Updates in post-partum haemorrhage

Moderators: Nicolas Brogly

Monday, June 08, 2026

1. CALCIUM AND NEW UTEROTONIC STRATEGIES

Paloma Toledo

The United States is one of the few developed countries in which maternal mortality and serious morbidity have increased in recent years[1,2]. Specifically, an increase in mortality due to severe haemorrhage has been identified; together with infection and sepsis, this is one of the most common causes of death[3].

Definition

- Blood loss > 1000 mL or signs/ symptoms of hypovolaemia.

Main consequences:

- Need for transfusion
- Organ damage
- Hysterectomy and loss of fertility.

A large proportion of deaths from haemorrhage are considered preventable and are due to an underestimation of the volume of blood loss or failure to recognise the signs and symptoms of hypovolaemia[4].

Therefore, it is key to improve the measurement of obstetric blood loss, using gravimetry rather than visual estimation[5,6].

From an aetiological perspective, postpartum haemorrhage can be attributed to 4 causes. It is important to identify and recognise at an early stage patients at high risk of postpartum haemorrhage, and to prepare appropriate preventive strategies. Uterine atony is the most common of those[7].

70% Tone	**20%** Trauma	**10%** Tissue	**1%** Thrombin (coagulopathies)

It is hard to predict what patients will experience postpartum bleeding, but there are certain factors that indicate a high risk.

Placenta praevia or low-lying placenta	Placenta accreta	Premature placental abruption	Active bleeding greater than expected	Coagulopathy
≥ 1 HPP previous	HELLP syndrome	Platelets < 50,000	Haematocrit < 24%	Intrauterine foetal death

HELLP, *Hemolysis, Elevated Liver enzymes and Low Platelets.*

In such cases, it is crucial to mobilise the necessary resources before the birth. In addition, postpartum monitoring should be initiated in patients who showed risk factors during labour and the postpartum period.

USE OF UTEROTONICS:

- Uterotonics should be tailored to each patient's risk.
- EIn the active management of the third stage of labour, oxytocin is the first-line uterotonic.
- As a second-line treatment, methylergonovine and carbetocin have been shown to have similar effectiveness[8].

USE OF INTRAVENOUS CALCIUM:

As well as playing a part in muscle contraction, calcium is an essential ion at various stages of the coagulation cascade[9].

In a clinical trial evaluating the efficacy of prophylactic intravenous calcium administration during C-section, the bleeding was reduced in the subgroup of patients with haemorrhage due to uterine atony[10]. A very recent meta-analysis also reported that the intravenous administration of calcium during the peripartum period is associated with a lower incidence of uterine atony, reduced blood loss and improved uterine tone within 5 minutes of delivery in patients with uterine atony during C-section[11].

ANAEMIA MANAGEMENT:

In order to prevent postpartum haemorrhage, it is important not to ignore anaemia during pregnancy:

- Between 30% and 40% of pregnant women suffer from anaemia[12].
- One third of women of childbearing age have an iron deficiency.
- Outcomes relating to postpartum haemorrhage are poorer in anaemic women.
- Anaemia is a common factor that can be addressed through screening and treatment.

The concept of allowable blood loss (ABL) is useful for estimating the volume of blood a patient can lose before requiring a transfusion. A recent analysis showed that a modest increase in reoperative haemoglobin has a positive impact on ABL and can avoid the need for a transfusion[13].

Overall, the available evidence proves that the implementation of Patient Blood Management (PBM) in obstetrics is essential for reducing exposure to transfusion and optimising maternal outcomes.

