Unveiling the Hidden Signature of Foetal Arch Anatomy in Coarctation of the Aorta

Uxio Hermida, Milou P.M. van Poppel, David F.A. Lloyd, Johannes K. Steinweg, Trisha V. Vigneswaran, John M. Simpson, Reza Razavi, Adelaide De Vecchi, Kuberan Pushparajah, Pablo Lamata

1. School of Biomedical Engineering and Imaging Sciences, King’s College London, U.K. 2. Evelina London Children’s Hospital, U.K. 3. Harris Birthright Centre, King’s College Hospital, U.K.

CLINICAL BACKGROUND

- Coarctation of the aorta (CoA) is one of the most common congenital heart defects.
- Characterised by a narrowing in the region of the main body artery (i.e., the aorta) after birth.

FOETAL IMAGING

- The standard clinical assessment is done with 2D echocardiography.
- The foetal heart and vasculature are 3D structures.
- Echocardiographic assessment is highly dependent on the sonographer’s expertise.
- 3D magnetic resonance imaging (MRI) shows potential as a complementary imaging modality.

LEARNING THE HIDDEN 3D FOETAL ARCH SHAPE IN COA

- We have provided unique insights into the distinct foetal arch shape patterns in CoA.
- The application of advanced engineering technologies can provide unique opportunities for the comprehensive exploration of the foetal vascular anatomy prenatally.

TOWARDS IMPACT IN PATIENT CARE

- The CoA shape risk score predicted CoA with 92% accuracy in a retrospective cohort of 112 fetuses. It shows a significant reduction in FP rate compared to standard 2D metrics.
- Prospective study
- Disease mechanisms
- Translation

- automate CoA shape risk score: from acquisition to clinical decision-making.
- Test prospectively the CoA shape risk score in a clinical setting.
- From 2D echo to 3D arch anatomies and CoA shape risk score using artificial intelligence.
- Simulation of the blood flow through the foetal vasculature