A case of early thrombosis following a percutaneous tricuspid valve in valve implantation managed by thrombolysis

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Abstract

Bioprosthetic valve thrombosis is a growing recognized entity, especially with the increasing use of the valve in vale procedures and the advent of new detection technologies (e.g., 4D CT and 4D echocardiography). However, the optimal management strategy in the acute context is not established. This paper presents a case of early thrombosis following the percutaneous tricuspid valve in vale procedure that was successfully managed with thrombolysis.

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Abstract:

Bioprosthetic valve thrombosis is a growing recognized entity, especially with the increasing use of the valve in vale procedures and the advent of new detection technologies (e.g., 4D CT and 4D echocardiography). However, the optimal management strategy in the acute context is not established. This paper presents a case of early thrombosis following the percutaneous tricuspid valve in vale procedure that was successfully managed with thrombolysis.

Keywords: bioprosthetic valve thrombosis, percutaneous valve in valve procedure, fibrinolysis, transesophageal echocardiography

Introduction:

Bioprosthetic Valves are generally considered to be less thrombogenic than mechanical valves. With an increased attitude for transcatheter heart valve implantation, which precludes high-risk cardiac reoperations, and evolving use of 4D echocardiography and computed tomography, the prevalence and recognition of bioprosthetic valve thrombosis(BPVT) are increasing. Prevention and optimal management of this condition, particularly in an acute setting, has not been fully elucidated. Herein we present a case of early thrombosis following transcatheter tricuspid valve in valve implantation that was favorably managed by thrombolysis.

Case presentation:

A 45-year-old woman presented to our clinic with Severe TR and degenerative Bioprosthetic TV leaflets following surgical VSD closure and Mechanical TVR 22 years before, Redo TVR with mechanical valve 17 years later, and 3do Bioprosthetic TVR after ten months due to TV malfunction. The patient underwent successful TV valve in valve implantation (Edward Sapien 3, size 29, MG: 3 mmHg) under TEE guidance with optimal results (Mg: 2mmHg, PHT:125 msec) and no complications. She was discharged on a dual antiplatelet regimen consisting of ASA and clopidogrel. She presented to the emergency department three weeks following the procedure with new onset of dyspnea and palpitation. TTE and TEE were performed and revealed: Normal LV size with mild systolic dysfunction, EF:45%, Moderate RV enlargement with severe systolic dysfunction, diffuse thickening of all three leaflets (thickness=7 mm) with reduced motion, significantly increased transvalvular gradients and PHT (MG: 13 mmHg, PHT:300 msec) with no transvalvular or paravalvular leakage (Figure 1).

Intensive anticoagulation with unfractionated heparin was initiated, and the Mean gradient dropped to 8 mmHg after two days of achieving therapeutic PTT. Nonetheless, the patient remained symptomatic, and no further improvements were made in the following days. After consultation with the heart team (Cardiac surgeon, peripheral interventionist, and echocardiologist), the decision to administer fibrinolysis was taken. 25 mg alteplase mg was infused over 25 hours using the ultra-slow regimen. Following that, unfractionated heparin was administered with the bolus of 70 units/kg and 16 units/kg/hr for 6 hours. The next day, TTE and TEE revealed a considerable decrease in transvalvular gradient and PHT (MG: 4 mmHg, PHT:200 msec), as well as relief of leaflet thickening and improved mobility (Figure 2 and 3). No complications occurred, and the patient was discharged on warfarin.

Discussion:

Bioprosthetic valve thrombosis (BPVT) has been described previously as a rare entity in the literature. Nevertheless, with developing 4D imaging technologies, detection of subclinical thrombosis, which was previously considered degenerative, is increasing. Clinically relevant thrombosis is believed to be less prevalent. BPVT appears to be more common in Transcatheter heart valves (THV) than in surgically implanted heart valves[1,] possibly as a result of leaflets manipulation and crimping of pericardial leaflet tissues during transcatheter procedures, which may predispose the valve to a superimposed clot[2]. In a large registry of 306 patients who underwent tricuspid valve in valve procedure, eight patients had clinical thrombosis detected by TEE. At three years, the cumulative incidence of thrombosis was reported to be 0.03 percent. Three of these events in this study occurred several days following the procedure, and two of these three patients were discharged without anticoagulation.[3] In another multicenter registry for transcatheter mitral heart valves, clinical thrombosis was detected in ten out of four hundred and eleven patients. The cumulative incidence of thrombosis was considerably higher in those who did not receive anticoagulation following the procedure (6.6 percent VS 1.6 percent).[4] Despite the lack of consensus, these studies outline the potential benefit of anticoagulation over DAPT for THV, especially in high-risk patients with a history of clot formation and the tricuspid valve position, which is assumed to be more thrombogenic than left-sided valve position. In 26 case series with THV thrombosis, the most common echocardiographic features consistent with the diagnosis of BPVT were increased transvalvular gradients and leaflet thickness (77 percent). In contrast, thrombotic

mass was found in only 23% of cases.[5] Egbe et al. have proposed a practical predictive model for surgical BPVT with high sensitivity and specificity. This model incorporated five variables, each has a single score: 1. 50% increase in transvalvular gradient, 2. increased cusp thickness>2 mm, 3. abnormal cusp mobility, 4. paroxysmal AF, 5. subtherapeutic INR.[6,7] Respecting similar echo findings in both surgical and transcatheter bioprosthetic valves, this model could be implemented for THVs. Applying this model to our patient yielded a score of four with 94% specificity for BPVT.

