Original Research

Indications, risk factors, and outcomes of emergency peripartum hysterectomy: A 7-year retrospective study at a tertiary center in Turkey

Tayfun Vural[1], Burak Bayraktar[1], Suna Yildirim Karaca[1], Ceren Golbasi[2], Ozan Odabas[1], Cuneyt Eftal Taner[1]

1. Department of Obstetrics and Gynecology, University of Health Sciences Tepecik Training and Research Hospital, Turkey
2. Department of Obstetrics and Gynecology, Izmir Tinaztepe University Faculty of Medicine, Turkey

Corresponding Author; Burak Bayraktar; **Email address**: drburakbayraktar@gmail.com

Abstract

Objective

To determine the incidence, indications, the risk factors, complications, maternal morbidity and mortality of emergency peripartum hysterectomy (EPH), and perinatal outcomes at a tertiary hospital, Turkey.

Methods

We analyzed 71 cases of EPH from 2012 to 2019 at a tertiary hospital in a retrospective study. There were 142 control patients.

Results

There were 71 EPH out of 69,504 deliveries, for an overall incidence of 1.02 per 1000 births. The main indication for peripartum hysterectomy was abnormal placentation (67.6%), followed by uterine atony (28.1%), and uterine rupture (4.2%). Cesarean section (CS) and previous CS are major risk indicators for EPH. Other risk indicators are advanced maternal age (≥ 35 years) and multiparity. All patients with abnormal placentation had a previous CS. 93% of EPH were performed during and/or after CS, and 7% after vaginal delivery. 69% of EPH were made in total and 31% were subtotal. The three most common maternal morbidity included: wound infection and febrile morbidity (26.7%), bladder injury (16.9%), and disseminated intravascular coagulopathy (11.2%). There were no maternal deaths but perinatal mortality was 4%.

Conclusion

The most common indication for EPH was abnormal placentation. Also, CS and previous CS are major risk factors of EPH. Other risk factors for EPH are advanced maternal age (≥ 35 years) and multiparity. Moreover, all unnecessary CS should be avoided.

Keywords: Emergency peripartum hysterectomy, cesarean section, abnormal placentation, maternal morbidity, maternal mortality

Introduction

The incidence of emergency peripartum hysterectomy (EPH) is increasing globally due to the increase in cesarean section (CS) rates[1]. In turn, these conditions increase the risk of EPH, which can lead to numerous maternal morbidity and mortality causes, including bladder/ureter injuries, blood transfusions, permanent loss of fertility, fever, infection, thrombotic complications, and death[2].

EPH is a life-saving hysterectomy performed at the time of delivery or in the immediate 24-hours after delivery[1]. Today, the only indication for EPH is postpartum hemorrhages that are not successfully treated with conservative methods, including uterine massage, uterotonics, uterine tamponade, hemostatic uterine suturing, hypogastric or uterine artery ligation/embolization. About a quarter of global maternal deaths are due to postpartum hemorrhage[3].

The aim of this retrospective study was to determine the incidence, indications, risk factors, and complications of EPH, and maternal-perinatal outcomes at a tertiary hospital.

Materials And Methods

We analyzed retrospectively all cases of peripartum hysterectomy performed from July 2012 to December 2019 at the University of Health Sciences, Tepecik Training and Research Hospital. All of the pregnant women in the study population were those who underwent EPH during delivery or in the first 24-hours after delivery. Elective cesarean hysterectomies for obstetric reasons were excluded. Women delivering with a gestational age of fewer than 22 weeks were also excluded. Data were abstracted from individual medical and laboratory records. Maternal demographic data, maternal morbidity and mortality, operational characteristics, and perinatal outcomes were investigated. The operative notes and pathology reports of the uterus and placenta were used to determine the indication for hysterectomy. Two control patients were selected for each patient who underwent a peripartum hysterectomy. The control group consisted of patients who presented to the hospital just before the index patients with hysterectomy.

