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Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Primary postpartum haemorrhage

Queensland Government

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Cultural acknowledgement

We acknowledge the Traditional Custodians of the land on which we work and pay our respect to the Aboriginal and Torres Strait Islander Elders past, present and emerging.

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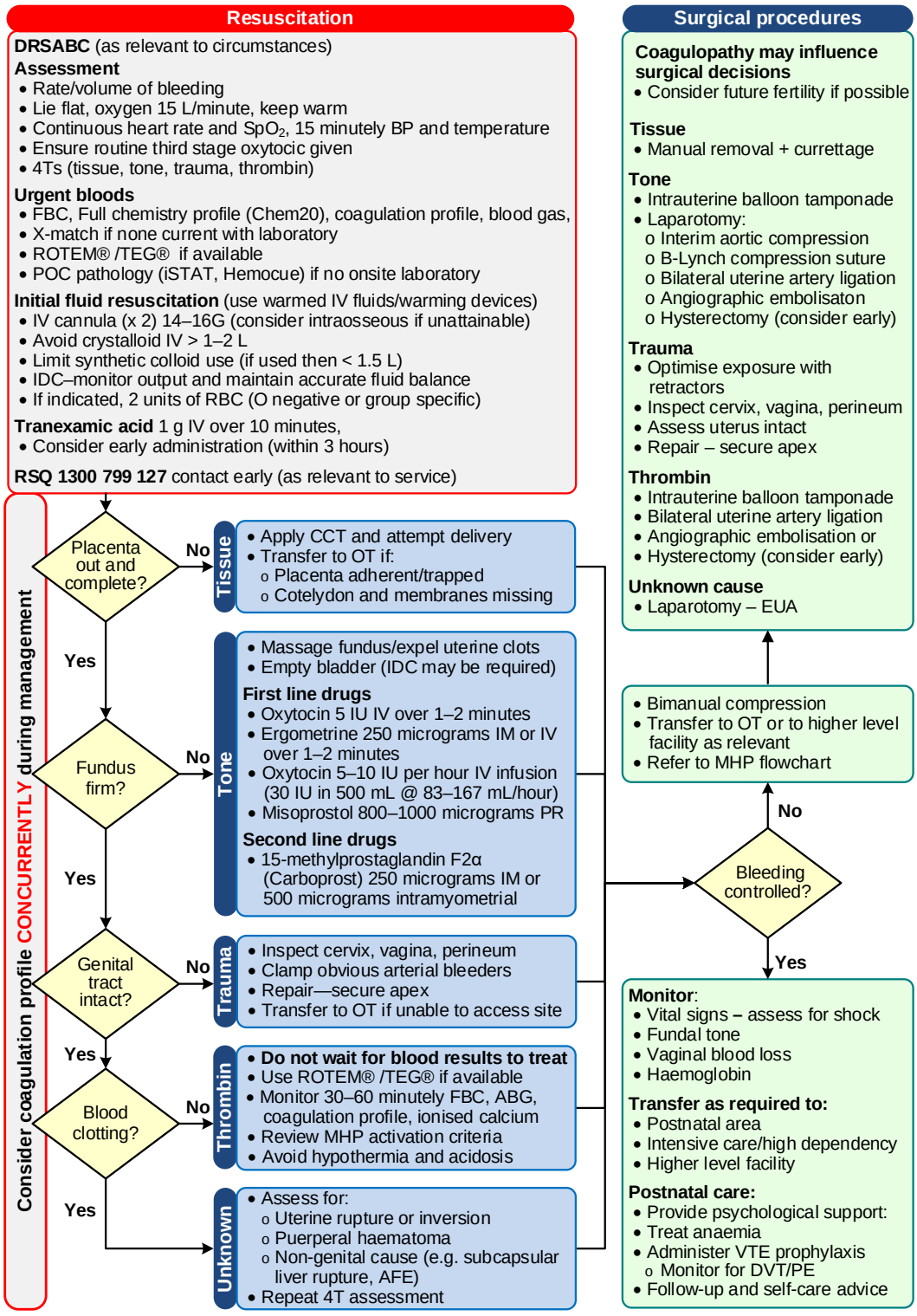
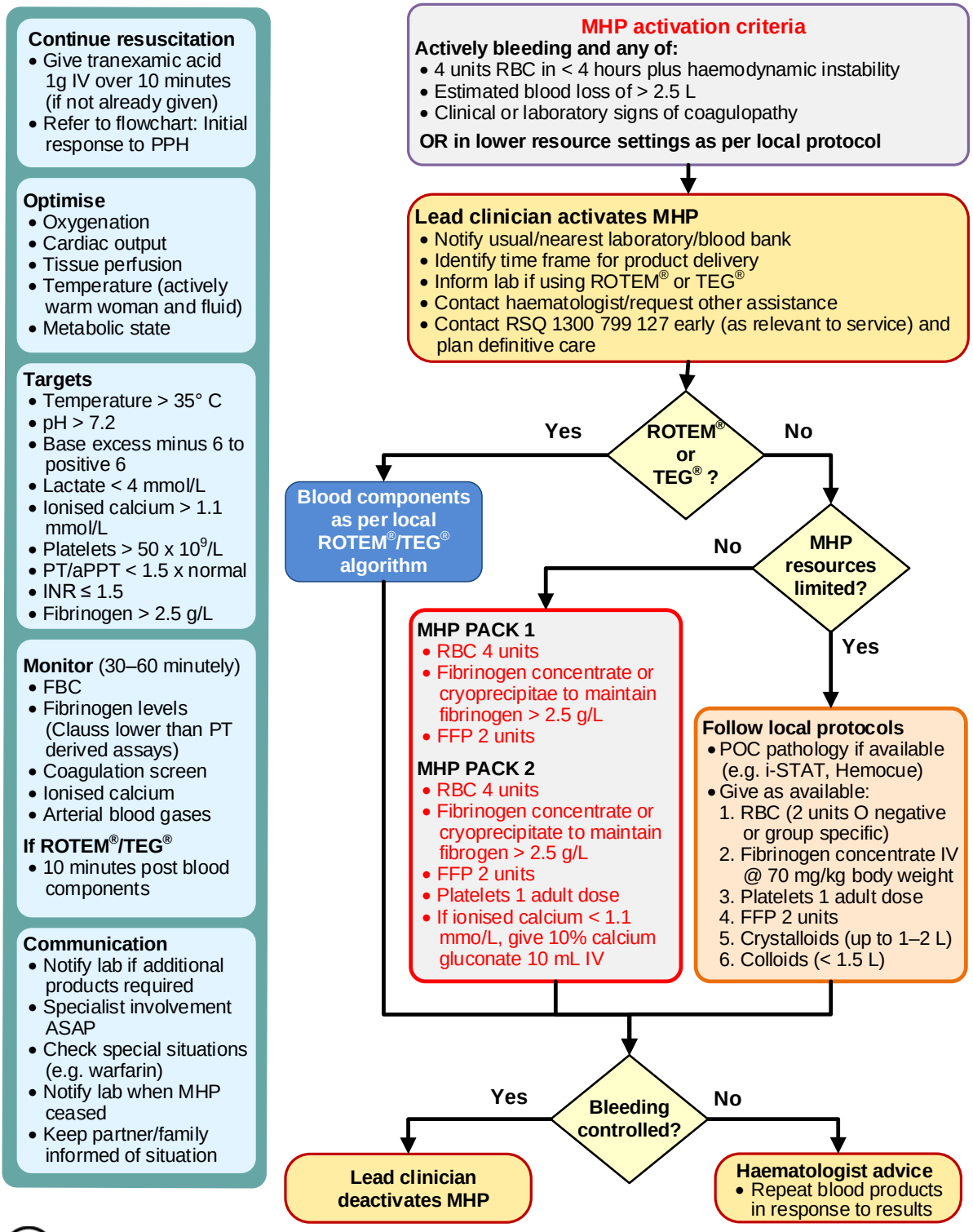
Flow Chart: Initial response to postpartum haemorrhage (PPH)



ABG: arterial blood gas, **AFE**: amniotic fluid embolism, **BP**: blood pressure, **CCT** controlled cord traction, **DRSABC**: standard emergency procedure Danger-Response-Send for help-Airway-Breathing-Circulation, **DVT**: deep vein thrombosis, **EUA**: examination under anaesthetic, **FBC**: full blood count, **FFP**: fresh frozen plasma, **IDC**: indwelling catheter, **IV**: intravenous **MHP**: massive haemorrhage protocol, **OT**: operating theatre, **PE**: pulmonary embolism, **POC:** point of care, **RBC**: red blood cells, **ROTEM®/TEG®:** types of blood clotting analysers, **RSQ**: Retrieval Services Queensland, **SpO_2**: saturation of oxygen, **VTE**: venous thromboembolism, **<**: less than, **>**: greater than

Flowchart: F18.1-1-V5-R23

Flow Chart: Massive haemorrhage protocol (MHP)



