Changing trends in emergency peripartum hysterectomy in a tertiary obstetric center in Turkey during 2000–2013

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Abstract

Objective: To evaluate emergency peripartum hysterectomy (EPH) cases over a 14-year period in a tertiary center in İstanbul, Turkey.

Material and Methods: In this retrospective descriptive study, the records of all cases of EPH performed at the Zeynep Kamil Women and Children's Training and Research Hospital between January 2000 and January 2014 were analyzed. Results for 2000–2006 and 2007–2013 were compared to identify changing trends. Demographic and clinical factors associated with EPH were assessed.

Results: During the 14-year study period, a total of 161,836 births occurred, out of which 104,783 (64.8%) were vaginal deliveries and 57,053 (35.2%) were cesarean section (CS). EPH was performed in 81 patients with an overall incidence of 0.5 in 1000 deliveries. The EPH rate in 2007–2013 (0.07%) was significantly higher than in 2000–2006 (0.03%). The major difference in the EPH populations between the two periods was the higher number of previous CS in 2007–2013 compared with 2000–2006 (p=0.01). Indications for EPH did not differ between the two periods. There were 7 (8.6%) maternal deaths in 2000–2013, with significantly fewer maternal deaths in 2007–2013 than in 2000–2006 (19.2% vs. 3.6%).

Conclusion: Rate of EPH increased considerably from 2000 to 2013. This increase was mostly related to the increasing rate of CS. Indications for EPH did not change over the study period, and the number of maternal deaths markedly decreased. (J Turk Ger Gynecol Assoc 2016; 17: 26-34)

Keywords: Postpartum hemorrhage, placenta accreta, emergency peripartum hysterectomy, trend

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Introduction

Emergency peripartum hysterectomy (EPH) is performed as a life-saving procedure in cases of intractable obstetric hemorrhage secondary to uterine atony, uterine rupture, placental disorders, fibroids, and lacerations during cesarean section (CS) or vaginal parturition (1). Postpartum hemorrhage is a leading cause of maternal morbidity and mortality (2-4).

The incidence of EPH varies from 0.2–1.6 per 1000 deliveries per year in developed countries, with a higher incidence in developing countries (5-7). Indications for peripartum hysterectomy have changed throughout the years. In developing countries, uterine atony and uterine rupture are the most common indications for EPH, but in developed countries, abnormal placental invasion is the most common indication (1, 7). In particular, the increasing rate of cesarean delivery worldwide has been associated with an increasing rate of placenta previa and accreta (8).

The incidence of EPH reported in previous studies from Turkey varies between 0.25 and 5.3 per 1000 deliveries (9-12). This wide variation is probably a result of differences in population characteristics and the availability of health services among regions in Turkey. During the past decade, the practice of obstetrics has changed and the rate of cesarean delivery has increased nationwide.

The aim of the present study was to review EPHs performed over a 14-year period at a tertiary care center and to determine trends in EPH by comparing two different time periods.

Material and Methods

In this retrospective descriptive study, the records of all cases of EPH performed at Zeynep Kamil Women and Children's Training and Research Hospital, between January 2000 and January 2014, were analyzed. The study was approved by the Institutional Ethics Committee. All participants' rights were protected, and informed consents were obtained according to the Helsinki Declaration.

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Table 1. Maternal and delivery characteristics of cases of emergency peripartum hysterectomy during 2000–2006 and 2007–2013

