

CASE REPORT

INTERMEDIATE

CLINICAL CASE SERIES

Case Series of Percutaneous Mechanical Aspiration of Mitral Valve Endocarditis



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ABSTRACT

Infective endocarditis of the mitral valve that is refractory to medical therapy requires surgical debridement. However, patients who are high risk for surgery have limited options. We report 3 cases of refractory infective endocarditis involving the mitral valve that were treated with percutaneous mechanical aspiration with an embolic protection system. **(Level of Difficulty: Intermediate.)** (J Am Coll Cardiol Case Rep 2022;4:523-528) © 2022 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Infective endocarditis (IE) is a fatal illness unless treated.^{1,2} Delay in treatment of IE may result in permanent valve destruction and end-organ damage from septic systemic embolization. Complications include stroke, embolization, heart failure, and intracardiac abscess. The incidence of intravenous drug use (IVDU)-related IE has risen over the past decade, particularly in the United States.^{3,4}

The indications for early surgery in patients with IE include heart failure, persistent infection, abscess, heart block, infection with highly resistant organisms, and recurrent emboli. Percutaneous aspiration of tricuspid valve IE has been reported.^{5,6} To our

knowledge, percutaneous mechanical aspiration of mitral valve vegetation has not been previously reported. Compared with tricuspid valve aspiration, significant challenges exist, including transeptal access and the need for cerebral embolic protection given the risk of systemic embolism. We describe 3 patients with mitral valve endocarditis who underwent percutaneous mechanical aspiration.

PATIENT #1

A 62-year-old man with a medical history of type 2 diabetes mellitus, hypertension, morbid obesity, chronic atrial fibrillation, coronary artery disease, chronic left ventricular systolic failure with an ejection fraction of 40% to 45%, and a chronic right foot ulcer was admitted with septicemia and osteomyelitis of the right foot.

Empiric antibiotics were initiated with vancomycin and cefepime. The patient developed septic shock with acute renal failure, requiring temporary hemodialysis. Results of blood cultures were positive for methicillin-resistant *Staphylococcus aureus* (MRSA),

LEARNING OBJECTIVES

- To recognize patients with infective endocarditis who are refractory to medical therapy.
- To treat patients who are high surgical risk with a percutaneous approach.
- To recognize complication of embolic events in patients with mitral infective endocarditis.

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**ABBREVIATIONS
AND ACRONYMS****CT** = computed tomography**IE** = infective endocarditis**IVDU** = intravenous drug use**MRSA** = methicillin-resistant
*Staphylococcus aureus***STS** = Society of Thoracic
Surgery**TEE** = transesophageal
echocardiogram

and vancomycin was continued. The patient underwent partial metatarsal amputation of the right foot on day 6 of admission, but despite this surgery had persistent fever and bacteremia with positive blood culture results. A transesophageal echocardiogram (TEE) was obtained showing native mitral valve endocarditis with a mobile vegetation measuring 1.2×0.8 cm on the P-2 scallop of the posterior valve leaflet with mild mitral regurgitation (Video 1). The patient was deemed prohibitive risk for surgery given a Society of Thoracic Surgery (STS) risk score of 33.3% for operative mortality.

Therapeutic options were discussed, including hospice vs feasibility of percutaneous mitral valve aspiration given the patient's persistent MRSA bacteremia despite appropriate IV antibiotics for 2 weeks.

The patient underwent percutaneous mitral valve aspiration 14 days after hospital admission. General anesthesia was induced, and TEE guidance was used for the procedure. Right radial artery was obtained, and a cerebral protection device (Sentinel, Boston Scientific Corporation) was deployed in the right innominate artery and left common carotid artery, respectively.

