

# Non-intubated uniportal left-lower lobe upper segmentectomy (S6)

Carlos Galvez<sup>1</sup>, Jose Navarro-Martinez<sup>2</sup>, Sergio Bolufer<sup>1</sup>, Julio Sesma<sup>1</sup>, Francisco Lirio<sup>1</sup>, Maria Galiana<sup>2</sup>, Maria Jesus Rivera<sup>2</sup>

<sup>1</sup>Department of Thoracic Surgery, Hospital General Universitario Alicante, Alicante, Spain; <sup>2</sup>Department of Anesthesiology and Surgical Critical Care, Hospital General Universitario Alicante, Alicante, Spain

Correspondence to: Carlos Galvez, MD. Department of Thoracic Surgery, Hospital General Universitario Alicante, Alicante, Spain.

Email: carlos.galvez.cto@gmail.com.

**Abstract:** Worldwide accepted indications of anatomical segmentectomies are mainly early stage primary adenocarcinomas, pulmonary metastasis and benign conditions. Their performance through uniportal VATS has become more and more popular due to the less invasiveness of the whole procedure under this approach. Recently, many efforts have focused on non-intubated spontaneously breathing management of lobectomies and anatomical segmentectomies, although specific selection criteria and main advantages are not completely standardized. In a 62-year-old thin man with two pulmonary residual metastasis from sigma adenocarcinoma, after chemotherapy plus antiangiogenic treatment, we indicated a single-incision video-assisted left-lower lobe (LLL) upper segmentectomy (S6) under spontaneous breathing and intercostal blockade. Total operation time was 240 minutes. Chest tube was removed at 24 hours and the patient was discharge on postoperative day 2 without any complication. Non-intubated uniportal VATS is a safe and reasonable approach for lung-sparing resections in selected patients, although more evidence is required for selecting which patients can benefit more over standard intubated procedures.

**Keywords:** Thoracoscopy/VATS; lung cancer surgery; anesthesia

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## Introduction

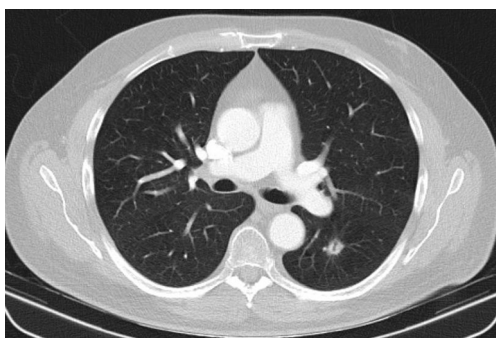
Although considered inferior to lobectomy in the treatment of primary lung cancer during many years, anatomical segmentectomies have been recently included as an alternative treatment in specific subtypes of primary lung adenocarcinomas (1). Secondly, more interest has been focused in sublobar resections for many indications such as benign conditions, pulmonary metastasis and those subtypes of early stage primary adenocarcinoma (2-6). Although initially considered challenging, non-intubated anatomical segmentectomies have gained popularity in the last 5 years, mainly in Asia where anatomical patient features and a different pattern in non-small cell lung cancer (NSCLC) have allowed an evolution in non-intubated sublobar resections (7,8). Here we report a non-intubated uniportal VATS left-lower lobe (LLL) upper segmentectomy after

chemotherapy within a two-stage treatment of bilateral pulmonary metastasis.

## Case presentation

A 62-year-old man with history of arterial hypertension, diabetes mellitus and previous smoker, was treated for a sigma adenocarcinoma in 2011 with surgery, and received adjuvant chemotherapy. After 24 months of follow-up, bilateral pulmonary nodules and mediastinal lymph nodes appeared, and after a first negative biopsy, in 2014 a new fine-needle biopsy evidenced pulmonary metastasis, so chemotherapy plus antiangiogenic treatment were administered, and with evidence of stable disease and two PET positive residual pulmonary nodules in right-upper lobe (RUL) and LLL (*Figure 1*), surgery of both lesions was indicated.

