

Case Reports

Robot-Assisted Surgical Treatment of Caseoma

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Abstract

This report reviews 5 cases of mitral annular caseoma. Four patients presented with fatigue, stroke, or mitral stenosis. Robot-assisted resection of caseoma with or without mitral valve replacement was successfully performed in all patients with good outcomes. These cases demonstrate the safety and efficacy of robotic surgery in treating caseoma.

Keywords: Robotic surgical procedures; mitral valve; mitral valve stenosis; cardiac surgical procedures; calcification, physiologic

Case Reports

Caseous calcification of the mitral annulus, or caseoma, is a rare variant of mitral annular calcification. Information about the surgical management of caseoma, particularly using a robotic approach, is sparse. These reports present 5 cases of successful robot-assisted caseoma resection with or without mitral valve replacement. The safety and efficacy of robot-assisted technology for decalcification and mitral valve annular reconstruction are highlighted.

Patient 1

A 51-year-old man with kidney failure who was receiving peritoneal dialysis presented to the hospital with malaise and fatigue. Transthoracic echocardiography and transesophageal echocardiography (TEE) revealed decreased left ventricular function at 30% and a mitral valve annulus mass measuring 2 cm that could be infectious vegetation or caseoma (Table I). Infectious disease evaluation was unremarkable. Robot-assisted resection was recommended to reduce the risk of infection and embolization.

Robot-assisted surgery was performed with the da Vinci Xi System (Intuitive Surgical). A 2-inch minithoracotomy incision was made in the right fourth intercostal space. The femoral artery was cannulated with a 19F arterial cannula. A 25F multistage venous cannula was advanced to the superior vena cava through the femoral vein. Cardiopulmonary bypass was initiated. An antegrade cardioplegic catheter was placed in the proximal ascending aorta. The aortic cross-clamp was applied before antegrade cardioplegia was administered. Robotic instruments were inserted. The left atrium was opened to expose the mitral valve. An irregular and calcified mass measuring $1.7 \times 1.9 \times 0.8$ cm was noted at the P1 segment of the posterior mitral valve annulus. The mass had a 0.6-cm to 0.7-cm stalk that was resected. Liquefied calcium at the base of the stalk was thoroughly removed, and the mitral valve was preserved, with no damage at the resection site. The mitral valve annulus was decalcified using robotic scissors and irrigated to remove debris. The left atrial appendage was closed. The patient was weaned off cardiopulmonary bypass

Citation: Wang N, Elsenousi A, Liao KK. Robot-assisted surgical treatment of caseoma. *Tex Heart Inst J*. 2025;52(1):e248448. doi:10.14503/THIJ-24-8448

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without difficulties. Transesophageal echocardiography confirmed complete resection of the mass and a competent mitral valve.

The patient was discharged on postoperative day 7. Pathology confirmed caseoma with extensive calcification. A 24-month follow-up visit showed no clinical issues.

Patient 2

A 55-year-old man with diabetes, coronary artery disease, and kidney failure who was receiving hemodialysis had a previous diagnosis of a right lacunar infarct. Transthoracic echocardiography and TEE performed during a recent stroke workup revealed decreased left ventricular function at 20% and a mobile calcified mass measuring 1 cm on the mitral valve annulus (Table I).

Robot-assisted surgery was performed using the same technique as in patient 1. Intraoperatively, a mass measuring $0.8 \times 0.2 \times 0.3$ cm with a stalk size of 0.15 cm was noted at the A1 segment of the anterior mitral valve annulus. The mass was resected, and all liquefied calcium leakage was thoroughly removed. The mitral valve was preserved, with no damage at the resection site. The left atrial appendage was closed. Transesophageal echocardiography confirmed complete resection of the mass with a competent mitral valve.

The patient was discharged on postoperative day 9. Pathology confirmed caseoma with extensive calcification. A 20-month follow-up visit showed no clinical issues.

