Global Hemostasis Testing Thromboelastography: Old Technology, New Applications

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KEYWORDS

• Thromboelastography • Review • Central laboratory
• Hemostasis • Whole blood assay

Thromboelastography (TEG) has been used for more than 60 years to assess primary and secondary hemostasis.[1,2] After the development of modern coagulation testing using plasma, such as prothrombin time (PT) and activated partial thromboplastin time (PTT), the utility of TEG became limited in clinical settings. With the increased frequency of complex surgeries such as liver transplants and cardiac bypass in the 1980s to early 1990s,[3–6] where a rapid assessment of global hemostatic function was needed, TEG, however, was revisited. Since then, numerous data have shown the utility of TEG in these settings for better management of bleeding, mainly by transfusion support. Although TEG tracing originally was plotted by ink and suffered from inconvenience, over the years there have been several technical improvements in the way TEG is performed that have improved its reliability, including computerized equipment, real-time view from remote computers, and automatic calculation of all TEG parameters. Currently, TEG is marketed by Haemonetics (Braintree, Massachusetts) in the United States. By contrast, thromboelastometry (ROTEM, Sysmex, Mioton Keynes, United Kingdom) is not widely used for clinical purposes in the United

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States as US Food and Drug Administration approval has not been granted. The difference between TEG and ROTEM has been reviewed elsewhere in detail.[7,8]

The TEG has been used primarily to manage transfusion therapy during surgery, with well-documented success.[9,10] This article focuses on the underdescribed utility of TEG when performed in central laboratories as part of nonurgent patient care. Because of the paucity of actual TEG patterns of various conditions in published literature, the authors' own experience was included in this article.

METHODOLOGY

The specimen type can be noncitrated or citrated whole blood. Citrated whole blood should be allowed to equilibrate at room temperature for 30 minutes, whereas the assay using noncitrated whole blood should be started within 4 to 6 minutes from draw, to avoid clot formation before testing. Calcium is added to TEG cup, and then the citrated specimen is added to initiate the coagulation process. The cup is raised, submerging a transducer pin. The cup moves 4.45° every 10 seconds, and as the specimen forms a clot, the pin moves with the cup. The movement of the pin is monitored electronically and translated into TEG tracing (**Fig. 1**). According to the manufacturer's guidelines, many parameters can be measured or calculated from the tracing. The normal ranges for each parameter may differ between arterial blood and venous blood samples.[11]

Measurements include:

Reaction time—the time in minutes from the start of a sample run until the first detectable levels of fibrin clot formation. Reaction time generally reflects coagulation factor levels, but does not always correlate with PT and PTT.

Angle—the size in degrees of the angle formed by the tangent line to TEG tracing measure at the reaction time. Angle reflects fibrinogen activity, but may not always correlate with direct measurements.

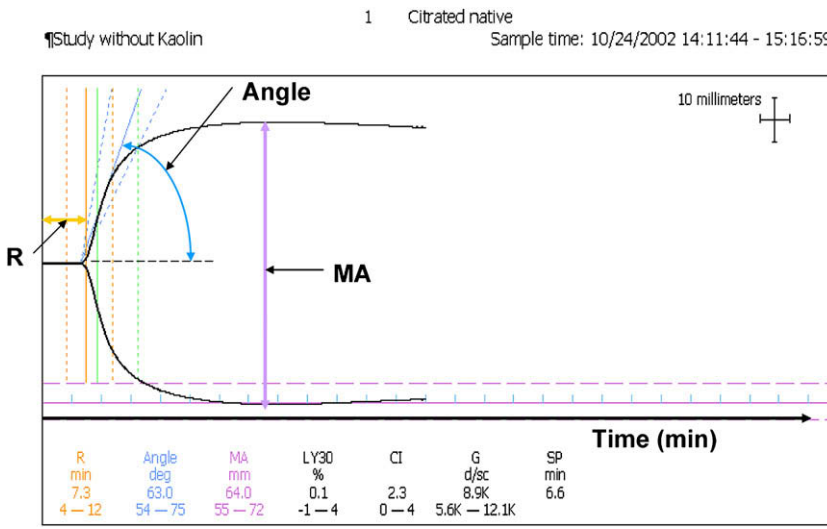

Fig. 1. Thromboelastography (TEG) profile parameters in normal TEG. *Abbreviations*: MA, maximum amplitude; R, reaction time.