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Acquired fibrinogen deficiency in severe trauma patients and its early detection

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Summary

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This thesis deals with developing and early diagnostics of acquired fibrinogen deficiency in patients with severe trauma. Fibrinogen is an essential glycoprotein of the coagulation system, which is converted by thrombin into insoluble fibrin, the fundamental component of a blood clot, in the final stage of blood coagulum formation. Trauma-induced coagulopathy is a complex disorder of blood coagulation resulting from extensive tissue damage, traumatic shock, activation of the sympathoadrenal system, dysregulation of fibrinolysis, as well as loss of coagulation factors through bleeding, consumption or dilution of remaining dilutions. Hypothermia, acidosis, hypocalcemia, or preexisting factors on the patient's side (e.g., anticoagulant or antiplatelet therapy) also contribute to impaired haemocoagulation.

Acquired fibrinogen deficiency (hypofibrinogenemia) is vital in the early phase of trauma-induced coagulopathy. Fibrinogen is the first of the coagulation factors to achieve a clinically significant decrease in plasma concentration. Hypofibrinogenemia is associated with the magnitude of blood loss, the need for massive transfusion, morbidity and mortality. Fibrinogen replacement is one of the essential measures to promote blood coagulation in patients with trauma-induced coagulopathy. Common methods of detecting hypofibrinogenemia include standard laboratory determination of plasma fibrinogen level or viscoelastic examination by the point-of-care method. Both of these options are burdened by the time interval required to collect the blood sample, examine it, and interpret the result, which may delay the detection of hypofibrinogenemia and the initiation of replacement therapy.

This thesis tests the hypothesis that the determination of the shock index (i.e., the ratio of systolic blood pressure to heart rate) can be used to diagnose severe hypofibrinogenemia. In a cohort of 264 patients with severe trauma, the shock index was calculated from all blood pressure measurements in prehospital care and the first measurement in the emergency department. Shock index <1 excluded severe hypofibrinogenemia <1.5 $g.l^{-1}$ with a predictive value of 97% and correctly classified 92% of patients. These results are similar to the performance of more complex scoring systems, which may require laboratory or imaging investigations for their calculation.