Medical Officers (call senior asap)	LAB	Theatre

APPT: activated partial thromboplastin time, **ASAP**: as soon as possible, **FBC**: full blood count, **FFP**: fresh frozen plasma, **INR**: international normalised ratio, **IV**: intravenous, **MHP**: massive haemorrhage protocol, **POC:** point of care, **PPH:** postpartum haemorrhage **PT**: prothrombin time, **RBC**: red blood cells, **ROTEM®/TEG®**: types of blood clotting analysers, **<**: less than, **>**: greater than

Flowchart: F18.1-2-V4-R23

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Abbreviations

ABG	Arterial blood gas
APTT	Activated partial thromboplastin time
CCT	Controlled cord traction
CI	Confidence interval
CS	Caesarean section
Hb	Haemoglobin
FBC	Full blood count
FFP	Fresh frozen plasma
GP	General Practitioner
IOL	Induction of labour
INR	International normalised ratio
LAM	List of approved medicines (QH)
MHP	Massive haemorrhage protocol (also known as massive transfusion protocol)
OR	Odds ratio
OT	Operating theatre
POC	Point of care
PPH	Postpartum haemorrhage
PT	Prothrombin time
RBC	Red blood cells
RR	Risk ratio
RSQ	Retrieval Services Queensland
TGA	Therapeutic Goods Administration
VE	Vaginal examination
VTE	Venous thromboembolism

Definitions

Full chemistry profile	Also referred to as a 'Chem20' in Auslab. Includes: sodium, potassium, chloride, bicarbonate, creatinine, urea, glucose, total protein, albumin, total bilirubin, direct bilirubin, urate, alt, AST, ALP, GGT, LD, calcium, phosphate, magnesium, anion gap, osmolality, urea/creatinine ratio, globulin, albumin-corrected calcium, eGFR (patients over 18 years).
Critical bleeding	Major haemorrhage that is life threatening and likely to result in the need for massive transfusion.[1]
Massive transfusion	In adults, massive transfusion may be defined as a transfusion of half of one blood volume in four hours, or more than one blood volume in 24 hours (adult blood volume is approximately 70 mL/kg).[1] In a near term pregnant woman volume is approximately 100 mL/kg due to physiological increase in blood volume.
Secondary postpartum haemorrhage	Excessive bleeding occurring between 24 hours post birth and 6 weeks post birth.[2]

1 Introduction

Primary postpartum haemorrhage (PPH) is the most common form of obstetric haemorrhage and is a leading cause of maternal morbidity and mortality in Australia[3] and worldwide.[4] In developed countries there is a trend of increasing PPH that has not been completely explained by the changing risk profile of women.[4-7] Obstetric haemorrhage (which includes antepartum haemorrhage) was responsible for 12 (11%) of Australian maternal deaths in 2008–2012 (a maternal mortality ratio of 0.8 per 100,000).[8]

1.1 Definition

Although there is no single definition, PPH is termed as excessive bleeding in the first 24 hours post birth. In an emergent situation, diagnosis most commonly occurs through estimation of blood loss volume and changes in the haemodynamic state.

Table 1. Postpartum haemorrhage definitions

Aspect	Definition
Blood loss volume	• After vaginal birth: 500 mL or more[4] • After caesarean section (CS): 1000 mL or more[9] • Severe: 1000 mL or more[10,11] • Very severe: 2500 mL or more[10] • Queensland perinatal data collection, categorises PPH blood volume as 500–999 mL, 1000–1499 mL, 1500 mL or more
Haemodynamic compromise	• Due to frequent underestimation of blood loss[11], PPH may first be detected through haemodynamic compromise[3] 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[12] • Conversely compromise may occur earlier in women with: o Gestational hypertension with proteinuria o Anaemia o Dehydration o Small stature
Haematocrit	• Retrospectively diagnosed by a 10% decline in postpartum haematocrit levels[9]
Blood transfusion	• Australian Council of Healthcare Standards PPH indicator[13] o Blood transfusion required after a massive blood loss greater than or equal to 1000 mL or in response to a postpartum haemoglobin (Hb) of less than 80 g/L
ICD-10	• Haemorrhage after delivery of fetus or infant and includes sub-classifications of [14]: o Third stage: haemorrhage associated with retained, trapped or adherent placenta o Other immediate: haemorrhage following delivery of placenta, postpartum haemorrhage (atonic) o Delayed and secondary: haemorrhage associated with retained portions of placenta or membranes o Postpartum coagulation defects: postpartum afibrinogenaemia or fibrinolysis

1.2 Incidence of PPH in Queensland

Table 2. Incidence of PPH in Queensland

	PPH (mL)	2011	2012	2013	2014	2015	2016
Total giving birth		61,125	62,667	62,182	62,811	60,942	61,872
Vaginal birth	500–999	1,517	1,640	1,591	1,813	1,953	2,094
	≥ 1000	701	*811	1,028	1,254	*1,327	*1,491
CS birth	≥ 1000	528	*500	526	570	605	732
PPH plus blood transfusion		257	312	285	433	554	625

*plus one PPH with volume not stated. Source: PDC data extracted July 2017

1.3 Aetiology

The common causes of PPH are referred to as the 'Four T's'. More than one cause may be present (e.g. tone and tissue)

Table 3. Aetiology of PPH

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

1.4 Clinical standards

Table 4. Clinical standards

Aspect	Consideration
Emergency systems	• Establish local protocols and systems to facilitate[1]: o A multidisciplinary response (e.g. medical emergency team (MET) call) o Massive haemorrhage protocol (MHP) activation o Access to emergency blood products and equipment o Relevant specialist advice
Low resource settings	• Where access to resources is limited (e.g. human resources, equipment, blood products, transfer options to higher level services): o Store and maintain access to fibrinogen concentrate (minimum 4 g) ▪ Rotate stock with larger facilities as required to minimise wastage due to expiration before use o Consider earlier triggers for activating requests for support (e.g. Retrieval Services Queensland (RSQ), blood products) o Refer to Section 2.3.4 Misoprostol for secondary prevention
Clinical education	• Adherence to evidence informed guidelines reduces maternal morbidity[15] • Implement regular multidisciplinary practice drills[4,15,16] 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 • Engage staff in critical incident debriefing after a PPH • Support staff training in debriefing to support effective communications with the woman and her family
Reporting and documentation	• Contemporaneous and accurate documentation is a fundamental principle of healthcare delivery • Refer to the National consensus statement: essential elements for recognising and responding to clinical deterioration[17] • Notify of PPH via local adverse event reporting systems • Use an approved maternity early warning tool, clinical pathway or proforma[12] o Standardises and records clinical response and care o Enables data collection and clinical audit

2 Prophylaxis

Although many women who have a PPH have no identifiable risk factors,[4] early implementation of risk management strategies may improve early detection[3] and treatment and so reduce PPH severity.[18] Assess for risk factors during the antenatal, intrapartum and postpartum period in order to plan for risk mitigation.

2.1 Risk factors

The magnitude of risk attributable to each factor varies across reports[19,20] and there may be unknown, interdependent and/or synergistic effects involved.

Table 5. Risk factors for PPH

Antenatal risk factor	Detail of study	OR	95% CI	Aetiology
Increased maternal age	≥ 35 years	2.0	1.90 to 2.20[21]	
Ethnicity	Asian Sub-Saharan Africa Pacific Island	1.31 1.54 1.75	1.01 to 1.72[22] 1.10 to 2.16[22] 1.43 to 2.15[23]	Tone Trauma
Parity	> 3	1.47	1.01 to 2.13[22]	Tone
Prior uterine surgery	Not otherwise specified	3.38	1.60 to 7.14[22]	Trauma
Previous PPH	> 1000 mL > 1500 mL	3.3 6.42	3.0 to 3.5[21] 3.9 to 10.6[22]	Tone
Uterine fibroid	Fibroid tumours	2.43	1.99 to 2.97[21]	Tone
Pre-eclampsia	Severe or HELLP	3.58	2.24 to 5.71[22]	Thrombin
Obesity	BMI ≥ 30 kg/m^2	1.38	1.18 to 1.61[23]	Tone
Anticoagulants		4.66	2.81 to 7.73[22]	Thrombin
Anaemia	Hb ≤ 9 g/dL	4.11	2.76 to 6.13[22]	—
Artificial reproductive technology	IVF/ICSI	2.92	2.18 to 3.92[22]	—
Diabetes	Gestational diabetes	1.56	1.05 to 2.31[22]	Tone
Multiple pregnancy		3.74	2.64 to 5.29[22]	Tone
Polyhydramnios		1.9	1.2 to 3.1[24]	Tone
Antepartum haemorrhage	Placenta praevia/abruption	3.8	3.0 to 4.8[24]	Tissue Tone Thrombin
Drug induced atonia	Magnesium sulphate Serotonergics Nifedipine	Not available		Tone
Intrapartum risk factor	**Detail of study**	**OR**	**95% CI**	**Aetiology**
Induction of labour		1.17	1.04 to 1.3[6]	Tone
Prolonged second stage	Failure to progress	1.9	1.2 to 2.9[12]	Tone
Prolonged third stage	≥ 30 mins	3.59	1.60 to 8.03[25]	Tone
Retained placenta		4.1	3.1 to 5.5[24]	Tissue
Instrumental vaginal birth		1.8	1.7 to 1.9[7]	Trauma
CS birth	In labour Without labour	1.7 1.3	1.5 to 2.0[24] 1.1 to 1.5[24]	Trauma
Macrosomia	> 4.5 kg > 4 kg	1.77 2.51	1.20 to 2.60[22] 1.63 to 3.86[25]	Tone
Perineal trauma	1st degree Episiotomy > 2nd degree tear	1.70 2.07 1.84	1.219 to 2.40[26] 1.57 to 2.73[26] 1.08 to 1.87[25]	Trauma
Uterine rupture		23.1	20.4 to 26.2[7]	Trauma
General anaesthesia		2.90	1.90 to 4.50[12]	Tone
Infection	PROM Temp > 38^O C in labour	1.51 2.53	1.19 to 1.93[22] 1.78 to 3.58[22]	Tone/Thrombin
Non-cephalic presentation		1.6	1.5 to 1.6[7]	Tone/Trauma
Precipitate labour		33.8	18.8 to 60.9[27]	Tone