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 1. Maternal characteristics in patients with Emergency Peripartum Hysterectomy (EPH)

	Mean±SD	Min-max	Number (n), Percent (%)
Maternal age (year)	31.8±5.6	18-41	-
Adolescent pregnancy ≤ 19	-	-	3 (4.2%)
Advanced maternal age ≥ 35	-	-	25 (35.2%)
Twin Gestation Prevalence	-	-	4 (5.6%)
Parity			
Nulliparous	-	-	8 (11.3%)
Multiparous	-	-	63 (88.7%)
Parity ≥ 3			24 (33.8%)
Gestational age (week)	35.3±4.1	22.6-41.4	-
Preterm Delivery Prevalence (< 37 weeks)	-	-	40 (56.3%)
Delivery type			
Vaginal delivery	-	-	5 (7%)
Cesarean section	-	-	66 (93%)
Primary CS Prevalence	-	-	9 (13.6%)
Previous CS Prevalence	-	-	57 (79.4%)
Preop Hb (g/dl)	9.91±2.1	4.3-13.4	-
Preop Anemia Hb<11 (g/dl)	-	-	48 (67.6%)
Postop Hb (g/dl)	8.75±1.8	4.4-13	-
Postop Anemia Hb<11 (g/dl)	-	-	65 (91.5%)
Number of Patients Given Blood Transfusion	-	-	69 (97.2%)
Blood Transfusion number (unit)	5.8±3.1	2-15	-

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 1 Cont....

Number of Patients Given Fresh Frozen Plasma	-	-	69 (97.2%)
Fresh Frozen Plasma number (unit)	4.1±2.5	1-11	-
Number of Patients Given Platelet Suspensions	-	-	7 (9.8%)
Platelet Suspensions number (unit)	3.5±3.1	1-10	-
Number of Patients Given Fibrinogen Concentrate		-	39 (54.9%)
Fibrinogen amount (g)	3.2±1.4	1-7	-
Hospitalization Period (day)	7.3±4	2-22	-
Number of ICU Transfers	-	-	7 (9.8%)
ICU Hospitalization Period (day)	6.5±9.3	1-27	-

Abbreviations: CS: caesarean section ; Hb: hemoglobin ; ICU: intensive care unit ; Preop:

; Postop: postoperative

Table 2. Operation characteristics and perinatal outcomes in patients with Emergency Peripartum Hysterectomy (EPH)

	Mean±SD	Min-max	Number (n), Percent (%)
Operation time (minute)			
At CS	131.9±40.8	70-230	52 (73.2%)
Post CS	121.4±44.1	74-240	14 (19.7%)
Post vaginal delivery	116.6±42.2	70-180	5 (7.6%)
Hysterectomy Indication			
Abnormal Placentation	-	-	48 (67.6%)
Increta	-	-	12 (16.9%)
Accreta	-	-	14 (19.7%)

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 2 Cont...

Accreta	-	-	14 (19.7%)
Percreta	-	-	22 (31%)
Atony	-	-	20 (28.1%)
After CS	-	-	15 (21.1%)
After vaginal delivery	-	-	5 (7%)
Uterine Rupture	-	-	3 (4.2%)
Hysterectomy Time			
At CS	-	-	52 (73.2%)
Post CS	-	-	14 (19.7%)
Post vaginal delivery	-	-	5 (7.1%)
Hysterectomy Type			
Total	-	-	49 (69%)
Subtotal	-	-	22 (31%)
Hypogastric Artery Ligation	-	-	23 (32.4%)
Complications			
Intraoperative			15 (21.1%)
Bladder Injury			12 (16.9%)
Ureteral Injury			2 (2.8%)
Intestinal Injury			1 (1.4%)
Postoperative			36 (50.7%)
Wound infection and Febrile morbidity			19 (26.7%)
Disseminated intravascular coagulation (DIC)			8 (11.2%)
Pelvic hematoma			3 (4.2%)
Gastrointestinal complications			2 (2.8%)
Thromboembolism			2 (2.8%)
Acute renal failure-dialysis			1 (1.4%)
Vesicovaginal Fistula			1 (1.4%)

Table 2 Cont...

Maternal Death			0
None			20 (28.2%)
Stillbirth *	-	-	1 (1.3%)
Birth weight (g) *	2501.3±742.4	830-4375	-
LBW (<2500 g) *	-	-	33 (44%)
APGAR Score *			
<7 at 1st minute	-	-	29 (38.6%)
<7 at 5th minute	-	-	12 (16%)
Perinatal Mortality *	-	-	3 (4%)

