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RESEARCH ARTICLE

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Prevention and Treatment of Postpartum Hemorrhage

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ABSTRACT

Background: Postpartum hemorrhage (PPH) is the primary cause of global maternal mortality and accounts for roughly one-quarter of all maternal fatalities globally. Prevention of excess maternal mortality needs a coordinated strategy to prevention, early identification, and intervention by a multidisciplinary team.

Aim of work: To explore the prevention and treatment strategies of postpartum hemorrhage.

Methods: Using the following search keywords, we performed a thorough search of the electronic literature in the MEDLINE database: prevention, treatment, management, postpartum, hemorrhage. To find relevant literature, the search was limited to articles from 2014 and 2023. We looked through scholarly articles related to my topic by doing a search on Google Scholar. Certain inclusion criteria influenced the articles that were chosen.

Results: The study's analysis included papers that were published between 2014 and 2023. The research was divided up into several parts, each having a header for the discussion portion.

Conclusion: Postpartum hemorrhage is a major cause of maternal death globally, making it crucial for healthcare teams to prevent, identify, and initiate non-surgical interventions within the first hour. An organized work structure in healthcare facilities is necessary for effective therapeutic treatment. Risk stratification and patient management challenges can be reduced by

identifying risk factors and optimizing pregnancy, labor, and postnatal care. Standardized procedures like oxytocin administration, active labor management, accurate blood loss estimation, and consistent diagnosis and treatment are essential. The primary challenges in reducing morbidity and mortality from postpartum hemorrhage include recognizing women's lives, developing local healthcare systems, and implementing programs to prevent maternal deaths.

Keywords: prevention, treatment, management, postpartum, hemorrhage.

INTRODUCTION

Obstetric hemorrhage is the leading cause of maternal mortality and bleeding after childbirth. About 25% of maternal deaths worldwide and 66% of instances of obstetric hemorrhage are caused by postpartum hemorrhage (PPH). There is disagreement about what constitutes PPH; some suggest that blood loss volumes more than 500 or 1000 mL might be indicative of either standard or severe PPH (World Health Organization, 2021). Pregnant women in otherwise excellent health usually don't notice much of a physiological shift in reaction to this level of blood loss. More appropriate clinical definitions, like persistent postpartum hemorrhage (PPH), are suggested by certain medical professionals (Abdul-Kadir ET AL., 2015). PPH is defined as continuous active bleeding exceeding 1000 mL within 24 hours of giving birth, even after first-line uterotonic therapy and uterine massage have been used.

Maternal fatalities are only a small part of the larger effect that significant bleeding has on maternal health. Women who have a life-threatening hemorrhage but do not succumb to PPH may encounter enduring health issues such as infertility and psychological distress. While the majority of women experiencing severe PPH reside in countries with poor economic resources, it is important to note that PPH and its associated consequences may impact women in any socioeconomic context. According to research conducted by Corbetta-Rastelli et al. (2023), data

from the United States indicate a rise in the incidence of severe PPH. Health care environments that are well-equipped with abundant resources, including trained practitioners, pharmaceuticals, and blood banks, provide the most favorable conditions for delivering optimum care to women. Early identification of atypical postpartum hemorrhage and timely mobilization of relevant personnel and resources are crucial in any healthcare environment to swiftly control bleeding and reduce the risk of complications and death.

Instead of being seen as a diagnosis in and of itself, PPH should be understood as a clinical sign of one or more underlying illnesses that need diagnosis and treatment. The "4 T's" (tone, tissue, trauma, and thrombin) are commonly referred to as the limited differential diagnosis, which includes uterine atony, retained placenta, and placental malimplantation (previa, accreta, increta, or percreta), in addition to genital tract trauma or coagulopathy (Schwendemann and Watson, 2021). Some women may develop risk factors for PPH during pregnancy or may already have them while going through labor and delivery. Pregnant patients who have been identified as having risk factors need to get treatment in an appropriate medical facility with a blood bank and staff who have received proper training. Preventive steps should be done during labor and delivery to lessen the chance of PPH and to treat it as soon as it happens. However, it is imperative that all workers who are in charge of women's health during labor and delivery be aware that most women who have severe PPH did not have any known risk factors prior to giving birth. As such, maintaining a high level of alertness is crucial. Throughout labor and delivery, it's critical to periodically assess the risk factors (Nyfløt et al., 2017).

