placenta previa[18].

Maternal age:

Advanced maternal age, usually defined as 35 years or greater, has been implicated in PAS development. This relationship may be confounded by higher parity and previa risk, as well as a higher probability of previous uterine procedures or fertility treatments, but also may represent an altered hormonal or implantation environment[19].

Previous uterine surgery:

Studies have produced inconsistent results regarding PAS development after previous uterine surgery. This may be due to grouping procedures with heterogenous risk profiles, or lack of an appropriate control group with no previous uterine procedures. Uterine curettage is likely the most commonly encountered uterine procedure in a patient's surgical history, but its role as an independent PAS risk factor has been unclear[20].

Previous placenta accreta:

While previous cesarean section is likely the most commonly encountered risk factor from a previous pregnancy, a previous history of accreta or adherent placenta will confer the highest absolute risk. Previous PAS is a novel risk factor, as cases of PAS historically ended in hysterectomy. However, uterine conservation is increasingly described in management of this condition. For patients who have experienced a subsequent pregnancy, PAS rates of 4.7% in the second pregnancy 7.6% in the third pregnancy[21].

Management:

Clinical management of patients with PAS disorders varies largely worldwide. Although the harmful consequences of PAS have been well recognized, few randomized controlled trials or prospective studies have investigated the optimal management of accreta placentation. Current recommendations are mainly based on expert consensus, case reports or series and clinical experience[22].

Caesarean hysterectomy with the placenta left undisturbed in situ after delivery of the fetus, is the most universally accepted procedure in the non-conservative management of PAS[23].

1.4.2 Uterine rupture

Definition:

Uterine rupture (UR) is one of most dangerous obstetric situations carrying an increased risk of maternal and perinatal morbidity and mortality, which is associated with poorly managed labour. UR related with some instant hitches, such as shock, anaemia, and a ruptured bladder, may leave surviving patients with term complications like vesicovaginal fistula and inability to deliver children[24].

Epidemiology:

The prevalence was found to be significantly higher in underdeveloped countries of Asia and Africa in comparison to high income countries. The incidence of uterine rupture has dropped significantly in developed countries and is most often encountered while attempting vaginal birth after CS. The risk of experiencing ruptured uterus during child birth is 5 times higher if the mother already had a CS.[25]

The situation is gloomy in developing countries, where this obstetric complication is frequently faced with disastrous consequences. Neglected labour is common in developing countries, especially in semi urban and rural areas. Many women are dying at home as home delivery is frequent due to culture taboos, lack of awareness, low socioeconomic group and inadequate access to medical care.[25]

Risk factors:

Factors that potentially increase the risk of uterine rupture include short inter-delivery interval (less than 12 months since last delivery), post-date pregnancy, maternal age of 40 years or more, obesity, lower pre-labour Bishop score, macrosomia and decreased ultrasonographic lower segment myometrial thickness.[26]

Presentation:

The clinical features associated with uterine scar rupture include: abnormal Cardiotocography (CTG), severe abdominal pain especially if persisting between contractions, acute onset scar tenderness, abnormal vaginal bleeding, haematuria, cessation of previously efficient uterine activity, maternal tachycardia, hypotension, fainting or shock, loss of station of the presenting part, change in abdominal contour and inability to pick up fetal heart rate at the old transducer site.[27]

Management:

A uterine rupture requires simultaneous delivery and treatment of maternal hemorrhage. In a smaller rupture, the uterus may be amenable to repair. When there is hemodynamic instability or significant uterine injury, a hysterectomy is indicated. Approximately one in three women who experience uterine rupture require a hysterectomy[28].

1.4.3 Post-partum hemorrhage:

Background:

Postpartum hemorrhage (PPH) remains one of the leading causes of maternal death, in both industrialized and non-industrialized nations. Approximately 140,000 women die annually from PPH worldwide and more than 50% of these mortalities occur within the first 24 hours postpartum[29].

Epidemiology:

Worldwide, postpartum hemorrhage accounts for 8% of maternal deaths in developed regions of the world and 20% of maternal deaths in developing regions[29].

Definition:

The traditional definition of postpartum hemorrhage is blood loss of more than 500 ml after a vaginal delivery or more than 1000 ml after a cesarean delivery. More recently, postpartum hemorrhage has been redefined as a cumulative blood loss of 1000 ml or more or blood loss associated with signs or symptoms of hypovolemia, irrespective of the route of delivery[30].

