SECTION 9: MANAGEMENT OF EMERGENCIES IN PREGNANCY

Hyperemesis gravidarum

Some nausea and vomiting are common in early pregnancy with nausea affecting between 70 and 85% of women. About half of pregnant women experience vomiting. However, in a small proportion of patients severe vomiting (hyperemesis) can occur. This condition is more common where there is a larger than normal placental mass (for example in multiple pregnancy and molar pregnancy). Hyperemesis peaks at 11 weeks with 90% resolved at 16 weeks

Associated conditions

Severe hyperemesis requiring hospital care is associated with the following:

- Depression and severe stress
- Multiple pregnancy
- Molar pregnancy

Consequences of hyperemesis that is severe enough to require hospital care

These include:

- Ketosis
- Hypochloraemic alkalosis, hypokalaemia, hyponatraemia
- Malnutrition with anaemia and hypoalbuminaemia
- Ulcerative oesophagitis
- Wernick's encephalopathy from thiamine deficiency
- Worsened depression with risks of seeking termination of pregnancy
- It is dangerous in type 1 diabetes and can result in ketoacidosis

Investigations:

- Ultrasound examination to exclude molar or multiple pregnancy
- Urine for ketones
- Blood for Hb, urea and electrolytes
- Special investigations as indicated to exclude serious medical problems affecting the gastrointestinal, genitourinary, neurological, metabolic or endocrine and psychological systems.

Treatment of severe hyperemesis

Intravenous 0.9% saline 1 litre over 4 hours initially and then repeated as required is the most effective treatment for severe hyperemesis with dehydration.

Small volumes (100-200 ml every 2-3 hours) of WHO oral rehydration salts (ORS) powder dissolved in one litre of water giving Na+ 75mmol/litre, K+ 20mmol/litre and glucose 75 mmol/litre can be given in addition to IV fluids until vomiting settles.

After IV fluids have been started, antiemetic drugs may not be required but if vomiting continues try prochlorperazine 12.5 mg IM and then orally 5 to10mg three times daily. An alternative is cyclazine 50 mg IM, IV or orally three times daily.

Supplements with thiamine must be considered if there is evidence suggesting a severe deficiency may be present (Wernicke-Korsakoff syndrome).

Wernicke-Korsakoff syndrome.

Symptoms of Wernicke's encephalopathy include the following:

- Confusion
- Loss of muscle coordination (ataxia)

- Leg tremor
- Vision changes
- Abnormal eye movements (back and forth movements called nystagmus)
- Double vision
- Eyelid drooping

Symptoms of Korsakoff syndrome:

- Inability to form new memories
- Loss of memory, can be severe
- Making up stories (confabulation)
- Seeing or hearing things that aren't really there (hallucinations)

Treatment of severe hyperemesis where possible symptoms or signs of Wernicke-Korsakoff syndrome are present

Give an IV infusion of 7ml of pabrinex in 100 ml of 0.9% saline over 1 hour (7ml contains 250 mg of thiamine plus ascorbic acid, nicotinamide, pyridoxine and riboflavin). Subsequently give oral thiamine 50 mg three times daily until vomiting has stopped.

Other managements on discharge from hospital

Withhold iron tablets until vomiting has resolved but ensure that subsequently they are taken as iron deficiency anaemia may have been an important consequence of the hyperemesis.

Try and help with any depression that is present and also, if resources to address intimate partner violence are present in the community, make sensitive inquiries of the woman or girl in case this is a factor.

The pregnant woman or girl with shock during pregnancy and the puerperium

Introduction

The pregnant patient who is shocked from hypovolaemia (the most important cause: see below) will be pale, cold and clammy, have a rapid weak pulse, and may have reduced conscious level, be confused or unconscious. If the shock is due to sepsis the patient's skin may become warm from vasodilatation. In labour, the most likely cause of shock is blood loss, but in the post-partum period the shock can also be due to infection acquired before or during labour.

Shock results from an acute failure of circulatory function. Maintenance of adequate tissue perfusion depends on:

a pump (the heart)	*failure leads to*	cardiogenic shock
the correct type and volume of fluid (blood)		hypovolaemic shock
controlled vessels (arteries, veins, and capillaries)		distributive shock
unobstructed flow		obstructive shock
red blood cells		dissociative shock

The most common causes of shock are hypovolaemia from any cause, septicaemia, the effects of trauma and very severe anaemia.

Classification of causes of shock

Common causes are in **bold** and all are further detailed in the relevant chapters

Table 1 Causes of shock

Cardiogenic	○ Arrhythmias ○ Cardiomyopathy ○ **Heart failure** ○ Cardiac valvular disease ○ Myocardial contusion
Hypovolaemic	○ **Haemorrhage** ○ **Gastroenteritis** ○ Volvulus ○ **Burns** ○ **Peritonitis**
Distributive (relative hypovolaemia)	○ **Septicaemia** ○ Anaphylaxis ○ Anaesthesia ○ Spinal cord injury
Obstructive	○ Tension pneumothorax ○ Haemopneumothorax ○ Flail chest ○ Cardiac tamponade ○ Pulmonary embolism
Dissociative	○ **Very severe anaemia** ○ Carbon monoxide poisoning

Diagnostic pointers: *during assessment and resuscitation, a focused history of the previous 24 hours and previous illnesses should be gained. This may point to the likeliest working diagnosis for emergency treatment.*

- A history of vomiting and/or diarrhoea points to **fluid loss,** either externally (e.g. **gastroenteritis**) or into the abdomen (e.g. appendicitis/peritonitis, early stages of gastroenteritis).
- A history of bleeding. This may be vaginally, or silently into the abdominal cavity, as in ectopic pregnancy, placental abruption or ruptured uterus.
- Fever or a rash points to **septicaemia**.
- Urticaria, angio-neurotic oedema or a history of allergen exposure points to **anaphylaxis**.
- Heart failure points to **severe anaemia** (usually with severe pallor) valve disease or cardiomyopathy.
- A history of sickle cell disease or diarrhoeal illness and low haemoglobin points to **acute haemolysis.**
- **A history of major trauma points to blood loss, and more rarely, tension pneumothorax, haemothorax, cardiac tamponade or spinal cord transection**.

- Severe tachycardia or signs of heart failure point to an **arrhythmia** or to a cardiomyopathy.
- A history of polyuria, sighing, respirations and a very high blood glucose points to diabetes (*see* **diabetic ketoacidosis**).
- A history of drug ingestion points to **poisoning**.

Physiology of shock

Definition: an acute failure of circulatory function, leading to poor delivery of nutrients and oxygen to, and poor removal of waste products from, tissues.

Shock is a progressive syndrome, but its effects can be divided into the following progression:

Phase 1 (compensated) shock

Table 2 Compensated shock

Physiology	Clinical Effects
Sympathetic reflexes maintain cardiac output by: - increased systemic arterial resistance - decreased blood flow to non-essential organs - increased heart rate - constriction of the venous reservoir - angiotensin and renin release lead to renal preservation of salt and water and reabsorption of intestinal fluid	Normal systolic blood pressure. (Diastolic pressure may be increased due to vasoconstriction) - tachycardia - cool skin and increased capillary refill time - decreased urine output <0.5m L/kg/hour or < 30 mL per hour in mother - confusion/agitation

Phase 2 (uncompensated) shock.

Table 3 Uncompensated shock

Physiology	Clinical Effects
Failure of compensatory mechanisms with decreased tissue perfusion leading to: - increased anaerobic metabolism, leading to lactic acidosis - acidosis impairs cardiac function and cellular homeostasis leading to a further decline in cellular metabolic functions - inflammatory mediators are released which further impair cell function and vital systems such as the coagulation cascade and platelet function	- hypotension - cold peripheries and markedly increased capillary refill time - acidotic breathing - absent urine output - impaired cerebral function

Phase 3 (irreversible) shock

The diagnosis of irreversible shock is a retrospective one.

Severe damage to vital organs leads to inevitable death due to diminished energy stores which cannot be replenished, even if circulatory function is restored

Hence early recognition and effective treatment of shock are vital

Physiology of septic shock

Tissue perfusion is decreased through the action of bacterial toxins and host inflammatory mediators.

- Abnormal distribution of blood in the microcirculation, sometimes with peripheral vasodilatation.
- Loss of intravascular fluid into the extra-vascular space due to capillary leakage
- Depressed myocardial contractility due to toxins and acidosis.
- Although cardiac output may be normal or raised from baseline, it may still be too low to deliver sufficient oxygen and nutrients to the tissues because in septic shock, cells do not use oxygen properly. There appears to be a block at the mitochondrial level in the mechanism of oxygen uptake. This progressive deterioration in cell oxygen consumption can lead to multiple organ failure.

Early (compensated) septic shock

This is characterised by:

- raised cardiac output with tachycardia.
- sometimes decreased systemic resistance, warm extremities, and a wide pulse pressure.
- sometimes increased systemic resistance with cold extremities and a raised diastolic BP.
- hyperpyrexia and hyperventilation .
- mental confusion.

All of these signs may be minimal: mental confusion in particular needs to be looked for carefully, if septic shock is not to be overlooked at this stage. In the group with increased systemic resistance, decreased capillary return is a useful sign in these circumstances.

A pregnant patient may lose 1200 – 1500 mL before obvious signs of shock (20% of circulating blood volume 6 to 7 litres). Maternal signs of hypovolaemia are late.

Fetal distress may be the first sign of shock in pregnancy.

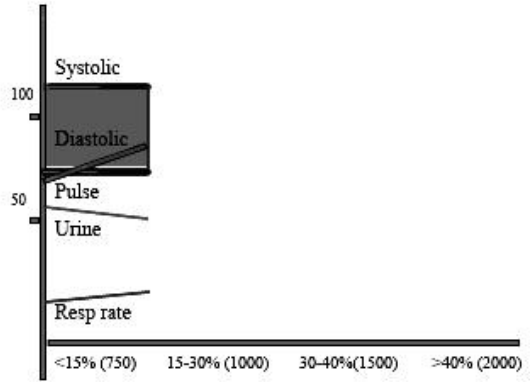
Graphs to indicate the progression of shock in relation to clinical signs

Stage 1

At first with less than 1000 mL loss, there are very few signs and symptoms. The patient may be slightly anxious and the pulse and respiratory rate are slightly elevated, but still within the normal range. Therefore, if that is the first recording taken, you may think this is normal for that patient but it may actually be abnormal for her (*see* figure 2.5.A.1 Stage 1 shock).

Note that in the anaemic mother, signs and risks may be worse earlier than this.

Figure 1 Stage 1 shock



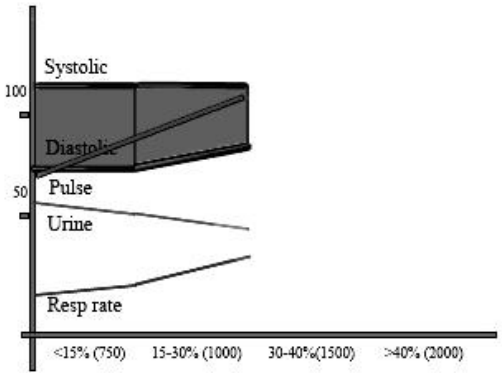
Stage 2

After further blood loss, the perfusion to organs is maintained by the body's stress response. This increases the diastolic pressure, with a resultant reduction in the pulse pressure and the pulse rate continues to rise, now over 100 (*see* figure 2 Stage 2 shock).

Meanwhile, urine is not being produced and the mother's respiratory rate starts to increase.

Note that in the anaemic mother, signs and risks may be worse earlier than this.

Figure.2 Stage 2 shock

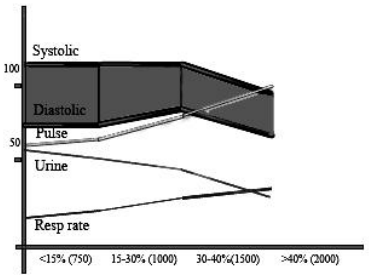


Stage 3

When 2000 mL has been lost, a drop in blood pressure is seen, along with other symptoms and signs of hypovolemia. It has to be reinforced that the commonly -used sign of hypotension as an indicator for severity of blood loss is a very late sign.

Generally, the pulse rate should be lower than the systolic blood pressure. If the pulse rate is higher than the systolic pressure, then the patient is in grave danger (*see* figure 2.5.A.3 Stage 3 shock).

Figure.3 Stage 3 shock

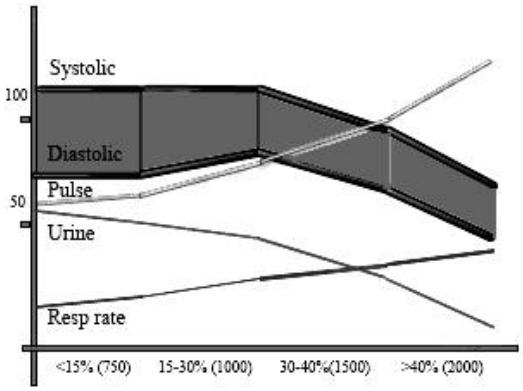


Note that in the anaemic mother, signs and risks may be worse earlier than this

Stage 4

If more than 2000 mL are lost, this is an uncompensated very late stage of hypovolaemia, which could result in death very rapidly if emergency measures are not instituted immediately (*see* **f**igure 2.5.A.4 Stage 4 shock).

Figure.4 Stage 4 shock



Note that in the anaemic mother, signs and risks may be worse earlier than this

In late (uncompensated) septic shock

- Hypotension occurs as a result of decreased vascular resistance, and even with a normal or raised cardiac output, shock develops.
- The cardiac output may fall gradually over several hours, or precipitously in minutes.
- As tissue hypoxia develops, plasma lactic acid levels increase.
- Survival in septic shock depends on the maintenance of a hyper-dynamic state.

Choice of fluid for volume replacement

Crystalloid or colloid fluids are appropriate for volume replacement in shock **(***see* fluid and electrolyte management section**)**

However, dextrose/glucose infusions (particularly hypotonic ones such as 5% glucose or 0.18% saline in 5% glucose) do not constitute appropriate fluid resuscitation and can be dangerous as they lower serum sodium which can produce seizures and brain swelling.

Compared to colloids, crystalloid fluids:

- diffuse more readily into the interstitial space
- may be associated with more peripheral oedema
- where capillary leak exists, allow more water to enter the interstitial space, because of lower osmotic pressure
- need 2-3 times the volume of colloids to expand the vascular space
- have been reported to be associated with lower mortality

Nevertheless, the use of both crystalloid and colloid is appropriate although crystalloids (e.g. Ringer-Lactate or Hartmann's or normal saline) are more likely to be available.

Choice of crystalloid

The fluid traditionally infused into the circulation for the management of shock has been normal saline (0.9% NaCl). This fluid has increasingly shown to be dangerous, especially in the sick patient. An infusion of normal saline causes a hyperchloraemic acidosis (a high chloride concentration leading to an acidosis) which in the shocked patient, who is already acidotic, causes a deterioration in the health of cells in vital organs even though perfusion of the cells has been improved by the increased circulating volume.

There are sodium containing alternatives to normal saline which are safer as they approximate more closely to human serum/plasma in content although they are a little more expensive. We recommend the use of either of these alternatives (*Ringer Lactate and Hartman's solution* are widely available) for all fluid replacement. Hospitals are advised to change their standard crystalloid from 0.9% ('normal') saline to Ringer Lactate or Hartmann's as soon as possible. Recognising that not all hospitals will have access to these solutions immediately, there may sometimes be no alternative but to start fluid replacement with normal saline. But if more than 20 mL/kg needs to be given, then one of the safer alternatives should be used in very sick patients if at all possible.

Blood
If there is significant blood loss or pre-existing severe anaemia in the face of any blood loss, blood will be needed. Full cross-match takes about 1 hour to perform. For urgent need, type-specific non-cross-matched blood (which is ABO- and rhesus- compatible, but has a higher incidence of transfusion reactions) takes about 15 minutes to prepare. In dire emergencies, O-negative blood must be given.

Warm fluids

Fluids should be warmed, especially if needed in large volumes. In the absence of heaters, bags of fluid /blood can be warmed by placing them under the clothes next to the skin of a relative. Even this takes time and another method is to pass the tubing of IV set through a bowl containing warm water.

Primary assessment and resuscitation

Suspect or anticipate shock if at least one of the following is present:

- bleeding in early pregnancy (e.g. miscarriage, induced abortion,, ectopic pregnancy or molar pregnancy)
- bleeding in late pregnancy or labour (e.g. placenta praevia, abruptio placentae, ruptured uterus)

- bleeding after childbirth (e.g. ruptured uterus, uterine atony, tears of genital tract, retained placenta or placental fragments)
- infection (e.g. induced or septic miscarriage/abortion, chorio-amnionitis, endometritis, pyelonephritis)
- trauma (e.g. injury to uterus or bowel during induced abortion, ruptured uterus, tears of genital tract).

Primary assessment indicating shock

- fast, weak pulse (100-110) per minute or more)
- pallor (especially of inner eyelid, palms or around mouth)
- sweatiness or cold clammy skin
- rapid breathing (> 30 breaths per minute)
- anxiousness, reduced conscious level, confusion or unconsciousness
- low BP (systolic less than 90 mm Hg, a late sign)
- reduced urine output (<30 ml per hour).

Resuscitation

If heavy bleeding is suspected as cause of shock: **t**ake steps simultaneously to stop the bleeding. These comprise uterotonic drugs such as oxytocin or misoprostol, uterine massage, bimanual compression, aortic compression and condom catheter, anti-shock garment in postpartum haemorrhage. Urgent surgical intervention may be required, for example for ruptured ectopic pregnancy.

Airway and try to stop bleeding by surgical or specific medical treatments as urgently as possible.

- Use an opening manoeuvre, if the airway is not open or is partially obstructed. Keep the airway open. If there is improvement but if airway closes without active opening support, consider airway adjuncts to maintain the airway if unconscious (P or U on the AVPU scale).
- Suction if necessary
- The airway may need to be maintained and protected by intubation, using experienced senior help (if available)

Breathing

- Provide high concentration of **oxygen** through a face mask with reservoir bag if adequate spontaneous respiration
- For inadequate ventilation, respiration should be supported with oxygen via a **bag-mask,** and experienced senior help summoned (if available)

Circulation

- Gain IV access
    - Use a short, wide-bore (16-18 gauge)IV cannula if possible, for IV access.
    - Internal jugular and external jugular vein access are good options if peripheral access is impossible. Long saphenous vein cut down may also be considered and the new intraosseous drill can be used when all else fails.
    - **Pressure on the site of the bleeding can be valuable in many circumstances, for example in post partum haemorrhage (*see* chapter 2.5.D.iv) and external haemorrhage from major trauma**
    - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost.

  - A BP cuff can be used to speed up infusions in emergency situations. Wrap the cuff around the blood/fluid bag and place inside a non-compressible bag. (*see* figure.5).
- Left lateral tilt position or recovery position to minimise aortic and vena caval compression, and to reduce the risk of aspiration if after 20 weeks gestation
- Elevate legs by raising the foot of the bed.
- Consider non-pneumatic anti-shock garment (NASG).
- Give initial **rapid bolus of 500ml to 1 L of Ringer-Lactate or Hartmann's or blood if hemorrhaging. A colloid in the same dose can also be given, if available**. It is essential that the bolus is given as rapidly as possible. In the absence of syringe pumps, they should be manually pushed in using 20-50 mL syringe (using a 3 way tap and link to an IV giving set).
- Further 500-1000 mL boluses will usually be required in the first 1 hour. Once >2 L has been given IV, complications such as pulmonary or cerebral oedema may occur. If available, expert help, including CVP monitoring, is valuable.

The concept of "**hypotensive resuscitation**" is important if the cause of hypovolaemic shock is haemorrhage. Here the initial boluses of IV crystalloids required to treat shock should only be given to keep the vital organs (especially brain, heart and kidneys) perfused before blood becomes available and, of most importance, surgery and specific medical treatments to stop the bleeding have started working. Giving too much IV fluids may increase the blood pressure and thus increase bleeding by disrupting early clot formation.

Our suggestion is that when giving boluses of crystalloid or blood in shock due to bleeding, only the amount needed to keep the BP at a level sufficient to perfuse the vital organs should be given. There is no clear evidence to indicate the precise blood pressure that should be achieved in a woman in shock due to haemorrhage in pregnancy and the puerperium. *Adequate perfusion of vital organs* may best be indicated by the following: a radial pulse which can be palpated and an alert conscious level. During pregnancy, the adequacy of the fetal heart rate may also be helpful.

In this situation, therefore, and to maintain a palpable radial pulse, start with IV boluses of 500ml of crystalloid or ideally blood and reassess after each.

Transfuse blood as soon as possible to replace blood loss

- *Tranexamic acid*

If bleeding is the cause of shock, this inexpensive and safe drug can be helpful. The drug should be started as soon as possible and within the first 3 hours after the onset of major haemorrhage to be effective.
The loading dose is 1 g over 10 minutes followed by an IV infusion of a further 1 gram over 8 hours. The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100ml bag of 0.9% saline and letting it run through over about 10-20 minutes (the exact timing is not crucial). The 8 hour infusion is given by injecting one gram of tranexamic acid into a 500ml bag of 0.9% saline and giving it over 8 hours (approximately 60 ml/hour).

- Keep warm but do not overheat, as this will cause peripheral vasodilatation and reduce blood to vital parts of the body such as the brain.

Figure 5 Pressure bag over the bag of Ringer-Lactate or Hartmann's to increase infusion rate (a blood pressure cuff can be used instead)

Determine the cause of bleeding.

- If *bleeding during first 24-28 weeks of pregnancy*, suspect miscarriage, induced abortion, ectopic pregnancy or molar pregnancy.
- If *bleeding after 24-28 weeks or during labour but before delivery*, suspect placenta praevia, abruptio placentae or ruptured uterus.
- If *bleeding occurs soon after childbirth*, suspect atonic uterus, retained placenta placental fragments, ruptured uterus, tears of genital tract and occasionally inverted uterus.

If *infection is suspected as the cause of shock:*

- collect appropriate samples (blood, urine, pus, swabs) for microbial culture before starting antibiotics, if facilities are available
- give combination of antibiotics to cover aerobic and anaerobic infections and continue until fever-free for 48 hours
    - benzyl penicillin 2.4 g initially then 1.2 g IV 6 hourly OR ampicillin 2g initially then 1 g IV/IM every 6 hours PLUS gentamicin 80mg IV/IM 8 hourly or 5mg/Kg body weight IV/IM once every 24 hours
    - or ceftriaxone 2-4 g IV once daily or cefotaxime 2 g 12 hourly IV PLUS metronidazole 500 mg IV every 8 hours.
- *do not give antibiotics by mouth or IM in shock it will not be absorbed.*
- reassess the patient's condition for signs of improvement.

If trauma is the cause of shock where haemorrhage is the most likely cause:

- prepare for surgical intervention
- give smaller IV fluid resuscitation boluses (500 mL) and reassess after each ("hypotensive resuscitation" see above)

General issues

Avoid IV boluses of 5% dextrose or dextrose saline (4%/0.18%) as they cause hyponatraemia, and may lead to cerebral oedema and death.

An antibiotic such as cefotaxime 1 gram IV should be given but, if not available, use any broad spectrum antibiotic that is available when a diagnosis of septicaemia is made obvious by the

presence of a purpuric rash (suspect meningococcal infection) or other clinical signs of severe infection.

Take blood for the following investigations (if available): full blood count (FBC), renal and liver function tests, blood culture, cross-match, blood clotting, glucose stick test and glucose laboratory test

> *Whole blood clotting time*
>
> (if lab clotting tests are not possible: - Take 2 mL of venous blood into a small, dry, clean, plain glass test tube (approximately 10 mm x 75 mm);
>
> Hold the tube in your closed fist to keep it warm (+ 37°C);
>
> - After 4 minutes, tip the tube slowly to see if a clot is forming. Then tip it again every minute until the blood clots and the tube can be turned upside down;
>
> **Failure of a clot to form after 7 minutes, or a soft clot that breaks down easily, suggests a blood clotting disorder.**

- Catheterise and monitor urine output
- If peritonitis is possible, add metronidazole IV

If a blood clotting disorder is present

Q. What can I do if fractionated blood products are not available?

- Use fresh whole blood (straight from the donor if possible). In general in obstetric emergencies, volume overload is not a problem.
- If volume overload is a concern, allow the whole blood to stand for 30 minutes. The red blood cells will drop to the bottom. The fluid/plasma above them containing clotting factors can be drawn off with a syringe and needle and the plasma only can be given.

Central venous access

This can be valuable provided that the health workers present have the skills needed to do this safely (ideally using a multi-lumen catheter coated with heparin). The catheter should be inserted in the intra-thoracic IVC or SVC via the femoral, internal jugular or subclavian vein routes. However, **it is essential that resuscitation is not delayed by trying to insert a central venous catheter and that if there is a clotting disorder, never use the subclavian route.**

A normal CVP is +4 to +10cm H_2O, and optimising CVP can improve cardiac output with less risk of inducing heart failure. Take great care if CVP> 12 cm H_2O, since cardiac failure may be induced by excessive IV fluids, especially if severe anaemia, malnutrition or a primary cardiac disorder are present.

Re-assess ABC on a regular basis

Reassess response to fluids to determine if the woman's condition is improving. Signs of improvement include:

- decreasing pulse rate (rate of 100 to 110 per minute or less);

- increasing blood pressure (systolic 90-100 mm Hg or more);
- improving mental status (less confusion or anxiety);
- increasing urine output (30 ml per hour or more).

Continue monitoring to ensure pulse rate and BP do not deteriorate after improvement indicating return of shock. If the mother's **condition improves**:

Adjust IV fluids to 1 L over 6 hours, and continue management for the underlying cause of shock.

If >3 L have been given IV in a mother, and if shock is still present and facilities are available, intubate by rapid sequence induction of anaesthesia and provide assisted ventilation.

Correct any hypoglycaemia

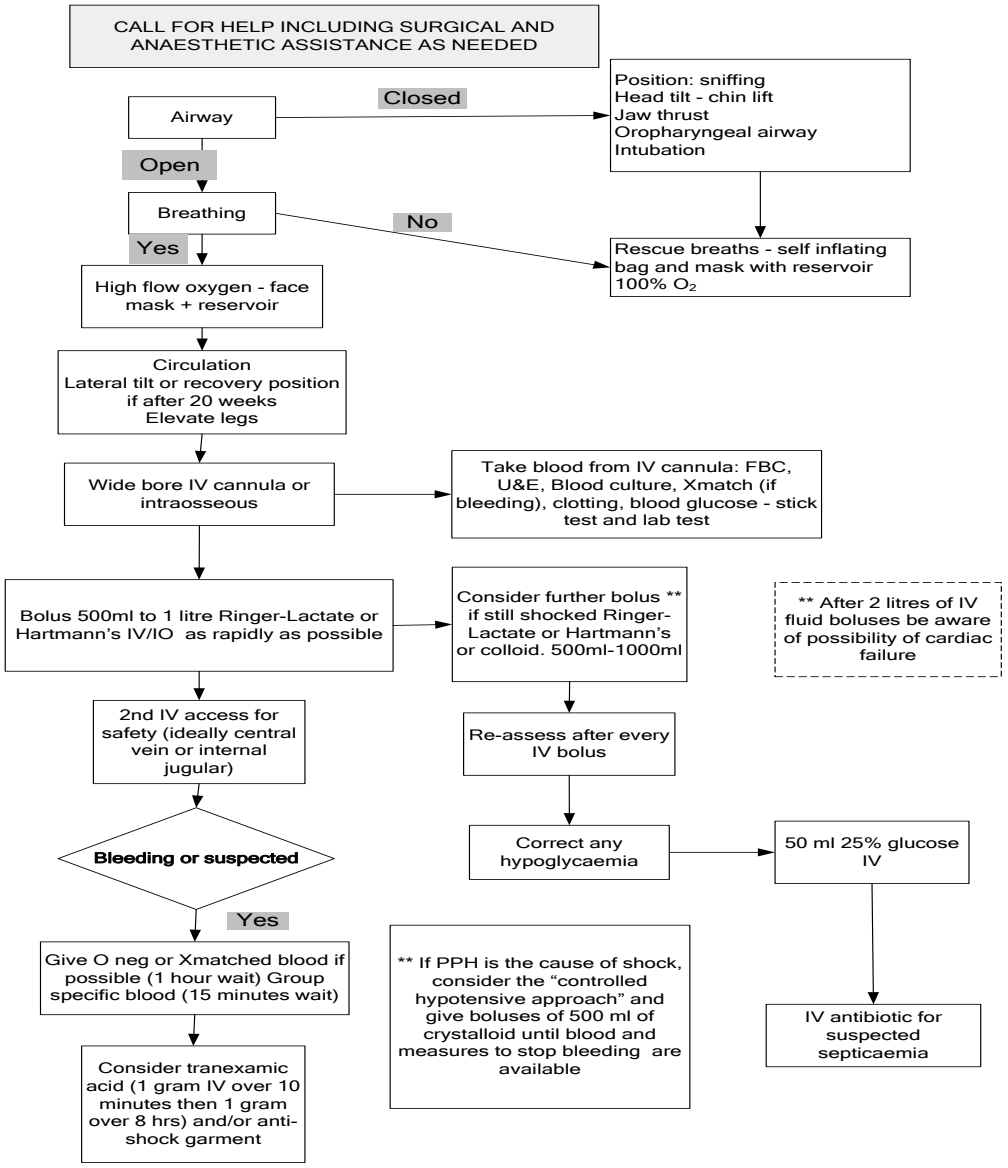
Inotropes

An IV infusion of dobutamine and/or dopamine at 5-20 micrograms/kg/minute should be considered, especially if a third bolus of fluid is required. Sometimes adrenaline by IV infusion at 0.05-2 micrograms/kg/minute may be required.

- These infusions can initially be given CAREFULLY through a peripheral vein until central venous access is obtained

Patients who require ventilation and inotropic support should be cared for in a high dependency or intensive care unit with invasive monitoring (if available). Seek early advice.

Figure 6 Shock in pregnancy or the puerperium: pathway of care



SECTION 9 Quiz 4

1) **If a pregnant woman or girl develops anaphylactic shock which of the following dose of adrenaline should be given**
   a) Adrenaline 1 mg IM
   b) Adrenaline 10 mg IM
   c) Adrenaline 10 mg IV

2) **Signs and symptoms of a pulmonary embolus in pregnancy include which of the following?**
   a) tachypnoea
   b) dyspnoea
   c) pleuritic pain
   d) shock
   e) hypothermia

ANSWERS:

1. a (both others are incorrect and dangerous)
2. abcd

SECTION 9 Quiz 5

1) **Which of the following are features of shock during pregnancy?**
   a) Patient is pale, cold and clammy
   b) Usually heart rate is <90 bpm
   c) Confusion
   d) Capillary refill 4 seconds or longer

2) **When treating shock due to haemorrhage in pregnancy which of the following are important actions?**
   a) ABC
   b) 100% O_2
   c) Supine position
   d) 2 wide bore IV cannulae
   e) 500 ml IV bolus Ringer-Lactate or Hartmann's

ANSWERS:
1. acd
2. abde

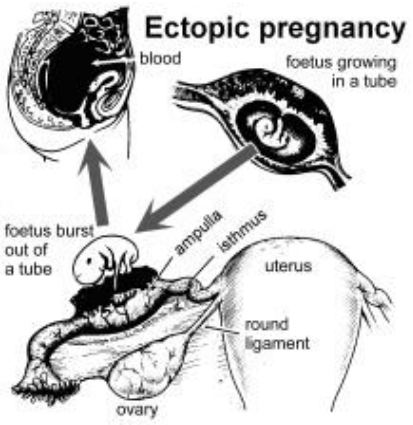
Major haemorrhage in the first trimester

Ruptured ectopic pregnancy

Introduction

The definition of an ectopic pregnancy is: the implantation of the fertilised ovum outside the uterus: usually within the fallopian tube.

The fetus implants in a tube and grows there. When it is a few weeks old it bursts out of the tube. When it does this, there is bleeding into the peritoneal cavity. In Figure 1, the fetus has implanted in the narrow middle part of a tube.



If the ovum is expelled – 'tubal abortion' – it leaves from the fimbrial end of fallopian tube with blood collecting as a haematoma; usually at about 8 week's gestation;

If the fallopian tube ruptures, there is severe abdominal pain, with or without shock, depending on the amount of bleeding. Rupture usually happens from 8 weeks gestation onwards.

