

Rapid Pacing Using the Guidewire During Transcatheter Tricuspid Valve-in-Valve Implantation

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Abstract

Transcatheter valve replacement is now widely used to treat high-risk patients. This approach is also expanding to the tricuspid valve, mostly for “valve-in-valve” and “valve-in-ring” implantations. Rapid pacing during transcatheter valve implantation is used to reduce cardiac output and minimize the risk of valve dislodgement. Rapid pacing is usually done using the patient’s permanent pacemaker or a temporary pacing electrode that is usually introduced retrogradely into the left ventricle or coronary sinus. Here, we describe the use of the tricuspid valve-in-valve implantation super-stiff guidewire for rapid pacing during implantation of the valve. This approach may obviate the need for ancillary steps that may increase procedure time, X-ray exposure, and risk of complications.

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Key Words

Tricuspid valve-in-valve • Rapid pacing

Introduction

It is well recognized today that significant tricuspid valve regurgitation is associated with poor prognosis [1, 2]. The long-term results of tricuspid surgical repairs are suboptimal, with more than 25% of patients developing progressive moderate or severe valve regurgitation within 5 years of repair [3, 4]. Similar to bioprostheses in other positions, tricuspid valve bioprostheses are prone to degeneration and dysfunction.

Tricuspid valve prosthesis longevity may be shorter than that of bioprosthetic valves in the systemic circulation, with 75% to 83% freedom from reintervention at 8-10 years and <60% at 15 years [5-7].

Transcatheter valve replacement is now widely utilized to treat high-risk patients with native valve disease and is expanding to encompass degenerated bioprosthetic valves. There are several reports of transcatheter tricuspid “valve-in-valve” and “valve-in-ring” implantations with reasonable short- and medium-term results [8, 9].

Rapid pacing during transcatheter valve implantation is used to reduce cardiac output and minimize the risk of valve dislodgement. Although the lower pressure in the right ventricle may reduce the need for rapid pacing during valve implantation, it is used in most cases when the Sapien valve is implanted [8, 9]. Rapid pacing is usually done using the patient’s permanent pacemaker or a temporary pacing electrode. The pacing electrode is usually introduced retrogradely into the left ventricle or coronary sinus; other positions used are the right atrium or right ventricle [8, 9]. Placing a pacing electrode in the left ventricle requires additional arterial access. Any positioning of a dedicated pacing electrode is time-consuming and involves additional X-ray exposure. However, several published reports describe successful and safe rapid pacing using the left ventricle guidewire during valve implantation in transcatheter aortic valve replacement (TAVR) [10, 11].



Here, we report the use of the tricuspid valve-in-valve implantation super-stiff guidewire for rapid pacing during implantation of the valve.

Case Presentation

A 57-year-old woman underwent mechanical aortic valve and mitral valve replacement and bio-prosthetic tricuspid valve replacement (27 mm Carpentier-Edwards, CE) in 2006 due to rheumatic heart disease. With time, she gradually developed severe stenosis of the tricuspid bio-prosthesis. The mean and peak pressure gradients over the tricuspid bio-prosthetic valve were 26 and 35 mmHg, respectively, with normal left ventricular and right ventricular systolic function as evaluated by echocardiography. She complained of shortness of breath with mild effort and edema of her legs. Her functional capacity was assessed as NYHA III-IV/IV.

During pre-procedural evaluation, the patient had a body weight of 62 kg and height of 155 cm,

blood creatinine 0.73 mg %, and an estimated glomerular filtration rate of 83 ml/min. The patient had a logistic EUROSCORE-II of 4% and STS scores of 2.1% for mortality and 17.9% for morbidity/mortality.

Considering the patient's high risk in re-operation, we decided to proceed to tricuspid valve-in-valve implantation. The procedure was performed with the patient under deep sedation. Using a JR4 catheter, the tricuspid valve was crossed with a long hydrophilic wire that was advanced to the left pulmonary artery. The wire was replaced by an Amplatz super-stiff 0.035" wire. An Edwards Sapien S3 26 mm valve was positioned over the wire in the bio-prosthetic tricuspid valve. After advancing the transcatheter tricuspid valve implantation (TTVI) system to the implantation position, an external cardiac pacemaker was connected to the guidewire. One electrode of the pacemaker was connected to the Amplatz super-stiff wire (Figure 1), and the other electrode was connected to a large suture needle that was placed

