How can ROTEM® testing help you in trauma?

Complicated bleeding situations can appear intra and post operatively. They can be life-threatening and always require immediate action. A fast differential diagnosis is the basis of targeted therapy.
1. What are the guidelines?
2. Does the ROTEM® analysis give quicker results than conventional lab tests?
3. Do ROTEM® results correlate with conventional lab results?
4. Are there any published algorithms available?
5. What are the advantages of using a therapy algorithm guided by ROTEM® (and other POC tests)?
6. Can ROTEM® be used to monitor fibrinogen and fibrinogen/PCC substitution?
7. Can ROTEM® detect hyperfibrinolysis?
8. Can ROTEM® help to predict acute traumatic coagulopathy or the need for massive transfusion?
9. Can ROTEM® provide information about the outcome?
10. Can ROTEM® guided bleeding management reduce costs?
11. Which ROTEM® tests should be measured when?
What are the guidelines?

Management of bleeding and coagulopathy following major trauma: an updated European guideline

Spahn et al.; Critical Care 2013, 17:R76

“We recommend that viscoelastic methods also be performed to assist in characterising the coagulopathy and in guiding haemostatic therapy.” (Grade 1C)

“We recommend treatment with fibrinogen concentrate or cryoprecipitate in the continuing management of the patient if significant bleeding is accompanied by thromboelastometric signs of a functional fibrinogen deficit or a plasma fibrinogen level of less than 1.5-2.0 g/l.” (Grade 1C)

“We recommend that each institution implement an evidence-based treatment algorithm for the bleeding trauma patient.” (Grade 1C)

“We suggest an initial fibrinogen concentrate dose of 3-4 g or 50 mg/kg of cryoprecipitate, which is approximately equivalent to 15-20 single donor units in a 70 kg adult. Repeat doses may be guided by viscoelastic monitoring and laboratory assessment of fibrinogen levels.” (Grade 2C)

“If a concentrate-based goal-directed strategy is applied, we suggest that PCC be administered in the bleeding patient with thromboelastometric evidence of delayed coagulation initiation.” (Grade 2C)

Management of severe perioperative bleeding
Guidelines from the European Society of Anaesthesiology


“Implementation of transfusion and coagulation management algorithms (based on ROTEM/TEG) can reduce transfusion-associated costs in trauma, cardiac surgery and liver transplantation.” B

“We recommend that a plasma fibrinogen concentration <1.5–2.0 g l^{-1} or ROTEM/TEG signs of functional fibrinogen deficit should be triggers for fibrinogen substitution.” 1C

“We suggest that fibrinogen concentrate (30–50 mg kg^{-1}) or cryoprecipitate (5 ml kg^{-1}) may be used to increase plasma fibrinogen concentrations above trigger values of 1.5–2.0 g l^{-1} or FIBTEM MCF > 7mm in bleeding children.” 2C

“We suggest the use of perioperative coagulation analysis using viscoelastic point-of-care monitoring (ROTEM/ TEG) for timely detection of coagulation defects including dilutional coagulopathy and hyperfibrinolysis.” 2C

“Targeted therapy with fibrinogen and/or PCC guided by ROTEM/TEG is not associated with an increased incidence of thromboembolic events.” C
Does ROTEM® analysis give quicker results than conventional lab tests?

Hyperfibrinolysis After Major Trauma: Differential Diagnosis of Lysis Patterns and Prognostic Value of Thrombelastometry


“Preliminary test results were available after a 5-minute waiting period, and the majority of the full test information after 10 to 20 minutes” (…”as opposed to 60–90 minutes”)

Diagnosis of early coagulation abnormalities in trauma patients by rotation thrombelastography


“ROTEM is a point-of-care device that rapidly detects systemic changes in in vivo coagulation in trauma patients”

Functional definition and characterization of acute traumatic coagulopathy.


“With a threshold of clot amplitude at 5 mins of <35 mm, rotational thromboelastometry can identify acute traumatic coagulopathy at 5 mins and predict the need for massive transfusion.”


Görlinger et al.; Br J Anaesth. 2013 Feb; 110(2):222-
Do ROTEM® results correlate with conventional lab results?

