

Breaking the Rules to Save a Life: Slow-infusion Thrombolysis in Mechanical Valve Thrombosis After Stroke: A Case Report and Review of the Literature

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ABSTRACT

Introduction: Prosthetic valve thrombosis (PVT) is a potentially life-threatening complication of mechanical heart valves, particularly when affecting left-sided valves. Management requires rapid and precise assessment, balancing the risks and benefits of thrombolysis versus surgical intervention, especially in high-risk patients.

Case Presentation: We report the case of a 64-year-old Iranian female with a history of mechanical aortic and mitral valve replacement (2019), chronic atrial fibrillation, and a recent cerebrovascular accident (October 2024), who presented with rapidly worsening dyspnea and pulmonary edema. Initial workup revealed atrial fibrillation with rapid ventricular response and signs of cardiogenic shock. Imaging confirmed mechanical aortic valve thrombosis with subtherapeutic international normalized ratio (INR) levels. Echocardiography demonstrated a severely reduced ejection fraction (20–25%), left ventricular enlargement, and hemodynamic evidence of prosthetic valve obstruction. Given her New York Heart Association (NYHA) Class IV status and significant surgical risk due to low Ejection Fraction (EF) and recent stroke, slow-infusion fibrinolytic therapy with alteplase was initiated as an alternative to surgery. The patient showed remarkable clinical and echocardiographic improvement, with resolution of pulmonary edema and restoration of normal valve leaflet motion. She was stabilized on anticoagulation therapy and discharged in good condition.

Conclusion: This case highlights the challenges in managing obstructive mechanical valve thrombosis in patients with high surgical risk and recent cerebrovascular events. Slow-infusion thrombolytic therapy may be a viable and effective alternative in carefully selected patients.

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Introduction

Mechanical valve (MV) dysfunction can arise from four primary phenomena: thrombosis, pannus ingrowth, degeneration, and endocarditis. These issues may occur concurrently, making it essential to identify the predominant cause of MV dysfunction for effective management (1-3).

Prosthetic valve thrombosis (PVT) is one of the most severe complications associated with mechanical heart valve replacement. This life-threatening condition is characterized by the formation of a thrombus on or near the valve prosthesis, leading to malfunction or obstruction. The incidence of PVT is estimated to range from 0.03% to 0.13% per patient-year for left-sided valves (mitral and aortic), while it can be as high as 20 per 100 patient-years for prosthetic tricuspid valves. European guidelines tend to favor urgent or emergency valve replacement in such cases (4,5).

Effective anticoagulation is crucial for managing PVT, as it is linked to fewer complications and favorable outcomes in patients with small, nonobstructive thrombi (less than 5 mm). In contrast, larger thrombi (greater than 5 mm) pose a greater risk of embolization (6). The European Society of Cardiology recommends optimizing anticoagulation therapy alongside regular imaging to monitor thrombus resolution (7). Unfractionated heparin or low-molecular-weight heparin (LMWH) can be administered for anticoagulation until the international normalized ratio (INR) reaches the therapeutic range. In cases involving larger thrombi (over 10 mm) and evidence of systemic embolization, surgical intervention is advised (7).

When dealing with obstructive mechanical valve thrombosis, the management strategy should be tailored to the specific clinical scenario. Therapeutic options include optimizing anticoagulation, thrombolysis, transcatheter manipulation, and surgery. The European Society of Cardiology guidelines currently provide a Class I recommendation for surgical treatment of obstructive MVT in critically ill patients without significant comorbidities. Thrombolysis may be considered for right-sided mechanical valves or when surgical options are deemed excessively risky or unavailable.

In comparison, the ACC/AHA guidelines also offer a Class I recommendation for either low-dose, slow thrombolytic therapy or surgical intervention based on clinical factors, including the experience of the clinical and surgical teams. However, there are currently no established guidelines regarding the timing or methodology for employing transcatheter techniques (7,8).

