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Lung: Case Report

Robot-Assisted Left Lower Sleeve Lobectomy for Mucoepidermoid Carcinoma

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Surgical resection with lung preservation is the treatment of choice for low-grade mucoepidermoid carcinoma of the tracheobronchial tree. This report describes a case of minimally invasive robot-assisted sleeve resection for tracheobronchial mucoepidermoid carcinoma and provides detailed instruction, with video demonstration, of the operative technique.

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Mucoepidermoid carcinoma (MEC) of the tracheobronchial tree is a rare malignant neoplasm, accounting for approximately 0.1% to 0.2% of primary lung tumors.[1,2] Tracheobronchial MEC arises from the mucous glands of the proximal airways; symptoms are commonly sequelae of airway obstruction and recurrent pneumonia.[3] Open surgical sleeve resection with pulmonary parenchymal preservation has demonstrated acceptable oncologic outcomes with long-term survival and low recurrence rates.[4,5] Safety and technical advantages of the robotic surgery platform have been well described in complex pulmonary operations.[6-8] Herein, we describe our approach to robot-assisted left lower lobe (LLL) sleeve resection with detailed technical instruction and video demonstration.

The patient is a 39-year-old healthy never-smoker who presented with dyspnea. Computed tomography of the chest revealed a 2-cm endobronchial lesion with post-obstructive air trapping but without atelectasis (Figure 1). The lesion was fluorodeoxyglucose avid with a maximum standard uptake value of 4.3 and no evidence of metastatic disease. Flexible bronchoscopy revealed an occlusive vascular tumor originating from the LLL bronchus without involvement of the left upper lobe (LUL). Pathologic examination confirmed low- to moderate-grade MEC. The patient was taken to the operating room, where a robot-assisted LLL sleeve lobectomy was performed as described here and as demonstrated in the Video. The patient tolerated the procedure well. The chest tube was removed on postoperative day 3, and the patient was discharged home on postoperative day 4. Final pathologic examination revealed a 1.6-cm low-grade MEC with a 2-cm negative margin. All lymph nodes were negative for disease.

The patient was intubated with a right-sided double-lumen endotracheal tube and placed in the right lateral decubitus position. Robotic ports were placed in the eighth intercostal space, as is our preference for all robotic pulmonary operations, using two 8-mm and two 12-mm ports to facilitate stapling from both anterior and posterior approaches as needed. The da Vinci Xi robotic system (Intuitive Surgical) was used with the 0-degree camera. Robotic thoracoscopic assessment revealed a congenitally absent pericardium and no evidence of metastatic disease. The operation commenced by dividing the inferior pulmonary ligament, followed by a mediastinal and hilar lymphadenectomy. Next, the major fissure was completed using the robotic stapler, followed by separate circumferential dissection and division of the lower lobe pulmonary artery and vein.

The left mainstem bronchus (LMSB) and LLL bronchus were cleared of peribronchial nodes in preparation for sleeve resection. Care should be taken not to denude the bronchus too far beyond the region of resection as this can compromise bronchial blood flow and potentially lead to anastomotic ischemia. Placing an umbilical tape around the LUL bronchus can facilitate elevation of the airway into the surgical field. Near-infrared imaging

