

# Mechanical Wenckebach Phenomenon in Thrombosed Tricuspid Valve Prosthesis



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## INTRODUCTION

Prosthetic valve thrombosis is a rare but serious clinical entity that is associated with significant morbidity and mortality. However, a diagnostic approach can be rather challenging, depending on clinical presentation and degree of valve dysfunction. In this case report we present a patient with periodic obstruction of the tricuspid valve, analogous to the electrical Wenckebach phenomenon. A short discussion of existing data regarding treatment and diagnostic options is provided.

## CASE PRESENTATION

A 78-year-old Caucasian woman presented with fatigue and bilateral ankle edema, progressively deteriorating over a 1-month period. Her medical history was notable for valve replacement surgery with a triad of bileaflet mechanical prosthetic implants in the mitral, aortic, and tricuspid valve positions, along with permanent pacemaker insertion. Her treatment regimen consisted of a vitamin K antagonist. However, coagulation panel results reported a suboptimal international normalized ratio of 1.9.

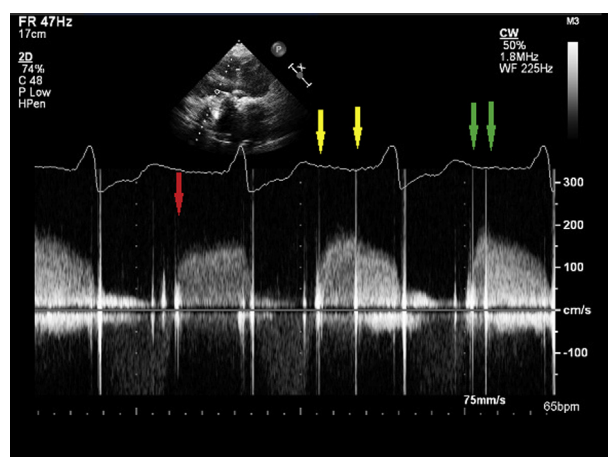
In the context of the patient's clinical presentation and suboptimal anticoagulation treatment, transthoracic echocardiography was undertaken to evaluate prosthetic valve function. Two-dimensional imaging revealed a progressively limiting excursion throughout consecutive cardiac cycles of the median tricuspid prosthesis disk, while the lateral disk was immobile, resulting in periodic partial obstruction of the valve. Color Doppler depicted a prominent aliasing diastolic transvalvular tricuspid flow, alternating with progressively weaker signals on consecutive cardiac cycles, as the valve was intermittently blocked (Video 1A). Accordingly, spectral Doppler demonstrated a progressive decrement in duration between opening and closing clicks, throughout consecutive cardiac cycles. Moreover, progressive alterations in peak velocities and transvalvular gradients analogous to the degree of opening of the partially mobile median disk were noted (maximal mean gradient, 10–12 mm Hg), thus mimicking a mechanical analogue to the Wenckebach electrical phenomenon. More restricted opening is accompanied by a less steep deceleration curve, while less restricted opening leads to pressure half-time

prolongation along with smoother flow patterns. Thus, in cycles with almost no disk opening, a blunt accelerative flow pattern is recorded (Figure 1). Respectively, M-mode imaging shows sequentially different morphology of the prosthetic valve's opening box (Figure 2). Moving forward, we proceeded with transesophageal echocardiography, which clearly demonstrated mechanical tricuspid valve dysfunction along with valve thrombus (Video 1B).

Similarly, on cine fluoroscopy, a characteristic periodic motion reduction of the partially opening disk was recorded (Video 2). On the basis of clinical presentation and laboratory and imaging findings, thrombosis of the tricuspid valve prosthesis was diagnosed, and thrombolysis was instituted.<sup>1</sup> We opted for a slow 5-hour infusion of tissue plasminogen activator, which has been demonstrated to have low complication rates.<sup>2</sup> After thrombolysis, the mobility of the partially dysfunctional disk was restored (mean gradient with continuous-wave Doppler estimated at 4 mm Hg) and the "mechanical" Wenckebach phenomenon was resolved (Figures 3 and 4, Video 3). This was also confirmed by cine fluoroscopy (Video 4). On discharge, anticoagulation therapy with a target international normalized ratio of 3.0–4.0 plus aspirin 75 mg/d was prescribed.<sup>1</sup>

## DISCUSSION

Tricuspid mechanical valve has a relatively higher nidus for thrombosis compared with other valve implants and may occur despite



**Figure 1** Spectral Doppler recording of the tricuspid valve flow. On the third beat (green arrows), opening clicks of the metallic prosthesis are close to each other, and the deceleration curve appears steep. When the click of the partially mobile disk occurs later in diastole (yellow arrows), the deceleration curve is smoother, with prolonged pressure half-time. Finally, when no opening of the click is observed (red arrow), a blunt accelerative pattern of transvalvular flow occurs.