“A significant correlation was found... between fibrinogen level and CA10-FIBTEM (r ¼ 0.85, P < 0.0001), and between platelet count and CA15-INTEM(r ¼ 0.57, P < 0.0001)”

Diagnosis of early coagulation abnormalities in trauma patients by rotation thrombelastography


Evaluation of rotation thrombelastography for the diagnosis of hyperfibrinolysis in trauma patients

Levrat et al.; Br J Anaesth 2008; 100: 792–7

Prevalence and impact of abnormal ROTEM® assays in severe blunt trauma: results of the ‘Diagnosis and Treatment of Trauma-Induced Coagulopathy (DIA-TRE-TIC) study’


“ELT was determined in a subgroup of 23 patients. In this group of patients, ROC analysis showed that for a threshold of 18 mm (MCF-EXTEM), 71% (CLI30) and 7% (increase of MCF-APTEM), sensitivity was, respectively, 100%, 75%, and 80% with a specificity of 100%.”

“ROTEM® parameters correlated with standard coagulation tests.”

“Our data enlarge the body of evidence showing that viscoelastic assays are more appropriate than are standard coagulation assays for diagnosing and treating TIC in blunt trauma patients.”
Are there any published algorithms available?

Prevention and treatment of trauma induced coagulopathy (TIC). An intended protocol from the Italian trauma update research group

Early and individualized goal-directed therapy for trauma-induced coagulopathy

ROTEM®-based algorithm for management of acute hemorrhage and coagulation disorders in trauma patients

Reduction of Fresh Frozen Plasma Requirements by Perioperative Point-of-Care Coagulation Management with Early Calculated Goal-Directed Therapy.

2009, 22:305–312


Görlinger et al.; Euroanaesthesia 2006 – Madrid

What are the advantages of using a therapy algorithm guided by ROTEM® (and other POC tests) 

Early and individualized goal-directed therapy for trauma-induced coagulopathy


“In contrast to a fixed ratio of FFP:PC:RBC, goal-directed coagulation therapy aims to adapt treatment to the actual needs of the individual patient, based on viscoelastic test results. This “theragnostic” concept offers several potential advantages: ...
- Rapid assessment of coagulation status and prediction of the need for massive transfusion
- Improving and maintaining clot quality in TIC”

Transfusion in trauma: thromboelastometry-guided coagulation factor concentrate-based therapy versus standard fresh frozen plasma-based therapy.


“TEM-guided haemostatic therapy with fibrinogen concentrate and PCC reduced the exposure of trauma patients to allogeneic blood products.”

Transfusion in trauma: why and how should we change our current practice?

Theusinger et al.; Current Opinion in Anaesthesiology 2009,22:305–312

“Our experience implementing and adhering to a transfusion algorithm is in accordance with previous studies showing significant reduction in the number of transfusions administered and decrease of blood loss and costs.”

ROTEM®-based algorithm for management of acute hemorrhage and coagulation disorders in trauma patients

Görlinger et al.; Euroanaesthesia 2006 - Madrid

“ROTEM - as a point-of-care (POC) method - enables a rapid diagnosis of coagulation disorders and a more goal-directed use of expensive blood products”

“ROTEM gives additional information to eliminate nonhaematological causes for haemorrhage”

“The presented algorithm is a step to improve management in bleeding trauma patients”

Reduction of Fresh Frozen Plasma Requirements by Perioperative Point-of-Care Coagulation Management with Early Calculated Goal-Directed Therapy.


“The implementation of perioperative POC coagulation management algorithms based on early, calculated, goal-directed therapy with fibrinogen concentrate and PCC is associated with a reduction in the transfusion requirements for FFP, PRBC and platelets as well as with a reduced incidence of massive transfusion”
Can ROTEM® be used to monitor fibrinogen and fibrinogen/PCC substitution?

Goal-directed coagulation management of major trauma patients using thromboelastometry (ROTEM)-guided administration of fibrinogen concentrate and prothrombin complex concentrate.


“ROTEM-guided haemostatic therapy with fibrinogen concentrate as first-line haemostatic therapy and additional use of PCC was goal directed, efficacious, and quick to administer”.

“Thromboelastometry allowed rapid and reliable diagnosis of the underlying coagulopathy”.

“A favourable survival rate was observed”.

Reduction of Fresh Frozen Plasma Requirements by Perioperative Point-of-Care Coagulation Management with Early Calculated Goal-Directed Therapy.


