IMPROVING OUTCOMES ASSOCIATED WITH ACUTE TRAUMA COAGULOPATHY IN MILITARY MEDICINE

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BACKGROUND

- Investigative studies of the wars in Iraq and Afghanistan, from 2001-2011, have shown that uncontrolled bleeding continues to be a major source of mortality from battlefield injuries. The subsequent hemorrhagic shock may result in Acute Trauma Coagulopathy (ATC).
- Military medicine has extended the boundaries of high quality care far beyond the home medical treatment facility. This forward deployment of medical assets demands improvements in the management of ATC near the point-of-injury.
- Early recognition of ATC is critical to ensuring survival of combat casualties. Effective treatment highly depends on both the accuracy and rapid assessment of clot strength by laboratory studies.

INTRODUCTION

- ATC is known to be associated with multi-organ failure, septic conditions, and prolonged critical care stays, making patients eight times more likely to die within a 24 hour period.
- Conventional laboratory tests independently measure platelets, fibrinogen, and clotting factors but do not accurately assess the interaction between clotting components.
- Many leading trauma centers around the world have transitioned to the use of point-of-care viscoelastic studies, such as thromboelastography (TEG) and rotational thromboelastometry (ROTEM), for more effective and timely management of ATC.

TECHNOLOGY REVIEW

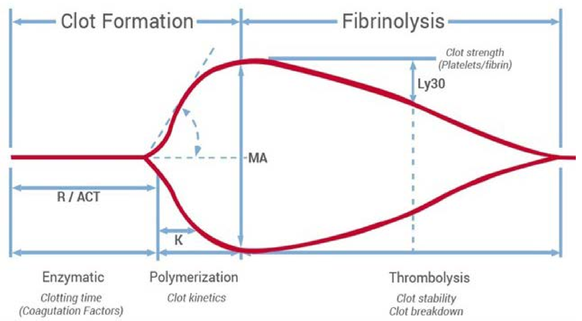

Figure 1. TEG hemostasis analyzer tracing image with parameters
By courtesy of Haemonetics Corporation

	TEG	ROTEM	Clinical Utility
Time from test initiation to 2 mm above baseline	R	CT	Prolongation may indicate a deficiency of coagulation factors or presence of anticoagulants
Time from 2 mm above baseline to 20 mm above baseline	K	CFT	Representative of the kinetics of clot formation; can be early indicators of clot deficiency or hypercoagulability
Alpha angle	α	α	Prolongation suggests platelet dysfunction or deficiency and fibrinogen deficiencies; shortening may indicate hypercoagulability
Amplitude at time X	A30, A60, etc	A5, A10, etc	Clot strength at given time during the analysis; values at these times are often used as "transfusion triggers"
Clot lysis at time X	LY30, LY60	LI30, LI45, LI60, etc	Indication of fibrinolysis and potential need for antifibrinolytics

TEG = thromboelastography; ROTEM = rotational thromboelastometry; R = reaction time; CT = clotting time; K = kinetics; CFT = clot formation time; A = amplitude; LY = lysis; LI = lysis index.

Table 1. TEG and ROTEM Parameters for Guiding Transfusion
Adapted from Abdelfattah, K., & Cripps, M. W. (2016). Thromboelastography and rotational thromboelastometry use in trauma. *International Journal of Surgery*, *33*, 196-201.

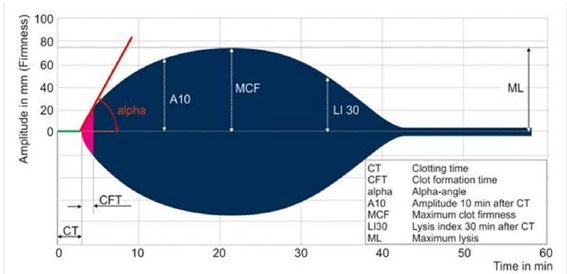

Figure 2. Parameters for interpreting ROTEM tracings.
By courtesy of Instrumentation Laboratory

EVIDENCE-BASED FINDINGS

- Conventional laboratory coagulation studies take a median time of 78-88 minutes to process and to provide clinicians with critical laboratory values.
- Studies demonstrate that TEG and ROTEM analysis strongly correlate with international normalized ratios (INR) laboratory results and provide clinicians with critical values within 15 minutes.
- The decreased time it take to process results in viscoelastic studies, compared to conventional laboratory studies, suggests the use of TEG and ROTEM may significantly speed ATC detection.
- ATC treatment algorithms have been developed and successfully implemented to better guide blood product administration.

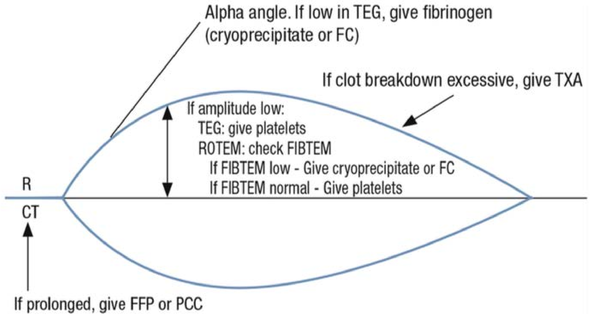

Figure 3. General blood product transfusion guidance based on graphic tracing from TEG or ROTEM analysis
Adapted from Abdelfattah, K., & Cripps, M. W. (2016). Thromboelastography and rotational thromboelastometry use in trauma. *International Journal of Surgery*, *33*, 196-201.

IMPLICATIONS FOR PRACTICE

- Present-day military contingencies remain in a constant state of unpredictability and demand a steady state of medical strategic readiness.
- As medical care transitions closer to the battlefield, it becomes imperative to bring evidence-based improvements to the forefront. Recent advancements in technology with viscoelastic studies have made it possible to bring this efficient and clinically relevant information to trauma teams near the frontlines. As point-of-care technology continues to evolve, it will be critical to push the capability further toward the tip of the spear.
- It is vital that military medicine stakeholders become well-acquainted with the functionality of viscoelastic studies, as they are integral constituents of resuscitation clinical practice guidelines in selected deployed settings.