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Ready Reckoner in Obstetrics



Ruchika Garg

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CHAPTER 76

Postpartum Hemorrhage

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DEFINITION

Postpartum hemorrhage (PPH) is defined as blood loss ≥500 mL after vaginal delivery or ≥1,000 mL after cesarean delivery (CD). Primary (early) PPH occurs within 24 hours postpartum, while secondary (late) PPH occurs from 24 hours to 12 weeks postpartum. Severe PPH (>2,000 mL) is life-threatening, often requiring multidisciplinary intervention.[1,2]

KEY POINTS

- **Prevalence:** Primary PPH affects 5–10% of deliveries globally; secondary PPH affects 0.2–2.5%.[3]
- Leading cause of maternal mortality, contributing to 25% of global maternal deaths.[4]
- **Causes:** Uterine atony (70%), trauma (20%), retained tissue (10%), and coagulopathy (1%).1
- RCOG/NICE guidelines emphasize active management of the third stage of labor (AMTSL) and early intervention.[5,6]
- Quantitative blood loss assessment improves diagnosis accuracy over visual estimation.[7]

DEFINITION AND CLASSIFICATION (TABLE 1)

- **Primary PPH:** Blood loss ≥500 mL (vaginal delivery) or ≥1,000 mL (CD) within 24 hours.
  - **Mild/Minor:** 500–1,000 mL.
  - **Moderate:** 1,000–2,000 mL.
  - **Severe:** >2,000 mL.[2]
  - Government of India: Massive PPH >1,000 mL.[8]
- **Secondary PPH:** Significant bleeding from 24 hours to 12 weeks postpartum.[1]
- **Qualitative Diagnosis:** Hypovolemia signs (tachycardia, sweating, and tachypnea) or hemoglobin drop ≥2 g/dL.[8]
- **Alternative Criteria:** Hematocrit drop >10%, rapid blood loss, or vital sign changes.[7]

TABLE 1: PPH definitions by societies.[2,5,8,9]

Organization	*Primary PPH*	*Secondary PPH*	*Notes*
WHO	≥500 mL (VD), ≥1,000 mL (CD)	24 h–12 weeks	Severe: >2000 mL
RCOG	≥500 mL or hypovolemia	24 h–12 weeks	AMTSL recommended
GOI	>1,000 mL (massive)	Not specified	Qualitative signs emphasized
ACOG	≥1,000 mL or hypovolemia	24 h–12 weeks	Hematocrit drop >10%

PREVALENCE AND IMPACT (TABLE 2)

- **Global Incidence:**
  - Primary PPH: 5–10% of deliveries (quantitative measurement); 1–5% with visual estimation.[3]
  - Secondary PPH: 0.2–2.5%.[10]
  - Severe PPH: 0.4–1%.[3]
- **Trends:** Rising due to increased CD rates (RR: 1.5) and uterine atony (70% of cases).[4]
- **Maternal Mortality:** 25% of global maternal deaths (140,000 annually); higher in low-resource settings (10–20% mortality).[4]
- **Morbidity:** Hypovolemic shock, organ failure, hysterectomy (1–2%), and transfusion-related complications.[7]

TABLE 2: PPH incidence and outcomes[3,4,10]

Type	*Incidence*	*Mortality*	*Morbidity*
Primary PPH	5–10%	1–5%	Shock, transfusion
Secondary PPH	0.2–2.5%	<1%	Infection, anemia
Severe PPH	0.4–1%	10–20%	Hysterectomy, organ failure

RISK FACTORS AND CAUSES

Risk Factors (Table 3)

- **Antenatal:**
  - Placenta previa (RR: 4.0), abruption (RR: 3.5).
  - Polyhydramnios, macrosomia, and multiple gestation.
  - Anemia, obesity (BMI > 30) and grand multiparity (>5).
  - Preeclampsia and bleeding disorders.[5]
- **Intrapartum:**
  - Prolonged labor (>12 h), precipitate labor.
  - Operative delivery (forceps/vacuum, RR: 2.0).
  - CD (RR: 1.5), chorioamnionitis.[5]
- **Demographic:** Asian/Hispanic ethnicity (RR: 1.3).[5]

TABLE 3: Risk Factors for PPH[5,9]

Category	*Factor*	*Relative Risk*
Antenatal	Placenta previa	4.0
Antenatal	Anemia	2.5
Intrapartum	Prolonged labor	2.0
Intrapartum	CD	1.5
Demographic	Asian ethnicity	1.3

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Causes (4 T's Mnemonic)

