

# Postpartum hemorrhage – a constant concern of obstetricians

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## Abstract

Postpartum hemorrhage (PPH) is a major public health concern, for both high-income and mid- or low-income countries, because it is associated with a high risk of morbidity and mortality. The risk factors and case specific managements are presented, along with emphasizing the idea of prevention, promptness and teamwork. This article will address primary PPH.

**Keywords:** hemorrhage, postpartum, definition, diagnosis, management, prevention

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## Rezumat

Hemoragia post-partum reprezintă o preocupare majoră de sănătate publică, atât în țările cu venituri mari, cât și în cele cu venituri medii sau mici pe cap de locuitor, deoarece este asociată cu un risc crescut de morbiditate și mortalitate. Sunt prezentați factorii de risc și conduita specifică unor cazuri particulare, împreună cu accentuarea ideii de prevenție, promptitudine și muncă în echipă. Acest articol abordează hemoragiile post-partum primare.

**Cuvinte-cheie:** hemoragie, post-partum, definiție, diagnostic, conduită, prevenție

## Hemoragia post-partum – o preocupare constantă a obstetricienilor

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## Introduction

Despite significant progress in monitoring pregnancies, postpartum hemorrhage (PPH) continues to be an important cause of morbidity and mortality worldwide. Although it is the first cause of maternal mortality in the developing countries, PPH continues to be a great concern even in high-income countries. The incidence of PPH in middle- and low-income countries is estimated at 20% of all maternal deaths, while in high-income countries the incidence is estimate at 8%<sup>(1)</sup>.

There are high disparities in PPH-associated survival between high-income and middle- and low-income countries, disparities that reflect the lack of resources needed to improve access to the healthcare and strategies to improve hospital facilities, rapid diagnosis and treatment<sup>(2)</sup>.

A very different picture is offered by data published by MBRRACE-UK, Maternal report 2021. The maternal mortality by hemorrhage is on the seventh place as cause of death, after cardiovascular, neurological, sepsis, thrombosis and thromboembolic events. Between 2017 and 2019, there were 14 cases of maternal death by obstetric hemorrhage, representing 7% of all maternal mortality. The leading cause of direct deaths within the 42 days is represented by thrombosis and thromboembolic events<sup>(3)</sup>.

Although USA is one of the most developed countries, it has one of the highest mortality rates related to PPH, estimated at 11%<sup>(4)</sup>.

Judging its position regarding maternal mortality rate, Romania ranks a position corresponding to a developing country, with a 29% mortality rate associated

with complications of the postpartum period and a 35% mortality rate associated with complications of the delivery itself (Figure 1)<sup>(5)</sup>.

## Definition of postpartum hemorrhage

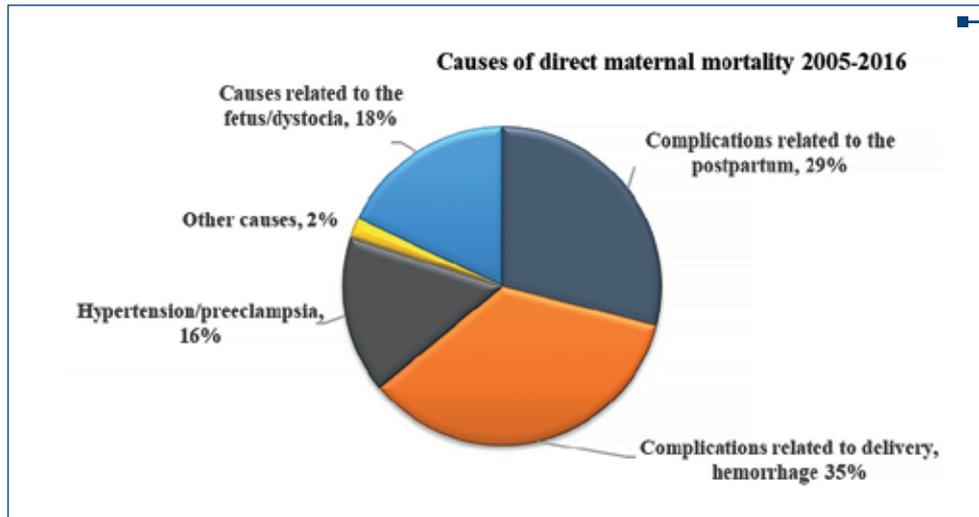
Although PPH was traditionally defined as blood loss of more than 500 mL after vaginal delivery and more than 1000 mL after caesarean section, a more recent consensus considers that PPH represents a cumulative blood loss equal to or greater than 1000 mL regardless of the way of delivery and associated with signs and symptoms of hypovolemia<sup>(6)</sup>.

