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Original article

Emergency hysterectomy for life-threatening postpartum haemorrhage: Risk factors and psychological impact



Hystérectomie d'hémostase dans l'hémorragie du post-partum sévère : facteurs de risque et impact psychologique

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ABSTRACT

Background. – Emergency postpartum hysterectomy (EPH) is usually considered the final resort for the management of postpartum hemorrhage (PPH). The aim of this observational study was to identify the risk factors for EPH, to evaluate the ability of EPH to stop bleeding and, finally, to estimate its psychological impact.

Methods. – This was a retrospective analysis of postpartum hysterectomy in all patients with PPH admitted between 2004 and 2011 to Lariboisière Hospital. We compared women for whom EPH was successful and those who required an advanced interventional procedure (AIP) to stop the bleeding despite hysterectomy. We also evaluated the severe PPH (SPPH) score in this particular setting. The psychological impact of emergency hysterectomy was also assessed.

Results. – A total of 44 hysterectomies were performed among 869 cases of PPH. Twenty were successful, while an additional AIP was required in 22 others (50%). Prothrombin time < 50% and a shorter interval between the onset of PPH and hysterectomy were independently associated with the need for an additional AIP. The area under the ROC curve of the SPPH score to predict the need for another AIP was 0.738 (95% confidence interval 0.548–0.748). Furthermore, 64% of the hysterectomized patients suffered from post-traumatic stress disorder.

Conclusion. – Failure of postpartum hysterectomy to control bleeding was frequent, and it was associated with persistence of coagulopathy. Hysterectomy in this context had important psychological impacts.

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R É S U M É

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Contexte. – L'hystérectomie d'hémostase (EH) est généralement considérée comme le dernier recours pour la gestion de l'hémorragie du post-partum (HPP). Le but de cette étude observationnelle était d'identifier les facteurs de risque d'EH, d'évaluer le risque d'échec de l'EH à arrêter le saignement et, enfin, d'estimer son impact psychologique.

Méthodes. – Ce fut une analyse rétrospective de l'hystérectomie post-partum chez tous les patientes admises pour HPP entre 2004 et 2011 à l'hôpital de Lariboisière. Nous avons comparé les femmes pour qui l'EH a réussi à stopper le saignement à celles pour qui une procédure interventionnelle invasive (PII)

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supplémentaire a été nécessaire pour arrêter le saignement. Nous avons également évalué l'intérêt du score Severe Post-Partum Hemorrhage (SPPH) dans ce contexte particulier. L'impact psychologique de l'hystérectomie d'hémostase a également été évalué.

Résultats. – Un total de 44 hystérectomies ont été effectuées parmi 869 cas d'HPP. Vingt-deux ont réussi, alors qu'une PII supplémentaire a été nécessaire dans 22 autres (50 %). Le temps de prothrombine < 50 % et un intervalle plus court entre le début de l'HPP et l'hystérectomie étaient indépendamment associés à la nécessité d'une PII supplémentaire. L'aire sous la courbe ROC du score SPPH pour prédire la nécessité d'une autre PII était de 0,738 (intervalle de confiance à 95 % : 0,548 à 0,748). En outre, 64 % des patients ayant subi une hystérectomie ont souffert du syndrome de stress post-traumatique.

Conclusion. – L'échec de l'hystérectomie d'hémostase pour contrôler le saignement est fréquent et semble associé à la persistance d'une coagulopathie. L'hystérectomie dans ce contexte a des répercussions psychologiques importantes.

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1. Introduction

Postpartum haemorrhage (PPH) is the leading cause of maternal death in many countries [1]. Emergency postpartum hysterectomy (EPH) is often considered the final resort for the treatment of PPH. The incidence of EPH varies from 0.5 to 2.5 per 1000 deliveries [2–11]. The morbidity associated with PPH requiring postpartum hysterectomy is unknown. Recent studies [12,13] have demonstrated that a requirement for further treatment after hysterectomy, damage to other structures and ICU admission are common after EPH. However, the short- and long-term effects of EPH remain unclear.

