Postpartum Haemorrhage

Minimize Maternal Morbidity and Mortality

EXAC

MLX

INTERACTIVE MANUAL

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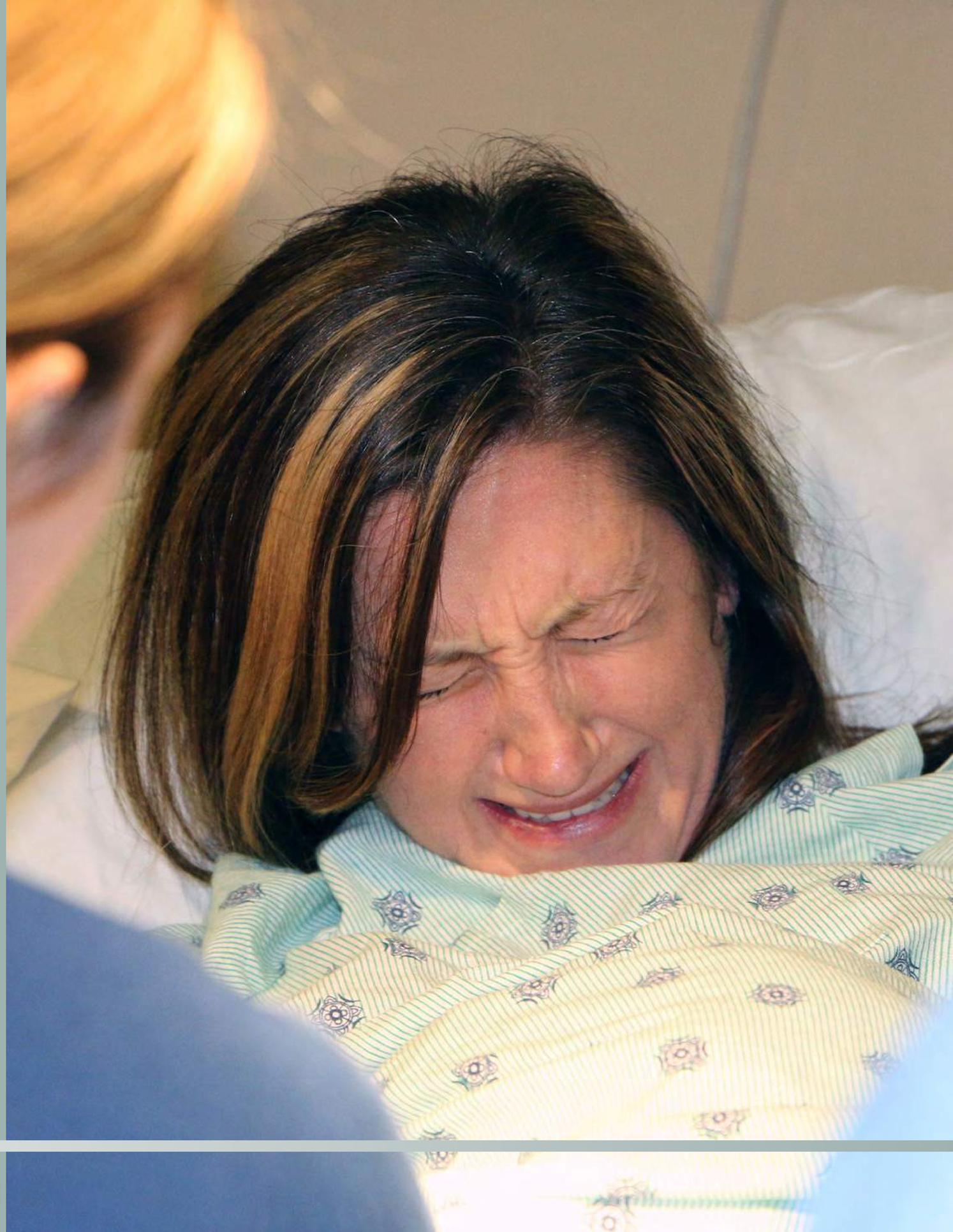
Introduction and Definitions

Introduction

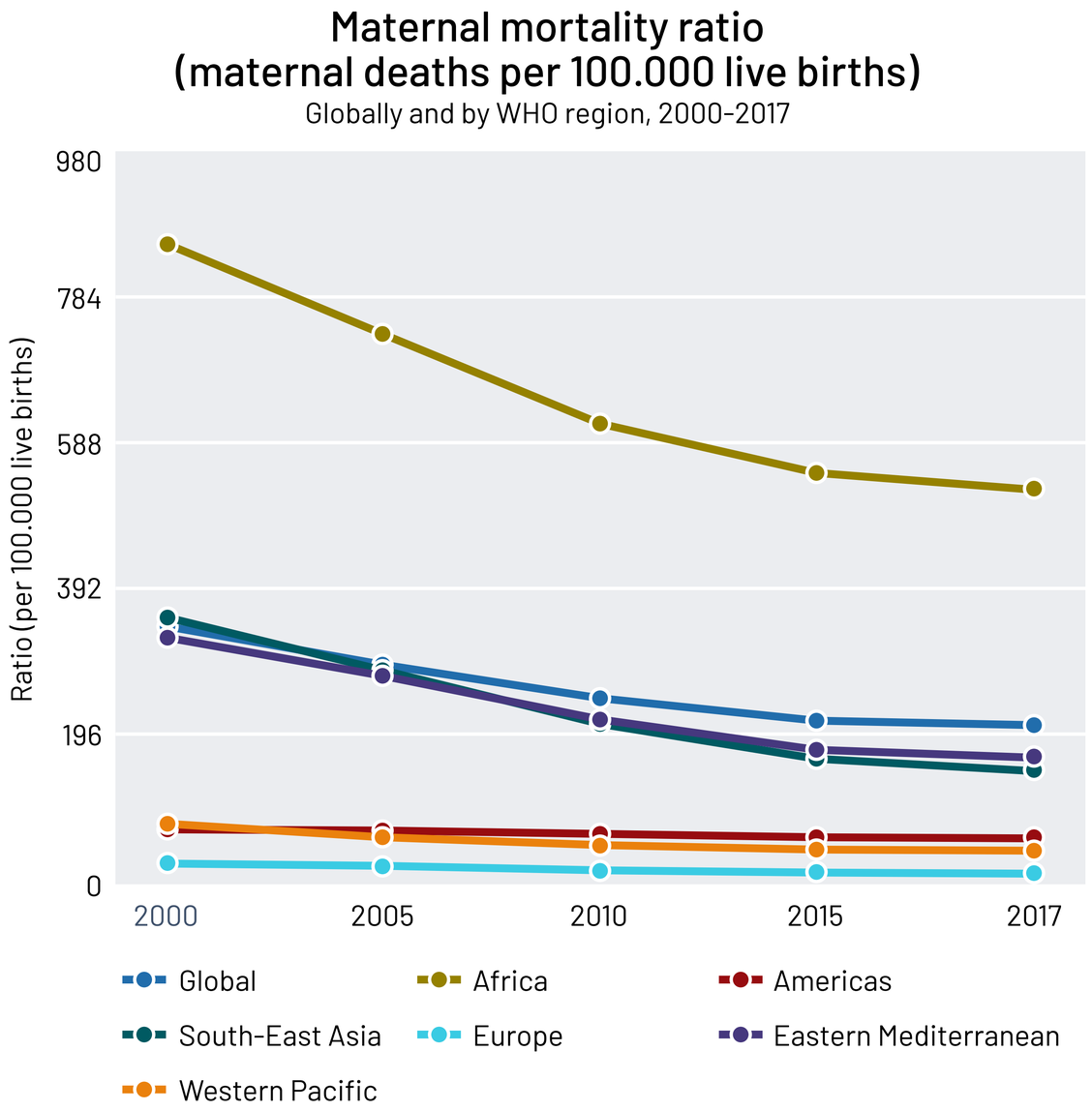
Definitions of Postpartum Haemorrhage (PPH)



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 (UN) third Sustainable Development Goal. Currently, 60 countries have a MMR above 140,and the MMR in Chad, Sierra Leone and South Sudan is above 1000.



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 ≥ 500 ml within the first 24 hours after delivery is called **primary postpartum haemorrhage (PPH)**, which is divided into two categories:

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

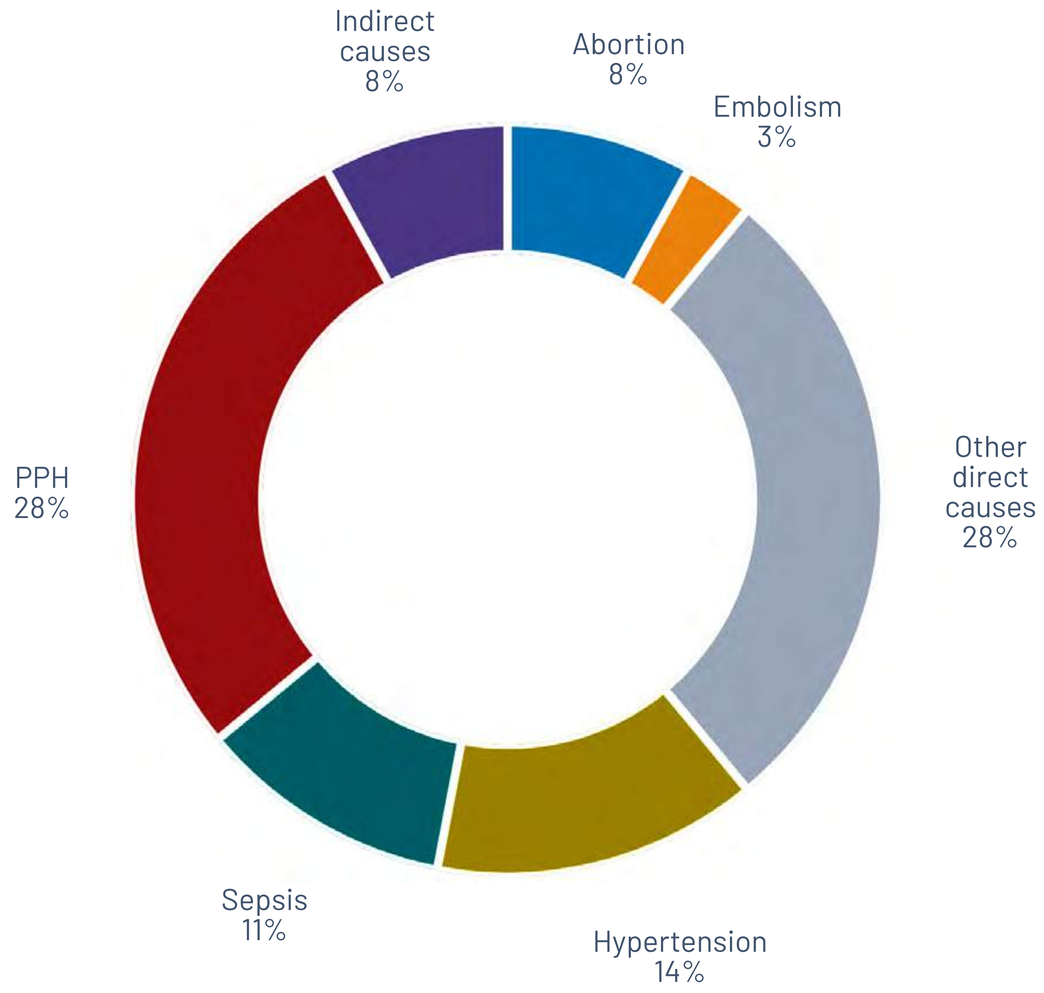
Secondary PPH is bleeding occurring 24 hours to 6 weeks after delivery.

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.

