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Review Article

Postpartum haemorrhage – current perspectives on prevention and management

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ABSTRACT

Postpartum hemorrhage (PPH) remains the leading cause of maternal mortality worldwide, disproportionately affecting women in low- and middle-income countries, including India. Despite measurable advances in obstetric care over the past decade, delayed recognition, inconsistent application of the management ladder, and fragmented guidance across professional bodies have continued to contribute to deaths that are, in the overwhelming majority of cases, preventable. This review draws on the October 2025 consolidated guidelines issued jointly by the World Health Organization (WHO), the International Federation of Gynecology and Obstetrics (FIGO), and the International Confederation of Midwives (ICM) - the first time these three bodies have produced a single unified framework on the subject - together with landmark trial evidence accumulated over the last decade, to synthesize current understanding of the prevention, diagnosis, and treatment of PPH. It examines risk factors and their limited predictive value, the increasingly central role of antenatal anemia correction alongside active management of the third stage of labor, the stepwise escalation of treatment from uterotonics and tranexamic acid through uterine balloon tamponade to surgical intervention, and the particular relevance of low-cost tamponade devices developed for and validated in resource-limited Indian settings. A comparative summary table is included to consolidate the escalation pathway into a single visual reference. The review is intended as an accessible, India-contextualized reference for postgraduate trainees and practicing obstetricians.

Keywords: Postpartum hemorrhage, Uterine atony, Tranexamic acid, Uterine balloon tamponade, Maternal mortality, India

INTRODUCTION

Postpartum hemorrhage (PPH) has conventionally been defined by a fixed volume threshold: cumulative blood loss of at least 500 ml within 24 hours of vaginal birth, or 1000 ml or more following cesarean delivery. This threshold-based definition, while useful for research standardization, is a poor guide to bedside decision-making. Visual estimation of blood loss is notoriously unreliable and tends to systematically underestimate true losses; more importantly, individual physiological tolerance varies widely - a healthy, well-nourished woman may tolerate losses considerably above the defined threshold without compromise, whereas an anemic or already hypovolemic woman may decompensate well

below it. The emphasis in contemporary practice has consequently shifted away from waiting for a specific volume to be crossed, and toward triggering intervention at the earliest clinical signs of ongoing bleeding, tachycardia, or hypotension.¹

The global burden of PPH remains substantial: hemorrhage alone is estimated to account for over a quarter of all maternal deaths worldwide.² With the heaviest concentration of that burden in low-resource settings where blood transfusion services, skilled birth attendance, and timely referral pathways are constrained. In the Indian context specifically, PPH continues to be the single leading direct cause of maternal mortality and is estimated to complicate approximately 3-6% of all deliveries.³ This

burden is not merely a clinical statistic - in a country conducting close to 25 million deliveries annually, even a small percentage complicated by PPH translates into an enormous absolute number of women at risk, many of them in secondary-level or rural facilities where the full escalation ladder described later in this review may not always be immediately available.

On 05 October 2025, the WHO, FIGO, and ICM jointly released the first consolidated guidelines on the prevention, diagnosis, and management of PPH, bringing together what had previously been fragmented and occasionally conflicting recommendations from separate bodies into a single evidence-based framework.¹ The launch, timed to coincide with the inaugural world postpartum haemorrhage day, was explicitly framed by its authors not merely as a clinical update but as a health-equity intervention - an attempt to close the gap in outcomes between women who bleed in well-resourced tertiary centres and those who bleed in settings where recognition and response are slower.⁴ This shift in framing is itself clinically significant, and this review accordingly treats the equity dimension as inseparable from the technical management ladder, rather than as a separate policy discussion.

CLASSIFICATION AND RISK FACTORS

PPH is classified as primary or secondary according to the time of onset relative to delivery. Primary PPH, occurring within the first 24 hours postpartum, accounts for the large majority of cases and is the principal focus of this review. Secondary PPH develops between 24 hours and 6 weeks after delivery and is more commonly linked to retained products of conception, endometritis, or subinvolution of the placental site - entities that call for a different diagnostic approach, generally centred on ultrasound assessment and, where infection is suspected, antibiotic therapy alongside evacuation of retained tissue.