The causes of ectopic pregnancy are unknown but associated factors are:

- pelvic inflammatory disease — salpingitis, especially from gonococcus, chlamydia or TB
- If pregnant with intra-uterine contraceptive device in place (a rare occurrence)
- previous tubal surgery — tubal ligation, tubal re-anastomosis
- previous ectopic pregnancy
- previous intra-abdominal infection (peritonitis)

Sites of implantation

Implantation in the fallopian tube is most common (>90%), usually at the ampulla; less common but more dangerous is at the interstitial end. The fetus can also rarely implant on the bowel, pelvic peritoneum, cervix and ovary.

Clinical presentation: symptoms and signs

- Abdominal pain which is lower abdominal (which tends to be unilateral), cramping or stabbing, due to distension of the tube and peritoneal irritation from blood in the abdominal cavity
- Shoulder tip pain, from blood irritating the diaphragm
- Rectal pain or perineal discomfort from blood in the pouch of Douglas
- Hypovolemic shock occurs as soon as sufficient blood has been lost. Often there will be fainting or a feeling of faintness requiring lying down.
- Fast weak pulse (heart rate 100 or more)
- Hypotension (a late sign after much blood lost: systolic pressure < 90 mmHg)
- Vaginal bleeding which can mimic a normal menses (75%)
    - Usually after the ovum has died.
    - Usually dark, not heavy.
    - May be irregular
- Signs and symptoms of early pregnancy are unusual- tiredness, nausea/vomiting (especially early morning), breast swelling, urinary frequency
- Anaemia if chronic, slower bleeding

In all women or girls of reproductive age with diarrhoea and /or dizziness/fainting undertake a pregnancy test and think about possible ectopic pregnancy.

Abdominal examination reveals muscle guarding, rebound tenderness, probably fever, the differential diagnosis is from appendicitis. There may be abdominal distension with shifting dullness if there is free blood in the abdomen.

Pelvic examination: c**aution must be exercised when doing a** bimanual **vaginal examination if an ectopic is possible because of the risk of rupture during and due to the examination.** Vaginal

examination may show general pelvic tenderness; with sometimes a mass in the fornix, or increased tenderness on one side. There may be cervical excitation, bluish discolouration of vagina and cervix and/or slight uterine enlargement

Diagnosis
Think of this diagnosis

Especially if any anaemia, shock or abdominal pain is greater than expected for amount of vaginal bleeding. Consider of the woman or girl has any risk factors for an ectopic pregnancy?

Differential diagnosis: threatened miscarriage, acute or chronic pelvic inflammatory disease (PID), torsion or ruptured ovarian cyst, acute appendicitis or peritonitis.

Tip test
Tilt head down. If blood in peritoneal cavity it will irritate diaphragm as shoulder tip pain. Useful if positive, but negative does not exclude haemorrhage

Do a pregnancy test in all potentially fertile girls/women with abdominal pain, fainting or shock. If unable to provide a specimen, consider urinary catheter to obtain one.

Ultrasound
If there is a positive pregnancy test but no intra-uterine pregnancy seen on the ultrasound, then an ectopic pregnancy is very likely. The likelihood of ectopic pregnancy increases if free fluid and/or an echogenic mass are seen.

Culdocentesis **is** not recommended as it may delay surgery and introduce infection.

Primary assessment and resuscitation if shocked

Call for help. A surgeon and anaesthetist must be urgently requested. The operating theatre must be prepared.

Airway

- Use an opening manoeuvre, if the airway is not open or partially obstructed. If there is improvement, use airway adjuncts to support the airway or ask assistant to hold it open.
- Suction if needed
- The airway may need to be maintained and protected by intubation using experienced senior help (if available).

Breathing

- Provide high concentration of oxygen through a face mask with reservoir bag for those with adequate spontaneous respiration
- For inadequate ventilation or depressed conscious level (AVPU = P or U), respiration should be supported with oxygen by bag-valve-mask inflations and experienced senior help obtained including an anaesthetist.

Circulation

- Elevate legs and consider Non-pneumatic Anti-Shock Garment
- Gain intravenous access
- Use a short, wide-bore IV cannula if possible (14-16G)

- External jugular vein access is a good option if peripheral access is impossible. Long saphenous vein cut down may also be considered and, if adequately trained, central venous access ideally via internal jugular can be extremely helpful or intraosseous if not possible
- Try to obtain two vascular access sites to give large volumes quickly and in case one line is lost
- Take blood for cross match of 4-6 units, FBC, renal function tests (if available), blood clotting
- Give 500 mL-1 L Ringer-Lactate or Hartmann's by rapid bolus whilst awaiting blood for transfusion
- Remember that young, healthy women/girls can lose a lot of blood before becoming shocked, especially if it is a slow leak, rather than a sudden large loss.

The concept of "controlled **hypotensive resuscitation**" is important when, as here, the cause of hypovolaemic shock is haemorrhage. Here the initial boluses of IV crystalloids required to treat shock should only be given to keep the vital organs (especially brain, heart and kidneys) perfused before blood and, of most importance, surgery have become available. . Giving too much IV fluids can increase the blood pressure and thus increase bleeding by disrupting early clot formation.

Our suggestion is that when giving boluses of crystalloid or blood in shock due to bleeding, only the amount needed to keep the blood pressure at a level sufficient to perfuse the vital organs should be given. There is no clear evidence to indicate the precise blood pressure that should be achieved in a woman in shock due to a ruptured and bleeding ectopic pregnancy. *Adequate perfusion of vital organs* may best be indicated by the following: a radial pulse which can be palpated and an alert conscious level.

In this situation, therefore, and to maintain a palpable radial pulse, start with IV boluses of 500ml of crystalloid or ideally blood and reassess after each.

Disability

Conscious level on AVPU scale

Central venous access

This is valuable if skilled staff are available to undertake it and it does not delay definitive surgical treatment. Ideally should be achieved using a multi-lumen catheter coated with heparin, if available, with catheter placed in the intra-thoracic IVC or SVC.

A normal CVP is +4 to +10cm H_2O and optimising CVP can improve cardiac output with less risk of inducing heart failure. Take great care if CVP> 12 cm H_2O since cardiac failure may be induced by excessive IV fluids, especially if severe anaemia, malnutrition or primary cardiac disorders are present.

Emergency treatment

If diagnosis is ruptured ectopic with shock, order blood for transfusion and immediately prepare operating theatre. Obtain surgeon urgently and proceed to urgent laparotomy while resuscitation is underway. Do not wait for blood.

At laparotomy, undertake salpingectomy. Repair of tube carries MAJOR risk of future ectopic pregnancy and should not be undertaken in poorly resourced situations.

Autotransfusion

If **blood is unquestionably fresh and free from infection,** blood can be collected after the abdomen is opened and transfused:

When the woman is on the operating table prior to surgery and the abdomen is distended with blood, it is sometimes possible to insert a needle through the abdominal wall and collect the blood in a donor set.

Alternatively, open the abdomen:

- scoop the blood into a basin and strain through gauze to remove clots
- clean the top portion of a blood donor bag (containing anti-coagulant) with antiseptic solution and open it with a sterile blade;
- pour the mother's blood into the bag and infuse it through a filtered set in the usual way;
- if a donor bag with anticoagulant is not available, add sodium citrate 0.3 molar 10 mL to each 90 mL of blood.

Advice post salpingectomy for ruptured ectopic pregnancy
Early ultrasound as soon as new pregnancy suspected.
Offer family planning advice

SECTION 9 Quiz 6

1) The symptoms/signs of an ectopic pregnancy can include which of the following?

a) a possibility of pregnancy
b) lower abdominal pain
c) vaginal bleeding
d) early pregnancy symptoms such as breast tenderness, nausea
e) collapse/fainting

2) Emergency treatments for an ectopic pregnancy that is actively bleeding with shock include which of the following?

a) ABC
b) Laparotomy whilst resuscitation underway
c) 2 wide bone IV cannulae
d) Repair of the fallopian tube
e) Boluses of IV Ringer-Lactate or Hartmann's
f) Cross match 1 unit of blood

ANSWERS:

1. abcde
2. abce (cross match 4 units and remove the tube containing the pregnancy)

Major haemorrhage in the first trimester

Miscarriage

Types of miscarriage

Consider miscarriage or induced abortion in any woman or girl of reproductive age with more than a month having passed since her last menstrual period, and having one or more of the following: bleeding, lower abdominal pain, and partial expulsion of products of conception, dilated cervix or smaller uterus than expected for gestation.

1. Spontaneous miscarriage is the loss of a pregnancy before fetal viability (28 weeks gestation in low resource settings) and occurs in at least 15% of pregnancies.

The stages of spontaneous miscarriage may include:

- *threatened miscarriage* (pregnancy may continue);
- *inevitable miscarriage* (pregnancy will not continue and will proceed to incomplete or complete miscarriage);
- *incomplete miscarriage* (products of conception are partially expelled);
- *complete miscarriage* (products of conception are completely expelled).

Miscarriages can be complicated by infection

Threatened miscarriage
Here there is light vaginal bleeding and sometimes cramping lower abdominal pain. On examination there is a soft uterus corresponding in size to the date of the last menstrual period and the cervix is closed.

If bleeding stops, advise woman to avoid strenuous exercise and sexual intercourse. Follow-up in the antenatal clinic. If bleeding continues, assess for fetal viability and if available undertake ultrasound scan. No medication can prevent progression to a complete miscarriage.

Inevitable miscarriage. See below for different managements if incomplete compared with complete.

Managing an incomplete miscarriage

If pregnancy is less than 16 weeks, use sponge forceps to remove products of conception protruding through the cervix and proceed to evacuate the uterus:

- Manual Vacuum Aspiration (MVA) (Figure 1) is the preferred method of evacuation. **Evacuation by curettage should only be done if MVA is not available.**
- if evacuation is not immediately possible and there is significant bleeding, give ergometrine 200 to 500 micrograms OR misoprostol 200 micrograms orally, sublingually or rectally.

  Proceed to evacuation as soon as possible.

If pregnancy is greater than 16 weeks:

- infuse oxytocin 40 units in 1 L IV fluids (Ringer-Lactate or Hartmann's) at 40 drops per minute until expulsion of products of conception occurs;

- if oxytocin infusion does not work, and especially if there is heavy bleeding, give misoprostol 200 micrograms orally/rectally every 4 hours until expulsion, but do not administer more than 800 micrograms;
- evacuate any remaining products of conception from the uterus if necessary.

If bleeding continues after evacuation and despite the use of a uterotonic drug, there is likely to be something wrong and probably retained products are still in the uterus.

Safe evacuation of retained products

- Consent – explain the procedure and reasons for undertaking it
- This must be a surgically aseptic procedure including the use of sterile gloves and gown. Apply antiseptic solution (chlorhexidine) to the vagina and cervix (especially the os) by first inserting a high-level disinfected or sterile speculum into the vagina and then using a sterile or high level disinfected sponge forceps with cotton or gauze swab and applying three applications of antiseptic.
- Where possible undertake procedure in the operating theatre if there is a risk of heavy bleeding – for examples molar pregnancy or suspected coagulation disorder
- Even when bleeding is not heavy, give oxytocin 10 units IM or ergometrine 200 microgram IM before MVA to make the uterus firmer and reduce the risk of perforation.
- Prepare the MVA syringe by closing the pinch valve and pulling back on the plunger until its arms lock. In the case of large amounts of retained products (eg molar pregnancy) prepare 2 or 3 syringes.
- Bimanually examine the uterus to assess whether it is anteverted or retroverted prior to instrumentation
- Provide an oral analgesic paracetamol 1 gram and, if the cervix is not dilated sufficient to pass the MVA catheter, prepare 20 mL of 0.5% lignocaine **(without adrenaline)** with a 3.5 cm long 22 or 25 gauge needle to perform a paracervical nerve block
- Using a Cusco's speculum visualize the cervix. You will need an adequate light source.
- Inject 1mL of 0.5% lignocaine into the anterior or posterior lip of the cervix whichever has been exposed if a tenaculum is to be used.
- Apply either a tenaculum or sponge(ring) forceps (the latter do not need prior local anaesthetic and are less likely to tear the cervix in incomplete miscarriage) to the lip of the cervix.
- If the cervix is insufficiently dilated for the MVA catheter undertake a paracervical nerve block following slight traction applied to the cervical lip to identify the junction between the cervix and vaginal wall where injections of lignocaine are to be made. Inject 2 mL of lignocaine just under the epithelium (no deeper than 3mm) at 3, 5, 7, and 9 o'clock positions. **Ensure that the needle is not in a vein with each injection** by drawing back before injection as IV injection of lignocaine is dangerous and can cause convulsions and cardiac arrest. Wait 2 minutes and check that the cervix is anaesthetised by pinching it gently with forceps. If the pinch is felt, wait for another 2 minutes.
- Grasp the lip of the cervix with the sponge forceps and apply gentle traction. Cervical dilatation with Hagar dilators is only needed where products have remained in the uterus for several days. Slowly introduce the dilators (smallest first) into the cavity being mindful of whether the uterus is anteverted or retroverted, until resistance is felt when the fundus is

reached. Note the depth of the cavity and DO NOT pass instruments beyond this. Risk of uterine perforation is higher in cases complicated by sepsis or in a post partum uterus with retained products of conception (see chapter 2.5.D.iv). Usually a dilatation of 10-12 mm is sufficient. Ensure that the cervix is not torn or a false passage created by the dilators.

Figure.1 Manual vacuum aspiration kit including cannulae of different sizes

Figure 2. Inserting the MVA cannula

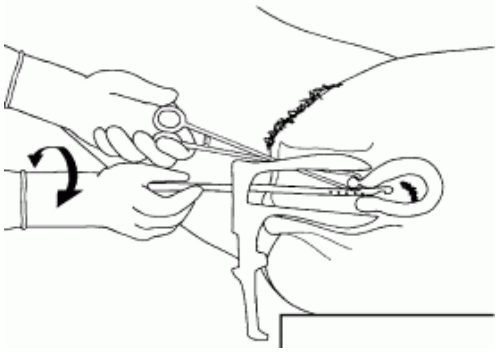
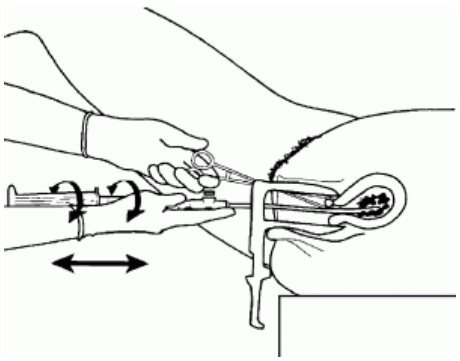


Figure 3. Evacuating the uterine contents



12) Pass the MVA cannula gently with a rotating movement through the cervix into the uterine cavity just beyond the internal os.

Slowly push the cannula into the uterus until it touches the fundus. Measure the depth by dots visible on the cannula and then withdraw the cannula by about 0.5 cm. Attach the prepared MVA syringe to the cannula and release the pinch valves allowing the vacuum to transfer to the cannula and inside of the uterus.

Evacuate uterine contents by gently rotating the syringe from 10 to 12 o'clock and moving the cannula back and forth within the uterus. Do not allow the cannula at this stage to be withdrawn past the cervical os into the vagina as vacuum will be lost. If vacuum is lost or syringe is more than

half full empty it and then reestablish the vacuum. Do not hold the syringe by the plunger arms whilst vacuum is present as they may become unlocked and the plunger slip back into the syringe pushing materials back into the uterus.

13) To ensure that all products have been removed, red or pink foam but no tissue is seen in the cannula. The uterus will have a 'gritty' feel when the cavity is empty and haemostasis should be achieved. The uterus may contract around the cannula. Always examine the syringe contents after the procedure. An absence of products in a patient with signs of pregnancy or positive pregnancy test and continued bleeding raises 3 possibilities: 1) the miscarriage was complete before evacuation 2) the products are still in the uterus (needs repeat evacuation) or 3) there is an ectopic pregnancy. Be very careful about the 3rd possibility.

14) If MVA is not available and a curette is used, undertake procedures up to 11) above. Apply the curette with firm but controlled movements in all 4 quadrants of the uterus (anterior wall, left lateral, posterior wall, right lateral). The uterus will have a 'gritty' feel when the cavity is empty and haemostasis should be achieved. If there is ongoing bleeding ensure the cavity is empty with additional gentle curettage.

15) IV antibiotics should be given as a single dose unless there are signs of sepsis when a full course of antibiotics should be given.

16) Anti-D immunoglobulin prophylaxis if available and affordable should be given to women with a Rhesus negative blood group. In well resourced countries, a dose of 250 IU of anti D Ig is given before 20 weeks gestation and 500 IU after 20 weeks.

17) Give paracetamol 500mg to 1 gram orally if needed for pain.

18). If an unsafe induced abortion is suspected, examine the woman for signs of infection and uterine, vaginal, bladder or bowel injury and thoroughly irrigate the vagina with sterile Ringer-Lactate or Hartmann's to remove any herbs, local medications or caustic substances before MVA is undertaken**.**

Follow up after a miscarriage, especially where evacuation has occurred.

Uncomplicated evacuations may not need follow up. The patient should be encouraged to eat and drink and be mobile. She should be advised to seek help if there are any symptoms such as ongoing bleeding, severe abdominal pain, offensive vaginal secretions, fever, or malaise. Rigors or fainting potentially indicate severe complications and the woman must return immediately to the hospital. Family planning should be discussed and the woman advised to avoid pregnancy for at least 3 months.

Uterine perforation

Uterine perforation may occur following evacuation of the uterus either in a medical or in non-clinical setting. The risk of complications, such as infection, perforation, damage to visceral organs such as bladder and bowel is high where procedures are carried out in non-clinical settings and here a laparotomy will be required along with high dose intravenous antibiotics.

In most perforations where only the uterus has been damaged, the hole will heal spontaneously. Keep the woman under close observations for at least 48 hours.

Symptoms and signs of perforation when it has occurred in a non-medical setting

Severe abdominal pain, vaginal bleeding, weakness, dizziness or fainting.

On examination of the abdomen there will be guarding, rebound tenderness or a rigid abdominal wall.
Frequently there will be signs of septic shock.

Complete miscarriage
Evacuation of the uterus is not needed, observe closely for evidence of bleeding and follow up the woman in the clinic.

2. Abortion is the deliberate termination of pregnancy before fetal viability.

- *Unsafe abortion* is a procedure performed by persons lacking necessary skills, and/or in an environment lacking minimal medical standards.
- *Septic abortion* is abortion complicated by infection. Sepsis may result from ascending infection from the lower genital tract. Sepsis is more likely to occur if there are retained products of conception and evacuation has been delayed. Sepsis is a frequent complication of unsafe abortion involving instrumentation.

*3. Molar pregnancy / gestational trophoblastic disease (relatively uncommon***).**

Gestational trophoblastic disease refers to molar pregnancy (complete and partial moles), choriocarcinoma and placental site trophoblastic tumour.

Complete and partial molar pregnancies are only distinguished by histopathological features. Complete moles usually result from duplication of a single sperm following fertilization of an empty ovum. There is no evidence of fetal tissue. Partial moles usually result from dispermic fertilization of an ovum. There is usually evidence of a fetus or fetal red cells. Only complete molar pregnancy is likely to progress to choriocarcinoma.

Signs of pregnancy are exaggerated – the uterus increases in size more rapidly than normal, vomiting is often but not always severe and constant, there may be pre-eclampsia in the first trimester, and ßHCG is very high. The symptoms and signs typically present are: heavy bleeding, dilated cervix, uterus larger than dates and softer than normal, with partial expulsion of products of conception which resemble grapes. MVA is required to evacuate the uterus (with anti-D prophylaxis in Rhesus negative women if available and affordable). Diagnosis in low resource settings is very difficult and requires good quality ultrasound and ability to monitor urine B-HCG levels. The products of conception should be examined histologically.

Management of molar pregnancy
This is difficult and referral to hospital, ideally with expert facilities, if available
MVA will usually be required
There is a higher risk of bleeding and therefore must cross match prior to MVA
Will need follow up ßHCG measurements, regular ultrasound and possibly chemotherapy (see below)
Will need CXR and ideally liver function tests.
The woman should be strongly advised not to become pregnant within the next 1 year and family planning advice is particularly important.

Chorioncarcinoma, a malignant condition, is the most serious form of mole. It may follow a normal pregnancy, manifest as continuing vaginal bleeding. Metastasis may occur to the lungs and other organs, and specialist care will be required, including chemotherapy.

Septic abortion or miscarriage

Introduction

Septic abortion is defined as abortion complicated by infection. Sepsis may result from infection if organisms rise from the lower genital tract following either spontaneous miscarriage or induced abortion. Sepsis is more likely to occur if there are retained products of conception and evacuation has been delayed. Sepsis is a frequent complication of unsafe abortion involving instrumentation.

Diagnosis

Consider the possibility of septic abortion in any woman or girl with a history of termination of pregnancy or attempted termination. Presentation is typically with some of the following symptoms and signs: lower abdominal pain, prolonged vaginal bleeding, tender uterus, foul smelling vaginal discharge, purulent cervical discharge, fever and malaise.

Treatment

If septic shock is present, this will be shown by some of the following signs and symptoms

- fast, weak pulse (100 to 110 per minute or more)
- pallor (especially of inner eyelid, palms or around mouth)
- sweatiness with cold or warm (vasodilated) skin
- rapid breathing (> 30 breaths per minute)
- anxiousness, confusion or unconsciousness
- low BP (systolic less than 90 mm Hg, a late sign)
- reduced urine output (<30 mL per hour).

Resuscitation then proceeds as follows:

Airway

- Use an opening manoeuvre, if the airway is not open or is partially obstructed. Keep the airway open. If there is improvement but if airway closes without active opening support, consider airway adjuncts to maintain the airway if unconscious (P or U on the AVPU scale).
- Suction if necessary
- The airway may need to be maintained and protected by intubation, using experienced senior help (if available)

Breathing

- Provide high concentration of **oxygen** through a face mask with reservoir bag if adequate spontaneous respiration
- For inadequate ventilation, respiration should be supported with oxygen via a **bag-mask,** and experienced senior help summoned (if available)

Circulation

- Gain IV access
    - Use a short, wide-bore (16-18 gauge)IV cannula if possible, for IV access.

  - Internal jugular and external jugular vein access are good options if peripheral access is impossible. Long saphenous vein cut down may also be considered
  - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost.
- Elevate legs by raising the foot of the bed.
- Give initial rapid IV/IO bolus of 500 mL – 1 L of Ringer-Lactate or Hartmann's. It is essential that the bolus is given as rapidly as possible.
- Further 500-1000ml boluses will usually be required in the first 1 hour. Once >2 L has been given IV, complications such as pulmonary or cerebral oedema may occur. If available, expert help, an anaesthetist, and the use of inotropes, sodium bicarbonate, IPPV with PEEP are all potentially valuable.
- A fresh blood transfusion may also be important.

Antibiotics after taking specimens for culture if facilities available (blood cultures high vaginal swab, urine)

All patients, shocked or not, require the following without delay:

Ampicillin 2 g IV every 6 hours PLUS Gentamicin 80mg IV/IM 8 hourly or 5mgs/kg body weight IV/IM every 24 hours

PLUS Metronidazole 500mg IV every 8 hours.

All until the woman is fever-free for 48 hours

Patients who are not apparently shocked on first examination, nevertheless need frequent observations to look for the early signs of shock for the first 6-12 hours, then frequency can be reduced.

Start antibiotics as soon as possible before attempting manual vacuum aspiration

The woman or girl may also need:

- manual vacuum aspiration (MVA) to remove infected products of conception. MVA should be preferred to curettage because perforation might have happened already, or is easily possible because of friable uterine wall.

- hysterectomy after stabilisation if infection cannot be controlled

Further reading

Surviving sepsis campaign http://www.survivingsepsis.org/GUIDELINES/Pages/default.aspx

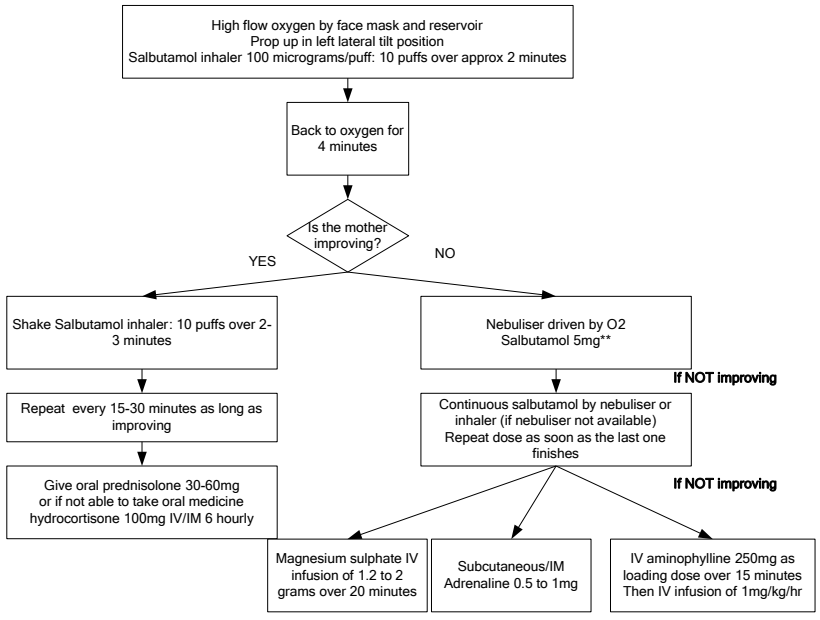
Severe Bronchial Asthma

Assessment

Features of severe asthma	Features of life-threatening asthma
too breathless to eat or talk	conscious level depressed / agitated
recession/use of accessory muscles	exhaustion
respiratory rate>40 breaths/min	poor respiratory effort
pulse rate >120 beats/min	SaO2 < 85% in air / cyanosis
	silent chest

- Bronchial asthma complicates 3–4% of pregnancies. Pregnancy is associated with worsening of the symptoms in one-third of affected pregnant women or girls.
- A CXR is indicated only if there is severe difficulty in breathing, uncertainty about the diagnosis, asymmetry of chest signs (possible pneumothorax) or signs of severe infection.
- Continuous pulse oximetry is valuable (if available) since hypoxaemia is a major feature of all severe asthma attacks.
- Avoid prostaglandins, except for misoprostol which does not effect asthma. For the prevention and treatment of post partum haemorrhage give oxytocin 10 units IM. Alternatives are ergometrine or misoprostol.

Severe Asthma – Pathway of Care in pregnancy



** Salbutamol may inhibit uterine contractions

Emergency treatment of acute severe asthma (see pathway of care)

- Assess ABC and resuscitate as needed
- Give high concentration of **oxygen** via a facemask with reservoir bag or nasal cannulae to keep SAO2 94-98%. Attach pulse oximetry (if available).
- Sit up with lateral tilt
- Give nebulised salbutamol 5mg driven with oxygen ½ hourly to 4 hourly via nebuliser or (10-20 puffs of a beta2-agonist inhaler, such as salbutamol or terbutaline, giving one puff at a time through a spacer with a mouthpiece or facemask)
- Oral prednisilone 30-60 mg, or if vomiting, IV/IM hydrocortisone 100 mg, followed by 100mg 6 hourly (note steroids will not show benefits for a number of hours)

What can I do if I have no inhalable beta-agonists?

Give steroids immediately orally or as IV/IM hydrocortisone (dose = 100mg 6 hourly) and support the patient until treatment is available or the patient can be transferred.

- Give oxygen if available
- Give magnesium sulphate 1.2 to 2 grams IV infusion over 20 minutes
- Give intravenous aminophylline (dose = 250mg over 15 minutes and then 500 micrograms/Kg/hour) if the severity warrants it

In severe situations in the absence of other measures adrenaline is a very effective agent. It should be given SC or IM (DOSE = 500 micrograms to 1mg), but may be given IV if life-threatening asthma as follows: place 1mg of adrenaline in 10ml of 0.9% saline and give 1 ml of this solution and wait for 1 minute and then keep on repeating 1ml doses IV every minute until improves or the whole 1 mg (10ml) has been given. Risk of cardiac side effects (tachycardia, cardiac arrhythmias) is low if given in this way.

If not responding, or deteriorating condition

1. Nebulised salbutamol may be given continuously.
2. If not on oral theophylline or other methylxanthines, give a loading dose of IV aminophylline 250mg over 15 minutes, monitoring ECG for arrhythmias (if possible) followed by 1mg/kg/hour by IV infusion.
3. IV salbutamol 250 micrograms over 10 minutes **is an alternative** to aminophylline, followed by IV infusion of 1 to 5 micrograms/kg/minute (but monitoring ECG and checking K regularly – may need extra potassium and monitoring of plama level is essential if this drug is given IV)
4. IV magnesium sulphate 1.2 to 2 grams as a slow infusion over 20 minutes is also an alternative
5. In those with poor respiratory effort, depressed conscious level and poor oxygenation despite maximum oxygen therapy

   - attempt to support ventilation with bag-valve-mask
   - summon experienced support if available and consider intubation for mechanical ventilation with IV ketamine or halothane induction

Indications for intubation and positive pressure ventilation (if available)

Increasing exhaustion
Progressive deterioration in
- clinical condition
- oxygenation decreasing and/or oxygen requirement increasing
- pCO2 increasing (if measureable from arterial/capillary gas)

Sudden deterioration
Massive atelectasis

Life threatening Pneumothorax

If responding and improving: continue inhaled salbutamol as often as indicated

Other measures

- Reassure patient, avoid upset
- IV fluids - restrict to two-thirds of the normal requirements
- Steroids to cover labour/delivery for prevention of Addisonian crisis in patients with history of taking steroids in the recent past.
- Antibiotics - give only if there are clear signs of infection (fever and other signs of pneumonia-CXRay may be helpful)
- When recovered, review maintenance treatment and inhaler technique

How can I give drugs like aminophylline or magnesium sulphate safely IV without syringe drivers or pumps?

- Bolus doses
  - The safest way is to give these by hand.
  - Microburettes can be used to give small volumes of IV fluids or drugs safely if available (see picture). The dropper in the picture holds 100ml. 1 drop per second = 1 ml per minute.
- IV Infusions
  - Where volume overload is not an issue the simplest method is to add the drug (eg aminophylline) to 500ml bags of 0.9% or 0.45% saline plus 5% dextrose or other available/appropriate fluid and run over 12-24 hours.

Burette as part of giving set

SECTION 9 Quiz 1

1) **Features of severe asthma in pregnancy are**
   a) respiratory rate < 40/minute
   b) too breathless to talk
   c) silent chest

2) **Management of severe asthma in pregnancy includes**
   a) high flow O_2
   b) salbutamol by metered dose inhaler and/or nebulisers
   c) misoprostol if PPH occurs in a mother with asthma
   d) prednisolone or hydrocortisone

ANSWERS:
1. bc 2. abcd (prostaglandins other than misoprostol are dangerous in asthma)

Lower respiratory tract infection

Always consider HIV infection, the resulting opportunistic infections and tuberculosis.

A high fever usually means pneumonia, epiglotittis or bacterial tracheitis. In the absence of stridor and wheeze, breathing difficulties in association with a significant fever are likely to be due to pneumonia.

Pleuritic chest pain, neck stiffness and abdominal pain may be present if there is pleural inflammation. Pleural effusions and empyema are complications of pneumonia.

Emergency treatment

- Assess ABC
- High concentration of oxygen via a facemask with reservoir bag. Attach pulse oximetry
  - If a low flow maintains SaO_2>94% then nasal cannulae may be used with a flow up to 2 l/min
- Antibiotics - cefuroxime ± fluxcloxacillin (for staph aureus), erythromycin (for chlamydia or mycoplasma pneumonia) or whatever is available locally and is appropriate
- Sit upright in left lateral tilt
- Maintain hydration
  - extra fluid may be needed to compensate for fluid loss from fever
  - restriction may be needed because of inappropriate ADH secretion
- Chest x-ray is indicated
  - large pleural effusions/empyemas should be diagnosed where possible by ultrasound and pleural drainage under ultrasound cover (beware of placing chest drain into the heart, liver or an undiagnosed tumour or hydatid cyst). **Remember that in advanced pregnancy the diaphragm is elevated.**
  - Effusions/empyemas adjacent to the heart on the left side may cause pericarditis and arrythmias (listen regularly for pericardial rub and ideally monitor ECG until stable)

Heart Failure

Assessment

Features suggesting a cardiac cause of breathing difficulty

- cyanosis, not correcting with O_2
- tachycardia out of proportion to respiratory difficulty
- raised jugular venous pressure
- gallop rhythm / murmur
- enlarged liver
- basal lung crepitations

Rheumatic Heart Disease

This is a common cause of heart failure in pregnant women or girls. The risk of heart failure is increased by anaemia.

