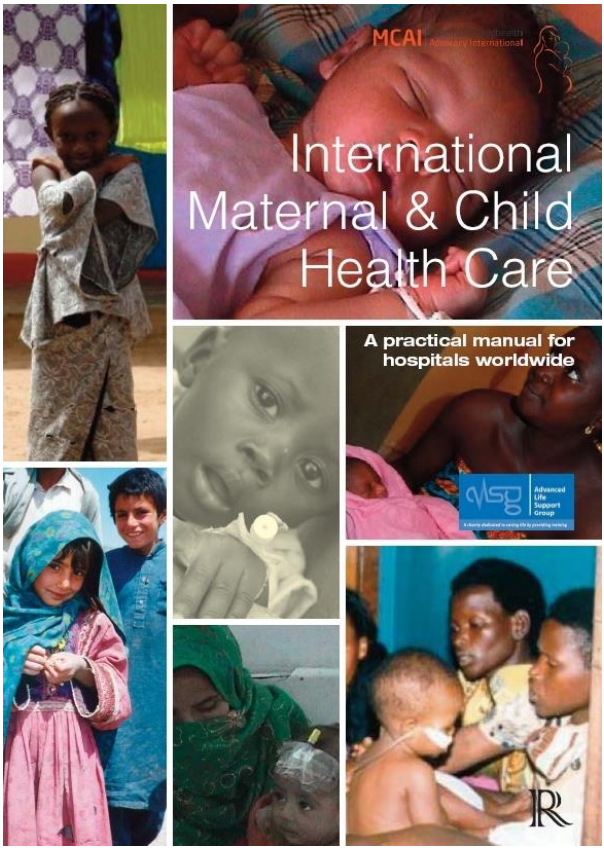
POCKET BOOK OF HOSPITAL CARE FOR OBSTETRIC EMERGENCIES INCLUDING MAJOR TRAUMA AND NEONATAL RESUSCITATION



MCAI Maternal & Childhealth Advocacy International

Advanced Life Support Group
A charity dedicated to saving life by providing training

This pocketbook is a summary of the emergency components of obstetrics and resuscitation of the newborn infant from our textbook *"International Maternal & Childhealth Care. A practical manual for hospitals worldwide".* The reader is referred to the textbook when more details on the medical problem under consideration are required.

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Contents

SECTION	TITLE	PAGE NUMBERS
1	Triage	5-7
2	Infection control and handwashing	8
3	Fluid administration: oral and intravenous	9
4	Blood transfusion	9-11
5	Pain Management	12-18
6	Transport of ill patients	19
7	Structured approach to emergency care	20-32
8	Basic life support and cardiopulmonary resuscitation in pregnancy	33-40
9	Skills in an emergency	41-64
10	WHO safe childbirth checklist	65-69
11	Symptoms and signs of emergencies in pregnancy	70-80
12	Shock during pregnancy and after birth	81-86
13	Severe anaemia in pregnancy including sickle cell disease	87-89
14	Septic abortion or miscarriage	90-91
15	Major obstetric haemorrhage: Ruptured ectopic pregnancy Miscarriage Antepartum haemorrhage: APH Post partum haemorrhage: PPH	92-124 92-94 94-100 100-108 109-124
16	Hypertension, pre-eclampsia and eclampsia	125-140
17	Prolonged and obstructed labour Uterine rupture Shoulder dystocia	141-151 146-147 147-151
18	Severe infection after birth: puerperal sepsis	152-155

SECTION	TITLE	PAGE NUMBERS
19	Pulmonary embolism	156-157
20	Amniotic fluid embolism	158
21	Reduced fetal movements and fetal death	159
22	Fetal distress during labour	160-161
23	Multiple births	162-165
24	Malpositions and malpresentations Occipito posterior Face Breech	166-180 172-174 175-176 177-180
25	Preterm pre-labour rupture of membranes and preterm labour	181-183
26	Prolapsed umbilical cord	184-186
27	Inverted uterus	187-190
28	Hyperemesis gravidarum	191-192
29	Heart failure	193-194
30	Severe asthma	195-196
31	Anaphylaxis	197-198
32	Diabetes and diabetic ketoacidosis	199-204
33	Reduced conscious level and coma	205-209
34	Pneumonia	210-211
35	Severe dehydration and gastroenteritis	212-216
36	Severe malaria	217-223
37	Appendicitis	225
38	Cystitis and pyelonephritis	226
39	Varicella zoster	227
40	Postnatal depressive illness	228-229

SECTION	TITLE	PAGE NUMBERS
41	**Emergency obstetric procedures:** Urethral catheter Ventouse (vacuum) delivery Forceps delivery Caesarean section Symphisiotomy Destructive procedures Episiotomy Cervical tear repair Manual removal of placenta Pudendal nerve block	230-248 230 230-237 238-240 240-241 241-242 242-243 243-244 244-245 245-247 247-248
42	**Major trauma in pregnancy** **Procedures:** Surgical cricothyrotomy Cervical spine immobilization Needle thoracocentesis Chest drain Needle pericardiocentesis Abdominal paracentesis Log roll	249-277 253-254 254-255 257-258 258-259 270-271 272-273 274
43	**Burns**	277-284
44	**Poisoning**	285-289
45	**Care of the newborn and neonatal resuscitation**	290-305
46	**Appendix**	305-311
	Index	

Section 1 Triage for women who are or who may be pregnant: seeing the sickest first

Triage involves **determining the priority of a patient's treatment based on the severity of their condition, not on when they arrived or their place in a queue.**
Triage divides patients into the following three categories:

1. those who are at imminent risk of death, and require immediate resuscitation
2. those who are seriously ill or injured, and who need timely emergency management
3. those who have conditions which can wait before further assessment and possible treatment.

Rapid initial assessment

When a woman is or might be pregnant presents to a health facility she is of immediate concern and should be given priority through triage without disadvantaging seriously affected men or older women. This process requires the ability to recognise first, those patients who need resuscitation **(immediate management, group 1, 'red'**), and secondly, those who need **urgent treatment (group 2, 'orange')** (*see* Table 1.1). This process must take only a few seconds, as any delay can be fatal.