Causes of maternal deaths



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.*

Q/A Q/A

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

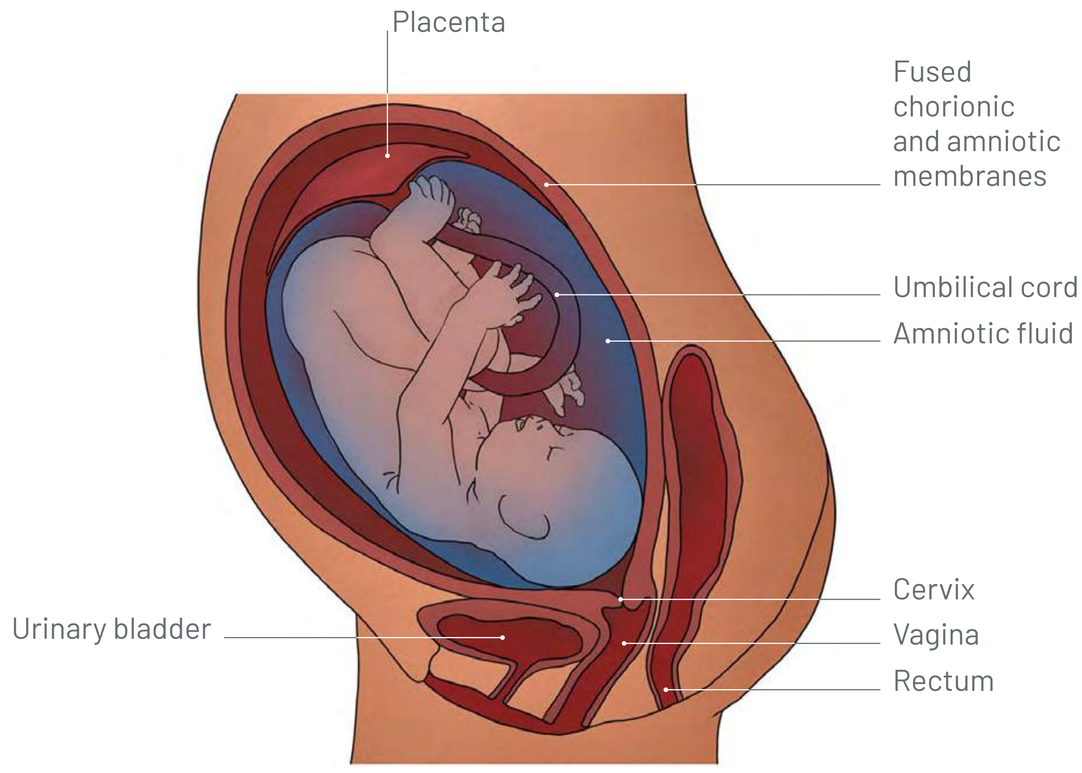
Anatomical and Physiological Changes During Pregnancy

The female body undergoes anatomical, physiological, and biochemical changes to meet the demands of pregnancy. Among other changes, the blood volume increases by 1-1.5 litres. This increase helps women tolerate normal blood loss after delivery, preventing hypovolaemia.

At term, 500-700 ml of blood circulates in the placenta and uterus per minute. This is one of the reasons that a life-threatening PPH can develop rapidly.

The propensity to form blood clots increases (hypercoagulability). This is vital to stop bleeding when the placenta has been expelled.

Anatomy of the female reproductive system



The Uterus

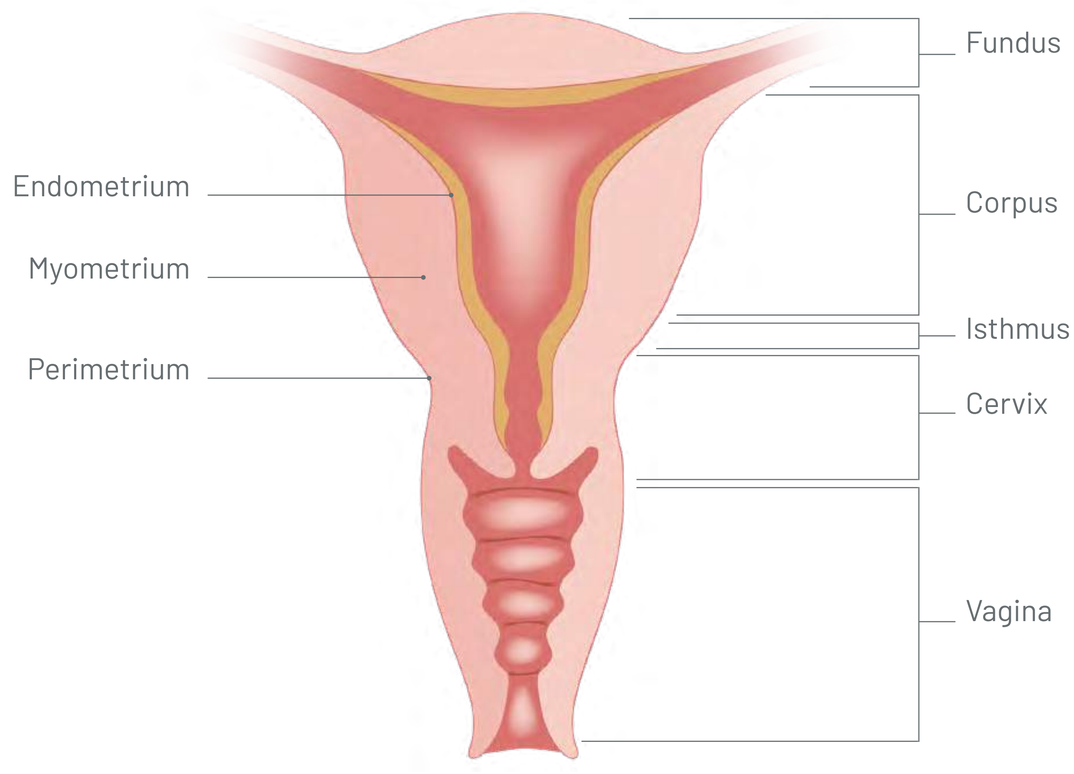
The uterus

The uterus consists of two parts, the body and the cervix. The upper part of the uterine body is called the fundus and the lower part is called the isthmus. The cervix is a canal between the isthmus and the vagina. During delivery, the cervix opens (dilation) and becomes thinner (effacement), and the baby is pushed through it into the vagina. 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) , thereby stopping bleeding. The urinary bladder is located in front of the uterus.

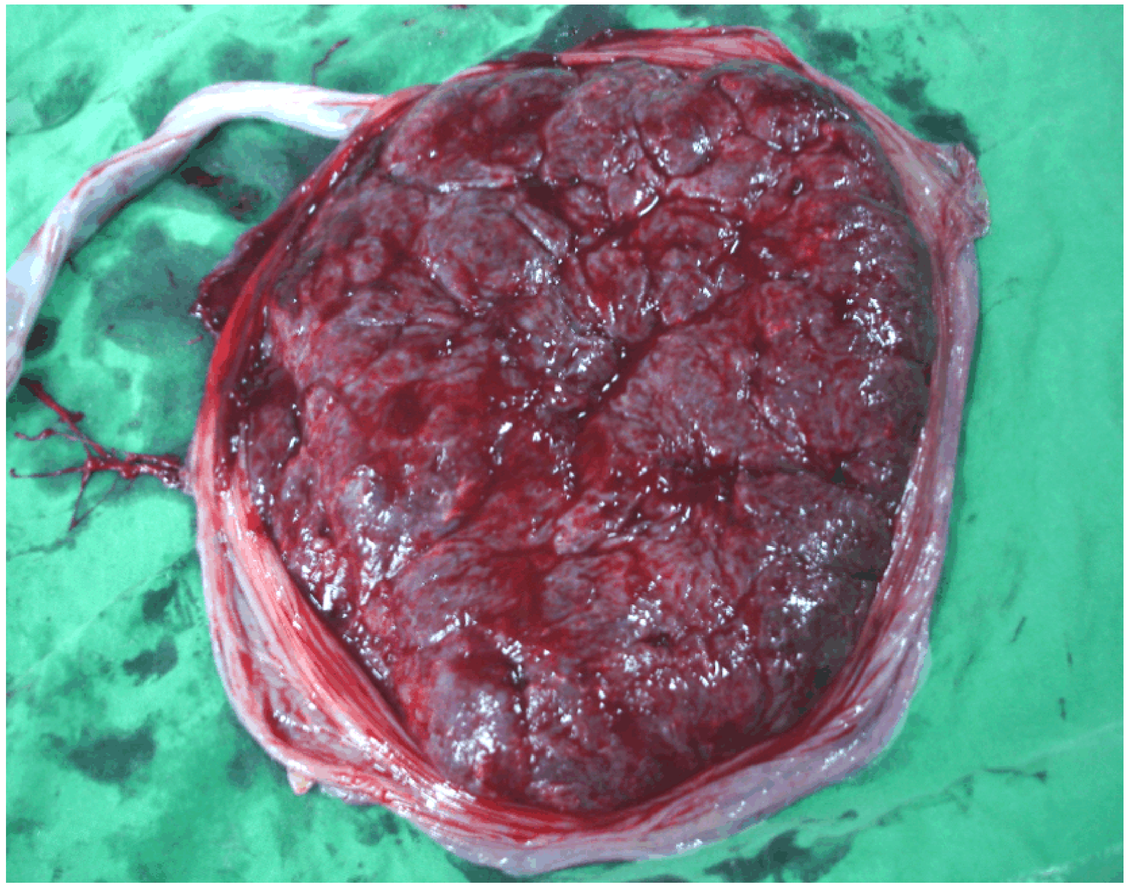
The uterine layers

The endometrium is the innermost lining of the uterus and is where the placenta embeds.
The myometrium is a muscular layer that consists of longitudinal, circular, and oblique muscle fibres that are very expandable.
The perimetrium is the thin covering on the outside of the uterus.

Anatomy of the uterus



The Placenta



Maternal surface of the placenta

Placenta and its membranes

The maternal surface of the placenta, embedded in the endometrium, is dark red. The surface is divided into lobes. Inspection of the maternal surface of the expelled placenta allows evaluation of whether it is complete or whether placental tissue remains in the uterus.

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

Source: ExAC

Stages of Labour

Labour is divided into three stages:

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

The WHO recommends active management of the third stage of labour for all deliveries, in order to prevent PPH. Active management includes:

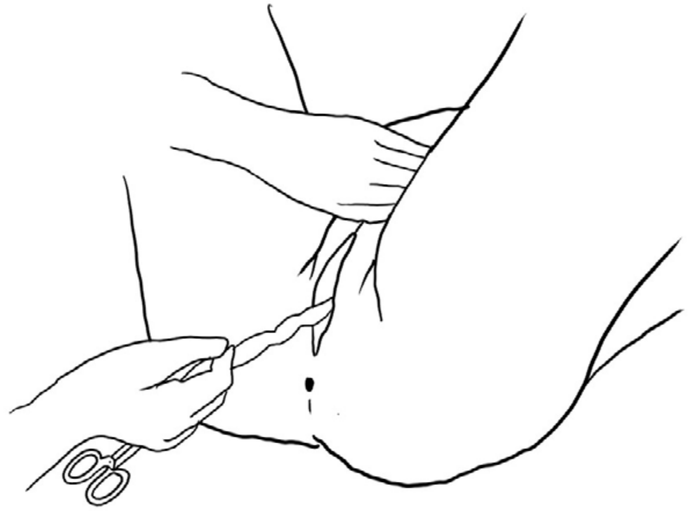
- **Injection of uterotonics** as soon as the baby is born (after confirming that there is no twin in the uterus). Uterotonics are drugs that stimulate the uterus to contract or become firmer (increase tone). The first choice is oxytocin 10 IU intramuscularly. If unavailable, other uterotonics may be used. If the healthcare provider is not trained in administering injections, misoprostol 400 - 600 mcg sublingually, orally or rectally is a good alternative. This is the most effective action to counteract PPH.

- **Delayed cord clamping** for 1-3 minutes or until pulsations have stopped. Delayed cord clamping is beneficial for the newborn baby as it receives additional blood from the placenta.

- **Controlled cord traction (CCT)** shortens the duration of placental separation and may help reduce blood loss. Note: CCT may only be performed by skilled birth attendants, due to risk of tearing the cord and uterine inversion. These are serious complications. If the cord tears, the placenta must be extracted manually. See more about uterine inversion below.

