

The anaesthetic management of postpartum haemorrhage

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Massive obstetric haemorrhage remains a leading cause of maternal mortality worldwide, with an estimated global mortality of 11 per cent maternal deaths. Life-threatening haemorrhage is much more common and may occur in one in 200 to 250 deliveries.

Obstetric patients account for 0.9 per cent of intensive care admissions, with haemorrhage being responsible for up to 35 per cent of cases. Management of massive postpartum haemorrhage (PPH) is challenging. It requires prompt recognition, effective teamwork and communication if it is to be successful.

Postpartum haemorrhage may be primary (within 24 hours of delivery) or secondary (after 24 hours). It is traditionally defined as blood loss exceeding 500ml for a vaginal delivery or 1000ml following caesarian section. This amount of blood loss is typically well-tolerated in otherwise healthy females. Severe PPH may be defined as blood loss exceeding 1000ml.

Massive obstetric haemorrhage is variably defined as:

- estimated blood loss over 1500ml
- blood loss over 150ml/min
- more than ten units of blood transfused in less than 24 hours
- drop in haemoglobin greater than 40g/l.

Anticipation

Although it is not possible to predict which patients will bleed, having a high index of suspicion in patients with increased risk factors is necessary (see Table 1). Management in such patients should be pre-emptive. They should be encouraged to deliver in an obstetric unit with appropriate onsite facilities, in some cases as elective cases in daylight hours. This allows better intensive care, radiological and transfusion service back-up. There should be a care plan made for active management of the third stage of labour. Communication between midwives, obstetricians and anaesthetists regarding the patient should be established. Large bore IV access (two times) should be established and blood taken for group and hold.

Table 1. Risk factors for postpartum haemorrhage

Maternal factors	Obstetric factors
<ul style="list-style-type: none"> • Previous postpartum haemorrhage • Body mass index >35kg/m² • Maternal age >35 years 	<ul style="list-style-type: none"> • Induction of labour • Precipitate labour • Uterine overdistension <ul style="list-style-type: none"> • multiple pregnancy • macrosomia • polyhydramnios • Grand multiparity (>5)
<ul style="list-style-type: none"> • Existing uterine abnormalities • Bleeding diathesis – congenital/acquired <ul style="list-style-type: none"> • pre-eclampsia • intrauterine death • sepsis • placental abruption • pre-existing clotting or platelet dysfunction 	<ul style="list-style-type: none"> • Prolonged labour (especially second stage) • Instrumental delivery • Operative birth • Morbidly adherent placenta

Identifying the bleeding patient

The gravid uterus receives up to 12 per cent of the cardiac output (700 to 800ml/min), thus obstetric haemorrhage can rapidly become life-threatening. Physiological reserve is increased in pregnancy and may conceal 'classical' signs of severe haemorrhage until blood loss is critical. Accurate estimation of blood loss is notoriously difficult. An 'early warning system' (EWS) modified as pregnancy progresses (Modified Early Obstetric Warning System MEOWS) may be a useful tool, which combine five or six variables that together serve for earlier detection, rather than waiting for obvious signs such as a drop in blood pressure, which may be a pre-terminal event. However, detection alone is insufficient – it must warrant prompt and effective management (see Table 2 for clinical signs).

Table 2. Clinical symptoms and signs of postpartum haemorrhage

Early	Late
Restlessness, anxiety	Confusion
Dizziness	Altered consciousness
Tachycardia	Cold clammy peripheries
Cool peripheries	Fall in blood pressure
Reduced pulse pressure	Air hunger
Rise in respiratory rate	Anuria
Oliguria	

Management

General

Communication

Senior anaesthetic and obstetric help is vital. Blood bank and a haematologist should be alerted and major haemorrhage protocols activated. Theatre staff should be notified to allow fluid warmers, level one infuser and cell salvage to be set up if available. Ideally, a dedicated porter should be allocated. Resource allocation should be undertaken by the senior medical staff to ensure all personnel available have a skills-appropriate role.

Maternal resuscitation

Airway and breathing should be assessed, oxygen 100 per cent via facemask:

- If not done already, insert two large bore cannulae, take blood and send for FBC, coag and X match.
- Simultaneously, give warmed fluids – crystalloid or colloid, blood products if available.

- Establish monitoring – pulse, ECG, blood pressure, oximetry, urine output.
- Invasive monitoring when feasible, but not at the expense of ongoing resuscitation.

Anaesthesia in the bleeding patient

Anaesthetic options will depend on haemodynamic stability of the patient. In elective cases regional techniques may be an option. However, many anaesthetists would opt for general anaesthesia if stability and operation time is uncertain. It cannot be stressed enough that anaesthesia in these cases requires extra personnel and that junior staff should involve experienced consultants early.