Table 1.1 A triage scale

Triage number	*Type of action*	*Colour*	*Maximum target time to action (minutes)*
Category 1	Immediate	Red	0
Category 2	Urgent	Orange	15
Category 3	Non-urgent	Green	60 (1 hour)

From the moment of arrival at the health facility (some information may be given before arrival, by contact between the ambulance crew and the facility), a decision on those who need resuscitation must be made. The decision making is based on the clinical signs listed in the second column of Table 1.2.
Once a triage category has been identified, the patient should have observations of respiration rate and characteristics (e.g. wheeze, stridor, recession), pulse rate/volume, blood pressure, temperature and a rapid measure of conscious level, such as AVPU score (Alert, responds to Voice, responds to Pain, Unconscious; *see* Section 7), measured and recorded.

Table 1.2 Clinical signs on simple observation or from history which indicate the need for immediate resuscitation in pregnancy

Underlying mechanism	*What does the healthcare worker undertaking triage see in the patient or hear from the relatives?*
A problem that is obstructing, or might obstruct, the upper airway A: AIRWAY	The patient is unconscious The patient is fitting or has been fitting There is major trauma to the face or head, including burns There is severe stridor or gurgling in the throat
Any problem producing apnoea, severe respiratory distress or cyanosis B: BREATHING	The patient is not breathing The patient is gasping The patient is cyanosed The patient is having so much difficulty breathing that they cannot speak

Underlying mechanism	*What does the healthcare worker undertaking triage see in the patient or hear from the relatives?*
Any problem producing cardiac arrest, shock or heart failure C: CIRCULATION	The patient has heavy vaginal bleeding The patient has suffered major trauma The patient appears shocked (very pale/white, cannot sit up, has a reduced conscious level)

Table 1.3 Clinical signs on simple observation or from the history in pregnancy which indicate the need for urgent management but not resuscitation

Underlying mechanism	*What does the healthcare worker undertaking triage see or hear from the patient or the relatives?*
A problem that might obstruct the upper airway in the future A: AIRWAY	There is trauma to the face or head, or burns to this area, but the patient is conscious and able to speak Ingestion or accidental overdose of drugs that may alter the conscious level?
A problem producing respiratory difficulty B: BREATHING	The patient has difficulty breathing but can speak, and there is no cyanosis
Any problem that might, unless rapidly treated, lead to shock or heart failure C: CIRCULATION	The patient has vaginal bleeding which is heavy*, but is not yet shocked (they are able to stand or sit up and speak normally) The patient has suffered major trauma and is not yet shocked, but may have internal bleeding (they are able to stand or sit up and speak normally) Any burns covering more than 10% of the body The patient has fainted and has abdominal pain (this includes possible ruptured ectopic pregnancy) but they are now able to stand or sit up and speak normally The patient has passed products of conception and is still bleeding, but is not shocked (they are able to stand or sit up and speak normally) The patient has severe abdominal pain, but is not shocked (they are able to stand or sit up and speak normally) The patient is extremely pale, but is not shocked (severe anaemia) (they are able to stand or sit up and speak normally)
Possible severe pre-eclampsia and impending eclampsia	The patient is complaining of a headache and/or visual disturbance
Severe dehydration	The patient is complaining of severe diarrhoea/vomiting and is feeling very weak, but is not shocked (they are able to stand or sit up and speak normally)
Possible complication of pregnancy	The patient has abdominal pain not due to uterine contractions of normal labour
Possible premature labour	The patient is not yet due to deliver, but has had ruptured membranes (with or without contractions)
Infection that might become dangerous	The patient has a high fever > 38°C (they are hot to touch or shivering, but are able to stand or sit up and speak normally)

Underlying mechanism	*What does the healthcare worker undertaking triage see or hear from the patient or the relatives?*
Possible intrauterine death	After 24 weeks of pregnancy the patient has not felt fetal movements for 24 hours or more
Prolapsed cord	The patient says that her membranes have ruptured and she can feel the umbilical cord

*Heavy bleeding is defined as a clean pad or cloth becoming soaked within less than 5 minutes.

Note that a low blood pressure in pregnancy is a late and dangerous sign.

Special priority signs

Haemorrhage

Category 1 patients (red) are those who are exsanguinating.
A haemorrhage that is not rapidly controlled by the application of sustained direct pressure, and which continues to bleed heavily or soak through large dressings quickly, should also be treated **immediately (Category 1, red).**

Conscious level

Category 1 or immediate priority (red) includes all unconscious patients (U or P on the AVPU scale).
In patients with a history of unconsciousness or fitting, further dangerous events are possible. Those who respond to voice are categorised as **Category 2 urgent (orange)**.

Pain
Patients with severe pain should be allocated to **Category 1 immediate (red)**, and those with any lesser degree of pain should be allocated to **Category 2 urgent (orange)**.

For patients who have sustained **significant trauma or other surgical problems,** anaesthetic and surgical help is required **urgently.**

If there is an **urgent referral** from another healthcare facility or organisation, the patient must be seen **immediately** or **urgently**, depending on the circumstances.

Importance of regular reassessment
Triage categories may change as the patient deteriorates or gets better. To achieve this, all clinicians involved in the pathway of care should rapidly assess priority whenever they encounter the patient. Changes in priority must be noted, and the appropriate actions taken.
All patients with symptoms or signs in the **immediate (red)** or **urgent (orange)** categories represent emergencies or potential emergencies, and need to undergo the structured approach to emergencies as outlined in Section...

Non-urgent cases
Proceed with assessment and further treatment according to the patient's needs once the immediate and urgent

Postpartum haemorrhage

A blood loss of more than 500 mL from a vaginal birth and more than 1 litre after a Caesarean section.

Estimates of blood loss are inaccurate and tend to be low, often around half the actual loss. Blood is mixed with amniotic fluid and sometimes with urine. It is also dispersed on sponges, towels and linen, in buckets and on the floor.
The importance of any given volume of blood loss varies depending on the mother's haemoglobin level. A mother with a normal haemoglobin level will tolerate blood loss that would be fatal for an anaemic woman. This is why **it is essential to ensure that every woman who reaches labour has an adequate haemoglobin level.**
Bleeding may occur at a slow rate over several hours, in which case the condition may not be recognised until the mother is shocked.

