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# Predicting adverse outcomes after TAVI procedure - a comparison of two CoreValve generations using real-life outcomes and patient-specific computer simulations

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**Background and aim:** Post-procedure conduction abnormalities (CA) and paravalvular aortic regurgitation (PAR) continue to strain TAVI outcomes. Computer simulations, based on patient-specific anatomy, valve properties, and implantation position, have been validated for prediction of these complications. The new-generation CoreValve Evolut PRO has been shown to have lower levels of PAR and CA than previous generations. The aim was to compare clinical outcomes after Evolut Pro implantation in real-life with outcomes of virtual deployment of the same size, implantation depth adjusted CoreValve Evolut R.

**Methods:** Patients undergoing Evolut Pro implantation at a single centre were included into the study. Postoperative Doppler echocardiography was assessed to define PAR, the pre- and postoperative 12-lead ECGs for CA, and the postoperative angiograms to measure implantation depth based on annular plane distance from the non-coronary and left coronary aortic valve cusps. Preoperative multislice computed tomography was used to generate patient-specific models of the native aortic root. Implantation of the Evolut R valve and corresponding aortic root deformation was simulated using computational mechanics, whereas blood flow and level of PAR were predicted using computational fluid dynamics. Prediction of CA – new onset left bundle branch block or atrioventricular block type II or III -was based on calculations of contact pressure in a patient-specific region of the aortic root containing the AV conduction system (ROI). Outcomes were predicted in three implantation depth positions - high, medium, low – where the position closest to the real-life implantation depth was chosen for outcome comparisons.

**Results:** Study diagram is shown in Figure 1. Thirty-three patients (57% female, mean age 82±6 years old) underwent a TAVI intervention with an Evolut PRO valve. Evolut PRO implantation depths were, in general, closest to the lowest modeled Evolut R depth. Comparison demonstrated similar overall incidence of moderate-to-severe PAR. The Evolut R simulation predicted 18 patients without PAR and 2 with PAR. With the Evolute PRO, 1 of the 18 not predicted developed significant PAR, and 1 of the 2 predicted did not develop PAR. CA were notably higher with the Evolut R simulation, where CA were present in 9 out of 12 patients, as compared to the observed 5 out of 12 with the Evolut PRO.

**Conclusion:** Single-centre outcomes after Evolut Pro implantation in real-life showed a similar overall incidence of moderate-to-severe PAR and a lower incidence of conduction abnormalities as compared to the same size, implantation depth adjusted, patient-specific Evolut R modeled outcomes. As inferred from the results, computer simulations may have high clinical utility in supporting clinical decisions regarding valve choice in TAVI procedures.

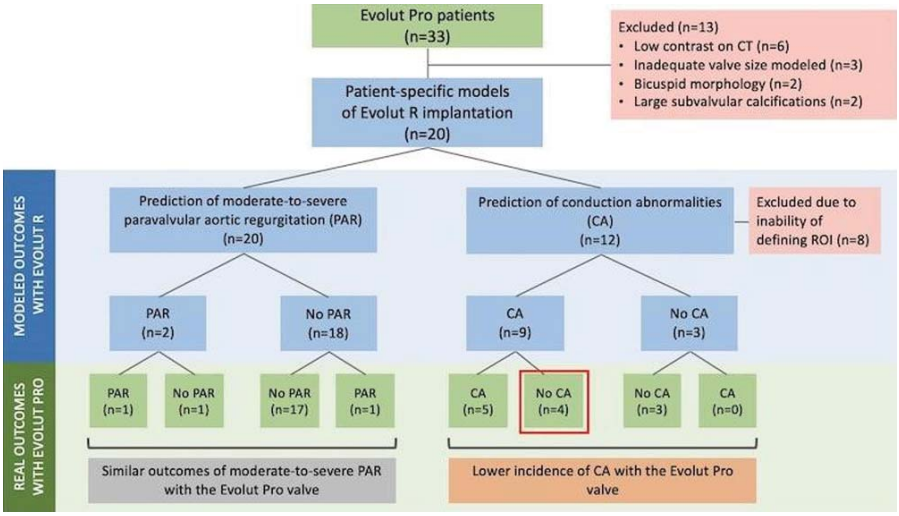


Figure 1