

Video-assisted thoracoscopic right lower lobectomy for lung cancer using the Harmonic scalpel

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ABSTRACT

A 68-year-old lady felt chest pain with tenderness of three years duration, who was a diagnosis of adenocarcinoma cell lung cancer. The accesses employed were based on the use of three ports through thoracoscope. With Harmonic scalpel all the hilar structures were isolated and separately sectioned, and systemic lymph node dissection was performed. Postoperative pathologic diagnosis was T2bN0M0 adenocarcinoma. Harmonic scalpel technique with video-assisted thoracoscopy surgery (VATS) has many advantages over traditional open thoracotomy and use of electrocautery for lobectomy in lung cancer surgery. Chief among these is greater patient safety. With Harmonic scalpel dissection, blood loss is minimal and this speeds patient recovery. It allows better visualization of key anatomic structures and permits better lymph node dissection, which is essential to reducing metastatic spread of the cancer.

KEYWORDS

Video-assisted thoracoscopy surgery (VATS); lobectomy; lung cancer; Harmonic scalpel

J Thorac Dis 2013;5(6):864-867. doi: 10.3978/j.issn.2072-1439.2013.11.34

Introduction

During the last few years, many surgeons have begun to utilize the Harmonic scalpel to perform video-assisted thoracoscopic lung surgery (VATS). Several papers have demonstrated the benefits of these devices compared with traditional electric coagulation techniques. Multiple studies of the Harmonic scalpel have shown that it is safe and can minimize blood loss in various surgeries, such as vaginal hysterectomies and laparoscopic nephrectomies. The purpose of this video was to show our institution's techniques and experience with the Harmonic scalpel during VATS lobectomy for lung cancer, especially in lymphadenectomy.

The technique of VATS lobectomy described here is currently employed in the unit of cardiothoracic surgery at The First People's Hospital of Yunnan Province, Kunming University of Science and Technology.

Clinical summary

A 68-year-old lady had chest pain with tenderness of three years' duration. CT scanning demonstrated a finding of a right lower lobe lesion. Past medical history included a fracture of a lumbar vertebra five years ago. CT imaging revealed a 55 mm AP × 40 mm TR, T2bN0M0 lesion in the right lower lobe which may be adherent to the chest wall (Figures 1,2). Bronchoscopy did not show any bronchial anomalies, but brushings and biopsy both returned a diagnosis of adenocarcinoma cell lung cancer. Lung function was assessed via formal spirometry with a FEV1 of 1.89 (101.3% predicted), a FVC of 2.02 (86.8% predicted) and an FEV1/FVC ratio of 94.6% (Video 1).

Technique

Positioning and incisions

The patient is placed in the left lateral decubitus position with a slight posterior tilt under single-lung ventilation. The surgeon stands on the anterior side of the patient. The 10-mm camera port is made at the eighth intercostal space in the posterior axillary line. The utility incision (no larger than 4 cm in length) is placed at the fourth intercostal space in the anterior axillary line. An additional 10-mm port is made at the ninth intercostal space

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Submitted Jul 17, 2013. Accepted for publication Nov 22, 2013. Available at www.jthoracdis.com

ISSN: 2072-1439

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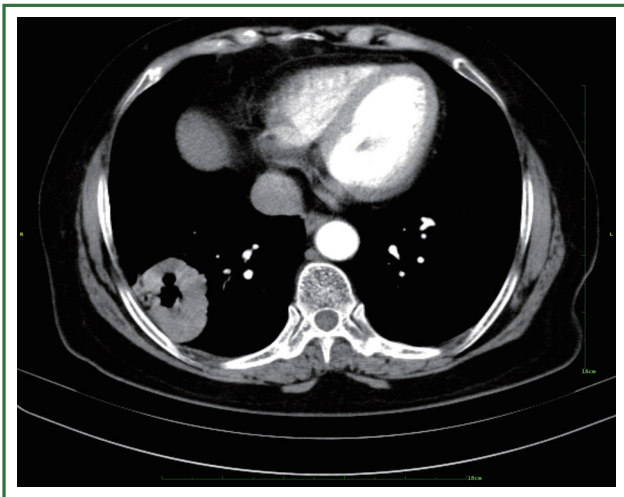


Figure 1. Axial contrast-enhanced chest CT shows a right lower lobe lesion on mediastinal window.