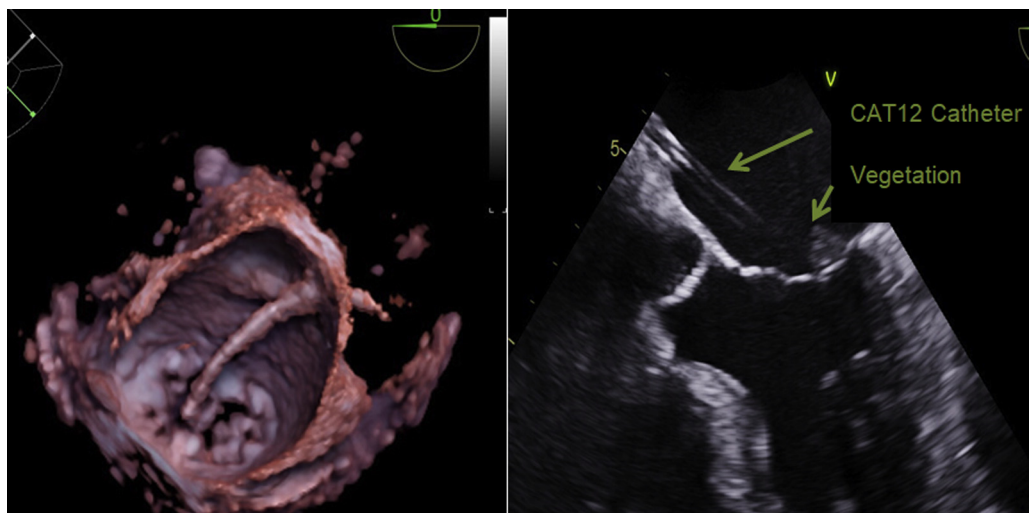
Transseptal access was obtained via the right femoral vein using TEE guidance. We advanced a wire

into the left atrium followed by a 12-F steerable sheath (FlexCath, Medtronic). Through the steerable sheath, we advanced the catheter (CAT12, Penumbra Inc) and performed mechanical aspiration (Figures 1 and 2, Videos 2 and 3).

Debris was retrieved from the canister (Figure 3). Pathology specimens showed blood, fibrin, necrotic debris, and neutrophils. Cultures of the debris from the canister were positive for MRSA. In addition, the debris captured in the cerebral protection device grew MRSA. Approximately 48 hours after aspiration, results of blood cultures were obtained showing no growth, confirming resolution of the bacteremia. The patient was discharged to a skilled nursing facility for 6 weeks of intravenous vancomycin. After 60-day follow-up, the patient had no recurrence of bacteremia.

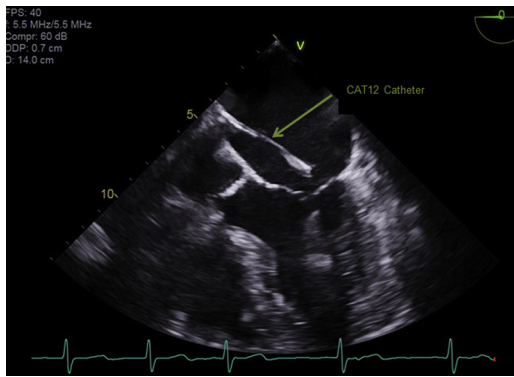
PATIENT #2

A 38-year-old man with a history of hepatitis C infection and ongoing IVDU was admitted with COVID-19 pneumonia with associated sepsis. Blood culture results were positive for methicillin-sensitive *Staphylococcus aureus*. A computed tomography (CT) scan of the chest showed numerous ill-defined cavitory nodules of varying sizes throughout the lungs consistent with extensive bilateral septic emboli. Large embolic splenic and renal infarcts were noted as well.

FIGURE 1 Transesophageal Echocardiogram Image-Guided Catheter Aspiration of Mitral Endocarditis

Transesophageal echocardiogram image with 3-dimensional guidance showing mitral vegetation engagement via 12-F steerable guide and 12-F aspiration catheter.

FIGURE 2 Transesophageal Echocardiogram Image After Aspiration of Vegetation



A transthoracic echocardiogram was performed and revealed 1.1×0.2 cm mitral and 2.0×0.9 cm tricuspid valve vegetation. The patient exhibited altered mental status. Magnetic resonance imaging of the brain confirmed multiple brain abscesses without evidence of midline shift. The patient had persistent bacteremia with recurrent embolization and underwent tricuspid valve mechanical aspiration as described previously.³ A cardiothoracic surgery consultation was obtained for mitral valve endocarditis; however, due to recent stroke, active IVU, and pancytopenia, the patient was deemed high risk for surgery despite an STS risk of 2.5%. There was concern for hemorrhagic conversion of the recent stroke during open heart surgery.

