Abstract: 1I

Seeing the baby grow: MRI to measure placental and cardiac function in the fetus

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Poor growth before birth impacts heart development doubling the risk of coronary artery disease in adult life (Barker et al., 1989). 10% of Australian babies are small for gestational age (SGA <10th centile; ~29,000 babies/annum). Some were always going to be small (SGA) but many experience fetal growth restriction (FGR; ~20,000 babies/yr) at any time during pregnancy. This is due to adverse events such as impaired placental function and maternal hypertension, reducing oxygen and nutrient delivery to the fetus, which it must adapt to. FGR is associated with low fetal oxygenation and major adverse pregnancy outcomes such as preterm birth and stillbirth. In adulthood, FGR individuals are at 40% greater risk of hypertension, a major risk for cardiovascular disease (CVD). Our data show that this CVD risk is programmed during fetal life via changes to cardiac structure and function, and these programmed effects persist after birth and are dependent on the timing, duration and severity of the reduction in oxygen and nutrients (Morrison, 2008, Darby et al., 2020).

Strikingly, nearly 50% of all FGR fetuses go undetected until after birth, despite improvements in obstetric imaging and management (Kajdy et al., 2019). Distinguishing SGA from FGR can be difficult (Martins et al., 2020). Thus, clinical decisions about when to deliver the FGR baby may not be optimal (Kajdy et al., 2019). To avoid stillbirth, for example, many FGR/SGA babies are delivered preterm and may face poor outcomes associated with immature organs. Currently, there are no standard clinical interventions to treat FGR. Several clinical trials have tested interventions for FGR in humans but show no benefit (Vitamin E/C) or were halted due to poor outcomes in FGR babies (e.g. sildenafil). However, preclinical studies in sheep had already shown that Vitamin C/E did not prevent FGR, and sildenafil led to poor outcomes in FGR fetuses. Thus, comprehensive testing of interventions in preclinical models of FGR to ensure effectiveness must be performed prior to human trials.

Our work focusses on two main goals. These are 1) better detection of FGR to improve outcomes and 2) finding ways to treat the FGR pregnancy to improve fetal growth. This talk will explore the basic mechanisms that underpin the links between poor growth in the womb to increased risk of cardiovascular disease in adulthood, ways to detect FGR earlier and identification and testing of interventions to improve fetal growth.

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