

CONTROVERSIES IN OBSTETRIC ANAESTHESIA

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Thromboelastography should be available in every labour ward

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Thromboelastography (TEG[®]) was invented by Hartet in 1948¹ and measures the viscoelastic changes of blood during clotting. It never gained popularity in coagulation laboratories, perhaps because it did not have the same reproducibility as conventional coagulation tests and cannot perform batch analyses as is required in a modern coagulation laboratory serving a large hospital. In the 1980s, the pioneering work of Kang led to the routine use of TEG[®] for near-patient monitoring of the complex haemostatic changes seen during liver transplantation.² Its use has been in monitoring perioperative haemostasis in a number of situations. The TEG[®] is unique in that, in under an hour, it can provide a "global" picture of haemostasis, that is an analysis of whole blood that assesses platelets, coagulation and fibrinolysis.

The term thromboelastography is taken from the properties of clot formation itself, and is a measure of the viscous and elastic properties of the clot over time. Its principle is very simple. Whole blood or plasma is placed in an oscillating cuvette warmed to 37°C and a pin attached to a torsion wire placed in the cuvette. As clots form between the pin and cuvette, the rotation of the cuvette is transmitted to the pin, and the change in tension is measured electro-magnetically producing a trace. The trace reveals not only the length of the clotting time, but also the strength of the clot achieved, which is dependent on platelets and coagulation factors. Fibrinolysis can also be observed; if there is fibrinolytic activation the clot is broken down in the cuvette and this is reflected in the trace. TEG[®] testing

has evolved so that activators such as tissue factor and celite can be added to speed the formation of the clot. Also the use of sophisticated software has made it possible to examine the various constituents of the trace e.g. the effects of platelets can be blocked to study underlying coagulation. Variants such as the RoTEM[®] are now being explored.³

The TEG[®] has been used perioperatively to monitor haemostasis and guide the use of blood products. In liver transplantation it has been shown in one study to improve haemostatic assessment and therefore decrease the unnecessary transfusion of blood products.² Its use has been demonstrated as being a significantly better predictor of postoperative haemorrhage and need for re-operation following cardiac surgery using cardiopulmonary bypass, than the activated clotting time or coagulation screen.⁴ Shore Lesserson *et al.*⁵ showed that a TEG[®]-guided transfusion algorithm could reduce transfusions in complex cardiac surgery when compared to clinician discretion, although more recently, Avidan *et al.*⁶ have shown that any algorithm, when compared to clinician discretion alone, reduces the use of blood components in cardiac surgery.

Considering the haemostatic concerns on the labour ward, there are situations where it can be argued that a routine coagulation screen and full blood count do not provide enough information. Such situations include assessing whether a woman is haemostatically fit for regional anaesthesia when she has a haemostatic defect or is taking an anti-thrombotic such as low molecular weight heparin. Another situation is assessing need for blood component support in a large post-partum haemorrhage. Moreover, in pregnancy in view of the underlying prothrombotic state, the physician is walking a tightrope between of over-treatment in a bleeding patient and

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predisposing to venous thrombosis. The risks of venous thrombosis in pregnancy remain about 1–2 per thousand pregnancies, and despite the increased use of thromboprophylaxis, and excellent guidelines from the Royal College of Obstetricians, venous thromboembolism and haemorrhage remain major causes of maternal death in the UK. The increased risk of venous thrombosis in pregnancy relates to changes in the vessel wall, reduced flow in the pelvis and legs and a prothrombotic state.

The prothrombotic state of pregnancy is demonstrated well by the TEG[®],^{7–9} with normalisation of parameters by a mean of 6 weeks postpartum.¹⁰ Gorton et al.¹¹ showed that the maximal amplitude (MA) was significantly increased. The MA reflects the strength of the clot and the interaction between platelets and fibrinogen. In pregnancy the amplitude is greater than that of a healthy non-pregnant woman. In gestational thrombocytopenia the MA remains greater than in a normal healthy woman until the platelet count falls well below $50 \times 10^9/L$, due to the increased levels of coagulation factors, especially fibrinogen.

So the TEG[®] has enormous potential in the labour ward for assisting the obstetric anaesthetist in haemostatic decision-making. It has been used to assess hypercoagulable states and coagulation defects in pregnancy.^{12,13} An interesting observation has been that women with recurrent miscarriage have an increased MA.¹⁴ By giving a global picture of haemostasis, thromboelastography can lead to improved decision-making about safety of using regional anaesthesia, it may be able to reduce inappropriate use of blood products¹⁵ and haemostatic drugs, and its fast feedback time makes it ideal for monitoring in a fast moving situation such as massive blood loss. Practically, quality control is necessary, and is probably best served by running thromboelastography in collaboration with the local pathology laboratory. What is also required is a large-scale study to assess the validity of the TEG[®] and practical algorithms in obstetric anaesthesia.

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The use of near-patient coagulation testing is increasing. In many situations clinicians feel that rapidly available

bedside tests aid clinical decision-making. Good examples of this include the use of activated clotting times to monitor heparinisation during dialysis and following cardiopulmonary bypass. Thromboelastography (TEG) was first developed during the Second World War and was put into clinical practice in the setting of orthotopic liver transplantation in the early 80s.¹ The principles and

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