Introduction

There are few case reports of successful percutaneous transcatheter tricuspid balloon valvuloplasty (PTTBV) to manage bioprosthetic tricuspid valve (TV) stenosis. Reviews of previously reported cases have suggested that PTTBV for bioprosthetic TV stenosis is effective and is associated with low morbidity\(^1\). However, the PTTBV technique is not established.

The present report describes the case of a Japanese man with bioprosthetic TV stenosis and two prior tricuspid valve replacements (TVRs) who was successfully treated with PTTBV without complications. In most cases, patients improve immediately after PTTBV; however, the patient in this case experienced a gradual improvement.

II Case Report

A 54-year-old man was admitted because of oliguria, exertional dyspnea, abdominal distension, and bilateral leg edema over the previous 2 months. He had a history of infectious endocarditis (IE) at age 20. TVR using a Star-Edwards Ball Valve was performed at age 25 for tricuspid stenosis (TS). Repeat surgical valve replacement is an extremely high-risk procedure. Percutaneous transcatheter tricuspid balloon valvuloplasty (PTTBV) is an acceptable treatment option for symptomatic severe tricuspid valve stenosis. There have been few reports of successful PTTBV performed after bioprosthetic TVR. Successful treatment with PTTBV for bioprosthetic tricuspid valve stenosis was achieved without complications in this patient. We believe that PTTBV can be performed either as a destination therapy or as a bridge to TVR. Shinshu Med J 67 : 289—292, 2019

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Key words: percutaneous transcatheter tricuspid balloon valvuloplasty, stenosed bioprosthetic tricuspid valve, tricuspid valve replacement

Percutaneous Transcatheter Balloon Valvuloplasty of a Stenosed Bioprosthetic Tricuspid Valve

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Bioprosthetic tricuspid valve stenosis is extremely rare. We report the case of a 54-year-old man with a history of infectious endocarditis (IE) and two previous tricuspid valve replacements (TVRs). The first TVR at age 25 was performed secondary to IE using a Star-Edwards Ball Valve. The repeat-TV using a St. Jude Medical Epic bioprosthesis was performed at age 51 due to severe ball valve stenosis. Repeat surgical valve replacement is an extremely high-risk procedure. Percutaneous transcatheter tricuspid balloon valvuloplasty (PTTBV) is an acceptable treatment option for symptomatic severe tricuspid valve stenosis. There have been few reports of successful PTTBV performed after bioprosthetic TVR. Successful treatment with PTTBV for bioprosthetic tricuspid valve stenosis was achieved without complications in this patient. We believe that PTTBV can be performed either as a destination therapy or as a bridge to TVR. Shinshu Med J 67 : 289—292, 2019

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ent of 17.9 mmHg and an estimated tricuspid valve area of 0.8 cm² (Fig. 1A–C). His left ventricular ejection fraction was preserved. The initial therapy consisted of a diuretic and dopamine, but he became anuric and hypotensive. He had not taken his warfarin for a long time, so we restarted warfarin therapy. Continuous hemodiafiltration and a continuous infusion of dopamine (> 10 mcg/kg/min) were required to maintain his renal function and blood pressure. Repeat surgical valve replacement was discussed, but he was considered to be high-risk for morbidity and mortality. The patient was also not willing to undergo another cardiac operation. We decided to perform PTTBV to reduce the gradient across the bioprosthetic tricuspid valve after obtaining approval from the ethics committee. During the right heart catheterization, the mean diastolic gradient across the tricuspid valve, right atrial pressure, and right ventricular end-diastolic pressure were measured and found to be 4.4, 13, and 11 mmHg, respectively (Fig. 2A, C). The valve was dilated sequentially using a 10×40 mm Mustang™ Balloon Dilatation Catheter (Boston Scientific, Marlborough, MA, USA), followed by a 14×40 mm XXL Balloon Dilatation Catheter (Boston Scientific) under fluoroscopic guidance (Fig. 3A–C). There were no immediate complications. Tricuspid regurgitation was not observed, but the tricuspid gradient did not change immediately. However, after PTTBV, his symptoms gradually improved, body weight decreased from 68kg to 62 kg, the diastolic rumble improved from Levine III / VI to I / VI, lower extremity edema was improved, and catecholamine administration was tapered. Moreover, three days
post PTTBV, he did not need hemodialysis.

