Queensland Clinical Guidelines

Translating evidence into best clinical practice

Maternity and Neonatal **Clinical Guideline**

Primary postpartum haemorrhage (PPH)

Queensland Government

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Acknowledgement

The Department of Health respectfully acknowledges the Traditional Owners and Cultural Custodians of the lands, waters and seas across Queensland. We pay our respects to Elders past and present, while recognising the role of current and future leaders in shaping a better health system.

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The guideline is not a substitute for clinical judgement, knowledge and expertise, or medical advice. Variation from the guideline, taking into account individual circumstances, may be appropriate.

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- Providing care within the context of locally available resources, expertise, and scope of practice
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- Advising consumers of their choices in an environment that is culturally appropriate and which enables comfortable and confidential discussion. This includes the use of interpreter services where necessary
- Ensuring informed consent is obtained prior to delivering care
- Meeting all legislative requirements and professional standards
- Applying standard precautions, and additional precautions as necessary, when delivering care
- Documenting all care in accordance with mandatory and local requirements

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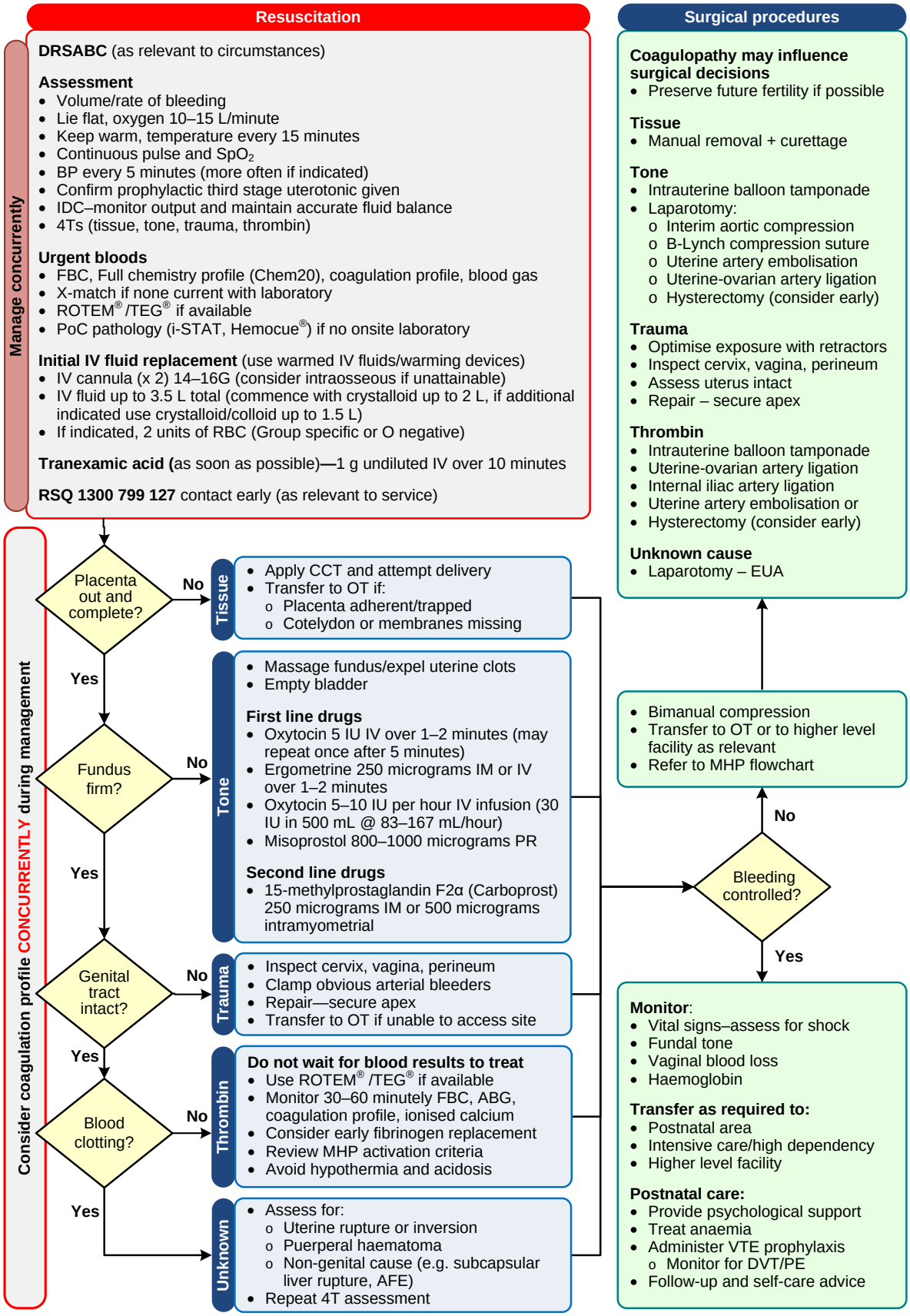
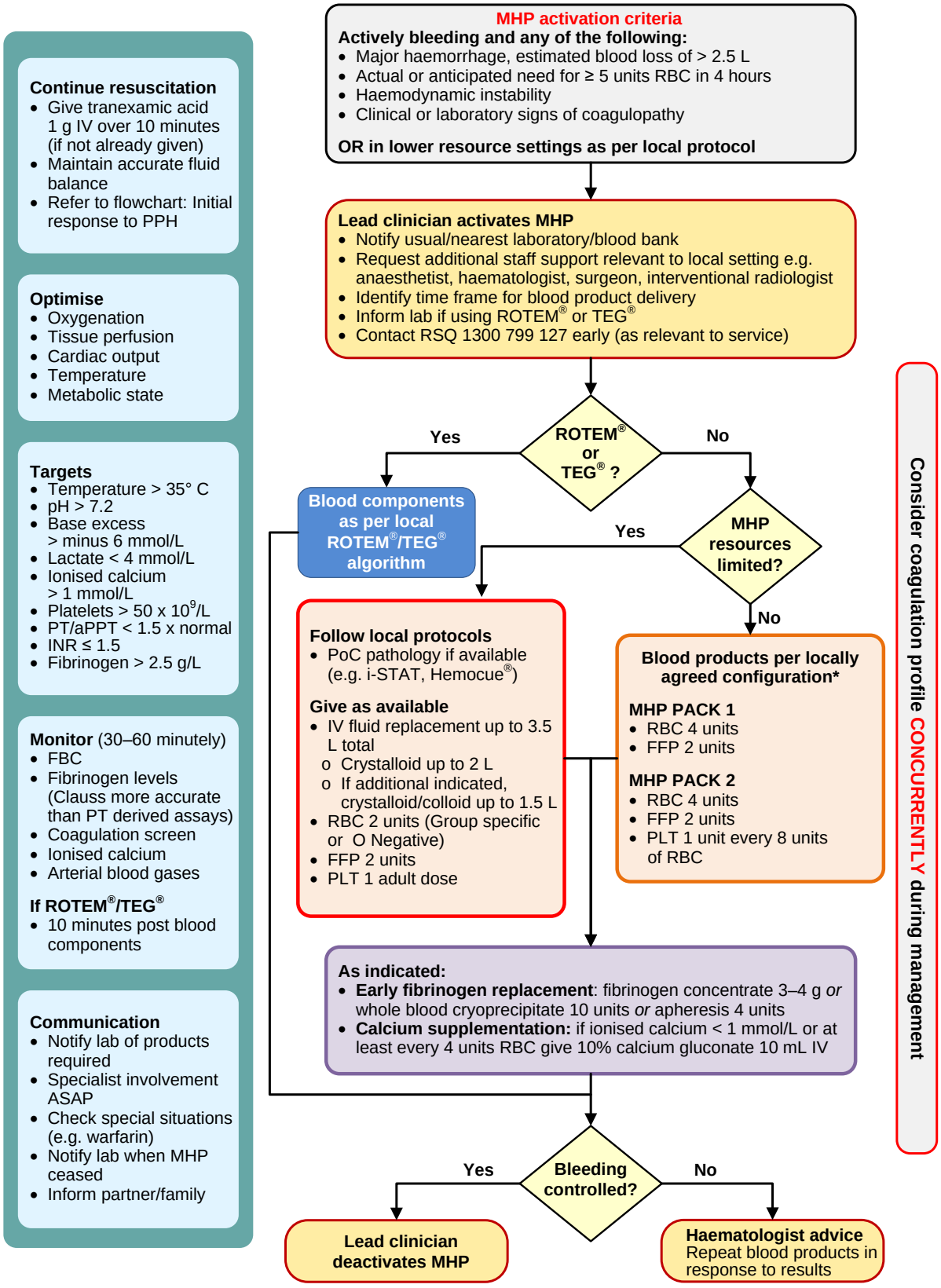
Flowchart: Initial response to postpartum haemorrhage (PPH)



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, **IDC:** indwelling catheter, **IM:** intramuscular, **IV:** intravenous, **MHP:** major 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: F24.1-1-V6-R29

Flowchart: Major haemorrhage protocol (MHP)



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**: major haemorrhage protocol, **PLT**: platelets, **PoC:** point of care, **PPH:** postpartum haemorrhage **PT**: prothrombin time, **RBC**: red blood cells, **ROTEM®/TEG®**: types of blood clotting analysers, **RSQ**: retrieval services Queensland, **<**: less than, **>**: greater than, **≥** greater than or equal to
**Aim for transfusion ratio RBC:FFP:PLT no lower than 2:1:1*

Flowchart: F24.1-2-V5-R29

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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
INR	International normalised ratio
MHP	Major haemorrhage protocol (also known as massive transfusion protocol or massive haemorrhage protocol)
OR	Odds ratio
OT	Operating theatre
PAS	Placenta accreta spectrum
PoC	Point of care
PPH	Postpartum haemorrhage
PT	Prothrombin time
RBC	Red blood cells
RR	Risk ratio
RSQ	Retrieval Services Queensland
VTE	Venous thromboembolism

Definitions

Critical bleeding	Defined as life threatening major haemorrhage that will likely result in the need for massive transfusion.[1,2]
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).
Massive transfusion	In adults, is defined as transfusion of greater than or equal to 5 units of red blood cells in four hours.[1]
Placenta accreta spectrum	A spectrum of abnormal placentation disorders, occurring when the placenta infiltrates deeply into the muscle layer of the uterus. Includes placenta accreta, placenta increta and placenta percreta.[3,4]
Secondary postpartum haemorrhage	Excessive bleeding occurring between 24 hours and 6 weeks post birth.[2]
Woman/women	QCG recognise that individuals have diverse gender identities. In QCG documents, although the terms *woman* and *women* are used, these guidelines are inclusive of people who are pregnant or give birth and who do not identify as female.[5,6]

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[7] and worldwide.[8,9] In developed countries there is a trend of increasing PPH that has not been completely explained by the changing risk profile of women.[10,11] Obstetric haemorrhage (which includes antepartum and postpartum haemorrhage) was responsible for 11 Australian maternal deaths between 2012–2021 (a maternal mortality ratio of 0.4 per 100,000).[12]

