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Minimizing Obstetric Hemorrhage

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Abstract

Patients undergoing cesarean deliveries are at risk for hemorrhage. In fact, hemorrhage is the leading cause of preventable maternal mortality and accounts for more than 140,000 deaths each year worldwide (O'Brien & Uih, 2016). Hemorrhage has been associated with a number of well-established risk factors which could be recognized prior to delivery. Women who do not have these risk factors could still experience postpartum hemorrhage, but using a risk assessment tool has been shown to identify 60-85% of women who will experience hemorrhage (Shields, Goffman, & Caughey, 2017). The postpartum hemorrhage (PPH) risk assessment tool, developed by the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN), identifies women with PPH risk factors. The tool allows clinicians to prepare for possible interventions and close monitoring of women at increased risk of bleeding, to ultimately prevent mortality. At a metropolitan hospital PPH risk assessments were not being discussed during standard pre-procedure huddles. This quality improvement project added the PPH risk assessment tool to the pre procedure huddle sheet. This facilitated interdisciplinary team discussion of PPH risk factors for patients undergoing cesarean deliveries. There were a total of 575 mothers in the study with 297 in the pre intervention period and 278 in the post. There was a statistically significant increase in estimated blood loss (EBL) between the pre and post intervention groups. While the study tool did not result in a decrease in EBL, it increased awareness among the interdisciplinary care team by facilitating discussion about PPH.

Keywords: Postpartum hemorrhage, PPH, obstetric hemorrhage, pre-procedural huddles

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Despite advances in medical technology, research and improved access to resources, childbirth is not without serious risks in the developed world. The United States (U.S.) ranks 46th in the world for maternal mortality, lagging behind Kazakhstan & Libya (Patient Safety Movement Foundation, 2018). Postpartum hemorrhage is the leading cause of preventable maternal mortality (Main et al., 2015). In fact, PPH takes the lives of more women globally than any other medical condition (Nathan, 2019). This global maternal health crisis accounts for more than 140,000 deaths each year worldwide (O'Brien & Uih, 2016). Low income countries experience a lack of modern blood bank resources, effective surgical techniques, prophylactic uterotonic medications, education, infrastructure, and skilled personnel. Although the U.S. does not experience the same resource deficiencies, hemorrhage continues to contribute to mortality rates. In the U.S., there is often a failure to identify the risk factors associated with PPH and an absence of early diagnosis of hemorrhage leads to fatal outcomes (Nathan, 2019).

At a metropolitan hospital performing over 1,500 cesarean deliveries each year, PPH risk assessments were not being discussed during standard pre-procedure huddles. Upon admission to the labor and delivery unit, it is mandatory for nurses to complete the PPH risk assessment located in the electronic medical record (EMR). However, the PPH risk assessment was not being verbalized during pre-procedural huddles due to its location. A lack of preoperative, interdisciplinary team discussion of hemorrhage risk factors generated patient safety concerns warranting an intervention at the project facility.

Background and Significance

The American College of Obstetricians and Gynecologists (ACOG) defines PPH as a “cumulative blood loss greater than or equal to 1,000 mL or blood loss accompanied by signs or

symptoms of hypovolemia within 24 hours after the birth process (includes intrapartum loss) regardless of route of delivery” (Shields, Goffman, & Caughey, 2017, p. e168). PPH is reported to occur more commonly among cesarean deliveries than vaginal deliveries (Shields, Goffman, & Caughey, 2017; Seligman et al., 2017). In addition, cesarean births result in an overall increased prevalence of maternal mortality (Sandall et al., 2018). In a large study in Norway, elective and emergency cesarean deliveries were found to double and triple the risk for severe PPH, respectively (Al-Zirqi, Vangen, Forsen & Stray-Pedersen, 2008). ACOG has outlined several medical conditions which warrant cesarean deliveries including: failure of labor to progress, concern for the baby such as umbilical cord compression, multiple pregnancies, placenta disorders (abruption, previa, and accreta), breech presentation, macrosomia, maternal infections, and/or maternal medical conditions such as diabetes or hypertension (Shields, Goffman, & Caughey, 2017). A medically indicated cesarean delivery can be a life saving measure, or a necessity when complications occur. However, in middle and high-income countries there has been an increase in non-medically indicated cesarean deliveries (Boerma et al., 2018; Betrán, et al., 2016). In 2014, the U.S. contemporary cesarean birth rates were reported to exceed 1.2 million (O’Brien & Uih, 2016). A decrease in the number of cesarean deliveries is unlikely to occur due to an increased number of women having children later in life, pre existing diseases, and prior cesarean deliveries (Jardine, Law, Hogg, Murphy, & Khan, 2016).

