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CASE REPORT

INTERMEDIATE

HEART CARE TEAM/MULTIDISCIPLINARY TEAM LIVE

Early Valve Thrombosis Management After Successful Transcatheter Tricuspid Valve-in-Valve Implantation

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ABSTRACT

Transcatheter tricuspid valve-in-valve implantation is a critical option in high risk bioprosthetic tricuspid valve dysfunction. In this case report, balloon-expandable transcatheter heart valve was implanted successfully into the tricuspid valve and early thrombosis was managed successfully. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2023;5:101584) © 2023 Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 65-year-old woman consulted at our clinic with dyspnea (New York Heart Association functional class III) and peripheral edema. Physical examination showed increased jugular venous pressure, bilateral weak respiratory sounds, abdominal ascites, and bilateral lower extremity edema. The electrocardiogram showed a normal sinus rhythm with a heart rate of 62 beats/min. Transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) showed a mean gradient of 8 mm Hg, pressure half time (PHT) of 85 ms, and atrial and ventricular nonobstructive pannus on mitral monoleaflet 29-mm Medtronic prosthetic valve. Evaluation of the bioprosthetic tricuspid valve (TV) showed immobile septal and anterior leaflets, and prominently degenerated valve structure. On TV, peak and mean gradient were calculated as 20 mm Hg and 12 mm Hg respectively, PHT was calculated as 215 ms, and mild to moderate tricuspid regurgitation was detected. The inferior vena cava (IVC) was dilated (41 mm) and collapsed with a rate of <50%. Laboratory examination revealed thrombocytopenia (platelet count 70,000/mm^3), anemia (hemoglobin10,4 g/dL and hematocrit 33%), and INR was 3.36 on the therapeutic interval. Then, the patient was evaluated by the heart team, and a transcatheter tricuspid valve-in-valve (TTVIV)

LEARNING OBJECTIVES

- To evaluate balloon-expandable transcatheter heart valve in degenerated tricuspid bioprosthetic valve in a patient with high comorbidity.
- To discuss the approach to bioprosthetic valve thrombus by summarizing guideline recommendations and current data.
- To manage tricuspid valve thrombus after balloon-expandable transcatheter heart valve implantation.
- To understand the course and manage the treatment in a symptomatic tricuspid valve thrombosis patient with high comorbidity; the treatment can be successful with combined antiaggregant and anticoagulant therapy with high INR value before a decision for aggressive treatment is made.

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ABBREVIATIONS AND ACRONYMS

ACC/AHA = American College of Cardiology/American Heart Association

ASA = acetylsalicylic acid

ESC = European Society of Cardiology

IVC = inferior vena cava

PHT = pressure half time

TEE = transesophageal echocardiography

TTE = transthoracic echocardiography

TTVIV = transcatheter tricuspid valve-in-valve

TV = tricuspid valve

VIV = valve-in-valve

VKA = vitamin K antagonist

implantation was planned because of the high risk of TV surgery. In the catheter laboratory, TTVIV was successfully performed with a balloon-expandable 29-mm transcatheter heart valve (Video 1). After the procedure, the mean gradient was calculated as 8 mm Hg, and PHT was calculated as 80 ms on TV. The patient's clinically stable condition was evaluated by hematology and hepatology specialists after thrombocytopenia was disclosed in laboratory examinations. After evaluation, the hepatologist recommended follow-up of the thrombocytopenia and discontinuation of acetylsalicylic acid (ASA) (owing to the high-risk prosthetic mitral valve, the patient had been taking 100 mg/day of ASA for 22 years as recommended by her cardiologist). Discharged with only vitamin K antagonist (VKA), patient was clinically better, and ascites regressed in the first 2 weeks. In the third week, the patient consulted to our clinic again with abdominal and lower extremity edema. The INR value was 2.74 during hospital admission. TEE showed that after TTVIV, the posterior leaflet was immobile, the anterior leaflet was slightly mobile, and the septal leaflet could not be observed (Video 2). Maximum and mean gradients were calculated as 21 and 13 mm Hg, respectively, and PHT was calculated as 239 ms (**Figure 1**). The diameter of the IVC was 40 mm, and it collapsed at a rate of <50%. TTVIV posterior leaflet motion constraint and thrombus were confirmed also by cardiac computed tomography (**Figure 2**).

