Postpartum Hemorrhage Following Vaginal and Cesarean Section Deliveries at a Single Tertiary Hospital: A 5-Year Cross-Sectional Study

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Abstract

Objectives: To study the prevalence, etiology, management, and outcomes of patients who had postpartum hemorrhage (PPH) following vaginal and cesarean delivery at Sultan Qaboos University Hospital (SQUH).

Methods: A cross-sectional study was conducted on women who delivered at SQUH from January 2017 to December 2021 and had PPH. PPH was defined as per the WHO criteria of blood loss more than 500 ml after vaginal delivery and 1000 ml after cesarean delivery. The demographic parameters, pre-delivery and discharge hemoglobin (Hb), estimated blood loss, etiology, pharmacological, mechanical, and surgical interventions undertaken to treat PPH and the need for blood and blood products were studied.

Results: There were 18,136 vaginal deliveries during the study period of which 729 women had PPH with an prevalence of 4%. There were 2771 cesarean sections of which 360 women had PPH, with a prevalence of 13%. Hb of less than 11 gm% was found in 278/729 (38%) and 140/360 (38%) women prior to vaginal delivery and cesarean section respectively. Grand multipara had the highest prevalence of PPH after vaginal delivery, noted in 311 (43%) women. While the majority, 179 (50%) were women of parity 2-4 in thePPH group after cesarean section. One hundred and forty (39%) women after cesarean delivery were with previous cesarean sections. Poor uterine tone was the cause of PPH in 616 (85%) and 263 (79%) women after vaginal and cesarean delivery respectively. Up to four uterotonics were used to treat atonicity. Surgical interventions required in 244 (34%) women following vaginal delivery, mainly suturing of vaginal or perineal tears. Eighty-two (23%) of women at cesarean section needed compression sutures or devascularization or hysterectomy. Average blood loss was 860 ml after vaginal delivery, and 1400 ml after cesarean section. Blood transfusion was required in 74 (10%) women after vaginal delivery and in 127 (35%)women after cesarean. There was one maternal mortality due to atonic PPH after vaginal delivery.

Conclusions: The prevalence of PPH was 4% and 13% after vaginal and cesarean delivery respectively. Active management of third stage of labor and repeated emergency obstetric drills to recognize and promptly act in the setting of PPH has reduced adverse outcomes. The prevalence of anemia in pregnancy was high which needs to be addressed. Carbetocin for prevention of PPH especially at cesarean section must be studied in our population.

Keywords: Postpartum Hemorrhage, Etiology, Therapy, Oxytocics, Hysterectomy.

Introduction

Post-partum hemorrhage (PPH) continues to be a leading cause of maternal mortality all over the world.[1] PPH is a cause of maternal mortality in 8% and 32% of the cases in developed and developing countries, respectively.[1] Incidence of PPH ranges from 3 to 8% of all deliveries.[2-4]

PPH is defined as per the World Health Organization (WHO) as blood loss more than 500 ml after vaginal delivery and 1000 ml after cesarean section.[5,6] In 2017 ACOG defined PPH as blood loss greater than 1000 ml or blood loss that was accompanied by signs and symptoms of hypovolemia occurring within 24 hours of delivery, regardless of the mode of delivery.[6] RCOG defines minor PPH as blood loss between 500 and 1000 ml and major blood loss as greater than 1000 ml.[7] Volume of estimated blood loss is unreliable and hence general state of the patient to also be considered in defining PPH.[8]

WHO recommends visual estimate of blood loss as standard for blood loss measurement. With the publication of E-motive trial in 2023,[9] WHO confirms that visual estimate does tend to corelate with other estimates like gravimetry and blood collection devices, although other studies have stated visual estimates underestimate blood loss by 33 to 50% as compared to spectrometry.[10,11] Other methods for assessment like gravimetric measurement, direct blood collection technique, and evaluation of hemodynamic parameters has been proposed as an alternative to visual estimate.[12-18]

