Key Information

Uncontrollable bleeding and associated coagulopathies are major causes of preventable death after a traumatic injury.¹⁻⁵

One measure to aggressively address coagulopathy and guide transfusion therapies in the ED is the implementation of thromboelastography (TEG) laboratory testing.

TEG is a point-of-care (POC) laboratory test.

TEG detects and quantifies whole blood coagulation, providing a graphic that allows assessment of platelet function, viscosity, and elasticity.¹⁻¹¹ TEG was developed in Germany in 1948, and has been used to determine deficiencies in clotting factors.³ There was limited availability of TEG in the U.S. until the 1980s.³ Today, TEG is being applied to perioperative care, including for cardiac, neurologic, and major orthopedic surgeries.¹⁻¹² Other applications of TEG have proven successful in coagulation assessment for liver and renal transplants, gestational hypertension, post-partum bleeding, hemorrhagic stroke, hemophilia, neoplasms, uremic syndromes, pulmonary thromboembolisms, and the toxic effects of certain snake bites or other poisons.¹⁻¹² TEG has also proved effective in the management of patients receiving anticoagulants and hemostatic therapy, and in transfusion guidance and trauma resuscitation.¹⁻¹² The use of TEG to evaluate the coagulation cascade in these populations has resulted in a decreased need for blood product replacement and increased survival rates.¹²

The TEG assay provides the trauma team with information on the clotting process that assists in recognizing specific therapies to treat coagulopathy and guides decisions on whether the patient requires thrombolytic medication, anti-fibrinolytics, fresh frozen plasma, or cryoprecipitate. TEG testing assists in identifying whether a patient has normal hemostasis or if bleeding is a direct result of coagulopathy or anticoagulant therapy.²⁻⁸ This test is emerging as an additional measure to assess coagulopathy, particularly in situations such as major trauma where the patient has

### Use of Thromboelastography (TEG) in the Emergency Department

**Purpose**

A major cause of preventable deaths following traumatic injury is uncontrolled bleeding and its associated coagulopathies.¹⁻⁵ Without prompt intervention and management, they can precipitate an intractable downward spiral in which both are exacerbated by hypothermia and acidosis.¹⁻¹² Consequently, mortality is substantially higher in patients with coagulopathy, which remains the primary life-threatening complication, especially in trauma patients.¹⁻⁵ Aside from trauma, coagulopathy in emergency department (ED) patients can be a direct result of hypothermia, gastrointestinal hemorrhage, medications, acute blood loss or resuscitation, or it can be multifactorial.⁶ One measure to aggressively address coagulopathy and guide transfusion therapies is the implementation of thromboelastography (TEG) laboratory testing. The purpose of this topic brief is to provide an overview of TEG, examine the implications of TEG for emergency nursing practice including its application in trauma resuscitation, and discuss opportunities for future research.

**Overview**

TEG is a point-of-care (POC) laboratory test that detects, quantifies, and provides a graphic representation of the efficiency of whole blood coagulation that can assess platelet function, viscosity, and elasticity.¹⁻¹¹ TEG has also been shown to be effective in the management of anticoagulant patients and hemostatic therapy, and in transfusion guidance and trauma resuscitation.¹⁻¹² TEG testing is underused because it has never been formally validated in direct comparisons with conventional tests.⁶,⁷,¹⁰⁻¹² TEG has several implications for emergency nursing practice and research.
the potential to quickly develop fibrinolysis.

**Basic Mechanism of TEG**

TEG’s application to the care of patients with hemorrhage or coagulopathy is related to its ability to analyze the coagulation cascade. If a coagulopathy or anticoagulation agent is causing the patient’s bleeding, TEG provides essential information to enable the restoration of normal homeostasis. Further, the information from TEG can be correlated with the specific treatment needed to confirm whether the use of fresh frozen plasma, cryoprecipitate, anti-fibrinolytic, or thrombolytic agents is indicated. The use of TEG to direct transfusion therapy has been shown to decrease the total amount of blood product replacements used. TEG measures the fibrin-platelet bond strength (MA; the maximum width of the tracing) and can determine the time to the start of fibrin formation (r-time), the speed of clot formation (α-angle), and the time for the clot to reach a certain strength (k-time). Analysis of these values allows the cause of the coagulopathy to be identified, whether it be hemodilution, coagulation protein loss, or platelet dysfunction. This information can significantly improve the management strategies employed by the trauma team. However, the technique is underused because it has never been formally validated in direct comparisons with conventional tests. Also, delay in processing can alter the test results, so using TEG on its own to identify a hypercoagulable state is not recommended.

**Implications for Emergency Nursing Practice and Research**

TEG has several implications for emergency nursing practice and research. ED nurses can collaborate with the interdisciplinary team to assess whether to implement TEG as a component of trauma resuscitation. Working with department leadership, ED nurses can assess the feasibility of operationalizing TEG in trauma resuscitation as well as its potential level of use by the ED and other clinical areas of the hospital. Additional considerations for implementation of TEG include the feasibility for POC testing, the related quality control requirements, operational costs, and the capability of individual EDs to implement TEG. Prior to implementation, ED nurses would require education on the purpose of TEG as well as how the results are used to guide treatment approaches; familiarization with the technique for operating the TEG instrument would also be part of the educative process, followed by verification of competency. A plan to maintain proficiency with the TEG process through continuing education would need to be developed.

ED nurses can also contribute to research on the application of TEG in the management of massive traumatic hemorrhage. Studies related to survival and functional outcomes in patients whose treatment was guided by TEG are needed. Prospective studies are needed to show that when TEG is used, patients are administered fewer blood products in cases of trauma-related massive hemorrhage. Additionally, research studies that analyze the ability to correlate TEG measurements with specific disorders, hemodilution or coagulopathy, will yield important information about the technique’s usefulness in guiding therapies.

**Conclusion**

The TEG assay presents new challenges and practice implications for emergency nurses. The use of TEG as an additional tool for the analysis of bleeding and coagulopathy is a promising adjunct specifically in the care of trauma patients. The TEG assay is a POC test that yields convenient, rapid results in critical circumstances where quick decisions are required, which helps to prevent unwarranted use of blood bank resources. TEG can potentially determine the cause of hemorrhage in the trauma patient, prevent coagulopathy, and promote effective control of bleeding in the presence of
Definitions of Terms

**Alpha-angle:** A measure of fibrin cross-linking, one of the four main values determined in the TEG assay.

**Fibrinolysis:** A normal body process that prevents blood clots from growing and becoming problematic. There are two types of fibrinolysis, primary and secondary. Primary fibrinolysis is the body’s natural process of breaking down blood clots, whereas secondary fibrinolysis is the breakdown of blood clots caused by medications, medical disorders, or other factors.

**k-time:** A measure of the speed of clot formation, a function of fibrin kinetics, and one of the four main values determined in the TEG assay.

**MA (Maximum amplitude):** The width of the tracing, representing clot strength, one of the four main values determined in the TEG assay.

**r-time:** The time to the start of clot or fibrin formation, one of the four main values determined in the TEG assay.

**TEG (Thromboelastography):** A whole-blood assay performed at the point-of-care that measures the fibrin-platelet bond strength to reflect changes in the clotting mechanism. TEG results can assist in determining if the patient has normal clotting function or a bleeding disorder. If abnormal clotting is present, TEG can be helpful in distinguishing between the presence of a coagulopathy and the results of anticoagulation therapy.
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References


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