

## ASSESSMENT OF RISK FACTORS FOR PRIMARY POSTPARTUM HEMORRHAGE AT ZAGAZIG UNIVERSITY HOSPITALS

*Amal A. El Badawy<sup>1</sup>, Eman H. Waly<sup>1</sup>, Nahla M. Zaitoun<sup>1</sup>, and Youssef Abo-Elwan<sup>2</sup>*

<sup>1</sup>Public Health and Community Medicine Department, Faculty of Medicine, Zagazig University, Zagazig, Sharkia, Egypt

<sup>2</sup>Obstetrics and Gynecology Department, Faculty of Medicine, Zagazig University, Zagazig, Sharkia, Egypt

### Corresponding author:

Eman Hasan Waly

### Email:

eman\_waly78@yahoo.com

Mobile: 00966541103810

### ABSTRACT

**Background:** Primary postpartum hemorrhage PPH is a major cause of maternal morbidity and mortality. Many risk factors for primary PPH have been evaluated, while with changes of obstetric population and technological advances, some of these factors became more important and others were less. **Aim:** To identify common risk factors of primary PPH and measure the association between these factors and the occurrence of primary PPH. **Methods:** A case control study was conducted in obstetrics and gynecology department at Zagazig University Hospitals. Participants were selected by systematic random sampling. Data were collected about the participants' age and social class as well as studied risk factors for primary PPH including previous delivery mode, previous antipartum hemorrhage APH, previous PPH, parity, birth weight, gestational age, maternal obesity, maternal hemoglobin level, labor induction, current delivery mode, delivery trauma, episiotomy, placenta previa and retained placenta. **Results:** Primary PPH was significantly higher among older ages (> 34 years). Primary PPH showed significant associations with the following factors; Previous APH (OR= 3.57), previous PPH (OR= 2.85), macrosomia (OR= 9.57), maternal anemia (OR= 5.37), obesity (OR= 4.01), vaginal delivery (OR= 2.13), labor induction (OR= 2.88), trauma (OR= 3.53), retained placenta (OR= 8.51), and placenta previa (OR= 3.51). **Conclusion:** Maternal anemia, retained placenta, Macrosomia, and previous PPH were the most significant risk factors for primary PPH. **Recommendations:** Organized antenatal visits are recommended to help early detection of PPH risk factors and improve females' knowledge about PPH risk. clinicians should optimize care for high risk women. Adequate supplies should be provided to health facilities for prompt management of PPH.

**Running header:** Risk Factors for Primary Postpartum Hemorrhage

**Key words:** Postpartum hemorrhage, Risk factors, Pregnant, Zagazig

### INTRODUCTION

Postpartum hemorrhage (PPH) is a major cause of maternal mortality and severe morbidity all over the world. <sup>[1]</sup> The World Health Organization (WHO) estimates that, PPH is a cause of approximately 25% of maternal deaths. <sup>[2]</sup> Recently, the industrialized countries have witnessed a slow but steady escalation in the incidence of PPH. <sup>[1]</sup>

Traditionally, PPH has been defined as blood loss of 500 ml or more after vaginal delivery or 1000 ml or more after cesarean delivery. <sup>[3]</sup> Primary PPH occurs within 24 hours of delivery and secondary PPH occurs after 24

hours and within 6 weeks of delivery. <sup>[4]</sup> Another definition of PPH is decline in hematocrit value by 10% between the antenatal and postpartum periods. <sup>[5]</sup> Also, PPH was defined as the need for red blood cell transfusion because of maternal anemia or hemodynamic instability. <sup>[6]</sup>

low-resource developing countries experience a much higher burden of PPH, it is also a momentous cause of maternal death in the developed world. <sup>[7]</sup> Death from PPH occurs in about 1 per 1000 deliveries in low-resource countries compared with 1 per 100,000 deliveries in high-resource countries. <sup>[8]</sup>

Globally, PPH causes 44,000 to 86,000 deaths per year considering it the leading cause of death in pregnancy.<sup>[9]</sup> Even though maternal deaths are lesser in high resource countries, the morbidity accompanied with severe PPH is considered a major problem.<sup>[10]</sup>

