



Uniportal segmentectomy: an alternative for resection of deeply situated lung metastases

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Abstract: There is no high level of evidence that lung metastasectomy offers better outcome in terms of survival than non-operative treatment. Retrospective case series have identified some preoperative and postoperative risk factors for recurrence and survival that have impacted current practice. Indication for lung metastasectomy should be an individual decision, taken by multidisciplinary boards. However, once the decision for resection has been made, the surgeon has to figure out the best strategy to achieve complete resection with minimal harm to the patient. The least invasive procedure is therefore usually a combination of a minimally invasive access route with a lung-sparing resection technique. Multiport and especially uniportal video-assisted thoracoscopic surgery (VATS) are therefore ideal approaches from an access point of view. For metastases that cannot be removed by extra-anatomic resections, sublobar anatomic resections are an alternative to lobectomy. Combining the advantages of the uniportal access with the technique of the parenchyma sparing segmentectomy minimizes postoperative morbidity. We present this option, illustrated with 3 videos of cases undergoing uniportal segmentectomy for lung metastasis.

Keywords: Uniportal surgery; anatomic segmentectomy; metastasis

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Introduction

Even though lung metastasectomy of different primary cancers is part of daily practice of many thoracic surgeons, there is only limited evidence concerning the benefit of such operations for the patient (1). A survey among members of the European Society of Thoracic Surgeons showed that local control at primary tumor site and possibility of complete resection of lung metastases were widely accepted prerequisites for surgery (2). Apart from that, surgical approach and extent of resection must be tailored to the individual case (3). VATS-approaches seem to offer similar oncologic outcome with less morbidity for cases with singular lesion or up to three lung metastases (4). Mastering of a wide arsenal of surgical techniques allows the thoracic surgeon to choose the optimal strategy. Multiport and especially uniportal VATS segmentectomy can help solving challenging situations.

Since there is no clear evidence that lung metastasectomy positively influences the outcome of patients, indications for surgery should be taken in multidisciplinary oncological boards. Once the two aforementioned requisites are fulfilled, i.e., local tumor control at primary site and feasibility of complete resection of lung metastases, the patient must be checked for tolerance of the planned procedure. Relative criteria influencing the decision towards surgery also comprise the length of disease-free interval after treatment of the primary tumor site as well as the number of lung metastases (5). The histology of the primary disease has an influence on the outcome, whereas colorectal cancer is the best studied entity (6). Following strict indication criteria, some centers have shown long term survival rates of almost 30% at 10 years (7).

In recent years the focus was on safety of VATS approaches compared to thoracotomy (8). The advantages of the lesser invasiveness and lower risk of adherence

building preserve the possibility of the patient to undergo further metastasectomy. VATS has been criticized for the limited possibility of palpation of the lung during the procedure, leaving up to 20% of metastases unrecognized, but no difference in survival has been found so far (9,10). In an attempt to minimize trauma to the patients, even series with uniportal non-intubated approaches have been published (11).

Minimal invasive segmentectomy has much developed in recent years and metastasectomy represent up to 20% of the indications (12,13). Others before have recognized a niche for sublobar anatomic resections in metastatic lesions which cannot be resected by extra-anatomic resections and would otherwise make a lobectomy necessary (14).

Case presentation

Case 1

A 52-year-old patient with a history of squamous cell carcinoma of the larynx, treated by laryngectomy and neck dissection followed by sequential adjuvant radiotherapy and chemotherapy, presented one year later with a solitary lung nodule. The positron emission tomography combined with computed tomography (PET/CT) showed a 12 mm spiculated nodule in the ventral segment of the left upper lobe (S3, *Figure 1*) with a standardized uptake value (SUV) of 3.1. There were no signs of recurrence in the neck. The differential diagnosis includes metastasis of the head and neck cancer as well as bronchial carcinoma. Lung function tests were not possible due to previous laryngectomy, but the patient reported no limitations in daily activities and was otherwise fit for surgery. In order to allow for a complete resection of this centrally located nodule by at the same time offering an oncological sound option in case of non-small cell lung cancer, we proceeded to a uniportal S3-segmentectomy with mediastinal lymphadenectomy (*Figure 2*). The chest tube was removed on postoperative day (POD) 1 and the patient was discharged on POD 2. The final histology showed a 2.5 cm metastasis of the known squamous cell carcinoma of the larynx with free resection margins and 9 negative lymph nodes (Stations 5, 6, 7, 9, 10, 11, 12 and 13). The board for head and neck malignancy proposed to proceed with an adjuvant chemotherapy.

Case 2

A 35-year-old male patient presented with a 5 cm mass in

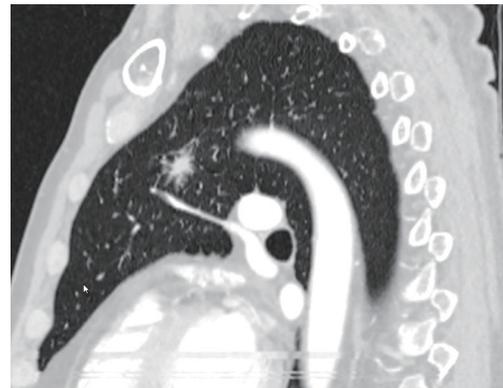


Figure 1 Sagittal CT-scan of patient 1 with spiculated nodule in left ventral upper lobe segment (S3).



Figure 2 Uniportal left anterior segmentectomy (S3) with near infrared imaging (ICG) for better identification of intersegmental plane (15).

