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Comparison of Residual Tricuspid Regurgitation Severity Assessed by Intraprocedural and Postprocedural Echocardiography in Patients Undergoing Transcatheter Tricuspid Valve Repair

To the Editor:

TRANSCATHETER TRICUSPID valve repair (TTVr) using edge-to-edge clipping devices has emerged recently to treat high-risk symptomatic patients with severe tricuspid regurgitation (TR).[1] Inaccurate grading of TR severity during the procedure may result in suboptimal results, leading to significant residual TR. Thus, an accurate estimation of intraprocedural TR is essential. Because systemic venous return and cardiac output are frequently decreased during anesthesia,[2] we hypothesized that residual TR during the procedure would be underestimated. This study compared the severity grades and color jet area (CJA) of residual TR, as assessed by the intraprocedural transesophageal echocardiography (TEE) and postprocedural transthoracic echocardiography (TTE), in patients undergoing TTVr. Patients who underwent isolated TTVr using the MitraClip system (Abbott Vascular) in our institution between January 2017 and November 2021 were included. Although baseline and postprocedural TTE were performed under conscious conditions, intraprocedural TEE was conducted under general anesthesia during mechanical ventilation. The baseline, intraprocedural, and postprocedural TR grades were collected from the echocardiography reports. The TR grades were classified by experienced cardiologists based on a multiparametric integrative approach in accordance with current guidelines,[3-5] as none/trace, mild, mild-to-moderate, moderate, moderate-to-severe, severe, and massive/torrential. The CJA of TR was measured by tracing the largest jet area in midsystole on color Doppler images, with an aliasing velocity of 50-to- 60 cm/s from the apical 4-chamber or right ventricle (RV) inflow view on TTE and the midesophageal four-chamber or RV inflow-outflow view on TEE.

Ninety-two patients were reviewed retrospectively. The etiology of TR was functional (n = 70), pacemaker lead-related (n = 16), and degenerative (n = 6). The number of implanted clips was 2.2 ± 0.8. The median time interval between

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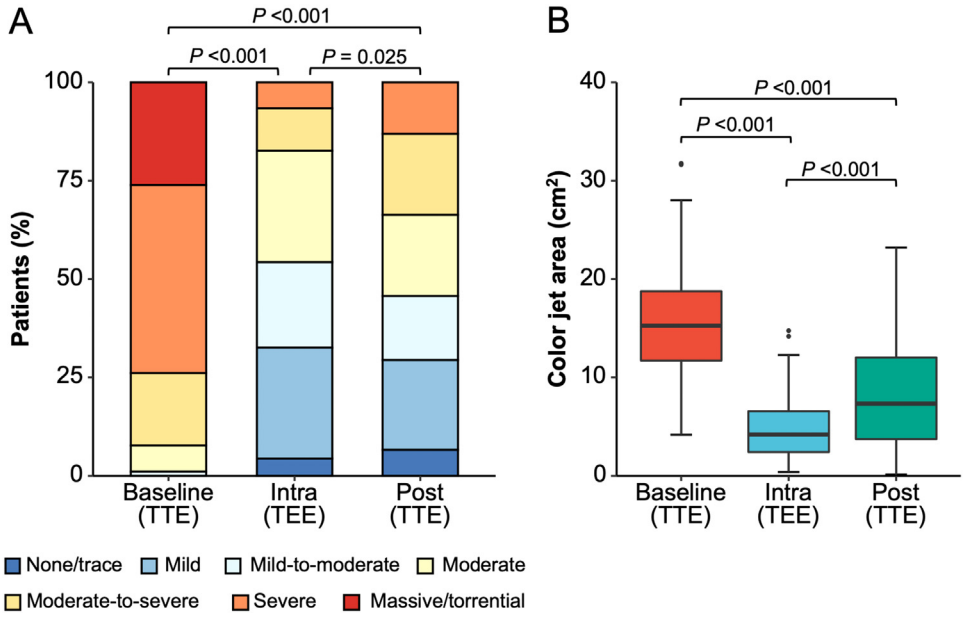

Fig 1. Comparison of tricuspid regurgitation (TR) severity assessed by the baseline, intraprocedural, and postprocedural echocardiography in patients who underwent transcatheter tricuspid valve repair. (A) Severity grades of TR and (B) the color jet area of TR. TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.

baseline TTE and TEE was 21 days (IQR: 7-59). All postprocedural TTE tests were performed within 2 days after TTVr. Figure 1A shows the distributions of TR grades at 3 time points. Moderate or greater TR on baseline TTE was observed in 91 patients. Both TEE and postprocedural TTE showed improvements in TR ($p < 0.001$ for both comparisons) compared to the baseline TTE. Moreover, the median grades of TR severity were "mild-to-moderate" and "moderate" on intraprocedural TEE and postprocedural TTE, respectively, and the grade distribution on intraprocedural TEE was less severe than that on postprocedural TTE ($p = 0.025$). Similarly, the CJA of TR significantly improved after the implantation of clips, and the CJA on intraprocedural TEE was smaller compared to postprocedural TTE (4.7 ± 3.2 *v* 8.4 ± 5.8 cm^2, $p < 0.001$), as shown in Figure 1B. The results demonstrated that intraprocedural TEE showed lower residual TR grades and smaller CJA than postprocedural TTE. Although there is a lack of evidence regarding the influence of anesthesia and mechanical ventilation on TR severity, previous studies demonstrated that intraoperative or intraprocedural mitral regurgitation severity can be underestimated during general anesthesia.[6,7] Positive-pressure ventilation may increase RV afterload, but anesthesia and mechanical ventilation can reduce systemic venous return, RV preload, and cardiac output.[2,8] A previous experimental study also described the impaired RV contractility and tricuspid annular dynamics during anesthesia.[9] Therefore, we speculated that the emergence from anesthesia is associated with RV preload and potentially worsening TR, as assessed by postprocedural TTE.