Aim of work:

To explore the prevention and treatment strategies of postpartum hemorrhage.

METHODS

We performed a thorough search using particular keywords like prevention, treatment, management, postpartum, hemorrhage, on reputable scientific platforms like Pubmed and Google Scholar. The goal was to include every relevant study articles. A set of criteria was used to choose the articles. After a thorough examination of the noteworthy titles and abstracts of every publication, we excluded case studies, duplicate papers, and publications without complete information. The research's reviews were published between 2014 and 2023.

RESULTS

The current investigation concentrated on prevention and treatment of postpartum hemorrhage between 2014 and 2023. As a result, the review was published under many headlines in the discussion area, including: Prevention of PPH, Diagnosis of PPH, Initial treatment measures of PPH, Pharmacological treatment of PPH, Intrauterine balloon tamponade for PPH, Hemostatic resuscitation management of PPH.

DISCUSSION

During pregnancy, the overall amount of blood in the body increases to around 5 to 7 liters, which is equivalent to 70-80 milliliters per kilogram of lean body mass. During pregnancy, the blood flow to the uterine arteries increases to around 500 to 600 mL per minute, compared to its usual level of 10 to 15 mL per minute outside of pregnancy (Gaidai, 2015). Following the expulsion of the placenta, the muscles of the uterus contract, essentially stopping the flow of blood from the area where the uterus and placenta were connected. Uterine atony, the presence of residual placental tissue, and aberrant placental implantation hinder the normal functioning of

the uterus in successfully completing this essential mechanical process of stopping bleeding. Due to the significant blood flow to the uterine arteries, it is evident how quickly a substantial amount of blood may be lost within a few period (Ifeadike et al., 2018).

The most efficient approach to avoid hypovolemic shock is to promptly manage the bleeding location. The concept of the "golden hour in obstetrics" has been established to describe a strategy for promptly managing the site of bleeding within one hour of its identification (Acho et al., 2019). It is important to be aware that in cases of excessive bleeding, prompt intervention is necessary to prevent severe consequences in the mother. To prevent the lethal triad of hemorrhagic shock (consisting of hypothermia, acidosis, and coagulopathy), it is crucial to adopt a proactive, efficient, and well-structured strategy without any delay (Alves et al., 2020). Therefore, it is crucial to establish a connection between the golden hour and the existence of a warning and response system for PPH.

Prevention of PPH

The extent of morbidity and death associated with PPH underscores the need of preventing it and identifying its risk factors. Anemia and hypertensive disorders are notable among the several risk factors associated with it. Utilizing risk stratification is an effective approach to decrease maternal mortality caused by postpartum hemorrhage (PPH). The high-risk variables include placenta previa or low-lying placenta, preeclampsia with severe symptoms, hematocrit levels below 30%, platelet count below 100,000/mm3, active bleeding upon admission, coagulopathies, use of anticoagulants, placental abruption, and placenta accrete (Lertbunnaphong et al., 2016).

The primary preventative interventions for PPH are the injection of oxytocin and the active management of the third stage of labor. The optimal preventative oxytocin regimen involves

administering 10 units of oxytocin intramuscularly shortly after childbirth. For cesarean delivery, an additional option is intravenous prophylaxis using the "rule of three". This involves slowly infusing three units of oxytocin, which may be repeated at three-minute intervals until the third dosage is administered. It is essential to constantly follow this protocol with a maintenance intravenous infusion. The infusion should consist of 15 units in 500 mL of 0.9% saline, administered at a rate of 100 mL per hour. The active management of the third stage of labor involves promptly clamping the umbilical cord within one to three minutes and performing controlled traction on the cord (known as the Brandt-Andrews technique). Additionally, it includes maintaining skin-to-skin contact between the mother and baby for a minimum of two hours and monitoring/massaging the uterus during the first two hours following delivery. Additional preventative methods include the judicious use of oxytocin during delivery, the cautious implementation of episiotomy, and the absolute prohibition of the Kristeller procedure (Gonzalez-Brown et al., 2020).

