variability in manual measurements. Agreement of prosthesis sizing between both observers was found in 45 patients (90%, $\kappa = 0.82$) for model-based measurements, but in only 40 patients for manual measurements (80%, $\kappa = 0.80$), indicating that the semiautomated approach may allow for a greater standardization of annulus measurements, particularly in less inexperienced observers.

Despite the availability of new automated systems, observers should still be proficient in the manual determination of all measurements required for TAVR planning. Furthermore, this study has the limitation that prosthesis sizing was on the basis of the valve model from a single vendor. Nevertheless, our data suggest that semiautomated morphological aortic annulus quantification enables fast and accurate procedural planning with excellent agreement in manual planimetry and has the potential to improve the workflow and standardize annular measurements in the evaluation of patients before TAVR.

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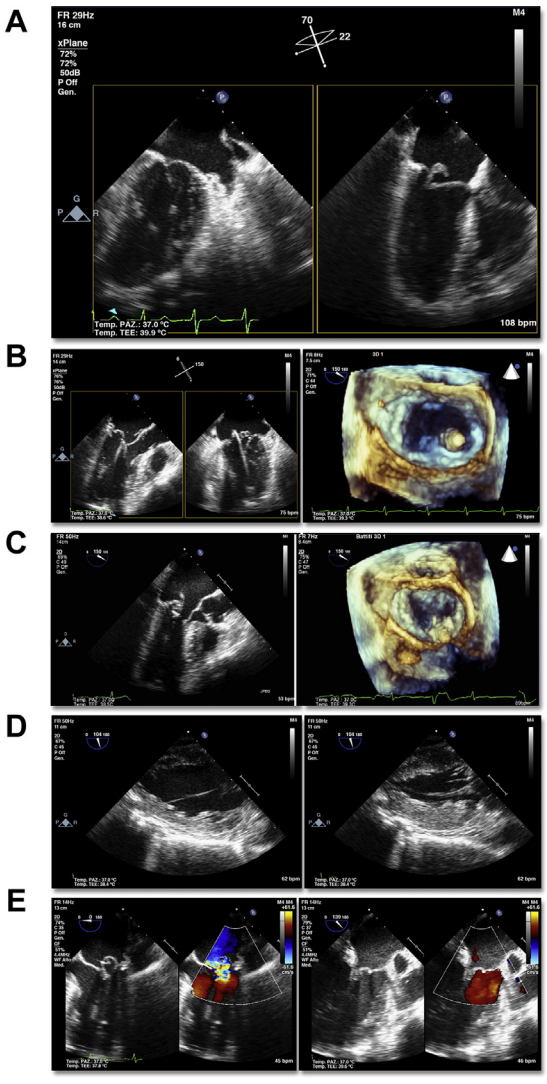

Figure 1. Mitral Valve Anatomy Assessment and Steps for Neochord Deployment

(A) A 2-dimensional (2D) transesophageal echocardiographic (TEE) view of the left ventricle and mitral valve (multiplane imaging, X plane at 0° and 90°) permits the identification of the most appropriate point of puncture of the left ventricle **(left)**. The device is maneuvered into the left ventricle through the mitral valve into the left atrium. Two reference images are visualized simultaneously. The first image is typically a reference view of MV at 90°, while the second image, which is inverted right-left (anterior in the right side and posterior in the left side **[right]**), or "lateral plane," represents a plane rotated at 90° from the reference plane (Online Video 1). **(B)** Once the device is into the left atrium, a 3-dimensional (3D) TEE view of the mitral valve, called "surgical view," presents the view of the valve similar to that seen by the surgeon from a left atrial perspective. This view is useful for optimal orientation with regards to the prolapsing segment of the leaflet (Online Video 2). The 2D and 3D real-time images **(C)** confirm the good grasping of the leaflet (Online Video 3). **(D)** The implanted neochord (Neochord DS1000) is easily visible in the left ventricle (Online Video 4). **(E)** Final length and tension of the neochord is achieved by pulling or relaxing it to obtain a satisfactory mitral valve competence under 2D and 3D TEE color Doppler evaluation. In the **left panel,** the neochord is relaxed, and in the **right panel,** the neochord is tensioned, achieving complete reduction on mitral regurgitation (Online Videos 5 and 6).

TEE-Guided Transapical Beating-Heart Neochord Implantation in Mitral Regurgitation

Transapical beating-heart neochord (Neochord DS1000, Minnetonka, Minnesota) implantation to repair mitral valve regurgitation has been demonstrated to be a safe and effective minimally invasive alternative to open surgical repair in selected patients with mitral leaflet prolapse (flail/chordae rupture) (1–3). Successful neochord implantation depends on accurate localization of

the site of regurgitation and efficient intraoperative communication between the echocardiographer and the surgeon. Two-dimensional (2D) and 3-dimensional (3D) transesophageal echocardiography (TEE) are mandatory to guide the surgeon during all phases of the procedure. We illustrate step-by-step the echocardiographic roadmap of the procedure using both 2D and 3D TEE. The additional value of 3D TEE lies mainly in the possibility of seeing the valve and the device in an anatomical context. For assessing mitral valve anatomy and guiding the device from the apex of the left ventricle across the mitral annulus, 2D TEE is preferred (Figs. 1A and 1B, Online Videos 1 and 2). Once the mitral valve has been crossed, the view is changed to real-time 3D TEE. 3D TEE allows for optimal orientation of the tip of the device with regards to the prolapsing segment of the leaflet (Fig. 1B). When appropriate positioning has been achieved, the jaws of the device are opened and the leaflet is grasped (Fig. 1C, Online Video 3). The GoreTex suture (W. L. Gore & Associates, Flagstaff, Arizona) is then deployed. The implanted neochord is easily visible on echocardiography (Fig. 1D, Online Video 4). Tension is applied on the GoreTex suture; if mitral regurgitation is effectively reduced, the neochordal position is considered to be good, and it is anchored to the apex of the heart. Depending on the operative result, additional neochords can be implanted by repeating the procedure to achieve maximal competence of the mitral valve (Fig. 1E, Online Videos 5 and 6).

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APPENDIX

For supplementary videos and their legends, please see the online version of this article.