Patient 3

A 55-year-old woman with kidney failure who was receiving peritoneal dialysis was evaluated for kidney transplant. Transthoracic echocardiography and TEE performed during cardiac clearance for kidney transplant revealed a mobile calcified mass measuring approximately 2 cm attached to the mitral valve annulus (Table I). The patient reported no symptoms.

Robot-assisted surgery was performed. Intraoperatively, a calcified mass measuring 2×1 cm with a stalk size of 1 cm was noted at the P1 and P2 segments of the posterior mitral valve annulus (Fig. 1A). The mass was resected, and all liquefied calcium leakage was thoroughly removed. Afterward, a 1-cm defect was noted in the mitral valve annulus and part of the valve leaflet, which was repaired with a 1-cm circular bovine pericardial patch. The left atrial appendage was closed (Fig. 1B). Transesophageal echocardiography confirmed complete resection of the mass and a competent mitral valve.

Key Points

- Caseoma is most commonly seen in patients with kidney failure who are receiving dialysis.
- Mitral caseoma is surgically treatable with good outcomes.
- The robot-assisted approach has unique advantages for mitral valve exposure and decalcification compared with conventional approaches.

Abbreviation

TEE, Transesophageal echocardiography

Supplementary Materials

For supplemental materials, please see the online version of this article.

The patient was discharged on postoperative day 8. Pathology confirmed caseoma with extensive calcification. A 22-month follow-up visit showed no clinical issues.

Patient 4

A 49-year-old man with kidney failure who was receiving hemodialysis and had a history of mitral valve stenosis was evaluated for kidney transplant. Transthoracic echocardiography and TEE found mitral stenosis, with a mean mitral valve gradient of 24 mm Hg and mitral valve annular calcification (Table I). The patient reported shortness of breath and fatigue. Because of his age, it was recommended that he undergo robot-assisted mitral valve replacement with a mechanical mitral valve.

Robot-assisted surgery was performed. Intraoperatively, the entire mitral valve annulus was noted to be severely calcified, particularly along the posterior annulus. A mobile nodule measuring 1×1.5 cm was found in the left atrium near the left atrial appendage (Fig. 2A). The mass was resected, and all liquefied calcium leakage was thoroughly removed. The left atrium wall was preserved, with no damage at the resection site. The anterior mitral valve leaflet was excised. The posterior mitral valve leaflet was decalcified using electrocautery and robotic scissors. The mitral valve annulus was reconstructed using 2 bovine pericardial strips, and a 27-mm St Jude mechanical valve (Abbott Laboratories) was inserted (Fig. 2B). The left atrium was closed. Transesophageal echocardiography confirmed good mechanical valve position and function, with a mean mitral valve gradient of 4 to 5 mm Hg and no paravalvular leakage.

TABLE I. Characteristics and Operative Details of Patients With Caseoma

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
Age, y	51	55	55	49	59
Sex	Male	Male	Female	Male	Male
Kidney failure	Yes	Yes	Yes	Yes	Yes
Dialysis	Peritoneal	Hemodialysis	Peritoneal	Hemodialysis	Hemodialysis
Mitral valve stenosis	No	No	No	Yes	Yes
Mitral valve calcification	Yes	Yes	Yes	Yes	Yes
Mitral valve mass	Yes	Yes	Yes	Yes	No
Left ventricular ejection fraction, %	30	20	>70	55	50
Coronary artery disease	Yes	Yes	No	No	Yes
Diabetes	No	Yes	No	Yes	No
Hypertension	Yes	Yes	Yes	Yes	Yes
Hyperlipidemia	Yes	No	Yes	No	No
Obesity (body mass index ≥ 30)	Yes, 31	No	No	No	Yes, 38
Smoker	No	No	No	Yes	No
Previous stroke	No	Yes	No	No	No
Previous operations	None	Pacemaker and percutaneous coronary intervention	None	No	Mitral valve replacement
Surgical indications	Symptoms and mass embolization risk	Symptoms, prior stroke history, and mass embolization risk	Mass embolization risk	Symptoms with severe mitral stenosis	Severe valve size and body mismatch
Reason for robotic approach ^a	Comorbidities and high risk of open sternotomy complications	Comorbidities and high risk of open sternotomy complications	Comorbidities and high risk of open sternotomy complications	Comorbidities and high risk of open sternotomy complications	Previous open sternotomy, with poor visualization and inadequate debridement
Procedure type	Mitral valve mass resection and annular decalcification	Mitral valve mass resection and annular decalcification	Mitral valve leaflet mass resection	Mitral valve replacement using a mechanical valve, with annular decalcification and incidental mass resection	Redo mitral valve replacement using a mechanical valve, with annular decalcification and enlargement
Procedure outcome	Discharged with no clinical complications	Discharged with no clinical complications	Discharged with no clinical complications	Discharged with no clinical complications	Discharged with no clinical complications