In addition, psychological morbidity due to severe PPH has rarely been assessed [14]. Post-traumatic stress disorder (PTSD) can develop after the occurrence of one or more traumatic events, such as serious injury or the threat of death. It is diagnosed when a group of symptoms (such as disturbing recurring flashbacks, avoidance or numbing of memories of the event, and hyperarousal) continue for more than one month after the traumatic event. PTSD has been described after classical delivery [15]. Severe PPH is associated with bad memories of delivery and persistent, disturbing, recurring flashbacks, fear of death and alteration of sex life [16].

The severe postpartum haemorrhage (SPPH) score associates biological and clinical parameters to predict the failure of medical treatment in cases of severe PPH [17]. Whether the score can accurately predict the failure of EPH remains unclear.

Accordingly, our study assessed the impact of EPH by:

- identifying the risk factors for EPH in our cohort;
- identifying the risk factors for the failure of EPH;
- evaluating the performance of the SPPH score;
- and assessing the long-term psychological impact of EPH.

2. Methods

Patients were identified from the computerised system of Lariboisière hospital. Any parturient patient admitted to the hospital is registered with a primary diagnosis. PPH was coded as "postpartum complication", "haemorrhagic shock", "acute anaemia" or "shock". These data were crosschecked against the registries of the Department of Obstetrics, the Department of Anaesthesia and Intensive Care and the Department of Radiology. According to the data, 869 patients with PPH were managed in Lariboisière Hospital from 2004 to 2011. The patients were mostly transferred after delivery from 82 primary care centres (academic and non-academic; public and private) located in or around Paris (Île-de-France region). Among these patients, 44 underwent an emergency postpartum hysterectomy (EPH), and 825 patients

remained in the control group. For all 44 women, we analysed the medical case records. Information obtained from the medical records included demographic data, relevant past history, details of pregnancy and delivery, including haemorrhage and its management and details of the hysterectomy and postoperative period.

We sent a postal questionnaire to all of the patients in March 2012 (between 3 months and 8 years after EPH, median 26.5 months). This questionnaire asked questions regarding depression and anxiety symptoms, sexual interest and social life. If the patient agreed, a telephone interview was arranged (in April 2012) to administer 2 additional questionnaires: the Hospital Anxiety and Depression Scale (HAD) and Impact of Event Scale-Revised (IES-R). The French version of the questionnaire has been previously validated [18]. This study was approved by the local ethics committee (CEERB no. 11-016), and the requirement for written informed consent was waived by the committee.

Statistics: the results are expressed as means and standard deviations (sd), medians and first to third quartiles or counts and percentages. Patients who underwent EPH were compared with patients who benefited from conservative management. Then, two groups of EPH patients were considered. The first group included patients for whom EPH successfully controlled the bleeding ("Successful EPH" group), and the second group included patients for whom an additional advanced interventional procedure (AIP) was necessary ("EPH + AIP" group). As previously described [17], AIP was defined as uterine artery embolization, a surgical procedure (arterial ligation or abdominal packing) or a combination of the two interventions.

Marginal associations between single variables and outcomes were assessed by Wilcoxon's rank-sum test for quantitative variables and Fisher's exact test. Multiple logistic regression was used to determine which variables were independently associated with each outcome (namely the need for EPH and the failure of EPH). Variables associated with the outcomes at a 0.15 level and with less than 5% missing data were considered in the multivariate model. Notably, for clinical application, the following continuous covariates were categorized: systolic blood pressure (SBP) < 90 mm Hg; diastolic blood pressure (DBP) < 55 mmHg; heart rate (HR) > 115 bpm (as described previously [19]); prothrombin time (PT) < 50%; and fibrinogen < 2 g/l; and troponin detectable or not (enabling the use of semi-quantitative measurement). PT and fibrinogen constituted the threshold for fresh frozen plasma (FFP) transfusion at Lariboisière Hospital centre (also described by Charbit et al. [20] as severity factors in PPH). The model selection was based on a backward stepwise variable selection algorithm. The discriminative ability of the final model was evaluated by the c-index (identical to the area under the receiver operating characteristics [ROC] curve) [21]. The ability of the SPPH score [17] to predict the need for an additional AIP after EPH was also estimated by the

