Postpartum Haemorrhage

Minimize Maternal Morbidity and Mortality





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Introduction and Definitions

Introduction

Definitions of Postpartum Haemorrhage (PPH)



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Introduction

The maternal mortality ratio (MMR) is defined as the number of maternal deaths, during pregnancy or within six weeks after delivery/end of pregnancy, per 100 000 live births. Most maternal deaths (94%) occur in low-income countries. Between 2000 and 2017, the MMR dropped by about 38% worldwide.

According to the United Nations (UM) third Sustainable Development Goal the global MMR should be reduced to fewer than 70 maternal deaths per 100,000 live births by 2030.



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Introduction



Definitions of Postpartum Haemorrhage (PPH)

Bleeding occurs after all deliveries due to separation of the placenta from the uterus, and to tears and lacerations in the vaginal tract. Bleeding \geq 500 ml within the first 24 hours after delivery is called **primary postpartum haemorrhage (PPH)**, which is divided into two categories:

- Mild primary PPH: Bleeding 500-1000 ml within the first 24 hours after delivery
- **Severe primary PPH:** Bleeding \geq 1000ml within the first 24 hours after delivery

Secondary PPH is bleeding occurring 24 hours to 6 weeks after delivery.

Primary PPH is more common than secondary PPH. Most bleeding occurs within the first two hours after delivery. Primary PPH also has a higher mortality rate.

Prevalences of mild and severe PPH differ greatly between countries and studies, due to underestimation, underreporting and unseen cases, e.g. home deliveries. According to the World Health Organization (WHO), severe PPH occurs in approximately 5% of all deliveries, but the actual rate is likely higher. PPH is the most common cause of maternal death (graph).

A more accurate definition of PPH is any blood loss causing physiological effects (e.g. low blood pressure) that threatens the woman's life.



Say et. al, 2014) Indirect causes refer to pre-existing medical disorders, for example HIV related deaths. Other direct causes refer to complicated deliveries, for example obstructed labour.

Other direct causes 28%



Normal Anatomy and Physiology

Anatomical and Physiological Changes during Pregnancy

The Uterus

The Placenta

Stages of Labour

Active Management of the third Stage of Labour

Monitoring of the Mother after Delivery





Anatomical and Physiological Changes During Pregnancy

The female body undergoes anatomical, physiological, and biochemical changes to meet the demands of the pregnancy.

The blood volume increases during pregnancy by approximately 1-1.5 litres, due to the demands of the growing foetus. This increase in blood volume helps women tolerate the normal blood loss (less than 500 ml) after delivery, and thereby prevent hypovolaemia.

At term, about 20% of the blood pumped out by the heart every minute (cardiac output) goes to the placenta and the uterus. This means that 500-700ml of blood per minute circulates the placenta at the end of the pregnancy and is one of the reasons why a life-threatening PPH can develop rapidly.

The ability of the blood to form blood clots (coagulation) factors) increases during pregnancy and the blood clots more easily (becomes hypercoagulable). This change is vital to stop the bleeding in the uterus when the placenta has been expelled after delivery.

Anatomy of the female reproductive system



Fused chorionic and amniotic membranes

Umbilical cord Amniotic fluid

Cervix Vagina Rectum



The Uterus

The uterus

The uterus has two main parts: the body and the cervix. The body of the uterus is divided into the upper part (fundus) and the lower part (isthmus). The cervix is a canal in the lower part of the uterus that enters the vagina. During delivery, the cervix will open (dilate) and becomes thinner (efface), and the baby is pushed through into the vagina. The urinary bladder is located in front of the uterus. The placenta often attaches to the upper part of the uterine body, where most of the oblique muscle fibres are located. After delivery, the oblique muscle fibres are essential for constricting the arteries and veins that pass through the uterine muscular layer (myometrium) and thereby stop the bleeding.

The uterine layers

The endometrium is the innermost lining layer of the uterus. **The myometrium** is a muscular layer in the uterus that consists of longitudinal, circular, and diagonal (oblique) muscle fibres that are very expandable.

The perimetrium is a thin covering on the outside of the uterus.

Anatomy of the uterus



The Uterus



The Placenta



Maternal surface of the placenta

Placenta and its membranes

The placenta embeds in the endometrium and in most pregnancies the placenta will be found in the fundus.

The maternal surface of the placenta, which has been embedded in the endometrium, is dark red in colour. The surface is arranged in sections (lobes). Inspection of the maternal surface of the placenta allows evaluation of whether the placenta is complete, or incomplete and if placental tissue is left within the uterus

The foetal surface of the placenta is shiny and is covered with the membranes of the amniotic sac, in which the foetus has lain in the amniotic fluid. It is important to make sure the membranes are expelled completely, as retained membranes in the uterus can cause excessive bleeding as well as infections.



Stages of Labour

Labour is divided into three stages:

- The **first** stage is defined as the opening (dilation) and thinning (effacement) of the cervix.
- The second stage starts when the cervix is fully dilated and effaced. The foetus moves downwards (descends) and ends with the delivery of the baby.
- The **third** stage is when the placenta separates from the uterine wall and moves down into the vagina (descends), and the placenta and its membranes are pushed out (expulsion). During the third stage of labour, the uterus will continue to contract due to the body's own production (endogenous) and release of the hormone oxytocin.

Clinical signs of placental separation from the uterus

- Firming of the uterus
- Sudden gush of blood
- Rising of the uterus when it firms; can be felt or seen at
- navel (umbilicus) level
- Lengthening of the umbilical cord

These contractions lead to two important mechanisms which control the bleeding:

- 1. The uterine contractions separate the placenta from the uterine wall. Due to the contractions the uterus becomes smaller. Unlike the uterus, the placenta is not elastic, and this leads to its separation. When the placenta completely detaches, the contractions will push the placenta into the vagina from where it is expelled.
- 2. Uterine contractions constrict the blood vessels in the muscular layer of the uterus (myometrium) that supply the placenta with blood from the mother. This constriction will immediately reduce the bleeding. A local activation of the coagulation system ensures the formation of blood clots which stop further bleeding.