Causes:

The causes of postpartum hemorrhage can be summarized by the four "T's": tone (uterine atony), trauma (lacerations or uterine rupture), tissue (retained placenta or clots) and thrombin (clotting-factor deficiency). The most common cause is uterine atony (accounting for approximately 70% of cases), followed by obstetrical lacerations (approximately 20%), retained placental tissue (approximately 10%) and clotting-factor deficiencies (<1%). Postpartum hemorrhage can lead to severe anemia requiring blood transfusion, disseminated intravascular coagulopathy, hysterectomy, multisystem organ failure and death[30].

Postpartum hemorrhage due to uterine atony is often preceded by chorioamnionitis, therapeutic use of magnesium sulfate, prolonged labor or precipitous delivery, labor induction or augmentation, uterine fibroids, or uterine overdistention as a result of multiple gestation, fetal macrosomia or polyhydramnios[31].

Cesarean delivery is associated with a higher risk of postpartum hemorrhage than vaginal delivery. Advanced maternal age and extremes of parity (0 and >4) are additional risk factors[32].

Other risk factors for postpartum hemorrhage are closely linked to the type of hemorrhage that develops. For example, obstetrical lacerations can be caused by operative vaginal delivery, precipitous delivery or episiotomy, whereas retained placental tissue can be caused by PAS which is associated with prior uterine surgery[33].

Retained placental tissue can also be the result of incomplete delivery of the placental tissue and membranes. Maternal coagulopathy that leads to postpartum hemorrhage can be a complication of severe preeclampsia and eclampsia, HELLP (hemolysis, elevated liver-enzyme level, and low

platelet count) syndrome, intrauterine fetal death, placental abruption or a coagulation disorder that is acquired (e.g., amniotic fluid embolism) or inherited[34].

Despite efforts to identify patients who are at increased risk for postpartum hemorrhage, this life-threatening complication often occurs in women who have no identifiable risk factors. Therefore, vigilance is crucial after all deliveries[30].

Management Options:
The treatment and management of postpartum hemorrhage are focused on resuscitation of the patient while identifying and treating the specific cause.

Exploratory laparotomy is typically indicated in the setting where less invasive measures for postpartum hemorrhage have failed or if the suspected reason for postpartum hemorrhage such as morbidly adherent placenta, demands it. A peripartum hysterectomy is associated not only with permanent sterility but also increased surgical risk with a higher risk of bladder and ureteral injury. Supracervical hysterectomy may be performed alternately as a faster surgery with potentially fewer complicated risks[35].

1.5 Method of prevention of peripartum hysterectomy

Antenatal: Certain measure are valuable and could prevent the need for peripartum hysterectomy, some of them are:

- Optimization of patient health by early detection of anemia and management of hypertensive disorder[36, 37].
- Localization of placental sites may be done using ultrasound scanning for women with high risk for PAS and MRI could have good role in the diagnosis[38].
- Identification and good preparation of high-risk patient (such as cases of previous history of multiple C/S, placenta previa, PAS, increased maternal age, multiple pregnancy)[39, 40]
- The selection of the place of delivery for high-risk pregnancies that should be strictly in a tertiary hospital[41].
- The availability of multidisciplinary teams (that involve, interventional radiologist, vascular surgeon, urological, and general surgeons) play a crucial role in the management of complicated cases[42, 43].
- Health education of the patient about high-risk vaginal delivery[44].
- Minimizing the length of transportation (by providing hotline for emergency delivery of high-risk pregnancy)[45] or admission of high-risk pregnancy women to hospital prior to delivery (after 35 weeks of gestation)[46].

Intrapartum, at labor ward:

- The high-risk labor cases should be managed by the most senior one with involvement of one-to-one care[47].
- Strict adherence to WHO partograph regarding progress of labor[48]
- Prevention (by using active management of 3rd stage of labour), early identification and proper management of cases of PPH[49].
- Early identification and proper management of any obstetrical injuries and treat them accordingly[50].
- Strict adherence to WHO recommended evidence-based medication for prevention of PPH (oxytocin)[51].

