MATERNITY & NEONATAL

Queensland Maternity and Neonatal **Clinical Guideline**

Primary postpartum haemorrhage

Queensland Government

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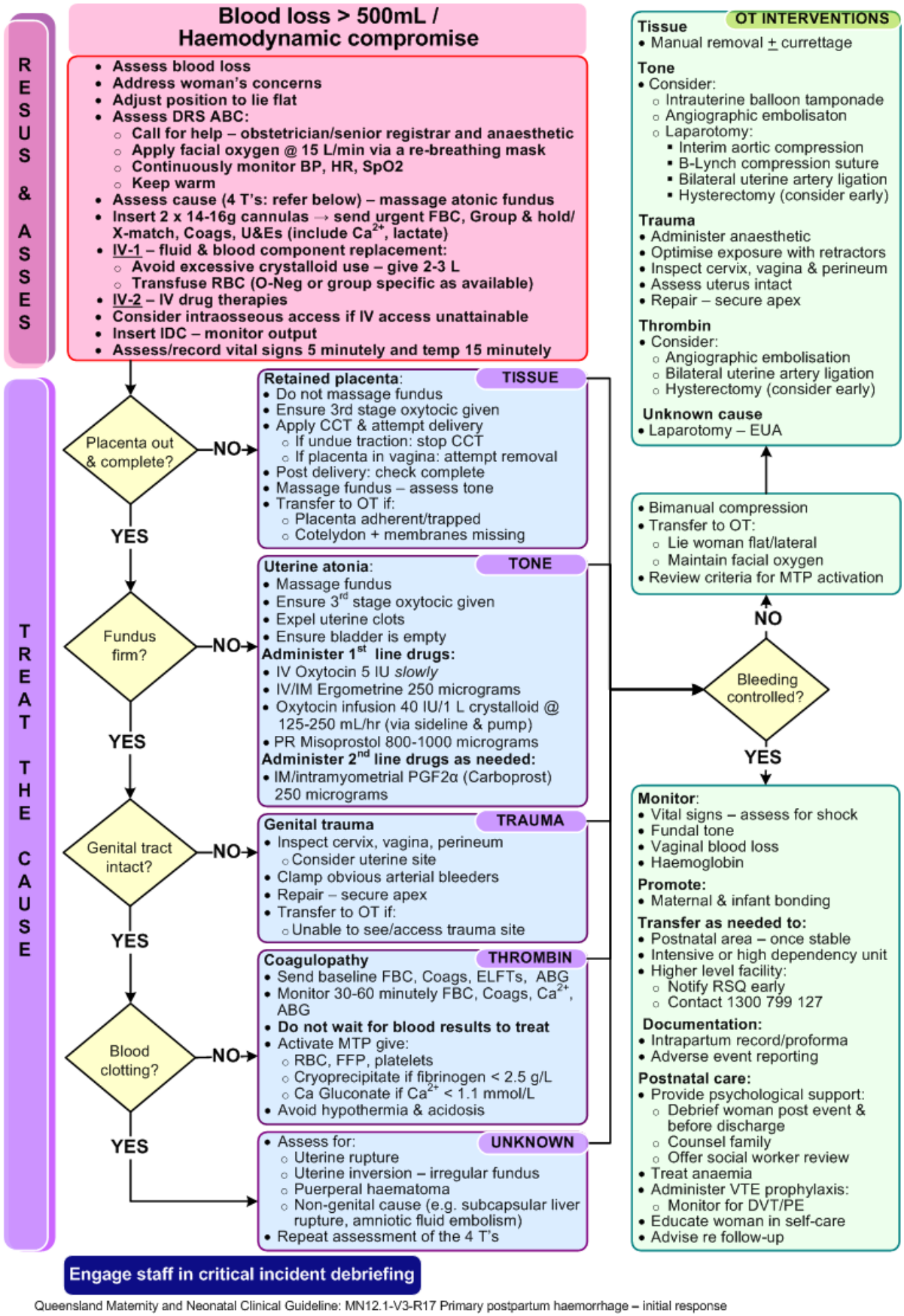
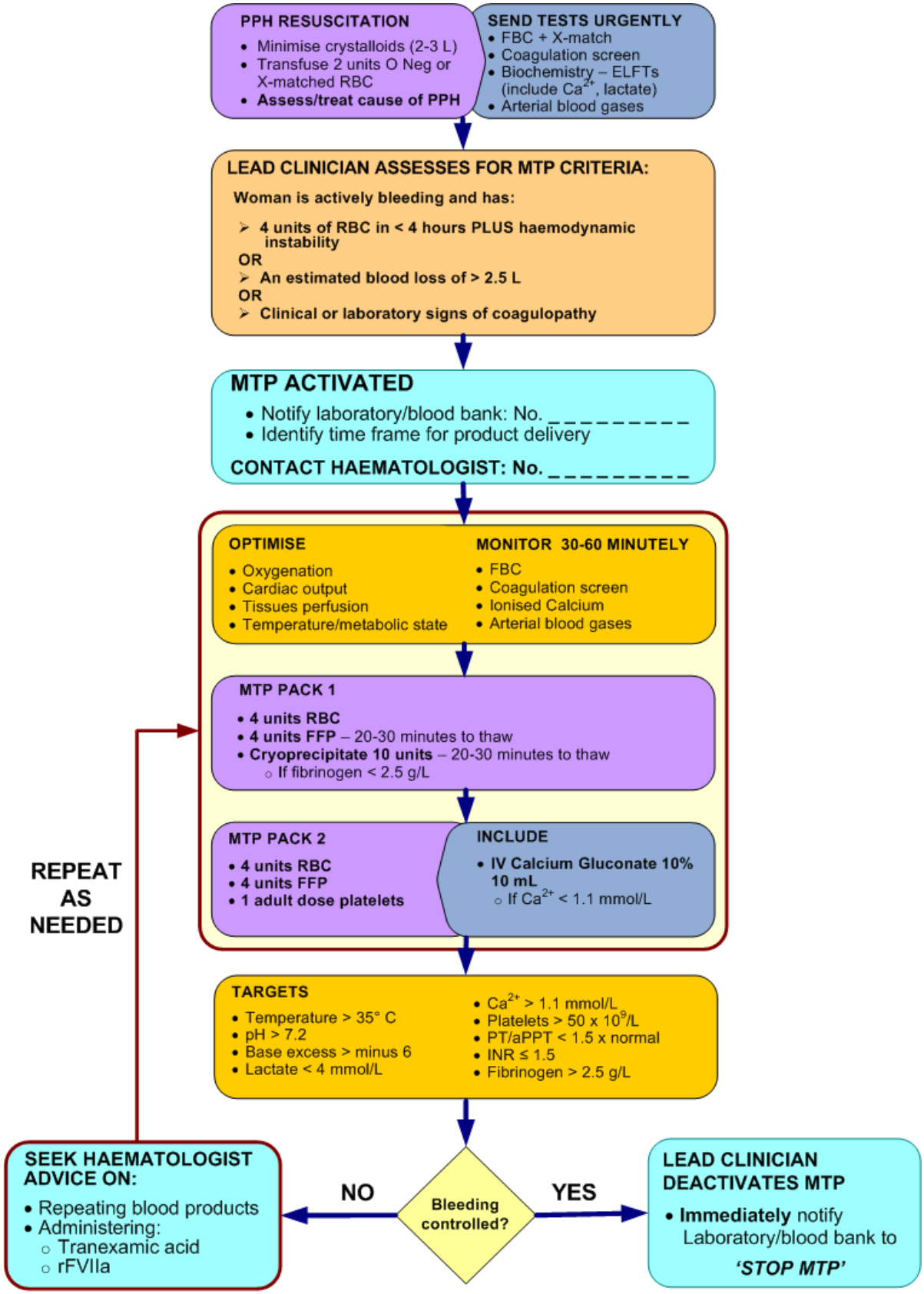
- Discuss care with consumers in an environment that is culturally appropriate and which enables respectful confidential discussion. This includes the use of interpreter services where necessary
- Advise consumers of their choice and ensure informed consent is obtained
- Provide care within scope of practice, meet all legislative requirements and maintain standards of professional conduct
- Apply standard precautions and additional precautions as necessary, when delivering care
- Document all care in accordance with mandatory and local requirements

Flow chart: PPH – initial response



Queensland Maternity and Neonatal Clinical Guideline: MN12.1-V3-R17 Primary postpartum haemorrhage – initial response

Flow chart: PPH – massive transfusion protocol (MTP)



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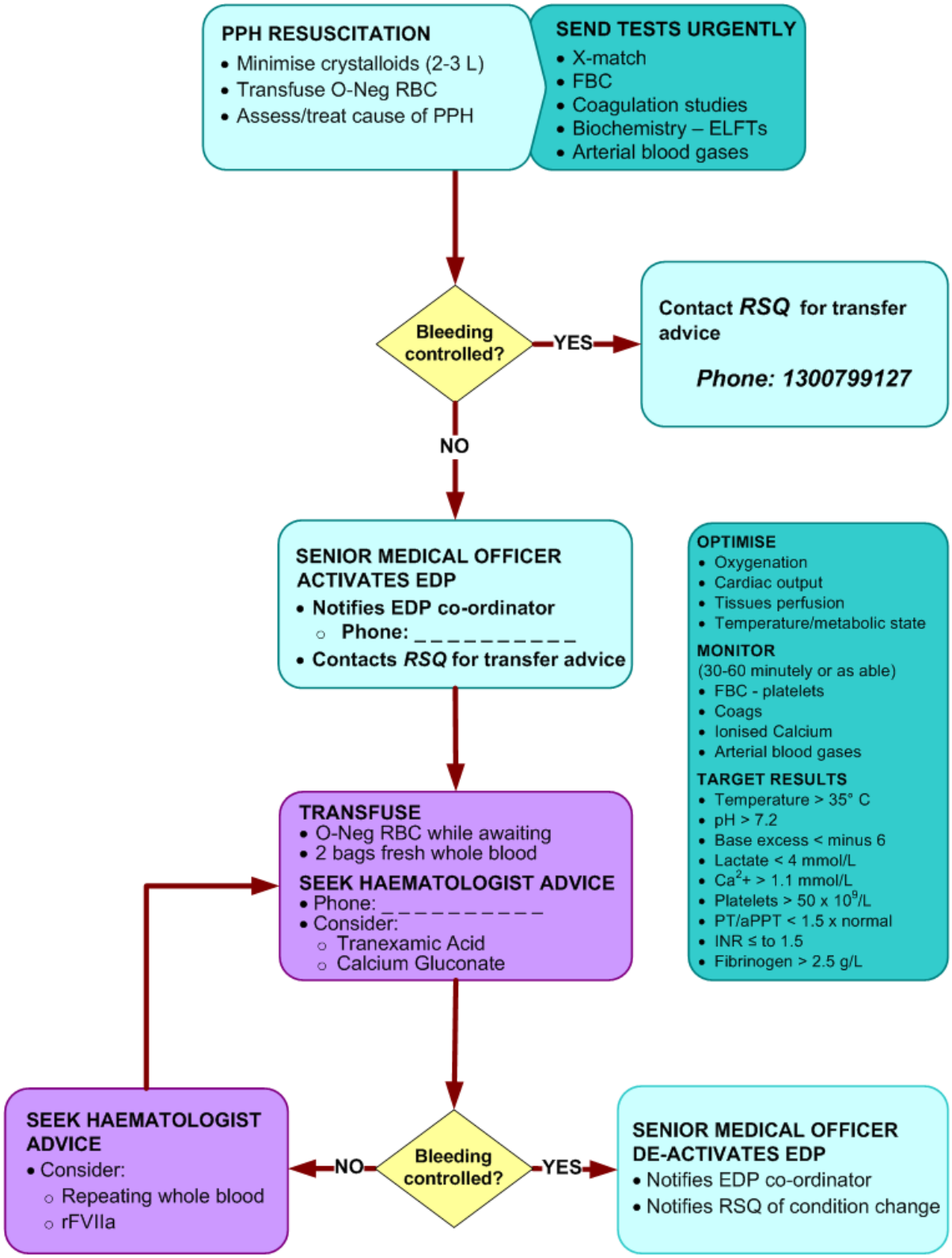
Flow chart: PPH – emergency donor panel activation