Active Management of Third Stage of Labour

Active management of the third stage of labour is recommended by WHO for all deliveries to prevent PPH. Active management includes:

- Injection of uterotonics as soon as the baby is born (after confirming that there is no second foetus in the uterus). The first choice is Oxytocin 10 IU. intramuscular (I.M.). If not available other uterotonics may be used. When health care worker are not trained in administering injections, Misoprostol 400 - 600 mcg sublingual/orally or rectally is a good alternative. This is the most effective action to reduce PPH. Uterotonics are drugs that stimulate the uterus to contract or to become firmer (greater tone).
- **Delayed cord clamping** for 1-3 minutes or when the pulsations have stopped. Delayed cord clamping is beneficial for the new born baby as the baby receives additional blood from the placenta.
- **Controlled cord traction (CCT)** is recommended for vaginal deliveries. It shortens the time for placenta separation and might help to reduce blood loss.

CCT is a procedure where traction is applied to the umbilical cord after the delivery. With one hand hold the umbilical cord, place the other hand as a counter pressure to the uterus just above the pubic bone. Exert a careful traction. If the placenta does not follow, wait a few minutes and then try again.



External Video link How to manage the third stage of labour https://globalhealthmedia.org/portfolio-items/managing-the-third-stageof-labor/





In settings where trained birth attendants are unavailable, CCT is **not** recommended. This is due to the risk of tearing of the cord AND/OR the risk for uterine inversion. If the cord tears the placenta needs to be extracted manually.

- After the expulsion of the placenta, abdominal uterine massage is recommended for all women. Uterine massage contributes to identification of soft uterus (uterine atony) which is the most common cause of PPH. Place your hand above the uterus and stimulate it by massaging gently and, if necessary, squeezing the uterus. Continue this manoeuvre until you feel the uterus contract. In most cases there will be an increase in vaginal bleeding when performing this manoeuvre as the blood in the uterus is discharged. The massage should be performed until the uterus is firm and should be repeated every 15 minutes for the first two hours, more often if the uterus is soft.
- Before the expulsion of the placenta, sustained uterine massage is not recommended in women who have received prophylactic oxytocin. There is a risk of partial placental separation and thus an increased risk for PPH. In addition, the procedure will cause unnecessary pain and discomfort.



Normal Anatomy and Physiology



Active Management of Third Stage of Labour

Clinical signs of placental separation from the uterus

- Hardening of the uterus
- Sudden gush of blood
- Rise of uterus when it hardens, which can be felt or seen at the level of the navel (umbilicus)
- Lengthening of the umbilical cord

International Medical Corr



Monitoring of the Mother after Delivery

Early detection of PPH is important to reduce illness and mortality. Most bleeding occurs within the first 2 hours after delivery, therefore, close monitoring and preventive measures are recommended during this period. The steps to follow are:

- If the placenta is not expelled within 30 45 minutes, consider performing a manual removal of placenta. Consider removal earlier if the bleeding is severe.
- Check the placenta for completeness minor membrane or placental tissue left in uterus can cause excessive bleeding. If any doubt and heavy bleeding, conisder manual exploration of the uterus.
- Check the firmness (tone) of the uterus every 15 minutes for the first 2 hours after delivery and at the same time check the amount of vaginal bleeding. If the uterus softens, perform uterine massage.
- Initiate breastfeeding or stimulate the nipples. This will release hormones that stimulate the contraction of the uterus.

- Check for bleeding from tears in the vaginal tract, suture if necessary. Compress tears with sterile gazuze if suture is not an option or the tears continue to bleed after suturing.
- Ensure that the mother can empty her bladder. If not, empty her bladder with a urinary catheter. A full bladder can hinder the uterus from contracting efficiently and thereby increase the bleeding. A full bladder should be suspected if the uterus can be palpated above the level of the navel.
- Remember to look for blood in sheets and pads.
- Monitor blood pressure and pulse rate.

Risk factors and preventive measures for PPH during pregnancy and delivery

It is not possible to predict if a woman will suffer from PPH and therefore all deliveries should be considered as having a potential risk for PPH. However, there are deliveries that have factors that in different ways contribute to a higher risk for PPH or increase the danger for PPH occurring.

See <u>table 1</u> and <u>table 2</u> for different risk factors and preventive measures to consider for minimising the incidence of PPH.

Table 1. Risk factors and preventive measures for PPH during pregnancy

Risk factor	How does this risk factor affect PPH?	Preventative measures to avoid incidence
Anaemia	Smaller blood loss can be fatal and low haemoglobin (HB) increases the risk of PPH occurring.	Hb control during pregnancy. Dietary advice. Iron supplementation during pregnancy. Common dis malaria, HIV cause anaemia and can be treated. should be given in cases of severe anaemia.
Overstretched uterus	High parity (≥ 5previous pregnacies), twin/triplets pregnancies, macrosomia babies (larger than 4 kg) or polyhydramnion increase the risk of an atonic uterus due to overstretching.	Family planning aiming at spacing of pregnancie of care when twin/triplet pregnancy or high pari- deliveries). Dietary advise and control for diabet
Uterine fibroids	Can reduces the uterus's ability to contract after delivery.	Identify and arrange referral to higher level of ca Family planning to avoid a new pregnancy.
Low positioned placenta	A low positioned placenta embeds in the part of uterus that has fewer oblique muscles and consequently the constriction of blood vessels is not as strong.	Repeated minor bleeding throughout the pregna placenta praevia or low sitting placenta. If place refer the woman for delivery by caesarian sectio
History of previous PPH	Statistically higher risk of recurrent PPH.	Identify and arrange referral to higher level of ca
Hypertension during pregnancy	Hypertension and pre-eclampsia can cause low platelets and DIC, and is associated with an increased risk of PPH.	Recognition, monitoring, treatment, referral to h
Intrauterine foetal death	Foetus retained in utero for days or weeks can cause a consumption of coagulation factors. If foetal death is caused by placenta abruption there will be an additional risk of PPH.	Identify and arrange referral to higher level of ca Induction of labour quickly after identifying intra
Community risk factors	 Availability e.g. poverty and lack of resources to treat conditions. Women's health is not prioritized. Accessibility e.g. long distances from women's home to health care facility. Transportation problems. Acceptability e.g. lack of trust in formal health care systems. 	It is important to recognise these issues to ensu quality care regardless of where she lives or if sh Some of these factors can be avoided, by educar and awareness.