Prevention of PPH

Active management of the third stage of labour is essential for prevention of PPH, and it consists of four possible interventions:

1 a prophylactic uterotonic drug after delivery, after checking that there is not a second twin present.
2 early cord clamping and cutting
3 controlled cord traction
4 uterine massage after delivery of the placenta.

A prophylactic uterotonic drug after delivery is the most important intervention:
Oxytocin 10 IU IM or, especially if the mother is shocked, 5 IU by slow (over 1–2 minutes) IV injection is the first choice because it causes uterine contractions to prevent atony rapidly and with minimal adverse effects. Atony is the most common cause of PPH (around 80% of cases). Where oxytocin is unavailable or does not work, other uterotonic drugs should be used, including:

- **Ergometrine** 200 or 500 micrograms IM
- **Misoprostol** 600 micrograms sublingually or orally if the mother is fully conscious 800 micrograms rectally if the mother is drowsy or unconscious.

All uterotonic drugs should be given within 1 minute of the complete birth of the fetus, to aid separation of the placenta by enhancing uterine contractions and reducing the risk of bleeding from an atonic (relaxed) uterus. **It is essential that, before giving such drugs, you are certain there is not another fetus in the uterus.**

Ensure that both oxytocin and ergometrine are protected from heat damage by paying close attention to the cold chain and their storage, otherwise they may not be effective. Ideally oxytocin should be stored in a fridge, but it can be kept at 15–30°C for 3 months. Oxytocin must never be frozen. Ergometrine should always be stored in a fridge at 2–8°C. Misoprostol can be stored at ambient temperature.
Ergometrine is contraindicated in heart disease, hypertension, pre-eclampsia and eclampsia, as it raises the blood pressure by vasoconstriction, which increases the risk of cerebrovascular accidents.

Early cord clamping and cutting

This is not an essential part of the active management of the third stage of labour, and is no longer recommended unless the infant needs resuscitation.

Controlled cord traction

This is optional where delivery is undertaken by a skilled birth attendant, but contraindicated if a skilled attendant is not available.

Strong uterine massage
This should **always** be undertaken immediately after delivery of the placenta until the uterus is contracted and remains so. Check the state of contraction of the uterus every 15 minutes for 2 hours, and repeat the massage if at any time the uterus becomes soft and relaxed.

In order to prevent PPH during or after Caesarean section, the use of oxytocin plus cord traction is recommended in preference to manual removal of the placenta.

How to manage the third stage of labour if uterotonic drugs are not available
Unfortunately it is not uncommon for hospitals in low resource countries to run out of uterotonic drugs. In this avoidable and dangerous situation, expectant and/or physiological management should be undertaken.

1 Place the baby on the mother's breast.
2 Leave the cord alone.
3 Observe for the following signs of placental separation:
- a small gush of blood
- a lengthening of the cord at the introitus
- the mother feeling uncomfortable, feeling a contraction and wanting to 'bear down'.

Most placentas separate within 1 hour of birth. If this does not happen, seek help.

4 Deliver the placenta.
- Sit the mother upright.
- Encourage her to bear down with a contraction (only after placental separation).
- Catch the placenta. If membranes are dragging behind it, gently twist a few turns and with slight traction and an up-and-down movement deliver the placenta plus membranes.

Controlled cord traction should not be undertaken prior to the separation of the placenta in the absence of uterotonic drugs.

TABLE 15.2 *Diagnosis of causes of PPH*

Symptoms	Signs	Possible diagnosis
Immediate heavy bleeding after birth	Uterus soft and not contracted	Atonic uterus
Immediate heavy bleeding after birth	Uterus contracted	Trauma to cervix, vagina or perineum
Bleeding which may be light if clot is blocking cervix	Placenta not delivered within 30 minutes of birth	Retained placenta
Bleeding which is usually light but continues for many hours	Portion of placenta missing Uterus contracted	Retained placental parts
Bleeding for more than 24 hours	Portion of placenta missing Foul-smelling lochia may be present Fever may be present Severe anaemia	Retained placental parts with or without infection

Symptoms	Signs	Possible diagnosis
Lower abdominal pain of varying intensity Immediate but usually light bleeding	Uterus not felt on abdominal palpation Inverted uterus may be seen at vulva Bradycardia may be present Shock	Inverted uterus
Usually during labour there has been a change from intermittent labour contractions to a constant pain which may become less after rupture has occurred Sometimes an oxytocin drip is in place Vaginal bleeding which may be light or heavy History of a previous Caesarean section or other operation on the uterus	Shock Abdominal distension Tenderness over uterus	Ruptured uterus (more likely before delivery of the baby)

Monitoring after the placenta has been delivered by active or expectant management

1 Monitor the blood pressure, pulse and state of the uterus (i.e. whether it is contracted) every 15 minutes for 2 hours after delivery of the placenta.

2 Examine the placenta for completeness.

Causes of PPH

Primary PPH

This occurs within 24 hours of birth, and in around 80% of cases is due to uterine atony. Remember the 4 T's: Tone, Tissue, Trauma, Thrombin.

- Tone: atonic uterus – failure to contract after birth.
- Tissue: retained placenta or placental fragments.
- Trauma: ruptured uterus, or trauma to the cervix, vagina or perineum.
- Thrombin: clotting defects, notably disseminated intra- vascular coagulation (DIC).

Remember also the following:

- Haemorrhage may be concealed within the uterus or within the abdominal cavity.
- A ruptured uterus can cause concealed bleeding, as can bleeding following Caesarean section.
- An inverted uterus is associated with PPH.
- Any degree of PPH is dangerous if there has been severe anaemia before delivery.

Secondary PPH

Secondary PPH (occurring from 24 hours or more after delivery up to 6 weeks after birth) is commonly associated with retained products of conception that undergo necrosis, become infected and prevent involution (sustained contraction) of the uterus. A fever suggests an infective component.

Factors that predispose to PPH

These include the following:

- previous APH
- retained products of conception

- trauma to the uterus or birth canal (e.g. from instrumental delivery)
- uterine over-distension (e.g. due to multiple pregnancy or polyhydramnios)
- grand multiparity
- prolonged labour.

