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Anesthetic Management of Postpartum Hemorrhage

Djoni Kusumah Himsani Pohan*
Medical Faculty
Universitas Jenderal Achmad Yani
Cimahi, Indonesia
*djoni.kusuma@fk.unjani.ac.id

***Abstract*—Postpartum haemorrhage (PPH) is a leading cause of maternal morbidity and mortality in the world. It requires a higher level of standard care. Peripartum haemorrhage is bleeding that occurs during pregnancy (antepartum), at birth (intrapartum) and after birth (postpartum). Management of postpartum haemorrhage should be done with multidisciplinary approach including determining the cause of PPH, close observation of vital signs, and intravenous access with a minimum of one large bore. Hemodynamic condition should be stabilized first. In 2020, WHO officially stated COVID-19 as a pandemic which requires the use of suitable Personal Protective Equipment (PPE) depending on the condition. When the diagnosis of PPH is made, prompt resuscitation with administration of crystalloid, colloid, oxygen therapy, and protection against hypothermia, obtaining initial blood sample. Pharmacological therapy includes oxytocin IV or IM, sulproston and carboprost as the effective and recommended drugs. Blood transfusion is required.**

Keywords—anesthetic managements, covid-19, obstetric anesthesia, postpartum hemorrhage

I. INTRODUCTION

Postpartum haemorrhage (PPH) remains as the leading cause of maternal morbidity and mortality worldwide [1] which requires a higher level of standard care. Peripartum haemorrhage is bleeding that occurs during pregnancy (antepartum), at birth (intrapartum) and after birth (postpartum).

Approximately 3-5% of women in labour experiences postpartum haemorrhage. About 50-60% is due to atony of the uterus, 16-17% due to residual placenta, 20-30% due to placental retention, 4-5% due to laceration of birth canal, and 0.5-0.8% due to coagulopathy [2,3].

Early detection of risk factors needs to be done for PPH to be handled properly and as quickly as possible. Providing education and explanation regarding the risk of peripartum bleeding as well as counselling related to the choice of place of delivery is important to improve welfare and reduce the risk of death both for the mothers and the babies.

Based on the 2016 Indonesian Demographic and Health Survey (IDHS), the Maternal Mortality Rate (MMR) in Indonesia is still classified as high, namely 359 per 100,000 live births. It is still far from the MDGs target of 102 per 100,000 live births [4,5].

On March 12th, 2020, WHO officially announced that COVID-19 was a pandemic. According to The Great Indonesian Dictionary, a pandemic is a plague that simultaneously affects the community and spreads to several countries or regions in the world. The current pandemic is the COVID-19 pandemic which is caused by the SARS-COV-2 Virus. Transmission mainly occurs from symptomatic or asymptomatic people to others in close contact through droplets, direct contact with infected people, or contact with contaminated objects and surfaces [6].

Patients who are positive for COVID-19 may have more problems if bleeding occurs. For COVID-19 patients with intrapartum and postpartum haemorrhage, blood transfusions will become more difficult. Therefore, prevention of postpartum haemorrhage in COVID-19 patients takes precedence over patients with non-COVID-19. It should also be noted that the Personal Protective Equipment (PPE) used is divided into 3 levels.

TABLE I. COVID-19 RISK STRATIFICATION IN PREGNANT WOMAN [7]

Low Risk	-Fever (-) or (+) -Respiratory symptoms (such as shortness of breath or cough) (-)
Moderate Risk	-Fever (+) -Respiratory symptoms (such as shortness of breath or cough) (+) -Without travel history to foreign countries or regions with local transmission within 14 days, and -Without a history of contact with patient under surveillance or confirmed cases.
High Risk	Fever (+) -Respiratory symptoms (such as shortness of breath or cough) (+) -With travel history to foreign countries or regions with local transmission within 14 days, and -history of contact with the patient under surveillance or confirmed case, or -Newly confirmed

Level 1 PPE corresponds to the routine PPE. Level 2 PPE is used by officers connected to or on duty in the COVID-19 room. While health workers who directly treat COVID-19 patients use PPE level 3 [7].

It is important to know that every patient who will be examined and receive medical treatment by health workers during this pandemic must be considered positive for COVID 19 until proven negative.