The causes of PPH are conventionally organized under the mnemonic of the “Four Ts”: Tone (uterine atony), Trauma (genital tract lacerations or uterine rupture), tissue (retained placental tissue or morbidly adherent placenta), and thrombin (underlying or acquired coagulation disorders). Of these, uterine atony is by far the dominant mechanism, now recognized as underlying up to 80% of PPH cases.⁵ What is clinically more difficult, and arguably under-appreciated in day-to-day practice, is that a meaningful subset of atonic PPH - particularly delayed atonic haemorrhage following an otherwise unremarkable vaginal delivery - occurs without any identifiable structural cause even after careful evaluation. This unpredictability is precisely the rationale behind guideline emphasis on prompt, standardized, protocol-driven management rather than on a diagnostic search for a cause before treatment is initiated: the physiology of bleeding does not wait for a diagnosis.

Several antenatal and intrapartum variables raise the statistical probability of PPH. A large analysis of nationwide delivery data identified maternal age under 20 or 40 years and above, caesarean delivery, hypertensive disorders of pregnancy, polyhydramnios, chorioamnionitis, multiple gestation, retained placenta, and antepartum haemorrhage as independent risk factors for atonic PPH severe enough to require transfusion.⁶ The same analysis, however, contains what is arguably its most clinically important finding: more than 60% of the women who went on to bleed severely had none of these recognized risk factors. This single statistic underlines why universal precaution, rather than selective risk-based vigilance, has become the guiding philosophy of modern PPH prevention. Additional recognized antenatal risk factors include anemia, grand multiparity, a prior history of PPH, and placenta previa or accreta, while prolonged or augmented labour and precipitate labour add further intrapartum risk.⁵ Because such a substantial proportion of affected women have no identifiable risk factor beforehand, active management of the third stage of labour is recommended as a default for every delivery rather than as a selectively applied intervention.⁷

PREVENTION: THE CENTRAL ROLE OF ANTENATAL ANEMIA CORRECTION

Anemia in pregnancy is highly prevalent in India and disproportionately amplifies the danger posed by even moderate postpartum blood loss, since women who enter labour with a low baseline haemoglobin have little physiological reserve to draw upon when bleeding begins. National survey data place the prevalence of anemia among pregnant women in India at just over half nationally.⁸ A facility-level analysis using the same national survey dataset found broadly similar overall prevalence but revealed that the burden is far from evenly distributed - rates are markedly higher among adolescent mothers, the poorest households, and women residing in the eastern states.⁹ This unevenness matters clinically: a national prevention strategy that treats anemia correction as a uniform intervention risks under-serving precisely the subgroups who stand to benefit the most.

Recent FIGO good-practice recommendations accordingly frame anemia correction not as adjunctive supportive care but as a first-line PPH prevention strategy in its own right, with emphasis on early antenatal detection, iron and folic acid supplementation, and optimization of maternal haemoglobin well before the point of delivery rather than reactive management of its consequences after bleeding has already begun.⁷ In practical Indian terms, this reframes the antenatal haemoglobin check from a routine screening item into an actionable PPH-prevention checkpoint, one that ideally should prompt escalation to intravenous iron therapy where oral supplementation has failed or where the interval to expected delivery is too short for oral repletion to be effective.

Active management of the third stage of labour (AMTSL) remains, alongside anemia correction, the single most effective preventive intervention available, and is recommended for all deliveries irrespective of individual risk status. It comprises three linked components: routine administration of a prophylactic uterotonic immediately after birth, controlled cord traction, and uterine massage - together reducing the volume of blood lost during placental separation and expulsion.⁷

STEPWISE MANAGEMENT

Modern management of PPH follows a stepwise approach, escalating rapidly from initial bedside measures through medical, mechanical, and ultimately surgical intervention if bleeding persists. A principle now made explicit in the 2025 consolidated guidelines - and one that changes how first responders should think about the sequence of care - is that resuscitation must proceed in parallel with definitive treatment rather than as a sequential step that delays it. In practice, this means fluid resuscitation, uterotonic administration, and the search for a bleeding source should be occurring simultaneously, not one after another.