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After ensuring adequate IV access and monitoring (preferably invasive blood pressure), a rapid sequence induction is usual, sometimes with agents such as ketamine or etomidate in the severely compromised patient. Induction may unmask or accentuate haemodynamic instability. This should be anticipated and treated with warm IV fluids, blood products and vasopressors. If central venous access is required, this can often be done once surgery has commenced. The internal jugular route under direct ultrasound vision carries least risk of complications. Maintenance is usually with a volatile agent with attention to depth of anaesthesia, given that all volatiles cause a degree of uterine relaxation. In terms of analgesia, attention to trying to maintain normothermia and muscle relaxation must not be neglected.

Regular blood gas sampling is necessary to monitor acid base status and electrolytes such as K⁺ and Ca²⁺ in the face of massive transfusion. These often require correction and hypocalcaemia may be a contributing factor in hypotensive patients. Blood should also be sent regularly for coagulation studies, and, if available, point of care testing of Hb (haemocue) and coagulation (TEG) utilised.

Transfusion and blood products

Cooperation and ongoing communication with the transfusion service is vital to the success of resuscitation. Many units have massive haemorrhage protocols in place and these should be activated early.

There is growing evidence in trauma settings to transfuse fresh frozen plasma (FFP) immediately with packed red cells in a ratio approaching 1:1 with early use of cryoprecipitate and platelets. This has been extrapolated to other areas where massive blood loss occurs. Using ratios of products targeted to simulate transfusion of whole blood makes physiological sense to prevent dilutional coagulopathy.

Recombinant factor VIIa, originally developed for management of haemorrhage in haemophiliacs has been successfully used 'off license' in non-haemophilic haemorrhage associated with coagulopathy. Although the data is limited, especially with regard to future thrombotic risk, its use may have a role in refractory cases with a response rate quoted as 68 per cent at a dose of up to 100mcg/kg. Expense and availability may be prohibitive and use should be on the advice from a haematologist.

Concerns about fetal squames inducing amniotic fluid embolism and rhesus iso-immunisation have traditionally prevented cell salvage in obstetrics, but there is increasing data to support its use, especially when separate suction is used for amniotic fluid and a leucocyte depletion filter is used. Its use is supported by several groups including the Confidential Enquiry into Maternal and Child Health (CEMACH), the Obstetric Anaesthetists Association and the National Institute for Clinical Excellence (UK).

Definitive treatments

Physical

Simple manoeuvres such as 'rubbing up' the uterus or bimanual compression may help in uterine atony, which is responsible for 80 per cent of cases.

Various rubber or silicone balloons such as the Bakri balloon, Rusch balloon, Sengstaken-Blakemore tube or Foley catheters may be used to achieve a tamponade effect. These vary in shape, volume and the presence of a drainage channel, and may be used alone, or in combination with other surgical interventions. Use may negate the need for laparotomy or reduce blood loss while transfer to theatre is undertaken, allowing time for resuscitation.

Pharmacological

Uterotonic agents may include repeat boluses of 5u intravenous oxytocin. It is usual to follow with an infusion of 20 to 40u in 500ml saline over 30 minutes to four hours. Ergometrine, either alone or in combination with oxytocin, may be given intramuscularly or cautiously intravenously at a dose of 250 to 500mcg. Its use should be avoided in pre-eclampsia as it exacerbates hypertension.

Prostaglandins such as PGF_{2A} (carboprost) may be given by intramuscular or intramyometrial injection in increments of 250mcg. Misoprostol, an analogue of prostaglandin E₁, can be given via the oral, sublingual, rectal and intrauterine routes in doses of 200 to 1200mcg. Literature review found limited evidence of efficacy and safety, recommending that misoprostol should be used when standard medical uterotonics were unavailable or unsuccessful. All prostaglandins have significant side effects, the most pertinent of which is bronchospasm in asthmatics, where their use is contraindicated.

Tranexamic acid is an antifibrinolytic agent and may be given in a dose of 10mg/kg intravenously.

Radiological

Radiological input may serve both to stabilise the patient by insertion of angioplasty balloons to the origins of the internal iliac arteries, and to offer definitive treatment by selective embolisation. High success rates are described in these techniques avoiding the need for hysterectomy. However, the implications for future pregnancies is as yet undetermined, concerns being it may lead to increased incidence of morbidly adherent placentation. Limitations include expediency, availability and need to transfer an unstable patient to a radiological suite for definitive treatment.

Surgical

Surgical options may include vaginal and uterine packing, uterine artery ligation, application of B-lynch sutures (with or without intrauterine pack or balloon) and hysterectomy. Optimal timing of hysterectomy is difficult and should be undertaken by a senior obstetrician, ideally only when conservative measures have failed but before irretrievable demise of the patient.

Postpartum haemorrhage

Once haemostasis and stability is achieved, the patient should be transferred to an area with the appropriate level of care for ongoing

monitoring and management of coagulopathy, acidosis and consequences of massive transfusion.

Explanation and counselling of the patient and relatives, particularly when hysterectomy has been undertaken, is important, together with advice regarding the implications for future pregnancies. Team debriefing and reflective learning should be undertaken by all staff involved to unearth any learning points. Such cases should also be reviewed at multidisciplinary morbidity and mortality meetings to audit practice and improve future management.

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