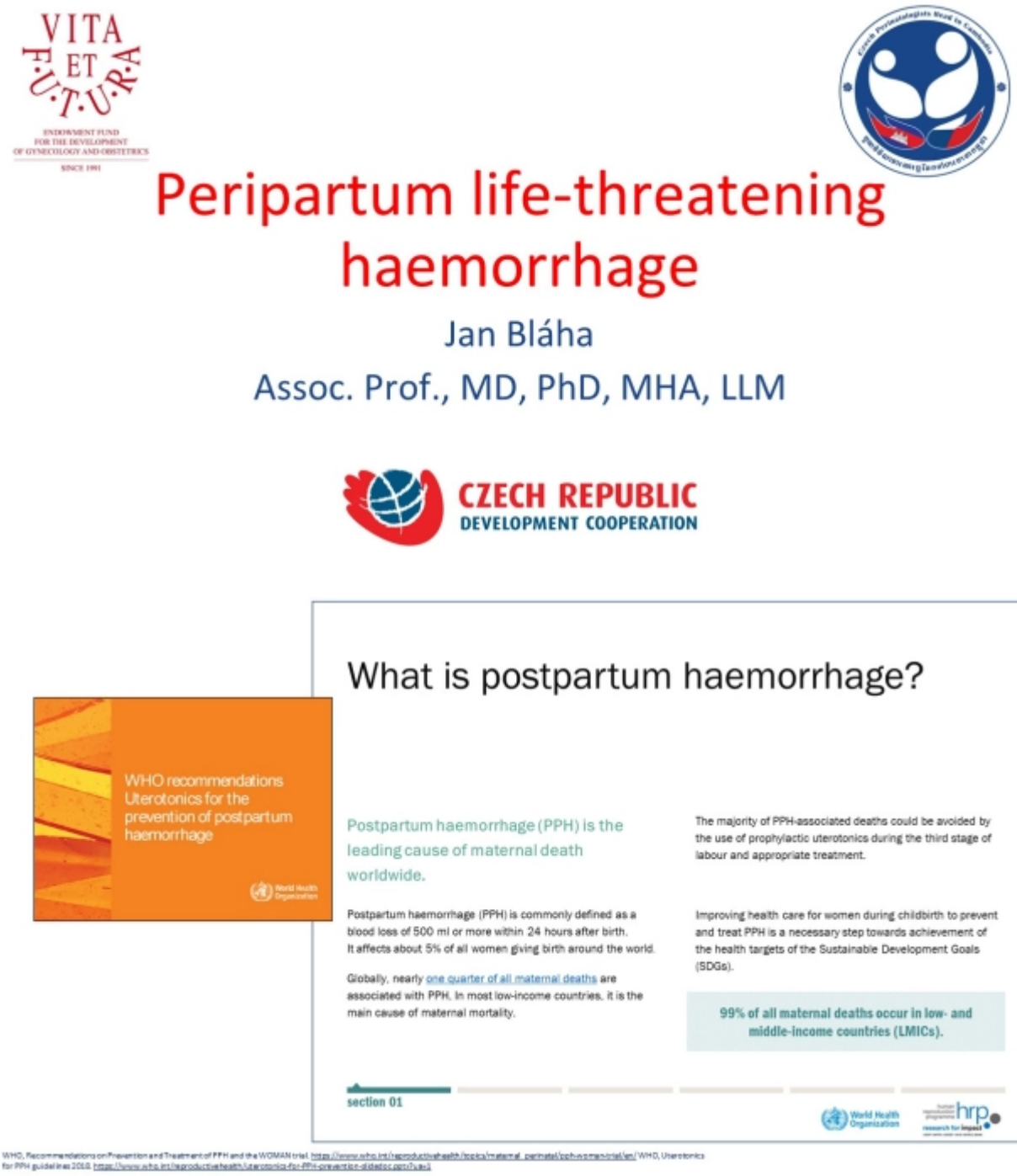
Peripartum life-threatening haemorrhage



Postpartum vs peripartum haemorrhage

- **Antepartum** (affects 2−5% of all pregnancies)1
  - Placenta previa
  - Placental abruption
  - Trauma
  - Rupture of the uterus

- **Postpartum** (complicates about 5% of all births)2
  - Uterine atony is responsible for the vast majority of postpartum haemorrhage (up to ~70%)3

1. Walfish M, et al. Br J Anaesth 2009;103:i47−56;
2. WHO PPH guidelines 2018. https://www.who.int/reproductivehealth/uterotonics-for-PPH-prevention-slidedoc.pptx?ua=1;
3. Evensen A, et al. Am Fam Physician 2017;95:442−9

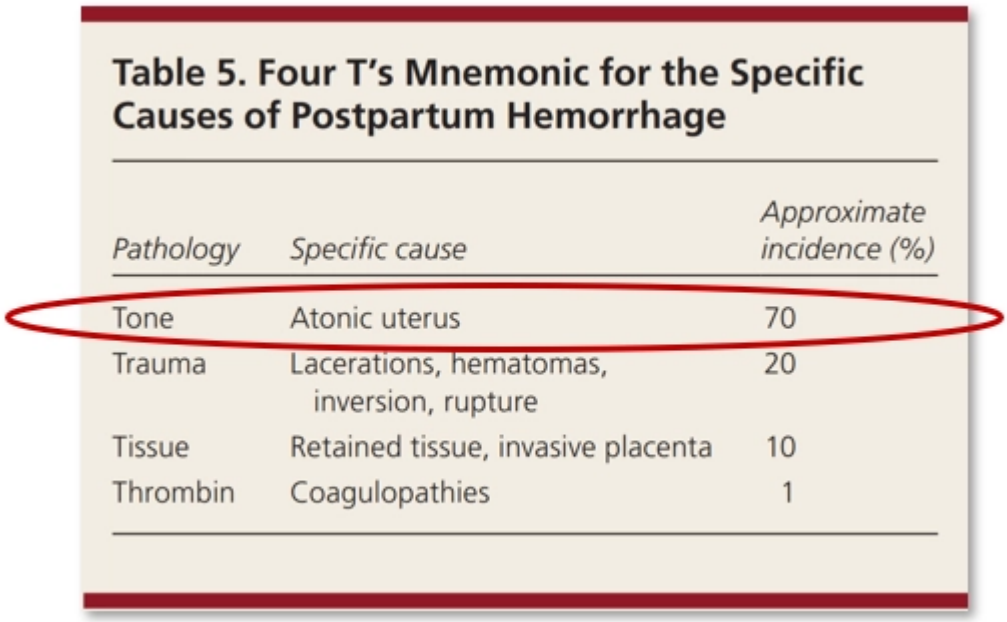


Table 5. Four T's Mnemonic for the Specific Causes of Postpartum Hemorrhage

Pathology	*Specific cause*	*Approximate incidence (%)*
Tone	Atonic uterus	70
Trauma	Lacerations, hematomas, inversion, rupture	20
Tissue	Retained tissue, invasive placenta	10
Thrombin	Coagulopathies	1

EJA

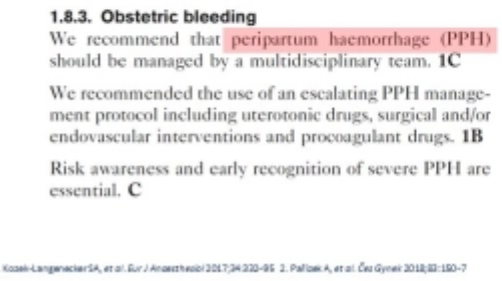
Eur J Anaesthesiol 2017; 34:332–395

GUIDELINES

Management of severe perioperative bleeding: guidelines from the European Society of Anaesthesiology

First update 2016

Sibylle A. Kozek-Langenecker, Aamer B. Ahmed, Arash Afshari, Pierre Albaladejo, Cesar Aldecoa, Guidrius Barauskas, Edoardo De Robertis, David Faraoni, Daniela C. Filipescu, Dietmar Fries, Thorsten Haas, Matthias Jacob, Marcus D. Lancé, Juan V.L. Pitarch, Susan Mallett, Jens Meier, Zsolt L. Molnar, Niels Rahe-Meyer, Charles M. Samama, Jakob Stensballe, Philippe J.F. Van der Linden, Anne J. Wikkelsø, Patrick Wouters, Piet Wyffels and Kai Zacharowski



1.8.3. Obstetric bleeding

We recommend that peripartum haemorrhage (PPH) should be managed by a multidisciplinary team. **1C**

We recommended the use of an escalating PPH management protocol including uterotonic drugs, surgical and/or endovascular interventions and procoagulant drugs. **1B**

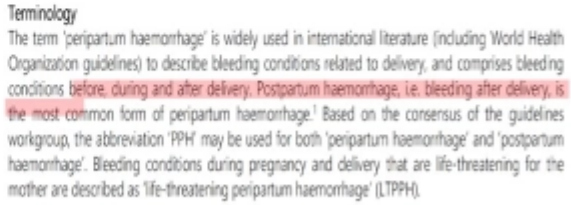
Risk awareness and early recognition of severe PPH are essential. **C**

1. Kozek-Langenecker SA, et al. Eur J Anaesthesiol 2017;34:332–95 2. Pařízek A, et al. Čes Gynek 2018;83:150–7

DIAGNOSIS AND THERAPY OF LIFE-THREATENING PERIPARTUM HAEMORRHAGE: CZECH-SLOVAK INTERDISCIPLINARY GUIDELINES

A. Pařízek[a], T. Binder[b,c], J. Blaha[d], J. Blatny[e], M. Bursik[f], J. Feyereisl[g], P. Janku[h], Z. Kolediova[a], P. Krepelka[g], J. Kvasnicka[h], M. Lubusky[i], D. Seidlova[j], O. Simetka[k], P. Stourac[l], V. Cerny[m,n]

Consensus interdisciplinary guidelines for the prevention and treatment of postpartum haemorrhage



Terminology

The term 'peripartum haemorrhage' is widely used in international literature (including World Health Organization guidelines) to describe bleeding conditions related to delivery, and comprises bleeding conditions before, during and after delivery. Postpartum haemorrhage, i.e. bleeding after delivery, is the most common form of peripartum haemorrhage.[1] Based on the consensus of the guidelines workgroup, the abbreviation 'PPH' may be used for both 'peripartum haemorrhage' and 'postpartum haemorrhage'. Bleeding conditions during pregnancy and delivery that are life-threatening for the mother are described as 'life-threatening peripartum haemorrhage' (LTPPH).

What is postpartum haemorrhage?

Postpartum haemorrhage vs. **severe** haemorrhage **in pregnancy ?**

Best Practice & Research Clinical Anaesthesiology

Volume 36, Issues 3–4, December 2022, Pages 325-339

ELSEVIER

Epidemiology and definition of PPH worldwide

Jan Blaha [Associate Professor], Teresa Bartolová Anaesthetist

Department of Anaesthesiology and Intensive Care Medicine, First Faculty of Medicine, Charles University and General University Hospital in Prague, U Nemocnice 2, 128 08, Prague 2, Czech Republic

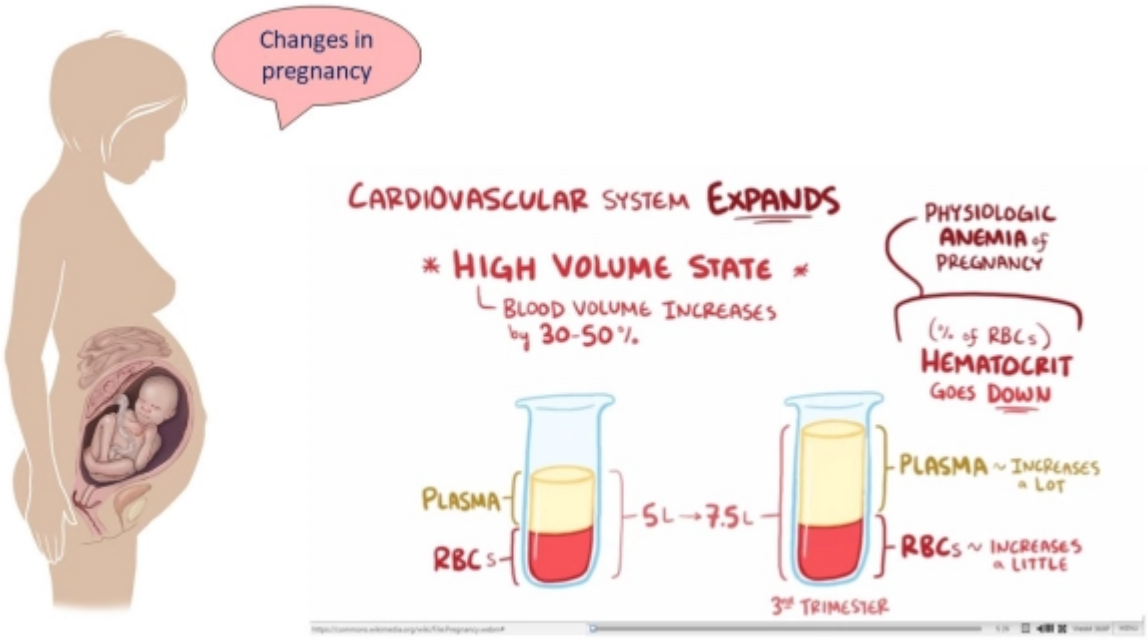
Available online 10 December 2022.

definition of PPH as blood loss > 500 ml was used in 29% of studies

... but also 700 ml, 800 ml, 1000 ml, 1500 ml

A comparison of published studies on PPH outcomes showed that although blood loss ≥500 ml was the most common primary inclusion criterium in randomized controlled trials, this definition was used in only 29% of studies [51,54]. However, other randomized trials investigating PPH treatments have used a range of blood loss volumes: 700 ml [55,56], 800 ml [57], 1000 ml [58], or 1500 ml [59]. In contrast, in systematic reviews, blood loss ≥1000 ml was the most often preferred definition of PPH, but was reported in only 13% of studies [51]. The preference for 500 ml in trials but 1000 ml in systematic reviews likely reflects the desire of study authors to maximize statistical power versus the preference of reviewers to primarily evaluate clinically relevant outcomes and outcomes associated more closely with maternal morbidity.

On the contrary, in systematic reviews blood loss of >1000 ml was most often used, but even so only in 13% of these reviews!



