



## PREVENTION AND MANAGEMENT OF POSTPARTUM HAEMORRHAGE

This is the first edition of this guideline.

### 1. Purpose and scope

Primary postpartum haemorrhage (PPH) is the most common form of major obstetric haemorrhage. The traditional definition of primary PPH is the loss of 500 ml or more of blood from the genital tract within 24 hours of the birth of a baby.<sup>1</sup> PPH can be minor (500–1000 ml) or major (more than 1000 ml). Major could be divided to moderate (1000–2000 ml) or severe (more than 2000 ml). The recommendations in this guideline apply to women experiencing primary PPH of 500 ml or more. Secondary PPH is defined as abnormal or excessive bleeding from the birth canal between 24 hours and 12 weeks postnatally.<sup>2</sup> This guideline also includes recommendations specific to the management of major secondary PPH. Women with pre-existing bleeding disorders such as haemophilia and women taking therapeutic anticoagulants are at increased risk of PPH; this guideline does not include specific recommendations for the management of such situations, nor for managing haemorrhage in women who refuse blood transfusion. Guidance on these topics is available from other sources.<sup>3–6</sup> The guideline has been developed primarily for clinicians working in consultant-led obstetric units in the UK; recommendations may be less appropriate for other settings where facilities, resources and routine practice differ.

### 2. Introduction and background

Obstetric haemorrhage remains one of the major causes of maternal death in both developed and developing countries. In the 2003–2005 report of the UK Confidential Enquiries into Maternal Deaths, haemorrhage was the third highest direct cause of maternal death (6.6 deaths/million maternities) with a rate similar to the previous triennium.<sup>7,8</sup> Even in the UK, the majority of maternal deaths due to haemorrhage must be considered preventable, with 10 of 17 (58%) cases in the 2003–2005 triennium judged to have received 'major substandard care'. Haemorrhage emerges as the major cause of severe maternal morbidity in almost all 'near miss' audits in both developed and developing countries.<sup>9</sup> In Scotland, the rate of life-threatening haemorrhage (blood loss 2.5 litres or more or women who received more than 5 units of blood transfusion or women who received treatment for coagulopathy after an acute event) is estimated at 3.7/1000 maternities.<sup>10</sup>

Because of its importance as a leading cause of maternal mortality and morbidity, and because of evidence of substandard care in the majority of fatal cases, obstetric haemorrhage must be considered as a priority topic for national guideline development. Obstetric haemorrhage encompasses both antepartum and postpartum bleeding. This Green-top guideline is restricted in scope to the management of postpartum haemorrhage (PPH). Nevertheless, antepartum haemorrhage is often associated with subsequent PPH and the content of this guideline will have relevance for the care of these women.

### 3. Identification and assessment of evidence

This RCOG guideline is based on an earlier guideline on the management of postpartum haemorrhage developed in 1998, under the auspices of the Scottish Committee of the RCOG, and updated in 2002.<sup>11</sup> This guideline was developed in accordance with standard methodology for producing RCOG Green-top Guidelines. The Cochrane Library (including the Cochrane Database of Systematic Reviews, DARE and EMBASE), TRIP, Medline and PubMed (electronic databases) were searched for relevant randomised controlled trials, systematic reviews and meta-analyses. The search was restricted to articles published between 2002 and March 2007. The databases were searched using the relevant MeSH terms, including all subheadings, and this was combined with a keyword search. Search words included ‘postpartum haemorrhage’, ‘factor VII’, ‘Syntocinon’, ‘carbetocin’, ‘carboprost’, ‘oxytocics’, ‘uterotonics’, ‘B-lynch suture’, ‘uterine artery embolism’, ‘bilateral ligation’, ‘balloon, Rusch, Sengstaken catheters’ and the search limited to humans and English language. The National Library for Health and the National Guidelines Clearing House were also searched for relevant guidelines and reviews. Guidelines and recommendations produced by organisations such as British Committee for Standards in Haematology Transfusion Taskforce and national bodies were considered. Where possible, recommendations are based on available evidence and the areas where evidence is lacking are annotated as ‘good practice points’.



### 4. Definition of postpartum haemorrhage

**Primary PPH involving an estimated blood loss of 500–1000 ml (and in the absence of clinical signs of shock) should prompt basic measures (close monitoring, intravenous access, full blood count, group and screen) to facilitate resuscitation should it become necessary.**



**If a woman with primary PPH is continuing to bleed after an estimated blood loss of 1000 ml (or has clinical signs of shock or tachycardia associated with a smaller estimated loss), this should prompt a full protocol of measures to achieve resuscitation and haemostasis.**



The traditional World Health Organization definition of primary PPH encompasses all blood losses over 500 ml.<sup>12,13</sup> Most mothers in the UK can readily cope with a blood loss of this order<sup>14,15</sup> and an estimated loss of more than 1000 ml has been suggested as an appropriate cut-off point for major PPH which should prompt the initiation of a protocol of emergency measures.<sup>16</sup> Blood volume depends on the body weight (approximate blood volume equals weight in kilograms divided by 12 expressed as litres). In estimating percentage of blood loss, consideration should be given to body weight and the original haemoglobin. A low antenatal haemoglobin (less than 11 g/dl) should be investigated and treated appropriately to optimise haemoglobin before delivery. There is also some evidence that iron deficiency anaemia can contribute to atony because of depleted uterine myoglobin levels necessary for muscle action.

This guideline adopts a pragmatic approach, whereby an estimated blood loss of 500–1000 ml (in the absence of clinical signs of shock) prompts **basic measures** of monitoring and ‘readiness for resuscitation’, whereas an estimated loss of more than 1000 ml (or a smaller loss associated with clinical signs of shock, tachycardia, hypotension, tachypnoea, oliguria or delayed peripheral capillary filling) prompts a **full protocol** of measures to resuscitate, monitor and arrest the bleeding. Allowing for the physiological increase in pregnancy, total blood volume at term is approximately 100 ml/kg (an average 70 kg woman-total blood volume of 7000 ml)<sup>17</sup> a blood loss of more than 40% of total blood volume (approx 2800 ml) is generally regarded as ‘life-threatening’. It seems appropriate that PPH protocols should be instituted at an estimated blood loss well below this figure, as the aim of management is to prevent haemorrhage escalating to the point where it is life-threatening.

As visual blood loss estimation often underestimates blood loss,<sup>18,19</sup> more accurate methods may be used, such as blood collection drapes for vaginal deliveries<sup>20</sup> and weighing swabs. Participating in clinical reconstructions

may encourage early diagnosis and prompt treatment of postpartum haemorrhage. Written and pictorial guidelines may help staff working in labour wards to estimate blood loss.<sup>21</sup>

## 5. Prediction and prevention of postpartum haemorrhage

*What are the risks of PPH and how can they be minimised?*

**Risk factors may present antenatally or intrapartum; care plans must be modified when risk factors present. Clinicians must be aware of risk factors for PPH and should take these into account when counselling women about place of delivery essential for the wellbeing and safety of both the mother and the baby.**



Most cases of PPH have no identifiable risk factors.

**Active management of the third stage of labour lowers maternal blood loss and reduces the risk of PPH.**



**Prophylactic oxytocics should be offered routinely in the management of the third stage of labour in all women as they reduce the risk of PPH by about 60%.**



**For women without risk factors for PPH delivering vaginally, oxytocin (5 iu or 10 iu by intramuscular injection) is the agent of choice for prophylaxis in the third stage of labour.**



**For women delivering by caesarean section, oxytocin (5 iu by slow intravenous injection) should be used to encourage contraction of the uterus and to decrease blood loss.**



A bolus dose of oxytocin may possibly be inappropriate in some women, such as those with major cardiovascular disorders, suggesting that a low-dose infusion might be a safer alternative.