Management of large PPH

First **call for help** (this must include a surgeon and an anaesthetist), palpate the uterus and massage it strongly and immediately, as it is most likely that an atonic uterus is the cause.

Procedures for stopping haemorrhage must be started immediately and then undertaken in parallel with IV fluid resuscitation.

Airway and breathing

- Ensure that the airway is open and remains so.
- Provide high-flow oxygen through a facemask with reservoir bag if there is adequate spontaneous respiration.

Give 100% oxygen (using a mask with reservoir and high flow rate).

- For patients with inadequate ventilation or depressed conscious level (P or U on the AVPU scale), respiration should be supported with oxygen via a bag-valve-mask, and experienced senior help should be summoned (if available).

Circulation

Primary assessment denoting shock

- Fast, weak pulse (≥ 100–110 beats/minute). Normal heart rates in a pregnant mother at rest are 60–90 beats/ minute. Tachycardia is an early sign of shock.
- Low-volume (weak) pulse.
- Pallor (especially of the inner eyelid, palms or around the mouth).
- Sweatiness or cold clammy skin.
- Prolonged capillary refill time (> 3 seconds).
- Rapid breathing (> 30 breaths/minute). Normal respiratory rates at rest are 15– 20 breaths/minute; tachypnoea can be due to acidosis.
- Low blood pressure (systolic pressure < 90 mmHg) is a very late sign. Healthy women and girls can maintain a normal or even high blood pressure while losing large volumes of blood.
- Nausea with or without vomiting.
- Anxiety, confusion or unconsciousness.
- Reduced urine output (< 30 mL/hour). Urinary catheterisation is needed for measurement of hourly urine output if the patient is shocked (normal output is > 30 mL/hour).

The aim with all treatments is for a pulse rate of ≤ 100–110 beat/minute and a systolic blood pressure that is ≥ 90–100 mmHg and stable in a woman who is fully alert and has a urine output of ≥ 30 mL/hour.

Measures to stop further haemorrhage due to uterine atony

1.Rubbing up a contraction

Poor contraction of the uterus after delivery is the commonest cause of PPH. Rub up a contraction of the uterus (do not just pinch the skin).

Abdominal massage of the uterus

If the uterus is atonic, a contraction may be rubbed up by abdominal massage.

- Massage the fundus in a circular motion with the cupped palm of your hand until it is contracted.
- When it is well contracted, place your fingers behind the fundus and push down in one swift action to expel clots.

2. Uterotonic drugs

Give 10 IU of oxytocin IM or 5 IU IV slowly, especially if the patient is already shocked, and repeat after 5 minutes if they are still bleeding and/or the uterus is not contracted. This is the drug of first choice.
Oxytocin starts to work 2–3 minutes after IV injection, but has a relatively short duration of action, and an infusion will be needed to maintain a contracted uterus. Following an oxytocin bolus, give an IV infusion of oxytocin 40 IU in 500 mL (60 drops/minute with a standard IV giving set where 20 drops = 1 mL) or 1 litre (120 drops/minute) of Ringer-lactate or Hartmann's solution over 4 hours.
Side effects include hypotension (due to vasodilatation when given as a rapid IV bolus) and fluid retention.

If the mother does not have eclampsia, pre-eclampsia or hypertension, ergometrine 200 to 500 micrograms IM **in addition** may help uterine contraction.

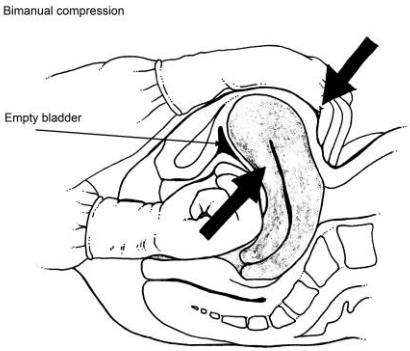
If the first dose of oxytocin does not stop bleeding within a few minutes, give misoprostol. It is given rectally as 4 × 200 microgram tablets or pessaries (800 micrograms in total) or, if the patient is conscious, orally as 3 × 200 micro- gram tablets or 2 × 200 micrograms of powder sublingually.

Ergometrine, either as part of Syntometrine (oxytocin 5 IU and ergometrine 500 micrograms IM) or alone, is contraindicated in pre-eclampsia, as its hypertensive action increases the risk of convulsions and cerebrovascular accidents.

3. Urinary catheterisation
This may help the uterus to contract.

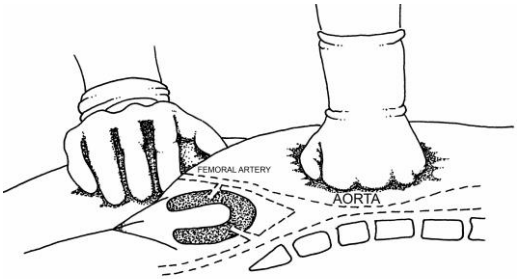
4. Bimanual uterine compression
If heavy PPH continues despite uterine massage, and with the placenta already delivered, this procedure can be very effective. If the placenta is still in place priority should be given to removing it as soon as possible.
- You must wear sterile or disinfected gloves (ideally long versions to the elbow).
- Introduce your right hand into the vagina, clench your fist with the back of your hand positioned posteriorly and your knuckles in the anterior fornix.
- Place your other hand on the abdomen behind the uterus and squeeze the uterus firmly between both hands.
- Continue compression until the bleeding stops (i.e. there is no bleeding when compression is released), and the uterus is contracted.

Although this procedure is painful, it is highly effective and can significantly reduce or even successfully treat uterine haemorrhage. Therefore, if the bleeding is profuse, and the number of staff attending the patient allows, it is a good idea for one member of the team to commence bimanual compression while uterotonic drugs are prepared and given, and initial fluid resuscitation commenced.
Figure 15.6 Bimanual compression



5. Aortic compression
If bleeding still persists, apply aortic compression.
- Apply downward pressure with a closed fist (with your thumb outside the fist) over the abdominal aorta directly through the abdominal wall.
- The point of compression is just above the umbilicus and slightly to the left.
- Aortic pulsations can be felt through the anterior abdominal wall in the immediate postpartum period. Press the aorta down on to the vertebral column.
- With your other hand, palpate the femoral pulse with four fingers parallel to and just below the inguinal ligament to check the adequacy of compression.
- If the pulse is palpable during compression, the pressure exerted by the fist is inadequate.
- If the femoral pulse is not palpable, the pressure exerted is adequate.

