

Serial Thrombelastography Identifies Distinct Pathophysiologic Responses Based on Fracture Type

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Purpose: Venous thromboembolism (VTE) risk remains high in patients with major orthopaedic fractures, despite thromboprophylaxis. Thrombelastography (TEG) is a whole-blood assay that provides a comprehensive analysis of hemostasis from clot initiation to fibrinolysis (clot breakdown). This study aimed to use serial TEG analyses to determine the distinct patterns of coagulopathy that emerge following major orthopaedic fractures.

Methods: This is a single-center prospective cohort study of patients with pelvic, acetabular, hip, or femoral diaphyseal fractures requiring surgical management. Patients underwent serial TEG analysis (TEG6s) at admission, preoperatively, then on postoperative day 1 (POD-1). Symptomatic and image-confirmed VTE events were captured. Most patients were receiving low molecular weight heparin thromboprophylaxis. The Kruskal-Wallis test was conducted to compare TEG parameters between groups, with post-hoc Dunn's test to adjust the p-values and identify pairwise group differences.

Results: In total, 487 patients were included (86 pelvic or acetabular fractures, 283 hip fractures, and 118 femur fractures; median age: 69 years [IQR: 49.0, 81.0], female: 52.2%). There were a total of 27 VTE events (5.5%), with 11 VTEs in patients with pelvic or acetabular fractures (12.8%), 11 in patients with hip fractures (3.9%), and five in patients with femur fractures (4.2%). On POD-1, patients with femur fractures had a significantly lengthened k-time compared to those with hip fractures ($p = 0.03$), but k-time was similar to those with pelvic or acetabular fractures ($p = 0.057$). Patients with pelvic fractures had a significantly elevated alpha-angle on POD-1 compared to those with femur fractures ($p = 0.0486$), but alpha-angle was similar to those with hip fractures ($p = 0.788$). On POD-1, all patients demonstrated fibrinolytic shutdown (reduced LY-30), but patients with hip fractures had significantly lower LY-30 compared to those with femur fractures ($p = 0.003$).

Conclusion: This study demonstrated a high risk for VTE, particularly following pelvic, acetabular, and femur fractures (5.5%–12.8%). Serial TEG analyses identified distinct pathophysiologic responses to injury type and surgical intervention. This study supports the need for further investigation into personalized thromboprophylaxis based on injury type and individualized response to injury and surgical intervention.