Wikimedia Commons, Pregnancy, https://commons.wikimedia.org/wiki/File:Pregnancy.svg#mw6 (Accessed 18 January 2021)

Royal College of Obstetricians & Gynaecologists

Prevention and Management of Postpartum Haemorrhage

Green-top Guideline No. 52

December 2016

Please cite this paper as: Mavrides E, Allard S, Chandraharan E, Collins P, Green L, Hunt BJ, Riris S, Thomson AJ on behalf of the Royal College of Obstetricians and Gynaecologists. Prevention and management of postpartum haemorrhage. BJOG 2016;124:e106–49.

1. Purpose and scope

Primary postpartum haemorrhage (PPH) is the most common form of major obstetric haemorrhage. The traditional definition of primary PPH is the loss of 500 ml or more of blood from the genital tract within 24 hours of the birth of a baby.[1] PPH can be minor (500–1000 ml) or major (more than 1000 ml). Major can be further subdivided into moderate (1001–2000 ml) and severe (more than 2000 ml). In women with lower body mass (e.g. less than 40 kg), a lower level of blood loss may be clinically significant. The recommendations in this guideline apply to women experiencing a primary PPH of 500 ml or more.

Secondary PPH is defined as abnormal or excessive bleeding from the birth canal after 24 hours but before 12 weeks postnatally.[1] This guideline also includes recommendations specific to the management of

Minor PPH 500–1000 ml or major PPH >1000 ml (*moderate 1001–2000 ml or severe >2000 ml*)[1]

How should PPH be managed?

Identification of the severity of haemorrhage

Clinicians should be aware that the visual estimation of peripartum blood loss is inaccurate and that clinical signs and symptoms should be included in the assessment of PPH. [*New 2016*] C

Communication and multidisciplinary care

Communication with the woman

Communication with the patient and her birthing partner is important, and clear information of what is happening should be given from the outset. [*New 2016*] ✓

Who should be informed when the woman presents with PPH?

Relevant staff with an appropriate level of expertise should be alerted of PPH. [*New 2016*] ✓

The midwife in charge and the first-line obstetric and anaesthetic staff should be alerted when women present with minor PPH (blood loss 500–1000 ml) without clinical shock. ✓

A multidisciplinary team involving senior members of staff should be summoned to attend to women with major PPH (blood loss of more than 1000 ml) and ongoing bleeding or clinical shock. ✓

Proper Estimation of Blood Loss on Scene of Trauma: Tool or Tale?

Matthias Frank, MD, Uli Schmucker, MD, Dirk Stengel, MD, PhD, Lutz Fischer, MD, Joern Lange, MD, Rico Grossjohann, Dipl. Phys., Axel Ekkernkamp, MD, PhD, and Gerrit Matthes, MD, PhD

(*J Trauma.* 2010;69: 1191–1195)

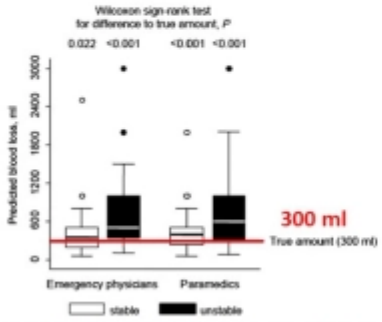


Figure 1. Estimation of blood loss by emergency physicians and paramedics for stable and unstable patients. Given *p* values indicate the statistical significance of the difference to the actual blood loss of 300 mL.

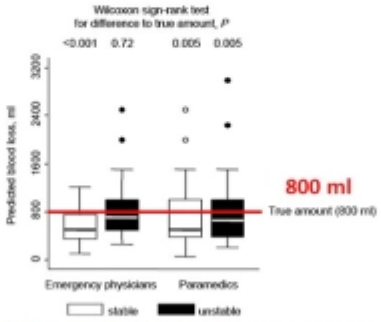


Figure 2. Estimation of blood loss by emergency physicians and paramedics for stable and unstable patients. Given *p* values indicate the statistical significance of the difference to the actual blood loss of 800 mL.

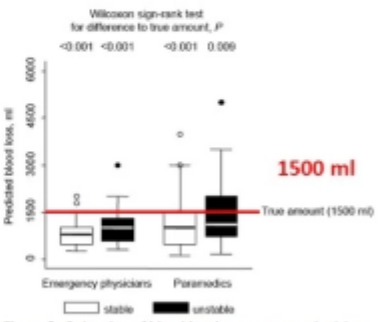


Figure 3. Estimation of blood loss by emergency physicians and paramedics for stable and unstable patients. Given *p* values indicate the statistical significance of the difference to the actual blood loss of 1,500 mL.

International Journal of Gynecology and Obstetrics (2006) 93, 220–224

Drape estimation vs. visual assessment for estimating postpartum hemorrhage

A. Patel [a,*], S.S. Goudar [b], S.E. Geller [c], B.S. Kodkany [b], S.A. Edlavitch [d], K. Wagh [b], S.S. Patted [b], V.A. Naik [b], N. Moss [e], R.J. Derman [d]

[a] *John H. Stroger Jr. Hospital of Cook County, Chicago, IL, USA*
[b] *J. N. Medical College, Belgaum, Karnataka, India*
[c] *Department of Obstetrics and Gynecology, University of Illinois at Chicago, Chicago, IL, USA*
[d] *University of Missouri at Kansas City School of Medicine, Kansas City, MO, USA*

Abstract

Objective: To compare (1) visual estimation of postpartum blood loss with estimation using a specifically designed blood collection drape and (2) the drape estimate with a measurement of blood loss by photospectrometry. *Methods:* A randomized controlled study was performed with 123 women delivered at the District Hospital, Belgaum, India. The women were randomized to visual or drape estimation of blood loss. A subsample of 10 drape estimates was compared with photospectrometry results. *Results:* The visual estimate of blood loss was 33% less than the drape estimate. The interclass correlation of the drape estimate to photospectrometry measurement was 0.92. *Conclusion:* Drape estimation of blood loss is more accurate than visual estimation and may have particular utility in the developing world. Prompt detection of postpartum hemorrhage may reduce maternal morbidity and mortality in low-resource settings.

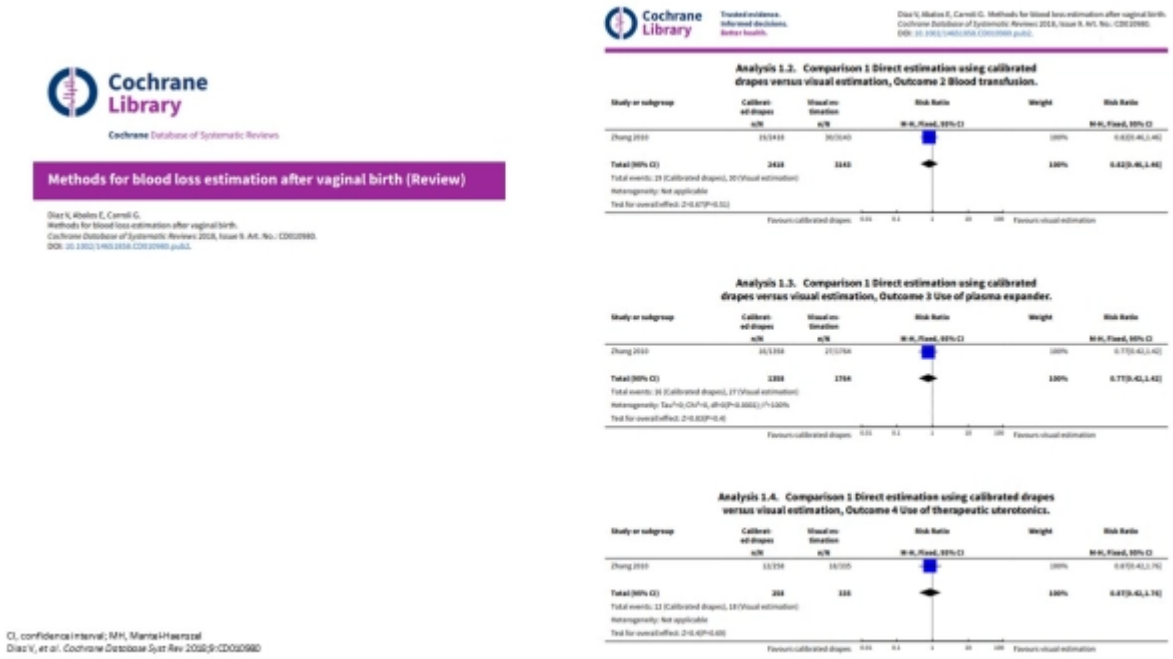
Figure 1 The BRAEL-P Drape, a specially designed blood collection drape with a calibrated collection pouch.

Table 1 Distribution of blood loss between study groups

	Visual group, $n=61$	Drape group, $n=62$
Blood loss, mean ± S.D. (range) (mL)	203.11 ± 147.49 (50–950)*	302.82 ± 173.28 (50–975)

*$P=0.0008$.

SD, standard deviation
Patel A, *et al. Int J Gynecol Obstet* 2006;93:220–4



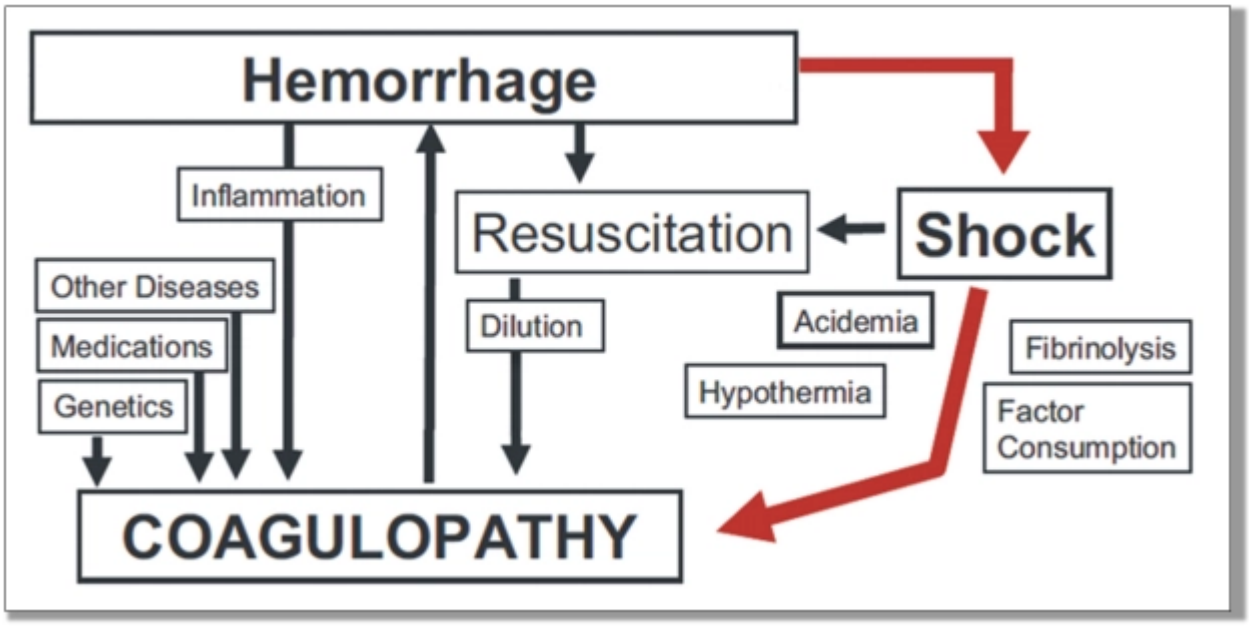
Characteristics of life-threatening bleeding

1. **Loss of a certain volume of blood per time unit, e.g.:1,2**
    I. Loss of whole blood volume within 24 hours (equivalent to about 10 erythrocyte transfusion units in an adult) or
    II. Loss of 50% of blood volume within 3 hours, or
    III. Ongoing blood loss in excess of 150 mL/min
2. **Blood loss at the site leading to a threat to vital functions** (e.g. bleeding into the CNS)1
3. **Presence of clinical/laboratory signs of tissue hypoperfusion** during bleeding2

CNS, central nervous system

1. JPAC Transfusion Handbook. https://www.transfusionguidelines.org/transfusion-handbook/7-effective-transfusion-in-surgery-and-critical-care/7-3-transfusion-management-of-major-haemorrhage

2. Kaur P, et al. J Emerg Trauma Shock 2011; 4:103−8



Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial

Published Online
April 26, 2017
http://dx.doi.org/10.1016/S0140-6736(17)30638-4

WOMAN Trial Collaborators*

Summary

Background Post-partum haemorrhage is the leading cause of maternal death worldwide. Early administration of tranexamic acid reduces deaths due to bleeding in trauma patients. We aimed to assess the effects of early administration of tranexamic acid on death, hysterectomy, and other relevant outcomes in women with post-partum haemorrhage.

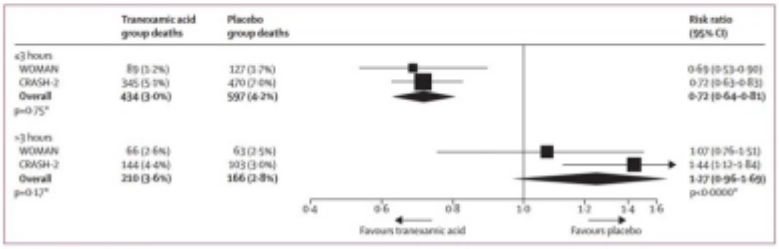


Figure 5: Time to treatment
*Heterogeneity p value.