Risk factors of PPH are important and should be studied even though up to 66% of cases of PPH had no identifiable risk factors.<sup>[5]</sup> The most common risk factors for PPH are poor uterine contraction following childbirth, retained placenta, uterine tears, or poor clotting of blood. It occurs more commonly in the anemic women, multiparity, obese or old aged women (> 40 years), with macrosomia.<sup>[11]</sup> Clinicians should try to identify risk factors antenatally and during labor in order to deliver high risk women at the highest level of care.<sup>[12]</sup>

Therefore, our objective in this study was to identify common risk factors of primary PPH and measure the association between the studied risk factors and the occurrence of primary PPH.

#### PATIENTS AND METHODS

**The study design and setting:** The study was carried out as a case control study over a period of five months; from June 2013 to October 2013 in obstetrics and gynecology department at Zagazig university hospitals.

**Study Population and Sampling:** The target population included females in last trimester of pregnancy of any age group were admitted to hospital for vaginal or cesarean section (CS) delivery. Assuming that the lowest prevalent risk factor is retained placenta (10.6%), with an odds ratio of 4.2,<sup>[13]</sup> the estimated sample size in each case and control group was 59 pregnant females (*total sample size 118*) calculated by Epi- info program version 6 with a confidence interval 95% and 80% as the power of test. Our participants were selected by the systematic random sampling technique. Listing of females coming in labor was done two days per week then in those days every 4<sup>th</sup> female fulfilling the inclusion criteria was chosen after a random starting point.

#### **Inclusion criteria:**

**The case group:** Females showing the clinical diagnosis of primary PPH who were admitted to the hospital for vaginal or cesarean section delivery in last trimester of pregnancy of any age and parity (nullipara, 1-3 previous para, or >3 previous para). Primary PPH was defined as: estimated blood loss of 500 ml or more after vaginal delivery and 1000 ml or more for a cesarean delivery,<sup>[3]</sup> or requirement for blood cell transfusion due of maternal anemia or hemodynamic instability.<sup>[6]</sup> Admission and post-delivery hematocrit values were not obtained on all admissions therefore, the criteria that were used in this study for PPH were the measured blood loss and need for blood transfusion. **The control group:** Females who were admitted to hospital for vaginal or cesarean section delivery in last trimester of pregnancy of any age and parity and and not suffered from primary PPH during labor.

#### **Exclusion criteria:**

Females were excluded if they had a condition introducing an indication or confounding bias in the association between induction of labor and PPH as prenatal chronic disease or coagulopathy as well as the females with pregnancy induced diseases as gestational diabetes and preeclampsia and those taking anti-coagulant drugs during pregnancy. Also, Women were diagnosed with secondary PPH,<sup>[4]</sup> were excluded from the study.

**Data collection:** A structured questionnaire was used to collect data regarding the participants' socio-demographic characteristics as well as some risk factors for PPH. The socio-demographic data included age and social class (social class was classified as low class <50%, moderate class ≥50-75%, high class ≥75%).<sup>[14]</sup> Data about risk factors for PPH that were considered in the study included; **a) Previous obstetric related factors:** previous delivery mode (vaginal or cesarean section) and previous antipartum or postpartum haemorrhage (APH or PPH). **b) Current obstetric related factors:** parity (nullipara, 1-3 previous para, and > 3 previous para), Birth

weight (low birth weight < 2500 g, normal weight, and Macrosomia  $\geq$  4,000g),<sup>[15]</sup> gestational age (preterm birth < 37 weeks, term pregnancy from 37 to 41 weeks, and post-term pregnancy > 41 weeks), maternal Body Mass Index BMI (considering < 18 is under weight, from 18 to  $\leq$  25 is normal weight, from 25 to  $\leq$  30 is overweight, and > 30 is obese),<sup>[6]</sup> and maternal hemoglobin Hb level (complete blood count is done before and after cesarean section in hospital and in case of vaginal delivery it is done for cases that exposed to PPH and if not exposed to PPH it depends on that they had done it during their antenatal care). c) *Delivery related factors*: induction of labor, delivery mode, trauma (cervical, vaginal, and perineal tears), episiotomy, placenta previa and retained placenta.