^a Clinically significant complications of open sternotomy include poor wound healing, infection, and debilitation.

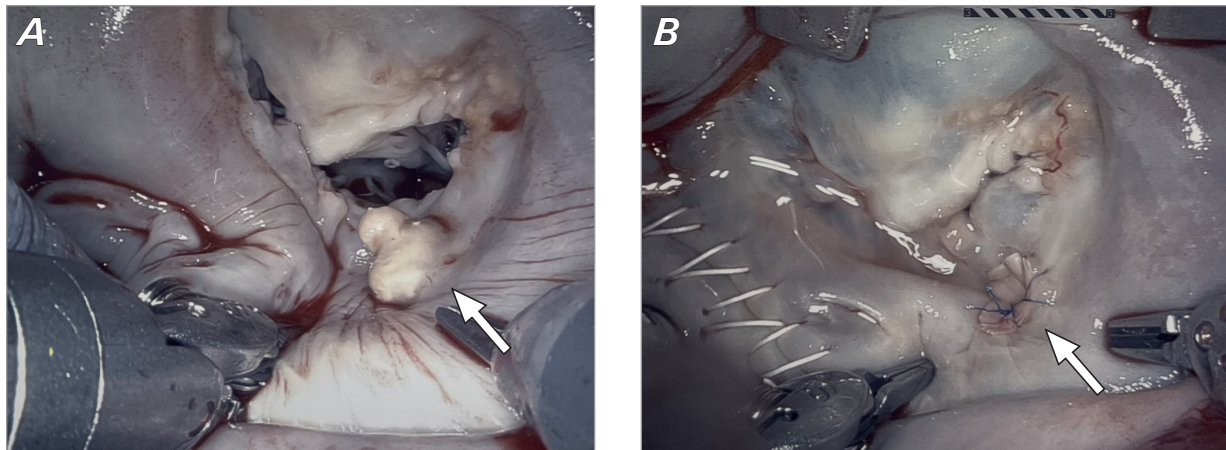


Fig. 1 Intraoperative photographs from patient 3 show (A) the mitral valve annular caseoma involving the posterior valve leaflet (arrow) and (B) mitral valve annulus after caseoma mass resection and repair with a 1-cm bovine pericardial patch (arrow).

