



# Uncommon pulmonary anatomic segmentectomies: state of the art and technical aspects

Video-assisted thoracoscopic surgery (VATS) anatomic segmentectomies are becoming increasingly popular as a type of resection to radically treat early stage lung cancer.

In the last edition of the European Society of Thoracic Surgeons (ESTS) database report 10% of all lung cancer operation are represented by segmentectomies. Surprisingly most of these operations are still performed using an open approach with only 25% performed by VATS.

The overall incidence of cardiopulmonary morbidity and 30-day mortality after segmentectomy reported in the ESTS database is 11% and 1.6%, respectively. These rates are somewhat better than the corresponding ones observed after lobectomy despite often segmentectomies are performed in more compromised patients.

One of the reasons for this improved outcome is due to a better preservation of the pulmonary function after sublobar resections.

It has been reported in fact that segmentectomies provide a functional advantage compared to lobectomy (1).

Several retrospective studies and meta-analyses have shown that sublobar resections are equivalent to lobectomies when performed for small (less than 2 cm) partly solid non-small cell lung cancers (NSCLC) (2).

In a recent large retrospective study from Japanese Association for Chest Surgery (JACS) and including more than 1,700 patients with clinical stage IA undergoing sublobar resections, the authors found that the 5-year overall and cancer free survival rates were 94% and 93.7% respectively. In particular, in those patients without radiologic features of invasive cancer (consolidation/tumour ratio  $<0.25$ ) the 5-year overall and cancer free survival rates were 97% (3).

Obviously, there are many caveats to take into the account when interpreting results of the sublobar resections. Size seems to matter and the better results are for those tumours smaller than 2 cm (4,5).

The other important attribute to account for is whether the sublobar resection was performed as an intentional procedure in a patient who would have tolerated a lobectomy or as a compromised one in an unfit patient. A very elegant meta-analysis has shown that intentional segmentectomies have the same overall survival compared to lobectomies while compromise segmentectomies portend a worse prognosis (6).

The location of the tumour is also an important characteristic, which could potentially affect the prognosis after a sublobar resection. Upper division segmentectomies are known to be equivalent to upper lobectomies for early stage lung cancer. The fate of other segmentectomies located in other lobes is still uncertain (7).

Many of these unanswered questions will be hopefully clarified by two on-going randomized trials comparing segmentectomies versus lobectomies for early stage lung cancer, which have completed their recruitments. The first is the JCOG0802/WJOG4607L, which is a non-inferiority study powered on overall survival and including intentional segmentectomies for patients with peripheral NSCLC smaller than 2 cm and with a C/T ration smaller than 0.5. The estimated follow-up completion date is 2020.

The other study is the CALGB 140503, which includes stage IA patients. It is a non-inferiority study powered on disease free survival and including not only segmentectomy but also wedge resection as intentional procedures for peripheral tumor smaller than 2 cm. The estimated follow-up completion date is March 2021.

Currently the most common indication for segmentectomies is for patients with increased risk of surgery due to underlying co-morbidities or limited cardiopulmonary fitness. However, a growing number of patients who would be otherwise fit for lobectomy is undergoing this lung sparing procedure as an intentional operation.

Patients with multiple synchronous early stage lung cancers both amenable to radical treatment, those who had previous resections, those with indeterminate nodules too deep for a wedge resection are all sound candidates for anatomic segmentectomy.

The most commonly performed segmentectomies are the superior segmentectomies of the lower lobes, the lingulectomy and the upper division segmentectomy of the left upper lobe. Other commonly performed segmentectomies are the basilar segmentectomies of the lower lobe (sparing the superior segment).

However, the increasing proportion of small ground glass opacities (GGOs) or partly solid tumours presenting often in multiple sites of the lung demand that the surgeon is prepared to perform even less common segmentectomies.

These segmentectomies present some peculiar technical challenges and specific steps that need to be followed to ensure an oncologically sound operation.

In this issue some of these less common segmentectomies are illustrated with videos and text by different surgeons who will present their techniques to stimulate debate and provide the readers with a more ample choice of technical tips.

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