Abbreviations: CS: caesarean section ; LBW: low birth weight

* 75 newborns

Table 3. Comparison of Total Hysterectomy Group and Subtotal Hysterectomy Group

	Total (n=49)	**Subtotal (n=22)**	**P value**
Maternal age (year) (mean±SD)	32±6	31±5	0.459
Adolescent pregnancy ≤19 (year) (n,%)	3 (6.1%)	1 (0%)	0.789
Advanced maternal age ≥ 35 (year) (n,%)	19 (38.8%)	6 (27.3%)	0.348
Parity (n,%)			0.217
Nulliparous	4 (8.1%)	4 (18.1%)	
Multiparous	45 (91.9%)	18 (81.2%)	
Previous CS history (n,%)	45 (91.8%)	17 (77.2%)	0.088
Gestational age (week) (mean±SD)	35.2±4.1	35.6±4.5	0.571
Delivery type (n,%)			0.014
Vaginal delivery	1 (2%)	4 (18.2%)	
Cesarean section	48 (98%)	18 (81.8%)	
Preterm Delivery Prevalence (<37 weeks) (n,%)	28 (57.1%)	12 (54.5%)	0.838
Hysterectomy Indications (n,%)			0.229

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 3 Cont....

Abnormal Placentation	34 (69.4%)	14 (63.6%)	
Uterine Atony/Rupture	15 (30.6%)	8 (36.4%)	
Hypogastric Artery Ligation (n,%)	16 (32.7%)	7 (31.8%)	0.945
Preop Hb (g/dl) (mean±SD)	9.7±2	10.3±2.4	0.089
Preop Anemia Hb<11 g/dl (n,%)	36 (73.4%)	12 (54.5%)	0.115
Postop Hb (g/dl) (mean±SD)	8.5±1.8	9.2±1.9	0.216
Postop Anemia Hb<11 g/dl (n,%)	46 (93.8%)	18 (81.8%)	0.115
Transfusion Unit (n,%)			
Number of Patients Given Blood Transfusion	48 (97.9%)	21 (95.4%)	0.555
Number of Patients Given Fresh Frozen Plasma	47 (95.9%)	19 (86.3%)	0.145
Number of Patients Given Platelet Suspensions	4 (8.1%)	3 (13.6%)	0.987
Number of Patients Given Fibrinogen Concentrate	30 (62.5%)	9 (40.9%)	0.111
Hospitalization Period (day) (mean±SD)	7.1±4.1	7.9±3.9	0.306
Number of ICU Transfers (n,%)	4 (8.1%)	3 (13%)	0.474
Complications (n,%)			
Wound infection and Postoperative Fever	12 (24.4%)	7 (31.8%)	0.303
Bladder Injury	10 (20.4%)	2 (9.1%)	0.239
Disseminated intravascular coagulation (DIC)	6 (12.4%)	2 (9.1%)	0.697
Operation time (minute) (mean±SD)	131.2±42.9	123.3±37.9	0.597

Abbreviations: Hb: hemoglobin ; ICU: intensive care unit ; CS: caesarean section ; Preop: preoperativ

; Postop: postoperative

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 4. Comparison of Abnormal Placentation Group and Uterine Atony/Rupture Group

	Abnormal Placentation (n=48)	Uterine Atony/Rupture (n=23)	P value
Maternal age (year) (mean±SD)	32.2±4.9	31±7.1	0.460
Adolescent pregnancy ≤19 (year) (n,%)	1 (2%)	3 (13%)	0.060
Advanced maternal age ≥ 35 (year) (n,%)	17 (35.4%)	8 (34.7%)	0.369
Parity (n,%)			<0.001
Nulliparous	1 (2%)	8 (34.7%)	
Multiparous	47 (98%)	15 (65.3%)	
Previous CS history (n,%)	48 (100%)	14 (60.8%)	<0.001
Gestational age (week) (mean±SD)	35.3±3.7	35.2±4.9	0.971
Preterm Delivery Prevalence (<37 weeks) (n,%)	31 (64.6%)	9 (39.1%)	0.043
Hysterectomy Type (n,%)			0.632
Total	34 (70.8%)	15 (65.2%)	
Subtotal	14 (29.2%)	8 (34.8%)	
Hypogastric Artery Ligation (n,%)	16 (33.3%)	7 (30.4%)	0.807
Preop Hb (g/dl) (mean±SD)	10.6±1.3	8.4±2.7	<0.001
Preop Anemia Hb<11 g/dl (n,%)	29 (%60.4)	19 (%82.6)	0.061
Postop Hb (g/dl) (mean±SD)	9.1±1.9	8±1.2	0.016
Postop Anemia Hb<11 g/dl (n,%)	41 (85.4%)	22 (95.6%)	0.201
Transfusion Unit (n,%)			
Number of Patients Given Blood Transfusion	47 (97.9%)	22 (95.6%)	0.589

https://dx.doi.org/10.4314/mmj.v35i1.7

Table 4 Cont...

