Early "Goal-directed Coagulation Therapy" approaches for the management of acute trauma-hemorrhage and trauma-induced coagulopathy

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Uncontrolled hemorrhage and trauma-induced coagulopathy (TIC) remain the major causes for preventable death after trauma. One out of four severely injured patients admitted to the trauma bay is bleeding with variable degrees of laboratory coagulopathy and early detection and management have been associated with improved outcomes. In the acute phase, the clinical strategies for treatment follow the „Damage Control Resuscitation" (DCR)-concept which advocates the empiric administration of blood products in predefined ratios. However, the optimum ratio is still under debate, no universal standard for the composition of these transfusion packages has yet been established and storage time may considerably affect the hemostatic competence of these products. As an alternative, several European but also a few US trauma centers have instituted the concept of „Goal-directed Coagulation Therapy" (GDCT) based upon results from early point-of-care (POC) viscoelastic testing assays.

The technology of blood viscoelastic testing was first described by Hartert, a German physician, back in 1948. These tests provide real time, point of care (POC) information on the dynamics of clot development, stability and dissolution thereby reflecting in-vivo hemostasis. While previous devices needed to be operated manually, the novel ROTEM® Sigma runs fully automated and test results, even if devices are located remotely, can be transferred to connected screens throughout the local IT infrastructure for direct clinical-decision making.

The concept of GDCT based upon results from early POC viscoelastic testing assays is intriguing, primarily driven by physiological understanding and thereby promoting individualized care for bleeding trauma patients. The concept has been shown to reduce bleeding, transfusions of RBC, plasma and platelet concentrates, and also mortality in mixed surgical populations. Moreover, early viscoelastic variables of clot firmness have been shown to be good predictors for the need of massive transfusion and mortality. A recent Cochrane review provided, apart from known reductions in transfusion requirement, for the first time, a survival benefit with the use of viscoelastic testing in bleeding patients.

It is not surprising that viscoelastic testing is increasingly being recognized for its potential to diagnose TIC as well as for the guidance of treatment to augment damage control resuscitation (DCR) during the acute care of bleeding trauma patients. Current guidelines advocate that monitoring and measures to support coagulation should be initiated immediately upon arrival of the patient to the trauma bay and that routine practice in coagulation monitoring in bleeding trauma patients should include the early and repeated monitoring of coagulation using viscoelastic testing assays. Further resuscitation measures should be continued using a goal-directed approach guided either by standard laboratory coagulation assays and/or POC viscoelastic testing assays, such as ROTEM®.

A number of individualized clinical algorithms based upon POC viscoelastic testing assays to guide hemostatic therapies in severe trauma-hemorrhage and TIC have been suggested mostly based upon retrospective registry data or expert opinion. Current trauma guidelines recommend the local implementation of algorithms for the management of bleeding trauma patients including clinical and safety management systems that include parameters to assess key measures of bleeding control and outcome. If key interventions and measures formulated in guidelines or algorithms are implemented, outcomes from trauma including hemorrhage are likely to be improved and death and other complications reduced. However, local algorithms can only consider products, measures and actions that are locally available and not all resources which would compose an optimal clinical pathway may be available anywhere at any time. Therefore, algorithms need to be adopted to local infrastructures and logistics.