There exist many identifiable risk factors for PPH. The identified risk factors for PPH include, older age, increased parity, history of previous PPH, uterine overdistention due to twins, macrosomia or polyhydramnios, presence of placenta previa, placenta accreta spectrum. or abruption. Intrapartum risk factors like, induced labor, prolonged labor, instrumental delivery. But most cases occur unexpectedly. Etiology for PPH has been suggested as four T, s for convenience. Tone, Trauma, tissue and Thrombin.[19] Uterine atony accounts for 70% of cases of PPH.[20] Uterine atony is anticipated in prolonged labor, chorioamnionitis, uterine overdistention as in twins, macrosomia, and polyhydramnios.[20]

Mortality and severe maternal morbidity after PPH can result from shock, acute respiratory distress syndrome (ARDS), disseminated intravascular coagulation (DIC), acute kidney injury and pituitary necrosis. Anticipating, preventing and early recognition with timely interventions has been consistently shown to reduce morbidity and mortality from PPH.[21,22]

Although PPH continues to be the main cause of maternal death, it can be prevented by, antenatally optimizing haemoglobin, by correcting anemia, anticipating PPH in high-risk pregnancies and keeping cross matched blood ready, multidisciplinary team preparation in cases of placenta accreta spectrum including cell salvage equipment. In addition, intrapartum recognizing and treating chorioamnionitis, judicious use of oxytocin over prolonged periods, post deliverypracticing active management of third stage universally which includes, use of oxytocic at delivery, controlled cord traction and uterine massage. Proper training of care providers, providing continuous education and regular PPH drills is crucial for better maternal outcomes.This can be achieved by setting up preventive measures and having clear protocols and guidelines on the management of PPH. This study aimed to look at PPH cases occurring in SQUH in order to find out the prevalence, risk factors, causes and outcomes.

Methods

A cross-sectional study was conducted between January 2017 and December 2021 (a five- year period) in all women who delivered at Sultan Qaboos University Hospital (SQUH), a tertiary health care institution in Oman. SQUH is a teaching hospital in Muscat, which is a 600 bedded hospital, with 12 delivery suites and 25 obstetric beds with60% of patients delivering in SQUH are being booked, and many of them referred as high-risk patients needing tertiary care. About 40% are unbooked who come in labour and deliver in our institution.Ethical approval was obtained from the College of Medicine and Health Sciences (COMHS) Medical and Research Ethics Committee (MERC # 2850) at Sultan Qaboos University.

This study defined PPH as per WHO to be blood of 500 mL or more after vaginal delivery, and 1000 mL or more after cesarean section.[5,6] The aim was to assesses the prevalence, risk factors, management and outcomes of postpartum hemorrhage occurring after vaginal and cesarean deliveries. In our delivery ward we have visual charts which depict the blood loss when standard size mops and drapes are soaked with blood which are used in estimating blood loss after vaginal delivery. In addition, the clots are weighed. At cesarean section, blood-soaked mops are weighed and blood in the suction bottles are measured.

All women delivering in SQUH, had active management of third stage of labor. During the study period, syntometrine was used as the oxytcic after vaginal delivery, and oxytocin after cesarean sections. Controlled cord traction and uterine massage was used after all deliveries.

When PPH is diagnosed, there exists a protocol for management, which includes, calling for help, obtaining IV access, IV fluid administration, and uterotonic administration in atonic PPH along with looking for and treating traumatic PPH. A Modified Early Obstetric Warning Score (MEOWS) chart is maintained, to monitor and decide on interventions.

