Assessment of the vortex flow in the post-stenotic dilatation above the pulmonary valve stenosis in an infant using echocardiography vector flow mapping

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A 15-month-old male diagnosed with double outlet right ventricle (DORV) suffered from right ventricular failure 8 months after DORV repair. The motion of the anterior cusp of the pulmonary valve (PV) after the commissurotomy of the bicuspid valve was poor on echocardiography, and computed tomography showed post-stenotic dilatation (Panels A and B). We assessed the blood flow in the post-stenotic dilatation site of the main pulmonary artery (mPA) using echocardiography vector flow mapping (VFM). VFM is a new technology that makes it possible to visualize the flow velocity vector, and to calculate energy loss (EL) which results from the viscous dissipation in turbulent blood flow using colour Doppler mapping and speckle tracking and is thought to be the ventricular workload. The flow velocity vector analysis clearly showed that a large vortex formed from the posteri- wall to the anterior wall just above the PV, and high EL was detected even though no pressure drop was detected by catheterization (Panels C and D). After PV plasty with commissurotomy, the vortex diminished, resulting in a decrease of the mPA diameter. Additionally, the EL level at the mPA during the systolic phase considerably decreased after the procedure (Panels E–G). In the present case, the flow vector analysis visualized the abnormalities of blood flow above the PV stenosis. In addition, although further accumulation of such cases is warranted, EL would be a novel parameter that can be used to quantitatively evaluate the pressure overload for the ventricles caused by stenotic lesions.

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