MEDICAL HISTORY

The patient had diabetes mellitus, hypertension, and chronic obstructive pulmonary disease. Twenty-two years earlier, a 29-mm mechanic monoleaflet valve had been implanted in the mitral position because of rheumatic severe mitral stenosis, and a No. 33 bioprosthetic valve had been implanted to tricuspid position because of severe tricuspid regurgitation in another clinic.

QUESTION 1: HOW WOULD THE APPROACH BE TO THE DEGENERATED BIOPROSTHESIS TRICUSPID VALVE? WHAT WAS THE RIGHT TREATMENT OPTION FOR THE PATIENT?

Transcatheter valve replacement is a critical alternative in native or postoperative occlusions for the treatment of aorta, mitral, pulmonary, and tricuspid

FIGURE 1 4-Chamber View of 2-Dimensional Transthoracic Echocardiography

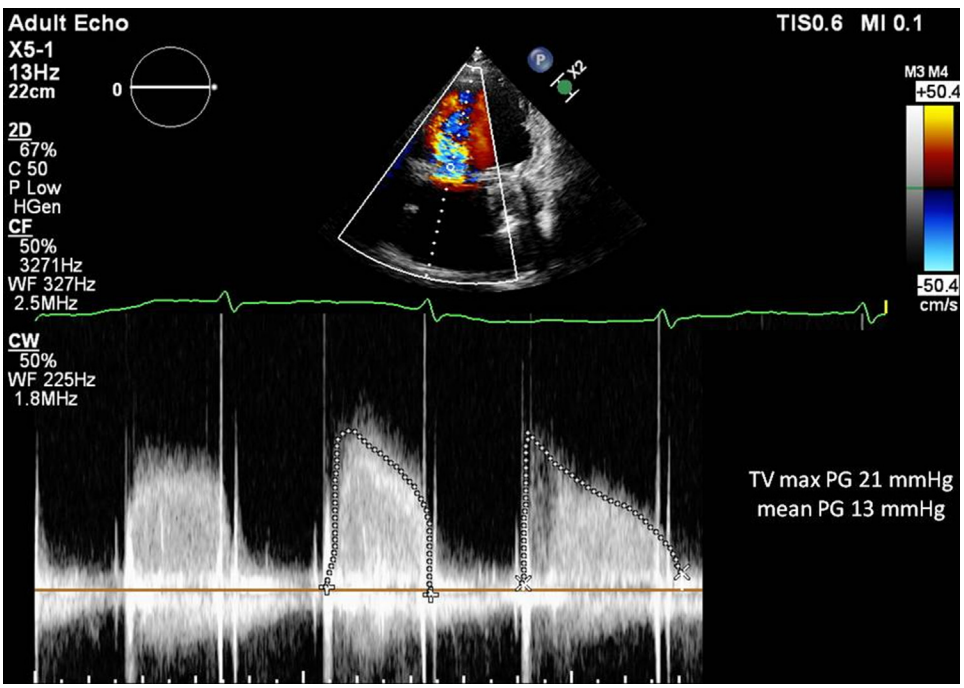

Image shows high-gradient tricuspid valve after transcatheter valve-in-valve implantation.

FIGURE 2 Cardiac Computed Tomography

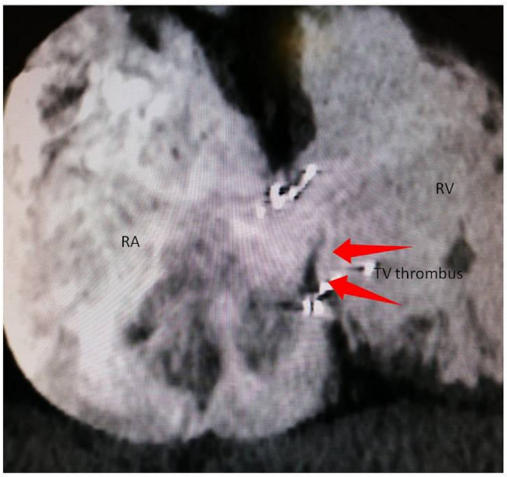

Image shows thrombus **(red arrows)** on tricuspid valve.

valves. According to the current 2021 European Society of Cardiology (ESC) valvular heart disease guidelines, patients who have a high surgical risk or are inoperable are recommended to undergo transcatheter VIV implantation in the aortic position on Class IIa level and transcatheter VIV procedure in the mitral and tricuspid positions on Class IIb level.[1] During our patient's first consultation, the reason for her severe right-sided heart failure was bioprosthetic TV dysfunction. Because of her apparent right-sided heart failure symptoms, the heart team decided that the patient had a high risk in a redo surgery, and TTVIV was a life-saving option for the symptomatic patient.

