

## A serial fluoroscopy-guided thrombolytic therapy of a mechanical tricuspid prosthetic valve thrombosis with low-dose and ultra-slow infusion of tissue-type plasminogen activator

### Mekanik triküspit protez kapak trombozunun seri floroskopi klavuzluğunda düşük doz doku plazminojen aktivatörünün çok yavaş infüzyonu ile tedavisi

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**Summary**– Prosthetic valve thrombosis is a life-threatening complication that is seen most commonly in patients with left-sided prosthetic valves. However, mechanical tricuspid valves carry the highest risk of thrombosis of any cardiac valve. Thrombolysis has been performed successfully in right-sided prosthetic valve thrombosis and has been recommended as the first-line treatment in these patients. Although two-dimensional and real-time three-dimensional transesophageal echocardiography are the gold standard imaging modalities for the diagnosis of prosthetic valve thrombosis, right-sided prosthetic valves may not be evaluated precisely. This is a serious problem during the follow-up of patients who receive thrombolytic therapy for tricuspid valve thrombosis. Fluoroscopy is an alternative noninvasive imaging method that provides valuable information about leaflet motion and may be used for such cases with restricted leaflets. Herein, we report a case of tricuspid valve thrombosis who was managed with low-dose (25 mg) and ultra-slow (25 hours) infusion of tissue-type plasminogen activator under the guidance of serial fluoroscopy.

**M**echanical tricuspid valve thrombosis is an important complication of right-sided valve surgery. Mechanical prosthetic valve in the tricuspid position is associated with a high incidence of valve thrombosis in patients with poor anticoagulation, as the low velocity of blood across the valve makes it prone to thrombosis. Thrombolytic therapy (TT) and intensified anticoagulation are the first choice of treatments in right-sided prosthetic valve thrombosis due to higher rates of mortality associated with surgery.

**Özet**– Protez kapak trombozu daha çok sol taraf protez kapağı olan hastalarda gözlenen hayatı tehdit edici bir komplikasyondur. Halbuki mekanik triküspit kapaklar diğer kapaklara göre daha yüksek tromboz riski taşımaktadır. Trombolitik tedavi sağ taraf protez kapak trombozlarının tedavisinde başarılı olarak uygulanmakta ve bu hastalar için ilk tercih tedavi yöntemi olarak önerilmektedir. İki boyutlu ve gerçek zamanlı üç boyutlu transözofajiyal ekokardiyografi protez kapak trombozu tanısında altın standart olmasına rağmen, sağ taraf protez kapakları yeterli derecede görüntülenemeyebilir. Bu durum triküspit kapak trombozu nedeniyle trombolitik tedavi uygulanan hastaların takibinde ciddi bir sorun oluşturur. Floroskopi kapak hareketleri hakkında değerli bilgiler sunan alternatif bir non-invaziv görüntüleme yöntemidir ve kapak kısıtlılığı bulunan bu tür hastalarda kullanılabilir. Bu yazıda, seri floroskopi klavuzluğunda düşük doz (25 mg) doku plazminojen aktivatörünün çok yavaş (25 saat) infüzyonu ile tedavi edilen triküspit kapak trombozlu olgu sunuldu.

A low-dose (25 mg) and slow (6 hours) infusion of tissue-type plasminogen activator (tPA) can be performed successfully as an alternative treatment regimen for prosthetic heart valve thrombosis.<sup>[1,2]</sup> Two-dimensional (2D) and real-time three-dimensional (RT-3D) transesophageal echocardiography (TEE) are the gold standard imag-

#### Abbreviations:

2D	Two-dimensional
RT-3D	Real-time three-dimensional
TEE	Transesophageal echocardiography
tPA	Tissue type plasminogen activator
TT	Thrombolytic therapy
TTE	Transthoracic echocardiography