Queensland Maternity and Neonatal Clinical Guideline: MN12.1-V3-R17 Primary postpartum haemorrhage – emergency donor panel activation

Abbreviations

ABG	Arterial blood gas
aPTT	Activated partial thromboplastin time
AFE	Amniotic fluid embolism
BLS	Basic life support
BP	Blood pressure
Ca^{2+}	Ionised calcium
Coags	Coagulation profile/screen
CS	Caesarean section
°C	Degrees Celsius
DIC	Disseminating intravascular coagulopathy
DRS ABC	Danger, Response, Send for help, Airway, Breathing, Circulation
DVT	Deep vein thrombosis
EDP	Emergency donor panel
ELFTs	Electrolytes and liver function tests
EUA	Evaluation under anaesthesia
FBC	Full blood count
FFP	Fresh frozen plasma
GP	General practitioner
Hb	Haemoglobin
HR	Heart rate
IDC	Indwelling catheter
IM	Intramuscular injection
INR	International normalised ratio
IU	International units
IV	Intravenous
LAM	List of approved medicines
mmHg	Millimetres of mercury
MTP	Massive transfusion protocol
NaCl	Sodium Chloride
O-Neg	O negative
OT	Operating theatre
O_2	Oxygen
PE	Pulmonary embolus
PND	Postnatal depression
PPE	Personal protective equipment
PPH	Primary postpartum haemorrhage
PR	Per rectum
PT	Prothrombin time
RBC	Red blood cells
RSQ	Retrieval Services Queensland
rFVIIa	Recombinant factor seven activated
SpO2	Oxygen saturation of haemoglobin as measured by pulse oximetry
TA	Tranexamic acid
TGA	Therapeutic Goods Administration
U&Es	Urea and electrolytes
VE	Vaginal examination
VTE	Venous thromboembolism
x	times
X-match	Cross-match

Definition of terms

Assisted vaginal birth	Assisted vaginal birth uses obstetric forceps and/or a vacuum cup to expedite vaginal birth where the risks of the procedure are less than the risks of awaiting spontaneous vaginal birth.
Autotransfusion	Reinfusion of a patient's own blood.[1]
Dilutional coagulopathy	A coagulation abnormality induced by dilutional effects of blood replacement on coagulation proteins and the platelet count.[2]
Four T's	Also called '4 T's': refers to the four most common aetiologies for PPH[3]: • Tone – uterine atony • Tissue – retained placenta or products of conception • Trauma – genital tract trauma • Thrombin – coagulopathy
List of approved medicines (LAM)	The official statewide formulary for medicines approved for use in all Queensland Health public hospitals and institutions.
Obstetrician	Local facilities may, as required, differentiate the roles and responsibilities assigned in this document to an "Obstetrician" according to their specific practitioner group requirements; for example to General Practitioner Obstetricians, Specialist Obstetricians, Consultants, Senior Registrars, Obstetric Fellows or other members of the team as required.
Permissive hypotension	A systolic BP of 80-100 mmHg until bleeding is controlled.[4]
Practice review	Relates to clinical audit and quality assurance activities aimed at improving individual medical officer's practice.[5] Completing the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) practice review and clinical risk management (CRM) worksheet attracts 5 Practice Review and CRM points.[5]
Restrictive-use episiotomy policy	Where episiotomy is not used routinely during spontaneous vaginal birth but only for specific conditions (e.g. selective use in assisted vaginal birth or if suspected fetal jeopardy).[6]
Sequential compression device	A pump device that wraps around the lower limbs and inflates sequentially with graded pressures – the aim on inflation is to squeeze blood from the underlying deep veins and displace proximally; on deflation the veins refill, ensuring blood flow through the deep veins.[7]
Sheehan's syndrome	Hypopituitarism caused by infarction of the pituitary gland after postpartum haemorrhage and associated hypovolaemic shock.[8]
Uterotonic	A drug that acts on the smooth muscle of the uterus to stimulate uterine contractions (e.g. Oxytocin, Ergometrine, Misoprostol).

Table of Contents

List of Tables

1 Introduction

1.1 Definition

Primary postpartum haemorrhage (PPH) is defined as excessive bleeding in the first 24 hours post birth. There is no single definition for PPH [refer to Table 1]. Diagnosing PPH in an emergent situation most commonly occurs through estimation of volume of blood loss and changes in the haemodynamic state.

Table 1. Postpartum haemorrhage definitions

Clinical Aspects	Definitions
Blood loss volume	• Traditional definitions of PPH include: o A blood loss in excess of 500 mL[9, 10] after vaginal birth o A blood loss in excess of 1000 mL[10-12] after caesarean section (CS) • Severe PPH is used to describe a blood loss greater than or equal to 1000mL[13] • Very severe[13] or major[14] PPH are used to describe a blood loss of greater than 2500 mL
Haemodynamic compromise	• Due to frequent underestimation of blood loss[15], PPH may first be detected through haemodynamic compromise[10] [refer to Table 6]: o **Manifests as increasing tachycardia and hypotension** • A healthy pregnant woman will only show mild signs of shock after a blood loss of 1000 mL[16, 17] • Conversely, **compromise may occur earlier** in women with[10]: o Gestational hypertension with proteinuria o Anaemia o Dehydration o Small stature[16, 18]
Haematocrit	PPH can be retrospectively diagnosed by a 10% decline in postpartum haematocrit levels[12]
Blood transfusion	The Australian Council on Healthcare Standards indicator for PPH is[19]: • Blood transfusion required after a massive blood loss equal to or greater than 1000 mL or in response to a postpartum haemoglobin (Hb) of less than 80 g/L
Secondary	Secondary postpartum haemorrhage is outside the scope of this guideline as it refers to excessive bleeding that occurs between 24 hours post birth and 6 weeks postnatally[18]

The World Health Organisation's International Classification of Diseases (ICD-10) defines postpartum haemorrhage as 'haemorrhage after delivery of fetus or infant' and includes sub-classifications of[20]:

- Third stage: haemorrhage associated with retained, trapped or adherent placenta
- Other immediate: haemorrhage following delivery of placenta, postpartum haemorrhage (atonic)
- Delayed and secondary: haemorrhage associated with retained portions of placenta or membranes
- Postpartum coagulation defects: postpartum afibrinogenaemia or fibrinolysis

1.2 Incidence

PPH is the most common form of obstetric haemorrhage and is a leading cause of maternal morbidity and mortality.[21] In 2010, 5.9% of birthing women in Queensland suffered a PPH.[22]

1.3 Clinical Standards

Each facility requires established standards [refer to Table 2] and systems [refer to Section 1.3.1] to ensure a best practice response to PPH.

Table 2. Clinical standards

Elements	Good practice points
Counselling	
Woman	• If treatment is likely to affect the woman's fertility – prioritise consent procedures and include partner in decisions • Prioritise consent prior to invasive or painful procedures • Provide debriefing by a senior team member at the earliest opportunity after the event and prior to discharge[21]: o Organise follow up as needed
Staff	• Engage staff in critical incident debriefing after a PPH[21], ask: o How is everyone feeling? o What went well & why? o What was difficult & why? • What would be done differently next time?
Staff education	• Familiarise staff with the guideline for managing PPH[23]: o Adherence to evidence-based guidelines reduces maternal morbidity • Implement regular multidisciplinary practice drills[21, 23, 24] to improve: o Identification of PPH (e.g. visual blood loss estimation, haemodynamic triggers) o Emergency response to PPH o Emergency response to maternal collapse
Reporting and documentation	• Notify of PPH via local adverse event reporting systems (e.g. PRIME) • Use the intrapartum record or a proforma[21] [refer to Appendix C] to: o Standardise and record clinical response and care o Enable data collection and clinical audit

1.3.1 Emergency systems

To optimise clinical response to major PPH ensure staff familiarity with the following:

- Activating a multidisciplinary response
- Duties and responsibilities when a massive transfusion protocol (MTP) is activated, including:
  - Contacting/calling-in medical and/or theatre staff in an emergency
  - Contacting or calling-in local laboratory/blood bank staff for the urgent supply of blood products and processing of blood samples
  - Contacting a haematologist/transfusion specialist for clinical or laboratory advice
  - Contacting Retrieval Services Queensland to discuss/facilitate maternal transfer
  - Contacting laboratory/blood bank when there is a decision to cease MTP
- Whether the facility is supported by an emergency donor panel (EDP) and, if so, duties/responsibilities for:
  - Activating the EDP
  - Contacting the EDP co-ordinator – at least 2 contacts for 24 hour coverage

Pre-plan access to an emergency blood supply by referring to:

- Where a blood bank/laboratory is on site or in easy access – the Queensland Health Emergency Blood Supply Policy[25]
- Where blood is not readily accessible and there is an established EDP – the Queensland Health Management Framework for Emergency Donor Panels[26]

2 Common causes

The common causes (aetiology) of PPH are referred to as the 'Four T's' and in order of most to least commonly occurring are[3, 21]:

