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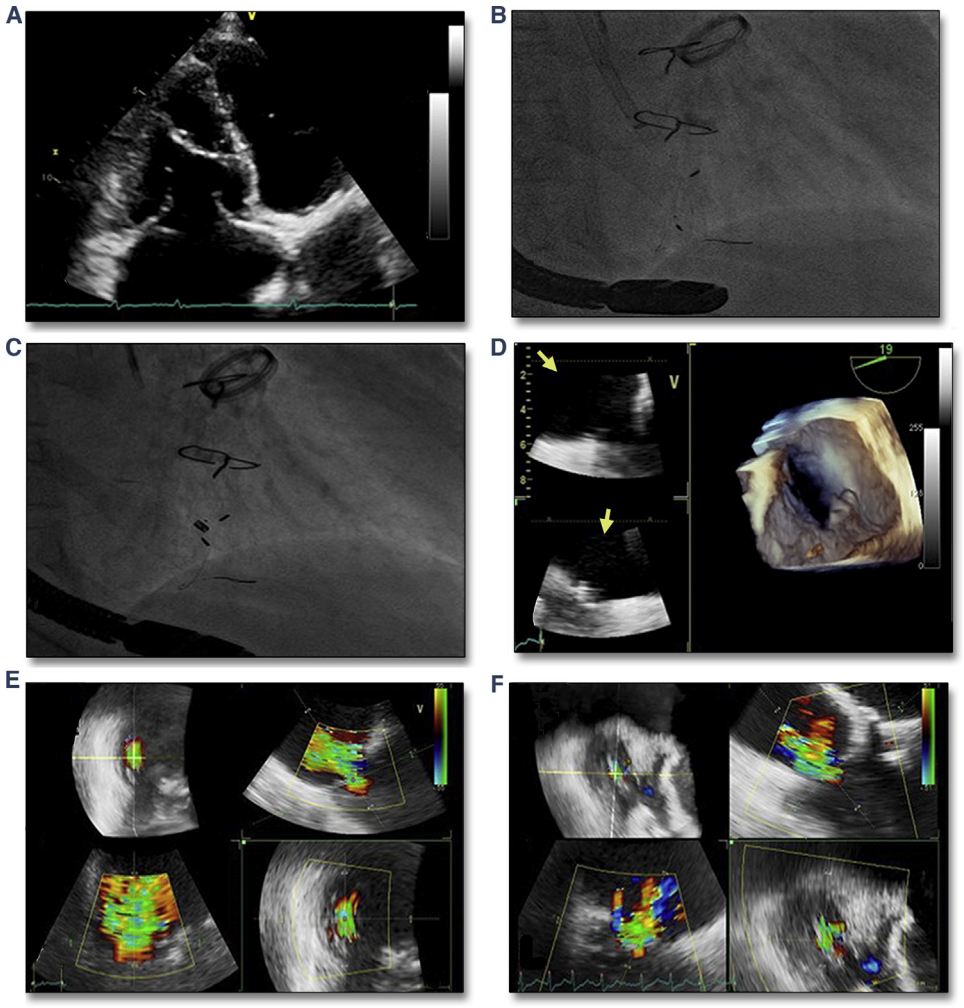
Percutaneous Bicuspidization of the Tricuspid Valve

A 75-year-old woman who was known to have had previous aortic and mitral valve replacement with mechanical prostheses, permanent atrial fibrillation, type 2 diabetes mellitus, and hypothyroidism presented with right-sided heart decompensation (severe edema of the lower extremities, pleural effusion, hepatomegaly, and stage IV chronic kidney disease). Echocardiography showed massive functional tricuspid regurgitation due to severe tricuspid annulus dilatation (diameter 49 × 37 mm) and complete absence of leaflet coaptation (**Figure 1A**); a severely dilated right ventricle (end-diastolic diameter 43 mm) with moderate dysfunction (TDI S′ 10 cm/s); systolic pulmonary arterial pressure 40 mm Hg; noncollapsible inferior vena cava with estimated right atrial pressure of 20 mm Hg; normal left ventricular function; normal gradients across mitral and aortic prosthetic valves; and mitral paravalvular leak with moderate mitral regurgitation.