**Syntometrine (® Alliance) may be used in the absence of hypertension (for instance, antenatal low haemoglobin) as it reduces the risk of minor PPH (500-1000 ml) but increases vomiting.**



**Misoprostol is not as effective as oxytocin but it may be used when the latter is not available, such as the home-birth setting.**



**All women who have had a previous caesarean section must have their placental site determined by ultrasound. Where facilities exist, magnetic resonance imaging (MRI) may be a useful tool and assist in determining whether the placenta is accreta or percreta.**



**Women with placenta accreta/percreta are at very high risk of major PPH. If placenta accreta or percreta is diagnosed antenatally, there should be consultant-led multidisciplinary planning for delivery. Consultant obstetric and anaesthetic staff should be present, prompt availability of blood, fresh frozen plasma and platelets be confirmed and the timing and location for delivery chosen to facilitate consultant presence and access to intensive care.**



**Available evidence on prophylactic occlusion or embolisation of pelvic arteries in the management of women with placenta accreta is equivocal. The outcomes of prophylactic arterial occlusion require further evaluation.**



Investigators from the USA,<sup>22</sup> the UK,<sup>23,24</sup> and Zimbabwe<sup>25</sup> analysed data from case-control studies to quantify the level of risk associated with various antenatal factors. Despite methodological limitations, these studies provide a guide to levels of risk which can help clinicians in their discussions with women about setting for delivery. The studies of Stones *et al.*<sup>23</sup> and Combs *et al.*<sup>22</sup> also provide data on risk factors becoming apparent

during labour and delivery. Information from these sources on risk factors for PPH is summarised in Table 1. The Society of Obstetricians and Gynaecologists of Canada has published a guideline on prevention and management of postpartum haemorrhage.<sup>26</sup> This guideline summarises the causes for PPH as related to abnormalities of one or more of four basic processes ('the four T's': tone, trauma, tissue, thrombin).

Four Cochrane reviews addressed prophylaxis in the third stage of labour for women delivering vaginally. The first (*Active Versus Expectant Management in the Third Stage of Labour*)<sup>27</sup> included five trials and found that active management (which included the use of a uterotonic, early clamping of the umbilical cord and controlled traction for the delivery of the placenta) was associated with lower maternal blood loss and with reduced risks of PPH and prolonged third stage. However, active management was also associated with an increased incidence of nausea, vomiting and raised blood pressure. A further Cochrane review included seven trials comparing prophylactic oxytocin versus no uterotonic.<sup>28</sup> The conclusion was that oxytocin reduced the risk of PPH by about 60% and the need for therapeutic oxytocics by about 50%.

A more recent Cochrane review addressed prophylactic ergometrine-oxytocin versus oxytocin for the third stage of labour;<sup>29</sup> six trials were included. The review indicated that ergometrine-oxytocin (Syntometrine), oxytocin 5 iu and oxytocin 10 iu, have similar efficacy in prevention of PPH in excess of 1000 ml (Syntometrine versus any dose oxytocin: odds ratio 0.78, 95% confidence interval 0.58–1.03; Syntometrine versus oxytocin 5 iu: odds ratio 0.14, 95% confidence interval 0.00–6.85; Syntometrine versus oxytocin 10 iu: odds ratio 0.78, 95% confidence interval 0.59–1.04). Using the definition of PPH of blood loss of at least 500 ml, there was a small reduction in the risk of PPH (Syntometrine versus oxytocin any dose: odds ratio 0.82, 95% confidence interval 0.71–0.95). The reduction of risk was greater for the lower dose of oxytocin 5 iu (Syntometrine versus oxytocin 5 iu: odds ratio 0.43, 95% confidence interval 0.23–0.83; Syntometrine versus oxytocin 10 iu: odds ratio 0.85, 95% confidence interval 0.73–0.98). There were major differences between ergometrine-oxytocin and oxytocin alone in the unpleasant side effects of nausea, vomiting and elevation of blood pressure, with ergometrine-oxytocin carrying a five-fold increased risk (odds ratio 4.92, 95% confidence interval 4.03–6.00). Thus, the advantage of a reduction in the risk of PPH, between 500 ml and 1000 ml blood loss, needs to be weighed against the adverse effects associated with the use of ergometrine-oxytocin.

The fourth review considered prostaglandins for the prevention of postpartum haemorrhage.<sup>30</sup> It included 32 trials and concluded that conventional injectable uterotonics were preferable to prostaglandins for routine prophylaxis and that research on prostaglandins in the context of obstetric haemorrhage should focus on treatment, rather than prevention. The oxytocic regimens used in individual trials comprised a mixture of intravenous and intramuscular administration. Appraisal of the evidence from these reviews, together with consideration of standard practice in the UK, suggests that, for women delivering vaginally, oxytocin 5 iu by intramuscular injection is the regimen of choice for prophylaxis in the third stage of labour.

Misoprostol (600 micrograms orally) is not as effective when compared with oxytocin (10 iu intravenously) in preventing PPH; it also carries increased adverse effects, which are dose related.<sup>31</sup> However, in situations where no oxytocin is available or birth attendants' facilities are limited (for example, a home birth) misoprostol reduces the risk of haemorrhage.

Four randomised trials have compared different uterotonics for prophylaxis in women delivering by caesarean section.<sup>32–35</sup> Appraisal of the evidence from these trials, together with consideration of standard practice in the UK, led the development group for the National Institute for Health and Clinical Excellence *Caesarean Section* guideline<sup>36</sup> to recommend oxytocin 5 iu by slow intravenous injection for prophylaxis in the context of caesarean delivery. A longer-acting oxytocin derivative, carbetocin, is licensed in the UK specifically for the indication of prevention of PPH in the context of caesarean delivery. Randomised trials suggest that a single dose (100 micrograms) of carbetocin is at least as effective as oxytocin by infusion<sup>37,38</sup> (there are no comparisons of carbetocin with the oxytocin regimen recommended in this guideline). Trials have also compared carbetocin with Syntometrine<sup>39</sup> and with oxytocin by infusion<sup>40</sup> in the context of vaginal

delivery. Again, carbetocin appeared to be at least as effective as the more conventional regimen. Carbetocin is not currently recommended for routine use because of the paucity of data and its high price.

**Table 1: Risk factors for PPH**

a) presenting antenatally and associated with a substantial increase in the incidence of PPH; women with these factors should be advised to deliver in a consultant-led maternity unit		
Risk factor	Four T's	Approximate odds ratio for PPH (99% CI)
• Suspected or proven placental abruption	Thrombin	13 (7.61–12.9)
• Known placenta praevia	Tone	12 (7.17–23)
• Multiple pregnancy	Tone	5 (3.0–6.6)
• Pre-eclampsia/gestational hypertension	Thrombin	4
b) presenting antenatally and associated with a significant (though smaller) increase in the incidence of PPH; these factors should be taken into account when discussing setting for delivery		
Risk factor	Four T's	Approximate odds ratio for PPH (99% CI)
• Previous PPH	Tone	3
• Asian ethnicity	Tone	2 (1.48–2.12)
• Obesity (BMI >35)	Tone	2 (1.24–2.17)
• Anaemia (<9 g/dl)	–	2 (1.63–3.15)
c) becoming apparent during labour and delivery; these factors should prompt extra vigilance among clinical staff		
Risk factor	Four T's	Approximate odds ratio for PPH (99% CI)
• Delivery by emergency caesarean section	Trauma	4 (3.28–3.95)
• Delivery by elective caesarean section	Trauma	2 (2.18–2.80)
• Induction of labour	–	2 (1.67–2.96)
• Retained placenta	Tissue	5 (3.36–7.87)
• Mediolateral episiotomy	Trauma	5
• Operative vaginal delivery	Trauma	2 (1.56–2.07)
• Prolonged labour (> 12 hours)	Tone	2
• Big baby (> 4 kg)	Tone/trauma	2 (1.38–2.60)
• Pyrexia in labour	Thrombin	2
• Age (> 40 years, not multiparous)	Tone	1.4 (1.16–1.74)