Diagnosis of PPH

According to the most recent definition, PPH may be diagnosed based on a cumulative volume of 1,000 mL, regardless of the mode of delivery (Shields et al., 2017). Nonetheless, blood losses during vaginal deliveries above 500 mL should be considered abnormal, especially when paired with risk factors. Massive hemorrhage is defined as losses more than 2,000 mL, whereas losses over 1,000 mL are classified as severe PPH. The majority of severe hemorrhages result in coagulopathy, a substantial drop in hemoglobin levels of at least 4 g/dL, and the need for several blood transfusions (No, 2016). Hematimetric indicators, including hematocrit and hemoglobin, decline later and could not correctly reflect the state of the patient's hematopoiesis at the moment. They are clinically limited since they show blood loss within four hours after the onset

of bleeding (Liu et al., 2017). Moreover, especially in healthy pregnant women, prenatal hypervolemia delays the onset of hypovolemic shock's first symptoms. Hemodynamic changes only happen when blood volume losses above 20% to 30%, or 1,500 to 2,000 mL. It is essential to start treatment right once and without delay in light of the clinical signs of significant blood loss (Alves et al., 2020).

Measuring the weight of compresses, surgical packs, sheets, and other materials used in delivery care is beneficial, particularly in cases of postpartum hemorrhage associated with cesarean sections and hysterectomies. Nevertheless, it requires familiarity and uniformity about the dimensions and mass of the inputs. The blood loss in milliliters may be determined by measuring the difference in weight between the blood-containing inputs and their dry weight, using 1 mL of blood and 1 g of weight as equivalents (Hazarika et al., 2022). The estimation obtained by using collecting devices positioned below the buttocks immediately after vaginal birth is considered more dependable than other methods, despite the possibility of occasional inaccuracies. This is due to the inclusion of blood samples that include amniotic fluid and urine (Lertbunnaphong et al., 2016).

Clinical measures, such as blood pressure and heart rate, serve as valuable indicators for assessing the severity of shock, evaluating the effectiveness of treatment, and deciding the need for further medications. The shock index is a supplementary tool used to assess the amount of fluid loss and identify early signs of unstable blood flow. It provides valuable information on the likelihood of requiring a blood transfusion and the necessity for transferring the patient to a higher level of care. The calculation is determined by dividing the heart rate by the systolic blood pressure. Values equal to or more than 0.9 suggest a substantial amount of blood loss, whereas values equal to or greater than 1 (heart rate higher than systolic blood pressure) indicate the need

for a rapid and forceful intervention, and the potential need for a blood transfusion. Values ranging from 1.3 to 1.7 (indicating moderate shock) and beyond 1.7 (indicating severe shock) suggest the necessity to evaluate the need for a large-scale blood transfusion (Tanacan et al., 2020).

Initial treatment measures of PPH

When a diagnosis of PPH is made, it is essential for the whole care team to have a comprehensive understanding of the treatment protocols based on the underlying reasons and be capable of implementing them. It is crucial to determine the cause of the bleeding and assess the severity of the problem as part of the medical treatment process. The primary factors contributing to postpartum hemorrhage (PPH) include uterine atony, birth canal lacerations, placental abnormalities, and coagulopathy. These factors are often referred to as the four Ts: tone, trauma, tissue, and thrombin. Each of these factors necessitates a distinct method for management (Lertbunnaphong et al., 2016).

Irrespective of the underlying reason, it is crucial that the whole team be well-acquainted with the basic protocols of treatment. The first phase involves effectively conveying the diagnosis and coordinating the interdisciplinary team. To ensure proper handling of the situation, it is necessary to obtain a hemorrhage kit and designate a team member to communicate with and guide the patient and their companions. It is essential for auxiliary workers to have a clear understanding of their responsibilities and carry them out concurrently. A team should be led by a member who ensures that activities are executed. To minimize bleeding, bimanual uterine compression is performed using either the Hamilton maneuver (for patients under anesthesia or with higher tolerance) or the Chantrapitak technique (Lertbunnaphong et al., 2016).