Number of Patients Given Fresh Frozen Plasma	44 (91.6%)	22 (95.6%)	0.539
Number of Patients Given Platelet Suspensions	1 (2.1%)	6 (26.1%)	0.001
Number of Patients Given Fibrinogen Concentrate	23 (47.9%)	16 (69.5%)	0.086
Hospitalization Period (day) (mean±SD)	6.9±3.4	8.2±5	0.971
Number of ICU Transfers (n,%)	2 (4.1%)	4 (17.4%)	0.060
Complications (n,%)			
Wound infection and Postoperative Fever	10 (20.8%)	9 (39.1%)	0.103
Bladder Injury	8 (16.6%)	4 (17.3%)	0.939
Disseminated intravascular coagulation (DIC)	5 (10.4%)	3 (13%)	0.743

Abbreviations: Hb: hemoglobin ; ICU: intensive care unit ; CS: caesarean section ; Preop: preoperative

Postop: postoperative

Table 5. Demographic-medical features and obstetric outcomes of Emergency Peripartum Hysterectomy (EPH) Group vs Control Group

	Peripartum Hysterectomy (EPH) (n=71)	Control (n=142)	P value	OR 95% CI
Maternal age (year) median (min-max)	33 (18-41)	26 (18-42)	<0.001	-
Adolescent pregnancy ≤ 19 (n,%)	3 (4.2%)	16 (11.3%)	0.089	0.35 (0.1–1.23)
Advanced maternal age ≥ 35 (n,%)	25 (35.2%)	9 (6.3%)	<0.001	8.03 (3.49–18.46)
Multiple Gestation Prevelance (n,%)	4 (5.6%)	3 (2.1%)	0.174	2.77 (0.6–12.71)
Parity (n,%)				
Nulliparous	8 (11.3%)	44 (31%)	0.001	0.28 (0.12–0.64)
Multiparous	63 (88.7%)	98 (69%)	0.001	3.54 (1.56–8)
Parity ≥ 3	24 (33.8%)	51 (35.9%)	0.760	0.91 (0.5–1.66)
Gestational age (week) (mean±SD)	35.3±4.1	37.5±2.9	<0.001	-

Table 5 Cont...

Preterm Delivery Prevalence (< 37 weeks) (n,%)	40 (56.3%)	41 (28.9%)	<0.001	-
Stillbirth (n,%)	1 (1.3%) *	2 (1.4%) #	0.977	-
Preop Hb (g/dl) (mean±SD)	9.91±2.1	11.5±1.4	<0.001	-
Preop Anemia Hb<11 (g/dl) (n,%)	48 (67.6%)	45 (31.7%)	<0.001	-
Postop Hb (g/dl) (mean±SD)	8.75±1.8	10.6±1.3	<0.001	-
Postop Anemia Hb<11 (g/dl) (n,%)	65 (91.5%)	83 (58.4%)	<0.001	-
Number of Patients Given Blood Transfusion (n,%)	69 (97.2%)	5 (3.5%)	<0.001	-
Blood Transfusion number (unit) (mean±SD)	5.8±3.1	0.1±0.6	<0.001	-
Hospitalization Period (day) (mean±SD)	7.3±4	2.4±2.2	<0.001	-
Delivery type (n,%)				
Vaginal delivery	5 (7%)	72 (50.7%)	0.001	0.07 (0.03–0.19)
Cesarean section	66 (93%)	70 (49.3%)	0.001	13.58 (5.16–35.7)
Primary CS Prevalence (n,%)	9 (12.7%)	38 (26.8%)	0.019	0.4 (0.18–0.88)
Previous CS Prevalence (n,%)	57 (80.3%)	32 (22.5%)	<0.001	14 (6.92–28.32)
Birth weight (g) (mean±SD)	2501.3±742.4 *	3041.69±671.56 #	<0.001	-
LBW (<2500 g) (n,%)	33 (44%) *	29 (20%) #	<0.001	-
APGAR Score (n,%)				
<7 at 1st minute	29 (38.6%) *	21 (14.5%) #	<0.001	-
<7 at 5th minute	12 (16%) *	7 (4.8%) #	0.005	-
Perinatal Mortality (n,%)	3 (4%) *	4 (2.7%) #	0.619	-