**Ethical consideration and administrative approach:** To carry out the study the necessary official permissions were taken from the heads of obstetrics and gynecology department and outpatient clinic at Zagazig University Hospitals. An informed written consent was obtained from the participants and they were reassured about the confidentiality of information and the results were used for the purpose of the scientific research and they were also given the right to refuse or participate in the study.

**Pilot study:** A pilot study was conducted before starting data collection which involved 10 females, five cases and five controls admitted to hospital for delivery and were not included in the study to test the clarity and applicability of the questionnaire and necessary modifications were made accordingly.

**Statistical Analysis:** Statistical analysis was conducted using SPSS software version 19.0. Qualitative data were represented as frequencies and relative percentages and chi square test was used to calculate significant differences among sociodemographic characteristics of both case and control groups.

Odds Ratio (OR) and their 95% confidence intervals (95% CI) were calculated to compare risk factors for PPH in both groups. Stepwise logistic regression analysis was performed for all significant risk factors affecting PPH.

## RESULTS

The total number of women included in the study was 118. Most of them were in the age group 19-34 years (81.4% of cases and 66.1% of controls) and primary PPH was significantly higher among older ages (> 34 years) (Figure 1). The majority of participants were of low social class (69.5% of cases and 79.7% of controls) (Figure 2).

Table I showed a statistical significant association between primary PPH and previous and current obstetric related factors. The females with previous history of APH and PPH had an increased risk for current PPH by more than three folds (OR= 3.57) and two folds (OR= 2.85) respectively. Also, macrosomia, maternal anemia, and maternal obesity were considered highly statistical significant risks for primary PPH with increased risk by more than nine folds (OR= 9.57), five folds (OR= 5.37), and four folds (OR= 4.01) respectively.

Regarding the delivery factors and occurrence of primary PPH; the vaginal delivery and induction of labor showed significant increased risks for PPH by more than two folds with the following odds ratios (OR= 2.13 and OR= 2.88) respectively, and delivery trauma showed significant increased risk for PPH by more than three folds (OR= 3.53). Also, both retained placenta and placenta previa were considered significant risk factors for PPH with increased risk by more than eight folds (OR= 8.51), and three folds (OR= 3.51) respectively (Table II). Stepwise logistic regression analysis of significant risk factors revealed that, maternal anemia, retained placenta, macrosomia, and previous PPH were the most statistical significant risk factors of PPH (Table III).

Figures and tables

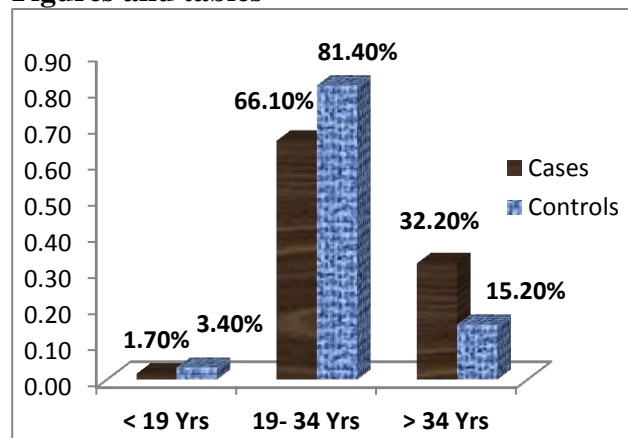


Figure I: PPH with age groups of participants (P= 0.03)

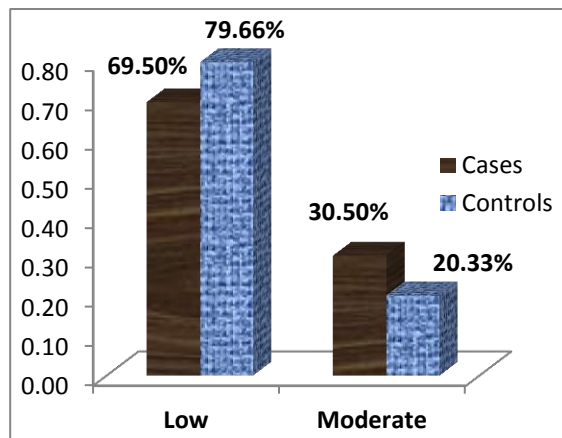


Figure II: PPH with participants' social class (P= 0.2)