Adjusted table content from Managing postpartum Haemorrhage A teachers guide 2012, WHO

e of PPH

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es Referral to higher level ity (more than 5 previous ces.

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are before due date.

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Table 2. Risk factors and preventable measures for PPH during delivery

Risk factor	How does this risk factor affect PPH?	Preventative measures to avoid incidence
Full urine bladder	Can inhibit contraction of the uterus.	Ensure that the bladder is emptied regularly du birth.
Retained placenta and/or membranes	Retained placenta, or retained placental tissue or membranes will inhibit uterus contraction and can cause PPH.	Careful delivery of placenta and membranes to placenta and membranes. Avoid uterus massaged delivered. Manual removal of placenta, if retent
Prolonged or rapid labour	Both long and very rapid deliveries can cause uterus fatigue leading to an atonic uterus. Female Genital Mutilation (FGM) can cause prolonged or obstructed labour.	Prolonged labour can sometimes be prevented partograph. If not contraindicated - augmentat prolonged labour. Referral to higher level of car delivery should constantly be considered in pro
Trauma to the birth canal, tears and lacerations. Uterus rupture	Ruptures in the birth channel occur spontaneously but are more common after unskilled instrumental (vacuum and forceps) delivery. Episiotomy should be selective. It is not necessary as a routine and can cause haemorrhages.	Skilled birth attendants supporting the perineu prevent trauma to the vagina and the perineum too early it can cause excessive bleeding before until the cervix is fully dilated.
Community risk factors	Traditional beliefs and/or harmful traditions can sometimes lead to inappropriate care in the third stage of labour. Lack of trust in formal health care services. Long distances to health care services. Low socioeconomic status and gender can also be the reason for not getting necessary treatment. Early marriage or teen pregnancy.	Education can prevent harmful procedures and seek health care. Problems with transportation complicate transferral to a higher level of care. high maternal mortality rate. Free healthcare for maternal death. Education and information are planning to ensure safe intervals between preg pregnancy at a young age.
Health service risk factors	Underestimation of the amount of bleeding. Ignorance or lack of awareness of the seriousness of excessive bleeding. Delays in manual removal of placenta in cases of retained placenta. Insufficiently trained staff. Lack of effective protocols. Midwives or other non- medical staff are not allowed to carry out lifesaving procedures.	All health care centres should have protocols for third stage of labour and PPH. The staff should management of third stage of labour, and preve lifesaving procedures. Formal health care servi and good quality care.

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Pathophysiology of PPH and Recognition of Bleeding

Causes of Bleeding – The 4 Ts

Measurement and Estimation of Blood Loss

Haemorrhagic Shock

Uterine Inversion





Causes of Bleeding - The 4 Ts

An understanding of the causes of PPH is important to be able to diagnose and provide proper treatment. There are 4 main causes of PPH, which can be remembered using the "4 Ts".

- **T**one uterus atony (soft uterus)
- **T**issue retained placental tissue or membranes in the uterus
- Trauma vaginal and uterine tears and lacerations
- Thrombin coagulation disorders

External Video link Post partum haemorrhage https://www.youtube.com/watch?v=SEQPKTceWp4





Tone

The most common cause of PPH is atony of the uterus (60-80%). Contractions can sometimes be weak and therefore inefficient, and excessive bleeding may occur. There are several reasons for weak contractions:

- Enlargement of the uterus caused by, for example, multiple previous pregnancies, excessive amniotic fluid (polyhydramnios) or twin (duplex) / triplet pregnancy.
- Uterine muscle fatigue due to prolonged or very rapid labour where the uterus has been contracting vigorously and frequently.
- Prolonged and/or excessive administration of oxytocin during delivery (augmentation).
- **Placental abruption** might cause blood to be trapped between the muscle fibres of the myometrium and the placenta (couvalaire uterus). This can disturb uterine contraction, even after the placenta has been expelled.



- A full bladder might interfere with uterine contraction as it is located in front of the uterus and can hinder the uterus from contracting efficiently.
- Medications: anaesthetic gases, magnesium sulphate, nifedipine and terbutaline are examples of drugs that inhibit uterine contraction.
- Uterine fibroids (also called leiomyomas) are growths made up of the muscle and connective tissue from the wall of the uterus. They may become a mechanical obstacle for compression and inhibit optimal contraction of the uterine myometrium.

Tissue

If the placenta is expelled:

Retained placental tissue or membranes in the uterus will cause bleeding, as the contraction of the uterus will be mechanically impaired. The blood vessels in the muscular layer of the uterus do not constrict properly and the woman might bleed excessively.

If the placenta is not expelled:

If bleeding occurs before placental separation and expulsion, it may be a sign of placenta accreta, increta or percreta. These conditions will inhibit the expulsion of the placenta.

- Placenta accreta embeds firmly into the uterus muscular layer. It does not pass through the uterus or impact the muscles of the uterus. This is the most common type of the three conditions.
- Placenta increta embeds into the deeper layer of the uterine muscle but not through the uterine wall.
- Placenta percreta grows through the uterine wall and can impact other organs like the bladder or the large intestine. These conditions makes the removal of the placenta difficult (sometimes impossible) and thereby increase the risk of PPH. The risk of abnormal embedding of the placenta increases after previous caesarean section.



However, most often, a retained placenta will not be due to accreta, increta or percreta.

Bleeding before separation and expulsion of the placenta can also be due to partial detachment of the placenta from the endometrium. In such cases, blood circulation to the area of the placenta that has not detached will continue, increasing the risk of PPH.

Delayed expulsion of the placenta increases the risk of postpartum haemorrhage. When active management of the third stage of labour is practiced, 98% of placentas are expelled within 30 minutes after the delivery of the baby. The risk of PPH increases the longer the placenta is retained. Manual removal of placenta should be considered if the placenta has not been expelled after 30 - 45 minutes.



Trauma

Episiotomy, tears and lacerations in the vagina, cervix and/or perineum can cause significant blood loss. Severe tears are more common with prolonged labour, instrumental (forceps, vacuum) delivery and the use of oxytocin during labour (augmentation).

Uterine rupture can cause bleeding inside the woman's abdomen (intra-abdominal bleeding). In these situations, the blood collects in the abdomen and is therefore not visible.