OR: odds ratio, CI: confidence interval

2.2 Antenatal risk management

Table 6. Antenatal risk

Clinical aspects	Risk reduction measures
Assessment	• Recommend routine blood group and antibody testing • If antenatal risk factors for PPH detected: o Highlight in the woman's health record o Consult/refer to obstetrician as required o Involve the woman in a plan of care aimed at mitigating risk • Discuss risks and potential interventions in the context of informed choice/consent as is relevant to the circumstances[1,16] for example: o Use of blood and blood products o Medical and/or surgical interventions o Antenatal transfer (if indicated) o Potential to impact future fertility and birth
Anaemia	• Haemoglobin levels in pregnancy are not well defined—normal reference range in Queensland for 25–42 weeks gestation is 98–143 g/L • Offer information about minimising anaemia[1] • Screen for anaemia as per routine antenatal schedule[16] • Investigate antenatal anaemia and optimise prebirth haemoglobin[12,16] • If iron deficiency anaemia, recommend oral iron supplementation as first line treatment[1,16] • If indicated (e.g. poor compliance or absorption of oral iron, close to term), consider parenteral iron therapy[1,16] • Routine use of erythropoiesis stimulating agents is not recommended o Consider only in selected women at high risk of substantial blood loss[1] in combination with iron therapy • If antenatal blood transfusion is required, ensure blood is cytomegalovirus (CMV) antibody negative (i.e. specify on request form)
Maternal blood disorders	• Involve specialist physician to[1]: o Optimise/stabilise coagulation profile prior to birth o Advise on birth options (e.g. mode of birth) • Seek anaesthetic opinion regarding options for analgesia during labour and birth
Abnormal placentation	• Determine placental site before birth, especially if previous CS[28,29] • Perform an ultrasonographic examination and/or magnetic resonance imaging[28] • If abnormal placentation, review by obstetrician is required as the risk of PPH is increased[29] • If placenta accreta or percreta, involve multidisciplinary team in preoperative planning[28,30] o Timing and location of birth o Presence of consultant obstetrician and consultant anaesthetist o Type of anaesthesia o Availability of blood and blood products o Availability of postoperative intensive care bed • Discuss plan of care and possible interventions with the woman prior to birth (e.g. hysterectomy, intervention radiology, leaving placenta in place)
Induction of labour (IOL) and elective CS	• Ensure routine blood results are less than three days old on admission (Full blood count (FBC), group and hold)[16,30] • For IOL, refer to Queensland Clinical Guideline: *Induction of labour*[29]

2.2.1 Transfusion not an option

Blood transfusion may not be a management option in some situations. This may be due to personal choice, religious and/or cultural beliefs, the presence of rare blood groups or complex antibodies, or the unavailability of blood products.[1]

Table 7. Blood products declined

Aspects	Risk reduction measures
Jehovah Witnesses[31]	• Individuals vary in their choice and it is important to establish individual preferences • Nearly all refuse transfusions of whole blood (including preoperative autologous donation and the primary blood components (red cells, platelets, white cells and unfractionated plasma) • Many accept the transfusion of derivatives of primary blood components such as albumin solutions, cryoprecipitate, clotting factor concentrates (including fibrinogen concentrate) and immunoglobulins • There is usually no objection to intraoperative cell salvage, apheresis, cardiac bypass or normovolaemic haemodilution providing the equipment is primed with non-blood fluids and continuity of connection to the woman is maintained • Recombinant products such as erythropoiesis stimulating agents and granulocyte colony stimulating factors are acceptable as are pharmacological agents such as intravenous iron and tranexamic acid
Plan care	• Clarify with each woman and document what constitutes unacceptable treatment in relation to blood products and fluid resuscitation management[32] • Discuss with the woman a plan of care that includes[1]: o Planned location of birth o Optimisation of pre-birth haemoglobin [refer to Table 6. Antenatal risk] o Identification of placental site [refer to Table 6. Antenatal risk] o Recommendation for active management of third stage of labour [refer to Section 2.3.1 Third stage management] o Recognition of the risk of uterine atonia associated with delay in first and second stages of labour[12] and corrective treatments (e.g. intrapartum oxytocin infusion[6,22] and assisted/operative birth[22]) o Risks and benefits of potential management options o Recommendation to complete an Advanced Health Directive[32] and placement of a certified copy in the medical record • If the woman declines blood products, follow local documentation protocols (e.g. specific consent forms, stickers, or chart notations)
Intrapartum	• At the onset of labour, recommend review by a consultant obstetrician and anaesthetist • Consider at an early stage pharmacological, mechanical and surgical procedures[16] • Hysterectomy is the definitive procedure to minimise life-threatening haemorrhage when transfusion is not an option[1] • If CS required and/or high risk of PPH consider (as is available at local facility): o Interventional radiology o Reinfusion drains o Intraoperative cell salvaging (if skilled team available and acceptable as a treatment)[1,16,32] particularly if blood volume loss is anticipated to result in transfusion

2.3 Intrapartum risk management

Table 8. Intrapartum risk

Aspects	Risk reduction measures
One or more risk factors for PPH	• Assess for both antenatal and intrapartum risk factors on presentation for birth o If clinically significant antibodies present, request cross-matched blood • Discuss with the woman a plan of care that encompasses: o IV access in active labour/CS ▪ Avoid (where possible) insertion of large bore catheters in areas of flexion and extension o FBC, group and hold o Prophylactic oxytocin[12] [refer to Section 2.3.1Third stage management]
Risk of chorioamnionitis	• Chorioamnionitis can increase the risk of PPH • If temperature elevated during labour increase frequency of monitoring and clinical surveillance for PPH • Follow local protocols for management of chorioamnionitis or refer to Queensland Clinical Guidelines *Preterm labour*[33]
Vaginal birth	• Increased length of first[34] and/or active second stage[35,36] are associated with increased risk of PPH o Take into account each woman's risk profile for PPH when recommending care during labour • If vaginal birth after CS (VBAC), monitor for early signs of uterine rupture: o Refer to Section 3.5.3 Uterine rupture] o Refer to Queensland Clinical Guideline: *Vaginal birth after caesarean section*[37] • Individually assess the need for episiotomy o Refer to Queensland Clinical Guideline: *Perineal care*[38]
Emergency CS	• Ensure IV access • Send *urgent* blood for: o FBC o Group and hold (if no valid group and hold available) o Cross match in selected circumstances if indicated • Experienced obstetrician required if: o Increased risk of extensions or lacerations (e.g. deep engagement of the fetal head, failed assisted vaginal birth) o Malpresentation o Evidence of abnormal coagulation o History of previous PPH or other significant risk factors • If risk of PPH, consider carbetocin 100 micrograms IV over one minute after birth of the baby[39] o Refer to Table 11. Carbetocin
Elective CS	• Consider (as is available at local facility): o Intraoperative cell salvaging[1,16,32] particularly if blood volume loss is anticipated to result in transfusion • If risk of PPH, consider carbetocin 100 micrograms IV over one minute after birth of the baby[39] o Refer to Table 11. Carbetocin
Not beneficial for PPH prophylaxis	• Early or late cord clamping[30] • Any particular maternal position during labour[30] • Very early breastfeeding (nipple stimulation)[30,40]

2.3.1 Third stage management

The care provided during the third and fourth stages of labour may assist in the prevention or earlier detection and treatment of PPH. Refer to Queensland Clinical Guidelines: *Normal birth*[41] for routine management of third stage.

