



## Let's think outside of the box

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Worldwide the surgical treatment of early-stage non-small cell lung cancer (NSCLC) is undergoing significant changes, and an unanimity is yet to be achieved. While lobectomy has been the standard treatment for patients with clinical stage I NSCLC for the last 30 years, two recently published pivotal multicenter phase 3 randomized trials, JCOG0802/WJOG4607L (1) and CALGB140503 (2), have opened the Pandora's box and challenged us with a new surgical standard. According to the trials, patients with peripheral less than 2 cm NSCLC undergoing sublobar resection, have at least similar if not superior, overall survival compared to those undergoing lobectomy. Mentioned studies were performed by experienced surgeons and with lymph node dissection (LND), including frozen sections. Some of them were converted to a lobectomy intraoperatively, and margins were kept around 2 cm (1,2). These trials demonstrated that sublobar resection is noninferior to lobectomy, furthermore a new standard of care is now established (3).

Segmentectomy and wedge resection are types of sublobar resections for lung tumors. Wedge resection is a non-anatomical removal of the tumor and some healthy surrounding tissue, while segmentectomy is a more complex procedure that involves dividing the segmental bronchus, artery, and vein, with the division of lung tissue based on the segmental blood supply (4). While the JCOG0802 and CALGB140503 trials have substantiated the oncological equivalence of sublobar resection, to lobectomy for small NSCLCs (1,2), concerns regarding the curative efficacy

of wedge resection were raised (5). Segmentectomy might be superior because it enables systematic LND (4), and it consistently achieves better surgical margins (6). Wedge resection, while less invasive, often falls short on oncologic outcomes, leading to a higher risk of inadequate tumor removal (7). The adequacy of surgical margins is of paramount consideration, as it directly influences the likelihood of residual disease and local recurrence (5). However, how can we know if an anatomic segmentectomy guarantees adequate oncologic margins for every case?

In this context, Qiu *et al.*'s study on anatomical partial lobectomy (APL) offers interesting insights on a new way to look at sublobar resections. This retrospective series, conducted over 6 years at China's National Cancer Center, assessed the short-term outcomes of APL in over 3,000 patients with early-stage lung cancer (8). The study brings to light a "novel concept" of sublobar resection, a more malleable definition, in which surgeons can perform *en-bloc* segmentectomy with wedge or combined segments to achieve oncological margins. In their method, unlike the conventional approach which focuses on resection extent through a combination of subsegments, the authors execute APL centered around the tumor-affected bronchial or vascular structures. They emphasize the necessity of ensuring oncologically adequate margins and maintaining the vascular integrity of the targeted lung parenchyma. A novel aspect of their technique involves using a "cutting plane" derived post inflation/deflation,

as opposed to the traditional “intersegmental border”, to decide on the preservation of intersegmental veins. The study reported a morbidity rate of 10.8% and no surgery-related mortality with most complications classified as mild. Additionally, with accumulated surgical experience the rate of complications decreased significantly.

In reality, APL is already being performed, predominantly in high-volume centers. Experienced surgeons are not confined to the traditional boundaries of segmentectomy but are transcending those limits combining segmentectomy with subsegmentectomy or wedge resection to preserve lung function while curing lung cancer. However, these technical advancements in surgical techniques, come with increased complexity pushing surgeons to mature their skills. The identification of intraparenchymal planes and the branches of pulmonary arteries, veins, and bronchi present significant challenges, especially when anatomical variations are present (9,10). Though the study shows promising short-term results, it draws our attention to the early adoption of sublobar resection in lung cancer treatment by the Chinese group. Their practice initiated years before standardization of the technique and guideline recommendation. This signals an ongoing tension between real-world practice and evidence-based medicine. Furthermore, the lack of a control group in this study, undervalues the methodology of the study since they have shown low complication rates with zero short-term mortality.

As technology and surgery continue to merge to help surgeons adhere to complex techniques, necessity of meticulous preoperative planning is clearer because conventional two-dimensional (2D) computed tomography (CT) imaging falls short (11,12). Qiu *et al.* emphasizes the enhanced role of three-dimensional (3D) reconstruction in preoperative planning for APL (13). This technology allows for a more precise cutting plane management, margin achievement, and the surgeon's understanding of individual lung anatomy (13). The innovation of employing 3D imaging for designing the extent of resection around the lesion is notable, enabling accurate anatomical separation and division of bronchi and arteries, with vein management guided by their drainage areas in APL planning.

The APL study from China illustrates a synergistic fusion of clinical expertise and evidence-based methodologies in surgeries for early-stage NSCLC. It's increasingly apparent that the management of such cases must be fluid and adaptive, effectively integrating the latest research discoveries, technological innovations, and the specific anatomical needs of each patient.

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