Table I: Association of primary PPH with previous and current obstetric related factors

Risk factors	Cases 59 (%)	Control 59 (%)	P	OR (95% CI)
<b>Previous cesarean section</b>				
Yes (N= 37)	23 (38.9)	14 (23.7)	0.076	2.05 (0.93- 4.56)
No (N= 81)	36 (61.1)	45 (76.3)		
<b>Previous APH</b>				
Yes (N= 23)	17 (28.8)	6 (10.2)	0.01*	3.57 (1.29- 9.86)
No (N= 95)	42 (71.2)	53 (89.8)		
<b>Previous PPH</b>				
Yes (N= 29)	20 (33.9)	9 (15.3)	0.02*	2.85 (1.17- 6.95)
No (N= 89)	39 (66.1)	50 (84.7)		
<b>Parity</b>				
1-3 previous-para (N= 52)	22 (37.3)	30 (50.8)		1
Nullipara (N= 21)	12 (20.3)	9 (15.3)	0.25	1.82 (0.65- 5.06)
Multipara (> 3) (N= 45)	25 (42.4)	20 (33.9)	0.19	1.7 (0.76- 3.81)
<b>Birth weight</b>				
Normal (N= 71)	25 (42.4)	46 (77.9)		1
Low BW (< 2500g) (N= 16)	8 (13.6)	8 (13.6)	0.27	1.84 (0.62- 5.49)
Macrosomia (≥ 4,000g) (N= 31)	26 (44.0)	5 (8.5)	0.000*	9.57 (3.26- 28.0)
<b>Gestational age (weeks)</b>				
Term (37- 41) (N= 91)	42 (71.2)	49 (83.1)		1
Preterm (< 37) (N= 19)	12 (20.3)	7 (11.8)	0.18	2.0 (0.72- 5.54)
Post-term (> 41) (N= 8)	5 (8.5)	3 (5.1)	0.38	1.94 (0.45- 8.62)
<b>Maternal Hb level</b>				
< 11gm/dl (N= 35)	27 (45.8)	8 (13.6)	0.000*	5.37 (2.17- 13.3)
≥ 11gm/dl (N= 73)	32 (54.2)	51 (86.4)		
<b>Maternal BMI</b>				
Normal (18- < 25) (N= 36)	13 (22.0)	25 (42.4)		1
Overweight (25- ≤ 30) (N= 43)	21 (35.6)	22 (37.3)	0.19	1.84 (0.75- 4.51)
Obese (> 30) (N= 37)	25 (42.4)	12 (20.3)	0.005*	4.01 (1.53- 10.5)

**Table II: Association of PPH with delivery related factors**

Risk factors	Cases 59 (%)	Controls 59 (%)	P	OR (95% CI)
<b>Delivery mode</b>				
Vaginal (N= 63)	37 (62.7)	26 (44.0)	0.04*	2.13 (1.02- 4.46)
Cesarean section (N= 55)	22 (37.3)	33 (56.0)		
<b>Induction of labor</b>				
Yes (N= 37)	25 (42.4)	12 (20.3)	0.01*	2.88 (1.27- 6.52)
No (N= 81)	34 (57.6)	47 (79.7)		
<b>Trauma</b>				
Yes (N= 26)	19 (32.2)	7 (11.9)	0.01*	3.53 (1.35- 9.21)
No (N= 92)	40 (67.8)	52 (88.1)		
<b>Episiotomy</b>				
Yes (N= 36)	15 (25.4)	21 (35.6)	0.23	0.62 (0.28- 1.36)
No (N= 82)	44 (74.6)	38 (64.4)		
<b>Retained placenta</b>				
Yes (N= 31)	26 (44.0)	5 (8.5)	0.000*	8.51 (2.97- 24.3)
No (N= 87)	33 (56.0)	54 (91.5)		
<b>Placenta previa</b>				
Yes (N= 16)	12 (20.3)	4 (6.8)	0.03*	3.51 (1.07- 11.6)
No (N= 102)	47 (79.7)	55 (93.2)		