Blood loss of more than 500 mL after spontaneous delivery or more than 1000 mL after caesarean delivery within 24 hours were defined as primary PPH. In clinical guidelines, any abnormal bleeding after delivery should be suspected as PPH because assessment of blood loss is usually inaccurate [1].

The cause of postpartum haemorrhage is known as the term or mnemonic which is widely known as 4T, namely Tonus, Tissue, Trauma, and Thrombin [8].

A. Tonus

Abnormalities in uterine tone includes uterine atony, a condition in which the uterine muscles (myometrium) fail to contract during the 3rd stage of labour. This condition may cause massive blood loss in a short time. The exact cause of contraction dysfunction in the uterus remains unknown clearly. There are several risk factors associated with uterine atony, including multi-parity, uterine overdistention, intraamniotic infection, fatigue of uterine muscles. The use of drugs that may cause relaxation of uterine muscles such as nitro-glycerine and magnesium sulfate can also cause tone disorders.

B. Tissue

The tissue abnormality includes retained placenta or residual placenta.

C. Trauma

In trauma, haemorrhage generally occurs as a result of X. Trauma usually occurs after prolonged or vigorous labour stimulated by oxytocin or prostaglandins, after extrauterine or intrauterine manipulation of the fetus, use of instruments such as forceps or as a result of an episiotomy.

D. Thrombin

Abnormalities in thrombin, namely disorders of coagulation factors or blood clots includes haemophilia A, Von Willebrand disease, idiopathic thrombocytopenic purpura, Disseminated Intravascular Coagulation (DIC). Disorder of coagulation is suspected as a cause of bleeding when other causes have been excluded and the patient has previous history of postpartum haemorrhage in previous delivery.

Atony of uterine causes about 50-60% of PPH and is defined as the leading cause of PPH. It usually presents as continuous painless bleeding that starts off slowly. Palpation of the abdomen is one of the diagnostic approaches for atony of uterine where the uterus is found soft and large in size.

The second most common etiology which concludes 20-30% of PPH is placental retention. It can be found as absent or incomplete placenta. Other causes of PPH include laceration of birth canal which is commonly found after the use of extraction devices, fetal macrosomia, rapid labour, and giving birth before the cervix is fully dilated.

Episiotomy is one of the significant causes of PPH if it is not corrected immediately. This should be considered after the two main causes of PPH, atony of uterine and placental retention, can be excluded. Vaginal and cervical examinations must be performed to make the diagnosis [1,2].

An uncommon etiology of PPH is uterus inversion where the inner surface of uterus protrudes to the vagina, wither partially or completely. The diagnosis of the condition can usually be made clearly. Excessive traction of umbilical or abdominal pressure can lead to uterine inversion.

Coagulation disorders can be both an etiology and complication of PPH itself. Causes of coagulation disorders can be congenital such as von Willebrand's disease or acquired such as HELLP syndrome, disseminated intravascular coagulopathy, and the use of anticoagulant therapy. Secondary PPH includes retention of placental fragments, chorioamnionitis, birth canal hematoma, submucosal fibroids, trophoblast disease, and chronic uterine inversion [1,9].

Management of postpartum haemorrhage should be carried out with a multidisciplinary approach from obstetricians, anaesthetists, haematologists, laboratory technicians, blood bank personnel, and radiologists who is capable of taking quick actions and avoiding negligence as the key to the management strategy [1].

II. Results and Discussion

When the diagnosis of PPH is made, the anaesthetist should immediately initiate an appropriate resuscitation with administration of crystalloid, colloids, oxygen therapy, and protection against hypothermia based on non-invasive monitoring (heart rate, blood pressure, and pulse oximetry), establishing or securing venous access, taking initial blood samples (antibody screening, complete blood count, platelets, and haemostasis), and plasma expansion. The anaesthetist must ensure that the patient is in the optimal safety conditions for the obstetricians so that they can carry out the diagnostic and interventional procedures properly [10].

If postpartum haemorrhage occurs before the placenta is released, the first procedure to be performed is manual removal of the placenta followed by uterine massage. Pharmacological treatment consists of IV or IM injection of oxytocin 5–10 IU followed by a maintenance infusion of 5–10 IU /hour for 2 hours. The cumulative dose should not exceed 40 IU. Second-line treatment should be started immediately if the first treatment is ineffective after a maximum period of 30 minutes. After manual removal of the placenta, administration of prophylactic antibiotic is recommended. In the treatment of severe or persistent PPH, we recommend Sulproston and Karboprost as the effective drugs. When oxytocin is ineffective, sulproston as an analogue of progstaglandin E2 is recommended to be given within 30 minutes after PPH diagnosis is made. Intrauterine balloon tamponade placement is

known to be effective when sulproston treatment fails and before interventional radiological or surgical management is performed [11].