Figure 15.7 Aortic compression



Continue until the bleeding stops. If it does not stop, continue to exert pressure while transferring the mother to a facility where expert help is available.

6. Uterine tamponade
Uterine packing with a hydrostatic balloon such as a Rusch balloon or condom over a simple in–out urinary catheter can help to control haemorrhage from an atonic uterus that does not respond to the above measures. The uterus may also be packed with a sterile pack or gauze, although it is important to ensure any gauze used is tied together, counted carefully, and extended into the vagina to facilitate removal.

A condom catheter, which is inserted into the uterus as a sterile procedure and filled with 250–500 mL of sterile Ringer-lactate or Hartmann's solution or 0.9% saline to create a uterine wall tamponade, is an effective way of stopping uterine bleeding that is continuing despite the use of uterotonic drugs and procedures (see Figure 15.8). It is important to check that the balloon is fully inside the uterus as it is inflated, and to take measures to ensure that it does not become displaced into the vagina. Packing the vagina with a sterile pack or gauze swab can do this.

Leave the balloon in position until the bleeding has stopped for up to 24 hours (the exact time needed is unclear). Before removing it, ensure that at least 1 unit of cross-matched blood for possible transfusion is available, with the possibility of making more available if required. Theatre staff and an anaesthetist should be warned in case bleeding occurs when the catheter is removed. One approach is to remove 50 mL every 30 minutes until it

is fully emptied. Observe the patient closely for 4 hours after removal of the catheter, looking at vaginal blood loss and vital signs. IV antibiotics should be given when the catheter is put in place, and should be continued for 48 hours.

Figure 15.8 Condom catheter inflated with sterile IV fluid

An alternative new approach (in low resource settings involves inflating a condom with air rather than IV fluids (see Figure 15.9). It includes the following components:

- a firm type of urinary catheter (used for temporary insertion and drainage of urine) rather than an indwelling Foley catheter, which is easily constricted
- a latex male condom from a sterile and unbroken pack
- the inflator (with its tube) of an aneroid blood pressure machine
- a surgical suture (preferably black silk) for tying the condom to the catheter
- a piece of sterile thread for tying the end of the condom after inflation to stop the escape of air
- sterile gauze to pack the vagina and maintain the inflated condom in the uterine cavity.

Figure 15.9 Condom catheter inflated with air

Using a sterile procedure throughout, the catheter is inserted into the condom, with the end part of the condom touching the tip of the catheter. The lower part of the condom is tied to the catheter using suture thread and inserted into the uterine cavity. The condom is then

held in place inside the uterine cavity using the non-dominant hand, the lower end of the catheter is connected to the inflator of the blood pressure machine (with the valve closed), and the condom is then inflated with air until the bleeding is either arrested or greatly reduced. Pneumatic pressure is rapidly achieved after a few inflations. The uterus gradually increases in size (this can be seen abdominally) as the condom is being inflated, and the woman should experience no more than slight discomfort. Excessive inflation of the condom must be avoided, and pain indicates that too much air is being forced into the condom. If this happens, loosening the valve of the inflator can easily reduce the volume of air.
Compared with inflating the condom with fluid (assuming that IV fluid is available, which is not always the case), this technique is much faster and easier, and good control is achieved by using the valve on the inflator.

7. Fluid resuscitation at the same time as the above manoevres
The aim of fluid resuscitation is to maintain perfusion of vital organs (the brain, heart and kidneys) during the manoeuvres described above.
1 Elevate the patient's legs (raise the foot of the bed).
2 Try to obtain two vascular access sites in order to give large volumes quickly, and in case one line is lost. Insert a wide-bore IV cannula (ideally two) (14 to 16G) and send blood for a full blood count, cross-matching (4–6 units) and clotting. If peripheral veins are difficult to access, the external jugular vein or long saphenous vein cut-down are good alternatives. If a skilled person is available, an internal jugular vein central line can be helpful, especially if the central venous pressure can be measured.
3 If venous access is not possible, consider inserting an intra-osseous line using the newly available drill system (see Section 9).
4 Give 500 mL of O-negative blood if it is immediately available. If not, standard practice is to give an initial rapid IV bolus of 1 litre of Ringer-lactate or Hartmann's solution (or of 0.9% saline if the former are not available) while waiting for blood for transfusion. It is essential that the IV bolus is given as rapidly as possible, with the aid of pressure bags or manual pressure. A blood pressure cuff that is wrapped around the fluid bag and inflated can be used to speed up infusions (see Figure 15.10). An alternative is to push the boluses in using a 20- to 50-mL syringe (with a three-way tap linked to the IV giving set).
5 As soon as it is available give 1 unit of blood (500 mL) as rapidly as possible, and repeat as required. Fresh blood is particularly useful for combat- ing the coagulopathy that occurs in major blood loss if specific coagulation components such as platelets are unavailable. Remember that blood loss is usually underestimated.
6 Further 500 to 1000-mL boluses of IV crystalloid or blood, if available, will usually be required in the first hour. Once more than 2 litres have been given IV, complications such as pulmonary oedema may sometimes occur, so be alert for circulatory overload.
The concept of *targeted crystalloid fluid resuscitation* requires urgent research. If this approach is adopted the initial boluses of IV crystalloids required to treat shock would only be given to keep the vital organs (especially the brain, heart and kidneys) perfused before blood becomes available and, most important of all, before specific treatments to stop the bleeding have started to take effect. Giving too much IV crystalloid fluid may theoretically increase bleeding by disrupting early clot formation and damaging the coagulation system. There is no clear evidence to indicate the precise blood pressure or clinical signs that should be achieved in a woman in shock due to PPH. Adequate perfusion of vital organs may be indicated by a radial pulse that can be palpated and a fully alert conscious level.