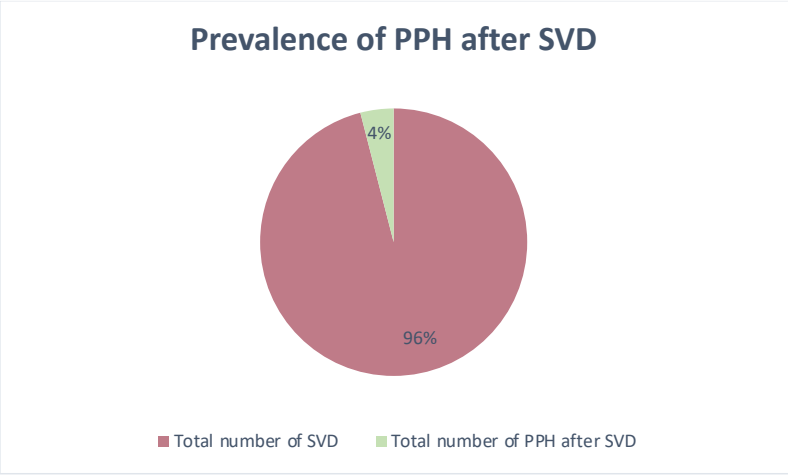
Regular obstetric drills and emergency obstetric workshops are conducted to reeducate and retrain midwives and doctors in managing emergencies like PPH.

The data was collected using the hospital patient information system (TrakCare) and delivery ward registry. The following data was collected: maternal demographics such as age, parity, history of previous cesarean section, pre-delivery hemoglobin, mode of delivery, estimated blood loss and neonatal birth weight. The cause and management of PPH such as medications used, blood transfusion, and surgical procedures was also collected. Hemoglobin at discharge was recorded.

The data was analyzed using the statistical package for the social sciences (SPSS) software version 28. Frequency tables and pie charts were used to display prevalence of different study parameters. Chi square test was used to test the association between the different risk factors and the need for blood transfusion. The percentages, frequencies, and categorical variables were reported. A p value of less than 0.05 was considered statistically significant.

Results

A total of 18,136 vaginal deliveries reported during our study period out of which 729 women had PPH resulting in a prevalence of 4% [Figure 1A]. The causes of PPH included uterine atony in 616 (85%), trauma in 61 (8%) and retained placenta tissues in 52 (7%) women. There were no reported cases with blood clotting (thrombus) factors [Figure 2].



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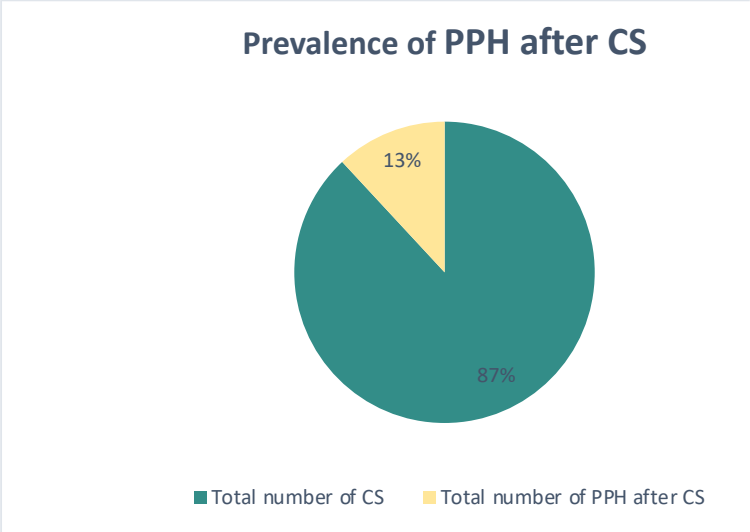

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Figure 1: Prevalence of PPH (a) after SVD and (b) after CS.

