

Influence of Hemodilution to Coagulation State in Patients after On-pump Cardiac Surgery

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Introduction. On-pump cardiac surgery can profoundly alter hemostasis due to enhanced fibrinolysis, hemodilution, platelet dysfunction and/or thrombocytopenia and coagulopathy secondary to the exposure of blood to artificial surfaces. The levels of antithrombin III, fibrinogen and different coagulation factors decrease approximately by 30% to 50% or more, due initially to hemodilution therefore contributing to changes of coagulation state and to bleeding complications.

The aim. The aim of the study is to investigate whether kaolin activated thrombelastography (kTEG) and heparinase modified kTEG (hep-kTEG) parameters (R, K, A, MA) reflect hypocoagulation state due to hemodilution comparing with standard coagulation tests (SCT) after on-pump cardiac surgery.

Materials and methods. 83 adult first time cardiac surgery patients were enrolled into a prospective study at Pauls Stradins Clinical University Hospital, Riga Latvia. Blood samples for SCT (activated partial thromboplastin time, prothrombin time, platelet count, fibrinogen) were collected preoperatively and on admission to the recovery. kTEG and hep-kTEG were performed on admission to the recovery. The patients were allocated to two groups depending on the volume of Deltajonin priming in extracorporeal circuit calculated on one patient body surface area (BSA) m²: I group (n = 40) had priming volume 1015 ± 200 ml/m², II group (n = 43) had priming volume 620 ± 116 ml/m². Postoperative blood volume was registered as milliliters 1 h, 4 h and 24 h after the surgery. Associations of hemodilution with kTEG, hep-kTEG parameters, SCT, postoperative blood loss were analysed with SPSS® 20.0.

Results. Values of kTEG performed on admission to the recovery differed significantly between groups I and II: R (12.6 ± 6 vs 9.7 ± 5, p = 0.04), K (5 ± 3 vs 3.8 ± 2.5, p = 0.02), A (40 ± 12 vs 50 ± 13, p = 0.001), MA (56 ± 9.7 vs 60 ± 10, p = 0.04). Values of hep-kTEG differed significantly within groups excepting R parameter: K (3.5 ± 1.5 vs 2.9 ± 1, p = 0.02), A (47 ± 11 vs 53 ± 11, p = 0.03), MA (59 ± 8 vs 62 ± 6, p = 0.04). Variables of SCT did not differ between groups, except for fibrinogen (2.9 ± 0.8 vs 3.5 ± 1.2, p = 0.01). Group I when compare with group II showed significantly greater blood loss at 4 h (237 ± 119 ml vs 182 ± 116 ml) and at 24 h (647 ± 254 ml vs 496 ± 267 ml), respectively (p = 0.04; p = 0.01).

Conclusion. Hemodilution causes hypocoagulability after on-pump cardiac surgery. It can be detected by the kTEG and the hep-kTEG. SCT have lower diagnostic value for detection of hypocoagulability due to hemodilution in comparison with the TEG. 24-hour postoperative blood loss can be affected by volume of priming solution used in extracorporeal circuit system.