Damage to the heart valves increases the chance of sub-acute bacterial endocarditis so that any invasive procedures and labour should be covered by antibiotics (1gm amoxycillin plus 120 mg gentamicin IM). If the pregnant woman or girl is allergic to amoxycillin an IV infusion of vancomycin (1gm over 60 minutes) plus gentamycin (120 mg IV) is an alternative..

Treatment

- Assess ABC
- High concentration of oxygen via facemask with reservoir bag
- If there are signs of pulmonary congestion or a large heart on chest x-ray give IV frusemide 40mg (and repeat as required). Venesection may be required.
- If severely anaemic a partial exchange transfusion may help. Careful transfusion of packed cells, with 40mg IV frusemide for each unit of packed cells, will almost always be required.
- Morphine 10mg IM
- Sit upright on left side
- Bed rest
- Consider digoxin
- Consider nitroglycerine 300 micrograms under the tongue, repeated in 15 minutes, if necessary.

Management of heart failure during labour

MAKE SURE THE PREGNANT WOMAN OR GIRL DELIVERS SITTING UP.

Give her oxygen from a face mask.

Limit infusion of IV fluids, to decrease the risk of circulatory overload, and maintain a strict fluid balance chart.

Ensure adequate analgesia.

If oxytocin infusion is required, use a higher concentration at a slower rate while maintaining a fluid balance chart (e.g. the concentration may be doubled if the drops per minute are decreased by half). Consider early reduction of oxytocin when contractions become established.

Increase the rate of oxytocin infusion only to the point where good labour is established and then maintain infusion at that rate.

Do not give ergometrine.

Avoid sustained bearing down efforts during the second stage, if possible.

Perform an episiotomy and assist delivery by vacuum extraction or forceps.

Ensure active management of third stage.

Heart failure is not an indication for Caesarean section.

SECTION 9 Quiz 2

1) When heat failure occurs during labour the following treatments are correct:

a) Sit up to deliver
b) give O_2
c) ensure adequate analgesia
d) give ergometrine after birth of baby
e) reduce maternal efforts during 2nd stage e.g. by vacuum delivery
f) frusemide

ANSWERS:

1. abcef (ergometrine is dangerous-give oxytocin only)

Severe Anaemia

In normal pregnancy there is an increased total blood volume and a marked increase in plasma, thus haemoglobin concentration falls. Pathological anaemia is mainly due to iron deficiency, associated with depleted iron stores before pregnancy and poor diet. Anaemic women cope poorly with blood loss at delivery. Oral iron supplementation is advised during all pregnancies. It is particularly important in pregnant women or girls who are anaemic before pregnancy or who have a poor diet. WHO recommends an iron supplement of 60 mg per day for pregnant women or girls with adequate iron stores and 120mg/ day for those with none. If oral therapy is not tolerated, or is not possible, give 250mg IM monthly x 3.

- Treat any malaria, consider and prevent future inoculations with impregnated bed nets etc.
- Treat any chronic parasitaemia eg hookworm or schistosomiasis.
- Genetic blood disorders such as thalassaemia and sickle cell syndrome may be causes of chronic anaemia and may be passed on to the fetus. Check for these using Hb Electrophoresis.
- Severe anaemia exists if Hb < than 5 g/dl or if there are signs of heart failure and Hb is <7.5g/dl. It is very dangerous for both pregnant women or girls and babies.
- In haemolysis the urine will usually be dark brown in colour.
- The patient will be weak, with palms, soles and tongue near white, and signs of heart failure
- If heart failure give high concentration of oxygen, bed rest and sit upright on left side
- A transfusion of 500ml whole blood or 1 unit (330 ml) of packed cells can increase the Hb by 1 gm/dl. Transfusion with packed cells is optimal when the Hb is less than 5 g/dl. If blood cannot be centrifuged let the bag hang until the cells have settled. Infuse the cells slowly and dispose of the remaining serum.
- **Give 40 mg frusemide IV with each unit of blood transfused.**
- Partial exchange transfusion may be safer
- Over-hydration may lead to pulmonary oedema

IF LABOUR occurs when **severely anaemic**

- deliver sitting up in left lateral position
- Cross match blood in case of subsequent post partum haemorrhage
- Consider shortening the second stage by using a ventouse
- Manage the third stage actively (give oxytocin) and suture any tears without delay
- The mother is in danger for at least 24 hours after delivery
- After delivery the store of iron in her body will probably not be normal, so give her iron 120mg/day for 3 months and folate 400 micrograms/day during the puerperium.

SECTION 9 Quiz 3

1) Severe anaemia is a serious problem in pregnancy. Which of the following treatments is appropriate?

a) treat and prevent malaria
b) treat parasitaemia
c) transfuse with 1 unit (330 ml) packed cells if Hb< 5g/dl
d) in labour deliver propped up in left lateral position
e) cross matching of blood is not necessary during labour

ANSWERS:

1. abcd

Anaphylaxis

Assessment

An allergic reaction to ingested, inhaled or topical substances, which may present as either shock or respiratory distress. Common causes include allergy to penicillin, radiographic contrast media, latex and certain foods, especially nuts.

This situation is potentially life-threatening and may result in: change in conscious level, collapse, respiratory or cardiac arrest. Some patients may carry their own adrenaline.

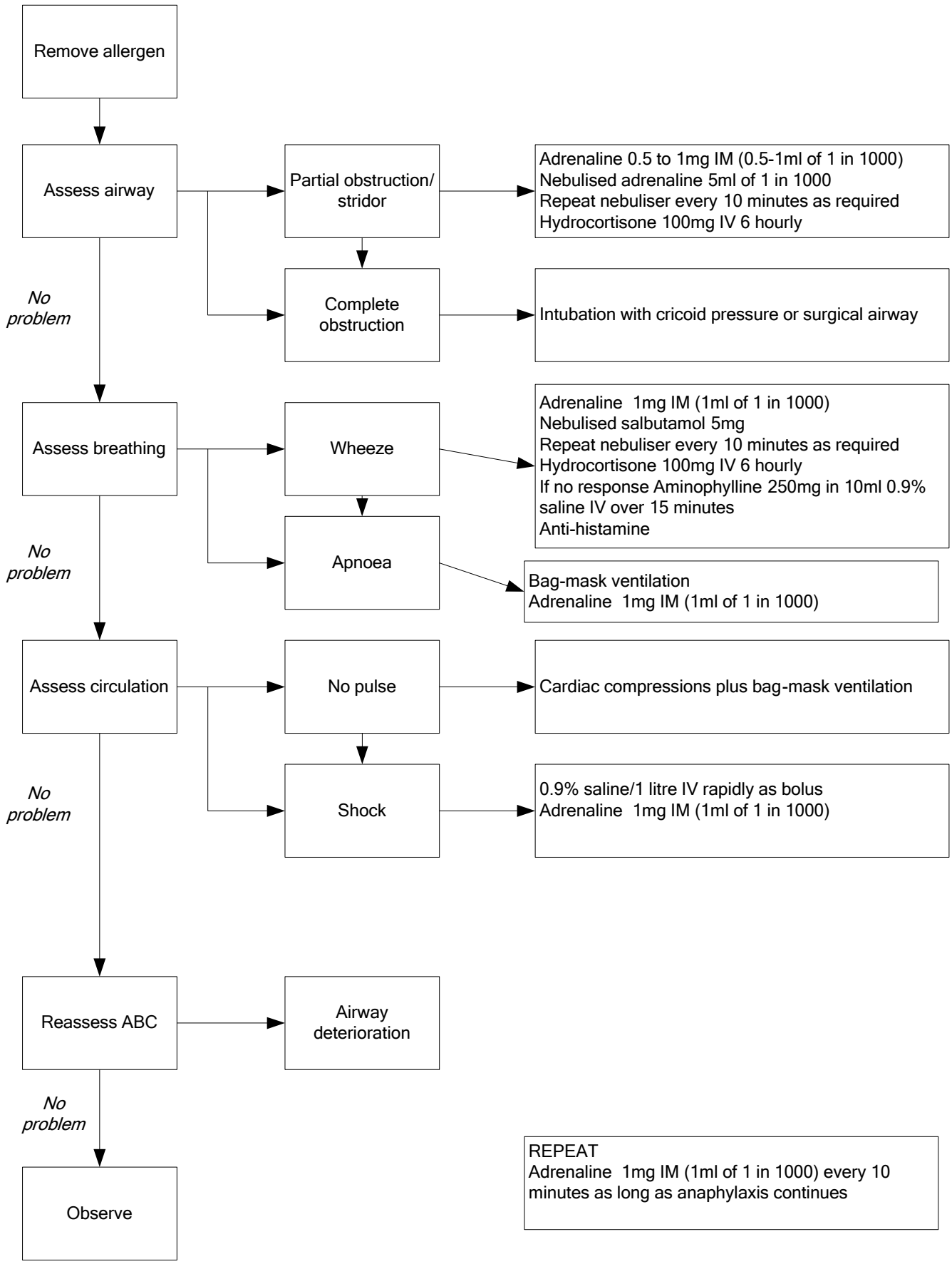
Note: Adrenaline 1mg is given IM, unless intractable shock or cardiac arrest on presentation when give the same dose IV

Moderate to severe anaphylaxis symptoms

	Moderate
Symptoms	- Coughing/ wheezing - Loose bowel motions - Sweating - Irritability
Signs	- Bronchospasm - Tachycardia - Pallor

	Severe
Symptoms	- Difficulty breathing - Collapse - Vomiting - Uncontrolled defaecation
Signs	- Severe bronchospasm - Laryngeal oedema - Shock - Respiratory arrest - Cardiac arrest

Pathway of care for Anaphylaxis in pregnancy



Pulmonary embolism

The incidence in pregnancy in the UK is between 0.3 and 1/1000. Pregnancy causes a 5-6 fold increase in risk. Most deep venous thromboses in pregnancy are in the ileo-femoral vessels which are more likely to embolise than calf thromboses. Additional risk factors include operative delivery, prolonged labour, instrumental vaginal delivery, pregnant women or girls are > 35 years and obese.

Signs and symptoms of pulmonary embolism

Findings	Patients with proven Pulmonary embolism (%)
Tachypnoea	89
Dyspnoea	81
Pleuritic pain	72
Apprehension	59
Cough	54
Tachycardia	43
Haemoptysis	34
Temperature $>37^0$C	34

Physical findings may be few. Prevention with anti-embolism stockings and subcutaneous heparin for medium and high-risk women, particularly if they are immobilised, is important.

Management

- Suspect pulmonary embolism in all patients presenting with sudden onset of shortness of breath, chest pain, unexplained rapid heartbeat or cardiovascular collapse.
- Call senior obstetrician, anaesthetist and medical team (if available)
- Assess and ensure adequate **A**irway, **B**reathing and **C**irculation
- Transfer the patient to a high dependency area and commence non-invasive monitoring of blood pressure, pulse oximetry, ECG and urine output. Send the blood for full blood count. Request chest x-ray and ECG.
- Treat any suspected pulmonary embolism (confirmatory tests are unlikely to be available).
- Patients in shock should be referred, when possible, for expert and intensive management such as intubation, ventilation, inotropes and more intensive monitoring.
- Commence anticoagulation. Treatment should be commenced with Low Molecular Weight Heparin (LMWH) such as enoxaparin given subcutaneously. The drug is available in syringes of 40, 60, 80 and 100 mg. The dose closest to the patient's pre-pregnancy weight should be given 12 hourly (for example if weight is 70Kg give 60 or 80mg). If coagulation tests are available the aim is to achieve an APTT of 1.5 to 2.5 times the pre-treatment level. If these tests are not available careful monitoring for signs of overdose which can cause haemorrhage should be performed and the pregnant woman or girl warned of the symptoms to look for.
- The pregnant woman or girl can then be discharged home having been taught how to administer the injections and dispose safely of the needles.
- LMWH should be continued for the duration of the pregnancy and at least 3 months after delivery. An expert should be consulted about the use of prophylactic heparin during any further pregnancy.
- On entering labour the pregnant woman or girl should not give any further doses of LMWH until after the delivery of the placenta. If an elective Caesarean section is planned the pregnant woman or girl should have the usual dose of LMWH on the night before surgery but omit the morning dose. After delivery the twice daily dose of enoxaparin should be restarted 4 hours after a vaginal delivery and 8 hours after a Caesarean Section.

DIAGNOSIS of abdominal pain in early pregnancy

Symptoms	Clinical Signs	Possible diagnosis
Abdominal pain Light vaginal bleeding	Palpable, tender discrete mass in lower abdomen Adnexal mass on vaginal examination	Ovarian cyst
Lower abdominal pain Anorexia Low-grade fever Nausea/vomiting	Rebound tenderness Paralytic ileus Increased white blood cell count	Appendicitis
Dysuria Retropubic/suprapubic pain Increased frequency and urgency of urination Abdominal pain		Cystitis
Dysuria Retropubic/suprapubic pain Spiking fever/chills Increased frequency and urgency of urination Abdominal pain Anorexia, nausea/vomiting	Loin tenderness	Acute pyelonephritis
Fever/rigors Lower abdominal pain Anorexia Nausea/vomiting	Rebound tenderness Rigid abdomen Abdominal distension Absent bowel sounds Shock	Peritonitis
Abdominal pain Fainting Light vaginal bleeding Amenorrhea Shoulder tip pain	Closed cervix Tender adnexal mass Uterus slightly larger than normal Uterus and cervix softer than normal	Ectopic pregnancy

Acute appendicitis in pregnancy

Introduction

Appendicitis should be suspected in any woman or girl with abdominal pain, whether pregnant or not. The diagnosis of appendicitis can be more difficult in pregnancy, due to the possibility of pregnancy-related conditions, including ectopic pregnancy, abruptio placentae, torsion of an ovarian cyst and pyelonephritis).

As pregnancy advances, the enlarging uterus displaces the appendix from its usual position, shifting the site of maximal tenderness towards the right upper quadrant (Figure 1). In the third trimester, it may consequently mimic cholecystitis. The site of an incision for appendicectomy should be over the point of maximum tenderness.

Clinical management

If appendicitis is suspected clinically, give a combination of antibiotics before surgery, and continue until the woman is postoperative and fever-free for 48 hours.

- Ampicillin 2 g IV every 6 hours;
- PLUS Gentamicin 80mg IV/IM every 8 hours or 5mg/Kg body weight IV/IM once every 24 hours;
- PLUS Metronidazole 500 mg IV every 8 hours.

Morphine 100 mcg./kg. body weight loading dose may be administered I.V. as analgesia.

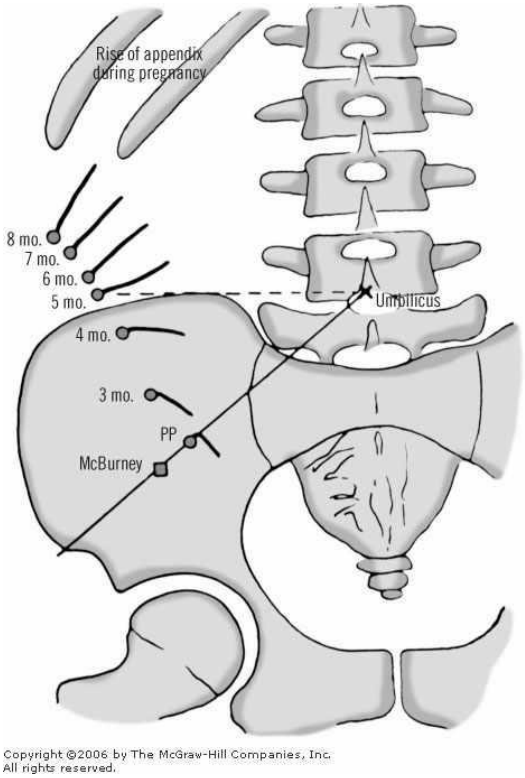
Immediate surgical exploration is required, regardless of stage of gestation. Appendicectomy should be performed even if the appendix does not look infected.

Note: Delaying diagnosis and treatment can result in rupture of the appendix, which may lead to generalized peritonitis. This has a high maternal mortality in pregnancy-as well as a significant risk of miscarriage or pre-term labour.

If there are *signs of peritonitis* (fever, rebound tenderness and guarding), give antibiotics as for peritonitis.

If *appendicitis occurs in late pregnancy*, the infection may be walled off by the gravid uterus. As the uterus rapidly decreases in size (involutes) after delivery, the infection may spill into the peritoneal cavity. In these cases, appendicitis then presents as generalised peritonitis.

Figure 1 Sites for appendicectomy as pregnancy advances



SECTION 9 Quiz 7

1) Which of the following are causes of abdominal pain in early pregnancy?

a) ectopic pregnancy
b) threatened miscarriage
c) urinary tract infection
d) appendicitis
e) Ovarian cyst

2) Which of the following are features suggesting a septic and unsafe abortion?

a) high fever
b) lower abdominal pain
c) peritonitis from uterine, vaginal or bowel injuries
d) purulent vaginal discharge

ANSWERS:

1. acde
2. abcd

Major haemorrhage in second or third trimester

Ante-partum haemorrhage

Introduction

Antepartum haemorrhage (APH) is defined as bleeding from the uterus or vagina occurring after potential viability from 24 weeks gestation. The main causes of APH are placenta praevia, placental abruption or bleeding from cervical or vaginal lesions.

Bleeding from the cervix is common but is not usually heavy. This may be due to rapid cervical dilatation, cervical ectropian or polyps. Ectropians and polyps may become more vascular and friable in pregnancy predisposing to bleeding.. Endo-cervical and vaginal infections such as *Chlamydia*, *Neisseria*, *Trichomonas* and *Candida* can give rise to bleeding. Cervical carcinoma is another cause of APH.

Speculum examination should be carried out to visualize the cervix and help assess the likely cause of bleeding as well as aid in evaluation of severity of bleeding.

Bleeding from the vagina or vulva may result from local trauma or infection. Vulval bleeding may be due to vulval varices, and may be heavy.

Diagnosis

Important points in history taking

- Provoked or unprovoked?
  - Bleeding due to placenta praevia is likely to be unprovoked, however bleeding may be precipitated by intercourse/vaginal examination
  - Abruption is more likely after abdominal trauma
  - Intercourse may cause bleeding from cervical or vaginal lesions
- Painful or painless?
  - Bleeding due to placenta praevia is usually painless

  - Bleeding due to placenta abruption is initially painless, but as it continues contractions will occur and eventually become tonic with constant severe pain and a woody feel to the uterus.
- Fresh bleeding or old blood?
- Amount of bleeding

Management of APH

ABC
Monitor vital signs
IV access and fluid resuscitation
Send urgent Hb, grouping and cross-match, Kleihauer if available
Catheterise
Abdominal examination – assess uterine tone, tenderness and for presence of contractions, auscultation of presence of fetal heart
Speculum examination – assess for vaginal/cervical lesions, severity of bleeding
USS if available to assess placental location if placenta praevia is expected prior to VE if indicated

Listen to fetal heart

Insert a venous cannula if active bleeding, contractions, tenderness or increased tone of the uterus. If shocked proceed to assessment and resuscitation (see below)

Investigations: Hb, platelets,clotting tests, urea and electrolytes, liver functions tests, cross match 4 units if major (50mL to 500mL) or massive (>500ml) haemorrhage, group and save if < 50 mL loss. Perform a Kleihauer test if women is Rhesus negative or major abdominal trauma and if available and affordable give anti-D immunoglobulin.

Table 1 Causes of major (50mL to 500mL) or massive (> 500 mL) antepartum haemorrhage

Symptoms	**Clinical signs**	**Diagnosis**	**Treatment**
Severe constant abdominal pain Light or heavy vaginal bleeding (or not visible bleeding in concealed abruption) Reduced fetal movements or absent Dizziness Shortness of breath Confusion	Shock Tense and tender uterus on abdominal examination Fetal distress or absent fetal heart rate	Placental abruption	Call for surgical and anaesthetic help Oxygen Left lateral tilt or recovery position IV fluid boluses for shock + blood Xmatch 4 units of blood and freeze dried plasma if available – transfuse prior to delivery if possible to try and correct any

			clotting abnormality Deliver fetus as soon as possible if viable either by inducing labour or by CS
Vaginal bleeding which can be light or very heavy Bleeding can be precipitated by intercourse or vaginal examination No pain	Soft uterus Presenting part may be higher than expected. Malpresentation is more common. Fetus may be distressed, non-viable or uncompromised with normal movements and normal fetal heart rate pattern Ultrasound will show placenta praevia Shock may be present depending on how much bleeding and for how long	Placenta praevia	Call for surgical and anaesthetic help Treat shock if present' including lateral tilt or recovery position (see above) **Must not undertake digital vaginal examination as this may precipitate massive bleeding which may be fatal by puncturing the placenta.** If preterm and bleeding not too heavy, give steroids, admit for bed-rest and only go for CS if there is a further bleed Xmatch ideally 4 units of blood
Continuous abdominal pain Vaginal bleeding which may be light or heavy	Shock (especially an increasing heart rate detected ideally on partograph) Tense, distended and tender abdomen Easily palpable fetal parts Absent fetal movements and heart sounds Malpresentation – transverse	Ruptured uterus	Call for surgical and anaesthetic help Treat shock if present Xmatch ideally 4 units of blood Prepare theatre for laparotomy while resuscitating patient Stop oxytocin

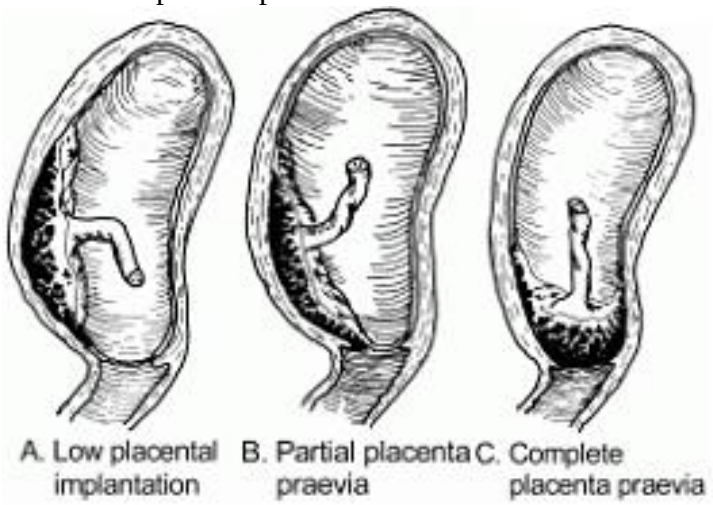
	lie Signs of CPD Scar from previous surgery Haematuria		infusion if in situ
Heavy vaginal and other bleeding	Bleeding from sites in addition to the vagina Signs of other conditions that may be responsible, such as: 1. Placental abruption, 2. Pre-eclampsia or eclampsia (high BP and proteinurea) 3. Retained dead fetus 4. Septicaemia, including intra-uterine sepsis 5. Incompatible blood transfusion 6. Amniotic fluid embolism	Coagulation failure	Fresh blood transfusion Blood products such as platelets, fresh frozen plasma and cryoprecipitate if available Antibiotics if appropriate
Vaginal bleeding which is light Bleeding can be precipitated by intercourse or artificial rupture of membranes No pain	Fetal distress or death	Vasa praevia – placental blood vessels lying in the membranes and in front of the baby's head.	If diagnosed by ultrasound before labour, plan for Caesarean section

Management of the different causes of APH

1). Placenta praevia

Placenta praevia is an abnormally-situated placenta in the lower uterine segment. It presents with painless bleeding often with no precipitating factor. Bleeding may be heavy and is bright red.

Figure 1 increasing levels of low implanted placentae



Prevention and protection

- Early detection of placenta praevia is very important to prevent serious bleeding.
- **Any bleeding during pregnancy must be investigated by an US scan.**
- Mothers with placenta praevia should have immediate access to an obstetric unit with facilities for CS.

Mothers >28 weeks with a placenta praevia and bleeding should stay in hospital until delivery by caesarean section, or live very near to an obstetric unit that can perform CS.

Never allow a digital vaginal examination to be undertaken on a patient known to have, or suspected to have placenta praevia. It can precipitate massive vaginal bleeding.

Careful speculum examination can help to exclude bleeding from the cervix or vagina.

2). Placental abruption

- Placental abruption refers to the premature separation of a normally situated placenta. The bleeding may be concealed or revealed or mixed. It may be partial or complete (with the latter the fetus will be dead).

- The characteristic symptoms and signs are initially painless bleeding and can be concealed but is more likely to occur vaginally. As abruption becomes worse contractions will occur and eventually become tonic with constant severe pain and a woody feel to the uterus. At this stage there will usually be shock, severe abdominal pain, and tenderness over the uterus. In early bleeding the uterus may still be soft to touch but after a few hours it has a hard 'woody' feel due to uterine contraction. It may be difficult to palpate fetal parts. There may be signs of fetal distress or intra-uterine fetal death. Disseminated intravascular coagulation (DIC) is a common complication. A large placental abruption can occur without any visible vaginal blood loss (concealed haemorrhage).

- Remember blood loss is invariably underestimated. Young, healthy women will compensate and maintain their blood pressure until they lose around 20% of their circulating volume.

- Risk factors for placental abruption include most frequently a previous abruption. Increased maternal age, maternal hypertension and trauma also increase risk

3. Ruptured uterus

Uterine rupture is full thickness tear of the uterine muscle and the overlying visceral peritoneum, associated with extrusion of the fetus, placenta or both into the abdominal cavity.

- Bleeding from a ruptured uterus can occur either before or after the onset of labour, although most cases occur during labour itself, especially if oxytocic agents are being used to augment contractions in combination with cephalopelvic disproportion.

- A previous caesarean section scar may rupture during labour. However obstructed labour, even without a uterine scar, particularly in a woman of high parity, may cause uterine rupture.

- Excessive doses of oxytocin during labour can also precipitate this. **Oxytocin is especially dangerous in multiparous women and no mother receiving this drug during labour should be left alone.**

- **Careful thought must be given to the administration of oxytocin in labour to a woman with a uterine scar, because of the increased risk of uterine rupture. This applies to women with previous myomectomy as well as to those with previous caesarean section. Women with scars in the uterus should only receive oxytocin before delivery in low resource countries when a high level of supervision is available.**

- Ideally, always use a burette in-line giving set to administer IV oxytocin to avoid over-dosage.

- Rupture of the uterus can also occur following violence or major trauma.

Symptoms and signs

- Characteristically there is pain and tenderness over the uterus with blood loss vaginally and cessation of contractions.
- Ruptured uterus usually presents with shock, some of which is due to bleeding and some to increased vagal nerve stimulation (so there may be a slow rather than a fast pulse). The baby is usually dead or has severe fetal distress.
- There may be a change in nature of the pain in labour from severe intermittent pain to a constant pain.

- Vaginal bleeding may or may not be present. Bleeding from a ruptured uterus can fail to drain vaginally due to an impacted fetal head, and the head should be manipulated to detect bleeding).

- Maternal shock can be made worse by dehydration, exhaustion and acidosis if prolonged obstructed labour has preceded the rupture.

- The abdomen is tender to palpation, and fetal parts are usually too easily palpable.

- On vaginal examination, the presenting part may be high or impacted: the fetal head may have retreated into the uterus.

- There may be a marked maternal bradycardia (<60/minute) due to increased vagal tone.

- The main differential diagnosis is placental abruption.

Management

1. Suspect in any patient with risk factors such as previous CS
2. Primary assessment, resuscitation and emergency treatment for shock (see below)
3. Call obstetrician and anaesthetist
4. Obtain consent and prepare operating theatre
5. Perform urgent laparotomy
6. Give prophylactic IV antibiotics (ampicillin 1 gram IV/IM 6 hourly, gentamicin 80mg IV/IM 8 hourly or 5mg/Kg body weight IV/IM once every 24 hours and metronidazole 500 mg IV 8 hourly) for 7 days.

See above for the dangers of oxytocin during labour and its management and contraindications.

4).Vasa praevia

- An uncommon, but life-threatening condition for the fetus/neonate. In this condition, fetal vessels run over, or close to, the cervix beneath the presenting part, unprotected by Wharton's jelly or placental tissue**.** These vessels are vulnerable to laceration and compression, most commonly at the time of delivery.

- Fetal or neonatal death can occur due to exsanguination or asphyxiation.

- Antenatal diagnosis can be made only by skilled ultrasound. CS is then needed to reduce high mortality rate

5). Failure of blood clotting

This may be due to a pre-existing coagulation problem, or to complications of the pregnancy causing excessive bleeding and disseminated intravascular coagulation (DIC, consumption of the clotting factors).
Causes include:

- placental abruption
- pre-eclampsia or eclampsia
- retained dead fetus
- septicaemia including intra-uterine sepsis
- incompatible blood transfusion
- amniotic fluid embolism

Primary assessment and resuscitation and secondary assessment and emergency treatment for bleeding in pregnancy

In any patient with vaginal bleeding after the uterus has been palpated abdominally, do not do a digital vaginal examination. If placenta praevia is present, such a procedure can precipitate massive and fatal haemorrhage. A careful speculum examination can rule out vaginal or cervical causes of APH and an ultrasound scan should be undertaken to help rule out placenta praevia.

Aims

To prevent shock and disseminated intravascular coagulation

To achieve intact fetal survival if viability is possible in the circumstances

Call for experienced obstetric and anaesthetic assistance (if available) and ensure the operating theatre is ready

Airway

- Open the airway using chin lift or jaw thrust techniques if it is closed or partially obstructed. If there is improvement, keep the airway open using either an assistant or an oropharyngeal airway if unconscious and tolerated without gagging.
- Suction if necessary
- The airway may need to be secured by intubation using experienced senior help (if available).

Breathing

- Normal respiratory rates in a pregnant mother at rest are 15 to 20/minute: tachypnoea can be due to acidosis.
- Provide high flow oxygen by face mask with reservoir bag for adequate spontaneous respiration regardless of SaO_2. This increases fetal O_2 delivery as well as improving maternal tissue oxygenation.
- If ventilation is inadequate, especially when there is depressed conscious level (P or U on AVPU scale), airway and breathing should be supported by bag-valve-mask inflations with high flow oxygen and experienced senior help called, including an anaesthetist if available.

Circulation

- Normal heart rates in a pregnant mother at rest are 60 to 90 bpm
- Normal blood pressure in a pregnant mother at rest is 105/60 to 120/70
- Don't forget to position the patient in the left lateral tilt or recovery position and elevate the legs
- Monitor HR and BP and reassess regularly. Aim to keep the heart rate at 100 to 110/minute or less and the systolic BP 100mm Hg or more

Recognise signs of hypovolaemia

- Tachycardia
- Tachypnoea
- Cold, pale, sweaty and possibly cyanosed skin
- Alteration of mental state: confusion or unconsciousness
- Fall in urine output < 30mls per hour
- Narrowed pulse pressure
- Hypotension (late sign)

Healthy women or girls who are pregnant can maintain a normal blood pressure when large volumes of blood are lost. Most, but not all, will demonstrate tachycardia if bleeding significantly, but bradycardia may also be observed.

Remember that young, healthy women can lose a lot of blood before becoming shocked, especially if it is a slow trickle, rather than a sudden large loss.

Restore circulating volume

- Position mother in the left lateral tilt or recovery position to minimise the effects of compression of the inferior vena cava or aorta. Lateral tilt can be undertaken with a pillow, blanket or rolled up towel. A wedge may be used during obstetric procedures. Assistants can also manually displace the uterus.

Figure 2 Manual displacement of uterus and left lateral tilt

- Gain intravenous access and take blood for full blood count, cross-match and blood clotting measurement. If access is not possible consider intraosseous needle insertion.
    - Use a short, wide-bore IV cannula if possible (14 (usually orange) or 16G (usually grey)
    - External jugular vein access is a good option if peripheral access is impossible. Long saphenous vein cut down may also be considered. If adequately trained personnel are available, central venous access, ideally via internal jugular vein, can be extremely helpful. If access is not possible consider intraosseous needle insertion (chapter 8.4.B)
    - Try to obtain two vascular access sites to give large volumes quickly, and in case one line is lost. Do not waste time, and as soon as the first IV cannula is in place, give an IV fluid bolus.
    - Take blood for XMATCH (ideally 4-6 units), FBC, renal function tests (if available), and blood clotting.
- Elevate legs
- Give an initial IV bolus of 500 mL to 1 L of Ringer-Lactate or Hartmann's solution as fast as possible using a three way tap and 20-50 mL syringes to push in as rapidly as possible. If re-assessment of the circulation shows little or no improvement, then a further 500ml should be repeated and followed by blood transfusion as soon as this is available. (A normal adult has 5 L circulatory blood volume, and when pregnant, this increases by 40% to 7 L).

