

Postpartum haemorrhage

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Postpartum haemorrhage can be either primary (within 24 hours of delivery) or secondary (within the following weeks). This article reviews the factors that may help anticipation of postpartum haemorrhage, and looks at issues involved in the management and treatment of women with this condition.

Postpartum haemorrhage (PPH) remains one of the major causes of maternal morbidity and mortality, accounting for up to 28% of maternal deaths worldwide (Chamberlain, 1992). Many cases could be avoided or reduced in severity by anticipation of risk factors, prompt diagnosis and fast, effective treatment. This review will focus on these issues and clarify the available courses of action for attending clinicians.

PHYSIOLOGY

In pregnancy the blood volume increases to approximately 100 ml/kg, giving an average 70 kg woman a circulating volume of 7 litres. Myometrial contraction after delivery of the baby results in involution of the uterus and placental separation. The uteroplacental blood volume is approximately 500 ml, and in normal circumstances much of this is autotransfused back into the maternal circulation.

DEFINITION AND DIAGNOSIS

PPH refers to blood loss of greater than 500 ml from the genital tract either within 24 hours of delivery (primary PPH) or over the ensuing days or weeks (secondary PPH). Clinicians are notoriously bad at estimating the volume of blood loss and as the diagnosis is usually made subjectively, many cases go undetected.

Massive PPH is said to have occurred if the blood loss is greater than 25% of the total circulatory volume, i.e. greater than 1750 ml in a 70 kg woman. However, because of clinical underestimates, a loss of greater than 1 litre is often used as a working diagnosis of massive PPH in practice.

CAUSES

Pathophysiological processes leading to PPH include uterine atony, retained placenta or membranes, laceration to the genital tract and coagulopathy. These causes and predisposing risk factors are shown in *Table 1*. Uterine lacerations, and less commonly lower genital tract lacerations, can produce concealed haemorrhage (intra-abdominal bleeding, broad ligament and vulval haematoma).

ANTICIPATION

Routine management to minimize the incidence of PPH

After a vaginal delivery, the expectant (or physiological) third stage involves waiting for uterine contraction producing placental separation and spontaneous delivery, aided only by maternal effort. With active management, in contrast, delivery of the placenta is expedited using a uterotonic drug, usually administered intramuscularly with or soon after delivery of the anterior shoulder of the baby. Active management of the third stage has been shown to result in at least a two-fold decrease in the risk of PPH, a reduced incidence of postpartum anaemia and less need for blood transfusion during the puerperium (Prendiville et al, 1999). The Cochrane Library reviewers conclude that active management should be routine for women expecting a singleton vaginal delivery in a maternity hospital.

Choice of uterotonic drugs

Uterotonic drugs used during or after the third stage of labour encourage contraction of the uterus. The two most widely used drugs are Syntocinon (oxytocin) and Syntometrine (a combination of oxytocin 5iu and ergometrine

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0.5 mg) (Alliance Pharmaceuticals Ltd, Chippenham, UK). Oxytocin alone is free from serious side-effects, and can be given either intravenously or intramuscularly. Ergometrine is generally used via the intramuscular route. It has the advantage of a more sustained uterine contraction, but is associated with nausea, vomiting and a rise in blood pressure.

Syntometrine is more effective in reducing the risk of PPH than either 5 or 10iu of oxytocin given intramuscularly (McDonald et al, 1999), but this should be weighed against the increased incidence of side-effects with the combination drug. The maximum safe dose is one vial intramuscularly (0.5 mg ergometrine) or half a vial intravenously.

More recently a prostaglandin E1 analogue, misoprostol (Cytotec, Searle, High Wycombe), has been used to manage the third stage of labour. It is prepared in tablet form, is cheap and is stable at ambient temperatures in contrast to Syntometrine. Misoprostol has shown promise as an alternative to other uterotonics, either via the oral or rectal route (El-Rafaey et al, 1997; Bamigboye et al, 1998). There are currently several ongoing studies comparing oral misoprostol with standard regimens or placebo, including a large international multicentre, randomized, double-blind trial of oral misoprostol vs oxytocin being coordinated by the World Health Organization (trial 97901).

Prophylaxis in high-risk cases

Identification of risk factors and avoidance of anaemia antenatally, with subsequent prophylactic measures in labour, can serve to decrease the volume of blood lost at delivery and to enable haemodynamic compensation. Prophylaxis includes intravenous access in labour, availability of cross-matched blood, active management of the third stage of labour, and prophylactic intravenous infusion of Syntocinon after delivery of the infant.

Jehovah's Witnesses present a specific challenge, with many refusing consent to the administration of blood and a range of substances containing blood products, including albumin. Specific details need to be discussed and clearly documented antenatally, and relevant consent forms signed. An obstetric emergency is not the appropriate time to require further clarification. It is vital that these patients enter labour with a good haemoglobin level and abundant iron stores.