A non-pregnant woman has volemia estimated at approximately 4 liters. The loss of 1500 ml of blood will represent 40% of her total blood volume and will induce severe hypovolemic shock (Class IV, Classification of Acute Hemorrhage – ACS)<sup>(7)</sup>.

A pregnant woman will have an increased of her blood volume in the third trimester by 45%. This means that a non-pregnant woman of 60 kg will have 60 mL/kg (3.6 L) of blood, while in pregnancy the whole blood volume will be approximately 75 mL/kg (5.2-6 L). In case of blood loss of 1500 mL (about 25%), a pregnant woman will keep her blood pressure and pulse within normal limits<sup>(8)</sup>.

There are two categories of PPH, depending on the moment when they appear. Primary PPH occurs in the first 24 hours post-delivery. Secondary PPH occurs between 24 hours and 12 weeks after delivery<sup>(6,9)</sup>.

PPH could have multiple causes which can be summarized in four categories, in order of their frequency,



**Figure 1.** Causes of direct maternal mortality in Romania between 2005 and 2016<sup>(5)</sup>

and marked with a “T” for ease of memorization: tone (uterine atony, representing 70% of all cases), trauma (uterine rupture or lacerations of the birth canal, in 20% of cases), tissue (retained placental tissue or clots, in 10% of cases) and thrombin (coagulation defects, in 1% of cases).

### Risk factors

The most frequent risk factors of PPH are represented by multiparity, prolonged labor, uterine myomas, multiple gestations, polyhydramnios, fetal macrosomia, chorioamnionitis, caesarean section or any other prior uterine surgery associated with the risk of abnormal placentation.

PPH can be a life-threatening condition, inducing severe anemia, hysterectomy, disseminated intravascular coagulation (DIC), multiple organ failure and even death<sup>(6)</sup>. Identifying these risk factors of PPH should be an important concern of every obstetrician during the antenatal follow-up of a pregnant female in order to prevent potentially severe complications<sup>(6)</sup>.

### Discussion

#### PPH – a complex team activity

The management of a PPH requires a multidisciplinary team, a good communication and a good coordination. In addition to the traditional collaboration between obstetrician, midwives and anesthetist, the team must also rely on the blood bank and laboratory, a gynecologic oncology surgeon, a urologist, the interventional radiology service and even a vascular surgeon. Team members must be available in case of major emergencies and must perform periodic simulations to increase the speed and accuracy of interventions, according to the motto “Train as a team those who have to work as a team”. Pregnant women with risk factors of PPH must be delivered in tertiary medical units.

All births at risk for PPH should be closely monitored. The first and most important gesture is to properly

assess the amount of blood lost and monitor maternal vital signs and symptoms (blood pressure, heart rate, skin color, respiratory frequency, consciousness, urinary output)<sup>(7)</sup>.

A wide intravenous access with two large cannulas is mandatory. A complete blood count and coagulation tests (fibrinogen, aPTT, PT) will be taken immediately.

Call for help is the next step. This refers to additional midwives, obstetrician and anesthetist. The anesthetist and obstetrician will decide the measures for the replacement of lost blood volume and start the evaluation of bleeding source. If they decide, they will call for additional help.

The replacement of the lost blood volume and the identification and stopping of the bleeding source must take place at the same time<sup>(10)</sup>.

Estimating blood loss is a difficult and approximate task. It can be done by visual estimation or by weighing the blood accumulated in the blood-soaked tissues (laparotomy sponges, drapes, pads, under buttock collector bag), and blood in the surgical aspirator. The quantitative method seems to be closer to the reality, but blood loss must be correlated with symptoms and signs of hypovolemia.

Blood bank should be notified urgently for 3 units of packed red cells (PRC) and 3 units of fresh frozen plasma (FFP). While waiting for blood, the circulatory volume will be restored using of crystalloids, as a first option, and colloids. A common recommendation is to infuse up to 3.5 L of warmed fluid, starting with 2 L of warmed isotonic crystalloid and continuing with the additional 1.5 L of crystalloid or colloid<sup>(9)</sup>.