Acknowledgments

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Conflict of Interest

Dr Makkar has received grant support from Edwards Lifesciences and St. Jude Medical and is a consultant for Abbott Vascular, Cordis, and Medtronic. All other authors have no conflict of interests to disclose.

Author Contributions

Dr Kuwajima: Conceptualization, methodology, data curation, formal analysis, and writing of the original draft. Dr Kagawa: Data curation and writing, review, and editing. Dr Yamane: Data curation and writing, review, and editing. Dr Hasegawa: Data curation and writing, review, and editing. Dr Makar: Data curation and writing, review, and editing. Dr Makkar: Data curation and writing, review, and editing. Dr Shiota: Conceptualization, methodology, supervision, and writing of the original draft.

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"Ripples in Water" Effect Detected by Ultrasound During Internal Jugular Catheterization

To the Editor:

Herein, I describe an interesting "ripples in water" effect in the right internal jugular vein using ultrasound guidance before its catheterization. A 54-year-old male with severe mitral stenosis, tricuspid regurgitation, pulmonary artery hypertension, and atrial fibrillation, was scheduled for mitral valve replacement. After the induction of anesthesia, the patient was positioned and prepared for a right internal jugular vein catheterization under ultrasound guidance. An ultrasound assessment revealed stasis of blood in the vessel and a "ripples in water" effect in a cross-sectional view (Fig 1; Video 1). Interrogation in a longitudinal view revealed the presence of a valve with thrombus, located more caudad (Fig 2; Video 2). This valve appeared to be fluttering because of the backward flow of blood into the vein from the right atrium due to elevation of the right ventricle end-diastolic pressure and a severe tricuspid regurgitant jet.[1]

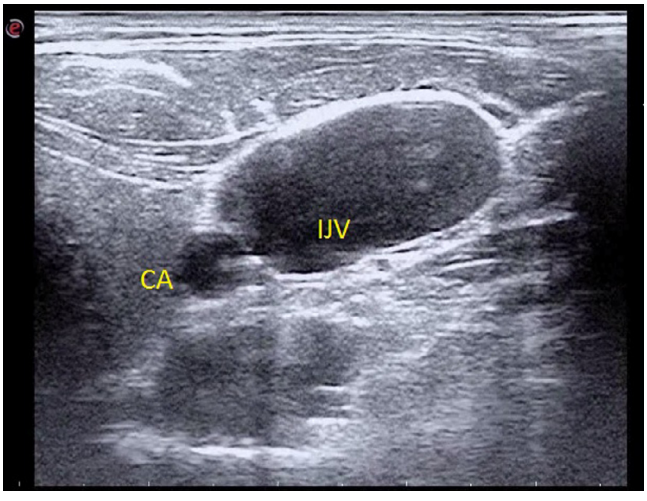

Fig 1. Ultrasound in a cross-sectional view showing venous stasis in the right internal jugular vein. CA, carotid artery; IJV, internal jugular vein.

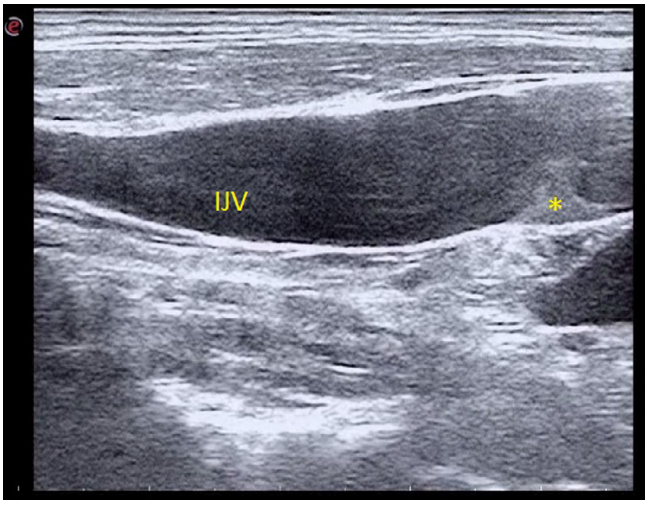

Fig 2. Ultrasound in a longitudinal view showing a valve with thrombus (*) in the right internal jugular vein. IJV, internal jugular vein.

Conflict of Interest

None.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1053/j.jvca.2022.06.034.

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Andexanet Alfa-Induced Heparin Resistance Missing From SCA Blood Management in Cardiac Surgery Guidelines

To the Editor:

Current 2021 Society of Cardiovascular Anesthesiologists (SCA) guidelines recommend giving novel oral anticoagulant-