As the RUL was initially accessible for a wedge resection,



**Figure 1** 15-mm central metastasis of intestinal adenocarcinoma in the upper segment (S6) of the left-lower lobe.



**Figure 2** Video-assisted intercostal blockades with Bupivacaine (9). Available online: <http://www.asvide.com/articles/1442>



**Figure 3** Video-assisted vagal blockade with Bupivacaine (10). Available online: <http://www.asvide.com/articles/1443>

LLL nodules was approached first. The patient was not obese (BMI 25), had normal FEV1 and DLCO values, and without anatomical limitations, we suggested a non-intubated uniportal VATS S6 LLL anatomical segmentectomy in April



**Figure 4** Anatomical upper segmentectomy of the left lower lobe through uniportal VATS in a spontaneously breathing patient (11). Available online: <http://www.asvide.com/articles/1444>

2016. Deep sedation was achieved with remifentanyl infusion 0.05–0.1 µg/kg/min and intravenous bolus of 1–2 mg of midazolam. Routine monitoring and BIS™ Quatro bispectral index between 40 and 60 was routinely applied to monitor the level of consciousness. During the operation, the patient was placed in the right lateral decubitus position; high-flow oxygen nasal prongs at 40 liter per minute (lpm), and non-invasive ET<sub>CO</sub><sub>2</sub> and invasive radial artery monitoring to control oxygen saturation and avoid excessive hypercapnia. A quiet surrounding atmosphere was created and material for a potential emergent situation was carefully set up. A 4 cm incision in the 5<sup>th</sup> intercostal space was performed and then covered by a wound protector retractor. An iatrogenic pneumothorax was created after dissecting into the chest cavity and the lung collapsed gradually while the patient remained spontaneously breathing. Intercostal blockade with Bupivacaine 0.5% 1–1.5 cc/space from the 3<sup>rd</sup> to the 7<sup>th</sup> space (Figure 2) and vagal block in the aortopulmonary window with 3–4 cc Bupivacaine 0.5% were done as routinely (Figure 3). A left-upper lobe wedge resection of a subcentimetric nodule was performed first, with intraoperative pathologic result without evidence of malignancy (bronchiectasis). Then, anatomical S6 segmentectomy was completed, and we did not perform systematic lymph node dissection (Figure 4). Air leak was checked by insufflating the lung through a facial mask under saline solution. Total operation time was 240 minutes (induction plus recovery time, and surgical time 25 and 215 minutes respectively), lowest oxygen saturation was 97%, and highest pCO<sub>2</sub> was 54 mmHg. Respiratory and hemodynamic parameters during the operation are reflected in Table 1.

Patient resumed oral intake 6 hours after the surgery, and

**Table 1** Intraoperative hemodynamic and respiratory parameters

Parameters	Two-lung breathing	One-lung breathing	End procedure (two-lung breathing)
Heart rate (bpm <sup>a</sup> )	97	97	90
Systolic blood pressure (mmHg)	120	110	100
Diastolic blood pressure (mmHg)	70	60	65
Respiratory rate (bpm <sup>b</sup> )	24	23	20
FiO <sub>2</sub> (%)	50	50	50
PaO <sub>2</sub> (mmHg)	367	91	107
PaCO <sub>2</sub> (mmHg)	43	54	52
pH	7.40	7.31	7.30
Sat O <sub>2</sub> (%)	100	97	100

bpm<sup>a</sup>, beats per minute; bpm<sup>b</sup>, breaths per minute.

**Figure 5** Postoperative chest X-ray at 48 hours.

began walking at postoperative day 1 (POD 1). The was no air leak so chest tube was removed at 24 hours, and patient was discharged home on POD 2 with normal chest X-ray (*Figure 5*). Pain measured with visual analogue scale (VAS) was 2, 3 and 2 at 6, 24 and 48 hours respectively.

Final pathologic exam was concordant with intestinal metastasis of 1.5 cm. And surgical margins of 5 mm. The patient is doing his normal life and continues follow-up with medical oncology.

## Conclusions

Sublobar anatomical segmentectomies are nowadays indicated for early stage primary adenocarcinomas, as well

as pulmonary metastasis and benign conditions (12). These lung-sparing resections are especially useful in pulmonary metastasis as they preserve healthier parenchyma and functional reserve, avoiding a pulmonary lobectomy in cases where central lesions contraindicate a wedge resection (13). Experience and a comprehensive segmental anatomical knowledge are mandatory in order to avoid complications. These procedures have spread specially in Asia, where predominance of small adenocarcinomas in a non-smoker non-obese population has fed the interest of thoracic surgeons in less aggressive lung-preserving surgery.