1.1 PPH Definition

Although there is no single definition, primary postpartum haemorrhage is termed as excessive bleeding in the first 24 hours post birth. PPH can be classified using definitions in Table 1. Postpartum haemorrhage definitions. In an emergent situation, recognition 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	• Blood loss of 500 mL or more[2,8,9] o Severe: 1000 mL or more[2,13] o Major haemorrhage: 2500 mL or more[2,8] • Queensland perinatal data collection, categorises PPH blood volume as: o 500–999 mL o 1000–1499 mL o 1500 mL or more
Haemodynamic compromise	• Assessed based on observation of clinical signs–use clinical judgement o Manifests as worsening tachycardia, hypotension and reduced urine output o Requires an intervention (e.g. intravenous fluids) • Due to frequent underestimation of blood loss, PPH may first be detected through haemodynamic compromise[7,13] • Signs of compromise may not be evident until large volumes of blood are lost[2,3]
Haemoglobin (Hb)	• Retrospectively diagnosed as a 10 g/L (10%) drop in postpartum Hb (an equivalent measure for 500 mL blood loss)[14]
International Classification of Diseases 11th revision (ICD-11)	• Haemorrhage after delivery of fetus or infant • Includes sub-classifications of[15]: o Third stage: caused by uterine atony, trauma, retained placenta, or coagulopathy o Other immediate: within first 24 hours after completion of third stage of labour, caused by uterine atony, trauma, retained placenta, or coagulopathy o Postpartum coagulation defects: caused by coagulation defects during the postpartum period

1.2 Incidence of PPH in Queensland

Table 2. Incidence of PPH in Queensland

	PPH (mL)	2017	2018	2019	2020	2021
Total births		59,399	59,644	59,559	58,731	62,482
Total PPH rate (%)		9.12%	10.17%	8.5%	8.75%	8.12%
Vaginal birth	500–999	2,118	2,426	2,041	2,087	1,947
	≥ 1000	1,615	*1,720	1,549	1,596	1,431
Caesarean section (CS) birth	500–999	985	1,151	747	687	852
	≥ 1000	702	769	726	769	843
PPH plus blood transfusion		627	616	560	606	600

*Includes 3 PPH with volume not stated. Source: PDC data extracted March 2024

1.3 Aetiology

The common causes of PPH are referred to as the 'Four Ts'. More than one cause may be present (e.g. tone and tissue).

Table 3. Aetiology of PPH

Cause (% of PPH)	Presentation
Tone (70-80%)	• Atonic uterus
Trauma (20%)	• Lacerations of the cervix, vagina and perineum, including episiotomy • 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[1,16]: o A multidisciplinary response (e.g. medical emergency team (MET) call) o Major 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 to minimise wastage from expiration o Consider earlier triggers for activating requests for support (e.g. Retrieval Services Queensland (RSQ), blood products) o Consider use of uterotonics that do not require cold-chain storage such as carbetocin and misoprostol • Refer to Section 4.2 Prophylactic uterotonics
Clinical education	• Adherence with evidence informed guidelines reduces maternal morbidity[17] • Implement regular multidisciplinary practice drills and simulation training to improve[16,18]: o Identification of PPH ▪ Assessment of blood loss (e.g. volume, speed and nature) ▪ Signs of haemodynamic compromise o Emergency response to PPH o Emergency response to maternal collapse • Engage staff in clinical event debriefing after a PPH[19,20] • Encourage staff training in debriefing to support effective communication with the woman and her family
Reporting and documentation	• Notify of PPH via local adverse event reporting systems • Use an approved maternity early warning tool (e.g. Q-MEWT), clinical pathway or proforma that[16]: o Standardises and records clinical response and care o Enables data collection and clinical audit
Standard care	• Refer to Queensland Clinical Guideline: *Standard care*[21] for care considered 'usual' or 'standard' o Includes for example: privacy, consent, decision making, sensitive communication, medication administration, staff education and support, culturally appropriate care

2 Risk factors

Wherever possible, identify PPH risk factors in advance. The magnitude of risk attributable to each factor varies across reports[22] and there may be unknown, interdependent and/or synergistic effects involved. Many women will experience a PPH with no identifiable risk factors.[3,14]

Table 5. Risk factors for PPH

Antenatal risk factor	Detail of study	OR	95% CI	Aetiology
Maternal age	> 35 years	1.1	1.0 to 1.3[23]	Tone
Ethnicity	Asian Sub-Saharan Africa Pacific Island	1.31 1.54 1.75	1.01 to 1.72[24] 1.10 to 2.16[24] 1.43 to 2.15[25]	Tone Trauma
Parity	> 3	1.47	1.01 to 2.13[24]	Tone
Prior uterine surgery	Not specified	3.38	1.60 to 7.14[24]	Trauma
Prior caesarean section (CS)	No praevia	0.61	0.60 to 0.62[26]	Trauma
	With praevia or PAS	5.58	5.35 to 5.81[26]	Trauma Tone Thrombin
Placenta praevia	No prior CS	2.39	2.31 to 2.47[26]	Tissue Tone Thrombin
Antepartum haemorrhage or placental abruption		2.07	2.02 to 2.12[26]	Tissue Tone Thrombin
Previous PPH	> 1000 mL > 1500 mL	3.3 6.42	3.0 to 3.5[27] 3.9 to 10.6[24]	Tone
Uterine fibroid	Fibroid tumours	2.43	1.99 to 2.97[27]	Tone
Pre-eclampsia	Severe features	2.90	2.79 to 3.03[26]	Thrombin
Obesity	Body mass index > 35	2.3	1.3 to 3.6[28]	Tone
Anticoagulants		4.66	2.81 to 7.73[24]	Thrombin
Anaemia	Hb ≤ 9 g/L 10 g/L reduction in antenatal Hb	4.11 1.36	2.76 to 6.13[24] 1.27 to 1.46[29]	Tone
Artificial reproductive technology	IVF/ICSI	1.8	1.5 to 2.1[23]	—
Gestational diabetes		1.56	1.05 to 2.31[24]	Tone
Multiple pregnancy		2.1	1.5 to 2.8[23]	Tone
Polyhydramnios		1.3	1.27 to 1.35[26]	Tone
Drug induced atonia	Magnesium sulphate SSRI use in pregnancy Nifedipine	1.4 1.34 N/A	1.11 to 1.77[30] 1.24 to 1.44[31]	Tone
Macrosomia	> 4000 g	2.4	2.2 to 2.6[23]	Tone Trauma
Inherited bleeding disorder	VWD[32]/Platelet function disorders	N/A		Thrombin
Intrapartum risk factor	**Detail of study**	**OR**	**95% CI**	**Aetiology**
Oxytocin use in labour		1.97	1.52 to 2.57[33]	Tone
Prolonged second stage	≥ 2 hours	1.9	1.2 to 2.9[16]	Tone
Prolonged third stage	≥ 30 mins	3.59	1.60 to 8.03[34]	Tone
Retained placenta		32.9	26.2 to 41.5[23]	Tissue
Manual removal of placenta		29.3	28.8 to 29.8[11]	Tissue
Assisted vaginal birth		1.31	1.29 to 1.33[11]	Trauma
CS birth	All Emergency (before or during labour)	1.6 2.1	1.4 to 1.7[23] 1.9 to 2.3[23]	Trauma
Perineal trauma	Episiotomy > 2nd degree tear	1.64 1.71	1.62 to 1.66[11] 1.66 to 1.76[11]	Trauma
Uterine rupture		23.1	20.4 to 26.2[35]	Trauma
General anaesthesia		2.90	1.90 to 4.50[16]	Tone
Infection	PROM Temp > 38^{O} C in labour Chorioamnionitis	1.51 2.53 2.5[2]	1.19 to 1.93[24] 1.78 to 3.58[24] Not available	Tone/Thrombin
Non-cephalic presentation		1.6	1.5 to 1.6[35]	Tone/Trauma
Precipitate labour		33.8	18.8 to 60.9[36]	Tone/Trauma

CI: confidence interval, ICSI: Intracytoplasmic sperm injection, IVF: In vitro fertilization, N/A: Not available, OR: odds ratio, PROM: prolonged rupture of membranes, SSRI: selective serotonin reuptake inhibitors, VWD: Von Willebrand Disease

3 Antenatal risk management

Table 6. Antenatal risk management

Clinical aspects	Risk reduction measures
Assessment	• Recommend routine blood group and antibody testing[37] • If antenatal risk factors for PPH identified: o Highlight in the health record o Consult/refer to obstetrician as required o Involve the woman in a plan of care aimed at mitigating risk o Refer to Section 11 Women who cannot receive a blood transfusion
Anaemia	• In Queensland, the normal Haemoglobin (Hb) reference range for 25–42 weeks gestation is 98–137 g/L[38] • A low antenatal Hb has a strong association with PPH[29] • Screen for anaemia as per routine antenatal schedule[37,39] o Assess Hb levels against gestation-related thresholds[37] o Investigate ferritin levels as indicated[40] • Offer advice about minimising anaemia (e.g. dietary information) • Optimise Hb antenatally o Women with anaemia cannot tolerate the same volume of blood loss as healthy women[29] • If iron deficiency anaemia diagnosed, recommend iron therapy in pregnancy[40] • First line treatment is with oral iron supplements[40] • If indicated (e.g. poor adherence to recommendations or absorption of oral iron, iron deficiency anaemia present in third trimester), consider intravenous iron therapy[40,41] • Routine use of erythropoiesis stimulating agents is not recommended o Consider only in selected women at high risk of substantial blood loss in combination with iron therapy and in consultation with haematologist[2,41] • 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[2,41]: 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	• Increased CS rates have contributed to an increase in occurrence of abnormal placentation[42] • Perform an ultrasonographic examination and, if indicated, magnetic resonance imaging[4] • Determine placental site and if abnormal placental adhesion present (e.g. placenta accreta spectrum)[42] • If abnormal placentation evident, consult obstetrician and involve multidisciplinary team in preoperative planning[4]: o Timing and location of birth o Presence of consultant obstetrician and anaesthetist, radiology expertise, neonatologist and cell salvage at birth 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)

4 Intrapartum risk management

Table 7. Intrapartum risk management

Aspects	Risk reduction measures
Care planning	• Review antenatal and intrapartum risk factors on presentation for birth o Continually assess and alter recommended management as risk factors arise or change during labour[43,44] • Discuss preferences and plan for management of third stage[16,43] o Refer to Section 4.1 Third stage
Maternal blood considerations	• If clinically significant antibodies are present, request cross-matched blood on presentation for birth • If maternal blood disorder, anticipate the risk of bleeding and engage multidisciplinary team[2,41] o Seek specialist care on presentation for birth as indicated (e.g. obstetrician, anaesthetist, haematologist) o Early consultation with laboratory/blood bank
Vaginal birth	• Consider each woman's risk profile for PPH when recommending care during labour • Use of an oxytocin infusion in labour and high cumulative doses associated with an increased risk of PPH[45,46] • Maternal position during labour does not influence the risk of PPH[47] • If PPH risk factors identified [refer to Section 2 Risk factors]: o Consider prophylactic IV access ▪ Lack of evidence regarding which labouring women should be offered an intravenous cannula[48] ▪ Consider the significance of PPH risk factor(s) identified and use clinical judgement o Consider collection of Full blood count (FBC) and group and hold • If vaginal birth after CS (VBAC), increased risk of uterine rupture and PPH[49,50] o Monitor for early signs of uterine rupture [refer to Table 26. Uterine rupture] o Refer to Queensland Clinical Guideline: *Vaginal birth after caesarean (VBAC)*[51]
Caesarean section (CS)	• Establish IV access • Confirm recent blood results (i.e. less than 72 hours old), or collect if necessary: 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. second stage CS, unsuccessful assisted vaginal birth) o Malpresentation o Evidence of abnormal coagulation o History of previous PPH or other significant risk factors
Induction of labour (IOL)	• On admission, confirm routine blood results are less than 72 hours old or collect if necessary: o FBC o Group and hold • Refer to Queensland Clinical Guideline: *Induction of labour*[52]
Intraoperative cell salvage	• If equipment and perfusionist available, recommend for women at high risk of severe PPH, experiencing major haemorrhage, or when RBC are unavailable (e.g. due to immunological reasons)[2,39]

4.1 Third stage

Refer to Queensland Clinical Guideline: *Normal birth*[53] for routine management of third stage.

