Fibrinogen, platelet and factor XIII supplementation in cardiac surgery

*In vitro and in vivo studies*

AKADEMISK AVHANDLING

som för avläggande av medicine doktorsexamen vid Sahlgrenska Akademin, Göteborgs Universitet, kommer att offentligen försvars i Förmaket, Sahlgrenska Universitetssjukhuset, Göteborg, den 24 november 2017, klockan 9:00 av

Caroline Shams Hakimi, MSc

Fakultetsopponent: Docent Agneta Wikman

Institutionen för Laboratoriemedicin, Karolinska Institutet

Avhandlingen baseras på följande delarbeten


II. Shams Hakimi C, Singh S, Hesse C, Jeppsson A. Effects of fibrinogen and platelet transfusion on hemostasis in cardiac surgery patients with ongoing bleeding. In manuscript.


Fibrinogen, platelet and factor XIII supplementation in cardiac surgery

In vitro and in vivo studies

Caroline Shams Hakimi

Department of Molecular and Clinical Medicine, Institute of Medicine,
Sahlgrenska Akademy, University of Gothenburg, Sweden

ABSTRACT

Background: There is a high risk of bleeding complications in cardiac surgery. Fibrinogen and platelet concentrates are often used to treat perioperative bleeding, but there is little information about its efficacy. The overall aim of this thesis project was to study the effects of fibrinogen, platelet and factor XIII concentrates on markers of hemostasis in blood samples from cardiac surgery patients.

Methods: Increasing doses of fibrinogen, platelets, and factor XIII were added to blood samples from patients or healthy volunteers (study I, III–V). In study II, blood samples from cardiac surgery patients with ongoing bleeding were analyzed before and after transfusion of fibrinogen and/or platelet concentrates. In all studies, platelet function was assessed with impedance aggregometry, and clot formation with thromboelastometry.

Results: Supplementation with fibrinogen improved clot formation while platelets improved both platelet aggregation and clot formation in blood samples from cardiac surgery patients (I). Fibrinogen to patients with ongoing bleeding improved clot formation and platelets improved platelet aggregation (II). Factor XIII supplementation to blood samples from cardiac and scoliosis surgery patients improved clot formation moderately (III). Supplementation with platelets improved platelet aggregation independently of antiplatelet therapy (IV). Time-dependent changes in platelet concentrates were detected with impedance aggregometry in vitro (V). The results predicted with moderate accuracy changes in aggregation after addition of the platelet concentrates to whole blood samples.

Conclusions: The results suggest that transfusion with fibrinogen or platelets improve hemostasis, whereas factor XIII should remain a secondary tool in the treatment of perioperative bleeding. Impedance aggregometry may be used to monitor the quality of stored platelet concentrates in vitro.

Keywords: Fibrinogen, platelets, factor XIII, platelet aggregation, clot formation, cardiac surgery.