Updates in post-partum haemorrhage

Moderators: Nicolas Brogly

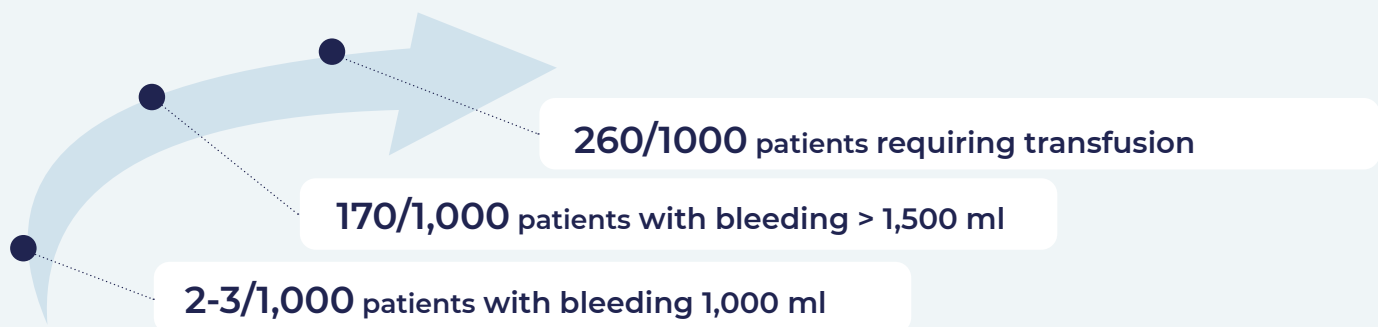
Monday, June 08, 2026

2. COAGULATION FACTORS REPLACEMENT

Lucy De Lloyd

Although coagulopathy is the least frequent primary cause for postpartum haemorrhage, an effective haemostasis is key for the measures aimed at treating the other causes of bleeding to be effective.

The incidence of coagulopathy in postpartum haemorrhage is relatively low in the early stages; however, it increases gradually along with the severity of the haemorrhage. In that regard, the frequency of coagulopathy is closely related to the volume of blood lost:



The extrapolation of evidence from other populations, such as patients with severe trauma, is not appropriate in the obstetric context, due to the specific physiological features of haemostasis during pregnancy. During this period, there is an increase in the plasma concentration of most coagulation factors, an enhanced capacity to generate thrombin, and a rise in fibrinogen levels, particularly during the third trimester and towards the end of pregnancy.

In patients with postpartum haemorrhage, two types of coagulopathy can be distinguished:

Dilutional coagulopathy

- It is secondary to massive replacement with crystalloids and packed red blood cells, and it usually appears at a later stage.
- Factors II, VII and X, as well as platelets, progressively decrease as blood loss increases, although they do not reach critical levels until the haemorrhage is very severe (> 3000 ml)[14].
- Factor VIII levels may rise in the early stages of bleeding, promoting thrombin generation[14].
- Factor XIII levels are reduced even at the onset of the bleeding[14]. However, the clinical significance of this finding has not yet been fully established and is currently being assessed in the SWIFT trial.
- Fibrinogen levels decrease linearly as postpartum haemorrhage progresses and reach critical concentrations before any other coagulation factor. This is why it is considered a "sentinel factor"[15].

Acute obstetric coagulopathy

- It appears at an early stage, is difficult to predict and is usually associated with greater severity.
- It is characterized by accelerated destruction and inhibition of fibrinogen and by a decreased proportion of functional fibrinogen relative to the total.
- It is accompanied by a steep elevation in D-dimer levels an activation of plasmin.
- The ability to generate thrombin remains intact at first.
- This phenotype may require high doses of fibrinogen from the early stages of treatment[14].

ADMINISTRATION OF FIBRINOGEN

Differences in the fibrinogen content of blood products justify prioritising fibrinogen concentrate or cryoprecipitate when the goal is rapid and effective fibrinogen replacement[16]:

FRESH FROZEN PLASMA	CRYOPRECIPITATE	FIBRINOGEN CONCENTRATE
• 2 g/L • 3000 mL to administer 6 g	• 12 g/L • 500 mL to administer 6 g	• 20 g/L • 300 mL to administer 6 g

Other recommendations regarding the treatment of postpartum haemorrhage-related coagulopathy

- Administering tranexamic acid as soon as abnormal bleeding is identified.
- Activate massive haemorrhage protocols at an early stage.
- Requesting coagulation studies from the beginning, since postpartum coagulopathy can be unpredictable.
  - Fibrinogen target > 2 g/L.
  - Coagulation time targets below 1.5 times the normal value.
- Regularly reassessing analytical or viscoelastic parameters following interventions to guide blood product replacement.
- Maintaining platelet counts > 50 × 10^9/L.

Updates in post-partum haemorrhage

Moderators: Nicolas Brogly

Monday, June 08, 2026

3. RESUSCITATIVE ENDOVASCULAR BALLOON OCCLUSION OF THE AORTA (REBOA)

Alexander Ioscovich

REBOA (*Resuscitative Endovascular Balloon Occlusion of the Aorta*) is an endovascular balloon that is inserted through the femoral artery and inflated in the aorta to temporarily reduce the distal blood flow and control the bleeding while the final treatment to address the primary cause is applied.

In obstetrics, the REBOA procedure is carried out in zone 3 (between the lowest artery and the aortic bifurcation) because it enables pelvic bleeding to be controlled and has proven to be effective in massive haemorrhages, both predictable and unpredictable, particularly in cases of placenta accreta.

