



Uniportal video-thoracoscopic mediastinal lymphadenectomy

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Abstract: Systemic mediastinal lymphadenectomy has a key role in lung cancer surgery, as it permits to define the pathological staging and therefore the treatment and the prognosis of the patients. Currently the video-assisted thoracoscopic approach is the most common technique to remove these tumours, if technically feasible. Particularly the uniportal approach provides with the best anatomic instrumentation and a direct view. In this paper, we describe our technique to perform a safe and effective radical mediastinal lymphadenectomy.

Keywords: Uniportal VATS; video-assisted thoracoscopic lymphadenectomy; non-small cell lung carcinoma

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Introduction

Uniportal video-thoracoscopic surgery (VATS) has become a widespread and well-established technique for major and minor pulmonary resections (1). It offers a valid alternative to conventional VATS techniques (bi- and tri-portal) and may imply improve postoperative pain and long-term advantages in pain and paresthesia (2-4). Recent studies show that also the length of stay may be reduced and patient's satisfaction may be improved with the uniportal approach (5). A fundamental part in the staging of the lung carcinoma is the systemic nodal dissection (SND) of the mediastinum. SND should be performed in a standardized manner: all the surrounding fat containing the lymph tissue should be isolated and removed systematically and en bloc within anatomical and marks from at least three mediastinal stations from the affected side (6).

One of the principal initial concerns about the minimally invasive approach was whether it was possible to perform the same lymphadenectomy as per thoracotomy. Nowadays it is recognised that VATS mediastinal lymphadenectomy is just as feasible as conventional surgery with similar results (7-9), also in case of positive N2 disease (10). Gonzalez-Rivas *et al.* analysed experience in VATS for major resections in La Coruña, Spain, for over a 3-year period involving 200 cases and they observed improvements in the learning curve:

the reduction of the conversion rate and of the mean surgical time, more accuracy in the number of lymph nodes as well as the explored nodal stations (11). The lymphadenectomy achieved by uniportal VATS can be even better than open approach thanks to the high definition. As more cases are treated with the single-port approach, the number of lymph nodes removed increases—thus reflecting improvement in the surgical technique. Delgado *et al.* report in their uniportal series, that the mean number of lymph nodes resected is greater than the mean number they reported by two or three port VATS (14.5 ± 7 vs. 11.9 ± 6.7) (12).

Equipment preference

The importance of the surgical instrumentation is crucial, as it helps to facilitate the surgeon and therefore to improve the quality of the lymphadenectomy. Instrumentation in VATS lymphadenectomy is vital because the surgeon works in a reduced space. A direct view is obtained, which makes the instrumentation easier as the view of the camera and the surgeon moving are in parallel.

In order to be able to perform a SND in our experience are needed:

- (I) 30° HD 10 mm thoracoscopy;
- (II) High definition monitor screen;
- (III) Curved suction;

- (IV) Energy devices;
- (V) Curved node grasper;
- (VI) Curved ring forceps;
- (VII) Sponge stick/Endo Peanuts.

Surgical technique

General aspects

The patient is placed in a lateral decubitus position. A 4-cm incision is performed in the fifth intercostal space in anterior position. The best location for the camera in the upper part of the incision and 3 or 4 instruments can be inserted below the camera to complete the SND, although often the dissection can be also completed by “no-touch technique” i.e., without retracting the lung and only using the tilting of the table to expose. The keys for an accurate lymphadenectomy in uniportal VATS are bimanual instrumentation and good exposition, which can be facilitated by rotating the table according to the position of the dissection area. For hilar lymphadenectomy, the rotation the operating table posteriorly permits the lung to drop posteriorly exposing the hilum. The anti-trendelenburg position is very helpful in the paratracheal dissection as it naturally makes the lung “fall down”. Whereas the trendelenburg position and the anterior table rotation facilitate the exposure for the subcarinal dissection. Preliminary division of the pulmonary ligament gives a better access to the subcarinal space and allows the removal of the lymph nodes in that area (station 9).

Although mediastinal LND is commonly performed after completion of the pulmonary resection, it can be done before lung removal under the drier operation field. The use of energy devices facilitates the dissection and reduces the rate of postoperative bleeding and lymphatic drainage.

Right lymphadenectomy

In the right paratracheal node dissection (station 2 and 4), all the mediastinal nodes and fat between trachea and cava vein should be ideally removed. We recommend opening the pleura inferiorly to the azygos vein and lifting the azygos vein, we anecdotally noted that the postoperative drainage is less in this way. The superior vena cava (SVC) is retracted anteriorly with an endoscopic peanut and the superior mediastinal fat is dissected from the lateral aspect of the SVC. The phrenic nerve is identified on the lateral border of the SVC. Then the mediastinal fat is retracted anteriorly and dissected from the vagus nerve and the



Figure 1 Dissection station 2 and 4 on the right hemithorax (13).

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trachea. At least the mediastinal fat and nodes are dissected from the innominate vein in caudal position (*Figure 1*).

The most challenging area in performing a mediastinal lymphadenectomy is probably the subcarinal space (station 7 right), as it is the deepest area. A longitudinal incision is made on the posterior mediastinal pleura between the right inferior pulmonary vein and the azygos vein. The small branches of the vagus nerve running into the lung are divided. To widen the subcarinal space, the oesophagus is retracted posteriorly by an endo peanut. The subcarinal fat with the nodes is then grasped by a lymph node grasper and dissected carefully from the oesophagus from one side and from the pericardium on the other side. The dissection is continued on the membranous portion of the intermediate bronchus toward the carina.

Paraesophageal and pulmonary ligament nodes (station right 8 and 9). The inferior pulmonary ligament contains the station 9 lymph nodes, which are normally dissected during the release of the ligament. The station 8 lymph nodes are dissected during exposure and division of the inferior pulmonary vein, but they are not always present.

Left lymphadenectomy

For the dissection of the aortopulmonary window space (station 5) and para-aortic nodes (station 6), usually it is necessary to retract the phrenic nerve to have a better exposure of the prevascular area. The vagus and phrenic nerves should be carefully preserved. A horizontal incision is made in the pleura just above the left main pulmonary artery. The aortopulmonary fat with the station 5 lymph nodes is grasped and retracted anteriorly and the dissection is continued until the exposure of the ligamentum arteriosum.

The recurrent laryngeal nerve must be carefully protected to avoid vocal cord paralysis. Then the fat containing station 6 lymph nodes is retracted posteriorly and removed.

Left subcarinal dissection (station 7 left). The mediastinal pleura is opened anterior and parallel to the descending aorta. The small branches of the vagus nerve running into the lung are divided. To widen the subcarinal space, the oesophagus is retracted posteriorly and the left main bronchus is retracted anteriorly using a sponge stick or another instrument like curved suction or endo peanuts. The dissection is easier if the working instruments are placed above the retracting instruments and below the camera. The subcarinal fat is then grasped and dissected from the oesophagus and from the membranous portion of the left main bronchus.

Station left 8 and 9. The procedure for the left side is same as that for the right side.

Tips, tricks and pitfalls

In the uniportal VATS it is helpful to give more than one use to the different instruments. For example, curved ring forceps are very useful to dissect and to pull the lymph nodes. The curved suction and sponge stick can be used to dissect and to expose the structures. The energy devices make the haemostasis easier and give a clean exposition of the area.

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aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patients for publication. A copy of the written consent is available for review by the Editors-in-Chief of this journal.

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