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IMAGES IN INTERVENTION

Transcatheter Mitral Valve Replacement Guided by Echocardiographic–CT Scan Fusion

Early Human Clinical Experience

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Both pre-operative planning and periprocedural guidance of transcatheter mitral valve replacement (TMVR) are based on the independent analysis of transesophageal echocardiography (echo) and *computed tomography scanner (CT) images* (1). Echo-CT fusion (Vivid E95, GE Healthcare, Horten, Norway) (**Figure 1**, Video 1) is an innovative tool that allows the visualization of both images in the same visual perspective on the echo screen in the operating room through the fusion of the pre-operative CT and the periprocedural live 3-dimensional transesophageal echocardiography. Echo-CT fusion thus provides more comprehensive periprocedural guidance and navigation by improving visualization and communication within the entire heart team.

In our experience, this is particularly beneficial in 3 steps during TMVR procedures: 1) catheter crossing of the annular plane avoiding the subvalvular apparatus; 2) position check of the delivery system before and during final deployment; and 3) left ventricular outflow tract impact after deployment of recapturable and retrievable prosthesis (**Figures 2 and 3**). Echo-CT fusion seems, therefore, a promising live tool in perioperative imaging of TMVR.

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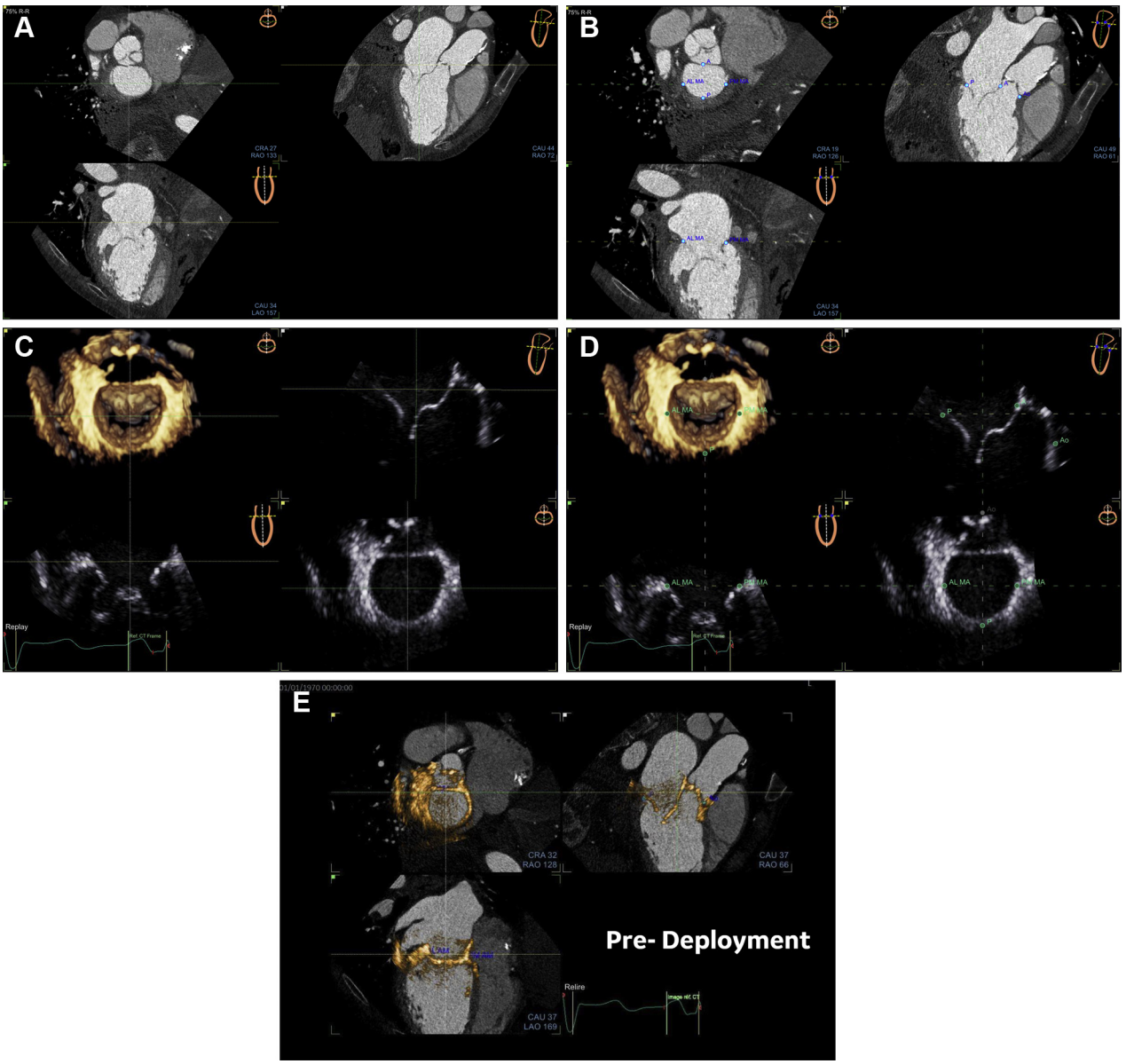
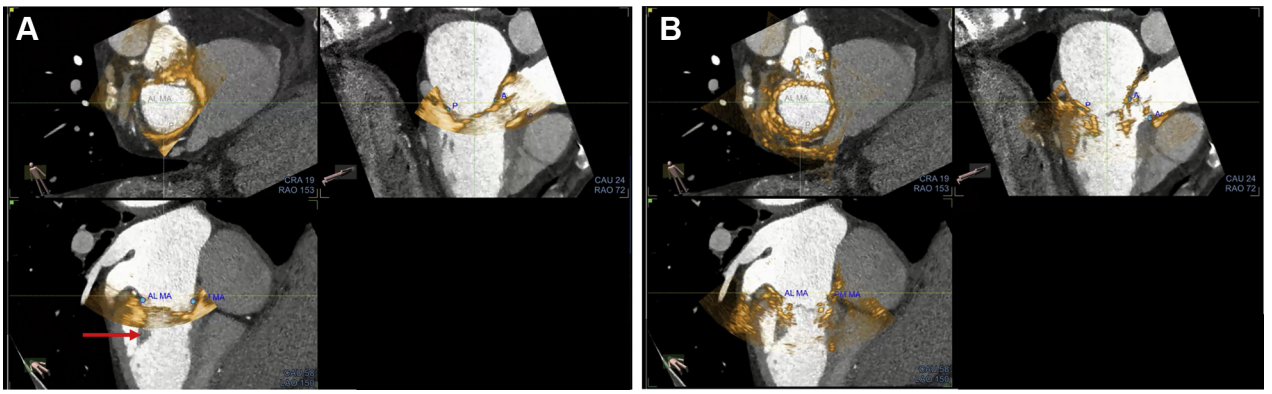
FIGURE 1 **Step-by-Step Echo-CT Fusion Overview**