Characteristics	2000–2006 (n=26)	2007–2013 (n=55)	p
Age (years)	32.8±5.1	33.4±5.6	0.55
18–25	2 (7.7%)	4 (7.3%)	
26–35	17 (65.4%)	35 (63.6%)	
36–40≥	7 (26.9%)	16 (29.1%)	
Gravidity	3.4±1.8	3.5±1.3	0.65
3≥	19 (73.1%)	46 (83.6%)	0.26
Parity	1.9±0.9	2.0±1.1	0.65
0	2 (7.7%)	3 (5.5%)	
1	7 (26.9%)	14 (25.5%)	
2≥	17 (65.4%)	38 (69.1%)	0.74
Prior dilatation and curettage	4 (15.4%)	7 (12.7%)	0.35
Prior abortion	4 (15.4%)	12 (21.8%)	0.29
Previous CS in EPH population	0.9±0.8	1.5±0.9	0.01
1	8 (30.8%)	16 (29.1%)	
2	8 (30.8%)	23 (41.8%)	
3≥	0	7 (8.6%)	
Gestational age (weeks)	33.9±4.7	35.3±4.3	0.37
24–32	9 (34.6%)	13 (23.6%)	
33–37	10 (38.5%)	25 (45.5%)	
38–42	7 (26.9%)	17 (30.9%)	
Birthweight (g)	2571±937	2616±957	0.83
<2500	11 (42.3%)	20 (36.4%)	
2500–3999	13 (50%)	34 (61.8%)	
4000≥	2 (7.7%)	1 (1.8%)	
Fetal position			
Vertex	20 (76.9%)	44 (80%)	
Breech	3 (11.5%)	9 (16.4%)	
Transverse	3 (11.5%)	2 (3.6%)	
Mode of delivery			
Vaginal delivery	3 (11.6 %)	6 (10.9%)	
Vaginal delivery with prior CS	0	1 (1.8%)	
Cesarean delivery	23 (88.4%)	49 (89.1%)	
Cesarean delivery with no prior CS	7 (26.9%)	4 (7.3%)	
Cesarean delivery with prior CS	16 (61.5%)	45 (81.8%)	
Cesarean delivery indications			
Placenta previa and prior CS	11 (47.8%)	33 (60%)	
Placenta previa and no prior CS	2 (8.7%)	0	
Previous CS alone	5 (21.7%)	12 (22%)	
Placental abruption with no previous CS	2 (8.7%)	1 (2%)	
Fetal distress	3 (13%)	1 (2%)	
Cephalopelvic disproportion	0	1 (2%)	
Primigravid breech position	0	1 (2%)	

Data are expressed as mean±SD or n (%).
EPH: emergency peripartum hysterectomy; CS: cesarean section

Table 2. Indications for emergency peripartum hysterectomy during 2000–2006 and 2007–2013

Hysterectomy indications	2000–2006 (n=26)	2007–2013 (n=55)	p
Placenta accreta with placenta previa	11 (42.3%)	27 (49.1%)	NS
Placenta accreta without placenta previa	3 (11.5%)	8 (14.5%)	NS
Uterine atony after CS	5 (19.2%)	3 (5.5%)	NS
Uterine atony after vaginal delivery	2 (7.7%)	5 (9.1%)	NS
Uterine atony due to placental abruption	2 (7.7%)	8 (14.5%)	NS
Uterine atony due to myoma utery	0	1 (1.8%)	NS
Ruptured uterus with placenta previa	2 (7.7%)	3 (5.5%)	NS
Uterine invertion with myoma utery	1 (3.8%)	0	NS

Data are expressed as n (%).
NS: not significant

Table 3. Indications for emergency peripartum hysterectomy during 2000–2006 and 2007–2013

Characteristics	2000–2006 (n=26)	2007–2013 (n=55)	p
Total Hysterectomy	15 (57.7%)	42 (76.4%)	0.04
Measures to prevent hysterectomy			0.67
Curetage and tamponade of the uterus	6 (23.1%)	6 (29.1%)	
Ligation hypogastric arteries	4 (15.4%)	5 (9.1%)	
Ligation uterine arteries	1 (3.8%)	4 (7.3%)	
B-Lynch procedure	0	2 (3.6%)	
Bacri ballon use	0	5 (5.9%)	
Timing of hysterectomy			0.48
Primary cesarean hysterectomy	16 (61.5%)	38 (69.1%)	
Re-laparatomy post CS	7 (26.9%)	11 (20%)	
Laparatomy post vaginal delivery	3 (10.5%)	6 (11%)	
Operating time (min)	114±43	108±39	0.56
Hospitalization (days)	10.4±5.1	8.4±5.1	0.11
Drainage of the abdominal cavity	24 (92.3%)	49 (89.1%)	0.65
Low midline incision	1 (3.8%)	8 (14.5%)	0.02
Need for blood transfusion (units)	6.8±3.7	5.9±2.8	0.21
Placenta pathology			0.24
Accreta	3 (11.5%)	6 (10.9%)	
Increata	7 (26.9%)	15 (27.3%)	
Percreata	4 (15.4%)	16 (29.1%)	0.18
Placenta previa	13 (50%)	33 (60%)	0.40
Totalis	10 (38.5%)	27 (49.1%)	

Data are expressed as mean±SD or n (%).