Shaare Zedek Medical Center handles approximately 20,000 deliveries a year, with around 10-12 yearly cases of placenta accreta. In 2019, the centre replaced prophylactic ligation of the uterine and iliac arteries and occlusion of the iliac arteries using REBOA in patients with a high suspicion of placenta accreta. The implementation of this strategy has been associated with the following outcomes:

- Reduction of the hysterectomy rate from 0.7% to 0.02% over a five-year period.
- Decrease in the use of blood products.

The REBOA is inserted via a femoral approach, guided by ultrasound, and, when performed by an expert, it can take between 5 and 15 minutes.

EFFICACY AND SAFETY RESULTS

- In women with placenta accreta spectrum disorders, REBOA is associated with better vascular control, lower perioperative blood loss, a reduced need for transfusion and hysterectomy, and shorter times in surgery, when compared to bilateral occlusion of the common iliac arteries[17].
- In patients with morbidly adhered placenta, REBOA has proven to be effective in preventing massive haemorrhage and reducing both the hysterectomy rate and transfusion requirements[18].
- A meta-analysis including six studies found no significant differences in the incidence of lower limb thrombosis between REBOA and the occlusion of the internal iliac arteries. However, REBOA was more effective at reducing intraoperative haemorrhage and foetal exposure to radiation[19].

POTENTIAL COMPLICATIONS OF REBOA

Complications are rare, but may include:

Vascular lesions | **Embolisation**

In a retrospective cohort including centres in Spain and Israel, a very low rate of complications was observed (4,3%)[20].

Updates in post-partum haemorrhage

Moderators: Nicolas Brogly

Monday, June 08, 2026

4. CAN WE IMPROVE SAFETY IN PPH THANKS TO ADEQUATE PROTOCOLS IN EUROPE

Emilia Guasch

The implementation of standardised evidence-based protocols on postpartum haemorrhage brings down morbidity and mortality, improves team coordination and optimises the use of resources.

Although recommendations in current first-world clinical practice guidelines vary[21], the main international guidelines agree on several fundamental aspects of postpartum haemorrhage management:

- Active management of the third stage of labour
- Early diagnosis
- Early administration of uterotonics
- Rapid escalation of treatment
- Transfusion protocols
- Early correction of coagulopathy
- Surgical or interventional treatment where necessary

Clinical protocols must be standardised and evidence-based. Ideally, they should promote equity and include the following:

- **Multidisciplinary approach: obstetricians, anaesthesiologists, haematologists, blood bank, nursing, and ICU**
- **Early identification of bleeding**
- **Standardised bundles of measures, suitable for any site, regardless of the resources available**
- **Team simulation and training**
- **PBM**

The EMOTIVE protocol is an example of a bundle of measures that has proven to be effective in improving clinical outcomes, even in low-income countries[22].

The following variables must always be assessed:

- Blood loss should be assessed using validated methods to avoid underestimation[23–25].
- The severity of the patient may be assessed on the basis of the vital signs, clinical symptoms, and abnormalities in coagulation and haemodynamics, or using the Shock Index[26].

PBM is particularly necessary in obstetrics for several reasons:

- High prevalence of iron deficiency
- High incidence and maternal morbidity and mortality
- Postpartum anaemia can affect the care of the newborn the family
- There is a gender bias
- Limited access to high-quality healthcare in high-income countries
- Lack of resources and knowledge in low- and middle-income countries

PROS AND LIMITATIONS OF PROTOCOLS TO MANAGE POSTPARTUM HAEMORRHAGE:

Pros

- They improve coordination within the multidisciplinary team, by promoting communication, role allocation, well-defined escalation procedures and a faster response.
- They help to optimise the use of resources through the early activation of the blood bank, the availability of uterotonics, the setting-up of the operating theatre, and the coordination with intensive care units.
- They are a key tool for continuous training: resident qualification, continuous education, mock exercises and audits aimed at improving the quality of care.

Limitations

- Availability of resources, such as blood products, interventional radiology, viscoelastic tests, access to the ICU or to lab support.
- Protocols developed in tertiary hospitals cannot always be directly applied to regional or rural hospitals, centres with limited resources, or institutions located in low- and middle-income countries.
- They do not replace individualised clinical judgement. Consequently, they may require adaptation in particularly complex situations, such as placenta accreta spectrum disorders, severe heart disease, hereditary coagulopathies, or sepsis.

In conclusion, international protocols to manage postpartum haemorrhage should be adapted to the resources, the organization and the clinical characteristics of each centre, while maintaining common elements such as an effective communication, early risk assessment and interventions with the highest level of evidence. Furthermore, it is key to promote a multidisciplinary approach and to strengthen strategies aimed at improving safety.