The anesthetic team will closely monitor the vital functions (blood pressure, heart rate, respiratory frequency, urinary volume), the coagulation status, the acid base balance and the body temperature. Due to the high volume of fluids used for resuscitation, body temperature can drop, thus a warming system is very useful to mitigate hypothermia.

## Case-specific management

### Uterine atony

Although traditionally recommended as the first measure of prophylaxis and treatment of uterine atony, the effectiveness of uterine massage is clear but not yet a reason to change the current practice<sup>(11)</sup>. Because the studies analyzed had limitations related to a low number of patients, more patients are needed to estimate the efficacy of sustained uterine massage. Thus, in settings where uterotonics are not available, uterine massage is recommended when needed<sup>(11)</sup>. More drastic in recommendations, the Royal College of Obstetricians and Gynecologists (RCOG) does not recommend uterine massage<sup>(9)</sup>.

#### Pharmacological methods

The recommendation of choice in uterine atony is oxytocin. It could be administered intravenously or intramuscularly, in a dose of 5-10 IU, and its action is very rapid. If the effect does not appear quickly, a dose of 40 IU will be administered in 500 mL of saline or Ringer lactate<sup>(9)</sup>. If oxytocin is not effective, ergometrine will be given as a second-line therapy in a dose of 0.2 mg, intramuscularly or even into the myometrium<sup>(1,12)</sup>. Ergometrine is contraindicated in case of hypertension associated to pregnancy.

Additional uterotonic drugs are carbetocin (a long-acting synthetic analogue of oxytocin), carboprost tromethamine (15-methyl analogue of prostaglandin F2 $\alpha$ ) and misoprostol (prostaglandin E1 analogue). Carbetocin and oxytocin seem to have the same efficiency in preventing PPH<sup>(13)</sup>.

Carboprost trometamine is given intramuscularly or as intramyometrial injection, at a dose of 250  $\mu$ g, at 15-90 minutes, for maximum 8 doses<sup>(1)</sup>.

As for misoprostol, a Cochrane review raised questions about its usefulness in preventing PPH<sup>(14)</sup>. In case when it is decided to be administered, it may be given by oral, sublingual or rectal route, in a single dose of 600-1000 mg<sup>(15,16)</sup>.

#### Tranexamic acid

The mechanism of action of tranexamic acid (TA) is the inhibition of the fibrinolysis process, stopping clot disintegration in the blood vessels of the uterus. It

is given intravenously, at a dose of 1 g for 10 minutes. If the bleeding continues, a second dose may be given after 30 minutes.

The results of the WOMAN trial showed a significant reduction of mortality in the subgroup of deaths from PPH (1.5% versus 1.9%) treated with TA compared with placebo<sup>(17)</sup>.

The highest efficiency is when TA is administered in the first three hours after the onset of bleeding. The use of TA in the prevention of PPH was analyzed by a Cochrane systematic review. The results showed that TA reduced the blood loss greater than 1000 mL after caesarean delivery, but not after vaginal delivery<sup>(18)</sup>. This is in contradiction with the study of Sentilhes et al. who showed that the administration of TA after vaginal delivery, adjuvant to oxytocin, reduced the PPH compared to placebo (7.8% versus 10.4%)<sup>(19)</sup>.

#### Surgical methods

If pharmacological methods fail to control the PPH caused by uterine atony, the mechanical and surgical methods will be taken into consideration. These are represented by intrauterine balloon tamponade (Bakri, Rusch), ligation of arterial pedicles (uterine, ovarian, hypogastric), uterine compression sutures (B-Lynch) and hysterectomy. Before starting any of the aforementioned procedures, the obstetrician will exclude the existence of remaining placental tissue in the uterine cavity and any lacerations of the birth canal<sup>(20)</sup>. It is the lead obstetrician who will decide the hierarchy of the applied measures.

#### Bakri balloon

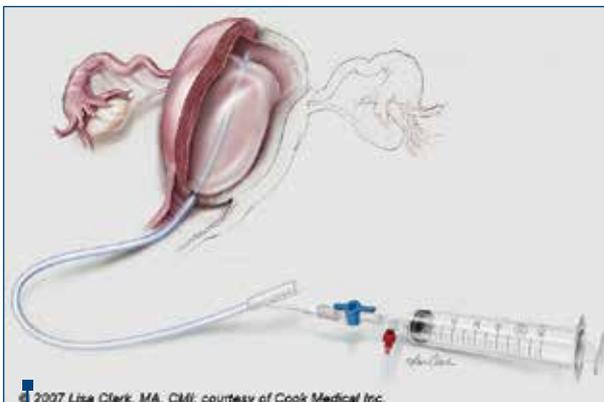
It is the first tamponade method recommended in case of vaginal delivery followed by PPH. The balloon is easily introduced through the dilated uterine cervix into the uterine cavity and inflated with 300 mL sterile saline (Figure 2). The balloon is connected to a collecting bag to measure the blood loss. It is kept in place for an average of 12 hours, but no longer than 24 hours, due to the risk of ischemia and infection. Prophylactic antibiotics must be added.