Table 9. Third stage management

Aspects	Risk reduction measures
Oxytocin	• Recommend prophylactic uterotonics to all women giving birth as they reduce the risk of PPH[4,12,42,43] (oxytocin is the uterotonic of choice) o For vaginal birth oxytocin 10 International units IM[4] o For CS birth oxytocin 5 International units IV over 1–2 minutes[4,12,30] • Timing of administration o Before versus after the birth of the placenta showed no significant difference in incidence of PPH greater than 500 mL (RR 0.81; 95% CI 0.62 to 1.04) or greater than 1000 mL (RR 0.98, 95% CI 0.48 to 1.98)[44] • Route of administration o One RCT (n=1075) compared IV oxytocin with IM oxytocin (10 international units). Reported significantly less PPH greater than 1000 mL (AOR 0.54, 95% CI 0.32 to 0.91) and blood transfusions (AOR 0.31, 95% CI 0.13 to 0.7) but not significantly less PPH greater than 500 mL[45]
Cord clamping	• Delayed cord clamping (waiting at least 1–3 minutes after birth of the baby) is recommended for all births while initiating simultaneous essential newborn care[4] o Routine early clamping of the cord is no longer recommended[4,12] • Early versus late cord clamping o No significant difference in PPH greater than 500 mL (RR 1.17; 95% CI 0.94 to 1.44) or greater than 1000 mL (RR 1.04; 95% CI 0.65 to 1.65)[46]
Controlled cord traction (CCT)	• Recommend CCT to all women following CS and vaginal birth[47] o The relative contribution of CCT to reducing PPH in the bundle of care known as 'active management/modified active management' may be limited[43] • Promote safety by: o Applying suprapubic counter pressure *prior* to CCT o Avoiding undue cord traction as there is a risk of cord snapping or uterine inversion o Directly supervising novice practitioners in this procedure
For women requesting physiological management	• Provide information about the risk and benefits of physiological versus active management of third stage • For women who choose physiological management recommend uterotonic if: o Excessive bleeding o Delay in placental birth greater than one hour o Woman requests to shorten third stage

2.3.2 Syntometrine

Table 10. Syntometrine

Aspect	Risk reduction
Evidence summary	• For prophylactic oxytocin versus ergot alkaloids o No significant difference for PPH greater than 1000 mL[48] (RR 1.07, 95% CI 0.62 to 1.85)[42] o A small reduction in risk of PPH greater than 500 mL[48] (RR 0.76, 95% CI 0.61 to 0.94)[42] with oxytocin o Four fold increased risk of nausea (OR 4.07, 95% CI 3.43 to 4.84), vomiting (OR 4.92, 95% CI 4.03 to 6.00) and hypertension (OR 2.40, 95% CI 1.58 to 3.64)[49] with syntometrine • Syntometrine versus carbetocin[48]—with carbetocin: o Reduction in PPH 1000 mL or more (RR 0.34, 95% CI 0.13 to 0.86) but not in PPH 500 mL or more (RR 0.96 95% CI 0.44 to 2.09) o Possible reduction in need for additional uterotonics (RR 0.54, 95% CI 0.30 to 1.00) o Significantly less nausea, vomiting, abdominal pain, shivering
Recommendation	• For low risk birth, routinely use oxytocin in preference to syntometrine[50] • If risk of PPH: o Individually assess the potential benefit of a small reduction in blood loss versus the more common adverse effects associated with the use of syntometrine o Consider carbetocin in preference to syntometrine

2.3.3 Carbetocin

Table 11. Carbetocin

Aspect	Risk reduction
Evidence summary	• Approved by the Therapeutic Goods Association (TGA) for the prevention of uterine atony and excessive bleeding following birth of the baby by caesarean section or vaginal birth • Stable at room temperatures (cold chain storage not required) • Following vaginal birth, carbetocin compared with oxytocin[48]: o No difference in PPH 500 mL or more (RR 0.67, 95% CI 0.34 to 1.30) or 1000 mL or more (RR 0.68 95% CI 0.21 to 2.20) o Reduced need for further uterotonics (RR 0.54, 95% CI 0.30 to 0.99) • Following CS birth, carbetocin compared with oxytocin[48]: o No difference in PPH 500 mL or more (RR 0.71, 95% CI 0.47 to 1.07) or 1000 mL or more (RR 0.62 95% CI 0.31 to 1.23) o Reduced need for further uterotonics (RR 0.45; 95% CI 0.27 to 0.74) • Has not been studied in women having a general anaesthetic[39]
Recommendation	• For low risk birth, routinely use oxytocin in preference to carbetocin o If storage at room temperature is considered a significant clinical advantage in the local context, carbetocin may be used • If risk of PPH, carbetocin may be considered for vaginal birth, or elective or emergency CS birth under epidural or spinal anaesthesia

2.3.4 Misoprostol for secondary prevention

Table 12. Secondary prevention with misoprostol

Aspect	Consideration
Indications	• Oxytocin not available (e.g. due to unexpected birth in low resource setting, storage conditions inadequate)[51] • Following routine third stage oxytocin if: o Blood loss is greater than or equal to 350 mL[51] o AND there is concern about treatment capability if PPH occurs (e.g. retrieval and transport considerations, low capability for medical and/or surgical management options)
Dose	• Misoprostol 800 micrograms sublingual once
Prescribing considerations	• Does not replace routine oxytocin administration during third stage (if available) • Not first line response to PPH [refer to Section 3 Treatment] • Refer to • Table 22. Misoprostol

2.4 Fourth stage monitoring

- If risk factors for PPH are identified, monitor for one to two hours immediately after birth.

Table 13. Monitoring

Observations	Frequency
Temperature	• 30 minutes
Pulse **Respirations** **Blood pressure**	• 15 minutes
Oxygen saturation	• Once or as clinically indicated
Fundus **Lochia**	• 15 to 30 minutes • Be alert to a slow steady trickle after third stage of labour • Visualise labia/perineum
Pain	• Initial assessment then as clinically indicated
Urine output	• Within the first two hours
Level of consciousness	• Once or as clinically indicated
Oral intake	• Use clinical judgement about commencement and consider individual circumstances
Ongoing observations a	• After first hour, continue as clinically indicated • After CS: incorporate into routine postoperative observation

2.5 Postnatal risk management

Table 14. Postnatal risk management

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 women, including for uterine tone, every 15 to 30 minutes • Actively encourage/assist women to void soon after birth • Promote endogenous release of oxytocin by: o Keeping the woman warm and calm post birth o Assisting with early breast feeding (if preferred feeding method) o Facilitating skin to skin contact with baby
If antenatal or intrapartum risk factor	• Consider prophylactic oxytocin infusion post birth depending on individual circumstances • Observations every 15 minutes for first hour post birth • Clinical surveillance for early signs of hypovolemic shock • Seek medical review before discontinuing IV access in the first 24 hours post birth
Early recognition of puerperal haematoma	• Suspect if: o Unable to identify the cause of PPH (4 T's) and/or o Hallmark sign is excessive or persistent pain ▪ Presentation will depend on site, volume and rate of haematoma formation ▪ Tachycardia is an early sign • Other signs are: o Abnormal vital signs (BP, pulse, respirations, perfusion, colour, cerebral perfusion) o Hypovolemic shock disproportionate to the revealed blood loss o Feelings of pelvic or rectal pressure o Urinary retention • Act promptly to: o Resuscitate as required [refer to 3.3 Resuscitation] o Perform vaginal/rectal examination to determine site and extent o Consider transfer to operating theatre (OT) for clot evacuation, primary repair and/or tamponade of blood vessels • Refer to Queensland Clinical Guideline: *Perineal care*[38]

3 Treatment

Major blood loss can develop rapidly around the time of giving birth in the absence of haemodynamic compromise. Therefore; close monitoring of all women and early recognition and rapid response, are critical.[1]

3.1 Estimation of blood loss

Visual estimation of blood loss often leads to underestimation.[52] Factors other than volume such as nature and speed of blood loss[30] and clinical findings due to hypovolemic shock can also guide blood loss estimation[11,12] and contribute to decision making.[53] Consider also:

- Weighing bloody linen, swabs and drapes[11]
- Pictorial guides to assist staff to estimate blood loss
- Clinical simulation and collaborative practice models

Table 15. Clinical findings in PPH

Blood loss (mL)	Systolic blood pressure	Signs and symptoms	Degree of shock
500–1000	Normal	Palpitations, dizziness, tachycardia	Compensated
1000–1500	Slight decrease	Weakness, sweating, tachycardia	Mild
1500–2000	Marked decrease (70–80 mm Hg)	Restlessness, pallor, oliguria	Moderate
2000–3000	Profound decrease (50–70 mmHg)	Collapse, air hunger, anuria	Severe

Source: Adapted from Bonnar, J. Bailliere's Clinical Obstetrics and Gynaecology Vol. 14, No. 1, pp 1–18, 2000

3.2 Point of care blood clotting analysers

Table 16. Point of care blood clotting analysers

Aspect	Considerations
Devices	• Both thromboelastography® (TEG®) and thromboelastometry (ROTEM®) point of care (POC) blood clotting analysers are in use in Queensland • Also referred to as visco elastic haemostasis assay (VHA) and visco elastic testing (VET)
Context	• Although generally of low quality, evidence is growing that application of TEG® or ROTEM® guided transfusion strategies may[54]: o Decrease the time for blood test result availability o Guide and evaluate haemostatic treatment o Distinguish between surgical cause of bleeding or coagulopathy o Diagnose the specific type of coagulopathic impairment o Reduce the need for blood products o Reduce morbidity in patients with bleeding
Local facility considerations	• If a POC blood clotting analyser is available: o Follow a locally agreed algorithm relevant to the device used o Education and training on use and interpretation of results is essential o Follow quality control activities as per manufacturer's instructions

3.3 Resuscitation

Initial response to PPH requires a multidisciplinary team approach[1,12] to restore the woman's haemodynamic state whilst *simultaneously* identifying and treating the cause of bleeding. As soon as PPH identified, notify (and request the immediate attendance of) an experienced/senior obstetrician.