EPH was defined as an operation performed up to 24 h after delivery to treat hemorrhage that could not be controlled using conservative approaches. EPH was only performed when medical or minor surgical procedures (bimanual uterine compression, administration of oxytocin and prostaglandins, uterine packing, and compression sutures such as the B-Lynch brace suture, etc.) failed to control postpartum hemorrhage.

The records of the 81 women who underwent EPH during the study period were reviewed to determine the following: (i) maternal demographic data (age, gravidity, parity, gestational age at delivery, previous uterine surgery, and a history of previous abortions), (ii) clinical details (mode of delivery, indications and type of hysterectomy, additional procedures, operating time calculated from endotracheal intubation to last skin suture, pre- and postoperative hemoglobin and

Table 4. Indications for emergency peripartum hysterectomy during 2000–2006 and 2007–2013

	Placenta accreta (n=49)	Uterine atony (n=26)	p
Age (years)	33.5±5.6	32.7±5.5	0.55
Parity	1.9±0.9	1.8±1.2	0.30
2≥	36 (73.5%)	14 (53.8%)	0.07
Gestational age (weeks)	34.1±4.4	36±4.2	0.04
Birth weight (g)	2483±952	2796±906	0.17
Need for blood transfusion (units)	5.9±3.2	7.3±3.2	0.09
Operating time (min)	112±40	102±40	0.30
Hospitalization (days)	8.6±5.1	10.2±5.5	0.21
Adnexectomy	4 (8.2%)	1 (3.8%)	0.001
Low midline incision	7 (14.3%)	2 (7.7%)	0.001
Couvelaire uterus	1 (2%)	3 (5.3%)	0.08
Placenta previa			0.001
Totalis	30 (61.2%)	7 (26.9%)	
Partialis	8 (16.3%)	1 (3.8%)	
Uterine rupture	7 (14.3%)	1 (3.8%)	0.16
Prior dilatation and curettage	7 (14.3%)	3 (11.5%)	0.73
Prior abortion	9 (18.4%)	6 (23.1%)	0.63
Mean previous CS number	1.7±0.8	0.7±0.8	0.001
Previous CS in EPH population	47 (95.9%)	13 (50%)	0.001
2≥	32 (65.3%)	5 (19.2%)	0.001
Total hysterectomy	35 (71.4%)	18 (69.2%)	0.84
Maternal complications	23 (46.9%)	21 (80.8%)	0.04
Bladder injury	9 (18.4%)	2 (7.7%)	
Pelvic hematoma	1 (2%)	1 (3.8%)	
Febrile morbidity	6 (12.2%)	3 (11.5%)	
Wound infection	0	3 (11.5%)	
Disseminated intravascular coagulopathy	3 (6.1%)	6 (23.1%)	
Acute renal insufficiency	0	1 (3.8%)	
Partial ureteral obstruction	1 (2%)	0	
Re-exploration after intraabdominal bleeding	1 (2%)	4 (15.4%)	0.03
Pneumonia	1 (2%)	0	
Cardiac ischemia	1 (2%)	1 (3.8%)	
Measures to prevent hysterectomy	16 (32.7%)	16 (61.5%)	0.04
Curettage and tamponade of the uterus	3 (6.1%)	9 (34.6%)	
Ligation hypogastric arteries	6 (12.2%)	2 (7.7%)	
Ligation uterine arteries	3 (6.1%)	2 (7.7%)	
B-Lynch-procedure	2 (4.1%)	0	
Bacri balloon	2 (4.1%)	3 (11.5%)	
Timing of hysterectomy			
Primary cesarean hysterectomy	42 (85.7%)	8 (30.8%)	0.001
Re-laparatomy post CS	6 (12.2%)	12 (46.2%)	
Post vaginal delivery	1 (2%)	6 (23.1%)	
Neonatal death	3 (6.1%)	6 (23.1%)	0.03
Maternal death	5 (10.2%)	2 (7.7%)	0.70
Intensive care unit admission	6 (12.2%)	9 (34.6%)	0.02

Data are expressed as mean±SD or n (%).
EPH: emergency peripartum hysterectomy; CS: cesarean section

Table 5. Maternal and clinical characteristics of total and subtotal emergency peripartum hysterectomy

