Comprehensive assessment of Valsalva sinus ruptured by using 4D flow cardiac magnetic resonance

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A 41-year-old sportsman, with a known perimembranous ventricular septal defect (VSD), was admitted for severe increasing dyspnoea for more than 1 month. Transthoracic echocardiography showed a small VSD, but different merging jet flows and resting tachycardia confused Doppler analysis.

Cardiac magnetic resonance was performed at 3 Tesla (Discovery MR 750 w, GEHC). However, due to signal void related to high blood flow velocity, steady state free precession cine images were not sufficient to provide a comprehensive assessment. An 11-min 4D flow acquisition (TR 4.3, TE 1.64, FA 15°, VPS 3, 2 × 2 × 1.56 mm, venc 5 × 5 × 5 m s⁻¹) was performed, and after cloud post-processing (Arterys®, California, USA), images showed a rupture of the right coronary sinus into the right ventricular outflow tract (Panel A, B, C, D, Supplementary data online, Movies 1 and 2). Streamlines representation was able to illustrate systole flow coming from left ventricular outflow tract (LVOT) through the rupture of the right sinus of Valsalva and going to the pulmonary trunk (Panel E). In diastole, streamlines were coming from the ascending aorta and going to the pulmonary trunk (Panel F). Furthermore, 4D flow was able to quantify flow at different levels as illustrated in Panel G, with a remarkable consistency regarding the conservation of blood flow principle. QP/QS ratio was calculated to 4.6.

At surgery, all imaging findings were confirmed, the VSD and rupture of Valsalva were closed, and the aortic valve was preserved. At 1 month, the patient had no symptoms.

In this case, 4D flow was essential to understand all anatomical lesions and was able to quantify such complex flows in the entire acquisition volume.

(A and C) Plane perpendicular to the aortic valve; (B and D) LVOT view (A and B modulus, C and D velocity vector mapping) showing rupture of the right coronary sinus into the infundibulum. (E) Systolic time and (F) diastolic time frames with Streamlines representation. (G) Results of estimated flow at various levels leading to quantification of QP/QS. FF, forward flow; RF, reverse flow; SVC, superior vena cava; IVC, inferior vena cava; RPA, right pulmonary artery; LPA, left pulmonary artery; MV, mitral valve; RA, right atrium; LA, left atrium; AV, aortic valve; PV, pulmonary valve; LV, left ventricle; RV, right ventricle; AA, ascending aorta.

Supplementary data are available at European Heart Journal – Cardiovascular Imaging online.

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