Fourteen days later, another right heart catheterization was performed. The mean diastolic gradient across the tricuspid valve (d-PGTV) is 4.4 mmHg. The mean right atrial pressure is 12 mmHg, and the right ventricular end-diastolic pressure is 9 mmHg.

B: After PTTBV day 14, the mean d-PGTV, the mean right atrial pressure and the right ventricular end-diastolic pressure decreased.

C: Comparison of pre- and post-PTTBV RHC data. Post-PTTBV the RHC parameters did not immediately improve; however, on post-PTTBV day 14, the patient's symptoms and RHC data improved.

<table>
<thead>
<tr>
<th></th>
<th>Pre (Pod14)</th>
<th>Post (Pod14)</th>
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<tbody>
<tr>
<td>mean RAP (mmHg)</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>s-RVP (mmHg)</td>
<td>41</td>
<td>13</td>
</tr>
<tr>
<td>RVEDP (mmHg)</td>
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<td>1</td>
</tr>
<tr>
<td>max d-PGTV (mmHg)</td>
<td>7</td>
<td>3.5</td>
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<tr>
<td>mean d-PGTV (mmHg)</td>
<td>4.4</td>
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**Discussion**

PTTBV can be considered in patients with severe, symptomatic, native TS without TR, as a class IIb therapy (Fig. 1C).
guideline indication\(^3\). Few PTTBV cases have been reported\(^1\), but, to the best of our knowledge, gradual improvement after a PTTBV procedure has never been reported. The number of years since the original bioprosthetic tricuspid valve implantation in patients who underwent PTTBV ranged from 0.5 to 40 years (mean, 11.2±10.3 yr, median, 9.0 yr)\(^1\). Our patient developed TS in only 3 years. We hypothesized that the small diastolic gradient across the TV and insufficient warfarin effect may have affected the thrombogenesis of the bioprosthetic valve. Bioprosthetic valve dysfunction results from leaflet calcification, thrombosis, pannus ingrowth or vegetation. Balloon valvuloplasty works by crumbling thrombus, tearing leaflets and perforating cusps, as seen in vitro, in studies performed on stenotic porcine bioprosthetic valves\(^4\).

Almost all cases of PTTBV have been successful, with only one unsuccessful procedure reported\(^1\); however, other cases with unfavorable results may exist, but may not have been published. A variety of interventional techniques were used in previous reports, with balloon sizes ranging from 15 to 30 mm. We used a 14 mm balloon because we had no previous PTTBV experience and were concerned about potential complications. We supposed that the use of a small size balloon led to insufficient thrombus crumbling. Therefore, TS improved gradually after PTTBV. Since RV pressure was decreased, the possibility of the effect of hemodialysis and diuretic cannot be denied (Fig. 2C). While PTTBV may be a reasonable therapeutic option for stenotic bioprosthetic TVs, in some cases the effects have lasted only a few months. It is unclear why our patient's ejection fraction (EF) worsened temporarily after the PTTBV. At present, our patient is asymptomatic; however, he has experienced a gradual worsening of his EF, left ventricular end-diastolic volume and left ventricular end-systolic volume (Fig. 1C). Therefore, we must continue long-term follow-up of this patient.

### IV Conclusion

Bioprosthetic TV stenosis is rare. Successful treatment without complications has been achieved with PTTBV in patients with bioprosthetic TV stenosis. PTTBV could be an alternative to operative valve replacement in high-risk surgical patients.

### V Conflict of Interest

The authors declare no conflict of interest.

### References