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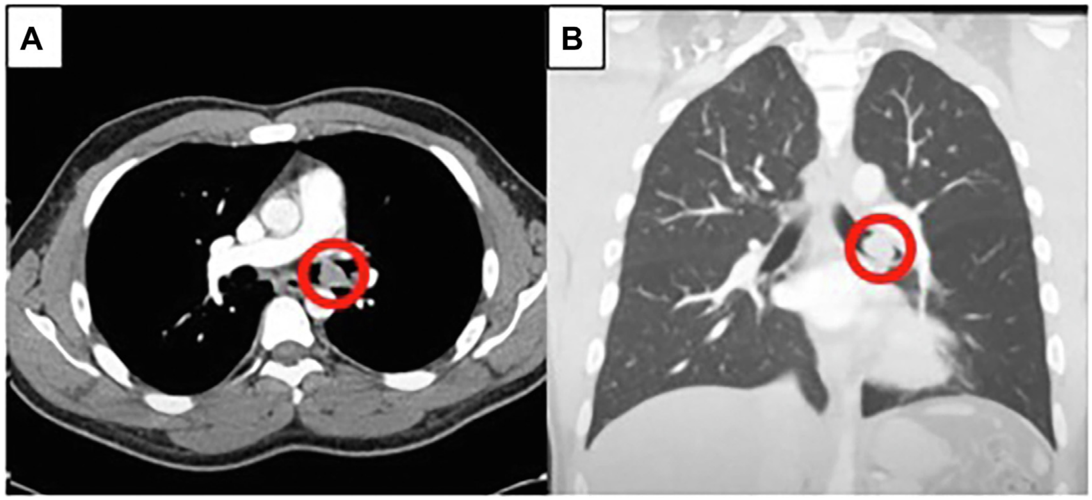

FIGURE 1 Cross-sectional imaging demonstrating an endobronchial tumor (circle) in the distal left mainstem bronchus invading into the left lower lobe bronchus. (A) Axial. (B) Coronal.

