Editorial

Minimally invasive bronchial and bronchovascular sleeve resections

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This is an Editorial comment on a single-center retrospective analysis with regard to outcomes with sleeve resections via a minimally invasive approach published by Caso *et al.* (1).

The most common sleeve lobectomy (SL) is the right upper lobe with bronchial anastomosis between the distal intermediate bronchus and the right proximal main bronchus. The first SL was performed by Sir Price Thomas already in 1947 (2). For many decades, SLs were performed as a parenchyma-sparing surgery for patients who are unfit for a pneumonectomy. Nowadays, SL is an established surgical procedure of first choice, whenever anatomically and oncologically feasible. The surgical armentarium provides varied sleeve resection options to avoid pneumonectomy (3,4). In the recent two decades, there was a shift towards minimally invasive bronchial and bronchovascular sleeve resections (5-7).

Monitoring of the bronchial healing process as well as prevention and detection of postoperative complications is of critical importance (8). Bronchoscopy is the most important tool for thoracic surgeons for the assessment of the tumor location, planning of the adequate surgical procedure, for pulmonary toilet immediately post procedure as well as monitoring of the bronchial anastomosis. In this context, the healing of bronchial anastomosis after SL might be classified according to Ludwig *et al.* (9). Routine postoperative bronchoscopy protocol and classification system allows appropriate patient selection for discharge or further observation and/or treatment. In the authors' experience, the rate of anastomotic dehiscence requiring secondary pneumonectomy is low (1.8%) (10). Secondary or completion pneumonectomy is often the only life-saving procedure at this point. However, this is a high-risk procedure with mortality rates varying between 15% and 20% (11,12). In case of early detection of bronchial anastomotic dehiscence, secondary sleeve resection might be possible to avoid pneumonectomy (13). Late anastomotic complications in terms of strictures and stenosis can be detected in about 2–5% of the cases (14). Nonetheless, the detection and treatment of early and late bronchial anastomotic complications via bronchoscopy is—at least in our experience—a conditio sine qua non. In the present study conducted by Caso *et al.* (1), no bronchial anastomotic complications were reported. However, the detection of anastomotic complications was not possible due to following reasons:

(I) The patients' median length of hospital stay was 5 days. However, most complications occur after postoperative day seven.

(II) There was no postoperative bronchoscopy protocol. The authors performed a VATS exploration in a case of suspected anastomotic complication instead of performing a bronchoscopy. It is usually very difficult to inspect the complete anastomotic region via VATS or thoracotomy after one week due to compensatory hyperinflation of the contralateral lung and mediastinal shift. The anastomosis can be usually found in the mediastinum which might be difficult to assess. It is only possible to detect and report on anastomotic complications if you

monitor for it. Thus, the results about anastomotic complications should be interpreted very cautiously.

In general, carinal resection is defined as the resection of the tracheo-bronchial bifurcation with or without lung resection (15). There are two cases with "carinal resection" described by Caso *et al.* (1) in their report performed by robotic-assisted thoracic surgery (RATS) approach. RATS approach might be the next level in the surgery of the bifurcation. Interestingly, the authors published case 14 of their present publication as a movie previously (16). We are very thankful that the authors share their experience. In this movie, the authors simulated the planned complex surgery in a cadaver first. They were able to detect some technical issues causing tension at the anastomosis. Afterwards they performed successfully a complete portal robotic "distal tracheal" and left main stem resection and reconstruction on ECMO. They closed the "tracheal" defect primarily with a running suture. The left main bronchus was anastomosed to the Bronchus intermedius. The authors have to be congratulated for their surgical approach and extraordinary skills.

However, we need a common definition for different surgical steps, whenever we perform a SL of the right upper lobe. In our experience, full mobilization and dissection of the involved bronchi is of critical importance. We use a knife to obtain straight and well vascularized margins at the bronchus. Furthermore, the intercartigilinary dissection is made always at the most proximal level of the main bronchus. The bronchial anastomosis at this level might reduce the risk of critical perfusion (ischemia) of the bronchial anastomosis. We always defined our approach as standard SL even if we are at the level of the distal trachea. In our opinion, the terms "carinal resection" and "resection of the distal trachea" might be misleading since the main carina was not resected in both cases of the present study.

In summary, the authors have to be applauded for their approaches and outcomes in minimally invasive bronchial and bronchovascular sleeve resections (1). However, there are some implications. Firstly, we need recommendations for uniform definitions of surgical techniques. Otherwise we are not able to compare different publications or to perform meta-analysis on a specific surgical topic. Secondly, we need uniform postoperative monitoring for postoperative outcomes. Decades ago, patients undergoing major lung surgery were hospitalized for weeks. It was possible to detect every postoperative morbidity. Nowadays, patients are discharged home before we can notice complications. This difference in perioperative management makes it difficult to compare morbidity between "old school" open surgery and "fancy" minimally invasive surgery.

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Footnote

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

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