QUESTION 2: WHAT DO WE KNOW ABOUT THE BIOPROSTHETIC TRICUSPID VALVE THROMBUS?

Thrombotic complications of a bioprosthetic valve include thromboembolic events and valve thrombosis. Observational studies show that the rate of symptomatic or hemodynamically significant bioprosthetic valve thrombosis is 0.3% in the first 30 days after valve implantation, and the long-term rate is <0.05% per year.[2] There are limited data related to the risk of thromboembolism for patients with tricuspid or pulmonary bioprosthetic valves because they may also have prosthetic mitral and/or aortic valves and other comorbidities. A systematical review of 9 studies, which had a follow-up period of ≥20 years, defined 8 thromboembolic events in 470 patients with bioprosthetic TVs and 42 events in 464 patients with mechanical TVs.[3] McElhinney et al.[4] studied data from 306 patients in an international registry who had undergone TTVIV and found that TV-related outcomes (endocarditis, thrombosis, or significant dysfunction) were 8% in a 3-year follow-up period. In that study, hemodynamically significant leaflet thrombus was detected in 3 patients through TEE or intracardiac echocardiography. Thrombus occurred in 3 patients in the short term, in 2 patients within 2 months, and in 3 patients after 6 months. Of those patients, only 2 were taking anticoagulant agents before thrombus was detected.

QUESTION 3: WHAT ARE THE CURRENT GUIDELINE RECOMMENDATIONS ABOUT ANTICOAGULATION IN A BIOPROSTHETIC VALVE?

Severity of symptoms and the reason for obstruction are determinant in the treatment decision of bioprosthetic valve thrombosis.[1,5] In an approaching bioprosthetic valve thrombosis, the thrombus size cannot be quantified because of an imaging artifact, and there is a lack of data related to thrombus size of bioprosthetic valves, so thrombus size is not a determinant for the initial therapy strategy.[6] Although bioprosthetic valve thrombosis is generally solved by effective anticoagulation, the heart team should determine which therapy to follow (fibrinolysis, valve surgery, or transcatheter valve intervention). Our patient was admitted to the hospital because of abdominal ascites and peripheral edema in the third week of after TTVIV, and noninvasive modalities showed TV thrombosis. Although subtherapeutic anticoagulation is the most frequent reason for prosthetic valve thrombosis, our patient's INR was effective during the patient's admission, and therefore management of this condition was critical. We need to emphasize that our patient's INR value was kept around 3.0 because of the accompanying prosthetic mitral valve surgery. Also, the patient had been taking VKA together with ASA for 22 years because she had a monoleaflet prothesis valve and atrial fibrillation. However, during follow-up after TTVIV, secondary thrombocytopenia was detected related to hepatic dysfunction, so the hepatology consultation recommended that the patient to take only VKA after discharge, whereas the 2020 American College of Cardiology/American Heart Association (ACC/AHA) valvular heart disease guideline[5] recommends VKA therapy for 3 to 6 months initially in bioprosthetic valve replacement on the Class IIa level, and the 2021 ESC valvular heart disease guideline[1] recommends

