Postpartum Haemorrhage (PPH) including Massive Obstetric Haemorrhage (MOH)

This guidance does not override the individual responsibility of health professionals to make appropriate decision according to the circumstances of the individual patient in consultation with the patient and /or carer. Health care professionals must be prepared to justify any deviation from this guidance.

Introduction

The latest MBRRACE report (2018-2020) evidenced that, in the UK there were 16 Direct maternal deaths from obstetric haemorrhage which contributes to 6% of maternal mortality. This represents a decline from the 21 reported in the previous report (2013-2015). This does not provide firm conclusions about the decline in incidence however it is hoped that the reduction in deaths may reflect improvements in the quality and safety of care, regular drills and skills exercises, the use of guidelines and closer multidisciplinary working.

THIS GUIDELINE SHOULD BE USED IN CONJUNCTION WITH THE WAHT **OBS-UK PPH SOP**.

This guideline is for use by the following staff groups:

All Maternity staff

Lead Clinician(s)

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Approved by Medicines Safety Committee on:	N/A
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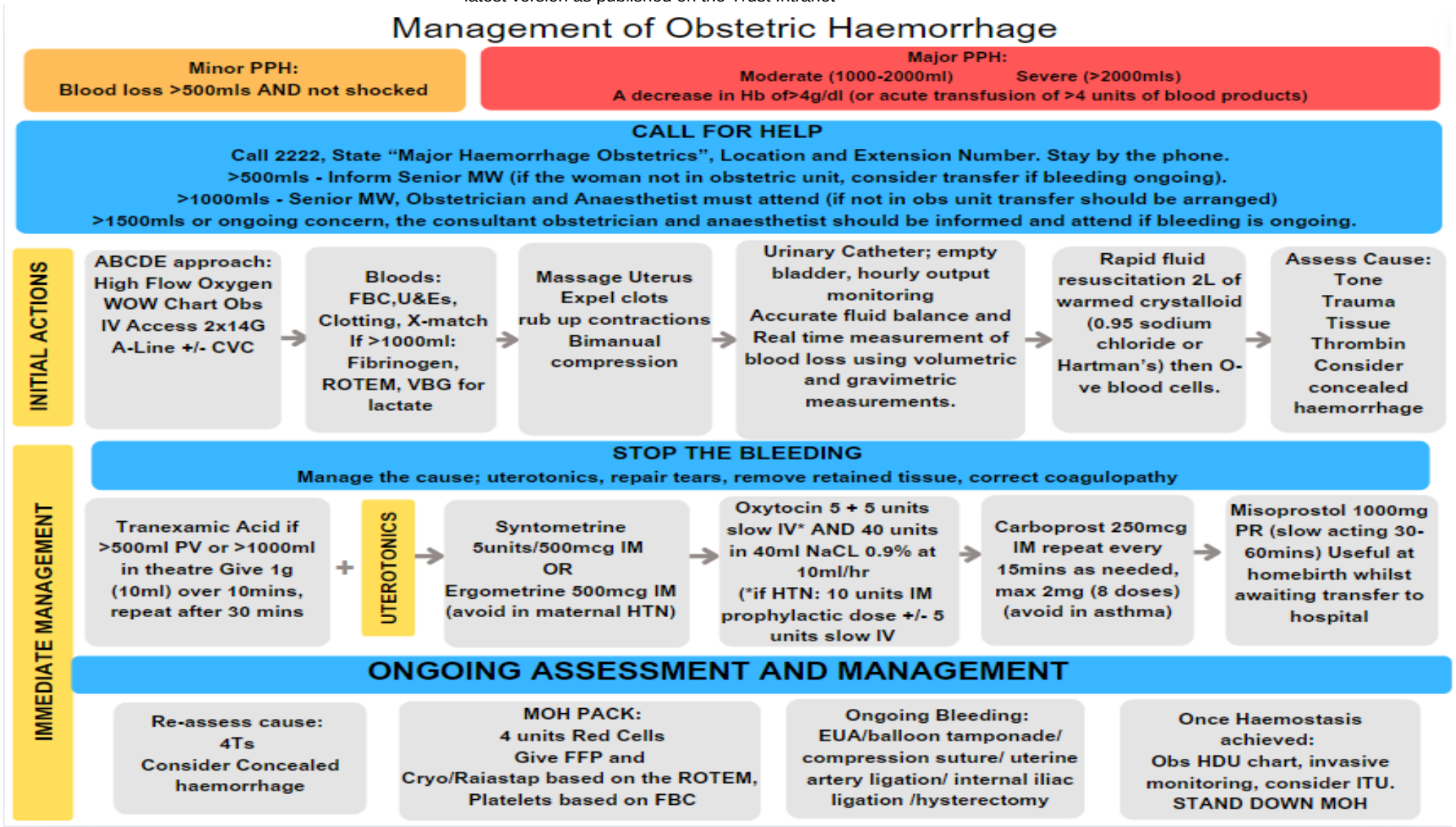
This is the most current document and should be used until a revised version is in place	

Key amendments to this guideline

Date	Amendment	Approved by:
Jan 2020	**New Document**	**MGM**
June 2024	**Full guideline Review and addition of OBS UK Trial**	**MGM**

Contents


Management of Obstetric Haemorrhage
Minor PPH:
Blood loss >500mls AND not shocked
Major PPH:
Moderate (1000-2000ml) Severe (>2000mls)
A decrease in Hb of>4g/dl (or acute transfusion of >4 units of blood products)
CALL FOR HELP
Call 2222, State "Major Haemorrhage Obstetrics", Location and Extension Number. Stay by the phone.
>500mls - Inform Senior MW (if the woman not in obstetric unit, consider transfer if bleeding ongoing).
>1000mls - Senior MW, Obstetrician and Anaesthetist must attend (if not in obs unit transfer should be arranged)
>1500mls or ongoing concern, the consultant obstetrician and anaesthetist should be informed and attend if bleeding is ongoing.
INITIAL ACTIONS
ABCDE approach: High Flow Oxygen WOW Chart Obs IV Access 2x14G A-Line +/- CVC
Bloods: FBC,U&Es, Clotting, X-match If >1000ml: Fibrinogen, ROTEM, VBG for lactate
Massage Uterus Expel clots rub up contractions Bimanual compression
Urinary Catheter; empty bladder, hourly output monitoring Accurate fluid balance and Real time measurement of blood loss using volumetric and gravimetric measurements.
Rapid fluid resuscitation 2L of warmed crystalloid (0.95 sodium chloride or Hartman's) then O-ve blood cells.
Assess Cause: Tone Trauma Tissue Thrombin Consider concealed haemorrhage
IMMEDIATE MANAGEMENT
STOP THE BLEEDING
Manage the cause; uterotonics, repair tears, remove retained tissue, correct coagulopathy
Tranexamic Acid if >500ml PV or >1000ml in theatre Give 1g (10ml) over 10mins, repeat after 30 mins
+
UTEROTONICS
Syntometrine 5units/500mcg IM OR Ergometrine 500mcg IM (avoid in maternal HTN)
Oxytocin 5 + 5 units slow IV* AND 40 units in 40ml NaCL 0.9% at 10ml/hr (*if HTN: 10 units IM prophylactic dose +/- 5 units slow IV
Carboprost 250mcg IM repeat every 15mins as needed, max 2mg (8 doses) (avoid in asthma)
Misoprostol 1000mg PR (slow acting 30-60mins) Useful at homebirth whilst awaiting transfer to hospital
ONGOING ASSESSMENT AND MANAGEMENT
Re-assess cause: 4Ts Consider Concealed haemorrhage
MOH PACK: 4 units Red Cells Give FFP and Cryo/Raiastap based on the ROTEM, Platelets based on FBC
Ongoing Bleeding: EUA/balloon tamponade/ compression suture/ uterine artery ligation/ internal iliac ligation /hysterectomy
Once Haemostasis achieved: Obs HDU chart, invasive monitoring, consider ITU. STAND DOWN MOH

Key Messages- PPH

The 'OBS Cymru' PPH care bundle was developed and is practiced in Wales. It has been rolled out as a quality improvement initiative and a randomised control trail across 36 maternity services across the UK including WAHT as OBS UK PPH care bundle (See OBS UK SOP). This runs for 30months from 1st February 2024. It consists of 4 elements, all of which are important and interrelated. These are:

1. **Risk assessment**
2. **Measured blood loss (MBL)**
3. **Escalation of multi-professional care to more senior staff at defined volumes of blood loss (or earlier if low maternal weight/BMI) with appropriate medical intervention**
4. **Point-of-care tests of coagulation, targeted blood component replacement and tranexamic acid infusion**

In addition, a **standardised documentation tool** (PPH proforma) is used for every birth (vaginal and operative births) for scribing as well as a prompt for management of PPH,

Key steps for good outcomes in PPH

Anticipate / avoid

- Treat antenatal anaemia
- Complete PPH risk assessment for all women on admission in labour including Caesarean section (Complete stage 0 of OBS UK PPH bundle)
- Cautious use of uterotonics in labour and IUD (intrauterine death)

Early recognition

- Real time measurement of blood loss from birth using gravimetric and volumetric measures
- Escalation of multi-professional care to more senior staff at defined volumes of blood loss. Earlier escalation in women with low maternal weight/BMI (booking weight <55kg or BMI <18) Be aware "Small women have small blood volumes"
- Accurate measurement of blood loss and communicate.
- Timely MEOWS observations
- Trigger responses if MEOWS score is abnormal
- If the heart rate is greater than the systolic pulse pressure, it is likely that shock is present and there is an urgent need for fluid replacement and blood transfusion
- Consider concealed haemorrhage

Multi-professional escalation based on measured blood loss

- **By 500 mL or with clinical concern**: **Activate stage 1 of OBS UK PPH bundle**

- The senior midwife is informed. If the mother is not in an obstetric unit and bleeding is ongoing, consider transfer to an obstetric unit if this has not already happened.
- **By 1L or ongoing clinical concern**: **Activate stage 2 of OBS UK PPH bundle**
- The senior midwife, an obstetrician and anaesthetist must attend the woman to diagnose and treat the likely cause of bleeding if this has not already happened.
- If the mother is not in an obstetric unit, transfer to an obstetric unit should occur.
- **By 1.5L or ongoing clinical concern**,: **Activate stage 3 of OBS UK PPH bundle**
- The consultant obstetrician and anaesthetist should be informed and attend if bleeding is ongoing if this has not already happened

Prompt effective resuscitation

- Consider all causes.
- Don't be misled by a single Hb result
- Use serial measurements of Hb, lactate Bae excess
- Tranexamic acid infusion
- Rapid access to O negative blood and Massive Obstetric Haemorrhage packs
- Point-of-care tests (POCT) of coagulation using ROTEM (thromboelastometry) for early identification of coagulopathy
- Targeted blood component replacement based on POCT/FBC
- Trigger MOH protocol for any women who has a major peripartum collapse whilst evaluation continues (as it could be Amniotic Fluid Embolism)

Control bleeding quickly

- Conservative measures are not always appropriate and if not working resort to definitive surgery including early hysterectomy – DO NOT DELAY

Human factors

- Improve communication, leadership and teamwork.