At theater:

- Proper management of the cases of PPH which include call for help, replacement with intravenous fluid and early replacement of blood products, compression on the uterus, administration of uterotonic agent like oxytocin, ergometrine, prostaglandin, or carboprost(52).
- Surgical management is divided into three groups of surgical techniques. The first restores uterine physiology and normal anatomy. This involves the repair of lacerations, removal of retained products, as well as restoring normal uterine anatomy after inversion. By restoring normal anatomy, these techniques aim to restore the process of uterine involution. The second group decreases uterine blood flow and decreases blood loss through surgical vascular ligation and uterine artery embolization, giving time for involution to take effect. The third group replicates vascular compression of uterine involution by tamponade through B-lynch or uterine balloon. Failing these uterine and fertility salvaging procedures, hysterectomy becomes the final method to treat post-partum hemorrhage(53).
- Patients with multiple surgeries or history of placenta previa or accreta need to be managed by a consultant obstetrician with the involvement of urologist or vascular surgeon if indicated[54].

1.6 Outcome of peripartum hysterectomy:

The maternal morbidity after EPH ranged from 26.5% to 31.5%, with maternal mortality ranged from 0 to 12.5% with a mean of 4.8%[55].

Peripartum hysterectomy may had its effect on both maternal and fetal sides, women that undergo such surgery would be indicated mainly for PPH, placental pathology or rupture uterus. All the indication of EPH susceptible to bleeding with risk of sock, acute kidney injury and multiorgan dysfunction, also requirement of massive blood transfusion increased with its additional morbidity. The course of surgery may also be complicated by inadvertent injury to other organs (bladder, ureter, and bowel injury). Intraoperative risk of bleeding also may be exaggerated by intravascular coagulopathy as part of the complication of blood transfusion. Postoperatively febrile episodes as part of tissue response to trauma, wound sepsis and acute kidney injury[56].

Neonatal outcome affected by both the indication of the termination of pregnancy and delay in the intervention. As placenta accreta and placenta previa complicated by prematurity, fetal hypoxia and low neonatal weight with high NICU admission rate[57]. On the other hand, rupture uterus occurred after trial of labor may put the fetus in the risk of fetal distress and increased risk for both NICU admission and neonatal death[58]. Table two, summarized maternal and neonatal outcome after peripartum hysterectomy.

Table 1: Maternal, and neonatal outcome after peripartum hysterectomy[59]:

Maternal complications	
Preoperative	**Post operative**
Bleeding	febrile episodes
Shock and organ failure	Requirement for intensive care unit admission
Intra-operative	
Bladder injuries	Chest infection
Bowel injury	wound infection
vaginal cuff bleeding and adnexectomy	Deep vein thrombosis
Complications related to blood transfusion	Urinary tract infection
Immunological reaction	Recto vaginal fistula
Infection complications	Ileus
Disseminated intravascular coagulation	
Fetal complications	
Prematurity	NICU admission
Fetal hypoxia	

1.7 Aim of Study

To determine the risk factors, maternal and neonatal outcome of cases of EPH at Al-Elwiyah Maternity Teaching Hospital.

2. Patients & methods

2.1 Study Design, Setting and Data Collection Time

This is a prospective cross-sectional study conducted in the Department of Obstetrics and Gynecology at Al-Elwiyah Maternity Teaching Hospital during a period extended from 1st of Jan., 2022 to 31st of Dec., 2022.

2.2 Study patients and sample size

The study included all pregnant women who required emergency peripartum hysterectomy during the study period.

2.3 Inclusion criteria

- Women with emergency peripartum hysterectomy for any indication, with no exclusion criteria.

2.4 Data collection:

- All patients were informed about the nature of the study and verbal consent was ensured and follow up was done for one week postoperative.
- Data had been collected through distribution of well-designed questionnaire including:

- ✓ General and clinical information as maternal age, educational level, occupation, residency, parity, mode of delivery and BMI which was calculated by weight in (kilograms) divided by the square of height in (meters).
- ✓ Clinical information regarding chief complaints, history of blood loss, history of obstructed labor, history of placenta previa or accreta reported by previous ultrasounds.
- ✓ Maternal adverse outcome included maternal mortality or one or more serious CNS, cardiorespiratory, hepatic, renal or hematological morbidities.
- ✓ Neonatal outcome regarding NICU admission, birthweight, Apgar score and rate of death.

2.5 Ethical considerations and official approvals

Verbal consent was obtained from each patient prior to collecting data and information was anonymous. Names were removed and replaced by identification codes. All information kept confidential in a password secured laptop and data used exclusively for the research purposes."

