

# **Development of an animal model for assessment of the hemostatic efficacy of fibrin sealant in vascular surgery.**

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Publication Date: 2001

## **Abstract:**

**Purpose.** Sustained hemostatic function of fibrin sealant (FS) is crucial when it is used in cardiovascular surgery. The purpose of this study was to develop a model that can determine the long-term hemostatic efficacy of tissue sealants in a vascular surgery. **Methods.** To determine the ability of the model to detect differences in FS performance, various concentrations of FS were prepared and tested. Tensile strength of FS clots was determined in vitro using a tensiometer. Laparotomy was performed on 49 anesthetized rabbits, and a segment of the aorta was occluded, transected, and then sutured in an end-to-end fashion with four or eight interrupted 9-O sutures. The four-suture repair was covered with FS or placebo, and blood flow restored. Spilled blood was absorbed with gauze and weighed to estimate blood loss. Four weeks after surgery the animals were euthanized and the vessels recovered for histology. **Results.** Average tensile strength of FS clots at 120, 90, and 60 mg/ml topical fibrinogen complex (TFC) concentration was  $0.42 \pm 0.07$  N, with no significant difference among them. The lowest TFC concentration, 30 mg/ml, produced weaker clots than either 120 or 90 mg/ml ( $P < 0.05$ ). All rabbits with four-suture anastomoses that were treated with placebo bled to death after the vessel was unclamped ( $n = 6$ ). Treatment of suture line with standard FS concentration (120 mg/ml TFC,  $n = 8$ ) sealed the anastomosis and prevented blood loss. Hemostasis was sustained for 4 weeks, allowing vascular healing. All rabbits with the eight-suture anastomosis survived the operation but lost  $42 \pm 9.2$  ml blood ( $n = 5$ ). Hemostatic efficacy of FS was unchanged when TFC was diluted to 90 mg/ml ( $n = 6$ ) but further dilution to 60 mg/ml with water ( $n = 8$ ) produced significantly less effective clots, with an average blood loss of 5.5

+/- 7.6 ml ( $P < 0.05$ ) and two fatal clot failures postoperatively. When FS was diluted to 60 mg/ml TFC with a buffer, it maintained its hemostatic strength ( $n = 6$ ). Further TFC dilution to 30 mg/ml led to consistent bleeding with an average blood loss of 35.3 +/- 10.3 ml ( $P < 0.001$ ,  $n = 6$ ). Conclusions. The four-suture anastomosis of rabbit aorta offers a consistent and reliable method for evaluating the short- and long-term hemostatic efficacy of FS products. This model is not only able to determine the functional differences in various concentrations of FS, but it is also sensitive to detect the subtle changes in FS preparation (e.g., medium composition) that is not detected by in vitro testing. © 2001 Academic Press.