



Uniportal video-assisted thoracoscopic surgery segmentectomy

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Abstract: Lobectomy was considered as the standard of care for lung cancer resection since 1995. In the past decade, segmentectomy has gained increasing popularity as a good alternative for stages 1A1 and 1A2 lung cancer patients, achieving the dual goals of a curative lung cancer operation and lung function preservation. The entity of multiple primary lung cancer (MPLC) and its significance are discussed. Important preoperative, intraoperative, and postoperative considerations for segmentectomy are outlined. Three cases are discussed to illustrate key concepts. In properly selected patients, an anatomical segmentectomy with proper bronchovascular dissection and good resection margins should be performed. Full nodal dissection of N1 and N2 lymph nodes must be performed in order to ascertain full pathological staging to guide further treatment. Uniportal video-assisted thoracoscopic surgery (UVATS) segmentectomy can be performed on all lung segments, and allows for full and early functional recovery.

Keywords: Uniportal; video-assisted thoracoscopic surgery (VATS); uniportal VATS (UVATS); segmentectomy

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The case for lobectomy

Lobectomy was established as the standard of care for lung cancer resection since Dr. Ginsberg published his landmark article in 1995 (1). Limitations of this study include the small sample size of about 120 patients in each arm, and the combining of wedge resection and segmental resection into a single category of limited resection. Since then, many studies have been performed to show the role of segmentectomy as a definitive treatment for lung cancer in selected patient populations.

Multiple primary lung cancer (MPLC)

The disease pattern of lung cancer is changing. Adenocarcinomas are becoming more common, and lung cancer incidence is rapidly rising in non-smokers. In Asia, we are seeing more frequently patients with MPLC who are never-smokers. A case in point was a 69-year-old gentleman who had coronary artery disease and was found to have a 1.6 cm ground glass opacity (GGO) with solid component

in the right lower lobe. There were also multiple other GGOs in the lung bilaterally of various sizes (*Figure 1*). This patient underwent coronary artery bypass surgery followed by uniportal video-assisted thoracoscopic surgery (UVATS) lobectomy of the right lower lobe. Multiple other GGOs in the right lung were also resected concurrently. He was found to have a total of nine separate primary lung adenocarcinomas ranging in size from 1 to 16 mm (*Figure 2*). These were all completely resected and the patient has no recurrence or progression at 2-year follow up.

The case for segmentectomy

It is clear that early resection of lung cancer offers a survival advantage; with worsening survival as the lung cancer becomes larger. The increasing prevalence of patients with MPLC illustrates the need for early complete resection of lung cancers while preserving lung. Key considerations for segmentectomy preoperatively, operatively, and postoperatively were summarized (*Tables 1-3*).

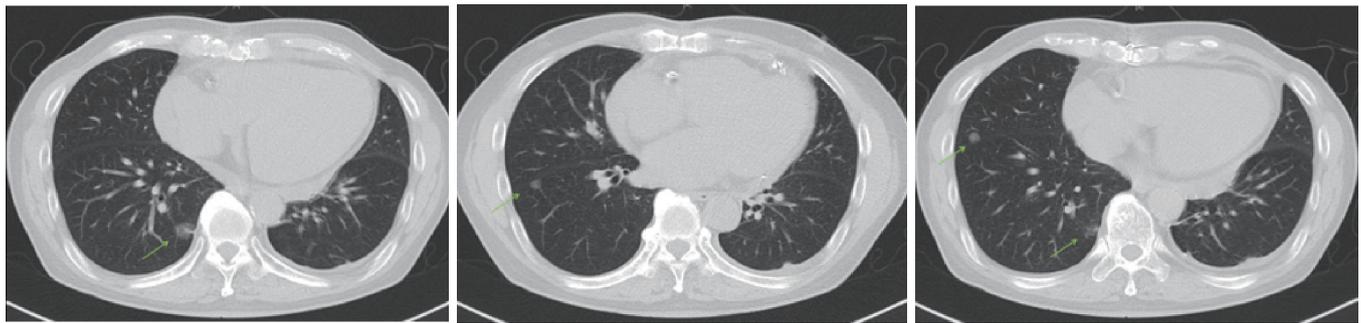


Figure 1 CT thorax of a 69-year-old gentleman with multiple primary lung cancers.

- Multifocal adenocarcinoma (x9), predominantly lepidic, size 0.1 to 1.6 cm
- No lymphovascular invasion or pleural invasion
- Resection margins are free of tumour involvement (see text)

(G-K) Right inferior pulmonary ligament, interlobar, subcarinal and paratracheal lymph nodes, biopsies:
 - 15 lymph nodes with no evidence of malignancy (0/15)

Figure 2 Histology report of a 69-year-old patient with multiple primary lung cancers (MPLC).