First response

The initial response includes calling for additional assistance, continuous assessment of blood loss and vital signs, uterine massage with bimanual compression, establishment of intravenous access, crystalloid fluid resuscitation, and prompt administration of a uterotonic, with oxytocin remaining the first-line agent. Trial evidence comparing oxytocin with heat-stable carbetocin has demonstrated broadly comparable effectiveness for preventing severe PPH after vaginal birth, with carbetocin carrying the practical advantage of heat stability in settings - common across much of rural India - where a reliable cold chain for oxytocin cannot always be guaranteed.¹⁰ Early administration of tranexamic acid, ideally within 3 hours of bleeding onset, is also strongly recommended: the landmark WOMAN trial demonstrated a significant reduction in death due to bleeding when tranexamic acid was given early, without a corresponding increase in thromboembolic events.¹¹ A more recent and, in this reviewer's assessment, genuinely practice-changing development is the WHO E-MOTIVE approach, which pairs a calibrated blood-collection drape - enabling earlier, more objective detection of PPH than visual estimation allows - with an immediate first-response treatment bundle. In a large multi-country cluster-randomised trial, this combined approach reduced severe PPH and its downstream complications substantially compared with usual care, an effect attributable largely to the simple mechanism of shortening the time to treatment initiation rather than to any single new drug or device.¹² The E-MOTIVE trial is worth dwelling on specifically because its central insight - that objective, earlier detection changes outcomes even without new pharmacology - is directly transferable to Indian secondary-care settings where

calibrated drapes are inexpensive and already being piloted in several states.

Escalating medical and mechanical therapy

If bleeding persists despite first-line oxytocin, second-line uterotonics such as methylergometrine, carboprost, or misoprostol are administered, with careful attention to contraindications - methylergometrine in particular should be avoided in women with hypertensive disorders of pregnancy - and refractory atony remains a recognized and persistent clinical challenge even when first- and second-line therapy has been appropriately administered.⁵ Misoprostol occupies an established, if modest, role at this stage: systematic evidence indicates it performs comparably to standard uterotonics when used to treat PPH once oxytocin has already been given, though it does not add meaningful benefit when simply layered on top of standard therapy rather than used as an alternative.¹³ Examination under anaesthesia is performed at this point to identify retained placental tissue or unrecognized genital tract trauma that may be sustaining the bleeding. For uterine atony unresponsive to medical treatment, uterine balloon tamponade (UBT) is recommended as the next step; both commercially available devices and low-cost balloon tamponade techniques specifically adapted for resource-limited settings have demonstrated good effectiveness and feasibility.¹⁴⁻¹⁶ Where bleeding is severe enough to cause haemodynamic compromise, a non-pneumatic anti-shock garment can serve as a valuable temporising first-aid measure while definitive treatment is arranged or the woman is transferred to a higher level of care.¹⁷

Surgical management

When conservative measures fail to control bleeding, surgical management becomes necessary. Available options include uterine compression sutures - of which the B-Lynch technique, first described in a series of five women in 1997, remains the prototype and most widely used approach.¹⁸ As well as stepwise uterine and internal iliac arterial ligation, uterine artery embolization where interventional radiology facilities exist, and hysterectomy as the definitive, life-saving procedure of last resort. A point that deserves particular emphasis for trainees is that hysterectomy should not be unnecessarily delayed once bleeding remains uncontrolled despite appropriate conservative treatment, since delay itself - often driven by a reluctance to perform a procedure with permanent reproductive consequences in a young woman - is a recognized and avoidable contributor to preventable maternal death.²

Evidence from Indian tertiary care centres suggests that a protocol-based approach combining early tranexamic acid administration, timely use of uterotonics, and uterine balloon tamponade can effectively control haemorrhage while measurably reducing the need for hysterectomy, reinforcing the broader point that outcomes in PPH depend

as much on the consistency and speed with which a pathway is followed as on the intrinsic efficacy of any single intervention within it.¹⁹

COMPARATIVE SUMMARY OF THE PPH MANAGEMENT LADDER

Table 1 consolidates the prevention and stepwise management approach described above into a single comparative reference, intended to support rapid orientation for trainees and to serve as a bedside-adjacent summary.