- Tranexamic acid can help in patients with continued bleeding, The loading dose is 1 g over 10 minutes followed by an IV infusion of a further 1 gram over 8 hours. The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100ml bag of 0.9% saline and letting it run through over about 10-20 minutes (the exact timing is not crucial). The 8 hour infusion is given by injecting one gram of tranexamic acid into a 500ml bag of 0.9% saline and giving it over 8 hours (approximately 60 ml/hour).

- Ensure adequate transfusion; the best resuscitation for the fetus is to resuscitate the mother. Inadequate transfusion is common, especially in cases of placental abruption.

- A central venous pressure (CVP) line can assist with deciding on whether more fluid is needed. However, insertion should not delay initial resuscitation, and must be undertaken by a competent person. If peripheral access is inadequate, this route may be used for volume replacement. If DIC is established, CVP insertion is more hazardous and the subclavian vein should be avoided, because it is not externally compressible.

- If shock is accompanied by a bradycardia < 60/minute, (for example with a ruptured uterus) give Atropine 500 to 600 micrograms as an IV injection.

Blood products

- Fresh whole blood is best in managing obstetric haemorrhage.

- Use cross-matched blood unless an immediately life- threatening emergency, when group-specific blood should be used, as cross-matching may take up to an hour.

- The patient's blood group should be established during pregnancy, which facilitates the provision of blood when needed.

- All large volume infusions should be warmed. In particular, do not infuse cold fluid through a CVP line. The patient should also be kept warm, as hypothermia will exacerbate poor peripheral perfusion, acidosis and coagulation abnormalities. Any benefits of blood filters may be outweighed by their deleterious effect on the speed of transfusion. A good way of warming blood is to place the cold bag under the clothes of a relative next to their skin until the blood is warmed.

- Hand- inflated pressure bags are effective to give blood and other fluids fast.

I*dentify and treat any blood clotting disorders.*

- Assess bedside clotting: failure of clot to form after 7 minutes, or a soft clot that breaks easily indicates coagulopathy. Suspect, and aggressively treat, blood clotting disorders using warmed fresh blood, platelets (if platelet count < 20,000), fresh frozen plasma (15 mL/kg) and cryoprecipitate as appropriate and if available.

- Freeze dried plasma is being used in the military in adverse conditions as it is shelf stable for two years and easily reconstituted within minutes with sterile water. It would be a very useful addition to the emergency stores in resource poor countries where the use fresh or frozen plasma involves major storage problems.

- Urinary catheterisation for measurement of hourly urine output. Aim for >30 mL/hour.

When stable, move to a place where there is adequate space, light and equipment to continue resuscitation and treatment.

Fetal assessment

When the mother has been resuscitated:

- listen for fetal heart sounds
- if significant haemorrhage has occurred and the fetus is considered viable after birth in the prevailing circumstances, consider immediate delivery **only if safe for the mother**.

Anaesthetic issues

Cardiovascular instability is a relative contra-indication to spinal anaesthesia.

- Rapid sequence induction agents with minimal peripheral vasodilator action, such as ketamine 1-2 mg/kg, should be considered.
- Adrenaline and atropine should be ready in case of cardiovascular collapse on induction. Ventilation with high oxygen concentrations may be needed until 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 (usually ketamine) if uterine atony is a problem.
- If spinal anaesthesia is used, compensatory lower limb vasoconstriction is abolished, so profound hypotension may occur.

Delivery options

- Diagnose and treat source of bleeding
- CS for major abruption or placenta praevia
- Induction of labour if the fetus is dead and no placenta praevia.
    - Urine output should be monitored hourly and CS considered if labour does not become established fairly quickly. The longer the dead fetus stays in utero the greater the chance of developing DIC
    - *Expect and be prepared for massive post partum haemorrhage whether the baby is delivered vaginally or by CS***.** In cases of severe APH requiring surgery, discuss the possibility of hysterectomy.

It is the APH that weakens and the PPH that kills because the APH uses up the clotting factors and platelets leaving the woman in danger if the PPH follows soon afterwards.

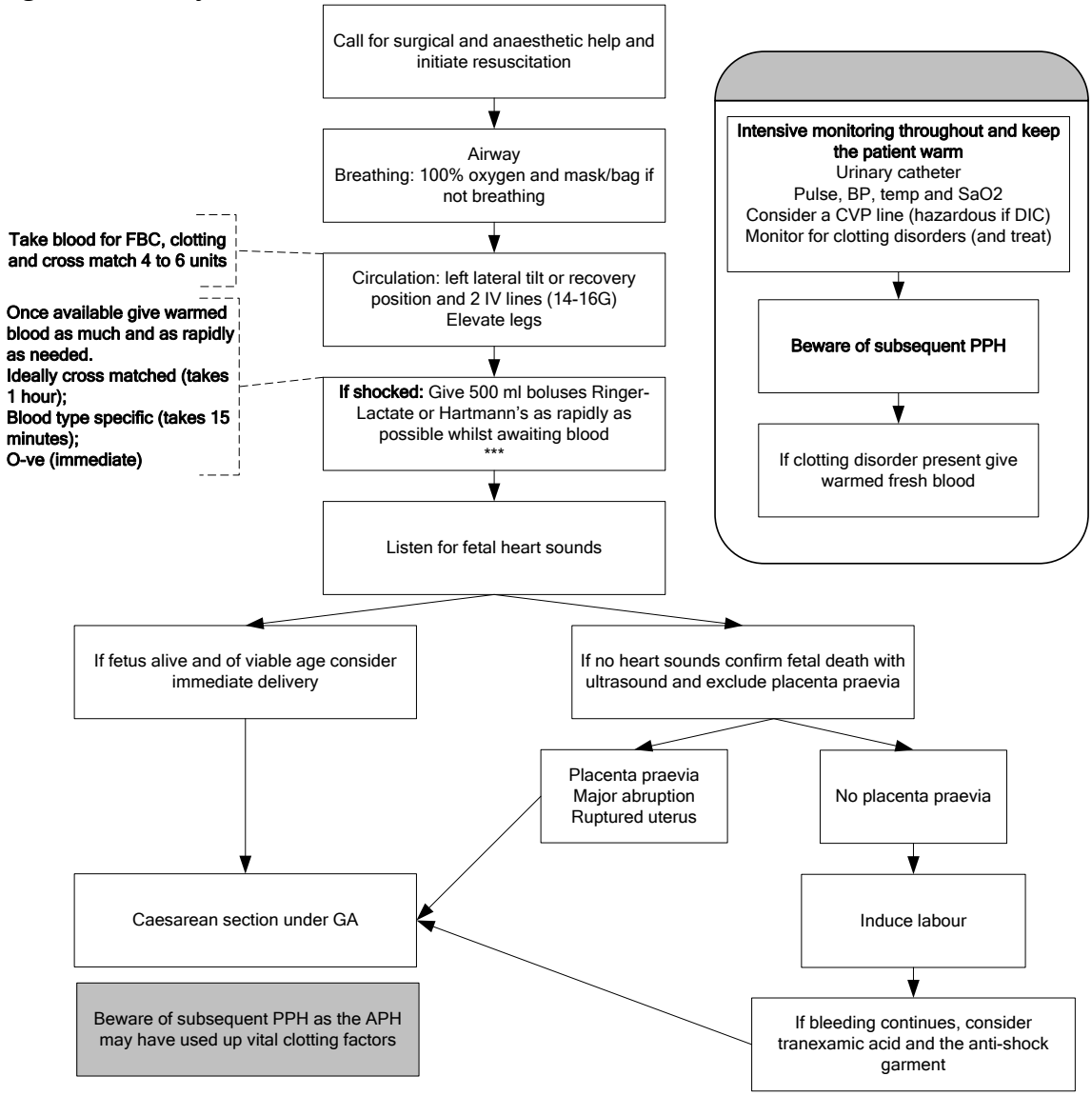
If no safe operating theatre facilities for CS are present, give oxygen, transfuse fresh blood and transfer as soon as safe/stable. Ensure IV fluids are in place, catheterise, and ensure nil by mouth.

Monitoring

Essential monitoring should include pulse rate and volume, blood pressure, respiratory rate, oxygenation (SaO_2 if available), temperature and fluid balance with a urinary catheter. Regular checks of the haematocrit, clotting studies and blood gases will help guide resuscitation.

Monitor blood glucose and treat any hypoglycaemia

Figure.3 Pathway of care for massive APH



SECTION 9 Quiz 8

1) Which of the following are causes of massive APH in the 2nd or 3rd trimester?

a) placental abruption
b) placenta praevia
c) vasa praevia
d) uterine rupture
e) ruptured ovarian cyst

2) When managing a massive APH describe the sequence that should be undertaken in order of priority with 1 first and 6 last

Listen for fetal heart sounds	1
Call for help and start resuscitation	2
Breathing 100% O_2	3
Airway control	4
Left lateral tilt and 2 IV lines	5
If shocked give IV boluses of Ringer-Lactate or Hartmann's whilst waiting for blood	6

ANSWERS:

1. abd
2. correct sequence in column is 2,4,3,5,6,1

Postpartum haemorrhage

Introduction

The definition of a postpartum haemorrhage (PPH) is blood loss of more than 500ml from a vaginal birth and > 1 litre after a caesarean section. It is common, occurring in 1-3% of all pregnancies, and globally causes 25-50% of maternal deaths being the leading cause of death in low resource settings.

Estimates of blood loss are inaccurate and tend to be low, often half the actual loss. Blood is mixed with amniotic fluid and sometimes with urine. It is dispersed on sponges, towels and linens, in buckets and on the floor.

The importance of a given volume of blood loss varies with the mother's haemoglobin level. A mother with a normal Hb will tolerate blood loss that would be fatal for an anaemic woman. This is why it is essential to ensure that every woman reaching labour has an adequate haemoglobin.

Even healthy, non-anaemic women can have catastrophic blood loss.

Bleeding may occur at a slow rate over several hours and the condition may not be recognized until the mother is shocked. Previously well women can compensate for substantial blood loss until a relatively late stage.

Risk assessment in the antenatal period does not necessarily predict women who will have PPH. However, identification and treatment of anaemia antenatally will allow women to better withstand life-threatening postpartum haemorrhage.

Prevention of PPH

Active management of the third stage of labour is essential in preventing PPH and consists of 4 possible interventions:

1. A prophylactic uterotonic drug after delivery after checking 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

Of these, 1. the uterotonic drug is the most important with oxytocin 10iu IM or, if shocked 5iu by slow (over 1-2 minutes) IV injection, is the first choice because it causes uterine contraction to prevent atony rapidly 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 uterotonics should be used including ergometrine 200 or 500 micrograms IM or misoprostol 600 micrograms sublingually or orally (provided the mother is fully conscious) or misoprostol 800 micrograms rectally if drowsy or unconscious

All uterotonics 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 you are certain there is not another fetus in the uterus before such drugs are given.*

Ensure that both oxytocin and ergometrine are protected from heat damage by close attention to the cold chain and their storage, otherwise they may not be effective. Store oxytocin ideally in a fridge but it can be kept at 15-30 degrees C for 3 months. Oxytocin must never be frozen. Store ergometrine in a fridge at 2-8 degrees C all of the time.
Remember that ergometrine is contraindicated in heart disease, hypertension, pre-eclampsia and eclampsia, as it raises the blood pressure by vasoconstriction, with the risk of cerebrovascular accidents. Misoprostol is not affected by ambient temperature.

Early cord clamping and cutting (2) as part of the active management of the third stage is not an essential part of the active management and is no longer recommended unless the infant needs resuscitation.

Controlled cord traction (3) is optional where delivery is undertaken by a skilled birth attendant but contraindicated if a skilled attendant is not available. Details are given in chapter 2.3.

Strong uterine massage (4) 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 massage if at any time the uterus becomes soft and relaxed.

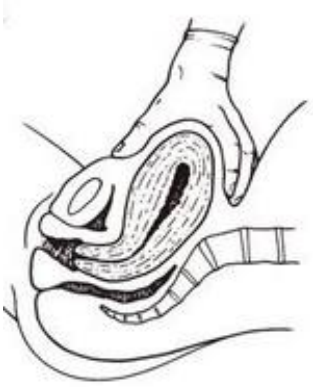


Figure 1 Strong massage applied to cause uterus to contract

Figure 2. The third stage

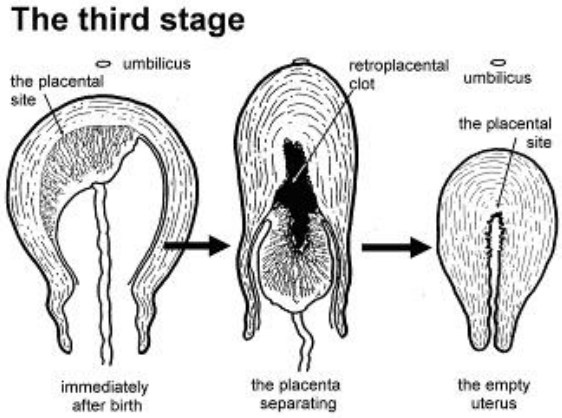
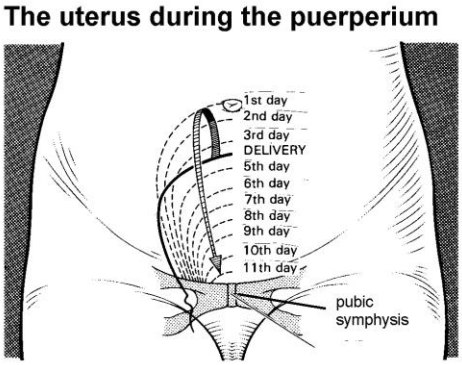


Figure.3 Uterus during the puerperium



In order to prevent PPH during/after caesarean section oxytocin plus cord traction is recommended in preference to manual removal of the placenta.

How to manage the 3rd stage if uterotonic drugs are not available?

Unfortunately it is not uncommon for hospitals to run out of uterotonic drugs. In this avoidable and dangerous situation, expectant/physiological management should be undertaken.

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

   Most placenta separate within 1 hour of birth. If not seek help.
4. Deliver the placenta
    - Sit the mother upright
    - Encourage mother to bear down with a contraction (only after separation)
    - Catch the placenta. If membranes are dragging behind 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.

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

1. Monitor BP, pulse and state of the uterus (is it contracted?) every 15 minutes for 2 hours after placenta delivery.
2. Examine placenta for completeness.

Causes of PPH

Primary PPH

Occurs within 24 hours of birth with 80% 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 cervix, vagina or perineum
Thrombin: clotting defects, notably disseminated intravascular coagulation (DIC)

Remember also:
Haemorrhage may be concealed within the uterus or within the abdominal cavity
Ruptured uterus can cause concealed bleeding, as can *bleeding following CS.*
Inverted uterus is associated with PPH

Any degree of PPH is dangerous if there has been severe anaemia before delivery.

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

See below for management of this problem.

Factors predisposing to PPH

- Previous APH
- Retained products of conception
- Trauma to uterus or birth canal (e.g. from instrumental delivery)
- Uterine over-distension (e.g. multiple pregnancy or polyhydramnios)
- Grand multiparity
- Prolonged labour

Table 1 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 > 24 hours	Portion of placenta missing Foul smelling lochia may be present Fever may be present Severe anaemia	Retained placental parts +/- infection
Lower abdominal pain of varying intensity Immediate but usually light bleeding	Uterus not felt on abdominal palpation Inverted uterus may be seen at vulva	Inverted uterus

	Bradycardia may be present Shock	
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 oxytocin drip in place Vaginal bleeding which may be light or heavy History of a previous CS or other operation on the uterus	Shock Abdominal distension Tender over uterus	Ruptured uterus (more likely before delivery of the baby)

Management of PPH

First call for help (include surgeon and anaesthetist), palpate the uterus and massage it strongly and immediately as it is most likely that an atonic uterus is the cause (*see* Figure 1).

Airway and Breathing

- Ensure the airway is open and remains open.

- Provide **high flow oxygen** through a face mask with reservoir bag if adequate spontaneous respiration. Give 100% oxygen (mask with reservoir and high flow rate).
- For inadequate ventilation or depressed conscious level (assessed by AVPU), respiration should be supported as appropriate with oxygen via a **bag-valve-mask,** and experienced senior help summoned (if available).

Circulation

Primary assessment denoting shock

- Fast, weak pulse (100 to 110 per minute or more). Normal heart rates in a pregnant mother at rest are 60-90 bpm. Tachycardia is an early sign of shock.
- Low volume (weak) pulse.
- Pallor (especially of inner eyelid, palms or around mouth).
- Sweatiness or cold clammy skin.
- Prolonged capillary refill time (> 3 seconds).
- Rapid breathing (> 30 breaths per minute). Normal respiratory rates at rest are 15 to 20; tachypnoea can be due to acidosis.
- Low BP (systolic less than 90 to 100mm Hg) is **a very late sign.** Healthy women and girls can maintain a normal or even high blood pressure while large volumes of blood are lost.

- Nausea +/- vomiting
- Anxiety, confusion or unconsciousness.
- Reduced urine output (<30 mL per hour). Urinary catheterisation is needed for measurement of hourly urine output if shocked (normal >30 mL/hour).

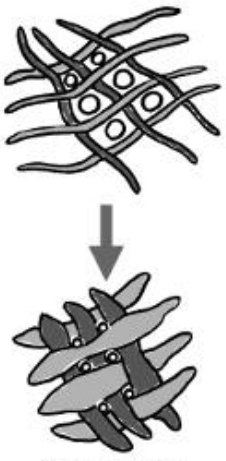
Procedures for stopping haemorrhage must be started first and then undertaken in parallel with IV fluid resuscitation.

Measures to stop further haemorrhage due to uterine atony

Rubbing up a contraction

Poor contraction of the uterus after delivery is the commonest cause of post-partum haemorrhage. *Rub up a contraction of the uterus* (not just pinch the skin).

Figure.4 Uterine contraction shuts blood vessels {near here}



As the muscle fibres are stimulated to contract, they compress the blood vessels running between the muscle fibres and help to stop bleeding.

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

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

Uterotonic drugs, drugs to make the uterus contract

Give 10iu of **oxytocin** IM or 5 iu IV slowly especially if already shocked and repeat after 5 minutes if still bleeding and/or uterus is not contracted. This is the drug of first choice.

It 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 per minute with a standard IV giving set where 20 drops = 1ml) or 1 litre (120 drops per minute) of Ringer-Lactate or Hartmann's 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** (which, unlike oxytocin and ergometrine, does not need to be kept in a refrigerator). It is given rectally as 4 x 200 microgram tablets or pessaries (800 micrograms total) or, if conscious, orally 3 x 200 microgram tablets or 400 micrograms powder sublingually.

Ergometrine as part of *Syntometrine* (oxytocin 5 iu ergometrine plus 500 micrograms IM) or alone, is contra-indicated in pre-eclampsia due to its hypertensive action where it increases the risk of convulsions and cerebrovascular accidents.

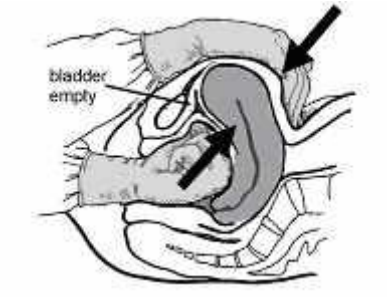
Urinary catheterisation
This may help the uterus contract.

Bimanual uterine compression
If heavy PPH continues despite uterine massage and oxytocin/ergometrine/misoprostol, and the placenta has been removed, apply bimanual uterine compression.

- Must wear sterile or disinfected gloves
- Introduce right hand into vagina, clench fist with back of hand posteriorly and knuckles in the anterior fornix.
- Place other hand on abdomen behind the uterus and squeeze the uterus firmly between both hands.
- Continue compression until bleeding stops (no bleeding when compression released), and uterus is contracted.

This procedure is painful and should only be undertaken when there is no other option. It is best used to give time for other actions to work.

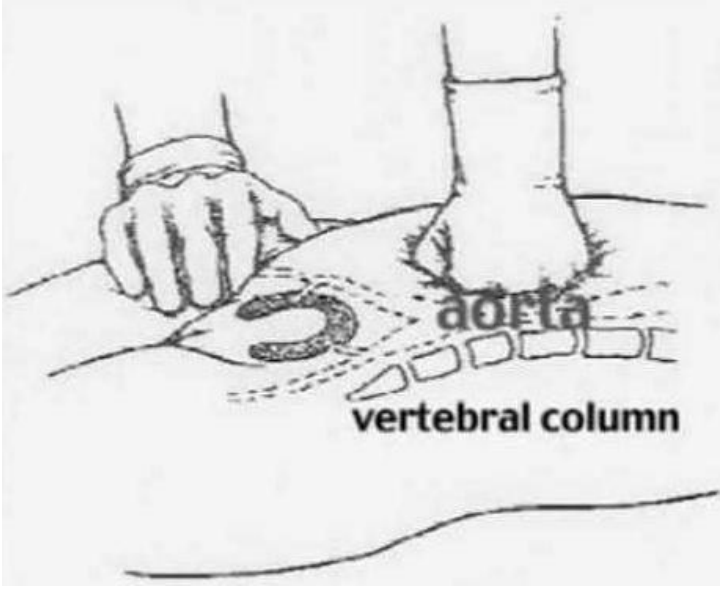
Figure.5 bimanual compression



Aortic compression
If bleeding still persists, apply aortic compression.

- Apply downward pressure with a closed fist (with the 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 onto the vertebral column.
- With the other hand, palpate the femoral pulse with 4 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.6 Aortic compression



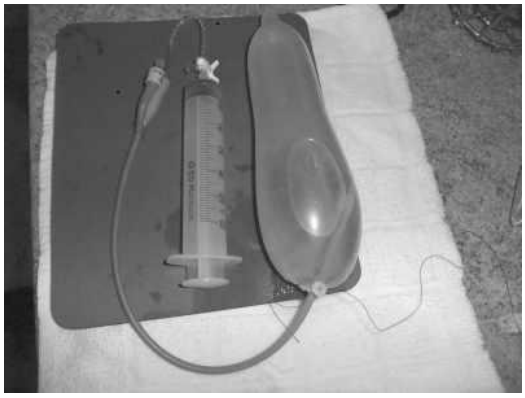
Continue until bleeding stops. If bleeding continues, continue pressure whilst transferring mother to a facility where expert help is available.

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.

A condom catheter, which is inserted into the uterus as a sterile procedure and filled with 250 to 500 mL sterile Ringer-Lactate or Hartmann's or 0.9% saline to create a uterine wall tamponade, is an effective way of stopping uterine bleeding which is continuing despite uterotonic drugs and procedures. (*See* figure.7). It is important that care is taken to ensure that the balloon is fully inside the uterus as it is inflated and that measures are taken to ensure that it does not become displaced into the vagina.

Figure 7 Condom catheter inflated with sterile IV fluid



Leave the balloon in until the bleeding has stopped for 3-4 hours. Prior to removal ensure that at least 1 unit of cross matched blood for possible transfusion is available, plus group and save procedure if more blood is required. Theatre staff and an anaesthetist should be warned in case of bleeding when the catheter is removed. One approach is to remove 50 mL every 30 minutes until it is fully emptied. Observe closely for 4 hours after removal, looking at vaginal blood loss and vital signs. IV antibiotics (ampicillin 2 g IV should be given when the catheter is put into place and continued (ampicillin 2 g 6 hourly) for 48 hours .

Fluid resuscitation to maintain perfusion of vital organs (brain, heart and kidneys) undertaken at the same time as the above manoeuvres

1. *Elevate legs (raise foot of bed).*
2. Try to obtain two vascular access sites to give large volumes quickly and in case one line is lost. Insert wide-bore IV cannula x 2 (14G-16G) and send blood for full blood count, cross-match (4-6 units) and clotting. If peripheral veins are difficult to access, external jugular or long saphenous vein cut-down are good alternatives. If a skilled person is available, an internal jugular vein central line is can be helpful especially if CVP can be measured.
3. If venous access is not possible consider inserting an intra-osseous line using the newly available drill system (see chapter 8.4.B)
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 liter of Ringer-Lactate or Hartmann's solution (or of 0.9% saline if the former are not available) whilst awaiting 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 BP cuff wrapped around the fluid bag and inflated can be used to speed up infusions. (Figure 9). An alternative is to push the boluses in using a 20-50 mL syringe (with a 3 way tap linked to the IV giving set).
5. *As soon as it is available, give as rapidly as possible* 1 unit of blood (500ml) and repeat as required. Fresh blood is particularly useful to combat the coagulopathy that occurs in major blood loss if specific coagulation components such as platelets are unavailable. Remember blood loss is usually underestimated.
6. Further 500-1000 mL boluses of IV crystalloid or blood, if available, will usually be required in the first 1 hour. Once >2 L has been given IV, complications such as pulmonary oedema may sometimes occur, so watch for circulatory over-load.

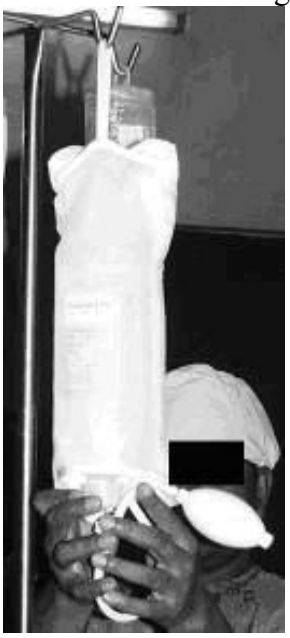
The concept of *"controlled hypotensive resuscitation"* may be relevant here. The initial boluses of IV crystalloids required to treat shock should only be given to keep the vital organs (especially brain, heart and kidneys) perfused before blood becomes available and, of most importance, specific treatments to stop the bleeding have started working. Giving too much IV crystalloid fluids could theoretically increase bleeding by disrupting early clot formation. There is no clear evidence to indicate the precise blood pressure that should be achieved in a woman in shock due to PPH.

Adequate perfusion of vital organs may be indicated by a radial pulse which can be palpated and a fully alert conscious level.

In this situation, therefore, we start with IV boluses of 500 mL of crystalloid or ideally blood and reassess after each.

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

Figure 9 pressure bag over Ringer-Lactate or Hartmann's bag



Blood products

Fresh whole blood is the best. Full cross-match of blood may take up to an hour. In an emergency, group specific blood should be used. The patient's blood group should have been established during pregnancy, which facilitates the provision of blood when needed. O rhesus negative blood can be transfused in acute emergencies.

All large volume infusions of blood should be warmed. A good way 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.

New treatments that could be valuable in treating PPH

Tranexamic acid

If there is continuing bleeding, especially if caused by trauma of the genital tract, this inexpensive and safe drug can be helpful. Recent evidence has shown that tranexamic acid can reduce mortality from major haemorrhage 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 to be effective.

The loading dose is 1 g over 10 minutes followed by an IV infusion of a further 1 gram over 8 hours.

The slow IV bolus dose is given by injecting 1 gram of tranexamic acid into a 100ml bag of 0.9% saline and letting it run through over about 10-20 minutes (the exact timing is not crucial).

The 8 hour infusion is given by injecting one gram of tranexamic acid into a 500ml bag of 0.9% saline and giving it over 8 hours (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. It feels like a tight diving wet-suit to wear and consists of 5 segments that compress the legs (segments 1-3), pelvis (segment 4) and abdomen (segment 5). (see Figures 10 and 11). The abdominal segment includes a foam compression ball that presses on the area of the uterus. The segments are held in place by Velcro. It is a very promising, potentially life-saving technique for low resource settings that continues to undergo clinical assessment.

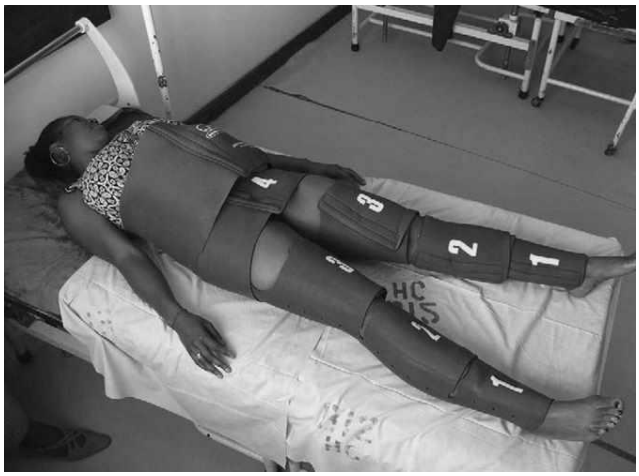
Figure 10 NASG garment before it is placed on the patient

Preliminary pre and post intervention trials have shown that it significantly reduces shock, reduces blood loss, reduces the need for emergency hysterectomy, and reduces maternal mortality and severe morbidity associated with PPH and other causes of obstetric haemorrhage. Randomised controlled trials are currently underway by WHO and others in Zambia and Zimbabwe.

The NASG is reported to reduce shock by compressing blood vessels in the lower parts of the body diverting up to 30% of total blood volume to the heart, lungs, brain and possibly kidneys. There is evidence that, through the applied pressures of 25-50 mmHg, it decreases blood flow in the pelvis and, in PPH, blood loss from the atonic uterus.

It is particularly promising in settings where there can be delays in transfer into sites where comprehensive EMOC is available and where blood transfusion and surgery can be undertaken. In such settings, even in hospitals, blood transfusion is frequently delayed for between 1 and 3 hours with O negative blood rarely available and supplies of stored blood precarious. The NASG by stabilising the patient gives time for blood transfusion to become established and other treatments to be given, as well as possibly/probably by reducing the amount of blood that subsequently needs to be transfused.

Figure 11 NASG on a patient



As reported by FIGO, the International Federation of Gynecology and Obstetrics, *"The NASG is not a definitive treatment-the woman will still need to have the source of bleeding found and definitive therapy performed".* We would qualify this and substitute the word "may" for "will", since sometimes the bleeding, particularly in PPH, may be reduced during the application of the NASG and advanced treatments such as surgery will not then be required.

The NASG is applied in sequence from the lower legs up to the abdominal compression segment (segment 5). With experience it can be applied by one person in 2 minutes, although taking from 5-10 minutes if the applicator is alone and unused to applying it. Help from others present, such as porters or relatives, can be valuable. In PPH from 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 it is in place the legs no longer need to be elevated and the uterus can still be externally massaged by placing a hand underneath the pelvic segment of the NASG. Vaginal examinations and repair of cervical or vaginal tears can be performed whilst 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 is known heart disease. The aim with all treatments is for a pulse rate 100-110 or less and BP systolic 90-100 mmHg or more and stable in a woman who is fully alert and has a urine output of 30 ml/hour or more.

The NASG is removed segment by segment when bleeding has reduced to safe levels and the patient has been cardiovascularly stable for at least 2 hours (BP 90-100 mmHg systolic or more, heart rate 100-110/minute or less and Hb 7g/dl or more). Removal begins at the ankles with 15 minute gaps between each segment opened and clinical measurements before each segment is removed. If the systolic BP drops by 20mmHg or more and/or heart rate increases by 20 / minute or more then re-apply that segment of the NASG and consider additional treatments such as more blood transfusion.

Between patients, the NASG can be laundered as for blood stained sheets. First soak in 0.5% chloride solution for 15 minutes. Then wash and scrub with a soft brush in soapy water. Finally rinse in clean water and air-dry. Fold and store when fully dried.

Each NASG can be used 50-100 times and costs at present 150 to 200 US dollars.

Stop bleeding due to trauma to perineum, cervix or vagina

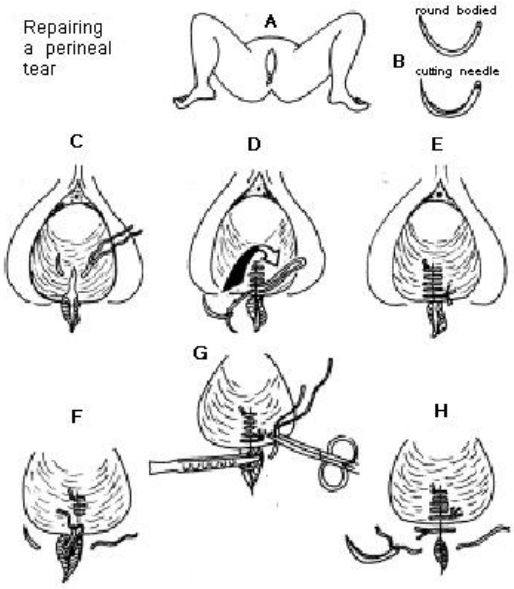
If the bleeding continues despite all the measure above, examine perineum, vagina and cervix with a sterile speculum. Postpartum bleeding with a contracted uterus is usually due to a cervical or vaginal tear. Trauma to the lower genital tract is the second most frequent cause of PPH, and may coexist with an atonic uterus.

