guidelines for trauma patients and although the exact haemoglobin concentration required to aid haemostasis is unclear targeting a level of 7–9 g dl⁻¹ has been suggested. Thus interpretation of VEM results in conjunction with the haemoglobin level and platelet count empowers the clinician to make appropriate decisions regarding further blood component therapy.

Haemostatic resuscitation and monitoring is in the midst of a paradigm shift. The treatment of the bleeding and coagulopathic mother after delivery is team based rather than specialty based and, as highlighted recently in this journal, many lifesaving decisions have to be made in the face of clinical uncertainty. This review highlights several ways for the obstetric anaesthetist to inform their decision-making when facing these complex and critical clinical situations.

Declaration of interest
None declared.

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Erythrocytes, haemostasis, and coagulation monitoring in postpartum haemorrhage (PPH)

Reply from the authors
Editor—We thank Dr Cullen for his positive comments for our article. We agree with his excellent points on the contribution of erythrocytes to haemostasis, and also on the recommendation to monitor and maintain appropriate haemoglobin levels in PPH patients. Many haematological and physiological factors influence the coagulation system, directly or indirectly, and it is crucial to understand whether these factors should impact clinical management of haemostasis during PPH.

As highlighted by Dr Cullen, erythrocytes can positively influence primary haemostasis. In anaemic and polycythaemic patients with normal platelet counts, erythrocyte concentration (haematocrit) correlates inversely with bleeding time. Similar findings have been reported for peripheral venous haematocrit in healthy patients, patients with idiopathic thrombocytopenic purpura, and patients with other bleeding disorders. Low haemoglobin levels are also independently associated with prolonged bleeding time. In addition, erythrocyte transfusion has been shown to normalize prolonged bleeding time in uraemic patients. One explanation for this is the margination of platelets, as cited by Dr Cullen, which is enhanced with increasing haematocrit. Platelet margination results from the difference in size between platelets and erythrocytes, and promotes the haemostatic function of platelets by increasing the frequency with which platelets collide with the vessel wall. While this mechanism may explain variations in primary haemostasis in non-bleeding patients, the capacity for platelet margination to impact haemostasis during major bleeding remains untested. Studies in the setting of obstetric, perioperative, or trauma-related bleeding would be required to investigate this hypothesis.

Additional prohaemostatic properties of erythrocytes have been postulated. For example, the identification of a fibrinogen receptor on human erythrocytes raises the possibility of specific fibrinogen–erythrocyte interactions, although whether there is any role for this interaction in clot formation during major bleeding remains uncertain. Irrespective of potential interactions with the coagulation system, erythrocyte transfusion is performed based on haemoglobin measurements to improve the patient’s oxygen-carrying capacity, not with the aim of increasing haematocrit to improve haemostasis. In keeping with this, PPH management guidelines from the Royal College of Obstetricians and Gynaecologists and from the World Health Organization, make recommendations on target levels for haemoglobin (8 g dl⁻¹) but not for haematocrit.

Changes in haematocrit also manifest in the results of whole-blood coagulation tests performed using viscoelastic methods (ROTEM/TEG). In these tests, high haematocrit levels are associated with reduced speed and quality of clot formation. At low haematocrit, viscoelastic measurements of fibrin-based clot quality correlate more closely with plasma fibrinogen concentration than at high haematocrit. The data suggest that at high haematocrit, the increased number of erythrocytes has a dilution effect on the coagulation factors that contribute to clot formation. However, it is important to remember that these findings reflect what is happening with whole-blood coagulation in vivo. It has been suggested that the contribution of haematocrit to clot quality should be taken into account when interpreting and making therapeutic decisions based on viscoelastic measurements, although this neglects the fact that haematocrit, as a component of whole blood, is central to the methodology of viscoelastic coagulation monitoring. In clinical practice, correction of haematocrit and haemoglobin is a precondition for further haemostatic therapy, so variations in dosing of haemostatic therapy in response to haemoglobin/haematocrit are not warranted. It is interesting to note that because guidelines specify a target haemoglobin level, clinicians are successful in maintaining this level, often with the aid of point of care haemoglobin monitoring. In contrast, appropriate target levels for coagulation tests during severe haemorrhage are unclear, as is the question of whether similar target levels
should apply to postpartum bleeding and clinical situations such as trauma and postoperative bleeding. This area requires further study.

As with the effects of haematocrit/haemoglobin on primary haemostasis, data on the contribution of haematocrit to viscoelastic clot quality are not PPH specific. Studies in this area may be interesting, although not clinically useful for coagulation management. In clinical practice, the aim should be to optimize erythrocyte levels based on the measurement of haemoglobin/haematocrit, and clot formation based on appropriate coagulation test results; with all treatment decisions made in the context of the specific clinical situation and the individual patient’s condition.

Declaration of interest

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Observational studies are not reliable enough when making decisions about individual patient care

Editor—we read with concern Koster and colleagues1 observational study of tranexamic acid and its association with increased rate of seizures and in-hospital mortality after heart surgery. Unfortunately, it is reminiscent of the beginnings of the sorry tale of aprotinin that led to its licence being suspended by drug regulatory agencies around the world.2 Similar observational studies led to concerns about the safety of aprotinin despite there being overwhelming evidence of its efficacy to reduce blood loss and transfusion and no evidence of increased incidences of adverse events from a meta-analysis of randomized controlled trials (RCTs).3 The final nail in the coffin that led to the suspension of the licence for aprotinin was the BART study, which was an RCT, which found aprotinin to be associated with a higher mortality than the lysine analogues including tranexamic acid.4 However, a subsequent review of the evidence by Health Canada and other health regulatory agencies around the world discredited the evidence from the observational studies.2 In addition, when the BART trial was reviewed and re-analysed by Health Canada, there was no difference in mortality between aprotinin and the lysine analogues. Consequently, Health Canada lifted the suspension of aprotinin’s licence in 2012 and the European Medicines Agency has also recommended to the EU that the suspension of the licence for aprotinin should be lifted.2

Great caution must be taken when interpreting the findings from any study that uses an observational design, such as Koster and colleagues have used, as it has great inherent bias that cannot be overcome by statistical adjustment. Also, observational studies should not be used as the basis for changing accepted clinical practice. When making decisions about using or losing a drug such as tranexamic acid, we should rely on the large body of robust evidence of efficacy and safety that precedes the observational