Medical therapy with cefazolin was continued, but despite 5 weeks of intravenous therapy, the patient had persistently positive blood cultures growing methicillin-resistant *S aureus*. He was referred for percutaneous intervention. The patient underwent

percutaneous mitral valve aspiration using a technique similar to that used in Patient #1 (Figure 4, Videos 4 and 5). Debris retrieved from the canister was not sent for culture, but pathology showed necrotic debris and fibrin. Results of blood cultures obtained 48 hours' postprocedure showed no growth. He was discharged to a transitional care to complete intravenous antibiotic course and was subsequently discharged home. Follow-up after 90 days showed no further admissions and no events.

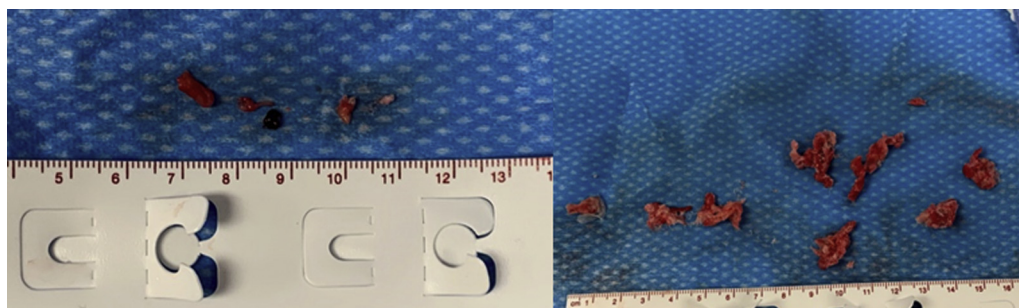
PATIENT #3

A 31-year-old woman with a history of IVU and mitral valve replacement with a bioprosthetic valve due to previous endocarditis 1 year prior presented to the emergency department with fevers, chills, and malaise. Blood culture results were positive for MRSA. Despite sensitivity-directed antibiotic coverage, the bacteremia persisted. The patient underwent TEE, which revealed 3.2×1.3 cm vegetation on the bioprosthetic mitral valve causing moderate to severe mitral stenosis on transthoracic echocardiogram with a mean gradient of 14 mm Hg (Figure 5, Video 6). Despite a total of 4 weeks of intravenous antibiotics including vancomycin and ceftaroline fosamil, blood culture findings remained positive for MRSA with persistent leukocytosis and fever.

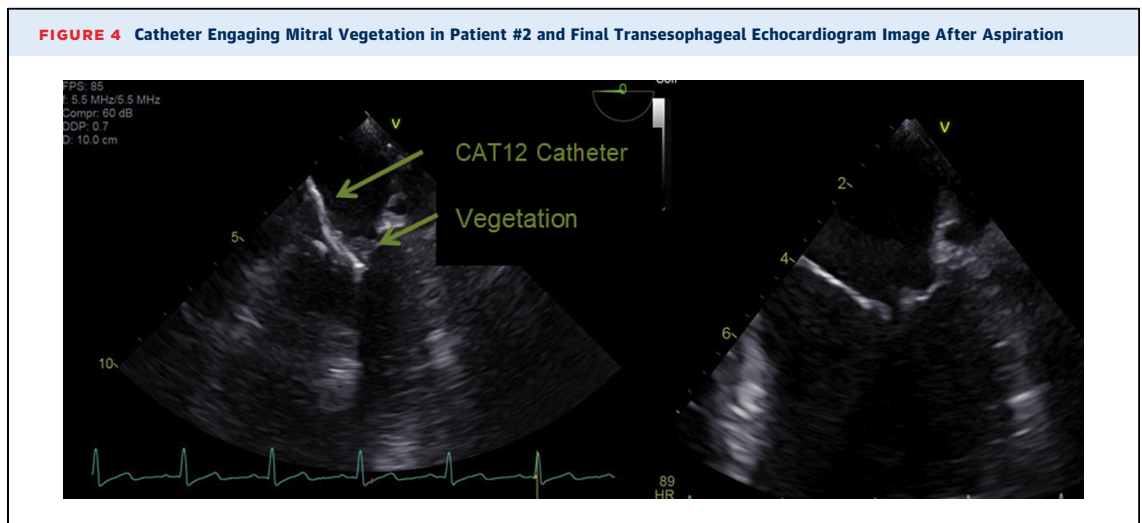
Cardiothoracic surgery was consulted for consideration of redo mitral valve replacement. Given the history of ongoing drug use and valve replacement within 1 year, the patient was not considered a candidate despite an STS risk score of 2.4%. CT scan of the abdomen revealed multiple splenic and renal infarcts.