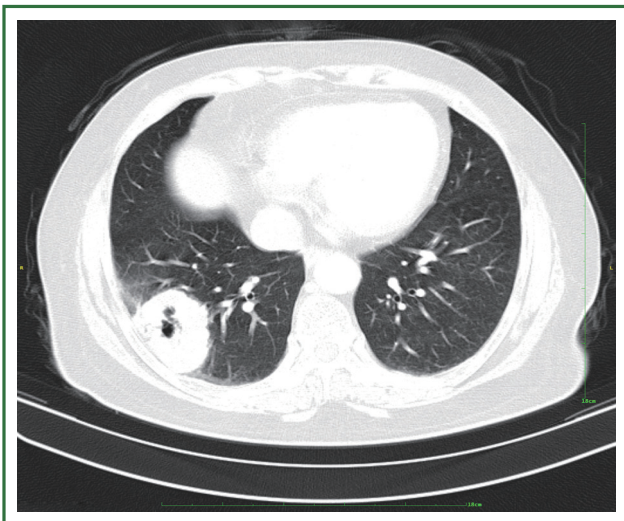


Figure 2. Axial chest CT shows a right lower lobe lesion on lung window.



Video 1. VATS lobectomy: The First People's Hospital of Yunnan Province, Kunming University of Science and Technology.

right below the tip of the scapula.

The first step in the procedure is to confirm resectability and identify invasion of the chest wall, pleurae and hilar structures including the aorta, pulmonary artery and bronchus.

Step 1: inferior pulmonary ligament takedown and level 9 lymph nodes

Exposure: the right lower lobe is held superiorly with a ring clamp through the posteroinferior incision. The thoracoscope is aimed anteriorly with the 30-degree lens pointing posteriorly. Harmonic scalpel is used to transect the inferior pulmonary ligament. The tip of the suction catheter should be held close to the Harmonic scalpel tip to aid in blunt dissection and removing the smoke created. Station 9 inferior pulmonary ligament lymph nodes are removed. Lymph nodes should be removed through the utility incision to avoid tumor implantation in smaller incisions. Harmonic scalpel introduced from the utility incision transects the ligament up to the level of the right inferior pulmonary vein. The lung is repositioned anteriorly.

Step 2: level 7 and 8 lymph nodes

The posterior mediastinal pleura is incised with Harmonic scalpel through the anterior incision. The pleura is carefully incised at its junction with the lung parenchyma. At this point, the inferior pulmonary vein and the posterior aspect of the bronchus intermedius are evident. The paraesophageal level 8 lymph nodes are removed in the process of this dissection. The border of the bronchus intermedius is removed, which ultimately leads to the subcarinal lymph node station. Dissection is used to reach station 7 and to remove the nodes. The bronchial artery usually found at the carina is cauterized. Lymph nodes are removed through the utility incision. The dissection planes include the esophagus posteriorly, the pericardium anteriorly, and the carina superiorly. After complete lymphadenectomy of the subcarinal region, the right and left mainstem bronchi are visualized.

Step 3: inferior pulmonary vein

The lung is retracted posteriorly and cephalad. The thoracoscope is aimed anteriorly with the 30-degree lens pointing posteriorly. The right inferior pulmonary vein is clearly identified to ensure that the right middle lobe vein does not aberrantly drain into the right inferior pulmonary vein. Harmonic scalpel instruments are used to dissect along the superior border of the vein. Injury to the back wall of the vein by directing the instrument tips toward the bronchus (superiorly) should be avoided rather than the vein wall. Extension between the vein and the bronchus

farther than the anvil is performed, since this approach ensures that the stapler completely crosses the vein before stapling. An endoscopic vascular stapler is introduced through the utility incision and across the vein. The stapler is closed and fired. After transecting the vein, the RLL bronchus can be seen and prepared for transection.