Female genital mutilation (FGM) is a procedure involving partial or total removal of the external genitalia or other injury to the female genital for non-medical reasons (WHO). There are varying types of FGM, ranging in severity.

The most severe cases can lead to PPH due to obstructed labour that can lead to atony, uterus rupture or complicated tears in the birth canal.



Thrombin

Thrombin is a component of the coagulation system and is the fourth T in the 4 T's (although all coagulation diseases are included under thrombin).

A lack of thrombocytes and coagulation factors is rarely the primary cause of PPH, since women during pregnancy have an increased level of coagulation factors. There are different conditions that can cause coagulopathy, for example:

- Severe anaemia
- HIV
- Infections
- Pre-eclampsia or HELLP (Haemolysis Elevated Liver enzymes and Low Platelets)
- Placental abruption
- Amniotic fluid embolism
- Anticoagulation therapy (medication)

In the treatment of PPH, intravenous fluids like Ringer'slactate or saline are often used to prevent haemorrhagic shock. However, it is important not to administer too much clear fluid as it leads to dilution of blood which reduces the levels of the coagulation factors which in turn reduces the ability to form blood clots.

If haemorrhagic shock has developed, this may lead to multiple organ failure and DIC (disseminated intra-vascular coagulation). DIC is a disturbance of the coagulation system triggered by certain coagulation conditions (e.g., septic, or haemorrhagic shock, eclampsia) and is characterised by generalised bleeding.

Blood normally clots within approximately 5 minutes. If blood fails to clot within 7 minutes, there is a clotting defect. Coagulopathy should be suspected when there is a delay in clotting time or the woman starts bleeding from multiple sites (e.g., nose, gums, skin). In these cases the patient needs to be transferred to a higher level of care.



Measurement and Estimation of Blood Loss

All women will bleed after delivery. Estimation of the volume of blood lost after delivery is important as this will alert the birth attendant to the presence of PPH. Early detection of PPH is crucial in reducing the blood loss and initiating treatment. However, it may be challenging to correctly evaluate the blood loss. Research indicates that the volume of blood lost often is underestimated; it even indicates that the greater the blood loss, the greater the underestimation. Training in estimating blood loss will aid awareness and accuracy, however this skill deteriorates with time so continuous focus on estimation and measurement is important.

When possible, use a measuring jug or a scale to measure the blood loss.

- 1. Quickly change wet and blood-stained towels/linens/pads from under the patient after delivery and save them for weighing.
- 2. Save the placenta in a separate bucket (should be checked) for completeness immediately after the delivery).

- 3. Try to collect the blood in a measuring jug and weigh towels/linens/pads.
 - Always be aware that large amounts of blood can be hidden in the uterus or vagina. By holding the top of the uterus and firmly pressing downwards, it is possible to squeeze the blood out. Be aware that the blood can be hidden under the woman or have run down onto the floor.
- 4. Have a list of the weight of dry towels/linens/pads and subtract the dry weight when the blood-stained items are weighed.
- 5. If weighing on a scale or collecting the blood in a measuring jug is not possible, a visual estimation of the blood loss needs to be done.

External Video link

Quantification of blood loss https://www.youtube.com/watch?v=3aKse0HbAac





Haemorrhagic Shock

Haemorrhagic shock is a form of hypovolaemic shock in which, if the bleeding remains untreated, severe blood loss leads to inadequate oxygen delivery in the body. If the bleeding continues untreated, death quickly follows.

If a patient shows clinical and vital signs of becoming hypovolemic, always consider bleeding as the cause. It is important to stop any ongoing bleeding and start fluid treatment.

Three important signs of shock are:

- Capillary Refill Time (CRT) > 3 seconds
- Rapid and weak puls
- Cold extremities

Other signs can be:

- Quick, shallow breathing
- Low blood pressure
- Feeling weak
- Pallor
- Cool clammy skin
- Confusion
- Dizziness

A healthy woman can often compensate for severe blood loss for an unexpectedly long time while having normal vital parameters. If the blood pressure is falling (hypotension) and pulse rate increases (tachycardia) it is important to act fast to prevent haemorrhagic shock.

A woman with pre-existing conditions such as anaemia or preeclampsia tolerates blood loss poorly and may therefore show changes in vital signs when the blood loss is less than 500ml. Therefore, close monitoring of all women after delivery is important and recommended.

A simple indicator to identify women who have developed hypovolaemia is the ratio between pulse and systolic blood pressure. If the woman heart rate is higher than the systolic blood pressure it indicates that the blood loss is severe and that the body compensates for the falling blood pressure by increasing the heart rate.

Uterine Inversion

This is a rare condition that occur in 0.5 – 3 patients for every 10,000 deliveries. The uterus is turned inside out, with the fundus of the uterus being forced through the cervix and protruding into or right outside of the vagina. To avoid uterus inversion, it is important to perform controlled cord traction carefully and have one hand on the uterus to provide counter-traction when delivering the placenta.

The condition should be suspected when a patient has strong pain in the upper abdomen after the delivery, is bleeding and has low pulse rate due to vasovagal stimulation. The women's condition can deteriorate rapidly due to a reduced ability to compensate for blood loss by raising the pulse.

The uterus will not be felt when palpating the abdomen. A vaginal inspection might reveal a visible/palpable inverted uterus, protruding into the vagina.

Treatment

Uterus inversion is a serious obstetric emergency which leads to severe shock. The uterus must be replaced as quickly as



possible, by firmly pushing with palm of the hand up through the vagina. When in place, lift the uterus toward the umbilicus (called the Johnson manoeuvre). Keep the hand inside until firm uterine contraction is felt.

Any oxytocin infusion should be stopped as this will make it more difficult to reposition the uterus. If hemodynamic stable patient, give uterine relaxants when immediate uterine replacement is unsuccessful for example Nitroglycerin (glyceryl trinitrate) as it has very short half-life which could be advantageous in patients with severe hemorrhage and hemodynamic instabilityIf the women suffer from bradycardia administration of atropine should be considered.

If the placenta is still in the uterus, it is recommended to leave it. Removal of the placenta increases the risk for bleeding. Wait 5-10 minutes after repositioning and then carefully try to remove placenta. If an ultrasound machine is available, check to ensure the uterus is repositioned. It is recommended to give oxytocin infusion for 24 hours and antibiotics for 24-48 hours post repositioning.