2.6 Administrative approvals were granted from the following:

1. The Council of Arabic Board of Health Specialization.
2. Approval and agreement of the Department of Obstetrics and Gynecology at Al-Elwiyah Maternity Teaching Hospital.

2.7 Statistical analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS) version 26. The data presented as mean, standard deviation and ranges. Categorical data presented by frequencies and percentages. Normality of the variables checked using Shapiro–Wilk test. Parametrical continuous variables checked using independent t-test (two tailed). While Mann–Whitney U test was used for non- parametrical continuous variables. The Chi square test was used to assess the association between categorical variables, and Fisher-Freeman-Halton exact test was used instead when the expected frequency was less than 5.

3. Results

The total number of women given birth in the hospital during the period of the study was 10377 women. The total number of C/S delivery was 4118 women. The study included **62** cases who underwent EPH during the study period. The prevalence of EPH in all hospital deliveries was 0.6%, and 1.51% of all C/S deliveries. The mean age of participants was 32.81 ±4.8 years and the mean parity was 4.92 ±1.86, with mean gestational age of 36.6 ±1.5 weeks. The majority of the participants had inadequate antenatal care visits. Primary education was the most common level of education in the participants, as **shown in Table 2.**

Table 2: Distribution of demographical data of cases:

Variables		Mean ±SD	Range
Maternal age (years)		32.81 ±4.8	22-41
Parity		4.92 ±1.86	2-9
Gestational age (weeks)		36.6 ±1.5	27-39
		No.	%
ANC	Adequate	21	33.9
	Inadequate	41	66.1
Educational level	Illiterate	4	6.5
	Primary	38	61.3
	Secondary	12	19.4
	higher	8	12.9

The distribution of cases according to the cause of hysterectomy were illustrated in **Figure 1**.

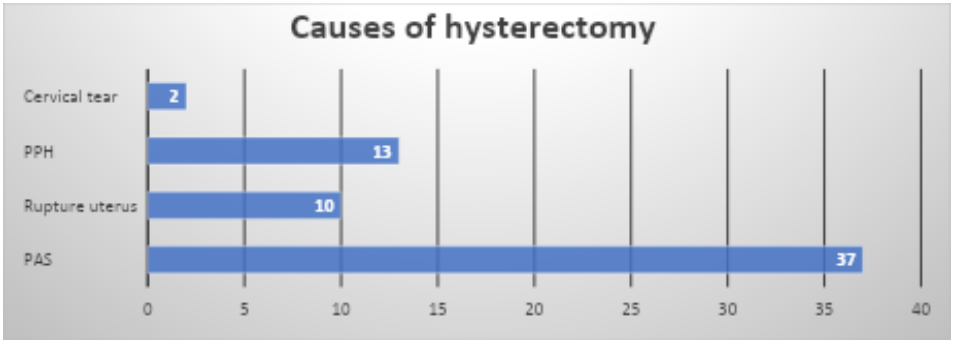

Figure 1: Distribution of cases according to the cause of hysterectomy.

Maternal age was different among different indications of hysterectomy, rupture uterus and cervical tear as a cause of hysterectomy had significantly older age group than cases of PAS or PPH.

The parity was different among the groups, cases of EPH due to PAS and PPH had mean parity more than 5, which is significantly higher than those due to rupture uterus and cases with cervical tear.

Gestational age at time of presentation, number of previous C/S, and diastolic blood pressure were not different among the causes of hysterectomy, though systolic blood pressure was significantly lower in cases of PAS than other indications, regarding adequacy of antenatal care, educational level, and past medical history had no statistical impact on the indication of hysterectomy, as shown in **Table 3**.

Table 3: Participants obstetrical characteristics:

Variables	PAS	Rupture uterus	PPH	Cervical tear	P value
	Mean ±SD No. (%)	Mean ±SD No. (%)	Mean ±SD No. (%)	Mean ±SD No. (%)	
Maternal age (years)	33.3 ±3.89	35.7 ±3.43	28.77 ±5.95	35.5 ±3.54	**0.002**
Parity	5.22 ±2	3.5 ±1.08	5.46 ±1.33	3 ±0	**0.015**