The structural heart team was consulted for consideration of percutaneous mitral valve

FIGURE 3 Debris Retrieved From Aspiration Canister



Debris retrieved from the canister in Patient #1 (left) and Patient #3 (right).



aspiration. Procedural technique was similar to that described for the aforementioned cases. However, we were unable to place the distal filter in the left common carotid artery due to a sharp angulation using the cerebral protection device. The proximal filter in the right innominate was deployed, and an embolic protection device filter (Nav6, Abbott Vascular) was deployed in the left internal carotid artery via left femoral artery access.

Debris retrieved was sent to pathology for analysis (Figure 3). This showed necrotic debris with fibrin. Cultures of the debris grew MRSA. There was a reduction in the size of the vegetation and improvement in mean gradient to 9 mm Hg (Figure 6, Videos 7 and 8). The thromboembolic protection devices were re-captured and removed.

The patient was extubated in the recovery unit, and a 2-hour postoperative neurologic examination showed no neurologic defects. On postoperative day 1, the patient remained afebrile with no chills. Results of repeat blood culture showed no growth.

On postoperative day 2, the patient developed worsening mental status. A CT scan of the brain showed no evidence of bleeding. Magnetic resonance imaging revealed acute ischemia in the pons. A CT angiogram of the head and neck revealed abrupt termination of flow within the basilar artery. The patient was not considered to be a candidate for thrombolysis or catheter-based thrombectomy. There was prior imaging of the head to compare findings.

The patient had persistent neurologic deficits despite supportive care. The family requested

transition to comfort care, and the patient subsequently died.

DISCUSSION

We present 3 patients with refractory mitral valve endocarditis who underwent percutaneous mechanical aspiration. Table 1 compares the baseline characteristics and outcomes. Percutaneous aspiration of the tricuspid valve has been reported with manual mechanical systems. Technical challenges exist to mitral valve vegetation aspiration, including risk of

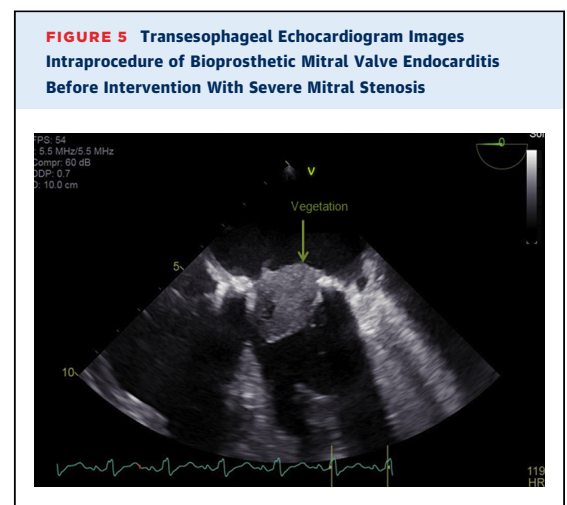
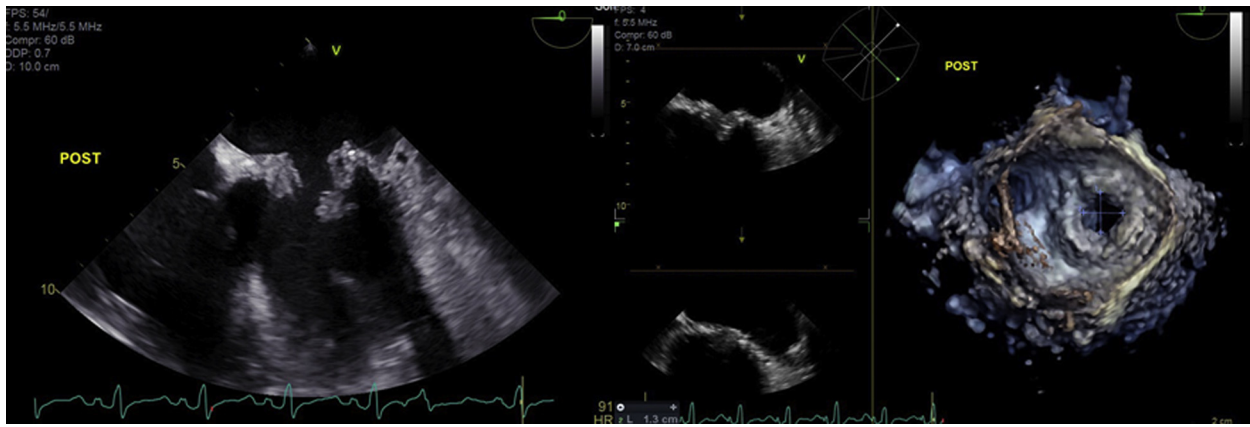