Schlimp et al. Critical Care 2013, 17:R137
http://ccforum.com/content/17/4/R137

CRITICAL CARE

RESEARCH Open Access

Estimation of plasma fibrinogen levels based on hemoglobin, base excess and Injury Severity Score upon emergency room admission

Christoph J Schlimp[1], Wolfgang Voelckel[2], Kenji Inaba[3], Marc Maegele[4], Martin Ponschab[5] and Herbert Schöchl[1,2*]

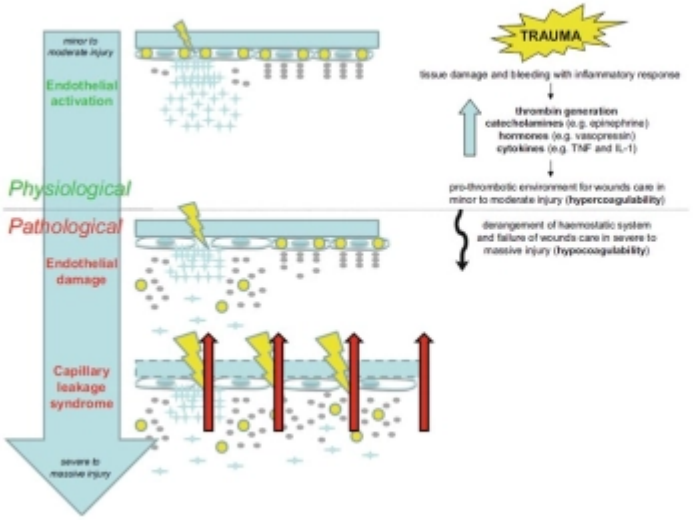
Table 1 Patient demographics stratified according to Inj

	ISS 16-24	ISS 25-34			4 group ences
Patients n (% of total)	242 (35.9%)	249 (36.9%)	97 (1		N/A
Age (range)	42.5 (26-56)	47 (29.5-60)ns	45 (24-59)ns	(25-59)ns	nsKruskal- Wallis
Male n (% of ISS group)	200 (82.6%)	195 (78.3%)ns	76 (78.4%)n	66 (75.9%)ns	nsChi-square
Mortality n (% of ISS group)	5 (2.1%)	32 (12.9%)***	27 (27.8%)	42 (48.3%)**	***Chi-square
FIB mg/dL (IQR)	235 (182.5-286.3)	191.0 (143-240)***	134 (94.5- 5)***	114 (69-156)*	***Kruskal- Wallis
Hb g/dL (IQR)	13.0 (11.7-14.2)	12.3 (10.6-13.7)***	10.9 (8.4-13.0)***	9.6 (7.0-11.6)**	***Kruskal- Wallis
BE mmol/L (IQR)	−2.6 (−4.5 to −1.4)	−3.7 (−6.2 to −2.1) ***	−5.7 (−8.5 to −2.9) ***	−7.1 (−10.9 to −4.6) **	***Kruskal- Wallis

ns, not significant, *P <0.05, **P <0.01, ***P <0.001, significance values for comparison with previ… …ogen; Hb, hemoglobin; IQR, interquartile range; ISS, Injury Severity Score.

Hb <100 g/l = fibrinogen <150 g/l

BE >6 mmol/l = fibrinogen <150 g/l



Giordano S et al. Intern Emerg Med (2017) 12:981–991

Intern Emerg Med (2017) 12:981–991 DOI 10.1007/s11739-017-1674-0

The current understanding of trauma-induced coagulopathy (TIC): a focused review on pathophysiology

Stefano Giordano[1] · Luca Spiezia[2] · Elena Campello[2] · Paolo Simioni[2]
[1] Thrombotic and Haemorrhagic Diseases Unit, Department of Medicine, University of Padua, Padua, Italy

Fig. 3 Evolution from progressive endothelial reaction (from physiological activation to pathological damage and capillary leakage) to progressive traumatic damage (from minor to massive injury, indicated with a thunderbolt in the figure). When trauma occurs, tissue damage and bleeding activate the inflammatory response with the generation of greater amounts of thrombin, catecholamines, hormones and cytokines. The aim is to create a pro-thrombotic environment with hypercoagulability capacities that are vital to restore endothelial function after minor-to-moderate injuries. In case of severe-to-massive injuries, a derangement of the haemostatic system takes place resulting in the failure of healing capacities. The final stage is the capillary leakage syndrome with excessive vascular permeability (*red arrow* in the figure) that leads to edema, hypovolemia and hypotension. *DIC* disseminated intravascular coagulation, *ACoTS* acute coagulopathy induced by trauma and shock, *FDPs* fibrinogen degradation products, *TM* thrombomodulin, *EPCR* endothelial protein C receptor, *APC* activated protein C, *EGL* endothelial glycocalyx layer, *Syn1* syndecan-1, *HA* hyaluronic acid, *HS* heparan sulfate, *CS* condroitin sulfate, *WPBs* weibel-palade bodies, *tPA* tissue plasminogen activator, *Ang2* angiopoietin-2, *PAR1* protease activated receptor 1, *TM* thrombomodulin, *APC* activated protein C, *NO* nitric oxide, PGI_2 prostaglandin I_2, *tPA* tissue plasminogen activator. ⟶ directly leads to, ⇢ inhibits, ⇝ indirectly leads to and ⟶ higher/lower levels of

Figure 3. Therapeutic approach. Patients presenting with severe tissue injury without shock are at high risk of thrombosis and every effort should be made to prevent this serious condition. However, shock and hypoperfusion in patients with severe trauma can induce hypocoagulability and hyperfibrinolysis. This state is associated with very high mortality and needs to be treated urgently with early hemostatic goal-directed resuscitation. Response to trauma is a complex, dynamic process in which risk can shift from bleeding to thrombosis depending on the injury pattern, treatment administered, individual responses, and comorbidities.

Duque et al. Anesth Analg 2020;130:684–94

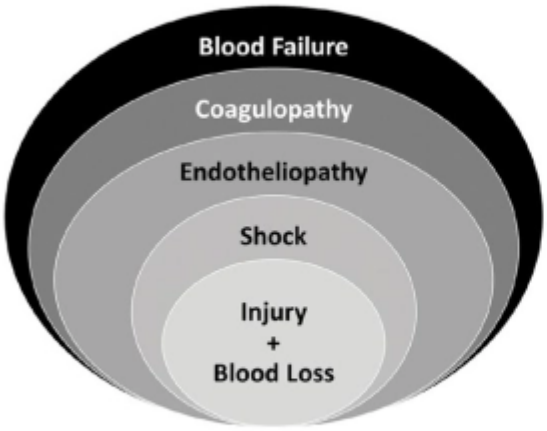


Figure 1.
Schematic representing the components of hemorrhagic blood failure.

Figure 2.
Schematic of key linkages between oxygen debt, cellular dysfunction, and coagulopathy during hemorrhagic blood failure.

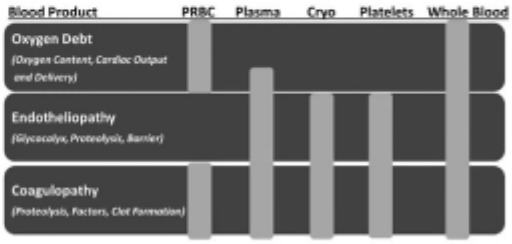


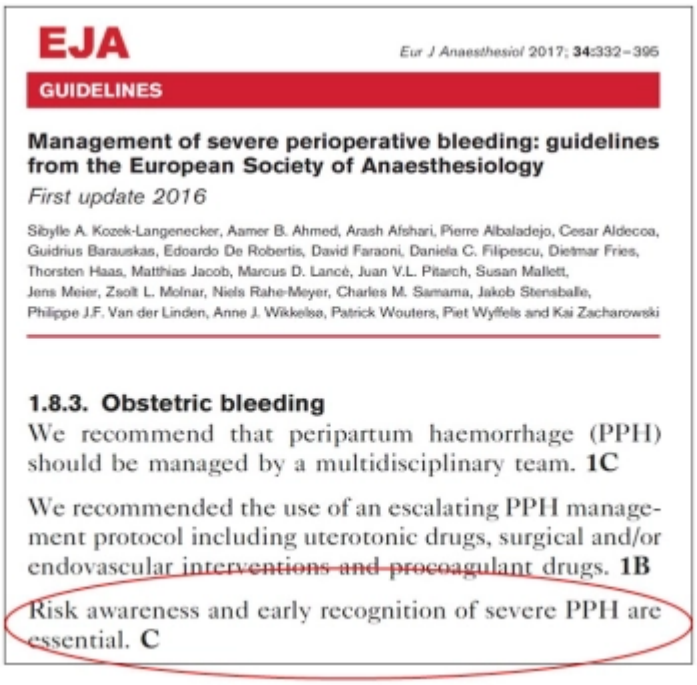
Figure 3.
Schematic summarizing the effects of individual blood products on the three components of hemorrhagic blood failure. PRBC= packed red blood cells, Cryo= cryoprecipitate

Trauma Acute Care Surg. 2017 June; 82(6) | 1043-1048

Factors determining the severity of bleeding1,2

- Rate and/or total amount of blood loss
- Primary cause/source of bleeding
- State of the coagulation system
- Number of units of blood products and/or blood derivatives
- Presence of clinical and/or laboratory signs of tissue hypoperfusion and/or signs of organ dysfunction

1. Pařízek A, et al. Čes Gynek 2018;83:150−7;
2. Blatny J, Blaha J, et al. ANESTEZIOLOGIE A INTENZIVNI MEDICINA 2017;28(4):103−8



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GUIDELINES

Management of severe perioperative bleeding: guidelines from the European Society of Anaesthesiology

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We recommend that peripartum haemorrhage (PPH) should be managed by a multidisciplinary team. **1C**

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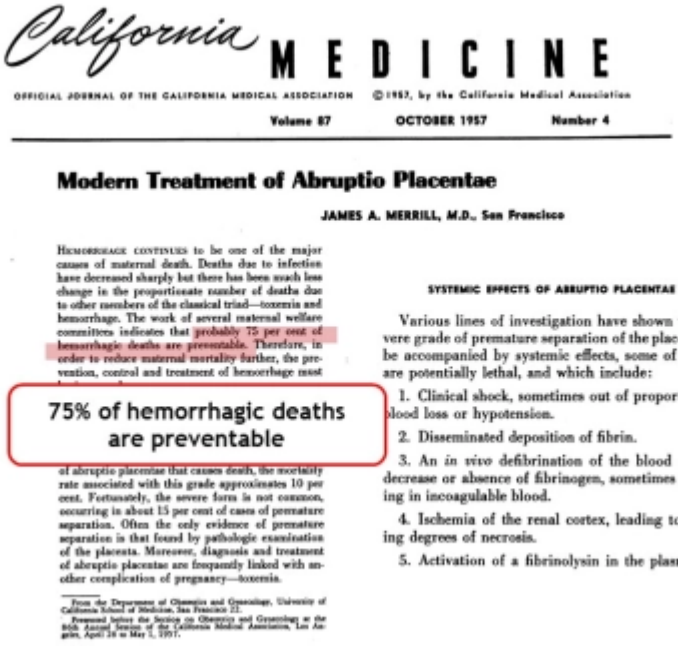

California MEDICINE

OFFICIAL JOURNAL OF THE CALIFORNIA MEDICAL ASSOCIATION

Volume 87 OCTOBER 1957 Number 4

Modern Treatment of Abruptio Placentae

JAMES A. MERRILL, M.D., San Francisco

Hemorrhage continues to be one of the major causes of maternal death. Deaths due to infection have decreased sharply but there has been much less change in the proportionate number of deaths due to other members of the classical triad—toxemia and hemorrhage. The work of several maternal welfare committees indicates that probably 75 per cent of hemorrhagic deaths are preventable. Therefore, in order to reduce maternal mortality further, the prevention, control and treatment of hemorrhage must

75% of hemorrhagic deaths are preventable

of abruptio placentae that causes death, the mortality rate associated with this grade approximates 10 per cent. Fortunately, the severe form is not common, occurring in about 15 per cent of cases of premature separation. Often the only evidence of premature separation is that found by pathologic examination of the placenta. Moreover, diagnosis and treatment of abruptio placentae are frequently linked with another complication of pregnancy—toxemia.

From the Department of Obstetrics and Gynecology, University of California School of Medicine, San Francisco 22.

Presented before the Section on Obstetrics and Gynecology at the 86th Annual Session of the California Medical Association, Los Angeles, April 28 to May 1, 1957.

SYSTEMIC EFFECTS OF ABRUPTIO PLACENTAE

Various lines of investigation have shown the severe grade of premature separation of the placenta to be accompanied by systemic effects, some of which are potentially lethal, and which include:

1. Clinical shock, sometimes out of proportion to blood loss or hypotension.
2. Disseminated deposition of fibrin.
3. An *in vivo* defibrination of the blood with a decrease or absence of fibrinogen, sometimes resulting in incoagulable blood.
4. Ischemia of the renal cortex, leading to varying degrees of necrosis.
5. Activation of a fibrinolysin in the plasma.