Table 1 Key preoperative considerations for segmentectomy

Histology and grade
Size and solid component
Location— which lobe/segment
Lung function
Presence of lung diseases such as ILD
SUV
Age—advanced octogenarians (where 5-year survival is impactful) or young (with many years still ahead for further changes)
Multiple comorbidities

ILD, interstitial lung disease; SUV, standardized uptake value.

Table 2 Key operative considerations for segmentectomy

Anatomical resection
Adequacy of margins
Adequacy of nodal evaluation and dissection, including especially peribronchial, hilar, and mediastinal nodes
Translating to:
Completeness of resection & accurate histological staging

Table 3 Key postoperative considerations for segmentectomy

Curative resection
Both cancer free survival & overall survival
Preserving function and minimizing suffering
Full recovery back to normal life

Case presentations of UVATS segmentectomy

Case 1

A 53-year-old gentleman who never smoked was found to have a speculated lung mass in the anterior segment of the right upper lobe, and two GGOs in the left lingua (*Figure 3*). He underwent sequential UVATS right upper lobe anterior segmentectomy followed by UVATS left upper lobe lingulectomy. Complete mediastinal nodal dissection was performed each time. Ninety percent of his lung volume was preserved. Histology showed 1.6 cm adenocarcinoma in the RUL anterior segment, and a 1.1 cm adenocarcinoma and a 0.4 cm adenocarcinoma in situ (AIS) in the lingula (*Figure 4*). All lesions were completely resected and chest radiograph showed well expanded lung fields bilaterally (*Figure 5*).

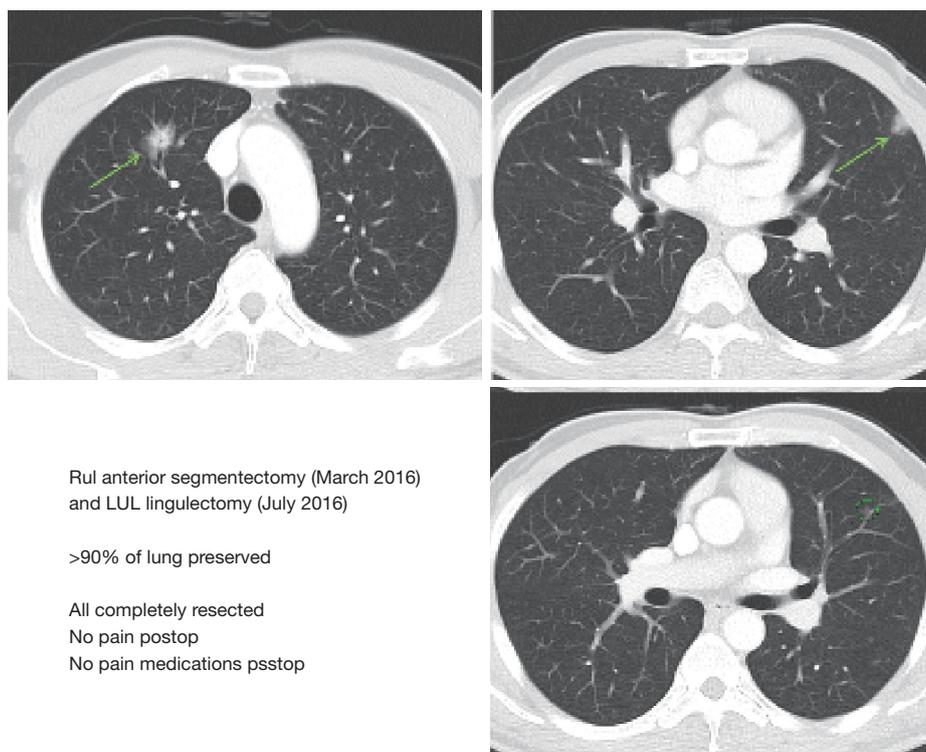


Figure 3 Case 1—CT thorax of a 53-year-old gentleman with bilateral lung cancers.

Histology – Right lung

Diagnosis

- (A) Lung, right upper lobe anterior segment, resection:
- Adenocarcinoma, predominant acinar pattern, measuring 1.6 cm
- Resection margins are not involved
- (B) Right paratracheal lymph node, excision:
- Two lymph nodes with no malignancy (0/2)
- (C) Peribronchial lymph node, excision:
- Five lymph nodes with no malignancy (0/5)
- (D) Hilar lymph node, excision:
- One lymph node with no malignancy (0/1)
- (E) Paraesophageal lymph node, excision:
- Two lymph nodes with no malignancy (0/2)
- (F) Subcarinal lymph node, excision:
- One lymph node with no malignancy (0/1)
- (G) Interlobar lymph node, excision:
- One lymph node with no malignancy (0/1)