Fluid resuscitation is recommended immediately when PPH is worsening to maintain adequate circulating blood volume and tissue oxygenation. Crystalloids and colloids constitute the first stage of fluid resuscitation that should be given to patients with ongoing bleeding. Guidelines from the RCOG (Royal College of Obstetricians and Gynaecologists) on the prevention and management of postpartum haemorrhage recommend 3,5 L as maximum volume of fluid resuscitation before starting blood transfusion, which consists of 2L of crystalloids and 1.5L of colloids. To support haemostasis and improve coagulopathy, blood products are also given. Plasma transfusions can be given to treat coagulation factor deficiency and packaged red blood cells can also support primary haemostasis through a different mechanism. Red blood cell transfusion can increase platelet concentration [12,13]. The amount of red blood cells administered is determined primarily by clinical signs of postpartum haemorrhage severity, without having to wait for the blood test results.

The goal of transfusion is to maintain a hemoglobin (Hb) concentration more than 8 g /dL. Fibrinogen levels should be maintained not less than 2 g /L during active bleeding. Based on the severity of bleeding or coagulopathy, fibrinogen, and fresh frozen plasma (FFP) can be given without waiting for blood test results. This is expected to anticipate regularity of blood component so that concentrated platelets can maintain a platelet count of 50,000 /mm^3 [11,12].

Etiology-based management should be undertaken, emptying of the bladder and administration 10-20 IU of oxytocin followed by uterine massage for uterine atony. Then, sulprostone is administered via an infusion pump with an initial dose up to 500 mcg in the first 60 minutes. The maximum dose of sulprostone is ≤1500 mcg per 24 hours. Manual uterine exploration for suspected placental retention should be carried out without delay even if examination of the placenta shows no retained products of conception. Manual removal of the placenta should be performed following anaesthesia if the placenta has not been born. Uterine reversal should be performed immediately by an obstetrician and can be facilitated by short-term tocolysis (trinitrine as first line), usually using a strong IV vasopressor at the same time to combat hypotension (phenylephrine or adrenaline). Coagulation disorders in PPH are complex disorders that can be treated with an antifibrinolytic agent such as tranexamic acid at a dose of 1-3 g. Other options to be taken for severe postpartum haemorrhage include transfusions with a high ratio of red blood cells and FFP more than 1:2 [14,15].

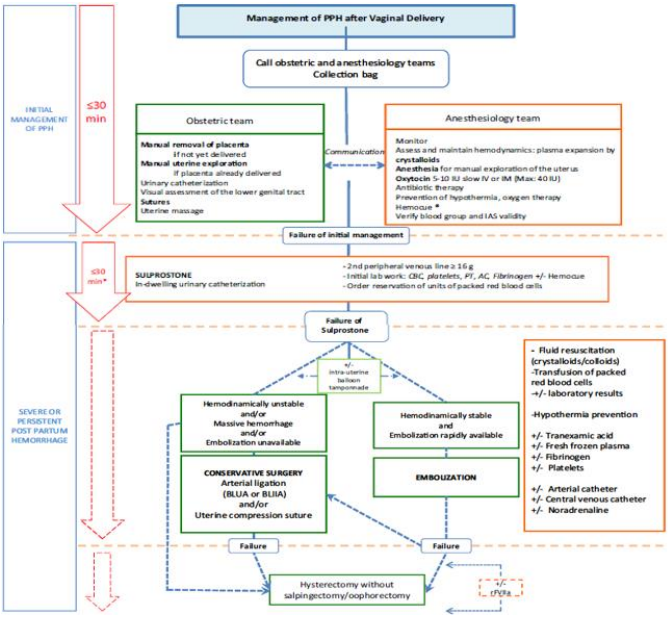

Fig. 1. Algorithm of postpartum hemorrhage management.