Table 8. Third stage risk management

Aspects	Risk reduction measures
Uterotonic	• Recommend a prophylactic uterotonic to all women giving birth o Reduced risk of PPH when compared with no uterotonic[8,43,54] • Refer to Section 4.2 Prophylactic uterotonics • Refer to Appendix C: Prophylactic uterotonics
Cord clamping	• Delayed cord clamping (not earlier than one minute after birth) is recommended for all births[16] and has not been shown to increase the risk of PPH[55]
Controlled cord traction (CCT)	• CCT as part of active/modified active management of third stage may reduce the incidence of PPH, the duration of third stage, and need for manual removal of placenta[56]
Physiological management	• Provide information about the risks and benefits of physiological versus active management of third stage • Recommend uterotonic if[43]: o Excessive bleeding o Delay in placental birth greater than one hour o Woman requests to shorten third stage
Not beneficial for PPH prevention	• Nipple stimulation and/or early breastfeeding o May increase uterine activity but has not been shown to reduce bleeding or incidence of PPH[57]

4.2 Prophylactic uterotonics

Refer to Appendix C: Prophylactic uterotonics

4.2.1 Oxytocin

Table 9. Oxytocin

Aspect	Consideration
Evidence summary	• In most circumstances, is the prophylactic uterotonic of choice[10,13] • Effective in reducing blood loss at birth and for PPH prevention when compared with no uterotonic[8,58] • Administered before versus after the birth of placenta showed no significant difference to PPH greater than 500 mL[59] • Route of administration o For vaginal birth: ▪ When compared with IM, IV oxytocin reduces the risk of PPH, need for blood transfusion[60-62], and incidence of retained placenta[61] ▪ No significant difference in side effects (e.g. hypotension and tachycardia) between routes[60,61] o For CS birth: ▪ Limited evidence for optimal IV dosing regimen[63,64] • If cardiovascular compromise exists (e.g. hypovolaemia, shock, cardiac disease) IV use may result in transient haemodynamic instability[61,65]: o Marked hypotension, tachycardia, chest pain and electrocardiogram changes
Recommendation	• If vaginal birth without IV access: o Oxytocin 10 International units IM[16,43] • If vaginal birth with IV access: o Oxytocin 10 International units IV injected slowly over 3–5 minutes[66] is recommended in preference to IM[2,61] • For CS birth: o Oxytocin 3–5 International units IV over 1–2 minutes[16,64,67] o Monitor for haemodynamic impact[67] • Avoid rapid IV bolus administration • If cardiovascular risks present, use caution with IV administration[2,61]

4.2.2 Syntometrine®

Ampoule contains oxytocin 5 International units and ergometrine maleate 500 micrograms per mL.[68]

Table 10. Syntometrine®

Aspect	Consideration
Evidence summary	• Compared with oxytocin o Reduced need for additional uterotonics and small (4%)[54] reduction in risk of PPH greater than 500 mL[54,69] o Increased nausea, vomiting, headache, diarrhoea, and hypertension[9,43,69] • Contraindicated for women with severe hypertension, pre-eclampsia, eclampsia, or severe cardiac, hepatic, renal or peripheral vascular disease[43,70]
Recommendation	• If no PPH risk factors identified: o Not recommended for routine use[13,71] • If PPH risk factors identified [refer to Section 2 Risk factors]: o Individually assess the potential benefit of a small reduction in blood loss versus increased risk of adverse effects associated with use[16,43] • If syntometrine® not appropriate, consider carbetocin in preference to oxytocin due to increased half-life and duration of action and similar side effect profile to oxytocin[69] [refer to Table 11. Carbetocin] • Offer antiemetics[43] to woman having syntometrine®

4.2.3 Carbetocin

Table 11. Carbetocin

Aspect	Consideration
Evidence summary	• Indicated for PPH preventative use after CS or vaginal birth[72] • Compared with oxytocin: o Vaginal birth ▪ Comparable for PPH prevention and reducing use of additional uterotonics[69,73,74] o CS birth ▪ Similar or better outcomes for PPH prevention[43,54] ▪ Less need for additional uterotonics (e.g. oxytocin infusion)[54,75,76] ▪ Reduction in PPH greater than 500 mL and severe PPH greater than 1000 mL[54] ▪ Insufficient evidence regarding use with general anaesthetic (GA)[72] • Compared with syntometrine®: o No significant difference, both considered effective for prevention of PPH[69] • Side effect profile like oxytocin[74]
Recommendation	• If vaginal birth and cold-chain storage of oxytocin can be guaranteed (e.g. hospital setting): o Routinely use oxytocin in preference to carbetocin[9,13] • If vaginal birth and cold-chain storage of uterotonic cannot be guaranteed: o Carbetocin is an effective alternative uterotonic o IM is preferred route of administration[72] • If CS birth under regional anaesthetic: o IV carbetocin may be considered as a cost effective uterotonic[43,44] • If CS birth under general anaesthetic: o Not recommended due to insufficient evidence • Single dose only—not for repeated use[72]

4.2.4 Misoprostol

Table 12. Misoprostol

Aspect	Consideration
Evidence summary	• Not listed for use as preventative uterotonic in List of approved medicines (LAM)[77] • Not recommended if alternative injectable uterotonics are available[71,78] • Compared to no uterotonic, is effective for prevention of PPH[54] • Compared with oxytocin, sole use of misoprostol increases the risk PPH, vomiting and fever[54] • Side effects can include vomiting, abdominal pain, diarrhoea, shivering and pyrexia[79]
Recommendation	• Use only if no other injectable uterotonic is available (e.g. due to unexpected birth in low resource setting, storage conditions inadequate)[10,78,80] • If in a low resource setting with limited PPH treatment capability, consider use if: o Injectable uterotonic has been administered AND o Continued bleeding is anticipated and/or blood loss is estimated to be greater than or equal to 350 mL[10,81] • Misoprostol 600 micrograms orally or sublingual once immediately after birth[10,78,80] • Not recommended for CS birth[71]

5 Fourth stage

This guideline defines fourth stage as the first six hours immediately following the birth.

Table 13. Fourth stage management

<table>
<tr><th>Aspects</th><th colspan="2">Risk reduction measures</th></tr>
<tr><td>Routine care</td><td colspan="2">• Frequent assessment is required, all women are at risk of PPH
o Be alert for signs of haemodynamic instability
• Prioritise placental inspection
o If incomplete or in doubt, monitor woman and consult obstetrician
• Facilitate repair of tears or episiotomies requiring suturing
o Refer to Queensland Clinical Guideline: Perineal care[82]
• Monitor women, including for uterine tone, every 15–30 minutes
o Refer to Queensland Clinical Guidelines: Normal birth[53]
• 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 breastfeeding (if preferred feeding method)
o Facilitating skin-to-skin contact with baby
• Document on a maternity early warning tool (e.g. Q-MEWT) to aid early detection of deterioration</td></tr>
<tr><td>PPH risk factors</td><td colspan="2">• In addition to routine care, if antenatal or intrapartum risk factors identified:
o Closely monitor every 15 minutes for the first hour post birth
• Maintain a low threshold for prophylactic oxytocin infusion depending on individual circumstances[83]
o Consider prolonged exposure to oxytocin causing receptor desensitisation and adverse haemodynamic effects[67,79]
• Seek medical review before discontinuing IV access in the first 24 hours post birth</td></tr>
<tr><td rowspan="8">Observations for women with PPH risk factors</td><td colspan="2">Minimum observations for the first two hours</td></tr>
<tr><td colspan="2">Alter frequency of observations as clinically indicated</td></tr>
<tr><td>Observation</td><td>Frequency</td></tr>
<tr><td>• Total Q-MEWT score
o Respiratory rate
o Oxygen saturation
o Blood pressure
o Heart rate
o Temperature
o Behaviour and consciousness</td><td>• Every 15–30 minutes for the first hour
• Every 30 minutes for the second hour</td></tr>
<tr><td>• Fundus</td><td>• Every 15–30 minutes</td></tr>
<tr><td>• Blood loss</td><td>• Every 15–30 minutes
• Be alert to a slow steady trickle
• Visualise labia/perineum</td></tr>
<tr><td>• Pain</td><td>• Initial assessment then as clinically indicated</td></tr>
<tr><td>• Urine output</td><td>• Within the first two hours</td></tr>
<tr><td>• Oral intake</td><td>• Use clinical judgement about commencement and consider individual circumstances</td></tr>
<tr><td>• Ongoing observations</td><td>• After first 2 hours, continue as clinically indicated
• After CS or surgical treatment: incorporate into routine postoperative observation</td></tr>
</table>

6 Recognition of PPH

Blood loss can occur rapidly around the time of birth, with or without haemodynamic compromise. As soon as PPH recognised, call for assistance including the immediate attendance of an experienced/senior obstetrician.