1. **Tone** (70 %):
    - Atonic uterus
2. **Trauma** (20%):
    - Lacerations of the cervix, vagina and perineum
    - Extension lacerations at CS
    - Uterine rupture or inversion
    - Consider non-genital tract trauma (e.g. subcapsular liver rupture)
3. **Tissue** (10%):
    - Retained products, placenta (cotyledon or succenturiate lobe), membranes or clots, abnormal placenta
4. **Thrombin** (< 1%):
    - Coagulation abnormalities

2.1 Risk factors

Table 3. Risk factors for PPH

Risk factors	Aetiology
Antenatal	
Increased maternal age – more than 35 years[6, 21]	Tone
Asian ethnicity[6, 21]	Tone/trauma
Obesity – Body mass index (BMI) of more than 35[6]	Tone
Grand multiparity – uncertain as mixed findings[6, 10, 15, 27, 28]	Tone/Tissue
Existing uterine abnormalities[6] (e.g. anatomical anomalies, fibroids[10])	Tone
Maternal blood disorders[6, 10]: • Von Willebrand disease • Idiopathic thrombocytopenia purpura • Thrombocytopenia caused by pre-eclampsia/gestational hypertension • Disseminating intravascular coagulation (DIC)	Thrombin
History of previous PPH[6, 21] or retained placenta[6]	Tone/tissue
Anaemia of less than 9 g/dl at onset of labour[29]	No reserve
Antepartum haemorrhage associated with[21,6]: • Suspected or proven placental abruption • Known placenta praevia	Tissue/Tone/ Thrombin
Over distension of the uterus[10]: • Multiple pregnancy • Polyhydramnios • Macrosomia – greater than 4 kg[10, 21]	Tone
Intrauterine fetal death[10]	Thrombin
Intrapartum	
Precipitate labour[6, 10]	Trauma/Tone
Prolonged labour – first, second or third stage[6, 10]	Tone/Tissue
Chorioamnionitis[6], pyrexia in labour[21] (e.g. prolonged membrane rupture[10])	Tone/Thrombin
Oxytocin use[30] – Induction of labour[6, 21] or augmentation[29]	Tone
Amniotic fluid emboli (AFE)/DIC[10]	Thrombin
Uterine inversion[10]	Trauma/Tone
Genital tract trauma[10] (e.g. episiotomy, ruptured uterus)	Trauma
Assisted vaginal birth[21]	Trauma/Tone
CS – more risk with emergency (e.g. extension or lacerations from deep engagement or malpresentation[10])	Trauma/Tone
Postnatal	
Retained products[21] (e.g. placenta, cotyledons or succenturiate lobe, membranes or clots[10])	Tissue
AFE/DIC[10]	Thrombin
Drug-induced hypotonia[10] (e.g. anaesthetic, magnesium sulphate)	Tone
Bladder distension preventing uterine contraction[10] (e.g. obstructed IDC, unable to void)	Tone

3 Third and fourth stages of labour

The care provided during the 3rd and 4th stages of labour may assist in the prevention or earlier detection and treatment of PPH.

3.1 Management of the third stage of labour

Table 4 compares outcomes of active management of the third stage versus physiological management for women with mixed risk of bleeding. Refer to Guideline: Normal birth[31] for further evidence considerations for physiological and active management in the low risk woman.

Table 4. Mixed risk: active versus physiological third stage management

***Active management considerations**	

Reduces[13]	• Severe PPH
	  o Effect not evident in women at low risk of bleeding
	• Postpartum haemoglobin less than 9 g/dL at 24-72 hours following birth
	  o Effect not evident in women at low risk of bleeding
	• Use of therapeutic uterotonics during the third stage of labour or in the first 24 hours after birth
	• Need for blood transfusion

Increases[13]	• Incidence of maternal diastolic BP greater than 90 mmHg • Vomiting after birth • After pain and use of analgesia from birth up to discharge from birth suite • Above three findings thought to be related to the use of Ergot compounds • Return to hospital as an in- or out-patient because of bleeding • Postnatal maternal haemoglobin
Technique	• Administer prophylactic oxytocic soon after birth o Insufficient evidence to identify optimal timing[13] • Commence controlled cord traction – with a strong uterine contraction[32] and after signs of placental separation [refer to Guideline: Normal birth[31]] • Massage uterine fundus after birth of the placenta, as appropriate[32]

Recommendations:
• Discuss with all women antenatally:
  o The risks and benefits of active and physiological management of third stage of labour[13]:
  o In active management the ability to minimise hypertensive effects and interference of placental transfusion by[13]:
  ▪ Omitting the ergot component of the prophylactic uterotonic
  ▪ Oxytocin 10 IU IM is the prophylactic uterotonic drug of choice [9, 10]
  ▪ Delaying cord clamping (for 2-3 minutes[33])
• For women at low risk of bleeding who choose physiological management, ensure option of uterotonic as a treatment is available if:
  o Excessive bleeding occurs[13]
  o Delay in placental birth greater than 1 hour[6]
  o Woman requests to shorten third stage[6]	

*Caution: refer to Australian pharmacopeia and List of Approved Medicines (LAM) for complete drug information

3.2 Monitoring in the fourth stage of labour

Women with intrapartum risk factors for PPH require postnatal monitoring[21] of vital signs, fundal tone and blood loss for 1-2 hours immediately after birth:

- Refer to Table 5 for recommended observations
- **ALERT:** alternative PPH presentation is a slow steady trickle *after* 3rd stage of labour[3]

Table 5. Recommended observations post birth

Normal birth **Low risk women** **First 2 hours post birth[31]**	**Intrapartum risk factor(s) for PPH** **High risk women** **First hour post birth**
Temperature – within the first hour	½ hourly temperature
Pulse, respirations and BP – once	¼ hourly pulse, respirations and BP[34] – or as clinically indicated
¼ - ½ hourly fundal/lochia assessment	¼[34] - ½ hourly fundal and lochia assessment
Pain – initial assessment, review if indicated	Pain – initial assessment, review if indicated
Urine output – within the first two hours	Urine output – within the first two hours
• If concerns: commence pulse, respirations and BP monitoring	• After first hour: continue as clinically indicated • After CS: incorporate into routine post-operative observations

3.2.1 Estimation of blood loss

Visual estimation of blood loss often leads to underestimation and requires[18, 21]:

- Weighing of bloody linen, swabs and drapes
- Use of pictorial guides to assist staff to estimate blood loss

Changes in clinical findings due to hypovolaemic shock can also guide blood loss estimation:

- Refer to Table 6 for signs and symptoms of hypovolaemic shock
- Early signs of shock include tachycardia and tachypnoea[34]

Table 6. Clinical findings in PPH[16]

Blood loss	**BP (systolic)**	**Signs and symptoms**	**Degree of shock**
500-1000 mL (10-15%)	Normal	Palpitations, dizziness, tachycardia	Compensation
1000-1500 mL (15-25%)	Slight decrease (80-100 mm Hg)	Weakness, sweating, tachycardia	Mild
1500–2000 mL (25-35%)	Marked decrease (70-80 mm Hg)	Restlessness, pallor, oliguria	Moderate
2000–3000 mL (35-45%)	Profound decrease (50-70 mm Hg)	Collapse, air hunger, anuria	Severe

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4 Resuscitation, assessment and treatment

Initial response to PPH [refer to Table 7] requires a multidisciplinary team approach[35] to restore the woman's haemodynamic state whilst *simultaneously* identifying and treating the cause of bleeding.

Table 7. Initial response: resuscitation and assessment

Elements	Good practice points
Keep woman warm[18] – monitor temperature every 15 minutes[21]	
On arrival	**Assess** rapidly – rate and volume of bleeding – caution with underestimation[18, 21] **Address** woman's and support person's concerns – briefly explain the situation **Adjust** position to lie woman flat[18]
DRS ABC assessment	**Danger:** check for risks (e.g. manage slippery floor, use PPE) **Response:** assess if woman is alert, drowsy or unconscious **Send for help:** trigger a multidisciplinary response[21] – including anaesthetic[18] **Airway:** position, as needed, to maintain an open airway[36] **Breathing:** apply facial oxygen (O_2) at 15 L /minute via re-breathing mask[21] • If breathing abnormal/absent start bag and mask ventilation[37] **Circulation:** assess perfusion; monitor BP, pulse and SpO_2 continuously[21] – record 5 minutely • Tolerate permissive hypotension until bleeding controlled[4] • If unresponsive and absence of normal breathing – initiate basic life support (BLS)[38]
Four T's assessment	**Tone: Fundus atonic** • Massage fundus and give uterotonics[18] • For drug therapy refer to Section 4.1 **Trauma: Fundus well contracted, blood clotting** • For trauma repair refer to Section 4.2 **Tissue: Retained placenta or fundus atonic and unresponsive to uterotonics** • For tissue removal refer to Section 4.3 **Thrombin: Fundus contracted (may become atonic), blood not clotting** • For coagulopathy correction refer to Section 4.4 **Unknown:** Assess for uterine rupture/inversion [refer to Section 4.2.3 and Section 4.2.4], concealed bleeding (e.g. vault haematoma) and non-genital causes (e.g. subcapsular liver rupture) • Transfer to operating theatre (OT) for exploration under anaesthetic
IV access	• IV cannula x 2[21] – insert 14-16 gauge o Send urgent bloods – FBC, group and hold/X-match (4-6 units[21]), coagulation profile, U&Es including Ca^{2+}, lactate • Consider intraosseous access if IV access unattainable **IV Line 1:** For fluid and blood replacement to promote tissue perfusion and O_2 carrying capacity[18, 35] • Avoid dilutional coagulopathy[39] • Avoid excessive crystalloid use[4, 35, 39], administer: o 2-3 L[8] of crystalloids[40] until red blood cells (RBC) ready • Do not use haemoglobin alone as a transfusion trigger • If bleeding continuing: transfuse RBC early[21, 35, 41]. Administer: o 2 units RBC[8] (O-Neg until group specific ready[18], then X-matched) ▪ Use rapid infusion sets, pump sets or pressure bags, blood warmer ▪ Refer to Appendix D. Blood administration: transfusion **IV Line 2:** For drug therapies to treat uterine atonia [refer to Table 8]
Apply bimanual compression[3, 18] (particularly with a delay in treatment or maternal collapse)	
IDC	• Insert IDC to empty bladder[18] • Monitor fluid balance[21] – aim for urinary output of 30 mL/hr or more[34]
Bleeding continues	• Consider need for surgical intervention early[18] [refer to Section 4.1.1] • Consider Activation of MTP[4] – refer to Section 4.5

4.1 Tone

Treatment of uterine atonia is outlined in Table 8. If bleeding becomes intractable refer to Section 4.1.1 for treatment.

The uterine cavity must be empty of tissue for effective uterine contraction.

