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IMAGING VIGNETTE

Interventional Correction of Sinus Venosus Atrial Septal Defect and Partial Anomalous Pulmonary Venous Drainage

Procedural Planning Using 3D Printed Models

Mari Nieves Velasco Forte, MBBS,[a,b,c] Nick Byrne, MSc,[a,d] Israel Valverde, MD,[a,b,c] Gorka Gomez Ciriza, MSc,[b] Antony Hermuzi, MBBS,[c] Pimpak Prachasilchai, MD,[c] Gur Mainzer, MBBS,[c] Kuberan Pushparajah, MD,[a,c] Markus Henningsson, PhD,[a] Tarique Hussain, MD, PhD,[a,e] Shakeel Qureshi, MD,[c] Eric Rosenthal, MD[c]

SINUS VENOSUS ATRIAL SEPTAL DEFECTS (SVASD) WITH PARTIAL ANOMALOUS PULMONARY VENOUS drainage (PAPVD) are conventionally treated surgically. Cardiac magnetic resonance (CMR) (**Figure 1**, Online Video 1), patient-specific 3-dimensional (3D) printing (Online Appendix) and in vitro simulation with rotational x-ray computed tomography (CT) (**Figure 2**, Online Videos 2 and 3) were used to explore a potential interventional catheterization treatment in 3 adult patients: placement of a custom-made covered Cheatham-Platinum stent in the superior vena cava to right atrium junction to close the SVASD while committing the anomalous pulmonary vein to the left atrium (**Figures 3 and 4**, Online Videos 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13).

Detailed cross-sectional imaging (CMR or CT) allowed patient-specific 3D printing of the anatomy. Simulation of the procedure gave us confidence that the pulmonary veins would remain patent before the clinical catheterization. Using a rigorous approach to accurately assess the anatomy of the SVASD and the PAPVD, we were able to develop a safe and clinically effective interventional catheterization treatment that was successfully performed in 3 patients (**Figure 5**).

ADDRESS FOR CORRESPONDENCE: Prof. Eric Rosenthal, Evelina London Children's Hospital, St Thomas' Hospital, Lambeth Palace Road, London SE1 7EH, United Kingdom. E-mail: Eric.Rosenthal@gstt.nhs.uk.

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APPENDIX For an expanded methods section, supplemental figure, and supplemental videos and their legends, please see the online version of this paper.