	Total (n=57)	Subtotal (n=24)	p
Age (years)	32.7±4.7	34.1±6.7	0.30
Gravidity (mean)	3.5±1.5	3.2±1.7	0.49
Parity (mean)	1.9±0.8	2.1±1.3	0.50
Primipar	1 (1.8%)	4 (16.7%)	
Gestational age (weeks)	34.9±4.6	34.7±4.3	0.85
Birth weight (g)	2576±954	2636±930	0.79
Placenta previa totalis	27 (47.4%)	10 (41.7%)	0.43
Previous cesarean delivery	45 (78.9%)	17 (70.8%)	0.11
Previous cesarean number (mean)	1.3±0.9	1.2±0.9	0.66
Cesarean delivery	48 (84.2%)	24 (100%)	0.04
Hysterectomy indication			
Placenta acreata	35 (61.5%)	14 (58.3%)	
Uterine atony	18 (31.6%)	8 (33.3%)	
Uterine rupture	3 (5.3%)	2 (8.3%)	
Uterine invertion	1 (1.8%)	0	
Anormal uterine insertion			
Placenta acreata	5 (8.8%)	4 (16.7%)	
Placenta increata	15 (26.3%)	7 (29.2%)	
Placenta percreta	16 (28.1%)	4 (16.7%)	0.28
Hemoglobin (g/dL)			
Preoperative	11.3±1.3	11.6±1.1	0.32
Postoperative	7.6±1.7	8.5±1.9	0.03
Haematocrit (%)			
Preoperative	33.4±3.6	34.5±3.1	0.17
Postoperative	23±5.1	25.4±5.2	0.05
Timing of hysterectomy			0.51
Primary cesarean hysterectomy	37 (64.9%)	17 (70.8%)	
Re-laparotomy post cesarean section	11 (19.3%)	7 (29.2%)	
Post vaginal delivery	9 (15.8%)	0	
Maternal complications			
Bladder injury	8 (14%)	3 (12.5%)	
Pelvic hematoma	2 (3.5%)	0	
Febrile morbidity	4 (7%)	5 (20.8%)	
Wound infection	2 (3.5%)	1 (4.2%)	
Disseminated intravascular coagulopathy	8 (14%)	2 (8.3%)	0.87
Acute renal insufficiency	1 (1.8%)	0	
Partial ureteral obstruction	2 (3.5%)	0	
Re-exploration after intraabdominal bleeding	4 (7%)	1 (4.2%)	0.56
Pneumonia	0	1 (4.2%)	
Cardiac ischemia	2 (3.5%)	0	
Need for blood transfusion (units)	6.4±3.3	6.1±3.3	0.71
Operating time (min)	111±38	105±46	0.54
Hospitalization (days)	8.7±5.1	9.9±5.2	0.36
Adnexectomy	3 (5.3%)	3 (12.5%)	0.26
Low midline incision	7 (12.3%)	2 (8.3%)	0.61
Drainage with drains of the abdominal cavity	50 (87.7%)	23 (95.8%)	0.26
Intensive care unit admission	11 (19.3%)	5 (20.8%)	0.87

Data are expressed as mean±SD or n (%).

Table 6. Maternal and fetal complications during 2000–2006 and 2007–2013

Complications	2000–2006 (n=26)	2007–2013 (n=55)	p
Maternal complications	15 (57.7%)	31 (56.3%)	0.79
Bladder injury	4 (15.4%)	7 (12.7%)	
Pelvic hematoma	1 (3.8%)	1 (1.8%)	
Febrile morbidity	3 (11.5%)	6 (10.9%)	
Wound infection	0	3 (5.5%)	
Disseminated intravascular coagulopathy	4 (10.9%)	6 (15.4%)	0.26
Adnexectomy	2 (7.7%)	4 (7.3%)	
Acute renal insufficiency	0	1 (1.8%)	
Partial ureteral obstruction	0	2 (3.6%)	
Re-exploration after intraabdominal bleeding	2 (7.7%)	3 (5.5%)	0.16
Pneumonia	1 (3.8%)	0	
Cardiac ischemia	0	2 (3.6%)	
Intensive care admission	7 (26.9%)	9 (16.4%)	0.26
Maternal death	5 (19.2%)	2 (3.6%)	0.02
Neonatal death	3 (11.5%)	7 (12.5%)	0.88

Data are expressed as n (%).