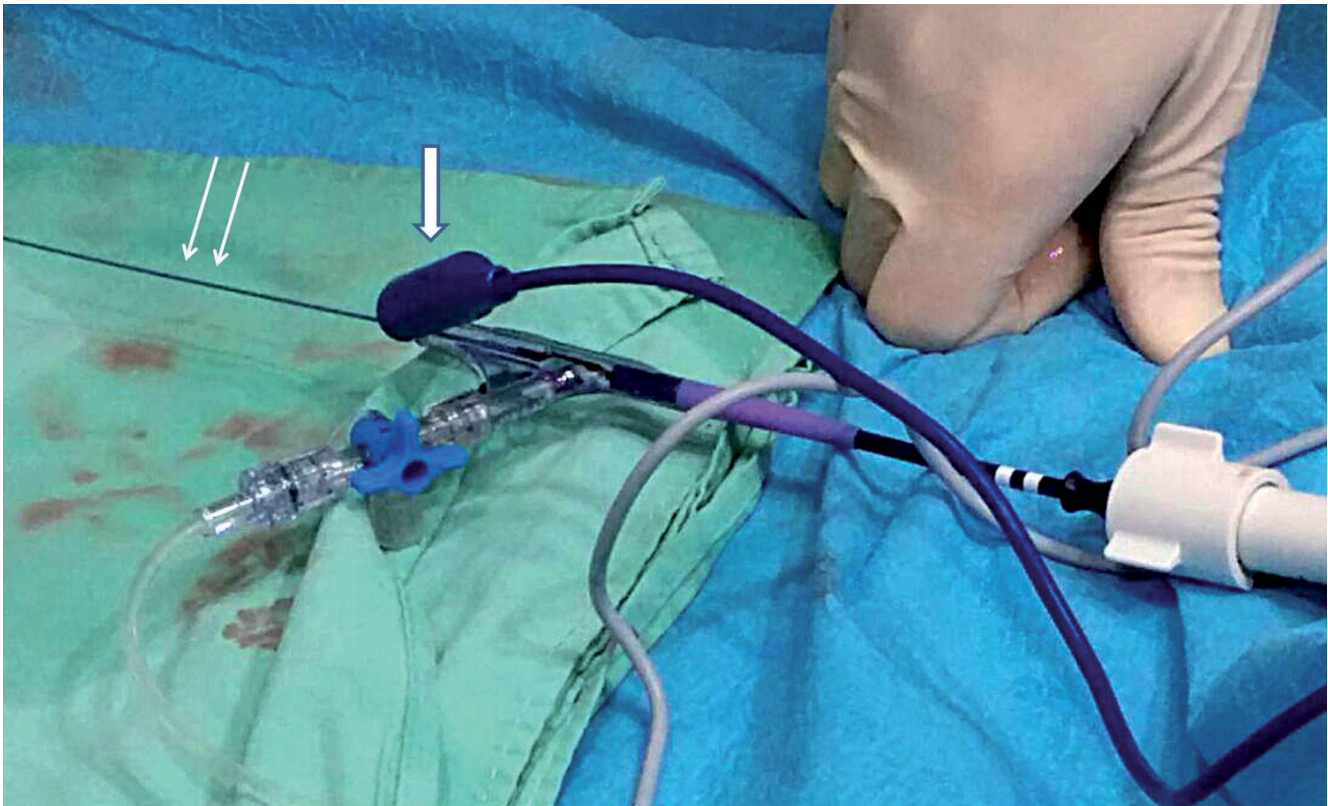


Figure 1. Pacemaker electrode (thick arrow) connected to the Amplatz super-stiff guidewire (thin arrows).