Case Presentation

A 64-year-old Iranian female patient with a history of MVR/AVR surgery in 2019, atrial fibrillation (AF), and a recent cerebrovascular accident (CVA) in October 2024 presented to the emergency department in February 2023. She reported that her dyspnea had started approximately one week prior, initially classified as New York Heart Association (NYHA) class 2 and 3. However, her condition progressively worsened, leading to severe dyspnea (NYHA class 4) and orthopnea by the time of her emergency visit. Initially, the patient was admitted with a diagnosis of AF with rapid ventricular response (RVR) and received initial treatment. The patient's general condition was severely poor, with an AF rate of approximately 130-140 beats per minute. She exhibited clear pulmonary edema, with audible rales up to the apex of the lungs, as well as severe orthopnea and prominent jugular venous distention (JVD), indicative of frank pulmonary edema. The electrocardiogram obtained during admission showed AF at 130-140 beats per minute (Figure 1). Due to her history of AVR and MVR and subtherapeutic INR levels, she underwent fluoroscopy and echocardiography. The fluoroscopic images showed mechanical aortic valve obstruction (Figure 2).

Echocardiographic findings revealed the following:

- Ejection Fraction (EF): 20-25%
- Left Ventricular (LV) enlargement with severe systolic dysfunction
- Left Atrial (LA) enlargement and Right Atrial (RA) enlargement.
- Prosthetic Aortic Valve with haziness, increased gradient, and abnormal hemodynamic data (PPG=46 msec, PV=3.4 cm/s, DVI=0.19, AT=90 msec, ET=254 msec, AT/ET=0.35).
- Prosthetic mechanical mitral valve

with normal disc motion and normal hemodynamic data (MPG=4 mmHg, DVI=2.0).

- Normal pulmonary valve with trace pulmonary insufficiency (PI) without pulmonary stenosis (PS).

- Mild tricuspid regurgitation (TR) without tricuspid stenosis (TS), TR gradient=25 mmHg, normal pulmonary artery systolic pressure (PASP)=30 mmHg.

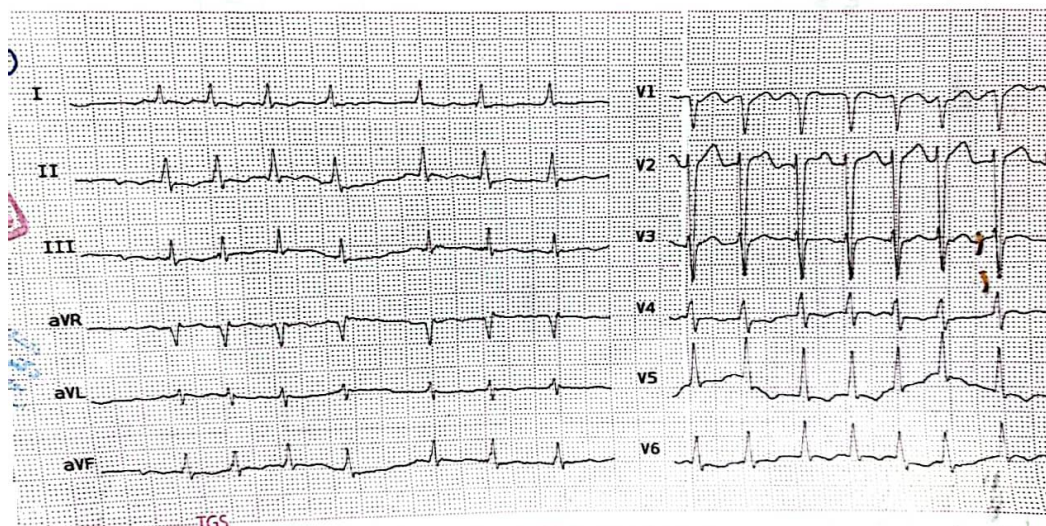


Figure 1: Patient's electrocardiogram shows significant AF RVR with an AF rate of approximately 130-140 beats per minute.