Table 7. Risk factors in patients who had EPH due to placenta accreta

	OR (95% CI)[a]	p
Previous cesarean delivery count	3.6 (1.6–8.2)	0.001
Gestational age (weeks)	0.8 (0.7-0.9)	0.03
Maternal age	1.0 (0.9-1.1)	0.72
Placenta previa	3.5 (1.0-12.1)	0.04
Parity	0.9 (0.4-1.9)	0.92

EPH: emergency peripartum hysterectomy; OR: odds ratio; CI: confidence interval
[a]Adjusted for parity, maternal age, gestational age, placenta previa, previous cesarean delivery count

hematocrit, need for transfusion, need for re-operation, postoperative complications, postoperative conditions, postoperative duration of hospitalization, and peripartum maternal and fetal morbidity and mortality), and (iii) associated risk factors (previous cesarean delivery, number of previous cesarean sections, current placenta previa, mode of delivery, and birth weight).

Primary indications for EPH were recorded under the following titles: uterine rupture, uterine atony, placenta accreta (isolated accreta or previa accreta), and uterine inversion. Operative notes and reports on the gross pathology of the uterus and placenta were used to determine the indication for hysterectomy. Women who delivered before 24 weeks of gestation and women who had a hysterectomy for other reasons, such as sterilization or cancer, were excluded.

To determine changing trends in EPH over the 14 years of the study period, records for 2000–2006 and 2007–2013 were compared. The records were also compared according to hysterectomy type (subtotal or total) and the indication for EPH (placenta accreta or uterine atony).

Statistical analyses were performed using SPSS version 17.0 (IBM; Armonk, NY, USA). Normal distribution of continuous variable was assessed using the Kolmogorov–Smirnov test; chi-square analysis was used for categorical variables. Student *t*-test was used for the analysis of normally distributed continuous variables. And for non-normally distributed variables, Mann–Whitney *U* test was used. A multivariate analysis was conducted for each outcome using binary logistic regression (backward likelihood ratio method). Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A *p*-value of <0.05 was considered to indicate statistical significance.

Results

During the 14 years of the study period, a total of 161,836 births occurred, out of which 104,783 (64.8%) were vaginal deliveries and 57,053 (35.2%) were CS. EPH was performed in 81 patients, with an overall incidence of 0.5 per 1000 deliveries. Of the 81 EPHs, 9 were performed after vaginal deliveries (0.09 per 1000 deliveries), and 72 were performed after CS (1.3 per 1000 deliveries). The rate of EPH was significantly higher in 2007–2013 (0.07%) than in 2000–2006 (0.03%).

The maternal and delivery characteristics of women who underwent EPH during 2000–2006 and 2007–2013 are presented in Table 1. The mean maternal age was not statistically different between the earlier and later period (32.8±5.1 vs. 33.4±5.6 years). Gravidity (3.4±1.8 vs. 3.5±1.3), parity (1.9±0.9 vs. 2.0±1.1), gestational age (33.9±4.7 vs. 35.3±4.3), and birthweight (2571±937 vs. 2616±957 g) were not statistically different between the two time periods. For women who required EPH, the ratio of vaginal to cesarean delivery was similar in the earlier and later periods (11.6% to 88.4% vs. 10.9% to 89.1%). The major difference between the two time periods was the number of previous CS in the EPH population (0.9±0.8 vs. 1.5±0.9, p=0.01).

The indications for hysterectomy during 2000–2006 and 2007–2013 are presented in Table 2. Overall, the most common indications for EPH were placenta accreta (60.5%), uterine atony (32.1%), uterine rupture (6.2%), and uterine inversion (1.2%). The indications did not differ between the two time periods.

The procedural characteristics of EPH cases during 2000–2006 and 2007–2013 are presented in Table 3. The mean operating time (114±43 vs. 108±39 min) and the mean duration of hospitalization (10.4±5.1 vs. 8.4±5.1 days) were similar for the two 7-year periods. All women received blood transfusions. The median number of units of transfused blood was 6 (range, 1–20). Ten patients (12.3%) needed ≥10 units. Compared with 2000–2006, during 2007–2013, the rate of total hysterectomy (57.7% vs. 76.4%) and the rate of low middle incision (3.8% vs. 14.5%) increased.

Maternal and delivery characteristics for women who underwent EPH for placenta accreta and uterine atony are presented in Table 4. Of women who required EPH for placenta accreta, 98% had a cesarean delivery, compared with 76% of women who required EPH for uterine atony ($p<0.01$). Placenta accreta was significantly more likely to be the indication for EPH than uterine atony when the number of previous CS was high ($p<0.01$).

