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Original Research Article

Risk factors for post-partum hemorrhage in patients who underwent operative vaginal delivery in a tertiary care center

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ABSTRACT

Background: Operative vaginal delivery is a timely intervention to cut short second stage labor when imminent delivery is in the interests of mother, fetus, or both. It reduces second stage cesarean section morbidity and uterine scar and its influence on future obstetric career. The possible structural neonatal adverse outcomes due to operative vaginal delivery are well quantified. However, its effects on maternal outcome need to be understood better. In this paper, we study the effect of operative vaginal delivery on maternal post-partum hemorrhage (PPH) and the associated risk factors.

Methods: It was a retrospective study carried out for the period July 2016 to July 2020 at Ramaiah Medical College, Bengaluru. Total number of vaginal deliveries in this period were 6318. Out of these, 1020 patients underwent assisted vaginal delivery using vacuum/ forceps/ sequential use of instrument. Blood loss greater than 500 ml is considered PPH for the purpose of this study. 15% of the study population was noted to have PPH. We employ a multivariate logistic regression to identify statistically significant risk factors for PPH in women undergoing operative vaginal delivery.

Results: The logistic regression model identifies multiparity, maternal age, neonatal birth weight more than 3.5 kg, application of forceps in women with hypertensive disorders, III-degree tear, cervical tear to significantly increase the risk of PPH in our study population.

Conclusions: Certain factors seem to increase the risk of PPH in operative vaginal delivery. The risks and benefits must be weighed properly before use of instruments.

Keywords: PPH, Operative vaginal delivery, Risk analysis, Logistic regression

INTRODUCTION

Post-partum hemorrhage is defined as blood loss of 500 ml or more within 24 hours of birth (WHO 2017).¹ Severe PPH is variably defined as blood loss of more than 1000 to 1500 ml within 24 hours of birth. Most of the blood loss is known to happen within 4 hours of delivery.

PPH per se contributes to high risk of severe maternal morbidity and mortality, in the form of ICU admissions, risk of multi organ dysfunction, need for massive blood transfusion and possible transfusion related lung injury.

Late consequences include chronic fatigue, anemia in next pregnancy and poor wound healing.

Historically, the etiology of PPH is classified according to the 4 "Ts"-tone, trauma, tissue, and thrombin. 70% cases of PPH are attributed to poor uterine tone.² Multiple antenatal and intrapartum factors have been identified as risk factors for occurrence of PPH. But it is also well established that 20% of patients with PPH have no risk factors at all.

RCOG has identified following risk factors to predispose to the development of PPH such as multiple pregnancy,

history of previous PPH, pre-eclampsia, fetal macrosomia, prolonged second stage of labor, placenta accreta spectrum, placenta previa, retained placenta, major perineal lacerations, use of liberal episiotomy, general anesthesia, caesarean section.³ Other authors have found a correlation between PPH and polyhydramnios, uterine structural abnormality, obesity, assisted vaginal delivery, assisted reproductive technology use. As is clearly seen, this list of predisposing factors is not exhaustive and severe PPH may occur in the low risk parturient with disastrous consequences.

There is conclusive evidence to suspect PPH occurrence in women with history of prior PPH and multifetal pregnancy. We focus our attention at the group of women who have undergone operative vaginal delivery and risked PPH using multivariate analysis.

The possible structural neonatal adverse outcomes due to operative vaginal delivery are well quantified. Through this paper, we would like to analyze the possible maternal complication of post-partum hemorrhage during operative vaginal delivery and the specific contribution of traumatic PPH to it, which seems to cause major maternal morbidity during operative vaginal delivery.

Improved surveillance during labor and immediate postpartum period for all parturients, like presence of qualified birth attendant in case of need of operative assistance, arranging adequate blood and blood products for all women in labor and ensuring delivery in a well-equipped maternity center with ICU and blood bank facilities will go a long way in reducing maternal morbidity due to PPH. Appropriate and timely intervention, after satisfying needful criteria, to apply instrument and complete second stage of labor will help in controlling increasing caesarean section rates.

METHODS

This was a retrospective study carried out for the period July 2016 to July 2020 at Ramaiah Medical College, Bengaluru. Total number of vaginal deliveries in this period were 6318. Out of these, 1020 patients underwent assisted vaginal delivery using vacuum/ forceps/ sequential use of instrument. 155 out of 1020 patients were suspected to have PPH (blood loss of more than 500 ml) by visual estimation of blood loss by the attending consultant, that is 15% of the study population was noted to have PPH.