Anticoagulation is the first step in managing thrombotic bioprosthetic valves in patients who do not have contraindications, according to the 2020 ACC/AHA guideline for managing valvular heart disease[1]. Most documented cases demonstrated a great response to this treatment with significant improvement in leaflet mobility, thickness, and gradients[8-10]. There is no consensus to decide on thrombolysis or perform high-risk surgery for those with ongoing symptoms and/or hemodynamic deterioration, such as this case. Thrombolysis is a promising treatment for Mechanical tricuspid valve thrombosis. In a therapeutic outcome study for tricuspid mechanical valve thrombosis, 41 patients received fibrinolytic therapy without intracranial or gastrointestinal bleeding and two episodes of retroperitoneal bleeding. The success rate was 84%[11]. The other study compared five thrombolytic regimens for treatment of prosthetic valve thrombosis, including 10 cases of the mechanical tricuspid valve, reported an 85% overall success rate for ultra-slow infusion of alteplase and the lowest complication rate compared to the other regimens. No complication was reported in patients with the tricuspid position of heart valve[12]. There are no published articles describing the use of fibrinolysis in bioprosthetic valves, and we found only one case report of thrombolytic therapy for transcatheter heart valve thrombosis. Akhras et al. demonstrated a case of transcatheter mitral valve thrombosis early after the procedure and significant improvement of gradients and sPAP eight hours after alteplase infusion at a rate of 10mg/hr[13]. Given the high likelihood of success for thrombolysis in tricuspid prosthetic valve thrombosis, the heart team preferred trying fibrinolysis to high-risk 4do surgery. Ultra-slow infusion of alteplase 1 mg/hr for 25 hr was chosen since it has been described in the literature as an efficient regimen with a low complication rate [12,14]. Although the safety and efficacy of thrombolysis and the best regimen in these situations warrant further investigations, this treatment was shown to be safe and effective without any complication and could be considered in similar cases.

Conclusion:

In the acute and symptomatic cases of bioprosthetic valve thrombosis without response to anticoagulation, fibrinolysis using an ultra-slow regimen is an effective treatment without any reported complication.

Conflict of interests: The authors declare that they have no conflict of interest.

Data Availability Statement : Data sharing was not applicable to this article as no datasets were generated or analyzed

Human rights statement and informed consent: All procedures were according to the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1964 and its modifications. The patient signed written informed consent and gave permission for being included in this study.

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Figure legends:

Figure 1 TTE and TEE at presentation; A. Thickened bioprosthetic valve leaflets (yellow arrows) in two perpendicular views by x-plane mode. B. Considerably Increased transvalvular bioprosthetic tricuspid valve gradients (mean gradient: 11 mmHg). C. Significantly increased bioprosthetic tricuspid Valve pressure half time (618 msec). Abbreviations: RA= right atrium, RV= right ventricle

Figure 2 TTE and TEE after thrombolysis A. Thinning of tricuspid bioprosthetic leaflets (yellow arrows) B. decreased transvalvular bioprosthetic tricuspid valve gradients (Mean gradient: 5 mmHg). Abbreviations: RA= right atrium, RV= right ventricle

Figure 3 Three-dimensional reconstruction of bioprosthetic TV valve from the right atrial side views A. Thickening and decreased maximum opening of tricuspid bioprosthetic valve leaflets at presentation (Thick white arrows point to three tricuspid valve leaflets) B. improvement of bioprosthetic tricuspid valve opening and relief of thickening after thrombolysis (Thin white arrows point to three tricuspid valve leaflets).

Supporting information: additional supporting information may be found online in the supporting information section.

Movie S1. Transesophageal echocardiography at presentation in two perpendicular planes. note the considerable thickening and limited motion of bioprosthetic tricuspid valve leaflets.

Movie S2. Transesophageal echocardiography following thrombolysis. Note the thinning of leaflets and

improvement of motion.

Movie S3. Three-dimensional reconstruction of bioprosthetic TV valve from the right atrial side views at presentation, thickening of all leaflets with a decreased opening orifice.

Movie S4. Three-dimensional reconstruction of bioprosthetic TV valve from the right atrial side views following thrombolysis, thinning of leaflets with an improved opening orifice.