Definition

Primary postpartum haemorrhage (PPH) is blood loss >500ml within the first 24 hours and secondary PPH is blood loss >500 after 24hours up to 12 weeks post-delivery.

Normal Blood Loss – < 500mls

PPH: 500-1000mls

Massive Obstetric Hemorrhage (MOH):

Moderate: 1000- 2000mls

Severe: >2000mls

Management of PPH

Key Points

- Routine and real time measurement of blood loss from birthis recommended for all births as estimated blood loss is often erroneous.
- All observations including respiratory rate should be carried out timely and recorded on MEOWS charts and abnormal results should be escalated promptly.
- Correlate clinical signs and symptoms manifest as physiological response to blood loss in the initial assessment of PPH (table 2).
- The physiological increase in circulating blood volume during pregnancy could make the signs of hypovolemic shock become less apparent in pregnancy.
- Hypotension occurs late in hypovolaemia and is usually indicative of a PPH in excess of 1500-2000ml (class 3). Therefore, a normal blood pressure should not be taken as a reassuring sign.
- If the heart rate is greater than the systolic pulse pressure, it is likely that shock is present and there is an urgent need for fluid replacement and blood transfusion.
- Clinicians should be aware that whilst a tachycardia commonly develops in the initial to hypovolemia, there can be a bradycardia and hypotension.
- Bradycardia and hypotension occur when about a third of the volume of circulating blood has been lost.
- Early recognition is vital; the associated bradycardia and hypotension is always a very late sign and precede circulatory collapse.
- Bradycardia may be observed in an intra-abdominal bleeding, as blood in the peritoneum can irritate the diaphragm cause reflex bradycardia.
- Tachycardic response in PPH may be masked in women taking Beta blockers such as labetalol.
- It is important taking the woman's weight into account when assessing the blood loss and resuscitation. The circulatory volume in pregnancy is approximately 100ml/kg body weight (may overestimate in obese women)
- Women with lower Body Mass Index (BMI) have smaller blood volumes, hence a lower level of blood loss maybe clinically significant (but may overestimate blood volume in obese women due to adipose tissues, table 3) and may decompensate more quickly.
- Blood loss alone should not be taken into consideration in early identification of PPH as concealed PPH is an important cause of maternal death.
- Correctly completed MEOWS charts are essential in early identification of such concealed blood loss.
- Consultant Obstetrician should be called in for any return to theatre

Call for help - Multi-professional escalation based on measured blood loss (see staggered MDT escalation under key messages)

- Pull the emergency call bell and summon help via 2222 requesting an "obstetric emergency to room X on Delivery suite" doing so will summon the following clinicians: On call Obstetric registrar & Consultant (if on site), anaesthetist and labour ward co-ordinator. Additional staff should respond to the emergency bell including midwives, maternity support workers (MSWs) and junior doctors. If the estimated blood loss is >1500mL and on-going the consultant obstetrician and senior anaesthetist should be contacted to attend (4th on anaesthetist, bleep 703, or consultant).
- the lead carer must declare a "massive obstetric haemorrhage (MOH), which will trigger the massive haemorrhage protocol as follows: Activate 2222 call and say 'Major Obstetric Haemorrhage' and give location. Switchboard will contact the lab, the anaesthetist on call, the porters and consultant haematologist. The major haemorrhage pack will be initiated.
- Alert the haematologist and blood transfusion laboratory at an early stage. When you alert the MOH via 2222, give them the phone number you are calling from. The lab will call you back on that number – therefore keep a member of staff near that phone to answer and liaise with the lab.

Consider the cause of the PPH

4 Ts		Risk Factors	Relative Frequency
Tone	'Boggy' Uterus (Not contracted)	• Multiple pregnancy • Previous PPH • Fetal macrosomia • Delayed 2nd stage • Prolonged 3rd stage • General anaesthesia • Placenta previa • Fibroid uterus • Chorioamnionitis • Uterine relaxants (terbutaline, mgso4) • Antenatal anaemia (Hb less than 90 g/l) • Hyperstimulation with injudicous use of uterotonics (Oxytocin's, Misoprostol for IUD)	**70%**
Trauma	Is there any trauma; Perineal/Vaginal Wall/Cervical Tears?	• Cervical • Vaginal • Perineal tears/laceration • Extensions at C-sections • Operative delivery • Pelvic haematoma • Inverted uterus • Uterine rupture	**20%**
Tissue	Is the Placenta complete? Could there be placental tissue/membranes retained?	• Retained tissue/succenturiate lobe • Invasive/adherent placenta (accreta)	**10%**
Thrombin	Consider AN LMWH use/Preexisting conditions/family history	• Coagulopathies • Disseminated Intravascular Coagulation (DIC) • Pre-existing bleeding disorders • Therapeutic anticoagulants	**1%**

Follow the ABCDE rule

Airway

- Assess and maintain patency/ lie patient flat (do not remove pillow - it improves airway position)
- 15L/min O2 via non-rebreathe bag irrespective of the oxygen saturation.
- Attach pulse oximeter to patient

Breathing

- Assess
- Protect airway
- Monitor respiratory rate

Circulation

Restoration of circulating volume should be the first priority, and labour ward anaesthetist should take charge of this.

- Insert 2 large bore IV cannulas
- Send urgent bloods for FBC, clotting studies, APTT, PT (INR), X–match (at least 4 units if MOH not called), U&Es.
- If PPH>1000ml, send a sample of blood for Fibrinogen (if a sample for clotting has been already sent, contact the haematology and request Fibrinogen as an add on) along with a blood sample for ROTEM for clotting analysis (see appendix 1) and a Venous gas to check for Lactate base excess and Hb
- The point-of-care test of coagulation should be repeated after each 500 mL additional blood loss, after infusion of fibrinogen concentrate, cryoprecipitate or FFP or at any time for clinical concern
- If Antenatal MOH – ensure CMV Negative blood is requested.
- Consider Arterial Blood Gas (ABG) to check for pH
- Clinical vigilance & ongoing assessment of patient
- Consider arterial/central line
- Administer IV Tranexamic acid (TXA): 1 gram intravenously over 10 minutes and if ongoing bleeding: repeat in 30 minutes or an infusion of 1 gram over 8 hours if necessary.
- Regularly assess (real time) ongoing volume loss by real time using Gravimetric and volumetric methods, observations (continuous or every 15 minutes depending on the severity of PPH) and maintain fluid balance chart.
- Replace volume loss: Urgently access blood and blood products. Administer warmed rapid infusion of IV fluids up to 3.5L while waiting for blood, unless otherwise specified by the anaesthetist / obstetrician. Administer blood as soon as it is possible. Do not give >3.5L clear fluids
- Despite volume replacement with IV fluid, if still haemodynamic instability, consider giving O Rhesus negative red cells until group specific or fully cross-matched blood become available
- Catheterize and monitor urine output hourly

- Keep the woman warm and check temperature to maintain normal body temperature
- **Weigh** all blood loss to keep an accurate measurement using scales.
- **Based on both clinical (**regular observations estimated blood loss and anticipated clinical course), **and haematological assessment decide the need for transfusion of blood and blood products to maintain:**
    - Hb>80/dl
    - PT/ APTT is less than 1.5 times (consider FFP at a dose FFP at a dose of 12-15mL/Kg if haemorrhage is ongoing and or if haemostatic results are unknown)
- Fibrinogen level >2g/L: (if <2, **treat with fibrinogen factor concentrate (Riastap) requested** via blood transfusion request form, or 2 adult pools of Cryoprecipitate – see below main guideline)
- Platelet count is >50x109/L on FBC: (4 pools of platelets should be transfused as indicated)
- NB. Can also use Rotem to guide administration of clotting products (see appendix 1).
- Check for hypocalcaemia and hyperkalemia if massive blood transfusion required.
- Liaise with Haematology.

D - Diagnose and Treat cause of bleeding ("Turn off the Tap")

Genital tract trauma

Arrange for repair promptly. This may need to be done in theatre for proper access and analgesia. Senior help should be sought sooner than later.

Retained products/ Placenta

see guideline – Retained Placenta

Coagulopathy/ Disseminated Intravascular Coagulation (DIC)

Suspect DIC in:

- Abruption
- Severe Preeclampsia
- Infected RPOCs
- amniotic embolism
- prolonged/untreated hypovolemic shock.

Request fibrinogen levels when sending clotting level in PPH >1000ml, and certainly if platelet count <50 or INR >1.5.

If ROTEM sample sent, review results promptly to guide coagulopathy management, see Appendix 1.

Concealed haemorrhage/ Intrabdominal Bleed

Should be suspected if clinical signs of tachypnoea, tachycardia, paradoxical bradycardia and hypotension, abdominal pain, pallor, reduced urine output, clinical signs of shock, heavy soaking wound dressings. Consultant Obstetrician should be called in for any return to theatre.

Uterine Atony

- Uterine atony
- The following measures should be instituted, in turn, until the bleeding stops:
    - Continuous Fundal Massage
    - Bimanual uterine compression
- Use of uterotonics:
    - Administer Syntometrine® (oxytocin 5units + ergometrine 500 microgram) 1ml IM (max 2 doses including the one used for active management of the third stage) or ergometrine 500 microgram IM / slow IV.
    - If delivering in theatre, 5 units oxytocin slow IV, which can be repeated.
    - If any maternal hypertension (avoid ergometrine/ Syntometrine®) give 10 units oxytocin IM for prophylaxis of PPH (active management of 3rd stage). For treatment of PPH, 5 units of oxytocin can be given slow IV if required.
- Commence an intravenous infusion of oxytocin (Syntocinon®) 40 units in 40mls sodium chloride 0.9% 10ml per hour by syringe driver.
- Give carboprost (Hemabate®) 250 micrograms IM. The dose can be repeated at 15 minute intervals. The total dose should not exceed 2 milligram (8 doses). Arrange transfer to theatre, if not already in theatre, for EUA after 2nd dose. Avoid Carboprost in women with asthma, active cardiac, pulmonary, renal, hepatic disease.
- Intramyometrial use of Carboprost is not recommended but may be used at the responsibility of the obstetrician in-charge.
- Misoprostol 1000 microgram can be inserted Per Rectum (PR): its uterotonic effect is slower in onset via that route(> 60 minutes) and therefore it is likely to prevent later uterine relaxation than have much effect on the acute loss.

Misoprostol is especially useful in cases of PPH after home birth. In such a situation the usual protocol for PPH should be followed and Misoprostol 1000 microgram can be inserted PR while awaiting transfer to the hospital.

E - Examination under Anaesthesia

If bleeding continues proceed to examination under anaesthesia (usually under general Anaesthetic) to exclude and manage:

- Inverted uterus, see guideline – Inverted uterus
- Retained placental tissue, including adherent placenta or placenta accrete.
- Genital tract trauma
- Screen for coagulation disorder and treat DIC if present.