Intravenous high-dose diuretic therapy was able to reduce systemic congestion and to improve kidney function: however, the patient was dependent on intravenous diuretic agents, and conversion to oral therapy was not achievable. The patient was not suitable for surgical treatment of tricuspid regurgitation because of high operative risk (logistic EuroSCORE [European System for Cardiac Operative Risk Evaluation] 24%).

A compassionate percutaneous treatment of the tricuspid valve was chosen: the Trialign system (Mitralign Inc., Tewksbury, Massachusetts) was used to plicate the tricuspid annulus, as described previously by Schofer et al (1). This procedure, which resembles the surgical Kay procedure with bicuspidization of the tricuspid valve via plication of the posterior leaflet, was performed under general anesthesia, with fluoroscopic and 3-dimensional echocardiographic guidance. The procedure was performed by a right transjugular approach with 2 14-F sheaths and steerable guiding catheters. An articulating 8-F wire delivery catheter was introduced in a retrograde fashion across the tricuspid valve through one of the 14-F guiding catheters. The catheter was articulated under the annulus to the posteroseptal commissure; an insulated radiofrequency wire was then advanced across the annulus into the right atrium at a distance of 2 to 5 mm from the base of the leaflet. This wire was snared via the second 14-F sheath, externalized, and used to advance the pledget catheter anterogradely across the annulus. Half the pledget was delivered and cinched in the subannular region of the ventricle, whereas the remaining pledget was extruded and cinched on the atrial surface of the tricuspid annulus. Another pledget was delivered in a similar manner on the anteroposterior commissure at a distance of 2.4 to 2.8 cm from the first pledget. At the end, the 2 pledgets were placed at the base of the posterior leaflet, near the anteroposterior and posteroseptal commissure. The 2 pledgeted sutures were pulled together with a plication lock catheter, and the sutures were cut, which resulted in plication of the tricuspid annulus (**Figures 1B and 1C**), thus effectively making the tricuspid valve bicuspid (**Figure 1D**); this translated to a significant reduction in annular dimensions (31 × 23 mm) and valve planimetric area (14.9 to 5.6 cm^2), increased coaptation of the leaflets, and reduction of final tricuspid regurgitation to moderate-severe with a large reduction in effective regurgitant orifice area (4.7 to 1.1 cm^2) (**Figures 1E and 1F**). No changes were documented in estimated systolic pulmonary arterial pressure (38 mm Hg) and right atrial pressure (20 mm Hg). A significant improvement in clinical status was achieved; intravenous diuretic discontinuation was possible, and the patient was discharged with high-dose oral diuretic therapy. This case highlights that the Trialign provides a novel solution for percutaneous tricuspid valve repair by replicating surgical bicuspidization of the tricuspid valve. Patient selection and defining the correct outcome measures will be an essential part of investigating this innovative therapy in this complex patient cohort.

FIGURE 1 Echocardiographic and Fluoroscopic Imaging Before and After Trialign Implantation



Echocardiography showing tricuspid annular dilation with complete absence of leaflet coaptation **(A)**. Intraprocedural pledget placement. Fluoroscopic images showing how 2 pledgets were placed at the base of the posterior leaflet **(B)** and showing the plication of the 2 pledgeted sutures **(C)**. Three-dimensional (3D) transesophageal echocardiography (multiple-plane reconstruction method) showing bicuspidization of the tricuspid valve **(D)**. **Yellow arrows** represent the point of view for the 3D reconstruction of the mitral valve. Leaflets coaptation and effective regurgitant orifice area. Tricuspid effective regurgitant orifice area before (4.7 cm^2) **(E)** and after (1.1 cm^2) **(F)** treatment is also shown.

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http://dx.doi.org/10.1016/j.jcmg.2016.03.008

Please note: Dr. Latib has served on the advisory board of Medtronic. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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