c-index. Notably, the SSPH score included five predictive factors (abnormality of placental implantation, prothrombin time < 50%, heart rate > 115 bpm, fibrinogen < 2 g/l and troponin I detectable with a value of 0 or 1 when absent or present after hysterectomy). The total ranged from 0 to 5 to be effective. Because we studied patients who underwent hysterectomy, the item "Abnormality of placental implantation" was not used. We also tested an SPPH score without this item (the total ranged from 0 to 4). A 2-sided *P* value of 0.05 was considered significant. All of the analyses were performed with R statistical software, version 2.10.2 (R Foundation for Statistical Computing, Vienna, Austria).

3. Results

3.1. Patient characteristics

From 2004 to 2011, 869 patients were consecutively admitted to Lariboisière Hospital for PPH. Most of the patients (*n* = 791, 91%) were transferred after delivery from primary care centres, and the other 9% were delivered at Lariboisière Hospital. The patient characteristics are presented in Table 1. The leading cause of PPH was uterine atony (70%) followed by genital tract lacerations (22%) and abnormalities of placental implantation (7%), including placenta previa, placenta accreta and placenta percreta.

3.2. Factors associated with postpartum hysterectomy

Among all of the studied PPH cases, 44 women underwent EPH (Fig. 1). The patient details are presented in Table 1. A multivariate analysis including maternal age, number of deliveries, uterine scar, caesarean section, uterine rupture, placental implantation and troponin I level, indicated that the following factors were

independently associated with EPH: abnormality of placental implantation (OR 2.64 [1.15; 6.06]); history of Caesarean section (OR 2.60 [1.27; 5.33]); uterine rupture (OR 5.94 [1.32; 26.81]); an increase of 5 years in maternal age (OR 1.50 [1.09; 2.05]); and multiparity (OR 3.03 [1.01; 9.12]) (Fig. 2A).

3.3. High prevalence of persistent bleeding after hysterectomy related to coagulopathy

Bleeding persisted in 22 patients (50%) despite EPH. These women underwent additional advanced interventional procedures (AIPs), including uterine artery embolization (*n* = 4), open surgery (packing and arterial ligation of hypogastric artery) (*n* = 10) or combined embolization and surgery (*n* = 8). The comparison between women in the "Post-EPH AIP" group and women in the "Successful EPH" group revealed few differences in the demographic and obstetric parameters collected prior to admission (Table 2). In the "EPH + AIP" group, hysterectomy was performed earlier, and the ratio of FFP-to-RBC (red blood cell) after delivery and prothrombin time were both lower compared to women in the "Successful EPH" group. The multivariate analysis identified two independent factors associated with the need for an additional AIP after EPH: PT < 50% at admission (odds ratio with 95% confidence interval at 14.12 [1.67–119.13], *P* = 0.015) and a short interval between the beginning of PPH and hysterectomy (OR with 95% CI for one additional hour: 0.54 [0.29–0.99], *P* = 0.04) (Fig. 2B).

3.4. Performance of severe PPH score

The SPPH score demonstrated an AUC of the ROC curve of 0.738 (95% confidence interval: [0.548–0.748]) and 0.778 (95% CI: [0.637–0.782]) when including or not including abnormalities of

Table 1
Patient characteristics (results are expressed as medians and interquartile ranges and counts with percentages).