The main responsibility of an assistant is to continuously observe the patient in order to calculate the shock index. Two more assistants will set up two large venous entry points (Jelco 14 or 16), which will allow for the collection of blood samples and the administration of medications and crystalloids. Blood type (if not previously performed), cross-matching, total blood count, coagulogram, fibrinogen, ionogram, clot test (Wiener), and, in dire circumstances, lactate and blood gas analysis are further tests that have to be taken into consideration. Use a 100% oxygen face mask to provide oxygenation at a rate of 8 to 10 liters per minute. A urinary catheter was inserted, the lower limbs were raised, the new mother was warmed up, the efficacy of antibiotic prophylaxis was assessed, the amount of blood loss was estimated, and the source of the bleeding was promptly identified by looking into the birth canal and locating any bleeding sources. The method of treating bleeding should be determined by the underlying reason. The early stages might include the use of a non-pneumatic anti-shock garment (NASG), if available. Then, to ascertain if a blood transfusion is required, the volume decrease and its effect on blood flow are reassessed (Alves et al., 2020).

Pharmacological treatment of PPH

The first administration should consist of oxytocin and tranexamic acid. Tranexamic acid should be given at a dosage of 1 gram, mixed with 100 mL of 0.9% saline solution. If bleeding is not under control, the administration may be repeated after 30 minutes. If bleeding reoccurs within 24 hours following the first delivery, an additional dose of 1 gram may be administered. Uterotonic infusion regimens exhibit variability. It is recommended to start with a gradual infusion of 5 units of oxytocin over a period of three minutes, followed by administering 20 to 40 units of oxytocin in 500 ml of saline at a rate of 250 ml per hour. The recommended approach is to provide a sequential maintenance schedule at a rate of 125 mL/h for a duration of four hours.

For the most extreme instances of uterine atony, it is advisable to administer oxytocin continuously for a period of 24 hours at a rate of 67.5 mL/h or 3 units/h. However, caution should be used to monitor for the risk of water intoxication (Lertbunnaphong et al., 2016; Drew and Carvalho, 2021).

Considering the insufficient reaction to oxytocin, it is required to provide various uterotonics in a sequential manner. It is important to make a choice within 15 minutes, since these medications have a rapid onset of action. If there is no arterial hypertension or usage of protease inhibitors, methylergometrine (0.2 mg given into the muscle) should be the second medication used to stimulate the uterus, and it may be repeated after 20 minutes. The last uterotonic agent is prostaglandin. The recommended dosage for misoprostol is 800 to 1,000 mcg when administered rectally or 600 mcg when administered sublingually (Lertbunnaphong et al., 2016).

The primary cause of PPH is uterine atony, which is the target of this pharmacological regimen. To rule out other reasons (such as birth canal lacerations, uterine rupture or inversion, placental remains, or coagulopathies), the clot test and delivery canal examination should be performed concurrently with its establishment. These conditions can be treated with laparotomy for repair or hysterectomy for uterine rupture, uterine curettage for placental remains, sutures for birth canal lacerations, uterine repositioning maneuver for uterine inversion, and transfusion of blood components for coagulopathies (Lertbunnaphong et al., 2016).

Intrauterine balloon tamponade for PPH

When pharmaceutical treatment fails to relieve uterine atony, the primary indication for an intrauterine balloon tamponade (UBT) is presented. Since achieving transitory hemostasis is another goal of tamponade, patients with coagulopathy who need specialized therapy or those

who will be sent to referral facilities might benefit from the temporary use of balloons. Pregnancy, internal genital infections, uterine cavity abnormalities, uterine rupture, allergy to balloon components, and arterial bleeding necessitating embolization or surgical therapy are the primary contraindications (Kong and To, 2021).