Until bleeding has been stopped and blood is available for transfusion, our personal practice, especially in low resource settings, is therefore to start with IV boluses of 500 mL of crystalloid and reassess after each bolus.

7 Keep the patient warm but do not overheat them, as this will cause peripheral vasodilatation and reduce the blood supply to vital centres. Hypothermia will exacerbate poor peripheral perfusion, acidosis and coagulation abnormalities.
8 If there is evidence of a blood-clotting problem, give fresh-frozen plasma and/or other clotting factors (if available).
9 Further IV fluid administration should be guided by the response of the pulse rate, blood pressure and capillary refill time, and later by the hourly urine output. Aim for a pulse rate of ≤ 100–110 beats/minute and a systolic blood pressure that is ≥ 90–100 mmHg and stable.

Figure 15.10 Pressure bag over bag containing Ringer- lactate or Hartmann's solution

Blood products
Fresh whole blood is the ideal choice if it is available. Full cross matching of blood may take up to an hour and is often unavailable in resource poor settings. In an emergency, group-specific blood should be used. The patient's blood group should have been established during pregnancy, as this facilitates the provision of blood when it is needed. O-Rhesus-negative blood can be transfused in acute emergencies.
All large-volume infusions of blood should be warmed. A good way of warming blood is to place each bag of blood or fluid under a relative's clothes next to their skin. Do not infuse cold fluid directly through a central venous line.

8. New potentially valuable treatments for PPH
Tranexamic acid
If there is continuing bleeding, especially if it has been caused by genital tract trauma, this inexpensive and safe drug can be helpful. Recent evidence has shown that tranexamic acid can reduce mortality from major haemor- rhage in major trauma in adults. The drug should be started as soon as possible, and within the first 3 hours after the onset of major haemorrhage, in order to be effective.
The loading dose is 1 gram over 10 minutes followed by an IV infusion of a further 1gram over 8 hours.
The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100-mL bag of 0.9% saline and letting it run through over a period of about 10–20 minutes (the exact timing is not crucial).
The 8-hour infusion is given by injecting 1 gram of tranexamic acid into a 500-mL bag of 0.9% saline and giving it over a period of 8 hours (i.e. approximately 60 mL/hour). If there is a gap between the initial bolus and the subsequent infusion this probably does not matter too much, but ideally one should follow the other.

The non-pneumatic anti-shock garment (NASG)
This compression garment is made from neoprene, a stretchable material that recoils and applies pressure through the skin and consists of five segments that compress the legs (segments 1, 2 and 3), the pelvis (segment 4) and the abdomen (segment 5) (see Figures 15.11 and 15.12).

Figures 15.11-15.12 NASG

The abdominal segment includes a foam compression ball that presses on the area of the uterus. Velcro holds the segments in place.

The NASG is reported to reduce shock by compressing blood vessels in the lower parts of the body, thereby diverting up to 30% of total blood volume to the heart, lungs, brain and possibly the kidneys. It is promising where there can be delays in transfer to facilities where comprehensive emergency obstetric care is available, and where blood transfusion and surgery can be undertaken. The NASG can give time for blood transfusion to become established and other treatments to be given, as well as reducing the amount of blood that subsequently needs to be transfused.

The NASG is applied in sequence from the lower legs up to the abdominal compression segment (segment 5). With experience one person can apply it in 2 minutes, although it takes from 5 to 10 minutes if the healthcare worker is alone and unused to applying it. Help from others present, such as porters or relatives, can be valuable.

In PPH due to uterine atony, it is particularly important that someone is massaging the uterus and giving the other treatments outlined above when the NASG is being applied. After the garment is in place the legs no longer need to be elevated and the uterus can still be externally massaged by placing one hand underneath the pelvic segment of the NASG. Vaginal examinations and repair of cervical or vaginal tears can be performed while the NASG is in place. The pelvic and abdominal segments can be opened for surgery such as emergency hysterectomy or B-Lynch sutures.

The NASG can be applied in addition to all the other measures for PPH described above when signs of shock first appear. The only contraindication to its use is known heart disease.

The NASG is removed segment by segment when bleeding has been reduced to safe levels and the patient's cardiovascular stability has been maintained for at least 2 hours (systolic blood pressure ≥ 90–100 mmHg, heart rate ≤ 100–110 beats/minute and haemoglobin concen- tration of ≥ 7 g/dL). Removal begins at the ankles with 15-minute gaps between each segment that is opened, and clinical measurements being made before each segment is removed. If the systolic blood pressure drops by ≥ 20 mmHg and/or the heart rate increases by ≥ 20 beats/ minute, reapply that segment of the NASG and consider additional treatments such as further blood transfusion.

Between patients, the NASG can be laundered in the same way as for bloodstained sheets (see Textbook).

Stopping bleeding due to trauma to the perineum, cervix or vagina
If the bleeding continues despite all of the measures described above, examine the perineum, vagina and cervix with a sterile speculum. Postpartum bleeding with a contracted uterus is usually due to a cervical or vaginal tear. Trauma to the cervix or vagina is the second most frequent cause of PPH, and may coexist with an atonic uterus. Examine the mother carefully and repair any tears.
Bleeding from trauma can be substantial and may be fatal, especially if there is pre-existing severe anaemia. Suture packs, a torch, a Sims' speculum and sutures must always be immediately available on the PPH emergency trolley.
Initially stop the bleeding with sterile packing until a surgeon is able to repair the wounds.

It is essential to ensure that the uterus is contracted even when a traumatic cause is present.

Repairing a perineal tear
Get a good light, and start at the top of the tear. If difficult ask for help if available.
1 Anything except very minor tears should be repaired in the lithotomy or similar position as it provides a better view and is more comfortable for the surgeon/midwife.
2 Use a cutting needle on the skin and a round-bodied needle on other tissues.
3 Put the first stitch in above the highest point of the tear (apex). This is usually within the vagina.
4 When you get to the junction between the vaginal mucosa and the skin, put a needle through the loop and tie a knot.
5 Continue by applying stitches into the muscle and fascia to close any dead space (gaping of the vaginal skin) and again tie a knot once done.
6 Next close the skin by placing the needle in through the skin on one side, and then in through the sub-cutaneous tissues and out through the skin on the other side. If using interrupted sutures, the stitches are usually inserted ~ ½ cm from the skin edges and approximately 1 cm apart from each other. Tie a knot after each stitch to oppose the skin.