Examine the mother carefully and repair tears. Bleeding from trauma can be substantial and lead to death, especially if there is pre-existing severe anaemia. Suture packs, torch, Sims speculum and sutures must always be immediately available on the PPH emergency trolley.

Initially stop bleeding with sterile packing until a surgeon is able to repair the wounds.

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

Figure 12 Repairing a perineal tear



Repairing a vaginal perineal tear
Get a good light, and start at the top of the tear.

A. Put into the lithotomy position only if the tear extends high into the vagina.
B. Use a cutting needle on the skin and a round-bodied needle on other tissues.
C Put the first stitch in high up.
D. When you get to the junction between the vaginal mucosa and the skin, put a needle through the loop and tie a knot.
E. The completed knot.
F. Putting the stitches into the muscle and fascia.
G and H. Put the needle in through the skin on one side, and then on the other.
I. Use interrupted sutures.

Repairing a bleeding cervical tear
Search all round the patient's cervix with ring forceps, and then suture by starting at the highest point.

If you cannot insert sutures, control bleeding by vaginal pack and transfer

Stopping bleeding due to retained placenta or retained products of conception.
Examine the placenta and ensure it is complete.

Retained placenta

Definitions: 1) After active management of the third stage and the placenta is not delivered within 30 minutes of birth
2) After expectant management of the third stage and the placenta is not delivered within 60 minutes of the birth.

Risk factors include a full bladder, a previous retained placenta, high parity, uterine fibroid, history of previous uterine surgery and placenta praevia. It may become trapped in the cervix or lower uterus. There may be no bleeding with a retained placenta, especially if there is abnormal adherence (placenta accreta).

It occurs in around 2% of deliveries.

Management of retained placenta

If there is a clinically significant post partum haemorrhage (PPH), the placenta must be removed urgently. Call for help including anaesthetist and obstetrician, insert a venous cannula, and take blood for Hb and cross match as for PPH and ensure operating theatre is ready.

Massage the uterus and, if there is atony, manage as for PPH above. However, although oxytocin should be used as necessary, **do not give ergometrine because it causes 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* stimulation, 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, a hand is present on the abdomen supporting the uterus and preventing it from inversion. *Note*: 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 the bladder or 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 placenta is required (see below). Note: 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 accrete* a situation that is more likely 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. In such cases the placenta can be left in-situ and should separate and expel itself over time. In these cases the mother must be observed carefully for signs of infection, given prophylactic (one dose) antibiotics (ampicillin 2g IV/IM plus 80mg gentamicin IV or IM 8 hourly or 5mg/Kg body weight IV/IM once every 24 hours) and warned about what to expect when the placenta is eventually expelled.

If *bleeding continues***,** assess clotting status using a bedside clotting test. Failure of a clot to form after 7 minutes or 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 placenta

This is a painful procedure with a high risk for infection unless undertaken using full sterile procedures. In many low resource settings, manual removal of the placenta is undertaken without analgesia or anaesthesia and often not even in the operating theatre.

Unless undertaken as an emergency for major PPH, we consider it should be undertaken in an operating theatre with preceding morphine or ketamine (1-2 mg/Kg or 50-100mg) slowly IV in the presence of an anaesthetist. Elbow-length sterile gloves should be used. Provided active PPH is not occurring, the mother should <u>first</u> be adequately resuscitated with IV fluids/blood and oxygen. There should be close monitoring of pulse rate, blood pressure, oxygen saturation and urine output. Facilities for blood transfusion and, if necessary, emergency hysterectomy should ideally be available.

After removal of the placenta, 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 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 (IV or IM ampicillin 2g plus 80 mg IM/IV gentamicin).

Figure 13 Introducing one hand into the vagina along the cord:

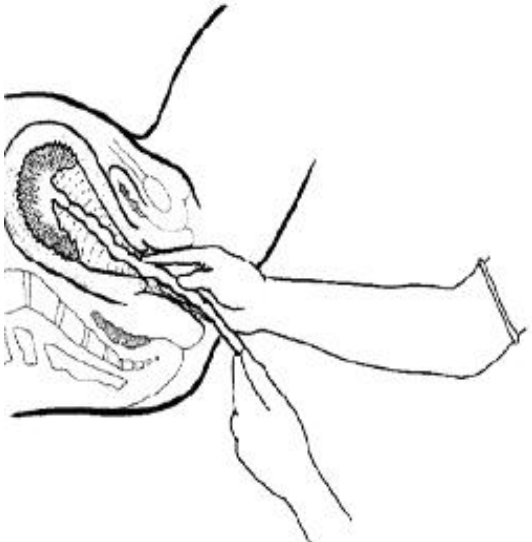


Figure 14 Supporting the fundus while detaching the placenta. Reach the placenta from the implantation site by keeping the fingers tightly together and using the edge of the hand to gradually make a space between the placenta and the uterine wall.

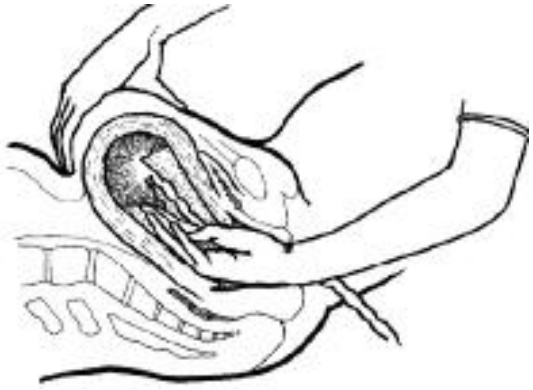
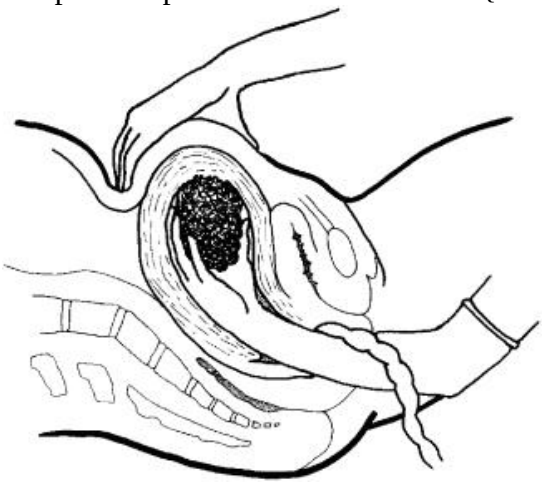


Figure 15 Withdrawing the hand plus the placenta from the uterus {near here}



Treatment of PPH which continues despite all of the above interventions

Reassess. Is bleeding continuing? Is there a clotting disorder? Assess clotting status using a bedside clotting test. Failure of a clot to form after 7 minutes or a soft clot that breaks down easily suggests coagulopathy.

If bleeding continues, re-examine and ensure that the oxytocin IV infusion is running correctly. (40 units oxytocin in 500 mL Ringer-Lactate or Hartmann's over 4 hours).

Exclude: Inverted uterus
Retained products
Damage to genital tract: check for bleeding from the cervix, vaginal walls and perineum.

Management if all of the above fails to control PPH
DO NOT WAIT TOO LONG
Operative interventions

- B –Lynch sutures
- Hysterectomy may be life- saving, and should be considered early to reduce risk of life-threatening coagulopathy.

Check Hb or haematocrit after resuscitation, and consider oral iron if anaemic.

Treatment of secondary PPH

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

Assess vital signs and temperature and if shocked proceed as above for massive PPH.

Assess the uterine size and perform speculum examination and note whether the cervix is still open. Take a high vaginal swab for bacteriology if available before antibiotics are given.

Insert an IV line and take blood for Hb, blood cultures, cross match and blood clotting (as DIC may occur)

Urgently start 7 days treatment with IV antibiotics as the bleeding is often secondary to infection. This especially likely if there is foul smelling lochia, a fever, or there has been prolonged rupture of membranes prior to delivery.

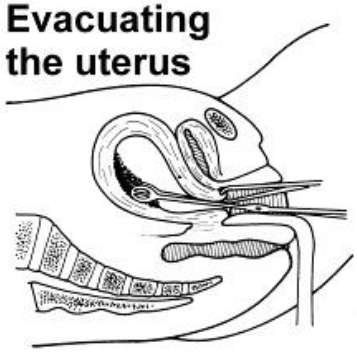
- Give IV ampicillin 2 g IV every 6 hours;
- PLUS gentamicin 80mg IV or IM every 8 hours or 5mg/Kg body weight IV/IM once every 24 hours;
- PLUS metronidazole 500 mg IV every 8 hours;

OR ceftriaxone 2grams IV or IM once daily plus metronidazole 500 mg IV every 8 hours.

Provide blood transfusion (ideally fresh blood) if Hb < 5g/dl or < 7.5 g/dl with symptoms suggesting early cardiac failure or shock.

Examine for suspected retained placental fragments but beware of the great 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 caution 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 a safer choice. Laparotomy is occasionally needed to deal with the continued bleeding from an infected or ruptured uterine incision or infected placental bed.

Figure 16 Evacuating the uterus



Management of placenta accreta

This serious complication is caused by the placenta being morbidly adherent to deeper layers in the uterine muscle or even external to the uterus. It is more common after a previous Caesarean section and in the presence of a placenta praevia. Any woman with a history of caesarean section and with a placenta praevia in this pregnancy is at serious risk of placenta accreta. Adherent portions should be left attached as trying to separate them can cause severe bleeding. There is a risk of infection and prophylactic antibiotics may help reduce this complication. Where there is significant haemorrhage, uterine and vaginal packing with gauze or balloon tamponade (in low resource situations a condom-catheter may be the most effective) can halt the bleeding and eventually allow the placenta to disintegrate on its own. Hysterectomy will be needed if bleeding cannot be stopped by the measures described above. Ensure cross matched blood is available and closely monitor for shock and regularly monitor haemoglobin and blood clotting status.

Anaesthetic issues in managing PPH

Cardiovascular instability is a relative contra-indication to regional blockade.

Rapid sequence induction agents with minimal peripheral vasodilator action, such as ketamine, should be considered. Adrenaline and atropine should be ready in case of cardiovascular collapse on induction. Ventilation with high concentrations of oxygen may be needed until 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 cryoprecipitate as appropriate and available. It is more likely if there has been a previous ante-partum haemorrhage.

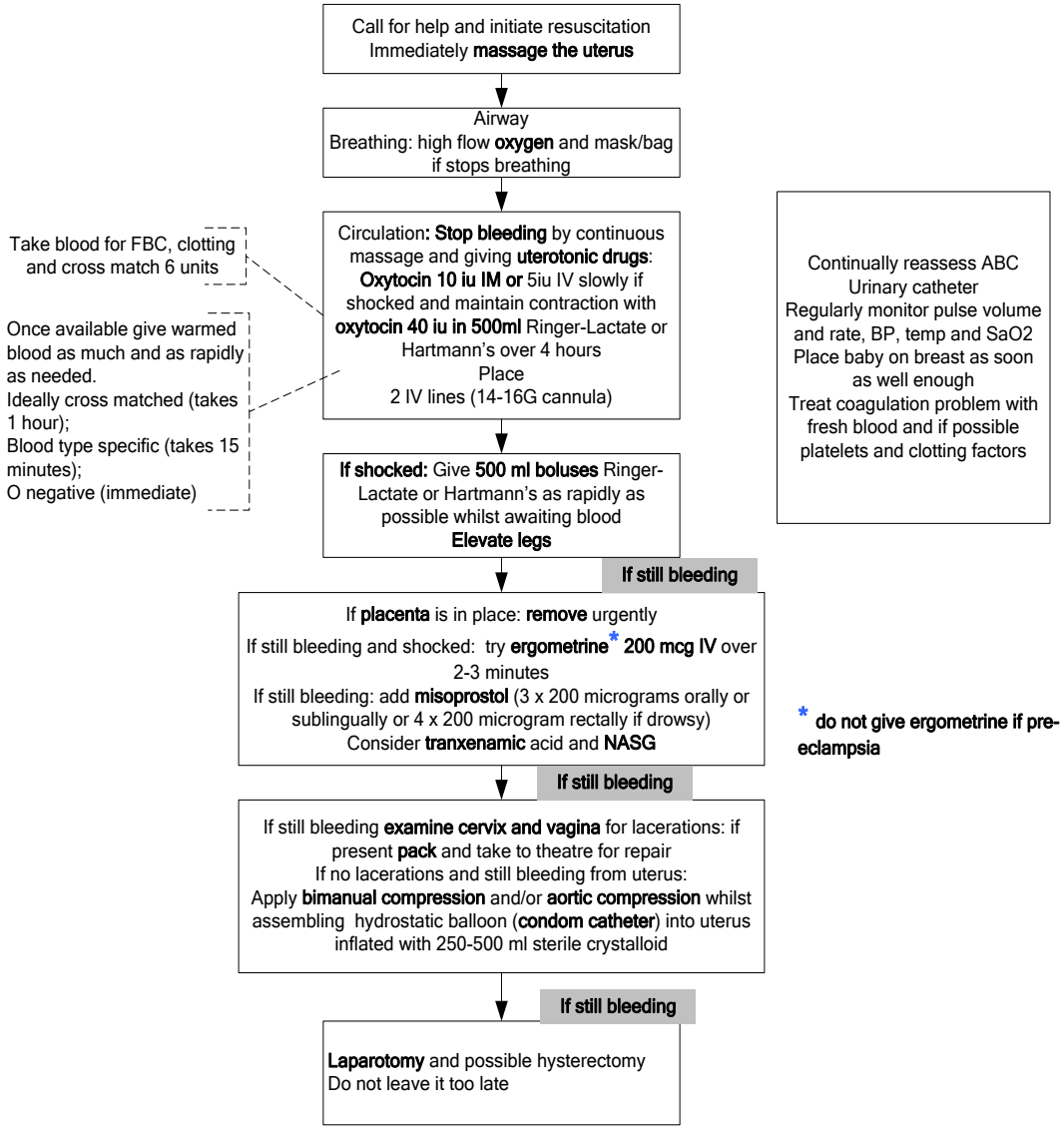
Sheehan's syndrome

Very rarely, massive PPH can cause pituitary infarction – Sheehan's syndrome. This presents initially as failure of breast-feeding, then no return of menstrual bleeding, fatigue, low blood pressure and loss of pubic and axillary hair. Treatment is with replacement hormones, including oestrogen, progesterone, thyroid and adrenal hormones. Specialist endocrinological advice is necessary

Monitoring after PPH

Once bleeding is controlled, frequent observations of respiratory rate, pulse rate, BP, 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 17 Pathway of care for PPH



Further reading

A Textbook of Postpartum Hemorrhage: a Comprehensive Guide to Evaluation, Management and Surgical Intervention.http://www.sapienspublishing.com/medical-publications.php?view=1

Videos on techniques used to treat PPH. http://www.glowm.com/

FIGO GUIDELINES Prevention and treatment of postpartum hemorrhage in low-resource settings FIGO Safe Motherhood and Newborn Health (SMNH) Committee
https://www.sfog.se/media/92536/figo_guidelines_prevention_and_treatment_of_pph_etc.pdf

WHO recommendations for the prevention and treatment of postpartum haemorrhage. 2012
http://apps.who.int/iris/bitstream/10665/75411/1/9789241548502_eng.pdf

SECTION 10 Quiz 10

1) In addition to ABC which of the following are techniques can help to stop a massive PPH?

a) rub up uterus +/- bimanual compression
b) left lateral tilt
c) oxytocin 10 units IM
d) misoprostal orally or rectally
e) hydrostatic balloon into uterus filled with 400 – 500 ml 0.9% saline

2) In addition to ABC which of the following techniques can help to treat a mother with uterine inversion?

a) remove the placenta before trying manual replacement
b) atropine IV if bradycardic
c) manual replacement under GA
d) hydrostatic replacement

ANSWERS:

1. acde 2. bcd

Septic causes of shock

Sepsis is a common cause of maternal death and long term morbidity.

Important causes of sepsis in obstetric patients

- Infection of the uterus and birth canal after septic abortion or birth of the baby: postpartum endometritis (puerperal sepsis)
- Acute gastroenteritis
- Pneumonia
- Meningitis
- Malaria
- Pyelonephritis
- Wound infection
- Acute appendicitis with peritonitis

Clinical signs of sepsis

- tachypnoea
- tachycardia
- fever
- altered mental state
- shock

Some septic patients may not have a fever. Infection after delivery can be slow in onset and progress rapidly. Treatment of underlying infection must be linked to monitoring and supporting failing organ functions. Appropriate monitoring in the early stages of sepsis includes temperature, pulse, respiratory rate, blood pressure, SaO_2 and hourly urine output. Early investigations include full blood count, whole blood clotting time, urine microscopy, urea and electrolytes, liver function tests and blood cultures.

Management of sepsis

Airway and Breathing

Maintenance of adequate oxygenation is an important step in the resuscitation of patients with sepsis. Many patients who develop shock will ideally require intensive care including intubation and ventilation because of the development of adult respiratory distress syndrome.

Circulation

Almost all patients with septic shock have hypovolaemia and IV fluid resuscitation is a mainstay of treatment. Patients who remain hypotensive despite adequate fluid resuscitation will require more intensive fluid management with central venous pressure monitoring and inotropes.

Prevention of infection

Prophylactic antibiotics should be seriously considered following invasive procedures such as Caesarean Section, manual removal of placenta and during the delivery of a mother with a valvular heart disease. Septic abortion is a major cause of mortality and antibiotic cover should be considered for instrumental uterine evacuation.

The pregnant woman or girl with severe acute gastroenteritis

- Is a common cause of dehydration and shock
- Assess fluid deficit (extent of dehydration) and measure ongoing losses of fluid
- Weigh
- Keep accurate fluid balance chart
- Important to give fluids which:

  - Correct deficit
  - Provide maintenance
  - Replace ongoing losses

Differential Diagnosis

Look for abdominal mass or abdominal distension.

Remember

- HIV infections
- surgical conditions such as acute appendicitis, peritonitis, bowel obstruction (if suspected resuscitate and call for surgical opinion)
- typhoid (high grade fever, rash, hepato-splenomegaly, toxicity)
- antibiotic associated colitis
- rarely, inflammatory bowel disease

Treatment if not shocked

- Start low osmolarity ORAL REHYDRATION SOLUTION (ORS) with 1 to 2 litres over 2-4 hours
- Carer gives small amounts of ORS fluid (eg small cup)
- Gradually increase the amount as tolerated using tablespoon, cup or glass
- REASSESS HYDRATION after 2-4 hours, then progress to the maintenance phase or continue re-hydration

Severe dehydration (> or =10% fluid deficit +/-shock)

- If shocked, start IV re-hydration immediately (2 intravenous lines if possible, or long saphenous vein cut down or intra-osseous needle)
- Give 1 litre bolus of Ringer's lactate (Hartmann's) solution as rapidly as possible IV
- Reassess pulse, perfusion (capillary refill) and mental status and repeat bolus if still abnormal
- DO NOT EVER USE low sodium containing IV fluids such as 0.18% saline with 4% glucose which can be DANGEROUS if given quickly (hyponatraemia and cerebral oedema). Instead use Ringer-Lactate or Hartmann’s, ideally also containing 10% glucose (obtained by adding 100ml of 50% glucose to each 500ml)
- **When shock has resolved and the patients level of consciousness returns to normal, the remaining estimated deficit MUST BE TAKEN by mouth or by gastric tube especially if severe malnutrition and/or anaemia (danger of large IV fluid volume IV)**

Assess hydration status frequently

Oral Fluids

Recommendations for oral replacement therapy in gastroenteritis are:

- use low osmolarity ORS
- Dose = 300-500ml/hour
- giving high osmolar fluids may contribute to hypernatraemia, whilst giving water alone, or low salt drinks may cause hyponatraemia
- oral glucose within ORS enhances electrolyte and water uptake in the gut
- home made ORS can be made by adding a pinch of salt (1ml) and a handful of sugar (5ml) to a glass of clean water (250ml)

Intravenous Fluids

- even in patients who are drinking poorly, try to give enteral fluids by mouth or by gastric tube until the IV drip is running
- use Ringer's Lactate or Hartmann's Solution which has Na 131mmol/l; K 5mmol/l; HCO3 29mmol/l; Ca 2mmol/l
- Hartmann's solution has no glucose to prevent hypoglycaemia: this can be corrected by adding 100ml of 50% glucose to 500ml of Hartmann's giving approximately a 10% glucose solution (adding 50ml gives a 5% solution)
- Ringer's Lactate Solution already prepared with 5% dextrose has the added advantage of providing glucose to help prevent hypoglycaemia.
- If Ringer's Lactate or Hartmann's is unavailable, use 0.9% saline. To replace potassium losses, add 5mmol/litre of Potassium Chloride. Also it does not contain glucose and therefore add 100ml of 50% glucose to 500ml of Ringer-Lactate or Hartmann's to give approximately a 10% glucose solution (adding 50ml of 50% glucose gives a 5% solution).

- **Do NOT use plain 5% glucose solutions, or 0.18% saline + 4% glucose. They do not contain adequate electrolytes, do not correct the acidosis or hypovolaemia and can produce dangerous hyponatraemia**
- all patients should start to receive some ORS solution (about 300ml per hour) when they can drink without difficulty, which is usually within 1 - 2 hours. This provides additional base and potassium, which may not be adequately supplied by the IV fluid. Alternatively give as soon as possible by gastric tube.

Over-hydration

- oedematous (puffy) eyelids may be a sign of over hydration, cardiac failure (as in severe malnutrition), chronic malnutrition or protein losing enteropathy
- cardiac failure (especially in severe malnutrition or severe anaemia), chronic malnutrition or protein losing enteropathy
- A CXR may be helpful in showing pulmonary plethora or oedema
- stop giving ORS solution, but give plain water and food
- do not give a diuretic

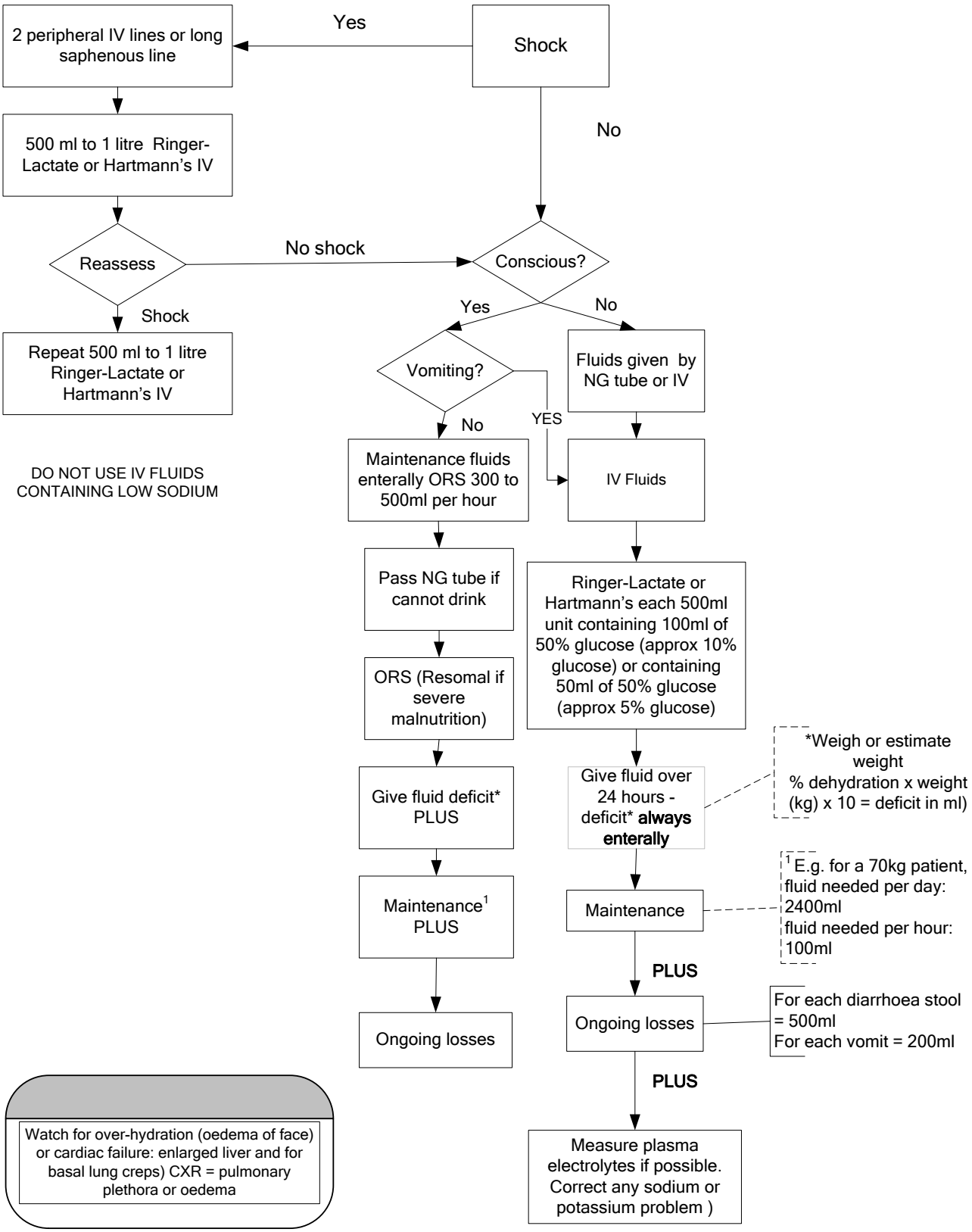
When the oedema has gone, resume giving ORS solution

Reassess

- ABC

- state of intravascular repletion
- plasma electrolytes if possible
- urine output and urine electrolytes
- give fluid according to plan, don't forget ongoing losses
- reassess regularly (including biochemistry if possible)
- don't forget glucose

Pathway of care for severe dehydration (10% or more) in pregnancy



SECTION 9 Quiz 11

1) Which of the following are features of severe sepsis in pregnancy?

a) tachypnoea
b) bradycardia
c) fever
d) altered mental state
e) shock
f) purulent vaginal discharge

2) When treating dehydration due to acute gastroenteritis in pregnancy which of the following statements are true?

a) 5% glucose or 0.18% saline plus 4% glucose are helpful when given IV if not able to take enteral fluids
b) Consider adding potassium and glucose to IV fluids
c) maintenance fluid in pregnancy is 100 ml/hour
d) % dehydration x body weight kg x 10 = deficit in ml
e) replace losses as 500 ml for each stool and 200 ml for each vomit

ANSWERS:

1. acdef 2. bcde (5% glucose or 0.18% saline with 4% glucose are dangerous in gastroenteritis)

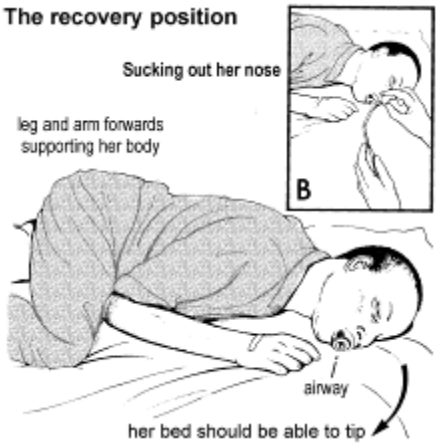
THE CONFUSED, FITTING OR UNCONSCIOUS PREGNANT WOMAN OR GIRL

Primary assessment and resuscitation

a) Airway

The patient with a reduced level of consciousness is more likely to have a compromised airway as the tongue falls into the back of the mouth. There is also a risk of aspiration. Assess the airway and maintain its patency. Apply oxygen at 15 litres per minute via a tight fitting face mask with a reservoir bag. If an anaesthetist is present intubation can be performed to protect the airway, otherwise adopt the recovery position. Careful suction of the nose and/or mouth maybe helpful.

the semi-prone or recovery position



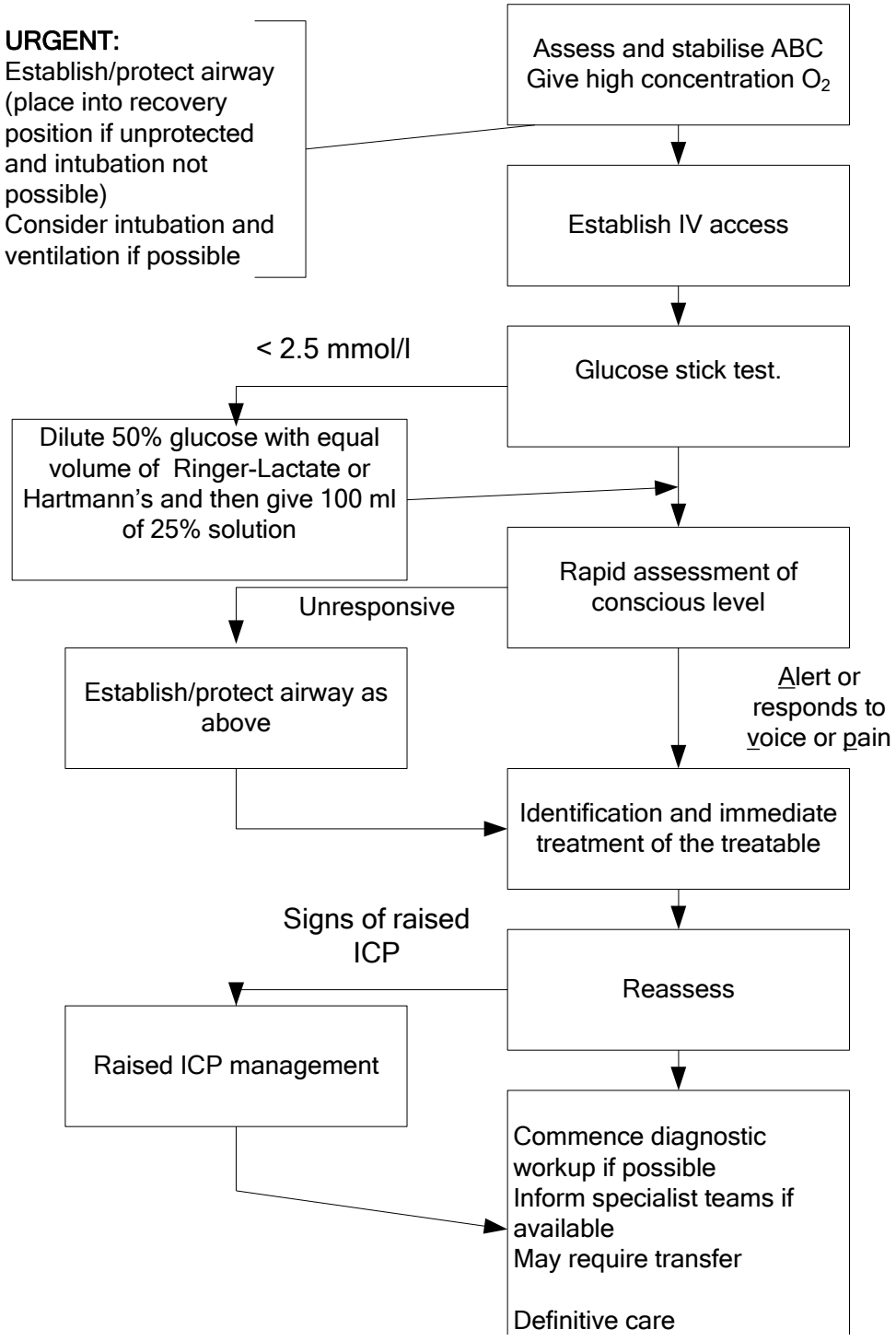
b) Breathing

Assess the breathing, give high flow O_2 via face mask and reservoir bag if necessary. Assist ventilation.