- Intrauterine direct pressure using hydrostatic balloon (See Uterine Tamponade Guideline)

Surgical Haemostasis

- If conservative measures fail, initiate surgical haemostasis sooner rather than later
- When severe haemorrhage occurs it is a good practice to call for the help of second consultant.
- Compression/ Haemostatic uterine suturing (e.g. B-Lynch/ Hayman suture / Box suture) should be considered in cases of uterine atony. A bimanual compression should be tried first to assess the potential success of the compression suture. Hayman compression suture can be tried without opening the uterus if not post LSCS.
- Stepwise devascularisation: involve senior gynaecologist and vascular surgeon
- Uterine artery embolisation if the service is available and the woman's CVS status is stable
- Hysterectomy should be considered early to reduce risk of coagulopathy. It is recommended to involve a second consultant obstetrician & gynaecologist in decision making and assist in performing the hysterectomy.

Multiple causes of PPH / Refractory cases of PPH

- If there is more than one cause of haemorrhage multiple techniques may need to be tried to control bleeding.
- In some refractory cases more than one technique may need to be tried e.g. compression suture and balloon tamponade at the same time before resorting to more invasive procedures.

Post PPH Care

- An enhanced care HDU MEOWS (WOW) chart should be used to continue monitoring the woman once the haemorrhage has been controlled until observations are stable enough to be transferred out of HDU care.
- All care received should be documented clearly in the badgernet record.
- A debrief should be offered to the woman and any birth partners present as soon as is reasonable after the events.
- Staff debrief should take place if appropriate at the time of the incident and follow up offered.

Minimizing risk of PPH (anticipate and avoid)

- Although most cases of PPH have no identifiable risk factors, the Confidential Enquiry into Maternal and Child Health has recommended that women with known risk factors for PPH should deliver at a hospital with Blood bank on site.
- Antenatal anaemia should be investigated and treated appropriately to reduce the morbidity associated with PPH as there is an association between antenatal anaemia

(Hb less than 90 g/l) and greater blood loss at delivery and postpartum. Hb of 110 g/l at first contact and 105 g/l at 28 weeks should be investigated and iron supplementation considered if indicated. It is recommended that parenteral iron therapy should be considered antenatally for women with iron deficiency anaemia who do not respond to oral iron.

- Complete OBS UK PPH risk assessment (stage 0) for everywoman admitted for delivery including for Caesarean sections – See Appendix 2.
- Uterotonics in the pregnant woman should be used judiciously. Oxytocin (Syntocinon®) should always be used carefully but this is especially true in spontaneously labouring multiparous women where extreme caution is needed
- Misoprostol should only be given according to current recommendations (WAHT management of IUD guideline)
- Measures for reducing blood loss at delivery:
    - Active management of the third stage: A Cochrane systematic review 2011 found that active management showed a reduction in blood loss more than 1000 ml; average
    - Routine use of prophylactic uterotonics in the management of the third stage of labour
    - For women delivering by caesarean section, oxytocin 5 units by slow intravenous injection)
    - For women delivering vaginally, Ergometrine–oxytocin may be used in the absence of hypertension as it reduces the risk of minor PPH (500–1000 ml).
    - Those with hypertension, oxytocin 10 units by intramuscular injection should be used (or 5 units IV by anaesthetist if in theatre)
    - Intravenous tranexamic acid (1g), in addition to uterotonics, at caesarean section should be considered to reduce blood loss, and should be given if PPH >1000ml
- Uterine massage is of no benefit in the prophylaxis of PPH
- Management of PPH

Management of PPH includes following elements which may require instigating simultaneously:

- Early Identification of PPH
- Resuscitation
- Arrest bleeding - "Turning off the Tap"
- Communication and human factors
- Monitoring

Early identification of PPH and the severity

Clinicians should be aware that the visual estimation of peripartum blood loss is inaccurate, therefore requires:

- Routine real-time measurement of blood loss **from birth for all births using Gravimetric and volumetric methods** (blood collection drapes for vaginal deliveries, weighing of swabs, any soaked incontinence sheets and garments and bed linen)
- The impact of blood loss on MEWOS (correlating clinical signs and symptoms expected from different blood loss values) to help target decisions on resuscitation, and also emphasised the importance of taking the woman's weight into account. Beware "small women (BMI<18 or weight <55kg) have small blood volumes"

Clinicians should be aware that the physiological increase in circulating blood volume during pregnancy could make the signs of hypovolaemic shock become less apparent in pregnancy:

- **1500ml loss:** Tachycardia >100, RR 20-30, Systolic BP normal, Diastolic BP increased.
- **>2000ml loss:** Tachycardia >120, RR>30, Hypotension (both Systolic and diastolic BP), confusion/agitation.

Clinicians should be aware that the drop in blood pressure is a late sign of PPH (Hypotension occurs late in hypovolaemia and is usually indicative of a PPH more than 1500 - 2000 ml (class 3). Therefore, normal blood pressure should not be taken as a reassuring sign.

Whilst significant haemorrhage may be apparent from observed physiological disturbances, young fit pregnant women may compensate remarkably well. Therefore, whilst a tachycardia commonly develops in the initial compensatory sympathetic reflex response to hypovolaemia (the response of heart rate to a reduction in the volume of circulating blood is usually biphasic), there can be a paradoxical bradycardia and hypotension. (MBRRACE-UK - Saving Lives, Improving Mothers' Care 2018).

The second phase occurs when about a third of the volume of circulating blood has been lost. Sympathetically mediated vasoconstriction and cardiac drive fall abruptly, and cardiac vagal drive increases. This simultaneously reduces mean arterial pressure and heart rate (paradoxical bradycardia and hypotension).

Early recognition of this vasodepressor-cardioinhibitory reaction to a reduced circulating volume is vital; the associated bradycardia and hypotension is always a very late sign and precede circulatory collapse. Hence, ongoing bleeding should be acted upon quickly.

Paradoxical bradycardia may be observed in an intra-abdominal bleed and as blood in the peritoneum can irritate the diaphragm cause reflex bradycardia via a vagal response.

Tachycardic response in PPH may be subdued in women taking Beta blockers such as labetalol.

In women with lower BMI has smaller blood volumes, (BMI<18) or booking weight <55kg, hence a lower level of blood loss maybe clinically significant (but may overestimate blood volume in obese women due to adipose tissues). See table below.

Clinicians should be aware of this, as smaller women may decompensate more quickly.

Completion of MEOWS (WOW: Worcestershire Obstetric Warning Score) charts correctly and results are acted upon promptly. These charts encourage observations to be carried out and recorded allowing early recognition of less apparent PPH and facilitate escalation of care. Therefore, all observations should be carried out in a timely fashion including respiratory rate, documented carefully and early escalation if abnormal.

Physiological Parameters and Types of Haemorrhage

	Class I	**Class II**	**Class III**	**Class IV**
Blood loss	15% 750ml	15-30%	30-40%	>40%
Approximate volume	1000ml	1500ml (1000-2000)	2000ml (2000-2700)	>2700ml
Resp rate	14-20	20-30	30-40	>40
Pulse	<100	>100	>120	>140
Systolic	Normal	**Normal**	**Decreased**	Decreased
Diastolic	Normal	Increased	Decreased	Decreased
Mental state	Anxious	Anxious Confused	Confused Agitated	Lethargic
Urine ml/hr	> 30	20-30	5-15	Negligible

Weight related blood volumes

Weight	Total blood volume*	15% blood volume loss	30% blood volume loss	40% blood volume loss
50kg	5000mls	750mls	1500mls	2000mls
55kg	5500mls	825mls	1650mls	2200mls
60kg	6000mls	900mls	1800mls	2400mls
65kg	6500mls	975mls	1950mls	2600mls
70kg	7000mls	1050mls	2100mls	2800mls

*Based on 100mls/kg blood volume in pregnancy (Royal College of Obstetricians and Gynaecologists 2011b) but may overestimate blood volume in obese women (Lemmens, Bernstein et al. 2006)

High index of suspicion of PPH

- While bleeding after delivery is inevitable 'heavy lochia 'should ring alarm bells and attempts should be made to tally up accumulated losses
- Blood loss alone should not be taken into consideration in early identification of PPH as concealed PPH (paravaginal, subperitoneal/retroperitoneal/pre-peritoneal space of Retzius hematoma) is an important cause of maternal death. Correctly completed MEOWS charts would therefore be helpful in early identification of such concealed blood loss.
- Intra-abdominal bleed should be suspected if clinical signs of tachypnoea, tachycardia, paradoxical bradycardia and hypotension, abdominal pain, pallor, reduced urine output, clinical s/o shock, heavy soaking wound dressings. Consultant Obstetrician should be called in for any return to theatre.

Resuscitation

- The aim of resuscitation is to maintain an effective circulating volume, adequate tissue perfusion and oxygenation and to minimise coagulopathy until the bleeding stops.
- A high concentration of oxygen (10–15 l/min) via a non-rebreathe mask, should be administered, regardless of maternal oxygen concentration.
- Establish intravenous access (2x14-gauge cannula)**.** May require interosseous route when access is particularly difficult.
- Methods to assess haemostatic impairment during PPH include clinical observation, laboratory-based tests (PT, APTT, fibrinogen and platelet count) and point of care testing.
- Send 20 ml of blood for: group and screen (cross match if PPH >1000ml) – full blood count – coagulation screen, including fibrinogen
- Do not falsely be reassured by normal early single Haemoglobin result. Acute point of care haemoglobin measurement results falsely reassure staff. If fluid resuscitation has not occurred, then neither has haemodilution and therefore haemoglobin measurements in this context show the starting position for a woman's haemoglobin measurement and do not help with estimating either the blood loss or the need for blood.
- Point of care testing using viscoelastometry, such as thromboelastography (TEG), and rotational thromboelastometry (ROTEM) combined with an agreed treatment algorithm, has been associated with decreased blood loss and blood product use, with the added advantage of availability of results sooner than for laboratory tests. The needed for Fibrinogen and FFP replacement is guided by the results of the ROTEM and is available for clinical use by the obstetric theatre anaesthetists and ODPs, see appendix 1 for more information.

- Fibrinogen tends drops as the bleeding progresses, unlike PT APTT and HB - which tend to become only later. Therefore, fibrinogen should always be measured as part of the routine coagulation screen in PPH>1000ml because falls early and may be reduced to a clinically significant level despite a normal PT/APTT. A blood sample for point of care testing (ROTEM) should be sent along with the blood sample for fibrinogen if PPH

exceeds 1000ml. If clotting has been sent already, request Fibrinogen as an add on. At the same time, a venous gas analysis should be performed to check lactate levels and Hb that may reflect the adequacy of fluid resuscitation.