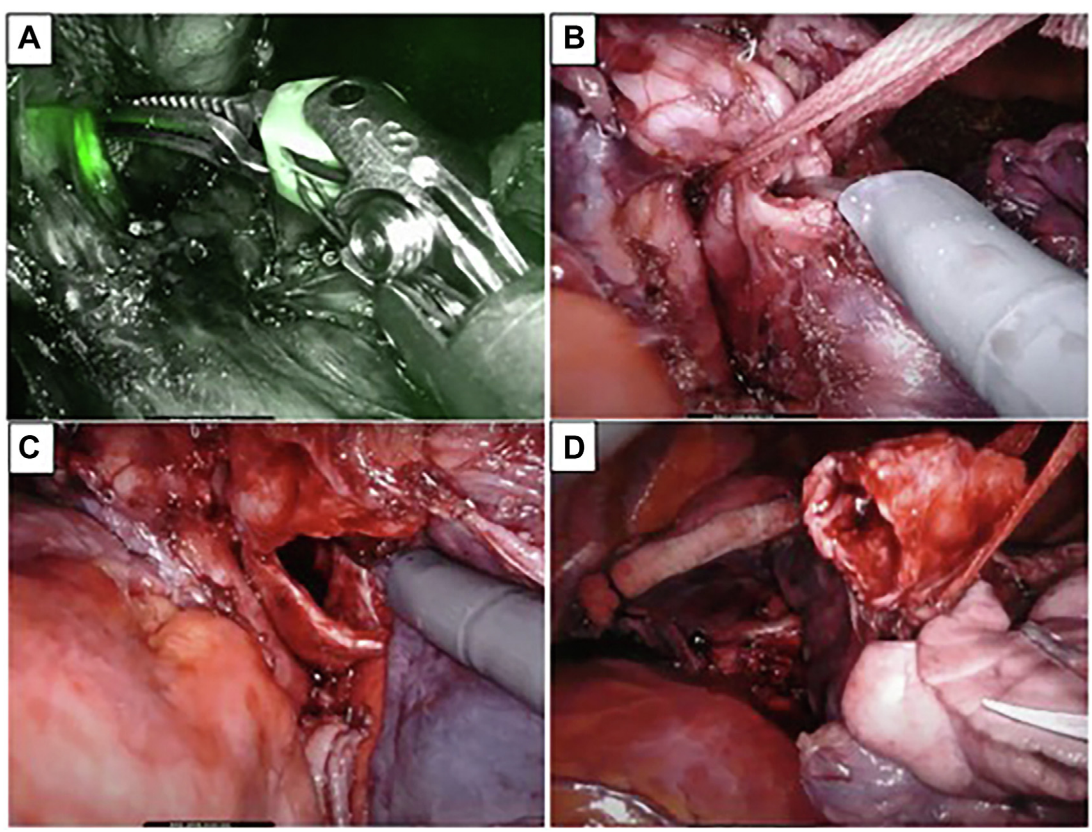

FIGURE 2 Images from robot-assisted left lower lobe sleeve resection. (A) Near-infrared imaging to identify tumor margins. (B) Use of an umbilical tape to help divide the left lower lobe bronchus sharply with scissors. (C) Division of the left mainstem bronchus proximal to tumor. (D) Segment of bronchus containing the mucoepidermoid carcinoma with negative proximal and distal resection margins.

