IMAGE FOCUS

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Paradoxical right heart failure due to persistent ductus arteriosus

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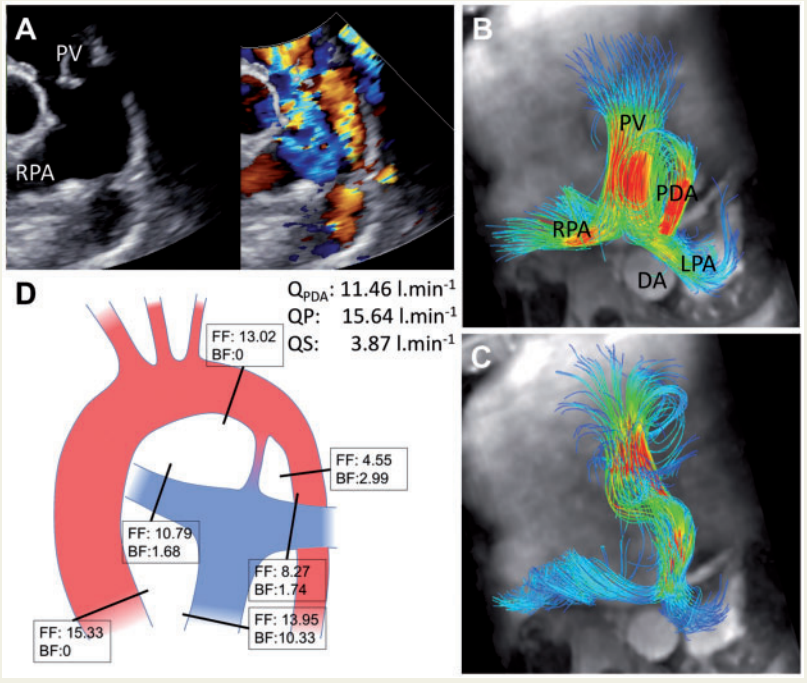
A 36-year-old Caucasian male was referred to our unit for subacute and severe heart failure, mainly right heart failure (RHF) with related cachexia. He was known to have patent ductus arteriosus (PDA) since childhood, associated with massive pulmonary regurgitation (PR) sequela of endocarditis, medically treated.

Transthoracic echocardiogram (*Panel A*) revealed dilated left ventricle and right ventricle with biventricular dysfunction and severe PR. PDA minimal diameter was about 5 mm with exclusive left-to-right shunt ($V = 4.5\ ms^{-1}$). Right atrium pressure was elevated. PR was thought to have a preponderant place in the clinical setting of RHF. Surgical pulmonary valve replacement (PVR) associated to PDA closure was initially viewed as the first therapeutic option. However, clinical presentation and biventricular dysfunction predicted a significant surgical risk.



To better understand this RHF pathophysiology, we performed a 4D flow magnetic resonance imaging (MRI) at 1.5 T (SignaHDxt, GEHC). First, streamlines representation illustrated flow coming from the PDA to the right ventricle through the PR (*Panels B* and *C*, see Supplementary data online *Video S1*). Second, we were able to measure precisely the flows at different levels (*Panel D*) and found that PR was responsible for right heart volume overload massively exacerbated by the PDA shunt (QP/QS = 4.0). We performed an isolated percutaneous closure of the PDA. Patient's symptoms improved within 24 h spectacularly. PVR is planned in the second stage, more safely. This case illustrates the help of 4D flow MRI in the understanding of complicated haemodynamic situations, alike congenital heart diseases, and thus in choosing therapeutic options.

Panels (*A*) Transthoracic echocardiography parasternal short-axis view showing the pulmonary regurgitation and the left to right shunt through PDA. 4D flow MRI sequences with (*B*) systolic time and (*C*) diastolic time frames with streamlines representation of the flow. (*D*) Results of estimated flow at various levels leading to quantification of QP/QS and Q_{PDA}.

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

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