IMAGES IN INTERVENTION

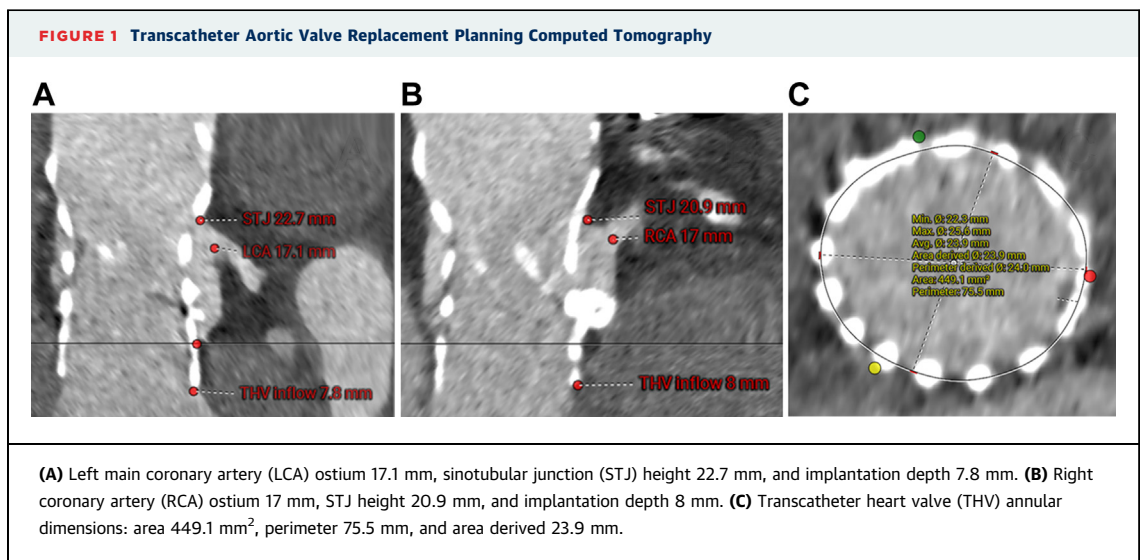# Patient-Specific Computer Modeling to Guide Redo Transcatheter Aortic Valve Replacement

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Redo transcatheter aortic valve replacement (TAVR) is rare and represents only 0.33% of total TAVR cases.[1] This number is expected to increase as TAVR expands to lower risk and younger patients.

A 75-year-old woman who had undergone TAVR 5 years previously was referred for redo TAVR following admission with heart failure and echocardiographic findings of severe bioprosthetic valve stenosis and severely impaired left ventricular function.
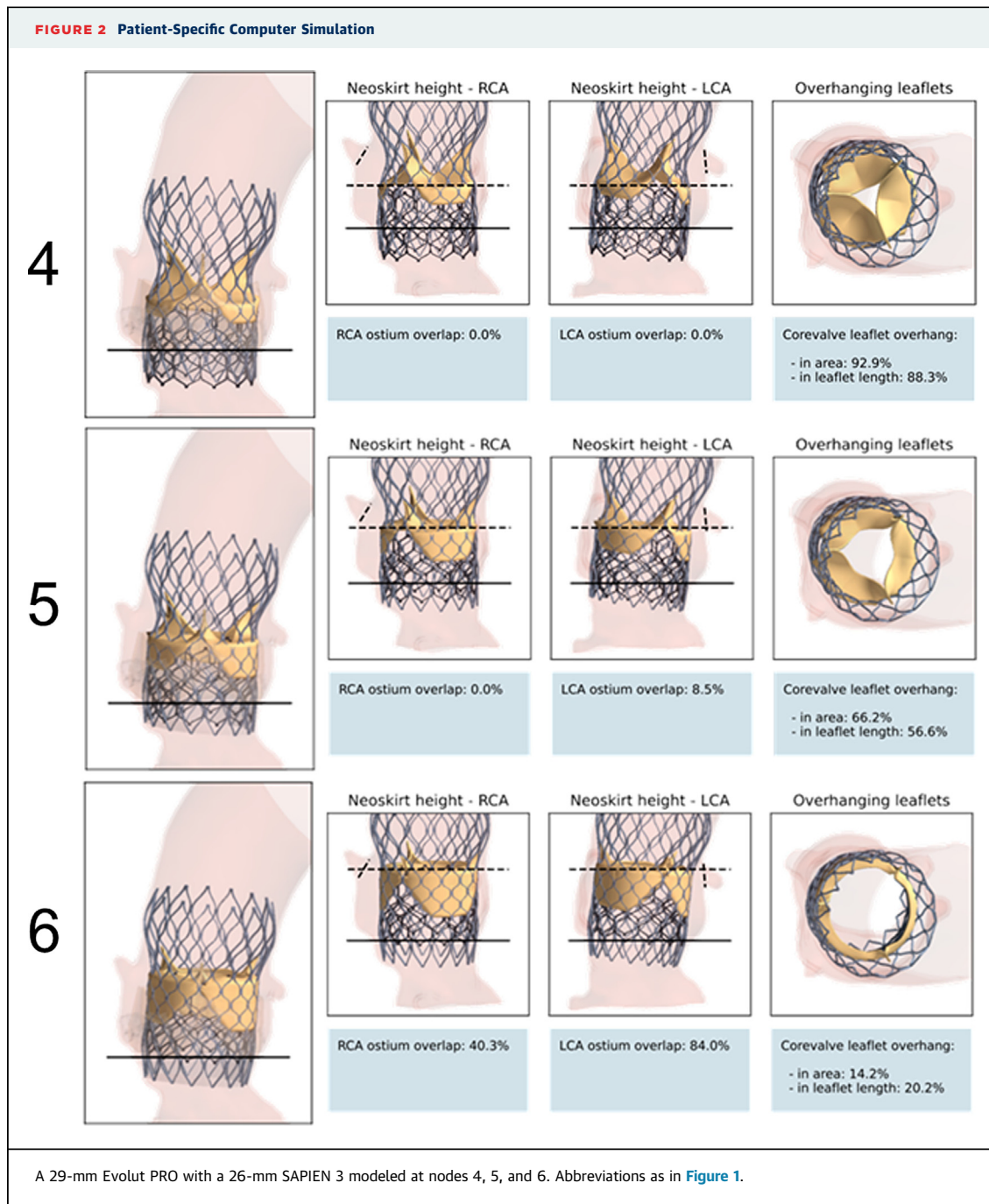
Computed tomography showed low implantation of a well-expanded 29-mm Evolut PRO (Medtronic) transcatheter heart valve (THV) (Figure 1). In addition to standard planning, we undertook patient-specific computer modeling using the HEARTguide