**Table III: Stepwise Logistic regression analysis of significant risk factors associated with primary PPH**

Risk factors	B	SE	Wald	df	Significance	OR (95%CI)
<b>Hb level (&lt; 11gm/dl)</b>	2.193	0.711	9.531	1	0.002*	0.112 (0.03- 0.49)
<b>Retained placenta</b>	2.428	0.799	9.221	1	0.002*	0.088 (0.09- 0.42)
<b>Macrosomia</b>	1.863	0.785	5.629	1	0.018*	0.155 (0.03- 0.72)
<b>Previous PPH</b>	1.792	0.758	5.164	1	0.023*	0.167 (0.04- 0.78)

## DISCUSSION

PPH was considered a public health issue for many years, primarily in low resource countries.<sup>[9]</sup> In recent years industrialized countries have viewed what seems to be a slow but steady increase in the incidence of PPH.<sup>[11]</sup> Our case control study revealed that, the risk for primary PPH was significantly increased as maternal age was increasing more than 34 years old (figure 1) in agreement with previous studies<sup>[16,17]</sup>. The majority of studies failed to show a clear impact of aging on PPH,<sup>[12,17]</sup> while it can be explained by that older mothers had more risks of placenta previa, retained placenta, macrosomia, uterine rupture and other medical complications causing PPH.<sup>[18]</sup> Agreeing with a previous study,<sup>[19]</sup> we found

that, there was no association between PPH and socioeconomic status, while other studies,<sup>[4, 2]</sup> found that, Low socioeconomic status was associated with increased risk for PPH.

### **Association of PPH with previous obstetric and current related factors**

Several studies showed that, previous CS was associated with increased risk of PPH.<sup>[12,16,21]</sup> In contrast, in the present study previous CS was not a risk factor for PPH (Table 1) which was constant with the results of many studies.<sup>[17,22,23]</sup> Our explanation is that, all women who have had a previous CS must have placental site demonstration by ultrasound that may be protecting from PPH.

Our finding revealing that, prior APH carried a risk for PPH (OR= 3.57) (Table 1) was

consistent with other studies had shown the following results; (OR= 3.8),<sup>[12]</sup> and (OR= 1.8).<sup>[24]</sup> In the current study, prior PPH was associated with an increased risk of PPH (OR= 2.85) (Table 1) in agreement with other studies.<sup>[5,25]</sup> Also, the prospective cohort study in Egypt,<sup>[26]</sup> reported that, prior PPH had a predictive probability of 70% for incidence of PPH.

Regarding parity, in agreement with several studies,<sup>[1, 13, 19, 27]</sup> our study revealed that, multiparity was not a risk factor for PPH as multiparous women at Zagazig University Hospitals were treated as a high risk group and managed vigilantly. However, other studies,<sup>[28, 29]</sup> have reported an association between multiparity and PPH. Also, we did not find an association between nulliparity and PPH which was consistent with previous studies,<sup>[13,17]</sup> and inconsistent with others.<sup>[20, 26]</sup>

We found that, fetal macrosomia was a significant risk factor for PPH (OR= 9.57) (Table 1) which was consistent with the following studies' results (OR= 1.4),<sup>[13]</sup> (OR= 2.01),<sup>[30]</sup> and (OR= 2.36).<sup>[31]</sup> Montreal,<sup>[12]</sup> Egyptian,<sup>[26]</sup> and New Zealand studies,<sup>[32]</sup> also demonstrated an increased risk for PPH with macrosomia in contrast with others.<sup>[17, 33]</sup> Macrosomia increases agenital trauma and uterine atony by uterine over distention and exhaustion. It is a lifestyle problem needing public health intervention.<sup>[34]</sup> The occurrence of PPH in our study was not affected by gestational age.