“The required fibrinogen dosage can be calculated based on the targeted increase in MCF or A10 in FibTEM and the body weight. Fibrinogen dosage (g) = targeted Δ MCF in FibTEM (mm) x body weight (kg)/140”
Can ROTEM® be used to monitor fibrinogen and fibrinogen/PCC substitution?

Hyperfibrinolysis Diagnosed by Rotational Thromboelastometry (ROTEM®) Is Associated with Higher Mortality in Patients with Severe Trauma.

Theusinger et al., Br J Anaesth. 2011 Sep;107(3):378-87

“Hyperfibrinolysis is significantly and independently associated with higher mortality in trauma patients. Thromboelastometry provides real-time recognition of hyperfibrinolysis and may contribute to a reduction in the extremely high mortality of traumatized patients with fulminant hyperfibrinolysis”

Hyperfibrinolysis After Major Trauma: Differential Diagnosis of Lysis Patterns and Prognostic Value of Thrombelastometry


“Hyperfibrinolysis occurs in major trauma and is a predictor of poor outcome. Monitoring with thrombelastometry allows early diagnosis of hyperfibrinolysis and differentiation of benign forms from severe refractory forms with 100% mortality”.

Evaluation of rotation thrombelastography for the diagnosis of hyperfibrinolysis in trauma patients

Levrat et al., Br J Anaesth 2008; 100: 792–7

“In the current study, ROTEM® was able to quickly ... and accurately detect hyperfibrinolysis”. “ROTEM® provides a rapid and accurate diagnosis of hyperfibrinolysis, which may guide therapy with antifibrinolytic agents.”
Can ROTEM® help to predict acute traumatic coagulopathy or the need for massive transfusion?

**FIBTEM provides early prediction of massive transfusion in trauma.**


“FIBTEM A10 and FIBTEM MCF provided similar predictive values for massive transfusion in trauma patients to the most predictive laboratory parameters”

**Prevalence and impact of abnormal ROTEM® assays in severe blunt trauma: results of the 'Diagnosis and Treatment of Trauma-Induced Coagulopathy (DIA-TRE-TIC) study'**


“When compared with standard coagulation tests, ROTEM® parameters accurately detect TIC and also proved to be independent factors associated with both mortality and RBC transfusion”.

“Thresholds for treating coagulopathy … were … EXTEM CT 100 s, EXTEM MCF 45 mm, and FIBTEM MCF 7 mm”.

**Functional definition and characterization of acute traumatic coagulopathy.**


“With a threshold of clot amplitude at 5 mins of <35 mm, rotational thromboelastometry can identify acute traumatic coagulopathy at 5 mins and predict the need for massive transfusion”.
Can ROTEM® provide information about the patient outcome?

Goal-directed coagulation management of major trauma patients using thromboelastometry (ROTEM®)-guided administration of fibrinogen concentrate and prothrombin complex concentrate.


The impact of fresh frozen plasma vs coagulation factor concentrates on morbidity and mortality in trauma-associated haemorrhage and massive transfusion.


“Thromboelastometry (ROTEM) allowed rapid and reliable diagnosis of the underlying coagulopathy and guided the haemostatic therapy”. “Observed mortality appeared lower than the mortality predicted by the TRISS and by the RISC score”.

“Standard management of coagulopathy in the ITB group consisted of fresh frozen plasma transfusion and/or administration of coagulation factor concentrates to correct thrombin generation and fibrinogen deficiency as indicated by standard coagulation tests and/or ROTEM®”.

“We found that in trauma patients with comparable pattern, severity and pathophysiology of injury a coagulation factor concentrate-based treatment was associated with a pronounced reduction
- for the need of allogeneic transfusion and
- the occurrence of multi organ failure as compared to patients receiving FFP for managing ATC”.

Can ROTEM® guided bleeding management reduce costs?

“Our experience implementing and adhering to a transfusion algorithm is in accordance with previous studies showing significant reduction in the number of transfusions administered and decrease of blood loss and costs”.

Transfusion in trauma: why and how should we change our current practice?

Theusinger et al., Current Opinion in Anaesthesiology 2009,22:305–312
Which ROTEM® tests should be measured and when in trauma?

Recommendations available from expert ROTEM® users are available in the ROTEM® delta HELP menu.

The ROTEM® delta haemostasis analyser is CE marked, ISO certified and FDA approved.

With more than 2000 installations worldwide and over 500 publications the ROTEM® technology is proven and accredited in the clinical setting.

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