Gestational age (weeks)		36.45 ±1.4	36.24 ±1.78	37.07 ±1.29	37.93 ±1.11	0.264
Number of previous C/S		3.24 ±1.82	2.1 ±0.74	3.46 ±2.3	3 ±0	0.286
Systolic blood pressure		102.03 ±17.32	118 ±9.23	117.15 ±8.78	111.5 ±3.54	**0.003**
Diastolic blood pressure		60.27 ±11.62	61.5 ±7.56	59.23 ±5.39	61.5 ±6.36	0.955
ANC	Adequate	12 (32.4)	4 (40)	4 (30.8)	1 (50)	0.921
	Inadequate	25 (67.6)	6 (60)	9 (69.2)	1 (50)	
Educational level	Illiterate	1 (2.7)	1 (10)	1 (7.7)	1 (50)	0.235
	Primary	25 (67.6)	7 (70)	5 (38.5)	1 (50)	
	Secondary	7 (18.9)	1 (10)	4 (30.8)	0 (0)	
	High	4 (10.8)	1 (10)	3 (23.1)	0 (0)	
Diabetes	Yes	6 (16.2)	2 (20)	2 (15.4)	1 (50)	0.666
	No	31 (83.8)	8 (80)	11 (84.6)	1 (50)	
Hypertension	Yes	9 (24.3)	4 (40)	4 (30.8)	1 (50)	0.699
	No	28 (75.7)	6 (60)	9 (69.2)	1 (50)	

Regarding maternal outcome, there was no significant association between mode of delivery and causes of hysterectomy. Disseminated intravascular coagulation developed in four cases and deep vein thrombosis developed in two cases one day post operatively with subsequent development of pulmonary embolism and referral to other hospital, though there was no statistical significance regarding the mentioned complications. Most cases of PAS and rupture uterus had required massive transfusion (>4 pints of blood), this was significantly higher than cases of PPH and cervical tear. Intensive care unit admission rate was significantly higher in PAS and rupture uterus cases, as shown in **Table** .

Table 5: Maternal outcome according to indication of hysterectomy:

Variables		**PAS (n=37)**	**Rupture uterus (n=10)**	**PPH (n=13)**	**Cervical tear (n=2)**	**P value**
		No. (%)	No. (%)	No. (%)	No. (%)	
Mode of delivery	NVD	4 (10.8)	0 (0)	1 (7.7)	2 (100)	0.698
	C/S	33 (89.2)	10 (100)	12 (92.3)	0 (0)	
DIC	Yes	1 (2.7)	1 (10)	2 (15.4)	0 (0)	0.403
	No	36 (97.3)	9 (90)	11 (84.6)	2 (100)	
DVT	Yes	2 (5.4)	0 (0)	0 (0)	0 (0)	N/A
	No	35 (94.6)	10 (100)	13 (100)	2 (100)	
Amount of Blood transfusion	1-4 units	5 (13.5)	1 (10)	10 (76.9)	2 (100)	**<0.0001**
	>4 units	32 (86.5)	9 (90)	3 (23.1)	0 (0)	
ICU	Yes	36 (97.3)	10 (100)	6 (46.2)	1 (50)	**<0.0001**
	No	1 (2.7)	0 (0)	7 (53.8)	1 (50)	
Bladder injury	Yes	11 (29.7)	5 (50)	7 (53.8)	0 (0)	0.229
	No	26 (70.3)	5 (50)	6 (46.2)	2 (100)	
Ureteric injury	Yes	3 (8.1)	2 (20)	2 (15.4)	0 (0)	0.659
	No	34 (91.9)	8 (80)	11 (84.6)	2 (100)	
Bowel injury	Yes	3 (8.1)	0 (0)	0 (0)	0 (0)	N/A
	No	34 (91.9)	10 (100)	13 (100)	2 (100)	
Pulmonary embolism	Yes	2 (5.4)	0 (0)	0 (0)	0 (0)	N/A
	No	35 (94.6)	10 (100)	13 (100)	2 (100)	
Second intervention	Yes	0 (0)	0 (0)	3 (23.1)	0 (0)	N/A
	No	37 (100)	10 (100)	10 (76.9)	2 (100)	

Regarding neonatal outcome birthweight was not differ according to the indication of hysterectomy, as shown in Table .

Table 6: Distribution of birthweight according to indications of hysterectomy:

Diagnosis	Birth weight		P value
	Mean	SD	
PAS	2936.35	374.99	0.444
Rupture uterus	2763.4	470.93	
PPH	2959.31	227.42	
Cervical tear	3127	141.42	

The same is true regarding NICU admission and neonatal death, as shown in Table .