LITERATURE

1. Fink DA, Kilday D, Cao Z, Larson K, Smith A, Lipkin C, et al. Trends in Maternal Mortality and Severe Maternal Morbidity During Delivery-Related Hospitalizations in the United States, 2008 to 2021. JAMA Netw Open. 2023 Jun 1;6(6):e2317641–e2317641. doi:10.1001/JAMANETWORKOPEN.2023.17641 PubMed PMID: 37347486.

2. Khalil A, Samara A, O'Brien P, Coutinho CM, Quintana SM, Ladhani SN. A call to action: the global failure to effectively tackle maternal mortality rates. Lancet Glob Health. 2023 Aug 1;11(8):e1165–7. doi:10.1016/S2214-109X(23)00247-4 PubMed PMID: 37474218.

3. Maternal Mortality in the United States, 2025 | Commonwealth Fund [Internet]. [cited 2026 Jun 19]. Available from: https://www.commonwealthfund.org/publications/issue-briefs/2025/jul/maternal-mortality-united-states-2025

4. Cantwell R, Clutton-Brock T, Cooper G, Dawson A, Drife J, Garrod D, et al. Saving Mothers' Lives: Reviewing maternal deaths to make motherhood safer: 2006-2008. The Eighth Report of the Confidential Enquiries into Maternal Deaths in the United Kingdom. BJOG. 2011 Mar;118 Suppl:1–203. doi:10.1111/J.1471-0528.2010.02847.X PubMed PMID: 21356004.

5. Toledo P, McCarthy RJ, Hewlett BJ, Fitzgerald PC, Wong CA. The accuracy of blood loss estimation after simulated vaginal delivery. Anesth Analg. 2007;105(6):1736–40. doi:10.1213/01.ANE.0000286233.48111.D8 PubMed PMID: 18042876.

6. World Health Organization. WHO recommendations for the prevention and treatment of postpartum haemorrhage [Internet]. 2012 [cited 2021 Nov 29]. Available from: http://www.who.int/reproductivehealth/publications/maternal_perinatal_health/9789241548502/en/

7. EVENSEN A, ANDERSON JM, FONTAINE P. Postpartum Hemorrhage: Prevention and Treatment. Am Fam Physician [Internet]. 2017 Apr 1 [cited 2023 Jun 8];95(7):442–9. Available from: https://www.aafp.org/pubs/afp/issues/2017/0401/p442.html

8. Cole NM, Kim JJ, Lumbreras-Marquez MI, Fields KG, Mendez-Pino L, Farber MK, et al. Second-Line Uterotonics for Uterine Atony: A Randomized Controlled Trial. Obstetrics and gynecology. 2024 Dec 1;144(6):832–41. doi:10.1097/AOG.0000000000005744 PubMed PMID: 39326051.

9. Ho KM, Pavey W. Applying the cell-based coagulation model in the management of critical bleeding. Anaesth Intensive Care. 2017 Mar 1;45(2):166–76. doi:10.1177/0310057X1704500206 PubMed PMID: 28267938.

10. Ansari JR, Yarmosh A, Michel G, Lyell D, Hedlin H, Cornfield DN, et al. Intravenous Calcium to Decrease Blood Loss During Intrapartum Cesarean Delivery: A Randomized Controlled Trial. Obstetrics and gynecology. 2024 Jan 1;143(1):104–12. doi:10.1097/AOG.0000000000005441 PubMed PMID: 37917943.

11. Wegner GRM, Wegner BFM, González GL, Miranda AM, Felippe VA, Spagnol LW, et al. Does peripartum intravenous calcium administration reduce the occurrence of uterine atony in caesarean sections?: A systematic review and meta-analysis. Eur J Anaesthesiol. 2026 Jun 1. doi:10.1097/EJA.0000000000002397 PubMed PMID: 41873623.

12. Gardner WM, Razo C, McHugh TA, Hagins H, Vilchis-Tella VM, Hennessy C, et al. Prevalence, years lived with disability, and trends in anaemia burden by severity and cause, 1990–2021: findings from the Global Burden of Disease Study 2021. Lancet Haematol. 2023 Sep 1;10(9):e713–34. doi:10.1016/S2352-3026(23)00160-6 PubMed PMID: 37536353.

13. Russo JP, De La Rua G, Rios A, Wu YY, Fletcher M, Banayan JM, et al. Impact of hemoglobin increases on allowable blood loss and transfusion needs during cesarean delivery. Transfusion (Paris). 2025 Dec 1;65(12):2259–62. doi:10.1111/TRF.18440 PubMed PMID: 41065519.