Table 8. Uterine atonia

Clinical aspects*	Good practice points
Clinical measures	• Give prophylactic oxytocic if not administered during 3rd stage management • Massage uterine fundus[18] • Check placenta and membranes are complete • Expel uterine clots – warn woman of discomfort o Refer to Table 14 for description of technique • Insert IDC to maintain empty bladder[18] – monitor output • Assess need for bimanual compression[18]
First line drugs	Refer to an Australian pharmacopeia and LAM for complete drug information

Oxytocin	• Give IV Oxytocin[18] 5 IU *slowly*[42] over 1-2 minutes[10]
	  o May repeat dose[21] after 5 minutes – up to a total dose of 10 IU[10]
	• CAUTION: rapid administration (in 30 seconds)[10] and a single dose greater than 5 IU[43, 44] is associated with transient tachycardia, hypotension and ischaemic electrocardiographic changes[42]
	  o A low-dose Oxytocin infusion may be a safer alternative to a bolus dose of Oxytocin in some women, such as those with major cardiovascular disorders
	• Start IV infusion of Oxytocin 40 IU/1 L of crystalloid solution at a rate of 125-250 mL/hr (5-10 IU/hour)

Ergot alkaloid (Ergometrine maleate)	• Give IV Ergometrine maleate 250 micrograms[21] diluted in 5 mL of 0.9% Sodium Chloride, *slowly*[45] over 1-2 minutes[18]:
	  o Or IM Ergometrine maleate 250 micrograms
	  o May repeat dose after 15 minutes[9] – up to a total dose of 500 micrograms[21]
	• CONTRAINDICATIONS**:** retained placenta, pre-eclampsia, eclampsia, hypertension or history of hypertension, severe/persistent sepsis, renal, hepatic or cardiac disease[45]

Misoprostol	• Give rectal Misoprostol 800-1000 micrograms[18, 46] • Unapproved as first line drug in Queensland Health's LAM[47] • Due to slow onset of action, early administration may help sustain uterine tone achieved through 1st line drugs
Second line drug: ***Prostaglandin F2 alpha (Carboprost: 250 micrograms in 1 mL)***	• Give intramyometrial/IM Carboprost 250 micrograms with a tuberculin syringe o Repeated as required every 15-90 minutes to a maximum of 2 mg (8 doses)[48] • CONTRAINDICATIONS: acute pelvic inflammatory disease, cardiac, pulmonary, renal, or hepatic disease, hypersensitivity to prostaglandin[48] • PRECAUTIONS: Asthma, anaemia, diabetes, epilepsy, hyper/hypotension, jaundice, uterine surgery[48] • SIDE-EFFECTS: Extremely high BP, fever with chills, headache, paresthesia, diarrhoea, nausea and vomiting, breast tenderness, dystonia, pulmonary oedema • The decision to administer by direct intramyometrial injection rests with the clinician prescribing and administering as Carboprost is not recommended for intramyometrial use[21] • LAM Restriction: Specialist Obstetricians and Gynaecologists and Rural Generalist General Practitioners with an Advanced Skill in Obstetrics and Gynaecology • Not TGA approved – when full consent cannot be obtained, record full details in the patients chart

4.1.1 Intractable bleeding

Whilst taking steps to manage intractable bleeding [refer to Table 9] be alert for signs of coagulopathy, if clinical signs present treat as per Section 4.4.

Table 9. Intractable bleeding arising from uterine atonia

Clinical aspects	Good practice points

Transfer to OT	• Institute blood component replacement as soon as possible
	  o Review criteria for MTP activation [refer to Section 4.5]
	• Requires urgent transfer to OT
	  o Transfer woman flat with face mask oxygen
	  o Apply bimanual compression
	  o Assess for analgesia[49]

In theatre preparation	• In theatre, keep woman warm[49] to facilitate clotting
	  o Warm blood and IV fluids
	  o Consider external warming device if prolonged procedure
	• Apply pneumatic calf compression device to reduce risk of venous thromboembolism (VTE)[49]
	• Where expertise available: consider cell salvaging[50]
	• Ensure experienced obstetrician performs or directly supervises procedures[49]
	• Seek consultant anaesthetic input[21]

Medical procedures	• Under anaesthetic check uterine cavity is empty and intact
	• If bimanual compression has been effective consider use of:
	  o Intrauterine tamponade balloon tamponade (e.g. Bakri)[9, 21, 49] [refer to Appendix B. Uterine atonia interventions]
	  o Vaginal packing not recommended as can conceal bleeding[9]
	• Consider selective angiographic embolisation[18, 21] (up to 90% effective) requires:
	  o Interventional radiologist and necessary infrastructure
	  o Relatively stable condition for length of procedure i.e. approximately 1 hour

Surgical procedures
 	
[Refer to Appendix C]
	• **Be alert for coagulopathy[49]**
	  o In the critically bleeding patient who needs an operation, the coagulopathy should be treated concurrently with the procedure to stop the bleeding
	• Perform a laparotomy
	• Judiciously apply aortic compression (below the level of the renal arteries[49]) as a temporizing measure[9]
	• Maintain uterine contraction – consider B-Lynch compression suture[18, 21]
	  o Insufficient quality evidence to support use of combined balloon tamponade with the B-Lynch suture[51, 52]
	• If compression or tamponade unsuccessful: consider bilateral uterine artery ligation[9, 18, 21], bilateral utero-ovarian artery ligation and if expertise available bilateral internal iliac artery ligation[53]
	• Perform a hysterectomy[18]:
	  o Early – if life is threatened[49, 54]
	  o If bleeding continues after use of conservative treatment options
	  o Timing is critical – weigh benefits of conservative versus aggressive management approach[54]
	  o Assess if quicker and safer to do subtotal hysterectomy based on surgeon's skill/maternal condition[21, 49]
	  o Use hot packs intra-abdominally
	• Post-laparotomy inspect carefully for haemostasis

4.2 Trauma

Trauma is the second most common cause of PPH and may involve the uterus, cervix, vagina and/or perineum.

Ensure uterus is well contracted before assessing for trauma.

4.2.1 Genital trauma

Genital tract trauma is most likely the cause of PPH when the fundus is well contracted. Table 10 outlines treatment for genital trauma.

Table 10. Genital trauma

Clinical aspects	Good practice points
Condition stable	• Attempt clamping of obvious arterial bleeding prior to repair • Position woman to maximise visualisation and maternal comfort • Repair – ensuring bleeding at the apex of the laceration is secured o For principles of repair – refer to Guideline: Perineal Care[55]
Condition compromised	• Treat shock [refer to Table 7] • Apply pressure on the wound or bimanual compression o Assess analgesia requirements[49] • Urgently transfer to OT for repair under anaesthetic
Suboptimal wound visualisation	• Transfer to OT • Maximise lighting and position in lithotomy • Under anaesthetic o Apply retractors to optimise visualisation, utilise assistants • Check uterine cavity is empty and uterus is intact

Anaesthetic ineffective	• Assess rate of bleeding and weigh options of:
	  o Top up local or regional anaesthetic
	  o Transfer to OT for general anaesthetic

Puerperal haematoma	• Large non-haemostatic haematoma:
	  o Treat shock [refer to Table 7]
	  o Transfer to OT for evacuation and repair
	  ▪ For treatment and care – refer to Guideline: Perineal care[55]

4.2.2 Cervical trauma

Cervical trauma [refer to Table 11] generally does not inhibit upper uterine segment contraction unless the uterine cavity fills with clots.

Table 11. Cervical trauma

Clinical aspects	Good practice points
Risk factors[8]	• Precipitous labour, assisted vaginal birth, cervical suture • May occur in absence of risk factors
Presentation	• Profuse haemorrhaging during and after 3rd stage of labour o Strengthened by exclusion of other causes of PPH

Treatment	• Urgently transfer to OT[17]
	• Undertake assessment and repair under anaesthetic
	• Assessment – optimise exposure through positioning, lighting, retractors and use of assistants
	  o Inspect entire genital tract[8]
	  o To inspect the cervix:
	  ▪ Grasp one side of the cervix between 2 sponge holders
	  ▪ Remove and reapply forceps one at a time moving in a clock wise direction, keeping forceps 2-3 cm apart
	  ▪ Inspect for tears between the forceps after each repositioning
	  ▪ Continue until the full 360° of the cervix has been inspected
	• Repair – ensure experienced obstetrician present
	  o Ensure bleeding at the apex of the laceration is secured[8]
	  ▪ If difficult to visualise – start sutures at distal end of tear and pull down on suture material to expose apex[8]
	  o Avoid suture placement cephalad to the anterior fornix due to risk of ureteral ligation[8]
	• If extensions (e.g. lower uterine, high vaginal, cardinal ligament)
	  o Consider performing a laparotomy to enable simultaneous vaginal and abdominal routes for repair[8]
	• If bleeding continues – consider further surgical intervention[56]

4.2.3 Uterine rupture

Uterine rupture can occur spontaneously or be associated with previous obstetric surgery.[8] The severity of the haemorrhage will depend upon the extent of the rupture.[17]

Table 12. Uterine rupture

Clinical aspects	Good practice points
Risk factors	• Previous uterine surgery or CS, administration of Oxytocin, malpresentation, dystocia during second stage of labour[57]

Presentation	• Intrapartum presentation – act to rapidly deliver baby and placenta
	• Intrapartum signs of uterine rupture may include[58]:
	  o **Maternal:** tachycardia and signs of shock, sudden shortness of breath, constant abdominal pain, possible shoulder tip pain, uterine/suprapubic tenderness, change in uterine shape, pathological Bandl's ring, inco-ordinate or cessation of contractions, frank haematuria, abnormal vaginal bleeding, abdominal palpation of fetal parts
	  o **Fetal:** abnormal CTG tracing, loss of fetal station
	• Postpartum presentation often associated with[8]:
	  o Pain, abdominal distension and persistent vaginal bleeding
	  o Haematuria may occur if rupture extends into the bladder

Diagnosis	• Confirm during surgery
Treatment	• Urgently transfer to OT • Under anaesthetic palpate uterine cavity to identify rupture site[8] • Repair rupture using multiple layers and absorbable sutures[17, 56] • Consider hysterectomy if defect is large, difficult to close[17] and/or the woman's haemodynamic stability is threatened[17, 56]

4.2.4 Uterine inversion

Uterine inversion is associated with immediate life threatening haemorrhage and shock. Delay in treatment increases the risk of mortality.[56] Consider anaesthesia prior to attempting repositioning of the fundus.