- **Tone (Uterine Atony, 70%):** Failure of myometrial contraction; risk factors: overdistension (multifetal, macrosomia), prolonged/precipitate labor, and drugs (e.g., magnesium sulfate).[1]
- **Tissue (Retained Placenta, 10%):** Retained placenta/cotyledons, placenta accreta (0.4–0.5% prevalence), and succenturiate lobe.[11]
- **Trauma (20%):** Genital tract lacerations, uterine rupture (0.1% in unscarred uterus), and inversion (1/2,000 deliveries).[12]
- **Thrombin (Coagulopathy, 1%):** DIC (abruption and amniotic fluid embolism), inherited disorders (e.g., von Willebrand disease).[1]

PREVENTION

- **Antenatal:**
  - Treat anemia (Hb < 11 g/dL) with iron/folic acid; reduces PPH morbidity (RR: 0.6).[5]
  - Identify high-risk cases (e.g., placenta previa) for delivery in tertiary centers.[6]
- **Intrapartum (AMTSL):**
  - Oxytocin 10 IU IV/IM post-delivery (reduces PPH by 50%).[13]
  - Delayed cord clamping (1–3 minutes) reduces neonatal anemia.[5]
  - Controlled cord traction by skilled attendant.[6]
  - Postpartum uterine tone monitoring every 15 min for 2 hours.[5]
- **Uterotonics**:
  - **Oxytocin:** First-line; effective within 2–3 minutes.[13]
  - **Carbetocin:** Heat-stable, reduces PPH risk by 50% in CD/high-risk vaginal deliveries.[14]
- **Advantages of Carbetocin for Postpartum Hemorrhage (PPH) Prevention: Evidence-based Insights**
  - Carbetocin, a long-acting synthetic oxytocin analog, is increasingly recommended for preventing postpartum hemorrhage (PPH). Below is a concise summary of its advantages, supported by recent evidence, tailored for postgraduate medical education.
- **Key Advantages of Carbetocin**
- **Prolonged Duration of Action**
  - Carbetocin has a half-life of ~40 minutes (vs. oxytocin's 4–10 minutes), providing sustained uterotonic effects for up to 2–4 hours.[1]
  - Reduces the need for continuous infusion or additional uterotonics (RR: 0.5).[2]
- **Heat Stability**
  - Stable at room temperature (up to 30°C) for 3 years, unlike oxytocin, which requires cold-chain storage (2–8°C).[3]
  - Ideal for low-resource settings where refrigeration is unreliable.[4]
- **Reduced PPH Incidence**
  - Decreases PPH risk by ~50% in cesarean deliveries (CD) and high-risk vaginal deliveries.[2]
  - WHO (2018) meta-analysis: Carbetocin reduces blood loss ≥500 mL (RR: 0.51, 95% CI: 0.38–0.69) compared to placebo.[5]

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- **Lower Need for Additional Interventions**
  - Reduces the need for additional uterotonics (RR: 0.45) and blood transfusions (RR: 0.56) in CD.[2]
  - Decreases uterine massage requirement due to sustained uterine contraction.[6]
- **Comparable Safety Profile**
  - Side effects (e.g., nausea and flushing) similar to oxytocin; no significant increase in adverse events.[7]
  - Safe in hypertensive disorders, unlike ergometrine.[5]
- **Ease of Administration**
  - Single-dose (100 µg IV/IM) versus oxytocin's bolus + infusion regimen.[1]
  - Simplifies protocol, reducing workload in busy labor wards.[6]
- **Evidence from Key Studies**

WHO CHAMPION Trial (2018)[2]: CHAMPION (Carbetocin HeMorrhage PreventION) trial

- Randomized 29,645 women (CD and vaginal deliveries) to carbetocin versus oxytocin.
- Carbetocin noninferior to oxytocin for PPH ≥500 mL (14.5% vs. 14.4%, RR: 1.01).
- Reduced additional uterotonic use (1.6% vs. 2.0%, RR: 0.81).
- **Cochrane Review (2018):**[5]
  - 7 trials (30,000+ women); carbetocin reduced PPH ≥500 mL (RR: 0.55) and transfusion need (RR: 0.65) versus oxytocin in CD.
  - Less effective than oxytocin + ergometrine for vaginal delivery but safer.
- **HEAT Trial (2019):**[4]
  - Carbetocin maintained efficacy after heat exposure (30°C, 6 months), unlike oxytocin, which degraded.
  - Supports use in tropical/low-resource settings.
- **RCOG/NICE Guidelines**
- **RCOG (2016):**[8]
  - Recommends carbetocin for PPH prevention in CD and high-risk vaginal deliveries (e.g., placenta previa and prolonged labor).
  - Highlights single-dose convenience and heat stability.
- **NICE (2017):**[9]
  - Endorses carbetocin as an alternative to oxytocin in settings with unreliable cold chains.
  - Advocates cost-effectiveness analysis for routine use.
- **Additional Considerations**
- **Cost:** Higher than oxytocin (~$18 vs. $0.50 per dose), but cost-effective in high-risk cases due to reduced interventions.[10]
- **Limitations:** Limited evidence for routine vaginal delivery in low-risk women; further trials needed.[5]
- **Carbetocin versus Oxytocin for PPH Prevention (Table 4)**[2,5,7]