6.1 Assessment of blood loss

Table 14. Assessment of blood loss

Aspect	Consideration
Visual estimation	• Visual estimation of blood loss is subjective, can be imprecise and often leads to[84-86]: o Underestimation of large volumes o Overestimation of small volumes • When conducting visual assessment of blood loss, consider: o Volume o Nature and speed[17] • Simulated scenarios and pictorial guides may improve staff accuracy[86,87]
Quantitative measurement	• Measure blood loss or weigh blood-soaked items (e.g. linen, pads, swabs, drapes) to quantify volume[44] o If weighing, 1 gram is equivalent to 1 mL blood loss[84] • Provides a more accurate assessment of blood loss when compared with visual estimation[86,87] • Recommend measure/weigh blood loss if visual assessment exceeds 300 mL[85]

6.2 Haemodynamic compromise

Signs of haemodynamic compromise are a late indicator of PPH and may not be evident until large volumes of blood are lost (e.g. up to 25% of total blood volume or greater than 1500 mL).[2,3,16]

Refer to Table 15. Clinical signs and symptoms of blood loss as a guide—many women will present without these direct correlations.[88] Conversely, compromise may occur earlier in women with[41,89]:

- Gestational hypertension with proteinuria
- Anaemia
- Dehydration
- Small stature
- Cardiac disease

Table 15. Clinical signs and symptoms of blood loss

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 mmHg)	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

7 Responding to PPH

7.1 Resuscitation

Initial response to PPH requires a multidisciplinary team approach[3,16] to restore the woman's haemodynamic state whilst *simultaneously* identifying and treating the cause of bleeding.[1]

Table 16. 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 volume and rate of bleeding—caution with underestimation[13] • Lie woman flat[13] • Temperature every 15 minutes—prevent hypothermia[13,16] • High flow oxygen,10–15 L/minute, via face mask regardless of maternal oxygen concentration[16,88] • Monitor haemodynamic stability: o Heart rate and pulse oximetry continuously (if able) o Blood pressure every 5 minutes (more frequently if indicated)
Identify cause (Four Ts)	• **T**one: fundus atonic • **T**rauma: lacerations, uterine rupture or inversion, adequate blood clotting • **T**issue: retained placental tissue and/or membranes. Fundus atonic and unresponsive to uterotonics • **T**hrombin: fundus contracted (may become atonic), blood not clotting • Unknown: assess for concealed bleeding (e.g. vault haematoma) and non-genital causes (e.g. subcapsular liver rupture) • Refer to Section 8 Management of Four Ts
IV access	• Establish IV access—ideally two IV cannulas (14–16 gauge)[16] o One IV for fluid replacement, second IV for pharmacologic therapy • Some circumstances may require large volume central venous access • If IV access unattainable, consider intraosseous access o Label blood samples as such, may not be suitable for all blood analysing equipment
Blood tests	• Facilitate urgent collection and processing of[13,16]: o FBC o Full chemistry profile (Chem20) [refer to Definitions] o Venous/arterial blood gas (ABG) (includes calcium and lactate) o Coagulation profile (PT, INR, aPTT, fibrinogen) o Blood cross match only required if: ▪ No valid group and hold or cross-match available in laboratory ▪ Woman has clinically significant antibodies • If point of care (PoC) blood clotting analyser available, request testing according to local guided strategy
Fluid replacement	• Use warm IV fluids during resuscitation wherever possible • Main aim is to promote tissue perfusion and oxygen carrying capacity • Avoid high-volume IV fluid replacement and dilutional coagulopathy[90,91] • Use crystalloid in preference to colloid[3,10] • Colloid use can be associated with dysfunction of clotting factors[90] • Limit IV fluids to total 3.5 L[16] o Crystalloid up to 2 L (1–2 mL every 1 mL of blood loss)[2] o If additional indicated, crystalloid or colloid up to 1.5 L can be infused[16] ▪ If colloid used, limit to 1.5 L[16] • If haemodynamic compromise or actively bleeding, consider RBC transfusion[16] • Monitor fluid balance[16] o Aim for urinary output of 30 mL/hour or more
Blood products	• If actively bleeding, transfuse early do not wait unnecessarily for laboratory results[16,47] o Clinical assessment is the main determinant[44] • Initially transfuse RBC two units (Group specific or O negative) o Use rapid infusion sets, pump sets or pressure bags, blood warmer o Consider MHP activation

7.2 Tranexamic acid

Give tranexamic acid (TXA) as soon as possible after onset of PPH[92]—ideally within three hours[1,2]

Table 17. Tranexamic acid

Tranexamic acid	Administration
Evidence summary	• Tranexamic acid in addition to uterotonics: o Reduces postpartum blood loss, need for blood transfusion, and laparotomy to control bleeding o Reduces death due to PPH (RR 0.81, 95% CI 0.65 to 1.00), especially if given within three hours of onset of PPH[79] (RR 0.69, 95% CI 0.52 to 0.91)[92] • Does not increase risk of thromboembolic events
Intravenous (IV)	• Tranexamic acid 1 gram undiluted (100 mg/mL) IV over 10 minutes[1,92] • If bleeding persists after 30 minutes or stops and restarts within 24 hours of the first dose, a second dose of 1 gram may be administered[10,92] • Refer to Appendix D: Drugs and blood products for PPH treatment
Prescribing considerations	• Not recommended for routine prophylaxis following vaginal or CS birth[16,93] o Evidence does not demonstrate improved outcomes • Restricted use in List of approved medicines (LAM)[94]

7.3 Point of care blood clotting analysers

Table 18. Point of care blood clotting analysers

Aspect	Consideration
Context	• Relative real time testing to detect early changes in coagulation parameters[95,96] • Use may add value to treatment planning through[95-98]: o More efficient diagnosis o Distinguishing between surgical cause of bleeding or coagulopathy o Diagnoses of specific type of coagulopathic impairment o Directed blood replacement therapy o Reduced over-transfusion of blood products o Detection of hypercoagulability in various conditions, such as gestational diabetes, pre-eclampsia, and HELLP syndrome • Subsequently, use of PoC testing may: o Decrease blood loss o Allow earlier termination of major haemorrhage protocol (MHP) o Reduce the incidence of postpartum hysterectomy o Reduce the length of inpatient stay • Limitations[95]: o Cannot detect von Willebrand disease or other conditions that affect adherence to the endothelium o Not recommended to test platelet function[99] o Uncertainty regarding accuracy to detect fibrinolysis during early severe PPH (i.e. 800–1500 mL) and is not recommended to guide use of tranexamic acid[100]
Devices	• Both thromboelastography (TEG®) and thromboelastometry (ROTEM®) PoC blood clotting analysers are used in Queensland • Also referred to as viscoelastic haemostasis assay (VHA) and viscoelastic testing (VET)
Local facility considerations	• If a PoC blood clotting analyser is available: o Follow a locally agreed algorithm relevant to the device used o Provide education and training on use and interpretation of results o Follow quality control activities as per manufacturer's instructions

7.4 Support during PPH

Table 19. Support during PPH

Aspect	Consideration
Communication	• Communicate sensitively and contemporaneously about the care being provided • As soon as possible, provide information to the woman and her support people regarding[16]: o The clinical circumstances of the PPH o The plan of management and treatment options • Address concerns raised by the woman and her support people
Pain management	• Consider pain relief requirements during initial resuscitation and all subsequent treatments
Consent	• If treatment is likely to affect woman's fertility, prioritise gaining informed consent

8 Management of Four Ts

8.1 Tone

The incidence of PPH caused by uterine atony is rising.[79] The uterine cavity must be empty of tissue for effective uterine contraction.

Initial clinical and mechanical measures include:

- Massage uterine fundus to stimulate contractions[2,16]
- Assess the need for bimanual compression[10,13] [refer to Appendix A: Uterine atonia interventions]
  - Consider early, can be a lifesaving measure
- Expel blood clots from uterus—fundal stimulation by repetitive massage or squeezing
- Check placenta and membranes are complete
- Insert indwelling catheter to maintain empty bladder[16]
- Timely administration of first line uterotonics if preventative uterotonics ineffective[79,101]

If bleeding persists, consider mechanical or surgical options [refer to Section 9 Intractable bleeding]

8.1.1 First line pharmacological therapy for uterine atony

The following uterotonics are useful in treatment of PPH due to atonia.[13] Drugs differ in effectiveness and side effects and should be chosen based on individual circumstances and in the absence of contraindications.[13,101] Generally drugs are administered in the order presented below and may be used in combination.[13,102] [refer to Appendix D: Drugs and blood products for PPH treatment].

Table 20. Oxytocin

Oxytocin	Administration
Intravenous (IV) bolus	• Oxytocin 5 International units IV over 1–2 minutes[13,16] • May repeat after five minutes, maximum dose 10 International units IV[13,16]
Intravenous (IV) infusion	• Add oxytocin 30 International units to 500 mL of either sodium chloride 0.9% *or* compound sodium lactate (Hartmann's solution) • Administer oxytocin 5–10 International units per hour via infusion pump[47] o At this concentration equates to 83–167 mL per hour via infusion pump o No consistent evidence to support a minimum infusion duration, most commonly 2–4 hours[63]—use clinical judgement[17,103]
Prescribing considerations	• Oxytocin is most common first line uterotonic for treatment of PPH[79] • If IV access unavailable or delayed, oxytocin 10 International units IM can be administered[2,47] • If IOL with oxytocin, may use the same infusion preparation at an increased rate o For women with unstable cardiovascular conditions (e.g. hypovolemia, shock, cardiac disease), infusion may be a safer alternative to bolus dose[61,79] • If carbetocin used for third stage management, consider a non-oxytocic uterotonic as first line therapy[71]

Table 21. Ergometrine

Ergometrine	Administration
Intramuscular (IM)/Intravenous (IV)	• Ergometrine 250–500 micrograms IM[13,16] • Ergometrine 250–500 micrograms IV over 1–2 minutes[13,16] • May repeat 5 minutely if necessary, to a maximum dose 1 mg[13]
Prescribing considerations	• If oxytocin unavailable or bleeding does not respond to oxytocin, consider use of ergometrine[10] • Contraindicated with retained placenta, severe hypertension, pre-eclampsia, eclampsia, severe/persistent sepsis, and severe renal, hepatic, vascular or cardiac disease[79,104] • Consider concomitant anti-emetic • Due to side effects, use with caution in IV administration[104]

Table 22. Misoprostol

Misoprostol	Administration
Sublingual or per rectum	• Misoprostol 800–1000 micrograms sublingual or per rectum[13,43] o Consider clinical circumstances when determining optimal route ▪ Rectal, longer absorption time with prolonged activity ▪ Sublingual, rapid onset of action with side effects more likely[9,105] • Repeat dose not recommended[102]: o Within two hours of previous dose o If experiencing hyperpyrexia and shivering
Prescribing considerations	• Not approved as first line medication on List of approved medicines (LAM)[77] • Consider misoprostol if[2,10,102]: o Alternative uterotonics unavailable or contraindicated (e.g. asthma, hypertension) o Bleeding not effectively controlled with oxytocin • Limited evidence for efficacy of misoprostol used in combination with oxytocin, compared with oxytocin alone[101] • Common adverse effects include fever, nausea and vomiting, shivering and diarrhoea[101,102] • Consider the slow onset of action when treating uterine atonia[102]