- Coagulopathy may evolve rapidly and repeated testing during continued bleeding ~~for~~ and trends of observation are more useful than single measurements. Therefore, POC test of coagulation should be repeated after each 500 mL additional blood loss, after infusion of fibrinogen concentrate, cryoprecipitate or FFP or at any time for clinical concern.
- The main therapeutic goals of the management of massive blood loss as maintaining as per the guidance from the British Committee for Standards in Hematology:
    - Hb greater than 80 g/l
    - Platelet count greater than 50 x 109/l (OBS UK PPH bundle recommends a platelet transfusion be guided by the platelet count of a FBC rather than based on the ROTEM)
    - Prothrombin time (PT) /activated partial thromboplastin time (APTT) ratio less than 1.5 times normal.
    - Fibrinogen greater than 2 g/l.
- **Trigger MOH protocol if PPH >1500ml and ongoing or if any sign of shock /peripartum collapse.**
- Keep the woman warm using appropriate available measures.
- Rapid (infuse with a pressure bag) warm (as hypothermia can worsen metabolic acidosis and coagulopathy) volume replacement with initially 2 l of warmed isotonic crystalloid (Hartmann's solution followed by colloid e.g. Volplex / Isoplex/ Gelofusine 500milllitres unless otherwise specified by the anaesthetist / obstetrician.
- Do not give >3.5L clear fluids while waiting for blood as over replacement with crystalloid and/or colloid could worsen any developing coagulopathy and be counterproductive.

Blood transfusion (red cell replacement)

- Transfuse blood as soon as possible, if clinically required
- There are no firm criteria for initiating red cell transfusion. The decision to provide blood transfusion should be based on both clinical (regular observations estimated blood loss and anticipated clinical course), and haematological assessment.
- Delaying the transfusion of blood and its products in the presence of haemorrhage can lead to sudden deterioration of the woman's condition and possibly death. Therefore, time should not be unnecessarily spent awaiting lab results to determine the need for blood and blood products.
- Blood should be transfused through a warming device to minimise the development of hypothermia.
- May require rapid access to group O, rhesus D (RhD)-negative and K-negative units, with a switch to group-specific blood as soon as feasible.
- Previous blood transfusion is an important cause of alloimmunisation, with antibodies other than anti-D, in particular anti-K, causing severe haemolytic disease of the fetus and newborn. Unless a woman is known to be K positive, only K-negative blood should be used for transfusion in women of childbearing age.,

- If clinically significant red cell antibodies are present, close liaison with the transfusion laboratory is essential to avoid delay in transfusion in life-threatening haemorrhage.
- Red cell antibodies may have implications for the selection of blood for transfusion in the mother owing to the risk of haemolytic transfusion reactions (0.1% with antibody checked emergency group specific blood, 1% if antibody not checked).
- Therefore, any labouring women with known red cell antibodies would require 2 units of cross matched blood requested.
- CMV-seronegative products should be used to avoid transmission of CMV to the fetus, although, the UK policy of universal leucocyte depletion substantially reduces the risk of CMV transmission. Therefore, when requesting for cross matched blood, the clinician should mark the relevant box on the request form to indicate the woman is pregnant and requires CMV negative blood.
- Where possible woman should be informed (both verbal and then followed by written information) on risks of blood transfusion
- In massive and rapid red cell infusion: check serum calcium levels and + infuse calcium with calcium gluconate 10% 10-20mL by IV infusion over 10mins with ECG monitoring (as stored blood has Na Citrate which binds with calcium to make calcium citrate resulting low calcium levels which could exert negative inotropic effect on myocardium) and coagulopathy.
- Similarly, checking serum potassium as hyperkalaemia is a risk with massive transfusion that could result cardiac arrest.

Cell salvage

- Could be considered for emergency use in PPH associated with both caesarean section where the anticipated blood loss is great enough to induce anaemia or exceed 20% of the patient's blood volume (and vaginal delivery although it may be practically difficult). However, the cost effectiveness of cell savage in the management of major bleeding is equivocal. In a RCT of >3000 women at risk of PPH, the use of cell salvage did not reduce the rate of blood transfusion.
- Cell salvage may also be associated with risks of fetal cells reaching maternal circulation.
- Therefore, previously nonsensitised RhD-negative women with RhD positive fetus, a minimum dose of 1500 units anti-D immunoglobulin should be administered following the reinfusion of salvaged red cells.
- A maternal blood sample should be taken for estimation of fetomaternal haemorrhage 30–40 minutes after reinfusion in case more anti-D is indicated.
- Consent should be obtained for IOCS where possible and its use in obstetric patients should be subject to audit and monitoring.
- Leucocyte depletion filters will reduce the amount of amniotic fluid reaching. These filters could cause hypotension.
- Suction pressure set lower than normal to reduce red cell breakage.

- The washed blood returning to circulation is only red cells and do not have clotting factors. This means it will dilute the clotting factors in the circulation and could contribute to dilutional coagulopathy.

Blood components

- In MOH, red cells transfusion will only improve oxygen carrying capacity, but as it doesn't have clotting factors could cause dilutional coagulopathy.
- Effective resuscitation for massive haemorrhage requires blood and blood components to be replaced rapidly and in the appropriate ratios. In many instances the women who died were given too little blood too late and the blood was often not accompanied by adequate and timely replacement coagulation products (MBBRACE)
- Clinicians should be aware that these blood components 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 preparation (e.g. thawing) and transport.
- Keilhauer testing is needed in Rhesus negative patients (unless fetus also Rhesus negative) and appropriate administration of Anti-D.

Plasma replacement - Fresh frozen Plasma (FFP)

- Coagulopathy is associated with worse outcomes and hypothermia; acidosis and hypocalcaemia will further worsen coagulation.
- In a woman who is bleeding and is likely to develop a coagulopathy or has evidence of a coagulopathy, it is sensible to give blood components before coagulation deteriorates and worsens the bleeding. (Handbook of Transfusion Medicine (United Kingdom Blood Services 2013). It is therefore important to attempt its correction as part of the initial haemostatic resuscitation.
- FFP is the component of choice to manage the coagulopathy of bleeding (as it contains clotting factors at physiological level), However it is not the optimal therapy fibrinogen supplementation as it contains insufficient fibrinogen to achieve the rapid rise in levels required to support haemostasis
- While data support the role of early empirical use of FFP (e.g., RBC /FFP 1:1 ratio) in major traumatic bleeding, in non-trauma settings the effect of high transfusion ratios of RBC and FFP on mortality is uncertain and may have potential risk of increased risk of transfusion-associated circulatory overload (TACO)
- If no haemostatic tests are available, early transfusion of FFP at least a 1: 2 unit ratio with red cells should be considered. After initial empirical transfusion of FFP, further plasma transfusion should be guided by serial results of coagulation tests - BSH guideline
- If PT/APTT is more than 1.5 times normal and haemorrhage is ongoing, volumes of FFP in excess of 15 ml/kg are likely to be needed to correct coagulopathy
- See appendix 1 for guidance on treatment of coagulopathy using point of care testing

Fibrinogen replacement

- Hypofibrinogenemia is common in major haemorrhage. Therefore, a plasma fibrinogen level of greater than 2 g/l should be maintained during ongoing PPH.
- If patient's fibrinogen is <2, treat with fibrinogen factor concentrate **(Riastap)** requested via blood transfusion request form. Dose via body weight and fibrinogen levels: No need to contact consultant haematologist to request Riastap-out of hours unless concerns.
- Alternatively, cryoprecipitate can be used as another standard concentrated source of fibrinogen in the UK. Two pools (1 pool is taken from five donors) may increase fibrinogen in an adult by ~1g/l
- Large abruption eg IUD with abruption usually consume large amount of fibrinogen hence may need early administration of fibrinogen/ Cryoprecipitate
- No anti-D prophylaxis is required if a RhD-negative woman receives RhD-positive FFP or cryoprecipitate
- **See appendix 1 for guidance on treatment of coagulopathy using point of care testing (OBS UK ROTEM protocol)**

Platelet replacement

- Platelets should be transfused at a trigger of 75 x109/l to maintain a level greater than 50x 109/l during ongoing PPH
- Significant thrombocytopenia is considered a late event in major haemorrhage.
- For pragmatic reasons, platelets should be requested if there is on-going MOH and the platelet count has fallen below 100 x109 /l
- Platelet transfusion should be given as one adult therapeutic dose (4 pooled units) when the platelet count falls below 50 x109 /l (Blood Transfusion Task Force, 2003)
- See appendix 1 for guidance on treatment of coagulopathy using point of care testing (OBS UK ROTEM protocol)

Tranexamic acid

- Prompt administration of Tranexamic acid is important in early clot formation
- Early administration of Tranexamic acid resulted in a significant reduction in the need for blood transfusion. and need for surgery and death from PPH (WOMAN trial) - the survival benefit decreased by 10% for every 15min of treatment delay until 3hr)
- If a PPH >1000ml (<1000ml if clinically indicated). Tranexamic acid: 1 gram intravenously over 10 minutes and can be repeated in 30 minutes or 1 gram intravenously over 10 minutes followed by an infusion of 1 gram over 8 hours.
- An infusion of 1 gram over 8 hours would give a therapeutic dose to patients weighing between 60-120kg.
- The continuous infusion needs to be given using a volumetric infusion pump or syringe pump. The injection should be diluted to an appropriate volume with sodium chloride 0.9%. Sodium chloride 0.9% is used as a flush. The infusion should not be infused via

the same line as any other medications or any other infusion fluids except sodium chloride 0.9%, glucose 5% or Hartmann's solution

- A meta-analysis of 216 trials (125550 patients) found no evidence to support an overall increased risk of thromboembolic complications with use of TXA, supporting the general safety of this drug.

Arresting the bleeding - "Turning off the Tap"

- With passage of time, the condition of the woman may continue to deteriorate and increase the complexity if the source of bleeding is not stopped ("turning off the tap") as consumptive coagulopathy can develop very rapidly.
- The recurring theme of the MBBRACE report is quite simple: TOO LITTLE, TOO LATE
- If medical therapy using multiple uterotonic agents has not worked within 1 hour, there is no logical reason to think that it will work in the next hour.
- Use a combination of pharmacological, mechanical and surgical methods to arrest PPH. These methods should be directed towards the causative factor(s) outlined below.
    - Genital tract trauma **-** Arrange for repair promptly. This may need to be done in theatre for proper access and analgesia. Senior help should be sought sooner than later. See surgical haemostatic methods
    - Retained products/ placenta – see guideline WAHT-OBS-091.
    - Coagulopathy/ DIC – Suspect DIC in massive abruption, severe PET, infected RPOCs, amniotic embolism or prolonged/untreated hypovolaemic shock. If platelet count <50 or INR >1.5 or Fibrinogen <2. Check fibrinogen/fibrinogen degradation (FDP) levels. Liaise with consultant haematologist sooner rather than later.
    - Uterine atony

Nonsurgical methods - Mechanical and Pharmacological methods

The most common cause of primary PPH is uterine atony. The initial management of PPH should, therefore, involve mechanical and pharmacological measures to stimulate myometrial contractions.