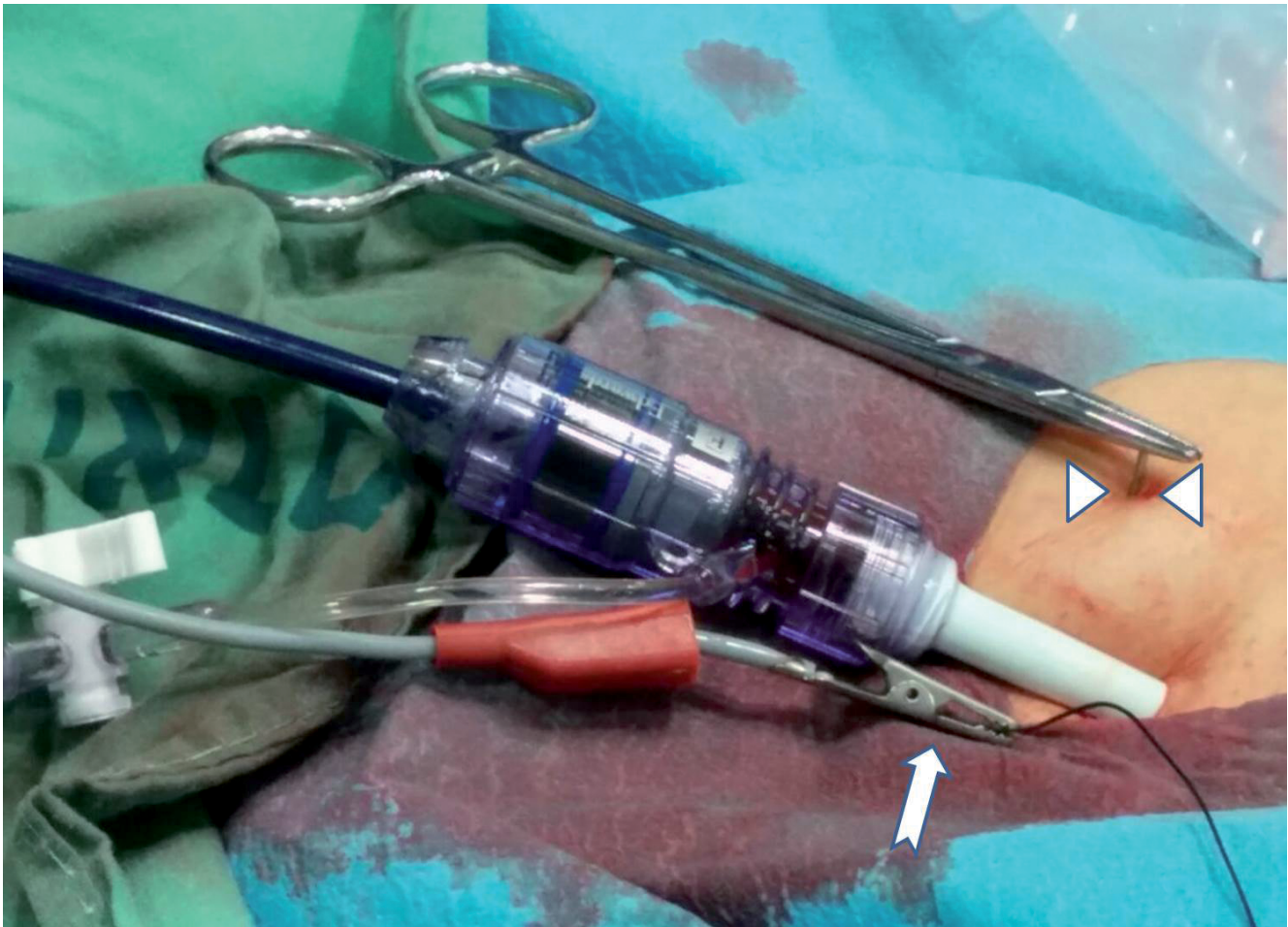


Figure 2. Pacemaker electrode (arrow) connected to a large suture needle (between arrowheads) placed trans-cutaneously in the right groin.

trans-cutaneously in the right groin (Figure 2). During rapid pacing at a rate of 160 beats per minute, the valve was expanded with slow inflation in the correct position (Figure 3). Following implantation, pacing was stopped (Figure 4).

Trans-thoracic echocardiography after the procedure showed no para-valvular leak and a trans-valve mean gradient of 5 mmHg. The procedure time was 1.5 h, and fluoroscopy time was 12.5 min.

Discussion

Rapid pacing during valve implantation in a bio-prosthetic valve or ring is usually used when a balloon-expandable valve is used. In our case, valve implantation was performed in a patient with a me-

chanical aortic valve, excluding the option of placing a pacing electrode retrogradely into the left ventricle. Pacing the right atrium is possible but may be unreliable and may not supply sufficient ventricular rhythm.

Two reports by Faurie et al. and Hilling-Smith et al. described successful and safe rapid pacing using the guidewire during TAVR. During TAVR, the guidewire is positioned in the left ventricle apex and has good contact with the myocardium. We describe good pacing capture while using the guidewire positioned through the outflow of the right ventricle and into the pulmonary artery.