Abbreviations: Hb: hemoglobin ; ICU: intensive care unit ; CS: caesarean section ; Preop: preoperative ; Postop: postoperative ; LBW: low birth weight * 75 newborns, # 145 newborns

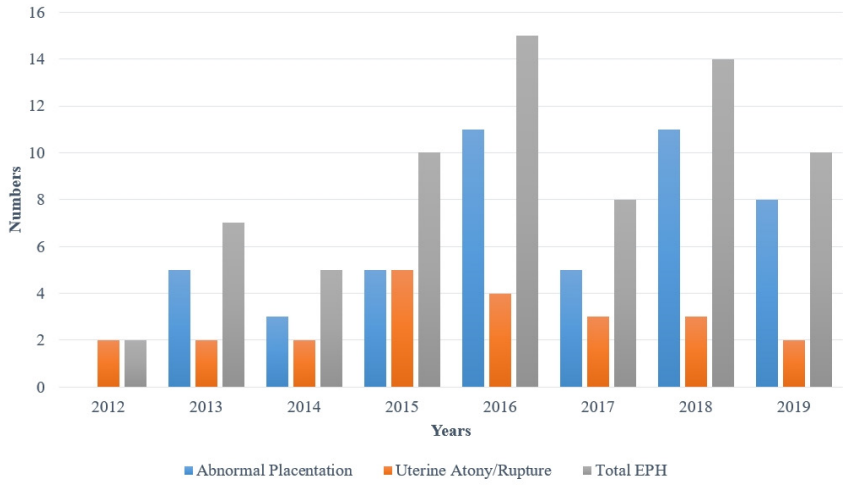

Figure 1. Emergency Peripartum Hysterectomy (EPH) by years

The study received ethical approval from the Hospital Ethics Committee (approval number: 2019/ 15-12). All procedures were performed according to the Declaration of Helsinki.

Statistical analysis

Statistical analysis of the data was analyzed in the Statistical Package for the Social Sciences 22.0 version (IBM Corporation, Armonk, New York, US). The normality distribution of the variables was made according to the Kolmogorov-Smirnov (n> 30), Shapiro-Wilk (n <30) tests, and Student T test for normally distributed variables; Mann-Whitney U test was used for variables that did not have a normal distribution. Data are shown as mean ± (SD), min-max. Nominal variables were shown as the number of cases and presented as a percentage. Chi square and Fisher's exact test were used for categorical variables. The odds ratio was used with a 95% confidence interval to determine the strength of association. Results with p <0.05 were considered significant.

Results

Over a period of 7 years, a total of 69,504 women delivered, 31,645 (45.6%) vaginally and 37,859 (54.4%) by CS. There were 71 peripartum hysterectomies (1.02/1,000 deliveries), of which 5 were performed after vaginal deliveries (0.15/1,000 vaginal deliveries), and 66 performed after CS (1.74/1,000 CSs). The EPH rate increased from 0.15/1,000 in the case of vaginal delivery to 0.24/1,000 in the case of primary CS and to 1.5/1,000 in the case of previous CS. Compared with vaginal delivery in unscarred uteri, a CS and a previous CS increased the risk of EPH by approximately 11 (OR 11.05, 95% CI 4.45–27.43; p<0.001) and 54 times (OR 53.74, 95% CI 18.23–158.39; p<0.001), respectively. Although primary CS increased the risk of EPH, compared to vaginal delivery, this increase was not statistically significant (OR 1.92, 95% CI 0.61–6.03; p=0.260).

The mean maternal age was 31.8±5.6 years. 57/71 (79.4%) of our patients undergoing EPH had at least one or more previous CS. Blood products were transfused in almost all cases Table 1.

As regards the primary indications for EPH, the most common was abnormal placentation in 48 cases (67.6%), followed by uterine atony in 20 cases (28.1%) and uterine rupture in 3 cases (4.2%). In CS, the risk of EPH due to atony was higher by approximately 10 times than in vaginal delivery (OR 9.95, 95% CI 2.15–37.66; p=0.001). There were one intrauterine fetal death and two neonatal deaths, giving a perinatal mortality rate of 4% and a neonatal mortality rate of 2.7%. The morbidity rate (71.8%) was high in the EPH group. The most common intraoperative complication was urinary tract injury (19.7%), and the most common postoperative complication was wound infection and febrile morbidity (26.7%). There were no maternal deaths in this study population (Table 2).