Mechanical methods

Continuous Fundal Massage. If uterus feels flaccid palpate the uterine fundus and rub it to stimulate contractions ('rubbing up the fundus').

Bimanual uterine compression If the uterus remains atonic apply bimanual compression. The fingers of the right hand are inserted into the vagina like a cone the hand is formed into a fist and placed in the anterior vaginal fornix, the elbow resting on the bed. The left hand is placed behind the uterus the fingers pointing towards the cervix. The uterus is brought forward and compressed between the palm of the left hand and the fist of the right hand.

The idea of fundal massage/ bimanual compression and evacuate clots from cervical opening is to expel any blood clots trapped in the uterus as this inhibits effective uterine contractions.

Evacuate clots from vaginal and cervical opening

Ensure that the bladder is empty (Foley catheter, leave in place) as full bladder could inhibit uterine contractions.

Pharmacological methods

Administer Syntometrine® (oxytocin 5units + ergometrine 500 microgram 1ml IM (max 2 doses including the one used for active management of the third stage) or ergometrine 500 microgram IM / slow IV.

If delivering in theatre, 5 units oxytocin slow IV, which can be repeated.

If any maternal hypertension (avoid ergometrine/ Syntometrine®) give 10 units oxytocin IM for prophylaxis of PPH (active management of 3rd stage). For treatment of PPH, 5 units of oxytocin can be given slow IV.

Commence an intravenous infusion of oxytocin (Syntocinon®) 40 units in 40mls sodium chloride 0.9% 10ml per hour by syringe driver.

Give carboprost (Hemabate®) 250 micrograms IM. The dose can be repeated at 15 minute intervals. The total dose should not exceed 2 mlligrams. Avoid Carboprost in women with asthma, active cardiac, pulmonary, renal, hepatic disease. Consider transferring to theatre for examination under anaesthesia and surgical management if the bleeding on going after the second injection or sooner if clinically indicated.

Give Misoprostol 1000 microgram PR. Clinicians should be aware that its uterotonic effect is slower in onset than other uterotonics (Onset of action 60 -120 minutes, sublingual route may have quicker onset of action than PR route). Therefore, delayed action of Misoprostol is likely to prevent later uterine relaxation than have much effect on the acute loss. Misoprostol is especially useful in cases of PPH after home birth. In such a situation the usual protocol for PPH should be followed and Misoprostol 1000 microgram can be inserted PR while awaiting transfer to the hospital

Surgical haemostatic methods

If initial pharmacological measures fail to control the haemorrhage, initiate surgical haemostasis sooner rather than later.

This requires Examination under anaesthesia (usually general), to diagnose and manage: Inverted uterus, Retained placental tissue, genital tract trauma and uterine atony refractory to pharmacological management.

Uterine Tamponade Balloon – See: Tamponade Balloon Guideline

Compression/ Haemostatic Uterine Suturing

B-Lynch suture

Vicryl No1, W9289 mounted on 80mm round bodied hand needle is recommended for B-Lynch and Hayman suture and is available in obstetric theatre.

The bladder peritoneum is reflected inferiorly to a level below the cervix (if it has been taken down for a prior LSCS, it is pushed down again).

The whole uterus is then compressed by placing one hand posteriorly with the ends of the fingers at the level of the cervix and the other hand anteriorly just below the bladder reflection.

If the bleeding stops on applying such compression, there is a good chance that application of the B-Lynch suture will work and stop the bleeding, **t**herefore a bimanual compression should be tried first to assess the potential success of the compression suture.

Given that the test criteria for the B -Lynch suture placement are met, the uterus remains exteriorized until application of the suture is complete.

The first stitch is placed 3 cm below the Caesarean section incision on the patient's left side (according to the dexterity of the surgeon) and threaded through the uterine cavity to emerge 3 cm above the upper incision margin approximately 4 cm from the lateral border of the uterus.

The suture is now carried over the top of the uterus and to the posterior side. Once situated over the fundus, the suture should be **vertical** and lie about 4 cm from the cornua.

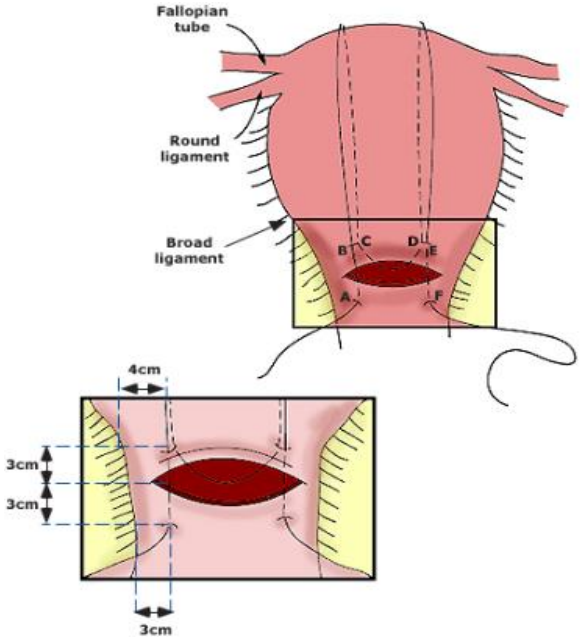
The location on the posterior uterus where the suture is placed through the uterine wall is on the horizontal plane at the level of the uterine incision at the insertion of the uterosacral ligament.

As the needle pierces the uterine cavity side of the posterior wall, it is placed over the posterior wall, bringing the suture over the top of the fundus and onto the anterior right side of the uterus. The needle re-enters the cavity exactly in the same way as it did on the left side, that is 3 cm above the upper incision and 4 cm from the lateral side of the uterus through the upper incision margin, into the uterine cavity and then out again through 3 cm below the lower incision margin. The tension on the two ends of the suture material can be maintained while the lower segment incision is closed and then place a double throw knot to secure. (It is important the assistant maintains the compression throughout the procedure)

There are some modifications to B-Lynch e.g. Marasinghe Modification by having an additional firm puncture just below the uterine fundus. This means that the suture is transfixed at the uterine fundus, thus eliminating the risk of the sutures sliding off at the uterine fundus.

Benefit of hysterotomy in a B Lynch is to allow exploration of the uterine cavity, exclude retained products of conception, evacuate large blood clots, and diagnose abnormal placentation and decidual tears, damage and bleeding. Any modification B-Lynch suture and Hayman suture without hysterotomy or re-opening of the Caesarean section wound runs the potential risk of secondary postpartum haemorrhage. Therefore, confirmation that the uterine cavity is completely empty is essential. It also avoids blind application of the suture and the possibility of obliteration of the cervical and/or uterine cavities that may lead to clot retention, infected debris and pyometra.

The B lynch suture compresses the upper segment, but the lower segment remains open. Hence in cases of placenta bed bleeding from praevia/accreta, transverse compression suture to the lower anterior or posterior compartment may be needed.

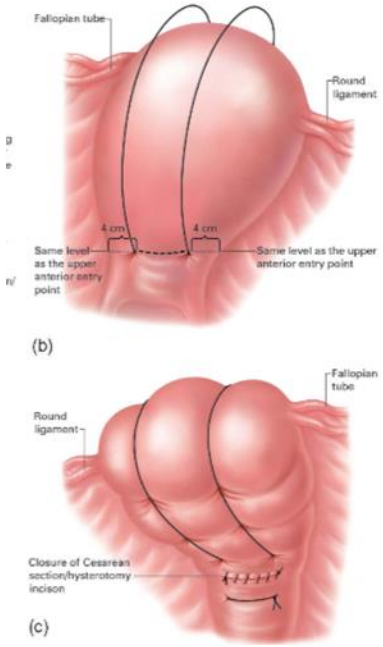


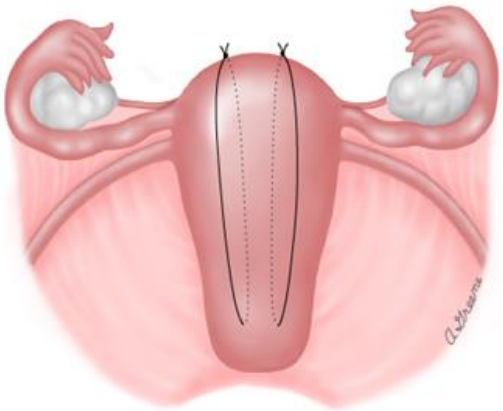
Hayman suture

If laparotomy is required for the management of atonic postpartum haemorrhage after normal vaginal delivery, hysterotomy is necessary to apply the B-Lynch suture.

Hayman suture circumvents the need for opening the uterus.

It involves two vertical compression sutures from the anterior to posterior uterine wall of the lower segment and tied at the fundus without hysterotomy.





Combined method: balloon tamponade and compression suture

Sandwich technique can also be considered, where in uterine compression suture and uterine balloon tamponade are applied simultaneously.

The suture must be inserted first: clearly, inserting a suture after the balloon risks puncturing it. Once the suture has been inserted, the balloon can be used to apply counter pressure more effectively.

Cho multiple square (box) sutures compressing anterior to posterior uterine walls

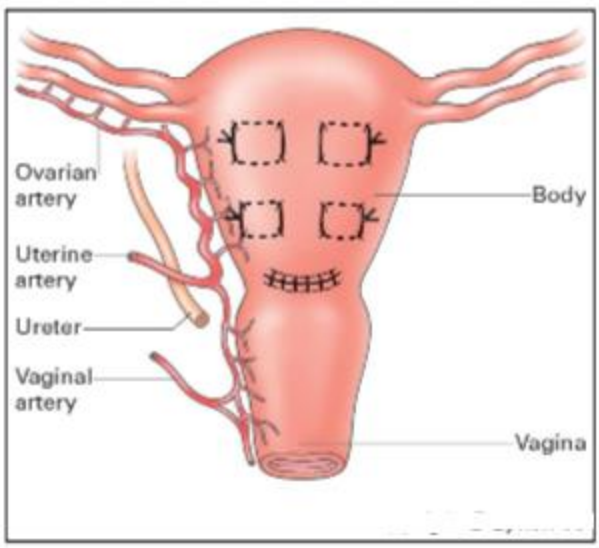
If the uterus has not previously been opened, multiple full thickness horizontal or vertical square sutures can be applied by opposing the anterior to the posterior walls of the uterus using straight needle.

Square suturing could help the particular problem of dealing with bleeding from the lower segment of the uterus as B- Lynch will only work for bleeding from upper segment.

The needle should ideally be 6 cm long so as to exceed the combined thickness of the anterior and posterior lower segment. hence use a straight needle usually bend this manually to a shallow curve, which makes it easier to insert in the depths of the pelvis while avoiding puncture of the structures immediately behind the lower segment.

Use multiple horizontal sutures than placing both vertically and horizontally as the latter may cause compression on both planes that could completely occlude of the blood supply within the square with resultant necrosis.

Drawback of box sutures is that apposition of the anterior and posterior walls of the uterus can impede drainage of lochia, resulting in pyometra.