VITA ET F·U·T·U·R·A
ENDOWMENT FUND FOR THE DEVELOPMENT OF GYNECOLOGY AND OBSTETRICS
SINCE 1991

Best Practice & Research Clinical Anaesthesiology
Volume 36, Issues 3–4, December 2022, Pages 325-339

Epidemiology and definition of PPH worldwide

Jan Bláha (Associate Professor) ✉, Tereza Bartoňová Anaesthetist ✉
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Available online 10 December 2022.

treatment delays or suboptimal care in up to 90% of cases

…es, during the period from 1993 through 20… …ing a blood transfusion increased from approximately 8 to 40 per 10 000 deliveries [103]. An increase in high-risk groups such as higher maternal age, obesity, more frequent and serious comorbidities, especially cardiovascular, or increased cesarean section rates cannot fully explain this rise [104,105]. The increasing incidence of PPH suggests an incomplete implementation of guidelines [106–108], resulting in treatment delays or suboptimal care, which are increasingly being reported in 30–90% of PPH cases [109–112]! Moreover, reports from confidential inquiries have shown that as many as 67% of the deaths in the United States and 85% of those in France are avoidable, resulting as they have from either delayed or inadequate treatment [113–115]. Delays in diagnosing and treating PPH are believed to directly affect the severity of bleeding, the development of complications such as coagulopathy, and result in high… …retation of the extent of bl… …and failure to escalate car…

as many as 67% of the deaths in the USA and 85% of those in France are avoidable

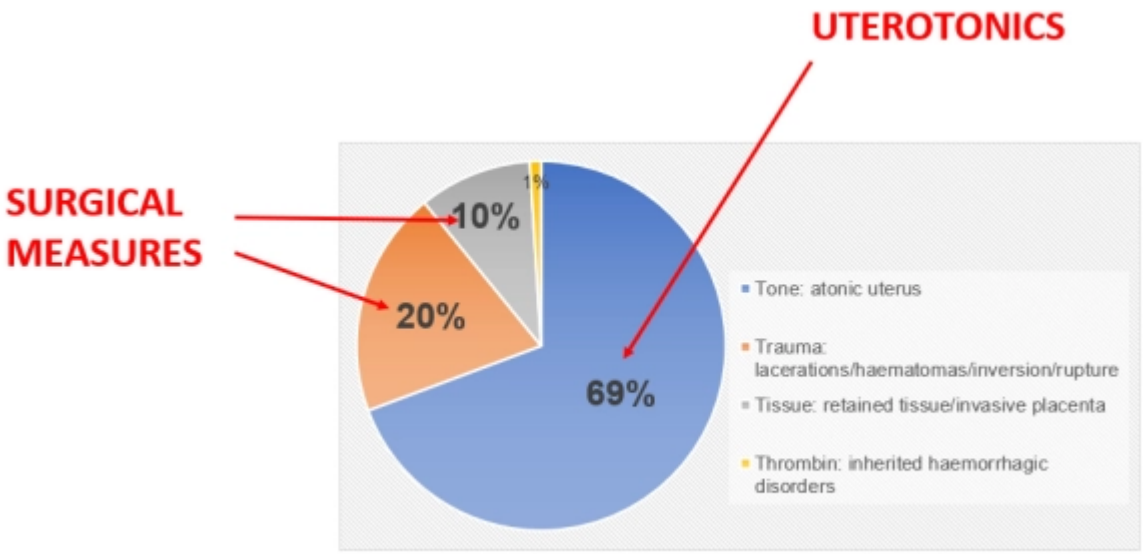
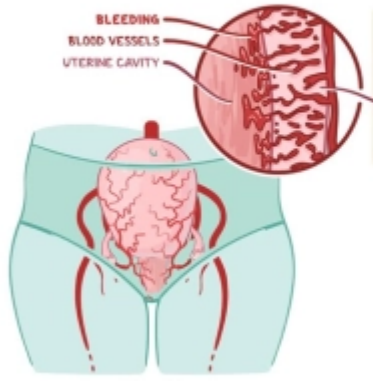
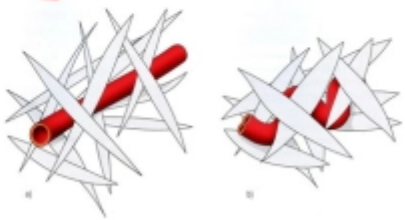


Figure 1. Causes and approximate incidence of PPH



BACKGROUND

- FAILURE of the UTERUS to CONTRACT SUFFICIENTLY DURING & AFTER DELIVERY of a BABY
  - MYOMETRIUM DOESN'T RESPOND to OXYTOCIN
- MOST COMMON CAUSE of POSTPARTUM HEMORRHAGE (OBSTETRIC EMERGENCY)



myometrial retraction → compression
= tourniquet of the uterine vascular system

OSMOSIS.org
www.osmosis.org/answers/uterine-atony

Patrick A. Peripartální krvácení. Obstetrickaforum.cz

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Postpartum hemorrhage care bundles to improve adherence to guidelines: A WHO technical consultation

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Abstract

Objective: To systematically develop evidence-based bundles for care of postpartum hemorrhage (PPH).

Methods: An international technical consultation was conducted in 2017 to develop draft bundles of clinical interventions for PPH taken from the WHO's 2012 and 2017 PPH recommendations and based on the validated "GRADE Evidence-to-Decision" framework. Twenty-three global maternal-health experts participated in the development process, which was informed by a systematic literature search on bundle definitions, designs, and implementation experiences. Over a 6-month period, the expert panel met online and via teleconferences, culminating in a 2-day in-person meeting.

Results: The consultation led to the definition of two care bundles for facility implementation. The "first response to PPH bundle" comprises uterotonics, isotonic crystalloids, tranexamic acid, and uterine massage. The "response to refractory PPH bundle" comprises compressive measures (aortic or bimanual uterine compression), the non-pneumatic antishock garment, and intrauterine balloon tamponade (IBT). Advocacy, training, teamwork, communication, and use of best clinical practices were defined as PPH bundle supporting elements.

Conclusion: For the first response bundle, further research should assess its feasibility, acceptability, and effectiveness; and identify optimal implementation strategies. For the response to refractory bundle, further research should address pending controversies, including the operational definition of refractory PPH and effectiveness of IBT devices.

TABLE 2 Description of WHO-recommended clinical interventions for PPH, 2012–2017.

Intervention	Description
Uterotonics	Administration of oxytocin (IV/IM), ergometrine/methylergometrine or other fixed-drug combination of oxytocin and ergometrine (IM) misoprostol (oral). The preferred drug for prevention of PPH is oxytocin (10 IU, IV/IM). If unavailable, give IM ergometrine/methylergometrine or the fixed drug combination of oxytocin and ergometrine, if not contraindicated. If IM or IV uterotonics are unavailable, give oral misoprostol (600 μg)
Controlled cord traction	After delivery of the newborn and if it is assessed that there are no other fetuses in utero, gentle traction is applied to the umbilical cord with one hand, while the other hand applies abdominal counter-pressure on the uterus
Postpartum abdominal uterine tonus assessment	Palpate the uterus to assess uterine firmness/tone; if the uterus is soft or flabby this may indicate uterine atony
Isotonic crystalloids	Administration of a starting dose: 500 mL of isotonic crystalloids IV, in 30 min; and continuing doses of 500 mL of isotonic crystalloids IV, in 60 min
TXA	A fixed dose of 1 g of TXA (100 mg/mL IV at 1 mL per min), within 3 h of the time of diagnosis (if unknown, time of delivery); a second dose of 1 g can be given if needed 30 min after the first dose
Uterine massage	Circular rubbing of the uterus achieved via manual massaging of the abdomen. This is typically sustained until the bleeding stops or the uterus contracts
Intrauterine balloon tamponade	The procedure entails insertion of a deflated/uninflated balloon into the uterine cavity and then inflating it to achieve a tamponade effect
Bimanual uterine compression	Two handed, one in the anterior vaginal fornix and one behind the uterine fundus, squeezing the uterus between the hands
External aortic compression	External compression applied with a closed fist at the level of the umbilicus and slightly to the woman's left
NASG	Used as a temporizing measure until source of bleeding found and treated. NASG is a lower body compressive device made of stretch neoprene which closes tightly with Velcro in segments: for the ankles, calves, thighs, pelvis, and abdomen and is applied rapidly starting at the ankles
A single dose of antibiotics	In the context of placental retention, the placenta should be extracted, and a single dose of antibiotics administered
Uterine artery embolization	If other measures have failed and if the necessary resources are available, the use of uterine artery embolization is recommended as a treatment for PPH due to uterine atony
Surgical intervention	If bleeding persists despite treatment with uterotonic drugs and other conservative interventions, surgical intervention should be used without further delay

Abbreviations: IM, intramuscular; IV, intravenous; NASG, non-pneumatic antishock garment; PPH, postpartum hemorrhage; TXA, tranexamic acid.

First response PPH bundle

Response to refractory PPH bundle

Colucci. Clin Appl Thromb Hemost 2018 Sep;24(6):894-899

Standardized Management Protocol in Severe Postpartum Hemorrhage: A Single-Center Study

Clinical and Applied Thrombosis/Hemostasis
1–10
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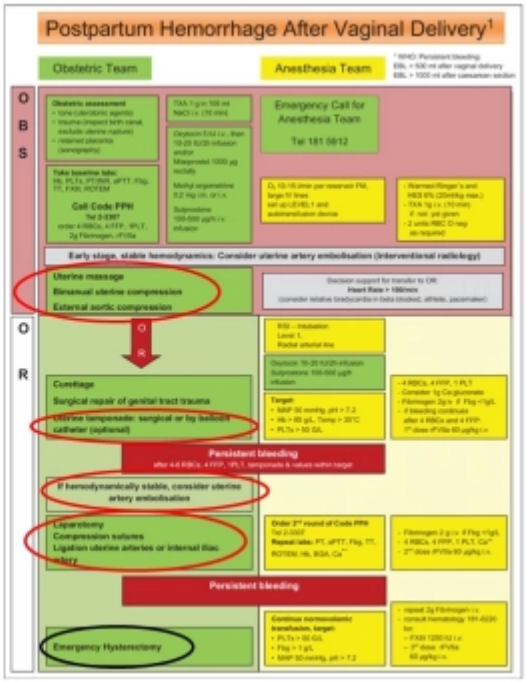
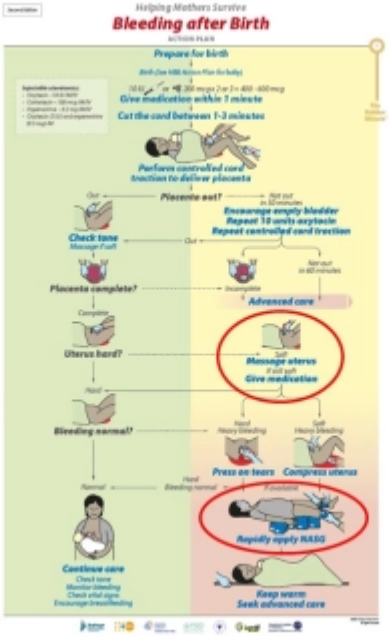
SAGE

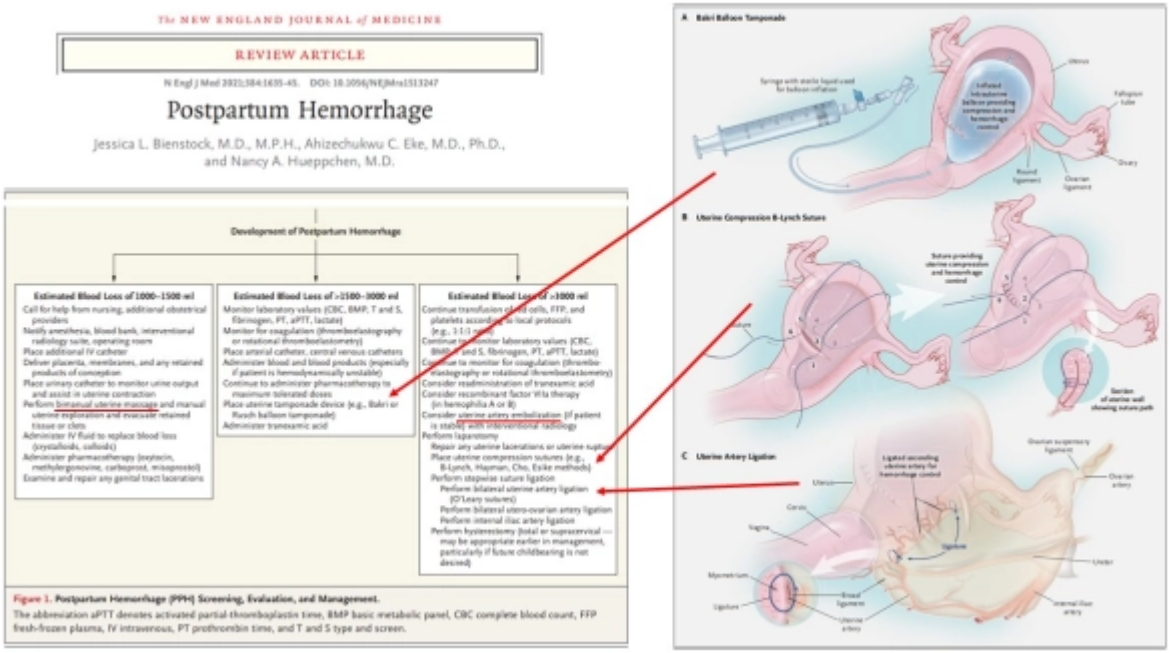
Giuseppe Colucci, MD[1,2], Karin Helsing, MD[1], Franziska Demarmels Biasiutti, MD[1], Luigi Raio, MD[3], Pirmin Schmid, MD[1], Dimitrios A. Tsakiris, MD[4], Balthasar Eberle, MD[5], Daniel Surbek, MD[3], Bernhard Lämmle, MD[1,6], and Lorenzo Alberio, MD[1,7]

Abstract

Severe postpartum hemorrhage (sPPH) is an obstetric emergency that needs prompt and effective therapy to reduce the risk of complications. In this study, women who developed sPPH (study cohort, n = 37) were treated according to a standardized management protocol prescribing sequential administration of uterotonic drugs, crystalloids, tranexamic acid, labile blood products, low-dose fibrinogen, and recombinant activated factor VII (rFVIIa). This group was compared to patients treated with different strategies during 2 preceding periods: an in-house guideline regulating the administration of rFVIIa (historical cohort 1, n = 30) and no specific guideline (historical cohort 2, n = 27). The management protocol was used over 33 months. The study cohort had a lower estimated blood loss ($P = .004$) and required less red blood cell concentrates ($P = .007$), fresh frozen plasma units ($P = .004$), and platelet concentrates ($P = .035$) compared to historical cohort 1 and historical cohort 2, respectively. The necessity of emergency postpartum hysterectomy was lower in the study group ($P = .012$). In conclusion, in patients with sPPH treated with this standardized management protocol, we observed a decreased requirement of labile blood products and lower need to proceed to emergency postpartum hysterectomy.







The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

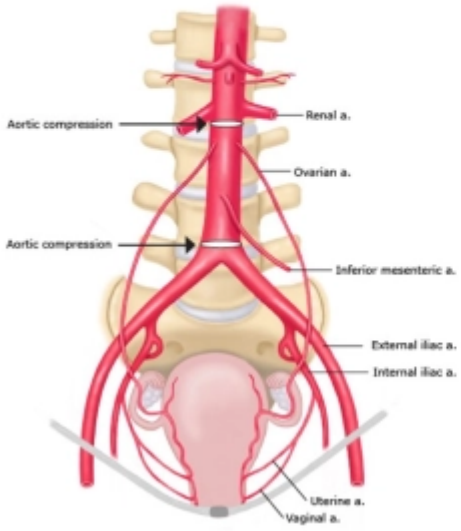
N Engl J Med 2021;384:1635-45. DOI: 10.1056/NEJMra1513247

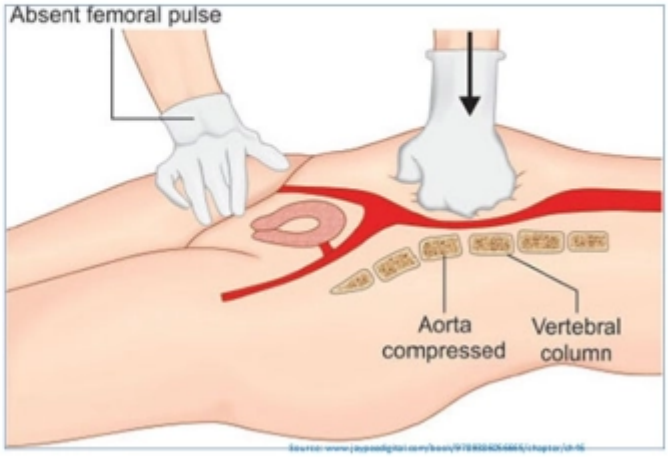
Postpartum Hemorrhage

Jessica L. Bienstock, M.D., M.P.H., Ahizechukwu C. Eke, M.D., Ph.D., and Nancy A. Hueppchen, M.D.