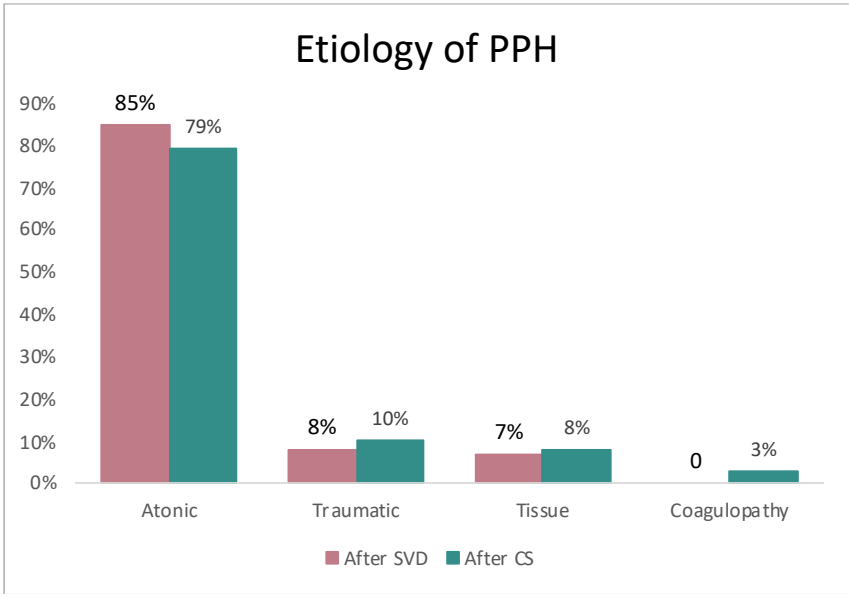


Figure 2: Etiology of PPH after SVD and CS.

The mean maternal age among our women with PPH after vaginal delivery was 31±12.3 (17-45) years. Among the reported PPH cases, the most prevalent age group was between 20-30 years in 383 (53%) cases, followed by age group between 31-40 years in 312 (43%) cases, and more than 40 years seen in 28 (4%) and less than 20 years were only 6 (0.8%) cases.

In terms of maternal parity, among the 729 women who had PPH, 174 (24%) women were primigravida, 244 (33%) were para 2-4 and 311 (43%) were para 5 and more. Out of 729 women with PPH, 608 (83%) had a spontaneous vaginal delivery including those who were born before arrival (BBA) to hospital (n=28 (4%) cases), while 119 (16%) had instrumental delivery, majority being vacuum deliveries. Two (0.3%) women had breech delivery.

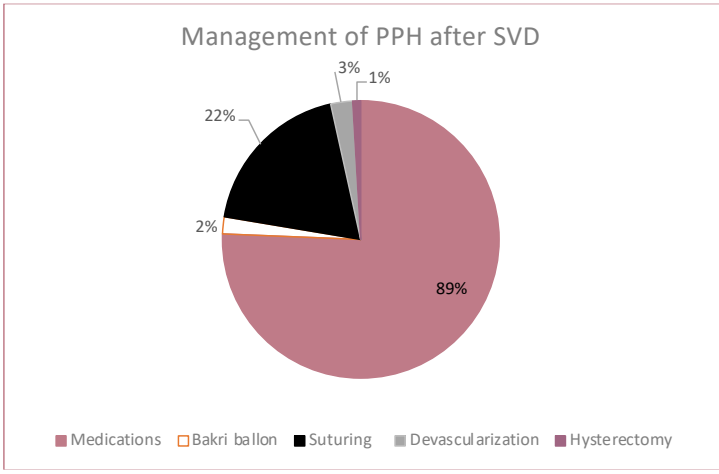
The mean estimated blood loss was 860 ±498.5ml (500mL-5000mL). See Table 1. The neonatal birth weights were categorized it into three main groups >4 Kg, 2.5-4 Kg and <2.5 Kg). The number of neonates weighing more than 4 kg were 13 (1.8%), 646 (88.6%) neonates weighed between 2.5-4 kg, 70 (9.6%) were less than 2.5 kg.

Table 1: Patient's demographics after SVD.