	All patients (<i>n</i> = 869)	Conservative management (<i>n</i> = 825)	Emergency postpartum hysterectomy (<i>n</i> = 44)	<i>P</i>
Age (years)	32 (28–35.6)	31.8 (28–35)	36 (31–39)	< 0.0001
<i>Obstetric parameters</i>				
Number of pregnancies	2 (1–3)	2 (1–3)	3 (3–4.2)	< 0.0001
Number of deliveries	2 (1–3)	2 (1–3)	3 (2–4)	< 0.0001
Uterine scar	105 (30.9)	89 (11%)	16 (37%)	< 0.0001
Previous postpartum haemorrhage	35 (11.8)	29 (11%)	6 (14%)	0.63
Uterine fibroma	21 (7.4)	20 (8%)	1 (2%)	0.16
Term of pregnancy (weeks)	39 (37–40)	39 (37–40)	39 (37–41)	0.86
Twin pregnancy	47 (5.5)	43 (5%)	4 (9%)	0.28
<i>Details of delivery</i>				
Caesarean section	293 (34.4)	268 (33%)	25 (57%)	0.0013
Instrumental manoeuvre	117 (13.7)	110 (14%)	7 (16%)	0.61
Intrauterine examination	565 (66.8)	546 (68%)	19 (44%)	0.0012
Vaginal examination	461 (55.4)	445 (56%)	16 (37%)	0.014
<i>Cause of haemorrhage</i>				
Abnormalities of placental implantation	59 (7%)	49 (6%)	10 (23%)	< 0.0001
Uterine rupture	9 (1.1)	6 (1%)	3 (7%)	
Primary uterine atonia	606 (70%)	583 (70%)	23 (52%)	
Genital tract laceration	195 (23.1)	187 (23%)	8 (18%)	
<i>Haemodynamic status on admission</i>				
Shock	154 (18.1)	124 (15%)	30 (77%)	< 0.0001
Systolic blood pressure (mmHg)	120 (100–130)	120 (100–130)	87 (74–90)	< 0.0001
Diastolic blood pressure (mmHg)	65 (55–75)	65 (55–75)	50 (45–60)	< 0.0001
Heart rate (bpm)	100 (90–120)	100 (90–120)	120 (110–130)	< 0.0001
<i>Biological status on admission</i>				
Haemoglobin (g/dl)	19 (9–69)	9.2 (7.9–10.4)	9.6 (7.9–10.4)	0.71
Platelet (103/mm ³)	91,500 (45,000–157,250)	95 (45–160)	64 (46–101)	0.061
Prothrombin time (%)	62 (50–73)	62 (50–73)	56 (47–73)	0.33
Fibrinogen (g/l)	2.4 (1.7–3.1)	2.4 (1.7–3.2)	1.8 (1.2–2.1)	< 0.0001
Troponin I (ng/ml)	0 (0–0.1)	0 (0–0.1)	0.3 (0–0.6)	< 0.0001

EPH: emergency postpartum hysterectomy.

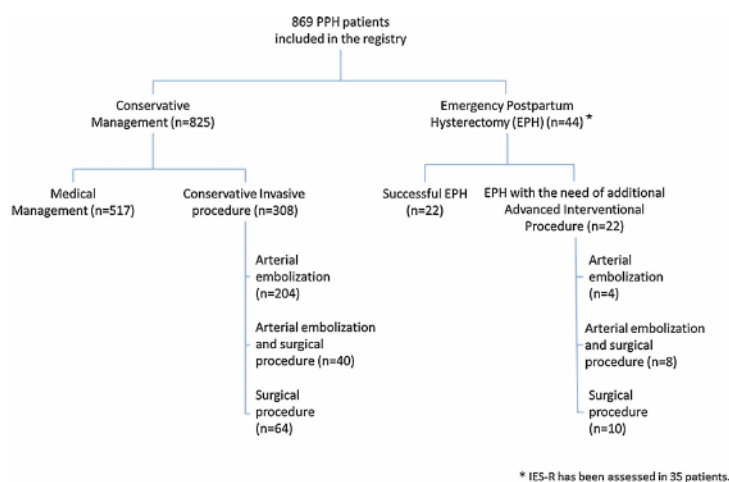


Fig. 1. Flow chart of the study. PPH: postpartum haemorrhage; EPH: emergency postpartum hysterectomy.

placental implantation in the score to predict persistent bleeding despite hysterectomy (Fig. 2C).