RECOGNITION

Maintaining a high index of suspicion for PPH increases the chance that it will be recognized and dealt with promptly. In many cases suturing

or uterine massage may be all that is required, but help should always be called for as soon as excessive loss is recognized.

TREATMENT

Any bleed greater than 500 ml in volume requires the attendance of a doctor, intravenous access, and full blood count and blood 'group and save' at the very least. The greater the volume lost, the higher the level of intervention required, including fluid replacement, cross-match, etc. The general and specific management processes for PPH are summarized in *Table 2*.

MASSIVE PPH

This is a life-threatening emergency, requiring swift and aggressive intervention. Multidisciplinary input from a consultant haematologist, anaesthetist and senior obstetrician is essential.

Initial assessment

It is crucial to remember that a fit, young woman can be very volume depleted while still maintaining her blood pressure. Pulse rate and other

TABLE 1.
Causes of postpartum haemorrhage (PPH)

	Cause	Associated risk factors
Primary PPH	Uterine atony	Retained placenta
		Retained cotyledon or membranes
		Prolonged labour, especially 2nd stage
		Multiple pregnancy
		Fibroid uterus
		Previous history of PPH or atony
		Advanced maternal age
		Grand multiparity
		Infection
	Lower genital tract lacerations (rarely concealed)	Instrumental delivery
		Episiotomy
		Shoulder dystocia
	Upper genital tract lacerations (may be concealed)	Instrumental delivery
		Previous caesarean section
		Uterine surgery/myomectomy
	Coagulation disorder	HELLP syndrome
		Severe sepsis
		Prolonged bleeding
		Amniotic fluid embolism
		Prolonged retention of a dead fetus
Secondary PPH	Retained cotyledon or membrane	History of manual removal of placenta
		Placenta accreta/increta/percreta
	Endometritis	Retained cotyledon or membrane
		History of prolonged ruptured membranes

HELLP = haemolysis, elevated liver enzymes and low platelets

TABLE 2.
Management of postpartum haemorrhage

General measures		Prompt recognition
		Intravenous access — two large bore cannulae (grey or brown)
		Crossmatch at least 2 to 6 units
		Full blood count
		Clotting screen
		Volume replacement
Cause	Clinical findings	Management
Uterine atony	Fundus high	Uterine massage
	Uterus soft and poorly contracted	Urinary catheter
		Syntometrine if not already given NB safe maximum dosage = 1 vial
		Intravenous infusion oxytocin (50 iu in 500 ml N/S over 4 hours)
		Consider carboprost 250 µg intramuscularly
		Uterine tamponade
Laparotomy		
Retained placenta (whole, cotyledon, membranes or clot)	Atony unresponsive to uterotonics. Incomplete placenta or membranes	Examination under anaesthetic Manual removal of placenta Gentle digital exploration (remember uterus soft and easily perforated)
Lower genital tract lacerations	Contracted uterus	Suture as soon as possible
	Vaginal bleeding	Adequate lighting, access and analgesia
		?Embolization
Uterine lacerations	Contracted uterus	Examination under anaesthetic
	Vaginal bleeding	Cervical repair if indicated
	Hypovolaemia with concealed bleed	Consider laparotomy and repair by experienced surgeon?
		Embolization
Coagulation disorder	Evidence of septicaemia, pre-eclampsia or AFE	Treatment of underlying disorder
		Consultation with haematologists
	Contracted uterus Haematuria Bruising	Replacement of clotting factors (fresh frozen plasma)
Endometritis	Pyrexia	Antibiotics
	Uterine tenderness	ERPC?

AFE = amniotic fluid embolism; ERPC = Evacuation of retained products of conception; N/S = normal saline

parameters such as colour of the patient and perfusion are more informative. In a patient who is cold and shivery, volume depletion should be considered before she is warmed up.

Fluid replacement

Fluid replacement may be with either crystalloid (such as Hartmann's or normal saline solution) or with a colloid (such as Haemaccel or Gelafusin) infused rapidly through the two large gauge (grey or brown) venous cannulae. Initial fluid replacement is of greater importance than

replacement of red cells, which can usually be delayed until an urgent crossmatch has been performed. Four to six units of packed cells should be requested. In an extreme emergency uncross-matched group-specific (more rarely O negative) blood may be used.

Coagulation abnormalities should be corrected with fresh frozen plasma, which may also be required as routine replacement in the event of massive blood transfusion (one unit for every four units of blood). This should be done in consultation with the haematologist. Platelets are required only if their level falls below 50×10^9 /litre and bleeding persists.