Abnormally adherent placenta (placenta accreta and the more severe forms: increta or percreta) is associated with catastrophic haemorrhage and carries a high mortality. The incidence appears to be increasing and has been linked to the increase in caesarean section, particularly repeat caesarean section.<sup>41</sup> Contemporary ultrasound techniques and/or magnetic resonance imaging mean that some cases of abnormally adherent placenta may be diagnosed antenatally. Such forward planning for delivery highlights the merits and importance of attending for antenatal checks and screening to minimise blood loss and morbidity.<sup>41–44</sup> Leaving the placenta in the uterus after delivery of the baby by fundal classical uterine incision may allow a procedure with very little blood loss. The value of subsequent treatment with methotrexate is debatable.<sup>45</sup>

At least seven groups of investigators have reported on the role of prophylactic interventional radiology for delivery in cases of antenatally diagnosed placenta accreta.<sup>42,46–51</sup> Interventions took the form of balloon occlusion or embolisation of pelvic arteries (internal iliac arteries, anterior division of internal iliac or uterine arteries). These case series included 36 women in total; reported outcomes included estimated blood loss, time spent in intensive care, transfusion requirement and need for hysterectomy. The three earlier studies suggested that prophylactic interventional radiology was beneficial,<sup>46–48</sup> whereas the later studies found equivocal<sup>49,50</sup> or no benefit.<sup>42,51</sup> A further case series evaluated prophylactic angiographic embolisation prior to mid-trimester hysterectomy for antenatally diagnosed placenta accreta (six cases) and reported encouraging results.<sup>52,53</sup> Notwithstanding these equivocal data, most case series addressing emergency use of arterial embolisation have found it to be of value in the control of primary and secondary PPH. This suggests that prophylactic arterial catheterisation (with a view to embolisation) could be considered where facilities permit until such time as further evidence becomes available.

## 6. How should PPH be managed?

Once PPH has been identified, management involves four components, all of which must be undertaken **SIMULTANEOUSLY**: communication, resuscitation, monitoring and investigation, arresting the bleeding.

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The practical management of PPH may be considered as having at least four components: **communication** with all relevant professionals; **resuscitation; monitoring and investigation**; measures to **arrest the bleeding**. Each of these components is discussed in turn in the guideline but, it must be emphasised, these components must be initiated and progressed **simultaneously** for optimal patient care. It is important to be aware that minor PPH can easily progress to major PPH and is sometimes unrecognised.

The pattern of management presented in this guideline is dependent on the woman being cared for in a consultant-led maternity unit with access to laboratory and blood bank facilities and with skilled obstetric and anaesthetic staff readily available. On occasions where primary PPH occurs in a woman delivering in a different setting (such as at home or in a midwife-led maternity unit), the role of the professionals on site is to institute 'first aid' measures while arranging transport to a consultant-led maternity unit by the most expeditious means.

### 6.1 Communication

*Who should be informed when the woman presents with postpartum haemorrhage?*

**Basic measures for MINOR PPH (blood loss 500–1000 ml, no clinical shock):**

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- **Alert the midwife-in-charge.**
- **Alert first-line obstetric and anaesthetic staff trained in the management of PPH.**

**Full protocol for MAJOR PPH (blood loss more than 1000 ml and continuing to bleed OR clinical shock):**

- **Call experienced midwife (in addition to midwife in charge).**
- **Call obstetric middle grade and alert consultant.**
- **Call anaesthetic middle grade and alert consultant.**
- **Alert consultant clinical haematologist on call.**
- **Alert blood transfusion laboratory.**
- **Call porters for delivery of specimens/blood.**
- **Alert one member of the team to record events, fluids, drugs and vital signs.**

Early involvement of appropriate senior staff (including anaesthesia team,) laboratory specialists is fundamental to the management of PPH. Clinicians and blood transfusion staff should liaise at a local level to agree:

- a standard form of words (such as '**we need compatible blood now**' or 'group-specific blood') to be used in cases of major obstetric haemorrhage
- a timescale in which to produce various products.

The use of the term 'controlled major obstetric haemorrhage' or 'ongoing major obstetric haemorrhage' may be used to define the urgency for the need of the team.

It is vital that junior obstetricians and anaesthetists do not perceive the calling of senior colleagues as involving 'loss of face'. Senior staff must be receptive to concerns expressed by juniors and by midwives. In contemporary UK maternity services, intrapartum care within consultant units should be consultant-based, rather than simply consultant-led. In the face of major PPH with continuing bleeding, a consultant obstetrician should be alerted and should normally attend to provide hands-on patient care. If a midwife perceives a need for a consultant obstetrician's presence, they should feel able to call a consultant colleague themselves if on-site obstetric junior staff appear reluctant to do so.

Communication with the patient and her birthing partner is important and clear information of what is happening should be given, as this is a very frightening event.

## 6.2 Resuscitation

A primary survey of a collapsed or severely bleeding woman should follow a structured approach of simple 'ABC', with resuscitation taking place as problems are identified; that is, a process of simultaneous evaluation and resuscitation. The urgency and measures undertaken to resuscitate and arrest haemorrhage need to be tailored to the degree of shock.

### A and B – assess airway and breathing

A high concentration of oxygen (10–15 litres/minute) via a facemask should be administered, regardless maternal oxygen concentration. If the airway is compromised owing to impaired conscious level, anaesthetic assistance should be sought urgently. Usually, level of consciousness and airway control improve rapidly once the circulating volume is restored.

### C Evaluate circulation

Establish two 14-gauge intravenous lines; 20 ml blood sample should be taken and sent for diagnostic tests, including full blood count, coagulation screen, urea and electrolytes and cross match (4 units). The urgency and measure undertaken to resuscitate and arrest haemorrhage need to be tailored to the degree of shock.

#### Basic measures for MINOR PPH (blood loss 500–1000 ml, no clinical shock):

- Intravenous access (14-gauge cannula x 1).
- Commence crystalloid infusion.

#### Full protocol for MAJOR PPH (blood loss > 1000 ml and continuing to bleed OR clinical shock):

- Assess airway.
- Assess breathing.
- Evaluate circulation
- Oxygen by mask at 10–15 litres/minute.
- Intravenous access (14-gauge cannula x 2, orange cannulae).
- Position flat.
- Keep the woman warm using appropriate available measures.
- Transfuse blood as soon as possible.
- Until blood is available, infuse up to 3.5 litres of warmed crystalloid Hartmann's solution (2 litres) and/or colloid (1–2 litres) as rapidly as required.
- The best equipment available should be used to achieve RAPID WARMED infusion of fluids.
- Special blood filters should NOT be used, as they slow infusions.
- Recombinant factor VIIa therapy should be based on the results of coagulation.

#### Fluid therapy and blood product transfusion (please refer to sections 6.2.1 and 6.2.2):

Crystalloid	Up to 2 litres Hartmann's solution
Colloid	up to 1–2 litres colloid until blood arrives
Blood	Crossmatched If crossmatched blood is still unavailable, give uncrossmatched group-specific blood OR give 'O RhD negative' blood
Fresh frozen plasma	4 units for every 6 units of red cells or prothrombin time/activated partial thromboplastin time > 1.5 x normal (12–15 ml/kg or total 1 litres)
Platelets concentrates	if PLT count < 50 x 10 <sup>9</sup>
Cryoprecipitate	If fibrinogen < 1 g/l

## Apply clinical judgement on each situation.



The cornerstones of resuscitation during PPH are restoration of both blood volume and oxygen-carrying capacity. Volume replacement must be undertaken on the basis that blood loss is often grossly underestimated.<sup>21,54</sup> Compatible blood (supplied in the form of red cell concentrate) is the best fluid to replace major blood loss and should be transfused as soon as available, if necessary. The clinical picture should be the main determinant for the need of blood transfusion and time should not be wasted waiting for laboratory results.<sup>55,56</sup> Obstetricians should draw on the expertise of their colleagues in anaesthesia, haematology and transfusion medicine in determining the most appropriate combination of intravenous clear fluids, blood and blood products for continuing resuscitation. A 2006 guideline from the British Committee for Standards in Haematology<sup>57</sup> summarises the main therapeutic goals of management of massive blood loss is to maintain:

- haemoglobin > 8g/dl
- platelet count > 75 x 10<sup>9</sup>/l
- prothrombin < 1.5 x mean control
- activated prothrombin times < 1.5 x mean control
- fibrinogen > 1.0 g/l.