Repairing a bleeding cervical tear
Place the patient in the lithotomy position and explain the procedure to the patient.
Get a good light and if at all possible an assistant.
Search all round the patient's cervix, if the cervix is not easily visible grasp it with a sponge holding forceps (or similar) and pull it into view. In order to visualise the entire cervix it is often necessary to follow the cervix round from anterior to posterior by pulling each segment down with the sponge holding forceps. Ideally two forceps are used and the next segment picked up with one set of forceps while traction is maintained with the other ('walking the cervix').
Once the cervical tear is identified start suturing it at its highest point (the apex).
If you cannot insert sutures, control the bleeding with a vaginal pack and transfer the patient.

Stopping bleeding due to retained placenta or retained products of conception
Examine the placenta and ensure that it is complete.
Retained placenta
A retained placenta is defined as occurring:
1 after active management of the third stage of labour, if the placenta is not delivered within 30 minutes of the birth

2 after expectant management of the third stage of labour, if the placenta is not delivered within 60 minutes of the birth.

Management of retained placenta
If there is a clinically significant PPH, the placenta must be removed urgently. Call for help (including an anaesthetist and an obstetrician), insert a venous cannula, take blood for haemoglobin and cross matching as for PPH, and ensure that the operating theatre is ready.
Massage the uterus, and if there is atony it should be managed as described for PPH above. However, although oxytocin should be used as necessary, ergometrine may cause tonic uterine contraction, which may delay expulsion.

Cause 1: The placenta is separated but trapped in the lower part of the uterus or cervix
- If the placenta is undelivered after 30 minutes of oxytocin, and the uterus is contracted and the placenta separated (usually indicated by the gushing of blood and rising of the uterus into the abdomen as a firm, more movable structure as with a normal placental separation and delivery), attempt controlled cord traction. During this procedure, and at all times, keep one hand on the abdomen to support the uterus and prevent its inversion.
- Avoid forceful cord traction and fundal pressure, as they may cause uterine inversion.
- This situation usually responds to firm and persistent traction on the cord with the other hand countering this on the uterus to prevent inversion. Ensure that the bladder is empty. Ask the mother to empty her bladder, otherwise catheterise the bladder if necessary.
- If you can see the placenta, ask the mother to push it out; an upright position may help. Undertake a sterile vaginal examination and if you can feel the placenta in the vagina or cervix, remove it.

Cause 2: The placenta has failed to separate from the uterus
If controlled cord traction plus uterotonic drugs are unsuccessful, manual removal of the placenta is likely to be required (see below).
If the cord has broken from the placenta, it is still possible for the placenta to be pushed out by contractions and by the mother.

Cause 3: The placenta is morbidly attached to the uterus. Very adherent tissue may be **placenta accreta,** a situation that is more likely to occur after a previous Caesarean section. Efforts to extract a placenta that does not separate easily may result in heavy bleeding or uterine perforation, which usually requires hysterectomy.
Therefore, if there is any suspicion of a morbidly adherent placenta the patient should ideally be referred to a hospital with operating facilities and a surgical team (if available). See pages below for more details on management. Where there is significant haemorrhage, uterine and vaginal packing with gauze or balloon tamponade/condom catheter can halt the bleeding and eventually allow residual placenta to disintegrate and resorb/expel on its own. Hysterectomy will be needed if bleeding cannot be stopped by the measures described above.
If bleeding continues, assess clotting status using a bedside clotting test. Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests coagulopathy.

If there are signs of infection (fever with foul-smelling vaginal discharge), give antibiotics as for endometritis.

Manual removal of the placenta

This is a painful procedure associated with a high risk of infection unless it is undertaken using full sterile procedures.

Unless it is performed as an emergency for major PPH, we consider that manual removal of the placenta should be undertaken in an operating theatre with preceding morphine or ketamine in the presence of an anaesthetist.

Elbow-length sterile gloves should be used.

Provided that active PPH is not occurring, the mother should first be adequately resuscitated with IV fluids/blood and oxygen. The pulse rate, blood pressure, oxygen saturation and urine output should be closely monitored. Ideally, facilities for blood transfusion and, if necessary, emergency hysterectomy should be available.

After the placenta has been removed, massage the uterus to encourage tonic uterine contraction. An IV infusion of oxytocin 40 units in 500 mL or 1 litre of Ringer-lactate or Hartmann's solution should be administered over 4 hours to ensure continued uterine contraction.

A single dose of prophylactic antibiotics should be given just before all manual removals (2 grams of ampicillin IV or IM plus 80 mg of gentamicin IM/IV).

Figure 15.13 Introducing one hand into the vagina along the cord

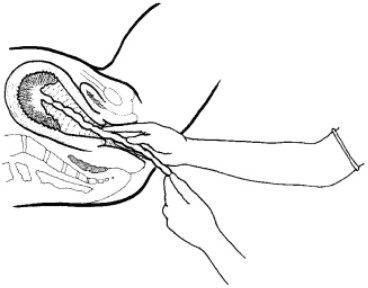
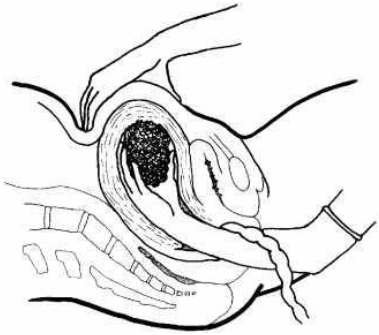


Figure 15.14 Supporting the fundus while detaching the placenta. Reach the placenta from the implantation site by keeping the fingers tightly together and using the edge of the hand to gradually make a space between the placenta and the uterine wall

Figure 15.15 Withdrawing the hand plus the placenta from the uterus.