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

Controlled chord traction



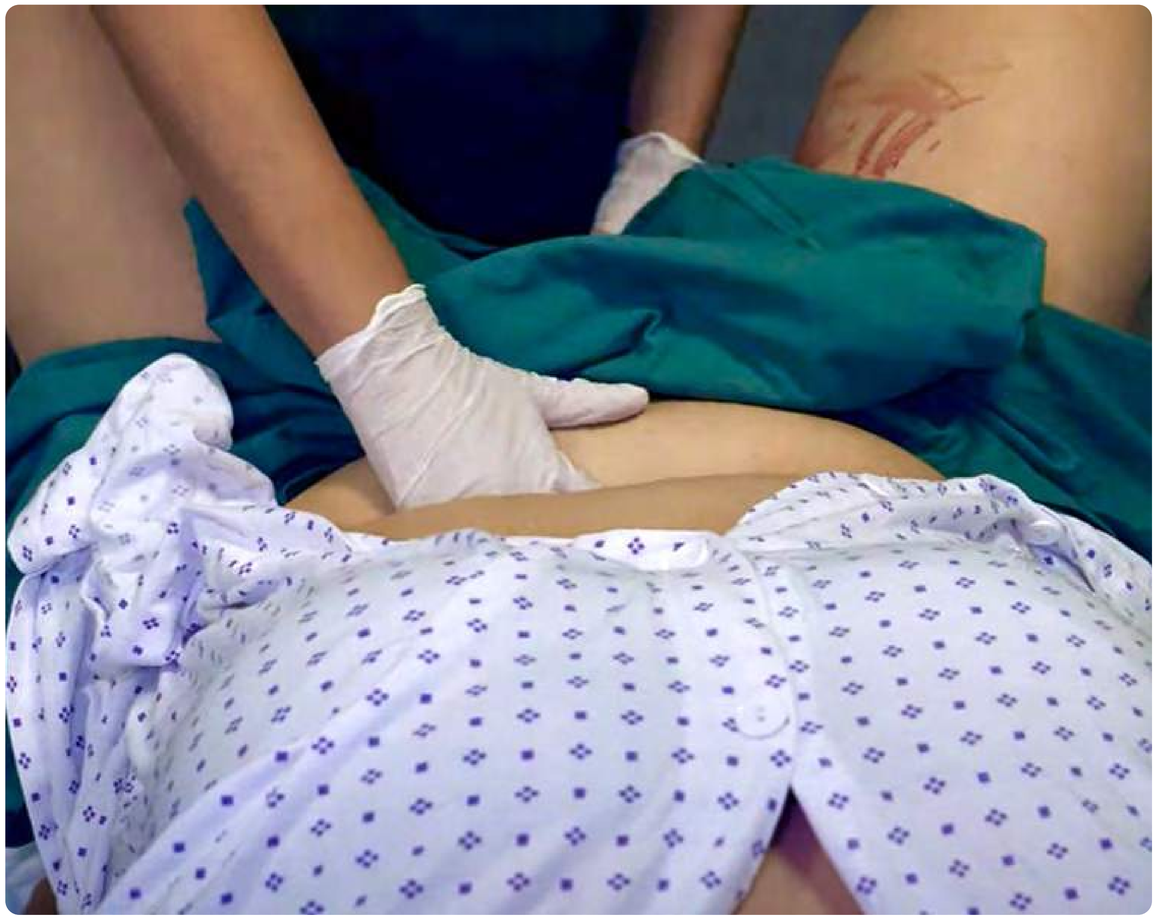
External Video link

How to manage the third stage of labour

https://globalhealthmedia.org/portfolio-items/managing-the-third-stage-of-labor/

- **After expulsion of the placenta, evalutation of uterine tone and abdominal uterine massage are recommended for all women.**
  Uterine massage helps identify a soft uterus (uterine atony), the most common cause of PPH. Place a hand on the uterus and stimulate it by massaging gently and, if necessary, by squeezing. Continue until you feel the uterus contract. In most cases, vaginal bleeding will increase as the blood is discharged from the uterus. Massage should be continued until the uterus is firm, and repeated every 15 minutes for the first two hours, more often if the uterus is soft.

- **Before 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 **increased** risk of PPH. Sustained massage will also cause unnecessary pain and discomfort.



Source: ExAC

Monitoring of the Mother after Delivery

Early detection of PPH is important to reduce morbidity and mortality. As most bleeding occurs within the first 2 hours after delivery, close monitoring and preventive measures are recommended during this period:

- If the placenta is not expelled within 30 - 45 minutes, consider manual removal. Consider removal earlier if 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 uterine tone and vaginal bleeding amount every 15
- minutes for the first 2 hours after delivery. If the uterus softens, perform uterine massage.

- Check for bleeding from vaginal tears, suture if necessary. Compress tears with sterile gauze if suturing is not an option or if 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 inhibit effective uterine contraction and thereby increase bleeding. A full bladder should be suspected if the uterus can be palpated above the level of the umbilicus.

- Remember to look for blood in sheets and pads.

- Monitor blood pressure and pulse rate if bleeding is suspected.

- Initiated breastfeeding or stimulate the nipples. This releases hormones that cause uterine contraction.

Risk factors and preventive measures for PPH during pregnancy and delivery

PPH is impossible to predict. All deliveries should thus be considered as carrying a potential risk of PPH. However, there are different factors creating higher risk of PPH in some deliveries. See Table 1 and Table 2 for different risk factors and preventive measures to consider for minimising PPH incidence.

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 of PPH
Anaemia	Minor blood loss can be fatal and low haemoglobin (Hb) increases the risk of PPH.	Hb monitoring during pregnancy. Dietary advice. Iron/folate supplementation during pregnancy. Common diseases such as infestation, malaria and HIV cause anaemia and can be treated. Blood transfusion should be given in cases of severe anaemia.
Overstretched uterus	High parity (≥ 5 previous pregnacies), twin/triplet pregnancies, macrosomia (birth weight over 4 kg) and polyhydramnion increase risk of atony due to overstretching	Family planning aiming at spacing of pregnancies. Referral to higher level of care for twin/triplet pregnancy or high parity. Dietary advice and control of diabetes.
Uterine fibroids	Can reduce uterine ability to contract after delivery.	Identify and refer to higher level of care early in pregnancy, family planning to avoid a new pregnancy.
Low positioned placenta	A low-lying placenta embeds in part of uterus with fewer oblique muscles, and consequently weaker constriction of blood vessels.	Repeated minor bleeding throughout pregnancy can indicate placenta praevia or low-lying placenta. If placenta praevia is diagnosed refer for delivery by caesarean section.
History of previous PPH	Statistically higher risk of recurrent PPH	Identify and refer to higher level of care before due date.
Hypertension during pregnancy	Hypertension and pre-eclampsia can cause low platelet levels and DIC, and are associated with increased risk of PPH.	Diagnose, monitor, treat, refer to higher level of care.
Intrauterine foetal death	Foetus retained in uterus for days or weeks can cause consumption of coagulation factors. Foetal death caused by placental abruption increases risk of PPH.	Identify and refer to higher level of care. Induce labour quickly after identifying intrauterine foetal death.
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 healthcare facility. Transportation problems. **Acceptability** e.g. lack of trust in formal healthcare systems.	Important to recognise these issues to ensure that women obtain quality care regardless of where they live of whether they are poor. Some of these factors can be mitigated by education, community support and awareness.

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

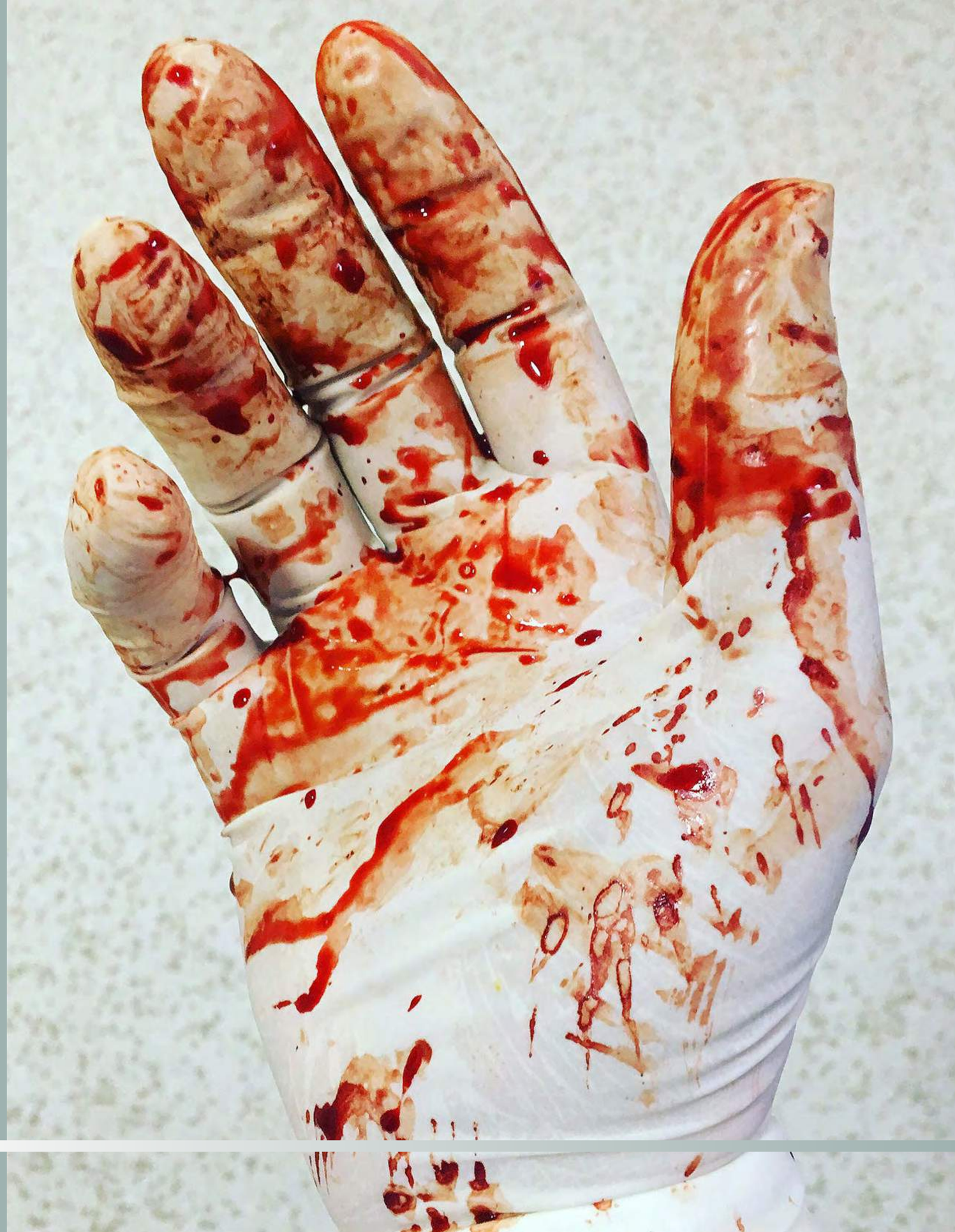
Table 2. Risk factors and preventable measures for PPH during delivery

Risk factor	How does this risk factor affect PPH?	Preventative measures to avoid incidence of PPH
Full urine bladder	Can inhibit contraction of the uterus.	Ensure that bladder is emptied regularly during the first hours after birth.
Retained placenta and/or membranes	Retained placenta, placental tissue or membranes inhibit uterine contraction and can cause PPH.	Meticulous delivery of placenta and membranes to ensure completeness. Avoid uterine massage before placenta is delivered. Manual removal of placenta or exploraton if retention is suspected.
Prolonged or rapid labour	Both prolonged and very rapid deliveries can cause uterine fatigue leading to atony. Female genital mutilation (FGM), primarily infibulation, can cause prolonged or obstructed labour if defibulation is required but not performed.	Prolonged labour can sometimes be prevented by the correct use of a partogram. Augmentation for prolonged labour, if not contraindicated. Assess FGM. Repeatedly consider referral to higher level of care or operative delivery in prolonged labour.
Trauma to the birth canal, tears and lacerations. Uterus rupture	Ruptures in the birth canal occur spontaneously but are more common after unskilled or complicated instrumental (vacuum and forceps) delivery. Episiotomy should be selective. It is not necessary as a routine and can cause haemorrhages.	Skilled birth attendant supporting the perineum at delivery can prevent trauma to the vagina and perineum. Timely episiotomy, if performed. Episotomy too early can cause excessive bleeding before delivery. Avoid pushing 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 healthcare services. Long distances to healthcare services. Low socioeconomic status and gender can also be reasons for not obtaining necessary treatment. Early marriage or teen pregnancy.	Education can prevent harmful procedures and ensure that patients seek healthcare. Transportation and infrastructure problems can complicate transferral to higher level of care. Poverty contributes to high MMR . Free universal healthcare can prevent maternal death. Education and information are needed regarding family planning to ensure safe intervals between pregnancies and avoid pregnancy at a young age.
Health service risk factors	Underestimation of bleeding amount. 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-doctor staff not allowed to carry out life-saving procedures.	All healthcare centres should have protocols for management of third stage of labour and PPH. Staff should regularly train third stage of labour management and prevention of PPH and other lifesaving procedures. Healthcare services should offer reliable and good-quality care.