Total and subtotal hysterectomy are compared in Table 3. There were no statistically significant differences between the two groups in terms of characteristics: the groups were similar in terms of demographic data, gestational age, preterm delivery (<37 weeks), hysterectomy indications, complications, hospitalization days, and operation times.

In Table 4, the abnormal placentation group and the uterine atony/rupture group are compared. We found that 100% of the patients in the abnormal placentation group had at least one previous CS. Also, almost all of the abnormal placentation group was multiparous, and preterm birth (<37 weeks) was significantly more frequent in this group than in the uterine atony/rupture group (OR 2.84, 95% CI 1.02–7.91; p=0.043).

Table 5 presents the findings obtained from the comparison of the EPH group and the control group. Compared to the control group, CS and previous CS increase the risk of EPH approximately 14 times (OR 13.58, 95% CI 5.16–35.7; p=0.001, and OR 14, 95% CI 6.92-28.32; p<0.001, respectively), and advanced maternal age (≥ 35 years) increases this risk approxi-mately 8 times (OR 8.03, 95% CI 3.49–18.46; p<0.001). In addition, the risk of EPH in multiparous patients has increased more than 3 times (OR 3.54, 95% CI 1.56–8; p=0.001). The distribution of EPH numbers by years is shown in Figure 1. Abnormal placentation, uterine atony, and uterine rupture were not observed in the control group.

Before the hysterectomy, 17 women (24%) had a uterine massage, 16 women (22.5%) 20-80 units of dilute oxytocin infusion, 17 women (24%) misoprostol (200–800 ug rectally/sublingual), 11 women (15.5%) methylergonovine (0.2-0.6 mg intramuscularly), 1 woman (1.4%) tranexamic acid (500 mg infusion), 3 women (4%) bumm curettage, 3 women (4%) Bakri balloon, 3 women (4%) B-Lynch suture, 8 women (11%) a uterine artery ligation, and 23 women (32.4%) a hypogastric artery ligation. Other procedures performed during hysterectomy were as follows: 1 woman (1.4%) underwent oophorectomy and 30 women (42.2%) bilateral salpingectomy.

Discussion

In our study, the incidence of EPH was found to be 1.02 per 1,000 births. The average incidence of EPH is 0.9 per 1,000 deliveries globally [4]. The incidence of EPH varies considerably among countries and regions. While the incidence of EPH is less than 1 per 1000 births in developed countries[5,6], it is 4 and 11 per 1000 births in Nigeria[7] and Pakistan[8], respectively. Our incidence of EPH may have been affected by the fact that our hospital is a tertiary center and our rates of vaginal births after cesarean (VBAC) is low. Also, EPH incidence in Turkey is quite different geographically. The incidence in tertiary centers in western[9], central[10], and eastern[11] regions

of Turkey were reported as 0.48, 0.51, and 5.38 per 1,000 deliveries, respectively. These differences may be due to cesarean rates, socioeconomic status, health care standards, and parity in the study populations.

There is a strong and consistent association between CS and EPH risk, regardless of the patient population, sample size, study type, and geography[12]. In our study, we found that compared to vaginal delivery, CS and previous CS increased the risk of EPH by approximately 11 and 54 times, respectively. Allam et al. reported that previous CS, as an independent predictor, increased the risk of EPH by 15 times[13]. Stivanello et al. reported that the risk of hysterectomy increased by approximately 4.5 times in CS compared to vaginal delivery[14]. In accordance with the literature, our findings demonstrated that CS and previous CS were a major risk factor for EPH.

The most common indication of EPH has been abnormal placentation instead of uterine atony in recent years due to the increase in cesarean delivery rates. A lower segment CS is now the most common major surgery performed in western countries[1]. In our study, as determined in many studies in the literature, the most common indication for EPH was abnormal placentation. 48/71 (67.6%) cases had a hysterectomy with the indication of abnormal placentation. In our study, placenta percreta was the most common pathology (31%) in the abnormal placentation group. This may be due to the referral of patients diagnosed with placenta percreta from surrounding hospitals. All abnormal placentation cases (100%) in our study had at least one previous CS history. Although the most common indication is abnormal placentation in developed countries, uterine atony and uterine rupture are the leading indications in developing countries[4].