Table 7: NICU admission and neonatal death according to indications of hysterectomy:

Variables		PAS	Rupture uterus	PPH	Cervical tear	P value
		No. (%)	No. (%)	No. (%)	No. (%)	
NICU	Yes	17 (45.9)	7 (70)	4 (30.8)	0 (0)	0.155
	No	20 (54.1)	3 (30)	9 (69.2)	2 (100)	
Neonatal death	Yes	5 (13.5)	0 (0)	1 (7.7)	0 (0)	0.579
	No	32 (86.5)	10 (100)	12 (92.3)	2 (100)	

Looking for the predictors for ICU, NICU admissions and neonatal birthweight, a regression analysis was applied and the result was; the single independent predictor for requirement of maternal ICU admission was the indication for surgery, while NICU admission was related mainly to gestational age and maternal hypertension, where is the birthweight was solely dependent on gestational age as shown in **Table** .

Table 8: Regression analysis to estimate predictors for ICU, NICU admission and birthweight:

Variables	ICU admission	NICU admission	Birthweight
Maternal age	0.066	0.083	0.376
Parity	0.466	0.583	0.841
Gestational age	0.460	**0.023**	**0.0001**
Antenatal care visits	0.119	0.594	0.421
Educational level	0.104	0.078	0.586
Diabetes	0.704	0.178	0.897
Hypertension	0.758	**0.030**	0.229
Number of C/S	0.152	0.702	0.926
Indication of EPH	**0.0001**	0.775	0.300

4. Discussion

Emergency peripartum hysterectomy (EPH) is a life-saving obstetric procedure reserved for conditions where medical treatment and conservative surgery have failed. EPH is associated with significant morbidity and mortality[60].

The study intended to investigate the risk factors and outcomes of various emergency indications of peripartum hysterectomy. The indications of hysterectomy were mainly for PAS disorder, next to it rupture uterus.

The maternal age showed that PPH had higher maternal age than remaining indications, to note that Lao et al[61] found that advancing maternal age is a risk factor for development of PPH, while Fofie et al[62] found that advancing maternal age associated with abnormal coordination of myometrial contractions, making higher risk for uterine rupture.

Cases of PPH and PAS had higher parity rate, similar result found by Sosa et al[63] who found that with multiparity myometrium tend to develop impairment in the contractions, either due to the effect of scar tissue or decreased elasticity and Tinari et al[64] found that increased maternal scarring (due to recurrent C/S delivery) in multiparous women associated with higher risk of PAS.

The mean gestational age was not different among cases of hysterectomy (depending on its indication) and similar result found by Triunfo et al[65].

The mean number of previous C/S was not different among the groups of the study. To note that Faraji et al[66], Hasson et al[67], and Zhou et al[68] found that higher rate of C/S associated with increased rate of PAS, rupture uterus and PPH respectively. Our study showed no difference in the rate of previous C/S as all the cases had high number of previous C/S.

The blood pressure at presentation was the lowest in cases of PAS, as they developed severe bleeding.

The adequacy of antenatal care visits showed no difference in regard to the indication of hysterectomy. Similarly Ikram-Ul-Haq et al[69], found adequate antennal care visits not associated with change in the rate of emergency hysterectomy. While Parvin et al[70] found that majority of cases of EPH had inadequate antenatal care and suggested that improvement of antenatal care could be associated with improved maternal outcome. Kallianidis et al[71] suggested that poor socioeconomic status rather than the inadequate antenatal care was associated with worse outcome after EPH.

No difference in educational level among the groups was found, but Ming et al[72] found that cases of PAS were more common in lower educational level and the inconsistent findings may be attributed to the difference in sample size.

Past medical history in the form of diabetes Miletus was not associated with one indication over the remaining. The diabetes could affect maternal outcome in the form of increased morbidity of the surgical intervention by contributing to the occurrence of deep vein thrombosis or requirement for ICU admission as suggested by Muche et al[73]. The same is true with hypertension as it had no effect on the indication of surgical intervention. Again, hypertension could add more morbidity to the mother but not alter the indication of hysterectomy. Mersha et al[74] found that mothers with hypertensive disorders had overall increased morbidity when compared with normotensive control.