Table 13. Uterine inversion

Clinical aspects	Good practice points
Risk factors[3, 8, 56]	• Uterine over distension, invasive placentation, short umbilical cord, tocolysis, Oxytocin use, primiparity, manual extraction of the placenta, excessive umbilical cord traction
Presentation	• Sudden onset of PPH • Irregular or absent palpable fundus • A complete inverted uterus may appear as a bluish grey mass at the introitus[3] • Haemodynamic instability • Excruciating pain and hypovolaemic shock disproportionate to revealed blood loss
Diagnosis	• Use bimanual examination to locate the uterine fundus in the lower uterine segment or vagina[3]
Treatment	• Prompt manual reduction[3]: o **If placenta in situ leave in place till after reduction** o Grasp protruding fundus with palm of hand o Direct fingers toward posterior fornix o Gently lift uterus up through the pelvis, into the abdomen and toward the umbilicus o Once reverted start uterotonic therapy to contract uterus and prevent reoccurrence o Attempt placental delivery • Hydrostatic pressure: o Lie woman flat or head slightly down o Commence manual reduction until fundus in vagina, then o Have assistants bring labia into firm apposition o Using IV tubing, infuse warm saline into vagina to create increased intravaginal pressure o Hydrostatic pressure may act to correct the inversion[17] • Surgical replacement: o Transfer to OT[8] o Under anaesthetic give tocolytic agent to relax uterus and cervix[8] o Work quickly to manually detach the placenta if not delivered o Apply *gentle* manual pressure to the uterine fundus and return it to the abdominal position[8] o If a dense constriction ring occurs consider[56]: ▪ A laparotomy to allow vaginal and abdominal manipulation of the fundus ▪ Use deep traction suture to manipulate fundus and to maintain positioning once retracted o Immediately start uterotonic therapy to contract uterus and prevent reoccurrence[8] o Consider applying bimanual compression until uterine tone returns[3] • Monitor to ensure there is no reoccurrence[3]

4.3 Tissue

Ensure the woman is informed and has adequate pain relief prior to attempting removal of tissue.

The uterine cavity must be empty of tissue for effective uterine contraction.

Table 14. Removal of tissue

Clinical aspects*	Good practice points
Clots in the uterine cavity due to uterine atonia	• Express clots by cupping the fundus in the palm of the dominant hand and compressing the uterus firmly between thumb and fingers • Observe for expulsion of clots – measure volume • Massage fundus firmly • Take steps to prevent further atonia
Trailing membranes	• Using sponge holders clamp membranes extending beyond the introitus, without traction, roll forceps to create a rope of membranes • Move forceps in an up and down motion and apply gentle traction o Maternal pushing may assist in removal • Once trailing membranes are delivered: o Perform vaginal examination (VE): assess if membranes in vagina o If membranes present: attempt delivery with fingers or forceps • Observe uterine tone and blood loss – be alert for slow steady trickle • If large amount of membranes retained: transfer to OT for manual removal
Retained placenta	• Insert in/out urinary catheter or IDC • Ensure prophylactic third stage uterotonic has been given o Ergometrine is not recommended as tetanic contractions may delay placental expulsion[9] o Do not use IV infusion of Oxytocin to assist the birth of the placenta[6] • Time constraints make the use of umbilical vein injection of Oxytocin[6] and/or Misoprostol[10, 59] inappropriate during a PPH • Re-attempt controlled cord traction o Maternal pushing and re-positioning may assist in delivery • If undue traction required: o Check if risk factors for abnormal placentation o If available: portable ultrasound may assist in placental location o Perform VE: assess if placenta remains within the uterus i.e. unable to be felt protruding through the cervix or lying high in the vagina o If placenta in vagina: attempt removal and inspect for completeness • Post-delivery: massage fundus and ensure sustained uterine tone • If unable to deliver placenta or appears incomplete transfer to OT for manual removal • Consider need for bimanual compression during transfer • If urgent and theatre is unavailable: consider manual removal of placenta under sedation using Nitrous Oxide, Midazolam, Fentanyl or Ketamine **In theatre under general anaesthetic:** • Gently manually remove retained products[8] • If manual removal unsuccessful: apply gentle curettage with a large blunt curette[8] • Post procedure: explore the uterine cavity to ensure it is intact • Check for cervical, vaginal and perineal trauma and repair as necessary • Check haemostasis achieved

*Caution: refer to Australian pharmacopeia and LAM for complete drug information

4.4 Thrombin

If coagulopathy is suspected consult with a haematologist or transfusion specialist for advice on blood component replacement, laboratory monitoring and result interpretation.[4]

Coagulopathy is a criterion for MTP activation.

Table 15. Coagulopathy

*Clinical aspects	Good practice points
Coagulopathy detection	**Clinical signs[60]:** • Oozing from puncture/cannulation/injection sites or surgical field • Haematuria • Petechial, subconjunctival and mucosal haemorrhage • Blood that no longer clots • Uterine atonia secondary to increased fibrin degradation products • **If clinical signs present do not wait for blood results to treat** **Laboratory signs[4]:** • Platelet count less than 50 x 10^9/L • Prothrombin time (PT) greater than 1.5 x normal • International normalised ratio (INR) greater than 1.5 • Activated partial thromboplastin time (aPTT) greater than 1.5 x normal • Fibrinogen level less than 2.5 g/L[39] o A fibrinogen level between 2 and 3 g/L, usually considered normal in a non-pregnant woman, is associated with a nearly doubled risk of severe haemorrhage and may constitute an early warning sign[61]
Coagulopathy correction	Optimise body temperature i.e. more than 35°C[4] while transfusing: • 4units RBC o Refer to Section 4.4.2 for logistics of RBC replacement o Refer to Appendix D. Blood administration: transfusion • 4 units fresh frozen plasma (FFP) • Cryoprecipitate 10 units[4] [refer to Table 4] • A single adult dose of platelets (after 8-10 units of RBC[62]) • Repeat as necessary – being guided by laboratory findings • Refer to Table 16 for laboratory targets and principles for transfusion **Include:** • Calcium Gluconate 10%, IV, 10 mL (in other vein)[2], if: o Ionised calcium (Ca^{2+}) less than 1.1 mmol/L[4] **Seek haematologist input if considering:** • Tranexamic acid[4] (TA) [refer to Section 4.4.4] • Recombinant Factor VIIa[4] (rFVIIa) [refer to Section 4.4.5]
Early DIC	• Be alert for *early* DIC[63] in: o Placental abruption[60] o Severe pre-eclampsia or HELLP syndrome o Acute fatty liver of pregnancy o Amniotic fluid embolism o Fetal death in utero o Septicaemia o Dilutional coagulopathy secondary to massive transfusion[60] • Reduce the risk of associated mortality – avoid precipitant factors[4, 43]: o Shock o Hypothermia o Acidosis

*Caution: refer to Australian pharmacopeia, LAM, Australian and New Zealand Society of blood transfusion, Australian Red Blood Cross, and National Blood Authority Australia for complete drug and blood component information

4.4.1 Laboratory considerations

Notify pathology of impending arrival of urgent blood samples. Communicate clearly the need for *emergency* provision of blood and blood components. Identify minimum time till blood product availability, include transport time. Where laboratory/blood bank is on site, approximate times for product availability are[43]:

- O Negative RBC – immediately
- Type specific RBC – 10 minutes
- Fully cross-matched RBC – 45 minutes

Table 16. Laboratory considerations

Clinical aspect	Good practice points
Laboratory monitoring	• Ensure baseline collection: o FBC, coagulation profile (PT, INR, APTT, fibrinogen), biochemistry (electrolytes and liver function tests (ELFTs), include Ca^{2+} and lactate), arterial blood gas (ABG) o Do not wait for blood results to treat • Monitor every 30[39]-60[4, 8] minutes: o FBC, coagulation profile, Ca^{2+}, ABG[4]
Target results[4]	• pH greater than 7.2 • Base excess greater than minus 6 • Lactate less than 4 mmol/L • Ca^{2+} greater than 1.1 mmol/L • Platelets greater than 50 X 10^9/L • PT and aPTT less than 1.5 x normal • INR equal to or less than 1.5 • Fibrinogen greater than 2.5 g/L[35, 39] • Hb greater than 70 g/L[60]
Coagulopathy principles for transfusion	**Blood component ratio** • Currently there is no evidence or consensus to guide optimal ratio of blood component replacement in obstetric haemorrhage[4, 8, 35] • Aim is to replace blood loss with blood components at a ratio equivalent to whole blood[64] o For average 70 kg adult advise: ▪ 4 units RBC: 4 units FFP ▪ Single adult dose of platelets after 8-10 units of RBC ▪ Repeat as necessary to achieve target results – see above o Low level evidence suggests that for trauma patients in haemorrhagic shock a ratio of 1:1:1 of RBC:FFP:platelets may increase survival[2, 64] – extrapolation to obstetrics is untested[35, 39] • If pre-cross matched RBC are not available – refer to Table 17. Logistics of red blood cell replacement **Fibrinogen levels** • Due to physiological elevation of fibrinogen levels in pregnancy – a level of 2 g/L or less represents a significant degree of consumption[39] • Advise early use of cryoprecipitate to maintain fibrinogen levels[4, 61] above 2.5 g/L[35, 39, 61] • Include Cryoprecipitate in first pack after MTP is activated • Laboratory tests lag behind the clinical DIC scenario and therefore fibrinogen results are likely to be higher than actual levels **Avoid hypothermia and acidosis** • Optimise clotting factors and platelet function by aiming for[4]: o Temperature above 35° C o pH more than 7.2 o Base excess greater than minus 6

4.4.2 Logistics of red blood cell replacement

Table 17 outlines the logistics of RBC replacement[60] in situations where pre-cross matched blood is not available.

