4D Flow MRI: A new diagnostic tool for congenital heart diseases

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Abstract

Purpose. To demonstrate the utility of 4D flow MR imaging for analyzing blood flow patterns and flow distribution in patients with congenital heart diseases. Methods: Six patients with congenital heart diseases were scanned using a standard cardiac MRI protocol, according to their condition. Additionally, 2D flow sequences of the great vessels, and a 4D flow sequence covering the entire heart were acquired. Flow patterns were visualized by using vector fields, streamlines and particle traces. Results: 4D flow technique depicted vortices and helical flow in the pulmonary artery of most patients, as well as in the aorta and superior vena cava of one patient with corrected aortic coarctation and a levoatrial cardinal vein. Conclusion: 4D flow MR imaging enables the identification of flow patterns difficult to detect with other diagnostic modalities. Comprehensive evaluation of flow patterns might help to understand the hemodynamic consequences of congenital heart diseases and their surgical procedures.

Keywords 4D flow, Congenital heart defect, Flow patterns, Magnetic resonance imaging