Although PPH can be unanticipated during labor, it has been associated with a number of well-established risk factors which could be recognized prior to delivery. If risk factors are recognized, interventions can be expedited and postpartum hemorrhage can be avoided (Nathan, 2019). Women who do not have these risk factors could still experience postpartum hemorrhage, but using a risk assessment tool has been shown to identify 60-85% of women who will

experience hemorrhage (Shields, Goffman, & Caughey, 2017). Einerson, Miller, and Groberman (2014) found identifying women at risk lead to earlier interventions including the use of multiple uterotonics. Interestingly, there was an increase in the number of women experiencing PPH. This suggested that early identification of PPH lead to greater awareness and an increased accuracy of the estimated blood loss.

The importance of the identification of risk factors for PPH is multifaceted and can help improve preparedness, allow increased surveillance leading to early recognition, increase the use of preventive measures, and prepare team members to institute a prompt and aggressive response to hemorrhage (Toledo et al., 2012). A PPH risk assessment should be considered at multiple times during the patient's care including during antepartum, on admission, prior to labor and delivery, and intrapartum due to new risks developing such as chorioamnionitis or prolonged labor (Main et. al 2015).

Several obstetric care bundles with a hemorrhage risk assessment component have been developed in recent years. Research on PPH bundles that incorporate a standard risk assessment have shown improvements in identification of women at risk for complications and a reduction in the incidence of PPH (Shields, Goffman, & Caughey, 2017; Mansfield, 2018). Unfortunately, many hospitals do not have the processes in place that contain all of the elements needed to manage PPH. Bingham, Scheich, Byfield, Wilson, and Bateman (2016) performed an assessment on the PPH preparedness elements at hospitals in Georgia and New Jersey. The assessment was performed after a survey, from an academic medical center, suggested that approximately one third of the hospitals did not have PPH protocols. The study found that of the 136 hospitals, only 45 reported a routine PPH risk assessment upon admission. Performing a routine hemorrhage

risk assessment prior to a cesarean delivery could prompt the healthcare team to plan early interventions.

A “culture of huddles” is recommended throughout the literature, yet there is a lack of standard protocols to discuss PPH risk factors among the entire delivery team (California Maternal Quality Care Collaborative, 2015; Main et al., 2015). Although PPH risk assessments are often a mainstay of obstetric care bundles, some guidelines do not provide specific communication tools to help teams identify women at risk (Association of Women’s Health, Obstetric and Neonatal Nurses, 2014; Council on Patient Safety in Women’s Health Care, 2015). To facilitate team communication, Smith, Erickson, Mercer, Hermann and Foley (2015) developed a safety checklist that incorporated a risk assessment to be reviewed face to face by all delivery team members. If risk factors were identified, the team would discuss their hemorrhage management plan. In addition to improved interdisciplinary team decision making, communication and teamwork, teams were more successful in identifying women at risk for birth complications. Tools that facilitate interdisciplinary team communication can help create a shared mental model and assist in emergency management planning and preparedness before a crisis occurs.

PPH risk assessments and team debriefings were incorporated in a study by Bingham, Scheich, and Bateman (2018). While collaborating with the Association of Women’s Health, Obstetric, and Neonatal Nurses (AWHONN), the project implemented five process changes in 58 hospitals located in Washington, DC, Georgia, and New Jersey (Bingham, Scheich, & Bateman, 2018). These changes included quantifying blood loss at births, performing risk assessments at admission and before birth, as well as performing debriefings after stage two and three hemorrhages (Bingham, Scheich, & Bateman, 2018). The outcomes measured included number

of maternal deaths, blood product transfusions, massive transfusions which consisted of four or more units of packed red blood cells, peripartum hysterectomies, and admissions to the intensive care unit (Bingham, Scheich, & Bateman, 2018). While many initiatives were successful, an eighteen month timeframe was too short to implement all the process changes, because PPH outcomes are low frequency and low volume (Bingham, Scheich, & Bateman, 2018). However, improvements such as an increase in performing risk assessments upon admission and before birth were observed.

