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Robotic-assisted Removal of a Recurrent Left Ventricular Myxoma

Short Title: Robotic left ventricular myxoma removal

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Conflicts of Interest: Dr. Murphy is a consultant for Intuitive, and Dr. Halkos is a member of advisory board for Medtronic.

Consent was obtained from the patient described in this case report.

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ABSTRACT

Ventricular myxomas are rare compared to atrial myxomas. Unlike atrial myxomas, it is usually challenging to visualize a ventricular mass because of the complex structures in the left ventricle. We report a case of 44-year-old woman who had a recurrent left ventricular myxoma 8 years after the initial surgical removal. We successfully performed reoperative tumor resection with robotic-assisted approach through the mitral valve. Robotic-assisted approach was extremely effective for visualization of the tumor and precise instrumentation without injuring the surrounding structures.
Cardiac myxomas are rare, benign, primary tumors of the heart which can cause variety of symptoms depending on its size, location, and mobility. Most are found in the left atrium, and those in the left ventricle (LV) are extremely rare. While surgical resection of the tumor is the gold standard treatment, it is generally challenging to visualize the tumor due to its location surrounded by complex structures in the LV. Commonly, surgery is performed by median sternotomy through the mitral valve, the aortic valve, or sometimes through the direct ventricular incision. However, concerns for potential damage to the valvular structure or the LV function remain, especially when the exposure of the tumor is not sufficient for tumor removal. We report a case of 44-year-old woman who had a recurrent LV myxoma, which was successfully removed by robotic-assisted approach through the mitral valve.

The patient is a 44-year-old woman with history of ovarian cancer, left renal angiomyolipoma, and multiple episodes of transient ischemic attack as well as stroke due to a LV myxoma followed by surgical resection via right thoracotomy 8 years ago. She presented to our institution after surveillance echocardiogram had shown a recurrent LV mass. On the transesophageal echocardiogram (TEE), the tumor was measured as 14mm x 17mm, located in the LV along the inferior posterior wall. (Figure1)

Given her previous stroke and the recurrence of LV tumor, surgical resection was indicated.
We decided to perform surgery by utilizing our previously described lateral endoscopic approach with robotics (LEAR) technique.1

After informed consent was obtained, the patient was taken to the operating room and placed in supine position. Following the induction of anesthesia, she was prepped and draped in a sterile fashion. A 2cm right thoracotomy incision was made superior to the previous right thoracotomy incision. For the robotic port placement, all sites of port placement were relatively free of any significant adhesions. A left femoral cutdown was performed and the left femoral artery and vein were exposed. A 17-French biomedicus (Medtronic Inc, Minneapolis, MN) venous cannula was placed in the right internal jugular vein. Then, a 25-French femoral venous cannula was placed in the left common femoral vein. A 23-French Thruport arterial cannula (Edwards Life Sciences, Irvine, CA) was placed into the left common femoral artery. The IntraClude endo-aortic occlusion balloon (Edwards Life Sciences, Irvine, CA) was placed in the ascending aorta through the side port. The robotic system was then docked. After cardiopulmonary bypass was initiated, the patient was cooled down to 32 degrees Celsius. Using robotic electrocautery, we were able to dissect away pulmonary adhesions to the pericardium as well as to the right and left atrium. We proceeded with our dissection along the right and left atrium and were able to develop planes between the residual area of pericardium and the epicardium. The IntraClude balloon was then inflated, and the ascending aorta was occluded. A liter of antegrade cardioplegia was then
delivered. Intermittent doses of antegrade and retrograde were given every 10-15 minutes.

Left atriotomy was then performed. We were readily able to identify the LV tumor through the mitral valve. It was well-visualized along the posterior aspect (Figure2A). It did not involve any chordal structures or valvular structures of the mitral valve. The attachment point of the tumor was identified on the trabeculated muscle. A wedge of muscle was transected to remove the mass en bloc with no residual debris or residual remnant of the mass (Figure2B).

After a thorough inspection, we irrigated the left ventricular and left atrial cavity with saline to remove any potential loose debris. We tested the mitral valve, which was competent without regurgitation. The left atrium was closed in a single layer running suture. The balloon was deflated. After de-airing, the LV vent was removed, and the suture line was secured. There was no residual mass noted on TEE. Mitral valve function was normal with no regurgitation. The cross-clamp time and cardiopulmonary bypass time were 58 minutes and 118 minutes, respectively. The patient was extubated then transferred to the intensive care unit. The postoperative course was uneventful, and she was discharged home on postoperative day 6. The tumor was confirmed as a myxoma by histopathologic examination. On follow-up echocardiogram 3 years after surgery, there was no evidence of recurrence. A supplemental case video is available (Case Video).

COMMENT
Cardiac myxomas are the most common type of benign cardiac tumor, accounting for approximately 50% of all benign cardiac tumors in adults. More than 80% of them are located in the left atrium, and less frequently in the left ventricle\(^2\). Myxomas are typically associated with the risk of embolic phenomena, especially if they are villous or papillary form, which tend to fragment spontaneously. Commonly, a fragmentation travels into the cerebrovascular system and causes stroke, leading to diagnosis of cardiac myxomas. In other cases, they can be discovered incidentally along with various imaging studies. Regardless of the presence of symptoms, surgical removal of myxomas should always be considered, especially in the setting of left-sided lesions, due to the potential risk for systemic embolization.

Unlike atrial myxomas, which are usually easily accessible by atriotomy, LV myxomas are more difficult to be exposed due to its location surrounded by complex structures. Traditionally, LV myxoma removal is performed by median sternotomy across the mitral valve, the aortic valve, or the ventriculotomy. Since the risk for damaging surrounding structures or performing incomplete removal can be higher if the exposure is suboptimal, the adequate exposure of the myxoma is essential for successful surgery.

The first reported case of LV myxoma was in 1959, and since then, more than 70 LV myxoma cases have been reported, and over 90% of these cases have been performed via median sternotomy\(^3\). There have been only a few cases treated with minimally invasive
approach utilizing thoracoscopic assist\textsuperscript{4,5}. No other case was found to date that was treated with robotic assisted approach for a recurrent LV myxoma. Since this patient had a previous surgery via right thoracotomy, a sternotomy approach may have been reasonable. However, our most important consideration was achieving optimal visualization to achieve an en-bloc resection given that she had already had recurrence once, which may have been due to incomplete resection or positive margins during her initial operation. Therefore, we concluded the visualization of the LV mass would be best achieved by LEAR. In fact, by using the robotic atrial retractor to ‘push away’ the anterior leaflet, as well as the atraumatic ball-tip suction to clear the blood by bedside assistant, we were able to obtain optimal visualization of the LV myxoma between the chordal structures. Based on our experience in this approach, we believe LEAR would be suitable for any LV myxomas, regardless of their location within the LV.

In conclusion, we successfully performed reoperative LV myxoma excision by utilizing our LEAR technique without damaging any surrounding structures. We believe that LEAR provided excellent visualization of the LV myxoma and enhanced a complete en-bloc resection, and it was accomplished safely without any perioperative complications.
References


Figure Legends

Figure 1. Preoperative transesophageal echocardiogram showing the left ventricular mass on the infero-lateral wall.

Figure 2. (A) The LV myxoma is well visualized across the mitral valve by LEAR technique.

(B) The LV myxoma is resected ‘En-bloc’ by fine robotic instruments.