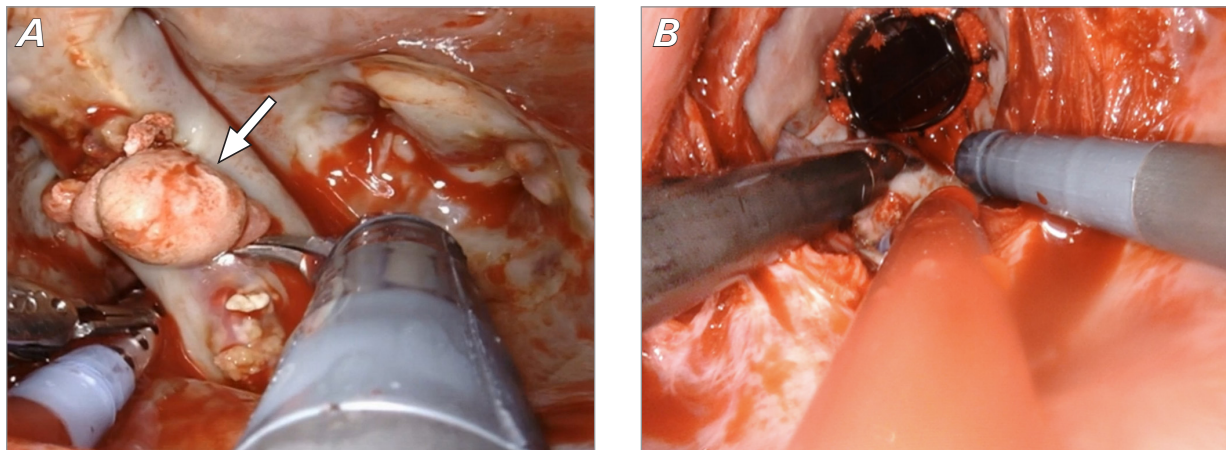


Fig. 2 Intraoperative photographs from patient 4 show (A) the calcified mitral valve annulus with left atrial caseoma near the left atrial appendage (arrow), with the supplemental motion image showing liquefied calcium leakage from the left atrial caseoma and thorough decalcification of the mitral valve annulus, and (B) the mitral valve annulus after mitral valve replacement using a mechanical valve and left atrial mass resection.

Supplemental motion image available for [Figure 2A](#)

The patient was discharged on postoperative day 8. Pathology confirmed caseoma with extensive calcification. A 41-month postoperative visit showed no clinical issues.

Patient 5

A 59-year-old man with coronary artery disease and kidney failure who was receiving hemodialysis was evaluated for kidney transplant. Transthoracic echocardiography and TEE revealed severe mitral valve stenosis with mitral valve annular calcification (Table I). He underwent mitral valve replacement by a different surgical group at our institution using a 21-mm St Jude

mechanical valve, with minimal debridement of mitral valve annular calcification. He was referred 2 weeks later for reoperation following report of symptoms of shortness of breath and failure to wean from ventilation resulting from severe valve size–body mass mismatch.

Robot-assisted redo mitral valve surgery with annular decalcification and enlargement was performed. The 21-mm mechanical valve was removed. Large chunks of mitral valve annular calcification were noted (Fig. 3A). Upon aggressive calcium debridement, clinically significant caseous liquefaction was found. Debris was irrigated and removed. The valve annulus was reconstructed using multiple bovine pericardial strips. A