3.5. Psychological impact of hysterectomy

Answers to the questionnaires were received from 35 (among the 44) patients who underwent a hysterectomy. The median time between delivery and questionnaire completion was 26.5 months. Answers to the questionnaire revealed an important impact on loss of libido (71%), dyspareunia (42%) and changes in socioprofessional

lives (48%). Sixty-four percent of the patients presented with PTSD (IER-R score > 30), and the median (and interquartile range) of IES-R score was 36 [20–52] (Fig. 3). The median (and interquartile range) of HAD anxiety score was 10 [8–12]. In total, 8 patients (57%) presented with certain anxious states, and only 2 women experienced no anxiety symptoms. The median (and interquartile range) of HAD depression score was 6 [2–8], and two women presented with certain depressive states. Fifty percent of the women who underwent an EPH saw a psychologist after the index hospitalisation.

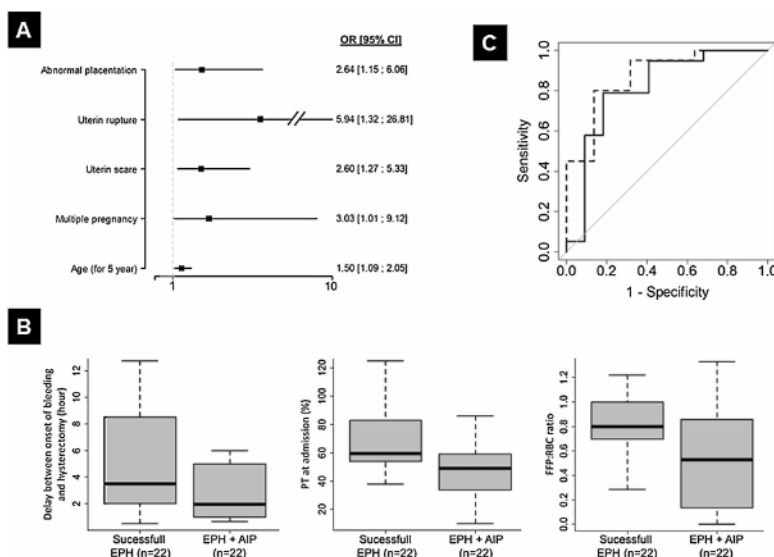


Fig. 2. Prediction of and risk of failure of emergency postpartum hysterectomy. Panel A depicts independent predictive factors of hysterectomy. Panel B shows factors predicting the need for another AIP following EPH. Panel C depicts ROC curve of the SSPH score to predict EPH failure (plain line corresponds to full SSPH score including placental implantation item and dashed line to the score without abnormalities of placental implantation in the score). OR: odds ratio; CI: confidence interval; AIP: advanced interventional procedure; EPH: emergency postpartum hysterectomy; ROC: Receiver Operator Characteristics; SSPH: Severe PostPartum Hemorrhage.

Table 2
Univariate analysis of risk factors for the need of an additional AIP following EPH.