Uterus Inversion





Management and Treatment of Primary PPH

Flowchart for Treatment of Primary PPH

External Aortic Compression (ExAC)

Initial Management and Treatment of PPH

Advanced Treatment of PPH





Early recognition is probably the most important factor in the treatment of PPH.

Treatment of PPH includes multiple interventions that should be initiated simultaneously. Calling for help is essential as more staff will be needed. The situation can often deteriorate quickly, sufficient and timely treatment is therefore vital. Blood loss and clinical signs must be assessed during all steps of the treatment.

There are different treatment options depending on the cause of bleeding. To assist in diagnosing the cause of bleeding the 4T's can be used. Keep in mind that multiple causes of PPH may be present at the same time.

The flowchart describing treatments in primary PPH refers to procedures that are explained in the external video links on the page following the diagram. These treatments will not be further described in this book. In this book the use of external aortic compression will be described in detail.



Flowchart of Management and Treatment of Primary PPH





External Aortic Compression (ExAC)

The major blood vessels that supply the uterus and birth canal originate from below where the aorta divides in two (aortic bifurcation). This means that compression of the aorta above the bifurcation will reduce the blood flow and thereby the bleeding below the compressed area, including the uterus and the birth canal. External aortic compression can be used regardless of the cause of bleeding.

External aortic compression does not treat the cause of the bleeding but buys time to diagnose and plan for appropriate treatment.

The location of the external pressure point is at the level of the navel (umbilicus) as the aortic bifurcation is located just below the umbilicus. It is important to compress the aorta above the bifurcation.

There is no evidence of harm if ExAC is used for an hour. However there is a need for further research to find out more about how long external aortic compression can be performed.



Pressure point

Uterus

Aortic bifurcation

How to perform External Aortic Compression

- Place a closed fist at, or slighly above, the navel.
- Use the other hand to locate the pulse in the groin (femoral) pulse).
- Carefully press down the fist towards the spine until you can feel the aortic pulsation, continue until aorta get compressed aginst the spine and the pulse in the groin stops. If a pulse in the groin is difficult to locate, other indications that the procedure is effective include:
 - Visually determining a decrease in bleeding.
 - Increased blood pressure and decreased heart rate.
- Continue to press the aorta against the spine. Pulsation will be felt clearly on the side of the fist that is towards the woman's head.
- Reposition the fist if the femoral pulse in the groin continues or the bleeding does not stop. Move the fist 1-2 cm to the left of the navel and press down, as the aorta is positioned slightly to the left. Repositioning of the fist can also be necessary because of unevenness between the bones of the knuckles and the bones of the spine.





It is important to have an even configuration of the hand with the thumb on the outside

Why use External Aortic Compression

External Aortic Compression is a procedure where the aorta is compressed externally to reduce the blood flow to the uterus and the pelvic organs. The authors of this book, based on clinical experience and local guidelines, recommend manual external aortic compression as an early intervention for temporary control of bleeding in PPH. WHO also recommends external aortic compression, but at a later stage in the management of PPH.

Benefits of performing external aortic compression early in the management of PPH are:

- 1. Temporarily control of bleeding independent of the cause.
- 2. Improved vital signs (blood pressure rises and pulse rate decreases) while performing aortic compression, allow time to find and treat the bleeding and reduce further blood loss and need of fluid resuscitation. Increased overview and control of the situation for the healthcare worker.
- Less invasive manoeuvre than bimanual uterine 3. compression.



- 4. Other procedures can be carried out simultaneously, such as establishing intravenous access, uterine massage, uterine balloon tamponade, and suturing tears and lacerations in the birth canal.
- 5. Can be performed before placenta expels or during caesarean section.
- 6. ExAC is easier than bimanual uterine compression to use during transportation of the patient, both within the hospital (to the operating theatre), or transport to a higherlevel healthcare facility (ambulance).



Peter Robert Mboma training on doing aortic compression on ExAC simulation doll. Left: Lamin Bassie. Masanga hospital, Sierra Leone.

Additional information about **External Aortic Compression**

The manoeuvre causes discomfort for the patient, like many other procedures performed in the treatment of PPH, therefore the reasoning behind the manoeuvre needs to be explained. The patient must lay flat on their back, and the birth attendant should stand on the left side of the patient's bed. It may be necessary to climb onto the bed beside the patient to achieve sufficient compression. The aorta is, in most people, placed above or slightly to the left of the midline and therefore it is often easier to get a good compression from the patient left side.

External Video link External aortic compression in a clinical setting https://www.youtube.com/watch?v=sLmHKgMFfzM

After delivery, the uterus is enlarged and can reach the level of the navel. In cases of atony, a full urinary bladder or retained placenta, the uterus may be found above the level of the navel. In such cases, the fist must be placed above the level of the umbilicus.

During pregnancy, the muscles of the stomach stretch and part. This reduces the resistance of the stomach muscles and makes it easier to perform the manoeuvre.

The manoeuvre is dynamic, and by carefully decreasing the compression, it is possible to evaluate if the bleeding has stopped to allow uterotonics to reach the uterus and assess if the patient is circulatory stable.



External Video link External aortic compression https://www.youtube.com/watch?v=HIsUV1_6f6U





Initial Treatment and Management of PPH

Depending on the cause of bleeding and the situation, treatment options will differ. In this chapter management and treatment of PPH will be described, following the flowchart.

Placenta inspection

Shortly after the expulsion of the placenta it should be checked for completeness. Minor retained placental tissue or membrane can cause excessive bleeding or reduced uterine tone.

- Check the maternal side of the placenta. The lobes of a complete placenta fit neatly together without any gaps. Broken fragments of lobes should be carefully put in place before making an accurate assessment. It is important to check the outer edges of the placenta to make sure that there are no missing parts.
- Check the foetal side of the placenta and look for blood vessels present in the foetal membranes. This may indicate lobes of the placenta in the membranes (succenturiate placenta) or a case of bi-lobed placenta/bi-partial placenta.

Initial Management and Treatment of PPH



Missing lobe





Succenturiate placenta



External Video link Examining the placenta https://globalhealthmedia.org/videos/examining-the-placenta/

Succenturiate placenta Lobes have different sizes

Bilobed placenta Placenta lobes have the same size or close to the same size lobes.