8.1.2 Second line pharmacological therapy for uterine atony

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

Carboprost	Administration
Intramuscular	• Carboprost 250 micrograms IM • Repeat as required every 15–90 minutes (not less than 15 minute intervals)[106] o Most women (73%) respond to a single dose[102] • Maximum up to 2 mg (8 doses)[16]
Intramyometrial	• Carboprost 500 micrograms • Intramyometrial use not recommend by manufacturer or Therapeutic Goods Administration (TGA) approved[106] • Administration via this route is at prescribing clinician's discretion[13]
Prescribing considerations	• Indicated if bleeding continues after use of first line medications[10,79,103] • Use should be guided by clinical context, absence of contraindications, and consideration of available mechanical and surgical treatment options o Refer to Section 9 Intractable bleeding • Prior to administration of carboprost, commence: o Oxygen therapy (prostaglandins can cause bronchospasm, abnormal ventilation-perfusion ratio and hypoxemia)[79,102] o Monitoring of heart rate, oxygen saturation and blood pressure • Concomitant use of oxytocin and prostaglandins can potentiate cardiovascular side effects[2] • Be aware of common side effects: hypertension, hypotension, pulmonary oedema, diarrhoea, nausea, vomiting, flushing, pyrexia and myalgia[79,102]

8.2 Trauma

8.2.1 Genital trauma

Table 24. Genital trauma

Aspect	Consideration
Condition stable	• Assess extent of trauma and facilitate repair as soon as possible[43] • Position to maximise visibility, lighting and maternal comfort[43] • Provide adequate pain relief • If arterial bleeders, promptly clamp or apply pressure o Repair may require surgical exploration or ligation[14] • Refer to Queensland Clinical Guideline: *Perineal care*[82]
Condition compromised	• Treat shock [refer to Section 7.1 Resuscitation] o Apply pressure on the wound o Assess analgesia requirements • Urgently transfer to operating theatre (OT) for repair under anaesthetic o Check uterine cavity is empty and uterus is intact o General anaesthetic usually more appropriate when hemodynamically unstable[107]
Suboptimal wound visualisation	• Transfer to OT • Maximise lighting and position in lithotomy • Under anaesthetic: o Apply retractors to optimise visualisation o Utilise assistants
Anaesthetic/ analgesia ineffective	• Assess rate of bleeding and weigh options of: o Local or regional anaesthetic top up o Transfer to OT for repair under regional or general anaesthetic
Puerperal haematoma	• Suspect in presence of: o Vaginal tears, episiotomy, instrumental delivery or vaginal trauma[108] o Inability to identify the cause of PPH (4 Ts) • May have no visible/obvious cause • Act promptly to: o Resuscitate as required [refer to Section 7.1 Resuscitation] o Perform vaginal/rectal examination to determine site and extent o Consider transfer to OT for clot evacuation, primary repair, embolisation procedures and/or balloon tamponade of blood vessels

8.2.2 Cervical trauma

Table 25. Cervical trauma

Aspect	Consideration
Risk factors	• Precipitous labour, assisted vaginal birth, cervical suture, previous cervical surgery, primiparous[109] • May occur in absence of risk factors
Presentation	• Profuse haemorrhaging during and after third stage of labour or a continuous bright red trickle[110] • Diagnosis strengthened by exclusion of other causes of PPH
Assessment	• If indicated, urgently transfer to OT • Undertake assessment and repair under anaesthetic • Optimise assessment with positioning, lighting, retractors and assistants • To inspect the cervix: o Grasp the cervix with two sponge forceps o Remove and reapply forceps one at a time moving in a clockwise direction around the cervix, keeping forceps 2–3 cm apart o Inspect for tears after each repositioning o Continue until the full 360° of the cervix has been inspected[110] • Inspect entire genital tract
Repair	• Requires experienced obstetrician • Most cervical tears will require repair in OT • Consider expectant management of small cervical tears (i.e. less than 2 cm) with minimal bleeding[109] • Use sponge forceps on either side of the laceration to aid visualisation[110] • Cervical tears may extend into the lower uterine segment[110] o If extensions, consider performing a laparotomy[109] • If bleeding continues, investigate further and consider surgical interventions [refer to Section 9.2 Surgical treatment of intractable bleeding]

8.2.3 Uterine rupture

Uterine rupture can occur spontaneously or be associated with previous uterine trauma. The severity of the haemorrhage depends upon the extent of the rupture and may be a life-threatening obstetric emergency.[50,111]

Table 26. Uterine rupture

Aspect	Consideration
Risk factors	• Previous uterine surgery/trauma or CS[50] o Refer to Queensland Clinical Guideline: *Vaginal birth after caesarean (VBAC)*[51] • Grand multiparity[112] • Age above 35 years[50] • Use of oxytocin infusion in labour[49,50] • Obstructed labour[112] • Malpresentation or undiagnosed cephalopelvic disproportion[113] • Dystocia during second stage of labour • Macrosomic fetus[49,112] • Abnormal placentation • Uterine abnormalities (e.g. rudimentary horn) • Epidural analgesia[113]
Presentation	• Signs of uterine rupture may include[50,112-114]: o **Maternal:** tachycardia and signs of shock, impaired consciousness, 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 cardiotocograph (CTG), often prolonged, persistent fetal bradycardia (most consistent early indicator),[113] loss of fetal station • Be alert to presenting signs—uterine rupture may be challenging to diagnose given the presentation can overlap with other conditions[111] • Postpartum presentation often associated with[115,116]: o Pain, abdominal distension and persistent vaginal bleeding or minimal lochia o Signs of shock, hypotension, and tachycardia o Haematuria may occur if rupture extends into the bladder
Treatment	• if suspected intrapartum act to rapidly deliver baby and placenta • Initiate procedure for Category 1 CS o Urgently transfer to OT • Under anaesthetic: o Expeditious laparotomy[114] o Identify rupture site and confirm diagnosis o Repair rupture using double layer closure (particularly for women who may contemplate future vaginal births)[113] 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

8.2.4 Uterine inversion

Requires immediate treatment due to possibility of life-threatening haemorrhage and shock.

Table 27. Uterine inversion

Aspect	Consideration	
Risk factors	• Uterine structural anomalies[117] • Uterine over distension • Invasive placentation • Short umbilical cord/excessive umbilical cord traction • Tocolysis[118]	• Oxytocin use • Pre-eclampsia • Manual removal of the placenta • Applying fundal pressure before separation of placenta • Prolonged labour
Presentation	• Severe lower abdominal pain • Hypovolaemic shock disproportionate to revealed blood loss[117] o Be alert to profound bradycardia and hypotension • Sudden onset of PPH, secondary to inadequate uterine contraction • Protrusion of uterus (bluish grey mass) through cervical or vaginal orifice • Irregularly shaped or absent palpable fundus[117]	
Diagnosis	• Perform bimanual examination to detect[117,118]: o Depression at the uterine fundus o Prescence of a smooth round mass protruding from the cervix or vagina, either visible or felt on pelvic examination	
Management	• Urgently replace the uterus into correct anatomical position • If oxytocin infusing, cease as replacement requires relaxed uterus[117] • If placenta in situ, cease attempts to deliver and leave in place for manual removal in OT[3,117] • Drugs may relax the cervical ring to facilitate replacement[3,118] o Glyceryl trinitrate (GTN) 400 micrograms spray o Terbutaline 250 micrograms subcutaneous or IV o Magnesium sulphate 4 g IV infusion over 5 minutes • Treat neurogenic and/or hypovolaemic shock[117]	
Manual reduction	• Perform promptly[117,118]: o Grasp protruding fundus with palm of hand o Direct fingers toward posterior fornix and lift uterus into vagina o Push the uterine fundus along long axis of vagina toward the umbilicus • Once reinverted, maintain bi-manual compression • Start uterotonic therapy to contract uterus and prevent re-occurrence[3] • Refer to Appendix A: Uterine atonia interventions	
Hydrostatic reduction	• Exclude uterine rupture • Lie woman flat or head slightly down, or in lithotomy • Commence manual reduction until fundus in vagina • Have assistants bring labia into firm apposition to create a vaginal seal, alternatively use a ventouse cup if available • Using IV tubing, infuse warm saline into vagina to create increased intravaginal pressure[117] • Uterus gradually returns to its correct position over 10–15 minutes • May require up to 5–6 L of warm saline[117]	
Surgical intervention	• If manual reduction and/or hydrostatic repositioning unsuccessful, or hemodynamic instability, promptly transfer to OT[117] • Under anaesthetic give tocolytic agent to relax uterus and cervix[118] • Apply *gentle* manual pressure to the uterine fundus and return it to the abdominal position • If a dense constriction ring occurs, may require laparotomy to allow vaginal and abdominal manipulation of fundus[117] o Place clamps on uterine round ligaments and apply upward traction o Use deep traction suture to manipulate fundus and to maintain positioning once retracted • If placenta in situ, reposition uterus then manually remove to limit PPH • Immediately start uterotonic therapy to prevent reoccurrence[118] • Assess uterine tone and consider intrauterine balloon tamponade • Monitor to detect re-occurrence	

8.3 Tissue

Table 28. Tissue

Aspect	Consideration
Trailing membranes	• Use sponge forceps to clamp membranes extending beyond introitus[119] • Without traction, roll forceps to create a rope of membranes[119] 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 additional membranes present, attempt delivery with fingers or forceps o If large amount of membranes retained—transfer to OT for manual removal • Observe uterine tone and blood loss—be alert to a slow steady trickle
Retained placenta	• Encourage maternal pushing and upright positions that promote gravity to assist delivery • Confirm prophylactic third stage uterotonic has been given • Insert in/out urinary catheter or indwelling catheter • Reattempt controlled cord traction (CCT) and consider additional oxytocin (10 International units IV or IM)[2,80] • Check if risk factors for abnormal placentation • If available, portable ultrasound may assist uterine cavity exploration[3,120] • If placenta appears trapped, perform a vaginal examination to firmly grasp and bring through cervix and introitus[120] o Post delivery of placenta, massage fundus to promote sustained uterine tone[119,120] • If placenta unable to be delivered after above steps, transfer to OT for manual removal[2,120]: o Consider oxytocin infusion if placenta retained and excessive bleeding[43] o Consider bimanual compression while awaiting and during transfer[43,121,122]
Manual removal under anaesthesia	• Consider ultrasound guidance during procedure[14] • Provide anaesthetic/analgesia for uterine exploration and manual removal of placenta[43] • If manual removal unsuccessful, apply gentle curettage with a large blunt curette[44] • Post procedure: o Explore the uterine cavity to verify it is intact and empty o Check for cervical, vaginal, and perineal trauma and repair as required o Check haemostasis achieved • Recommend uterotonic drugs to promote uterine contractions[2] • Consider the need for intrauterine balloon tamponade[3,119] o Refer to Section 9.1 Mechanical treatment of intractable bleeding • Recommend a single dose of antibiotics[2,120] (ampicillin or first generation cephalosporin)[80]
Unexpected placenta accreta	• If placenta does not separate after birth of the baby, placenta accreta spectrum disorder (PAS) may be present[123] o Do not attempt to forcibly remove the placenta[123] • Individualise care, no single standard treatment for PAS[124,125]: o Conservative approach—uterine preservation techniques (e.g. surgical resection) may be considered dependent on degree of invasion and pelvic hypervascularity[123,124] o Radical treatment—prompt hysterectomy may be necessary[4,120,125] ▪ Refer to Section 9.2 Surgical treatment of intractable bleeding
Not recommended	• Use of controlled cord traction (CCT) in the absence of uterotonic drugs or prior to signs of placental separation[2] • Ergometrine—as tetanic contractions may delay placental expulsion[43,80] • Prostaglandin E2 alpha (dinoprostone)[43,80] • Oxytocin IV infusion to assist the birth of the placenta[2,43] • Use of umbilical vein for oxytocin injection[43,120] and/or misoprostol[80]