14. De Lloyd L, Jenkins P V., Bell SF, Mutch NJ, Martins Pereira JF, Badenes PM, et al. Acute obstetric coagulopathy during postpartum hemorrhage is caused by hyperfibrinolysis and dysfibrinogenemia: an observational cohort study. Journal of Thrombosis and Haemostasis. 2023 Apr 1;21(4):862–79. doi:10.1016/J.JTHA.2022.11.036 PubMed PMID: 36696216.

15. De Lloyd L, Bovington R, Kaye A, Collis RE, Rayment R, Sanders J, et al. Standard haemostatic tests following major obstetric haemorrhage. Int J Obstet Anesth. 2011 Apr;20(2):135–41. doi:10.1016/j.ijoa.2010.12.002 PubMed PMID: 21439811.

16. Collins PW, Solomon C, Sutor K, Crispin D, Hochleitner G, Rizoli S, et al. Theoretical modelling of fibrinogen supplementation with therapeutic plasma, cryoprecipitate, or fibrinogen concentrate. Br J Anaesth. 2014 Oct 1;113(4):585–95. doi:10.1093/bja/aeu086 PubMed PMID: 25064078.

17. Riazanova O V., Reva VA, Fox KA, Romanova LA, Kulemin ES, Riazanov AD, et al. Open versus endovascular REBOA control of blood loss during cesarean delivery in the placenta accreta spectrum: A single-center retrospective case control study. European Journal of Obstetrics and Gynecology and Reproductive Biology. 2021 Mar 1;258:23–8. doi:10.1016/j.ejogrb.2020.12.022 PubMed PMID: 33388487.

18. Ioscovich A, Greenman D, Goldin I, Grisaru-Granovsky S, Gozal Y, Zukerman B, et al. Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in the Multidisciplinary Management of Morbidly Adherent Placenta. Israel Medical Association Journal. 2023;25(7):462–7. PubMed PMID: 37461170.

19. Liu C, Yang D dan, Qu H bo, Guo Y, Liu L jun. Efficacy and safety of prophylactic abdominal aortic balloon occlusion versus internal iliac arterial balloon occlusion for placenta accreta spectrum disorder: A systematic review and meta-analysis. Clin Imaging. 2021 Oct 1;78:250–5. doi:10.1016/j.clinimag.2021.06.020 PubMed PMID: 34171597.

20. Azem K, Orbach-Zinger S, Ioscovich A, Brogly N, Spiegel E, Shoham A, et al. Anaesthetic strategies for managing placenta accreta spectrum with REBOA: Insights from an international multicentre retrospective study. Eur J Anaesthesiol. 2025 Sep 1;42(9):791–9. doi:10.1097/EJA.0000000000002218 PubMed PMID: 40474704.

21. de Vries PLM, Deneux-Tharaux C, Baud D, Chen KK, Donati S, Goffinet F, et al. Postpartum haemorrhage in high-resource settings: Variations in clinical management and future research directions based on a comparative study of national guidelines. BJOG. 2023 Dec 1;130(13):1639–52. doi:10.1111/1471-0528.17551 PubMed PMID: 37259184.

22. Gallos I, Devall A, Martin J, Middleton L, Beeson L, Galadanci H, et al. Randomized Trial of Early Detection and Treatment of Postpartum Hemorrhage. N Engl J Med. 2023 Jul 6;389(1):11–21. doi:10.1056/NEJMOA2303966 PubMed PMID: 37158447.

23. Lilley G, Burkett-St-Laurent D, Precious E, Bruynseels D, Kaye A, Sanders J, et al. Measurement of blood loss during postpartum haemorrhage. Int J Obstet Anesth. 2015 Feb 1;24(1):8–14. doi:10.1016/j.ijoa.2014.07.009 PubMed PMID: 25433576.

24. Kahr MK, Brun R, Zimmermann R, Franke D, Haslinger C. Validation of a quantitative system for real-time measurement of postpartum blood loss. Arch Gynecol Obstet. 2018 Dec 1;298(6):1071–7. doi:10.1007/S00404-018-4896-0 PubMed PMID: 30225686.

25. Diaz V, Abalos E, Carroli G. Methods for blood loss estimation after vaginal birth. Cochrane Database Syst Rev. 2018 Sep 13;9(9). doi:10.1002/14651858.CD010980.PUB2 PubMed PMID: 30211952.

26. Nathan HL, El Ayadi A, Hezelgrave NL, Seed P, Butrick E, Miller S, et al. Shock index: an effective predictor of outcome in postpartum haemorrhage? BJOG. 2015 Jan 1;122(2):268–75. doi:10.1111/1471-0528.13206 PubMed PMID: 25546050.

CSL Behring