Walking the Tightrope of Bleeding and Thrombosis: Viscoelastic Testing (VET) in Patient Blood Management

Background.
TIC is a complex, multifactorial process involving endothelium, platelets, coagulation factors, and immune pathways. Traditional plasma-based assays (PT/INR, aPTT) capture only a fraction of this biology and lack consensus thresholds for TIC; by contrast, VET provides whole-blood, dynamic assessment of clot initiation, propagation, and stability at the point of care, supporting goal-directed transfusion during damage-control resuscitation. Early hemorrhagic mortality remains highly preventable through structured protocols (e.g., rapid MTP activation) and timely hemostatic therapy.

Diagnostic Strategy.
Guidelines endorse early and repeated assessment of hemostasis using either CCT (PT/INR, Clauss fibrinogen, platelet count), POC PT/INR, and/or a viscoelastic method to inform resuscitation. In practice, combined use leverages laboratory reliability and VET's real-time trajectory to tailor product selection (plasma, platelets, cryoprecipitate/fibrinogen) and adjuncts.

Evidence Snapshot (iTACTIC RCT).
In a multicenter RCT (n=690), empiric transfusion guided by VET (ROTEM/TEG) showed no superiority over CCT for the primary outcome (alive and massive-transfusion-free at 24 h: VET 67% vs CCT 64%; OR 1.15). A prespecified TBI subgroup (n=74) demonstrated lower 28-day mortality with VET (44% vs 74%; OR 0.28), although only 29% of the overall cohort had overt coagulopathy. These findings support VET as a targeted tool with potential subgroup benefit rather than a universal replacement for CCT.

From Hemostasis to Thrombosis.
As hemorrhage control is achieved, the clinical priority pivots to thrombosis prevention. Initiate pharmacologic VTE prophylaxis (e.g., LMWH) within **24–72 h** once bleeding is controlled, balancing rebleeding risk (e.g., TBI or solid-organ injury with interval imaging). Anti-Xa–guided dose adjustment is frequently required because fixed dosing (e.g., 30 mg BID) often underachieves target activity in trauma populations.

Anemia Targets after the Bleeding Phase.
A restrictive transfusion strategy is generally appropriate (Hb **7–9 g/dL**) after the initial hemorrhagic phase. In severe TBI, contemporary data show no outcome advantage for a liberal target (Hb 10 g/dL) over a restrictive target (Hb 7 g/dL), supporting cautious, individualized thresholds.

Implementation & Quality.
Effective programs combine (a) multidisciplinary MTP governance (trauma surgery, anesthesia, ED, transfusion service), (b) real-time product logistics and verification, and (c) explicit, stepwise algorithms that translate VET/CCT findings into product choices and endpoints (anatomic

hemostasis; physiologic normalization). Continuous QI (e.g., MTP case lists, O‑negative utilization reviews) sustains adherence and outcomes.

Known Limitations of VET.
VET is **not** a quantitative assay for direct oral anticoagulant (DOAC) levels; when drug measurement is required, use anti‑Xa or drug‑specific assays. Physiologic and technical confounders (hypothermia, acidosis, hypocalcemia), inter‑device and reagent variability, and operator factors can degrade validity. Safe deployment depends on **Algorithm + Education** plus robust QC and training.

Key Takeaways.

- TIC is dynamic: early bleeding risks give way to later thrombotic risk (“tightrope” balance).
- VET adds actionable, real‑time information to CCT and enables goal‑directed resuscitation.
- iTACTIC supports selective value (not universal superiority), with signal in TBI.
- After hemostasis, prioritize timely LMWH prophylaxis with anti‑Xa–guided dosing.
- Restrictive post‑hemorrhage Hb targets are appropriate; liberal triggers confer no TBI benefit.
- Reliability requires standardized algorithms, education, and quality control.