8.4 Thrombin

Coagulopathy risk assessment should include consideration of obstetric conditions and aetiology of PPH, not just estimation of blood loss.[91,99] If coagulopathy is suspected, consult with a haematologist or transfusion specialist for advice on blood component replacement, laboratory monitoring and result interpretation.[41]

8.4.1 Coagulopathy principles

Remain cognisant that coagulopathy can occur at any stage of a PPH, and often co-occurs with other causes.[1,10]

Table 29. Coagulopathy principles

Aspect	Consideration
Clinical presentation	• Physiological, biochemical and metabolic derangement[1] o Refer to Table 31. Laboratory values • Be alert to differing presentations of coagulopathy of PPH and use clinical judgement to treat accordingly[99,126]: o Dilutional coagulopathy associated with significant blood loss, massive transfusion of blood products and high-level IV fluid replacement o Localised consumption (e.g. placenta abruption) o Generalised systemic coagulation failure with widespread clotting abnormalities (e.g. amniotic fluid embolism) o Acute obstetric coagulopathy characterised by severe hyperfibrinolysis and dysfibrinogenemia ▪ Diverse causes of bleeding and can present in various situations[127]
Communication with laboratory	• Inform if PoC blood clotting analyser (ROTEM®/TEG®) is being used • Notify of impending arrival of urgent blood samples[16] • Communicate clearly the need for *emergency* provision of blood and blood components[16] • Identify minimum time till blood product availability, include transport time
Laboratory monitoring	• Baseline collection and processing of[1,17]: o FBC o Blood group cross match o Full chemistry profile (Chem20) [refer to Definitions] o Venous/arterial blood gas (includes calcium and lactate) o Coagulation profile (PT, INR, aPTT, fibrinogen) • Monitor FBC, coagulation profile, calcium and ABG every 30–60 minutes depending on severity of the bleeding, or until bleeding stops, and at least every 4 units of RBC[1,128] o Repeated testing, comparison of results and reassessment are vital to management[128] • If PoC blood clotting analyser (ROTEM®/TEG®) available, follow local algorithm for targeted replacement • Refer to Table 31. Laboratory values
Avoid hypothermia and acidosis	• Optimise body temperature[1] (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 every 15 minutes • 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')[2]
Hypocalcaemia	• Monitor and correct calcium levels[2,129] • Provide calcium supplementation at least every 4 units of RBC, or if ionised calcium less than 1 mmol/L[130] o Citrate from transfused blood often causes hypocalcaemia[129] • Recommend 10% calcium gluconate 10 mL IV [130]
Disseminated intravascular coagulation (DIC)	• Be alert to early DIC characterised by falling platelets and fibrinogen levels and rising fibrin degradation products[99] • Associated with placental abruption, amniotic fluid embolism, severe pre-eclampsia or HELLP (haemolysis, elevated liver enzymes and low platelets) syndrome; acute fatty liver of pregnancy; fetal death in utero; septicaemia, dilutional coagulopathy

8.4.2 Correction of coagulopathy

Table 30. Correction of coagulopathy

Aspect	Consideration
Context	• Give RBC in response to haemodynamic changes and estimated blood loss rather than Hb trigger—do not wait for blood results to treat[17,41,99]: 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
Blood product replacement	• If PoC blood clotting analyser (ROTEM®/TEG®) available, use PoC guided correction as per locally agreed algorithm[2,91,99] o Targeted blood and blood product replacement • If PoC blood clotting analyser not available, transfuse blood components as per locally agreed ratio-based configuration[1] o Be guided by laboratory findings • No strong evidence for optimal blood product transfusion ratio[1,3] • Aim for red blood cell (RBC):fresh frozen plasma (FFP):platelet ratio of at least 2:1:1[1] o Equates to at least 1 unit of FFP for every 2 units of RBC, and 1 adult dose of platelets (equivalent to 4 donor units) for every 8 units RBC[1] • Promptly achieve ratio and maintain until bleeding controlled[1] • FFP administered before haemostatic testing may be justified for placental abruption, amniotic fluid embolism or delayed PPH recognition[99] • Evidence suggests early FFP transfusion (i.e. within first 60 minutes) not associated with adverse maternal outcomes when compared with no or late plasma transfusion[131] • During active PPH, if platelets less than 75 x 10^9/L transfuse to maintain target of 50 x 10^9/L[103,126] • Assess fibrinogen and replace as required[1] • Blood products frequently issued from blood bank as ‘packs’ to avoid over provision, over transfusion or waste of blood products[132]
Fibrinogen replacement	• Fibrinogen deficiency, not thrombin, is the main indicator of haemorrhage severity[98,133] • Fibrinogen is the first coagulation factor to decrease and may be low despite normal PT/aPTT[98,99] • Pregnancy is associated with hypercoagulability[95-97] o Fibrinogen in pregnancy 4–6 g/L, compared to 2–4 g/L non-pregnant[134] • Fibrinogen level less than 2 g/L is a positive predictor for progression to severe PPH[95,98,99,135] • Monitor fibrinogen early and use timely replacement therapy[2] • Request Clauss or clottable fibrinogen laboratory test o More reliable than derived fibrinogen assays (e.g. prothrombin time)[41] • If PoC blood clotting analyser available, replace fibrinogen when: o ROTEM® FIBTEM A5 less than 12 mm[2,91,95,134] o TEG® CFF A10 less than or equal to 17 mm[136,137] • Replace fibrinogen if less than or equal to 2.5 g/L[41,133,134] • Earlier use may be indicated—use clinical judgement, consider[41,133,138]: o Volume, rate, and nature of bleeding (e.g. greater than 1–1.5 L) o Suspicion of coagulopathy o Access to timely laboratory testing o Availability of resources • Recommended fibrinogen replacement: o 3–4 g of fibrinogen concentrate *or* 10 units of whole blood cryoprecipitate *or* 4 units of apheresis[1] • Replacement achieved faster with fibrinogen concentrate when compared with cryoprecipitate[139] • Fibrinogen concentrate use in PPH is considered off label[1]

8.4.3 Laboratory values

Measure the following parameters early and frequently. With successful treatment, values should trend toward normal.[38,41,140]

Table 31. Laboratory values

Investigation (gestation)	Reference range	Units	Critical physiologic derangement
Hb (25–42 weeks)	98–137	g/L	less than 70
Platelets (> 25 weeks)	150–430	x 10^9/L	less than 50
APTT (Adult)	25–38	seconds	greater than 1.5 x normal
INR (Adult)	0.9–1.2	Result is a ratio	greater than 1.5 x normal
Prothrombin time (Adult)	9–13	seconds	
Fibrinogen (by term)	5–6	g/L	less than 2.0
Ionised calcium	1.15–1.32	mmol/L	less than 1
pH	Arterial 7.35–7.45 Venous 7.32–7.43		less than 7.2
Lactate	0.5 – 2.2	mmol/L	greater than 4
Base excess	greater than minus 6	mmol/L	less than minus 6

8.4.4 Cross matched RBC not available

Take blood for cross matching prior to giving O negative RBC—do not wait for results.[16]

Table 32. Blood cell replacement

Aspect	Consideration
No blood group and antibody screen	• Send blood for urgent group and antibody testing • Request compatible blood • Transfuse O negative RBC (ideally Kell negative)[44]
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

9 Intractable bleeding

Uterine atony is a leading cause of intractable bleeding that does not respond to first line interventions, first and second line uterotonics, and requires mechanical or surgical interventions to control.[102,141,142]

Initiate life-saving mechanical and/or surgical interventions early[13]:

- Selection of procedure is best determined based on cause of bleeding, clinical expertise, service capabilities and individual clinical circumstances[13]
- Treat coagulopathy concurrently [refer to Section 8.4.2 Correction of coagulopathy]

Table 33. Intractable bleeding

Aspect	Consideration
Persistent bleeding	• Urgently identify the source and cause of bleeding[1] o If uterus atonic, apply bimanual compression[102] [refer to Appendix A: Uterine atonia interventions] • Increase monitoring of observations guided by clinical judgement[13] • Initiate blood component replacement as soon as possible • Review criteria for: o MHP activation [refer to Section 10 Major haemorrhage] o PoC blood clotting analysis (if available)
Transfer to operating theatre	• If urgent transfer to OT required o Transfer woman flat with high-flow oxygen
In theatre preparation	• Provide warmth to facilitate clotting[2] o Warm blood and IV fluids o Warm OT environment and consider external warming device • Apply pneumatic calf compression device to reduce risk of venous thromboembolism (VTE) • Involve the most experienced staff (consider external consultations if necessary) including obstetrician and anaesthetist • Where expertise available consider cell salvaging[2,39]

9.1 Mechanical treatment of intractable bleeding

Table 34. Mechanical procedures

Aspect	Consideration
Context	• Under anaesthetic check uterine cavity is empty and intact • Confirm source of bleeding is uterine atony
Intrauterine tamponade balloon	• If bimanual compression has been effective, consider intrauterine balloon tamponade (e.g. Bakri®)[13,16] [refer to Appendix A: Uterine atonia interventions] • Provides an efficient treatment option for uterine atony[17,102] • After insertion, assess blood loss: o If bleeding continues, balloon tamponade may be ineffective—review aetiology of PPH, check balloon placement[10] and consider surgical interventions[17,132] o If bleeding ceases on insertion, monitor fundal height, uterine cramping and signs of increased blood loss regularly[143] • Assess drainage port for cumulative blood loss regularly • Increasing uterine size with no drainage from balloon may indicate blocked drain and/or bleeding within uterine cavity o If blocked drain, flush port to clear clots o If bleeding suspected, assess woman's haemodynamic stability and consult obstetrician[143] • Concurrently monitor coagulation, ideally with TEG® or ROTEM® o If coagulopathy present, liaise early and closely with anaesthetic staff • Commence broad spectrum antibiotics • Continue or commence oxytocic infusion after insertion
Uterine packing	• Weak evidence suggests uterine packing not recommended for the management of uterine atony as can conceal bleeding[80]—use clinical judgement