Table 17. Logistics of red blood cell replacement

Clinical aspects	Good practice points
Take blood for cross matching prior to giving O negative red cells – do not wait for results.	
No blood group and antibody screen	• Transfuse O Negative RBC • Send urgent blood for antibody testing and cross match
Blood group and antibody screen negative	**Laboratory onsite** • Transfuse compatible RBC **Laboratory offsite** • Transfuse O Negative RBC • Await group specific RBC
Blood group and antibody screen positive	• Await antibody testing and cross match needed for provision of compatible blood • While waiting, in consultation with a haematologist o If urgent: transfuse most suitable uncross matched RBC
Screened homologous blood unavailable in time frame	• Transfuse O Negative RBC emergency stock o Consider activation of Queensland Health Clinical Emergency Blood Supply Policy ▪ If applicable, ensure an awareness of local donor panel sites o Where supported: Senior medical officer to activate EDP to access fresh whole blood ▪ Give 2 units (contains clotting factors and calcium) ▪ Advise woman of higher risk of transfusion complications • Contact Retrieval Services Queensland (RSQ) early to arrange urgent retrieval of woman

4.4.3 Optimising the metabolic state

Mortality is increased when hypothermia and acidosis occur with coagulopathy[4] – the 'lethal triad'. Strategies outlined in Table 18 act to improve the woman's metabolic state and chance of survival.[4]

Table 18. Prevention of hypothermia and acidosis

Avoid hypothermia	Avoid acidosis
• Use fluid warmers and forced air warmers • Minimise exposure • Remove wet linen • Provide warm blankets • Monitor temperature at least 15 minutely	• Maintain: o Oxygenation o Cardiac output o Tissue perfusion • Monitor ABG: pH, base excess

4.4.4 Tranexamic Acid

Tranexamic Acid has been shown to improve survival of non-obstetric trauma patients by reducing the risk of death from bleeding and all-cause mortality.[4, 65] The 'World Maternal Antifibrinolytic' (WOMAN) trial is currently investigating safety and efficacy of TA use in PPH. Lower level obstetric research shows:

- Prophylactic use of TA reduces mean blood loss post vaginal and caesarean birth[66]
- High dose TA can reduce blood loss and maternal morbidity in ongoing PPH[67]

Table 19. Tranexamic Acid

Clinical aspects	Considerations
Caution: refer to Australian pharmacopeia and LAM for complete drug information	
Clinical context	• In trauma patients: used if massive transfusion required or if blood components (e.g. FFP, platelets) are not readily available[65] o Administered within 3 hours of trauma or start of bleeding[65] • The World Health Organisation: suggests TA use when 1st and 2nd line drugs are ineffective at controlling PPH or when bleeding is thought to be due to trauma[9]
Dose[4]	• Consult haematologist if considering for obstetric use • Loading dose: IV Tranexamic Acid 1 g in 100 mL of 0.9% Sodium Chloride over 10 minutes • Maintenance dose: IV Tranexamic Acid 1g in 100mL of 0.9% Sodium Chloride over 8 hours (at 12.5 mL/hour)

LAM restriction[47]	• For use by specialist anaesthetists, intensivists, surgical staff and cardiac perfusionists for:
	  o Major haemorrhage with concomitant hyperfibrinolysis; and
	  o Prophylaxis of intra/post-operative bleeding during major surgical procedures which have a high likelihood of transfusion requirement
	• As PPH management is not a TGA approved indication for use:
	  o When appropriate informed consent cannot be obtained, full details should be recorded in the patient chart

4.4.5 Recombinant activated factor VII

Use of rFVIIa to arrest continuing PPH:

- Is considered 'off-licence'[4, 47] and is not recommended for general use
- Could be life saving but it is also associated with life threatening side effects[9]
- The decision to use rests with the clinician prescribing and requires practice review[4]

Table 20. Recombinant activated factor VII

Clinical aspects	Considerations
Caution: refer to Australian pharmacopeia and LAM for complete drug information	
Clinical context	• In uterine atony, if all medical, radiological and surgical interventions, other than hysterectomy, have failed and preserving fertility is desired[60] • Woman's beliefs prohibits life saving administration of blood products[43]
Exclusion criteria	• Inadequate platelets and fibrinogen, pH less than 7.2 and a body temperature less than 34°C[4]
Dose	• Consult haematologist if considering for obstetric use[18] • LAM dose: rFVIIa IV, 30-50 micrograms/kg, over 3-5 minutes[47] o Case series/registry data median dose: 90 micrograms/kg[68, 69] • 2nd dose after thirty minutes and after checking for exclusion criteria[68] • Maximum of 2 doses[69] – if bleeding continues perform hysterectomy[68]
Caution	• Increases the already higher risk of VTE[4] in obstetric women[60] • In life threatening situations – 'off-licence' consent may be problematic

4.5 Massive transfusion protocol

Reduction of morbidity and mortality associated with major PPH can be achieved through:

- A rapid and coordinated multidisciplinary clinical response[35]
- Implementation of a MTP[4, 70] i.e. developed and reviewed annually by key stake holders

For maternity services without an established MTP: Table 21 identifies elements for MTP development and the Flow chart*: PPH – massive transfusion protocol (MTP)* provides a template for local adaptation. Considerations for EDP activation are outlined below and in the Flow chart: *PPH – emergency donor panel activation*.

Table 21. Obstetric MTP

Elements	Good practice points
Activation criteria	Woman is actively bleeding and has one or more of the following criteria: • Major obstetric bleed[4] – i.e., estimated blood loss more than 2500 mL[14] • Actual/anticipated 4 RBC units in less than 4 hours *plus* haemodynamic instability[4] • Clinical or laboratory evidence of coagulopathy[14]
Roles and communication	• Lead clinician: o Identifies need for massive transfusion o Contacts laboratory/blood bank staff to activate the MTP • Laboratory staff[4]: o Prepares (e.g. thaws) and issues blood products as per MTP o Anticipates repeat testing and blood component requirements o Minimises test turn around times o Considers staff resources o Follows Queensland Health Emergency Supply of Blood Policy[25] • Haematologist/transfusion specialist: o Contacted by laboratory staff to notify of situation o Contacted by lead clinician to seek input, as needed, regarding: ▪ Blood component and other therapies ▪ Result interpretation • EDP (if supported): o Senior medical officer contacts EDP co-ordinator to activate EDP o Identifies time frame till supply of fresh whole blood • RSQ: contact early for transfer advise, where needed
Co-ordination of blood component and other therapies	• Pre-designate: o Dose, timing and ratio of blood component therapy ▪ Configurations may vary according to facility resources – consider RBC:FFP ratio of 1:1 o Triggers for administration of Cryoprecipitate and Calcium Gluconate o Triggers for haematologist input e.g., if considering use of: ▪ Tranexamic Acid [refer to Section 4.4.4] and/or ▪ rFVIIa [refer to Section 4.4.5] ▪ Additional blood component therapy for continued bleeding
Laboratory testing	• Pre-designate: o Baseline blood tests o Tests to be repeated every 30-60 minutes[4] o Refer to Table 15 and Table 16 • Reliability of point-of-care laboratory tests is uncertain in obstetrics[35]
Laboratory targets	• Establish laboratory targets [refer to Table 16]
Deactivation	• Lead clinician: promptly contacts laboratory/blood bank staff to deactivate MTP[4] once bleeding is controlled • Senior medical officer: contacts EDP co-ordinator to deactivate EDP

5 Postnatal Care

Immediately post PPH, the woman and their family require debriefing by a senior team member who, preferably, was present at the event. Significant clinical aspects of ongoing inpatient care are outlined in Table 22.

Table 22. Postnatal care

Clinical aspects	Good practice points
Inter-hospital transfer	• Make the decision to transfer early – contact RSQ on **1300 799 127**
Monitoring:	
Haemodynamic state	• Transfer to high dependency/intensive care unit for observation[21] • If condition not critical: o Observe in birth suite for 2 hours – once stable transfer to postnatal area o First 24 hours post birth: monitor vital signs, uterine tone and blood loss at least 4 hourly o After 24 hours post birth: monitor as per clinical condition
Haemoglobin	• Take 6 hours after stabilisation – repeat within 24 hours of birth[71] • If Hb less than 70 g/L and/or symptomatic: offer RBC transfusion o If refusal on basis of beliefs: consider IV Iron therapy[71] • If Hb less than 70 g/L and asymptomatic: commence Iron therapy with Vitamin C supplement o Provide information on ways to increase dietary iron o Inform woman Iron tablets can be lethal for babies[71] • If the Hb is less than 70-80 g/L in the postnatal period and where there is no continuing or threat of bleeding, the decision to transfuse should be made on an informed individual basis[50]
VTE	• Increased risk after PPH – consider offering pharmacological VTE prophylaxis to postnatal women who have had excess blood loss or blood transfusion[72] [refer to Guideline: VTE prophylaxis[73]] • If spinal/epidural catheter in situ: apply sequential compression device o After removal, proceed to graduated elastic compression stockings and/or pharmaceutical prophylaxis • Encourage early mobilisation and avoid dehydration • Observe for deep vein thrombosis and pulmonary embolism
Mothercraft	• Support maternal and infant bonding o Facilitate regular skin-to-skin contact under direct supervision • Support infant feeding – offer midwifery/lactation consultant assistance o If unable to lactate or persistent hypotension consider Sheehan's syndrome[60] • Discuss risks and advise against co-sleeping and bed sharing given possible fatigue associated with anaemia
Preparation for discharge	• Offer social worker review • Offer woman and family clinical disclosure/debriefing with senior clinician, preferably present at time of the event[21, 70] • Educate woman about signs, symptoms and self referral to General Practitioner (GP) for: o Infection – risk of secondary PPH o Postnatal depression (PND) – risk associated with anaemia[71] o VTE – risk associated with PPH • Encourage follow up with GP (e.g. monitor Hb, lactation, mental health) • Complete discharge summary (e.g. via electronic discharge information system (EDIS)) • Referral to local Child Health services for lactation support and close follow up in view of anaemia and PND risk. • Offer advice regarding maintaining bowel functions if using iron supplements • Inform woman of increased risk of PPH in subsequent pregnancies and the need to inform future primary carers of PPH complication

6 Risk assessment and management

6.1 Antenatal risk management

Although most cases of PPH will have no significant risk factors[21, 35], it is still worthwhile to assess antenatal women for risk of PPH[35] [refer to Table 3] and where possible take steps to mitigate risk/s [refer to Table 23].

Table 23. Antenatal risk reduction measures

Clinical aspects	Risk reduction measures
Routine care	• Optimise pre-birth haemoglobin[43]: o Screen for and treat anaemia o Check haemoglobin again at 36 weeks gestation • Assess for PPH risk factors, if detected: o Highlight in woman's documents o Consult/refer to specialist, as needed o Collaborate with the woman to document a plan of care that attempts to mitigate risk[21]
Maternal blood disorders	• Involve specialist physician to: o Optimise/stabilise coagulation profile prior to birth o Advise on birth options (e.g. types of pain relief, mode of birth)
Risk of abnormal placentation	• Perform an ultrasonographic examination and/or magnetic resonance imaging (e.g. if previous CS)[21, 43, 54] • If abnormal placentation: arrange review by a consultant obstetrician o Discuss and document planned elements of care • If placenta accreta: satisfy following elements of care prior to surgery[21]: o Discussion and informed consent regarding possible interventions (e.g. hysterectomy) o Planned presence of obstetric and anaesthetic consultant o Availability of blood and blood products (e.g. FFP, platelets, X-matched RBC) o Multidisciplinary involvement in pre-operative planning o Local availability of intensive care bed post surgery
Booked elective CS or induction of labour	• Discuss PPH risk as part of informed choice • Ensure evidence-based indication for procedure[54] • Check FBC, group and hold, are current[50] on admission for procedure
Informed refusal of blood products	• Discuss with the woman a plan of care that encompasses[34, 43]: o Identification of placental site o Optimisation of pre-birth haemoglobin to prevent avoidable anaemia o Active management of third stage of labour o Identification of acceptable fluid resuscitation management o At an early stage, considering pharmacological, mechanical and surgical procedures to avert the use of banked blood and blood components[50] o Optimisation of erythropoiesis using Folic Acid and/or Vitamin B12 and/or Erythropoietin treatment o Content of existing Health Directive o As available at local facility, alternative therapies/treatments e.g. Tranexamic acid, intraoperative cell salvaging and reinfusion drains • If CS required and/or high risk of PPH discuss: o Risks, benefits and access logistics of: ▪ Interventional radiology[43] ▪ Intraoperative cell salvaging[43] (requires a skilled team[50]) • Discuss risk of uterine atonia [refer to Table 3] associated with delay in 1st and 2nd stages of labour and corrective treatments such as intrapartum Oxytocin infusion and assisted/operative birth

6.2 Intrapartum risk management

Assess women for antenatal and intrapartum PPH risk factors [refer to Table 3] on presentation and during labour. If detected collaborate with the woman to develop a plan of care to mitigate risk [refer to Table 24].