In a recent systematic review and meta-analysis, it was estimated that Bakri balloon is a safe method to control the PPH, with an efficiency of 85%<sup>(21)</sup>.

In case of bleeding that doesn't stop, laparotomy will be the next step. In this case, the obstetrician will decide between ligation of arterial pedicles and uterine compression sutures.

#### Arterial ligatures

The first arteries recommended to be ligated are the uterine arteries, lateral to the lower uterine segment. If this procedure fails, the next step is the bilateral ligation of ovarian vessels at their entrance in the pelvis. A special attention must be paid to the identification of the ureter. If this procedure also fails, the last solution is the hypogastric artery ligation. It is the last, because it is a first-line surgical maneuver and needs skill, time for dissection, and its efficiency is estimated at 50-60% (Figure 3)<sup>(22)</sup>. There is a risk of injury to the ureter and hypogastric vein, and the procedure is recommended to be performed by a gynecologic oncology surgeon.



**Figure 2.** Bakri balloon (source: Peltecu et al.<sup>(20)</sup> – reproduced with permission)

### Uterine compression suture

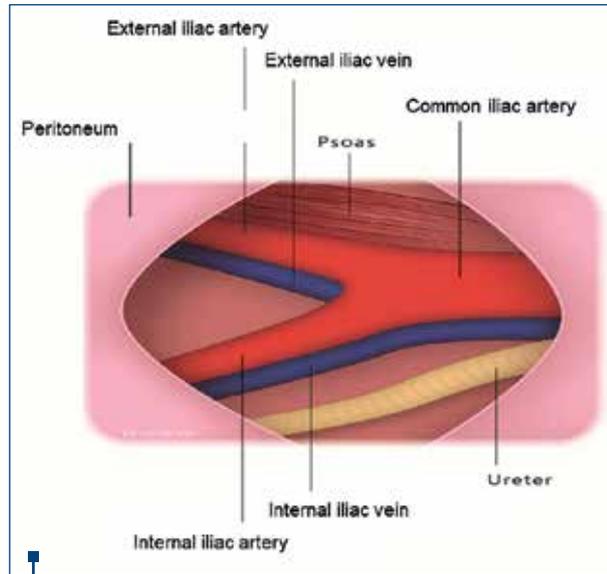
The best-known technique is B-Lynch suture (Figure 4A, 4B). It is commonly used after caesarean section and is the most efficient with this indication. Its success rate is estimated by some studies at 90%<sup>(22,23)</sup>, while other studies indicate a fail rate of 25%<sup>(24)</sup>. Uterine necrosis is a potential complication when the arterial pedicles have been previously ligated. Another potential complication is uterine synechia. It does not seem to have a negative influence on fertility.