Table 17. Resuscitation

Aspect	Consideration
DRS ABC	• Follow standard procedures for emergency resuscitation • **D**anger, **R**esponse, **S**end for help, **A**irway, **B**reathing, **C**irculation
Initial assessment	• Assess rate and volume of bleeding—caution with underestimation[11] • Lie woman flat[11] or if hypotensive, Trendelenburg position • Keep warm[11,12] o Monitor temperature every 15 minutes[12] • Administer oxygen via face mask at 10–15 L/min regardless of maternal oxygen concentration • Monitor vital signs continuously (if able) or at a minimum of every 15 minutes (more frequently if indicated)
Four T assessment	• Tone: fundus atonic [refer to Section 3.4 Tone] • Trauma: fundus well contracted, blood clotting [refer to Section 3.5 Trauma] • Tissue: retained placenta or fundus atonic and unresponsive to uterotonics [refer to Section 3.6 Tissue] • Thrombin: fundus contracted (may become atonic), blood not clotting [refer to Section 3.7 Thrombin] • Unknown: **a**ssess for uterine rupture/inversion concealed bleeding (e.g. vault haematoma) and non-genital causes (e.g. subcapsular liver rupture)
IV access	• Establish IV access—ideally two IV cannula (14–16 gauge)[12] • Large volume central venous access may be appropriate in some circumstances o IV line one for fluid replacement o IV line two for pharmacologic therapy • If IV access unattainable, consider intraosseous o Label blood samples as such, as may not be suitable for all blood analysing equipment
Urgent blood tests[11,12]	• If available, request POC blood clotting analyser (ROTEM®/TEG®) guided strategy • Full chemistry profile (Chem20) [refer to Definitions] • FBC • Coagulation profile • Venous/arterial blood gas (includes calcium and lactate) • Blood cross match only required if: o No valid group and hold or cross-match sample available in laboratory o Woman has clinically significant antibodies
Fluid replacement	• Warm IV fluids during resuscitation • Main aim is to promote tissue perfusion and oxygen carrying capacity • Avoid dilutional coagulopathy—preferentially give red blood cells (RBC) o Until RBC arrive: ▪ Up to 2 L of crystalloids[12,55] ▪ Up to 1.5 L colloid[12] • Monitor fluid balance[12] o Aim for urinary output of 30 mL/hour or more
Blood products	• Transfusion triggers[12] o Clinical assessment is the main determinant o Do not wait unnecessarily for laboratory results o Undertake volume replacement on the basis that blood loss is often underestimated • If continued bleeding, transfuse RBC early[12] o Two units RBC (O negative if group specific unavailable) o Use rapid infusion sets, pump sets or pressure bags, blood warmer o Consider MHP activation

3.3.1 Tranexamic acid

Give tranexamic acid as soon as possible after onset of PPH[56]—preferably within three hours of PPH.

Table 18. Tranexamic acid

Tranexamic acid	Administration
Intravenous (IV)	• Tranexamic acid 1 gram (100 mg/mL) IV over 10 minutes[56] o Refer to Appendix B: PPH drug and blood products • If bleeding persists after 30 minutes or stops and restarts within 24 hours of the first dose, a second dose may be administered[56]
Prescribing considerations	• Not recommended for routine prophylaxis of PPH or before birth[12] • Not approved as first line drug in LAM
Evidence summary	• Tranexamic acid (in addition to uterotonics): o Reduces postpartum blood loss, blood transfusion, laparotomy to control bleeding and death due to PPH o Reduces death due to PPH (RR 0.81, 95% CI 0.65 to 1.00), especially if given within three hours of birth (RR 0.69, 95% CI 0.52 to 0.91) o Does not increase risk of thromboembolic events

3.3.2 Support during PPH

Table 19. Support during PPH

Aspect	Consideration
Communication	• Communicate sensitively and contemporaneously with the woman about the care being provided • As soon as possible, provide information to the woman and her family about: o The clinical circumstances surrounding the PPH o The plan of management and likely treatment options • Address woman's and support person concerns
Pain management	• Consider pain relief requirements during initial resuscitation and all subsequent treatments
Consent	• If treatment is likely to affect the woman's fertility, prioritise consent procedures
Venous thrombo-embolism (VTE)	• Consider VTE prophylaxis (e.g. application of compression stockings) as clinically indicated

3.4 Tone

The uterine cavity must be empty of tissue for effective uterine contraction. Initial clinical and mechanical measures include:

- Massage uterine fundus to stimulate contractions[4,11,12,30]
- Assess need for bimanual compression[4,11]
- Check placenta and membranes are complete
- Expel uterine clots
- Insert indwelling catheter to maintain empty bladder[11,12]

3.4.1 First line pharmacological therapy for uterine atony

Table 20. Oxytocin

1.1 Oxytocin	Administration
Intravenous (IV)	• Oxytocin 5 International units IV over 1–2 minutes[11] • May repeat dose after five minutes • Maximum dose: 10 International units IV
Intravenous (IV) infusion of oxytocin 30 IU in 500 mL	• Add oxytocin 30 International units to 500 mL of either 0.9% sodium chloride *or* compound sodium lactate (Hartmann's solution) • Administer oxytocin 5–10 International units per hour via infusion pump o Equates to 83–167 mL per hour of oxytocin 30 International units in 500 mL solution o No evidence to support a minimum infusion duration, although four hours is common—use clinical judgement[47]
Prescribing considerations	• An oxytocin infusion may be a safer alternative to a bolus dose of oxytocin in some women (e.g. major cardiovascular disorders) • If IOL with oxytocin, may use same infusion at increased rate • Rapid bolus administration may cause hypotension, tachycardia, arrhythmia and myocardial ischaemia • If carbetocin has already been given, consider non-oxytocin uterotonic instead

Table 21. Ergometrine

1.2 Ergometrine	Administration
Intramuscular (IM)	• Ergometrine maleate 250 micrograms IM[39] • May repeat dose after 5 minutes[11] • Maximum dose: 500 micrograms[57] to 1000 micrograms[11]
Intravenous (IV)	• Ergometrine maleate 250–500 micrograms IV over 1–2 minutes[11] o Dilute 250 micrograms to 5 mL with 0.9% sodium chloride • May repeat every 2–3 minutes to maximum 250 micrograms[39] to 1 mg[11]
Prescribing considerations	• Contraindicated with retained placenta, pre-eclampsia, severe/persistent sepsis, and renal, hepatic or cardiac disease[57] • Consider concomitant anti-emetic

Table 22. Misoprostol

1.3 Misoprostol	Administration
Sublingual or per rectum	• Misoprostol 800[12] to 1000[11] micrograms sublingual[51] or per rectum (consider clinical circumstances when determining optimal route) • Repeated doses not recommended
Prescribing considerations	• Not LAM approved as first line medication[58] • Increases pyrexia greater than 38 ˚C (misoprostol versus controls RR 3.97, 95% CI 3.13 to 5.04)[59] o Greater than 40 ^{O}C reported in 1–14%[60]
Evidence summary	• No strong evidence that misoprostol is more effective than other uterotonics[59,61,62] • Most useful where injectable uterotonics are unavailable[51] or contraindicated (e.g. asthma, hypertension) • Regardless of route (vaginal, sublingual or rectal) misoprostol takes 1–2.5 hours to increase uterine tone[12], therefore early administration may help sustain uterine tone achieved through other first line drugs

3.4.2 Second line pharmacological therapy for uterine atonia

Table 23. 15-methyl prostaglandin F2 alpha (carboprost)

Carboprost	Administration
Intramuscular[63]	• Carboprost 250 micrograms IM • Repeat as required every 15–90 minutes (not less than 15 minute intervals) • Maximum dose: 2 mg (8 doses)
Intramyometrial[11]	• Carboprost 500 micrograms intramyometrial • Manufacturer does not recommend intramyometrial use[64] o Administration via intramyometrial route is at prescribing clinician's discretion
Prescribing considerations	• Not TGA approved o Available under Special Access Scheme Category A • Prior to administration commence: o Oxygen therapy o Monitoring heart rate, oxygen saturation and blood pressure

3.4.3 Intractable bleeding

Table 24. Intractable bleeding

Aspect	Consideration
Continued bleeding	• Institute blood component replacement as soon as possible • Review criteria for: o MHP activation [refer to Section 4 Massive haemorrhage] o POC blood clotting analysis (if available)
Transfer to OT	• If urgent transfer to OT required: o Transfer woman flat with face mask oxygen o Apply bimanual compression o Assess need for analgesia[65]
In theatre preparation	• Provide warmth to facilitate clotting o Warm blood and IV fluids o Consider external warming device • Apply pneumatic calf compression device to reduce risk of VTE • Involve the most experienced staff (consider external consultations if necessary) including: o Obstetrician o Anaesthetist • Where expertise available consider cell salvaging[16]