- Ensure that the amniotic membranes are complete. It can be challenging to ensure that amniotic membranes are complete since they can be torn into small pieces. Careful delivery of the placental membranes is important, to avoid tearing of the membranes.
 Different techniques can be used such as twisting the placenta during the delivery of the placenta or asking the women to cough if the membranes do not slide out easily (coughing increases the abdominal pressure and thereby contributing to the expulsion of the membranes).
- If retained placental tissue or membranes are suspected, pay close attention to the bleeding and tone of the uterus.

If excessive bleeding occurs, consider manual removal of remaining tissue.

Initial Management and Treatment of PPH



Manual removal of placenta and removal of remaining tissue or membranes

If there is no excessive bleeding allow up to 60 minutes for the placenta to be expelled before considering a manual removal. Active management of third stage of labour is described on page 11.

Manual removal of the placenta or tissue should always be carried out by a trained healthcare worker. It should be performed as a full aseptic technique, to reduce the risk of infection.

The procedure is painful. Anaesthesia should be given before the procedure to relieve pain and relax the uterine muscles. If there is a severe bleeding anaesthesia should not be a delaying factor. If possible, do the procedure in an operating theatre so that a laparotomy can be performed without delay if needed. In some cases of placenta accreta, increta or percreta, manual removal is not possible, and the patient will need surgical intervention.

Place woman in dorsal lithotomy position

- Empty the urine bladder
- Any ongoing infusion with uterotonics should be stopped
- Cone your hand and insert it into the vagina and through the
- cervix to the uterus

Manual removal of the placenta

Follow the umbilical cord as a guide when the coned hand is inserted to the vagina.

Feel for a separated edge of the placenta. The fingers are used in a sideways slicing movement, detaching the placenta from the uterine wall.

When the placenta is completely free, keep the hand on the fundus while carefully and slowly extracting the placenta from the uterus.

Check the placenta immediately to ensure completeness. If it is not complete, the hand should be reinserted in the uterus to remove remaining tissue.

Removal of remaining tissue or membranes

Systematically search the whole uterine cavity for remaining tissue or membranes.

In many cases there will be coagulated blood in the cavity which may contain remaining placental tissue/membranes.

If necessary (and if available), a nonsharp curette can be used to remove the remaining tissue.

• A uterotonic drug should be given after the procedures. Prophylactic antibiotics are strongly advised after a manual removal of placenta and removal of remaining tissue and/or membranes.

Medication

The most common cause of PPH is an atonic uterus where medications play a vital part in the treatment. This chapter will describe the medications recommended by WHO. There are a few other drugs available, however these are not recommended, due to a variety of factors including price, that they are not proven to be of better quality than existing drugs and short shelf life or heat instability. Uterotonics are recommended as a prophylactic measure after all deliveries.

Below is an overview of medications that can be used in the prevention and treatment of PPH. Please see table for dose, and how to administer.

Be aware that local protocols may differ from the table; based on medications availability, choice in different healthcare institutions and knowledge among the healthcare workers. Always follow your local guidelines.

Uterotonic drugs

Uterotonic drugs are given to facilitate the contraction of the uterus. These drugs are used both for prevention and treatment of PPH. There are 4 main uterotonic drugs.

- Oxytocin (Syntocinon[®], Pitocin[®] & Carbetocin[®])
- Ergometrine/methylergometrine (Methergin[®])
- Ergometrine-oxytocin combination drug (Syntometrine[®])
- Misoprostol (Cytotec[®])

Tranexamic acid

Tranexamic acid is given for support of the coagulation system. It is an antifibrinolytic drug that reduces bleeding by inhibiting the breakdown of clots. Preferably it should be given early after PPH has been diagnosed.

Fluid resuscitation

Crystalloid fluid (normal saline and Ringer's lactate) is given to to establish stable blood flow (haemodynamic stability), restore adequate intravascular volume and improve oxygen tissue delivery. When given in large volumes, clear fluids can cause dilution of clotting factors resulting in impairment of coagulation and coagulopathy.

Blood and blood products

Transfusion of blood and blood products are indicated in severe PPH, severe anemia, clotting failure or cardiac failure.



Table 3. Overview of drugs used in prevention and treatment of PPH

Name	Effect	Dose	Administration route	Comment	Side effect
Oxytocin	Uterotonics stimulate rhythmic uterus contractions.	10IU	IM / IV Slow IV administration.	For prevention, and, if needed, a second dose as a treatment for PPH. It needs refrigiration 2-8°C. Some brands can be stored ≤25°C but have a shorter shelf life.	Can cause low quickly IV.
Ergometrine/ Methylergometrine (Ergot Alkaloids)	Uterotonic that initiates strong, lasting contractions in the uterus.	0.2 mg	IM / IV IM given directly IV diluted in 9 ml normal saline. Slow administration.	For prevention or as treatment for PPH. Can only be used if hypertensive disorders can be ruled out. Do not use if retained placenta. Store between 2-8° C and protect from light.	Nausea, vomiti hypertension.
Syntometrine Oxytocin 5IU/ Ergometrine 500 micrograms	Uterotonic that combines rhythmic contractions and greater tone in uterus.	500 mcg/ 5IU	IM	For prevention or as treatment for PPH. Can only be used if hypertensive disorders can be ruled out. Store between 2-8° C Protect from light. Can be stored up to 25° C for 2 months if protected from light.	Nausea, vomiti hypertension.
Misoprostol	Prostaglandin, stimulates uterus to contract but is less efficient than oxytocin.	400- 600 mcg	Sublingual /Orally. Rectal administration if patient is unconscious.	Used prophylactic or as treatment for PPH. Cheap drug that does not require injections. Heat stable	No clear evider superior. The h effects such as diarrhoea.
Oxytocin infusion	Uterotonics stimulates rhythmic uterus contractions.	20IU/ 1L	IV - 60 drops/min.	The doses in the uterotonic infusions used in PPH varies, follow your local guideline	
Carbetocin	Rhythmic contractions of the uterus, increased frequency of existing contractions, and increased uterine tone.	100 mcg	IV / IM	For prevention	Carbetocin is li reducing PPH. undesirable eff
Tranexamic acid	Antifibrinolytic drug. Inhibit the breakdown of blood clots.	1gram	IV	Slow administration 100 mg = 1 ml/min. Should be given within the first 3 hours after PPH is diagnosed.	Hypotension, n
Ringer's lactate/ normal saline	Crystalloids.	1-3L	IV	1L given as a rapid infusion, WHO recommend 2-3 L. Preferbly warm fluid 37° C.	Clotting disord fluid. Low body administration
Blood or blood products	Erythrocytes or fullblood.	-	IV	The access to safe blood products varies follow local guidlines.	Blood transfus out by trained of patient the for blood preassur



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blood pressure if given

ing, headache, diarrhoea,

ing, headache, diarrhoea,

nce of which dose is higher dose has more side s fever, shivering, and

ikely superior to oxytocin in No clear difference in fects compared to placebo.

nausea.

ders caused by too much IV y temperature due to rapid of cold fluid.

sions should only be carried clinicians that monitor side effects, as fever, low re etc.

