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## HIGH-RISK THROMBOSIS OF A MECHANICAL AORTIC VALVE: SUCCESSFUL THROMBOLYSIS AS A BRIDGE OR AN ALTERNATIVE TO SURGERY

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**Abstract.** High-risk thrombosis of a mechanical aortic valve: successful thrombolysis as a bridge or an alternative to surgery. Kipot A.O., Stetsyuk L.R., Todurov M.B., Todurov B.M. Thrombosis of a mechanical aortic valve prosthesis is a rare, yet potentially life-threatening complication that demands urgent recognition, rapid diagnostic evaluation, and immediate therapeutic intervention. We describe a detailed clinical case of a 52-year-old male patient who developed critical thrombosis of a mechanical aortic valve prosthesis despite maintaining an adequate and well-controlled anticoagulant regimen. The patient presented with profound hemodynamic instability, markedly reduced ejection fraction, and clinical manifestations consistent with acute decompensated heart failure. On physical and instrumental examination, his condition corresponded to ASA class IV, with a calculated surgical risk of EuroSCORE II=17.28%, indicating an extremely high perioperative mortality risk. Considering both the elevated risk of surgical re-intervention and the rapidly worsening heart failure, the multidisciplinary team decided to initiate systemic thrombolytic therapy as a life-saving alternative. Thrombolysis was performed according to an accelerated protocol using intravenous alteplase at a total dose of 100 mg. Within the first hour of infusion, echocardiography revealed a clear positive trend – restoration of leaflet mobility, a notable reduction in the transprosthetic gradient, and significant improvement in myocardial contractility. Subsequent management continued in the intensive care unit with careful hemodynamic and laboratory monitoring. The patient was discharged on the eighth day in a stable condition, free of complications. Follow-up echocardiography two months later confirmed normal and sustained function of the mechanical prosthesis. This case illustrates the high efficacy of systemic thrombolysis as a viable and guideline-supported (ESC/EACTS 2021, Class I, Level B) therapeutic option when surgical treatment is contraindicated or technically impossible.

**Реферат.** Гострий тромбоз механічного протеза аортального клапана: успішний тромболізис як проміжний етап або альтернатива хірургії. Кіпот А.О., Стецюк Л.Р., Тодуров М.Б., Тодуров Б.М. Тромбоз механічного протеза аортального клапана є рідкісним, але потенційно фатальним ускладненням, що потребує невідкладної діагностики та лікування. Наведено клінічний випадок 52-річного пацієнта з критичним тромбозом механічного протеза аортального клапана на фоні адекватної антикоагулянтної терапії. Стан хворого супроводжувався тяжкою гемодинамічною нестабільністю, зниженням фракції викиду, тобто ознаками гострої серцевої недостатності. Об'єктивно стан хворого відповідав IV класу за ASA, із розрахунковим хірургічним ризиком EuroSCORE II=17,28%. У зв'язку з високими ризиками при проведенні можливого оперативного втручання та швидким прогресуванням явищ гострої серцевої недостатності ухвалено рішення про застосування системного тромболізу. Проведено тромболітичну терапію за пришивидним протоколом із введенням альтеплази в дозі 100 мг внутрішньовенно. Уже через 1 годину після початку інфузії відмічено позитивну динаміку ехокардіографічних

показників – відновлення рухливості стулок, зменшення транспротезного градієнта, покращення скоротливої функції міокарда. Подальше лікування тривало в умовах палати інтенсивної терапії. Хворого виписано на 8-му добу в стабільному стані, без ускладнень. На контрольному обстеженні через 2 місяці підтверджено адекватне функціонування механічного протеза аортального клапана. Описаний клінічний випадок підтверджує ефективність системного тромболізу як потенційної альтернативи хірургічному втручанню при неможливості останнього, відповідно до рекомендацій ESC/EACTS (Class I, Level B) 2021 року.

Despite significant progress in cardiac valve surgery, prosthetic valve thrombosis remains a clinically significant complication that can lead to catastrophic outcomes. The incidence of aortic valve prosthesis thrombosis ranges from 0.3% to 1.3% per year and depends on several factors, including surgical technique, prosthesis type, anticoagulation regimen, and individual patient compliance with therapeutic targets. In clinical practice, the most challenging cases to diagnose and manage are those in which thrombosis develops despite adequate anticoagulation control and is accompanied by severe acute heart failure [1-4].

In such situations, the standard strategy – repeat surgical intervention – may be contraindicated due to an extremely high risk at the stage of anesthesia induction and intraoperative management, prompting clinicians to consider alternative approaches, particularly thrombolytic therapy. Although the efficacy of systemic thrombolysis for obstructive mechanical aortic valve thrombosis is acknowledged in the current 2021 ESC/EACTS Guidelines (Class I, Level B), this approach remains controversial because of the risks of embolic and hemorrhagic complications [3-7, 11].

