

Embolized mechanical aortic valve leaflet causing infrarenal aortic stenosis and claudication

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ABSTRACT

Leaflet escape from mechanical heart valves is a rare but potentially fatal complication of prosthetic valve replacement. Historically, the incompetent valve is replaced emergently and the escaped leaflet is subsequently retrieved from its settlement in a distal vessel. If it is not retrieved, the fragment can increase the risk of infection, thrombosis, and migration. We report a case of a mechanical aortic valve leaflet that embolized during valve reoperation and caused occlusive aortic disease found 2 years later. This case emphasizes the importance of locating leaflet fragments after they are noticed missing. (*J Vasc Surg Cases and Innovative Techniques* 2020;6:534-8.)

Keywords: Leaflet escape; Prosthetic heart valve; Aortic valve replacement; Intravascular foreign body; Case report

Leaflet escape from prosthetic heart valves is a rare condition that typically results in severe valvular regurgitation and pulmonary edema.^{1,2} Leaflet embolization is most commonly caused by a mechanical valve defect but can result from operative manipulation as well. The standard treatment approach after leaflet escape has been identified is an emergent replacement of the faulty valve and removal of the valve fragments.¹ The fragment can be difficult to locate, but computed tomography (CT) scans have historically had the greatest success compared with plain radiography, angiography, and ultrasound.³ If the fragment is not found and is left in the patient's circulation, there is increased risk of infection, thrombosis, and migration.⁴ We report a case of mechanical valve fragment retrieval during an aortic endarterectomy in which we believe the fragment was dislodged during reoperation on the mechanical valve 2 years earlier. The patient has consented to the publication of this case report.

CASE REPORT

A 56-year-old woman with a past medical history including peripheral artery disease, obesity, and significant tobacco use presented with claudication of the bilateral lower extremities for approximately 8 months. She did not have extremity pain at rest. Her surgical history included a hysterectomy 27 years ago,

a two-vessel coronary artery bypass with aortic valve replacement 8 years ago, and a subsequent second valve replacement 2 years ago. The valve was replaced by repeated sternotomy as the valve was reported to be stuck, causing severe aortic stenosis. The original valve was replaced with a 21-mm Carpentier-Edwards tissue valve (Edwards Lifesciences, Irvine, Calif).

The ankle-brachial index was 0.58 on the right and 0.61 on the left. Bilateral lower extremity arterial duplex ultrasound examination showed low flow and monophasic waveforms of the lower extremity arterial systems bilaterally. CT scan of the abdomen and pelvis showed focal high-grade near-occlusive stenosis of the infrarenal abdominal aorta with evidence of a 10.5- × 10.5- × 1.5-mm triangular platelike radiodensity in the abdominal aorta (Fig 1). We suspected that this density was a mechanical valve leaflet from the first mechanical valve, which was dislodged during the subsequent valve replacement. It is unclear whether the missing leaflet from the first mechanical valve was recognized at the time of the second valve replacement.

Because of the significant stenosis of the infrarenal abdominal aorta along with the patient's symptoms, we considered proceeding with either an open aortic endarterectomy with possible bypass of the stenosed segment or endovascular bypass with endograft placement. The patient was counseled on the options and ultimately decided she would prefer an open approach despite higher complication rates.⁵

During the operation, significant abdominal adhesions were lysed and the small bowel, transverse colon, and sigmoid colon were reflected to expose the retroperitoneum, which was taken down to access the abdominal aorta. The aorta was opened, and a significant atherosclerotic plaque was exposed with a foreign body embedded in the plaque. The foreign body was removed and appeared to be a 1.5- × 1.5- × 0.1-cm piece of triangular tan-black plastic consistent with a prosthetic valve leaflet (Fig 2). Significant atherosclerotic plaque was separated from the aorta wall. Because of our suspicion that the stenotic area was the primary cause of the patient's symptoms, we decided to forgo the bypass and to proceed with bovine patch angioplasty.