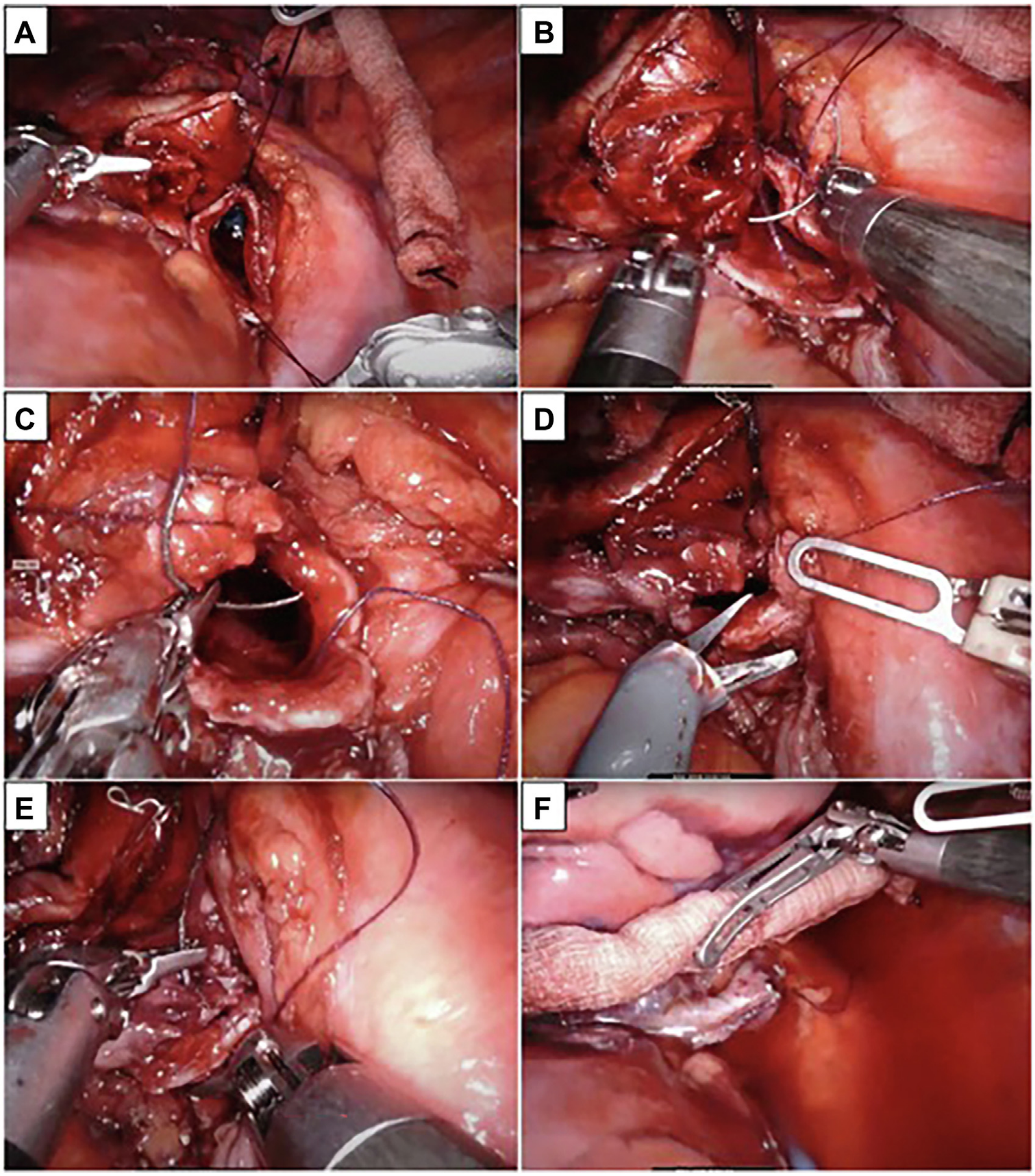

FIGURE 3 Images from robot-assisted left mainstem bronchus to left upper lobe bronchus anastomosis. (A) Placement of 3-0 Vicryl stay sutures for retraction. (B) Use of a 4-0 V-Loc suture to reconstruct the cartilaginous portion of the bronchial anastomosis. (C) Use of a second 4-0 V-Loc suture to reconstruct the membranous portion of the bronchial anastomosis. (D) Trimming redundant tissue on the left mainstem bronchus to address size mismatch. (E) Completion of the anastomosis. (F) Positive pressure leak test under water.

with bronchoscopy was used to define the proximal and distal margins of the tumor. The LUL bronchus was divided sharply with the monopolar curved scissors. The umbilical tape was then placed around the LLL bronchus to help elevate the LMSB, which was divided sharply to obtain the proximal margin (Figure 2). We divide the bronchus with cold scissors without energy application to the bronchial ends to avoid thermal damage in the region of anastomosis. The LLL was then removed. Frozen section analysis confirmed negative proximal and distal bronchial margins.

The bronchial anastomosis was initiated by placing 3-0 Vicryl stay sutures at the cartilaginous-membranous junctions of the LMSB. The bronchial anastomosis was performed with 2 robotic needle drivers. A fenestrated bipolar or Cadiere forceps can be used in the fourth arm to grasp the stay suture and to elevate the LMSB. Two separate running 4-0 barbed absorbable sutures (V-Loc; Medtronic) were used to construct the anastomosis. The first suture begins at the lateral cartilaginous-membranous junction and reconstructs the anterior cartilaginous airway. The second suture similarly begins at the lateral cartilaginous-membranous junction and reconstructs the posterior membranous airway. The use of barbed suture is effective in maintaining proximity of the bronchial edges and managing tension as one completes the anastomosis. The LMSB should be trimmed to correct for the inherent size mismatch between the LMSB and LUL bronchus. Careful attention should also be paid to distance traveled while suturing to adequately align the LMSB and LUL bronchus (Figure 3). The 2 barbed sutures are then tied together, completing the bronchial reconstruction. To confirm integrity of the anastomosis, an underwater positive pressure air leak test was performed. A thymic fat pad was rotated to buttress the anastomosis as well as interposed between the bronchial suture line and left main pulmonary artery. When thymic or pericardial fat pad is unavailable, we harvest an intercostal muscle flap to reinforce the anastomosis. The LUL was then reinflated under direct vision to confirm complete reexpansion and absence of lobar torsion. Completion bronchoscopy showed an intact anastomosis.

COMMENT

This case demonstrates the feasibility and detailed technical aspects of robot-assisted sleeve resection in the surgical management of primary tumors of the airway, such as MEC. The technique is safe, achieves appropriate oncologic margins, and offers enhanced visualization and ergonomic optimization. The techniques used can be applied broadly to other complex pulmonary and tracheobronchial operations and further expand the role of robotics in thoracic surgery.

The Video can be viewed in the online version of this article [https://doi.org/10.1016/j.atssr.2023.04.010] on http://www.annalsthoracicsurgery.org.

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Dr Elliot Servais has received consulting honorariums from Intuitive Surgical.

PATIENT CONSENT

Obtained.

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