3.4.4 Medical treatment of intractable bleeding

Table 25. Medical treatment of intractable bleeding

Aspect	Consideration
Context	• Under anaesthetic check uterine cavity is empty and intact o If bimanual compression has been effective, consider use of intrauterine balloon tamponade (e.g. Bakri)[4,11] o Refer to Appendix A Uterine atonia interventions
Balloon tamponade	• Assess for signs of increased bleeding and uterine cramping • At frequent intervals, check uterine fundal height and blood loss through drainage portal for tamponade effect o Increasing uterine size with no drainage from balloon may indicate blocked drain and continued bleeding within uterine cavity o If concern about blocked drainage, vital signs (pulse rate, respiratory rate, oxygen saturation, fundal height, urine output) every 30 minutes[66] • Concurrently check with TEG® or ROTEM® for adequate coagulation replacement (fibrinogen, cryoprecipitate, fresh frozen plasma) • If clinical signs of coagulation failure, liaise early and closely with anaesthetic staff o Refer to Section 3.8 Thrombin • If bleeding continues and woman is haemodynamically unstable after blood and blood product replacement, and balloon tamponade is ineffective—consider surgical or radiological interventions • Commence broad spectrum antibiotic cover • Continue or commence oxytocic infusion
Uterine packing	• Weak evidence suggests uterine packing not recommended for the management of uterine atony as can conceal bleeding[4]–use clinical judgement
Angiographic embolisation	• Consider selective angiographic embolisation[4,11,30] (up to 90% effective[67]) requires: o Interventional radiologist and necessary infrastructure o Relatively stable condition for length of procedure (approximately one hour)

3.4.5 Surgical treatment of intractable bleeding

Table 26. Surgical treatment of intractable bleeding

Aspect	Consideration
Context	• In the critically bleeding woman treat the coagulopathy concurrently[47] • Timing is critical o Weigh benefits of conservative versus aggressive management o Assess if quicker and safer to do subtotal hysterectomy based on surgeon's skill/maternal condition o Use hot packs intra-abdominally
Surgical procedures	• Perform a laparotomy • Judiciously apply aortic compression (below the level of the renal arteries) as a temporising measure[4,12] • Maintain uterine contraction o Consider B-Lynch compression suture[11,12,30] • If compression or tamponade unsuccessful, consider: o Bilateral uterine artery ligation[11,30] o Bilateral utero-ovarian artery ligation o If expertise available, bilateral internal iliac artery ligation[11,30] • Perform a hysterectomy[11]: o Early if life is threatened[1,30] o If bleeding continues after use of conservative treatment options • Post laparotomy inspect carefully for haemostasis • Refer to Appendix A Uterine atonia interventions

3.5 Trauma

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

3.5.1 Genital trauma

Table 27. Genital trauma

Aspect	Consideration
Condition stable	• Attempt clamping of obvious arterial bleeding prior to repair o Position woman to maximise visualisation and maternal comfort o Repair ensuring bleeding at the apex of the laceration is secured o Refer to Queensland Clinical Guideline: *Perineal Care*[38] for repair principles
Condition compromised	• Treat shock [refer to Section 3.3 Resuscitation] o Apply pressure on the wound or bimanual compression o Assess analgesia requirements • Urgently transfer to OT for repair under anaesthetic o GA usually more appropriate when hemodynamically unstable
Suboptimal wound visualisation	• Transfer to OT • Maximise lighting and position in lithotomy • Under anaesthetic: o Apply retractors to optimise visualisation, utilise assistants o Check uterine cavity is empty and uterus is intact
Anaesthetic ineffective	• Assess rate of bleeding and weigh options of: o Transfer to OT for general anaesthetic o Top up local or regional anaesthetic (and/or transfer to OT as clinically relevant)
Puerperal haematoma	• Large non-haemostatic haematoma: • Treat shock [refer to Section 3.3 Resuscitation] • Transfer to OT for evacuation and repair

3.5.2 Cervical trauma

Table 28. Cervical trauma

Aspect	Considerations
Risk factors	• Precipitous labour, assisted vaginal birth, cervical suture • May occur in absence of risk factors
Presentation	• Profuse haemorrhaging during and after third stage of labour • Diagnosis strengthened by exclusion of other causes of PPH
Assessment	• Urgently transfer to OT • Undertake assessment and repair under anaesthetic • Optimise assessment with positioning, lighting, retractors and assistants • Inspect entire genital tract • To inspect the cervix: o Grasp one side of the cervix between two sponge holders o Remove and reapply forceps one at a time moving in a clock wise direction, keeping forceps 2–3 cm apart o Inspect for tears between the forceps after each repositioning o Continue until the full 360° of the cervix has been inspected
Repair	• Requires experienced obstetrician • Ensure bleeding at the apex of the laceration is secured • If difficult to visualise: o Start sutures at distal end of tear and gently retract on suture material to expose apex o Avoid suture placement cephalad to the anterior fornix due to risk of ureteral ligation • If extensions (e.g. lower uterine, high vaginal, cardinal ligament), consider performing a laparotomy to enable simultaneous vaginal and abdominal routes for repair • If bleeding continues, consider further surgical intervention

3.5.3 Uterine rupture

Uterine rupture can occur spontaneously or be associated with previous obstetric surgery. The severity of the haemorrhage depends upon the extent of the rupture.

Table 29. Uterine rupture

Aspect	Considerations
Risk factors[68,69]	• Previous uterine surgery or CS • Oxytocin administration • Malpresentation or undiagnosed cephalopelvic disproportion • Dystocia during second stage of labour • Grand multiparity • Macrosomic fetus • Placenta percreta • Uterine abnormalities (e.g. rudimentary horn)
Presentation	• Intrapartum—act to rapidly deliver baby and placenta • Signs of uterine rupture may include[37] 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, incoordinate or cessation of contractions, frank haematuria, abnormal vaginal bleeding, abdominal palpation of fetal parts, absent presenting part o **Fetal:** abnormal CTG tracing, loss of fetal station • Postpartum presentation often associated with: o Pain, abdominal distension and persistent vaginal bleeding o Haematuria may occur if rupture extends into the bladder
Treatment	• Urgently transfer to OT • Confirm diagnosis during surgery • Under anaesthetic: o Palpate uterine cavity to identify rupture site o Repair rupture using multiple layers and absorbable sutures • Consider hysterectomy (with midline rather than transverse incision) if: o Defect is large or difficult to close o Haemodynamic stability is threatened

3.5.4 Uterine inversion

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

Table 30. Uterine inversion

Aspect	Consideration
Risk factors	• Uterine over distension • Invasive placentation • Short umbilical cord/excessive umbilical cord traction • Tocolysis • Oxytocin use • Primiparity • Manual extraction of the placenta
Presentation[69]	• Sudden onset of PPH • Irregularly shaped or absent palpable fundus • A completely inverted uterus may appear as a bluish grey mass at the introitus • Haemodynamic instability • Excruciating pain and hypovolaemic shock disproportionate to revealed blood loss
Diagnosis[69]	• Use bimanual examination to locate the uterine fundus in the lower uterine segment or vagina • Non-surgical measures reported successful in 99 out of 102 uterine inversions
Management[69]	• If oxytocin infusing, cease as replacement requires relaxed uterus • If placenta in situ leave in place for manual removal in OT • Drugs may relax the cervical ring to facilitate replacement o Glyceryl trinitrate (GTN) 400 micrograms spray o Terbutaline 250 micrograms subcutaneous or IV o Magnesium Sulphate 4 g IV infusion over 5 minutes
Manual reduction[69]	• Perform promptly o Grasp protruding fundus with palm of hand o Direct fingers toward posterior fornix and lift uterus up through the cervix/pelvis, into the abdomen and toward the umbilicus o Once reverted, maintain bi-manual compression until a strong uterine contraction is felt o Start uterotonic therapy to contract uterus and prevent reoccurrence • Refer to Section 3.6 Tissue for manual removal of placenta
Hydrostatic pressure[69]	• Exclude uterine rupture • May act to correct the inversion o Lie woman flat or head slightly down o Commence manual reduction until fundus in vagina, then have assistants bring labia into firm apposition to create a vaginal seal o Using IV tubing, infuse warm saline into vagina to create increased intravaginal pressure • Uterus gradually returns to its correct position over 10–15 minutes • May require up to two litres of warm saline
Surgical replacement[69]	• Under anaesthetic give tocolytic agent to relax uterus and cervix • If placenta not delivered, work quickly to manually detach • Apply *gentle* manual pressure to the uterine fundus and return it to the abdominal position • If a dense constriction ring occurs consider: o A laparotomy to allow vaginal and abdominal manipulation of the fundus o Use deep traction suture to manipulate fundus and to maintain positioning once retracted o Then immediately start uterotonic therapy to contract uterus and prevent reoccurrence o Consider applying bimanual compression until uterine tone returns o Monitor to ensure there is no reoccurrence