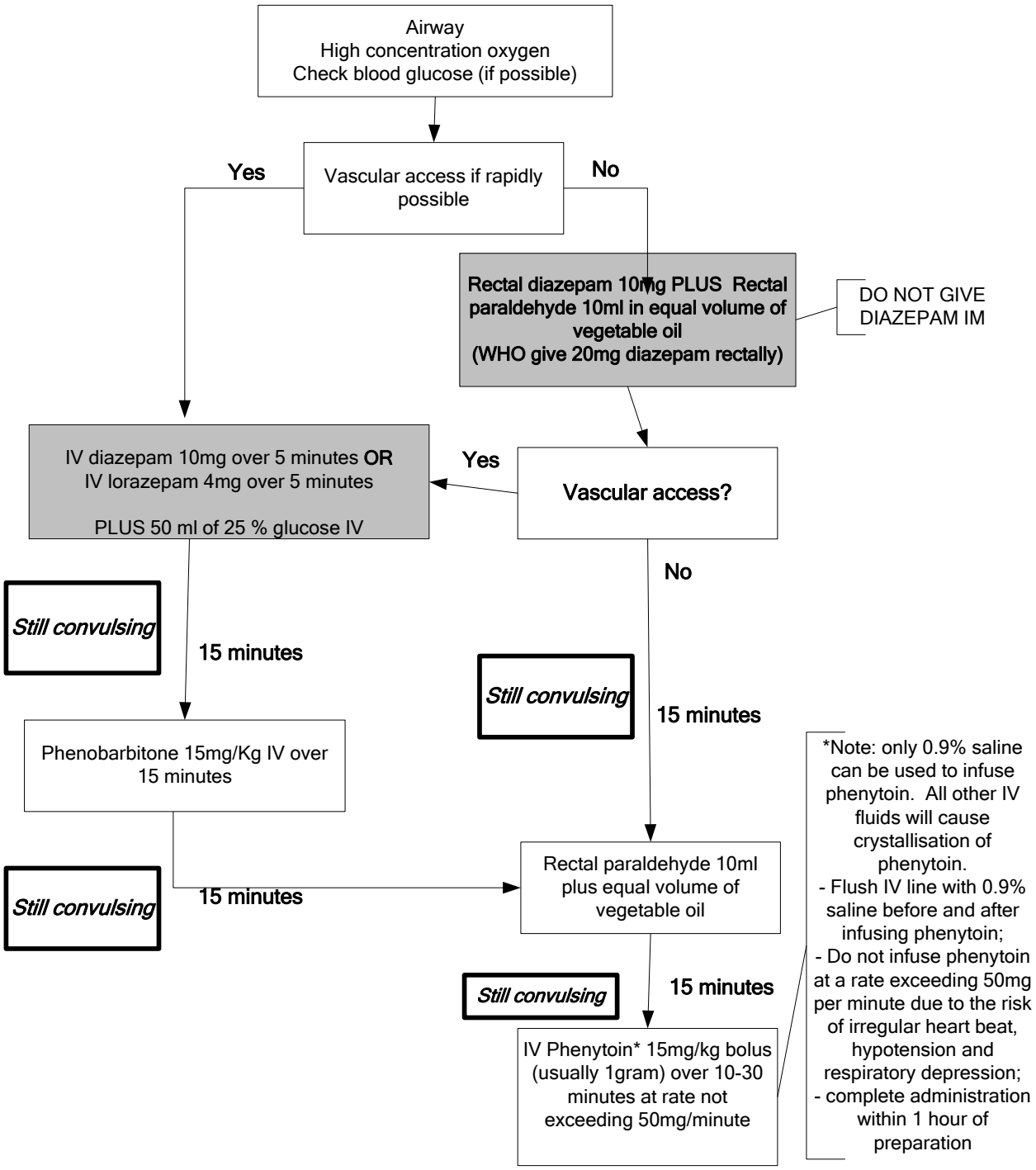
c) Circulation

Inadequate perfusion of blood to the brain initially produces confusion and later coma. Measurement of the blood pressure in addition to other markers for shock is crucial in recognising hypovolaemia after haemorrhage or unconsciousness after an eclamptic fit with hypertension. IV access should be achieved and blood sent for blood count, blood smear for malarial parasites, electrolytes, liver function tests, blood glucose, and blood culture. **If the blood sugar is low** give 50 ml of 25% glucose IV and add 100ml of 50% glucose to each 500ml of Ringer-Lactate or Hartmann's infused (10% dextrose in Ringer-Lactate or Hartmann's).

Pathway of care in coma in a pregnant woman or girl



Pathway of Care status epilepticus in pregnancy (not due to eclampsia)



When the patient is stable, consider the following causes of confusion, coma or fits.

1 Eclampsia
2 Trauma
3 Cerebral malaria

4 Meningitis
5 Pre-existing epilepsy
6 Sub-arachnoid haemorrhage
7 Cerebral thrombosis
8 Hypoglycaemia (usually if on insulin especially in early pregnancy)
9 Drug intoxication
10 Anaesthetic complications eg total spinal block.

Convulsions

If there are fits, is the pregnant woman or girl suffering from eclampsia? Test the urine for protein and measure her blood pressure.

If she is not suffering from eclampsia, prevent her having more fits with a loading dose and subsequent maintenance doses of phenytoin.

Phenytoin

Loading dose Infuse phenytoin 1 g (approximately 18 mg/kg body weight) in 50–100 ml 0.9% saline over 30 minutes (final concentration not to exceed 10 mg per ml):

Note: Only 0.9% saline can be used to infuse phenytoin. All other IV fluids will cause crystallization

Flush IV line with 0.9% saline before and after infusing phenytoin.

Do not infuse phenytoin at a rate exceeding 50 mg per minute due to the risk of arrhythmias, hypotension and respiratory depression.

Complete administration within 1 hour of preparation.

Maintenance dose

Give phenytoin 100 mg IV slowly over 2 minutes or by mouth every 8 hours beginning at least 12 hours after the loading dose.

SECTION 9 Quiz 12

1) Which of the following can cause generalised convulsions in pregnancy?

a) eclampsia
b) cerebral malaria
c) pre-existing epilepsy
d) cerebral haemorrhage
e) ectopic pregnancy

2) When managing a mother with status epilepticus not due to eclampsia please put the following treatments in order of their priority that is 1 first and 5 last

Phenytoin loading dose IV	1
ABC including high flow O_2	2
Rectal diazepam 5 – 10 mg	3
IV Lorazepam 4 mg over 5 mins	4
IV access if rapidly possible	5

ANSWERS:

1. abcd 2. Sequence is 2,5,4,3,1

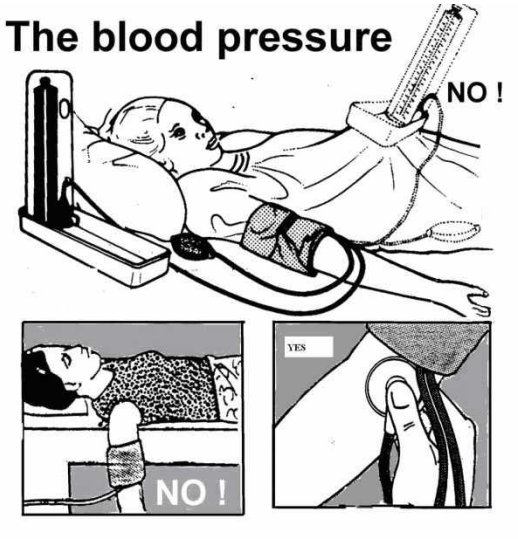
Hypertension, Pre-eclampsia and eclampsia

Introduction

Hypertension in pregnancy is when systolic BP is greater than or equal to 140 mm Hg and/or diastolic BP is greater than or equal to 90 mm Hg. If the BP is elevated, confirm by repeated measurements (see below).

Severe hypertension (systolic pressure greater than or equal to 170 mm Hg and/or diastolic blood pressure greater than or equal to 110 mm of mercury) must be treated urgently, because systolic or a diastolic blood pressure at or above these levels risks cerebral haemorrhage and hypertensive encephalopathy.

Measuring blood pressure and looking for hypertension



When you measure a woman or girl's blood pressure, she should be rested and seated at a 45° angle with the machine on the bed beside her. Don't prop it up on her abdomen. Do not lie her down as this causes compression of the central veins. Open the cuff out flat. Be sure to place the centre of the inner bladder on the artery. A falsely high reading is obtained if the cuff's bladder does not encircle at least 80% of the circumference of the arm.

If the blood pressure is consistently higher in one arm, this arm should be used for all subsequent measurements.

The systolic pressure is the onset of the first sound (K1). The diastolic pressure is the complete disappearance of sounds (K5). The normal systolic blood pressure in pregnancy is between 95 and 135 mmHg. The normal diastolic blood pressure is between 60- 85 mmHg. Diastolic blood pressure measures peripheral resistance and does not vary with the woman's emotional state to the same degree that systolic pressure does. The BP normally falls during pregnancy reaching its lowest in the second trimester and being back to pre pregnancy levels at term.

If the systolic pressure is 140 or more and/or the diastolic blood pressure is 90 mm Hg or more on two consecutive readings taken 4 hours or more apart, diagnose hypertension. If *urgent delivery is needed*, or if the systolic BP is 170 or more and/or the diastolic blood pressure is 110 mm Hg or more, repeat after 15 minutes

In addition to a blood pressure of 140/90, any increase in systolic pressure of 30 mm Hg or more or diastolic of 15 mm Hg or more over recent previous measurements requires close monitoring even if the pressures do not reach 140 systolic or 90 diastolic.

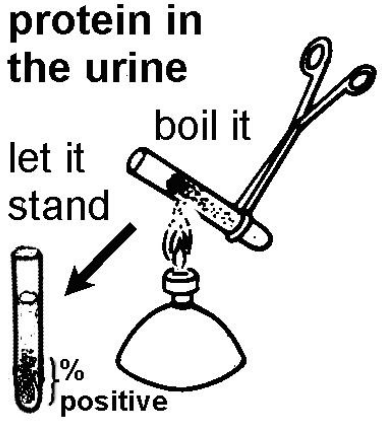
The causes of hypertension in pregnancy
These can be classified as follows:

1. **Pre-eclampsia** is hypertension (BP 140/90 or greater) after 20 weeks gestation usually, but not always, in association with proteinuria (greater than or equal to 0.3 gram in a 24 hour specimen). This level correlates with 1+ or more on dipstick testing.

Pre-eclampsia is a multi-system disorder.

Other conditions cause proteinuria, and false positive results are possible, for example from contamination with normal vaginal discharge or amniotic fluid. Urinary infection may also produce proteinuria, but rarely ≥2+. Blood in the urine due to catheter trauma, schistosomiasis and contamination from vaginal blood may also give false positive results.

Random urine sampling, such as the dipstick test for protein, is a useful screening tool. A change from negative to positive during pregnancy is a warning sign. If *dipsticks are not available*, a sample of urine can be heated to boiling in a clean test tube. Add a drop of 2% acetic acid to check for persistent precipitates that can be quantified as a percentage of protein in the sample. Only clean-catch mid-stream specimens should be used. Catheterisation for this purpose is not justified due to the risk of urinary tract infection.



Eclampsia is fitting associated with the syndrome of pre-eclampsia - seizures can occur without any previous signs or symptoms.

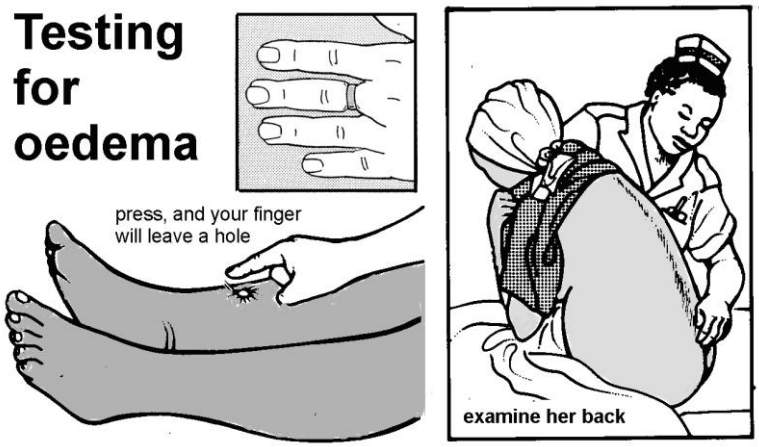
The diagnosis of preeclampsia is made when there is hypertension after 20 weeks gestation along with one or more of the following:

- Significant proteinurea (see above)
- Renal involvement (serum/plasma creatinine > 90micromol/L with or without oliguria)
- Haematological involvement (low platelets, haemolysis, DIC)
- Liver involvement (raised transaminases, epigastric or right upper quadrant abdominal pain)
- Neurological involvement (headache, persistent visual disturbances including photophobia, scotomata, blindness and retinal vasospasm, hyper-reflexia with sustained clonus, stroke)
- Pulmonary oedema
- Intra-uterine growth retardation
- Placental abruption

HELLP is a syndrome comprising **H**aemolysis, **E**levated **L**iver enzymes and **L**ow **P**latelets. It may occur in pre-eclampsia, sometimes without significant hypertension.

Pre-eclampsia and eclampsia remains one of the main causes of maternal mortality and morbidity in low resource countries. In one study, 38% of eclamptic fits occur antenatally, 18% intra-partum and the remaining 44% post-partum, usually in the first 48 hours after delivery. Sometimes the first fit occurs post-natally.

Oedema occurs equally in women with or without pre-eclampsia and is no longer part of the diagnosis. However, if oedema develops suddenly and is widespread always screen for pre-eclampsia. Test for oedema by pressing with your finger for one minute over the bony part of the pregnant woman or girl's tibia. If there is a dent when you take your finger away, there is oedema. If the pregnant woman or girl has been lying down, look for oedema over the sacrum. Oedema can also make a finger ring tight. Oedema of the face is more likely to represent a sign accompanying pre-eclampsia.



2. Gestational hypertension

This is hypertension developing only after 20 weeks gestation but with no other features of preeclampsia and which resolves within 3 months after birth. Patients presenting early in pregnancy (after 20 weeks) and with severe hypertension are more likely to develop pre-eclampsia.

3. Chronic hypertension

a) Essential hypertension occurs prior to 20 weeks without cause (see b) below)
b) Secondary to other medical conditions such as chronic renal disease, endocrine disorders or diabetes mellitus

It is important to control the hypertension in these cases keeping it below 150/100 mm Hg but not permitting the diastolic pressure to go below 80 mmHg.

4. Pre-eclampsia in a woman with chronic hypertension

Additional systemic features of pre-eclampsia (such as proteiuirea) develop after 20 weeks gestation.

Risk factors for pre-eclampsia

First pregnancy
Multiple pregnancy
Family history of pre-eclampsia
Chronic hypertension (see above)
Renal disease
Hypertension/preeclampsia during a previous pregnancy

Diabetes mellitus

Investigations
Urine dipstick test for protein and microscopy to exclude infection
Hb, platelet count
Urea and electrolytes and creatinine
Liver function tests
LDH and uric acid
Fetal growth assessment by ultrasound
If there are signs of DIC, clotting studies should be undertaken (whole blood clotting time in low resource settings: see below).

If there is severe early pregnancy hypertension, investigations (if available) for the rarer causes such as auto-immune disorders, phaechromocytoma etc. may be indicated

Management of pre-eclampsia and gestational hypertension
Preeclampsia progresses during pregnancy and the only definitive treatment is delivery. If the patient is at term (after 36 weeks) then, after stabilisation of the woman/girl, the baby should be delivered as soon as possible.

There is no evidence that bed rest improves outcome for the woman or fetus. However, heavy physical labour is clearly inappropriate. However, it is common to see women in low income settings working in this way despite being in advanced pregnancy.

Mild cases can be cared for without hospital admission but there needs to be regular at least weekly checks on BP and urine and knowledge by the family of the warning signs of severe preeclampsia or eclampsia (see below).

If there is severe pre-eclampsia or eclampsia, if the blood pressure cannot be adequately controlled, if there is pulmonary oedema, deteriorating renal or liver function, placental abruption or evidence of falling platelets or DIC, then delivery is urgent but always after stabilisation. If before 37 weeks gestation, an injection of dexamethasone or betamethasone dexamethasone 12 mg IM 2 doses 12 hours apart or 6 mg IM 4 doses 12 hours apart, improves the chances of avoiding neonatal respiratory failure (see chapter 3.1).

Stabilisation involves correction of severe hypertension, control of fluid intake and output, correction of blood clotting disorder (in low resource settings with fresh blood transfusion) and prevention/control of eclampsia (see below).

Anti hypertensive drugs for pre-eclampsia

Mild pre-eclampsia does not require anti hypertensive drugs.

In moderate pre-eclampsia, where either the systolic BP is 150-160 mmHg and/or diastolic BP 95-105mmHg on two measurements 4 hours apart treatment with oral antihypertensive drugs should be considered.

Blood pressures ≥170 mm Hg systolic and/or ≥110 mmHg diastolic must be treated with antihypertensive drugs. **However, it is essential that BP is not lowered too rapidly as this can seriously affect the woman's cerebral circulation and circulation to the placenta and fetus.**

Oral anti-hypertensive drug treatment

Methyldopa. This drug acts directly on the central nervous system and takes 24 hours to work. Doses are 250mg tds initially increasing every 2 days up to 750 mg tds. Side effects include dry mouth, postural hypotension, sedation and depression. It is contraindicated in depression and liver disease.

Labetolol. This is a beta blocker with mild alpha blocking effects. Doses are 100-400 mg tds. Side effects are bradycardia, bronchospasm, weakness, scalp tingling (only for 24-48 hours), nausea and headache. It is contraindicated in asthma.

Hydralazine. This is a vasodilator. Doses are initially 25mg bd increasing gradually to 50 mg tds. Side effects are flushing, tachycardia, palpitations, headache and, uncommonly, a lupus syndrome.

Treatment of severe hypertension
It is vital that severe hypertension is controlled at any gestation, before and after delivery.

Anti-hypertensive drugs should be given urgently to all patients with a systolic BP of ≥170 mm Hg and/or diastolic BP ≥110 mmHg.

Without urgent treatment there is a risk of cerebral haemorrhage, eclampsia and pulmonary oedema.

The aim should be a gradual and sustained reduction in BP with one or more of the following drugs.

BP must not be allowed to fall below 140/80 mmHg.

Hydralazine

This is the anti-hypertensive drug of choice. Give 5 mg IV slowly over 5 minutes (it acts within 5 minutes), then 5 mg IV every 15 minutes until *diastolic* BP is 90-100mmHg. Repeat hourly as needed, or give hydralazine 12.5mg IM every 2 hours as needed.

Alternatively, give hydralazine IV infusion, 20 mg in 200 mL 5% dextrose at 0.5 mL (10 drops) per minute **(***20 drops = 1mL for a standard giving set***),** and stop the drip when diastolic BP is 90 mm Hg or less. Hydralazine may cause increased maternal heart rate.

Side effects are flushing, tachycardia, palpitations, headache and, uncommonly, a lupus syndrome.

Labetolol

Intravenous labetolol is preferable to hydralazine if the maternal pulse rate exceeds 120 beats per minute.

Labetolol dosage is 10 mg IV. If *response is inadequate* (diastolic blood pressure remains above 110 mm Hg) after 10 minutes, give a further dose of labetolol 20 mg IV. Increase the dose to 40 mg and then 80 mg if satisfactory response is not obtained after 10 minutes of each dose.

Alternatively use an IV infusion of 200 mg in 200 mL Ringer Lactate at 40 mg/hour, increasing dose at half-hourly intervals as required to a maximum of 160 mg/hour.

Side effects are bradycardia, bronchospasm, weakness, scalp tingling (only for 24-48 hours), nausea and headache. **Labetolol is contra-indicated in asthma, as it may cause severe bronchospasm**.

Nifedipine

Nifedipine is a calcium antagonist which may be administered as an initial 10mg oral dose (onset of action within 10-20 minutes) with a repeat of 10 mg if inadequate response after 30 minutes. Subsequent oral doses are 20 mg bd. Side effects are severe headaches associated with flushing and tachycardia. Oedema, weakness and constipation may occur. It is contraindicated in aortic stenosis. It may inhibit labour. **It may interact with magnesium sulphate, and give profound hypotension and/or heart block.**

Give prophylactic magnesium sulphate if severe hypertension is accompanied by at least 2 + of proteinuria and/or symptoms suggesting that eclampsia may occur (see below).

Eclampsia or severe pre-eclampsia

Although pre-eclampsia and eclampsia are commonest in primigravidae, they can occur in multiparous patients.

{Header 2}Symptoms and signs of impending eclampsia

- Headache, visual disturbances, epigastric pain, vomiting.
- Rapidly developing generalised (especially facial) oedema
- Pulmonary oedema
- Right upper quadrant tenderness
- Recently developed hypertension ≥170/110 with proteinuria >1 g/24hours or rapid rise in blood

pressure

- Increased tendon reflexes
- Rapidly changing biochemical/haematological picture, including raised urates and low platelets (if measurable)

Differential diagnosis (*see* table)

Status epilepticus

- in patient with known epilepsy
- in severe malaria
- in head injury
- in meningitis/encephalitis

Table Differential diagnosis of hypertension and convulsions in pregnancy

Symptoms	**Signs**	**Results of Investigations**	**Diagnosis**	**Treatment**
None unless very severe	BP≥140/90mmHg before 20 weeks gestation	Urine for protein negative Renal function tests normal	Essential hypertension	Consider antihypertensive drugs
None unless very severe	BP≥140/90mmHg before 20 weeks	Proteinuria up to 2+	Hypertension secondary to	Treat hypertension with drugs if severe

	gestation		other disease such as renal impairment, auto-immune disease	and treat the underlying condition
None unless very severe	BP≥140/90mmHg after 20 weeks gestation	No proteinuria	Pregnancy induced hypertension	Treat hypertension with drugs if severe Adequate rest
None unless very severe	BP≥140/90mmHg before 20 weeks gestation	Proteinuria up to 2+	Mild to moderate pre-eclampsia	Avoid work involving heavy labour
Headaches increasing in frequency and unrelieved by paracetamol Visual disturbance Upper abdominal pain Shortness of breath Passing small amounts of urine Oedema	BP ≥140/90mmHg after 20 weeks gestation..Hyper-reflexia Passing less than 400 mL urine in 24 hours Pulmonary oedema. Facial and rapidly developing oedema	Proteinuria 2+ or more	Severe pre-eclampsia	Urgent admission to hospital Magnesium sulphate
May be history of the above Generalised convulsions Unconscious	Generalised fitting Coma BP≥140/90mmHg after 20 weeks gestation Facial and rapidly developing oedema	Proteinuria 2+ or more	Eclampsia	ABC Magnesium sulphate
Difficulty opening mouth and swallowing	Spasms face, neck, trunk. Arched back Board-like abdomen		Tetanus	ABC, Penicillin, anti tetanus immunoglobulin Muscle relaxants (magnesium and/or diazepam) NG feeding
Past history of convulsions	Convulsions Coma Normal BP	EEG abnormal	Epilepsy	ABC, blood glucose Anticonvulsant drugs
Chills/rigors Headache Muscle/joint pain	Fever Convulsions Coma Severe anaemia Jaundice	Blood smear for malarial parasites	Severe malaria	ABC, blood glucose Anti-malarial drugs
Headache Stiff neck Photophobia Vomiting	Fever Stiff neck Reduced conscious level or coma Convulsions	Full blood count Blood culture LP (unless raised	Meningitis or encephalitis	ABC Anti-bacterial or antiviral drugs

		intracranial pressure)		
Headache Blurred vision Photophobia History of migraine	Normal BP	No proteinuria	Migraine	Paracetamol Bed rest in dark room
			Cerebral venous thrombosis	

Maintain a high index of suspicion of pre-eclampsia/eclampsia even in those with malaria, migraine or epilepsy, as they may co-exist.

A small proportion of pregnant women or girls *with eclampsia have normal blood pressure. Treat all convulsions as eclampsia until another diagnosis is confirmed.*

***Convulsions with signs of pre-eclampsia indicate eclampsia**.*

Convulsions due to eclampsia:

- can occur regardless of the severity of hypertension;
- are difficult to predict but rarely occur without increased tendon reflexes, headache or visual changes;
- are tonic-clonic and resemble grand mal convulsions of epilepsy;
- may recur frequently, as in status epilepticus, and may be fatal;
- will not be observed if the woman is alone;
- may be followed by coma that lasts minutes or hours depending on the frequency of convulsions.
- occur after childbirth in about 44% of cases, usually but not always within the first 24 hours after birth. The longer the gap between delivery and a fit, the more likely the diagnosis is to be *other than* eclampsia (for example cerebral venous thrombosis).

The first eclamptic fit is usually self limiting.

Control of BP is essential in the management of severe pre-eclampsia or eclampsia where high BP may cause a cerebrovascular accident (stroke) Magnesium sulphate is essential in preventing eclampsia and, if eclampsia occurs, in preventing further fits.

Maternal complications of severe pre-eclampsia:

- eclampsia
- cerebro-vascular accident (stroke)
- renal failure
- HELLP, possible leading to rupture of liver capsule
- pulmonary oedema
- placental abruption, possibly leading to DIC

Primary assessment, resuscitation and emergency treatment of convulsions in eclampsia

Call for help

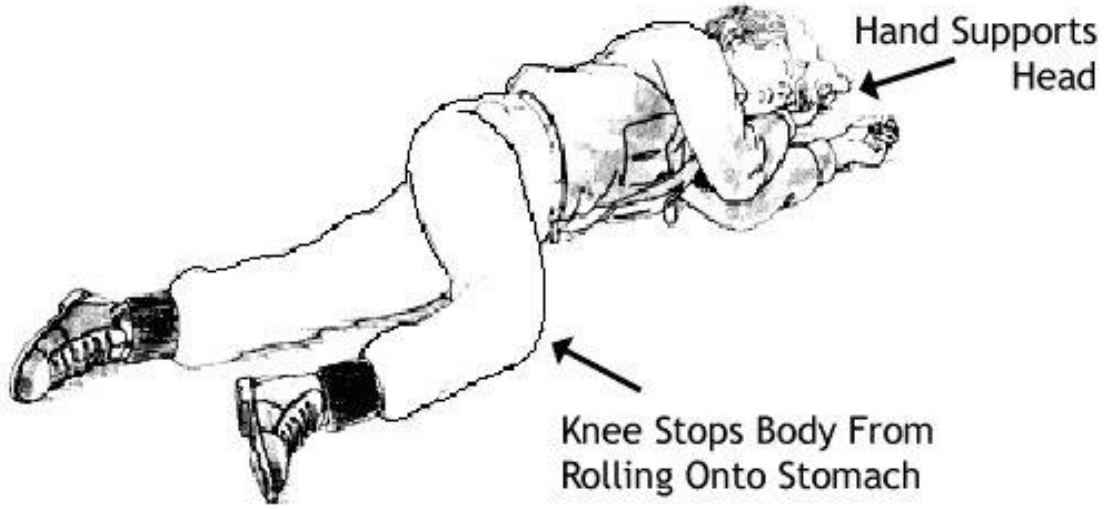
Never leave the patient alone

Prevent maternal injury during the convulsion

Airway

- If the airway is not open - use an airway opening manoeuvre and keep it open. Consider an airway adjunct such as an oropharyngeal airway or intubation
- The oropharynx may need gentle suctioning under direct vision being careful to avoid inducing laryngospasm
- The recovery position should be adopted to minimise the risk of aspiration of vomit

The recovery position



Breathing

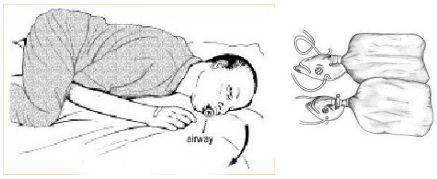
- If there is spontaneous breathing, give high concentration of oxygen via a facemask plus reservoir. Give 100% oxygen (mask with reservoir and flow rate of at least 6L/min) regardless of the pregnant woman or girl's oxygen saturation (increases fetal O_2 delivery as well as improving maternal tissue oxygenation).
- If apnoea or hypoventilation, provide chest inflations with bag-valve-mask-reservoir ventilation and 100% oxygen

Circulation

- Look for signs of life (breathing, movement, gagging/coughing) or for a pulse at the carotid: if absent or you are not sure, initiate CPR (*see* chapters 1.12 and 1.13)
- If over 20 weeks gestation, left lateral tilt and/or manually displace uterus to reduce vena caval compression
- Secure IV or intraosseous access
- Monitor blood pressure
- Attach pulse oximeter
- Insert urinary catheter with strict fluid input/output chart
- Insert a 14G-16G IV cannula and take 20 mL blood for full blood count, cross-match (4 units = 2 L) and clotting. Undertake a 20 minute whole blood clotting time (WBCT20) test if laboratory studies not available
- A central venous pressure (CVP) line may be a helpful monitor to avoid fluid overload, but the benefits must be weighed against risks. If disseminated intravascular coagulation (DIC) is established, CVP insertion is more hazardous (must avoid subclavian vein access).

Pathway of care for eclampsia (pregnant woman or girl fitting) Liberia

Call for surgical and anaesthetic help and initiate resuscitation
Protect from injury



Airway open and place in recovery position: consider oropharyngeal airway
Breathing: 100% oxygen and mask/bag if not breathing

Circulation: assess pulse and BP place in left lateral tilt and IV access
Do not overload with fluid

CONTROL FITS
Magnesium sulphate $MgSO_4$

TREAT HYPERTENSION

RECORD DRUGS GIVEN

DELIVER THE BABY

Magnesium sulphate

Loading dose: 4g IV of magnesium sulphate over 20 minutes: add 8ml 50% to 92ml Ringer-Lactate or Hartmann's.

This is followed by 10g 50% MgSO4 solution IM (5g in each buttock: deep IM injections with lidocaine as above in same syringe). **Ensure needle is not in a vein**

Maintenance dose: 5g MgSO4 50% solution with lidocaine every 4 hours into alternate buttocks

If eclampsia recurs and only after 15 minutes:

give 2g MgSO4 over 5 minutes IV : add 4ml 50% to 16ml of Ringer-Lactate or Hartmann's

Stop $MgSO_4$ if:
respiratory rate < 12-15/ minute
OR if SaO2 <94%
OR urine output< 30 ml per hour
Antidote: 10% calcium gluconate 10 ml IV over 10 minutes

Antihypertensives

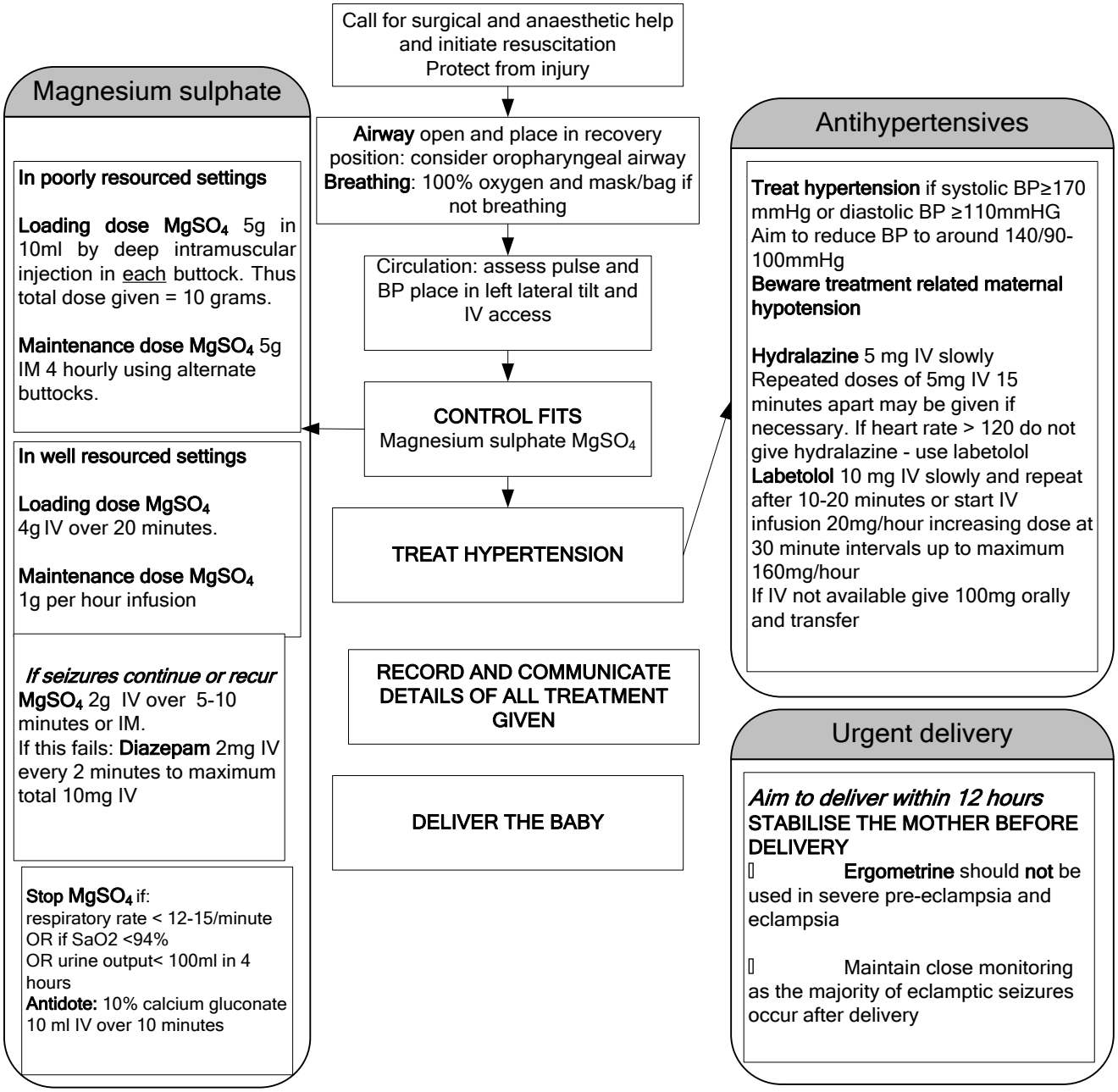
Treat hypertension if systolic BP≥170 mmHg and/or diastolic BP ≥110mmHG
Aim to reduce BP to around 140-150 systolic and/or diastolic 90-100mmHg
Do not allow BP < 140/80

Hydralazine 5 mg IV slowly
Repeated doses of 5mg IV 15 minutes apart may be given if necessary. If heart rate > 120 do not give hydralazine - use labetolol
Labetolol 10 mg IV slowly and repeat after 10-20 minutes or start IV infusion 40mg/hour increasing dose at 30 minute intervals up to maximum 160mg/hour
If IV not available give 100mg orally and transfer

Urgent delivery

Aim to deliver within 12 hours
STABILISE THE MOTHER BEFORE DELIVERY
- **Ergometrine** should **not** be used in severe pre-eclampsia and eclampsia
- Maintain close monitoring as the majority of eclamptic seizures occur after delivery

Pathway of care in eclampsia (MCAI/ALSG regime)



Emergency drug treatment of eclampsia

Stage 1 Stop convulsion and prevent further convulsions

The majority of seizures are self-limiting.

