

Thoracoscopic Lobectomy Using Robotic Technology

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ABSTRACT

Background: While robotic technology is gaining popularity in cardiac surgery, it also is being used to facilitate thoracoscopic procedures, such as insertion of phrenic pacemakers and resection of mediastinal masses. This report describes the use of robotic technology in performing thoracoscopic lobectomy.

Methods: One patient underwent a left lower lobectomy with the da Vinci robotic surgical system (Intuitive Surgical, Mountain View, CA, USA). With 3 1-cm port incisions and a 4-cm minithoracotomy in the left chest, visualization of the pertinent anatomy was excellent. Standard lymph node dissection was performed. The specimen was removed through the 4-cm minithoracotomy incision.

Results: Pathologic examination revealed mucinous adenocarcinoma. The margins of the specimen were negative, and there was no vascular or bronchial invasion. The patient's postoperative course was uneventful, and he was discharged to home on postoperative day 5.

Conclusion: Robotic technology enhances visualization and instrument dexterity during thoracoscopic intrathoracic procedures. This technology can be used to facilitate development of minimally invasive thoracic approaches.

INTRODUCTION

Robotic technology has been gaining popularity and is currently used to perform various cardiac surgical procedures. Among them are internal mammary artery mobilization [Nataf 2000], atrial septal defect repair [Argenziano 2002], mitral valve repair [Chitwood 2000, LaPietra 2000], and coronary artery bypass grafting [Stephenson 1998, Damiano 2000, Prasad 2001]. Robotic technology also has been applied in several thoracic procedures, including insertion of phrenic nerve pacemakers and resection of mediastinal masses. This report describes the use of robotic technology in performance of thoracoscopic lobectomy.

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CASE REPORT

The patient was a 70-year-old man with a significant history of smoking, emphysema, coronary artery disease, carotid disease, right carotid endarterectomy, abdominal aortic aneurysm repair, and ejection fraction of 52%. He presented with a 2.0 × 1.6 cm left lower lobe lesion visualized with computed tomography (CT). Biopsy was not performed because of the central location of the lesion. The mass had increased in size from 1.1 cm in the 6 months preceding presentation. Bone scan revealed no evidence of metastatic disease. Informed consent was obtained from the patient, and the patient underwent bronchoscopy, mediastinoscopy, and robotically assisted left lower lobectomy.

The patient was intubated with a double-lumen endotracheal tube and positioned in the right lateral decubitus position. Three 1-cm port incisions were made: in the 5th intercostal space, 2 cm anterior to the anterior axillary line, and in the 3rd and 6th intercostal spaces, slightly anterior to the camera port site. A 4-cm minithoracotomy was performed in the left side of the chest. Visualization of the pertinent anatomy was achieved. The inferior pulmonary vein was divided with an Endo-GIA V stapler (US Surgical, Norwalk, CT, USA) (Figure 1). The fissure was dissected with Endo-30 and Endo-45 staplers (Figure 2). The bronchus was stapled with an Endo-33.5 stapler, and the pulmonary artery with an Endo-30 V stapler. Standard lymph node dissection was performed. The specimen was removed through the 4-cm minithoracotomy incision. Pathologic examination revealed mucinous adenocarcinoma. The margins of the specimen were negative, and there was no vascular or bronchial invasion. Level 9 and 11 lymph nodes were negative for tumor. The patient did well postoperatively, had no complications, and was discharged to home on postoperative day 5.

DA VINCI ROBOTIC SYSTEM

The da Vinci robotic system (Intuitive Surgical, Mountain View, CA, USA) consists of a surgeon's control console and a surgical arm unit that positions and maneuvers detachable surgical instruments (Figure 3). A patient-side surgeon assists with exchange of robotic instruments through the trocar unit. Endoscopic instruments include various forceps, scissors, clip applier, electrocautery, and ultrasonic shears. From the console, the surgeon has a 3-dimensional, magnified, stereoscopic view of the operative field. The surgeon telemanipulates the

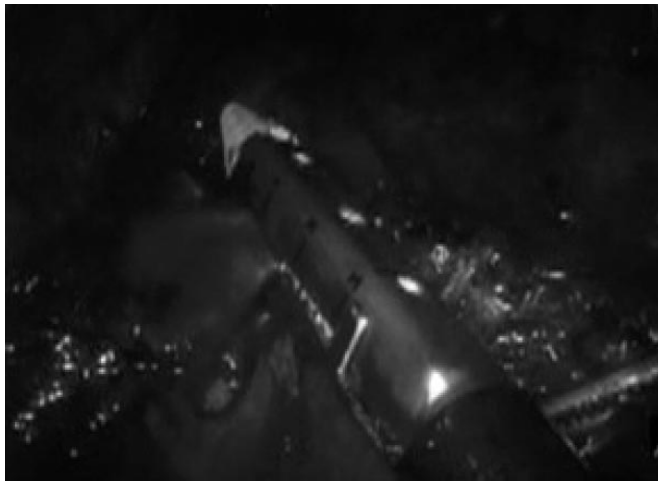


Figure 1. Division of pulmonary vein with an Endo-GIA stapler.

2 “master” handles, which are positioned beneath the console (Figure 4). The robotic system provides the surgeon with 7 degrees of freedom. This expanded movement allows greater range of motion than humanly possible [Falk 2000, Kappert 2000]. The wrists of the robot mimic the motions made by the surgeon.

DISCUSSION

Pulmonary lobectomy can be performed safely and successfully with robotic technology [Melfi 2002]. Preoperative CT aids in definition of the lesion and relevant anatomy and guides proper port placement. Robotic technology provides excellent visualization of intrathoracic anatomy. The visualization and manual dexterity achieved with robotic technology are superior to those with video-assisted thoracoscopic surgery.



Figure 2. Dissection of fissure using Endo-30 and Endo-45 staplers.

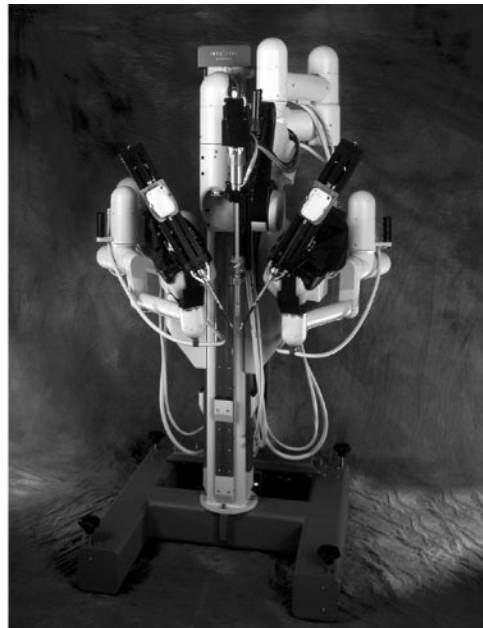


Figure 3. Da Vinci robotic system.

Although a standard thoracoscopic approach may be used to perform the described procedures, a specialized skill set is required. Robotic technology has superior optics and enhances dexterity, and it allows surgeons with little thoracoscopic experience to easily perform relatively challenging thoracoscopic procedures. As robotic technology becomes more popular, comparative studies between conventional and robotically assisted approaches should be undertaken for analysis of outcome variables such as hospital stay and postoperative quality of life. The cost of this technology needs to be factored into the overall benefit derived from this approach. Studies assessing postoperative quality of life as well as cost of robotic technology are underway at our institution.



Figure 4. Two “master” handles positioned beneath the console.

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