Table 24. Intrapartum risk reduction measures.

Clinical aspects	Risk reduction measures
Episiotomy	• Implement a restrictive-use episiotomy policy[6]
Active management of third stage of labour*	• Offer active management of third stage of labour [refer to Section 3.1] to women at risk of PPH[13] • IM Syntocinon® 10 IU is the uterotonic of choice in vaginal birth[13] • Syntometrine® is contraindicated in women with hypertensive disorders[3, 21] o SIDE EFFECTS: nausea, vomiting, pain[74] o CAUTION: IV use increases risk of retained placenta[10] • Promote safety during active management by: o Applying suprapubic counterpressure *prior* to CTT o Avoiding undue cord traction – risk of cord snapping or uterine inversion o Directly supervising novice practitioners in this procedure
Physiological third stage of labour	• Support choice for women at low risk of PPH, following a normal, physiological labour and birth[6] [refer to Section 2.2.1] • Assign care to staff skilled in the procedure[13] ensuring: o *No* manipulation of the uterine fundus or use of CCT o Refer to Guideline: Normal birth[31] for best practice • Ensure at anytime the option of an uterotonic as treatment is available[13]
One or more risk factors for PPH	• Assess for both antenatal and intrapartum risk factors on presentation • Discuss with the woman a plan of care that encompasses: o IV access in active labour o Blood sample sent for FBC, group and hold o Active management of the 3rd stage [refer to Section 3.1]
Risk of chorioamnionitis	• If temperature elevated during labour increase frequency of monitoring • If temperature greater than 38.5°C consider: o Collecting FBC (with differential) and blood cultures o Need for: ▪ IV fluids ▪ IV antibiotics
Emergency CS	• Ensure IV access • Send *urgent* blood for FBC, group and X-match • Ensure senior obstetrician present if increased risk of PPH: o Increased risk of extensions or lacerations[10]: ▪ Deep engagement of the fetal head (e.g. protracted 1st or 2nd stage of labour, failed assisted vaginal birth) ▪ Malpresentation o Evidence of abnormal coagulation
Instrumental birth	• Individually assess need for episiotomy - avoid routine use
Vaginal birth after caesarean	• Monitor closely for early signs of uterine rupture o Refer to Table 12 for clinical signs in intrapartum presentation

*Caution: refer to Australian pharmacopeia and LAM for complete drug information

6.3 Postnatal risk management

Postnatal PPH is most likely to occur within the first hour post birth[34]. Refer to Table 3 for risk factors arising in the postnatal period and Table 25 for possible risk reduction measures.

Table 25. Postnatal risk reduction measures

*Clinical aspects	Risk reduction measures

Routine care	• Prioritise placental inspection
	  o If incomplete, or in doubt, monitor woman and consult obstetrician
	• Facilitate prompt repair of genital trauma
	• Monitor all women post birth – refer to Section 3.2
	  o Assess uterine tone ¼ - ½ hourly[31] and massage if tone is decreased
	  ▪ If appropriate, demonstrate technique to woman and supervise
	• Actively encourage/assist women to void soon after birth
	• Promote endogenous release of oxytocin by[48,75]:
	  o Keeping the woman warm and calm post birth
	  o Assisting with early breast feeding
	  o Facilitating skin-to-skin contact with baby, under supervision
	  ▪ Check baby for deteriorating condition, risks of fall or smothering

PPH risk factor/s: antenatal or intrapartum	• Consider prophylactic Oxytocin infusion post birth
	  o LAM restricts prophylactic use of PR Misoprostol to a second line drug in the treatment of PPH[47]
	• ¼ hourly observations for 1st hour post birth [refer to Table 5]
	  o Be alert for early signs of hypovolaemic shock [refer to Table 6]
	• Maintain IV access for 24 hours post birth

Elective CS	Consider administration of Carbetocin instead of Oxytocin infusion[10] [refer to Section 6.3.1]

Early recognition of puerperal haematoma	• Suspect if:
	  o Unable to identify the common causes of PPH (4 T's) and/or
	  o Hallmark sign of excessive or persistent pain
	  ▪ Presentation will depend on site, volume and rate of haematoma formation
	• Other signs are:
	  o Hypovolaemic shock disproportionate to the revealed blood loss
	  o Feelings of pelvic pressure
	  o Urinary retention
	• Act promptly to
	  o Resuscitate as required [refer to Table 7]
	  o Perform vaginal/rectal examination to determine site and extent
	  o Consider: transfer to OT for clot evacuation, primary repair and/or tamponade of blood vessels
	• Refer to Guideline: Perineal care[55] for diagnosis, treatment and follow-up

*Caution: refer to an Australian pharmacopeia and LAM for complete drug information

6.3.1 Carbetocin

High level evidence indicates prophylactic Carbetocin is no more effective then Oxytocin in preventing PPH greater than 500 mL or 1000 mL.[10] Carbetocin has not been compared with bolus dose intramuscular or intravenous Oxytocin vaginal birth.[76] A summary of evidence and recommendations regarding use of Carbetocin is provided in Table 26.

Table 26. Carbetocin in comparison with other uterotonics

***Carbetocin compared with selective oxytocics[76]**	
Compared to Oxytocin infusion	• In women with at least 1 risk factor for PPH – decreases the need for uterine massage as a uterotonic intervention • In elective CS – decreases the need for uterine massage and therapeutic oxytocics but does not decrease incidence of PPH
Compared to Syntometrine	In vaginal births: • Decreases blood loss • Fewer adverse effects including postpartum hypertension • Does not decrease incidence of PPH
Cost effectiveness	• Limited data on cost-effectiveness of Carbetocin • One study only – Carbetocin more cost effective than Oxytocin
Recommendations: • In elective CS consider substituting Oxytocin infusion with Carbetocin[10, 76] IV 100 microgram in 1 mL, given slowly over 1 minute after birth of the baby[77] • Carbetocin (Duratocin®) is for use in elective CS and is currently not indicated in emergency CS or after vaginal birth[47, 77]	

*Caution: refer to Australian pharmacopeia and LAM for complete drug information

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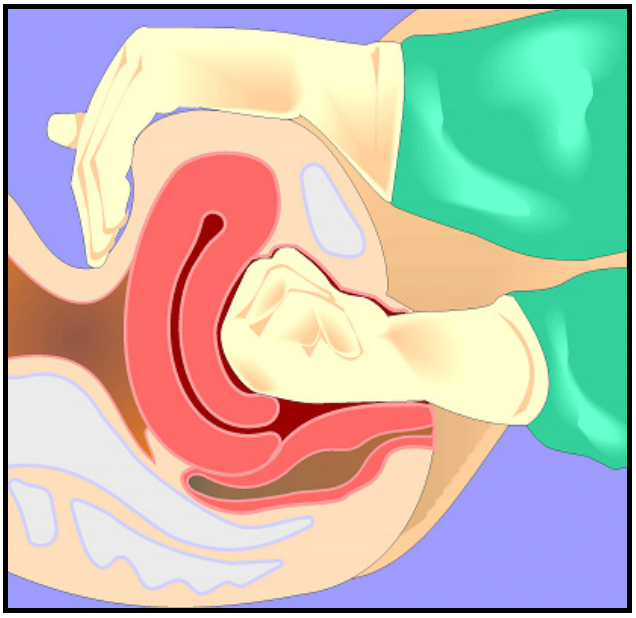
Appendix A: Bimanual compression

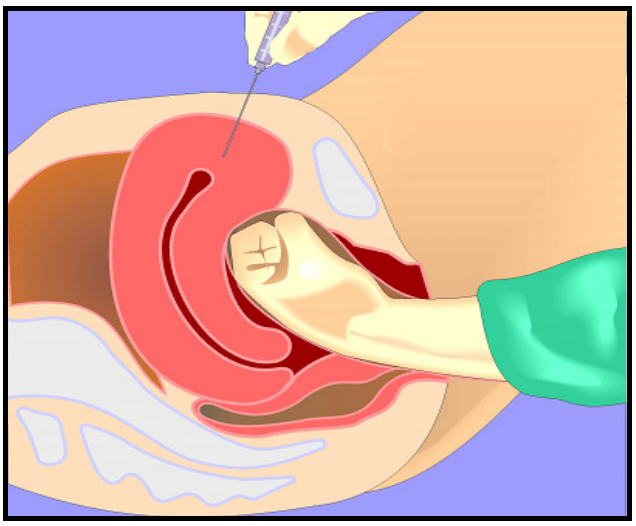
Bimanual compression



If conscious, inform woman of procedure and provide analgesia, then

- Using non-dominant hand:
  - Keeping fingers straight and thumb tucked in palmar side of index finger insert hand into vagina with palm facing the woman's thigh
  - Once fingers meet resistance roll the hand so that palm is upward and curl fingers into a fist placing thumb on top of index finger
  - Place the fist into the anterior fornix of the vagina and apply upward pressure
- Using other (dominant) hand:
  - Identify the uterine fundus
  - Deeply palpate to situate fingers behind the fundus
  - Cupping the fundus compress it firmly around the intravaginal fist
  - Maintain compression and evaluate effect

Administering PF2α



If conscious, inform woman of procedure and provide analgesia, then:

- Situate non-dominant hand using same techniques as above
- The dominant hand is used to administer intramyometrial PF2α via an injection in multiple sites of the uterine fundus
- Stabilisation of the fundus can be achieved by having an assistant situate their fingers behind the fundus