Maternal demographics		**Frequency**
Mean maternal age	31	
Parity	primiparous	174
	2-4	244
	>=5	311
Mean birth weight	3.2 kg	
Previous CS	1	223
	2-3	67
	>=4	0
HB level before delivery	<9g/dL	33
	9-11 g/dL	245
	>11 g/dL	451
HB level after delivery	<9g/dL	221
	9-11 g/dL	333
	>11 g/dL	175
Mean blood loss	860 ml	

The hemoglobin (Hb) level (pre- and post-delivery) was collected for all women and categorized into three groups, >11, 9-11 and <9 g/dL. The Hb before delivery was more than 11 g/dL in 451 (61.8%) women, 9-11 g/dL in 245 (33.6%) women and less than 9 g/dL in 33 (4.5%) women. About 38% of our women who had PPH, had a predelivery Hb of less than 11 g/dl. On the other hand, the Hb level at discharge was found to be higher than 11 g/dL in 175 (24%), between 9-11 g/dL in 333 (45.7%)and less than 9 g/dL in 221 (30.3%) women. Treatment and management:

Figure 3A shows the management of PPH including 649 (89%), women who received pharmacological treatment. This was divided into four different groups. First group included 430 (59%) women who received syntometrine and oxytocin. The second group were those who received three uterotonics syntometrine, oxytocin and misoprostol and this was noted in 193 (27%) women. The last group included 34 (6%) women who received four uterotonics, syntometrine, oxytocin, misoprostol and carboprost. Of the overall, there were 164 (22%) women who received combination of surgical and pharmacological management.



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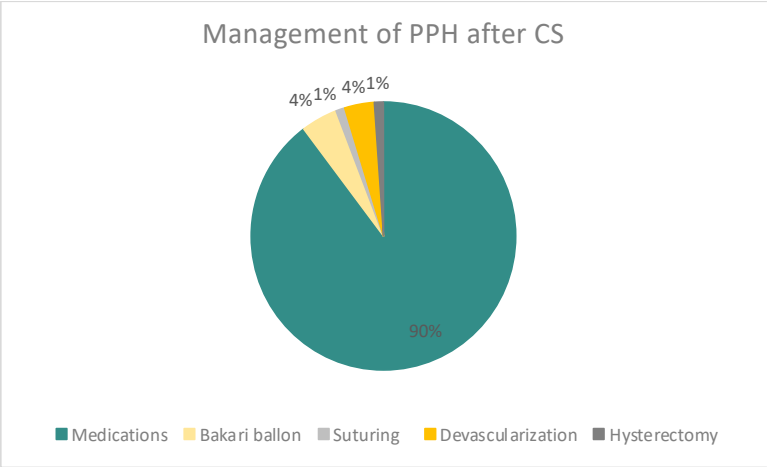

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Figure 3: Management of PPH (a) after SVD and (b) CS.

Surgical intervention was required in 244/729 (34%) women. Out of all the PPH cases post vaginal delivery, suturing for vaginal, cervical and perineal tears was required in 162 (22%), manual removal of placenta in 21 (3%) women and Bakri balloon was inserted in 17 (2%) women. Twenty-seven (4%) women underwent examination under anesthesia. Nine (1%) had vaginal packs, and only eight (1%) women had hysterectomy. Vaginal pack was required to apply pressure as the vaginal tissue was very friable and edematous. Twenty-two (3%) women underwent devascularization procedure either internal iliac artery or uterine artery ligation. Regarding blood and blood products, sixty-two (9%) women received packed red blood cell (PRBC), 12 (2%) women received PRBCs and other blood product such as fresh frozen plasma (FFP) and cryoprecipitate.

The maternal mortality rate due to PPH after vaginal delivery was 0.13% (one patient). The patient had atonic PPH which was managed with four uterotonics, Bakri balloon, devascularization and hysterectomy. PPH after cesarean delivery Prevalence and causes:

Of the 2771 cesarean deliveries, a total of 360 (13%) women had PPH (figure 1B). The most common cause was uterine atony in 263 (79%) women, followed by traumatic PPH in 33 (10%), placental causes in 27 (8%) and coagulopathy in 10 (3%) women (figure 2A).

The mean maternal age was 34±5.06 (19-47). In terms of maternal parity, 106 (32%) women were primigravida, 179 (54%) were para 2-4 and 79 (24%) were para 5 and more. Previous cesarean sections accounted for 39% (n=129) of the cases [Table 2]. Macrosomia was the least common risk factor in this study sample, accounting for 3.1% (n=11) of the cases.