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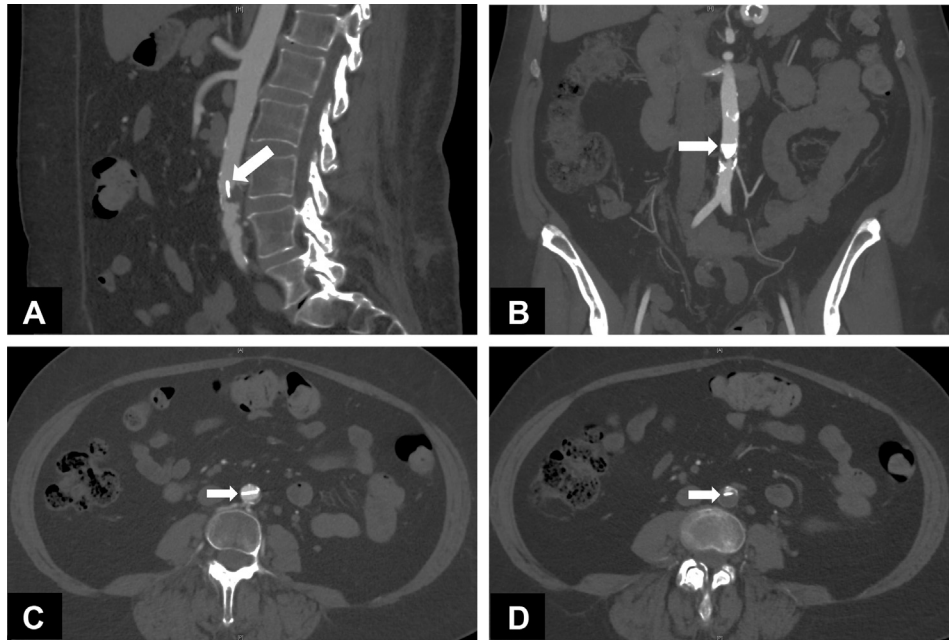


Fig 1. Abdominal and pelvic computed tomography (CT) scan showing a triangular platelike radiodensity measuring $10.5 \times 10.5 \times 1.5$ mm (arrows) associated with intraluminal thrombus or soft plaque. **A**, Coronal view. **B**, Sagittal view. **C** and **D**, Transverse views.

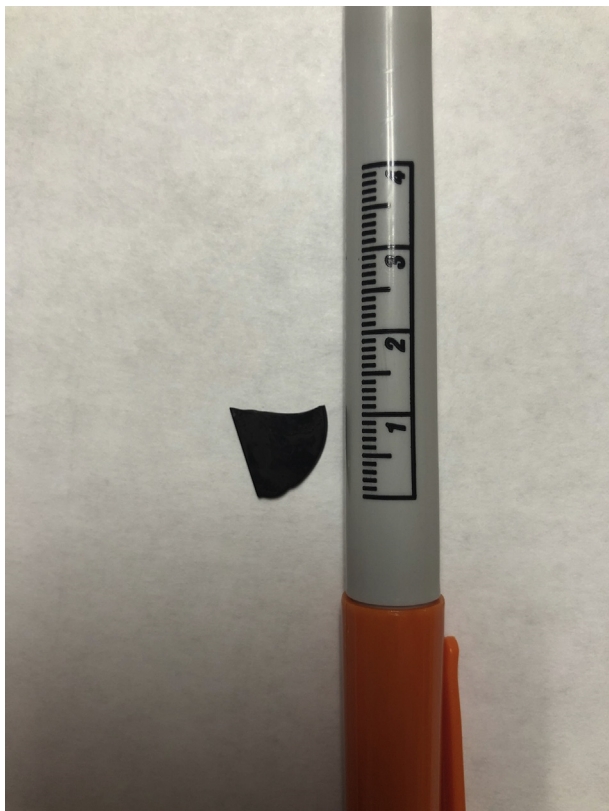


Fig 2. Retrieved leaflet compared with ruler in centimeters.

Once the aorta was patched and unclamped, intraoperative Doppler ultrasound evaluation of the bilateral dorsalis pedis and tibialis posterior arteries revealed satisfactory triphasic signals. The remainder of the surgical site was closed in typical fashion with no complications. Estimated blood loss for the procedure was 1300 mL. The patient was discharged 5 days after the operation. She has been recovering well on follow-up visits with a 2-month postoperative ankle-brachial index of 1.04 on the right and 1.1 on the left.

INVESTIGATIONS

Twenty-four publications reporting 30 cases of leaflet escape from mechanical mitral or aortic valves were reviewed and revealed that the embolized leaflet in a recovered patient was not retrieved in only one case² (Table). In that case, the valve was dislodged during mitral valve replacement and found parallel to circulation in the descending thoracic aorta. The patient denied reoperation to retrieve the leaflet and died 13 years later of terminal heart failure. In seven of the cases, the patient died before the valve replacement or soon after the operation.