Summary

RUL – 1.6 cm adenocarcinoma

LUL – 1.1 cm adenocarcinoma, and 0.4 cm adenoca-*in-situ*

Histology – Left lung

Diagnosis

- (A) Left lung, lingular segment, resection:
- Lepidic predominant adenocarcinoma, well-differentiated, size 1.1 cm
- Tumour is surrounded by lung and visceral pleura
- Adenocarcinoma *in-situ*, size 0.4 cm
- No lymphovascular invasion seen
- Resection margins free of tumour
- (B) Interlobar lymph node (1):
- One lymph node, negative for malignancy (0/1)
- (C) Interlobar lymph node (2):
- One lymph node, negative for malignancy (0/1)
- (D) Aortic pulmonary lymph node:
- One lymph node, negative for malignancy (0/1)
- (E) Inferior pulmonary ligament lymph node:
- One lymph node, negative for malignancy (0/1)
- (F) Peribronchial lymph node (s):
- Three lymph node fragments, negative for malignancy
- (G) Left lower lobe lymph node:
- One lymph node, negative for malignancy (0/1)

Figure 4 Histology of bilateral UVATS segmentectomy. UVATS, uniportal video-assisted thoracoscopic surgery.

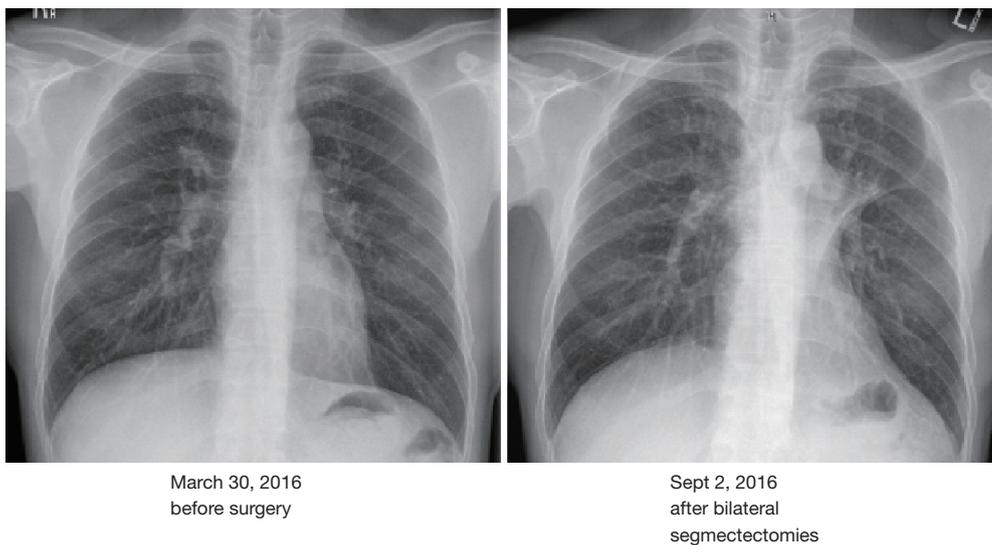


Figure 5 Chest radiograph after bilateral UVATS segmentectomy. UVATS, uniportal video-assisted thoracoscopic surgery.

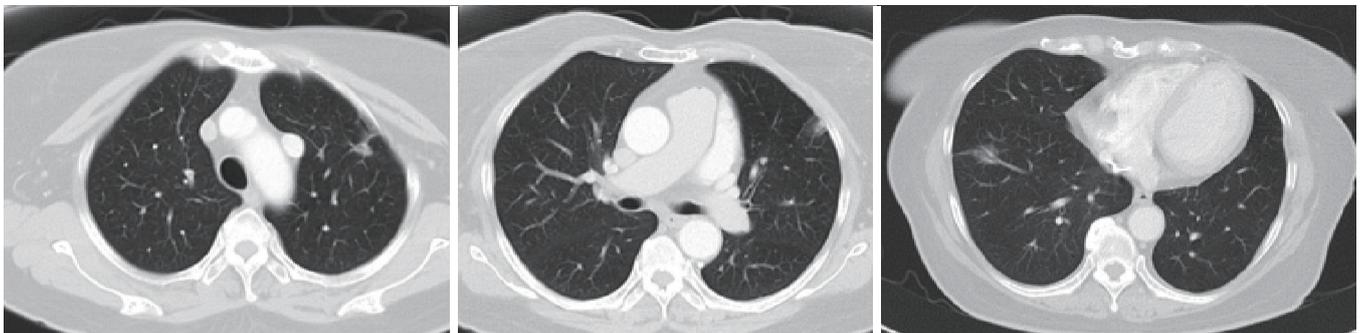


Figure 6 Case 2—CT thorax of a 68-year-old lady with 2 nodules in the left upper lobe and one nodule in the right lower lobe anterolateral basal segment.