FIGURE 6 Transesophageal Echocardiogram View of the Prosthetic Mitral Valve After Mechanical Aspiration



Residual vegetation is seen on the ventricular side of the prosthetic valve (left). Three-dimensional transesophageal echocardiogram view of the mitral valve showing no residual vegetation on the left atrial side (right).

systemic embolization. We mitigated the risk by deploying the cerebral protection device using a similar technique that was established for transcatheter aortic valve replacement. Patients with mitral valve endocarditis have higher mortality and morbidity given the risk of thrombotic embolization.⁷ All of our patients had evidence of ongoing systemic embolization and septicemia.

All 3 cases had successful vegetation aspiration with clearance of blood cultures. Unfortunately, there was a delayed thromboembolic event after 48 hours in Patient #3. Prosthetic valve endocarditis with *S aureus* has been associated with a mortality rate as

high as 70%.⁸ Patient 3 also had the largest vegetation and a prosthetic mitral valve that was placed for previous mitral valve endocarditis. Patients with prosthetic valve endocarditis have a higher mortality for repeat surgical valve replacement, especially with ongoing IVDU. The thromboembolic phenomenon may have occurred from the remaining vegetation and debris on the mitral valve into the left vertebral artery and basilar artery. The left vertebral artery was unprotected during the procedure. Future consideration should be given to protect the left vertebral artery during mitral valve vegetation aspiration.

TABLE 1 Demographic Characteristics, Case Presentations, and Outcomes

	Case 1	Case 2	Case 3
Age	62 y	43 y	32 y
Sex	Male	Male	Female
History of intravenous drug abuse	No	Yes	Yes
Size of mitral vegetation	1.8 × 0.9 cm	1.8 × 0.6 cm	3.2 × 1.3 cm
Blood culture findings	MRSA	MSSA	MRSA
Duration of antibiotics before aspiration	2 wk	5 wk	4 wk
Septic emboli	None	Cerebral/splenic/pulmonary/renal	Splenic/renal
Indication for surgery	Persistent bacteremia	Persistent bacteremia	Persistent bacteremia and embolic events
Urgency of procedure	Urgent	Urgent	Urgent
Procedural complications	None	None	Delayed cerebrovascular event
Debris cultures from canister	MRSA	Not sent	MRSA
Blood loss	100 mL	600 mL	500 mL
Postprocedure blood culture findings	No growth	No growth	No growth
Outcome	Discharge to skilled nursing facility	Discharge home	Inpatient death

MRSA = methicillin-resistant *Staphylococcus aureus*; MSSA = methicillin-sensitive *Staphylococcus aureus*.

Surgical debridement remains the standard of care for endocarditis refractory to medical therapy and high-risk features. This is especially challenging with ongoing IVUD, as surgical approaches are known to have poor outcomes.⁹ Recent studies have shown that surgery does not confer long-term survival advantage in the IVUD population.¹⁰ Further studies are needed in nonoperable patients to determine the role of percutaneous debulking.

CONCLUSIONS

We report in-hospital outcomes with limited short-term follow-up and no long-term follow-up. Each case was unique, with heterogeneity in treatment

concepts. Higher-than-average rates of MRSA endocarditis are seen in our region due to the high prevalence of drug abuse.

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The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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KEY WORDS drug abuse, endocarditis, mitral valve

APPENDIX For supplemental videos, please see the online version of this paper.