S\textsuperscript{1} segmentectomy for early stage NSCLC in the apical segment of the right upper lobe

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Abstract: In the last years, the role of segmentectomy for the treatment of patient with early stage lung cancer is gaining more and more importance. Compared to lobectomy, performing a segmentectomy needs more surgical experience and anatomical knowledge, in particular if individual upper and lower lobe segmentectomies are considered. Here, we present a case of a patient with a minimally invasive adenocarcinoma (MIA) in the S\textsuperscript{1} segment of the right upper lobe treated with an apical (S\textsuperscript{1}) segmentectomy. A 54-year-old female patient came to our attention with a chest CT-scan finding of an 8.8 mm subsolid nodule in the S\textsuperscript{1} segment of the right upper lobe. As we considered the lesion highly suspicious of early stage lung cancer, a surgical excision was proposed. A right S\textsuperscript{1} segmentectomy by minimally invasive approach was performed. The post-operative course was uneventful, and the patient was discharged on the 4\textsuperscript{th} post-operative day. Final histopathological examination revealed a MIA of the lung, staged as pT1miN0M0. In the treatment of patients with early stage lung cancer located in S\textsuperscript{1} segment of the right upper lobe, video-assisted thoracoscopic surgery (VATS) S\textsuperscript{1} segmentectomy represents a safe and radical therapeutic procedure which allows to spare the remaining segments of the right upper lobe.

Keywords: Video-assisted thoracoscopic surgery (VATS); VATS segmentectomy; sublobar resection; segmentectomy; lung cancer

Introduction

Lobectomy together with lymph node dissection or systemic sampling has been considered the standard procedure for patients with early stage lung cancer (1). Limited resections such as wedge resection or segmentectomy are only considered in high-risk patients with compromised functional status. However, with the introduction of high-resolution computed tomography (HRCT) screening, detection of small-sized (<2 cm) ground glass opacities (GGO) suggestive of adenocarcinoma in situ (AIS) or minimally invasive adenocarcinoma (MIA) has significantly increased in recent years (2,3). Considering the relatively indolent nature of the disease and the rarity of lymphatic involvement, there has been a reviving interest in sublobar resections such as segmentectomies (4). A significant number of reports comparing lobectomy and segmentectomy has appeared, showing that segmentectomy may be oncologically equivalent to lobectomy in terms of recurrence and survival for early stage lung cancers without nodal involvement (5-9). In addition, segmentectomy was certainly an acceptable procedure for patients with metastatic lung lesions arising from other malignancies such as colon cancers (10,11) and non-malignant diseases, such as severe haemoptysis (12), pulmonary arteriovenous fistulas (13), congenital bronchial arteria (14), intralobar pulmonary sequestration (15), inflammatory pseudotumors (16).

Video-assisted thoracoscopic surgery (VATS) has been well established as the recommended surgical approach for
A 54-year-old female patient presented a year and half ago with an 8.8 mm mixed GGO in the S^1 segment of the right upper lobe detected on CT scan for physical check-up. She was in good clinical condition, with no smoking history and no significant past clinical history. The nodule remained almost unchanged on follow-up CT scans. Although her serum tumor markers were within normal range, PET scan showed a slight FDG uptake. Early stage lung cancer was suspected, and surgical excision was suggested to remove the lesion for treatment and diagnosis. Informed consent of the patient was acquired before surgery. Considering that the lesion was a subsolid nodule less than 1 cm and with a slow growth pattern, a S^1 segmentectomy instead of a standard right upper lobectomy was proposed. Two hours before the operation, a hook wire was inserted percutaneously into the lesion under CT-guidance. After induction and a double-lumen intubation, the patient was placed in a left decubitus position, with her right arm abducted and suspended on a frame above her head. A routine three-port VATS approach was selected. In the Figure 1, we show the surgical procedure. First, a camera port was created in the mid-axillary line in the 7th intercostal space, and a 10-mm 30-degree thoracoscope was introduced through an ordinary trocar for exploration. Under the guidance of the camera, a 4 cm working port in the anterior axillary line in the 4th intercostal space, and a 2 cm assisting port in the posterior axillary line in the 8th intercostal space were created. Upon exploration, the lesion was confirmed to be located in the middle of the S^1 segment according to the position of the hook wire. Therefore, we proceeded with the planned S^1 segmentectomy believing that sufficient resection margin could be obtained. First, the hilum of the right upper lobe was exposed with a harmonic scalpel, to reveal anteriorly the superior pulmonary vein and the truncus superior artery with its branches to the anterior (A^1) and apical (A^3) segments, and posteriorly the bifurcation between the upper lobar bronchus and the intermedius bronchus. An important trick is to expose the vessels of the targeted segment as distally as possible, so that the lung could be removed together with the hilar structures and to make an anatomical segmentectomy instead of a big wedge resection. This will also help to achieve a maximum resection margin. The vein for the apical segment of the RUL (V^3) was ligated with suture tie and a hemolock cordially, and then closed with a hemolock as distally as possible. So, when V^3 was divided with harmonic scalpel, the pulmonary artery branch to the anterior segment (A^3) could be clearly exposed and protected. Double ligation with suture and hemolock is preferred over stapling devices during segmentectomies, as it not only reduces cost, but also saves time and it helps