In the VIVID registry [9], which is a large international registry of TTVI, rapid pacing during valve implantation was used mostly during Sapien

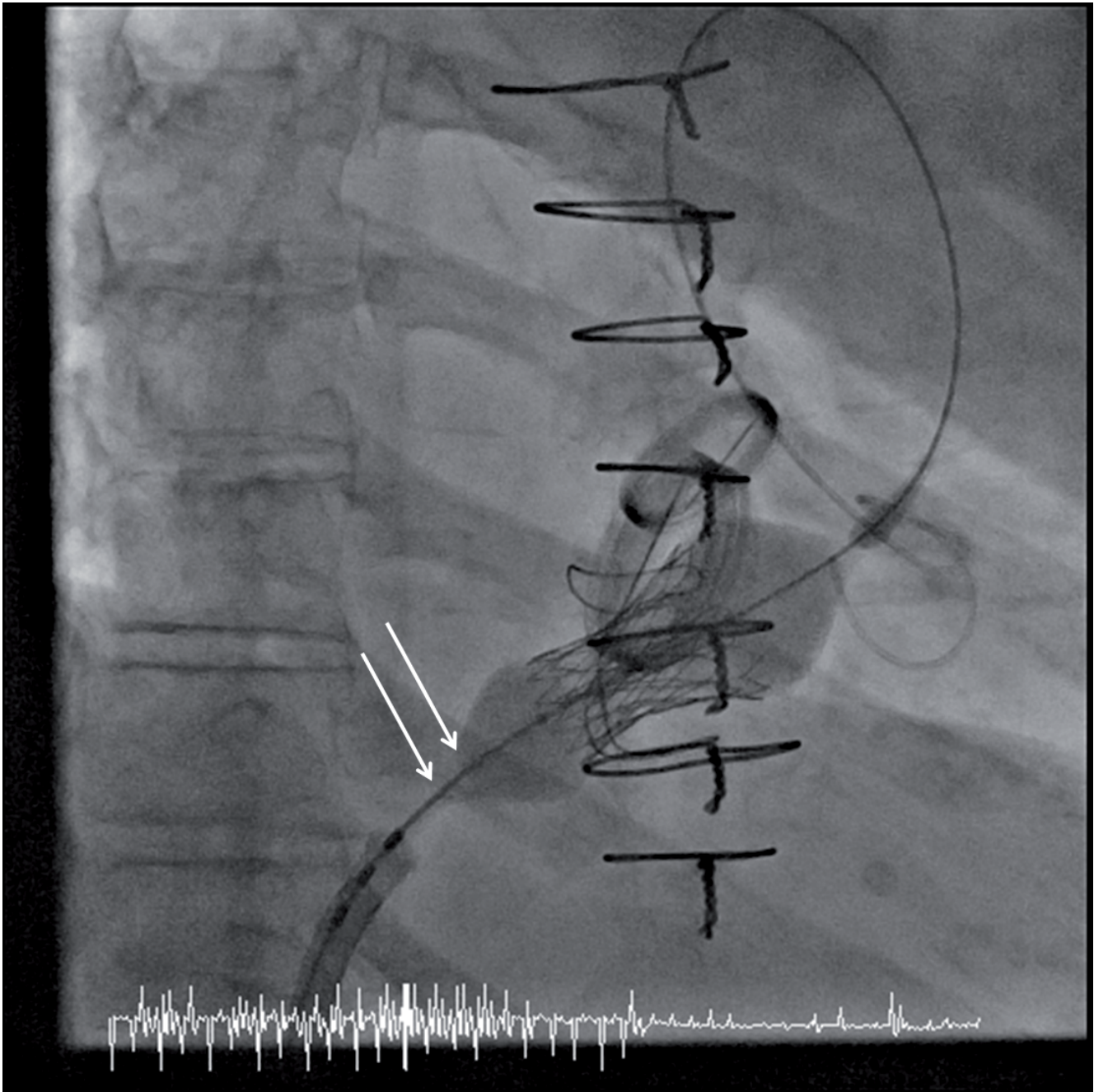


Figure 3. Rapid pacing (see rhythm strip at bottom) through the Amplatz super-stiff guidewire (arrows) positioned through the tricuspid valve in the right ventricle into the pulmonary artery during implantaion of a Sapien S3 valve.

valve implantation. Pacing was performed through existing leads or with a temporary pacing catheter/wire, most often introduced retrogradely into the left ventricle or coronary sinus. Only one patient out of 156 had complete atrio-ventricular block requiring a permanent pacemaker; therefore, it seems there is no

need for a back-up pacing electrode during TTVI in valve. Rapid pacing using the guidewire as a unipolar electrode saves puncture of the femoral artery for retrograde left ventricular pacing.