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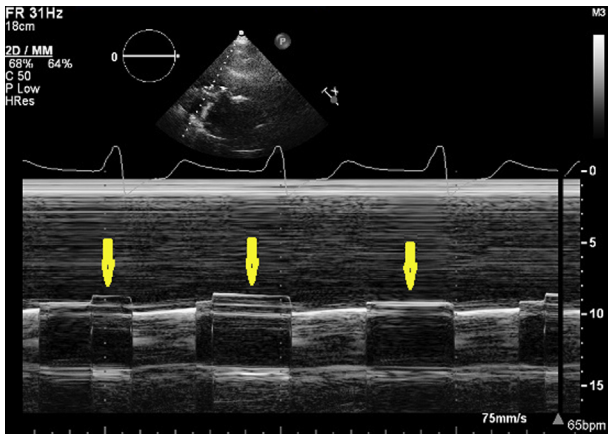
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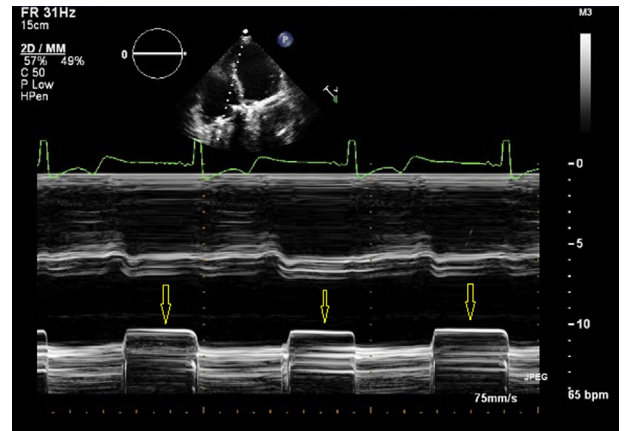
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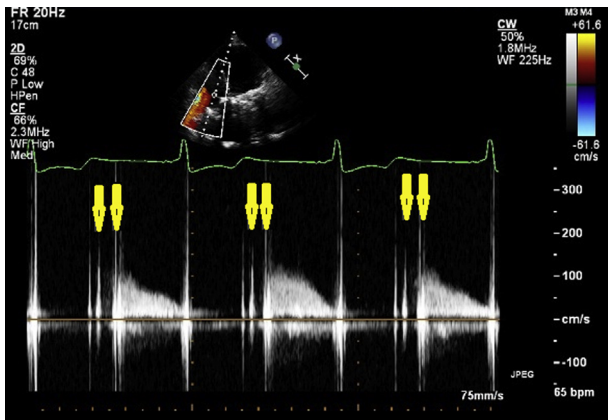
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**Figure 2** M-mode recordings showing different morphology of the opening box in the tricuspid valve as the range of motion of the partially mobile disk changes intermittently from one cardiac cycle to another (yellow arrows).



**Figure 4** M-mode imaging showing opening box of the tricuspid prosthetic valve after successful thrombolysis. Note the constantly wide range of motion of the formally partially dysfunctional disk (yellow arrows).



**Figure 3** After thrombolysis, timing of the opening clicks (yellow arrows) of the metallic prosthesis remains constant throughout the cardiac cycles.

an international normalized ratio  $> 3.0$ .<sup>3</sup> However, symptoms may develop insidiously, making diagnosis truly challenging, especially in cases with intermittent valve dysfunction.<sup>4</sup> Clinical suspicion, bedside echocardiography, and cine fluoroscopy are the cornerstone elements for establishing the proper diagnosis. Of note, most echocardiography laboratories acquire images using one or two frames. In this case, prolonged acquisition time improved the diagnostic yield of the echocardiography study, as the tricuspid valve was intermittently dysfunctional. Specific thrombolytic protocols may offer therapeutic options with a low complication rate.

## CONCLUSION

The mortality associated with prosthetic valve thrombosis is quite significant. Therefore, suspicion of prosthetic valve thrombosis is a clinical emergency, which needs to be immediately confirmed. Clinical findings, echocardiography, and fluoroscopy are the mainstays of diagnosis. Treatment options are dependent on prosthetic valve position and patient hemodynamic status.

## SUPPLEMENTARY DATA

Supplementary data related to this article can be found at <http://dx.doi.org/10.1016/j.case.2017.03.006>.

## REFERENCES

1. Nishimura R, Otto C, Bonow R, Carabello BA, Erwin JP, Guyton RA, et al. 2014 AHA/ACC guideline for the management of patients with valvular heart disease. *Am J Cardiol* 2014;63:57-185.
2. Ozkan M, Kaymaz C, Kirma C, Sonmez K, Ozdemir N, Balkanay M, et al. Intravenous thrombolytic treatment of mechanical prosthetic valve thrombosis: a study using serial transesophageal echocardiography. *Am J Cardiol* 2000;35:1881-9.
3. Kao CL, Lu MS, Chang JP, Yang TY, Cheng HW. Thrombotic obstruction of a mechanical prosthetic valve in tricuspid position. *Images Cardiovasc Med* 2009;36:261-3.
4. Zoghbi WA, Chambers JB, Dumesnil JG, Foster E, Gottdiener JS, Grayburn PA, et al. Recommendation for evaluation of prosthetic valves with echocardiography and Doppler ultrasound. *J Am Soc Echocardiogr* 2009;22:975-1015.