The maternal and clinical characteristics for cases of total and subtotal EPH are presented in Table 5. Postoperative hemoglobin levels were significantly lower after total hysterectomy than after subtotal hysterectomy ($p=0.03$).

Maternal and fetal complications during 2000–2006 and 2007–2013 are presented in Table 6. Operative and postoperative complications did not differ in two periods. Bladder injury was the most common operative complication in both periods (15.4% and 12.7%, respectively). There were 10 (12.3%) neonatal deaths during the 14-year study period. The neonatal mortality rate was similar for the two time periods. There were 7 (8.6%) maternal deaths during the 14-year study period. The number of maternal deaths was significantly lower during the second 7-year period (19.2% vs. 3.6%).

Associated risk factors in women who underwent EPH for placenta accreta are presented in Table 7. The number of previous cesarean deliveries was an important risk factor for EPH for placenta accreta (OR 3.6, 95% CI 1.6–8.2). Gestational age and placenta previa were other important risk factors (OR 0.8, 95% CI 0.7–0.9 and OR 3.5, 95% CI 1.0–12.1, respectively).

Discussion

There is considerable variability in the incidence of EPH among countries and institutions. The overall incidence of EPH at our hospital was 0.5 per 1000 deliveries. In the literature, reported incidence rates are 0.33 per 1000 deliveries in the Netherlands (1), 0.41 per 1000 in the USA (5), and 4 per 1000 in Pakistan (7). The incidence of EPH at our hospital was consistent with the incidence reported in developed countries. However, there is a wide variation in the incidence of EPH in different regions of Turkey and for different study periods (0.25–5.3 per 1000 deliveries) (9-12).

In the present study, the incidence of EPH was 0.09 per 1000 after vaginal deliveries and 1.3 per 1000 after CS. Women who have had a previous CS have an increased risk of EPH compared with women with previous vaginal deliveries (6, 8, 13, 14). An increase in the number of cesarean sections has given rise to an increase in abnormal placentation, placenta previa, and scarred uterus (1, 5, 8, 9, 13, 15). Our study showed that the overall rate of CS and the incidence of EPH were higher in our hospital during the second 7 years of the study period compared with the first 7 years. The findings of a previous study (14) at our hospital showed that, during 1990–2003, the incidence of EPH was 0.02% and overall CS rate was 17%. Compared with 1990–2003, the incidence of EPH during 2007–2013 was 3.5 times higher, and the overall rate of CS was 2.5 times higher. This observation is alarming and reflects the rapidly increasing rate of cesarean section in Turkey. However, the magnitude of this increase at our hospital could be exaggerated because it is a referral center that accepts many high-risk obstetric patients. Therefore, our hospital has a high overall rate of CS, repeat CS delivery, and a high rate of placenta percreta. In other countries, Parazzini et al. (16) and Bateman et al. (5) reported that EPH incidence had increased by the time, but Flood et al. (6) reported a decrease in EPH incidence due to their lower CS rates and higher vaginal birth after CS rate.

In our study, placenta accreta was the most common indication (60.5%) for EPH performed during the 14-year study period. The percentage did not differ between the earlier and later 7-year periods, although the overall rate of CS was higher in the later period. However, a previous study at our hospital found that, during 1990–2003, only 10% of EPH was performed for placenta accreta (14). Therefore, there was approximately a six-fold increase in EPH for placenta accreta from the years 1990–2003 to 2007–2013.

Uterine atony was the second most common indication (32.1%) for EPH in our study, and the rate was similar for the earlier and later 7-year periods (34.6% vs. 30.9%). However, compared with the findings of the 1990–2003 study (14), which reported uterine atony as the indication for EPH in 62.7% of cases, there was a marked decrease in the 14 years of the present study.

Uterine rupture is a complication of a prolonged obstructed labor. Although it is the most common indication for EPH in developing countries (7), in our study, it was the third most frequent indication (6.2%). This result agrees with recent reports by Kwee et al. (1) and Flood et al. (6), which showed a decreasing incidence of uterine rupture as an indication for EPH (8.3% and 9%, respectively). The incidence of EPH for uterine rupture was similar for the two 7-year periods of the present study (7.7% vs. 5.5%). Rates of EPH for uterine rupture varied widely among studies from different parts of Turkey, ranging from 9% to 35% (14, 15, 17, 18).