Antenatal women admitted to labor room for delivery were subjected to detailed history taking, complete physical examination and appropriate laboratory investigations. Vitals were regularly monitored with specific attention to fourth hourly blood pressure charting. If patient had 2 or more blood pressure readings greater than 130/90, 4 hours apart, then pre-eclampsia work up was done and anti-hypertensives were started. 2-pint PRBC was routinely arranged for all women admitted for delivery. If HELLP,

severe thrombocytopenia, placenta previa or accreta was suspected, massive transfusion protocol alert was sounded to the blood bank and blood accordingly arranged.

After delivery, all women were closely observed for possible PPH and blood loss visually estimated and documented. Patients with blood loss greater than 500 ml have been categorized to have had PPH1.

Inclusion and exclusion criteria

The study population included all the pregnant women aged 18 to 45 years who underwent instrument assisted vaginal delivery at Ramaiah Medical College, Bengaluru, between July 2016 and July 2020. The specific inclusion criteria were patients at term and pre-term, beyond 28 weeks till 41 weeks POG, cephalic presentation, who underwent assisted vaginal delivery, with or without history of previous LSCS. The exclusion criteria were placenta previa, placenta accreta, 2 or more previous LSCS and women with coagulopathy before delivery.

Methodology

The total number of vaginal deliveries in the above said period was 6318, out of which 1020 patients had a successful operative vaginal delivery. We use reusable soft silastic vacuum cup and Wrigley's outlet forceps to assist delivery in second stage. Maternal variables like parity, induction of labor or spontaneous labor, use of oxytocin, duration of 1st and 2nd stage of labor, type of instrument applied, indication for assisted vaginal delivery, birth weight of the neonate were charted. Maternal comorbidities of preeclampsia, chronic hypertension, gestational hypertension, gestational diabetes, previous LSCS were noted. Apgar scores were calculated and taken down for 1 and 5 minutes

Maternal morbidity was studied with respect to estimate of the amount of post-partum blood loss, incidence of atonic PPH, contribution of trauma to post-partum hemorrhage, in the form of cervical tear, 3rd degree tear and 4th degree tear, retained placenta and combined causes for PPH. In our hospital, routine active management of third stage of labor is practiced, using oxytocin. Number of patients who needed manual removal of placenta and thus suffered PPH were enlisted.

Statistical methods

These women were divided into two groups-those who had PPH and those who didn't and were studied using logistic regression analysis. In order to study the impact of various factors on risk of developing PPH, a logistic regression model was developed with PPH (blood loss \geq 500 ml coded as 1 and blood loss $<$ 500 ml coded as 0) as the dependent outcome variable. The risk factors considered include (a) parity [primipara/multipara] (b) gestational age [continuous] (c) artificial rupture of membrane [yes/no] (d) vacuum application [yes/no] (e) forceps application

[yes/no] (f) III degree tear [yes/no] (g) cervical tear [yes/no] (h) oxytocin use [yes/no] (i) baby birth weight ≥ 3.5 kg [yes/no] (j) presence of hypertension [yes/no] (k) fetal distress [yes/no] (l) GDM [yes/no] (m) eclampsia [yes/no] (n) sequential application of vacuum and forceps [yes/no] and (o) application of forceps in patients with hypertension [yes/no].

RESULTS

During the study period, there were total of 6318 vaginal deliveries in our hospital, out of which 1020 (15%) had operative vaginal delivery. Of these 1020 assisted vaginal deliveries, 887 (86.9%) were vacuum assisted, 40 (3.9%) were forceps assisted and 93 (9.1%) were both vacuum and forceps assisted. Of those who had an operative vaginal delivery, 655 (65.8%) received labor analgesia, 197 (19.2%) received intrathecal alone and 458 (45%) received combined spinal epidural analgesia. Out of 1020 patients, 155 patients (15%) had post-partum hemorrhage. The average age of mothers who had PPH was 26.31 years while those who did not have PPH was 26.39 years. The comparison of patient age distribution between the PPH group and non-PPH group is shown in Figure 1. The chi-squared test showed that there was no statistically significant difference between the two distributions.

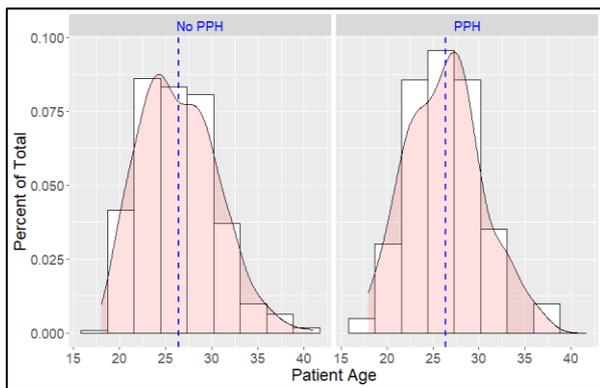


Figure 1: Comparison of patient age between the non PPH and PPH group.