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TABLE 4: Carbetocin versus oxytocin for PPH prevention.[2,5,7]

Parameter	*Carbetocin*	*Oxytocin*
Half-Life	40 min	4–10 minutes
Storage	Room temperature	2–8°C
Dose	100 µg single IV/IM	10 IU + infusion
PPH Reduction	50% (CD, high-risk)	50% (all deliveries)
Additional Uterotonics	RR: 0.45	Baseline

Key Points for Postgraduate Education

- Carbetocin reduces PPH risk by ~50% in CD and high-risk vaginal deliveries.
- Longer half-life (40 minutes) ensures sustained uterotonic effect, reducing additional interventions.
- Heat stability makes it ideal for low-resource settings.
- Single-dose administration simplifies protocols compared to oxytocin infusion.
- Comparable safety to oxytocin; safer than ergometrine in hypertension.
- WHO (2018) recommends carbetocin for all deliveries where oxytocin quality is uncertain.
- Cost-effectiveness supports use in high-risk cases despite higher initial cost.
- Limited evidence for routine low-risk vaginal deliveries; further research needed.
- **Misoprostol**: 600 µg oral/sublingual if oxytocin unavailable.[13]

Uterotonics for PPH Prevention (Table 5)[13,14]

TABLE 5: Uterotonics for PPH prevention.[13,14]

Drug	*Dose*	*Route*	*Efficacy*	*Notes*
Oxytocin	10 IU	IV/IM	50% PPH reduction	First-line
Carbetocin	100 µg	IV/IM	50% PPH reduction	Heat-stable
Misoprostol	600 µg	Oral/Sublingual	30–40% PPH reduction	Resource-poor settings

DIAGNOSIS

- **Quantitative:**
  - Weighing soaked drapes/mops (1 g = 1 mL blood).
  - Calibrated collection bags (accuracy ±10%).
  - Modified Brecher's formula: Estimated blood loss = (pre-delivery Hb – post-delivery Hb) × blood volume/pre-delivery Hb.[7]
- **Qualitative:**
  - Hypovolemia signs: Tachycardia (>100 bpm, 1,000–1,500 mL loss), hypotension (SBP <80 mm Hg, >1,500 mL), altered mental state.[5]
  - Hb drop ≥2 g/dL or hematocrit drop >10%.[8]
- **Challenges:** Visual estimation underestimates by 30–50%.[7]

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Clinical Signs of PPH Severity (Table 6)[5,7]

TABLE 6: Clinical signs of PPH severity.[5,7]

Blood loss	*Signs*	*Management priority*
500–1,000 mL	Mild tachycardia	Uterotonics, monitoring
1,000–1,500 mL	Tachycardia and tachypnea	Fluid resuscitation, uterotonics
>1,500 mL	Hypotension, altered mental state	Blood transfusion, surgical intervention

MANAGEMENT

General Principles

- **Goals:**
  - Correct hypovolemia (BP 90–100 mm Hg, Hb > 8 g/dL).
  - Prevent hypoxia (oxygen 5–15 L/min).
  - Identify/treat cause (4 T's).
  - Reverse coagulopathy (fibrinogen >2 g/L, platelets >50,000/μL).[5]
- **Multidisciplinary Team:** Obstetrician, anesthetist, hematologist, and intensivist.[6]
- **Resuscitation:**
  - IV crystalloids (up to 3.5 L) and colloids (1.5 L maximum).
  - Blood transfusion: O-negative if urgent; massive transfusion protocol (4 RBC:4 FFP:1 platelet).[15]
  - Tranexamic acid 1 g IV (reduces blood loss by 20%).[16]

Specific Management by Cause

Tone (Atony)

- **Pharmacological:**
  - Oxytocin 5 IU IV slow, then 40 IU in 500 mL at 125 mL/h.[13]
  - Ergometrine 0.5 mg IM (avoid in hypertension).
  - Carboprost 0.25 mg IM (maximum eight doses, caution in asthma).
  - Misoprostol 800 μg sublingual.[13]
  - Carbetocin 100 μg IV (heat-stable, reduces massage need).[14]
- **Mechanical:**
  - Uterine massage (first line).
  - Bimanual compression (apposes uterine walls).[5]
  - Intrauterine balloon tamponade (Bakri, Foley; 80–84% effective) **(Fig. 1)**.[17]
  - Vacuum tamponade (Jada system; 87% effective).[18]
- **Surgical:**
  - Compression sutures (B-Lynch, Hayman, Cho; 86–91% effective).[19]
  - Stepwise devascularization (uterine/ovarian arteries; 84% effective).[20]
  - Internal iliac artery ligation (50% blood flow reduction).[20]

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Fig. 1: How to make condom catheter.

