Fetal growth restriction – an excursion in major organ systems impacting cardiovascular function in adolescence

Introduction
Preterm birth and fetal growth restriction (FGR) are risk factors for future cardiovascular disease and chronic kidney disease. Magnetic resonance imaging (MRI) provides reliable measures of cardiovascular structure and function and can potentially be used also for renal structural assessment in disease development. Whether FGR adds to the negative effects of preterm birth on the cardiovascular system remains to be clarified in order to improve prevention.

The overall aim of this thesis was to evaluate the independent and combined effects of very preterm birth and fetal growth restriction on the adolescent heart, greater vessels, and kidneys.

Research questions/methods
Paper I: Can renal parenchymal volumes be reliably assessed with a widely available non-contrast-enhanced MRI method?
Paper II: How does very preterm birth with and without FGR impact arterial stiffness and blood pressure regulation?
Paper III & IV: How does very preterm birth with and without FGR impact cardiac structure and function?
Paper V: How does very preterm birth with and without FGR impact renal structure and function?

Preliminary results
Paper I: Renal cortical and medullary volumes can be reliably assessed with a widely available non-contrast-enhanced MRI method, increasing clinical applicability.
Paper II: There were no differences in arterial stiffness or prevalence of prehypertension or hypertension between groups. A trend of increased blood pressure was observed in boys, where FGR added to the effect of preterm birth.
Paper III: Adolescents born very preterm with FGR had a more globular heart than healthy controls born at term.
Abstract

Paper IV: There were no differences in left ventricular mass, measures of cardiac pumping or global myocardial perfusion between groups.

Paper V: Adolescent girls born very preterm with FGR have significantly lower renal cortical and medullary volumes compared to term controls.

Importance

This thesis showed that very preterm birth independently and more so in combination with fetal growth restriction predisposes for subtle changes in the cardiovascular system in adolescents. The current findings indicate a lessened negative effect of very preterm birth and fetal growth restriction on the cardiovascular system as compared to that reported in earlier studies which lends support to the clinical decision of active delivery of fetuses with fetal growth restriction early in gestation. Importantly, a window of opportunity for prevention of future cardiovascular disease might still be open.

Papers

Manuscript

I. **Liefke J**, Steding-Ehrenborg K, Asgeirsson D, Nordlund D, Kopic S, Morsing E, Hedström E. Non-contrast-enhanced magnetic resonance imaging can be used to assess renal cortical and medullary volumes – a validation study.

Extended abstracts:

II. Subtle changes in blood pressure and pulse wave velocity in adolescents born very preterm with and without fetal growth restriction.

III. Fetal growth restriction is associated with a globular left ventricle at adolescence: a cardiac magnetic resonance shape analysis study.

IV. Cardiac morphology and function in adolescents born very preterm with fetal growth restriction.

V. Renal structure and function in adolescence after very preterm birth and fetal growth restriction.