Project Aims

The primary aim is to discuss the PPH risk assessment score during pre procedure huddles before each cesarean delivery. The secondary aim is to decrease blood loss by ten percent. This will be measured by analyzing each patient's estimated blood loss (EBL) in the electronic health record. This will facilitate an increased awareness among the interdisciplinary team.

Methods

Context for Planning the Intervention

The team consisted of three student nurse anesthetists who attend the University of Pennsylvania who recognized the need for attention to the hemorrhage risk assessment prior to cesarean deliveries. The project champions included a clinical nurse specialist from the labor and delivery unit at the hospital and a doctorally prepared certified registered nurse anesthetist (CRNA). The intervention targeted all staff members that participated in the pre-procedure huddle, including attending obstetricians, residents, nurse anesthetists or anesthesiologists, nursing students, circulating nurses and scrub technicians.

Intervention

The strategy of this project is to first, incorporate the established PPH risk assessment in the EMR and second, add it to the preoperative huddle sheet. The current pre-procedure huddle sheet was reviewed (see Figure 1.). Items on the pre-procedure huddle sheet included introduction of team members, procedure name, patient name, date of birth, allergies, labs, anesthesia plan, safety concerns, necessary supplies, neonatology concerns and location for the c-section to occur. The team chose to modify the pre-procedure huddle sheet to include the PPH risk assessment tool, previously located only in the EMR. This modified huddle sheet served as the study tool (see Figure 2.). The PPH risk assessment identified patients as either average, elevated, or highest risk for PPH. It also included a reference list of criteria that placed patients into elevated or highest risk categories.

Measures

A retrospective chart review was conducted to obtain pre intervention data. Medical records from January to April 3rd, 2019 were reviewed, examining PPH risk assessment scores, patient risk factors, and EBL. The study tool was implemented from July 25th to September 30th, 2019. Preoperative huddles were randomly observed to ensure proper utilization of the study tool. Labor and delivery nurses led the pre-procedure huddle and discussed the huddle sheet. Additionally, nurses verbalized the PPH risk as either average, elevated, or highest. Post intervention data was collected from July 25th to September 30th, 2019 to compare the PPH risk assessment scores, patient risk factors, and EBL prior to intervention.

Sample population

The inclusion criteria comprised of scheduled, level 1, and level II cesarean section patients. Vaginal deliveries were excluded in this study as well as cesarean sections with blood loss not documented.

Analysis

To test the normality of distribution of the continuous variable EBL, a Shapiro-Wilk's W test was performed. Due to the non-normal distribution of this data, a Kruskal-Wallis test was used to compare the differences across the three risk groups and the Dunn's test was used for post hoc pairwise comparisons (Grove & Ciper, 2017). Changes between time periods were then examined. The pre period was defined as January 1st to April 3rd 2019 and the post period was defined as July 25th to September 30th 2019. The Mann Whitney U test was used to assess the difference in EBL within risk groups across the pre and post period (Grove & Ciper, 2017). To examine differences in the proportion of subjects in each risk group across the pre and post period, nominal level variables, a Chi square test was performed (Grove & Ciper, 2017).

Ethical Consideration

In June 2019, the Human Subjects Electronic Research Application (HS-ERA) for the University of Pennsylvania's Institutional Review Board (IRB) was completed. Exemption was granted because the project did not meet criteria for human subject research. There were no ethical concerns during the implementation of this quality improvement initiative.

Results

There were a total of 575 parturients in the study with 297 in the pre intervention and 278 in the post intervention groups. We compared overall blood loss between pre and post intervention groups using the Mann Whitney U test. There was a significant increase in blood loss from a median of 800 milliliters (mL) in the pre period to 1000 mL in the post period ($p=0.006$). Chi-square tests indicated no difference in the proportion of patients screened between pre and post intervention groups, see Table 1.