	Successful EPH (n = 22)	EPH + AIP (n = 22)	p
Age (years)	36 (32.2–38.8)	36.5 (31–38.8)	0.81
Obstetric parameters			
Number of pregnancies	3 (3–4)	4 (3–4.8)	0.99
Number of deliveries	3 (2–3.8)	3 (2–4)	0.97
Previous postpartum haemorrhage	3 (14%)	3 (14%)	1
Uterine fibroma	1 (5%)	0 (0%)	1
Term of pregnancy (weeks)	39 (35–41)	39 (38–41)	0.69
Twin pregnancy	2 (9%)	2 (9%)	1
Details of delivery			
Caesarean section	13 (59%)	12 (55%)	1
Instrumental manoeuvre	2 (9%)	5 (24%)	0.24
Intrauterine examination	8 (38%)	11 (50%)	0.54
Vaginal examination	9 (41%)	7 (33%)	0.75
Sulprostone administration	18 (86%)	19 (95%)	0.61
Cause of haemorrhage			
Abnormalities of placental implantation	6 (27%)	4 (18%)	0.49
Uterine rupture	1 (5%)	2 (10%)	
Primary uterine atonia	11 (50%)	12 (55%)	
Genital tract laceration	4 (18%)	4 (19%)	
Haemodynamic status on admission			
Shock	13 (65%)	17 (90%)	0.13
Systolic blood pressure	100 (84–110)	95 (80–137)	0.9
Diastolic blood pressure	58 (50–61)	60 (45–80)	0.49
Heart rate (bpm)	108 (90–127)	117 (108–130)	0.14
Biological status on admission			
Haemoglobin (g/dl)	9.1 (7.9–10.4)	9.8 (8–10.9)	0.59
Platelet (103/mm ³)	78 (57–115)	53 (38–87)	0.091
Prothrombin time (%)	59 (54–81)	49 (34–59)	0.016
Fibrinogen (g/l)	1.7 (1.5–2.2)	1.8 (0.8–2)	0.28
Troponin I (ng/ml)	0.1 (0–0.4)	0.5 (0.2–0.9)	0.036
Lactate (mmol/l)	2.6 (2.2–3.2)	4.1 (2.2–4.6)	0.13
Creatinine (μmol/l)	58 (52–68)	83 (59–117)	0.0062
Time (hours)			
Delivery-PPH	0.5 (0.2–0.8)	0.4 (0.2–2.1)	0.67
PPH-hysterectomy	3.5 (2–8.5)	2 (1–4.9)	0.085
Before hysterectomy			
RBC	7 (5–11)	10 (6–15)	0.12
FFP/RBC ratio	0.8 (0.7–1)	0.5 (0.1–0.9)	0.04

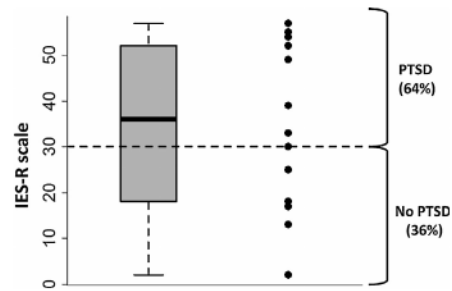
AIP: advanced interventional procedure; EPH: emergency postpartum hysterectomy; FFP: fresh frozen plasma; RBC: red blood cell.

4. Discussion

4.1. Main findings

The most interesting and less known result of this study concerned the long-term, psychosocial morbidity due to EPH with a median follow-up of 26.5 months. The results of our questionnaires revealed major impacts of EPH on women's lives, particularly their sex lives. Hysterectomy may degrade feminine identity. The telephone interviews revealed real PTSD in the majority of the patients. In recent studies, PTSD following a complicated delivery occurs in 1.3 to 6% of patients [22,23]. In fact, delivery itself could be a traumatic event [24]. Risk factors for PTSD in the literature include pain during delivery, the feeling of losing control and a lack of information [15,25]. In this study, PTSD occurred in the majority of women who underwent an EPH, and PTSD persisted for a long period (perhaps due to the near-death experience). These women require psychological follow-up.

Our study also described the factors associated with the need for hysterectomy in the setting of life-threatening PPH, and it indicated high incidences of persistent bleeding and long-term

**Fig. 3.** Distribution of the Impact of Event Scale (IES) (revised) and incidence of post-traumatic stress disorder (PTSD).

psychological disorders after EPH. We demonstrated that age, multiparity, abnormality of placental implantation, history of Caesarean section and uterine rupture were independent risk factors for hysterectomy in patients with life-threatening PPH. This result agrees with recent published case series [12,13].

Furthermore, the SPPH score efficiently predicted the need for an additional interventional procedure after EPH, and this score might be used as an early warning system.

4.2. Strengths and limitations

The present study reports the experience of a large referral centre covering a variety of primary centres. Thus, the findings are likely generalizable. Despite the rarity of the event, we have provided solid results, which could have direct clinical implications, concerning a life-threatening condition. Last, we present relatively novel information regarding the psychological impact of EPH.