*What fluids can be used for volume resuscitation?*

### 6.2.1 Fluid replacement

By consensus, total volume of 3.5 litres of clear fluids (**up to 2 litres of warmed Hartmann's solution as rapidly as possible, followed by up to a further 1.5 litres of warmed colloid if blood still not available**) comprises the maximum that should be infused while awaiting compatible blood.<sup>11</sup> There is controversy as to the most appropriate fluids for volume resuscitation.<sup>57-59</sup> The nature of fluid infused is of less importance than rapid administration and warming of the infusion. The woman needs to be kept warm using appropriate measures.

### 6.2.2 Blood transfusion

If fully crossmatched blood is unavailable by the time that 3.5 litres of clear fluid have been infused, the best available alternative should be given to restore oxygen-carrying capacity. The most suitable alternative will vary, depending on location and individual patient circumstances. Group O RhD-negative blood may be the safest way to avoid a mismatched transfusion in an acute emergency. However, for most women, the ABO and rhesus groups will have been determined on a current admission sample; if not, testing on a new sample takes 10 minutes; then ABO & D group-compatible, uncrossmatched blood can be issued.

All delivery units, especially small units without a blood bank on site, should maintain a supply of O RhD-negative blood, as this might offer the only means of restoring oxygen-carrying capacity within an acceptable timescale. The minimum number of units of O RhD-negative to be maintained on site should be agreed within local protocols and should reflect the likely period of delay in the arrival of further supplies should a dire emergency arise. Small delivery units remote from the nearest blood bank will require a larger minimum supply than those within a short distance of a blood bank. In addition, the Confidential Enquiry into Maternal and Child Health recommends that women with known risk factors for PPH should not be delivered in a hospital without a blood bank on site.<sup>7</sup>

These recommendations are compatible with those in the recent Green-top Guideline on blood transfusion in obstetrics.<sup>60</sup> More detailed guidance on the transfusion of red cells and other blood components can be found in that document.<sup>60</sup> Bedside testing of haemoglobin should be used to give an indication of urgency and therefore of the type of blood to be transfused. However, the use of adequate quality control for testing devices, together with the training of theatre staff and the use of standard operating procedures and compliance with the hospital guidelines should be maintained. The Serious Hazards of Transfusion (SHOT) reporting scheme has highlighted the risk of errors in using near-patient testing of haemoglobin measurements to guide transfusion ([www.shotuk.org](http://www.shotuk.org)).<sup>61</sup>

Intraoperative cell salvage (the process whereby blood shed during an operation is collected, filtered and washed to produce autologous red blood cells for transfusion to the patient) is commonly being used in cardiac, orthopaedic and vascular surgery with relative reduction of blood transfusion by 39% and absolute risk reduction by 23%, with cell salvage not appearing to impact adversely on clinical outcomes.<sup>62,63</sup> Although large prospective trials of cell salvage with autotransfusion in obstetrics are lacking, to date, no single serious complication leading to poor maternal outcome has been directly attributed to its use. Several bodies based on current evidence have endorsed cell salvage in obstetrics. Current evidence supports the use of cell salvage in obstetrics, which is likely to become increasingly commonplace, but more data are required concerning its clinical use.<sup>64</sup>

A National UK survey in 2007 showed that, in 2005–2006, 38% of all UK maternity units were using cell salvage and that 28% incorporated cell salvage into their massive haemorrhage guidelines.<sup>65</sup> In particular, this survey showed that a lack of training was the main perceived barrier to its use: 48% of units specifically stated that their reason for not using cell salvage was lack of training and equipment, with fears about safety being expressed by only 10%. However, the potential difficulty is the effective removal of amniotic fluid and the degree of contamination with fetal red cells with potential maternal sensitisation, intraoperative cell salvage may be a useful technique in women who refuse blood or blood products (Jehovah's Witnesses guideline)<sup>5</sup> or those where massive blood loss is anticipated (placenta percreta or accreta). For women who are RhD-negative, to prevent sensitisation, the standard dose of anti-D should be given and a Kleihauer test taken 1 hour after cell salvage has finished, to determine whether further anti-D is required.<sup>66</sup>

### *6.2.3 What blood components can be used?*

When the blood loss reaches about 4.5 litres (80% of blood volume) and large volumes of replacement fluids have been given, there will be clotting factor defects and blood components should be given. While acknowledging the general principle that results of coagulation studies and the advice of a haematologist should be used to guide transfusion of coagulation factors, up to 1 litre of fresh frozen plasma (FFP) and 10 units of cryoprecipitate (two packs) may be given empirically in the face of relentless bleeding, while awaiting the results of coagulation studies.<sup>67</sup> Such empirical use of FFP and cryoprecipitate is in line with recommendations in the British Committee for Standards in Haematology guideline.<sup>57,61,68</sup> These guidelines can be downloaded from [www.transfusionguidelines.org.uk](http://www.transfusionguidelines.org.uk). Clinicians should be aware that these blood products must be ordered as soon as a need for them is anticipated, as there will always be a short delay in supply because of the need for thawing.

### *6.2.4 Is there a use for recombinant factor VIIa therapy?*

Recombinant activated factor VII (rFVIIa) was developed for the treatment of haemophilia. Over the past decade, it has also been used to control bleeding in other circumstances. A 2007 review identified case reports of 65 women treated with rFVIIa for PPH.<sup>69</sup> Although the case reports suggested that rFVIIa reduced bleeding, 30 of the 65 women underwent peripartum hysterectomy and particular caution is required in interpreting data from uncontrolled case reports. In the face of life-threatening PPH, and in consultation with a haematologist, rFVIIa may be used as an adjuvant to standard pharmacological and surgical treatments. A suggested dose is 90 micrograms/kg, which may be repeated in the absence of clinical response within 15–30 minutes.<sup>70</sup> Although there is no clear evidence of thrombosis with the use of rFVIIa in obstetric practice, there have been case reports of thrombosis with the use in cardiac surgery.<sup>71–73</sup>

Women with PPH are particularly susceptible to defibrination (severe hypofibrinogenaemia) and this is particularly relevant to the most severe cases that will be considered for rFVIIa; rFVIIa will not work if there is no fibrinogen and effectiveness may also be suboptimal with severe thrombocytopenia (less than  $20 \times 10^9/l$ ). Therefore, fibrinogen should be above 1g/l and platelets greater than  $20 \times 10^9/l$  before rFVIIa is given. If there is a suboptimal clinical response to rFVIIa, these should be checked and acted on (with cryoprecipitate, fibrinogen concentrate or platelet transfusion as appropriate) before a second dose is given.

### 6.2.5 Is there a use for antifibrinolytic drugs?

Although evidence is conflicting, there is a consensus view that fibrinolytic inhibitors (such as tranexamic acid) seldom, if ever, have a place in the management of obstetric haemorrhage.<sup>57,67</sup>

### 6.3 Monitoring and Investigation

*What investigations should be performed and how should the woman be monitored?*

**Basic measures for MINOR PPH (blood loss 500–1000 ml, no clinical shock and bleeding ceasing):**

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- Consider venepuncture (20 ml) for:
  - group and screen
  - full blood count
  - coagulation screen including fibrinogen
  - pulse and blood pressure recording every 15 minutes.