In our patient population, the second most common indication for EPH was uterine atony (28.1%). In our study, most of the uterine atony cases (75%) occurred after CS. We found that CS increased the risk of EPH due to uterine atony by approximately 10 times compared to vaginal delivery. In the literature, the risk of EPH due to atony is reported to increase by 4-fold with previous CS and by 2.5-fold with primary cesarean delivery[15]. Previous studies have also reported that uterine atony is the most common indication in rural regions of eastern Turkey[11].

Uterine rupture was the third common indication for EPH (4.2%) in our study. In the literature, there was a decreasing trend in the incidence of uterine rupture as an indication for EPH in developed countries[1,15]. However, in Nigeria, a ruptured uterus (73.3%) was reported as the most common indication for EPH[16].

We did not find any differences between total and subtotal hysterectomy groups in terms of indications and maternal outcomes. Consistent with our findings, some studies in the literature have shown that neither total nor subtotal hysterectomy has any advantages over each other[2].

In our study, contrary to the literature, there was no difference between the abnormal placentation group and the uterine atonia/rupture group in terms of hysterectomy type (total/subtotal). In the studies in the literature, it was reported that total hysterectomy was inevitable for abnormal placentation and subtotal hysterectomy was preferred in the uterine atony/rupture group[9,17]. We preferred total hysterectomy to subtotal hysterectomy in cases with abnormal placentation located in the lower segment of the uterus.

When the EPH group and the control group were compared, CS and previous CS increase the risk of EPH approximately 14 times and advanced maternal age (≥ 35 years) increases the risk of EPH approximately 8 times. In addition, the risk of EPH in multiparous patients has increased more than 3 times. In our study, CS and previous CS were major risk factors for EPH. Many studies in the literature support our finding[14,18]. Macharey et al. also found that ≥ 35 years of age increased the risk of EPH by approximately 4 times[18].

The most common complications in our study were noted as follows: wound infection and febrile morbidity (26.7%), bladder injury (16.9%), and DIC (11.2%). In the literature, the morbidity associated with EPH was reported as 61.3% 6 and 56%[2]. Our morbidity rate was 71.8%. The high rate of morbidity compared to the literature may be due to our being a tertiary center. The most severe complication of EPH is maternal death. There were no maternal deaths in this study population. In the literature, the maternal mortality rate ranges from 0 to 16.7% [2,12,17]. In Turkey, the maternal mortality rate was reported as 4.5% by Sahin et al.[9], and 9.28% by Yalinkaya et al.[11].

In a meta-analysis performed in 2016, the overall perinatal mortality rate was 33.4%. The perinatal mortality rate was highest in lower-income (57.2%) and lowest in high-income settings (5.6%)[4]. We found the perinatal mortality rate as 4% in our study.

Our study has some obvious limitations. The data in this study were collected retrospectively. Also, the retrospective design of this study may have led to the inclusion bias. Since we are a tertiary center, the incidence and complication rates may be higher due to patient referrals. The main strength of this study is that it investigates a sufficient number of patients holistically over a long period of time.

Conclusion

This study confirms that the major indication for EPH is abnormal placentation. Also, CS and previous CS are major risk factors for EPH. In addition, advanced maternal age (≥ 35 years) and multiparity are significantly associated with EPH. Therefore, all efforts should aim at preventing unnecessary CS and reducing CS rates.

Declarations of interest

The authors have no conflicts of interest to declare.

Funding

None.

References

1. Flood KM, Said S, Geary M, Robson M, Fitzpatrick C, Malone FD. Changing trends in peripartum hysterectomy over the last 4 decades. Am J Obstet Gynecol. 2009;200(6):632.e1-6. doi:10.1016/j.ajog.2009.02.001

2. Rossi AC, Lee RH, Chmait RH. Emergency postpartum hysterectomy for uncontrolled postpartum bleeding: a systematic review. Obstet Gynecol. 2010;115(3):637-644. doi:10.1097/AOG.0b013e3181cfc007

3. Jaffer D, Singh PM, Aslam A, Cahill AG, Palanisamy A, Monks DT. Preventing postpar-tum hemorrhage after cesarean delivery: a network meta-analysis of available pharma-cologic agents. Am J Obstet Gynecol. Published online September 14, 2021:S0002-9378(21)00973-X. doi:10.1016/j.ajog.2021.08.060