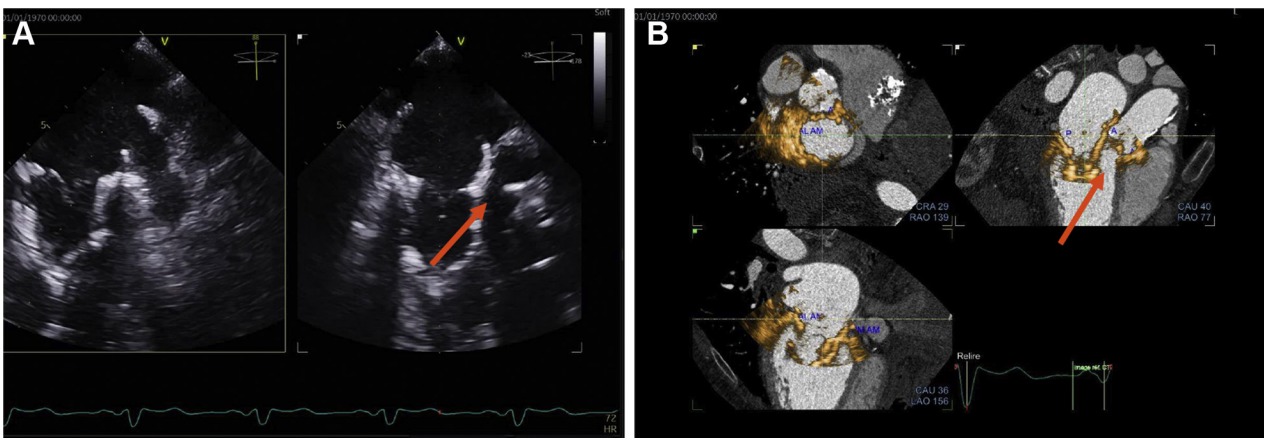
(A) Alignment with computed tomography (CT) acquisition is the first mandatory step to ensure standardized and expected views where vertical axis crosses through the center of the mitral valve while the horizontal axis is parallel to the mitral valve. **(B)** 5 landmarks are then placed (2 mitral annulus points, 2 anterior/posterior points plus the aorta point. **(C)** An alignment step is then performed on a 3-dimensional volume of the mitral annulus set. **(D)** Finally, the same landmarks are placed on the 3-dimensional transesophageal echocardiography volume allowing **(E)** echo-CT fusion imaging.

FIGURE 2 Example of Echo-CT Fusion With the Intrepid Prosthesis



Echo-CT fusion pre- **(A)** and post- **(B)** deployment of the Intrepid (Medtronic, Minneapolis Minnesota) prosthesis and its utility in crossing the mitral annulus plan with the prosthetic system while avoiding the subvalvular apparatus **(red arrow)**. CT = computed tomography.

FIGURE 3 Example of Echo-CT Fusion to Assess Neo-LVOT After TMVR With the Tendyne Prosthesis



(A) After the deployment, the amount of material and the shadowing of the device made the assessment of the neo-left ventricular outflow tract (neo-LVOT) difficult. **(B)** With echo-CT fusion, the assessment of the neo-LVOT **(red arrow)** may be more accurate to assess LVOT obstruction. This could be very useful for the Tendyne (Abbott Vascular, Santa Clara, California) prosthesis, which is fully recapturable and retrievable. CT = computed tomography; LVOT = left ventricular outflow tract; TMVR = transmitral valve replacement.

REFERENCE

1. Bax JJ, Debonnaire P, Lancellotti P, et al. Transcatheter Interventions for Mitral regurgitation: multimodality imaging for patient selection and procedural guidance. J Am Coll Cardiol Intv 2019;12:2029-48.

KEY WORDS fusion imaging, mitral regurgitation, TMVR

APPENDIX For a supplemental video, please see the online version of this paper.