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

Pathophysiology of PPH and Recognition of Bleeding

- Causes of Bleeding - The 4 Ts
- Measurement and Estimation of Blood Loss
- Haemorrhagic Shock
- Uterine Inversion

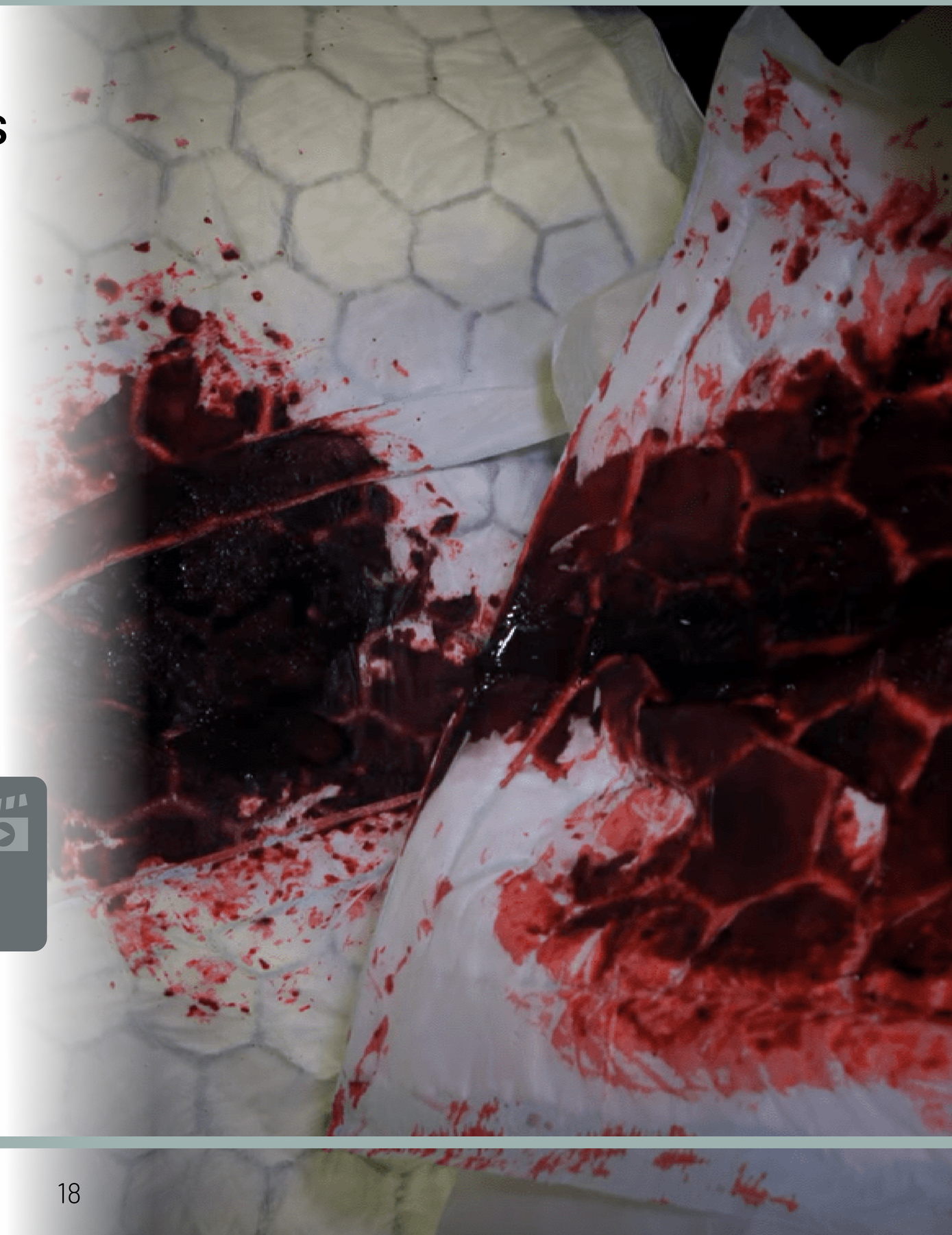


Causes of Bleeding - The 4 Ts

An understanding of PPH causes is important in order 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
- **T**issue – retained placental tissue or membranes in the uterus
- **T**rauma – vaginal and uterine tears and lacerations
- **T**hrombin – coagulation disorders

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

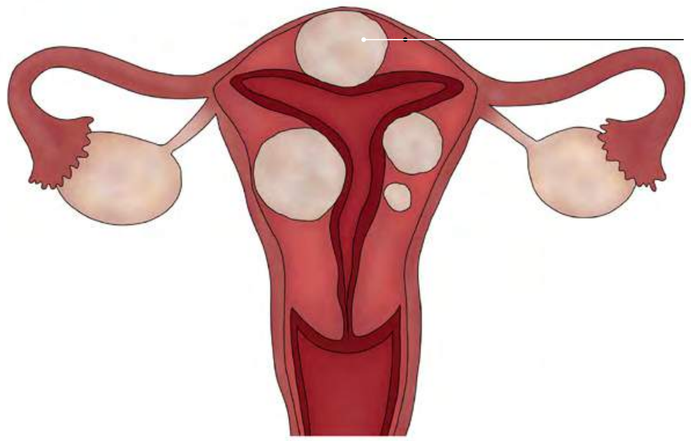


Tone

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

- Enlargement of the uterus caused, for example, by multiple previous pregnancies, excessive amniotic fluid (polyhydramnion) or twin/triplet pregnancy
- Uterine muscle fatigue due to prolonged or very rapid labour, i. e. the uterus has been contracting vigorously and frequently
- Prolonged and/or excessive administration of oxytocin (induction or augmentation) during delivery
- **Placental abruption** can cause blood to be trapped between the myometrial muscle fibres and the placenta (couvelaire uterus). This can disturb uterine contraction, including after placental expulsion.
- A full bladder can inhibit uterine contraction due to its location in front of the uterus.
- Medications: anaesthetic gases, magnesium sulphate, nifedipine and terbutaline are examples of drugs that inhibit uterine contraction.
- **Uterine fibroids** (also called leiomyomas) are growths consisting of muscle and connective tissue emanating from the uterine wall. They may be a mechanical obstacle for compression and inhibit optimal contraction of the myometrium.

Uterine fibroids



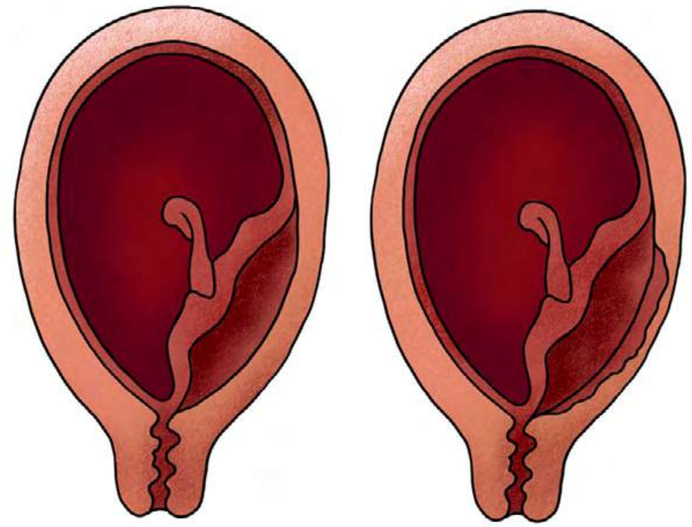
Tissue

If the placenta is expelled:
Retained placental or membrane tissue in the uterus mechanically impairs uterine contraction and causes bleeding. The blood vessels in the myometrium do not constrict properly and the woman may 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 inhibit expulsion of the placenta.

- **Placenta accreta** embeds firmly into the myometrium. It does not perforate the uterus or impact the muscles of the uterus. This is the most common of the three conditions.
- **Placenta increta** embeds into the deeper layer of the myometrium but does not penetrate the uterine wall.
- **Placenta percreta** grows through the uterine wall and can impact other organs like the bladder or the large intestine.

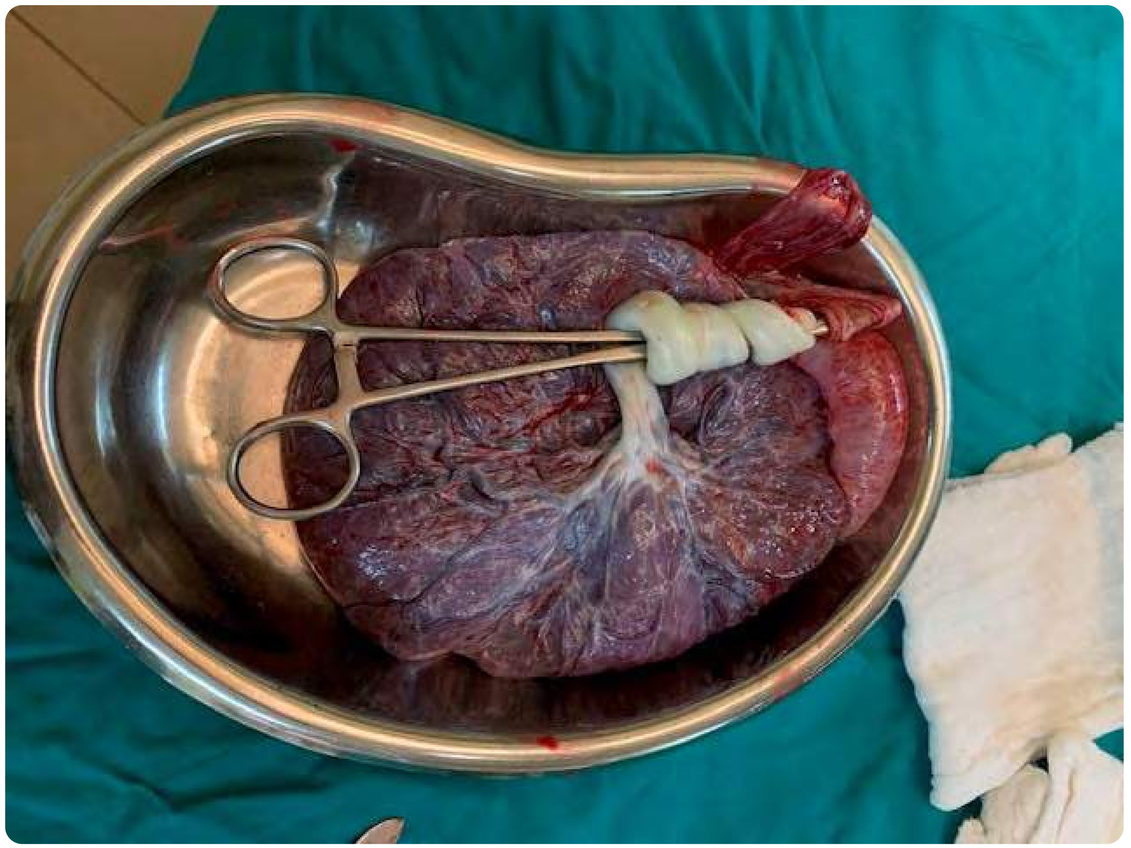
These conditions make removal of the placenta difficult (sometimes impossible), thereby increasing the risk of PPH. The risk of abnormal embedding of the placenta is increased if the woman has undergone previous caesarean section.



However, retained placenta is most often not 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 undetached part of the placenta will continue, increasing the risk of PPH.

Delayed expulsion increases the risk of PPH. When active management of the third stage of labour is implemented, 98% of placentas are expelled within 30 minutes after delivery. The risk of PPH increases the longer the placenta is retained. Manual removal should be considered if the placenta has not been expelled after 30 - 45 minutes. A single prophylactic dose of antibiotics is recommended after manual removal.

