Thoracoscopic superior segmentectomy

Jacob R. Moremen[1], Betty C. Tong[2], DuyKhanh P. Ceppa[1]

[1]Division of Cardiothoracic Surgery, Indiana University School of Medicine, Indianapolis, Indiana, USA; [2]Division of Cardiothoracic Surgery, Duke University, Durham, North Carolina, USA

Correspondence to: DuyKhanh P. Ceppa, MD. Division of Cardiothoracic Surgery, Department of Surgery, Indiana University School of Medicine, 545 Barnhill Drive, EH 215, Indianapolis, Indiana, USA. Email: dpceppa@iupui.edu.

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Clinical vignette

The patient is a 59-year-old formerly smoking male with a history of T2N0M0, stage I colon cancer. He underwent a left hemicolectomy five years prior to presentation and was referred for an enlarging 7 mm pulmonary nodule noted on surveillance imaging. His past medical history was significant for coronary artery disease and hypertension. Given the deep location of the pulmonary nodule and the patient's limited pulmonary function, we opted to perform a diagnostic and therapeutic superior segmentectomy.

Surgical technique

Preparation

All patients undergoing a pulmonary resection are evaluated pre-operatively with pulmonary function testing (spirometry and diffusion capacity). Upon arrival at the operating room and induction with general anesthesia via a dual lumen endotracheal tube, the patient is placed in a lateral decubitus position with the bed flexed just above the hip. The surgeon stands anterior to the patient and the assistant drives the thoracoscope while standing posteriorly to the patient.

Exposition

The patient is prepped and draped in a sterile fashion. We use a two-incision approach—the first incision is at the eighth interspace at the posterior axillary line and the second access incision is at the fifth interspace anteriorly. The access incision is approximately 3 cm in length.

Operation

The hemithorax is explored for evidence of pleural disease, effusions, or additional, unexpected pulmonary nodules. The presence of the lung nodule of interest is confirmed. The lung is retracted superolaterally as the inferior pulmonary ligament is incised, along with the pleura anterior and posterior to the hilum. With the lung retracted superolaterally, the inferior pulmonary vein is encountered first. The branch draining the superior segment is identified, circumferentially dissected out and ligated. More superolateral retraction reveals the lower lobe bronchus, and the segmental bronchus to the superior segment is identified. Once the superior segmental bronchus is circumferentially dissected out and transected, more superolateral retraction on the lung exposes the pulmonary artery. The pulmonary artery branch to the superior segment is circumferentially dissected out and ligated.

Upon division of the hilar structures, the fissure is completed and the parenchymal margin is divided. The parenchymal margin is occasionally identified by a segmental fissure. Otherwise, a test inflation may assist in delineating the parenchymal margin. The segment is removed from the hemithorax in a specimen bag. All structures are divided using a linear stapler with a vascular load for the vein and artery and a 3.5 to 4.5 mm load (or equivalent) for the bronchus and parenchyma.

Completion

Upon completion of the segmentectomy, a mediastinal lymph node dissection is performed. The vascular and bronchial stumps are inspected for hemostasis. A thoracostomy tube is introduced via the camera incision and the lung is reinflated under direct visualization. All ports and the camera are then removed. The anterior access incision is closed using absorbable suture to reapproximate the serratus fascia and skin.

Comments

Clinical results

Segmentectomy was originally popularized as a procedure for tuberculosis, bronchiectasis and other suppurative pulmonary processes. While still useful in this scenario, segmentectomy is now more commonly utilized in the treatment of early stage lung cancer in patients with limited pulmonary function and in the treatment of pulmonary metastasectomy. Although a technically more challenging operation than lobectomy, segmentectomy has been shown to have similar complication rates, local recurrence rates, and 5-year survival (1). The only randomized trial comparing sublobar pulmonary resection with lobectomy demonstrated a higher recurrence and cancer-related death rate in the sublobar resection cohort (2). However, this study did not distinguish between wedge resection and segmentectomy. The study also did not specifically assess the role of segmentectomy in smaller nodules and one third of the tumors were greater than 2 cm. A more recent series by Okada *et al*. reviewed the outcomes of segmentectomy versus lobectomy in over 500 patients with tumors less than 2 cm (3). They report that the 5-year survival in both cohorts were similar.

Advantages

A meta-analysis of 24 studies from 1990 to 2010 demonstrated the benefit of lobectomy over sublobectomy—but not over segmentectomy—in overall survival and cancer specific survival for patients with stage I NSCLC (4). This survival advantage was lost, however, in patients with stage IA tumors less than 2 cm. Current literature suggests that compared to lobectomy, segmentectomy has equivalent cancer-free survival and local control with its main advantage being preservation of lung parenchyma (5). Postoperative pulmonary function testing in patients undergoing lobectomy found a significantly decreased forced expiratory volume in one second (FEV1) at two and six months and reduced exercise capacity when compared to patients undergoing segmentectomy (6). Reduced morbidity, decreased hospital length of stay, and lower cost are additional advantages of thoracoscopic segmentectomy over segmentectomy by thoracotomy (5). Furthermore, when compared to wedge resection of small pulmonary nodules, segmentectomy has been associated with a better lymph node dissection and increased parenchymal margin (7).

Caveats

Despite its advantages, thoracoscopic segmentectomy is more technically challenging than lobectomy. Additionally, this technique should be reserved for small pulmonary lesions (≤2 cm) that can be fully resected with an adequate parenchymal margin by segmentectomy. Data from randomized trials investigating the role of segmentectomy versus lobectomy are currently under way.

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