Commence *magnesium sulphate*

Magnesium sulphate ($MgSO_4$) treatment
Magnesium sulphate is the anti-convulsant of choice.

If pregnant woman or girl is conscious always warn her that there will be a feeling of warmth passing through her body when MgSO4 is infused and that this is not harmful. Failure to do so may result in the mother pulling out her IV cannula and other potentially dangerous reactions.

Loading dose in well- resourced settings
Four grams $MgSO_4$ as 20 mL of a 20% solution of magnesium sulphate IV added to 80 mL of 5% dextrose solution given slowly over 20 minutes (total 100ml). (To make 20 mL of a 20% solution, add 8 mL of 50% MgSO4 solution to 12 mL sterile water).

If convulsions recur after completion of the loading regime, give 2 g $MgSO_4$ (10 mL of 20% solution is added to 90 mL Ringer-Lactate or Hartmann's) and given IV slowly over 10 minutes.

Do not use the same IV line to inject other drugs if $MgSO_4$ is being given by IV infusion.

Loading dose in poorly - resourced settings
Five grams $MgSO_4$ (10 mL of 50% solution) by deep intramuscular injection in <u>each</u> buttock. Thus total dose given = 10 grams. *(sometimes 0.5mL of 2% 0r 1mL of 1% lignocaine is given in the same syringe for each injection of 5 grams to reduce the pain of the injections*). An aseptic technique is essential
.
Never give lignocaine intravenously, as it causes cardiac arrhythmia and death. Therefore always draw back on syringe when giving magnesium sulphate to ensure the needle is not in a vein.

Maintenance dosage

- *Well- resourced countries*: Provided there is close monitoring (ideally with a burette in giving set), give 1g $MgSO_4$/hour IV for 24 hours that is 25ml/hour of the loading dose solution of 4 grams in 100ml described above.
- *Poorly –resourced countries*: 5 g IM 4 hourly (plus 1 mL of 1% lignocaine [0.5 mL of 2%] in same syringe) using alternate buttocks.

Alternative regime recommended in Asia where pregnant women are smaller than in Africa and resources better

Loading dose: Four grams $MgSO_4$ as 20 mL of a 20% solution added to 80 mL of 5% dextrose solution slowly IV over 20 minutes (total 100ml). (To make 20 mL of a 20% solution, add 8 mL of 50% MgSO4 solution to 12 mL sterile water).
Then immediately give 3 g (6 mL of 50% solution) by deep intramuscular injection in **each** buttock. *(sometimes 1 mL of 1% or 0.5mL of 2% lignocaine is given in the same syringe to reduce the pain of the injections*)

Maintenance dose
Give 2.5 gram $MgSO_4$ IM every 4 hours in each alternate buttock.

If seizures continue or recur:

Give MgSO4 2 g < 70kg; 4 g >70kg as an extra loading dose IV over 5-10 minutes or IM in low resource settings.

Alternative regime undertaken in some West African countries and recommended in 2003 by WHO

Loading dose: 4g IV of magnesium sulphate over 20 minutes: add 8ml 50% to 92ml Ringer-Lactate or Hartmann's. This is followed by 10g 50% MgSO4 solution IM (5g in each buttock: deep IM injections with lidocaine as above in same syringe). **Ensure needle is not in a vein**

Maintenance dose is 5g MgSO4 50% solution with lidocaine every 4 hours into alternate buttocks

If eclampsia recurs and only after 15 minutes give 2g MgSO4 over 5 minutes IV : add 4ml 50% to 16ml of Ringer-Lactate or Hartmann's

Continued treatment with magnesium sulphate

Continue $MgSO_4$ for 24 hours after delivery or the last convulsion, provided that:

- **respiratory rate is > 12-16 per minute**
- **urine output > 30 mL per hour (WHO figure is >100 mL over 4 hours)**
- **tendon reflexes are present**

Discontinue magnesium sulphate when:

- BP stable and consistently below 150/100
- Diuresis started
- No neurological symptoms

Monitor the fetus by regular heart rate assessments.
A fluid blance chart must be kept (see below)

Remember to subtract volume containing $MgSO_4$ infused from total maintenance infusion volume to avoid fluid overload

When using magnesium sulphate, monitor hourly urine output, respiratory rate, SaO_2 and tendon reflexes every 15 minutes for the first 2 hours, and then every 30 minutes

Progressive symptoms of magnesium toxicity:

1. feeling of warmth, flushing, double vision, confusion, slurred speech, nausea and weakness
2. loss of tendon reflexes
3. respiratory depression (<12-15 breaths per minute) and/or SaO2 < 94%
4. respiratory arrest
5. cardiac arrest

If magnesium toxicity is suspected, stop infusion and administer antidote of 10 mL 10% calcium gluconate IV over 10 minutes.
Stop infusion of magnesium sulphate if:

- patellar reflexes are absent
- there is respiratory depression (respiratory rate less than 12-15/min) or a fall in oxygen saturation ≤92% on a pulse oximeter. Give oxygen to keep oxygen saturation 94-98%.
- urine output is less than 30 mL/hour over last 4 hours

If respiratory depression develops: give 100% oxygen by face mask with reservoir, and give calcium gluconate 1 g (= 10 mL of 10% solution) IV slowly over 5 minutes. Too rapid administration can result in loss of consciousness, cardiac arrhythmias and cardiac arrest

If respiratory arrest occurs:

- give chest inflations with bag-valve-mask ventilation with 100% oxygen
- inject calcium gluconate 1 g (10 mL of 10%) IV slowly over 5 minutes

The magnesium sulphate infusion may be recommenced at a reduced dose, if thought necessary, once normal respiration and reflexes have returned.

Note for anaesthetists: there is an increased sensitivity to muscle relaxants (particularly non-depolarising agents) in patients on magnesium.

Note for obstetricians: **If possible, avoid the use of nifedipine for lowering BP when magnesium sulphate is being used or anticipated, because of potential cardiac toxicity when the two drugs are given together.**

In patients with known renal disease or myasthenia gravis, magnesium sulphate is contraindicated and, if available, phenytoin should be used. The loading dose is 15 mg/Kg (maximum dose 2grams) over 20 minutes by slow IV injection. Subsequently a dose of 100mg bd orally can be given. IV injection if given too rapid can cause severe hypotension, cardiac arrhythmias or respiratory arrest.

Other anticonvulsant drugs

If repeated fits occur despite magnesium sulphate, give either rectal paraldehyde (dose = 10-20 mL as an enema mixed with 10 parts of Ringer Lactate; do not give if brownish colour or smells of acetic acid. NB. crosses the placenta) or rectal diazepam (dose = 500 micrograms/kg or 10-20 mg; may cause neonatal hypothermia, hypotonia and respiratory depression).

Other causes of fitting should be considered if fits persist/recur despite magnesium sulphate. These include a cerebrovascular accident (stroke), malaria and meningitis.

If magnesium sulphate is not available: use diazepam(see below)

Diazepam

Must have bag valve mask immediately available in case patient stops breathing

Loading dose

Diazepam 2 mg increments IV every 2 minutes up to 10 mg.
If convulsions recur, repeat loading dose.

Maintenance dose

Diazepam 40 mg in 500 mL Ringer-Lactate/Hartmann's, titrated to keep the pregnant woman or girl sedated but able to be woken and without hypoventilation.

Maternal respiratory depression may occur when dose exceeds 30 mg in 1 hour:

- Assist ventilation (bag-valve-mask, anaesthesia apparatus, intubation), if necessary.
  Do not give more than 100 mg in 24 hours.

*Rectal administration: g*ive diazepam rectally when IV access is not possible. The loading dose is 20 mg in a 10 mL syringe. Remove the needle, lubricate the barrel and insert the syringe into the rectum to half its length. Discharge the contents and leave the syringe in place, holding the buttocks together for 10 minutes to prevent expulsion of the drug. Alternatively, the drug may be instilled in the rectum through a catheter.

If *convulsions are not controlled within 10 minutes*, administer an additional 10 mg per hour or more, depending on the size of the woman and her clinical response.

Be prepared for neonatal resuscitation when diazepam has been used, especially if in large doses.

Severe pre-eclampsia

Stage 1 Prevention of fitting

If significant increased tendon reflexes often also with ankle clonus, before delivery or afterwards, and the patient shows other signs of impending eclampsia, (e.g. confused, jittery, has severe headache), prophylactic 'anticonvulsant' therapy (where possible magnesium sulphate) should be commenced.

Other indications for magnesium sulphate treatment where eclampsia has not yet occurred:

- Persistent hypertension despite adequate antihypertensive drugs and good fluid management
- Evidence of thrombocytopenia or liver dysfunction if these can be measured

The same regimen of magnesium sulphate (or diazepam if magnesium sulphate is not available) is used for prophylaxis as described above for the treatment of eclampsia. A loading dose alone may suffice.

Stage 2. Reduction of BP and expansion of intravascular volume.

Hypertension should be treated if ≥170/110 mm Hg as described above. Careful fetal monitoring during commencement of treatment is vital as a rapid fall in maternal blood pressure may cause fetal heart rate abnormalities, especially in a growth-restricted or compromised fetus.

If the gestation is less than 36 weeks, dexamethasone or betamethasone 12 mg IM in two doses 24 hours apart should be given to improve fetal lung maturity and decrease the risk of neonatal respiratory failure if time allows.

Anti-hypertensive drugs (see earlier)

Volume expansion during anti-hypertensive treatment

Antihypertensive agents such as nifedipine and hydralazine, act as vasodilators. In pre-eclampsia where intra-vascular volume is reduced, a small volume load should be given immediately prior to IV antihypertensive treatment (300 mL Ringer-Lactate/Hartmann's IV over 20 minutes). Better still, if available, is a colloid or starch such as Haemaccel (500 mL) which remains for longer in the intravascular compartment. Clinical examination for signs of cardiac failure should be sought before and after such treatment.

Stage 3 Anticipate/manage complications

Airway and Breathing

- Keep airway clear.

- The respiratory rate should be recorded regularly. Respiratory rate should be 15 to 40 breaths per minute.
- *Beware of* over-sedation, aspiration, pulmonary oedema and laryngeal oedema (which presents with stridor)
- If respiratory rate <12-15 breaths per minute, particularly if the pregnant woman or girl is receiving magnesium sulphate or opiates for pain control, action should be taken and other signs of toxicity sought (*see* above).
    - If an opiate is being used, naloxone may be required.
    - If magnesium sulphate is being given, stop magnesium sulphate and give calcium gluconate (*see* above).
- Oxygen can be given using nasal cannulae (ideally with SaO_2 monitoring) if SaO_2 <94%. Keep SaO_2 94-98%.
- Arrange chest X-ray if aspiration is suspected.
- An increased respiratory rate is an early sign of pulmonary oedema.

Circulation
Consider fluid balance/fluid overload (urinary catheterisation is important)

Usually there is net fluid overload in pre-eclampsia, but the fluid has leaked out of the intra vascular compartment due to low oncotic pressure (partly due to hypoalbuminaemia) and increased capillary permeability.
Complications of excessive fluid in the wrong compartment include cerebral oedema, pulmonary oedema and laryngeal oedema (stridor).

Renal failure may develop secondary to the hypertension or to intravascular hypovolaemia (or as a primary injury in severe pre-eclampsia).

Keep IV fluids at a rate less than 100 mL per hour or less than 1ml/Kg per hour (WHO suggests a rate < 1 L in 6 to 8 hours). Fluid restriction should be maintained until there is post partum diuresis which is easy to recognize as there is usually oliguria in severe pre-eclampsia. If there is APH or PPH fluid restriction will probably not be appropriate.

- Insert indwelling urinary catheter, and keep strict intake-output chart with hourly running totals. The total maintenance fluid intake should not exceed 1.5 - 2 L over 24 hours. If the average urine output is less than 30 mL per hour over a period of four hours, this is usually due to the decreased intra vascular volume and will respond to a bolus of 200 mL of IV Ringer-Lactate/Hartmann's, which can be repeated if necessary.
- In the presence of over hydration, particularly with heart failure or renal impairment, furosemide 20-40 mg IV should be given. *Mannitol is not advisable because of the fluid load resulting from its administration and because of its rebound effects*.
- Beware cardiac arrhythmias: ideally monitor potassium regularly and ECG continuously.
- Magnesium sulphate is renally excreted and so careful observation for magnesium toxicity is required if there is oliguria.
- Fluid infusion equal to the same quantity as the urinary output in the preceding hour plus 30 mL is a guide to IV fluid administration.
- Central venous pressure monitoring may be useful to guide management, especially if urine output is low. (Keep at up to +6 in a spontaneously breathing patient)

Additional organ involvement

Neurological complications

These include cerebro-vascular accidents and cerebral oedema.

Undertake regular (two hourly) neurological examination (including pupillary and tendon reflexes) and record AVPU and/or Glasgow Coma Scale (GCS) levels. All patients should open their eyes to stimulus, obey commands and respond to questions about name and age - if not they are over-sedated or may be developing cerebral complications.

GCS is made up of three components with maximum score of 15:

E	Eye-opening response (E)	Spontaneous	4
		To speech	3
		To pain	2
		None	1
M	Best motor response (M)	Obeys command	6
		Localizes to pain stimulus	5
		Withdraws	4
		Abnormal flexion/decorticate posture	3
		Extensor response/decerebrate posture	2
		No movement	1
V	Verbal response (V)	Oriented	5
		Confused	4
		Inappropriate words	3
		Incomprehensible sounds	2
		None	1

A GCS of 8 or less indicates coma and an airway that is not protected by pharyngeal/laryngeal reflexes.

Cerebral oedema is usually localised to the occipital and parietal cortical areas and is a result of cerebral vasospasm. Magnesium sulphate can help prevent this by vasodilating these vessels. Mannitol is not indicated. Recurrent convulsions despite magnesium sulphate +/- other anticonvulsants may require intubation and controlled ventilation (if available).

Haematological complications

These include disseminated intravascular coagulation (DIC).

- Group and save and cross-match fresh blood.
- Check FBC including platelet count if possible.
- Do a whole blood clotting test as well as APTT (if available) *see* 7.5. Failure of a clot to form after 7 minutes or a soft clot that breaks down easily suggests coagulopathy.
- Measurement of fibrinogen and fibrin degradation products-FDPs may be helpful if available
- If platelet count is >100 000 x 10^9, a major coagulation problem is unlikely. Spontaneous haemorrhage may occur with counts below 40,000 x 10^9.
- In frank DIC, give whole fresh blood.

Hepatic complications

These include jaundice, bleeding tendency, hepatic failure, hepatic sub-capsular oedema or hepatic rupture (the last two causing right upper quadrant or epigastric pain).

Do daily liver function tests if possible. Delivery of the baby is urgent.

Fetal problems

These include intra-uterine growth retardation, fetal distress in labour, preterm delivery as a result of obstetric intervention, fetal death due to placental abruption or fetal asphyxia in labour.

General nursing care

- Airway management as appropriate
- Inspired oxygen to keep SaO_2 94-98% or**,** if no oximetry, to keep pregnant woman or girl centrally pink (usually minimum 2 L/minute by nasal cannulae)
- Maintain patient in lateral tilt at all times before delivery
- Indwelling aseptically placed urinary catheter and hourly urine output measurement
- Change of posture two hourly
- Care of eyes and oral hygiene

HELLP (Haemolysis, Elevated Liver enzymes, Low Platelet counts) syndrome

This is a dangerous form of severe preeclampsia.
If the platelet count is <50,000 $x10^9$ there is a high risk of bleeding and if bleeding occurs in the absence of platelet transfusions, fresh blood may be helpful.
Liver dysfunction may cause upper abdominal pain and lowering of the BP may help. Delivery is urgent

Stage 4. Delivery of the baby

The need for in-utero transfer should be considered, particularly if there are maternal complications likely to require a caesarean section or high dependency care. The need for delivery is dependent on the maternal and fetal conditions. Either caesarean section (CS) or induction of labour may be appropriate, depending on the clinical findings. Although delivery will resolve the disease, it is inappropriate to deliver an unstable pregnant woman or girl, even if there is fetal distress. Once eclamptic seizures are controlled, severe hypertension treated and any hypoxaemia corrected, delivery can be expedited.

In severe pre-eclampsia, aim to deliver within 24 hours of symptoms. In eclampsia, aim to deliver within 12 hours of the onset of convulsions.

It is important to stabilise the pregnant woman or girl's condition first – then decide about the mode of delivery

In selected patients, labour may <u>be induced</u> if the following conditions apply:

- the cervix is favourable
- the maternal condition is stable, – eclampsia and blood pressure are controlled - there is no fetal distress and a cephalic presentation

Assess the cervix

- If the *cervix is favourable* (soft, thin, partly dilated), rupture the membranes with an amniotic hook or a Kocher's forceps, and induce labour using an oxytocin infusion (see chapter 2.3) or oral misoprostol (see chapter 2.3 and below).
- If *vaginal delivery is not anticipated* within 12 hours (for eclampsia) or 24 hours (for severe pre-eclampsia), deliver by CS.
- If there are *fetal heart rate abnormalities* (less than 110 or more than 160 beats per minute), consider CS if safe for the pregnant woman or girl.

- If the *cervix is unfavourable* (firm, thick, closed) and the *fetus is alive*, deliver by CS if the pregnant woman or girl is adequately resuscitated.
- If *there are no facilities for caesarean section* or if the *fetus is dead or too premature for survival* then deliver vaginally.

Aiming for vaginal delivery

If the *cervix is unfavourable* (firm, thick, closed), and the fetus is alive, caesarean section should be carried out. If the fetus is dead, consideration should be given to induction of labour using misoprostol (unless there has been a previous caesarean section when misoprostol is contraindicated).
There are many possible misoprostol regimens for induction of labor (vaginal misoprostol tablet, oral misoprostol solution or oral misoprostol tablet). Each has been widely used. The latest evidence is that oral misoprostol solution is the most appropriate treatment (Cochrane reviews).

Oral misoprostol solution. A single misoprostol tablet is dissolved in drinking water (200 micro grams tablet in 200 mL water or a 100 micrograms tablet in 100 mL of water), and 20-25 mL of misoprostol solution(20-25 micrograms) is then given every two hours. The solution is stable for up to 24 hours at room temperature but should then be discarded

Oral misoprostol tablets. 100 microgram misoprostol tablets cut to 25 micrograms size and administered orally every 2 hours to a maximum of 6 doses. However, this may not be very accurate and there is a danger of incorrect dosage: the solution above is much safer.

Caesarian section (CS)

If CS is performed, ensure that coagulopathy has been treated. Have fresh blood for transfusion available.

Spinal anaesthesia is usually safer than GA for Caesarean section unless there is a contraindication ie. maternal refusal, coagulopathy, thrombocytopenia, decreased conscious level or ongoing seizures. There does not appear to be an exaggerated decrease in blood pressure after spinal anaesthesia and vasopressors (such as ephidrene, should be used cautiously to avoid a hypertensive response. An IV bolus of 500ml of Ringer-Lactate or Hartmann's may occasionally be required if BP does fall.

General anaesthesia in severe preeclampsia/eclampsia is high risk – there may be laryngeal oedema making airway management difficult and increases in blood pressure during intubation and extubation, risking intracranial haemorrhage. Drugs to weaken the vasopressor response to intubation should be used.

Local anaesthesia or ketamine in women with pre-eclampsia or eclampsia are contraindicated unless facilities and/or expertise dictate that these are the safest options in that situation.

Stage 5. Management after delivery

- If post-eclampsia or at high risk of convulsions, continue parenteral anticonvulsants i.e. magnesium sulphate (or diazepam if $MgSO_4$ is not available) for 24 hours after birth. Continue for as long as the patient has increased tendon reflexes.
- **Do not give ergometrine to women with pre-eclampsia, eclampsia or high blood pressure because it increases the risk of convulsions and cerebrovascular accidents.**
- Monitor the mother closely.
- Use antihypertensive agents if diastolic BP > 105-110 or systolic BP >160mmHg.

- Continue oxytocin infusion to keep the uterus contracted.
- **Syntometrine (which contains ergometrine and can cause/worsen hypertension) is contraindicated.** Give oxytocin alone or with misoprostol and avoid possible hypertensive effects of ergometrine. If post partum haemorrhage manage as in chapter 2.5.D.iv.
- Keep in delivery unit/high observation area for at least 24 hours after the last fit.
- Review need for further anti-convulsants and anti-hypertensives.
- Regular monitoring.
- Plans for care should be communicated with the patient and her attendants. The attendants should be educated about the left lateral tilt pre delivery, recovery position post convulsion, risk of aspiration of food and care of IV site.
- Before going home, the family and attendants should be warned about the risk of postnatal depression, especially if the outcome has been poor. The woman/girl should be followed up closely in the community.
- Antenatal care by the hospital during a future pregnancy is important. There is an increased risk of preeclampsia and hypertension if these problems have been present.
- All patients are at risk of deep vein thrombosis and so close observation and appropriate treatment when identified are important (see chapter 2.5.H). Anti-embolism stockings and low molecular weight heparin prophylaxis should be considered early on.

Hypertension may take many days and even up to 3 months to resolve. Resolution will happen if the diagnosis is pre-eclampsia unless there is an underlying medical cause

Monitoring and preparation for emergencies

- Pulse rate and volume, BP, respiratory rate and oxygen saturation regularly.
- Monitor fluid intake and urinary output hourly.
- Monitor AVPU/GCS, reflexes, and pupil responses hourly.
- Monitor for confusion and visual disturbance.
- Monitor fetus regularly.

Record all drugs used.

Each maternity unit should have an emergency box to ensure that appropriate equipment and drugs are readily available.

Emergency box for eclampsia	
Equipment	Quantity
Drugs	Magnesium sulphate 50%, 5 g in 10 mL ampoule x 10 ampoules Calcium gluconate 10% 10 mL ampoule x 2 ampoules Hydralazine 20 mg in 1 mL ampoule x 2 ampoules Labetalol 200 mg in 20 mL ampoule x 1 ampoule 0.9% Sodium chloride 10 mL ampoule x 10 ampoule Diazepam 5mg/ml ampoules x 20
Intravenous fluids	500 mL bag of Ringer-Lactate/Hartmann's Giving set x 1 IV blood giving set x 1
Venous access	20-gauge Cannula (pink) x 2 18-gauge cannula (green) x 2 16-gauge cannula (grey) x 2 Tourniquet x 1 Fixation tape x 1 roll

Airway equipment	Guedel airways: sizes 4, 3, and 2 **Self inflating bag, mask and valve** Green oxygen tubing 2 meters and high and Medium Concentration (MC) facemasks for oxygen delivery Yankaeur sucker
Other equipment	50 mL syringe x 2 20 ml syringe x 2 10 mL syringe x 2 Green needles x 2 Patella hammer x 1 Urinary catheter Charts for vital signs and fluid balance

SECTION 9 Quiz 13

1) **Which of the following are features of pre-eclampsia or eclampsia?**
   a) High BP
   b) proteinuria
   c) oedema
   d) a risk of generalised convulsions
   e) abdominal pain

2) **Which of the following BP levels could indicate pre-eclampsia?**
   a) 150/90
   b) 130/80
   c) 160/110

3) **Which of the following are complications of severe pre-eclampsia or eclampsia?**
   a) HELLP
   b) Cerebrovascular accident
   c) Ruptured uterus
   d) Pulmonary oedema

ANSWERS:
1. abcde 2. ac 3. abd

SECTION 9 Quiz 14

1) **In severe pre-eclampsia which of the following levels of BP need urgent antihypertensive drug treatment?**
   a) 180/110
   b) 200/100
   c) 160/100

2) **When managing a mother with eclampsia please put the following treatments in order of their priority**

Breathing high level O_2	1
IV access/fluid restriction < 100 ml/hour	2
Call for help and do not leave alone	3
Treat hypertension if > 170/110 to levels of around 130 – 140 systolic	4
Magnesium sulphate	5
Airway including recovery position	6
Deliver the baby	7

ANSWERS:
1. ab 2. sequence is 3,6,1,5,4,2,7

SECTION 9 Quiz 15

1) **When treating eclampsia or imminent eclampsia with Magnesium sulphate which of the following are true?**
   a) Magnesium is second line treatment after Diazepam
   b) can be given IV or IM (IM is safer in poorly resourced settings)
   c) should be discontinued if patella reflexes are absent or respiratory rate < 15/min or urine output < 30 ml/hour over previous 4 hours

2) **Which of the following are side effects of Magnesium sulphate treatment?**
   a) warmth – flushing
   b) headache
   c) absent tendon reflexes
   d) respiratory depression

ANSWERS:
2. bc 2. acd

Meningitis

Signs and symptoms:

- Headache
- Vomiting
- Neck stiffness
- Opisthotonus
- Photophobia
- Rash
- Altered consciousness

A lumbar puncture may be dangerous in the presence of raised intracranial pressure. High dose IV antibiotics will be needed for at least 10 days.

Severe complicated malaria, *usually falciparum*

Severe malaria is a complex, multi-system disease, which constitutes a medical emergency.

Mortality approaches 100% without treatment, and death often occurs within the first few hours. Prompt initiation of antimalarial treatment in peripheral health facilities and comprehensive management in hospital are necessary to prevent deaths.

Care should be provided within 15 minutes of arrival at a health facility. **Triage systems** should be in place in health centres and hospitals to pick up severely ill patients, referral should be rapid, and emergency facilities be instituted in hospitals with a high standard of medical and nursing care available 24 hours a day.

Any seriously ill or unconscious patient in a malaria endemic area must be tested for malaria by RDT (remember that parasites may not be present in the peripheral blood of a patient with cerebral malaria).

Even if a diagnostic test is not available **the patient should be given an antimalarial before transfer to the hospital (IV, IM, or rectally depending on the skill of the staff in the facility.)** This can be repeated if transfer is impossible or is delayed for more than 12 hours. ***A note of what has been given should be sent with the patient as soon as transfer can be arranged.***

If any doubt exists about the diagnosis it is safer to treat than not to treat before transfer.

Immediate measures (in hospital):

- Vital signs: temperature, pulse, blood pressure, respiration (rate and depth)
- State of hydration
- Estimation or measurement of body weight
- Level of consciousness (AVPU or Glasgow coma scales)
    - *The depth of coma may be assessed rapidly by observing the response to standard vocal or painful stimuli (rub knuckles on the woman's sternum; if there is no response, apply firm pressure on thumbnail bed).*

- RDT and malaria smear (thick and thin film) for diagnosis and for continued monitoring of the progress of the disease. **Do not wait for a malaria smear result before initiating treatment as it can take up to an hour.** If the RDT is positive, commence treatment immediately.
- Lumbar puncture if patient is unconscious to eliminate meningitis[1].
- Measurement of glucose (finger prick), haemoglobin and haematocrit (Packed Cell Volume (PCV)).
- Group and cross match blood and **search for a suitable donor**.
- **Parenteral treatment (see below for details):**
    - First choice: IV artesunate (2.4 mg/kg by slow IV injections at 0, 12 and 24 hours)
    - Second choice: IM artemether (loading dose of 3.2 mg/kg followed by 1.6mg/kg every 24 hours)
    - *If artemisinins are not available or the MoH does not allow their use, commence with a loading dose of quinine 20mg/kg by slow infusion over 4 hours followed by 10mg per kg every 8 hours for 7 days or until the patient is able to take oral drugs.*

Every effort should be made to convince the authorities to allow the use of artemisinins to treat severe malaria in hospital as mortality may be reduced by up to 30% over the use of quinine.

Additional measures where needed:

- Insert nasogastric tube to minimize the risk of aspiration pneumonia if the patient's level of consciousness is low. *This can also be used to give food to prevent hypoglycaemia if the patient is unconscious for a long period and is unable to eat.*
- Insert IV cannula and restore circulating volume.
    - ***Fluids should be given with caution*** *and the need for them assessed on an individual basis after ascertaining the nutritional status and degree of dehydration present.*
    - ***In general, patients with metabolic acidosis who have not previously received parenteral fluids are dehydrated and should be managed accordingly.***
- Give oxygen, especially if metabolic acidosis is suspected or shock is present.
- Treat severe anaemia with a safe blood transfusion if the patient is showing signs of decompensation.
- Give anticonvulsants (diazepam preferred initially then phenytoin if convulsions persist) if the patient is fitting to prevent long term neurological damage.

Convulsions are common before or after the onset of coma. They are significantly associated with morbidity and sequelae. They may present in a very subtle way – important signs include intermittent nystagmus, salivation, minor twitching of a single digit or a corner of the mouth and an irregular breathing pattern.

[1] There is some disagreement about whether a lumbar puncture should be done routinely in a patient with suspected cerebral malaria. Only a lumbar puncture can rule out bacterial meningitis. If it is decided to delay lumbar puncture, antibiotics must be given to cover the possibility of bacterial meningitis.

- Prophylactic anticonvulsants have been recommended in the past, but recent evidence suggests that **phenobarbital is harmful.**
- IV broad spectrum antibiotics should be given routinely in an unconscious patient.

The patient will need intensive nursing care at least until they regain consciousness. The patient may urgently need glucose or a blood transfusion if hypoglycaemia or haemolysis is severe.

Special issues regarding severe malaria in pregnancy

Severe malaria is malaria with severe drowsiness, coma, vomiting, inability to walk, jaundice, fits or pulmonary oedema. These women are usually non-immune multigravida, or semi-immune primagravida, with falciparum malaria.

Severe malaria in pregnancy may be misdiagnosed as eclampsia. **If a pregnant woman living in a malarial area has fever, headaches or convulsions and malaria cannot be excluded, it is essential to treat the woman for both malaria and eclampsia**.

Pregnant women with severe malaria are particularly prone to hypoglycaemia, pulmonary oedema, anaemia and coma.

Malaria is especially dangerous during the last trimester.

Treat malaria in pregnancy urgently and early!

Calculate the dose in mg/kg. If you cannot weigh the patient, an average pregnant woman weighs about 60 kg, a small woman weighs around 50Kg and a large woman 70Kg. Don't confuse doses of salt and base. Quinine is usually prescribed as the salt (10 mg of quinine dihydrochloride = 8.3 mg of base).

Where available, artesunate IV or artemether IM are the drugs of choice in the second and third trimesters. Their use in the first trimester must balance their advantages over quinine (better tolerability, less hypoglycaemia) against the limited documentation of pregnancy outcomes. *Artemesin* and *artesunate* may be given rectally.

IV/IM Artesunate

Artesunate IV/IM: 2.4 mg/kg by direct IV (over 5 minutes) or IM injection at 0, 12 and 24 hours; then once daily until oral therapy is possible.

A solution for parenteral use should be prepared for either IV (10 mg/ml) or IM (20mg/ml) use, following manufacturer's instructions, using the sodium bicarbonate and saline solution supplied to dilute the concentrated artesunate.

For a small pregnant woman (estimated 50 KG body weight) each dose would be 12ml IV (10mg/ml) or 6ml IM (20mg/ml)

Artesunate IM should be administered in the antero-lateral thigh, drawing back before injection to ensure needle is not in a vein.