Ligation of the uterine vessels (unilateral or bilateral)

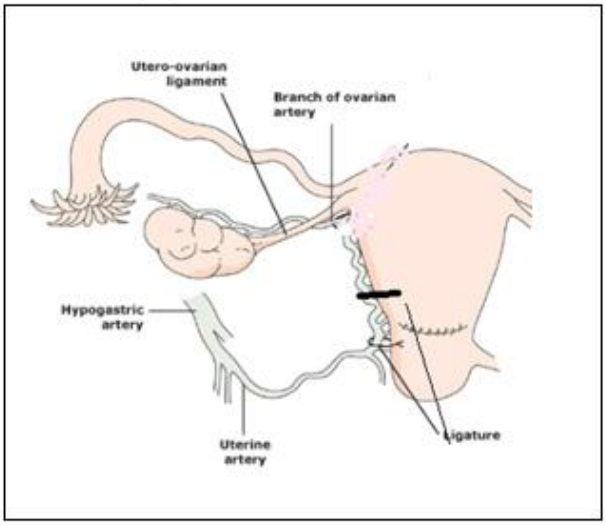
This is the preferred approach for controlling PPH from laceration of the uterine artery due to angle extensions at caesarean section. It is preferable to internal iliac artery ligation because the uterine arteries are more readily accessible.

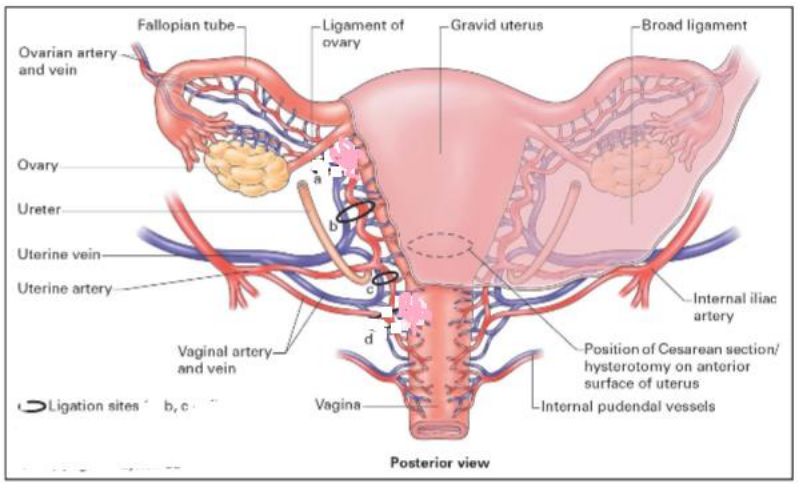
The avascular spaces in the broad ligament, roughly opposite the level of a transverse lower segment caesarean incision, should be identified.

The needle is passed into and through the myometrium from anterior to posterior 2–3 cm medial to the uterine vessels and brought through the avascular area of the broad ligament lateral to the artery and the vein. This is performed at two places 2-3cm above and below the uterine incision (cervic isthmic junction) either side to include both uterine and vaginal arteries.

It is important that the uterus is exteriorised, pulled up as much as towards to the opposite side of the uterine vessels being sutured to minimise the inadvertent ureteric injury.

There appear to be no consequences for future pregnancies of such ligation, presumably because a collateral circulation develops from other vessels (particularly the ovarian arteries) to compensate.





Stepwise uterine devascularization and internal iliac artery ligation

This requires involvement of senior Gynaecologist and a vascular surgeon.

Interventional radiology

If the woman is stable and service is available as limited interventional radiology service is available in the Trust.

Pre-operative placement of vascular catheters for uterine artery embolization can be considered in elective cases with high suspicion/diagnosis of placenta accreta by liaising with the consultant interventional radiologist.

Hysterectomy/ subtotal hysterectomy

Hysterectomy should not be delayed until the woman is in extremis as performing hysterectomy will deplete at least 1.5 litres of blood from the already compromised patient's circulation.

Hence a hysterectomy should be considered early to reduce risk of coagulopathy.

It is recommended to involve a second consultant obstetrician & gynaecologist in decision making.

Subtotal hysterectomy is the operation of choice in many instances of PPH requiring hysterectomy unless there is trauma to the cervix or a morbidly adherent placenta in the lower segment.

Clinicians should be aware that hysterectomy is designed to treat bleeding from the uterine fundus (upper pedicles i.e. ascending branch of the uterine artery (90%) and ovarian artery (10%)) and will not effectively treat bleeding from the lower uterine segment/cervix, parametrium and upper vagina such as lacerations following instrumental delivery, because the bleeding pedicles are different (the lower part of the uterus supplied by the descending branch of the uterine artery and the vaginal artery). In fact, performing hysterectomy in such instances may worsen the overall condition of the patient.

Damage control approach for persistent bleeding after hysterectomy

Bleeding may occur from the cervical stump in the case of subtotal hysterectomy, the side walls of the pelvis, or even the ovarian pedicles. Usually this can be controlled with local haemostatic agents.

Patients with continued severe bleeding after hysterectomy can enter a lethal downward spiral characterized by hypothermia, coagulopathy, and metabolic acidosis.

Criteria proposed for this "in extremis" state include pH <7.30, temperature <35°C, combined resuscitation, and procedural time >90 minutes, nonmechanical bleeding, and transfusion requirement >10 units packed red blood cells.

To abort the cycle, the bleeding area is tightly packed with large gauzes, the skin is closed to prevent heat and moisture loss and transfer to ITU for further monitoring and correcting coagulopathy.

Alternate is a plastic bag filled with gauze that can be placed in the pelvis with the opening of the bag brought out through the vaginal apex which had been left open.

Once the patient is stabilized then patient needs to be taken back to theatre (usually 24hrs after) for removal of the pack.

Specific scenarios

Vaginal wall tears

If vaginal trauma is found to be the principal cause of the bleeding, practitioners may be confronted with one of three different circumstances.

There may be one or two tears of the vagina which are amenable to simple corrective suturing.

If tears are of an explosive nature, i.e. multiple small tears not amenable to individual suturing, or if sutures pull through the oedematous tissue thereby causing more bleeding, it is reasonable to inflate a balloon which compresses the entire vaginal wall throughout its circumference. Other alternative available, packing the vagina with antiseptic impregnated gauge can also be of value.

The third variation is the most serious. It is the deep vaginal tear that extends into the abdominal cavity causing either a retroperitoneal hematoma(s) or compromising the urinary tract.

It is important to remember that a simple suture of the vaginal wall over what looks to be a deep tear in the posterior or lateral wall may include the rectum, bladder and/or ureter, even though ureteric injury with a tear is most unlikely.

Adequate exposure may be needed and can be achieved by performing an episiotomy (if not present already or if it is too small can be extended) and use of long blade retractors (Briesky Navratil vaginal wall retractors- available in small medium and large)

For refractory cases may require selective angiography and interventional radiology procedure.

Bleeding Placental Bed

Bleeding from the placental site following delivery of placenta praevia is common**.**

Senior and experienced obstetric and anaesthetic staff should be present for all caesarean sections for placenta praevia with or without accreta.

The following techniques can be tried to control haemorrhage from the placental site. Such procedures may allow one to buy time while awaiting senior/experienced help.

- Firm packing of the lower uterine segment for 5 minutes help reduce the bleeding or help delineate specific bleeding sites that can be over-sewn with the "figure of 8 sutures".
- Square suture going through the entire thickness of uterine wall may help stem oozing areas.
- Intrauterine direct pressure using balloon tamponade.
- Bilateral ligation of uterine may also prove effective but this will not sufficiently reduce the bleeding from area of internal os.
- In most cases of placenta accreta hysterectomy will be required (see above).
- Interventional radiology – Limited interventional radiology service is available in the Trust. Pre-operative placement of vascular catheters for uterine artery embolization can be considered in elective cases with high suspicion/diagnosis of placenta accreta by liaising with the consultant interventional radiologist.

Monitoring and subsequent care

Direct arterial pressure monitoring (and central venous pressure monitoring) should be used when the cardiovascular system is compromised.

Continuous monitoring of pulse, blood pressure and respiratory rate (using oximeter) is essential in acute stage. Regularly monitoring of BP, pulse, respiratory rate, temperature and urine output with an indwelling catheter are required during and 24hrs following major PPH. All observations should be recorded on a HDU WOW (MEOWS) chart whilst enhanced monitoring is in place.

Indwelling Foley catheter should be sited to monitor hourly urine output with a urometer, and accurate fluid balance should be maintained.

If the PPH was managed in operating theatre, it is important that the anaesthetic/recovery staff hand over the volume of fluid replaced in theatre to the obstetric staff for accurate charting of fluid balance.

The need to continually re-evaluate the woman's condition, even when bleeding appears to have stopped, is essential to recognise continuing bleeding, therefore requires regular senior review in the first 24hrs as a minimum following a major PPH

Periodic testing of haematological parameters (FBC Clotting Fibrinogen, U&E) is required

Blood gas acid base (HCO3 and base deficit) and lactate measurements are important measures of significant hypovolaemia and inadequate tissue perfusion due to blood loss. Repeated measurements of serum lactate, base deficit and haematocrit/haemoglobin are recommended European Society of Anaesthesiology to monitor tissue perfusion and oxygenation during haemorrhage and resuscitation

For major PPH, transfer to high dependency unit on delivery suite or an intensive care should be considered jointly by the obstetric and the anaesthetic team once bleeding is under control.

Due to reduced immunity following a major PPH, intravenous antibiotics should be administered for 24hrs

VTE is one of the most common causes of maternal death. Therefore, once the risk of re-bleed is less likely, if platelet count >75 $x10^9$ and eGFR>30, thromboprophylaxis with LMWH appropriate for the weight should be administered. In the interim, an intermittent pneumatic compression device should be used to reduce the risk of thrombosis.

TED stockings should be the bare minimum in all cases of PPH

Non-steroidal anti-inflammatory drugs are contraindicated immediately following PPH and only prescribed if no AKI and platelet count >75 $x10^9$ on the blood tests performed 4-6hrs following a PPH.

Communication and multidisciplinary care (human factors)

Situational awareness, communication, leadership, and teamwork are pivotal to successful management of PPH.

The management of PPH requires a multidisciplinary approach with appropriate and early involvement of senior staff based on the degree of PPH and haemodynamic stability

The midwife in charge and the first-line obstetric and anaesthetic staff should be alerted when women present with minor PPH (blood loss 500–1000 ml) without clinical shock.

A woman with major PPH and ongoing bleeding or clinical shock requires following members of staff to attend:

- Midwife in charge.
- Midwives
- Maternity support workers
- Obstetric middle grade
- On call consultant obstetrician (If PPH >1500ml and ongoing)
- Anaesthetic middle grade
- Operating Department Practitioner
- On call consultant Anaesthetist at the request by the anaesthetic middle grade
- On-call clinical haematologist with experience in major haemorrhage
- Porters for delivery of specimens/blood.