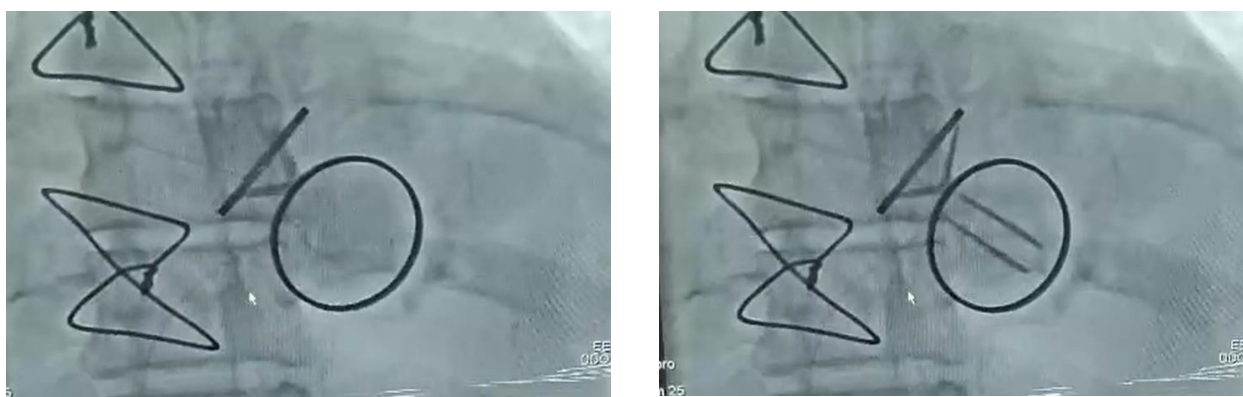


Figure 2: In the above fluoroscopic images, it is clearly evident that one of the aortic valve discs is completely immobile.

Treatment

The patient was in cardiogenic shock with low blood pressure and exhibited clear pulmonary edema and rales in the lungs. Additionally, she experienced severe orthopnea and prominent JVD. Given these considerations, intravenous digoxin was administered as a single dose, followed by treatment with amiodarone according to protocol. The patient's heart rhythm was subsequently controlled.

Furthermore, given her NYHA Class IV status and evident pulmonary edema in the setting of mechanical Aortic valve obstruction, surgical intervention was

preferred according to existing protocols and guidelines. However, considering that her EF was around 20-25%, she was at high risk for surgery. Furthermore, administering fibrinolytics posed challenges; one of the most significant being that it had been four months since her last CVA, which constituted a relative contraindication for fibrinolytic therapy. Nevertheless, it was decided to proceed with fibrinolytic therapy (alteplase) instead of surgery.

Outcome and Follow-up

Using a slow infusion method for alteplase, the patient responded remarkably well to the treatment (Figure 3). Prior to alteplase

infusion, routine treatments for pulmonary edema such as diuretics (furosemide) were administered. However, significant improvement was observed following fibrinolytic administration. After alteplase infusion and subsequent evaluation, the motion of the valve leaflets was completely normal, the patient was relieved from pulmonary edema, and her general condition significantly improved. The patient's AF rate decreased to 70-80 beats per minute, resolving the RVR. She remained free from tachycardia until discharge, and both orthopnea and rales subsided.

The patient was treated with heparin infusion and subsequently discharged on oral warfarin therapy with INR levels within the therapeutic range.

Discussion

Obstruction of prosthetic heart valves remains a rare but serious complication, most often due to thrombus formation, pannus overgrowth, or both (1). Clinical manifestations vary from mild dyspnea to severe respiratory failure. Given the potential for sudden decompensation, rapid diagnosis and intervention are critical. While both fibrinolytic therapy and surgery are viable treatment options, there are no randomized trials directly comparing the two, leading to reliance on case series and observational studies to guide management (2).

