

Coagulation in paediatric cardiac surgery: clinical studies

Akademisk avhandling

Som för avläggande av medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligens försvaras i Tallen, Drottning Silvias Barnsjukhus, den 2/12 2022, klockan 13.00 av

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Avhandlingen baseras på följande delarbeten

- I. Romlin B.S, Söderlund F, Wåhlander H, Nilsson B, Baghaei F, Jeppsson A. Platelet count and function in paediatric cardiac surgery: a prospective observational study. *British Journal of Anaesthesia* 2014; 113(5): 847 – 854.
- II. Söderlund F, Asztély AK, Jeppsson A, Nylander S, Berggren A, Nelander K, Castellheim A, Romlin B.S. In vitro anti-platelet potency of ticagrelor in blood samples from infants and children. *Thrombosis Research* 2015; 136: 620 – 624.
- III. Pernbro F, Singh S, Wåhlander H, Hansson E.C, Romlin B.S. Platelet aggregation analysis using multiple electrode aggregometry and VASP assays in surgery for paediatric cardiac surgery. *Manuscript (submitted)*.
- IV. Söderlund F, Wåhlander H, Hansson E.C, Romlin B.S. Preoperative heart failure is not associated with impaired coagulation in paediatric cardiac surgery. *Cardiology in the Young* 2021; 31: 979 – 984.
- V. Pernbro F, Wåhlander H, Jeppsson A, Romlin B.S. Fibrinogen or platelet transfusion as first-line treatment for coagulopathy after cardiac surgery in infants: method description of a randomized, controlled study. *Manuscript (method description)*.

Coagulation in paediatric cardiac surgery

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Abstract

Background: Surgical correction of congenital heart defects has a profound effect on the coagulation of the patients during and immediately after surgery. The aim of this thesis was to increase the knowledge of this effect, and to add to the work of establishing methods for treating this coagulopathy.

Methods: Study I investigates the platelet response to paediatric cardiac surgery by analysis of platelet count and platelet aggregation measured with multiple electrode aggregation (MEA) before, during and after surgery. Study II measures the *in vitro* potency of the platelet inhibitor ticagrelor by measuring platelet aggregation using light transmission aggregometry and MEA. Study III compares MEA with a vasodilator activated phosphoprotein assay (VASP) before and after cardiac surgery. Study IV examines the coagulation in children with preoperative cardiac failure using rotational thromboelastometry. Study V is a method description of an ongoing study where patients are randomized to platelets or fibrinogen concentrate as the primary treatment of coagulopathy after cardiac surgery.

Results: Platelet count and aggregation fall significantly during cardiac surgery, and impaired aggregation increases the risk of blood transfusion. The potency of ticagrelor *in vitro* does not vary with patient age. The correlation between MEA and VASP is poor. MEA results are similar in children with cardiac defects and healthy children. Preoperative cardiac failure does not have a significant impact on thromboelastometry results.

Conclusions: Cardiac surgery in certain paediatric populations causes significant coagulopathy. Impaired platelet aggregation increases the risk of transfusion. Cardiac failure does not cause coagulopathy in infants. Ticagrelor potency is similar in patients of different ages.

Keywords: Coagulation, platelets, fibrinogen, paediatric cardiac surgery, congenital cardiac defect