Non-invasive mapping of organ perfusion and blood flow by CT and MRI highlighted by a case of pulmonary artery stenosis

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A 65-year-old man with bilateral pulmonary artery stenosis was treated with percutaneous transluminal angioplasty (PTA) and stent implantation in 2002. After being symptom free for 10 years, the patient presented with worsening episodes of acute right ventricular failure and severe dyspnoea.

Echocardiography demonstrated a high-grade stenosis of the pulmonary arteries with accelerated flow velocities up to 4.5 m/s. Computed tomography (CT) using a dual-energy technique documented instentrestenosis with endoluminal soft tissue growing (Panel A, black arrow) and amputated pulmonary vessels (white arrows). CT-colour-coded perfusion images revealed severe perfusion defects in both lungs (Panel B). Flow-sensitive 4D magnetic resonance imaging (MRI) illustrates the haemodynamic conditions in the pulmonary arteries with a scarce flow in the right pulmonary artery and post-stenotic helical flow in the left pulmonary artery (Panel C, white arrows; Supplementary data online, Movies S1–S3). At catheterization, there was a 67 mmHg gradient to the right pulmonary artery and a 35 mmHg gradient to the left pulmonary artery. The pulmonary arteries were then sequentially balloon dilated.

Nine months after PTA, the status of the patient is stable. Dual-source CT scans with a dual-energy technique documented a well-patent stent in the right pulmonary artery (Panel D) and demonstrated a satisfactory perfusion of the lungs in colour-coded perfusion images (Panel E).

Post-procedural MRI demonstrated an increase in right and left ventricular function (30–37% and 55–65%, respectively). The flow-sensitive 4D MRI also shows haemodynamic improvement with increased blood flow in the pulmonary arteries (Panel F, white arrows; Supplementary data online, Movies S4–S6).

The current case impressively demonstrated the potential of CT and MRI to obtain non-invasive information on organ perfusion and blood flow with simultaneous anatomic orientation.

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