Tricuspid Clip
Step-by-Step and Clinical Data

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KEYWORDS

• Tricuspid regurgitation • MitraClip • Pacemaker lead

KEY POINTS

- Significant tricuspid regurgitation (TR) without treatment carries a dismal prognosis.
- Transcatheter tricuspid repair with the MitraClip system is safe.
- Patient screening using both transthoracic and transesophageal echocardiography is critical to assess procedural feasibility and extent of TR reduction.
- Integrating echocardiographic and fluoroscopic imaging simplifies device orientation and facilitates leaflet grasping and procedural success.
- The dedicated TriClip system and clips with longer grip arms may further improve ease of transcatheter tricuspid repair and clinical outcomes.

INTRODUCTION

Significant tricuspid regurgitation (TR) is a serious problem with few effective treatment options. Most cases are secondary to mitral regurgitation (MR) but a segment of the patient population may have primary TR caused by degenerative or congenital disease.[1,2] Untreated patients develop progressive right ventricular volume overload and dilatation, right heart failure, and the sequelae of peripheral edema and chronic liver congestion. Pacemaker or automatic implantable cardioverter defibrillator (AICD) lead-associated TR is common and these patients have higher mortality and morbidity than those without a right ventricular (RV) lead.[3,4] Prognosis in patients with untreated TR remains poor and surgery to repair or replace the tricuspid valve (TV) carries significant mortality and morbidity.[1,2] Current guidelines recommend a more aggressive approach in surgical repair of significant TR but many patients remain on medical therapy only.[1,2]

Transcatheter tricuspid repair with MitraClip has recently been shown to improve cardiac output in an ex-vivo model.[5] The system, designed for transcatheter mitral repair, recently emerged as a feasible treatment options in patients with significant TR deemed high risk for surgery.[6–21] More than 300 procedures have been performed worldwide and preliminary results are promising.[20,21] This article summarizes the step-by-step approach to TV repair with the MitraClip system and discusses currently available data.

PREPROCEDURAL SCREENING

Echocardiography

High-quality echocardiographic imaging is critical to determine the feasibility of tricuspid repair with the MitraClip system. Recent guidelines and reviews have been written on comprehensive echocardiographic evaluation of the TV.[22,23] Transthoracic echocardiography (TTE) is the initial study to acquire to determine TR severity and anatomy (Table 1), followed by transesophageal echocardiography (TEE) to determine whether the tricuspid anatomy, location, and severity of the TR jet, and TEE views will be adequate for leaflet grasping (Table 2). In patients with an RV lead, it is important to ensure that the lead will not cause excessive acoustic shadowing and its position will not

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Table 1
Transthoracic echocardiographic views and parameters to evaluate tricuspid valve repair with MitraClip system

I. Parasternal long-axis view	• LVOT with and without color Doppler (include zoomed view) • AV with and without zoomed view
II. Parasternal inflow view of TV	• TV with and without color Doppler CW • Doppler aligned with TR jet PW Doppler at level of TV annulus • PW Doppler at level of TV leaflet tips • PISA of TR jet
III. Parasternal outflow view of PV	• PV with and without color • Doppler PW of PV • CW of PV
IV. Parasternal short-axis view	• 2D RV (base, mid-RV, apex levels) • 2D TV (leaflet level: anterior, posterior, and septal), tips of TV leaflets • Color Doppler of TV over TV orifice
V. Basal parasternal short-axis view (level of AV)	• PV with and without color • Doppler TV with and without color Doppler • Pulsed Doppler of pulmonary flow at PV level If image well aligned: • CW Doppler aligned with TR jet PW Doppler at level of TV annulus • PW Doppler at level of TV leaflet tips • PISA TR jet
VI. Apical 4-chamber view	• 2D TV with and without color Doppler • CW Doppler of TR jet • PW Doppler at level of TV annulus • PW Doppler at level of TV leaflet tips PISA TR jet • Tissue Doppler of TV annulus • 2D RA with TV in middle of sector (include zoomed view) • RV (basal and annulus levels) (include zoomed view)
VII. Subcostal view	• IVC with and without a sniff • Color Doppler of IVC and hepatic vein • Pulsed Doppler of hepatic vein (forward and reversed flow) If image well aligned: • CW Doppler aligned with TR jet • PW Doppler at level of TV annulus • PW Doppler at level of TV leaflet tips • PISA TR jet
VIII. M mode	• LV/RV below tips of MV/TV leaflets

Abbreviations: AV, aortic valve; CW, continuous wave; 2D, two-dimensional; IVC, inferior vena cava; LV, left ventricle; LVOT, left ventricular outflow tract; PISA, proximal isovelocity surface area; PV, pulmonic valve; PW, pulse wave; RA, right atrium; RV, right ventricle; TR, tricuspid regurgitation; TV, tricuspid valve.

interfere with the clip delivery system (CDS) positioning and leaflet grasping. RV lead extraction may be an option in patients who are not pacer dependent and require an AICD.[19] Patients who are pacer dependent may instead have a coronary sinus or left ventricular lead implanted, or placement of a leadless pacemaker.[19] Those who need the benefit of an AICD may benefit from a subcutaneous device instead.

The 3 critical TEE views to determine the anatomy of the TR jet and feasibility of repair with MitraClip are:

1. Four-chamber view to visualize septal and anterior/posterior leaflets
2. TV inflow-outflow view (equivalent to bicommissural view of mitral valve [MV]) with X-plane to visualize septal and anterior/posterior leaflets for leaflet grasping
3. Transgastric basal short-axis view to visualize all 3 leaflets, and to determine TR jet location and width, and septal leaflet mobility

Three-dimensional (3D) TEE is helpful to visualize the 3 leaflets and device positioning relative to various commissures and leaflets.