FIGURE 3 4-Chamber View of 2-Dimensional Transthoracic Echocardiography

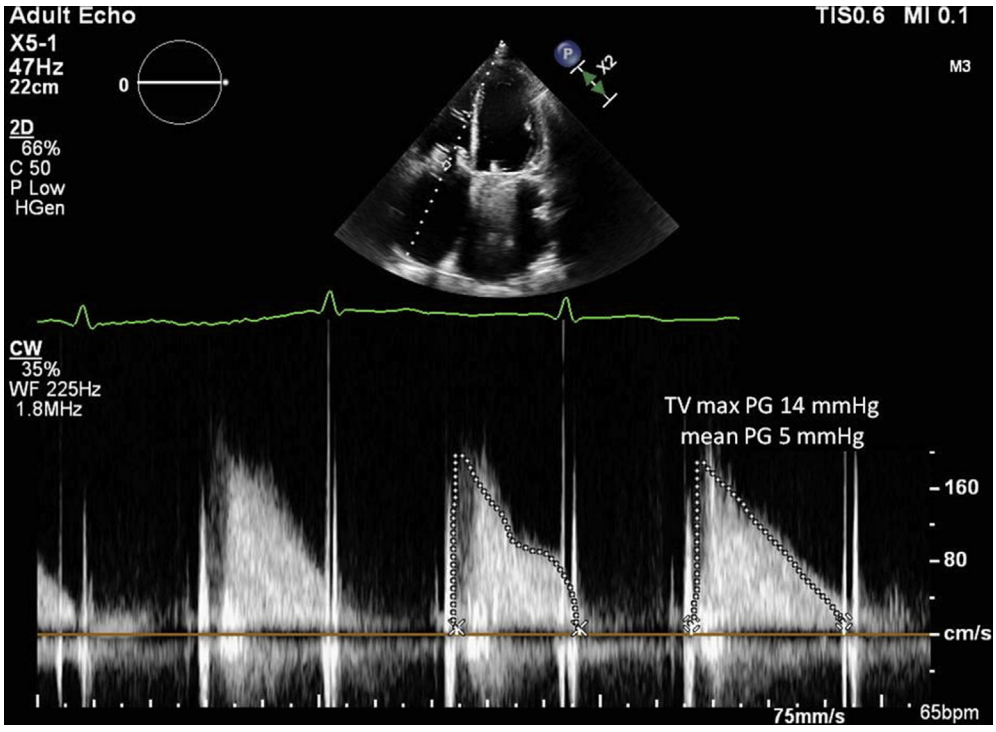

Image shows normal-gradient tricuspid valve after the successful management of bioprosthetic valve thrombosis.

VKA therapy for 3 months for mitral and tricuspid positions on the Class IIa level. Whereas target INR values are determined according to the patient's risk factors and thrombogenicity of the prosthetic valve for mechanical valves, there are recommendations for the short-term use of VKA for bioprosthetic valves; however, to our knowledge there are no data on target INR values.

QUESTION 4: WHAT WOULD BE THE TREATMENT APPROACH IN BIOPROSTHETIC TRICUSPID VALVE THROMBOSIS IN A PATIENT WITH HIGH COMORBIDITIES? HOW WOULD YOU TREAT THE PATIENT?

Our patient experienced early-term TTVIV thrombosis under effective INR. The only difference in treatment was that ASA was discontinued. Although thrombolytic treatment is usually included in prosthetic valve thrombosis, we are unaware of any no randomized studies regarding bioprosthetic valve thrombosis.[6] Recommendations are mostly on a clinical basis. As for current guidelines, the 2020 ACC/AHA valve diseases guideline[5] recommends VKA with Class IIa indication in the presence of bioprosthesis valve thrombosis, And the 2021 ESC guideline[1] recommends anticoagulation with VKA and/or unfractionated heparin on the Class I level. Owing to our patient's high comorbidity level and thrombocytopenia history, which developed after the transcatheter VIV procedure, we planned an initial treatment with a higher INR level (>3.0) and added ASA (100 mg/day) with the approval of gastroenterology. As a second plan, low-dose thrombolytic treatment approach was planned in case of a worsening clinical course of the patient during hospitalization and follow-up, and the patient was informed about the risks. However, the success in the initial treatment has been a valuable clinical experience for us regarding our treatment management.

Eventually, the heart team decided that INR would be kept higher and ASA (100 mg/day) would be added to the treatment regimen. On the tenth day of hospital stay, the mean gradient was calculated as 9 mm Hg on TV by TTE. After a month, the mean gradient was calculated as 5 mm Hg and PHT was calculated as 135 ms on TV; the IVC diameter was 28 mm, and the IVC collapsed at a rate of >50% (**Figure 3,** Video 3). In the

third month of therapy, the patient was asymptomatic during her follow-up visits.

PERSPECTIVES

The current guidelines clearly underline surgical, mechanical, and bioprosthetic valve replacement, but clinical experiences have just come into prominence in the management of complications regarding transcatheter bioprosthetic valve replacement. Today, although transcatheter valve replacement is life-saving in patients with high surgical risk, there are limited data especially on TTVIV. We believe that our case report will contribute to the published studies in terms of 2 topics: 1) A combination of an anticoagulant and antiaggregant should not be avoided after transcatheter bioprosthetic valve implantation in selected patient groups, especially in patients with a predisposition for thromboembolic events. 2) Percutaneous transcatheter interventions have a life-saving role in high-risk patient groups. However, the management of the complications that develop is just as vital. Therefore, combined antiaggregant and anticoagulant therapy with high INR value can also be successful with close clinical follow-up before aggressive treatment is started.

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KEY WORDS percutaneous valve, thrombus, transcatheter valve implantation, tricuspid valve

APPENDIX For supplemental videos, please see the online version of this paper.

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