Treatment of PPH that continues despite all of the above interventions
Reassess the patient and determine whether bleeding is continuing and whether there is a clotting disorder. Assess the clotting status using a bedside clotting test (see page XX) Failure of a clot to form after 7 minutes, or formation of a soft clot that breaks down easily, suggests coagulopathy.
If bleeding continues, re-examine the patient and ensure that the oxytocin IV infusion is running correctly (40 units of oxytocin in 500 mL of Ringer-lactate or Hartmann's solution over 4 hours).
Exclude the following:

- inverted uterus
- retained products of conception
- damage to the genital tract: check for bleeding from the cervix, vaginal walls and perineum.

If the above measures fail to control PPH, do not wait too long.
The following operative interventions are available:

- B-Lynch sutures
- hysterectomy, which may be life-saving, and should be considered early in order to reduce the risk of life- threatening coagulopathy.

Check the haemoglobin levels or haematocrit after resuscitation and when the patient is stable. Consider administering oral iron if the patient is anaemic.

Treatment of secondary PPH
This is particularly dangerous in low-resource settings. Severe and life-threatening anaemia can develop rapidly, and frequently the woman is admitted in shock and urgently requiring blood transfusion. Severe life-threatening septic shock can also develop.

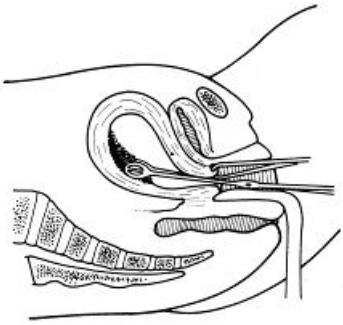
1. Assess vital signs and temperature, and if the patient is shocked proceed as described above for massive PPH. Assess the uterine size, and perform a speculum and vaginal examination and note the degree of bleeding, whether the blood is offensive, whether the cervix is still open, and whether there is cervical and uterine tenderness.
2. Take a high vaginal swab for bacteriology (if available) before antibiotics are given. Insert an IV line and take blood for haemoglobin, blood cultures, cross matching and blood clotting (or clotting/ bleeding time if unavailable) (as DIC may occur).
3. Urgently start 7 days of treatment with IV antibiotics, as the bleeding is often secondary to infection. This is especially likely if there is foul-smelling lochia, a fever, or there has been prolonged rupture of membranes prior to delivery.

- Give IV ampicillin 2 grams IV every 6 hours
- **plus** gentamicin 80 mg IV or IM every 8 hours or 5 mg/ kg body weight IV/IM once every 24 hours
- **plus** metronidazole 500 mg IV every 8 hours.

Alternatively, give ceftriaxone 2 grams IV or IM once daily **plus** metronidazole 500 mg IV every 8 hours.
4. Provide blood transfusion (ideally fresh blood) if the haemoglobin level is < 5 g/dL, or if it is < 7.5 g/dL with symptoms suggesting early cardiac failure or shock or if there is brisk ongoing blood loss.
5. Examine for suspected retained placental fragments, but beware of the high risk of uterine perforation. Feel inside the uterus using elbow-length sterile gloves, and try to remove any retained products manually or using ovum forceps. Be very careful not to perforate the uterus. Placental tissue that sticks to the uterus may be placenta accreta, which may result in heavy bleeding (see below for management). If the cervical os has already started to close, this approach might not be possible. If a curette is used, it should be blunt, and great care should be taken as the uterus will be soft and easy to perforate. A

vacuum aspirator (as used for treating miscarriage) or digital curettage may be safer options. Laparotomy is occasionally needed to deal with the continued bleeding from an infected or ruptured uterine incision or infected placental bed.

Figure 15.16 Evacuating the uterus.



Management of placenta accreta
The placenta being morbidly adherent to deeper layers in the uterine muscle or even external to the uterus causes this serious complication. It is more common after a previous Caesarean section and in the presence of a placenta praevia. After Caesarean section an attempt should be made to assess the site of the placenta with ultrasound to determine whether it is likely to overlie the previous scar. If the patient undergoes a new Caesarean section, or has a retained placenta, the procedure should be carried out by the most experienced practitioner possible and preparations made for major haemorrhage, i.e. experienced anaesthetic assistance, good intravenous access, cross matched blood and availability of the non-pneumatic anti-shock garment.

Option 1. Allow the placenta to be left in situ where it may separate and expel itself over time. This risks haemorrhage, infection and DIC and in these cases the mother must be made aware of these risks. She must be observed carefully for signs of infection, given prophylactic antibiotics (single dose of ampicillin 2 g IV/IM plus gentamicin 5 mg/ kg body weight IV/IM) and warned about what to expect when the placenta is eventually expelled. She must have rapid access to emergency care and be monitored as an inpatient.

Option 2. Attempt to remove the placenta. Haemorrhage should be anticipated and the procedure performed in theatre with adequate IV access, monitoring, cross-matched blood available and the most experienced anaesthetic and surgical personnel possible.

Option 3. Immediate hysterectomy in order to prevent later complications and the necessity for very close post-partum monitoring. The decision will need to be based on the patient's wishes, the resources available and the doctor's abilities. If there is no facility for emergency hysterectomy, the patient should be transferred to a facility where this is available.

Anaesthetic issues when managing PPH
Cardiovascular instability is a relative contraindication to spinal anaesthesia.
Rapid sequence induction agents with minimal peripheral vasodilator action, such as ketamine, should be considered (see Textbook). Adrenaline and atropine should be readily available in case cardiovascular collapse occurs on induction. Ventilation with high concentrations of oxygen may be needed until the bleeding is controlled. Volatile agents have been associated with increased blood loss due to their relaxant effects on uterine

muscle. Anaesthesia should be maintained with IV agents (ketamine or etomidate) if uterine atony is contributing to haemorrhage.

Disseminated intravascular coagulation (DIC)
Suspect and aggressively treat coagulopathy using warmed fresh blood, platelets, fresh-frozen plasma and cryoprecipi- tate as appropriate and available. DIC is more likely to occur if there has been a previous antepartum haemorrhage.

Monitoring
Once the bleeding has been controlled, frequent observations of respiratory rate, pulse rate, blood pressure, urinary output and oxygen saturation (if available) are vital both to detect problems and to monitor the response to treatment. At least 48 hours of close observations are required.

Figure 15.17 Pathway of care for massive postpartum haemorrhage (PPH). NASG, non-pneumatic anti-shock garment