3.6 Tissue

Table 31. Tissue

Aspect	Consideration
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 and measure volume • Massage fundus firmly • Take steps to prevent further atonia
Trailing membranes	• Use sponge holders to clamp membranes extending beyond the introitus, without traction, roll forceps to create a rope of membranes o 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) 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 indwelling catheter • Ensure prophylactic third stage uterotonic has been given • Reattempt CCT and consider additional oxytocin (10 International units IV or IM)[4] if the woman is bleeding excessively[50] o Maternal pushing and repositioning may assist in delivery • Check if risk factors for abnormal placentation o If available, portable ultrasound may assist in placental location • VE to assess if placenta remains within the uterus (i.e. unable to be felt protruding through the cervix or lying high in the vagina) • If unable to deliver placenta or appears incomplete, transfer to OT for manual removal o Consider need for bimanual compression during transfer • Only consider manual removal procedures outside of the OT environment if sufficient and appropriately skilled clinicians and resources available (e.g. for administration of sedation, continuous monitoring, resuscitation)[70] • Post-delivery of the placenta, massage fundus to promote sustained uterine tone
Manual removal under anaesthesia	• Consider use of USS during procedure • Gently manually remove retained products • If manual removal unsuccessful apply gentle curettage with a large blunt curette • Recommend a single dose of antibiotics (ampicillin or first generation cephalosporin)[4] • Post procedure: o Explore the uterine cavity to ensure it is intact o Check for cervical, vaginal and perineal trauma and repair as necessary o Check haemostasis achieved
Unexpected placenta accreta	• If manual removal of placenta is not successful, prompt hysterectomy may be necessary[11,71,72] o Refer to Section 3.5.2 Surgical treatment of intractable bleeding
Not recommended	• Ergometrine—as tetanic contractions may delay placental expulsion[4] • Prostaglandin E2 alpha (dinoprostone)[4] • Oxytocin IV infusion to assist the birth of the placenta[50] • Use of umbilical vein for oxytocin injection and/or misoprostol[4,73]

3.7 Thrombin

Late diagnosis or underestimation of the volume of bleeding may be associated with coagulopathy.[74] If coagulopathy is suspected consult with a haematologist or transfusion specialist for advice on blood component replacement, laboratory monitoring and result interpretation.[1]

Table 32. Blood products

Aspect	Considerations
Clinical presentation	• Give RBC in response to haemodynamic changes and estimated blood loss rather than Hb trigger—do not wait for blood results to treat[30,74]: o Oozing from puncture/cannulation/injection sites or surgical field o Haematuria o Petechial, subconjunctival and mucosal haemorrhage o Blood that no longer clots o Uterine atonia secondary to increased fibrin degradation products o Temperature less than 35 ^{o}C • Laboratory signs[1] [refer to Table 32. Laboratory values]
Coagulopathy correction	• If POC blood clotting analyser available (ROTEM®/TEG® guided), correct in response to results (as per locally agreed algorithm) for targeted replacement of blood and blood products • If POC blood clotting analyser not available transfuse (and repeat as necessary) guided by laboratory findings: o RBC four units o Fibrinogen concentrate or cryoprecipitate to maintain fibrinogen level greater than 2.5 g/L o Fresh frozen plasma (FFP) two units o Platelets[1] to maintain platelet level greater than 50 x10^9 ▪ If no level available, one therapeutic adult dose of platelets after 8–10 units of RBC • No evidence to guide optimal ratio of RBC:FFP:platelets in PPH[65]
Fibrinogen	• Use fibrinogen concentrate or cryoprecipitate early and aim to maintain fibrinogen levels[65,74] above 2.5 g/L o Clauss fibrinogen levels more reliable (lower) than prothrombin time (PT) derived fibrinogen assays—consider requesting clottable fibrinogen o Fibrinogen falls earlier than other coagulation factors and may be low despite normal PT/APTT[74] o Fibrinogen/fibrin deficiency (and not thrombin) is the major informative marker for the severity of haemorrhage[75] o Level of 2 g/L or less is associated with progression of bleeding, increased RBC and blood component requirement and need for invasive procedures[1,74] • Use considered off label in PPH

3.7.1 Target results

Measure the following parameters early and frequently. With successful treatment values should trend toward normal.[1]

Table 33. Laboratory values

Investigation (wks gestation)	Reference range	Units	Physiologic derangement[1]
Hb (35–42 weeks)	110–147	g/L	less than 80
Platelets (> 25 weeks)	150–430	x 10^9/L	less than 50
APTT (0–41 weeks)	26–41	seconds	greater than 1.5 x normal
INR (0–41 weeks)	0.9–1.3		greater than 1.5 x normal
Prothrombin time	9.6–12.9	seconds	
Fibrinogen (by term)	5–6	g/L	less than 2.0
Ionised calcium	1.16–1.30	mmol/L	less than 1.1
pH	7.35–7.45		less than 7.2
Lactate	Lab dependent less than 4	mmol/L	greater than 4
Base excess	greater than minus 6		less than minus 6
Body temperature	36–37.2	^{o}C	less than 35 ^{o}C

3.7.2 Coagulopathy principles

Table 34. Coagulopathy principles

Aspect	Considerations
Communication with laboratory	• Inform if POC blood clotting analyser (ROTEM®/TEG®) is being used • Notify of impending arrival of urgent blood samples[12] • Communicate clearly the need for *emergency* provision of blood and blood components[12] • Identify minimum time till blood product availability, include transport time
Laboratory monitoring	• If POC blood clotting analyser available (ROTEM/TEG guided), follow locally agreed algorithm for targeted replacement • Baseline collection of[1,47]: o Full chemistry profile (Chem20) [refer to Definitions o FBC o Venous/arterial blood gas (ABG) (includes calcium and lactate) o Coagulation profile (PT, INR, APTT, fibrinogen) • Monitor FBC, coagulation profile, calcium, ABG every 30–60 minutes[65,74] o Refer to Table 32 Laboratory values
Avoid hypothermia and acidosis	• Optimise body temperature[65] (i.e. more than 35 °C) o Use fluid warmers and forced air warmers o Minimise exposure, remove wet linen, provide warm blankets o Monitor temperature at least 15 minutely • Maintain oxygenation, cardiac output, tissue perfusion o Monitor arterial blood gases (pH, lactate base excess) • Mortality is increased when hypothermia and acidosis occur with coagulopathy (the 'lethal triad')
Hypocalcaemia	• If ionised calcium less than 1.1 mmol/L[65], include IV 10% calcium gluconate 10 mL o Citrate from transfused blood often causes hypocalcaemia[76]
Early DIC	• Be alert to early disseminating intravascular coagulation (DIC) as associated with placental abruption, severe pre-eclampsia or HELLP syndrome, acute fatty liver of pregnancy, amniotic fluid embolism, fetal death in utero, septicaemia, dilutional coagulopathy secondary to massive transfusion

3.7.3 Cross matched RBC not available

Take blood for cross matching prior to giving O negative RBC—do not wait for results.

Table 35. Blood cell replacement

Aspect	Consideration
No blood group and antibody screen	• Send blood for group and antibody testing • Request compatible blood • Transfuse O negative RBC (ideally Kell negative)
Blood group and antibody screen negative	• Laboratory onsite o Transfuse ABO Rh compatible RBC • Laboratory offsite o Transfuse O negative RBC o Await group specific RBC
Blood group and antibody screen positive	• Await antibody testing and cross match for provision of compatible blood • While waiting and if urgent, in consultation with a haematologist, transfuse most suitable uncross matched RBC
Screened homologous blood unavailable in time frame	• Transfuse O negative RBC emergency stock • Contact RSQ for urgent retrieval

4 Massive haemorrhage

Reduction of morbidity and mortality associated with critical bleeding can be achieved through:

- A structured approach that includes escalation procedures and timely and appropriate use of blood components
- A rapid and coordinated multidisciplinary clinical response[65]
- Implementation of a massive haemorrhage protocol that is reviewed annually by local key stakeholders
  - An example MHP is provided below

Table 36. Example MHP bleeding protocol

Aspect	Considerations
Activation criteria	• Woman is actively bleeding and has one or more of the following criteria: o Major obstetric bleed[65] (i.e. estimated blood loss more than 2500 mL) o Actual or anticipated four RBC units in less than four hours *plus* haemodynamic instability[65] o Clinical or laboratory (including ROTEM®/TEG®) evidence of coagulopathy • In low resource settings as per locally developed protocol
Roles and communication	• Lead clinician: o Identifies need for protocol activation o Contacts laboratory/blood bank staff to activate the protocol • Laboratory staff[65]: o Prepares (e.g. thaws) and issues blood products o Anticipates repeat testing and blood component requirements o Minimises test turnaround times o Considers staff resources • Haematologist: o Contacted by laboratory staff and notified of situation o Contacted by lead clinician to seek input as needed regarding: ▪ Blood component and other therapies ▪ Result interpretation • RSQ: contact early for transfer advice when required
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 2:1 and one dose of platelets every second MHP pack o Triggers for administration of fibrinogen concentrate, cryoprecipitate and calcium gluconate o Triggers for haematologist input ▪ Tranexamic Acid [refer to Table 18. Tranexamic acid] and/or ▪ Additional blood component therapy for continued bleeding
Laboratory testing	• Pre-designate: o Baseline blood tests o Tests to be repeated every 30–60 minutes[65] ▪ Refer to Table 32. Laboratory values
POC blood clotting analyser algorithm	• If POC clotting analyser available (e.g. ROTEM®/TEG®), agree an algorithm relevant to local conditions that aids: o Correct specimen collection o Interpretation of results o Component replacement triggers o Retesting requirements o Identification of the location of the POC blood clotting analyser o Access to expert advice
Deactivation	• Lead clinician promptly contact laboratory/blood bank staff to deactivate protocol[65] once bleeding is controlled • Return unused products