9.2 Surgical treatment of intractable bleeding

Table 35. Surgical procedures

Aspect	Consideration
Context	• If critically bleeding, treat the coagulopathy concurrently[10] • 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 and maternal condition o Use hot packs intra-abdominally • Closely monitor haemostasis after any surgical procedure and consider appropriate transfer to intensive or high dependency units[16,17]
Haemostatic uterine suture (e.g. B-Lynch suture)	• Use to treat uterine atony[132] • Laparotomy[132] or hysterotomy[10] is required to place absorbable suture • May be considered appropriate where active bleeding can be controlled while preparing for surgery[17] • May reduce the need for hysterectomy[132] • Refer to Appendix A: Uterine atonia interventions
Uterine or internal iliac artery embolisation	• If blood pressure stable, consider selective uterine or internal iliac artery embolisation[10,44] • Indicated for bleeding after vaginal or CS birth, or complications due to surgery[44] • Requires interventional radiologist and necessary infrastructure[44] • Highly effective, 87–95% success rate based on no need for hysterectomy or other invasive procedures[10,44,102]
Utero-ovarian artery ligation	• Consider when compression or tamponade unsuccessful • Use to temporarily slow blood flow to the uterus, not obliterate it[44] • Fertility preserving surgical technique[10] • Can involve ligation of one or both uterine arteries, lower uterine arteries or one or both ovarian arteries[16] with absorbable suture[44] • Success rate of 42–88% for control of bleeding[10] • Refer to Appendix B: Surgical ligation procedures
Internal iliac artery ligation	• Consider in cases where rapid control of PPH is required[10] and compression or tamponade unsuccessful • Only consider if appropriate clinical expertise is available (e.g. onco-gynaecologist, vascular surgeon)[16] • Consider if fertility preservation is important[132] • May be used as a preventative measure or after a hysterectomy with persistent bleeding[10,132] • Refer to Appendix B: Surgical ligation procedures
Hysterectomy	• May be necessary in cases of uterine rupture, abnormal placentation, or when other measures have ineffectively controlled bleeding[132] • Judiciously apply aortic compression (below the level of the renal arteries) as a temporising measure[17] • Perform early if life is threatened[17,44] • Decision to proceed should be made by an experienced consultant clinician and preferably discussed with a second experienced clinician[2,16]

10 Major haemorrhage

Reduction of morbidity and mortality associated with critical bleeding can be achieved through[1]:

- Early detection and a rapid, coordinated multidisciplinary approach to control the haemorrhage, correct coagulopathy and normalise physiological parameters
- Implementation of a major haemorrhage protocol (MHP) that is reviewed annually by local key stakeholders
- A structured approach that includes laboratory escalation procedures for timely delivery and administration of blood components
- For further considerations, refer to Table 36. MHP considerations

10.1 Major haemorrhage protocol considerations

Table 36. MHP considerations

Aspect	Consideration
Activation criteria	• Woman is actively bleeding with one or more of the following[1]: o Major obstetric haemorrhage (i.e. greater than 2500 mL)[2,142] o Actual or anticipated requirement of greater than or equal to 5 units of RBC in four hours o Haemodynamic instability o Clinical or laboratory evidence of coagulopathy • In low resource settings as per locally developed protocol
Roles and communication	• Senior clinician[1]: o Identifies need and activates MHP o Contact specialist staff according to local setting (e.g. laboratory/blood bank, anaesthetist, haematologist, surgeon, interventional radiologist). o Contact RSQ early for transfer advice as required • Laboratory staff[1]: o Prepares (i.e. thaws) and issues blood components o Provides group specific blood components as soon as possible o Anticipates additional blood component requirements o Considers staff resources o Liaises with haematologist • Haematologist: o Consults on blood component and other therapies o Assists with result interpretation
Co-ordination of blood component and other therapies	• Recommend early use of Tranexamic acid[1] o Refer to Section 7.2 Tranexamic acid • Pre-designate: o Dose, timing and ratio of blood component therapy o Triggers for administration of fibrinogen replacement therapy and calcium gluconate o Refer to Section 8.4 Thrombin
Laboratory testing	• Pre-designate: o Baseline blood tests for collection on activation of MHP ▪ Refer to Table 29. Coagulopathy principles o Critical targets for results ▪ Refer to Table 31. Laboratory values
PoC blood clotting analyser algorithm	• If PoC blood clotting analyser (e.g. ROTEM®/TEG®) being utilised, agree on an algorithm relevant to local conditions that aids: o Correct specimen collection o Interpretation of results o Blood and blood product replacement therapy triggers o Retesting requirements o Identification of the location of the PoC blood clotting analyser o When to access expert advice • Refer to Section 7.3 Point of care blood clotting analysers
PoC testing obstetric specific reference ranges	• Significant variation in reference ranges exist between the pregnant and non-pregnant population[144,145] • Inclusion of obstetric specific reference ranges can optimise management of major obstetric haemorrhage[97,134,145] • ROTEM® o Gestational diabetes and body mass index do not change hypercoagulability of pregnancy[146,147] • TEG® o No widely accepted and utilised TEG® reference ranges for pregnancy[95,148] • Refer to Appendix E: PoC testing obstetric specific reference ranges
Deactivation	• If bleeding controlled, senior clinician contacts laboratory/blood bank staff to deactivate MHP[1] • Continue with targeted optimisation of coagulation, ongoing assessment and correction of physiological and biochemical parameters • Return unused blood products to laboratory/blood bank

11 Women who cannot receive a blood transfusion

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.[41,149]

Table 37. Blood products declined

Aspects	Risk reduction measures
Jehovah Witnesses	• Women vary in their choice, therefore establish individual preferences[149] • Generally, will not accept: o Whole blood or any of its four major components (RBC, platelets, white blood cells and plasma)[150] o Use of any blood sample for blood cross-matching[151] o Autologous blood transfusion, but some women may accept blood in a continuous loop (e.g. cardiopulmonary bypass, haemodialysis, intraoperative cell salvage)[150] • Generally, will accept: o Recombinant products such as erythropoiesis stimulating agents and granulocyte colony-stimulating factors o Pro-thrombotic drugs such as tranexamic acid o Intravenous iron[149] • Some accept blood fractions/derivatives (e.g. albumin solutions, coagulation factors, globulins, fibrinogen concentrate)
Plan care	• Document woman's preferences clearly, ideally during the antenatal period[39] • Clarify what constitutes unacceptable treatment in relation to blood products and fluid resuscitation management[39,149] • Recommend and discuss [41]: o Planned location of birth o Optimisation of antenatal haemoglobin o Early treatment for any degree of anaemia[150] o Identification of placental site o Active management of third stage of labour o Risk of uterine atonia associated with longer duration of active labour, oxytocin in labour and operative/assisted birth[24,33,152] o Risks and benefits of potential management options o Advance Health Directive[151] and place a certified copy in the medical record • Refer to Table 6. Antenatal risk management • Refer to Section 4.1 Third stage • If blood products declined, 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, and consult with haematologist as required[149] • Consider the need for pharmacological, mechanical and surgical procedures to control bleeding early[39,150] • Hysterectomy is the definitive procedure to minimise life-threatening haemorrhage when transfusion is not an option[41] • 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 salvage (if skilled team available and acceptable as a treatment)[39,41,150] particularly if blood loss is anticipated to be significant

12 Postnatal care after PPH

Table 38. Postnatal care

Aspects	Consideration
Inter-hospital transfer	• Transfer early, contact RSQ on **1300 799 127**
Haemodynamic state	• Transfer to high dependency/intensive care unit for observation[16] • If condition not critical o Observe in birth suite for two hours, transfer to postnatal unit if stable 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 • Offer treatment for postpartum anaemia—contributes to fatigue, postpartum depression, poor infant bonding and poor lactation[44] • If Hb less than 70 g/L and/or symptomatic offer RBC transfusion[2,41] 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, asymptomatic and no continued threat of bleeding, offer parenteral iron therapy or oral therapy with vitamin C supplement on an individual basis[39,41] • Provide information on ways to increase dietary iron
VTE	• Consider mechanical and pharmacological VTE prophylaxis as increased risk following PPH[2,17] • Encourage early mobilisation and avoid dehydration • Refer to Queensland Clinical Guideline: *Venous thromboembolism (VTE) prophylaxis in pregnancy and the puerperium*[153] • Observe for VTE
Mother-infant interaction	• Support maternal and infant bonding o Facilitate regular skin-to-skin contact with supervision • Support infant feeding and offer lactation support as required o If unable to lactate or persistent hypotension, consider Sheehan's syndrome • Discuss risks of co-sleeping and bed sharing due to anaemia related fatigue [refer to Queensland Clinical Guideline: *Safer infant sleep*[154]]
Debriefing	• Offer the woman and family debriefing/clinical disclosure by senior team member(s), preferably by clinicians who were at the event[16,155] • Offer additional opportunities for discussion/debrief six weeks postpartum • Offer information about possible psychological and psychosocial responses following PPH (e.g. flashbacks, anxiety, depression, post-traumatic stress, relationship stress) and provide support resources[155] • Offer social worker review
Preparation for discharge	• Advise anticipate a longer physical recovery and possible issues with initiation and maintenance of exclusive breastfeeding[155,156] o Particularly if severe or major haemorrhage, or a blood transfusion • Communicate a comprehensive discharge summary to other health care providers o Consider personal contact (e.g. telephone) with the General Practitioner (GP) prior to discharge • Encourage follow up with GP (e.g. monitor Hb, lactation, mental health) • Encourage ongoing assistance from family and friends during recovery[155] • Educate about signs, symptoms and self-referral to GP regarding: o Persistent or increasing bleeding o Infection and risk of secondary PPH o Postnatal depression o Venous thromboembolism (VTE) • Referral to local Child Health services for ongoing lactation support and close follow up in view of anaemia and postnatal depression risk • Offer advice regarding bowel regularity 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

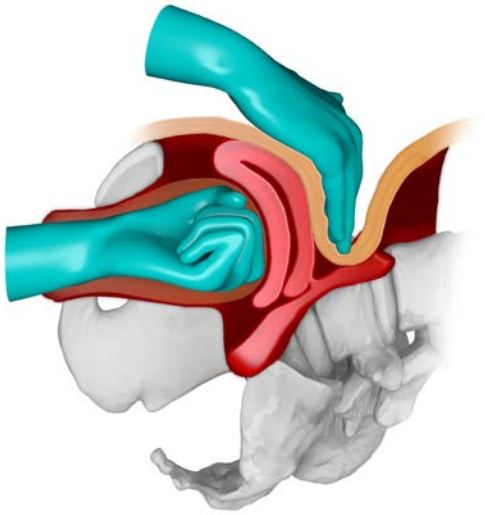


Image provided by the Clinical Skills Development Service, Metro North Health

- Consider early if
- Bimanual compression of the uterus vaginally and abdominally
- Vaginally—Keep fingers straight and thumb tucked across palm, 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
- Abdominally—Identify the uterine fundus
  - Deeply palpate to situate fingers behind the fundus
  - Cupping the fundus compress it firmly around the intravaginal fist

Maintain compression until uterotonics take effect or surgical intervention initiated

Intrauterine balloon tamponade

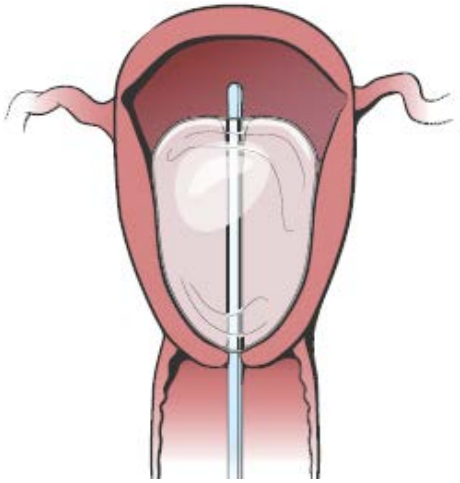


Image provided courtesy of CooperSurgical, Inc.