Empty bladder - Urinary Catheterisation

Since a full urine bladder can disturb the contraction uterus after delivery, an intermittent urinary cather recommended when a woman are unable to pass ur spontaneously. Use an aseptic technique and inform patient about the procedure.

- Separate the labia, clean the area around urethral
- Insert the urinary catheter, upward in a 30-degree until urine begins to flow.
- When urine stops flowing remove the catheter.
- In case of PPH, place a permanent catheter until bleeding has resolved to monitore urine output.

on of the rization is rine m the	Bimanual uterus compression is a manual internal/external compression of the uterus. The procedure is painful for the woman, so information is important.
l opening. e angle	 Cone your hand and insert it into the vagina and through thecervix to the uterus, close the fist, while the other hand holds a firm grip on the top of the uterus (fundus).
	 The hands are pushed together to create a compression of the uterine wall. The procedure is used if the uterus is atonic.
the	 This manoeuvre can be used to gain temporary control of the bleeding when transferring the patient to an operating room or other healthcare facilities.
	Most PPH will resolve by these initial treatment options and

a higher level of care.

Bimanual uterus compression



sion is a manual internal/external





Advanced treatment of PPH

Intrauterine balloon tamponade (IBT) (Bakri balloon)

The purpose of IBT is to create pressure against the uterine wall and thereby reduce the bleeding. The most widely known device is the Bakri[®] balloon, but it is also possible to simply use a condom attached to a urine catheter. Please see video link for illustration of how to make an intrauterine balloon tamponade using a condom.

- Place the woman in a gynaecological position.
- Insert a speculum to locate the cervix. If available, place ring If bleeding has stopped and patient is stable, empty the forceps on the cervix. balloon completely and observe for 30 minutes. Remove it if there is no further bleeding.
- Insert the balloon into the uterine cavity, using aseptic technique.
- Fill the balloon with lukewarm normal saline until the bleeding stops (normally 300-500 ml).

If the cervix is soft and still dilated it is recommended to fill the vagina with gauze in order to counteract expulsion of the balloon. Make a mark on the abdomen indicating the level of the uterus. If the uterus raises above this it indicates an unseen internal bleeding.



• After 6–24 hours, if the uterus fundus remains at the same level and there is no active vaginal bleeding, deflate the balloon 50–100 mL every hour as long as there is no further bleeding at each interval.

- If the woman starts to bleed when the balloon is deflated or the oxytocin has stopped, reinflate the balloon and start the oxytocin infusion again.
- IBT should only be used when there is a certainty that uterus rupture or remaining tissue is not the cause of the bleeding.

External Video link Condom tamponade technique https://www.youtube.com/watch?v=76yXRe6F3wc







B-lynch

B-Lynch Brace Suture/Compression suture is a surgical technique. It requires an operating room and anaesthesia. This simple surgical technique has proven to be useful in maintaining uterine contraction and thereby preventing blood loss. When used it may prevent a hysterectomy.



B-lynch incision

Sorce: MLX

Hysterectomy

In most severe cases where all other treatment options fail, the only option might be to remove the uterus, called a hysterectomy. Once the uterus has been removed further pregnancies will not be possible. Hysterectomy should only be performed by trained health care officials.





More external video links

Manual removal of the placenta 1 https://www.youtube.com/watch?v=4iHSXADzc98

Manual removal of the placenta 2 https://vimeo.com/72407733

How to use the uterine balloon tamponade https://www.youtube.com/watch?v=0ycliSjvcF4

Inserting a urinary catheter https://globalhealthmedia.org/videos/inserting-a-urinary-catheter/

Taking a blood pressure https://globalhealthmedia.org/videos/taking-a-blood-pressure/

Uterine compression https://globalhealthmedia.org/videos/uterine-compression/

Aortic compression

https://globalhealthmedia.org/videos/aortic-compression-english/

Inserting an IV needle https://globalhealthmedia.org/videos/inserting-an-iv-2/

Giving IV fluids

https://globalhealthmedia.org/videos/giving-iv-fluids/

Saphenous cut-down

https://www.youtube.com/watch?v=70_LfYtaXHE

More videos about childbirth

https://globalhealthmedia.org/language/english/ ?_sft_topic=childbirth

- Inspection of the placenta
- Care in third stage of labour
- Severe bleeding
- Investigating for ruptures; suturing cervical, perineal or labial tears

Secondary PPH





Secondary PPH is abnormal bleeding or excessive bleeding from the uterus occurring between 24 hours and 6 weeks postpartum. Most secondary PPH occurs within 10 to 14 days postpartum. The bleeding is usually due to the remains of placental tissue and/or membranes, or a large blood clot in uterus that inhibits uterine contraction. The blood may also have an offensive smell if infection is present. If infection is present, the patient may have rapid pulse, fever and increased pain.

Normally, vaginal bleeding in the first days after delivery (lochia) will decrease and change in colour to dark pink or brown (old blood). In secondary PPH the blood will be bright red (fresh blood).

Secondary PPH most commonly occurs after patients have left the health care facility, therefore, it is important to inform them of the signs of secondary PPH. The patient should be advised to contact health care facilities if their bleeding changes.