Case 2

A 68-year-old lady who has never smoked with past medical history of diabetes, hypertension, hyperlipidemia, sick sinus syndrome with pacemaker was found to have two lung nodules in the left upper lobe and a GGO in the anterolateral basal segment of the right lower lobe (*Figure 6*). She underwent UVATS left upper lobectomy followed by UVATS right lower lobe anterolateral basal segmentectomy. Complete mediastinal nodal dissection was performed during each operation. The upper lobe nodules were found to be two separate primaries (2.1 cm lepidic and papillary adenocarcinoma, and 0.8 cm mucinous adenocarcinoma), and the right lower lobe nodule in the anterolateral basal segment was found to be a 1.7 cm non-mucinous AIS. There were no nodal metastasis and all tumors were completely resected (*Figure 7*).

Case 3

A 79-year-old gentleman was found to have a 3.3 cm mass in the posterior segment of the right lower lobe. PET scan showed mild avidity with SUV 3.2 (*Figure 8*). He underwent UVATS right upper lobe posterior segmentectomy and mediastinal nodal dissection. Histology showed a 3.3 cm typical carcinoid tumor with mitotic activity less than 1 per 2 mm². All nodes were negative and the tumor was completely resected.

Conclusions

UVATS segmentectomy with true anatomical dissection and complete nodal dissection may be considered for:

- ❖ Lesions ≤ 2 cm for adenocarcinoma, minimally

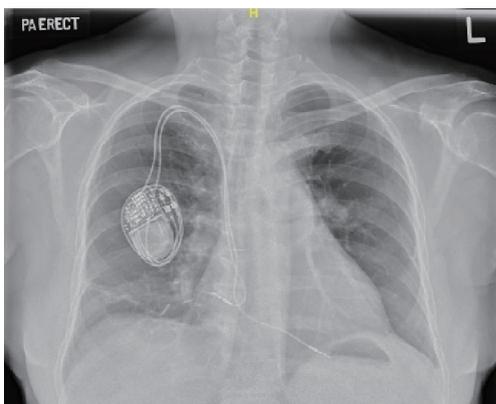


Figure 7 Case 2—postoperative chest radiography of patient post UVATS LUL lobectomy and UVATS RLL anterolateral basal segmentectomy. UVATS, uniportal video-assisted thoracoscopic surgery; LUL, left upper lobe; RLL, right lower lobe.

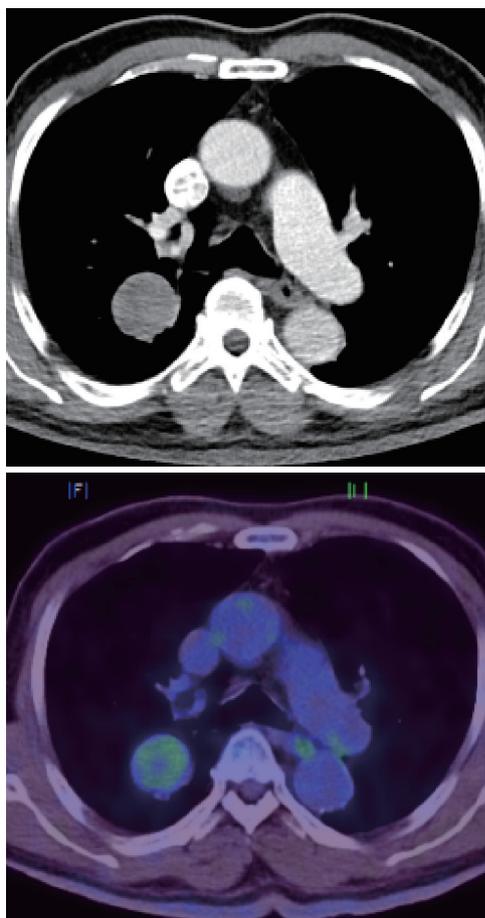


Figure 8 Case 3—CT thorax and PET scan image of a 79-year-old gentleman with 3.3 cm tumor in the posterior segment of the right upper lobe.

invasive adenocarcinoma (MIA), AIS;

- ❖ Especially for lesions with lepidic pattern, low SUV (<3.3), or low-grade neoplasm such as typical carcinoid tumor;
- ❖ No known nodal metastasis (cN0);
- ❖ Patients with multiple lung lesions who may require multiple resections now or in the future;
- ❖ Especially for patients with advanced age, poor/borderline lung function, or multiple comorbidities;
- ❖ In properly selected patients, UVATS segmentectomy allows the achievement of complete resection with good anatomical margin, full pathological staging, and lung parenchymal sparing resulting in full and early functional recovery.

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Footnote

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