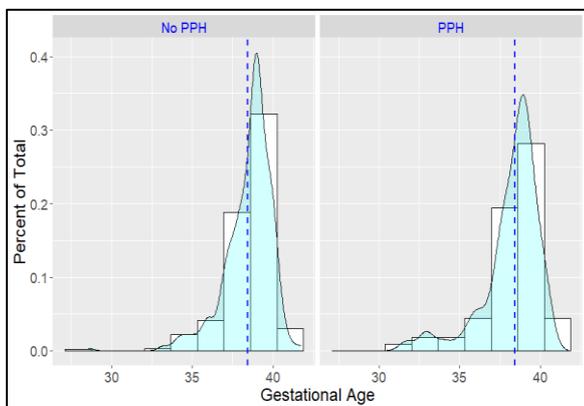


Figure 2: Comparison of gestational age between the non PPH and PPH group.

Table 1: Comparison of risk factors of PPH.

Variable	PPH - Blood loss ≥ 500 ml (n=155)	No PPH - Blood loss < 500 ml (n=865)
Average mothers age (years)	26.31	26.39
Average gestational age (weeks)	38.21	38.49
Parity		
Primiparous	128 (82.6%)	593 (91.2%)
Multiparous	27 (17.4%)	272 (8.8%)
Use of vacuum extractor		
Yes	139 (89.7%)	789 (91.2%)
No	16 (10.3%)	76 (8.8%)
Use of forceps		
Yes	43 (27.7%)	180 (20.8%)
No	112 (72.3%)	685 (79.2%)
III degree perineal tear		
Yes	13 (8.4%)	36 (4.2%)
No	142 (91.6%)	829 (95.8%)
Cervical tear		
Yes	11 (7.1%)	16 (1.8%)
No	144 (92.9%)	849 (98.2%)
Hypertension		
Yes	29 (18.7%)	155 (17.9%)
No	126 (81.3%)	710 (82.1%)
Baby birth weight ≥ 3.5 kg		
Yes	25 (16.1%)	60 (6.9%)
No	130 (83.9%)	805 (93.1%)
Oxytocin used to accelerate labor		
Yes	135 (87.1%)	807 (93.3%)
No	20 (12.9%)	58 (6.7%)

The average gestational age of mothers in the PPH group was 38.21 weeks while the average in the non-PPH group as 38.49. The distribution had no statistically significant difference as is as shown in Figure 2.

Atonic PPH was noted in 102 patients accounting for 65.2% of the PPH cases. The next commonest was traumatic PPH in 30 patients (19.3%). The combined causes of PPH (atonic+traumatic) were observed in 19 patients (12.3%) and retained placenta was noted in 4 patients (2.6%).

The risk factor distribution for PPH is given in Table 1. A logistic regression model was fitted relating the PPH outcome [yes/no] with the risk factors and hypothesized interaction effects. The contribution to variation in

outcome by the various statistically significant risk factors and their interaction terms are given in Table 2. Parity, gestational age, III-degree tear, cervical tear, oxytocin use, baby birth weight, and forceps application in hypertension patients are found to be significant.

Table 2: Results from logistic regression - coefficients odds ratio of risk factors.

Risk factor	Coefficient	Odds ratio	P value
Parity	0.7804	2.1823	0.0301 ^(*)
Gestational age	-0.1343	0.8743	0.0691 ^(^)
III degree tear	0.9181	2.5045	0.0959 ^(^)
Cervical tear	1.7949	6.0187	0.0068 ^(**)
Oxytocin use	-0.9898	0.3716	0.0305 ^(*)
Birth weight	0.9466	2.5771	0.0292 ^(*)
Forceps+ Hypertension	1.8807	6.5580	0.0417 ^(*)
Induction of labor	0.1912	1.2107	0.5192
Hypertension	-0.1376	0.8714	0.7414
GDM	0.4229	1.5263	0.7118
Labor I stage ≥14 hr	0.1499	1.1617	0.7999
Labor II Stage ≥2 hr	0.2659	1.3046	0.4294

Significance codes: 0.01 ^(**) 0.05 ^(*) 0.1 ^(^).

The impact of the risk factors in terms of the model coefficients and odds ratio given in Table 2 shows that increase in gestational age and oxytocin use decrease chances of PPH. On the other hand, increasing parity, 3rd degree tear, cervical tear, and higher birth weight increase the chances of PPH. Further, use of forceps in patients with hypertension, also increases the chances of PPH with an odds ratio of 6.5580. Cervical tear has a high degree of impact on PPH with an odds ratio of 6.0187.

DISCUSSION

This is a single center retrospective, consecutive study on pregnant women delivered by assisted vaginal delivery in a single institution from July 2016 to June 2020. We had 1020 study participants, of whom 155 suffered PPH (visual estimation of blood loss more than 500 ml), 86.9% women were vacuum assisted, 3.9% were forceps assisted and 9.11% were both vacuum and forceps assisted deliveries. 102 women suffered atonic PPH, 30 had traumatic PPH, 19 had combined causes of PPH and 4 had retained placenta and manual removal of placenta done.