Performing the procedure in a spontaneously breathing patient has the potential advantage of faster resumption of oral intake and mobilization and a decrease of postoperative morbidity, and also shortens the chest drain length and hospital stay (7,14), thus it has been included as an enhanced recovery after surgery (ERAS) pathway for improving patient care. On the other hand, there is very little evidence about the oncological outcomes regarding on the hypothetical minor alteration of the antitumor immune response. Indications of non-intubated lung-preserving resections are continuously growing as the most innovative surgical teams develop more and more procedures under safety conditions with excellent results (15).

Non-obese patients without pulmonary underlying disease, where pulmonary metastasis develop after or during primary site treatment, seem a good patient profile for non-intubated operations regarding the better anatomical and functional status. Preoperative chemotherapy within a systemic multimodal treatment does not represent a limitation and shouldn't preclude the surgery as it does not

limit the procedure technically.

Uniportal VATS has proved feasible and safe for almost every pulmonary resection, including non-intubated sublobar resections (16), thus becoming an ideal approach in expert hands in order to decrease the aggressiveness of global patient surgical care.

Investigation beyond this point focuses on acquiring evidence of quality about its comparative benefits over standard intubated procedures.

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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.

### References

1. NCCN Guidelines version 3.2017. Non-small cell lung cancer. National Comprehensive Cancer Network. Available online: <https://www.nccn.org>
2. Speicher PJ, Gu L, Gulack BC, et al. Sublobar Resection for Clinical Stage IA Non-small-cell Lung Cancer in the United States. *Clin Lung Cancer* 2016;17:47-55.
3. Khullar OV, Liu Y, Gillespie T, et al. Survival After Sublobar Resection versus Lobectomy for Clinical Stage IA Lung Cancer: An Analysis from the National Cancer Data Base. *J Thorac Oncol* 2015;10:1625-33.
4. Cao C, Chandrakumar D, Gupta S, et al. Could less be more?—A systematic review and meta-analysis of sublobar resections versus lobectomy for non-small cell lung cancer according to patient selection. *Lung Cancer* 2015;89:121-32.
5. Macke RA, Schuchert MJ, Odell DD, et al. Parenchymal preserving anatomic resections result in less pulmonary function loss in patients with Stage I non-small cell lung cancer. *J Cardiothorac Surg* 2015;10:49.
6. Sesti J, Donington JS. Sublobar Resection: Ongoing Controversy for Treatment for Stage I Non-Small Cell Lung Cancer. *Thorac Surg Clin* 2016;26:251-9.
7. Guo Z, Yin W, Pan H, et al. Video-assisted thoracoscopic surgery segmentectomy by non-intubated or intubated anesthesia: a comparative analysis of short-term outcome. *J Thorac Dis* 2016;8:359-68.
8. Liu J, Cui F, He J. Non-intubated video-assisted thoracoscopic surgery anatomical resections: a new perspective for treatment of lung cancer. *Ann Transl Med* 2015;3:102.
9. Galvez C, Navarro-Martinez J, Bolufer S, et al. Video-assisted intercostal blockades with Bupivacaine. *Asvide* 2017;4:134. Available online: <http://www.asvide.com/articles/1442>
10. Galvez C, Navarro-Martinez J, Bolufer S, et al. Video-assisted vagal blockade with Bupivacaine. *Asvide* 2017;4:135. Available online: <http://www.asvide.com/articles/1443>
11. Galvez C, Navarro-Martinez J, Bolufer S, et al. Anatomical upper segmentectomy of the left lower lobe through uniportal VATS in a spontaneously breathing patient. *Asvide* 2017;4:136. Available online: <http://www.asvide.com/articles/1444>
12. McDonald F, De Waele M, Hendriks LE, et al. Management of stage I and II nonsmall cell lung cancer. *Eur Respir J* 2017;49. pii: 1600764.
13. Yoshimoto K, Nomori H, Mori T, et al. Postoperative change in pulmonary function of the ipsilateral preserved lung after segmentectomy versus lobectomy. *Eur J Cardiothorac Surg* 2010 ;37:36-9.
14. Liu J, Cui F, Li S, et al. Nonintubated video-assisted thoracoscopic surgery under epidural anesthesia compared with conventional anesthetic option: a randomized control study. *Surg Innov* 2015;22:123-30.
15. Peng G, Cui F, Ang KL, et al. Non-intubated combined with video-assisted thoracoscopic in carinal reconstruction. *J Thorac Dis* 2016;8:586-93.
16. Hung MH, Cheng YJ, Hsu HH, et al. Nonintubated uniportal thoracoscopic segmentectomy for lung cancer. *J Thorac Cardiovasc Surg* 2014;148:e234-5.

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