Patient and methods

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to avoid accidental injuries often associated with passing a stapler around the vessels. Identifying pulmonary arteries for the apical segment of the RUL could be quite tricky, as sometimes there is a recurrent branch to the posterior segment (Rec. A1) originating from the truncus superior artery. But, when the ventral branch of A1 (A1b) was first divided, differentiating the dorsal branch of A1 (A1a) from a recurrent A1 becomes much easier. A recurrent A1 usually runs away from B1, while A1a runs along it into the S2 parenchyma. In this case there was no recurrent A1 and A1a was then divided in a similar way to A1b. After removing the lymph nodes (station 12) between the pulmonary artery and the upper lobe bronchus, the apical segmental bronchus (B1) could then be exposed. But, before dividing B1, it is always important to double-check if it is indeed the correct bronchus to the apical segment. To do this, B1 was clamped with a stapler in place and the right lung was inflated by the anaesthesiologist. The S1 segment would remain collapsed while the rest of the right upper lobe (S1 and S3) would re-expand. After, the stapler was fired to divide B1. Then, the distal end of B1 was lifted with a sponge clamp and the surrounding lung parenchyma was dissected away from the hilum along the preserved neighbouring structures (A1 and B1). After hilum dissection had been completed, the anaesthesiologist was asked to inflate the right lung again. This helped to create a clear inflation-deflation line between the S1 to be resected and the inflated remaining lung. When technically possible, it is also helpful to use the intersegmental pulmonary vein to guide the cutline between S1 and S2. Then, S1 was resected with endoscopic staplers. To do this, the anvil of the stapler was placed right in between the divided stumps of the hilar structures (bronchus and vessels), and the cartridge was oriented along the inflation-deflation line in the surface of the lung. Before the first and second fire, anaesthesiologist was again asked to inflate the lung to avoid inadvertent injury to the neighbouring segmental bronchus. Finally, the resected segment was removed in an endoscopic retrieving bag through the working port and sent for frozen section. For small, subsolid lesions, systemic lymph node dissection is not necessary because of a very low involvement rate. So, only hilar and superior mediastinal nodes were sampled for the staging purpose.

Role of members of our multi-disciplinary team

The members of our multi-disciplinary team include: nurses, radiologists, anaesthesiologists, assistant holding the thoracoscope (usually a junior surgeon in training), assistant surgeon and main surgeon. Radiologists are important during the analysing process of the CT scan and then, if necessary, to mark the nodule by inserting the hook wire in the pulmonary lesion. The anaesthesiologist is clearly important to ensure a good general anaesthesia of the patient, a good selective bronchial intubation and finally a good coordination with the surgeon during the re-expansion of the lung, to guarantee a good inflation-deflation line between the segment to remove and the remaining lung. The anaesthesiologist can also help the surgeon to localize the targeted segmental bronchus using a flexible bronchoscope.

The three surgeons, with different roles, are clearly important to perform the surgical resection of the pulmonary segment, in a constant process of interaction during the entire surgical procedure.

Results

The post-operative course was uneventful, and the patient was discharged on the 4th post-operative day. Final histopathological examination revealed a MIA of 8 mm, staged as pT1miN0M0 according to the 8th UICC staging system. No additional treatment was considered necessary and the patient was put under routine follow-up.

Conclusions

S2 segmentectomy represents a safe and acceptable therapeutic procedure for small, low grade, early stage lung cancers and other metastatic or benign lesions located in the peripheral part of the apical segment of the right lung. Comparing to wedge resection, it helps to ensure enough resection margin and the removal of intersegmental and hilar lymph nodes; comparing to a standard lobectomy, it may also diminish pulmonary function loss by sparing lung parenchyma. The combination of limited resection and minimally invasive approach is thus beneficial to selected patient, when surgical and oncological principles could be observed.

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None.

Footnote

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

Informed Consent: Informed consent of the patient was acquired before surgery.

References


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