Mode of delivery did not differ between the groups. Noting that cases of PAS were diagnosed by either ultrasound preoperatively or by severe bleeding post vaginal delivery (in four cases) or during surgery. While cases of rupture uterus were due to prolong or obstructed labor (mainly with midwifery interference) that ended with caesarean hysterectomy. But cases of cervical tear happened during vaginal delivery in precipitated labor. Thus, the mode of delivery could have its own effect or part in the pathogenesis of development of complication that require EPH, but only seven cases had delivered vaginally this small number of cases could lead to falsely eliminated the effect mode of delivery on the indication of hysterectomy (type II error).

The disseminated intravascular coagulation rate was not different according to indication of hysterectomy. This coagulopathy is mainly attributed to the blood loss and replacement that happened in such cases. Shamshirsaz et al[75] found that significant associated with cases of PAS but attributed it mainly to blood transfusion complications. Deep vein thrombosis developed in only two cases of PAS. In general DVT increased in cases of pelvic surgery, and Wandabwa et al[76] found increased risk of DVT in cases of EPH.

All cases of EPH in this study required blood transfusion, the amount of blood required was of more than four units (massive blood transfusion) in 86.5% and 90% of cases of PAS and rupture uterus respectively, this reflects the danger of these two pathologies with difficulties of controlling the hemorrhage. Bayram et al[77] found that rate of blood transfusion to be 97.6% in cases of EPH. Oge et al[78] found that cases of elective hysterectomy had significantly lower rate and amount of blood transfusion than EPH.

The requirement of ICU admission was significantly higher in PAS and rupture uterus, this mainly attributed to prolonged surgery, requirement for blood transfusion or development of complications

(DIC). Similar result found by Bolnga et al[79] who found higher rate of ICU admission in cases of EPH, with rupture uterus being the commonest indication. Arulpragasam et al[60] found that the rate of high dependency unit (HDU) admission and adult special care unit (ASCU) were increased in cases of EPH while admission to ICU (due to requirement of support of more than one organ failure or circulatory or respiratory support) were not increased after EPH. Regression analysis in our study showed that the single independent predictor of ICU admission was the indication of EPH.

Birthweight was not differed among various indications of EPH in this study, while Sereke et al[80] found that the cases of EPH had lower birthweight when compared with cases of normal pregnancy with uncomplicated delivery. This may be attributed to the effect of abnormal placentation as in cases of PAS that had many effects on perinatal outcome which had also been found by Palacios-Jaraquemada et al[81]. Furthermore, cases of EPH resulted in delivery of premature babies that may explaine the low birthweight in different studies. Though after application of regression analysis in our study, we found that the birthweight is dependent on gestational age and the cause of the EPH had no effect on birthweight which could be explained to certain extent by the small sample size.

Although prematurity and complicated delivery are associated with increased neonatal morbidity, yet no difference in NICU admission rate according to the indication of EPH was found in this study. Rana et al[82] found that the rate of NICU admission in cases of EPH was 18.2% and Sereke et al[80] found that cases of EPH had increased rate of NICU admission. This difference in result may be attributed to the difference in the inclusion criteria, as in the current study only cases of EPH were included, while Sereke et al[80] had compared EPH outcome with normal pregnancy with uncomplicated deliveries. Regression analysis showed that NICU admission was dependent on two factors history of maternal hypertensive disorder and gestational age and the indication of EPH had no effect on rate of NICU admission and neonatal death was not different according to the indication of EPH.

5. Conclusion & Recommendations

CONCLUSION

- The prevalence of EPH in all hospital deliveries was 0.6%, and 1.51% of all C/S deliveries.
- The main causes of EPH in our hospital were PAS followed by postpartum hemorrhage.
- EPH associated with increased rate of ICU admission, and requirement of blood transfusion.
- Parity was significantly higher in cases of EPH due to PAS and PPH than in cases due to rupture uterus or cervical tear.
- The single independent predictor for requirement of maternal ICU admission was the indication for EPH.
- NICU admission was related mainly to gestational age and maternal hypertension.

RECOMMENDATIONS

- This study could be considered the starting point for a larger comparative study that examine the maternal and neonatal outcomes across different indications of EPH and compare it with normal pregnancy.
- The need for health educations to childbearing women about the hazards of multiparity and high number of C/S delivery.
- Capacity building of medical staff for doing more and more conservative surgical approach to avoid more radical intervention as hysterectomy.

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