To demonstrate a clinical case in which systemic thrombolysis proved to be the only life-saving option for a patient with critical thrombosis of a mechanical aortic valve, accompanied by severe hemodynamic instability and an unacceptable level of surgical risk.

## MATERIALS AND METHODS OF RESEARCH

A clinical observation and treatment outcomes of a patient with obstructive thrombosis of a mechanical aortic valve prosthesis and acute heart failure are presented. Diagnosis and monitoring were performed using continuous multiparametric vital sign monitoring, central venous pressure measurement, and transthoracic echocardiography in accordance with current professional society recommendations, including the updated ASE 2024 guidelines for the evaluation of prosthetic valves [8, 13]. Laboratory testing included a coagulation profile, biochemical, and general clinical parameters. Surgical risk was assessed using the EuroSCORE II scale [9]. Non-invasive ventilation (BiPAP) was applied when indicated, in accordance with current guidelines for the management of acute heart failure [10, 12].

The therapeutic strategy included systemic thrombolysis with alteplase using an accelerated protocol

(100 mg over 1 hour). Effectiveness was evaluated based on clinical improvement, transthoracic echocardiography parameters (gradients, EOA, leaflet mobility), and laboratory findings [8, 13].

Statistical analysis methods were not applied due to the single-case study format.

The management of the patient, observation, and publication of this clinical case were carried out in accordance with the principles of bioethics established by the Declaration of Helsinki, the Council of Europe Convention on Human Rights and Biomedicine, and local ethical standards. Written informed consent for publication was obtained from the patient. The study was approved by the Local Bioethics Committee of the State Institution “Heart Institute of the Ministry of Health of Ukraine” (protocol No. 8 dated 15.10.2025).

## Clinical Case

A 52-year-old patient with a history of mechanical aortic valve replacement (St. Jude Medical prosthesis, 21 mm, implanted in 2018 for combined aortic valve disease) was admitted with progressive exertional dyspnea and retrosternal chest pain that had persisted for 7 days and had markedly worsened within the last 24 hours.

On admission, the patient presented with tachypnea (respiratory rate 25/min), hypotension (BP 90/60 mmHg), and tachycardia (HR 107 bpm). Auscultation revealed a systolic murmur, while the characteristic clicking sound of the mechanical valve was absent.

Transthoracic echocardiography demonstrated a bileaflet mechanical aortic valve with severely restricted mobility of the left leaflet. An echogenic mass measuring 9×12 mm was visualized, partially obstructing the valve orifice. The peak and mean transvalvular pressure gradients were 85 mmHg and 60 mmHg, respectively. The effective orifice area was 0.5 cm<sup>2</sup>. The left ventricle was dilated (end-diastolic diameter 78 mm) with severe hypokinesia, and the ejection fraction was 13%.

The patient was on warfarin therapy (alternating doses of 4.5 mg and 6 mg daily); the INR at admission was 2.46. The patient was not taking acetylsalicylic acid. Arterial blood gas analysis revealed: pH 7.30; pCO<sub>2</sub> 68 mmHg; HCO<sub>3</sub><sup>-</sup> 30 mmol/L; paO<sub>2</sub> 60 mmHg (on NIV/BiPAP support).

Initial management included intravenous administration of unfractionated heparin (0.3 U/kg/h),

dobutamine (5 µg/kg/min), dopamine (10 µg/kg/min), and norepinephrine (1 µg/kg/min). Despite escalating doses of inotropes (dobutamine up to 11 µg/kg/min, dopamine up to 20 µg/kg/min, norepinephrine up to 2 µg/kg/min), hemodynamic stabilization was not achieved.

Given the high surgical risk assessed by EuroSCORE II (17.28%) and ASA class IV, the multidisciplinary team considered surgical intervention excessively hazardous. Systemic thrombolysis with alteplase was initiated (50 mg bolus followed by 50 mg infusion over 1 hour).

One hour after thrombolysis, follow-up echocardiography showed complete thrombus resolution, restored leaflet mobility, and a marked reduction in transvalvular gradients (peak – 25 mmHg, mean – 10 mmHg). The effective orifice area increased to 1.9 cm<sup>2</sup>, and the ejection fraction improved to 29%. No complications were recorded.

The patient was discharged on the 8th day with NYHA functional class III. At the two-month follow-up, the ejection fraction was 30%, and the mechanical valve prosthesis functioned normally (Table 1, 2).