IM Artemether

Artemether IM: loading dose 3.2 mg/kg on Day 0, followed by 1.6 mg/kg daily for at least 2 more doses, then continue until oral therapy is possible.

A 80mg/ml presentation is preferred to reduce the volume of the injection.

For a small pregnant woman (estimated 50 KG body weight) each dose would be 2ml IM (80mg/ml)

Artemether IM should be administered in the antero-lateral thigh drawing back before injection to ensure needle is not in a vein.

Artemether is not well absorbed in shock; an alternative treatment (parenteral or rectal artesunate, IV quinine) should be chosen.

Rectal artesunate

- Should be available in all rural settings, including settings with trained village health workers
- Can be given at 12 hourly intervals
- The minimum dose is 10mg/kg. Larger doses are not harmful but are not more effective
- Can also be given to vomiting patients, or those unable to tolerate oral drugs
- Must always be followed by a full course of ACT when the patient is able to take oral drugs

At present, WHO only recommends rectal artesunate as a pre-referral treatment. Where referral is not possible ensure that a full course of ACT is given as soon as the patient is able to take oral treatment.

Available as a rectal capsule: 50 mg and 200 mg
(WHO approved rectal capsule to be available soon as 100 and 400 mg presentation)

Dose is 10mg/Kg and therefore average sized pregnant woman or girl needs 600mg per dose.
Give 3 of 200 mg rectal suppositories at 0, 12, 24, 36, 48 and 60 hours.

Follow on treatment

When the patient has received at least 3 parenteral doses of artesunate or artemether, and is able to tolerate oral intake, give a full course (3 days) of **ACT** orally.

If artesuante or arthemer are not available:

Give Quinine dihydrochloride

Always give quinine with glucose

LOADING DOSE

Infuse quinine dihydrochloride 20 mg/kg body weight (usually 1.2 grams for the average 60 kg pregnant woman) in 500ml of IV fluids (Ringer-Lactate or Hartmann's plus 5 or 10% glucose or Ringer's lactate plus 5 or 10% glucose) over 4 to 8 hours hours. Don't let it go in too quickly. Quinine is usually available in 2 ml ampoules of 150 mg/ml, where 1.2 g is thus 8 ml.

Do not give quinine in 5% dextrose solutions as there is a danger of hyponatraemia. Add 50ml of 50% glucose to 500ml Ringer-Lactate or Hartmann's to produce Ringer-Lactate or Hartmann's plus 5% glucose solutions. Add 100ml of 50% glucose to Ringer-Lactate or Hartmann's to give 10% glucose solutions

Never give an IV bolus injection of quinine as it is likely to cause cardiac arrest

- If it is **definitely known that the** pregnant woman or girl **has taken an adequate dose of quinine** (1.2 g) within the preceding 12 hours, do **not** give the loading dose. Proceed with the maintenance dose (see below).

- If the **history of treatment is not known or is unclear**, give the loading dose of quinine.

Alternatively omit the loading dose if the patient has received 3 or more doses of quinine in the last 48 hours, or mefloquine or halofantrine within the last 3 days.

• Wait 8 hours before giving the maintenance dose.

MAINTENANCE DOSE

Infuse quinine dihydrochloride 10 mg/kg body weight (usually 600mg for the average pregnant woman) in 500ml of fluids IV over 4 hours. Repeat every 8 hours (i.e. quinine infusion for 4 hours, no quinine for 4 hours, quinine infusion for 4 hours, etc.) for 24 hours and then change to oral medication if the woman is conscious and able to safely swallow.

For follow on oral treatment give a 3 day course of **ACT or seven days of oral quinine**. (If the combination AS+MQ is used, wait 12 hours after the last dose of quinine before giving MQ. Do not use AS+MQ if the patient developed neurological signs during the acute phase.)

The dose of oral quinine dihydrochloride or quinine sulfate 10 mg/kg body weight (usually 600mg for the average size of pregnant woman) by mouth every 8 hours to complete 7 days of treatment. Ask the patient to swallow tablets quickly with milk.

Note: **Monitor blood glucose levels for hypoglycaemia every hour while the patient is receiving quinine IV.**

Quinine may enhance the risk of hypoglycaemia and may cause haemolysis in patients with G6PD and this may result in the passage of blood in the urine called Blackwater Fever.

Make sure plenty of fluids are given so that the urine output is adequate. Keep a strict fluid balance chart. Monitor the volume of fluid you give, and the urine output. Don't overload with fluid.

If the haemoglobin falls below 6 g/dl try to give blood but observe closely for fluid overload (see pages XX). When improving give iron and folate tablets.

Intramuscular quinine

If you cannot place an IV line, you can give quinine IM – at strength of not more than 60 mg/ml. Some ampoules are 60 mg/ml (usually 10 ml ampoules). Some ampoules are 300 mg/ml or 600 mg/ml. Dilute these in 0.9% saline to a concentration of 60 mg/ml. (For example, 600 mg of quinine in 10 ml of saline). If you don't dilute quinine, the pregnant woman or girl may get an injection abscess. Use the same dose as you would give IV. Give half the dose into each anterior thigh.

When giving quinine by IM injection, regularly draw back to ensure needle is not in a vein as an IV injection of quinine is likely to cause cardiac arrest.

Continuing care of pregnant women or girls with severe malaria in hospital

This should include:

- Nurse in the lateral position if > 20 weeks pregnant to avoid inferior vena caval compression.
- If unconscious, nurse in the recovery position, alternating sides frequently.
- Observe hourly pulse, blood pressure, respiratory rate, level of consciousness (using the AVPU scale-see pages XX).
- Frequent measurement of blood glucose (every hour if reduced conscious level, especially when receiving quinine and/or where the level of consciousness does not improve).
- If patient is conscious, regularly (4 hourly) determine blood glucose to exclude hypoglycaemia if the patient is not eating well. This is especially important in pregnant women especially those receiving quinine therapy.
- A daily microscopic blood slide to determine level of parasitaemia and to follow treatment efficacy.
- Regular haemoglobin measurement. The frequency will depend on the rate of red blood cell breakdown. This may be very rapid in cases of high parasite density.
- Blood transfusion where necessary with careful monitoring to prevent fluid overload. Packed cells should be used where possible. If overload is suspected, give a single dose of frusemide: 20mg IV.
- If unconscious or in shock, administer IV broad spectrum antibiotics to mange septicaemia, pneumonia or meningitis, which are often associated with cerebral malaria.
- Oxygen for patients in respiratory distress.
- Blood gases and urea and electrolytes where possible.
- Controlled IV fluids.
- Fluid balance charts: unconscious patients should be catheterised to measure urine output and facilitate correct fluid balance and to detect possible renal failure.

Fluid replacement

If the patient is unable to drink, maintain daily fluid requirements using the NG (preferred) or IV (greater risk of fluid overload) route. Measure urine output (a foley catheter should be used in unconscious patients).

Weight	Daily fluid requirement	Hourly fluid requirement
In pregnancy	50 ml/kg	2.1 ml/kg

IV Fluids: a Ringer-Lactate or Hartmann's + glucose mix is commonly recommended. Use a 10% glucose mix with Ringer-Lactate or Hartmann's if hypoglycaemia is identified. Monitor carefully for fluid overload, especially when the IV route is used. Switch to the oral route as soon as possible.

Fluids given should be included in the daily fluid requirement totals to avoid over-hydration.

Antibiotics

All patients who are in shock or who remain severely ill following resuscitation should receive a presumptive treatment with broad spectrum IV antibiotics.

Unconscious patients should have a lumbar puncture to exclude meningitis. Where this is not possible a presumptive treatment with a suitable antibiotic should be given.

Management of complications of severe malaria which are life-threatening

Severe anaemia (due to haemolysis)

Monitor haemoglobin levels daily.

Severe haemolytic anaemia: <5gms Hb/dl or HCT < 15

Severe anaemia may be the presenting feature in malaria. Patients with severe anaemia, especially pregnant women, should be tested for malaria.

- Establish safe transfusion as soon as possible
- Transfuse with screened blood only if severely symptomatic. For patients with Hb < 5g or HCT < 15, recheck haemoglobin at least every 4 hours. Transfuse if haemoglobin starts to fall or symptoms develop.
    - Packed cells are preferred for transfusion in pregnancy. Allow red blood cells to settle at the bottom of the bag, and stop infusion when cells have been used.
    - Perform microscopy following transfusion, and repeat or extend antimalarial treatment if parasitaemia is increasing.
- **Transfusion rates** may depend on the status of the patient. Take caution with malnourished patients.
- **Suggested rates:** 2 of 500ml units over 4-6 hours giving IV 20mg of frusemide with each 500ml.
- If the patient shows signs of fluid overload, give additional **frusemide**
    - 20 mg IV
    - Repeat after 1–2 hours if indicated

Give ferrous sulfate or ferrous fumerate 60 mg by mouth PLUS folic acid 5mg by mouth once daily upon discharge.

Hypoglycaemia

Hypoglycaemia: < 2.5 mmol/L glucose

Check for hypoglycaemia in patients who are unconscious, in shock or deteriorating especially if malnourished, and all patients receiving quinine. Often it causes no symptoms until it results in coma and death. Watch for abnormal behaviour, sweating, and sudden coma. Always give glucose with quinine. If drowsy, delirious or unconscious, don't assume the pregnant woman or girl has cerebral malaria: she is probably hypoglycaemic.

Treat with IV glucose infusion[2]:

50 ml of 25% glucose over 15 minutes. If you give 50% glucose it irritates the veins, so dilute it with sterile water or Ringer-Lactate or Hartmann's to make a 25% solution. Then give 500ml of 5% dextrose in Ringer-Lactate or Hartmann's over 8 hours (see above how to make this).

If you don't have IV glucose, give sugar water by mouth or by nasogastric tube. Dissolve 4 level teaspoons (20 g) in a 200 ml cup of clean water.

Retest 15 minutes after completion of infusion, and repeat infusion if blood glucose remains low. Repeat until blood glucose recovers, then infuse with 5–10% glucose in Ringer-Lactate or Hartmann's (according to hypoglycaemia risk) to prevent recurrence. Ensure regular feeding when oral intake can be sustained. Fluids used to treat hypoglycaemia must be included in daily fluid requirements.

N.B. Hypoglycaemia is a major cause of death in severe malaria patients, especially in pregnant women. Remember that quinine will potentiate hypoglycaemia. Patients should receive regular feeding, including by NG tube, when unable to take oral foods.

Fluid balance problems

Maintain a strict fluid balance chart and monitor the amount of fluids administered and urine output to ensure that there is no fluid overload. Assess clinical status regularly.

Note: Pregnant women with severe malaria are prone to fluid overload.

If **urine output is poor** (less than 30 ml per hour):

- Rehydrate with IV fluids (Ringer-Lactate or Hartmann's).

If **urine output does not improve**, give frusemide 40 mg IV as a single dose and monitor urine output.

If **urine output is still poor** (less than 30 mL per hour over 4 hours) and the **serum creatinine is more than 2.9 mg/dL**, refer the pregnant woman or girl to a tertiary care centre for management of renal failure (if available).

Pulmonary oedema is very dangerous. The pregnant woman or girl may have it on admission, or it may come after several days. Fast difficult breathing is the first sign. Frothy (bubbly) fluid may be coming from the mouth. It causes hypoxia, fits, coma and death. It can also be caused by too much fluid. Sometimes it is caused by malaria and too much IV fluid, so watch the central (JVP) venous pressure regularly and ideally if skilled measure central venous pressure.

- Keep upright, so prop up with pillows and lower the foot of the bed.
- Give high concentrations of oxygen using face mask and reservoir
- Give frusemide 40 mg IV. If there is no response (no increase in urine output) increase the dose progressively, every 4 hours, to a maximum of 200 mg
- If the woman might be getting too much IV fluid, stop all drips
- If the woman does not improve, withdraw 250 ml of blood into a transfusion bag. Give it back to her later.

Convulsions

[2] An NG tube may be used if IV access is not possible

If there are FITS, has the pregnant woman or girl got eclampsia? Test the urine for protein and measure her blood pressure.

If she has eclampsia treat with magnesium sulphate. If she does not have eclampsia, prevent more fits with anticonvulsants.

Note: *seizure activity in cerebral malaria needs to be looked for carefully as it may just appear as a twitching of the thumb or mouth.*

Give diazepam: 10 mg PR or by slow IV injection over 2 minutes.

Do not exceed 10 mg /dose. Always have a bag valve mask of suitable size available in case the pregnant woman or girl stops breathing.

Alternatively, paraldehyde 0.1 ml/kg of body weight may be given by deep intramuscular injection (usually 6ml total dose) or 0.4 ml/kg of body weight (usually 24ml) intra-rectally using a sterile glass syringe (a disposable plastic syringe may be used provided that the injection is given immediately after the paraldehyde is drawn up and the syringe is never reused).

Consider preventing subsequent convulsions with phenytoin (below).

Phenytoin

Loading dose

Infuse phenytoin 1 g (approximately 18 mg/kg body weight) in 50–100 ml 0.9% saline over 30 minutes (final concentration not to exceed 10 mg per ml):

Note: Only 0.9% saline can be used to infuse phenytoin: all other IV fluids will cause crystallization of phenytoin.

Flush IV line with 0.9% saline before and after infusing phenytoin;

Do not infuse phenytoin at a rate exceeding 50 mg per minute due to the risk of irregular heart beat, hypotension and respiratory depression;

Complete administration within 1 hour of preparation.

Maintenance dose

Give phenytoin 100 mg IV slowly over 2 minutes or by mouth every 8 hours beginning at least 12 hours after the loading dose.

Respiratory distress

Rapid laboured breathing: check/treat for secondary pneumonia (antibiotics and oxygen) or anaemia (transfuse), or pulmonary oedema, which may occur with or without fluid overload. Check fluid balance (reduce IV fluids), supply O_2, nurse semi-sitting, plus trial of **frusemide**:

- 40 mg IV
- Repeat after 1–2 hours if indicated

Slow laboured breathing (acidotic): (Kussmaul breathing) – ensure appropriate fluid replacement (plus transfusion if indicated), and treat associated conditions and infections.

Metabolic acidosis

Deep breathing with a clear chest is a sensitive and specific sign for the presence of metabolic acidosis. It is the single most important determinant of survival and can lead to respiratory distress syndrome. Metabolic (lactic acidosis) has been identified as an important cause of death in severe malaria.

Metabolic acidosis in severe malaria has been attributed to the combined effects of several factors that reduce oxygen delivery to tissues:

1. Increased production of lactic acid by parasites (through direct stimulation by cytokines)
2. Decreased clearance by the liver
3. Marked reductions in the deformability of uninfected RBCs may compromise blood flow through tissues
4. Dehydration and hypovolemia can exacerbates microvascular obstruction by reducing perfusion pressure
5. Destruction of RBCs and anaemia further compromises oxygen delivery.

Management:

- Maintain airway patency and oxygen delivery; intubate if the patient is unconscious, in severe shock, or otherwise unstable
- Establish an IV line; replace adequate intravascular fluid volume if the patient has tachycardia, hypotension, or other signs of poor tissue perfusion like poor capillary refill
- Monitor for cardiac arrhythmias
- The use of sodium bicarbonate is controversial and generally should be avoided

Pulmonary oedema

Pregnant women with malaria are particularly prone to pulmonary oedema, especially during labour and delivery.

- Check for increased respiratory rate, chest signs (crackles on auscultation) and hepatomegaly
- Position the patient upright give oxygen if available, stop IV fluids and give IV frusemide 40mg
- Pulmonary oedema is often associated with blood transfusion. Give packed cells where possible. If fluid overload is suspected during transfusion, give frusemide 40mg IV and restart transfusion at a lower rate

Acute renal failure (ARF)

ARF is defined as an abrupt decline in the renal regulation of water, electrolytes and acid-base balance and continues to be an important factor contributing to the morbidity and mortality of malaria patients.

Oliguria or anuria is often associated with jaundice, anaemia and bleeding disorders.
Note: Dehydration is a common cause of poor urine output.

- The basic principles of management are avoidance of life-threatening complications, maintenance of fluid and electrolyte balance, and nutritional support.
- Patients must be catheterised so urine output can be accurately measured
- Acute renal failure is suspected when the **hourly** urine output is <30ml /hour over 4 hours). Blood concentrations of urea and creatinine are usually raised > **2.9 mg/dL**

- Make sure the patient is adequately hydrated, but avoid overload.
- If possible monitor plasma electrolytes especially serum potassium levels.

If urine output continues to be low despite adequate hydration, peripheral perfusion, and normal blood pressure, give frusemide 40mg IV

If renal failure is established, restrict fluid to insensible loss (30ml per hour) plus urine output. If possible refer the pregnant woman or girl to a tertiary care centre for management of renal failure. Consider peritoneal dialysis if available.

Shock

While severe malaria alone may cause shock (algid malaria), it is uncommon and bacterial sepsis often co-exists which must be treated.

Management includes initial assessment for severe anaemia which can be the cause. If severe anaemia is responsible see above for management.

If the patient is not severely anaemic and particularly if dehydrated give rapid fluid replacement provided there are no signs of pulmonary oedema:

Ringer-Lactate or Hartmann's IV, 500 ml over 30 minutes then reassess. If no improvement in capillary refill or tachycardia, repeat the infusion once or twice more, as required.

Give IV broad spectrum antibiotics to treat septicaemia and any associated infections.

Abnormal bleeding

- Transfuse with fresh blood
- Give vitamin K 10 mg IV or PO
- Avoid IM injections and NSAIDs

Co-existing infections

Treat any associated pneumonia, dysentery, metritis (see appropriate chapters).

SECTION 9 Quiz 16

1) **When treating severe malaria in pregnancy with quinine which of the following are true?**
   a) a bolus of IV of quinine can be very dangerous or even fatal
   b) in poorly resourced hospitals IM quinine can be safer
   c) hyperglycaemia can develop
   d) blood glucose levels should be regularly measured during treatment

2) **The following are complications of severe malaria**
   a) severe anaemia
   b) hyperglycaemia
   c) pulmonary oedema
   d) generalised convulsions

ANSWERS:

1. abd 2. acd (hypoglycaemia is a very important complication)

Diabetes mellitus in pregnancy

This is associated with increased perinatal mortality and congenital malformations. Pregnancy causes changes in the maternal physiology to make it a diabetogenic state so that women who have pre-existing or undiagnosed diabetes will have a problem with glucose control which has important effects on their management. Before the discovery of insulin, perinatal maternal mortality was 40% and diabetics need special care during pregnancy. In certain races, including Asians, there is a higher incidence of Type 2 diabetes and they are likely to need insulin therapy.

Insulin has led to a dramatic improvement in maternal survival but in comparison to non-diabetic pregnancy there is still a 5 times increase in perinatal death and a 10 times increase in congenital malformations. These risks can be reduced by strict attention to the control of the diabetes before and during pregnancy.

Management

Before pregnancy

- Advise any diabetics of reproductive age of the importance of close monitoring and modified treatment in pregnancy
- Obesity – dietary advice
- Tight control of diabetes –aim for blood glucose levels of 4-6 mmol/L
- Folic acid 5mg daily if planning pregnancy

In Early pregnancy

- Nausea and vomiting are common
- Hypoglycaemia is common in insulin treated diabetes. Provide glucagon at home if possible, and explain its use to other household members. Inform patient and others about the signs of hypoglycaemia
- Convert pregnant women or girls treated with oral hypoglycaemic agents to insulin
- As soon as possible assess gestational age. Early Ultrasound scan to detect fetal abnormalities

During pregnancy

Insulin dependent pregnant women or girls **(Type 1 Diabetes)**
Close control of diabetes is needed. Expect insulin requirements to increase 50% or more above pre-pregnant levels. There is an increased risk of congenital abnormalities, macrosomia, polyhydramnios, pre-term labour and pre-eclampsia. Plan delivery with care. The risks of infection and development of diabetic keto-acidosis are high. Signs of hyperglycaemia include a gradual onset of drowsiness and polyuria, dehydration, hypotension, difficulty breathing and a ketotic smell to the breath. Signs and symptoms of hypoglycaemia are usually of rapid onset with sudden onset of unconsciousness, particularly if the pregnant woman or girl has taken insulin but has not taken her usual food.

Type 2 diabetes

Convert treatment to insulin and monitor as above

Gestational Diabetes

Often undiagnosed and suspect if:

- Family history of diabetes
- Past history of a large baby, stillbirth or gestational diabetes
- Recurrent glycosuria

Diagnosis of Diabetes with a Glucose Tolerance Test

75 g oral glucose loading dose

Plasma glucose	Fasting (mmol/L)	2 hr measurement (mmol/L)
Diabetes	>8	>11
Gestational impaired glucose tolerance	6-8	9-11
Normal	<6	<9

Delivery

For spontaneous labour, induction of labour and elective Caesarean Section

1. Measure glucose on admission and hourly in labour
2. Site IV line with 500 ml 10% dextrose containing potassium chloride 10mmol and give at 60 ml /hour

.

Blood glucose mmol/l	**Hourly subcutaneous injections of insulin**
<2	No insulin –dextrose only
2 to 4.0	1 unit
4.1 to 9.0	2 units
9.1 to11.0	3 units
11.1 to16.9	4 units

If the glucose level is >17 mmol/l expert advice should be sought
Aim for glucose levels of 4 – 9 mmol/l
Reduce insulin by half at delivery and aim to resume pre-pregnancy insulin dosage 24 hours after delivery. If the mother is breast feeding, her insulin requirement may be lower.

SECTION 9 Quiz 17

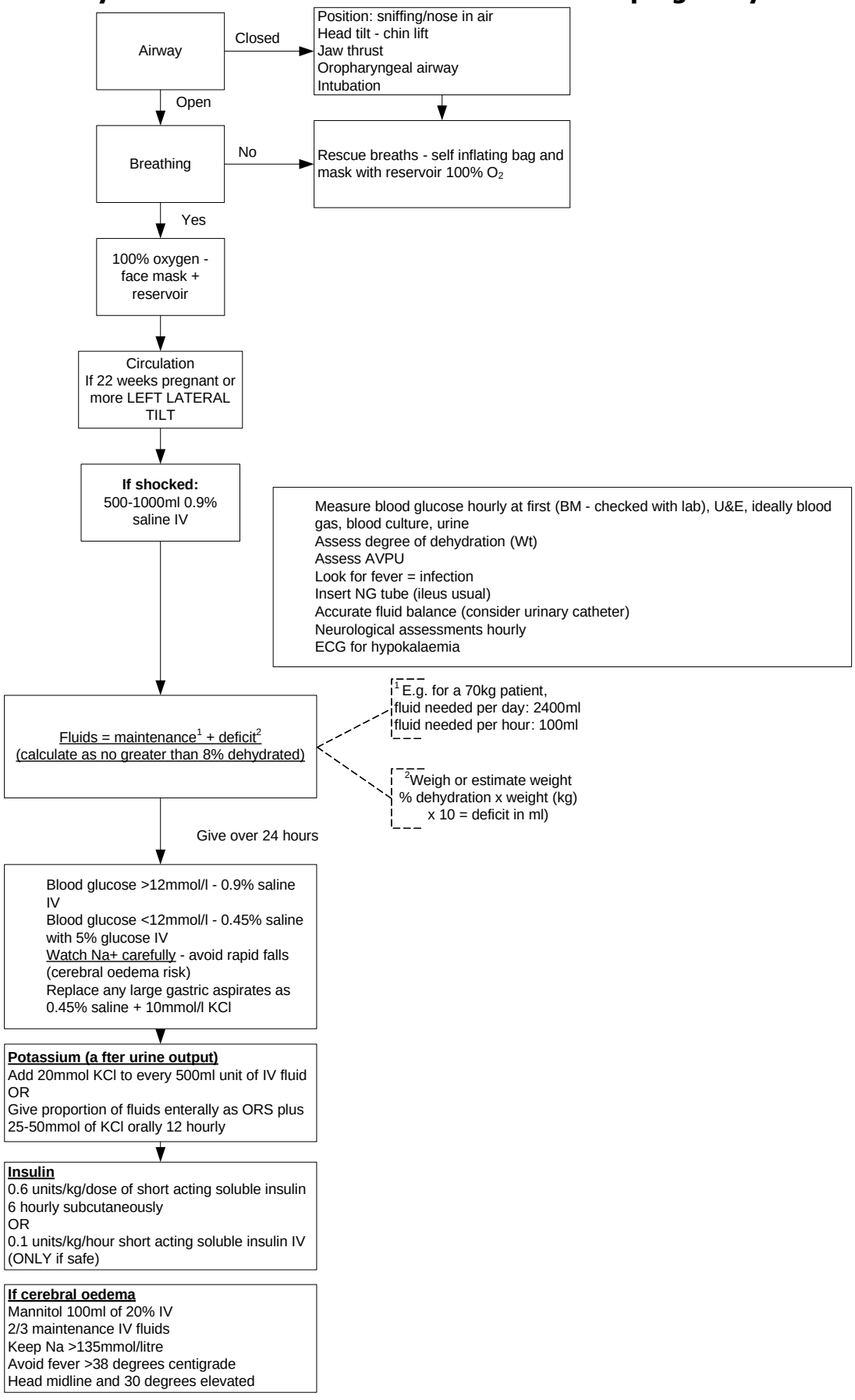
1) **When managing a mother with severe diabetic ketoacidosis during pregnancy put the following treatments in order of their priority that is 1 first and 5 last.**

1 litre 0.9% saline IV if shocked	1
Left lateral tilt if > 22 weeks gestation	2
Airway	3
Calculate fluids as maintenance + deficit (max 8%)	4
Breathing and high flow oxygen	5
Potassium chloride 20 mmol/500 ml IV fluid after urine output has occurred	6
Insulin 0.6 units/kg/dose 6 hourly subcutaneously	7

ANSWERS:

1. Correct sequence is 3,5,2,1,4,7,6

Pathway of care: severe diabetic keto-acidosis in pregnancy



Reduced fetal movements, intrauterine death and stillbirth

Initial management

Check for fetal heart sounds and, if present, measure the fetal heart rate.

If the fetal heart cannot be detected with a pinard stethoscope, Doppler device or ultrasound scan, refer to the table below:

Diagnosis

Table 1 Diagnosis of reduced fetal movements

Symptoms	Signs	Investigation	Diagnosis	Treatment
Decreased or absent fetal movements Bleeding (but may not be external) Collapse Severe constant abdominal pain	Shock in mother Tense/tender uterus Fetal distress or absent fetal heart sounds	Pinard stethoscope, Doppler device or ultrasound scan	Placental abruption	Deliver baby as soon as possible (see below) by caesarean section if signs of fetal life
Decreased or absent fetal movements Bleeding (but may not be external) Collapse Severe constant abdominal pain	Shock in mother Diffuse uterine tenderness with easily felt fetal parts Fetal distress or absent fetal heart sounds	Pinard stethoscope, Doppler device or ultrasound scan	Ruptured uterus Major risk factors are prolonged labour, previous caesarean section and use of oxytocin	Treat shock When stable do laparotomy
Decreased or absent fetal movements If membranes ruptured, meconium staining of liquor	Abnormal fetal heart rate (less than 100 or more than 180 beats per minute)	Pinard stethoscope, Doppler device or ultrasound scan Partogram should show alerts	Fetal asphyxia	Deliver baby as soon as possible (*see* below) by caesarean section if signs of fetal life
Absent fetal movements	Symphysis-fundal height decreases	Pinard stethoscope, Doppler device or	Fetal death	Deliver baby as soon as possible (*see* below)

Symptoms	Signs	Investigation	Diagnosis	Treatment
If membranes ruptured, meconium staining		ultrasound scan Full blood count in mother Clotting screen, including measurement of platelets in mother		

Fetal death in the absence of an abruption

Fetal death in utero may be the result of fetal asphyxia from placental failure, fetal infection, cord accident or congenital anomalies. Where *syphilis* is prevalent, a large proportion of fetal deaths are due to this disease.

Fetal death can be confirmed by abdominal ultrasound with confidence if there is lack of fetal heart activity.

If fetal death in utero is diagnosed, inform the woman/girl and her family and discuss with them the options for management.

Expectant management

Explain to the mother that in 90% of cases the fetus is spontaneously expelled within 1 month of diagnosis. However, most mothers and their families will request delivery as soon as possible.

If *platelets are decreasing* or clotting studies become deranged or more than *4 weeks have passed without spontaneous labour,* consider active management.

Active management

If the cervix is favourable (soft, thin, partly dilated), induce labour using oxytocin. **Avoid rupturing membranes early as this can increase risk of infection,** and also the presenting part can be very soft in these circumstances.

If the cervix is unfavourable (firm, thick, closed), ripen the cervix using misoprostol). The regime for administration of misoprostol is as follows:

Give misoprostol 25 micrograms orally. Repeat after six hours if required.

If there is *no response after two doses of 25 micrograms,* increase to 50 micrograms every 6 hours.

Note: Do not use more than 50 micrograms at a time and do not exceed a total of 200 micrograms, as this may lead to uterine rupture.

If the membranes have been ruptured for more than 24 hours, and even if no signs of infection, consider IV antibiotics during labour.

Do not use oxytocin within eight hours of using misoprostol. Monitor strength and frequency of uterine contractions closely in all patients undergoing induction of labour with prostaglandins.

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

*If a clotting test shows failure of a clot to form after seven minutes, or a soft clot that breaks down easily, suspect coagulopathy. Obtain fresh blood for transfusion and give broad spectrum IV antibiotics including metronidazole***.**

Avoid caesarean section if possible, except for unavoidable obstetric reasons such as transverse lie, suspected uterine rupture or major abruption.

Fetal death in the presence of an abruption

Adopt the active management approach described above.

Stillbirths

Introduction
Worldwide, between 2.08 and 3.79 million stillbirths occur each year. 98% occur in low and middle income countries and 55% in rural families in sub-Saharan Africa or South Asia where facilities for giving birth are much poorer than in urban areas (less skilled birth attendants and comprehensive EmOC). Around 45% of stillbirths occur during birth (intra-partum). The global average rate is 19/1000 births, the rate in low resource settings is ≥25/1000 births and in well resourced settings < 5/1000 births.

Most stillbirths are not registered and the body disposed of without any recognition or rituals such as naming, funeral services or even with the mother holding or dressing her baby. In some settings, there is a belief that sinning by the mother or evil spirits are responsible and the dead baby may be seen as a taboo object. Families affected may be subjected to stigma and marginalization. Some health workers believe that few stillbirths are preventable and were just "not meant to live". There is considerable suffering involved for the family, and mothers frequently become depressed or anxious after a stillbirth, with similar emotions to the death of a child.

Definitions

Early stillbirths are defined by the International Classification of Diseases as a birth weight of ≥500 grams or, if missing, ≥22 completed weeks of gestation or, if missing, body length ≥25 cm.

WHO defines stillbirth as a birth weight ≥1000 grams or, if missing, ≥28 completed weeks of gestation or, if missing, body length ≥35 cm.

Causes

The major causes are listed below and these are the same as the causes of maternal and neonatal mortality:

- Complications of childbirth
- Maternal infections in pregnancy (for example syphilis)
- Medical disorders of pregnancy (especially pre-eclampsia/hypertension)
- Maternal under-nutrition and fetal intra-uterine growth retardation
- Congenital abnormalities

Prevention

The most important issues in low resource situations are to increase the number of skilled birth attendants who can manage antenatal and intra-partum care, an increase in facility based births, and the prevention and treatment of syphilis and malaria during pregnancy.

Specifically the following 10 interventions have been subject to systematic review and reported to reduce stillbirth rates:

1. Folic acid before and soon after conception
2. Insecticide treated bed nets or intermittent preventive drug treatment against malaria
3. Syphilis detection and treatment
4. Detection and management of hypertensive disorders in pregnancy
5. Detection and management of diabetes
6. Detection and management of fetal growth restriction
7. Routine induction to prevent post-term pregnancy
8. Skilled care at birth
9. Basic emergency obstetric care
10. Comprehensive emergency obstetric care

The main aim is to strengthen the health systems involved in ante-partum and intra-partum care which include in addition to the 10 items above:

- Prevention of malaria and syphilis in endemic areas
- The availability of emergency obstetric surgery, in particular caesarean section, without delay with attention to “task shifting” to improve access especially in rural areas.
- Improved antenatal care
- Advocacy to address poverty and its consequences (stillbirth rates inversely correlate with wealth and development)
- Systems to manage and prevent domestic violence
- Efforts to achieve sexual equality, improve reproductive health and the secondary education of boys and girls

Bereaved families should join together and advocate for change at all of the levels identified above.

Further reading

The Lancet series on stillbirths. Launched in London, New York, Hobart, Geneva, New Delhi, Florence, and Cape Town on April 14, 2011
http://www.thelancet.com/series/stillbirth