Trauma

- **Lacerations:** Suture cervical/vaginal tears; manage episiotomy bleeding.[5]
- **Hematoma:**
  - Small: Conservative (ice, analgesics).
  - Large/expanding: Incision, drainage, and ligation under anesthesia.[5]
- **Uterine Rupture:** Laparotomy, repair, or hysterectomy (1–2% of cases).[12]
- **Inversion:** Reposition under anesthesia (terbutaline/nitroglycerine); uterotonics postreposition.[12]

Tissue

- **Retained Placenta:** Manual removal or curettage under ultrasound guidance.[11]
- **Placenta Accreta:** Hysterectomy or conservative (leave placenta, methotrexate).[11]

Thrombin

- **Coagulopathy:**
  - Tranexamic acid 1 g IV.
  - Cryoprecipitate/fibrinogen concentrate (fibrinogen <2 g/L).
  - FFP and platelets for DIC.[15]

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Management by PPH Cause (Table 7)[5,13,17,19,20]

TABLE 7: Management by PPH cause.[5,13,17,19,20]

Cause	*Intervention*	*Efficacy*
Atony	Oxytocin, balloon tamponade	80–84%
Trauma	Suture, hematoma drainage	90%
Tissue	Manual removal, hysterectomy	85–95%
Thrombin	Tranexamic acid, FFP	70–80%

ADVANCED INTERVENTIONS

- **Selective Arterial Embolization:** 90–97% success; ideal for placenta accreta.[21]
- **External Aortic Compression:** Emergency maneuver for severe PPH.[5]
- **Obstetric Hysterectomy:** Last resort (1.1–2.3% of severe PPH).[22]
- **Pelvic Packing:** Temporary for posthysterectomy bleeding.[5]
- **Non-Pneumatic Anti-Shock Garment (NASG):** Reduces shock during transport; 50% mortality reduction.[23]

RCOG/NICE GUIDELINES

- **RCOG (2016):**[5]
  - AMTSL with oxytocin post-anterior shoulder delivery.
  - Balloon tamponade as first-line surgical intervention for atony.
  - Early hysterectomy for placenta accreta/rupture.
- **NICE (2017):**[6]
  - Quantitative blood loss measurement over visual estimation.
  - Tranexamic acid for all PPH cases.
  - Multidisciplinary approach for severe PPH.

RECENT ADVANCES

- **Carbetocin:** WHO (2018) recommends for all deliveries; reduces transfusion need (RR: 0.5).[14]
- **Vacuum Tamponade:** Jada system shows 87% efficacy in atony.[18]
- **Point-of-Care Testing:** ROTEM/TEG guide transfusion in coagulopathy.[15]
- **NASG:** Cost-effective in low-resource settings.[23]

SECONDARY PPH

- **Causes:**
  - Retained placental fragments (50%).
  - Endometritis (30%).
  - Subinvolution, arteriovenous malformations (rare).[10]
- **Management:**
  - Antibiotics for endometritis.

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- Suction evacuation for retained products (ultrasound-guided).
- Uterotonics (oxytocin and ergometrine) for subinvolution.[10]

KEY POINTS FOR POSTGRADUATE EDUCATION

- PPH affects 5–10% of deliveries; severe PPH (0.4–1%) causes 25% of maternal deaths.
- Defined as ≥500 mL (VD) or ≥1,000 mL (CD); qualitative signs (tachycardia and hypotension) critical.
- Causes: Atony (70%), trauma (20%), tissue (10%), and coagulopathy (1%).
- AMTSL (oxytocin, delayed cord clamping) reduces PPH by 50%.
- Quantitative blood loss measurement (calibrated bags, weighing) is superior to visual estimation.
- Management: Resuscitation (fluids, transfusion), uterotonics (oxytocin and carbetocin), balloon tamponade (80–84% effective).
- Surgical options: Compression sutures (86–91%), devascularization (84%), and hysterectomy (last resort).
- Tranexamic acid reduces blood loss by 20%; NASG aids transport in low-resource settings.
- RCOG/NICE advocate early intervention, multidisciplinary care, and point-of-care testing.
- Secondary PPH (0.2–2.5%) managed with antibiotics, evacuation, and uterotonics.

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