### Hysterectomy

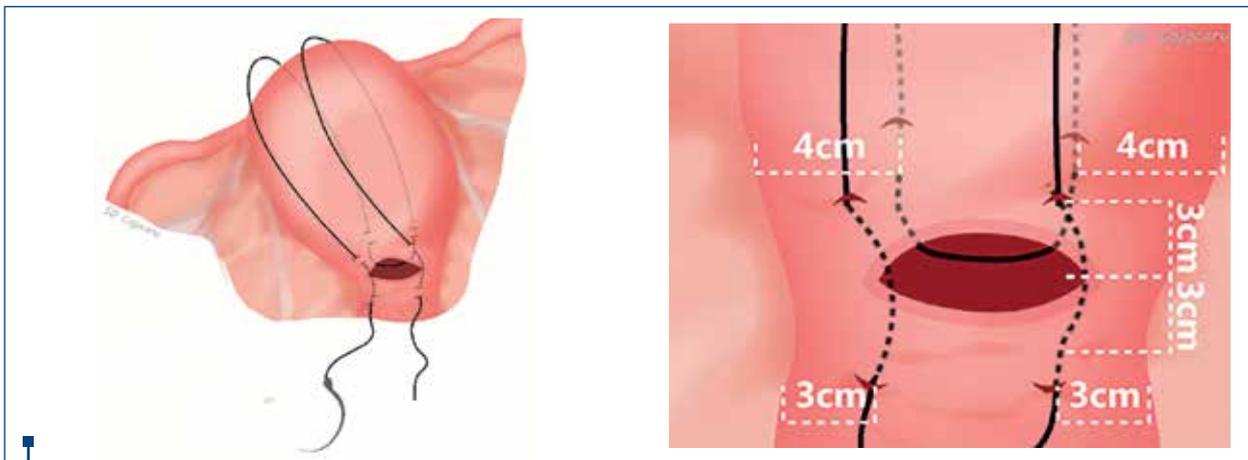
This decision must be made sooner rather than later, because it can be a life-saving procedure. It can be total or subtotal (supracervical), depending on individual cases and the severity of bleeding. Supracervical hysterectomy is a much faster surgical procedure, with lower risk of bladder and ureter injuries, but it is not recommended in case of low-lying *placenta accreta*, uterine rupture or cervical uterine rupture extended to the low uterine segment.

### Retained placental tissue

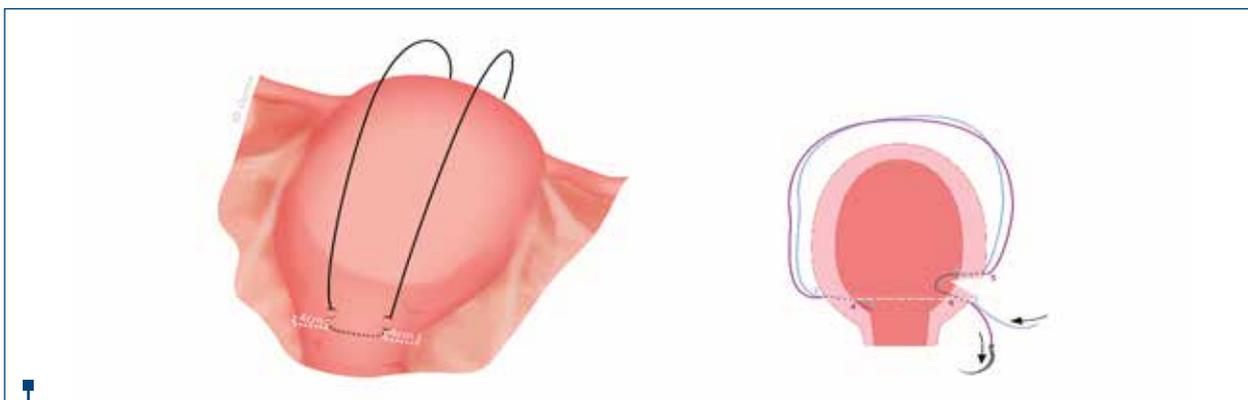
Retained placental tissue can be avoided by the careful examination of the placenta after delivery. It can be



**Figure 3.** Right internal iliac artery prepared for ligation (source: Peltecu et al.<sup>(20)</sup> – reproduced with permission)



**Figure 4A.** Uterine compression suture (B-Lynch), anterior aspect (source: Peltecu et al.<sup>(20)</sup> – reproduced with permission)



**Figure 4B.** Uterine compression suture (B-Lynch), posterior and lateral aspect (source: Peltecu et al.<sup>(20)</sup> – reproduced with permission)

identified using the ultrasound and the removal can be performed by suction, blunt curette or by hand. The manual control of the uterine cavity will be performed under anesthesia and with a single dose of prophylactic antibiotic.

#### Lacerations of the birth canal

In the absence of episiotomy and postpartum bleeding, vaginal inspection is not recommended. If bleeding is present, vaginal examination is performed to identify the source of bleeding. If there is a laceration of the birth canal, it should be clearly identify and sutured.

#### PAS: hysterectomy or delayed surgery?

*Placenta accreta* spectrum (PAS) is an important cause of PPH. It is related in almost all cases to a previous caesarean section. Antenatal diagnosis and delivery by caesarean hysterectomy in a tertiary center is associated with a low risk of morbidity and mortality<sup>(25,26)</sup>. If PAS is diagnosed antenatal, the risk of transfusion is 59%, while if the diagnosis is established intrapartum, the transfusion need is estimated to be 94%<sup>(27)</sup>.