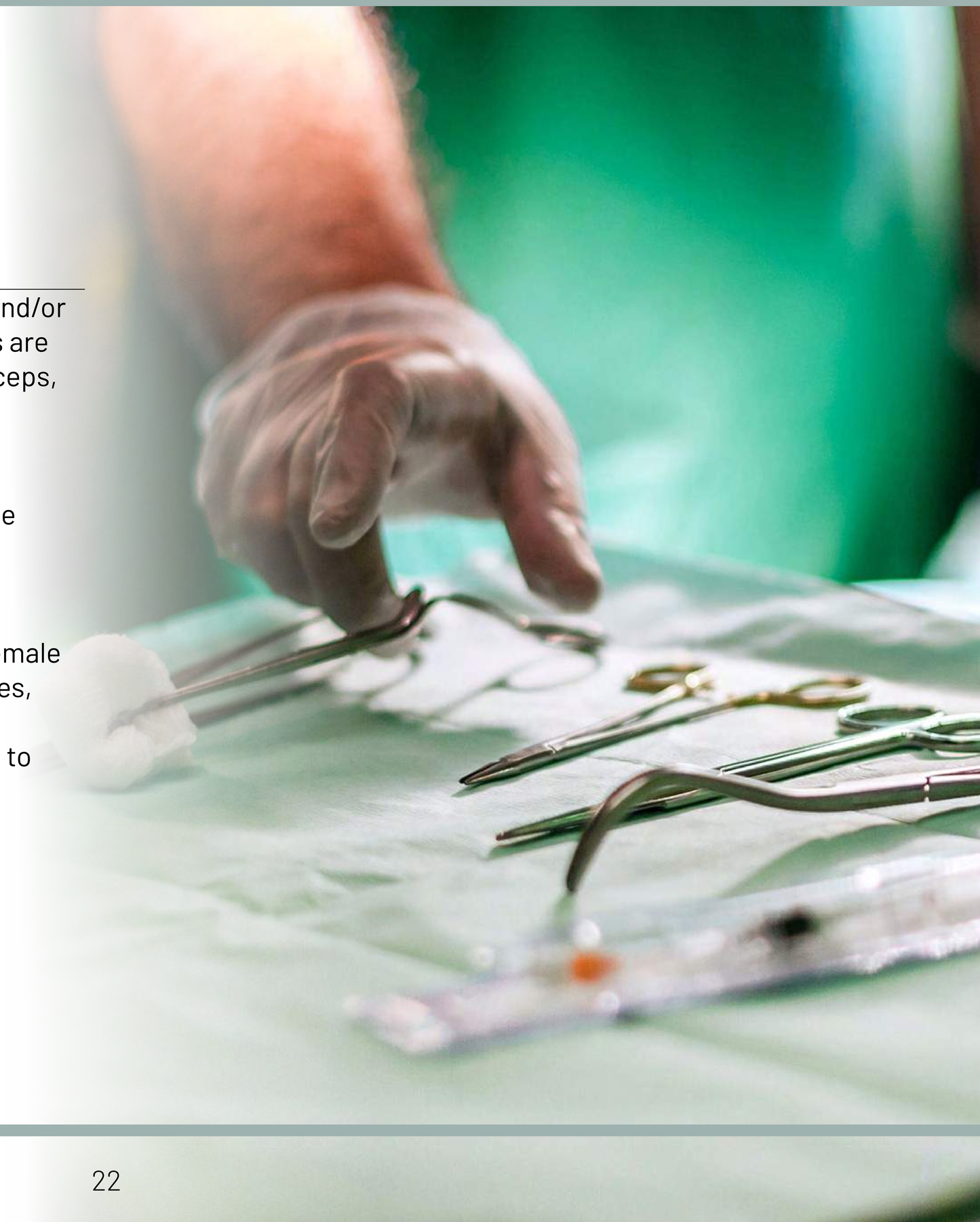


Trauma

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 augmentation.

Uterine rupture can cause bleeding in the abdomen (intraabdominal bleeding). Since the blood collects in the abdomen it is not visible.

Female genital mutilation (FGM) entails partial or total removal of the external genitalia or other injury to the female genitals for non-medical reasons. There are varying types, ranging in severity. The most severe types, primarily infibulation, or complications after other types can lead to obstructed labour or complicated birth canal tears, if defibulation or other intervention is required but not performed.



Thrombin

Thrombin is a coagulation system component. All coagulation disorders are included under this fourth T.
Low levels of thrombocytes and coagulation factors are rarely the primary cause of PPH, since pregnancy leads to increased coagulation factor levels. Different conditions can cause coagulopathy, for example:

- Severe anaemia
- HIV
- Infections
- Pre-eclampsia or HELLP (**H**aemolysis **E**levated **L**iver enzymes and **L**ow **P**latelets)
- Placental abruption
- Amniotic fluid embolism
- Anticoagulation therapy (medication)

In treating PPH, intravenous fluids like Ringer's lactate 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, reducing coagulation factors which in turn reduces clotting ability.

If haemorrhagic shock develops, this may lead to multiple organ failure and disseminated intravascular coagulation (DIC). DIC is a coagulation system disturbance triggered by certain conditions (e.g. septic or haemorrhagic shock, pre-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 clotting delay or if bleeding starts from multiple sites (e.g. nose, gums, skin). In these cases the patient be transferred to a higher level of care.

Measurement and Estimation of Blood Loss

Estimation of blood loss after delivery is essential to enable early detection of PPH, which is vital for reducing blood loss and initiating treatment. However, correct estimation can be challenging. Research indicates that blood loss is often underestimated; the greater the blood loss, the greater the underestimation. Training in estimating blood loss aids awareness and accuracy. However, this skill deteriorates with time so continuous focus on estimation and measurement is important.

When possible, use a measuring vessel 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, after checking for completeness immediately after delivery.

3. Try to collect the blood in a measuring vessel and weigh towels/linens/pads.

   Always be aware that large amounts of blood can be concealed in the uterus or vagina. By grasping the fundus and firmly pressing downwards, the blood can be squeezed out.
   Be aware that blood can be concealed under the woman or may have run down onto the floor.

4. Have a list of the weight of dry towels/linens/pads and subtract these dry weights when the blood-stained items are weighed.

5. If weighing on a scale or collecting the blood in a measuring vessel is not possible, blood loss must be visually estimated.

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

Haemorrhagic Shock

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

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

Three important signs of shock:

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

Other signs can be:

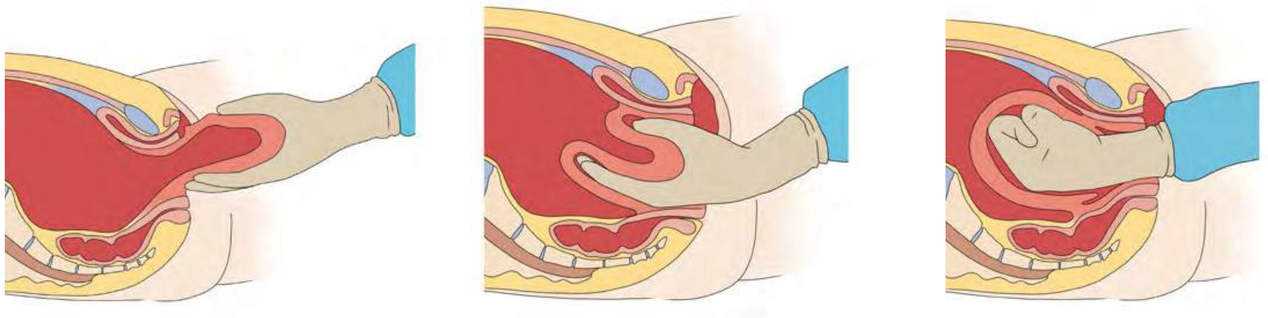
- Quick, shallow breathing
- Low blood pressure
- Feeling weak
- Pallor
- Cool clammy skin
- Confusion
- Dizziness

A healthy woman can often compensate for severe blood loss for an unexpectedly long time with normal vital parameters, due to increased blood volume during normal pregnancy, as well as to increased pulse rate (tachycardia) and constriction of blood vessels (vasoconstriction). If tachycardia occurs and the blood pressure falls (hypotension), it is important to act fast to prevent haemorrhagic shock. Tachycardia occurs before hypotension.

However, a woman with pre-existing conditions such as anaemia or pre-eclampsia tolerates blood loss poorly and may therefore show changes in vital signs when blood loss is less than 500 ml. Therefore, close monitoring after all deliveries is recommended.

The modified shock index is the ratio between pulse and systolic blood pressure. If the heart rate is higher than the systolic blood pressure, it indicates severe blood loss and that the the falling blood pressure is being compensated for by the increasing heart rate.

Uterine Inversion



This is a rare condition occurring in 0.5 – 3/10 000 deliveries. The uterus is turned inside out, with the fundus forced through the cervix and protruding into or just outside the vagina. To avoid uterine inversion, it is important to perform CCT 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 severe upper abdominal pain after delivery, is bleeding and has a low heart rate due to vasovagal stimulation. The woman's condition can deteriorate rapidly due to reduced ability to compensate for blood loss by increasing the pulse.

The uterus is not detectable on abdominal palpation. Vaginal inspection may reveal the inverted uterus, protruding into the vagina.

Treatment

Uterine inversion is a serious obstetric emergency leading to severe shock due to vagal stimulation. The uterus must be replaced as quickly as possible, by firmly pushing with the palm of the hand up through the vagina. When in place, lift the uterus toward the umbilicus (the Johnson manoeuvre). Keep the hand inside until a firm uterine contraction is felt.

Any oxytocin infusion should be stopped, as it makes repositioning more difficult. If patient is hemodynamically stable, give uterine relaxants, e.g. nitroglycerine (glyceryl trinitrate) if immediate repositioning is unsuccessful. While nitroglycerine induces vasodilation that may increase hemodynamic instability, it has a very short half-life and the destabilising effect can be counteracted with vasoactive drugs. In case of 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 of bleeding. Wait 5-10 minutes after repositioning and then carefully try to remove placenta. If ultrasound is available, check to ensure that the uterus is repositioned. It is recommended to administer oxytocin infusion for 24 hours and antibiotics for 24-48 hours post-repositioning.

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 managing PPH.

Treatment of PPH includes multiple interventions that should be initiated simultaneously. Calling for help is essential as more staff will be needed. As the situation can often deteriorate quickly, adequate and timely treatment is 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. The 4 Ts assist in diagnosing the cause of bleeding. Keep in mind that multiple causes may be present at the same time. The flowchart describing treatments for primary PPH refers to procedures explained in the external video links on the following page.

These treatments will not be further described in this book, but external aortic compression (ExAC) will be described in detail.

Flowchart of Management and Treatment of Primary PPH

Blood loss of more than 500ml or clinical signs of hypovolaemia

Call for help (to assist in controlling and treating the bleeding)
Assess the woman's condition, start interventions simultaneously
Vital signs (blood pressure, pulse, respiratory frequency)
Visual blood loss evaluation (weigh or measure)
IV access (2 large bore, for fluids and medications)
Oxygen (if available)
Keep patient **warm** (blanket)
Check the placenta for completeness immediately after expulsion

External Aortic Compression
should always be considered to gain temporary control of the bleeding to allow time for treatment

Tissue

Expelled placenta?

No

Uterotonics
Controlled cord traction
Ensure empty urinary bladder
Initiate breastfeeding or nipple stimulation
Manual removal of placenta
If increta/percreta is suspected - hysterectomy

Yes

Remaining tissue?

Compress / massage uterus vigorously.
Manual removal of remaining tissue.

Tone

Soft uterus? Blood in uterus?

Uterine massage
Ensure empty urinary bladder
Incomplete placenta? Remaining placental tissue?
Uterotonic drugs and other medications
Bimanual compression of uterus
Uterine balloon tamponade
Laparotomy / hysterectomy

Trauma

Uterus

Uterine rupture

Laparotomy / hysterectomy

Birth canal

Tears / Lacerations

Suturing
Packing (use fingers to compress the tear with gauze)

Thrombin

Clotting disorder?

