Can Thrombelastography Predict Venous Thromboembolic Events in Patients with Severe Extremity Trauma?

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Background/Purpose: Despite increased bleeding risk during the acute trauma resuscitation, trauma-induced coagulopathy is associated with greater likelihood of hypercoagulability, and eventual venous thromboembolic events (VTEs). Rapid thrombelastography (r-TEG) is a whole-blood assay that identifies both hypo- and hypercoagulable states. Graphical r-TEG results are available within minutes, correlate with conventional coagulation laboratory values, and predict early transfusion requirements. In addition, an elevated maximal amplitude (mA) value on admission can identify general trauma patients with increased risk of VTE. We hypothesized that (1) the risk of VTE traditionally assigned to injury lies specifically in those who sustain major orthopaedic trauma, and (2) an elevated admission mA value could be used to identify patients with major orthopaedic injuries at risk for VTE during initial hospital admission.

Methods: This is a retrospective review of a prospectively collected database of 9090 consecutive trauma patients admitted to an urban Level I trauma center between September 2009 and February 2011. We then evaluated only those patients who met highest-level trauma activation criteria, were 18-85 years of age, and were direct scene transports. Patients with burn wounds greater than 20% total body surface area or who died within 30 minutes of arrival were excluded. Two groups were created, one whose extremity abbreviated injury severity (AIS) score was 2 or greater (ORTHO) and one whose extremity AIS score was <2 (non-ORTHO). VTEs were defined as those pulmonary emboli confirmed by CT angiography and those symptomatic deep vein thromboses confirmed by venous duplex. Univariate analyses were conducted followed by purposeful regression analysis.

Results: 1818 patients met the inclusion criteria (310 ORTHO, 1508 non-ORTHO). While there was no difference in median age (32 vs. 34), ORTHO patients were more likely to be female (29% vs. 21%), white (62% vs. 54%), and blunt trauma (89% vs. 73%); all $P < 0.05$. With the exception of median extremity AIS (3 vs. 0, $P < 0.001$), there were no differences in individual systems AIS scores. ORTHO patients had lower systolic blood pressure (115 vs. 130), higher pulse (107 vs. 95), and worse base deficit (–5 vs. –2) on arrival; all $P < 0.05$. Despite more hypocoagulable r-TEG values on arrival (alpha angle 71 vs. 73 and mA 62 vs. 64, both $P < 0.05$), ORTHO patients had higher rates of VTE (6.5% vs. 2.7%, $p<0.001$). Time to VTE was similar (5.5 days vs. 5.5 days). Stepwise regression generated four values to predict development of VTE (age, male gender, white race, and ORTHO). After controlling for these variables, admission mA of ³65 (odds ratio 3.66) and ³72 (odds ratio 6.70) were independent predictors of VTEs during hospitalization.

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Conclusion: Admission r-TEG mA values can identify patients with major orthopaedic trauma injuries who present with an increased risk of in-hospital deep vein thrombosis and pulmonary embolism. Patients presenting with admission r-TEG mA value of ³65 are at a 3.6-fold increased risk (and those with mA ³72 at a 6.7-fold risk) for in-hospital VTE. Admission r-TEG values can help to identify patients at greatest risk for VTE and best target those who might benefit from an early, aggressive prophylaxis strategy.

See pages 99 - 147 for financial disclosure information.