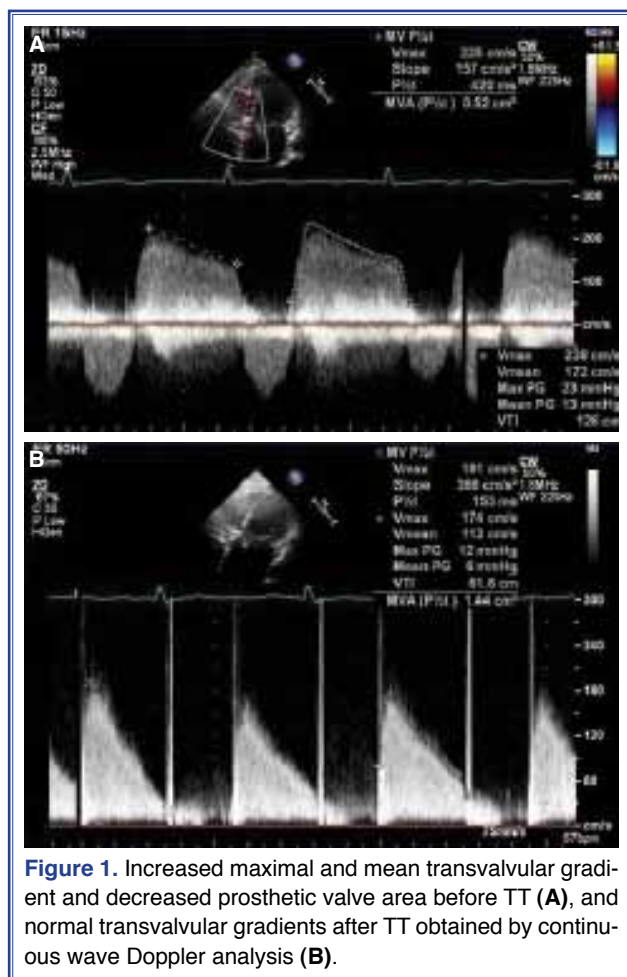
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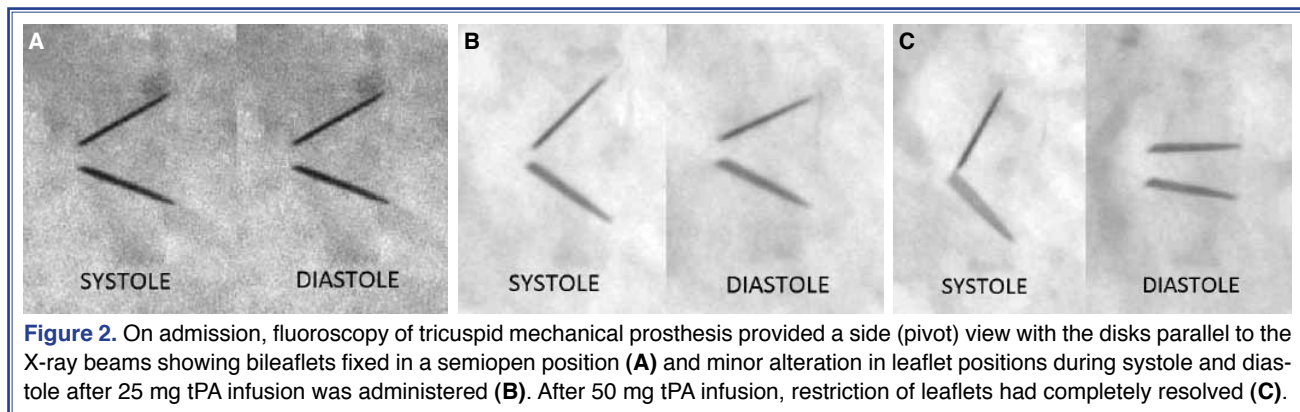
ing modalities for the diagnosis of prosthetic valve thrombosis. However, delineation of leaflet motions and thrombotic mass by TEE may not be satisfactory in all patients with prosthetic valves in the tricuspid position, leading to a noteworthy issue during the follow-up of patients who receive TT for tricuspid valve thrombosis.<sup>[3]</sup> Fluoroscopy provides valuable