Early administration of tranexamic acid
Careful administration of crystalloid fluids
(WHO recommends 2-3L)
Infusion of blood products

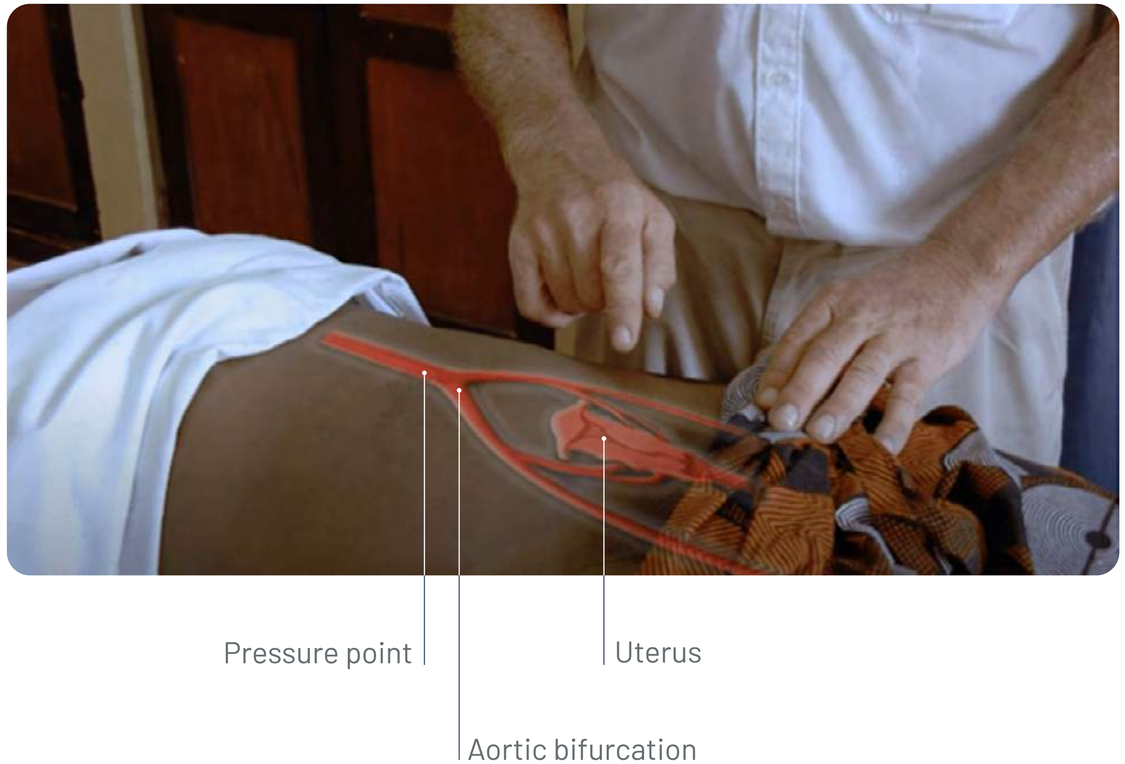
External Aortic Compression (ExAC)

The major blood vessels that supply the uterus and birth canal originate from below the aortic bifurcation, i. e. the place where the aorta divides into two. Compression of the aorta above the bifurcation will reduce blood flow and thus bleeding below the compressed area, including the uterus and birth canal. ExAC can be applied regardless of the cause of bleeding.

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

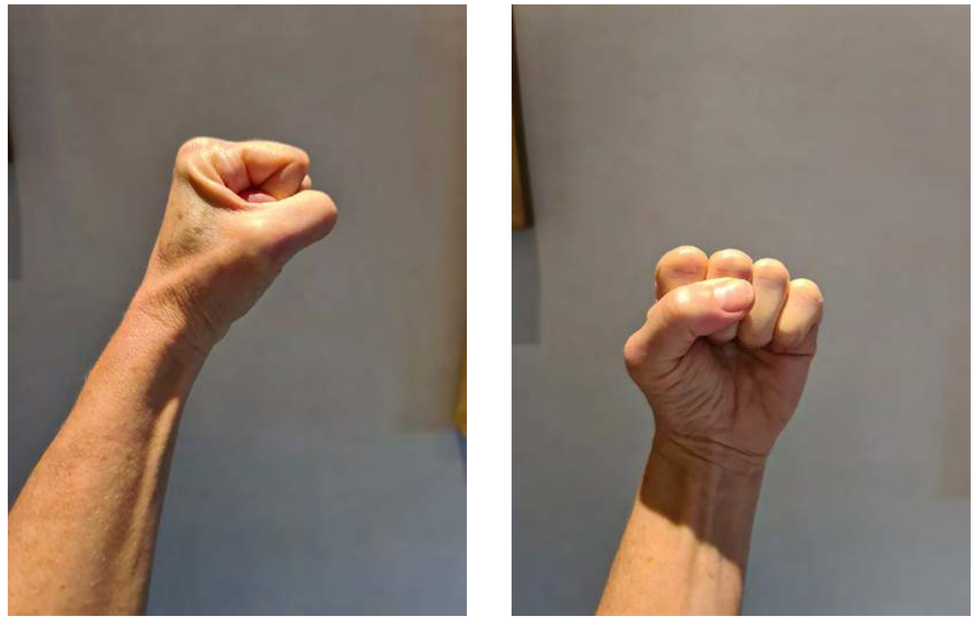
The external pressure point is at the level of the umbilicus, just below which the aortic bifurcation is located. It is important to compress the aorta above the bifurcation.

There is no evidence of harm if ExAC is applied for up to one hour. However, further research is required to ascertain how long it can be applied.



How to perform External Aortic Compression

- Place a closed fist on, or slighly above, the umbilicus.
- Use the other hand to locate the pulse in the groin (femoral pulse.
- Carefully press the fist towards the spine until you can feel the aortic pulsation. Continue until the aorta is compressed against 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 clearly felt on the side of the fist 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 due to unevenness between the bones of the knuckles and the bones of the spine.



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

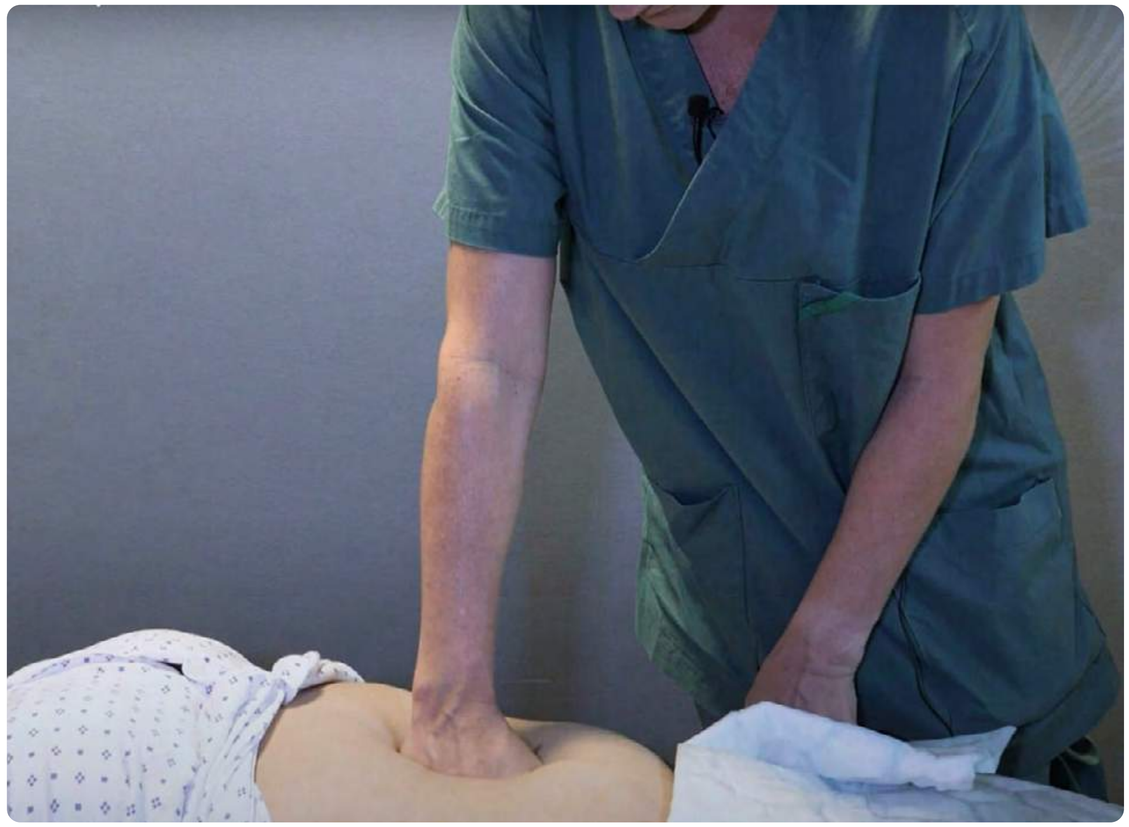
Why use ExAC

ExAC is a manoeuvre with which the aorta is compressed externally to reduce blood flow to the uterus and pelvic organs. We recommend manual ExAC as an early intervention for temporary control of PPH. WHO also recommends ExAC, but at a later stage in the management of PPH.
Benefits of performing ExAC early in the management of PPH are:

1. Temporary control of bleeding regardless of the cause

2. Improved vital signs (blood pressure rises and pulse rate decreases) while performing ExAC, allowing time to investigate and treat the bleeding, thus reducing further blood loss and need for fluid resuscitation. Increased overview and control of the situation for the healthcare worker.

3. Less invasive manoeuvre than bimanual uterine 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 placental expulsion or during caesarean section.

6. ExAC is easier than bimanual uterine compression during transportation of the patient, both within the hospital (to the operating theatre), or to a higher-level healthcare facility (ambulance).

Peter Robert Mboma training ExAC on ExAC simulation doll.
Left: Lamin Bassie.
Masanga Hospital, Sierra Leone.

Additional information about ExAC

Like many other interventions performed in the treatment of PPH, ExAC causes discomfort to the patient. The reasoning behind the manoeuvre must thus be explained to her. The patient must lie flat on her back, with the birth attendant standing on her left side. It may be necessary to climb onto the bed beside the patient to achieve sufficient compression. In most people, the aorta is located above or slightly to the left of the midline, and good compression is often easiest to achieve from the patient's left side.

After delivery, the uterus is enlarged and can reach the level of the umbilicus. In cases of atony, a full urinary bladder or retained placenta, the uterine fundus may be found higher up. 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 their resistance and makes it easier to perform ExAC.

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

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

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

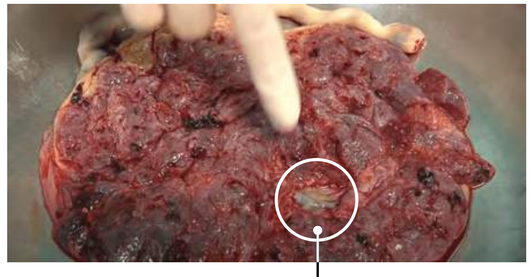
Initial Treatment and Management of PPH

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.

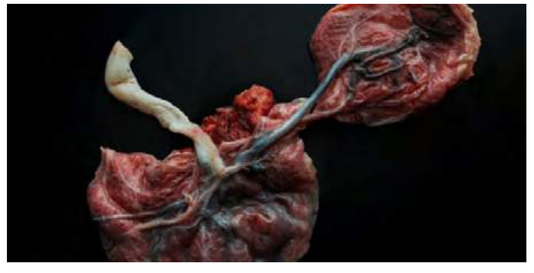
Placenta inspection
Shortly after expulsion of the placenta, it should be checked for completeness. Minor retained placental tissue or membranes can cause excessive bleeding or reduced uterine tone.

- 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 assessment. It is important to check the outer edges of the placenta to make sure that there are no missing parts.

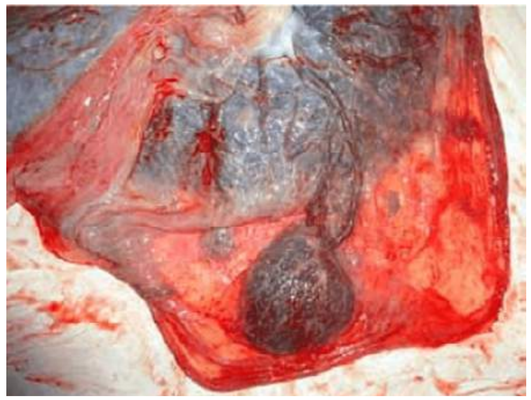
- Check the foetal side of the placenta and look for blood vessels in the foetal membranes. This may indicate lobes of the placenta in the membranes (succenturiate placenta) or bilobed/ bipartial placenta.



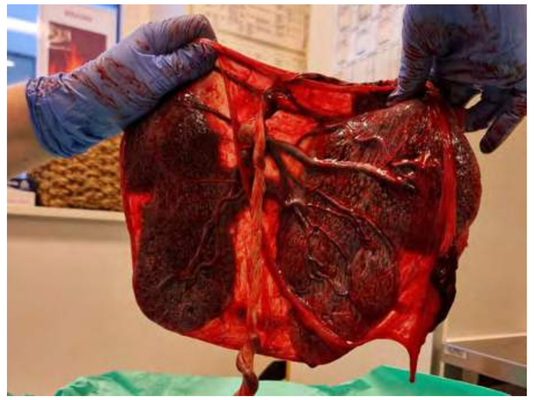
Missing lobe



Succenturiate placenta
Lobes are different sizes



Succenturiate placenta



Bilobed placenta
Placenta lobes are the same size or close to the same size

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

- Ensure that the amniotic membranes are complete. This can be challenging since they can be torn into small pieces.
  Careful delivery of the placental membranes is important, to avoid tearing. Different techniques can be used such as twisting the placenta during its delivery or asking the women to cough (increases abdominal pressure) if the membranes do not slide out easily.

