

Total video-assisted thoracoscopic (VATS) resection of a left-sided sulcus superior tumor after induction radiochemotherapy: video and review

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Abstract

Background Video-assisted thoracoscopic surgery (VATS) has gained increasing acceptance for surgical therapy of early stage non small cell lung cancer (NSCLC). Even for extended pulmonary resections in advanced tumor stages, increasing evidence suggests feasibility and safety of the VATS approach. However, so far very little experience has been reported on VATS management of sulcus superior tumors.

Methods We report on a 56-year-old female patient with a left-sided anterior sulcus superior adenocarcinoma (cT3 cN1 cM0), which was completely resected by VATS after induction radiochemotherapy.

Results The surgical procedure was performed completely minimally invasively via a three-incision anterior thoracoscopic approach. The total operating time was 285 min (composed of 116 min for hilar lobectomy, 103 min for sulcus superior preparation and chest wall resection, and 26 min for systematic en-bloc lymph node dissection). The single chest tube was removed on postoperative day two and the patient was discharged on postoperative day six. No intraoperative and no postoperative complications were observed. Histopathology confirmed a complete (R0) resection of an ypT2aN0M0 bronchogenic adenocarcinoma.

Conclusion With increasing experience even extended pulmonary resections are safe and feasible by a video-assisted thoracoscopic approach. We propose that in sulcus superior tumors without tumor invasion of vascular structures VATS can be considered.

Keywords Video-assisted thoracoscopic surgery · VATS · Pancoast tumor · Sulcus superior tumor · Lung cancer · NSCLC

Pancoast tumors, i.e., tumors of the sulcus superior, represent less than 5 % of all bronchogenic carcinomas. Due to their origin in the apex of the lung, Pancoast tumors involve the apical chest wall and are commonly adjacent to or even infiltrate vascular and neural structures of the thoracic inlet [1]. Histologically the majority are bronchopulmonary adenocarcinomas. Several surgical approaches have been established, which provide excellent access to anterior and posterior sulcus superior tumors [1]. However, they all cause significant tissue trauma and bear the risk of ongoing postoperative discomfort and dysfunction [2]. Minimally invasive surgical approaches so far have only played a subsidiary role in the surgical treatment of sulcus superior tumors like for thoracoscopic guidance of chest wall resection or for hilar dissection in hybrid approaches [3, 4]. No reports on the feasibility of a complete video-assisted thoracoscopic surgery (VATS) resection of sulcus superior tumors have been published so far.

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Case report

A 56-year-old female patient was admitted to our hospital for coughing and neurologic symptoms in the left branch. Initial radiographic imaging showed evidence of a left-

sided sulcus superior tumor. Staging was completed with positron emission tomography with computed tomography (PET-CT), showing a tumor (cT3 cN1 cM0), with contact to the aortic arch. Bronchoscopy with biopsy confirmed a broncho-pulmonary adenocarcinoma. Following the institutional protocol for tumors of the sulcus superior, the patient received induction radiochemotherapy (50, 4 Gray and Cisplatin + Vinorelbine). Re-staging after 4 months showed partial tumor response and the patient was scheduled for surgery by means of VATS.

Total operating time was 285 min, composed of 116 min for left upper lobectomy, 103 min for dissection of the sulcus superior tumor off the chest wall, vessels, and plexus, and 26 min for systematic lymph node dissection.

Operation started with the hilar control of the left upper lobe structures (segmental arteries, left upper pulmonary vein, and left upper lobe bronchus) in order to achieve optimal mobilization of the lobe for the dissection of the superior sulcus. Up at the sulcus superior, the parietal/mediastinal pleura was incised with the cautery hook circumferentially distant to the adjacent lung apex. Since no ribs were affected, a partial (soft tissue) chest wall resection was performed in order to mobilize the lung apex, starting from postero-laterally. Proceeding from anteriorly, a macroscopically clear plane was followed to dissect the apex off the subclavian vessels and the brachial plexus. Dissection was performed partially with the cautery hook and partially bluntly with an endo-kittner or the thoracoscopic suction device. The procedure was completed with the systematic lymph node dissection, starting in the lower mediastinum (ATS levels 7, 8, and 9), followed by the hilar (ATS 10) and interbronchial (ATS 11) levels, and ending with dissection of the upper mediastinal lymph nodes (ATS 4, 5, and 6) [5]. Histopathology confirmed complete (R0) tumor resection of an ypT2a pN0 L0 V0 G3 adenocarcinoma of the lung with less than 10 % of vital tumor cells (tumor regression grade IIb) [6].

No intraoperative and no postoperative complications were observed. The chest tube was removed on postoperative day two and the patient was discharged home at postoperative day six. Six months follow-up has shown no evidence of local or distant tumor recurrence.

Discussion

VATS has gained increasing acceptance not only for pulmonary lobectomies but also for more challenging procedures like sublobar resections in early stage lung cancer [7–11]. Recently, some series have suggested that VATS is a safe approach even for the treatment of advanced tumors (stage IIIA NSCLC) in which induction therapy and

extended procedures like bronchial sleeve resections are indicated [8, 12]. Compared to conventional open surgery, the VATS approach provides better functional outcome [13]. Large series and meta-analyses have shown better postoperative results after VATS, indicated by improvements in postoperative complication rate, shorter chest tube duration and hospitalization [14, 15]. A lower complication rate and surgical trauma contribute to an improved quality of life and earlier recovery after VATS compared to open approaches as shown consistently by Demmy et al. and Aoki et al. [16, 17]. Furthermore, large meta-analyses indicate that the systemic recurrence rate might be lower and the long-term survival might be improved after VATS in early stage NSCLC compared to open approaches [15, 18, 19].

Despite the increasing adoption of VATS even for challenging surgical procedures like pneumonectomies and vascular or bronchial sleeve resections, this approach so far has been very rarely applied for sulcus superior tumors [20–24]. A potential reason might be that in contrast to technically rather simple lateral chest wall resections, Pancoast tumors warrant for delicate dissection in a difficult to reach anatomic region with various vulnerable structures [25].

Therefore, VATS in Pancoast tumors so far had been primarily applied as part of hybrid procedures, where the hilar lobar structures were controlled by VATS in order to spare a thoracotomy, while the sulcus superior dissection was performed via an open approach or as an adjunct approach for exploration of the pleural cavity and additional guidance during the surgical resection of the chest wall [3, 4, 26, 27]

Our video proofs the VATS approach as being feasible and safe also for sulcus superior dissection in selected patients, in who no vascular reconstructions are indicated. VATS provides excellent view to the thoracic inlet and its vulnerable structures and thus enables for a precise and safe dissection. Although not performed in this case, even first rib resections were shown to be safe and feasible by means of VATS, suggesting that a bony chest wall infiltration is not a strict contraindication for a VATS approach [25]. This case demonstrates that the ongoing technical (instruments) and surgical (increasing experience) progress of VATS enables its gradual adoption to more complex surgical procedures and thus allows an increasing number of lung cancer patients to benefit from a minimally invasive approach.

Disclosures Martin Reichert, Stefanie Kerber, Anca-Laura Amati and Johannes Bodner have no conflicts of interest or financial ties to disclose.

Informed consent Informed consent was obtained from the patient for publication of the clinical course and operation video.

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