Figure 1. Postpartum Hemorrhage (PPH) Screening, Evaluation, and Management.
The abbreviation aPTT denotes activated partial thromboplastin time, BMP basic metabolic panel, CBC complete blood count, FFP fresh-frozen plasma, IV intravenous, PT prothrombin time, and T and S type and screen.

External aortic compression





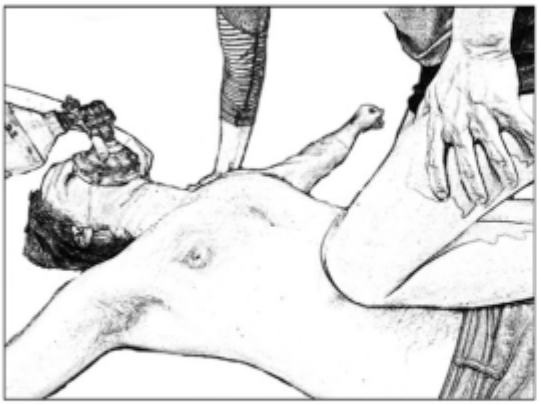
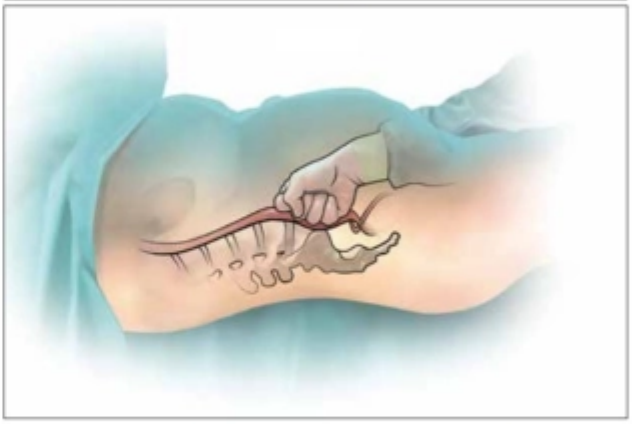


Figure 1. Manual external aortic compression using a knee.

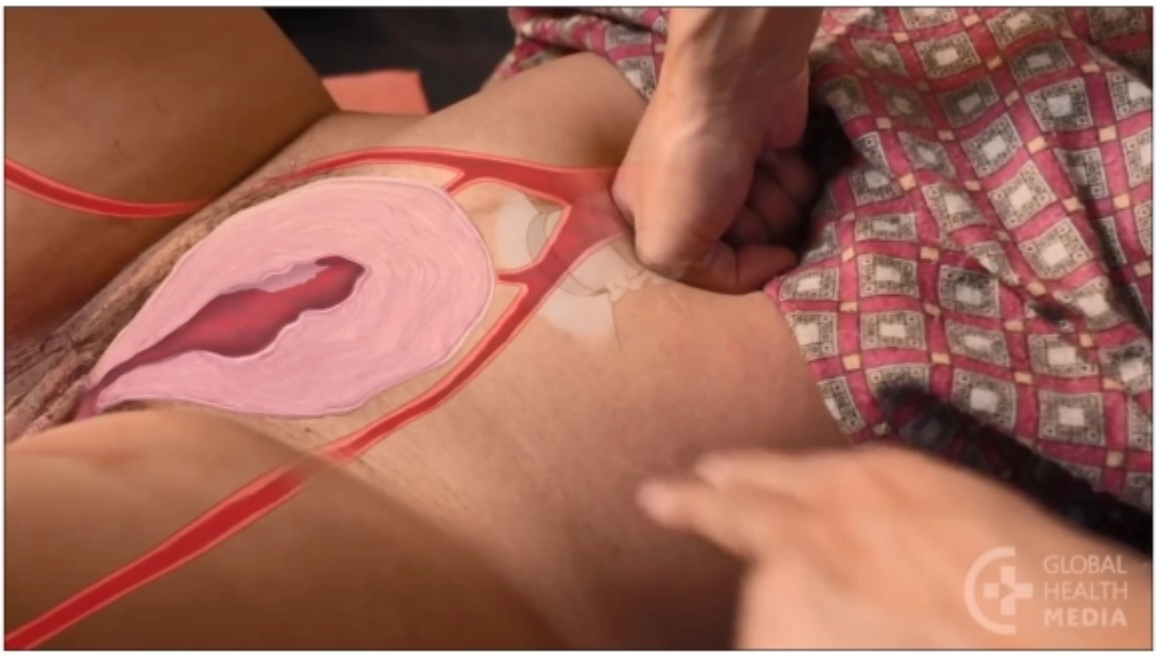
Source: Soeylandet al. Ann Emerg Med . 2022 Mar;79(3):287-310

Aortic compression through an open abdominal incision



During cesarean delivery through a low transverse abdominal incision, the surgeon directly applies pressure to the aorta just above the lumbosacral promontory

Source: Barbieri RL. OBG Manag. 2018 October;30(10):10-12, 14



Prehospital assessment and management of postpartum haemorrhage- healthcare personnel's experiences and perspectives

Ann-Chatrin Linqvist Leonardsen[1,2*], Ann Karin Helgesen[1], Linn Ulvøy[2,3] and Vigdis Abrahamsen Grøndahl[1]

Abstract

Background: Postpartum hemorrhage (PPH) is a serious obstetric emergency, and one of the top five causes of maternal mortality globally. The most common causes of PPH include uterine atony, placental disorders, birth trauma and coagulation defects. Timely diagnosis and early management are critical to reduce morbidity, the need for blood transfusion or even mortality. External, manual aortic compression (AC) has been suggested as an intervention that reduce PPH and extend time for control of bleeding or resuscitation. This procedure is not commonly utilized by healthcare personnel. The incidence of home-births is increasing, and competence in PPH assessment and management is essential in prehospital personnel. The objective was to explore prehospital personnel's competence in PPH and AC, utilizing different tools.

Methods: The study was conducted in a county in South-eastern Norway, including five ambulance stations. All prehospital personnel (*n* = 250) were invited to participate in a questionnaire study. The questionnaire included the PPH self-efficacy (PPHSE) and PPH collective efficacy (PPHCE) tools, as well as tool developed utilizing the Delphi technique. Descriptive statistics were used to analyze the quantitative data, while quantitative content analysis was used to analyse free-text responses.

Results: A total of 87 prehospital personnel responded to the questionnaire, 57.5% male, mean age 37.9 years. In total, 80.4% were ambulance workers and/or paramedics, and 96.6 and 97.7% respectively reported to need more education or training in PPH. Moreover, 82.8% reported having managed patient(s) with PPH, but only 2.9% had performed AC. Prehospital personnels' responses varied extensively regarding knowledge about what PPH is, how to estimate and handle PPH, and how to perform AC. Mean self-efficacy varied from 3.3 to 5.6, while collective efficacy varied from 1.9 to 3.8.

Conclusions: This study indicates that prehospital personnel lack knowledge about PPH and AC, due to various responses to the developed questionnaire. Even though AC is an acknowledged intervention in PPH, few participants reported that this was utilized. Our findings emphasize the need for education and training in PPH and PPH handling generally, and in AC specifically.

Experience

Prehospital personnel's experience with PPH and AC is shown in Table 4.

Reasons for not using AC were 'lack of education' (74.7%), 'lack of training' (10.3%), 'feel unsecure on the procedure' (10.3%), and 'difficult to cause the patient pain' (4.6%) (fixed response alternatives).

Our findings indicate that prehospital personnel lack knowledge about postpartum hemorrhage (PPH) and manual aortic compression (AC). As much as 82.8% had experienced PPH, but only 2.3% had utilized AC.

Table 4 Experiences with PPH and AC (*n* = 87)

	n (%)
Have experience with PPH	72 (82.8)
Have used AC	2 (2.3)
Have considered using AC	5 (5.7)
Had patients where AC may have been appropriate	
Yes	6 (6.9)
No	70 (79.3)
Undecided	11 (13.8)

AC = external, manual, aortic compression

Injury, Int. J. Care Injured 48 (2017) 26–31

Bi-manual proximal external aortic compression after major abdominal-pelvic trauma and during ambulance transfer: A simulation study

M.J. Douma[a], D. O'Dochartaigh[b], P.G. Brindley[c,*]

[a] Royal Alexandra Hospital Emergency Department, Alberta Health Services, Canada
[b] Edmonton Zone Emergency Departments, Alberta Health Services, Canada
[c] Department of Critical Care Medicine, University of Alberta Hospital, Edmonton, Alberta, Canada

ABSTRACT

Background: Applying manual pressure after hemorrhage is intuitive, cost-free, and logistically-simple. When direct abdominal-pelvic compression fails, clinicians can attempt indirect proximal-external-aortic-compression (PEAC), while expediting transfer and definitive rescue. This study quantifies the sustainability of simulated bi-manual PEAC both immediately on scene and during subsequent ambulance transfer. The goal is to understand when bi-manual PEAC might be clinically-useful, and when to prioritize compression-devices or endovascular-occlusion.

Methods: We developed a simulated central vessel compression model utilizing a digital scale and Mallwain intra-abdominal pressure monitor inside a cardiopulmonary resuscitation mannequin. Twenty prehospital health care professionals (HCPs) performed simulated bimanual PEAC i) while stationary and ii) inside an 80 km/h ambulance on a closed driving-track. Participants compressed at "the maximal effort they could maintain for 20 min". Results were measured in mmHg applied-pressure and kilograms compressive-weight. The Borg scale of perceived-exertion was used to assess sustainability, with < 16 regarded as acceptable.

Results: While stationary all participants could maintain 20 min of compressive pressure/weight: within five-percent of their starting effort, and with a Borg-score < 16. Participants applied 88–300 mmHg compression pressure; (mean 180 mmHg), 16–55 kg compression-weight (mean 31 kg), and 37–66% of their bodyweight (mean 45%). In contrast, participants could not apply consistent or sustained compression in a moving ambulance: Borg Score exceeded 16 in all cases.

Conclusions: Survival following major abdominal-pelvic hemorrhage requires expedited operative/interventional rescue. Firstly, however, we must temporize pre-hospital exsanguination both on scene and during transfer. Despite limitations, our work suggests PEAC is feasible while waiting for, but not during, ambulance-transfer. Accordingly, we propose a chain-of-survival that cautions against over-reliance on manual PEAC, while supporting pre-hospital devices, endovascular occlusion, and expeditious but safe hospital-transfer.

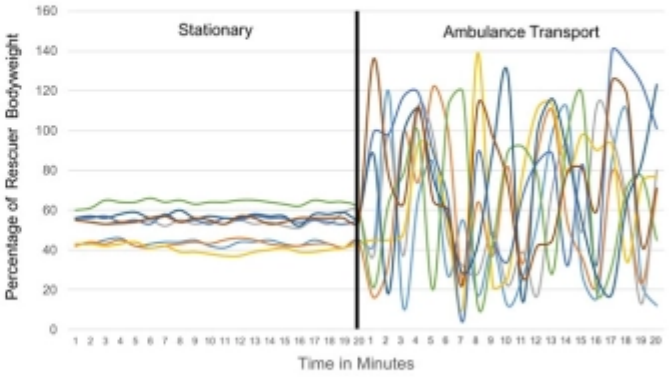


Fig. 3. Combined Stationary and Ambulance Transport Compression.

Brede et al. Critical Care (2022) 26:57 https://doi.org/10.1186/s13054-022-03942-0

COMMENT Open Access

Resuscitative endovascular balloon occlusion of the aorta: the postpartum haemorrhage perspective

Jostein Rødseth Brede[1,2,3,4*], Edmund Søvik[5] and Marius Rehn[2,6,7]

Keywords: REBOA, Postpartum haemorrhage, PPH, Aortic occlusion

Not only in trauma centres, but also in hospitals with obstetric departments, REBOA should be considered an emergency procedure to be immediately available 24/7 by physicians trained in ultrasound-guided and fluoroscopy-free Seldinger technique. Local considerations will decide whether the REBOA is placed by an emergency physician, anaesthesiologist, obstetricians, interventional radiologist or the general surgeon.

Conclusions

REBOA carries more indications than trauma and should be increasingly considered and evaluated in management of PPH. REBOA may not only save a life, it might also save a uterus.