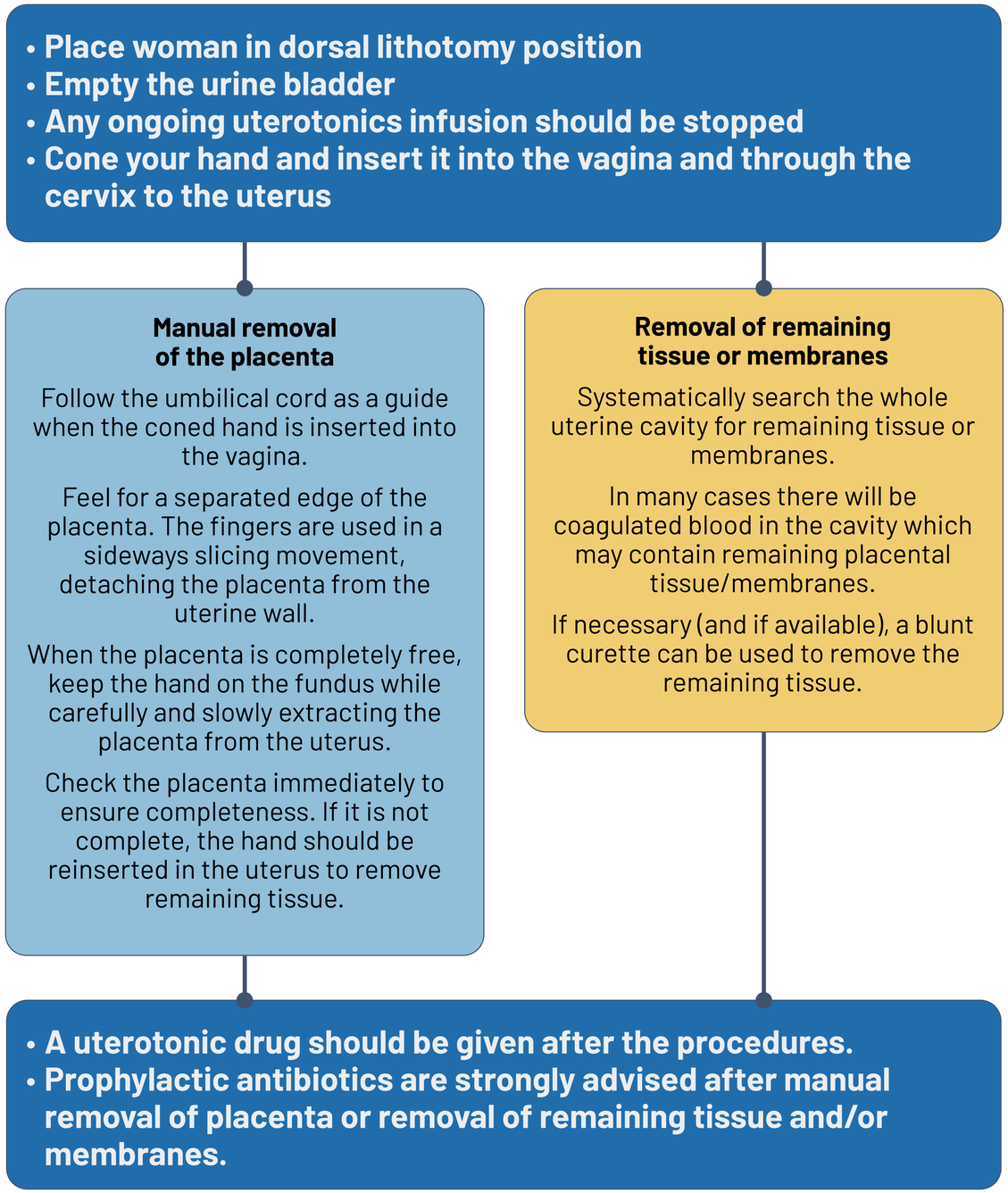
- If retained placental tissue or membranes are suspected, pay close attention to the bleeding and tone of the uterus.
  If excessive bleeding occurs, consider manual removal of remaining tissue.

Manual removal of placenta or of remaining tissue or membranes

If there is no excessive bleeding, allow up to 60 minutes for the placenta to be expelled before considering manual removal. Active management of the 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 fully 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. However, if there is 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 necessary. In some cases of placenta accreta, increta or percreta, manual removal is not possible, and the patient will need surgical intervention.



Medication

The most common cause of PPH is an atonic uterus, and medications play a vital part in treatment. This chapter will describe the medications recommended by the WHO. There are a few other drugs available, but these are not recommended due to a variety of factors including price, lack of evidence of better quality than existing drugs, short shelf life and 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 mode of administration.
Be aware that local protocols may differ from this table, based on medication availability, routines in different healthcare institutions and knowledge among healthcare workers.
Always follow your local guidelines.

Uterotonic drugs

Uterotonic drugs are given to facilitate 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 (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. It should preferably be given early after PPH has been diagnosed.

Fluid resuscitation

Crystalloid fluid (normal saline and Ringer's lactate) is given to establish haemodynamic stability, restore adequate intravascular volume and improve tissue oxygen 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 anaemia, clotting failure or cardiac failure.

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

Name	Effect	Dose	Administration route	Comment	Side effects
Oxytocin injection	Uterotonics stimulate rhythmic uterus contractions.	10IU	IM / IV Slow IV administration.	For prevention, and, if needed, a second dose as a treatment. Requires refrigiration 2-8°C. Some brands can be stored ≤25°C but have a shorter shelf life.	Can cause low blood pressure if given quickly IV.
Ergometrine/ methylergometrine (ergot alkaloids)	Uterotonic that initiates strong, lasting uterine contractions.	0.2 mg	IM / IV IM given directly IV diluted in 9 ml normal saline. Slow administration.	For prevention or as treatment. Can only be used if hypertensive disorders can be ruled out. Do not use if placenta is retained. Store at 2-8° C and protect from light.	Nausea, vomiting, headache, diarrhoea, hypertension.
Oxytocin 5IU/ ergometrine	Uterotonic that leads to rhythmic contractions and greater tone in uterus.	500 µg/ 5IU	IM	For prevention or as treatment. Can only be used if hypertensive disorders can be ruled out. Store at between 2-8° C. Protect from light. Can be stored at up to 25° C for 2 months if protected from light.	Nausea, vomiting, headache, diarrhoea, hypertension.
Misoprostol	Prostaglandin, stimulates uterus to contract but is less efficient than oxytocin.	400-600 µg	Sublingual /Oral. Rectal administration if patient is unconscious.	For prevention or treatment. Cheap, heat-stable drug that does not require injections.	No clear evidence on which dose is superior. The higher dose has more side effects such as fever, shivering, and diarrhoea.
Oxytocin infusion	Uterotonic, stimulates rhythmic uterine contractions.	20IU/ 1L	IV - 60 drops/min.	Doses in the uterotonic infusions used in PPH vary; follow your local guidelines.	
Carbetocin	Rhythmic uterine contractions, increased frequency of existing contractions and increased uterine tone.	100 µg	IV / IM	For prevention	Is likely superior to oxytocin in reducing PPH. No clear difference in undesirable effects compared to placebo.
Tranexamic acid	Antifibrinolytic drug. Inhibits the breakdown of blood clots.	1 gram	IV	Slow administration 100 mg = 1 ml/min. Should be given within the first 3 hours after PPH is diagnosed.	Hypotension, nausea.
Ringer's lactate/ normal saline	Crystalloids.	1-3L	IV	1 L given as a rapid infusion, WHO recommends 2-3 L. Preferably warm fluid (37° C).	Clotting disorders caused by too much fluid. Low body temperature due to rapid administration of cold fluid.
Blood or blood products	Erythrocytes or whole blood.	-	IV	Access to safe blood products varies; follow local guidlines.	Blood transfusions should only be carried out by trained clinicians that monitor patient for side effects such as fever, low blood pressure, etc.

Table derived from WHO recommendations: *Uterotonics for the prevention of postpartum haemorrhage.* Geneva: World Health Organization; 2018. License: CC BY-NC-SA 3.0 IGO

Empty bladder - Urinary Catheterisation

Since a full urinary bladder can inhibit uterine contraction after delivery, intermittent urinary catherisation is recommended when a woman is unable to pass urine spontaneously. Apply aseptic technique.

- Separate the labia, clean area around urethral opening.
- Insert catheter, upward at a 30-degree angle until urine begins to flow.
- When urine stops flowing, remove the catheter.
- However, a permanent catheter

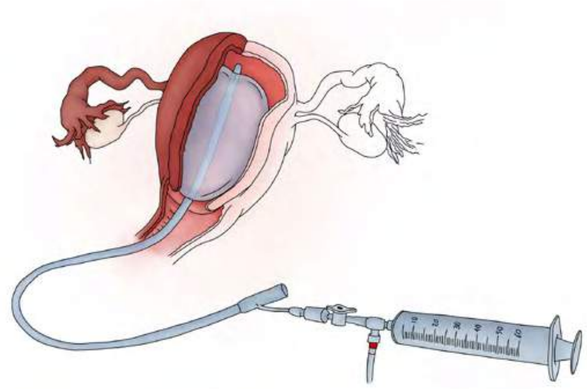
Bimanual uterus compression

Bimanual uterus compression is a manual internal/external compression, to be applied if the uterus is atonic. The manoeuvre is painful, so information is important.

- Cone your hand and insert it into the vagina, pressing against the uterus. Make a fist, while the other hand maintains a firm grip on the uterine fundus.
- Press your external and internal hand together to compress the uterine body.
- This manoeuvre can be used to gain temporary control of the bleeding when transferring the patient to an operating room or to other healthcare facilities.

Most PPHs will be resolved by these initial treatment options and this level of care. However, some cases will need further management and a higher level of care.

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 bleeding. The most widely known device is the Bakri® balloon, but it is also possible to simply use a condom attached to a urinary catheter.
Please see video link for illustration of how to make an intrauterine balloon tamponade using a condom.

- Place the woman in the position for gynaecological exam.
- Insert a speculum to locate the cervix. Grip cervix with ring forceps, if available.
- 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 the vagina should be packed with gauze in order to counteract expulsion of the balloon. Make a mark on the abdomen indicating the level of the fundus, in order to detect concealed internal bleeding if the fundus rises above the mark.

- Start oxytocin infusion (20 units in 1 L of normal saline or Ringer's lactate, at 60 drops/min) and prophylactically administer IV antibiotics after the procedure.
- After 6–24 hours, if the uterine 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 bleeding has stopped and patient is stable, empty the balloon completely and observe for 30 minutes. Remove it if there is no further bleeding.
- If bleeding starts again when the balloon is deflated or the oxytocin infusion has stopped, reinflate the balloon and start the oxytocin infusion again.
- IBT should only be applied if uterine rupture and remaining tissue have been ruled out as causes of the bleeding.