The team should identify a team leader (to have a helicopter view) depending on the seniority and the leadership may need to be delegated appropriately if the most senior clinician is actively engaged in controlling the haemorrhage.

If the patient needs to go to theatre for a surgical intervention, an experienced anaesthetist should promptly assess the patient in order to decide on the most suitable mode of anaesthesia, depending on the patient's haemodynamic status While general anaesthesia in

obstetric patients is associated with increased morbidity and mortality when compared with regional anaesthesia due to the physiological changes that occur in pregnancy, it may be preferable in patients who are haemodynamically unstable or who have a coagulopathy.

One member of the team should be assigned the task of recording events/ go through check list of actions.

Details of the staff present and the management plan by each member of staff must be clearly documented to ensure effective communication.

When requesting blood and blood products (if not activating MOH protocol), be clear in your request to the haematologist and porters about the urgency and state what you need, when you need it and enquire when it will be ready for collection.

Communication with the patient and her birthing partner is important, and clear information of what is happening should be given from the outset.

Risk Management and Documentation

Accurate documentation of PPH is essential. Therefore, it is important to assign a member of staff by the team leader to scribe the events during the management of PPH.

All cases of PPH involving a blood loss of greater than 1500 ml should require incident reporting via DATIX for formal clinical review.

Midwifery and Medical staff involved in delivery of frontline maternity care should have multiprofessional annual training update (PROMPT) on the management of PPH,

Debriefing of the staff involved in major PPH is important preferably immediately after the incident.

An opportunity to discuss the events surrounding the obstetric haemorrhage should be offered to the woman with her birthing partner/s at a mutually convenient time.

Secondary PPH (PPH after 24 hrs of delivery)

Secondary PPH is defined as abnormal or excessive bleeding from the birth canal between 24 hours and 12 weeks postnatally.

Secondary PPH may be due to endometritis, retained tissues.

Follow WAHT antimicrobial treatment for chorioamnionitis for the recommended antibiotic regime for treatment of endometritis.

Surgical measures should be undertaken if there is excessive or continuing bleeding, irrespective of ultrasound findings.

In continuing haemorrhage, insertion of balloon catheter may be effective.

On call Obstetrics and Gynaecology consultants should be involved in decision making for surgical management of retained products of conception (RPOC). This should be undertaken in CEPOD theatre whenever feasible.

Surgical evacuation may require US guidance as high risk of uterine perforation and should be undertaken or supervised by a consultant.

PSEUDOANEURYSM of the uterine artery should be suspected if the bleeding is heavy and intermittent after a few weeks or a month in addition to the retained placental fragments.

This condition should be considered when patients have undergone a difficult instrumental delivery, curettage for retained placental fragments, or difficult fetal extraction during a caesarean section.

This diagnosis is suspected if the patient has had one, two or more negative ultrasound scans for RPOC.

Diagnostic confirmation is by colour Doppler or CT angiography of the pelvic vessels

If this diagnosis is suspected, curettage or hysterectomy should not be attempted as the tissues are exceedingly friable and there is real risk of massive haemorrhage.

A consultant gynaecologist, a Vascular surgeon and an intervention radiologist should be involved in planning the care as may require embolization.

Investigations of secondary PPH should include:

- VBG/ABG
- Full blood count, clotting, fibrinogen
- C-reactive protein.
- High vaginal swabs, Blood cultures if pyrexial,

A pelvic ultrasound to help to exclude the presence of RPOC, although the appearance of the immediate postpartum uterus may be unreliable.

Appendix 1: ROTEM

Use of Rotational Thromboelastometry (ROTEM) in Major Obstetric Haemorrhage at WRH

1. What is ROTEM?

Rotational Thromboelastometry (ROTEM) is a point of care test which evaluates the quality of a blood clot formation and stability by assessing its viscoelastic properties. It can be used in major haemorrhage for rapid assessment of coagulation, and to help guide correction of coagulopathy following major transfusion.

2. Location and use of ROTEM at WRH

The ROTEM machine is currently located in Main Theatre Recovery, Level 2 (A ROTEM machine will be made available to be located on the Delivery suite during the period of OBSUK trial). It requires a login profile to process a sample and ODPs have been provided with logins once they are trained to use the ROTEM.

The ROTEM requires a blue top coagulation blood bottle sample, with at least 2.7mls (ideally 4.5ml) of arterial or venous blood (not mixed. 2.7mls is a standard blue top bottle filled to the filling line, larger bottles are available for 4.5ml samples). It will require a runner to take the sample to Main Theatre Recovery on level 2 and request a trained ODP to process the sample. The quickest ROTEM can obtain a useful result is 10 minutes. The runner should remain with the sample and return to theatre with the printed results at the earliest opportunity to be reviewed by the anesthetist.

Below is a printable practical guide for taking a sample for ROTEM and process for obtaining a result, for display in theatres and delivery suite. A presentation about use of the ROTEM can be found here https://www.worcestericu.com/equipment.

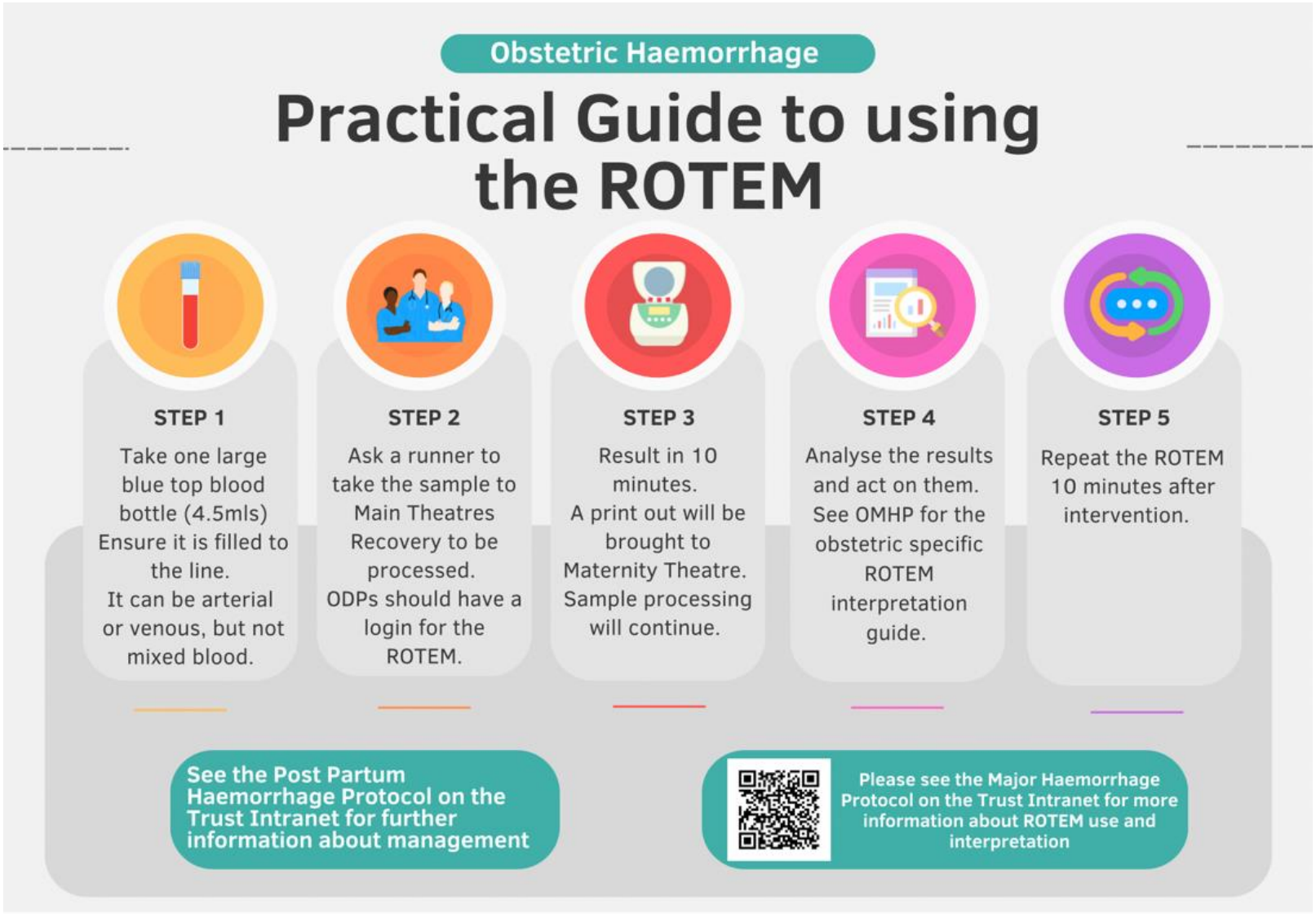
3. Use of the ROTEM in Major Obstetric Haemorrhage

Use of the ROTEM should be initiated early upon activation of the major obstetric haemorrhage protocol or if the PPH >1000ml (<1000ml if clinically indicated). Note should be made that the 'normal 'reference ranges for ROTEM differ in pregnancy, and the ROTEM interpretation guide for use in obstetrics has been modified to account for this. The interpretation guide is found in this appendix of the Post Partum Haemorrhage guideline.

When a sample for ROTEM is sent, a corresponding clotting sample should be sent to the lab.

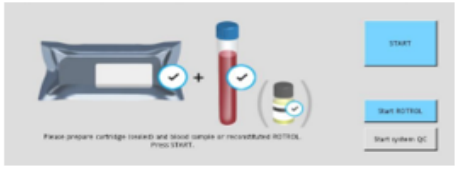
4. Understanding ROTEM Results

There is a comprehensive guide to the data ROTEM provides in the Major Haemorrhage Guideline (WHAT-KD-001). For the obstetric specific interpretation guide please refer below.


Obstetric Haemorrhage
Practical Guide to using the ROTEM
STEP 1
Take one large blue top blood bottle (4.5mls) Ensure it is filled to the line.
It can be arterial or venous, but not mixed blood.
STEP 2
Ask a runner to take the sample to Main Theatres Recovery to be processed.
ODPs should have a login for the ROTEM.
STEP 3
Result in 10 minutes.
A print out will be brought to Maternity Theatre.
Sample processing will continue.
STEP 4
Analyse the results and act on them.
See OMHP for the obstetric specific ROTEM interpretation guide.
STEP 5
Repeat the ROTEM 10 minutes after intervention.
See the Post Partum Haemorrhage Protocol on the Trust Intranet for further information about management
Please see the Major Haemorrhage Protocol on the Trust Intranet for more information about ROTEM use and interpretation

ROTEM Sigma Quick Sample Guide

1. Prepare to Run a Sample

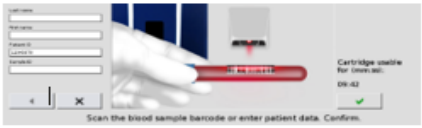


Enter the Measurement Module Icon and *Wait for the START button to turn blue (when all channels have achieved ready status).*

2. Unpack Sigma cartridge

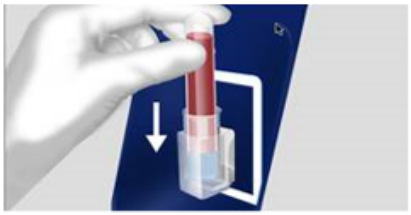
Press **START,** unpack Sigma cartridge and slide into the Sigma device. A timer will appear on the screen to prompting the user to use the cartridge within 10 minutes of opening.