RELEVANCE TO INDIAN CLINICAL PRACTICE

The burden of PPH in India is shaped by three overlapping structural factors: the high background prevalence of antenatal anemia, limited availability of blood transfusion services and interventional radiology in many facilities outside major cities, and the sheer volume of deliveries conducted in secondary-level and rural hospitals where advanced resources are least available. Low-cost uterine balloon tamponade devices developed specifically for such settings have been shown to reduce the need for surgical intervention and improve maternal outcomes. A large before-and-after study across health facilities in India found that introducing a low-cost condom-catheter balloon

tamponade device (the ESM-UBT) was associated with a significant decline in the combined rate of PPH-related maternal death and invasive procedures such as artery ligation, compression sutures, or hysterectomy.¹⁴ Cost-effectiveness modelling conducted in Indian public health facilities has further supported this device as not only clinically effective but cost-saving relative to standard condom-catheter tamponade.¹⁵ A comparative study from Uttar Pradesh similarly demonstrated the feasibility of other India-developed low-cost tamponade and vacuum-based devices in tertiary-care settings.¹⁶ Taken together, these three lines of Indian evidence support a broader point: devices need not be expensive or imported to be effective, and locally developed, context-appropriate technology may in some respects be better suited to the realities of Indian secondary care than commercially manufactured alternatives designed primarily for high-resource settings.

These low-cost devices are particularly valuable in district hospitals and primary health centres where advanced treatment options may not be readily available, and the 2025 consolidated guidelines explicitly recognize PPH as a major health-equity issue, calling for timely, evidence-based management to be made available across all levels of the healthcare system rather than concentrated at tertiary centres.^{1,14-16}

Table 1: Comparative overview of prevention and stepwise management of postpartum hemorrhage.

Managem-ent level	Approach	Key interventions	Setting/notes
Preven-tion	Active management of the third stage of labour (AMTSL); antenatal anemia correction	Prophylactic uterotonic (oxytocin/heat-stable carbetocin), controlled cord traction, uterine massage; iron/folic acid supplementation, early anemia screening	Universal, recommended for all deliveries regardless of risk status
First response	Immediate bedside measures with resuscitation running in parallel	Call for help; uterine massage and bimanual compression; IV access and crystalloids; first-line oxytocin; early tranexamic acid (within 3 h); E-MOTIVE bundle where available	All levels of care, including primary and secondary facilities
Escalating medical/mechanical therapy	Second-line pharmacologic agents and mechanical tamponade if bleeding persists	Methylergometrine, carboprost, or misoprostol (with attention to contraindications); examination under anaesthesia; uterine balloon tamponade (commercial or low-cost condom-catheter devices); non-pneumatic anti-shock garment for haemodynamic compromise	Secondary and tertiary facilities; low-cost UBT particularly relevant in resource-limited Indian settings
Surgical manage-ment	Definitive control when conservative measures fail	Uterine compression sutures (e.g., B-Lynch); stepwise arterial ligation; uterine artery embolization (where interventional radiology exists); hysterectomy as last resort	Tertiary centres with surgical/interventional radiology capacity; hysterectomy should not be delayed once conservative measures fail

CONCLUSION

Postpartum haemorrhage remains one of the leading yet largely preventable causes of maternal mortality worldwide, and this is nowhere more true than in India, where the combination of high background anemia and

uneven access to advanced obstetric resources compounds an otherwise manageable clinical problem into a persistent public health one. Early recognition rather than reliance on a fixed volume threshold, universal rather than risk-selective active management of the third stage of labour, prompt administration of tranexamic acid, and timely

escalation to mechanical or surgical intervention together form the backbone of effective management. Recent trial evidence has sharpened understanding of exactly how much speed of action matters, shifting the emphasis of the field from which drug or device is used toward how quickly any effective intervention is actually delivered. The newly consolidated global guidelines provide, for the first time, a single standardized and evidence-based framework for PPH care, while affordable, India-developed innovations such as low-cost uterine balloon tamponade devices offer genuinely practical solutions for improving outcomes in resource-limited settings. The task ahead for Indian obstetric practice is less about discovering new interventions than about ensuring the interventions already proven to work reach every labour room, in every district, without delay.

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