How-to-do-it

Total port-access robot-assisted pulmonary lobectomy without utility thoracotomy

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Abstract

Robot-assisted lobectomy has been reported elsewhere as a feasible technique for lobectomy. We report a modification of the previously reported technique using a complete port-access approach without utility thoracotomy.

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1. Introduction

Video-assisted thoracoscopic lobectomy is a widely accepted method of lobectomy [1]. However, there are some potential disadvantages to the technique. These include an intercostal access thoracotomy with subsequent limitation of the tumour size that can be extracted; inability to maintain CO₂ insufflation; repeated instrument insertion through percutaneous port sites and limited views of the mediastinal nodal stations. We report a novel technique of total port-access pulmonary lobectomy avoiding these limitations. Standard techniques of robotic lobectomy also include utility thoracotomy [2].

2. Procedure

The patient is placed under general anaesthesia and the robot is positioned at the head of the operating table (Fig. 1). The patient is intubated with a double lumen endotracheal tube and positioned in the standard thoracotomy position. The anterior end of the 11th rib is palpated and marked. The chest is prepped from the vertebral column to the anterior midline and from the shoulder to the umbilicus and appropriately draped.

A 7-mm port is inserted just anterior at the tip of the 11th rib on the anterior abdominal wall below the 10th rib (Fig. 1) and bluntly tunnelled over the ninth rib and the chest is entered through the eighth intercostal space. A 5-mm thoracoscopic camera is inserted and a pneumothorax is induced with CO₂ (pressure/flow 8 mmHg and 8 m/s).

Using the thoracoscopic camera visualisation as a guide, the robotic camera port is placed in the fifth or sixth intercostal space directly over the mid-fissure area. Two other ports are then placed in the same intercostal space anteriorly and posteriorly (Fig. 1). Placing the three ports in the same intercostal space limits injury to multiple intercostal neurovascular bundles. The 7-mm inferior thoracoscopic camera port is then removed and replaced with a 12-mm port. Once these port placements are complete, the robot is docked and the robotic camera is inserted in position. The dissecting instruments are inserted and viewed through the robotic camera. The surgeon then moves to the robotic console.

Dissection is commenced with a partial lymph nodal dissection of the N1 nodes (American Joint Committee on Cancer (AJCC) levels 10—12). For upper lobectomy, the vascular structures are approached through the fissure and dissection is carried from caudal to cranial, with the pulmonary artery branch in the fissure being divided first and the upper lobe bronchus next. The superior pulmonary vein is then divided and the anterior trunk of the pulmonary artery is divided last. The staplers are inserted through the inferior port. The mediastinal nodal dissection (AJCC levels 2—9) is then performed. The assistant then inserts the specimen removal bag into the chest and the surgeon uses the robotic arms to hold the specimen bag open while the assistant inserts the lobe into the bag.

The robot is then undocked and the surgeon moves to the patient. The 12-mm inferior subcostal port incision is extended from 12 mm to 3 cm. Bovie cautery dissection is performed in a pre-peritoneal plane dividing the diaphragm...
from its attachment to the 10th rib (Fig. 2). The specimen bag is then removed from the chest. Two non-absorbable sutures are then placed in the diaphragm to reattach it to the 10th rib. A size-24 French chest tube is inserted through the anterior port and the lung inflated under vision. The incisions are then closed after injecting local anaesthetic below the incisions.

3. Results

Since January 2008, our teams have performed 74 robotic-assisted lobectomy procedures using the above technique, a total of 76 attempted cases. Sixty-six of these were for non-small-cell lung cancer (NSCLC) and the rest were for metastatic disease to the lungs. All NSCLC patients were in clinical stage 1 or stage 2. The median length of hospital stay was 72 h and mortality was 0%. Atrial fibrillation occurred in three patients, three patients had air leak of 5 days or more, one patient had a myocardial infarction and two patients had postoperative pneumonia. Average operating time was 150 min (range: 122–187 min). Time required for set-up of the robot was an average of 46 min, and median number of lymph node stations dissected was 5. Mean follow-up was 10.2 months. All patients with early-stage IA or IB NSCLC were alive and without evidence of recurrent disease at this time. One patient with metastatic colon cancer died 18 months after surgery with cerebral metastases.

4. Conclusion

This technique avoids an intercostal access thoracotomy and limits surgical trauma to one intercostal neural apparatus. The inferior subcostal incision for lobe extraction lacks any restricting bony structures in its anatomic path. We recommend this technique as the preferred approach for minimally invasive pulmonary lobectomy.

References