Treatment of secondary PPH

- Initial treatment of secondary PPH is uterine massage and oxytocin injection.
- If uterine massage and an injection of oxytocin is not sufficient, it is recommended to give the patient an oxytocin infusion (20 IU in 1 litre of fluid, given at 40 drops per min).
- If retained placental tissue is the cause and oxytocin is not sufficient, prepare the patient for **manual vacuum** aspiration (MVA).
- Check the patient for signs for infection. If infection is suspected, start IV antibiotics.
- Administer intravenous fluid or blood transfusion if clinical signs indicate that the woman has lost a lot of blood (hypovolaemic).



Abortion





Abortion can turn into a life-threatening condition. Around 8% of all maternal deaths are related to abortion and are most frequent in areas where unsafe abortion is common. Unsafe abortion refers to the termination of pregnancy by persons lacking the necessary skills, or in an environment lacking the minimal standard of care, or both. This is most often seen in countries where abortion is illegal or socially not accepted. Causes of death related to abortion are either bleeding or infections. The infection often occurs days or weeks after the abortion and may be due to retained foetal or placental tissue, or due to the use of unclean instruments.

External aortic compression can be used in haemorrhage related to abortion as the mechanism for bleeding is similar to that of PPH. Bleeding after an abortion is often due to foetal or placental tissue retained in the uterus and thus manual vacuum aspiration should also be performed to treat the bleeding.

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Glossary of terms





Accreta - Abnormally adherent placenta through the muscle layer of the uterus.

Amniotic Fluid Embolism - A rare condition caused by amniotic fluid entering the maternal circulation via the uterine sinuses of the placental bed. The condition is often fatal. It is most likely to occur in labour or in the immediate postpartum period.

Anaemia is a condition in which the number of red blood cells or the haemoglobin concentration within them is lower than normal. Haemoglobin is needed to carry oxygen and if you have too few or abnormal red blood cells, or not enough haemoglobin, there will be a decreased capacity of the blood to carry oxygen to the body's tissues. This results in symptoms such as fatigue, weakness, dizziness and shortness of breath, among others. Clinical evidence of anemia or if haemoglobin is <11 g/dl.

https://www.who.int/health-topics/anaemia#tab=tab_1

Anuria - No urine output.

Aorta - The largest blood vessel carrying blood away from the heart to the body.

Aseptic - Aseptic technique refers to special precautions taken to achieve a bacteria-free environment. Precautions include use of the correct hand-washing technique, correct use of sterile instruments and drapes and the wearing of sterile clothing by staff, e.g., gown, cap and gloves.

Augmentation - To increase. In augmented labour, oxytocin may be used to increase the effectiveness of the contractions if progress is slow.

Capillary filling time is the time it takes for the circulatory system to fill up the capillaries after they have been emptied of blood. This gives a good indication of how good a person's micro circulation is.

Cardiac output - The volume of blood the heart is able to pump out every minute.

Coagulation - Also known as clotting. Coagulation is the process by which blood changes from a liquid to a gel, forming a blood clot.

Coagulation factors - Coagulation factors are proteins in the blood that help control bleeding. There are several different coagulation factors in the blood. When a cut or other injuries that causes bleeding occurs, the coagulation factors work together to form a blood clot, preventing further blood loss.

Diabetes - Metabolic disorder due to deficiency of insulin.

Disseminated Intravascular Coagulation (DIC) - Disturbance of the coagulation system triggered by certain coagulation conditions (e.g., septic or haemorrhagic shock, eclampsia) and characterised by generalized bleeding.

Embolization - Blocking of a blood vessel.

Fibrin - Fibrin is converted from fibrinogen. Fibrin is a network of long, sticky strands that traps the blood to form a clot.

Fibrinogen - A protein in the blood that is converted into fibrin which ultimately forms a blood clot.

Fibroids - Non-cancerous tissue growth in the uterus.

Fluid load - A bolus of Ringer's-lactate or saline administered intravenously in a controlled but rapid fashion to increase systemic blood pressure.

Haematoma - A localised collection of blood in an organ or tissue due to blood leaking from a blood vessel.

Haemodynamically stabilised - Blood circulation that is sufficient to maintain normal blood pressure and heart rate.

Haemoglobin (Hb) - A protein within the red blood cells. If Hb levels are low, the red blood cell count is also low (anaemia).

HELLP (Haemolysis Elevated Liver enzyme and Low Platelet count syndrome) - HELLP syndrome is a complication that can occur during pregnancy or just after birth. It is a condition characterised by the destruction of red blood cells (haemolysis, H), elevated liver enzymes in the blood (EL) and the decrease in the number of platelets (LP).

Hypercoagulable - A hypercoagulable state is the medical term for a condition in which there is an abnormally increased tendency towards blood clotting (coagulation).

Hypothermia – Reduced body temperature below 36 degrees Celsius.

Hypovolaemia - Abnormally low volume of circulating blood in the body. This occurs when the body loses a lot of blood or when severely dehydrated.

Hysterectomy - Surgical removal of the uterus.

Increta - Abnormally adherent placenta in the perimetrium of the uterus.

Infestation - Presence of large number of microbes; here referred to helminth infections such as worms.

Intravascular - Within the blood vessels.

Manual vacuum aspiration - A technique used to perform an abortion or remove placental residue. A larger vacuum syringe is used to remove unwanted tissue or pregnancy products.

Morbidity - Suffering from disease or medical disorder.

Mortality - Death.

Partograph - A record of the clinical observations made of a woman in labour. The central feature of which is the graphic recording of the dilatation of the cervix, as assessed by vaginal examination, and descent of the head. It includes an alert and action line which, if crossed when recording cervical dilatation, indicates that labour is progressing more slowly than normal and intervention is required. **Percreta** - Abnormally adherent placenta through the muscle layer of the uterus.

Placental abruption - Premature separation of a normally situated placenta.

Polyhydramnios - A condition characterized by an excess of amniotic fluid. It is associated mainly with multiple pregnancies, foetal abnormalities and diabetes. **Pre-eclampsia** - A condition specific to pregnancy characterised by hypertension and and signs of damage to another organ system, most often the liver and kidneys. Subjective symptoms include oedema, headache, light sensitivity and epigastric pain.

Uterine inversion - the uterus turns partially or completely inside out (after vaginal delivery).

Vagal stimulation - Vagal stimulation is a parasympathetic reaction caused by stretching of the tissue. The reaction is similar to shock, but with bradycardia.



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