4. van den Akker T, Brobbel C, Dekkers OM, Bloemenkamp KWM. Prevalence, Indica-tions, Risk Indicators, and Outcomes of Emergency Peripartum Hysterectomy World-wide: A Systematic Review and

Meta-analysis. Obstet Gynecol. 2016;128(6):1281-1294. doi:10.1097/AOG.0000000000001736

5. Campbell SM, Corcoran P, Manning E, Greene RA, Irish Maternal Morbidity Advisory Group. Peripartum hysterectomy incidence, risk factors and clinical characteristics in Ireland. Eur J Obstet Gynecol Reprod Biol. 2016;207:56-61. doi:10.1016/j.ejogrb.2016.10.008

6. Awan N, Bennett MJ, Walters WAW. Emergency peripartum hysterectomy: a 10-year review at the Royal Hospital for Women, Sydney. Aust N Z J Obstet Gynaecol. 2011;51(3):210-215. doi:10.1111/j.1479-828X.2010.01278.x

7. Omole-Ohonsi A, Taiwo Olayinka H. Emergency peripartum hysterectomy in a develop-ing country. J Obstet Gynaecol Can. 2012;34(10):954-960. doi:10.1016/S1701-2163(16)35409-3

8. Khan B, Khan B, Sultana R, Bashir R, Deeba F. A ten year review of emergency peripar-tum hysterectomy in a tertiary care hospital. J Ayub Med Coll Abbottabad. 2012;24(1):14-17.

9. Sahin S, Guzin K, Eroğlu M, Kayabasoglu F, Yaşartekin MS. Emergency peripartum hys-terectomy: our 12-year experience. Arch Gynecol Obstet. 2014;289(5):953-958. doi:10.1007/s00404-013-3079-2

10. Danisman N, Baser E, Togrul C, Kaymak O, Tandogan M, Gungor T. Emergency peripar-tum hysterectomy: Experience of a major referral hospital in Ankara, Turkey. Journal of Obstetrics and Gynaecology. 2015;35(1):19-21. doi:10.3109/01443615.2014.935712

11. Yalinkaya A, Güzel AI, Kangal K. Emergency peripartum hysterectomy: 16-year experi-ence of a medical hospital. J Chin Med Assoc. 2010;73(7):360-363. doi:10.1016/S1726-4901(10)70078-2

12. de la Cruz CZ, Thompson EL, O'Rourke K, Nembhard WN. Cesarean section and the risk of emergency peripartum hysterectomy in high-income countries: a systematic review. Arch Gynecol Obstet. 2015;292(6):1201-1215. doi:10.1007/s00404-015-3790-2

13. Allam IS, Gomaa IA, Fathi HM, Sukkar GFM. Incidence of emergency peripartum hys-terectomy in Ain-shams University Maternity Hospital, Egypt: a retrospective study. Arch Gynecol Obstet. 2014;290(5):891-896. doi:10.1007/s00404-014-3306-5

14. Stivanello E, Knight M, Dallolio L, Frammartino B, Rizzo N, Fantini MP. Peripartum hysterectomy and cesarean delivery: a population-based study. Acta Obstet Gynecol Scand. 2010;89(3):321-327. doi:10.3109/00016340903508627

15. Bateman BT, Mhyre JM, Callaghan WM, Kuklina EV. Peripartum hysterectomy in the United States: nationwide 14 year experience. Am J Obstet Gynecol. 2012;206(1):63.e1-8. doi:10.1016/j.ajog.2011.07.030

16. Obiechina NJA, Eleje GU, Ezebialu IU, Okeke C a. F, Mbamara SU. Emergency peripar-tum hysterectomy in Nnewi, Nigeria: a 10-year review. Niger J Clin Pract. 2012;15(2):168-171. doi:10.4103/1119-3077.97303

17. D'Arpe S, Franceschetti S, Corosu R, et al. Emergency peripartum hysterectomy in a ter-tiary teaching hospital: a 14-year review. Arch Gynecol Obstet. 2015;291(4):841-847. doi:10.1007/s00404-014-3487-y

18. Macharey G, Ulander VM, Kostev K, Väisänen-Tommiska M, Ziller V. Emergency peri-partum hysterectomy and risk factors by mode of delivery and obstetric history: a 10-year review from Helsinki University Central Hospital. J Perinat Med. 2015;43(6):721-728. doi:10.1515/jpm-2013-0348