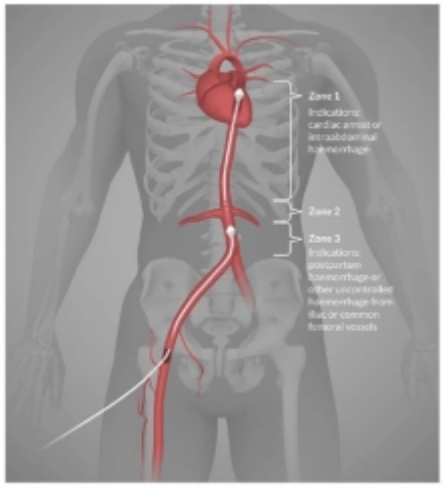
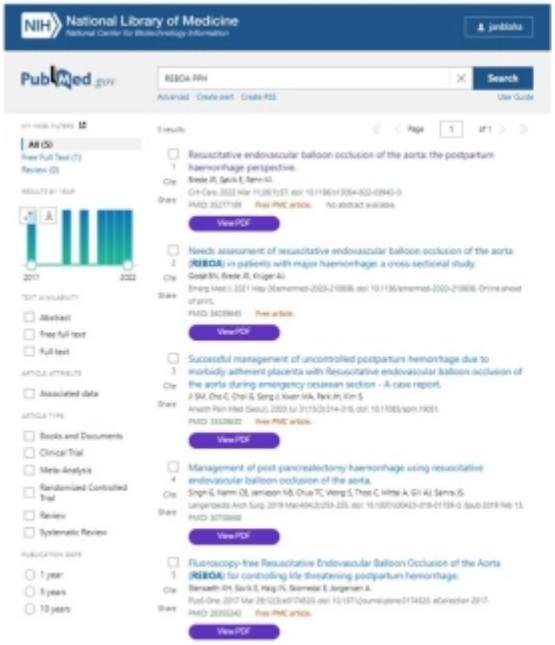


Fig. 1 Aortic zones and indications for occlusion



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ENDOWMENT FUND FOR THE DEVELOPMENT OF GYNECOLOGY AND OBSTETRICS
SINCE 1991

European Journal of Trauma and Emergency Surgery (2018) 44:535–550 https://doi.org/10.1007/s00068-018-0999-y

REVIEW ARTICLE

A systematic review and meta-analysis of the use of resuscitative endovascular balloon occlusion of the aorta in the management of major exsanguination

B. L. S. Borger van der Burg[1] · Thijs T. C. F. van Dongen[1,2] · J. J. Morrison[3] · P. P. A. Hedeman Joosten[1] · J. J. DuBose[4] · T. M. Hörer[5] · R. Hoencamp[1,2,6]

Abstract

Background Circulatory collapse is a leading cause of mortality among traumatic major exsanguination and in ruptured aortic aneurysm patients. Approximately 40% of patients die before hemorrhage control is achieved. Resuscitative endovascular balloon occlusion of the aorta (REBOA) is an adjunct designed to sustain the circulation until definitive surgical or endovascular repair. A systematic review was conducted for the current clinical use of REBOA in patients with hemodynamic instability and to discuss its potential role in improving prehospital and in-hospital outcome.

Methods Systematic review and meta-analysis (1900–2017) using MEDLINE, Cochrane, EMBASE, Web of Science and Central and Emcare using the keywords "aortic balloon occlusion", "aortic balloon tamponade", "REBOA", and "Resuscitative Endovascular Balloon Occlusion" in combination with hemorrhage control, hemorrhage, resuscitation, shock, ruptured abdominal or thoracic aorta, endovascular repair, and open repair. Original published studies on human subjects were considered.

Results A total of 490 studies were identified; 89 met criteria for inclusion. Of the 1436 patients, overall reported mortality was 49.2% (613/1246) with significant differences ($p < 0.001$) between clinical indications. Hemodynamic shock was evident in 79.3%, values between clinical indications showed significant difference ($p < 0.001$). REBOA was favored as treatment in trauma patients in terms of mortality. Pooled analysis demonstrated an increase in mean systolic pressure by almost 50 mmHg following REBOA use.

Conclusion REBOA has been used in trauma patients and ruptured aortic aneurysm patients with improvement of hemodynamic parameters and outcomes for several decades. Formal, prospective study is warranted to clarify the role of this adjunct in all hemodynamic unstable patients.

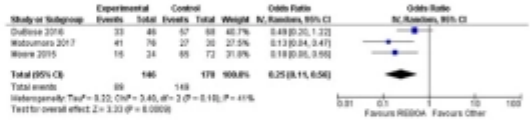

Fig. 2 Meta-analysis of mortality after use of REBOA in trauma. *REBOA* indicates resuscitative endovascular balloon occlusion of the aorta, *IV* inverse variance, *Random* random effect, *CI* confidence interval, *df* degrees of freedom, *P p* value

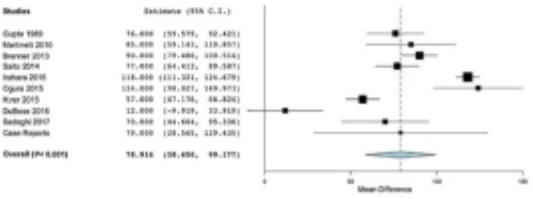

Fig. 3 Meta-analysis of rise in SBP after REBOA use in trauma. *SBP* indicates systolic blood pressure in mmHg, *REBOA* resuscitative endovascular balloon occlusion of the aorta, *CI* confidence interval, *P p* value

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SINCE 1991

Prevention and Management of Postpartum Haemorrhage

Green-top Guideline No. 52 December 2016

Please cite this paper as: Mavrides E, Allard S, Chandraharan E, Collins P, Green L, Hunt BJ, Riris S, Thomson AJ on behalf of the Royal College of Obstetricians and Gynaecologists. Prevention and management of postpartum haemorrhage. BJOG 2016;124:e106–e149.

5.6.2 What surgical treatments can be employed to arrest the bleeding?

If pharmacological measures fail to control the haemorrhage, surgical interventions should be initiated sooner rather than later. D

Intrauterine balloon tamponade is an appropriate first-line 'surgical' intervention for most women where uterine atony is the only or main cause of haemorrhage. C

Conservative surgical interventions may be attempted as second line, depending on clinical circumstances and available expertise. C

It is recommended that a laminated diagram of the brace suture technique be kept in theatre. ✓

Resort to hysterectomy sooner rather than later (especially in cases of placenta accreta or uterine rupture). C

Ideally and when feasible, a second experienced clinician should be involved in the decision for hysterectomy. ✓

The use of pharmacological agents other than those detailed should not delay recourse to surgery. Once the decision is made to embark on surgical haemostasis, the most appropriate choice of procedure will depend, in part, on the experience and expertise of available staff.

Compression of the aorta may be a temporary but effective measure to allow time for resuscitation to catch up with the volume replacement and the appropriate surgical support to arrive. The judgement of senior clinicians, taking into account the individual woman's future reproductive aspirations, is required in deciding the appropriate sequence of interventions.

EJA

Eur J Anaesthesiol 2022; **37**:1–10

OPEN

REVIEW ARTICLE

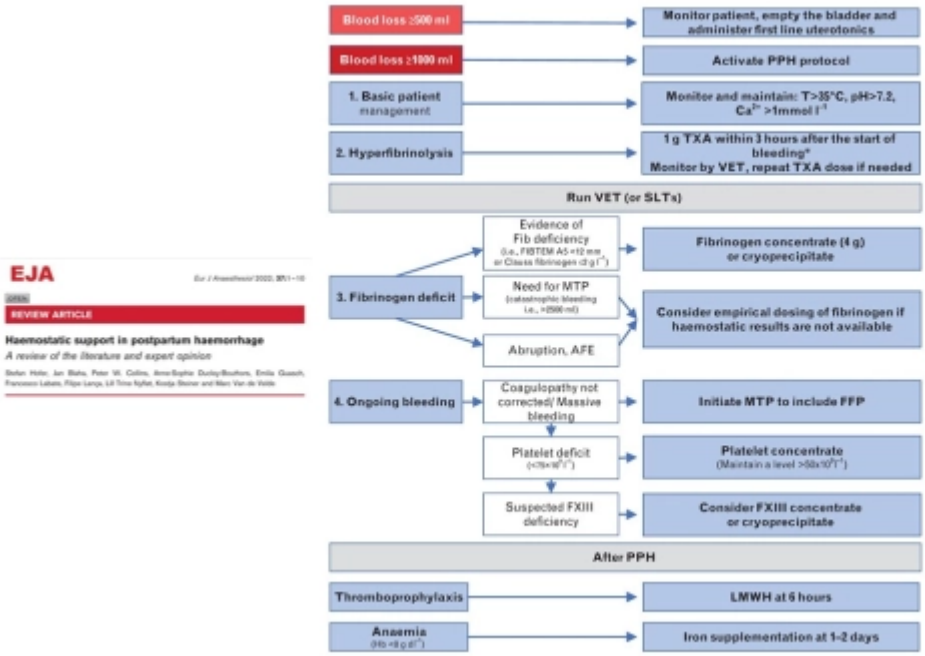
Haemostatic support in postpartum haemorrhage

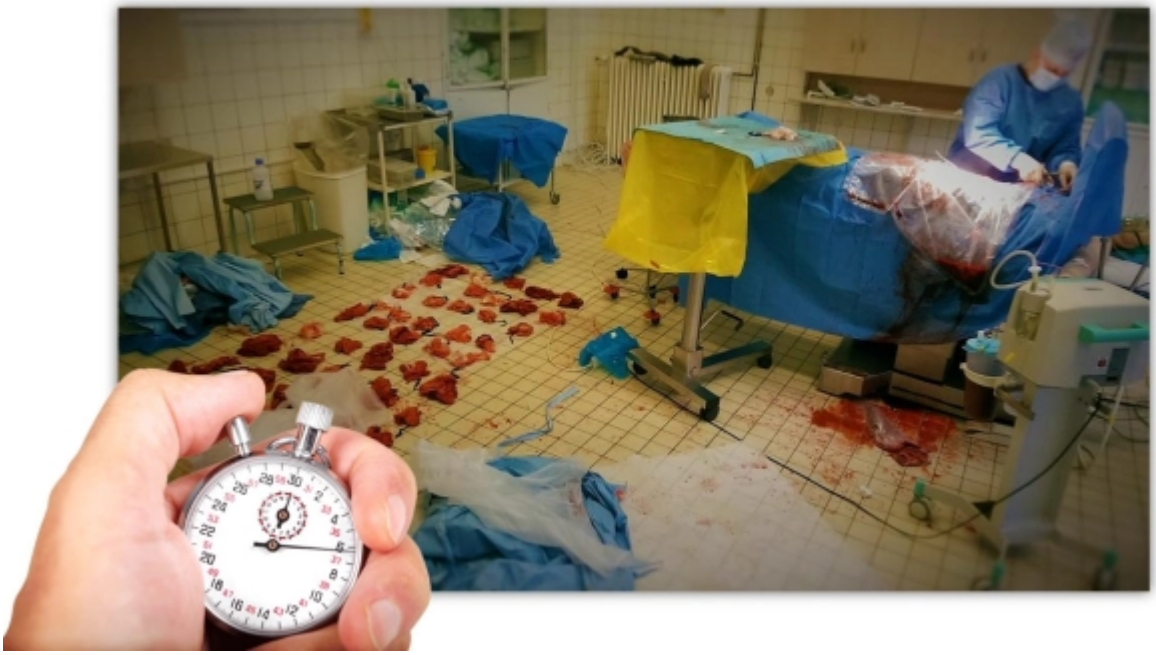
A review of the literature and expert opinion

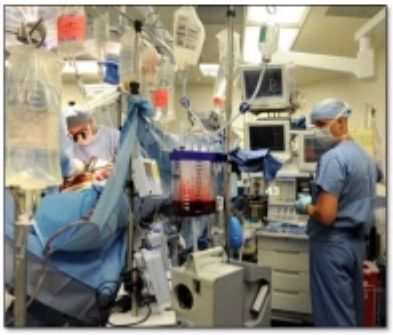
Stefan Hofer, Jan Blaha, Peter W. Collins, Anne-Sophie Ducloy-Bouthors, Emília Guasch, Francesco Labate, Filipe Lança, Lill Trine Nyflot, Kostja Steiner and Marc Van de Velde

Postpartum haemorrhage (PPH) remains the leading cause of pregnancy-related deaths worldwide. Typically, bleeding is controlled by timely obstetric measures in parallel with resuscitation and treatment of coagulopathy. Early recognition of abnormal coagulation is crucial and haemostatic support should be considered simultaneously with other strategies as coagulopathies contribute to the progression to massive haemorrhage. However, there is lack of agreement on important topics in the current guidelines for management of PPH. A clinical definition of PPH is paramount to understand the situation to which the treatment recommendations relate; however, reaching a consensus has previously proven difficult. Traditional definitions are based on volume of blood loss, which is difficult to monitor, can be misleading and leads to treatment delay. A multidisciplinary approach to define PPH considering vital signs, clinical symptoms, coagulation and haemodynamic changes is needed. Moreover, standardised algorithms or massive haemorrhage protocols should be developed to reduce the risk of morbidity and mortality and improve overall clinical outcomes in PPH. If available, point-of-care testing should be used to guide goal-directed haemostatic treatment. Tranexamic acid should be administered as soon as abnormal bleeding is recognised. Fibrinogen concentrate rather than fresh frozen plasma should be administered to restore haemostasis where there is elevated risk of fibrinogen deficiency (e.g., in catastrophic bleeding or in cases of abruption or amniotic fluid embolism) as it is a more concentrated source of fibrinogen. Lastly, organisational considerations are equally as important as clinical interventions in the management of PPH and have the potential to improve patient outcomes.

Published 2022







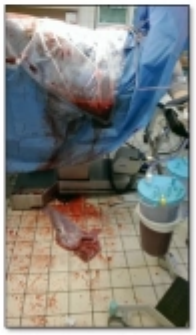


FIGURE 75.—Medical care on Omaha Beach, June 1944. Note the absence of a litter.

Vietnam, 1968

Iraq, 2003

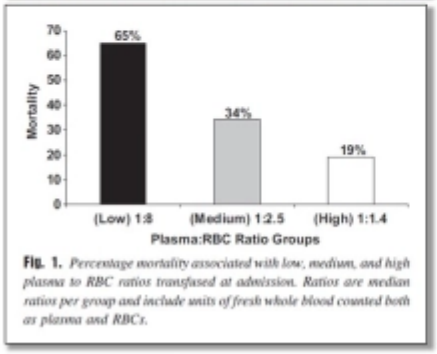
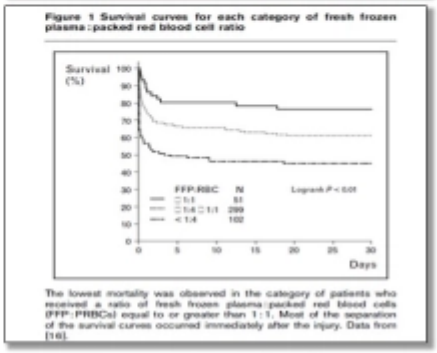


FIG. 1. *Percentage mortality associated with low, medium, and high plasma to RBC ratios transfused at admission. Ratios are median ratios per group and include units of fresh whole blood counted both as plasma and RBCs.*

Borgman et al. | Trauma. 2007;63:805–813.