The UBT may or might not be able to hemostasis. Preoperative procedures include cleaning the vulva, vagina, and cervix, inserting a urinary catheter, and inspecting the vagina and cervix in order to put the device into the vagina after delivery. The intrauterine balloon may be introduced manually, with the use of Foerster forceps, or under the guidance of pelvic ultrasonography after the anterior lip of the uterine cervix has been clamped. It is advised to secure the balloon before infusion, preferably using vaginal compresses. As an alternative, fixation may be accomplished by securing the cervix's edges using vascular clips or clamps or by employing cervix sutures. The balloon is then filled with saline solution once it has been fastened. 350 to 500 mL is the recommended infusion volume after vaginal delivery. It is crucial to confirm the permeability of a drainage system by performing a gentle infusion to make sure there are no obstacles before attaching it to a collecting bag. Suarez et al. (2020) advocate administering antibiotic prophylaxis, especially cephalosporin, along with a maintenance dose of oxytocin throughout the tamponade phase.

The tamponade test assessment starts after the infusion. A favorable prediction of effective tamponade is made if the drainage reveals less than 50 mL within 30 minutes of infusion. Thus, the tamponade test is optimized when balloons with a drainage function are used (Phillips et al., 2023).

One may inject the balloons either during or after a cesarean procedure. In these circumstances, a smaller infusion volume (250–300 mL) is recommended to prevent dehiscence during

hysterorrhaphy. It resembles the vaginal postpartum when the balloon implantation is carried out after the cesarean surgery. It is preferable to introduce the balloon during a cesarean section via the abdominal route (by hysterotomy); this is more challenging with balloons that have three ways. Applying straps to compress the three-way and attaching a flexible probe to the balloon axis—adapting the probe as a guide so the balloon underpasses through the cervical canal—will help overcome this challenge. Using a surgical forceps to enter the uterus via the vaginal entrance is an additional option. Using forceps, the balloon axis is gripped and drawn into the vagina. The balloon will be placed vaginally if these methods prove ineffective (Overton et al., 2023).

The duration of the UBT may extend for a maximum of 24 hours. Nevertheless, if there is effective management of bleeding and stable blood flow, it is recommended to remove the object promptly (Einerson et al., 2017). It is advised to gradually decrease inflation (by 100 mL every 15 minutes) throughout the day in a dedicated operating room, while maintaining an infusion of oxytocin. If there is a hemorrhagic recurrence during the removal procedure, the UBT (uterine balloon tamponade) should be reintroduced and the patient should be prepared for laparotomy (Butwick et al., 2020).

Hemostatic resuscitation management of PPH

Hemorrhagic shock affects around 0.6% of newborns and requires hemotherapy. In birthing facilities, it is essential to comprehend the principles of hemostatic resuscitation and to have a well-established big blood transfusion protocol that includes emergency transfusion protocols (Liu et al., 2021). Promptly addressing coagulopathy and hypothermia is as important as stopping bleeding and restoring tissue perfusion in the treatment regimen for hemorrhagic shock.

Lower temperatures aggravate coagulopathy by decreasing tissue oxygen perfusion and promoting acidosis (Liu et al., 2021).

The response in volume resuscitation has to be evaluated after each 500 mL of infused crystalloid. Prior to surgically controlling the hemorrhagic focus, rapid and excessive infusion of crystalloids can raise blood pressure. This can have paradoxical effects, such as promoting hypothermia (the consumption of cold liquids), increasing bleeding (the destruction of formed clots), and diluting coagulation factors, which raises the risk of dilutional coagulopathy and the progression to the deadly triad. Immediately after receiving 1,500 mL of crystalloids, patients who are hemodynamically unstable should be assessed for a possible blood transfusion, particularly if there is ongoing bleeding. Blood components should be used to sustain resuscitation after 2,000 mL of crystalloids have been infused (Schol et al., 2021). The shock index may be used to anticipate when a blood transfusion will be necessary. In the early stages of hemostatic resuscitation, Hb and Ht measures are useless since they fluctuate slowly (Schol et al., 2021).

The many transfusion protocols that are now in use were developed based on research done on trauma patients. When organizing hemostatic resuscitation, it is important to consider the early onset of hypofibrinogenemia in PPH. A 100% positive predictive value for fibrinogen indicates severe PPH at values less than 200 mg/dL. As a result, treating hypofibrinogenemia requires a proactive approach (Zaidi et al., 2020).

