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Reduced Fibrin Adhesion on Urokinase-Coated Hemodialysis Catheters: An In Vitro Study

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Objectives : Thrombosis-related catheter dysfunction is a major complication of dialysis catheters. Catheters with urokinase immobilized on both inner and outer surfaces have been developed to achieve long-lasting antithrombotic effects. This study aimed to evaluate the usefulness of urokinase coating by conducting a 24-hour circulation experiment using an in vitro system capable of assessing catheter antithrombotic properties, followed by analysis and quantification of proteins adhered to the catheter surface.

Methods : Three types of catheters were used: Nipro Corporation's Blood Access UK catheter (UK), a structurally identical catheter without coating (non-UK), and Baxter Corporation's GamCath catheter (GamCath) with a different structure. Fresh pig blood was circulated at 1.5 L/min for 24 hours. Immediately after initiation and at 20 hours, simulated dialysis was performed via the catheter at 200 mL/min for 4 hours. Serum D-dimer levels were measured to assess fibrinolytic activity. Additionally, total protein adhered to the catheter was measured, and fibrin levels were quantified by Western blotting.

Results : No D-dimer was detected in any group, and no clear increase in urokinase-mediated fibrinolytic activity was observed. Total protein concentration was lower in the UK group than in the non-UK and GamCath groups. Fibrin expression was detected in one sample each from the UK and non-UK groups, whereas all GamCath samples showed fibrin expression. The UK group showed the lowest fibrin content among the adherent proteins. These results suggest that the antithrombotic effect of the urokinase-coated catheter may be associated with reduced adhesion of fibrin and proteins rather than fibrinolytic activity.

Conclusions : Urokinase coating was associated with reduced thrombogenicity and lower fibrin adhesion, suggesting that its antithrombotic effect may be related to reduced adhesion of fibrin and proteins rather than fibrinolytic activity.