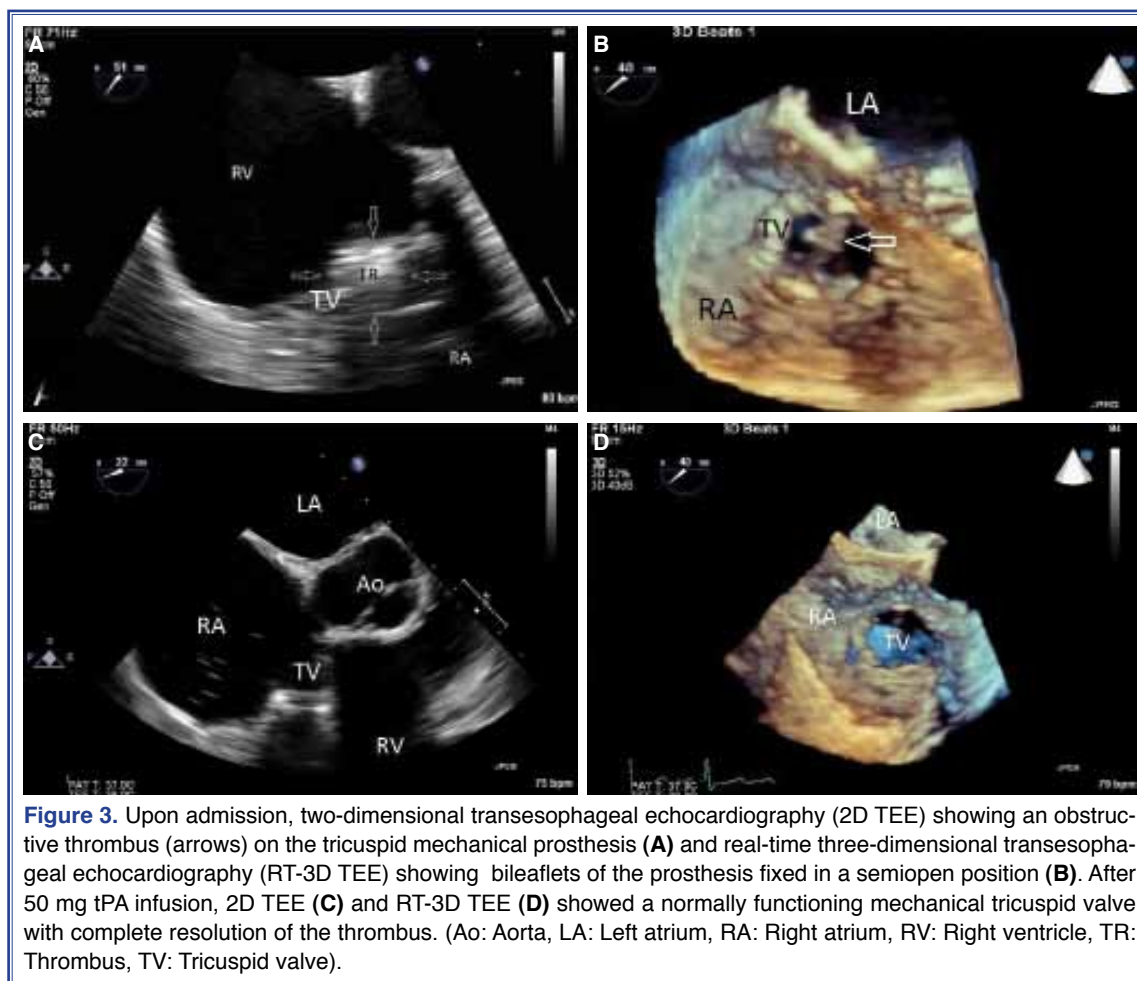
information about leaflet motion and may be used in a serial manner for cases with restricted leaflets who receive TT.<sup>[4,5]</sup>

Here, we present a case of tricuspid valve thrombosis who underwent thrombolysis by further prolonging the duration (25 hours) of the TT regimen with a low dose (25 mg) of tPA under the guidance of serial fluoroscopy.

**CASE REPORT**

A 27-year-old woman with a New York Health Association (NYHA) functional class 2 dyspnea and palpitation within the past two weeks was admitted to the outpatient clinic. She had undergone tricuspid valve replacement with a no. 27 St. Jude Medical bileaflet mechanical valve 18 years earlier. Her chest radiograph was normal and electrocardiogram revealed sinus tachycardia. Laboratory findings were unremarkable except for subtherapeutic (1.6) international normalized ratio (INR) under 5 mg/day warfarin therapy. Transthoracic echocardiography (TTE) showed increased transvalvular gradients (23/13 mmHg) and decreased prosthetic valve area (0.5 cm<sup>2</sup>) obtained by continuous wave Doppler analysis (Figure 1b). Although 2D TEE and RT-3D TEE revealed a thrombus on the tricuspid mechanical prosthesis, the motion of mechanical bileaflets was not clearly assessed (Figure 3a, b). A moderate transvalvular tricuspid regurgitation was demonstrated with color Doppler imaging. Right anterior oblique caudal fluoroscopy provided a side (pivot) view with the disks parallel to the X-ray beams, showing both of the leaflets fixed in a semio-pen position (Figure 2a, Video 1\*). TT with low-dose (25 mg) and ultra-slow (25 hours) infusion of tPA was performed. After 25 mg tPA infusion, fluoroscopy revealed mild movement of both leaflets (Figure 2b,





Video 2\*), but transthoracic Doppler parameters were the same. After an interval of unfractionated heparin infusion for 6 hours, a second TT session with 25 mg tPA for 25 hours was performed, and restriction of leaflets was completely resolved (Figure 2c, Video 3\*). TTE showed a normally functioning prosthesis with decreased transvalvular gradients and increased valve area (Figure 1b). 2D TEE and RT-3D TEE showed a normally functioning mechanical tricuspid valve with complete resolution of the thrombus (Figure 3c, d).