However, this project was a single-centre study. The patients were mostly transferred after delivery from primary care centres because full management of PPH, including arterial embolization, is available 24 h per day at Lariboisière Hospital. Recruitment bias was also present because women who underwent a hysterectomy and were stable were not transferred to our centre. Moreover, the study was retrospective and based on an ongoing registry that has been well established in our centre. Its exhaustiveness is regularly controlled. Despite the potential bias, we had a large number of cases for a low-incidence event. Last, we described a high incidence of PTSD in patients who underwent EPH, but we were not able to compare this incidence to a control group of PPH patients with no need for EPH. This needs to be further explored.

4.3. Interpretation

Our study suggested several clinical implications. First, because psychosocial morbidity from EPH has a major impact on life, a psychological follow-up should be systematically proposed to patients undergoing EPH. Second, we defined five independent risk factors for emergency postpartum hysterectomy that might help obstetricians to manage life-threatening PPH. Third, we confirmed that the SPPH score could predict the persistence of bleeding, even after EPH. Fourth, our study strongly suggested aggressive treatment of coagulopathy (ideally with a high FFP-to-RBC ratio and before hysterectomy).

Morbidity associated with peripartum hysterectomy is very important. Many studies have described a high EPH complication rate (due to the need for massive blood transfusions), coagulopathy, and injury to the urinary tract or other structures. Two studies indicated that women often require re-exploration due to

persistent bleeding after EPH [12,13]. In the present study, half of the patients presented with persistent bleeding following EPH and required an additional AIP to stop the bleeding.

In the present study, we identified two factors associated with the need for an additional interventional procedure to stop haemorrhaging after EPH: prothrombin time < 50% and a short interval between the beginning of PPH and hysterectomy. These results may indicate that coagulopathy was an important determinant of successful EPH. The effect of the interval between PPH and EPH might be linked to an insufficient correction of coagulopathy, potentially explained by very severe PPH onset. Interestingly, a higher FFP-to-RBC ratio transfused before EPH, although not statistically significant, was associated with fewer requirements for further treatment to control bleeding. Pasquier observed the same result in his recent study and suggested a possible benefit of a higher FFP-to-RBC ratio in patients with severe PPH who require transfusion in cases of massive, continuous bleeding [26]. However, the severe coagulopathy and the short time to perform hysterectomy might also be interpreted as markers of severity. Further studies are needed to determine if a more aggressive treatment of coagulopathy would lead to a lower risk of EPH in this setting.

In our cohort of EPH cases, placental implantation abnormalities were not the most frequent cause of bleeding. This result is in contrast to recently published data (38% abnormal placentation) in the review by Rossi in 2010 [5]. This finding could be explained by differences in the management of abnormal placenta. A conservative strategy is usually preferred in our centre [27,28].

5. Conclusion

Most importantly, EPH has long-term psychosocial morbidity, including sexual function disorders, anxiety and post-traumatic stress disorders. This should imply an adapted follow-up of those patients, including psychological support. In addition and briefly, age, multiparity, placental implantation abnormalities, history of Caesarean section and uterine rupture were all independent risk factors for hysterectomy in patients with severe PPH. The morbidities associated with peripartum hysterectomy were very important. In the present study, half of the patients presented with persistent bleeding despite EPH and required an additional AIP to stop the bleeding. Two risk factors were associated with the need for another interventional procedure to stop haemorrhaging after EPH: prothrombin time < 50% and a short interval between the beginning of PPH and hysterectomy.

Ethical approval

This study was approved by the local ethics committee (CEERB no. 11-016), and the requirement for written informed consent was waived by the committee.

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Contribution to authorship

A.M. and E.G. designed the study. D.M. wrote the manuscript. D.M., A.R., C.V., and C.G. collected the data. E.G. performed the statistical analyses. M.J.-L., P.S., M.R., E.B., A.M. edited the manuscript. All authors approved the final version of the manuscript.

Disclosure of interest

The authors declare that they have no competing interest.

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1. EPH has long-term psychosocial morbidity, including sexual function disorders, anxiety and post-tra...

Anchor Name: long-term psychosocial morbidity

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