3. Enter Patient Data



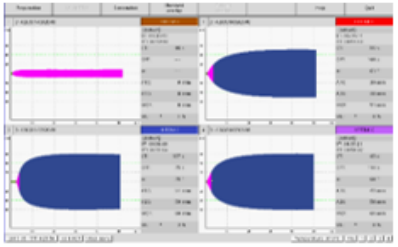
Enter all Patient ID fields required by either manual or scan entry.

4. Place Sample on cartridge



When prompted, insert sample into cartridge and ensure the sample is pushed down firmly avoiding any bounce back.

5. Measurements and Results



Measurement will start automatically and will run for up to 60 minutes

6. Stop, Save and Clear

Press STOP once all measurements required have been achieved.

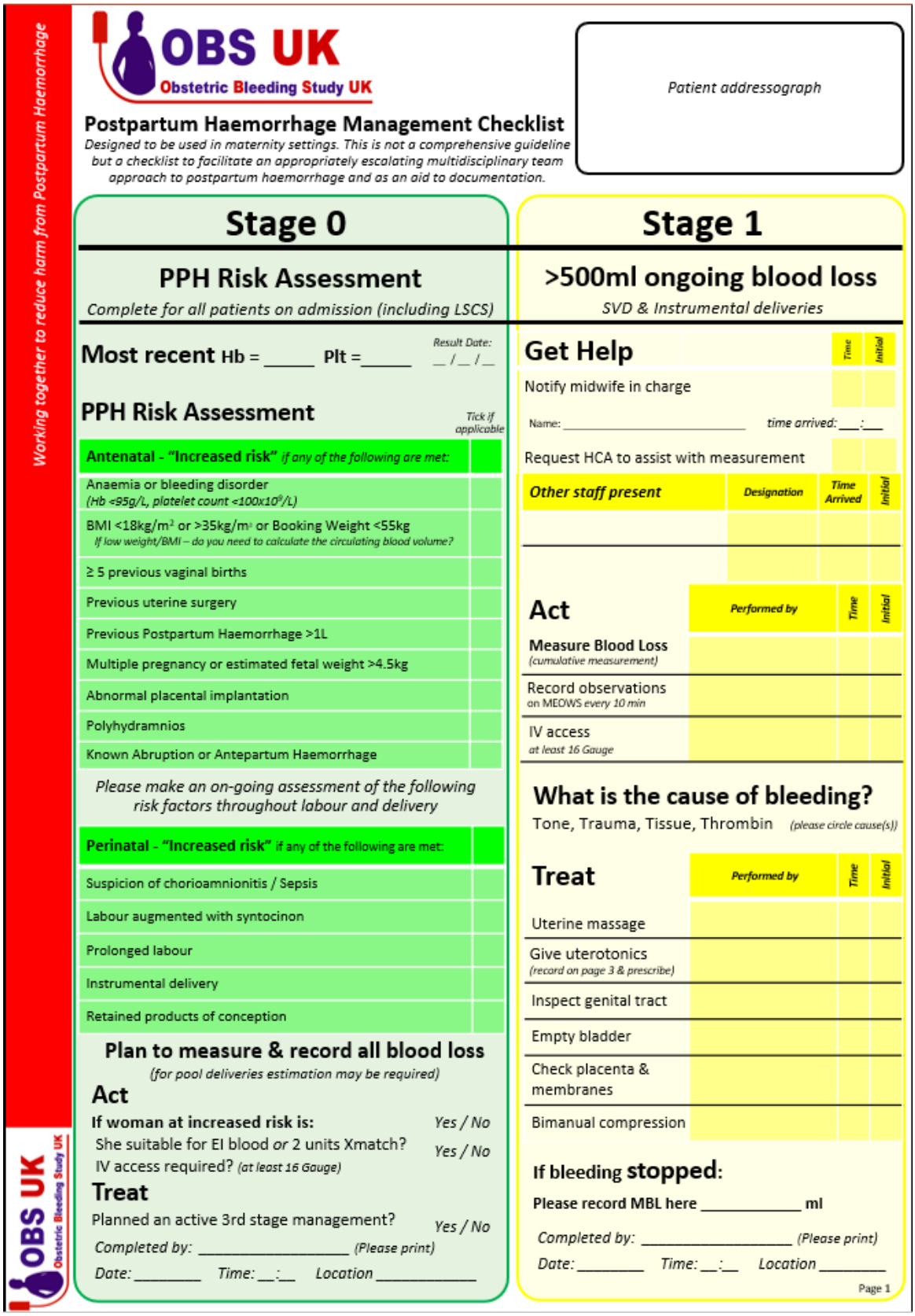
SAVE/CLEAR all results and PRINT if required

ROTEM

OBS UK Obstetric Bleeding Study UK

werfen

Appendix 2 – OBS UK Risk Assessment



Working together to reduce harm from Postpartum Haemorrhage

OBS UK
Obstetric Bleeding Study UK

Postpartum Haemorrhage Management Checklist

Designed to be used in maternity settings. This is not a comprehensive guideline but a checklist to facilitate an appropriately escalating multidisciplinary team approach to postpartum haemorrhage and as an aid to documentation.

Patient addressograph

Stage 0

PPH Risk Assessment

Complete for all patients on admission (including LSCS)

Most recent Hb = _____ Plt =_____ Result Date: __ / __ / __

PPH Risk Assessment *Tick if applicable*

Antenatal - "Increased risk" *if any of the following are met:*	
Anaemia or bleeding disorder *(Hb <95g/L, platelet count <100x10⁹/L)*	
BMI <18kg/m² or >35kg/m² or Booking Weight <55kg *If low weight/BMI – do you need to calculate the circulating blood volume?*	
≥ 5 previous vaginal births	
Previous uterine surgery	
Previous Postpartum Haemorrhage >1L	
Multiple pregnancy or estimated fetal weight >4.5kg	
Abnormal placental implantation	
Polyhydramnios	
Known Abruption or Antepartum Haemorrhage	

Please make an on-going assessment of the following risk factors throughout labour and delivery

Perinatal - "Increased risk" if any of the following are met:	
Suspicion of chorioamnionitis / Sepsis	
Labour augmented with syntocinon	
Prolonged labour	
Instrumental delivery	
Retained products of conception	

Plan to measure & record all blood loss

(for pool deliveries estimation may be required)

Act

If woman at increased risk is: *Yes / No*

She suitable for EI blood *or* 2 units Xmatch? *Yes / No*

IV access required? *(at least 16 Gauge)*

Treat

Planned an active 3rd stage management? *Yes / No*

Completed by: _____ *(Please print)*

Date: _____ *Time:* __:__ *Location* _____

Stage 1

>500ml ongoing blood loss

SVD & Instrumental deliveries

Get Help | Time | Initial

Notify midwife in charge

Name: _____ time arrived: __:__

Request HCA to assist with measurement

Other staff present	Designation	Time Arrived	Initial

Act

	Performed by	Time	Initial
Measure Blood Loss *(cumulative measurement)*			
Record observations *on MEOWS every 10 min*			
IV access *at least 16 Gauge*			

What is the cause of bleeding?

Tone, Trauma, Tissue, Thrombin *(please circle cause(s))*

Treat

	Performed by	Time	Initial
Uterine massage			
Give uterotonics *(record on page 3 & prescribe)*			
Inspect genital tract			
Empty bladder			
Check placenta & membranes			
Bimanual compression			

If bleeding stopped:

Please record MBL here _____ ml

Completed by: _____ *(Please print)*

Date: _____ *Time:* __:__ *Location* _____

Page 1

Stage 2

>1000mL blood loss *OR* clinical concern (e.g. abruption or concealed bleeding) ***OR* abnormal vital signs indicating urgent medical review**

Progress to here from stage 1 if SVD / instrumental delivery. Re-start here after stage 0 if LSCS

Get Help

		Time arrived:	Other staff		Time arrived:
MW in charge	Name:	time: __:__	Name:	Designation:	time: __:__
Obstetrician	Name:	time: __:__	Name:	Designation:	time: __:__
Anaesthetist	Name:	time: __:__	Name:	Designation:	time: __:__
HCA	Name:	time: __:__			

Act

	Performed by	Time	Initial
Measure & record cumulative blood loss			
Record observations on MEOWS *every 10 min*			
2nd IV access *(at least 16 Gauge)* & fluid bolus			
Take bloods Point of care tests - ROTEM, venous lactate, venous Hb Lab test - FBC, Coag, XMatch, U&E			

	Initial VBG Test Results		Initial ROTEM Test Results	
Time:	*Hb =*	*Lactate =*	*FIBTEM A5 = (Aim ≥ 12mm)*	*EXTEM CT = (Aim < 75 sec)*

Review causes *(circle all identified)* Tone / Trauma / Tissue / Thrombin

Treat	Performed by	Time	Initial	Treat	Performed by	Time	Initial
Review uterotonics *(record on page 3)*				Empty bladder			
Give tranexamic acid *(1g IV)*				Foley catheter inserted			
Bimanual compression				Inspect & repair genital tract			
Consider ranitidine				Check placenta & membranes			

If bleeding stopped ensure PPH post-event checklist completed & Management plan written in notes

Completed by: _____ *(Please print)* *Date:* _____ *Time:* __:__ *Location* _____

If bleeding *ongoing* transfer patient to theatre *time arrived:* ___:___

Stage 3

>1500mL blood loss *OR* ongoing clinical concern

Act

	Performed by	Time	Initial
Communicate current measured blood loss to team			
Activate MOH protocol			
Inform Obstetric and Anaesthetic consultants			
Order blood and coagulation products as per MOH and ROTEM protocol - *Do you need to discuss the case with a haematologist?*			

Review causes *(circle all identified)* Tone / Trauma / Tissue / Thrombin

Treat

	Performed by	Time	Initial
Review uterotonics *(record on page 3)*			
Consider repeat tranexamic acid if bleeding ongoing *(1g IV)*			
Consider advanced surgical techniques *(record on page 4)*			

Additional Staff Present: *Name:* _____ *Designation:* _____ *time arrived:* ___:__ *Name:* _____ *Designation:* _____ *time arrived:* ___:__

Once bleeding stopped ensure PPH post-event checklist completed & Management plan written in notes

Completed by: _____ *(Please print)* *Date:* _____ *Time:* __:__ *Location* _____ Page 2

References

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Contribution List

This key document has been circulated to the following individuals for consultation;

Designation
All Maternity staff (Newsletter)

This key document has been circulated to the chair(s) of the following committee's / groups for comments;

Committee
Maternity Governance Meeting Maternity Guidelines Meeting x 2