Masters of Cardiothoracic Surgery

Technical aspects of robotically assisted left atrial myxoma resection

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Clinical vignette

A 67-year-old male presented with a 2-month history of lightheadedness and a near-syncopal episode. Transesophageal echocardiogram (TEE) demonstrated a mobile, 4.1 cm mass in the superior and medial aspect of the left atrium concerning for myxoma. Coronary angiography demonstrated tumor neovascularization with a primary feeder vessel arising from the proximal right coronary artery.

Surgical techniques

Preparation and induction of anesthesia

After induction of general anesthesia, a single lumen tube with a bronchial blocker is placed. The patient's arms are tucked and the right chest is elevated up to 30 degrees. A venous cannula is inserted via the right neck into the superior vena cava percutaneously under ultrasound guidance. A TEE probe is inserted. The patient is then prepped and draped, widely exposing the entire chest and both groins.

Thoracotomy and port placement

Single lung ventilation with complete right lung collapse is initiated. A right mini thoracotomy is performed in the fourth intercostal space anterior to the anterior axillary line. A small Alexis soft tissue retractor is inserted, over which a small metal retractor may be placed as needed. If necessary for exposure, a pledgeted diaphragmatic traction suture is placed and brought out through the inferolateral chest wall. Under finger guidance, 8 mm instrument ports are placed two intercostal spaces from the mini thoracotomy cranially (port 1) and caudally (port 2). A right-parasternal port for the left atrial retractor is inserted in the same intercostal space as the mini thoracotomy or one interspace lower (port 3). The transthoracic Chitwood clamp is inserted through another small incision at the axilla. Another small incision is made caudally to the mini thoracotomy to insert the left atrial suction tube. The cardiac fat pad is removed using electrocautery via the mini thoracotomy.

Cannulation

The right common femoral artery and vein are exposed and purse-string sutures placed. The patient is heparinized. A distal leg perfusion cannula is routinely placed in the ipsilateral superficial femoral artery. A multi-stage venous cannula is inserted up to the level of the superior vena cava under TEE guidance. The common femoral artery is then cannulated. All cannulas are connected to the heart-lung machine tubing.

Myxoma resection

The DaVinci Xi robotic system is docked to the robotic ports while femoral cannulation is completed. First, Arm 3 is connected to the atrial retractor port (port 3). Arms 1 and 4 are connected to instrument port 1 and 2, respectively. The 30-degree angled camera is inserted into Arm 2 with the view down. After the institution of cardiopulmonary bypass, a pericardiotomy is made anterior to the right phrenic nerve and the pericardium is suspended with

transthoracic silk sutures using the Endoclose device. A long cardioplegia cannula is inserted into the ascending aorta through the mini thoracotomy and secured with a pledgeted 3-0 Prolene suture with a tourniquet. Cardioplegia and root vent lines are connected. The aorta is cross clamped with the Chitwood clamp, with careful attention paid to the left atrial appendage and right pulmonary artery. Del Nido cardioplegia is initiated to induce myocardial arrest. Carbon dioxide is insufflated into the thoracic cavity via instrument port 2. A left atriotomy is performed at the junction between the right superior pulmonary vein and the left atrium. The left atrial retractor is inserted. A suction tube is placed into the left atrium to clear the operative field. In the case described, the tumor was attached to the roof of the left atrium with a broad base. The base of the tumor was marked with a 4-0 Prolene suture both for traction and to keep the large tumor secured. The tumor was then resected from the left atrial wall with robotic curved shears tangentially toward the interatrial septum. A small atrial septal defect was noted and closed with 4-0 Gore-Tex running suture in this case. We created a loop on the tail of the Gore-Tex suture beforehand to secure the first bite of the suture in the field.

After resection is complete the competence of the mitral valve is interrogated by a water test. The left atriotomy is closed with running 4-0 Gore-Tex suture and reinforced with interrupted figure-of-eight 4-0 Prolene sutures.

Weaning from cardiopulmonary bypass and closure

A temporary epicardial pacing lead is placed on the right ventricle. The heart is de-aired through the aortic root venting cannula. The aortic cross-clamp is then released. The cardioplegia cannula is removed and the puncture site is closed with the pre-secured pledgeted suture and Cor-knot. The patient is then weaned from cardiopulmonary bypass, femoral cannulas and the SVC cannula are removed, then protamine is given. When hemostasis is confirmed all robotic instruments are removed and the robotic system is undocked. The ports are removed under direct visualization. All port sites are thoroughly cauterized. A chest tube is typically inserted through instrument port 2, double lung ventilation is resumed and then all incisions are closed.

Comments

Atrial myxoma is a benign cardiac tumor often found in the left atrium and arising from the fossa ovalis. Given the acute risk of thromboembolic and obstructive events, urgent resection is generally recommended. While the historical approach is via median sternotomy, there are fewer than 100 cases reported in the literature of successful robotic-assisted myxoma excisions since the first in 2005 (1-4). Operative suitability is restricted to patients who can tolerate single-lung ventilation before initiating cardiopulmonary bypass. Patients must also be suited for peripheral cannulation with careful preoperative evaluation of the aorta and the iliac and femoral arteries being key.

The robotic technique provides excellent visualization and exposure providing an advantage for the whole surgical team who may strain to see the surgeons view in traditional open cases involving a left atriotomy. The multi-wristed robotic instruments allow easier excision of the tumor than with long shafted minimally invasive cardiac surgery (MICS) instrumentation. Patient outcome data demonstrate shorter ICU and hospital stay (2-4), superior cosmesis, and improved subjective post-operative quality of life (3) compared to sternotomy.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

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