5 Postnatal care after PPH

Table 37. Postnatal care

Aspects	Considerations
Inter-hospital transfer	• Make the decision to transfer early, contact RSQ on **1300 799 127**
Haemodynamic state	• Transfer to high dependency/intensive care unit for observation[12]If condition not critical o Observe in birth suite for two hours, once stable transfer to postnatal unit o First 24 hours post birth, monitor vital signs, uterine tone and blood loss at least four hourly, monitor fluid balance o After 24 hours post birth monitor as per clinical condition
Haemoglobin	• Take six hours after stabilisation and repeat within 24 hours of birth • If Hb less than 70 g/L and/or symptomatic offer RBC transfusion[1] o If RBC transfusion declined offer parenteral iron therapy • If Hb less than 70 g/L and asymptomatic, offer parenteral iron therapy • If Hb is between 70–90 g/L and asymptomatic and where there is no continuing threat of bleeding offer parenteral iron therapy or oral therapy with vitamin C supplement on an individual basis[16] • Provide information on ways to increase dietary iron
VTE	• Consider pharmacological VTE prophylaxis as increased risk following PPH[30] • Refer to Queensland Clinical Guideline: *Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium*[77] • 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
Mother/baby support	• Support maternal and infant bonding o Facilitate regular skin-to-skin contact under direct supervision • Support infant feeding and offer midwifery/lactation consultant assistance o If unable to lactate or persistent hypotension consider Sheehan's syndrome • Discuss risks and advise against co-sleeping and bed sharing given possible fatigue associated with anaemia
Debriefing	• Offer the woman and her family debriefing/clinical disclosure by senior team member (s) who preferably, were present at the event[12] • Offer additional opportunities for discussion/debrief six weeks postpartum • Offer information about possible emotional responses following PPH and support resources available • Offer social worker review
Preparation for discharge	• Ensure comprehensive discharge summary communicated to other health care providers o Consider personal contact (e.g. telephone) with the General Practitioner (GP) prior to discharge • Educate woman about signs, symptoms and self-referral to GP regarding: o Persistent or increasing bleeding o Infection and risk of secondary PPH o Postnatal depression associated with anaemia o VTE • Encourage follow up with GP (e.g. monitor Hb, lactation, mental health) • Referral to local Child Health services for lactation support and close follow up in view of anaemia and postnatal depression risk[78] • 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

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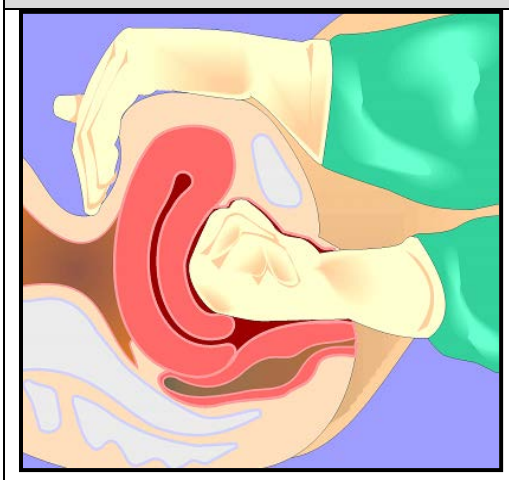
Appendix A Uterine atonia interventions

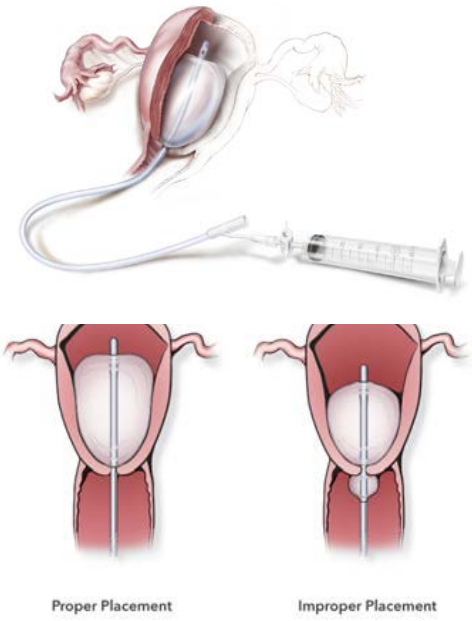
Bimanual compression



- With one 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
- With the other 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

Image reproduced with permission from Advanced Life Support Obstetrics (ALSO) Asia Pacific

Balloon tamponade



- 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 (approximately 250-500 mL); the uterus should now be firm with minimal blood loss
- Assess for signs of increased bleeding and uterine cramping.
- Monitor blood loss through drainage portal for tamponade effect. If bleeding continues tamponade ineffective and surgical intervention required
- Check fundal height to identify bleeding in presence of blocked drainage portal
- Check TEG® or ROTEM® for adequate coagulation replacement
- Commence broad spectrum antibiotic cover Continue or commence oxytocic infusion

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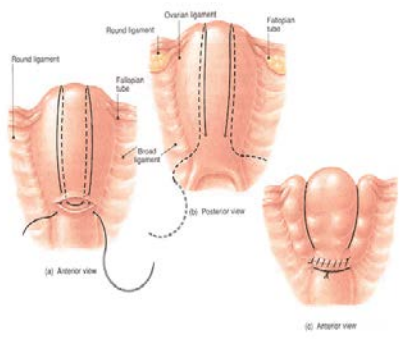
B-Lynch compression suture (performed at laparotomy or CS)



- (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

Image reproduced with permission from Wiley. Reference: B-Lynch C, Coker A, Lawal A, et al. The B-Lynch surgical technique for the control of massive postpartum haemorrhage: an alternative to hysterectomy? Five cases reported. BJOG 1997; 104:372–375

Appendix B: PPH drug and blood products

Consult a pharmacopeia for full details of indications, cautions, contraindications and interactions

Drug/Product	Dose/Route	Reconstitution	Maximum	Comments
Tranexamic acid	1 gram IV over 10 minutes	Nil required	If bleeding persists after 30 minutes or stops and restarts within 24 hours of the first dose, a second dose may be administered	Rapid administration may cause hypotension, dizziness Use infusion device/pump
Oxytocin	5 International units IM	Nil	May repeat after 5 minutes to maximum total dose of 10 International units	Instead of Ergometrine if BP elevated Ensure placenta is expelled
	5 International units IV over 1–2 minutes	Nil		
	5–10 International units per hour IV via infusion pump	Oxytocin 30 International units in 500 mL crystalloid or 0.9% sodium chloride Infuse at 83–167 mL/hour		
Ergometrine	250 micrograms IV over 1–2 minutes	Dilute 250 microgram up to 5 mL with 0.9% sodium chloride (50 microgram per mL)	May repeat every 2–3 minutes to maximum total dose of 250 micrograms–1 mg	Administer with anti-emetic Contraindicated with retained placenta, pre-eclampsia May cause severe hypertension
	250 micrograms IM	Nil	May repeat after 5 minutes to maximum total dose of 500 micrograms–1 mg	
Misoprostol	800–1000 microgram per rectum	Nil	Repeat dose not recommended	Use when oxytocin and ergometrine are not successful Due to slow onset of action, consider early administration
Carboprost	250 micrograms IM	Nil	May repeat after 15 minutes to maximum total dose of 2 mg (8 doses)	Manufacturer does not recommend intramyometrial —use at clinician's discretion Commence cardiac monitoring and oxygen therapy prior to administration
	500 micrograms intramyometrial	Nil	Unknown/repeat not recommended	
Fibrinogen concentrate	Dose in response to fibrinogen level If fibrinogen level unknown then 50–70 mg/kg body weight IV at a rate not exceeding 5 mL per minute	Reconstitute with 50 mL of sterile water Swirl gently to ensure fully dissolved Do not shake vial	Unknown	Dosing based on product information for congenital fibrinogen deficiency Administer via infusion device/pump Dose per vial approximately 1 g 4 g increases fibrinogen by approximately 1 g/L
Cryoprecipitate	Dose in response to fibrinogen level One adult standard dose IV is equivalent to10 whole blood or five apheresis units	Stored frozen Defrost over 30 minutes before administration	Unknown	Derived from either whole blood or collected via apheresis Australian Red Cross states one standard adult dose provides 3–4 g of fibrinogen; clinical experience suggests 2–3 g or less

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