Step 4: right lower lobe bronchus

The right lower lobe is held superiorly while the inferior surface of the bronchus is dissected with the Harmonic scalpel through the utility incision. Any lymph nodes that obstruct the view of the bronchus should be removed separately or swept aside so that they can be removed en bloc. If small bronchial vessels are damaged, the Harmonic scalpel can be used to stop the bleeding. Clips should be avoided because they can disrupt later stapling. Harmonic scalpel is used to dissect the right lower lobe bronchus away from the underlying pulmonary artery. With a clamp, extension between the vein and the bronchus farther than the anvil is carefully performed. Injury to the pulmonary artery is avoided by keeping instrument tips close to the bronchus. The dissection plane distal to the right middle lobe bronchus but proximal to the superior segment of the right lower lobe is created. An endoscopic stapler for thick tissue (usually a green load cartridge) is brought into the chest through the utility incision and across the bronchus, the stapler is closed without firing. Reinflation of the lung at this time helps to ensure that the correct bronchus is occluded and that there is no impingement on other bronchi (i.e., right middle lobe bronchus). It must be ensured that there are no devices within the airway, and fire the stapler.

Step 5: right lower lobe pulmonary artery

After transecting the bronchus, the right lower lobe pulmonary artery can be seen. Harmonic scalpel is used to dissect the surface of the artery to create a tunnel for the stapler between the fissures. The right lower lobe pulmonary artery should be clearly visible. It is very important not to force instruments during dissection. The stapler is stabilized at the chest wall level to prevent movement during stapling. It must be ensured that the vascular stapler completely crosses the artery before firing. The artery is visualized well to see that the stapler will not compromise a possible accessory artery for the right middle lobe.

Step 6: major fissure completion

The major fissure is pulled into the stapler for maximum efficiency when transecting it. The right lower lobe is placed into an open bag for removal through the utility incision.

Step 7: level 10 lymph nodes

The right upper lobe is pulled with a long, curved ring clamp inferiorly and posteriorly.

The thoracoscope is aimed anteriorly, and the 30-degree lens is pointed at the superior hilar region. The triangle bordered by the superior aspect of the right hilum, the azygous vein, and the superior vena cava (SVC) is identified. With the Harmonic scalpel brought through the anterior incision, the pleura is incised along these named structures to begin the nodal dissection. Using the Harmonic scalpel and blunt dissection with the suction catheter, all the soft tissue is removed in this level 10 station. All tissue and lymph nodes are removed through the utility incision in case they contain cancer cells. Posterior dissection is performed on the surface of the vein from the apex of the right upper lobe as it passes over the superior hilum, which exposes the anterior trunk of the right pulmonary artery.

Step 8: level 4 and 2 lymph nodes

The mediastinal pleura is incised parallel to the SVC and along the superior aspect of the azygous vein. The phrenic nerve on the lateral aspect of the SVC is identified. To avoid damage to the nerve, the tips of Harmonic scalpel are turned so the phrenic nerve can be seen. The azygous vein is isolated with the right-angle clamp inserted through the utility incision. With a combination of blunt and sharp dissection, all the tissue is removed between the SVC, the pericardium over the ascending aorta, and trachea from the level of the pulmonary artery to the innominate artery, which removes all level 4 and 2 lymph nodes. While the vagus nerve is visualized and protected posteriorly, and the tissues are held posteriorly away from the SVC, and dissection by Harmonic scalpel is used to minimize bleeding. Often, a small vein drains the level 4 nodes into the SVC. It should be identified and clipped. This process is continued cephalad to dissect the level 2 lymph nodes. A complete mediastinal lymph node dissection done with VATS often provides better visualization than with a thoracotomy. On completion of the full lymph node dissection, the paratracheal region is bare, and the important anatomic landmarks are clearly identified. The usage of Harmonic scalpel at the superior margin of this dissection is minimized to prevent damage to the recurrent laryngeal nerve.

Comments

Harmonic scalpel technique with VATS has many advantages over traditional open thoracotomy and electrocautery for lobectomy in lung cancer surgery. Chief among these is greater patient safety. With Harmonic scalpel dissection, blood loss

is minimal, which speeds patient recovery. It does not leave behind foreign materials, such as sutures or clips, and therefore there is more rapid wound healing and less chance of delayed complications. It allows better visualization of key anatomic structures and permits better lymph node dissection, which is essential to reduce metastatic spread of the cancer.



Cite this article as: Peng J, Chen XL, Mao X, Liu J, Ning XG. Video-assisted thoracoscopic right lower lobectomy for lung cancer using the Harmonic scalpel. J Thorac Dis 2013;5(6):864-867. doi: 10.3978/j.issn.2072-1439.2013.11.34

Acknowledgements

Funding: The Fund of Application Basis Research of Yunnan Province (2010ZC216).

Disclosure: The authors declare no conflict of interest.