Overall blood loss was examined across the three risk groups (average, elevated and highest) of both pre and post intervention groups (n=575) using the Kruskal-Wallis test ($p < 0.001$). Post hoc pairwise comparisons found the median blood loss of individuals at highest risk was 1000 mL. This was 100 mL higher than those at elevated risk, who had a median blood loss of 900 mL ($p < 0.001$). The difference in median blood loss between those at average risk, which was 800 mL, and highest risk was also statistically significant ($p < 0.001$), as shown in Table 2. However, when stratified by pre and post groups the distribution of EBL was statistically similar between average and elevated risk in the pre intervention group. Clinicians consistently documented the greatest amount of blood lost among patients in the highest group as evident in the significant post hoc test. This found that the median blood loss was 200 mL higher in the highest group compared to either average or elevated risk groups, as shown in Table 3. In the post period, the distribution of EBL significantly differed between risk groups with clinicians estimating the least amount of blood lost in the average risk group compared to the highest risk group, refer to Table 4.

Due to the non-normal distribution of the data, Mann-Whitney U tests were used to compare differences in median EBL, within each risk category, between pre and post groups. There were statistically significant differences in EBL within the highest risk assessment category between pre and post groups ($p = 0.0331$). There was no difference in other risk groups EBL across pre and post periods, see Table 5.

Discussion

Summary interpretations

Overall there was a statistically significant increase in blood loss between pre and post intervention groups. If the study tool increased awareness of patients at risk of PPH, this increase

in blood loss may reflect an improvement in blood loss estimations. This may have resulted in a more precise documentation of EBL, rather than an actual increase in blood loss. Despite an increase in blood loss overall, when the groups are stratified into subcategories of average, elevated and highest risk, there is a statistically significant difference in blood loss within the highest risk category ($p=0.0331$) (see Figure 3). However, the median EBL increased in the elevated risk group from 800 mL in the pre intervention group to 1000 mL in the post intervention group. Additionally, the upper limit of the interquartile range (IQR) increased in the highest risk group, from 1200 mL to 1500 mL, from pre to post intervention groups. This may reflect better utilization of the PPH tool itself. Additionally, documentation may have become more accurate in the post group with nurses capturing more precise and more elevated levels of blood loss. However, future studies will need to examine these relationships more in depth, beyond the scope of this project.

Limitations

This project was implemented at one facility. Therefore, it cannot be generalized to other hospitals in different locations and with different populations. Pre-procedure huddles may have been influenced by the Hawthorne Effect, because clinicians were aware of our presence during implementation of the study tool. Patients who did not have an EBL recorded in their chart were excluded from the project, which could have influenced the results. Since project team members could not be present for all pre-procedure huddles (i.e. evenings, weekends, holidays, etc) we cannot know for sure if the study tool was properly utilized during every pre-procedure huddle. Another limitation is EBL can be subjective and can vary from clinician to clinician.

Conclusion

Prevention of PPH begins with increased awareness and recognition. Despite a lack of statistical significance among the results, this project prompted the discussion of the PPH risk assessments through an interdisciplinary team approach. Even though there was not a decrease in overall blood loss, it created more awareness among the healthcare team to those at higher risk for hemorrhage. The intervention was well received by all staff members on the labor and delivery unit. A new safety huddle sheet was created based on recommendations from the literature. While our data collection has ended, the safety huddle sheet continues to be utilized by staff members to facilitate conversations regarding PPH risk stratification. This sustainable intervention has become part of unit policy at the project facility.

Recommendations for future quality improvement projects include implementing an intervention such as uterine administration to those patients in the elevated and highest risk categories. Additionally, replicating this project using a larger sample size and over a longer period of time could produce more robust results.

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Table 1

Estimated Blood Loss (EBL) within Each Risk Assessment Category Across Time Periods

	Pre	Post	P Value
n	297	278	
EBL, mL, median	800	1000	0.006
	[800, 1000]	[800, 1038]	
n (%)			0.446
Average Risk	72 (24.2)	66 (23.7)	
Elevated Risk	151 (50.8)	130 (46.8)	
Highest Risk	74 (24.9)	82 (29.5)	

Note. Interquartile ranges are in brackets.