Surgical intervention may be proceeded if haemorrhagic shock occurs, and bleeding continues. Preoperative evaluation becomes a safety goal for obstetric haemorrhage. Surgery on placenta increta or percreta is a multidisciplinary effort, depending on the location of the abnormal placentation and the degree of invasion. Preoperative consultation with obstetric anaesthesiology, gynaecological oncology, urology, vascular surgery, and /or interventional radiology may be required. Prior to surgery, the anaesthetist should be aware of the significant bleeding that is expected. Coordination with the blood bank personnel prior to surgical procedure is mandatory to ensure an adequate supply of red blood cells, platelets, and fresh frozen plasma. Furthermore, an experienced operating room team with all the necessary instrumentation should be in place. Rapid infusion and perfusion devices to aid rescue should also be considered in preparation for surgery [13].

Prior anaesthesia management, we should already determine the cause of PPH to predict what surgical interventions may be required, ensure close monitoring of vital signs and continuous monitoring of heart rate, pulse oximetry and blood pressure every 5 minutes. Intravenous access with at least 1 large intravenous line and can be added if needed. Hemodynamically unstable should first be stabilized with IV fluids and vasopressors. A shock index (SI) should be determined for each PPH patient to predict the adverse outcome of PPH. The SI is the ratio of the beats per minute to the SBP. An early warning scoring system can also be used to predict adverse outcomes in PPH [15,16].

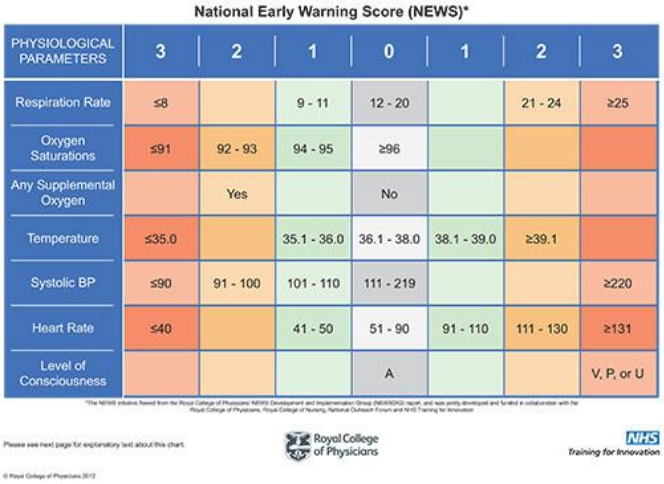

Fig. 2. Early warning score.

Consideration and caution should be taken to carry out general anaesthetic preparations when a patient with placental abruption is planning for a C-section. Volume status monitoring with central venous pressure (CVP) and measurement of urine output are mandatory to guide fluid resuscitation and transfusion. Aesthetic management for uterine inversion consists of induction of rapid sequence general anaesthesia with a halogenating agent for uterine relaxation and terbutaline, magnesium sulfate, or nitro-glycerine in a 50mcg bolus. All patients with lacerations of birth canal should be given intravenous crystalloids and /or colloids via a large bore intravenous line to treat shock. In patients with a pre-existing epidural catheter with stable vital signs, regional analgesia is more preferred by the surgeon if general anaesthesia is not required [9].

The definitive surgical management for postpartum haemorrhage that is often required is hysterectomy. Regardless of varied findings from literature, the estimated rate of peripartum hysterectomy is ≤1 per 1000 births. The main indications for hysterectomy are placenta accrete, uterine atony, placenta previa, and uterine rupture. Massive uterine incision, infection, leiomyoma, and disseminated intravascular coagulation, are also indicated for hysterectomy although they are not common. General anaesthesia might be used more frequently in emergency postpartum hysterectomy than epidural anaesthesia. Epidural anaesthesia may not be recommended for the following reasons:

- Duration of surgery may last twice cesarean section which may cause fatigue and discomfort for the patient
- Greater intraperitoneal manipulation, retraction, and dissection than cesarean section which may cause maternal pain, nausea, and vomiting.
- Hyperaemic pelvic viscera with engorged oedematous vessels require a quiet operating field [9].

III. Conclusion

Treatment for postpartum haemorrhage should be considered as a multidisciplinary approach involving obstetricians and gynaecologists, anaesthetists, blood bank laboratory personnel and technicians, and radiologists. The initiation of anaesthetic treatment that can be done is ensuring two venous access using large bore cannula, administering resuscitation fluids including crystalloids and colloids, administering oxygen supplementation using face mask or nasal cannula, as well as performing a close monitoring of vital signs and urine output.

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