Monitoring

Observations of pulse and blood pressure should be performed and recorded every 15 minutes; pulse oximetry should be continuous and recorded hourly, together with urine output. Central venous pressure monitoring is essential in any case where there is continued bleeding or confusion over clinical estimates of blood loss. Investigation as to the cause of haemorrhage should be undertaken, as in *Table 2*.

Refractory uterine atony

Medical treatment: Refractory uterine atony, persisting despite empty uterine cavity and uterotonic drugs, may respond to intramuscular prostaglandin F_{2α} (carboprost, Hemabate, Pharmacia & Upjohn, Milton Keynes). The initial dose is 250 µg injected intramuscularly, but this may be repeated if necessary every 15 minutes to a maximum of eight doses (2000 µg). Although it is not licensed for intramyometrial injection (because of the risk of injection directly into a uterine sinus) it can be given via this route, either through the abdominal wall or directly into the myometrium at laparotomy. Carboprost has been shown to decrease bleeding in up to 88% of patients with refractory atonic uterine haemorrhage (Merrikay and Mariano, 1990).

Non-invasive surgical techniques: In the face of continued haemorrhage despite aggressive medical management, surgical alternatives need to be considered early (especially in the case of a Jehovah's Witness). However, non-invasive techniques have also been described which may be of use. The simplest is packing the uterine cavity with gauze, which may be removed hours or days later, hopefully without resumption of the haemorrhage (Maier, 1993).

Inflation of a balloon within the uterus also employs the principle of tamponade. This can be either a hydrostatic urinary catheter balloon

blown up to 100 ml (Rusch, 16F Hydrostatic Catheter), or a Sengstaken-Blakemore tube (Katesmark et al, 1994). It is left in situ for up to 24 hours, allowing ample time for resuscitation of the patient and correction of clotting disorders, after which it can be slowly deflated and removed.

Invasive surgical techniques: Surgical techniques that may be considered before hysterectomy include bilateral ligation of the uterine arteries. The vessel is ligated with a suture placed just below the level of a caesarean section incision, involving myometrial tissue (O'Leary, 1995). Collateral circulation maintains the viability of the uterus, but a second higher ligature may be necessary at the junction of the ovarian ligament and the uterus to prevent this collateral circulation continuing the haemorrhage (Clark and Phelan, 1984). Alternatively ligation of the internal iliac arteries also decreases the uterine blood supply and can be successful in controlling the haemorrhage (Clark et al, 1985). A high degree of surgical skill is required for this procedure as major complications such as damage to the iliac vein or ureter are possible.

A uterine brace suture (The B-Lynch surgical technique) (B-Lynch et al, 1997) has been described and can be useful to exert compression on the uterine body to aid contraction, providing it is initially possible to stimulate the uterus to contract.

Total abdominal hysterectomy, although a last resort, may be the only method of staunching the haemorrhage and can be life-saving, especially in patients who refuse blood products. The technique is the same as that for a routine hysterectomy, but the uterus delivers easily into the wound, increasing the risk of going into the vagina too low (with the attendant risks of damage to the ureters and foreshortening of the vagina). A subtotal hysterectomy may be sufficient, providing bleeding is not evident below this.

Intervention radiology

Embolization of the uterine vessels has been used in specialist centres and can be of value in controlling haemorrhage associated with trauma (Duggan et al, 1991). The help and advice of colleagues from the interventional radiology department may therefore be valuable. The clinical case depicted in *Figure 1* is one such example.

Labour ward protocol

The procedure to be followed in the case of massive PPH should be included in local labour ward guidelines, as recommended by the

Confidential Enquiries (Department of Health, 1998). The establishment of a protocol whereby massive obstetric haemorrhage can be alerted as a 'crash call' through the hospital switch board ensures that multidisciplinary personnel are on standby, including consultant staff, haematology technicians and a porter, saving labour ward staff valuable time contacting these people individually.

The existence of a procedure checklist encourages adherence to the protocol, and with clearly defined standards of management, audit is facilitated and care can be improved. In our hospital, an ongoing audit system has been in operation since 1997 and results of the