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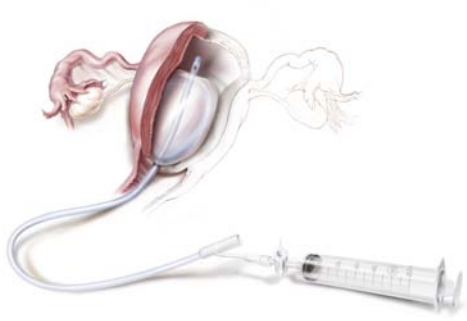
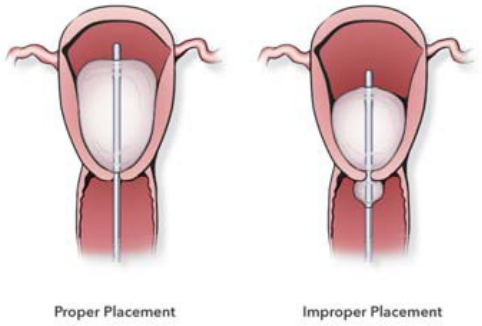
Appendix B: Uterine atonia interventions

Balloon Tamponade





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The process for using the intra-uterine balloon is as follows[49]:

- Empty uterine cavity of clots
- Insert the end of the balloon through the cervix into the uterine cavity, ensuring the balloon is completely inside the uterus
- Inflate the balloon with sufficient volume of **warm** sterile saline (approx 250-500 mL); the uterus should now be firm with minimal blood loss
- Assess blood loss through drainage portal for tamponade effect. If bleeding continues tamponade ineffective and surgical intervention required
- Commence broad spectrum antibiotic cover
- Continue or commence oxytocic infusion

B-Lynch compression suture

The technique is performed at laparotomy or CS:

- (Re) open the abdomen and (re) open the uterus
- Check the uterine cavity for bleeding sites that might be oversewn
- Test for haemostasis before using the B-Lynch suture using bimanual compression and swabbing the vagina – if bleeding is controlled temporarily in this fashion the B-Lynch suture is likely to be effective
- Placement of the suture, as demonstrated, requires surgical expertise

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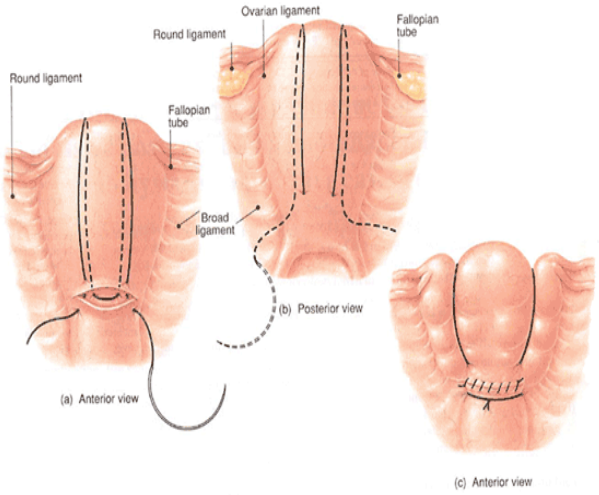

Uterine artery ligations[17]

This technique is performed at laparotomy or CS

- The goal of arterial ligation is to decrease uterine profusion and subsequent bleeding
- It is considered less technically challenging and time consuming than ligation of other arteries e.g. internal iliac

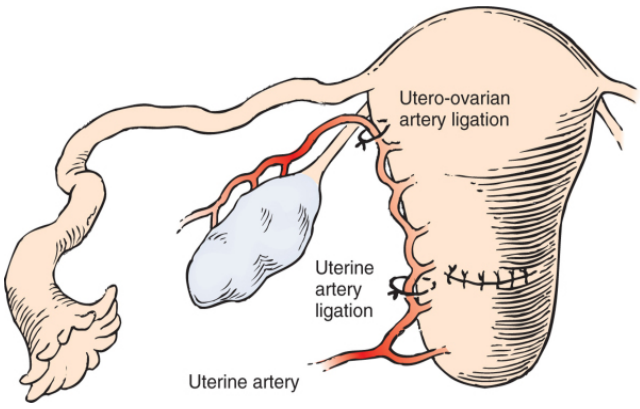

Image: © 2012 Saunders, An Imprint of Elsevier
Reference: Francois K, Foley M. Chapter 19: Antepartum and postpartum hemorrhage. In: Gabbe S, Niebyl J, Simpson J, Landon M, Galan H, Jauniaux E, et al., editors. Obstetrics: normal and problem pregnancies. 6th ed. Philadelphia: Saunders, Elseiver; 2012

Appendix C: Sample PPH proforma

This example form requires approval for use by the local health service

NB: Recommended for use in tracking events when sufficient clinical staff available. Proforma does not replace need to complete standard medication or fluid forms

PPH identified: hrs Date: …../…../….. By: Help called @ hrs

Initial management			Assess for cause – 4 T's				Arrival of team members	
EBL	Start	mL	*Tone	Tissue	Trauma	Thrombin	Person/designation	Time
	End	mL	▪ Fundus contracted? ▪ Oxytocic given?	▪ Placenta delivered? ▪ Products complete?	▪ Cervix ▪ Vagina ▪ Perineum intact?	▪ Blood clotting? ▪ Absence of oozing?		
Action		**Check**						
Address woman								
Adjust position – lie flat/trendelenburg			*Drug and route		Dose	Time		
Airway / 0_2 @15 L/min								
IV cannula (1) sited								
IV cannula (2) sited								
Bloods labelled/sent: ▪FBC ▪ X-match ▪ ELFTs ▪ Coags								
IDC sited								

Fluids – avoid excessive crystalloids			Time	T	P	BP	$Sp0_2$	Ready for OT and consent obtained	
Time	Type and volume	Rate						Transfer OT (O_2 on, flat, left lateral)	
								ID LABEL	

Adapted from Royal College of Obstetricians and Gynaecologists (RCOG) – PPH Chart (Reference: RCOG, Prevention and management of postpartum haemorrhage. Green-top Guideline No.52. 2009)

Appendix D. Blood administration: transfusion

Clinical aspects	Good practice points
Informed consent	• Refer to Queensland Government procedural consent form: *Blood and blood products transfusion consent*
Explain	• Likely cause of bleeding or low blood count – include any uncertainty • Nature of the transfusion – what is involved • Benefits expected • Risks common and rare but serious • Alternatives – include risk of doing nothing
Ask	• Do you have any questions or is there anything you didn't understand?
Provide	• Interpreter as required • Written information – refer to Queensland Government: Consent information – Patient copy, Blood and Blood Products Transfusion consent
Document	• Consent or refusal or, if required, Advanced health directive
Commencing the transfusion	• Two clinicians to cross check: o Details on crossmatch label on blood bag with the UR, name and date of birth on woman's ID bracelet and prescription order o Unit number information matches the crossmatch label and crossmatch report o Blood type on bag with blood group results filed in the woman's chart (will not match if O Negative blood in an emergency transfusion is used) o Blood has not expired o Integrity of the blood product (e.g. leaks, large clots, haemolysis) • Transport in esky to keep blood cool – units are not to be placed directly on ice-bricks • Do not leave the bag out of blood fridge for more than 30 minutes • Equipment – ensure giving sets, filters, infusion pumps and blood warmers are appropriate for use in blood transfusion o Prime with 0.9% Normal saline or blood component • Do not mix blood with intravenous drugs or infusions or colloids with calcium added (e.g. Haemocel) • Proceed with the transfusion no faster than 5 mL/minute for the first 15 minutes, unless otherwise indicated by the patient's clinical condition
Monitoring the transfusion	• Document pulse rate, respiration rate, BP and temperature – for each blood component pack: o Immediately prior to commencing or at transfusion start o 15 minutes after commencing administration o At transfusion end • Increase frequency of observations as clinically indicated • Closely observe for the first 15 minutes for reactions • Regular visual observation is essential • If applicable, refer to local health service policy for any additional observations • Adverse reactions: o Discontinue if a significant adverse reaction and initiate appropriate therapy o Do not take down blood component o Maintain IV access via a sideline o Do not resume transfusion without a clinical review: o Report: ▪ Via local clinical incident reporting systems (e.g. PRIME) ▪ To the supplying laboratory or blood bank o Return the remainder of any implicated blood units (and other empty bags transfused) to the Blood Bank for investigation o Refer to Queensland Incidents in Transfusion (QiiT) and local transfusion reaction guidelines
Completing the transfusion	• Ensure documentation of all blood products given • Promptly return unused blood products to the Blood Bank or laboratory/blood fridge • If no reaction: discard empty product bags or collect and save as per local hospital and health service policy

Caution: Refer to sources for complete information: Australian and New Zealand Society of blood transfusion, Australian Red Blood Cross, and Queensland Blood Management Program

Appendix E. PPH drug table

Caution: refer to an Australian pharmacopeia and LAM for complete drug information

Order of administration	Dose	Route	Reconstitution	Side Effects	Contraindication	Comments
1. Oxytocin	5 IU After 5 minutes repeat as required to maximum total dose of 10 IU	IV slowly over 1-2 minutes IM	-	Painful contraction, nausea or vomiting, water intoxication, hypotension	Hypersensitivity to Oxytocin	In place of Ergometrine if BP elevated Ensure placenta is expelled
	5-10 IU/hour (125-250 mL/hour)	IV infusion	40 IU in 1 L crystalloid/ 0.9% NaCl			
2. Ergometrine	250 microgram Repeat as required, after 15 minutes to a maximum total dose of 500 micrograms	IV slowly over 1-2 minutes	Dilute 250 microgram to 5mL with sodium chloride 0.9%	Tonic uterine contraction, Nausea, vomiting and raised BP	Retained placenta; severe hypertension; hepatic, renal or cardiac disease; sepsis; Hypersensitivity to Ergometrine	Administer with anti-emetic (e.g. Metoclopramide 10mg IV) Avoid use if placenta not expelled
		IM	-			
3. Misoprostol	800 to 1000 microgram (4 to 5 tablets)	Rectal	-	Nausea, vomiting, diarrhoea, headache, abdominal pain, pyrexia	Hypersensitivity to Misoprostol	Use when oxytocin and Ergometrine are not successful Slow onset of action – consider early administration Off-label use
4. Carboprost (Prostaglandin F2 alpha)	250 microgram in 1mL Repeat as required every 15-90 minutes Maximum total dose: 2 mgs(8 doses)	Intra-myometrial* IM (use a tuberculin syringe)	-	Fever with chills, headache, paresthesia, diarrhoea, nausea and vomiting, breast tenderness, extremely high BP, dystonia, pulmonary oedema	Acute pelvic inflammatory disease, cardiac, pulmonary, renal, or hepatic disease, hypersensitivity to prostaglandin Caution: Asthma, anaemia, diabetes, epilepsy, hyper/ hypotension, jaundice, uterine surgery	*Not recommended for intramyometrial use – responsibility rests with administering clinician LAM restrictions Not TGA approved indication Ensure IV line, cardiac monitoring and oxygen therapy in place Check BP frequently (e.g. 5 minutely)

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