**Full Protocol for MAJOR PPH (blood loss greater than 1000 ml and continuing to bleed OR clinical shock):**

- Consider venepuncture (20 ml) for:
  - crossmatch (4 units minimum)
  - full blood count
  - coagulation screen including fibrinogen
  - renal and liver function for baseline.
- Monitor temperature every 15 minutes.
- Continuous pulse, blood pressure recording and respiratory rate (using oximeter, electrocardiogram and automated blood pressure recording).
- Foley catheter to monitor urine output.
- Two peripheral cannulae, 14- or 16-gauge.
- Consider arterial line monitoring (once appropriately experienced staff available for insertion).
- Consider transfer to intensive therapy unit once the bleeding is controlled or monitoring at high dependency unit on delivery suite, if appropriate.
- Recording of parameters on a flow chart such as the modified obstetric early warning system charts.
- Documentation of fluid balance, blood, blood products and procedures.

Fluid replacement and the use of blood and blood products should be strictly monitored and the amount given should be dictated by the lead clinician (consultant anaesthetist or consultant obstetrician) aided by the results of full blood count and clotting screen under the guidance of a haematologist and/or consultant in transfusion medicine. The full blood count will include estimation of haematocrit and platelet count. The clotting screen should include prothrombin time, thrombin time, partial thromboplastin time and fibrinogen assay. The Haemostasis and Thrombosis Task Force suggested that obtaining appropriate specimens for crossmatching, full blood count and clotting studies in emergency situations may be facilitated by keeping packs of all the necessary sample tubes for these tests in labour-ward refrigerators, provided that they do not exceed their expiry date.<sup>61</sup> Record keeping on intensive-care unit-style charts would help in monitoring the clinical situation (Appendix 1).

The presence of a central line not only provides a means of accurate central venous pressure (CVP) monitoring but also a route for rapid fluid replacement. Nevertheless, the threshold for instituting invasive monitoring has been controversial, with some authorities advising early recourse to central venous pressure monitoring<sup>15,67,74</sup> and others advocating caution.<sup>61,69</sup> The 2000–2002 report of the UK Confidential Enquiries into Maternal Deaths (CEMD) includes the recommendation: 'Central venous and direct arterial pressure monitoring should be used when the cardiovascular system is compromised by haemorrhage or disease'.<sup>7</sup>

CVP monitoring requires early involvement of a senior skilled anaesthetist, who will usually take responsibility for this aspect of management. The use of ultrasound is more likely to make the procedure safer,<sup>7</sup> as this procedure carries significant morbidity and mortality.<sup>8</sup> Once bleeding is under control, transfer to an intensive care or high-dependency unit on delivery suite should be considered, depending on the severity of the blood loss. It is also important that, once the bleeding is arrested and any coagulopathy is corrected, thromboprophylaxis is administered, as there is a high risk of thrombosis. Alternatively, pneumatic compression devices can be used, if thromboprophylaxis is contraindicated in cases of thrombocytopenia.

Continuous physiological monitoring is necessary and the recording of parameters over time on a flowchart that will give the reader good visual cues on the clinical progress of the patient (Appendix 2). The need to continually re-evaluate the woman's physiological condition, even when bleeding appears to have stopped, is essential to recognise continuing bleeding. New devices based on pulse oximeters can give almost beat-to-beat readings of haemoglobin concentration and their use might be considered in the later monitoring of PPH.

The woman and the partner should be kept informed of the situation and possibly reassured.

#### 6.4 Anaesthetic management

The anaesthetist needs to be able to assess the woman quickly, to initiate or continue resuscitation to restore intravascular volume and provide adequate anaesthesia.

The presence of cardiovascular instability is a relative contraindication to regional anaesthesia. Blockage of the sympathetic system can potentially lead to worsening hypotension due to haemorrhage. If cardiovascular stability has been achieved and there is no evidence of coagulation failure, regional anaesthesia can be used. This may be particularly appropriate where a working epidural has been in place during labour. Continuous epidural block is preferred over spinal, as it allows better blood pressure control and for prolonged surgery.

When there is continuing bleeding and the cardiovascular stability is compromised, general anaesthesia is more appropriate. Rapid sequence induction is the gold standard to reduce the risk of aspiration. Cardiotable induction agents with minimal peripheral vasodilators should be considered and adrenaline and atropine being available during induction. Ventilation with high oxygen concentrations may be needed until the bleeding is under control.

#### 6.5 Arresting the bleeding

Causes for PPH may be considered to relate to one or more of 'the four Ts':

- **tone (abnormalities of uterine contraction)**
- **tissue (retained products of conception)**
- **trauma (of the genital tract)**
- **thrombin (abnormalities of coagulation).**

**The most common cause of primary PPH is uterine atony. However, clinical examination must be undertaken to exclude other or additional causes:**



- **retained products (placenta, membranes, clots)**
- **vaginal/cervical lacerations or haematoma**
- **ruptured uterus**
- **broad ligament haematoma**
- **extragenital bleeding (for example, subcapsular liver rupture)**
- **uterine inversion.**

When uterine atony is perceived to be a cause of the bleeding, the following mechanical and pharmacological measures should be instituted, in turn, until the bleeding stops:

B

- Bimanual uterine compression (rubbing up the fundus) to stimulate contractions.
- Ensure bladder is empty (Foley catheter, leave in place).
- Syntocinon 5 units by slow intravenous injection (may have repeat dose).
- Ergometrine 0.5 mg by slow intravenous or intramuscular injection (contraindicated in women with hypertension).
- Syntocinon infusion (40 units in 500 ml Hartmann's solution at 125 ml/hour) unless fluid restriction is necessary.
- Carboprost 0.25 mg by intramuscular injection repeated at intervals of not less than 15 minutes to a maximum of 8 doses (contraindicated in women with asthma).
- Direct intramyometrial injection of carboprost 0.5 mg (contraindicated in women with asthma), with responsibility of the administering clinician as it is not recommended for intramyometrial use.
- Misoprostol 1000 micrograms rectally.

If pharmacological measures fail to control the haemorrhage, initiate surgical haemostasis sooner rather than later. Intrauterine balloon tamponade is an appropriate first-line 'surgical' intervention for most women where uterine atony is the only or main cause of haemorrhage. If this fails to stop the bleeding, the following conservative surgical interventions may be attempted, depending on clinical circumstances and available expertise:

C

- balloon tamponade
- haemostatic brace suturing (such as using procedures described by B-Lynch or modified compression sutures)
- bilateral ligation of uterine arteries
- bilateral ligation of internal iliac (hypogastric) arteries
- selective arterial embolisation.

It is recommended that a laminated diagram of the brace technique be kept in theatre.



Resort to hysterectomy SOONER RATHER THAN LATER (especially in cases of placenta accreta or uterine rupture).

C

A second consultant clinician should be involved in the decision for hysterectomy.



Uterine atony is the most common cause of primary PPH. Treatment must be accompanied by careful clinical examination to ascertain that the uterus is indeed atonic and that other sources of bleeding, such as genital tract lacerations or uterine inversion, have been excluded. A 2006 Cochrane review addressing the treatment of primary postpartum haemorrhage identified only three randomised controlled trials meeting the Cochrane selection criteria.<sup>1</sup> All three studies related to the role of misoprostol in the treatment of PPH; no trials dealing with surgical techniques, radiological interventions or other haemostatic drugs were identified. Thus, recommendations on treatment strategies are based on observational data and consensus only.

