

VATS segmentectomy utilizing the Copenhagen approach

René Horsleben Petersen, Henrik Jessen Hansen

Department of Cardiothoracic Surgery, Copenhagen University Hospital, Rigshospitalet, Denmark

Correspondence to: René Horsleben Petersen. Department of Cardio-thoracic Surgery, Copenhagen University Hospital, Rigshospitalet, Blegdamsvej 9, DK-2100 Copenhagen, Denmark. Email: rene.petersen@rh.regionh.dk.



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Clinical vignette

The patient is a 68-year-old woman with a history of thoracoscopic (VATS) lobectomy of the right lower lobe in 2011 for T2aN0M0, stage Ib (4.9 cm) adenocarcinoma. She did not receive adjuvant chemotherapy and her comorbidities include hypertension and alcohol consumption. On follow-up computed tomography (CT) scans, a growing tumor central in the left upper lobe was discovered. Her pulmonary function tests demonstrated 69% of predicted FEV₁ and 59% of predicted DLCO. VATS left upper trisegmentectomy was scheduled. This article and the accompanying video (*Video 1*) will discuss the minimally invasive segmentectomy approach used in this case.

Surgical techniques

Preparation

The basic set-up used for a VATS segmentectomy is the same as previously described for VATS lobectomy (1,2). The patient is positioned on the side, with the table bending at the level of the xiphoid to allow the intercostal spaces to open. The surgeon and the assistant are positioned on the anterior (abdominal) side of the patient and with the surgeon cranially. All VATS segmentectomies are performed with a 10 mm, 30 degree angled HD video-thoracoscope. A double-lumen tube is used for deflation of the left lung.

Operation

A 4 cm anterior utility incision is made without any tissue retractor or rib spreading. The wound is protected by a plastic soft tissue retractor (Alexis Retractor, Applied Medical USA), which also improves exposure. This incision

is later used for specimen retrieval and is positioned between the breast and the lower angle of the scapula in the fourth intercostal space, just anterior to the latissimus dorsi muscle. In case of a conversion to open procedure, this incision can be easily expanded to a 10 to 15 cm muscle sparing thoracotomy. Through this incision, the cavity is evaluated with the camera looking for unexpected pathology, adhesions, and the level of the diaphragm. A low anterior 1 cm camera-port is positioned at the level of the top of the diaphragm and anterior to the level of the hilum and the phrenic nerve. The third incision is 1.5 cm, positioned at the same level but more posteriorly and inferiorly from the scapula and anterior to the latissimus dorsi muscle. To palpate, free and prepare the structures, we used an array of peanut or sponge sticks and an electrocautery blade hook controlled with a normal surgical handhold. The tip of the hook can then be used to lift and divide the tissue. To present vessels and other structures to be divided, we use an elastic vessel loop made of rubber.

Localization of the tumor is confirmed by palpation. The pleura over the hilum is divided and the vein branches from the upper lobe segments are visualized. The plane between the artery and the upper lobe vein is opened, so the vein from the three upper segments can be exposed using a vessel loop. The branches are divided with a tan Tri-stapler (Covidien, USA) introduced from the posterior port. Next the superior branch of the pulmonary artery is divided in the same way and thereafter, a plane between the artery and the bronchus can be created. The bifurcation of the left upper and lower lobe bronchi is identified, and the left upper lobe bronchus is dissected to the next level of division to visualize the bronchus to the three upper segments. Following application of a sling, a purple Tri-stapler is subsequently introduced via the posterior port. The bronchi

to the three upper segments are closed with the stapler and the left lung is inflated by the anesthesiologist. The borders of the segments are visualized and the level of division is confirmed, allowing subsequent division of the bronchus. Hilar lymph nodes are removed, followed by stapling with a purple or black Tri-stapler along the borders of the segments. The port protector is removed and the segment is removed in a protective bag.

Lymph node dissection is performed with an en-block removal of lymph nodes from station 5, 6, 7, 8. The remaining lung is inflated under water to ensure expansion and is then tested for air leak. Finally, one intercostal drain is placed through the anterior camera incision. After surgery, the patient was transferred to an intermediate ward and to the normal ward the day after.

Comments

Clinical results

The postoperative course of the patient was uneventful, with an in-hospital stay of four days. Final pathology revealed another primary lung cancer (adenocarcinoma 11 mm T1aN0M0, stage Ia). She was scheduled for follow up with CT scans for the next five years.

Advantages

The Copenhagen anterior approach for a VATS segmentectomy represents a standardized, effective approach to VATS lobectomy, with secure access to the main vessels in the hilum. In case of conversion, the anterior utility incision can be expanded to a muscle sparing anterior thoracotomy

within few minutes. The utility incision allows for bi-digital palpation of even small tumors deep in the lung parenchyma, making it easier to secure sufficient resection margin in segmentectomies.

Caveats

Since the approach is anterior, difficulties can occur during exposure of the posterior field in superior segmentectomies of the lower lobe. Occasionally, the camera is introduced through the posterior port in these cases. Like any other procedure, there is a learning curve. However for surgeons experienced in VATS lobectomy, this approach will allow shorter operative duration compared to transition from open to VATS lobectomy (3).

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