Table 2: Patient's demographics after CS.

Maternal demographics		**Frequency**
Mean maternal age	34	
Parity	primiparous	106
	2-4	175
	>=5	79
Mean birth weight	2.9 kg	
Previous CS	1	55
	2-3	56

	>=4	18
HB level before delivery	<9g/dL	12
	9-11 g/dL	128
	>11 g/dL	220
HB level after delivery	<9g/dL	188
	9-11 g/dL	156
	>11 g/dL	16
Mean blood loss	1.4 L	

The neonatal birth weights were categorized it into three main groups (>4 Kg, 2.5-4 Kg and <2.5 Kg). The number of neonates weighing more than 4 kg were 11 (3.1%), 254 (70.5%) neonates weighed between 2.5-4 kg, 95 (26.4%) were less than 2.5 kg. The mean estimated blood loss was 1400 mL±0.61 (1000 mL-5500 mL). See Table 2. The hemoglobin (Hb) level (pre- and post-delivery) was collected for all women and categorized into three groups, >11, 9-11 and <9 g/dL. The Hb before delivery was more than 11 g/dL in 220 (61.1%) women, 9-11 g/dL in 128 (35.6%) women and less than 9 g/dL in 12 (3.3%) women. On the other hand, the Hb level at discharge was found to be higher than 11 g/dL in 16 (4.4%) women, between 9-11 g/dL in 156 (43.3%) women and less than 9 g/dL in 188 (52.2%) women.

The PPH was managed with medication which included Tranexamic acid and uterotonics in 300 (90%) women. Bakri balloon was used in 13 (4%) women. Thirteen (4%) women needed devascularization procedures, three (1%) women required compression sutures and three (1%) women needed hysterectomy. No interventional radiology including uterine artery embolization (UAE) was required.

Oxytocin alone was used in 133 (40%) of the cases, two and three uterotonics were required in 35 (11%) and 30 (9%) cases respectively. However, only 12 (4%) cases required a combination of 4 uterotonics. The findings of this study showed that most of the women did not require blood transfusion (n=233, 64.7%), while the other 35.7% (n=127) required blood transfusion. Among those who required blood transfusion, 78.7% (n=100) received only PRBC, 15.8% (n=20) received a combination of PRBC, FFP and platelets. While 5.5% required cell saver (n=7).

Discussion

In our study the prevalence of PPH after vaginal delivery was 4%. This is in concurrence with world literature of 3 to 8%[2-4].There are no studies reported on the prevalence of PPH in Oman. PPH after cesarean section was higher (13%), compared to normal vaginal deliveries. Cesarean births especially, emergency cesareans remain a risk factor for both PPH and severe PPH.[23,24] It is well known that method of birth are shown to be an important risk factor for minor PPH and may be a better predictor of PPH than antenatal risk factors.[25] This higher prevalence with cesarean section could be because of a larger number of multiple previous cesarean sections, which is high risk for PPH due to placental abnormalities and adhesions. The other reason could be a more objective measurement of blood loss by measuring blood in suction device and weighing mops. The risk factors for severe PPH after cesarean deliveries include, previous cesarean.[21,26] Our study found the rates of previous scars to be 39%, in our patients who had PPH after cesarean.

The other risk factors which positively corelated with PPH after cesarean include antepartum hemorhage,[21,24] twins,[23] preeclampsia,[21] general anesthesia,[23,24] anemia,[21] and maternal age above 35.[27]

Our study found the prevalence of anemia to be 38%, which is higher than most studies which showed it to be between 25 and 30%,.[28] There is a need for introspection on this account, as to why women after receiving antenatal care present to the delivery ward with anemia. This could be attributed to high parity, repeated pregnancies and lactation. In addition, during the antenatal care there is a need to check for compliance of oral iron preparations, and also worth reviewing if the prenatal vitamins that are routinely given to pregnant women who are not anemic at the start of pregnancy, have sufficient iron content to prevent anemia.