#### 6.5.1 What mechanical and pharmacological strategies can be used?

The simple mechanical and physiological measures of 'rubbing up the fundus', bimanual uterine compression and emptying the bladder to stimulate uterine contraction, represent time-honoured first-line management of PPH. No published studies were identified to provide an evidence-base for these interventions; nevertheless, professional consensus supports their continued use. A non-pneumatic antishock garment may be useful in UK settings where women with PPH require transfer from midwife-led to consultant-led units. Further evaluation is required before a recommendation can be made.<sup>75</sup>

Despite decades of empirical use in clinical practice, there are no trials comparing ergometrine and oxytocin as first-line agents for the treatment (rather than prevention) of PPH. It seems appropriate to use both agents, although oxytocin is to be preferred initially especially in women with prior hypertension or pre-eclampsia. Previous guidance advocated an initial dose of 10 units of oxytocin by slow intravenous injection for treatment (rather than prophylaxis) of PPH.<sup>11</sup> The British National Formulary continues to recommend a dose of '5-10 units by slow intravenous injection';<sup>76</sup> however, The 1997-1999 report of the UK CEMD highlighted the risk of profound hypotension, which may be associated with oxytocin injection.<sup>73</sup> We thus have adopted the CEMD recommendation that 'when given as an intravenous bolus, the drug should be given slowly in a dose of not more than 5 units'. This dosage is in line with guidance from other authorities.<sup>26,76</sup>

Similarly, there are no trials comparing the prostaglandin carboprost (15 methyl prostaglandin F<sub>2</sub>) with other uterotonic agents. However, two case series from the USA<sup>77,78</sup> comprising 26 and 237 cases, respectively, report success in controlling haemorrhage, without resort to surgical means in 85% and 95% of cases. Two of the four failures in the smaller series were associated with placenta accreta. If bleeding occurs at the time of caesarean section, intramyometrial injection of carboprost should be used and, if laparotomy is undertaken following failure of pharmacological management, intramyometrial carboprost injection should be the first-line measure once the uterus is exposed. It is also possible to inject intramyometrial carboprost through the abdominal wall in the absence of laparotomy.

Two systematic reviews<sup>1,79</sup> focused on misoprostol to treat PPH and address optimal route, dosage and efficacy. In view of the scant data available, the more established uterotonic prostaglandin, carboprost, would seem preferable for the treatment of PPH in UK settings. Where parenteral prostaglandins are not available or where there are contraindications (usually asthma) to prostaglandin F<sub>2</sub>, misoprostol (prostaglandin E<sub>1</sub>) may be an appropriate alternative. There is no evidence that on the use of misoprostol with breastfeeding, therefore a washout period of usually 24 hours should be considered.

### *6.5.2 What surgical treatments can be employed to arrest the bleeding?*

The use of pharmacological agents other than those listed should not delay recourse to surgery. Once the decision is made to embark on surgical haemostasis, the most appropriate choice of procedure will depend, in part, on the experience and expertise of available staff. Compression of the aorta may be a temporary but effective measure to allow time for resuscitation to catch up with the volume replacement and the appropriate surgical support arrives. The judgement of senior clinicians, taking into account the individual woman's future reproductive aspirations, is required in deciding the appropriate sequence of interventions. The decision for hysterectomy should be made by an experienced consultant clinician (and the decision preferably being discussed with a second experienced consultant clinician, if available)<sup>7</sup> and the procedure should be carried out by a surgeon who is experienced in carrying out hysterectomy. Surgical techniques like 'tamponade and haemostatic suture' may give immediate arrest of haemorrhage and facilitate an early decision regarding the need for hysterectomy. Early recourse to hysterectomy is recommended, especially where bleeding is associated with placenta accreta or uterine rupture. Hysterectomy should not be delayed until the woman is in extremis or while less definitive procedures with which the surgeon has little experience are attempted. Subtotal hysterectomy is the operation of choice in many instances of PPH requiring hysterectomy, unless there is trauma to the cervix or lower segment; the risk of neoplasia developing in the cervical stump several years later is not relevant in the context of life-threatening haemorrhage.

### *6.5.3 Balloon tamponade*

In recent years, tamponade using various types of hydrostatic balloon catheter has superseded uterine packing for control of atonic PPH. Case series have used a Foley catheter,<sup>80</sup> Bakri balloon,<sup>81</sup> Sengstaken-Blakemore oesophageal catheter<sup>82,83</sup> and a condom catheter.<sup>84</sup> The urological Rusch balloon has been described as preferable by virtue of larger capacity, ease of use and low cost.<sup>85</sup> A group from Sheffield has provided a detailed protocol for uterine tamponade using the Rusch balloon.<sup>85</sup> The Scottish Confidential Audit of Severe Maternal Morbidity identified 64 cases where balloon tamponade was used for the management of major PPH;

hysterectomy was averted in 50 (78%) women.<sup>7</sup> This success rate is of the same order as that reported in other case series.

Some of the reports of balloon tamponade<sup>84,86</sup> describe the intervention as the 'tamponade test'. A 'positive test' (control of PPH following inflation of the balloon) indicates that laparotomy is not required, whereas a 'negative test' (continued PPH following inflation of the balloon) is an indication to proceed to laparotomy. The concept of balloon tamponade as a 'test', serves to affirm its place as first-line 'surgical' management. There is no clear evidence how long the balloon tamponade should be left in place. In most cases, 4–6 hours of tamponade should be adequate to achieve haemostasis and, ideally, it should be removed during daytime hours, in the presence of appropriate senior staff, should further intervention be necessary.<sup>82,83</sup> Before its complete removal, the balloon could be deflated but left in place to ensure that bleeding does not reoccur.

#### 6.5.4 Haemostatic suturing

Over the past decade, case series have been published describing success with haemostatic brace sutures. The best known version, described by B-Lynch in 1997, requires hysterotomy for its insertion and is thus particularly suitable when the uterus has already been opened at caesarean section.<sup>87</sup> A description of the B-Lynch technique is available at [www.cblynch.com/HTML/bjog1.html](http://www.cblynch.com/HTML/bjog1.html). A review published in 2005 summarised nine case series of B-Lynch suturing (a total of 32 cases), reporting success in all but one case.<sup>88</sup>

In 2002, Hayman *et al.* described a modified compression suture which does not require hysterotomy.<sup>89</sup> In 2007, Ghezzi *et al.* reported success in 10/11 women managed with the Hayman suture.<sup>90</sup> Other authors have described variants on these techniques; for example, Hwu *et al.* described success in 14/14 women using a simplified technique of vertical compression sutures<sup>91</sup> and Kafali *et al.* described success in 3/3 women using a variant designed to control bleeding of cervical origin.<sup>92</sup>

The Scottish Confidential Audit of Severe Maternal Morbidity identified 52 cases where haemostatic brace suturing was used for the management of major PPH; hysterectomy was averted in 42 (81%) women.<sup>9</sup> Again, this success rate is of the same order as that reported in other case series.