Table 1

### Hemodynamic and echocardiographic parameters before and after thrombolysis and at 2-month follow-up

Parameter	Before thrombolysis	1 hour after	After 2 months
Systolic BP, mmHg	90	110–116	124
Heart rate, bpm	107	88–92	78
Peak gradient across AV, mmHg	85	25	24
Mean gradient across AV, mmHg	60	10	12
Effective orifice area, cm <sup>2</sup>	0,5	1,9	1,9
LVEF, %	13	29	30
NYHA class	IV	III	III
LVEDD, mm	78	74	68

Notes: BP – blood pressure; HR – heart rate; AV – aortic valve; LVEF – left ventricular ejection fraction; NYHA – New York Heart Association; LVEDD – left ventricular end-diastolic diameter.

Table 2

### Timeline of Clinical Events

Day	Clinical Event
–7	Onset of dyspnea and chest pain
0	Hospitalization; diagnosis of obstructive thrombosis of the mechanical aortic valve prosthesis; hemodynamic instability
0	Surgery declined by multidisciplinary team; initiation of thrombolysis
+1 hour	Restoration of leaflet mobility, reduction of transvalvular gradient, improvement in LVEF
+1 day	Clinical stabilization; discontinuation of inotropic support
+8 days	Discharge (NYHA III)
+60 days	Follow-up: stable prosthetic valve function, LVEF ≈30%

## RESULTS AND DISCUSSION

At the time of admission, obstructive thrombosis of the mechanical aortic valve prosthesis was confirmed: peak/mean transprosthetic gradients of 85/60 mmHg, effective orifice area 0.5 cm<sup>2</sup>, and left ventricular ejection fraction (LVEF) 13%. Despite intensive inotropic support, hemodynamic instability persisted. Given the ASA-PS class IV and EuroSCORE II of 17.28%, surgical risk was deemed unacceptable. Systemic thrombolysis with alteplase (100 mg over 1 hour) was performed.

After 1 hour, echocardiography demonstrated complete visual resolution of the thrombotic mass, restoration of leaflet mobility, and a decrease in transprosthetic gradients to 25/10 mmHg. The effective orifice area increased to 1.9 cm<sup>2</sup>, and LVEF improved to 29%. The hospital course was uneventful, without bleeding or other complications. The patient was discharged on day 8. At a 2-month follow-up, the gradients across the mechanical aortic valve remained stable at 24-26 mmHg, with LVEF≈30%.

In patients with thrombosis of a mechanical aortic valve prosthesis and NYHA class IV heart failure, when surgery is unavailable or carries an unacceptably high risk, the 2021 ESC/EACTS Guidelines recommend thrombolysis as a justified treatment option (Class I, Level B) [5, 8, 10]. Our case supports this approach: the accelerated alteplase protocol resulted in rapid thrombus resolution, normalization of prosthetic valve function, and stabilization of the patient's clinical condition.

Although recent studies increasingly favor slow or low-dose regimens due to their improved safety profile [5-7, 11], in situations of critical hemodynamic instability, a "fast protocol" may be a reasonable bridge to surgery or even a definitive therapy – provided that meticulous echocardiographic monitoring and a multidisciplinary strategy are ensured [4, 5, 10, 13].

The key factors contributing to the successful outcome in our case likely included early diagnosis, absence of infective endocarditis, and prompt, well-

coordinated team actions aligned with the current ESC/EACTS recommendations [5, 10, 12, 13].

## CONCLUSIONS

1. In this case of mechanical aortic valve prosthesis thrombosis accompanied by severe heart failure, systemic thrombolysis proved to be an effective and life-saving treatment strategy.

2. The high surgical risk (Euro SCORE II – 17.28%, ASA IV) justified the decision to forego surgery in favor of a medical management approach.

3. The use of a rapid alteplase thrombolysis protocol (100 mg over 1 hour) resulted in prompt thrombus resolution, restoration of valve leaflet mobility, a significant reduction in transvalvular gradient, and improvement of ejection fraction from 13% to 29%.

4. The key factors contributing to success included early echocardiographic verification, absence of infective endocarditis, adequate intensive care, and a multidisciplinary decision-making process.

5. Thrombolytic therapy in such cases may serve not only as a "bridge" to potential surgical intervention but also as a definitive treatment when performed in strict accordance with the 2021 ESC/EACTS Guidelines (Class I, Level B).

## Contributors:

Kipot A.O. – conceptualization, investigation, data collection, drafting of the initial manuscript, editing, and revision;

Stetsyuk L.R. – data collection, formal analysis (echocardiographic), editing, and revision of the manuscript;

Todurov M.B. – editing and revision of the manuscript, scientific supervision, and project administration;

Todurov B.M. – scientific supervision, project administration, and final approval of the manuscript.

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