Thromboelastography (TEG) and rotational thromboelastometry (ROTEM) for trauma-induced coagulopathy in adult trauma patients with bleeding

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Authors' objectives

Background: Trauma-induced coagulopathy (TIC) is a disorder of the blood clotting process that occurs soon after trauma injury. A diagnosis of TIC on admission is associated with increased mortality rates, increased burdens of transfusion, greater risks of complications and longer stays in critical care. Current diagnostic testing follows local hospital processes and normally involves conventional coagulation tests including prothrombin time ratio/international normalized ratio (PTr/INR), activated partial prothrombin time and full blood count. In some centres, thromboelastography (TEG) and rotational thromboelastometry (ROTEM) are standard tests, but in the UK they are more commonly used in research settings.

Objectives: The objective was to determine the diagnostic accuracy of thromboelastography (TEG) and rotational thromboelastometry (ROTEM) for TIC in adult trauma patients with bleeding, using a reference standard of prothrombin time ratio and/or the international normalized ratio.

Search methods: We ran the search on 4 March 2013. Searches ran from 1970 to current. We searched The Cochrane Library, MEDLINE (OvidSP), EMBASE Classic and EMBASE, eleven other databases, the web, and clinical trials registers. The Cochrane Injuries Group's specialised register was not searched for this review as it does not contain diagnostic test accuracy studies. We also screened reference lists, conducted forward citation searches and contacted authors.

Selection criteria: We included all cross-sectional studies investigating the diagnostic test accuracy of TEG and ROTEM in patients with clinically suspected TIC, as well as case-control studies. Participants were adult trauma patients in both military and civilian settings. TIC was defined as a PTr/INR reading of 1.2 or greater, or 1.5 or greater.

Data collection and analysis: We piloted and performed all review stages in duplicate, including quality assessment using the QUADAS-2 tool, adhering to guidance in the Cochrane Handbook for Diagnostic Test Accuracy Reviews. We analysed sensitivity and specificity of included studies narratively as there were insufficient studies to perform a meta-analysis.

Main results: Three studies were included in the final analysis. All three studies used ROTEM as the test of global haemostatic function, and none of the studies used TEG. Tissue factor-activated assay EXTEM clot amplitude (CA) was the focus of the accuracy measurements in blood samples taken near to the point of admission. These CAs were not taken at a uniform time after the start of the coagulopathic trace; the time varied from five minutes, to ten minutes and fifteen minutes. The three included studies were conducted in the UK, France and Afghanistan in both civilian and military trauma settings. In two studies, median Injury Severity Scores were 12, inter-quartile range (IQR) 4 to 24; and 22, IQR 12 to 34; and in one study the median New Injury Severity Score was 34, IQR 17 to 43. There were insufficient included studies examining each of the three ROTEM CAs at 5, 10 and 15 minutes to make meta-analysis and investigation of heterogeneity valid. The results of the included studies are thus reported narratively and illustrated by a forest plot and results plotted on the receiver operating characteristic (ROC) plane. For CA5 the accuracy results were sensitivity 70% (95% CI 47% to 87%) and specificity 86% (95% CI 82% to 90%) for one study, and sensitivity 96% (95% CI 88% to 100%) and specificity 58% (95% CI 44% to 72%) for the other. For CA10 the accuracy results were sensitivity 100% (95% CI 94% to 100%) and specificity 70% (95% CI 56% to 82%). For CA15 the accuracy results were sensitivity 88% (95% CI 69% to 97%) and specificity 100% (95% CI 94% to 100%).

No uninterpretable ROTEM study results were mentioned in any of the included studies. Risk of bias and concerns around applicability of findings was low across all studies for the patient and flow and timing domains. However, risk of bias and concerns around applicability of findings for the index test domain was either high or unclear, and the risk of bias for the reference standard domain was high. This raised concerns around the interpretation of the sensitivity and specificity results of the included studies, which may be misleading.

Authors' conclusions: We found no evidence on the accuracy of TEG and very little evidence on the accuracy of ROTEM. The value of accuracy estimates are considerably undermined by the small number of included studies, and concerns about risk of bias relating to the index test and the reference standard. We are unable to offer advice on the use of global measures of haemostatic function for trauma based on the evidence on test accuracy identified in this systematic review. This evidence strongly suggests that at present these tests should only be used for research. We consider more thoroughly what this research could be in the Discussion section.


Bibliographic details

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