For asymptomatic pregnant women (no uterine contractions or bleeding) with PAS, the timing of delivery will be set between 35 and 36 weeks. For symptomatic cases, the timing of delivery will be established between 34 and 35 weeks if the suspicion of morbidly adherent placenta is high. The decision will be taken in order to avoid an emergency surgery with all its disadvantages. All these cases will be known in the department and medical and human resources will be prepared and ready for action<sup>(28)</sup>.

Ideally, the caesarean section must be planned before the onset of bleeding or labor<sup>(29,30)</sup>. For caesarean section, the abdominal wall incision will be vertical midline and will be extended above the umbilicus. The placenta localization will be determined by ultrasound, preoperatively or even intraoperatively. The pregnant uterus will be exteriorized from the abdominal cavity and the fetus will be extracted by fundic hysterotomy, away from the periphery of the placenta.

There will be no active maneuvers to initiate placental delivery. If placenta does not detach, it will be considered a confirmation of an abnormal adhesion. The umbilical cord will be tied and cut at the base of its placental insertion, the uterine incision will be continuously sutured, and decision to perform or not hysterectomy must be taken. The decision to continue with hysterectomy is based on the surgeon's estimate of controlling the bleeding without the risk of producing ureterovesical and vascular lesions. Hysterectomy is the safest way to control the bleeding<sup>(28)</sup>.

The second option is a conservative attitude, meaning leaving placenta in situ, and a planned delayed surgery, four to six weeks later. It is believed that the spontaneous regression of placenta may reduce the risk of bleeding and other organ damages during the delayed hysterectomy. The best timing for hysterectomy is unclear. The follow-up is not without risks during this period, as infection, bleeding or even disseminated intravascular coagulation (DIC) may occur, which may require medical treatment (antibiotics, transfusion) or even emergency surgery.

Rare cases of complete spontaneous resolution of the placenta are also described. In a retrospective study by

Sentilhes et al., on a group of 167 patients, in 78% of cases the uterus was preserved after CS, but 25% of them had a delayed hysterectomy within six weeks or later due to bleeding or infection<sup>(31,32)</sup>.

#### Blood replacement

Resuscitation in case of PPH aims to restore blood volume and an adequate level of the oxygen transporter. Until the transfusion plan is established, the restoration of the blood volume with crystalloids and colloids will begin. The timing of initiation of transfusion is not clearly defined in protocols. It is generally considered when the blood loss exceeds 1500 mL or when the patient is hemodynamically unstable. The obstetrician must be aware of the underestimation of blood loss.

Lost blood replacement therapy is done with packed red cells (PRC), fresh-frozen plasma (FFP) and platelet concentrate (PC). The ratio of these blood components is taken from the protocols of resuscitation in trauma and is 1 unit of FFP to 1 unit of PRC. One pack of PC is given when platelet count is less than 75,000/mm<sup>3</sup> or 1 pack to every 4 units of PRC. When the level of fibrinogen is under 1 or 2 g/L, it is recommended to administer cryoprecipitate at a dose of 2 units<sup>(1)</sup>.

#### Prevention

The preventive measures could reduce the risks of PPH. Identifying risk factors could start even during the preconception period. Educating women for a natural delivery and reducing the number of caesarean sections without obstetric indication will reduce the risk of PPH, especially those related to PAS. Choosing the most appropriate location for delivery for women at risk is a duty for every obstetrician.

In case of vaginal delivery, it is recommended to promote the active management of the third stage of labor using uterotonics. In case of suspicion of PAS, it is crucial to refer the woman to a tertiary center for a planned caesarean section between 35 and 36 weeks of gestation.

#### Conclusions

PPH is an important cause of maternal morbidity and mortality. It is the most important cause of mortality in developing countries, but it is still important even in developed ones. The rate of PPH increased in the developed countries due to the postpartum atony, while the maternal mortality decreased.

PPH is an unpredictable event, thus every pregnant woman should be taken into consideration. It is recommended to identify the risk factors even in the early stage of pregnancy and special cases must be referred to deliver in tertiary units. This is especially true in the case of placenta praevia or low-lying placenta with high suspicion of PAS.

Identifying risk factors, along with preventing and treating in appropriate units could save lives. Education with the aim to reduce the number of unnecessary caesarean delivery will bring benefits in the future. ■

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