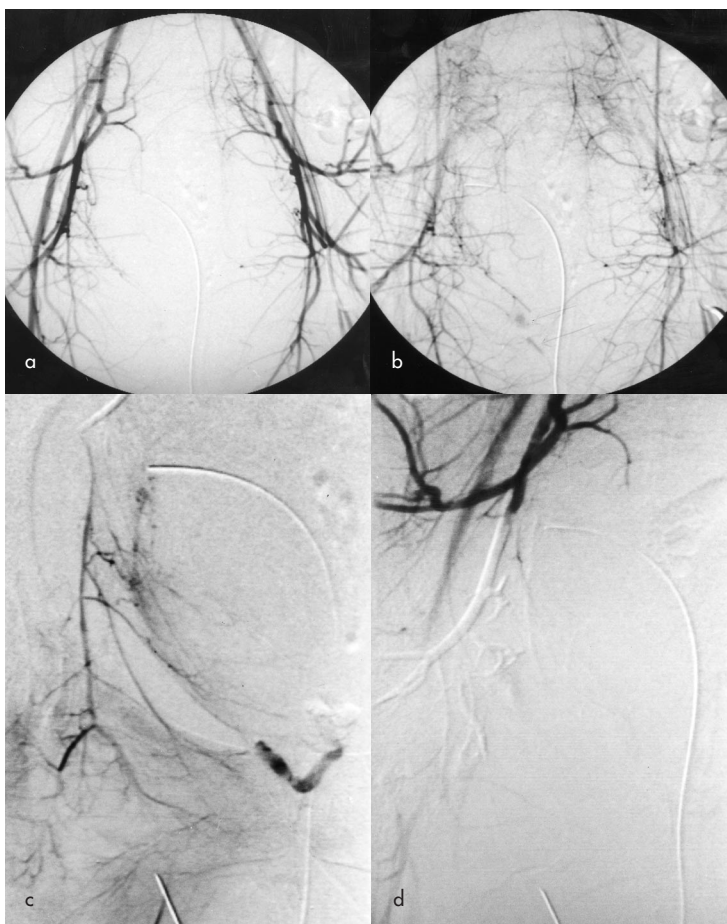


Figure 1. A 22-year-old woman who developed a vaginal tear intrapartum haemorrhage was not controlled by primary surgical repair and required a 33-unit blood transfusion before successful treatment by angiographic embolization. a. Iliac arteriogram performed using a digital subtraction technique with the angiographic catheter within the lower abdominal aorta. The early arterial phase appears normal. b. During the later arterial phase of the same arteriogram contrast medium extravasation is seen within the right lower pelvis from the internal pudendal artery (arrows). c. Selective right internal pudendal artery angiogram demonstrates brisk contrast medium extravasation overlying the symphysis pubis arising from a branch vessel. d. Right internal iliac arteriogram following embolization of its anterior division. There is no further contrast medium extravasation seen.

Name	Date...../...../.....	
Hosp no	EBL.....	
Age.....	Mode of delivery.....	
Consultant.....		
Risk factors	APH/Prev PPH/Pl praevia/retained placenta Multiple pregnancy/Macrosomia/IOL/PGs used syntocinon augmentation/prolonged labour Fibroids/Previous CS/ Previous uterine SX Others.....	
Was this PPH anticipated	Yes/No	
In retrospect could it have been anticipated?		
How was 3rd stage managed?	Physio/CCT/MROP	
What prophylactic measures were taken? (circle all)	IV access FBC/G+S/XM synto/syntometrine synto infusion	
Uterotonics used (state routes and total dose)	syntometrine syntocinon haemabate	
Staff issues	lab staff liaised with Porter in attendance	Yes/No Yes/No
	consultant obstetrician	informed/present
	obstetric SP	informed/present
	consultant haematologist	informed/present
	consultant anaesthetist	informed/present
Management	recognition rapid/delayed 2xIV access bloods for FBC/clotting/FDP/XM n= resuscitation adequate Yes/No	
Fluids used (state how much)	Monitoring (state how often)	
crystalloid.....mls	P/BP every 15mins	
colloid.....mls	Urinary catheter	
blood.....units	Hourly fluid balance	
FFP.....units	Oxygen saturation	
other.....	CVP	
Procedures needed	EUA/laparotomy hysterectomy/Brace other..... analgesia used: regional/GA	
Complications	sepsis/DIC/other...	
Admission to ITU	Yes/no (duration of stay...)	
Consultant saw before discharge	Yes/No	
Discharge Hb.....g/dl		
Postnatal check at QCCH	Yes/No	who saw?
Comments		

Figure 2. Postpartum haemorrhage checklist. Further details are available from the authors if required.

KEY POINTS

- Avoid anaemia antenatally.
- Recognize risk factors and ensure prophylactic measures are in place.
- Recognize the problem promptly and take swift action.
- Obtain intravenous access and give adequate fluid replacement.
- Ascertain and treat the cause.
- Multidisciplinary input in the acute event should be routine.
- Local guidelines, audit and active testing of the system should help maintain and improve management.

audit are regularly presented at unit meetings. Major obstetric haemorrhage scenarios are also enacted unannounced on labour ward to test the system. We have found it extremely helpful in identifying procedural weaknesses or communication breakdowns and can therefore constantly update and improve the protocol. Details of our PPH checklist are given in Figure 2.

CONCLUSION

PPH in the UK has recently shown a decline in incidence (Department of Health, 1998). Hopefully, through the implementation of their recommendations regarding the establishment of local labour ward protocols in every obstetric unit, this decrease will continue and fewer women's lives will be put at risk by substandard care. HM

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