Reichman et al did a study on grouping parturients by parity, previous caesarean, and mode of delivery (P-C-MoD classification) and concluded the model helps to better identifies groups at risk for PPH. In her study, the crude PPH rate was 7% out of 1,26,693 parturients.⁴ The rates of PPH in primipara was seen to be 14%, multipara was 4%, operative vaginal delivery carried a risk of 22% of PPH and caesarean section was associated with 15% risk of PPH. Prevalence of PPH was highest in primipara undergoing operative vaginal delivery (27%) compared to multipara with spontaneous vaginal delivery (3%). In contrast to this in the study conducted by Jaleel mean parity of cases was 3.1 in PPH group and 2.15 in control non-PPH group.⁵ Similarly, the study being reported in this paper also finds multiparous patients to be at a higher risk for PPH. Jaleel et al performed a risk analysis for PPH in a general hospital setup in Karachi, Pakistan and arrived at a risk assessment model for PPH. Mean age of patients with PPH was 28.8 years and controls was 26.8 years. This is also in conformance with our finding where the average age of PPH group is higher than the average age of non-PPH group (Table 1).

Xu et al studied differential effects of different delivery methods on progression to severe PPH between Chinese nulliparous and multiparous women in a retrospective cohort study of 151333 women.⁶ They concluded delivery methods are associated with PPH both in primi-parous as well as multi-parous women. Compared to spontaneous vaginal delivery, they identified an adjusted odds ratio of 9.32, with 95% CI of 3.66- 23.7, for progression to severe PPH, to be higher in multiparous women due to forceps assisted delivery.

Adjusted odds ratio for severe PPH due to vacuum assisted delivery was comparable to spontaneous vaginal delivery in multiparous women, 2.41, not significantly different from nulliparous women, aOR of 1.05. They concluded forceps assisted delivery and caesarean section methods were found to increase risk of PPH. Though the current study being reported in this paper does not find significant risk in use of forceps for PPH, the interaction between forceps and hypertension seems to have a significant effect on PPH. Hirsch et al in a retrospective study concluded that in women undergoing vacuum extraction, hypertensive disorders are associated with increased risk for PPH.⁷ These findings have implications for obstetric delivery method choices.

Hubena et al studied the prevalence and outcome of OVD among mothers who gave birth at Jimma University Medical Centre in Southwest Ethiopia.⁸ They found that 98.9% of mothers by undergoing operational vaginal delivery had favorable outcome. They found baby birth weight to be the only predictor of maternal outcome. 8 cases, i.e., 3.3% cases of operational vaginal delivery were complicated with PPH. This is similar to our finding where we have found baby birth weight (odds ratio 2.5771) to be a significant risk factor for PPH in women undergoing operational vaginal delivery.

In an earlier study by Brun Induction of labor was found not be associated with increases blood loss and this is also in conformance with our study where induction of labor did not increase the risk for PPH.⁹

Eskandar identified occipito-posterior position during delivery, primi-gravida and high birth weight as risk factors for third- and fourth-degree perineal tear.¹⁰ Instrumental delivery in an occipito-posterior position can significantly increase risk of tear and cause PPH. We have found III-degree tear and cervical tear to be highly significant risk factors for PPH in women undergoing operational vaginal delivery. Maso et al also found III-degree tear to be a significant risk factor for PPH in a study conducted in Friuli Venezia Giulia, Italy.¹¹

The main limitation of this present study is that there were not sufficient number of multiple pregnancies to study its effect on PPH under the application of an instrument. Similarly, other potentially contributing factors such as bod mass index (BMI) of the mother could not be included due to lack of data. Also, there were not sufficient numbers of grand multiple parity, and hence we could not form a separate group and study its effect.

CONCLUSION

This study was aimed at understanding the influence of operative vaginal delivery in the incidence of post-partum hemorrhage. We employed a logistic regression model to understand the risk factors contributing to PPH in women undergoing operative vaginal delivery. This study conducted in a tertiary care center in Bangalore showed that the presence of cervical tear and III-degree tear increased the chances of PPH. Further the study also showed that application of forceps in women with hypertension increases the risk of PPH though hypertension by itself did not seem to increase the risk in a statistically significant way. Further our study also found parity and fetal birth weight to be contributing factors. Any patient in labor might need assistance in the second stage. RCOG advices to counsel primigravida about possible need of assisted vaginal delivery in II stage after 32 weeks of gestation. Assessment of patients undergoing operative vaginal delivery for risk factors for PPH such as this study will alert the clinician to take adequate measures for prophylaxis and management.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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