



Presence of aortic root vortex formation after TAVI with CENTERA confirmed using 4D-flow magnetic resonance imaging

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Novel nitinol, self-expandable, short bodied transcatheter aortic valve implantation (TAVI) prostheses allow for magnetic resonance imaging (MRI)-based evaluation of the left ventricle and aortic root, due to a relatively small susceptibility artefact. We have employed four dimensional (4D-) flow MRI-analysis in 3 patients, 2 years after uncomplicated TAVI with the new CENTERA prosthesis (Fig. 1c, patients included in the CENTERA-EU Trial, NCT02458560). Thoracic 4D flow MRI was conducted at 3.0 T with a spatial and temporal resolution of 2.5 mm³ and ± 42 milliseconds. Vortex formation in the three sinuses of Valsalva was analyzed using advanced streamline techniques.

Figure 1a shows an overview of blood flow in the ascending aorta. The aortic root was transected and color-coded according to direction relative to the center of the aorta, as schematically depicted in Fig. 1b, to show the vortices in the individual sinuses more clearly. Vortices in all three sinuses of Valsalva were identified in all 3 patients (example of one patient seen in Fig. 1d).

Vortical blood flow patterns in the sinuses of Valsalva facilitate coronary perfusion and allow for rapid opening and closure of the aortic valve minimizing the stress on the aortic valve leaflets, as first hypothesized by Leonardo Da Vinci in the early sixteenth century [1]. Our finding suggests

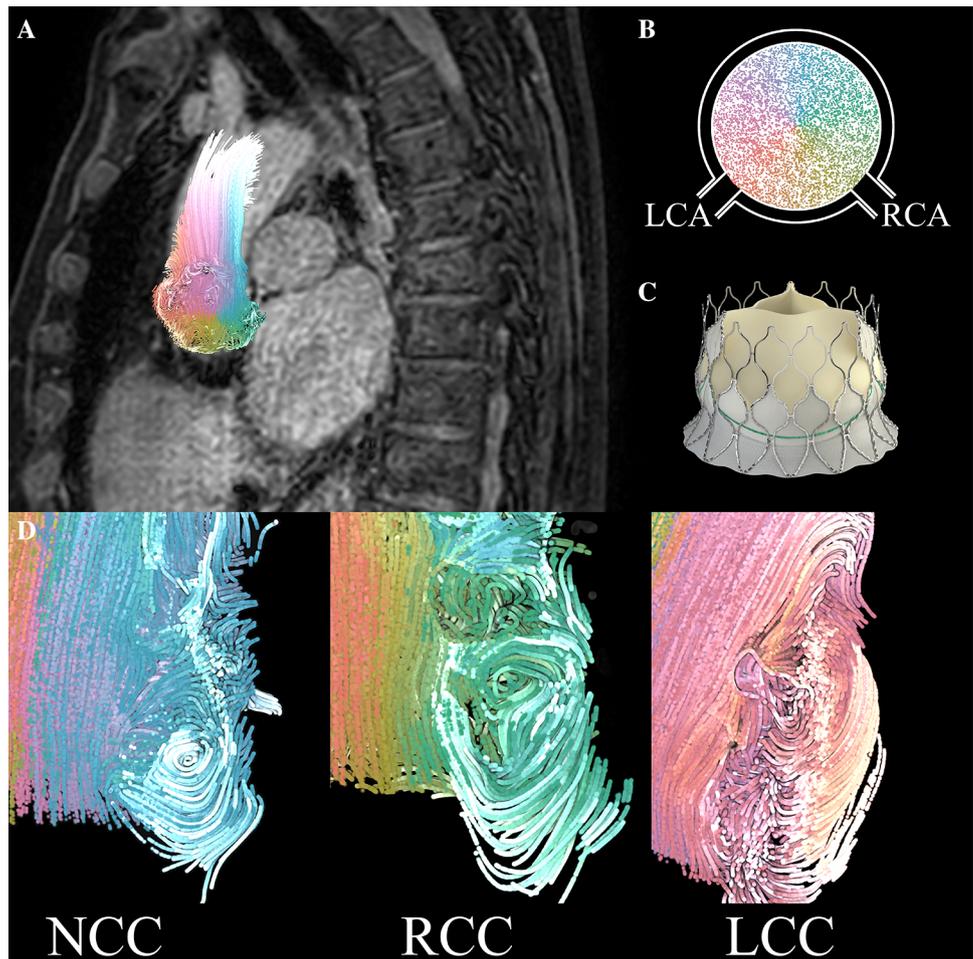
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Fig. 1 Blood flow in the ascending aorta after TAVI with CENTERA



restoration of native sinus function after minimally invasive TAVI. This finding may have important clinical implications, as valve durability and coronary perfusion remain topics of debate in the era of potential TAVI in lower-risk patients.

Compliance with ethical standards

Conflict of interest J. Baan Jr. receives an unrestricted research grant from Edwards Lifesciences and is proctor for Edwards Lifesciences.

Reference

1. Bissell MM, Dall'Armellina E, Choudhury RP (2014) Flow vortices in the aortic root: in vivo 4D-MRI confirms predictions of Leonardo da Vinci. *Eur Heart J* 35:1344