# VIRTUAL TREATMENT PLANNING OF TRANSCATHETER EDGE-TO-EDGE MITRAL VALVE REPAIR

**Marco Barink (1), Katharina Vellguth (2,3), Juliana Franz (2,3), Jan Brüning (2,3), Valentina Lavezzo (1)**

*1. Philips Research, AI, Data Science and Digital Twin department, The Netherlands; 2. Deutsches Herzzentrum der Charité, Institute of Computer-assisted Cardiovascular Medicine, Germany; 3. Charité - Universitätsmedizin Berlin, Germany*

## Introduction

For patients with mitral valve regurgitation who are at high surgical risk, transcatheter edge-to-edge repair (TEER) can be a suitable treatment alternative to a surgical procedure [1]. The TEER device serves to reduce the backflow of blood through the mitral valve by reducing the regurgitant orifice area. At the same time, a sufficiently large diastolic orifice area should remain to prevent mitral stenosis after treatment. In this study, we investigate whether pre-interventional virtual planning based on echocardiographic data could support clinicians in finding the optimal device position for a patient. This could reduce the need for intra-operative planning and device placement attempts.

## Methods

3D transesophageal echocardiography images of the left ventricle and mitral valve of a patient undergoing TEER treatment were acquired and segmented. A mechanical model of the pre-interventional mitral valve was built based on these segmentations. Virtual TEER interventions were performed by inserting different device types at various positions in the mitral valve model. Computational fluid dynamics simulations were performed to assess mitral valve hemodynamics both before and after the virtual intervention.

## Results

Inserting the TEER device at different positions in the mitral valve model influences both the regurgitant and the diastolic orifice areas. The best device position determined with the model agrees well with the location the device was placed in the patient (Fig.1). The CFD simulations show an increased mitral valve pressure gradient in the post-interventional state, which is an expected trend due to the reduced diastolic orifice area.

## Discussion

This work demonstrates a general workflow for virtual planning of TEER procedures based on routinely acquired echocardiographic images. Clinically relevant parameters including the mitral valve orifice areas and the mitral valve pressure gradient after the intervention can be computed with this approach. More patient cases need to be processed and evaluated to assess the applicability of the proposed workflow for making patient-specific outcome predictions.

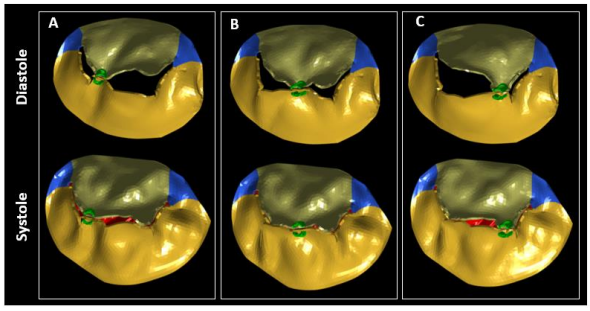


*Figure 1: Virtual mitral valve model with TEER devices inserted at different positions. Configuration B reduces the regurgitant orifice area the most (red area during systole), which agrees well with the central device positioning chosen in the actual intervention.*

## References

1. Otto CM et al., Circulation, 143:e72–e227, 2021.