Table 2

Estimated Blood Loss(EBL) of Each Risk Group: Pre & Post Intervention

	Average	Elevated	Highest	P Value
n	138	281	156	<0.001
EBL, mL, median	800	900	1000	
	[800,1000]	[800,1000]	[800,1400]	

Note. Interquartile ranges are in brackets.

Table 3

Estimated Blood Loss (EBL) of Each Risk Group: Pre Intervention

	Average	Elevated	Highest	P Value
n	72	151	74	0.003
EBL, mL, median	800	800	1000	
	[750, 1000]	[800, 1000]	[800, 1200]	

Note. Interquartile ranges are in brackets.

Table 4

Estimated Blood Loss(EBL) of Each Risk Group: Post Intervention

	Average	Elevated	Highest	P Value
n	66	130	82	<0.001
EBL, mL, median	800 [800, 1000]	1000 [800, 1000]	1000 [800, 1500]	

Note. Interquartile ranges are in brackets.

Table 5

Comparison of Estimated Blood Loss (EBL) Within Each Risk Group

	Pre	Post	P Value
Average			0.1084
n	72	66	
EBL, mL median	800 [750, 1000]	800 [800, 1000]	
Elevated			0.9778
n	151	130	
EBL, mL median	800 [800, 1000]	1000 [800, 1000]	
Highest			0.0331
n	74	82	
EBL, mL median	1000 [800, 1200]	1000 [900, 1500]	

Note. Interquartile ranges are in brackets.

Figure 1. OR Pre-Procedure Huddle Sheet

Pennsylvania Hospital
Penn Medicine

Patient Sticker

OR Pre-Procedure Huddle

Required Personnel: Attending OB; OB Resident;
Anesthesia/CRNA; Circulating RN; OB Scrub Tech


Information to be Reviewed:

- Begin with Introductions of team members
- Procedure/Indication for C/S (primary/repeat/BTL/LARC)
- Patient name & DOB
- Gestational Age
- Allergies
- Pertinent medical history
- Tubal or Birth control plan
- Labs (CBC, T&S)
- Consents signed- Attending performing procedure signed consent or documented in chart
- Anesthesia plan
- Safety Concerns/Special Equipment/Supplies needed
- Neonatology concerns (when should RN call peds)
- Has a case been created?
- Location for c/section to occur

Please place in PACU bin when completed.

Figure 1. Pre-procedural huddle sheet prior to modification.

Figure 2. Revised OR Pre-Procedural Huddle Sheet



Patient Sticker

OR Pre-Procedure Huddle

Required Personnel: Attending OB; OB Resident; Anesthesia/CRNA; Circulating RN; OB Scrub Tech

Information to be Reviewed:

- Begin with introductions of team members
- Procedure/Indication for c/s (primary/repeat/BTL/LARC)
- Patient name & DOB
- Allergies
- Pertinent medical history
- Tubal or Birth Control plan
- Labs (CBC, T&S)
- Consents signed- Attending performing procedure signed consent or document in chart
- Anesthesia Plan
- Safety Concerns/Special Equipment/Supplies Needed

- Hemorrhage Risk Assessment
 - Average= 0
 - Elevated= 1
 - Highest= 2
- Neonatology Concerns (when should RN call peds)
- Has a case been created?
- Location for c/section to occur

Elevated Risk	Highest Risk
Prior c-section/uterine surgery	Placenta previa
Multiple Gestations	Suspected accreta / percreta
Polyhydramnios	Platelets < 50K
EFW > 4000 grams	Hgb < 9
Hx of Postpartum hemorrhage	Known coagulopathy
Chorioamnionitis	Active bleeding (> bloody show)
Oxytocin administration >24 hr	
Achievement of 40u/min oxytocin	
Operative vaginal delivery	
Significant myomas	
Retained placenta	
Prolonged 2 nd stage	
Magnesium sulfate administration	
Vasa previa	

Please place in PACU bin when completed

Figure 2. Pre-procedural huddle sheet after modification, which includes the hemorrhage risk assessment.