Iron deficiency anemia may weaken uterine muscle or lower resistance to infectious diseases, contributing to PPH and subsequent mortality.<sup>[26,35]</sup> In accordance with previous studies our study found a significant association of anemia and PPH (OR= 5.37) (Table 1).

The International Postpartum Hemorrhage Collaborative Group stated a key recommendation to further investigate maternal obesity as a potential risk factor for PPH.<sup>[21]</sup> In the present study, obese women have an increased risk of PPH (OR= 4.01) (Table 1) regardless of mode of delivery. Several studies

were consistent with our results,<sup>[18,27]</sup> and a population based observational study in UK found that, vaginally delivered obese women had higher risk for PPH compared to overweight women (OR=1.5).<sup>[36]</sup>

#### **Association of PPH with delivery related factors**

The finding in the current study that vaginal deliveries carried the risk for PPH (OR= 2.13) (Table 2) was confirmed in several studies.<sup>[18, 37]</sup> CS cases were placed under close observation and have early diagnosis of hemorrhage with earlier interventions therefore, planned CS seems to play a protective role against PPH.<sup>[38]</sup>

A potential factor for PPH is the practice of labor induction that is presently performed more frequent than before.<sup>[21,39]</sup> In our study, labor induction was a significant risk factor for PPH (OR= 2.88) (Table 2) in agreement with previous studies showed the following results (OR= 1.71),<sup>[23]</sup> (OR=1.74),<sup>[31]</sup> and (OR= 1.22).<sup>[39]</sup> This finding can be explained by that, labor induction may increase duration of labor which may increase frequency of PPH and also, the drugs inducing labor cause direct uterine contractions, act as a fatigue factor on the uterine muscle leading to postpartum atony and PPH.

Regarding the genital tract trauma, our results demonstrated a significant PPH risk with trauma (OR= 3.53) (Table 2) which was in agreement of previous studies.<sup>[13,26]</sup> Iatrogenic trauma by the indiscriminate use of a midline or medilateral episiotomy was associated with excessive blood loss and PPH in two previous studies,<sup>[1,13]</sup> with the following results (OR= 1.7) and (OR= 1.27) respectively. In contrast, we found that episiotomy was not a risk factor for PPH (Table 2) consistently with the results of other studies.<sup>[39,40]</sup>

Retained placenta accounts for approximately 10% of all cases of PPH, occurs after 0.5-3% of deliveries.<sup>[41]</sup> In the current study, retained placenta had a significant increased risk for PPH (OR= 8.51) (Table 2) in agreement with many studies.<sup>[4,17,43]</sup> Retained placental

fragments inhibit adequate uterine contraction and subsequent uterine atony and PPH.<sup>[4]</sup>

Placenta previa was associated with PPH (OR=12) representing the highest of any major risk factor.<sup>[23]</sup> We found that, placenta previa was a significant risk factor for PPH (OR=3.51) (Table 2). The same finding was reported by other studies.<sup>[4,12]</sup> This finding may be explained by that, placenta previa causes poor myometrial contraction cannot stop bleeding from numerous vessels beneath placental implantation area.<sup>[5]</sup>

Finally, Stepwise logistic regression showed that, maternal anemia, retained placenta, macrosomia, and previous PPH were the most statistical significant risk factors of primary PPH (Table 3).

### CONCLUSION

There are many risk factors for primary PPH as increasing maternal age, previous APH and PPH, macrosomia, maternal anemia, obesity, vaginal delivery, labor induction, delivery trauma, retained placenta and placenta previa. Maternal anemia, retained placenta, macrosomia, and previous PPH were the most significant risk factors for primary PPH.

### RECOMMENDATIONS

In order to reduce the maternal morbidity and mortality, we recommend properly organized antenatal visits helping early detection of risk factors of PPH and providing an opportunity to educate the women about the risk factors of PPH and training on active management of the third stage of labour for the prevention and treatment of PPH. Clinicians should identify risk factors before and during labour as early as possible to optimize care for high risk women. Finally, Every health facility should have adequate supplies of uterotonic drugs, equipment and protocols for the prevention and treatment of PPH as well as blood transfusion facilities.

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The authors declare that there are no conflicts of interest.

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