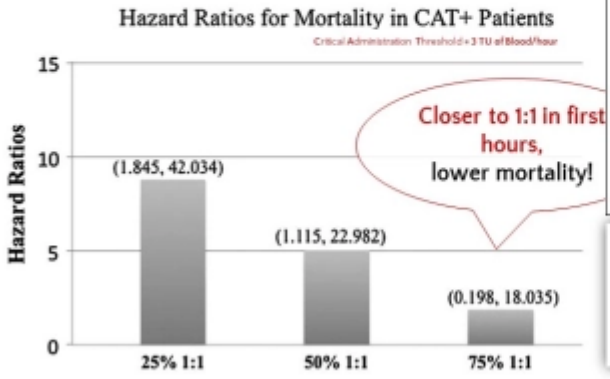


Gilliss et al. Current Opinion in Anaesthesiology. 2010;23:263–268.

Time matters in 1:1 resuscitations: Concurrent administration of blood:plasma and risk of death

Stephanie A. Savage, MD, Ben L. Zarzaur, MD, Martin A. Croce, MD, *and* **Timothy C. Fabian, MD,** *Memphis, Tennessee*

J Trauma Acute Care Surg 2014; Volume 77, Number 6



Optimal Dose, Timing and Ratio of Blood Products in Massive Transfusion: Results from a Systematic Review

Zoe K. McQuilten [a,b,*], Gemma Crighton [a], Susan Brunskill [c], Jessica K. Morison [a], Tania H. Richter [a], Neil Waters [a], Michael F. Murphy [c], Erica M. Wood [a]

ARTICLE INFO

ABSTRACT

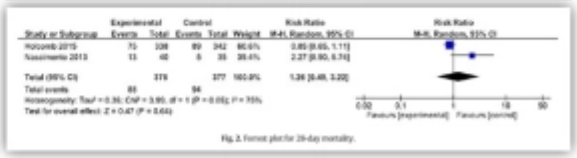


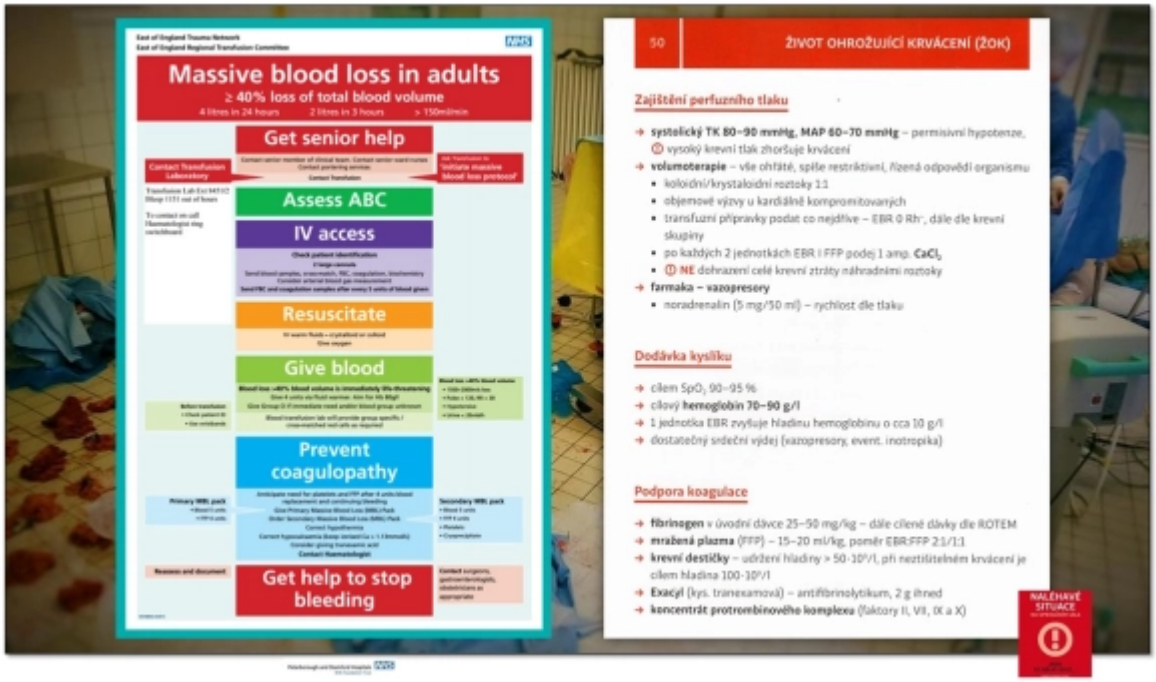
Fig. 2. Forest plot for 28-day mortality.


• We start fluid resuscitation,
• we order blood products,
• and will wait… !!!


PLASMA
A

35
minutes

8
minutes



Meta-analysis of colloids *versus* crystalloids in critically ill, trauma and surgical patients

S. H. Qureshi[1], S. I. Rizvi[2], N. N. Patel[3] and G. J. Murphy[1]

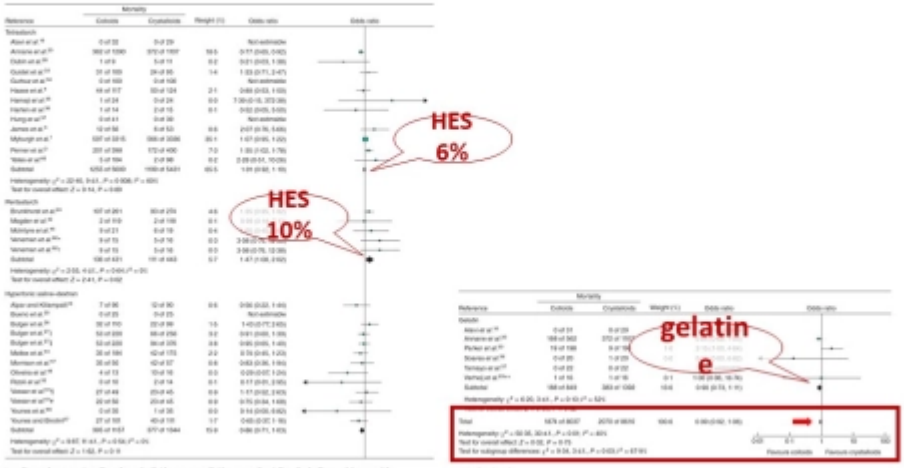


Fig. 2 Continued

ORIGINAL ARTICLE

Impact of experimental haemodilution on platelet function, thrombin generation and clot firmness: effects of different coagulation factor concentrates

Carolina Caballo[1], Gines Escolar[1], Maribel Diaz-Ricart[1], Irene Lopez-Vilchez[1], Miguel Lozano[1], Joan Cid[1], Marcos Pino[1], Joan Beltrán[2], Misericordia Basora[2], Arturo Pereira[1], Ana M. Galan[1]

[1]*Haemotherapy-Haemosta* *nent, Hospital Clinic, IDIBAPS, Bar* *lepar* [2]*Anaes* *ogy,*
Hospital Clinic, Barcelon

Table II - Effect of 60% haemodilution with different crystalloids and colloids on viscoelastic properties of forming clots.

	Baseline	Saline	Ringer lactate	Plasmalyte	HES 130/0.4	5% Albumin	Gelatin
CT (s)	60.9±2.0	88.6±3.0**	75.5±4.3*	70.3±3.2*	163.5±17.1**	111.3±4.6**	104.3±22.7*
CFT (s)	79.6±3.6	205.4±16.5**	202.9±15.4**	210.7±17.1**	457.9±42.5**	243.7±16.4**	344.0±63.2**
A10 (mm)	57.0±1.1	33.7±1.3**	34.3±1.1 **	33.8±1.3**	23.6±1.3**	31.3±1.0**	28.7±3.5**
MCF (mm)	65.0±1.6	42.7±2.3**	44.7±2.3 **	41.0±2.1**	36.5±3.5**	40.7±1.8**	40.8±2.3**

Legend Data are expressed as mean ± S.E.M. (n= 8). *: P <0.05; **: P <0.001 *vs* baseline.

Initial assessment on the impact of crystalloids *versus* colloids during damage control resuscitation

Chrissy Guidry, DO,[a,b] Elizabeth Gleeson, MD, MPH,[a,c] Eric R. Simms, MD,[a] Lance Stuke, MD, MPH,[d] Peter Meade, MD, MPH,[a] Norman E. McSwain Jr, MD,[a] and Juan C. Duchesne, MD[a,*]

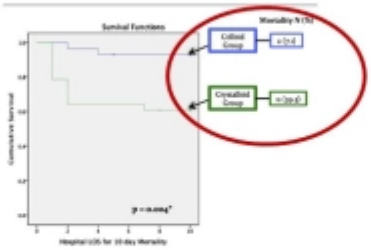


Fig. 1 – KM survivability curve for matched case control.

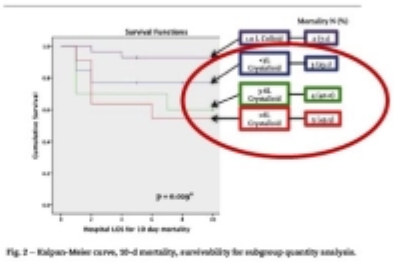


Fig. 2 – Kaplan-Meier curve, 10-d mortality, survivability for subgroup quantity analysis.

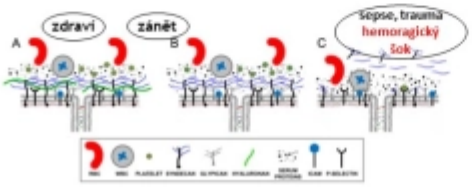


Figure 1.
A) An intact endothelial glycocalyx provides a barrier between the plasma compartment and the cell membrane and lamin RBC, WBC and platelets from contacting the cell surface. The glycocalyx and associated immobile protein layer overlies the cell junction contributing to endothelial barrier properties for both water and protein flux. **B)** During mild to moderate inflammation, shedding and proteolytic cleavage of the glycocalyx (in this case removal of hyaluronan) increases the porosity of the glycocalyx. **C)** During severe inflammation and trauma, breakdown of the glycocalyx exposes ICAM and P-selectin resulting in increased WBC and platelet adhesion, respectively, and propagation of the inflammatory response. Note the presence of shed syndecans and heparan sulfates in the plasma that are hypothesized to contribute to auto-heparinization and the coagulopathy of trauma (see text for detail).

Chignalia. Shock 2016 April; 45(4): 338–348

In massive bleeding, fibrinogen is the first factor to reach critically low levels!

Brenni M., et al. Acta Anaesthesiol Scand. 2010;54:1111–1117

Injury, Int. J. Care Injured 48 (2017) 1074–1081

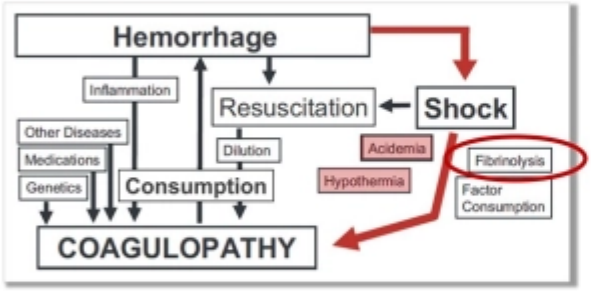
Fibrinogen is an independent predictor of mortality in major trauma patients: A five-year statewide cohort study

Zoe K. McQuilten[a,b,*], Erica M. Wood[b], Michael Bailey[a], Peter A. Cameron[c], David J. Cooper[a]

Table 2
Patient outcomes according to fibrinogen level on admission.

Outcome	less 1 g/L	1–1.5 g/L	1.6–2.0 g/L	2.1–4.0 g/L	Greater than 4 g/L	p-value
Massive transfusion	63 (55.3%)	93 (32.9%)	104 (16.9%)	124 (4.1%)	12 (1.6%)	<0.01
ICU LOS days[a], mean (95% CI)	8 (6, 11)	7.5 (6, 9)	6 (5, 7)	5 (4, 5)	5 (4, 5)	<0.01
Hospital LOS days[a], mean (95% CI)	21 (17, 26)	17 (15, 19)	12 (11, 13)	8 (8, 9)	9 (8, 10)	<0.01
24-h mortality	36 (31.6%)	29 (10.2%)	24 (3.9%)	44 (1.5%)	3 (0.4%)	<0.01
In-hospital mortality	54 (47.4%)	71 (25.1%)	77 (12.5%)	186 (6.2%)	53 (7.2%)	<0.01

ICU – intensive care unit; LOS – length of stay.
[a] Restricted to patients who survived until hospital discharge.



Adaptionsino J Hess et al. J Trauma. 2008;65:748-54

Effect of early tranexamic acid administration on mortality, hysterectomy, and other morbidities in women with post-partum haemorrhage (WOMAN): an international, randomised, double-blind, placebo-controlled trial

WOMAN Trial Collaborators*

Summary

Background Post-partum haemorrhage is the leading cause of maternal death worldwide. Early administration of tranexamic acid reduces deaths due to bleeding in trauma patients. We aimed to assess the effects of early administration of tranexamic acid on death, hysterectomy, and other relevant outcomes in women with post-partum haemorrhage.

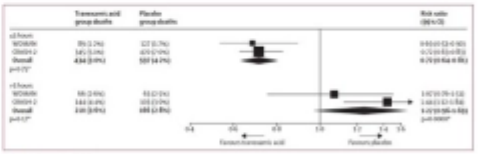


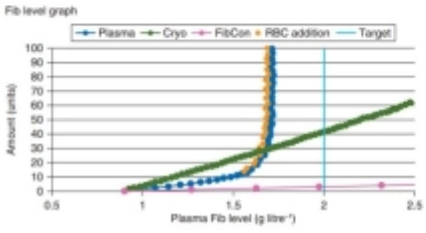
Figure 2: Time to treatment
*Heterogeneity p value.

BJA

British Journal of Anaesthesia 113 (4): 585–95 (2014)

Theoretical modelling of fibrinogen supplementation with therapeutic plasma, cryoprecipitate, or fibrinogen concentrate

P. W. Collins1*, C. Solomon2,3, K. Sutor4, D. Crispin4, G. Hochleitner5, S. Rizzi5, H. Schoch1,6, M. Schreiber7 and M. Bonsu2,3



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MINIREVIEW

Signa Vitae

Blood management in post-partum haemorrhage, including point of care coagulation tests

Martha Belete1,†, Edmund Gerrans1,†, Madhavi Keskar1,*

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*Correspondence
(Madhavi Keskar)

† These authors contributed equally

Abstract

Postpartum haemorrhage (PPH) is the leading global cause of maternal mortality, and an important cause of morbidity and mortality in the UK. Management of PPH requires a patient centred team approach to ensure effective management. Early recognition and treatment as soon as ...