- Empty uterine cavity of clots and insert balloon portion of catheter through the cervix into uterine cavity. Balloon must be completely inside uterus
- Inflate the balloon with sufficient volume of **warm** sterile saline (approximately 250–500 mL). Do not fill with more than 500 mL
- Uterus should be firm with minimal blood loss
- Ultrasound can confirm balloon correctly placed
- Monitor blood loss through drainage portal for tamponade effect
- Recommend prophylactic broad-spectrum antibiotics while in place
- Consider oxytocin infusion post insertion to maintain uterine tone
- Closely monitor vital signs, urine output, bleeding, and uterine cramping
- Maximum indwelling time is 24 hours

Removal either all at once or slowly, no evidence to favour either approach

B-Lynch compression suture

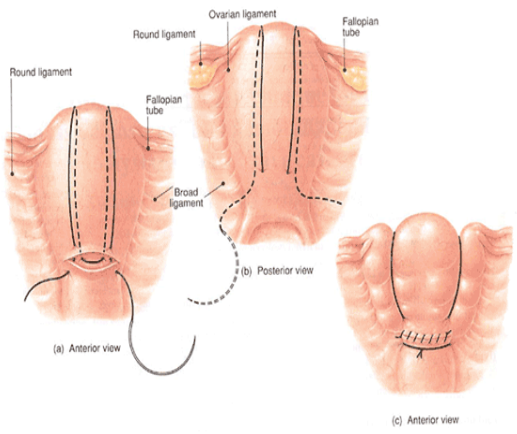


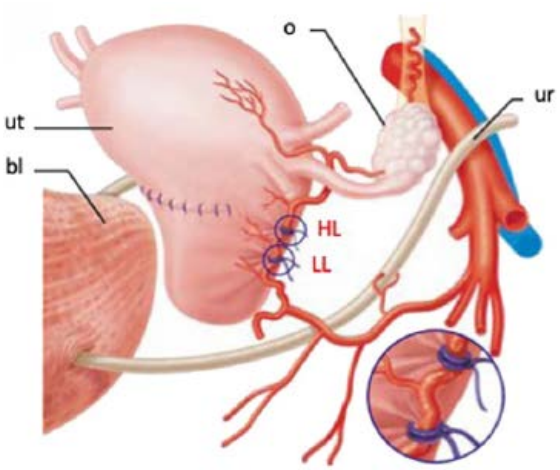
Image reproduced with permission from Wiley. B-Lynch C, Coker A, Lawal A, et al. The B-Lynch surgical technique for the control of massive postpartum haemorrhage: an alternative to hysterectomy? Five cases reported. BJOG 1997; 104:372–375

- (Re) open the abdomen and (re) open the uterus
- Check the uterine cavity for bleeding sites that might be oversewn or retained products
- 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

Appendix B: Surgical ligation procedures

Ligation of the uterine arteries

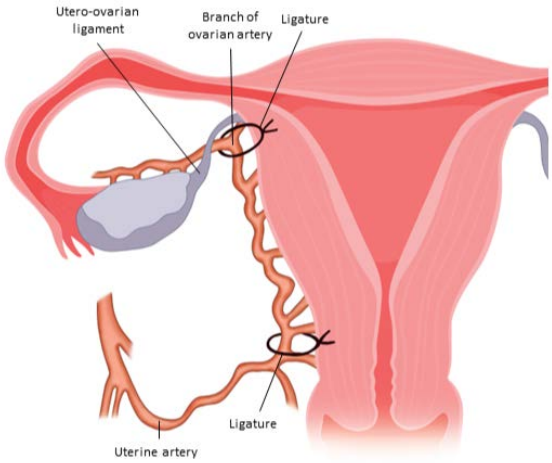


- Perform transabdominally
- Use absorbable suture
- Firstly place the high ligation on the ascending uterine artery
- A second low ligation can be performed 2–3 cm below to occlude the branches feeding the cervix
- Double ligation of each uterine artery reduces the risk of ineffective ligation

Bilateral ligation is ligation of arteries on both the left and right sides of the uterus

HL: high ligation of the uterine arteries; LL: a second low ligation 2–3 cm below the first; o: ovary; bl: bladder; ut: uterus; ur: ureter
Image reproduced with permission from Elsevier Ltd. Bouchghoul. Uterine-sparing surgical procedures. Am J Obstet Gynecol 2024

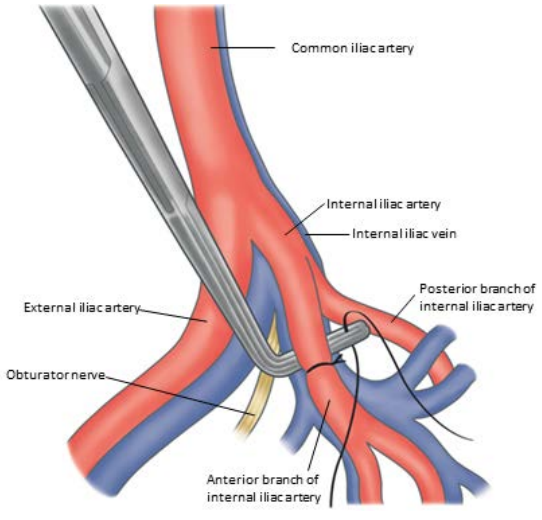
Uterine and ovarian artery ligation



- Progressive uterine devascularisation, involving a stepwise ligation approach
- Ligate the ascending branch of one of the uterine arteries
- Follow with ligation of the contralateral artery
- Then ligate the uterine branch of one of the ovarian arteries
- Follow with ligation of the contralateral branch
- The sequence stops as soon as haemorrhage is controlled

Uterine blood flow is maintained through anastomoses from the vesical and rectal arteries

Internal iliac artery ligation



- Ligation of the anterior branch of the internal iliac artery
- Demonstrates the vulnerability of the internal iliac vein and obturator nerve in proximity

Appendix C: Prophylactic uterotonics

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

Drug/Product	Dose/Route	Reconstitution	Maximum	Comments
Oxytocin	*Vaginal birth* 10 International units IM/IV. IV injected slowly over 3–5 minutes	Nil	Repeat dose not recommended	Requires cold-chain storage Avoid rapid IV bolus
	Caesarean section birth 3–5 International units IV over 1–2 minutes	Nil	10 International units IV as a slow bolus	
Syntometrine®	Oxytocin 5 International units/Ergometrine maleate 500 micrograms (per 1 mL) IM	Nil	Repeat dose not recommended	Requires cold-chain storage Administer with anti-emetic May cause severe hypertension Contraindicated with retained placenta, pre-eclampsia
Carbetocin	100 micrograms IM/IV	Nil	Repeat dose not recommended	Heat-stable formulation does not require cold-chain storage Not recommended for use with GA Modified to increase half-life, duration of action and heat stability Half-life 40 minutes, compared with 3–17 minutes for oxytocin Higher index cost when compared with oxytocin
Misoprostol	600 micrograms sub lingual	Nil	Repeat dose not recommended	Use when other uterotonics are not available Heat-stable, does not require cold-chain storage Absorbed 9–15 minutes after sublingual, oral, vaginal or rectal use Oral and sublingual routes have rapid onset Vaginal and rectal routes offer prolonged activity Can take 1–2.5 hours to increase uterine tone

Appendix D: Drugs and blood products for PPH treatment

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

Drug/Product	Dose/Route	Reconstitution	Maximum	Comments
Tranexamic acid	1 gram undiluted IV over 10 minutes	Nil required	If bleeding persists after 30 minutes or stops and restarts within 24 hours of first dose, can give a second 1 gram dose	Rapid administration may cause hypotension, dizziness Use infusion device/pump
Oxytocin	10 International units IM	Nil		May repeat as first line treatment if delayed IV access
	5 International units IV over 1–2 minutes	Nil	May repeat after 5 minutes to maximum dose of 10 International units	
	5–10 International units per hour IV via infusion pump	Oxytocin 30 International units in 500 mL sodium chloride 0.9%. Infuse at 83–167 mL/hour via infusion pump		Check for complete expulsion of placenta
Ergometrine	250–500 micrograms IV over 1–2 minutes	Dilute 250 microgram (0.5 mL) up to 5 mL with sodium chloride 0.9% (Concentration equals 50 microgram per mL)	May repeat 5 minutely to maximum dose of 1 mg	Administer with anti-emetic May cause severe hypertension Contraindicated with retained placenta, pre-eclampsia
	250-500 micrograms IM	Nil		
Misoprostol	800–1000 microgram per rectum	Nil	Repeat dose not recommended	Use when other uterotonics are not available or ineffective
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	3–4 gram 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	Inject slowly via IV injection or IV infusion device/pump Dose per vial approximately 1 g 1 gram of fibrinogen replacement increases fibrinogen by 0.25 g/L
Cryoprecipitate	One adult standard dose IV is equivalent to10 whole blood or four apheresis units	Stored frozen Defrost over 30 minutes before administration	Unknown	Derived from 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

Appendix E: PoC testing obstetric specific reference ranges

Reference ranges for ROTEM® parameters

	Reference range		
Parameter	**Non-labouring pregnant woman**[97]	**Labouring women**[144]	**Non-pregnant population**[145]
FIBTEM Parameters			
A5 (mm)	13–28	14–33	9–25
A10 (mm)	14–30	15–37	
MCF (mm)	16–34	16–40	
EXTEM Parameters			
CT (sec)	43–69	40–65	42–74
A5 (mm)	39–66	44–67	63–81
A10 (mm)	50–73	56–74	49–71
MCF (mm)	60–78	63–77	
INTEM Parameters[#]			
CT (sec)	115–245	118–222	137–246
A5 (mm)	38–63	43–65	

A5: amplitude (firmness) at 5 minutes; A10: amplitude at 10 minutes; CT: clotting time; MCF: maximum clot firmness
[#]*Most sensitive to heparin*

Reference ranges for TEG® 6S parameters

Parameter	**Reference range**	
MA CFF	Obstetric	16.63–40.15
	Manufacturer	15–32
A10 CFF	Obstetric	18.47–37.12
	Manufacturer	15–30
R Time (min) CK	Manufacturer	4.6–9.1
MA CRT	Manufacturer	52–70
Lysis at 30 minutes (%) CRT	Manufacturer	< 2.2

Source: Adapted from Crossland et al. International Society on Thrombosis and Haemostasis 2022. Abstract: Validation of clinical reference ranges for viscoelastometric assessment of haemostasis (TEG® 6S) and standard laboratory tests in obstetric patient[157]
A10: amplitude at 10 minutes; CFF: citrated TEG® functional fibrinogen; CK: Citrated Kaolin; CRT: citrated rapid TEG; MA: maximum amplitude

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