FIGURE 1 Transcatheter Aortic Valve Replacement Planning Computed Tomography

(A) Left main coronary artery (LCA) ostium 17.1 mm, sinotubular junction (STJ) height 22.7 mm, and implantation depth 7.8 mm. **(B)** Right coronary artery (RCA) ostium 17 mm, STJ height 20.9 mm, and implantation depth 8 mm. **(C)** Transcatheter heart valve (THV) annular dimensions: area 449.1 mm², perimeter 75.5 mm, and area derived 23.9 mm.

FIGURE 2 Patient-Specific Computer Simulation

A 29-mm Evolut PRO with a 26-mm SAPIEN 3 modeled at nodes 4, 5, and 6. Abbreviations as in Figure 1.

platform (FEops) to simulate potential outcomes dependent on second THV implantation height (Figure 2).

We modeled the implantation of a 26-mm SAPIEN 3 (Edwards Lifesciences) valve with outflow heights at nodes 4, 5, and 6 of the index Evolut THV. The simulation predicted leaflet overhang at nodes 4, 5, and 6 of 92.9%, 66.2%, and 14.2%, respectively.

There was no neoskirt ostial overlap at node 4, 8.5% left main coronary artery overlap at node 5, and 48.3% right coronary artery ostial overlap and 84% left main coronary artery overlap at node 6.

FIGURE 3 After Redo Transcatheter Aortic Valve Replacement
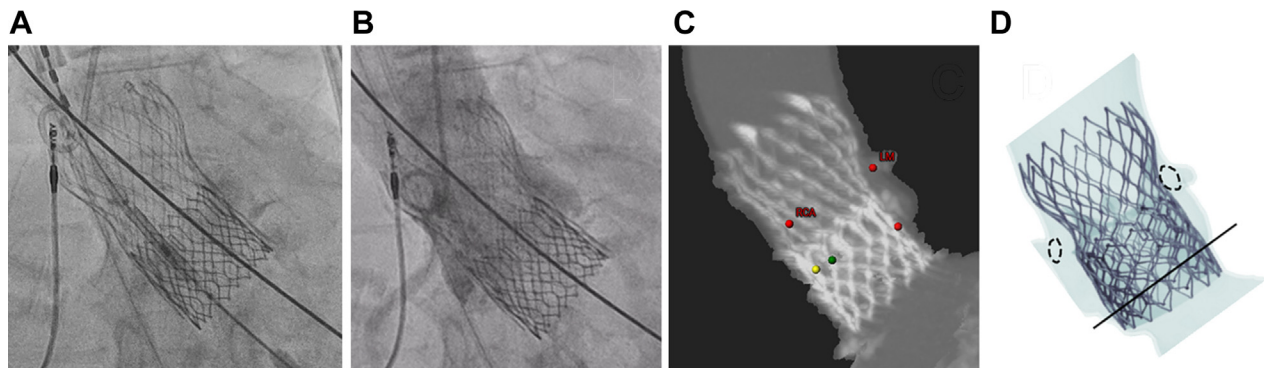
(A, B) Fluoroscopy. **(C)** Postprocedural computed tomographic scan. **(D)** Simulated valve at node 5. LM = left main coronary artery; RCA = right coronary artery.

The decision was to implant the outflow at node 5 to balance risk for leaflet overhang against coronary overlap. Resulting THV implantation was between nodes 4 and 5 (**Figure 3**). Postprocedure echocardiography showed a well-seated and functioning THV with no paravalvular leak.

We have demonstrated the value of patient-specific computer modeling to guide redo TAVR, which has importance in lifetime planning and ensuring predictable outcomes. This novel and promising technique is still under development and warrants further investigation in larger trials.

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REFERENCE

1. Landes U, Webb JG, De Backer O, et al. Repeat transcatheter aortic valve replacement for transcatheter prosthesis dysfunction. *J Am Coll Cardiol.* 2020;75(16):1882–1893. https://doi.org/10.1016/j.jacc.2020.02.051