Figure 3. Comparison of Estimated Blood Loss (EBL) within Each Risk Assessment

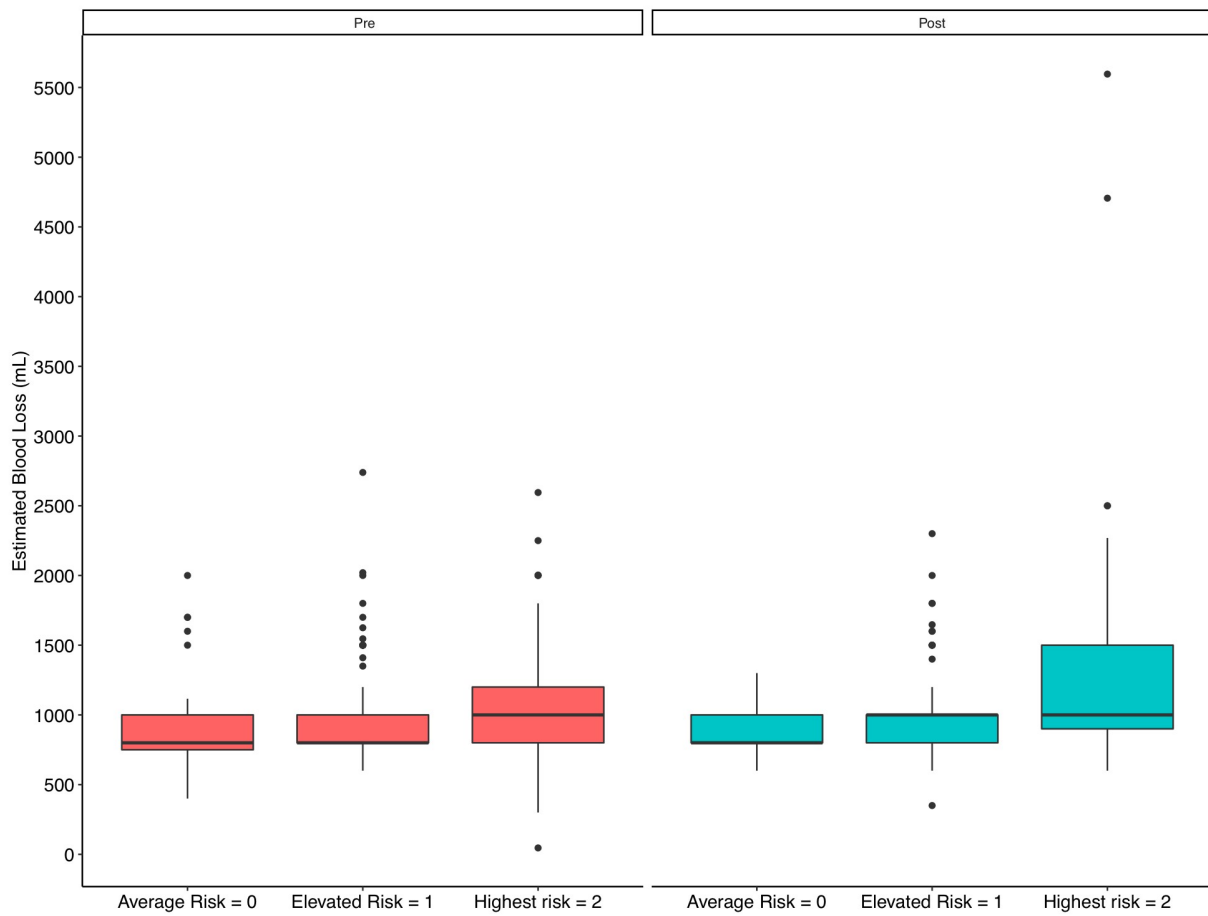


Figure 3. Comparison of EBL within each risk assessment category. When the groups are stratified into subcategories of average, elevated and highest risk, there is a statistically significant increase in blood loss within the highest risk category in the post group (p=0.03).

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