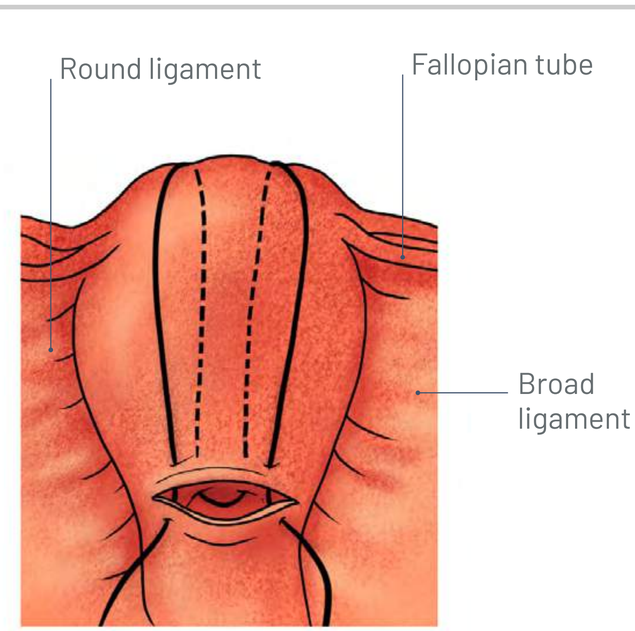
External Video link
Condom tamponade technique
https://www.youtube.com/watch?v=76yXRe6F3wc

B-Lynch

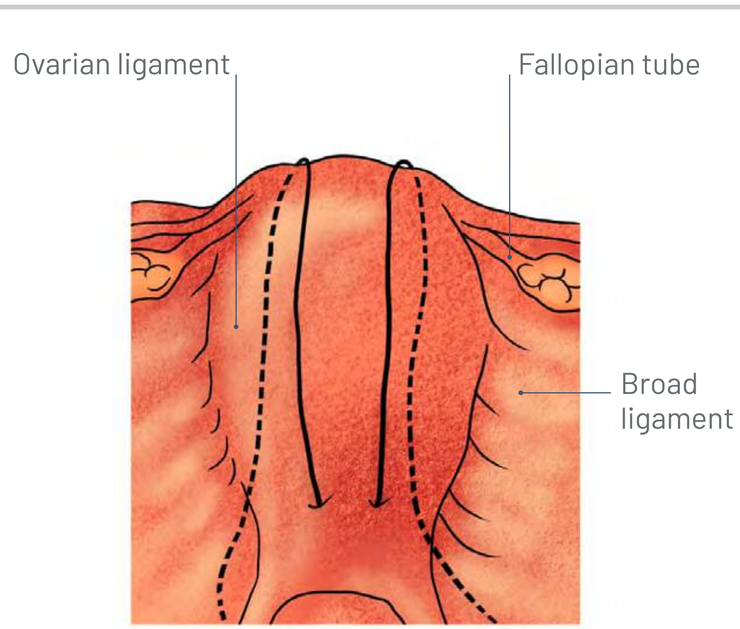
The B-Lynch brace suture/compression suture is a surgical technique. It requires an operating theatre and anaesthesia. This simple surgical technique has proven to be useful in maintaining uterine contraction, thereby preventing blood loss. It may prevent a hysterectomy.

Hysterectomy

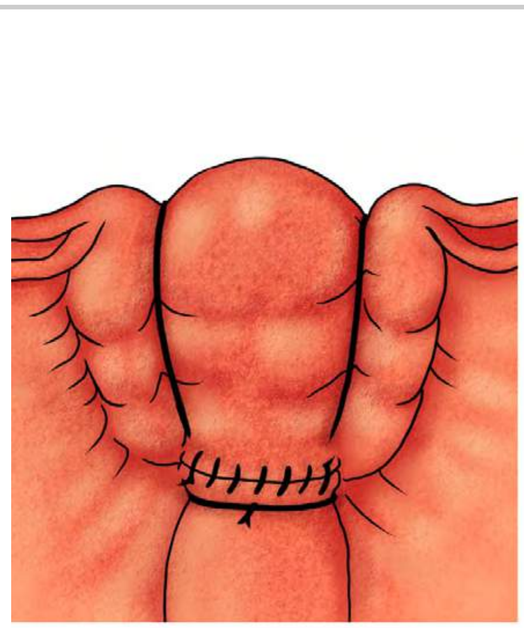
In the most severe cases where all other treatment options fail, the only option may be to remove the uterus, i.e. perform a hysterectomy. Once it has been removed further pregnancies will not be possible. Hysterectomy should only be performed by trained healthcare professionals.



Anterior view



Posterior view



Anterior view

B-Lynch incision

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 or excessive uterine bleeding occurring 24 hours to 6 weeks postpartum. Most secondary PPHs occur 10 to 14 days postpartum. The bleeding is usually due to retained placental tissue and/or membranes, or to a large blood clot that inhibits uterine contraction. If there is an infection, the blood may have an offensive odour and the patient may have a rapid pulse, fever and increasing pain.

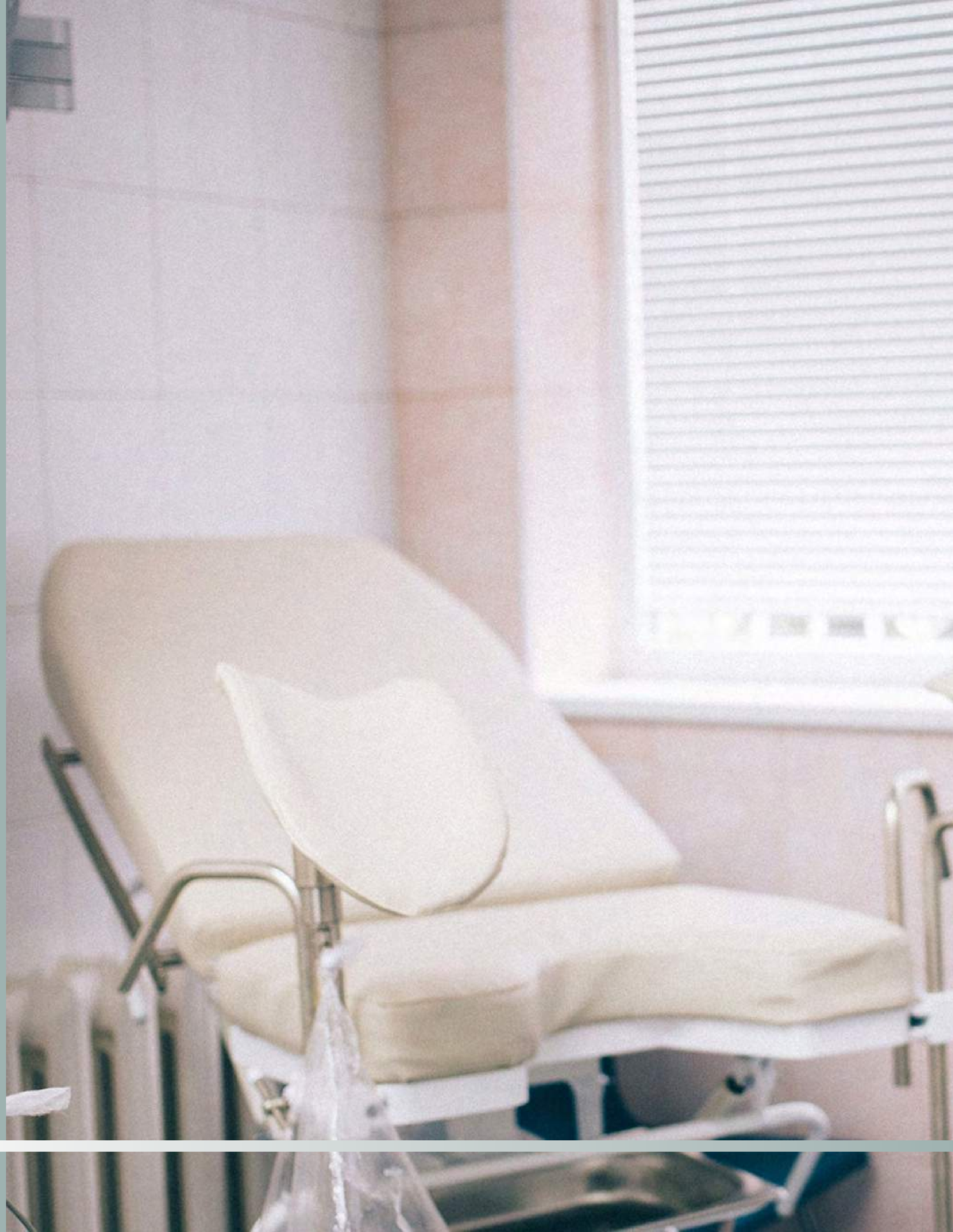
Normally, vaginal bleeding during the first days after delivery (lochia) decreases and changes colour to dark pink or brown (old blood). In secondary PPH, the blood is bright red (fresh blood).

Secondary PPH occurs most commonly after patients have left the birthing facility. It is thus important to inform them of the signs of secondary PPH and advise them to contact healthcare units if their bleeding changes.

Treatment of secondary PPH

- Initial treatment of secondary PPH is uterine massage and oxytocin injection.
- If uterine massage and oxytocin injection of oxytocin are not sufficient, administer oxytocin infusion (20 IU in 1 L of fluid, at 40 drops per min).
- If retained placental tissue is the cause and oxytocin is not sufficient, prepare the patient for **vacuum aspiration (VA)**.
- Check the patient for signs of 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 (hypovolaemia).

Abortion



Abortion can turn into a life-threatening condition. Around 8% of all maternal deaths are related to abortion; this occurs most frequently 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 bleeding and 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.

ExAC can be used in haemorrhage related to abortion, as the mechanism behind the bleeding is similar to that of PPH. Bleeding after an abortion is often due to retained foetal or placental tissue and VA should thus also be performed to treat the bleeding.

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.

References

Chapter 1

Bell SF, Watkins A, John M et al.
Incidence of postpartum haemorrhage defined by quantitative blood loss measurement: a national cohort.
BMC Pregnancy Childbirth. 2020 May 6;20(1):271.

Full article

Carroll M, Daly D, Begley CM
The prevalence of women's emotional and physical health problems following a post partum bleeding: Systematic review
BMC Pregnancy Childbirth. 2016; 16(1): 261.

Full article

Say L, Chou D, Gemmill A et al.
Global causes of maternal death: a WHO systematic analysis.
Lancet Glob Health 2014 Jun;2(6):e323-33

Full article

WHO fact sheets maternal mortality, 2019

Full article

Marshall J, Raynor M (Editor).
Myles Textbook for Midwives.
Saunders Elsevier 16th ed. 2014

Sustainable Development Goal 3: Health
UN Report 2022

Full article

Chapter 2

World Health Organization. 2012
WHO recommendation for the prevention and treatment of post-partum haemorrhage. WHO / e-book

Full article

Marshall J., Raynor M. (Editor).
Myles Textbook for Midwives.
Saunders Elsevier 16th ed. (2014).

Perlman NC, Carusi DA
Retained placenta after vaginal delivery: Risk factors and management.
International Journal of Women's Health
2019:11 527–534

Full article

Weeks A, Berghella V, Barss VA
Retained placenta after vaginal birth
Uptodate 30/10/2022

Abstract

Chapter 3

Bell SF, Watkins A, John M et al.
Incidence of postpartum haemorrhage defined by quantitative blood loss measurement: a national cohort.
BMC Pregnancy Childbirth. 2020 May 6;20(1):271.

Full article

World Health Organization. 2012
WHO recommendation for the prevention and treatment of post-partum haemorrhage. WHO / e-book

Full article

Committee on Obstetric Practice
Quantitative blood loss in obstetric hemorrhage
American Colleague of Obstetricians and Gynecologist.
ACOG committee opinion 2019.

Full article

Nwafor JI, Obi CN et al.
What is the normal range of obstetric shock index in the immediate postpartum period in a low-resource setting?
IIJGO 10/2020, Vol 51, 1, 83-90

Abstract

Nathan HL, El Ayadi A, et al.
Shock index: an effective predictor of outcome in postpartum haemorrhage?
An international Journal of Obstetrics and Gynaecology.
BJOG 1/2015, Vol 122, 2, 268-275

Abstract

Al-Kadri HM, Dahlawi, H et al.
Effect of education and clinical assessment on the accuracy of post partum blood loss estimation.
BMC Pregnancy Childbirth 14, 110 (2014)

Full article

Chapter 4

World Health Organization. 2012
WHO recommendation for the prevention and treatment of post-partum haemorrhage. WHO / e-book

Full article

World Health Organization. 2018
WHO recommendations Uterotonics for the prevention of postpartum haemorrhage. WHO / e-book

Full article

Kartoglu U, Widmer M, et al.
Stability of oxytocin along the supply chain: A WHO observational study.
Biologicals. Vol 50.
Page 117-124.

Abstract

Riley DP, Burgess RW.
External Abdominal Aortic Compression: A Study of a Resuscitation Manoeuvre for Postpartum Haemorrhage
Anaesth Intens Care 1994; 22: 571-575

Full article

World Health Organization. (2017).
WHO recommendation on tranexamic acid as treatment of postpartum haemorrhage. WHO / e-book

Full article

Rosenberg J, Ahmad I, Sharara N, Weintraub R.
Advancing a New Drug to Improve Global Maternal Health Through a Tripartite Agreement
Harvard Medical School

Full article

Chapter 4

Widmer M, Piaggio G,
Heat-Stable Carbetocin versus Oxytocin to Prevent Hemorrhage after Vaginal Birth
N Engl J Med 2018;379:743-52.

Full article

World Health Organization. 2017
Managing complications in pregnancy and childbirth: a guide for midwives and doctors
2nd ed. Geneva

Full article

Chapter 5 and 6

World Health Organization. 2012
WHO recommendation for the prevention and treatment of post-partum haemorrhage. WHO / e-book

Full article

Marshall J., Raynor M. (Editor).
Myles Textbook for Midwives.
Saunders Elsevier 16th ed. (2014).