Of the 17 cases in which leaflet retrieval was reported, the average time from escape to retrieval was approximately 21 days with a range of immediate recovery to 3 months, with most occurring within the first postoperative month. In our case, the time between leaflet escape and retrieval was 2 years. Each retrieval operation in the

Table. Comparison of published articles reporting mechanical valve leaflet escape and outcomes

Author	No. of cases	Mechanical valve position	Location of embolized fragments	Fragment retrieved?	Time from valve replacement to fragment retrieval	Patient outcome
Yildiz et al ⁶	1	Mitral	Aorta bifurcation	No	N/A	Death 1 week after operation due to pneumonia and respiratory failure
Tsui et al ³	2	Mitral	Aorta bifurcation	Yes	17 days	Successful recovery
		Aortic	Right SFA	Yes	9 days	Successful recovery
Pawale et al ⁷	1	Mitral	Thoracic aorta	Yes	6 days	Successful recovery
Cianciulli et al ⁸	1	Mitral	Aorta bifurcation	Yes	3 months	Successful recovery
van Steenberg et al ¹	1	Aortic	Part in left SFA, part in left popliteal artery	Left SFA fragment retrieved	NR, <1 year	Successful recovery
Calik et al ⁹	1	Mitral	Left femoral artery	Yes	15 days	Successful recovery
Klepetko et al ¹⁰	2	Mitral	Bilateral iliac arteries	Yes	4 days	Successful recovery
		Mitral	Left CIA	Yes	5 days	Successful recovery
Michelsen et al ¹¹	1	Mitral	Noncoronary aortic cusp	Yes	Immediately	Successful recovery
Dimitri et al ¹²	1	Mitral	Aortic bifurcation	During autopsy	N/A	Death few days after emergent valve replacement with global cerebral injury
Schurawitzki et al ¹³	2	Mitral	Right CIA	Yes	NR	Successful recovery
		Mitral	Left CIA	Yes	NR	Successful recovery
Devbhandari et al ²	1	Mitral	Thoracic aorta	No	N/A	Death 13 years after valve replacement and concomitant leaflet escape due to terminal heart failure
Kumar et al ¹⁴	2	Mitral	Left CIA	Yes	3 days	Successful recovery
		Mitral	Left CIA	Yes	4 days	Successful recovery
Jazayeri et al ¹⁵	1	Mitral	Aorta bifurcation and left femoral artery	Yes	2 days	NR
Pfeiffer et al ¹⁶	1	Mitral	Bilateral CIA	During autopsy	N/A	Death before valve replacement surgery
Reddy et al ¹⁷	1	Aortic	Distal abdominal aorta	N/A	N/A	Death before valve replacement surgery
Kim et al ⁴	1	Mitral	Infrarenal abdominal aorta	Yes	11 days	Successful recovery
Higuchi et al ¹⁸	1	Mitral	Distal abdominal aorta and left CIA	Yes	9 weeks	Successful recovery
Baumgartner et al ¹⁹	1	Mitral	Right femoral artery and left iliac bifurcation	Yes	3 months	Successful recovery
Deuvaert et al ²⁰	1	Mitral	Abdominal aorta	During autopsy	N/A	Death 8 days after emergent valve replacement due to sepsis
Hjelms ²¹	1	Mitral	Abdominal aorta	Yes	28 days	NR
Bottio et al ²²	2	Mitral	Abdominal aorta	Yes	NR	NR
		Aortic	Thoracic aorta	During autopsy	N/A	Death before valve replacement surgery

Table. Continued.

Author	No. of cases	Mechanical valve position	Location of embolized fragments	Fragment retrieved?	Time from valve replacement to fragment retrieval	Patient outcome
Hemmer et al ²³	2	Mitral	Aortic bifurcation and left CIA	Yes	NR	Successful recovery
		Mitral	Left proximal EIA	Yes	NR	Successful recovery
Kornberg et al ²⁴	1	Mitral	Infrarenal abdominal aorta	Yes	6 days	Successful recovery
Tatou et al ²⁵	1	Mitral	Right CIA and left iliac bifurcation	Yes	2 days	Successful recovery
Our case	1	Aortic	Infrarenal abdominal aorta	Yes	2 years	Successful recovery

CIA, Common iliac artery; *EIA*, external iliac artery; *N/A*, not applicable; *NR*, not reported; *SFA*, superficial femoral artery.

reviewed case reports was reported to be performed with an open approach. There were no reports of leaflet embolization to the upper extremity vessels.

DISCUSSION

The approach to spontaneous mechanical leaflet escape typically involves emergent valve replacement with subsequent urgent leaflet retrieval. We demonstrate a case in which the leaflet embolized during a mechanical valve replacement and was not detected until a CT scan 2 years later. The embolized leaflet served as a nidus for plaque buildup and caused subacute claudication from occlusive aortic disease. This case represents the importance of thorough inspection of a removed mechanical valve to detect any defects. If a leaflet is fragmented or missing, early CT scan should be considered to optimize the chances of finding the leaflet and reducing complications of an intravascular foreign body.

CONCLUSIONS

An open surgical approach has been the standard in the management of a fractured leaflet settled in the aorta and iliac vessels. There has not been a reported case of an endovascular approach, but retrospectively, an endovascular approach using an endograft would likely have restored perfusion to the lower extremities. However, there would be a possibility of vessel perforation, stent disruption, or further embolization. This should be an area of future research in certain populations of patients who may not tolerate an open aortic procedure.

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