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Levels of Protein C and Protein S, Tissue-Plasminogen Activator, and Fibrinogen During Cardiopulmonary Bypass



Yahya ÜNLÜ¹

Salim B. TEKİN²

Hikmet KOÇAK¹

¹Department of Cardiovascular Surgery, Faculty of Medicine, Atatürk University, Erzurum - TURKEY

²Department of Hematology, Faculty of Medicine, Atatürk University, Erzurum - TURKEY

 [Keywords](#)
 [Authors](#)



medsci@tubitak.gov.tr

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Abstract: Aim: The exposure of blood to foreign surfaces during cardiopulmonary bypass (CPB) leads to an activation of the coagulation system. The goal of this study was to evaluate the levels of protein C and protein S, tissue-plasminogen activator (t-PA) and fibrinogen before, during and after CPB. Materials and Methods: Thirty-three patients undergoing elective coronary artery bypass grafting (CABG) and 11 patients undergoing non-cardiac surgery (control group) were included in this study. Blood samples were taken at different time intervals preoperatively, before, during and after CPB, and in the postoperative period. Protein C and protein S, t-PA and fibrinogen levels were measured before, during and after CPB. Results: Protein C, protein S and fibrinogen levels were decreased during CPB ($p<0.05$). As a marker of hyperfibrinolysis, levels of t-PA were higher during CPB, which might suggest ongoing subclinical hemostatic activation associated with CABG. Before release of aortic cross clamp, t-PA level had increased eight-fold. t-PA levels remained elevated throughout CPB and into the early postoperative period. Protein C, protein S and fibrinogen levels remained decreased throughout CPB, and the decrease continued until the end of CPB. There was no difference in the hemostatic markers in the control group. There was a statistically significant difference between the groups ($p<0.01$) before the induction of anesthesia and during CPB for all parameters ($p<0.01$). Conclusions: As a marker of hyperfibrinolysis, levels of t-PA were increased during CPB and remained elevated in the early postoperative period. Protein C, protein S and fibrinogen levels were decreased during CPB. These results showed that thrombin generation is increased during CPB.

Key Words: Cardiopulmonary bypass, protein C and protein S systems, tissue plasminogen activator, fibrinogen

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