Neo-Aorta and Aortic Arch after Arterial Switch Operation for Transposition of Great Vessels: A Morphometric and Geometric Study.

Ntsinjana H., Capelli C., Biglino G., Taylor A.M., Schievano S.
Centre for Cardiovascular Imaging, UCL Institute of Cardiovascular Science, & Cardiorespiratory Unit, Great Ormond Street Hospital for Children, NHS Foundation Trust, London, UK

Introduction
In the current era, neonatal arterial switch operation (ASO) is the preferred surgical method for repair of transposition of great arteries (TGA). Among the late complications of ASO are aortic root dilatation and acute angulation at the level of the arch. These morphological changes might influence the patterns and severity of aortic arteriosclerotic disease and have an impact on future surgical or endovascular intervention involving head and neck vessels. Our aim was to quantify the morphometric differences between ASO patients and healthy controls.

Methods
A total of 20 ASO patients and 20 age and BSA matched healthy controls were enrolled in this study. All individuals signed informed consent. Cardiac magnetic resonance imaging (MRI) was performed in all subjects with a 1.5 Tesla MRI scanner. Using standard MRI sequences, balanced steady state free precession (bSSFP) 3D-wholeheart images were acquired to reconstruct a three-dimensional (3D) model of the left heart of each individual which included: left ventricle (LV), left ventricular outflow tract, aortic root, ascending aorta, aortic arch and descending aorta to diaphragm level. The geometrical analysis assessed: (i) the angle between the line connecting the valve centre with the LV apex and the aortic valve plane; (ii) the angle between the aortic valve plane and the sinotubular junction plane; (iii) the indexed length of the vessel centreline starting from the centre of the aortic valve to the level of the diaphragm; (iv) the indexed curvature of the aortic arch, from the inverse of the radius ($\frac{1}{r}$) of the maximum circumference fitted at the highest point of the centreline ($=1/r$), and (v) the aortic root volume. Independent samples T-test was used to compare mean differences.

Results
GEOMETRIC DIFFERENCES BETWEEN THE TWO GROUPS ARE SHOWN IN FIGURE. THE TWO GROUPS WERE CLOSELY MATCHED FOR AGE (15.3±1.8 VS. 14.9±1.9 YEARS FOR ASO VS. CONTROLS) AND BSA (1.8±0.2 VS. 1.6±0.2 M² FOR ASO VS. CONTROLS).

Conclusions
This work highlights quantifiable differences in the 3D morphology of the thoracic aorta in ASO patients compared to healthy controls. This geometrical abnormality might reflect in the development of unusual flow patterns and potential arteriosclerotic disease.