The patient's clinical status—specifically, the shock index—should be the first factor considered when deciding whether to start a blood transfusion. The transfusion goals and the ratios of blood component utilization must be included in the protocols. When initial fluid replacement with crystalloids does not result in any clinical improvement, hemostatic resuscitation is often

necessary. Patients who have lost a significant amount of blood and are having unstable hemodynamics should get two units of red blood cell concentrates very away. If crossmatching is not possible, it is advised to provide O negative blood for transfusions. Blood transfusions are often not necessary in situations with mild shock (defined as having a severity level of 1 or above). Nonetheless, blood that is compatible with the recipient's blood type must be used for the transfusion if it is determined to be necessary. In cases of severe shock (SI> 1.7), a large-scale transfusion of equal parts red cell concentrate, cryoprecipitate, fresh frozen plasma, and platelets must be administered. Evaluating fibrinogen levels is essential, and viscoelastic testing may assist reduce the need for blood components if at all feasible. Hemoglobin levels over 8 g/dL, fibrinogen levels between 150 and 200 mg/dL, platelet counts above 50,000/mm3, and an international normalized ratio (INR) of less than or equal to 1.5 are among the treatment goals (Zaidi et al., 2020).

CONCLUSION

Given that postpartum hemorrhage is the primary factor contributing to maternal death globally, it is crucial for healthcare teams to possess the capability to prevent, identify, and initiate non-surgical interventions within the critical first hour. The need to implement various activities simultaneously for the effective therapeutic treatment of postpartum hemorrhage supports the necessity of an organized work structure in healthcare facilities. In order to decrease the likelihood of complications and illness resulting from postpartum hemorrhage, it is essential to include risk stratification into healthcare services and alleviate challenges in patient management via the prompt identification of risk factors and the optimization of pregnancy, labor, and postnatal care. Prophylactic administration of oxytocin, active management of the third stage of labor, accurate estimation of blood loss, and consistent diagnosis and treatment are essential

procedures that care teams should provide in a standardized and uniform way. The presence of UBT, and blood components, together with the expertise and proficiency of healthcare professionals in their proper use, enhance the care requirements for an effective non-surgical treatment of postpartum hemorrhage. The primary challenges in reducing morbidity and mortality from postpartum hemorrhage are the recognition and appreciation of women's lives, the development of local healthcare systems, and the implementation of programs aimed at preventing maternal deaths. These programs should focus on enhancing the skills of healthcare professionals and removing obstacles to accessing care.

RECOMMENDATIONS

- To determine the placental position, every pregnant woman who has had a prior cesarean section should get an ultrasound scan. Placental dopplerfluxometry and the examination of other ultrasonography indicators of placenta accreta are recommended in cases of placenta previa. When there is a possibility of parametrial invasion in the placenta previa situated on the posterior wall, an inquiry may benefit from the use of nuclear magnetic resonance or three-dimensional ultrasonography. These expectant mothers need to give birth at a tertiary facility.
- The primary method of preventing postpartum hemorrhage involves actively managing the third stage and injecting 10 units of oxytocin intramuscularly as soon as the baby is delivered.
- In cases of postpartum hemorrhage, the order of care should be as follows: calling for assistance, carrying out a uterine compression maneuver, quickly determining the cause, preserving tissue perfusion and oxygenation, securing large venous access points for the

collection of blood samples and requesting laboratory testing, replacing blood volume, administering uterotonics and tranexamic acid, assessing the effectiveness of antibiotic prophylaxis, and estimating blood loss.

- Visual evaluation, weighing surgical compresses, using collection devices, or clinical procedures may all be used to evaluate blood loss.
- If hypovolemic shock is moderate or severe, transfusion of blood components is needed and volume resuscitation with crystalloids should not exceed 2,000 mL. Patients who have had severe blood loss and are hemodynamically unstable should undergo an emergency transfusion of two red cell concentrates. If crossmatching is not available, O negative blood should be transfused.
- With certain volumes of infusion, the intrauterine balloon tamponade may be used during or after a cesarean section as well as following vaginal birth. Balloons that have a drainage function should be chosen, depending on the results of the tamponade test. It is recommended to provide uterotonics and antibiotics for the duration of the tamponade period. After hemodynamic stability, the balloon should be taken out using a designated operating room and a phased deflation.

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