We present a challenging case of a 64-year-old woman with a history of mechanical aortic valve replacement, atrial fibrillation, and recent CVA, who presented with acute decompensated heart failure due to prosthetic aortic valve thrombosis. Her management was particularly complex given a severely reduced ejection fraction (20–25%), subtherapeutic INR, and a CVA within the preceding four months. Surgical intervention posed a high perioperative risk, while thrombolysis was relatively contraindicated due to the recent CVA. Despite these challenges, fibrinolysis with low-dose slow infusion of alteplase was selected. This decision was driven by her severe symptoms (NYHA class IV dyspnea, pulmonary edema, rapid AF with HR 130–140 bpm), critical hemodynamic instability, and inoperability. The favorable response, including resolution of pulmonary edema,

improved valve function, and stable rhythm, supports the cautious use of fibrinolytics in highly selected patients, even in the presence of relative contraindications (3,4,9).

Literature supports this nuanced approach. A case reported in JACC Case Reports (2020) described successful thrombolysis in a patient with contraindications but noted the occurrence of an embolic coronary event during treatment (10). Similarly, a SAGE Open Medical Case Reports study (2021) reported successful fibrinolytic use in a hemodynamically unstable patient, reinforcing the importance of individualized, rapid decision-making in managing PVT (5). Our case emphasizes the importance of evaluating each patient's risk-benefit profile.

Given her noncompliance with anticoagulation, poor cardiac function, and surgical ineligibility, thrombolytic therapy emerged as a justifiable and ultimately effective intervention. It also illustrates the potential of alternative alteplase regimens (slow infusion with concurrent heparin) in reducing bleeding risk while achieving therapeutic goals. Although fibrinolysis is generally reserved for lower-risk patients or those with embolic complications, this case highlights its feasibility in complex, high-risk settings. Few reports exist where fibrinolysis was successfully used in patients with recent CVA and severe LV dysfunction. Our experience contributes to the evolving understanding that, under close monitoring, fibrinolytic therapy can serve as a life-saving measure even in patients who would traditionally be considered unsuitable.

In conclusion, this case advocates for flexibility in clinical decision-making. It demonstrates that while guidelines provide a framework, individualized assessment is crucial, and fibrinolysis can be a viable alternative when surgical options are limited and time-sensitive intervention is necessary.

Conclusion

This case supports the selective use of fibrinolytic therapy in mechanical prosthetic valve thrombosis, especially when surgery or anticoagulation is contraindicated. It underscores the importance of individualized treatment and careful risk assessment. Further evidence is needed to better define indications in high-risk patients, such as

those with recent CVA or reduced left ventricular function.

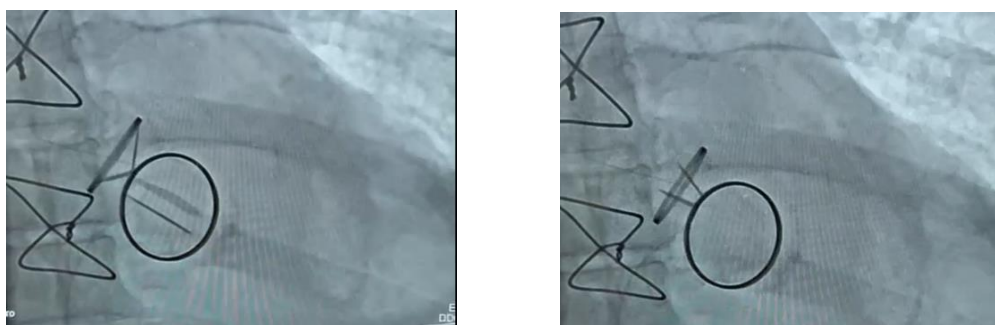


Figure 3: In the above fluoroscopic images, it is clearly observed that the previously immobilized and fixed disc has returned to its normal position.

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Ethics Approval and Consent to Participate

Written informed consent was obtained from the patient for participation in this case report. The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval for this case report was waived by the institutional review board of the Ethics Committee of Mashhad University of Medical Sciences, as it describes a single clinical case and does not involve experimental interventions or collection of identifiable data beyond standard clinical practice.

Consent for Publication

Written informed consent was obtained from the patient for the publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of Data and Materials

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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