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the left lower lobe (*Figure 3*). Three years previously he had undergone left orchidectomy followed by chemotherapy for a mixed form of a testicular tumor (seminoma and teratoma). The CT-scan showed the lesion in the posterobasal segment (S10) of the left lower lobe with no other signs of tumor manifestation. Lung function tests were normal with a forced expiratory volume in the first second (FEV1) of 117%. Upon discussion in the board for thoracic malignancy we proceeded to the S10-segmentectomy with en-bloc resection of lymph node station 8 and mediastinal lymphadenectomy (*Figure 4*). The chest tube was removed on POD 2 and the patient was discharged the same day. Histopathology revealed a rhabdomyosarcoma in form of a somatic transformation of the teratoma after chemotherapy with free margins of more than 2 cm. There were 4 negative

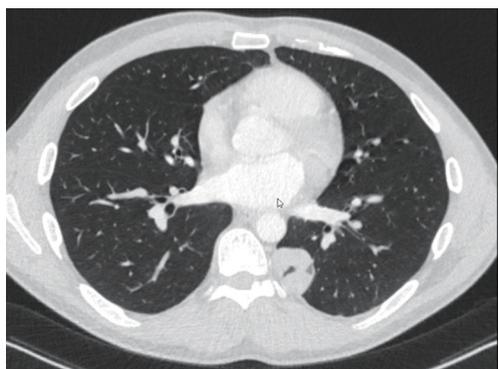


Figure 3 Axial CT-scan of patient 3 with mass in left posterobasal lower lobe segment (S10).



Figure 4 Unilateral left posterobasal segmentectomy (S10) with “en-bloc” lymphadenectomy (8+9) and accessory port for better stapling angle (16).

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lymph nodes in the en-bloc resected station 8, and 11 more in stations 6, 7, 9, 11 and 13. The case was discussed in the board for sarcoma. Since evidence for usefulness of adjuvant chemotherapy is lacking, no formal treatment was proposed besides follow-up.

Case 3

A 50-year-old female patient had undergone resection of a retroperitoneal leiomyosarcoma 3 years earlier. Twelve months ago retroperitoneal recurrence of the leiomyosarcoma was treated with neoadjuvant radiotherapy followed by *en-bloc* resection of the tumor, the right kidney, adrenal gland and gallbladder. The current follow up CT-scan showed a solitary 14 mm round lesion in the laterobasal segment (S9) of the left lower lobe, consistent with a lung

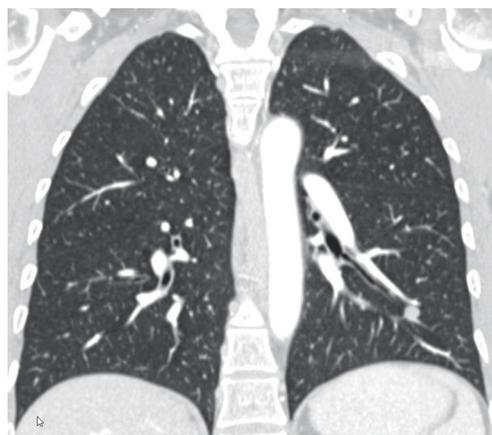


Figure 5 Coronal CT-scan of patient 2 with round nodule in left laterobasal lower lobe segment (S9).

metastasis, and no other signs for recurrence (*Figure 5*). The board for sarcoma proposed a metastasectomy. The FEV1 was 109% and the patient was fit for surgery. Due to the central location of the nodule we performed a unilateral S9-segmentectomy (*Figure 6*). The chest tube was removed on POD 1 and the patient was discharged home on POD 2. Histopathology confirmed a metastasis of the leiomyosarcoma with free resection margins. There were 9 negative lymph nodes (Stations 6, 7, 9, 10, 11 and 12). The board for sarcoma recommended no adjuvant treatment and to pursue the CT-scan follow up.

Tips and tricks

- ❖ Use of a soft wound protector minimizes spilling of the camera.
- ❖ Intercostal, subpleural nerve blockage with long lasting local anesthetic provides good pain control for the first 24 h (*Figure 7*).
- ❖ Camera with 30° optic is held by the 1st assistant.
- ❖ Gentle constant aspiration on the operated lung can help deflate the lung (especially in case of relevant air trapping or of use of a bronchial blocker).
- ❖ Distal preparation of the vessels (arteries and veins) far into the parenchyma is mandatory for reliable anatomic identification.
- ❖ Thorough lymphadenectomy up to segmental station 13 helps identify the sublobar structures.
- ❖ Polymer locking ligation system (Hem-o-lok) combined with energy devices allows more flexibility for section of small vessels.



Figure 6 Uniportal left laterobasal segmentectomy (S9) with near infrared imaging (ICG) for confirmation of correctness of segmental artery and identification of intersegmental plane (17).

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Figure 7 Intercostal, subpleural nerve blockage with long lasting anesthetic (18).

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- ❖ Near infrared imaging with systemic injection of indocyanine green can be used:
 - ♦ to confirm correctness of segmental artery (*Figure 6*).
 - ♦ to identify the intersegmental plan (especially in mono-segmentectomy of the basilar pyramid) (*Figures 2,6*).
 - ♦ can be repeated safely.
- ❖ An accessory port for stapling is useful in some rare cases.

Conclusions

The technique of uniportal segmentectomy is a good and safe, minimally invasive as well as lung-sparing technique

for the resection of centrally located metastasis. In many of these cases also a less demanding surgical resection in form of a ‘wide-wedge’ would be possible, but at the prize of more resected lung parenchyma as well as a reduced control of resection margins. Finally uniportal surgery probably provokes less pleural adherences leaving options of redo-surgery for metachronous metastasis open.

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Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

Informed Consent: Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

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