6.2 Replacing Fibrinogen

Fibrinogen should be replaced either by giving cryoprecipitate or fibrinogen concentrate [1, 55]. Both contain higher concentrations of fibrinogen compared to FFP, which has relatively low concentrations of fibrinogen and can dilute down existing fibrinogen within the circulation [13]. A multicentre double-blinded RCT in primary PPH showed outcomes were not improved when fibrinogen was empirically replaced [59]. 2 pools of cryoprecipitate or 4 g of fibrinogen concentrate should be transfused if FIBTEM A5 7-11 mm or Clauss fibrinogen is < 2 g/L. If FIBTEM A5 < 7 mm then 3 pools of cryoprecipitate or 6 g fibrinogen concentrate should be transfused [55]. Cryoprecipitate requires thawing, which can delay transfusion. Fibrinogen concentrate does not require thawing and so can be more rapidly transfused [13]. If these transfusion triggers are met but bleeding has stopped and there is no clinical concern then fibrinogen replacement can be withheld [40, 55].

Thrombosis Research Volume 116, Issue 4, 2005, Pages 345-356
https://doi.org/10.1016/j.thromres.2004.12.009

Regular Article

A new global assay of coagulation and fibrinolysis

Neil A. Goldenberg [a, b, *], William E. Hathaway [a, b], Linda Jacobson [b], Marilyn J. Manco-Johnson [a, b]

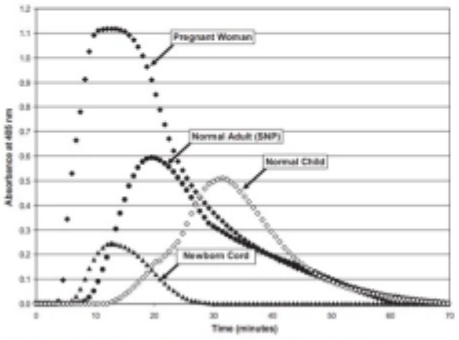


Figure 2 Representative ClotAL curves from a healthy adult and child, newborn infant, and pregnant woman. SNP=standard normal pooled adult plasma.

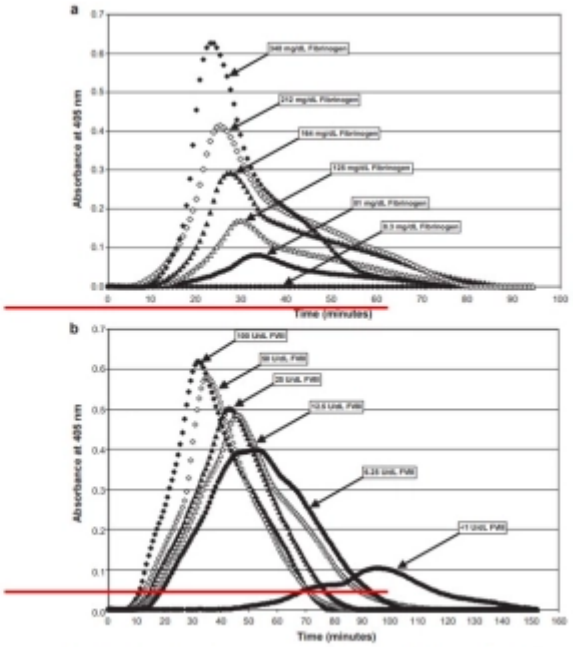
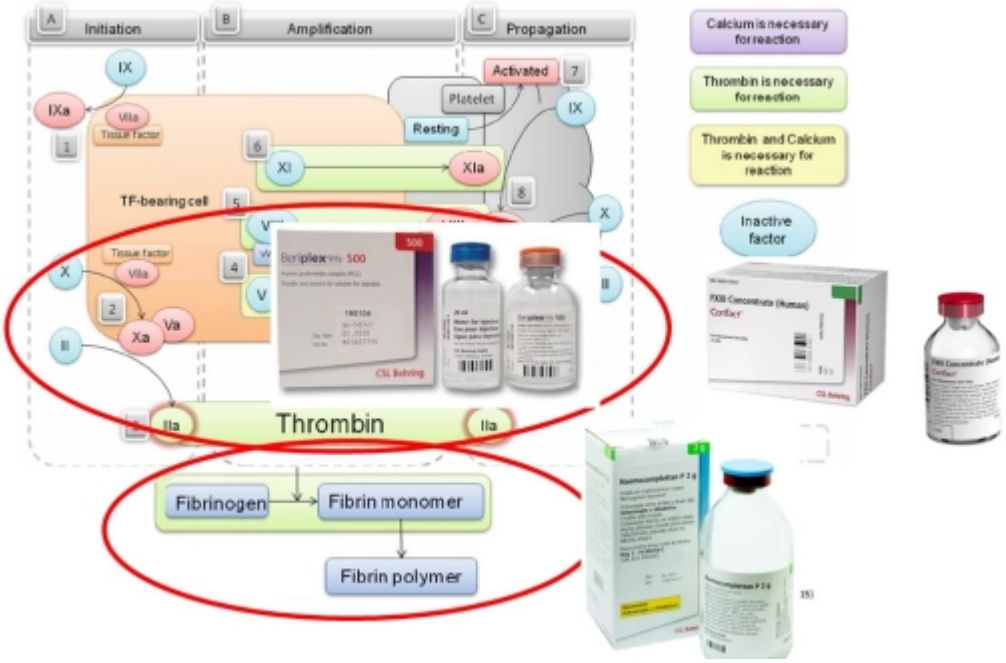
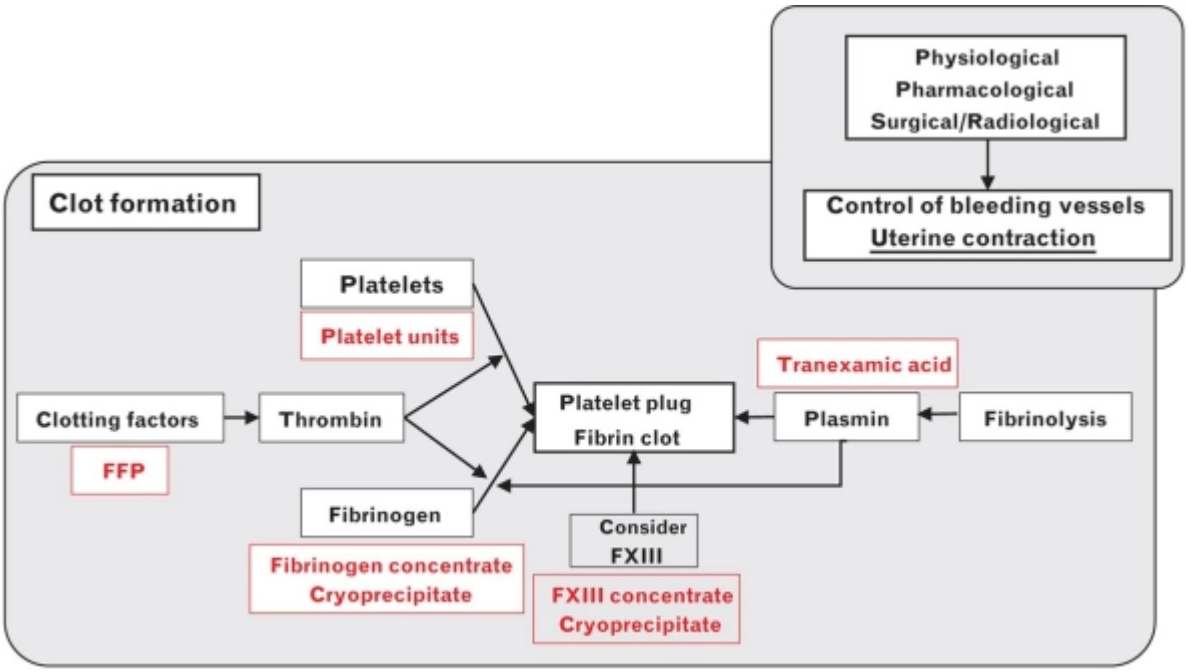


Figure 3 Influence of (a) fibrinogen concentration and (b) factor VIII activity upon the ClotAL curve.





Eur J Anaesthesiol 2022; **37**:1–10

JAMA. 2002;288:1499-1507 www.jama.com

Anemia and Blood Transfusion in Critically Ill Patients

Jean Louis Vincent, MD, PhD, FCCP for the ABC Investigators

Table 6. Difference in Mortality by Number of Units Transfused

Units Transfused	No.	Mortality, % Survived (n = 2422)	Mortality, % Died (n = 614)	*P* Value*
0	1896	85.1	14.9	<.01
1	157	84.1	15.9	
2	377	79.6	20.4	
3	157	70.7	29.3	
4	130	69.2	30.8	
>4	319	55.2	44.8	

*Numbers do not total 3534 because of missing data (some forms incomplete).

Impact of Plasma Transfusion in Trauma Patients Who Do Not Require Massive Transfusion

Kenji Inaba, MD, FRCSC, FACS, Bernardino C Branco, MD, Peter Rhee, MD, FACS, Lorne H Blackbourne, MD, FACS, John B Holcomb, MD, FACS, Pedro GR Teixeira, MD, Ira Shulman, MD, Janice Nelson, MD, Demetrios Demetriades, MD, PhD, FACS

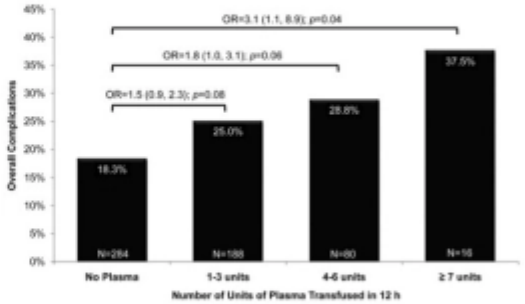


Figure 2. Overall complication rates stratified by the number of units of plasma transfused in 12 hours. OR, odds ratio (95% confidence interval); p-values were derived from McNemar's chi-square test.

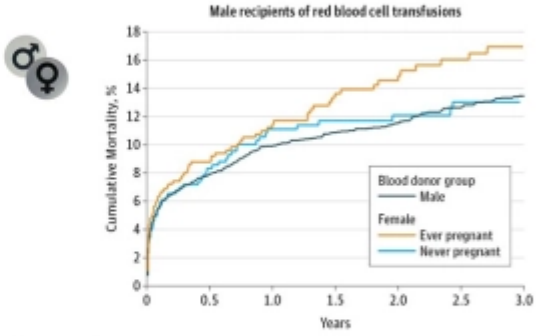
Table 1. Transfusion-related risks, modified according to Marcucci and colleagues (1)

Type of Risk	Estimate of Current Risk (Infection Rate Per Unit) High HDI Countries	Low HDI Countries
Infections		
Viruses		
HIV	1:1,468,000 (53)–1:4,700,000 (10)	1:50 (54)–1:2,578 (55)
HBV	1:31,000 (10)–1:205,000 (53)	1:74–1:1,000 (56)
HCV	1:1,935,000 (53)–1:3,100,000 (10)	1:2,578 (55)
Bacteria	1:2,000–1:8,000 (platelet pools) 1:28,000–1:143,000 (red cells) (10)	?
Parasites		
Malaria	1:4,000,000 (10)	≤1:3 (57)
Prions		
vCJD	First two cases (4,5)	?
Immunological reactions		
Hemolytic transfusion reactions		
Acute hemolytic	1:13,000 (10)	?
Delayed hemolytic	1:9,000 (10)	?
Alloimmunization	1:1,600 (10)	?
Immunosuppression	1:1 (58,59)	?
TRALI	1:4,000–1:267,000* (60)	?
Mistransfusion	1:14,000–1:18,000 (2)	?

HDI, human development index, an index based on life expectancy, literacy, enrollment in scholarly education, and per capita income; HIV, human immunodeficiency virus; HBV, hepatitis B virus; HCV, hepatitis C virus; vCJD, variant Creutzfeld-Jacob disease; TRALI, transfusion-related acute lung injury. Values in parentheses are reference numbers.

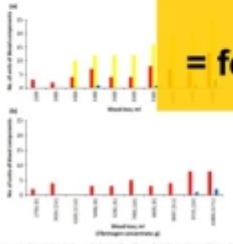
Original Investigation October 12, 2017

Association of Blood Transfusion From Female Donors With and Without a History of Pregnancy With Mortality Among Male and Female Transfusion Recipients



No. at risk by donor group							
Male	6189	2408	2102	1833	1624	1421	1236
Female							
Ever pregnant	1190	438	367	305	245	197	163
Never pregnant	1084	393	331	279	225	177	146

Fibrinogen concentrate vs. fresh frozen plasma for the management of coagulopathy during thoraco-abdominal aortic aneurysm surgery: a pilot randomised controlled trial



COAGULATION FACTORS versus PLASMA

= fewer transfusion products administered!

Reversal of trauma-induced coagulopathy using first-line coagulation factor concentrates or fresh frozen plasma (RETIC): a single-centre, parallel-group, open-label, randomised trial

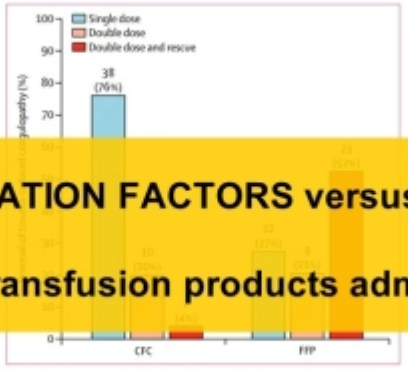


Figure 3: Percentage of patients with reversal of coagulopathy after either single-dose or double-dose study drug administration during the first therapy loop, and percentage of patients needing double-dose and rescue medication during the first 24 h in the intention-to-treat population
CFC=coagulation factor concentrates. FFP=fresh frozen plasma.

OPEN

The Clinical Efficacy of Fibrinogen Concentrate in Massive Obstetric Haemorrhage with Hypofibrinogenaemia