Surgical Technique on Thoracic Surgery

# Uniportal anatomic combined unusual segmentectomies

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**Abstract:** Nowadays, sublobar anatomic resections are gaining momentum as a valid alternative for early stage lung cancer. Despite being technically demanding, anatomic segmentectomies can be performed by uniportal video-assisted thoracic surgery (VATS) approach to combine the benefits of minimally invasiveness with the maximum lung sparing. This procedure can be even more complex if a combined resection of multiple segments from different lobes has to be done. Here we report five cases of combined and unusual segmentectomies done by the same experienced surgeon in high volume institutions to show uniportal VATS is a feasible approach for these complex resections and to share an excellent educational resource.

**Keywords:** Uniportal video-assisted thoracic surgery (uniportal VATS); minimally invasive thoracic surgery (MITS); anatomic segmentectomy; sublobar resection

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## Introduction

In recent years, interest in anatomic sublobar resections has raised (1) as its role in NSCLC has been re-evaluated (2,3). It is now considered a valid treatment for a subset of patients (4) with early stage adenocarcinoma (5).

However, this technique should already be available in every thoracic surgery unit (6) as a lung sparing resource (7) for high risk patients with limited lung function (8) or lesions such as benign conditions, metastatic disease and undiagnosed pulmonary nodules that are not amenable to wedge resection.

Although anatomic segmentectomy is considered more technically challenging than lobectomy due to the further distal dissection needed, evolving in uniportal VATS (9,10) has made possible to combine the maximum lung parenchyma preservation with the least invasive approach (11) even in lesions that require complex, unusual and combined anatomic sublobar resections. Performing anatomic en bloc segmentectomies (2 or 3 combined segments) is a good alternative to preserve lung parenchyma when several GGO are located in different adjacent segments or when the lesion is located in the intersegmental plane.

In this article we report five of these combined anatomic procedures to show its feasibility and share our experience for educational purposes.

## Patients and workup

Five patients underwent uniportal anatomic sublobar resections performed by an experienced surgeon in very high volume institutions (12). The diagnose leading to these procedures went from solitary or multiple GGO nodules to solid lesions involving the fissure in patients who did not endure pneumonectomy.

## Procedure

Double-lumen endotracheal tube, venous access line, arterial line and urinary catheter were placed under general anesthesia. The patients were positioned on lateral decubitus position. A single 3 cm incision was made in the 5$^{th}$ intercostal space and a soft wound protector was placed after entering the chest cavity. Lung and pleura were explored and lesion location was confirmed by digital


**Figure 1** Uniportal VATS right S10a + S6 + S2 en bloc anatomic segmentectomy (13). VATS, video-assisted thoracic surgery. Available online: http://www.asvide.com/articles/1593


**Figure 2** Uniportal VATS S3 + lingula anatomic segmentectomy (14). VATS, video-assisted thoracic surgery.
Available online: http://www.asvide.com/articles/1594

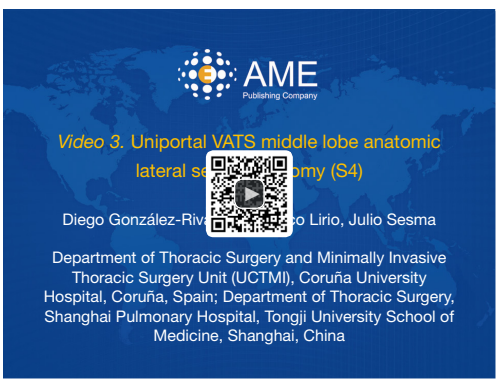


**Figure 3** Uniportal VATS middle lobe anatomic lateral segmentectomy (S4) (15). VATS, video-assisted thoracic surgery. Available online: http://www.asvide.com/articles/1595

palpation.

The way of approaching the segments does not differ much from conventional VATS. Because the segmental vessels and bronchi are more distal and lateral, the angles for dissection and insertion of staplers are actually less limited (the more hilar or proximal the dissection, the more difficulty to insert staplers). Segmental vascular branches were proximally ligated with polymer clips (Click'a V®, Grena) by using a 45° uniportal specific applier and distally divided using energy devices. Bigger vessels and bronchi were divided using staplers. The segmental plane was identified inflating the lung after clamping the segmental bronchus. It should be noted that the more distal the bronchovascular anatomy, the more likely it is to find anatomical variants. It is always recommended to ventilate the lung before cutting the segmental bronchus. The boundary between inflated and non-inflated lung will serve as a good guide to delimit the intersegmental plane. The specimen was extracted with a retrieval bag avoiding rib retraction and lymph node dissection was completed.

In the first case (*Figure 1*), en bloc anatomic segmentomy was performed for a solid tumor that surpassed the fissure involving segments 2, 6 and 10a. Inferior vein is dissected from posterior and V6 is cut. Incomplete fissure is divided anteriorly to expose the artery and A8, A9+10 and A6 segmental branches are identified. Intersegmental plane is delimited by V10a vein. Bronchovascular structures for S6 and then for S2 are cut pulling the bloc cranially. Division between S2 and the remaining upper lobe is made after closing B2 for segmental boundary confirmation.

In the second case, we chose to perform a combined anatomic segmentectomy (*Figure 2*) for a lingular GGO lesion located very close to S3. Superior pulmonary vein is exposed and lingular and S3 branches are identified and transected. Fissure is opened and lingular arteries are cut. Bronchial division between culmen and lingula is dissected and lingular bronchus is cut. B3 can be seen after ligating A3 lateral and medial branches. Intersegmental plane is delimited after insufflation and lobe must be rotated counter clockwise to get the correct stapler angle.

In the third case (*Figure 3*), a small undiagnosed lesion was located in the lateral segment of the middle lobe. This unusual anatomic segmentectomy can be done with a very similar exposure than middle lobectomy. Nevertheless, dissection must be distal enough to ensure the lack of bronchial or vascular abnormalities. Segmental vein, bronchus and artery are accessed and transected trough the major fissure and middle lobe is split with staplers.


**Figure 4** Uniportal VATS right S2 + S3 anatomic segmentectomy (16). VATS, video-assisted thoracic surgery.
Available online: http://www.asvide.com/articles/1596


**Figure 5** Uniportal VATS apicoposterior anatomic segmentectomy (abnormal trunk A1 + A3) (17). VATS, video-assisted thoracic surgery.
Available online: http://www.asvide.com/articles/1597

In the fourth case, two GGO nodules were located in the anterior and posterior segments of the right upper lobe and a combined S2–S3 anatomic segmentectomy was performed (*Figure 4*). Hilum is exposed and central vein can be transected (in this case, separate branches were cut). Pulmonary artery is identified behind its stump allowing to divide the fissure over the arterial plane if not complete. Posterior ascending arterial branch and A3 can be identified and cut allowing the exposure of the bronchial plane. Posterior and anterior bronchi are divided separately and intersegmental plane is confirmed and divided after insufflation.

In the fifth case, anatomical abnormalities were found while performing apicoposterior anatomic segmentectomy (*Figure 5*). A1 and A3 shared a common trunk and careful distal dissection was needed to confirm the situation and separate two branches that went towards S1.

## Conclusions

Uniportal VATS approach can be used in complex anatomic segmental resections as a feasible and effective option to maximize parenchymal sparing and minimize surgical invasiveness.

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## Footnote

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

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