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CARDIOVASCULAR FLASHLIGHT

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In vivo myofibre architecture in the systemic right ventricle**Jack Harmer^{1†*}, Kuberan Pushparajah^{1†}, Nicolas Toussaint¹, Christian T. Stoeck², Rachel Chan³, David Atkinson³, Reza Razavi¹, and Sebastian Kozerke^{1,2}**¹Division of Imaging Sciences and Biomedical Engineering, King's College London, London, UK; ²Institute for Biomedical Engineering, University and ETH Zurich, Switzerland; and ³Centre for Medical Imaging, University College London, London, UK*Corresponding author. Division of Imaging Sciences, The Rayne Institute, 4th Floor, Lambeth Wing, St Thomas' Hospital, London SE1 7EH, UK. Tel: +44 207-188 5441; Fax: +44 207 188 5442, Email: jack.harmer@kcl.ac.uk

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Heart failure in the systemic right ventricle (RV) is a common pathway in end-stage disease in patients affected with congenital heart disease. Using state-of-the-art magnetic resonance (MR) diffusion acquisition schemes, we present the first *in vivo* diffusion tensor imaging (DTI) data of the beating heart acquired in an adult with a systemic RV following an atrial switch procedure for transposition of the great arteries. Magnetic resonance-based DTI acquisitions provide information about the predominant direction of structures within each voxel of the acquired image. These aggregates, which are often interpreted as fibres, appear as coherent orientational structures throughout the myocardium. Knowledge of cardiac myocyte architecture has the potential to transform our understanding of cardiac function and the mechanisms behind heart failure. Until recently, direct visualization of myofibre architecture has been limited to *ex vivo* specimens due to cardiac motion. However, recent advances in MRI now allow for robust DTI of the beating heart and can provide *in vivo* knowledge of myofibre architecture. In the data presented here, diffusion tensors are shown across multiple slices and are colour coded to indicate helix angle (Panels A–E). Full 3D reconstructions

across the volume of the heart are also shown. Helix angle distributions indicate a predominance of circumferential fibres across the entire healthy LV and in the anterior and inferior segments of the systemic RV. However, in the lateral wall of the systemic RV, helix angles are skewed towards negative values. This indicates a predominance of longitudinal and oblique fibres with a clockwise helix orientation and is likely brought about to adaptation of the RV to systemic pressure and load.

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