Taking steps for anemia correction prior to delivery will benefit our patients thus reducing the rate of PPH. Anemia can be a cause as well as consequence of PPH. Reduced myoglobin in the myometrial fibres predispose to atonicity. Smaller amount of blood loss can hemodynamically compromise an anemic patient.

The etiology of PPH, after vaginal deliveries was 85% atonicity, which is similar to other larger studies.[2,4,29] Trauma accounted for 8% of our PPH cases and 7% was due to retained tissue. There were no cases where PPH was attributed to coagulation abnormalities. Trauma and coagulation abnormalities were found as an etiology for PPH in around 20% and 1% in other studies,[26] which is higher than what was found in our study.

The etiology for PPH after cesarean section was comparable to other studies which quote the incidence to be 84%,10%, 5.5% and 0.3% for atony, trauma, placental abnormalities and coagulation abnormalities, respectively.[2,29] The coagulation abnormalities in our study was higher than other literature. Advanced maternal age, also thought to be a risk factor,[2,28,29] was not found to be common in our women with PPH. This could be explained that most of our women delivering at our institution were at a younger age.

The prevalence of PPH increased from 0.3% in nulliparous women to 2% in women with parity greater than four[2] which corelated with our PPH rates after vaginal delivery.

Active management of 3rd stage of labor has been shown to reduce the prevalence of PPH substantially.[30,31] Active management of 3rd stage includes, oxytocic at delivery of anterior shoulder, controlled cord traction, (when trained birth attendants are available). Early cord clamping is not recommended. This has been strictly adhered to in our population. The E-MOTIVE intervention included, M (uterine Massage)(Oxytocic),T(Tranexamic acid),IV(IV fluids), E(Examination and Escalation).[9] The oxytocic that is used in our institution is syntometrine after vaginal delivery, if not contraindicated and 20 units oxytocin infusion after cesarean section. However, we are working on further reducing the PPH rate thus we have introduced Carbitocin for all cesarean sections as a preventive measure and better utilization of Tranexamic acid as there is good evidence of the effectiveness of both.[32-35]

Macrosomia causes uterus to be overdistended and increases risk of atonic PPH. The incidence of macrosomia is increasing due to lifestyle diseases of obesity and GDM.[36,37]

In our patients of PPH after vaginal delivery and cesarean section, the percentage of babies with a birthweight of more than 4 kgs was 1.8 and 3.1% respectively. Hence Macrosomia as an etiology for PPH was not very high. Macrosomia has been identified as a risk factor for PPH in studies in Uganda and Tanzania.[38,39] Uterine overdistention, causing thinning and poor myometrial contraction can cause PPH.[39]

Blood products were transfused in 84 and 120 patients after vaginal delivery and after cesarean section. In 5.5% of our cesarean section patients with PPH, we utilized cell saver. These were in our patients with placenta accreta spectrum. Having the availability of blood products and such resources can improve maternal outcomes. Improving health care services by allocating sufficient resources including human resources would contribute to significantly reduce the rate of PPH.[40]

Our study had few limitations such as small sample size and the study being retrospective. We did not look at whether the patients who had PPH after vaginal delivery, were patients who had vaginal birth after cesarean section. (VBAC). Few risk factors were not addressed in the study including induced labor, prolonged labor, multiple pregnancies, preeclampsia were not addressed separately.

Conclusions

The prevalence of PPH after vaginal delivery was comparable to international rates. The prevalence was high after cesarean section due to various risk factor. High rate of anemic women when admitted for delivery was noted, which definitely needs corrective measures.

Regular emergency obstetric drills in management of PPH, and a very robust blood bank at our institution have contributed to minimizing the severe maternal morbidity and mortality. The effect of tranexamic acid and caebetocin was not studied, and it may be useful to conduct studies in our population for the same to see if they benefit our population. Future studies including multicenter is recommended.

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