These observational data suggest that haemostatic suture techniques are effective in controlling severe PPH and in reducing the need for hysterectomy. In the absence of comparative data to demonstrate that any one variant is superior to another, obstetricians are encouraged to familiarise themselves with one technique, under the supervision of an experienced colleague. It is recommended that a laminated diagram of the brace technique be kept in theatre. Experience with these techniques is limited and few complications have been reported. There is an inevitability that as more clinicians adopt these techniques, reports of complications will ensue. For example, a case of pyometria following a uterine brace suture was reported in 2002<sup>93</sup> and of partial uterine necrosis in 2004.<sup>94</sup>

#### 6.5.5 Internal iliac artery ligation

A recent case series describes 84 women with PPH from various causes who underwent internal iliac artery ligation as the first-line surgical intervention. Hysterectomy was required in 33 women (39%).<sup>95</sup> The lack of comparative studies means that it is impossible to assess which of the various 'surgical' haemostatic techniques is most effective. Nevertheless, the available observational data suggest that balloon tamponade and haemostatic suturing may be more effective than internal iliac artery ligation and they are unquestionably easier to perform. A follow-up study of 45 women suggested that internal iliac artery ligation does not impair subsequent fertility and pregnancy outcomes.<sup>96</sup>

#### 6.5.6 Selective arterial occlusion or embolisation by interventional radiology

A 2002 review summarised case series totalling 100 women and reporting 97% success with selective arterial embolisation for obstetric haemorrhage.<sup>97</sup> Subsequent case series have reported success in 1/1,<sup>98</sup> 4/4,<sup>99</sup>

10/10<sup>100</sup> and 26/29<sup>101</sup> women. The Scottish Confidential Audit of Severe Maternal Morbidity identified 14 cases where arterial embolisation was used for the management of major PPH; hysterectomy was averted in 10 (71%) women.<sup>9</sup> The logistics of performing arterial occlusion or embolisation where the equipment or an interventional radiologist may not be available mean that uterine balloon tamponade (which appears to have similar efficacy) is a more appropriate first-line treatment. Nevertheless, interventional radiology may be considered in cases of placenta praevia with accreta if intra-arterial balloons can be placed in the radiology department before the woman goes to theatre for caesarean section. Follow up studies of 17<sup>102</sup> and 25<sup>103</sup> women who had undergone arterial embolisation for control of PPH suggest that the intervention does not impair subsequent menstruation and fertility.

### 6.5.7 Intensive and high-dependency unit

Once the bleeding has been controlled and initial resuscitation has been completed, continuous close observations in either intensive care unit or high-dependency unit on the labour ward is required. The recording of the observation on an obstetric early-warning score system would help in the early identification of continuous bleeding, especially in cases which are not apparent, as recommended by CEMACH (Appendix 3).<sup>8</sup>

## 7. How should secondary PPH be treated?

**Secondary PPH is often associated with endometritis. When antibiotics are clinically indicated, a combination of ampicillin (clindamycin if penicillin allergic) and metronidazole is appropriate. In cases of endomyometritis (tender uterus) or overt sepsis, then the addition of gentamicin is recommended.**



**Surgical measures should be undertaken if there is excessive or continuing bleeding, irrespective of ultrasound findings.<sup>2</sup>**



**A senior obstetrician should be involved in decisions and performance of any evacuation of retained products of conception as these women are carrying a high risk for uterine perforation.**



A 2002 Cochrane review (updated in January 2008) addressed treatments for secondary postpartum haemorrhage.<sup>2</sup> No trials were identified which met the review group's inclusion criteria and no recommendations were made regarding effective treatments. Investigations of secondary PPH should include high and low vaginal swabs, blood cultures if pyrexial, full blood count, C-reactive protein. A pelvic ultrasound may help to exclude the presence of retained products of conception, although the appearance of the immediate postpartum uterus may be unreliable.<sup>104,105</sup>

It is generally accepted that secondary PPH is often associated with infection and conventional treatment involves antibiotics and uterotonics. In continuing haemorrhage, insertion of balloon catheter may be effective. A 2004 Cochrane review specifically addressed antibiotic regimens for endometritis after delivery.<sup>106</sup> The conclusions were that: a combination of clindamycin and gentamicin is appropriate; for gentamicin, daily dosing regimens are at least as effective as thrice daily regimens; once uncomplicated endometritis has clinically improved with intravenous therapy, there is no additional benefit from extended oral therapy. This antibiotic therapy does not contraindicate breastfeeding.

## 8. Risk management

### 8.1 Rehearsal

*What measures can be taken to ensure optimal management of PPH?*

**Training for all birth attendants in the management of postpartum haemorrhage is recommended by the Royal College of Midwives (RCM) and RCOG.**



The optimal frequency of rehearsals is not known.

**A formal follow-up meeting which analyses the case and addresses what could be done better in the future should be triggered for every significant PPH.**



In the seventh CEMD report, failure of identification and management of intra-abdominal bleeding, uterine atony and placenta percreta were the main reasons for the substandard care of 10 of 17 women. Furthermore, a reduction in postgraduate training programmes and reduced hours have led to less practical experience, which may result in failure to recognise even the clear signs and symptoms of intra-abdominal bleeding. CEMACH and the Royal Colleges (RCOG, RCM) have thus recommended annual 'skill drills', including maternal collapse. These drills are also now one of the requirements in the new Maternity Clinical Negligence Scheme for Trusts standards.

Annual 'skill drills' should ensure all members of staff, including those operating the blood bank, know exactly what to do, ensuring that appropriate blood products are delivered to the labour ward. A multidisciplinary approach to treatment should ensure that everyone knows how to work together to ensure prompt and efficient treatment in such an emergency. A prospective randomised trial in the UK demonstrated that practical, multi-professional training in the management of obstetric emergencies has been shown to increase midwives' and doctors' knowledge. Furthermore, conducting such training locally or in a simulation centre was no different.<sup>107-109</sup>

## 8.2 Documentation

*How can successful litigation be avoided when PPH occurs?*

**Accurate documentation of a delivery with postpartum haemorrhage is essential.**



Inadequate documentation in obstetrics can lead to potential medico-legal consequences.<sup>9</sup> It may be helpful to use a structured pro forma to aid accurate record keeping. PPH should be notified through a clinical incident reporting or risk management system in place. An example is provided in Appendix 1.

It is important to record:

- the staff in attendance and the time they arrived
- the sequence of events
- the time of administration of different pharmacological agents given, their timing and sequence
- the time of surgical intervention, where relevant
- the condition of the mother throughout the different steps
- the timing of the fluid and blood products given.

## 8.3 Debriefing

**Major obstetric haemorrhage can be traumatic to the woman, her family and the birth attendants; therefore, debriefing is recommended by a senior member of the team who was involved at the time of events at the earliest opportunity.**



This should include arrangements for proper follow-up and investigations as necessary, such as screening for coagulopathies if there are other indicators and screening for the rare complication of panhypopituitarism (Sheehan syndrome) secondary to hypotension.<sup>110</sup>

## 9. Support

- Patient UK. Postpartum haemorrhage, article by Dr Hayley Willacy [[www.patient.co.uk/showdoc/40000261](http://www.patient.co.uk/showdoc/40000261)].
- Netdoctor.co.uk. 'I suffered with postpartum haemorrhage', [[www.netdoctor.co.uk/ate/womenshealth/207160.html](http://www.netdoctor.co.uk/ate/womenshealth/207160.html)].

## 10. Auditable standards

1. Monitor all cases with blood loss greater than 1000ml.
2. Appropriate management of women with previous PPH.
3. Documentation of management, especially with the timing of events for women who had PPH.
4. Appropriate management of labour and outcome in women with PPH.
5. Notification to the risk management team for women with PPH.
6. Appropriate training of the obstetric team (midwifery and medical staff).