In the emergency postpartum setting, total hysterectomy was the most common (70.4%) surgical procedure in our study. This finding was consistent with the findings of other studies (6, 8, 15). In the previous study at our hospital, Ozden et al. (14) found that total hysterectomy was performed in 42% of EPH. In the present study, during 2007–2013, total hysterectomy was the preferred procedure for EPH, although subtotal hysterectomy is reported to be technically easier with shorter operating time, less blood loss, shorter duration of hospitalization, and lower

morbidity (9, 19). However, we did not observe any significant difference in operating time, the need for blood transfusion, operative complications, or duration of hospital stay between total and subtotal hysterectomy groups. Only postoperative hemoglobin levels were significantly different. In cases of placenta accreta, where there is a high risk of low segment bleeding from the cervical branch of uterine artery, total hysterectomy is preferable to subtotal hysterectomy. Total hysterectomy should be considered when there is active bleeding from the lower uterine segment or cervix. However, the skill and experience of the surgeon should determine the method of choice. In a study, the rate of surgical injury of the ureter was higher in total hysterectomy (17).

In the present study, the complication rate did not differ between the two 7-year periods. The incidence of bladder injury was 13.6%, which lies within the range of 4%–15% reported in other studies (9, 12, 14, 18). Vesicouterine scars caused by previous CS increase the risk of bladder injury (11). In our study, there was a higher rate of bladder injury in women who had EPH for placenta accreta than uterine atony but did not differ between total and subtotal hysterectomy cases, although some studies have reported a higher rate of bladder injury after total hysterectomy and placenta accreta (10, 18).

In the present study, 12.3% of patients developed disseminated intravascular coagulation (DIC). Although maternal care and intensive care unit facilities improved over the study period, the rate of DIC was similar for the earlier and later 7-year periods (10.9% vs. 15.4%). Because our hospital is a tertiary health center, women referred for emergency treatment are often hemodynamically instable on admission. The rate of DIC was higher in women who underwent EPH for uterine atony than for placenta accreta (23.1% vs. 6.1%).

Re-exploration after EPH and re-laparotomy EPH after cesarean section were associated with an increased bleeding rate. In nonobstetric hysterectomy, re-exploration is required in only 0.5% of cases (17). In our study, 6.2% women underwent re-exploration after EPH for persistent bleeding. In other studies, this rate varied from 4% to 25% (10, 12, 14, 18). In the present study, EPH for uterine atony had a higher rate than EPH for placenta accreta (15.4% vs. 2%). Re-exploration was more likely after total hysterectomies compared with subtotal hysterectomies, but the difference was not significant (7% vs.4.2%). Wright et al. (18) and Gungorduk et al. (9) reported a higher rate of re-exploration after subtotal hysterectomies, but Ozden et al. (14) reported a higher rate after total hysterectomies.

Re-laparotomy for bleeding and sepsis after CS is associated with a high mortality. In our study, 22.2% women required re-laparotomy after CS, but the rate decreased from the earlier to the later 7-year period. Women who had EPH for uterine atony had a higher rate of re-laparotomy compared with women who had EPH for placenta accreta. Compared with women who did not require re-laparotomy, women who had re-laparotomy after EPH had a higher rate of surgical complications (46% vs. 94%), DIC (4.8% vs. 38.7%), and admission to the intensive care unit (11% vs 50%). Seffah (20) reported a rate of re-laparotomy after CS 0.7%, and the most frequent indication was bleeding secondary to uterine atony.

The strength of our study is that it brings a comprehensive overview on EPH with 14-years following period and it compares between the earlier and later 7-year periods, which gives valuable information on trends in EPH in the largest tertiary referral obstetrics center in Istanbul. Major limitation of our study is its retrospective design, so the cause and effect relationship cannot be established.

In conclusion, our results demonstrated an increasing trend in the rate of EPH in parallel with an increasing rate of repeat CS, emphasizing the importance of the mode of delivery. Cesarean deliveries lead to repeat CS, which increases the incidence of abnormal placentation and the risk of EPH. Because EPH is associated with significant morbidity and mortality, to prevent repeat CS, vaginal delivery may be advised after CS deliveries. Although the indications for EPH did not change over the 14-year study period, the maternal death rate decreased as a result of improvements in health care.

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