A 14-year-old female patient with a double inlet left ventricle and discordant ventriculoatrial connection underwent completion of the Fontan circulation with a non-fenestrated extracardiac conduit (ECC) at 3.5 years of age. Cardiac magnetic resonance (CMR) examination was performed including time-resolved, three-dimensional, three-directional, velocity-encoded (4Dflow) CMR to assess the Fontan circulation with velocity encoding of 80 cm/s (Panel A). Flow volume was determined with reformatting planes with through-plane velocity encoding perpendicular to the inferior caval vein (IVC)/ECC: 49 mL, superior vena cava (SVC): 27 mL, left pulmonary artery (LPA): 32 mL, and right pulmonary artery (RPA): 27 mL. A 29% difference between total caval vein flow (76 mL) and total pulmonary artery flow (59 mL) was present. Streamlines and particle tracing analysis showed blood flow from the IVC and SVC (Panels B and C) fusing to a helical flow pattern in the RPA (Panels D and E). This helical flow, unlike the laminar flow in the IVC and LPA (Panels F–H), caused non-laminar flow in the RPA (Panels D, E, and I, and see Supplementary data online, Video S1). The angle of flow vectors to the normal showed almost no angle in the VCI and the LPA, but angles of 90° in the RPA (Panels J, K, and L). Because flow volume quantification is only reliable in the case of laminar flow perpendicular to the reformatted plane, this helical flow most likely influenced our flow volume measurements. This case shows the necessity of flow pattern visualization within the Fontan circulation with 4Dflow CMR, before flow volume measurements from through-plane velocity mapping are performed in the evaluation of the Fontan circulation and collateral flow.

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