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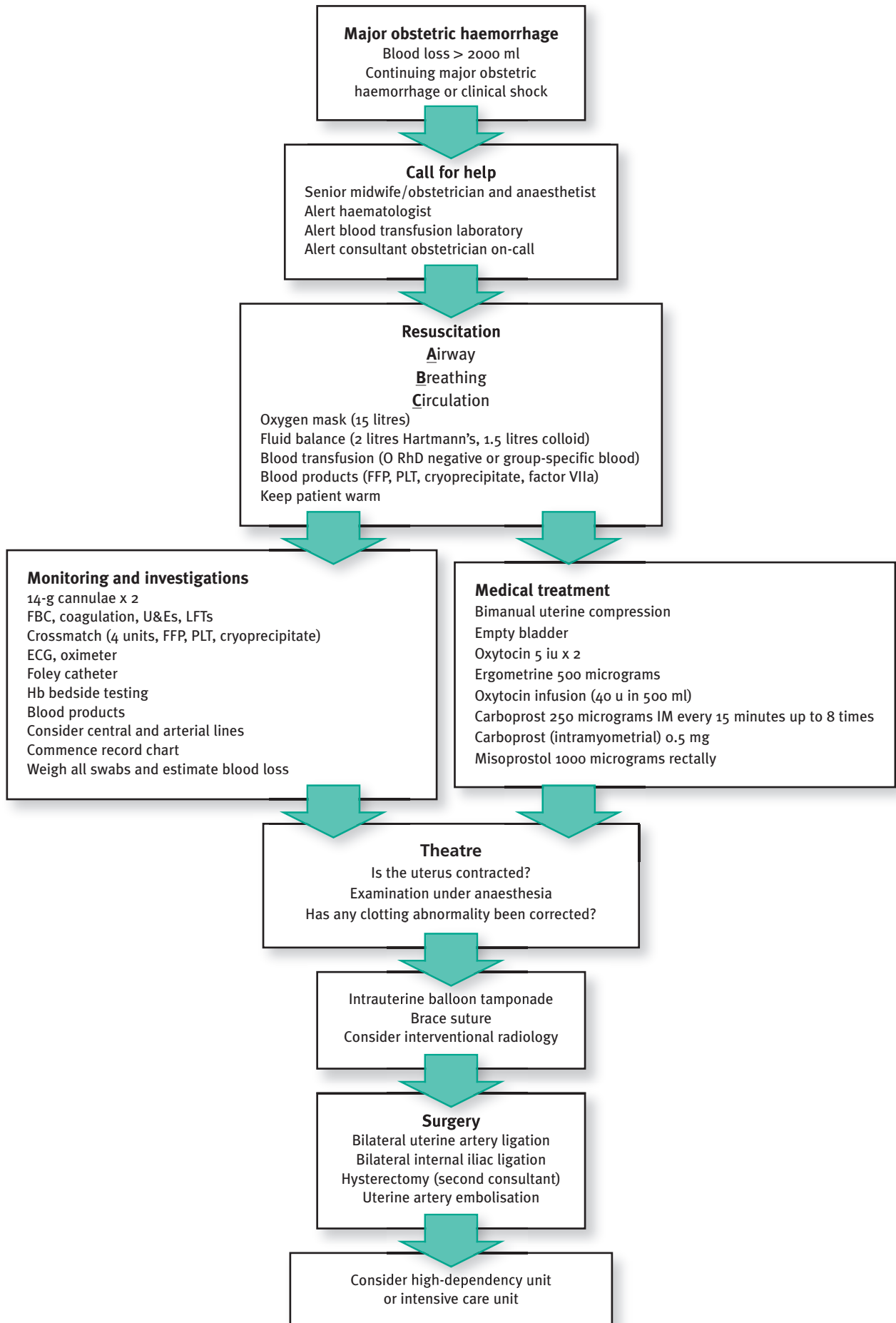
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**APPENDIX II** : A flow chart of the different steps for the management of major postpartum haemorrhage

**Resuscitation, monitoring, investigation and treatment should occur simultaneously**



**APPENDIX III : Obstetric Early Warning Chart**

**OBSTETRIC EARLY WARNING CHART. FOR MATERNITY USE ONLY**



**NAME:** \_\_\_\_\_ **DOB:** \_\_\_\_\_

**CHI:** \_\_\_\_\_ **WARD:** \_\_\_\_\_

**CONTACT DOCTOR FOR EARLY INTERVENTION IF PATIENT TRIGGERS ONE RED OR TWO YELLOW SCORES AT ANY ONE TIME**


Date :															
Time :															
RESP (write rate in corresp. box)	>30													>30	
	21-30													21-30	
	11-20													11-20	
	0-10													0-10	
Saturations	90-100%													90-100%	
	<90%													<90%	
O2 Conc.	%													%	
Temp	39													39	
	38													38	
	37													37	
	36													36	
	35													35	
HEART RATE	170													170	
	160													160	
	150													150	
	140													140	
	130													130	
	120													120	
	110													110	
	100													100	
	90													90	
	80													80	
	40													40	
Systolic blood pressure	200													200	
	190													190	
	180													180	
	170													170	
	160													160	
	150													150	
	140													140	
	130													130	
	120													120	
	110													110	
	50													50	
Diastolic blood pressure	130													130	
	120													120	
	110													110	
	100													100	
	90													90	
	80													80	
	70													70	
	60													60	
	50													50	
	40													40	
	Passed Urine	Y or N													Y or N
Lochia	Normal													Normal	
	Heavy / Foul													Heavy / Foul	
Proteinuria	2+													2+	
	> 2+													> 2+	
Liquor	Clear / Pink													Clear/Pink	
	Green													Green	
NEURO RESPONSE (✓)	Alert													Alert	
	Voice													Voice	
	Pain / Unresponsive													Pain /Unresponsive	
Pain Score (no.)	2-3													2-3	
	0-1													0-1	
Nausea (✓)	YES (✓)													YES (✓)	
	NO (✓)													NO (✓)	
Looks unwell	YES (✓)													YES (✓)	
Looks unwell	NO (✓)													NO (✓)	
Total Yellow Scores															
Total Red Scores															

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## APPENDIX IV

Clinical guidelines are: 'systematically developed statements which assist clinicians and patients in making decisions about appropriate treatment for specific conditions'. Each guideline is systematically developed using a standardised methodology. Exact details of this process can be found in Clinical Governance Advice No. 1: *Development of RCOG Green-top Guidelines* (available on the RCOG website at [www.rcog.org.uk/index.asp?PageID=75](http://www.rcog.org.uk/index.asp?PageID=75)). These recommendations are not intended to dictate an exclusive course of management or treatment. They must be evaluated with reference to individual patient needs, resources and limitations unique to the institution and variations in local populations. It is hoped that this process of local ownership will help to incorporate these guidelines into routine practice. Attention is drawn to areas of clinical uncertainty where further research may be indicated.

The evidence used in this guideline was graded using the scheme below and the recommendations formulated in a similar fashion with a standardised grading scheme.

Classification of evidence levels	Grades of recommendations
1++ High-quality meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a very low risk of bias	<b>A</b> At least one meta-analysis, systematic reviews or randomised controlled trial rated as 1++ and directly applicable to the target population; or A systematic review of randomised controlled trials or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results
1+ Well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias	<b>B</b> A body of evidence including studies rated as 2++ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 1++ or 1+
1- Meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a high risk of bias	<b>C</b> A body of evidence including studies rated as 2+ directly applicable to the target population and demonstrating overall consistency of results; or Extrapolated evidence from studies rated as 2++
2++ High-quality systematic reviews of case-control or cohort studies or high-quality case-control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal	<b>D</b> Evidence level 3 or 4; or Extrapolated evidence from studies rated as 2+
2+ Well-conducted case-control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal	<b>Good practice point</b>
2- Case-control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal	 Recommended best practice based on the clinical experience of the guideline development group
3 Non-analytical studies; e.g. case reports, case series	
4 Expert opinion	

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The final version is the responsibility of the Guidelines Committee of the RCOG.

The guideline review process will commence in 2012 unless evidence requires an earlier review

#### DISCLAIMER

The Royal College of Obstetricians and Gynaecologists produces guidelines as an educational aid to good clinical practice. They present recognised methods and techniques of clinical practice, based on published evidence, for consideration by obstetricians and gynaecologists and other relevant health professionals. The ultimate judgement regarding a particular clinical procedure or treatment plan must be made by the doctor or other attendant in the light of clinical data presented by the patient and the diagnostic and treatment options available.

This means that RCOG Guidelines are unlike protocols or guidelines issued by employers, as they are not intended to be prescriptive directions defining a single course of management. Departure from the local prescriptive protocols or guidelines should be fully documented in the patient's case notes at the time the relevant decision is taken.