## DISCUSSION

Mechanical valvular prostheses have evolved considerably since their first use in the 1960s. One of the most life-threatening complications of mechanical prostheses is valvular obstruction by pannus, thrombus, or both. Until the 1990s, the treatment of choice for mechanical valve obstruction was surgery. The first reports of TT for the treatment of mechanical

valve obstruction secondary to thrombosis were published in the 1970s and 1980s.<sup>[4-6]</sup> Over the last decade, TT has been used increasingly and has become an alternative to surgery as the first-line therapy in patients with thrombosed mechanical valves. tPA at a low dose and with prolonged infusion time has recently contributed to the success of TT, with decreased complication rates.<sup>[1,2]</sup> Based on our experience in the TROIA trial, we hypothesized that further prolongation of the TT regimen could be associated with lower complication rates.<sup>[2]</sup>

The reconstituted tPA solution may be diluted further with sterilized physiological saline solution (0.9% sodium chloride) immediately before administration. The tPA solution should not be mixed with other drugs, neither in the same infusion vial nor the same venous line. Chemical and physical in-use stability of the reconstituted solution has been demonstrated for up to 24 hours at 2-8°C. However, during infusion at

room temperature, stability of the solution is restricted to 8-10 hours. According to our TT protocol, we use 10 mg tPA vials and perform TT as 10+10+5 mg tPA for 25 hours totally in each TT session.

Tricuspid mechanical prosthetic valves carry higher risk of thrombosis than any cardiac valves. Early experience with monoleaflet valves was associated with a much greater annual incidence of tricuspid valve thrombosis compared with recent experience with bileaflet valves, which are more favorable because of their better hemodynamic profile as compared with older valve models.<sup>[7]</sup> Bileaflet models have the advantage of independent function of both leaflets, reducing the risk of complete obstruction. There is an ongoing controversy in the medical literature regarding replacement of the tricuspid valve with a mechanical prosthesis. Bioprosthetic valves provide a good alternative to mechanical prostheses in patients requiring tricuspid valve replacement; however, they carry a higher rate of structural deterioration.

The role of TTE in the evaluation of valve obstruction is limited and usually provides little information concerning the etiology of the obstruction. TEE has become the procedure of choice for evaluating mechanical valve obstruction and is sometimes useful in distinguishing pannus from thrombus. However, TEE may not be sufficient for evaluation of leaflet motion and the cause of obstruction in patients with tricuspid valve obstruction.<sup>[3]</sup>

Fluoroscopy is the most widely used method for diagnosing stuck valves.<sup>[8]</sup> It is readily available in most centers and can be performed rapidly, particularly in unstable patients. Fluoroscopy is not useful in distinguishing pannus from thrombus since neither pannus nor thrombus can be identified fluoroscopically. In the case of bileaflet valves, the disks can be directly visualized, and opening and closing angles can be measured using a side (pivot) view with the disks parallel to the X-ray beams.<sup>[9]</sup> These angles can be compared to the normal angles for the individual valves. Moreover, fluoroscopy may be particularly utilized as an easily repeatable modality to follow stable patients for evaluation of valve motions during TT,<sup>[10]</sup> as in the present case.

In conclusion, low-dose (25 mg) and ultra-slow (25 hours) infusion of tPA may be a valuable alternative treatment regimen for prosthetic heart valve thrombosis. Since mechanical prosthetic valves in the

tricuspid position may not be viewed satisfactorily by TTE and TEE, serial fluoroscopy may be a reliable, easy, non-invasive, and readily available technique for following patients with tricuspid valve thrombosis who undergo TT.

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**\*Supplementary video file associated with this article can be found in the online version of the journal.**

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**Key words:** Echocardiography, transesophageal; fluoroscopy; prosthetic valve thrombosis; tricuspid valve; thrombolytic therapy.

**Anahtar sözcükler:** Ekokardiyografi, transözofajiyal; floroskopi; protez kapak trombozu; triküspit kapak; trombolitik tedavi.