Embodied 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 replacement 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 as 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 × 15-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.
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 case (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
| 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 Steenbergen et al | 1            | Aortic                    | Part in left SFA, part in left popliteal artery | Yes                  | 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\(^17\)| 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\(^18\)    | 2            | Mitral                    | Left CIA                        | Yes                 | 3 days                                         | Successful recovery                                                            |
| Jazayeri et al\(^19\) | 1            | Mitral                    | Aorta bifurcation and left femoral artery | Yes                 | 4 days                                         | Successful recovery                                                            |
|                         |              | Mitral                    | Left CIA                        | Yes                 | 2 days                                         | NR                                                                            |
| Pfeiffer et al\(^20\) | 1            | Mitral                    | Bilateral CIA                   | During autopsy      | N/A                                            | Death before valve replacement surgery                                         |
| Reddy et al\(^21\)    | 1            | Aortic                    | Distal abdominal aorta          | N/A                 | N/A                                            | Death before valve replacement surgery                                         |
| Kim et al\(^22\)      | 1            | Mitral                    | Infrarenal abdominal aorta      | Yes                 | 11 days                                        | Successful recovery                                                            |
| Higuchi et al\(^23\)  | 1            | Mitral                    | Distal abdominal aorta and left CIA | Yes                 | 9 weeks                                        | Successful recovery                                                            |
| Baumgartner et al\(^24\)| 1         | Mitral                    | Right femoral artery and left iliac bifurcation | Yes                 | 3 months                                       | Successful recovery                                                            |
| Deuvaert et al\(^25\) | 1            | Mitral                    | Abdominal aorta                 | During autopsy      | N/A                                            | Death 8 days after emergent valve replacement due to sepsis                   |
| Hjelms\(^26\)         | 1            | Mitral                    | Abdominal aorta                 | Yes                 | 28 days                                        | NR                                                                            |
| Bottio et al\(^27\)   | 2            | Mitral                    | Abdominal aorta                 | Yes                 | NR                                             | NR                                                                            |
|                        |              | Aortic                    | Thoracic aorta                  | During autopsy      | N/A                                            | Death before valve replacement surgery                                         |
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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