In a report of 22 patients with tricuspid valve regurgitation who underwent catheterization

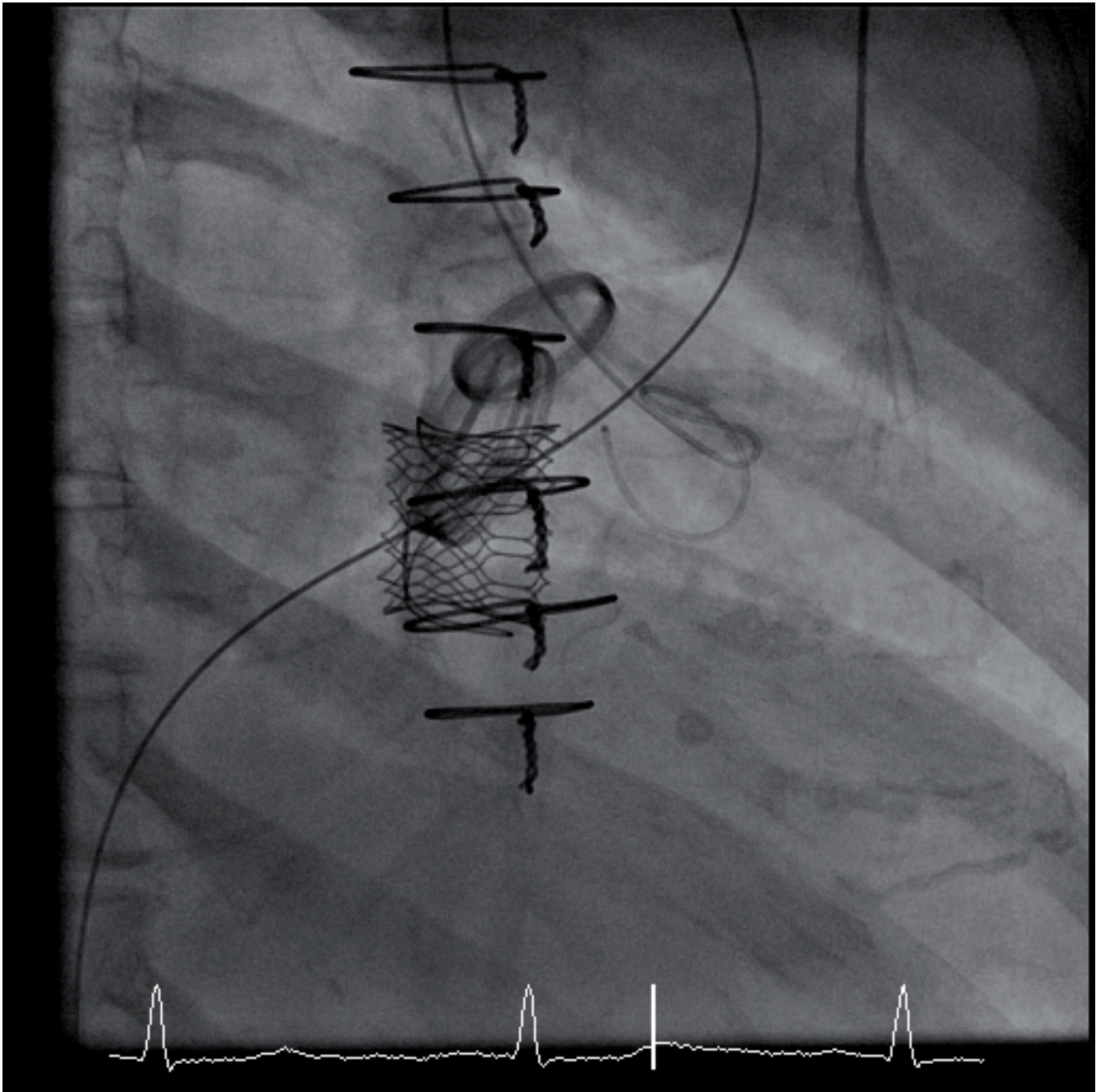


Figure 4. Final result after valve implantation in a correct position.

with the intent to perform transcatheter tricuspid valve-in-ring implantation [8], rapid pacing was implemented in 56% of cases via an existing pacing system ($n = 9$) or a transvenous atrial pacing wire ($n = 2$). In four patients with a transvenous right ventricular pacing lead traversing the tricuspid valve annulus, the lead was entrapped

by the tricuspid valve-in-ring implantation. In one patient, the right ventricular lead was dislodged, although that patient did not require ventricular pacing.

Rapid pacing using the guidewire allows a reliable right ventricular pacing method without the risk of electrode entrapment. Due to the need for isolation of

the wire, pacing can be performed only after delivering the TTVI system over the wire.

In conclusion, rapid pacing during TTVI using the guidewire as a unipolar electrode is feasible, safe, and easy to perform. It may shorten the duration of and save unnecessary steps during the procedure.

Conflict of Interest

The authors have no conflict of interest relevant to this publication.

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