From the [a]Division of Imaging Sciences and Biomedical Engineering, King's College London, London, United Kingdom; [b]Cardiovascular Pathology Unit, Institute of Biomedicine of Seville, IBIS, Virgen del Rocio University Hospital/CSIC/University of Seville, Seville, Spain; [c]Department of Congenital Heart Disease, Evelina London Children's Hospital, Guy's and St Thomas NHS Foundation Trust, London, United Kingdom; [d]Department of Medical Physics, Guy's and St. Thomas' NHS Foundation Trust, London, United Kingdom; and the [e]Department of Pediatrics, UT Southwestern Medical Center, Dallas, Texas. This work was supported by the National Institute for Health Research (NIHR) Cardiovascular Health Technology Cooperative (HTC) and Biomedical Research Center (BRC) awarded to Guy's & St Thomas' NHS Foundation Trust in partnership with King's College London (grant code MRJKAGR). All authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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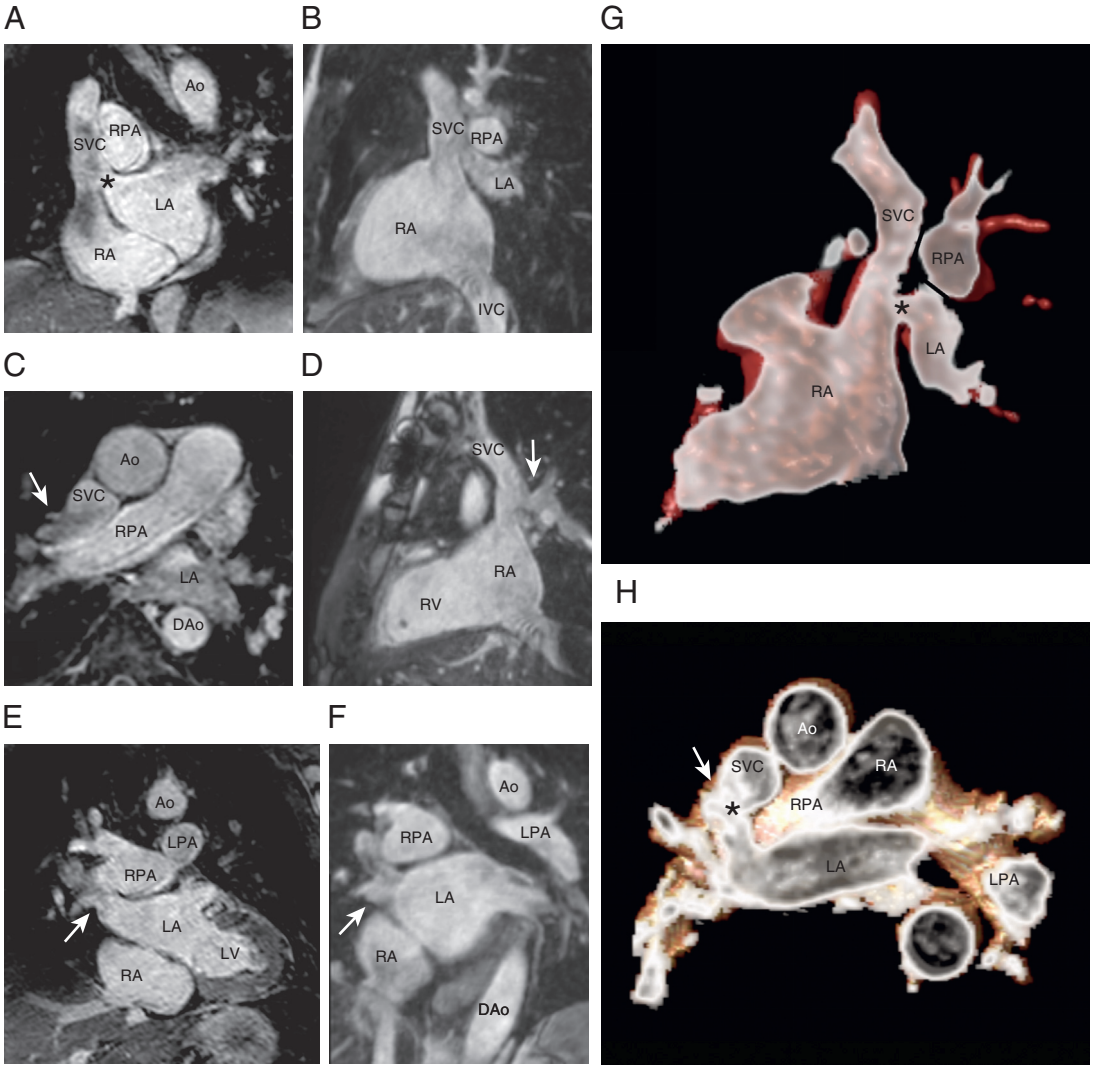
FIGURE 1 CMR



Representative images from cardiac magnetic resonance (CMR) are displayed. In all patients, CMR was diagnostic of partial anomalous pulmonary venous drainage **(white arrows)** involving the right upper pulmonary vein and right middle pulmonary vein, and a sinus venosus atrial septal defect (SVASD) **(asterisk)**. Multiplanar reformat of an electrocardiogram-gated and respiratory navigated 3-dimensional balanced steady-state free precession (Online Appendix) acquisition shows the diagnostic features of this condition: superior vena cava (SVC) overriding the superior rim of the atrial septum in coronal **(A)** and sagittal **(B)** reformats, anomalous pulmonary veins (PVs) draining into the SVC in axial **(C)** and sagittal **(D)** orientations, and pathway continuation of the anomalous PVs to the left atrium (LA) in coronal view **(E and F)**. Volume-rendered images demonstrate the SVASD **(*) (G)** and the course of the PVs: initially draining anomalously to the SVC before subsequent continuation to the LA **(H) (white arrow)** (Online Video 1). Ao = aorta; DAo = descending aorta; IVC = inferior vena cava; LPA = left pulmonary artery; LV = left ventricle; RA = right atrium; RPA = right pulmonary artery; RV = right ventricle.