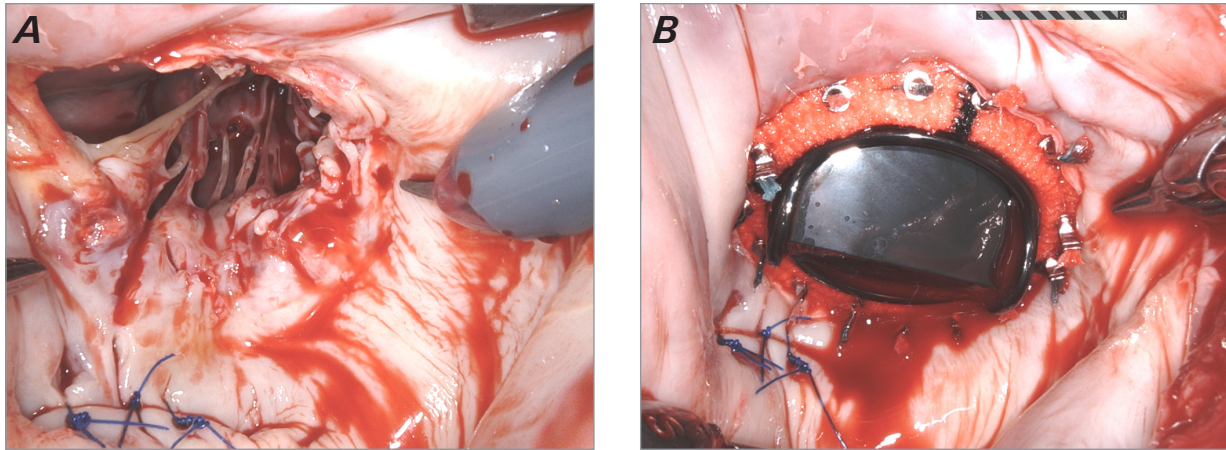


Fig. 3 Intraoperative photographs from patient 5 show (A) the calcified mitral valve annulus after removal of the prior mechanical valve, with the supplemental motion image showing excellent calcium debridement and no mitral valve disruption using the electrocautery feature of robotic scissors, and (B) the mitral valve annulus after decalcification and redo mitral valve replacement using a mechanical valve.

Supplemental motion image available for Figure 3A

27-mm St Jude mechanical valve was inserted (Fig. 3B). Transesophageal echocardiography confirmed good mechanical valve position and function, with no paravalvular leakage.

The patient was discharged on postoperative day 19 after the second surgery. A 16-month follow-up visit showed no clinical issues.

Discussion

Caseous calcification of the mitral valve annulus, also known as caseoma, is a chronic degenerative disease classified as a rare variant of mitral valve annular calcification. Reportedly affecting 0.6% of patients with mitral valve annular calcification, caseoma presents as a calcified mass with a fluid-like core and is usually located on the posterior mitral valve annulus.¹ In this caseoma series, 3 cases originated from the posterior annulus, 1 from the anterior annulus, and 1 from the left atrium. Given the ability of liquefied calcium to grossly mimic an abscess, pathology reports were obtained for all patients to rule out infection. Although the pathogenesis of caseoma is not fully understood, the higher prevalence of caseoma in patients with chronic kidney disease, especially patients receiving dialysis, suggests a potential link with calcium metabolism abnormalities.² Notably, all 5 of these patients had kidney failure requiring hemodialysis or peritoneal dialysis.

Reports of the surgical treatment of caseoma have been sparse because of the disease's typically asymptomatic nature. In addition, the potential risks related to calcium debridement, such as systemic embolization and even left atrioventricular groove disruption, have resulted in recommendations for conservative management of caseoma, excluding cases of mitral valve dysfunction, stroke history, or uncertain diagnosis.³ Among the 4 symptomatic patients presented here, 1 presented with nonspecific symptoms such as fatigue, 1 with stroke, and 2 with symptoms of mitral valve stenosis. The 1 asymptomatic patient had prophylactic indications for surgery based on the presence of a large mobile mass capable of causing stroke. Robot-assisted annular decalcification with or without mitral valve replacement was successfully performed in all patients to reduce embolic risk and improve mitral valve function. The 4 symptomatic patients experienced symptom improvement, and all patients recovered well with good function.

Decalcification of the mitral valve annulus is a complex procedure with a high risk of debris embolization and even mitral valve annular disruption. This report illustrates the safety and efficacy of surgical intervention using novel robotic technology in treating this group of challenging pathologies. The robotic approach can offer better exposure of valve pathology and superior visualization than conventional approaches, allowing for safer and more precise calcium debridement. In contrast to the established use of ultrasonic emulsification for calcium removal in open settings, limited robotic

surgical tools exist for decalcification. In these cases, robotic scissors were used with the electrocautery attachment to successfully perform decalcification. Electrocautery was applied to break the calcium capsule membranes, and the heated scissors with attached electrocautery were then used to gently cut and break apart calcium particles. By pairing this maneuver with focal suction, calcium could be removed without disrupting the valve annulus. Although this feature has not been reported in the literature or demonstrated with conventional scissors, this experience has shown that this technique is feasible and effective. This case series is believed to be the first to describe the surgical treatment of caseoma using robotic technology.

Article Information

Published: 13 March 2025

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Author Contributions: All authors contributed to the final manuscript.

Conflict of Interest Disclosure: None.

Funding/Support: None.

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