



Bronchovascular reconstruction in the era of mini-invasiveness

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In the era of mini-invasiveness the question a surgeon has to answer is: “Is mini-invasiveness crucial in the surgical approach, or in sparing lung parenchyma?” The answer is: “Obviously both”.

Recently, a special issue on open thoracic surgery and, in particular, articles on open lung-sparing reconstructive operations have been published in this journal.

The choice of an open approach to treat locally advanced lung cancer or N1 lymph-nodes infiltrating hilar structures provides a very accurate intraoperative evaluation of tumour extent. It allows to perform a reconstructive operation, if oncologically feasible, and to ensure tumour-free lung parenchyma not to be sacrificed. It is useless to remind that recent experience has shown us the right route: wherever possible, a pneumonectomy should always be avoided (1-3).

In a recent paper (4) from the current author and in the paper on right side sleeve lobectomy (SL) published in the above mentioned special issue (5), is reported that even demanding procedures like lower SL can be performed open safely and accurately.

It is not always easy to establish the correct indication for a reconstructive procedure before surgery. In fact, in a limited number of cases intraoperative exploration shows that tumour infiltration is limited to the external surface of the bronchial wall, thus not visible endoscopically. Sometimes, when a tumour arises at the origin of the bronchus intermedius or at the origin of the lower lobe bronchus, thus requiring a lower sleeve bilobectomy or lobectomy, the final indication to perform such a demanding bronchial reconstructive operation must be established by careful intraoperative assessment; that could be very difficult to achieve by VATS. Moreover, in such

challenging settings the open approach allows the surgeon to meticulously assess the infiltration of tumour arising from the superior segment of the lower lobe, certifying that the fissure is not involved.

The right indication for a sleeve resection of the pulmonary artery (PA) may be even more challenging to define, preoperatively. Even if magnetic resonance imaging (MRI) and angiography of the blood vessels can provide useful details to assess the PA infiltration, the decision is usually made during surgery. In fact, the preoperative study may overestimate or underestimate the vascular involvement, thus resulting in differences between radiological evidence and intraoperative findings that may be responsible for wrong indications (6).

More complex and controversial is establishing the correct indication after induction therapy. At preoperative instrumental re-evaluation after chemotherapy and radiotherapy, it is usually difficult to distinguish residual tumour from the diffuse desmoplastic and fibrotic tissue. Anyway, doubts about the presence of viable tumour in the context of fibrotic scarring tissue may persist even intraoperatively; thus, an extensive use of intraoperative frozen-section analysis is required in order to decide the most appropriate oncologic operation. As a result, the final decision to perform a SL as an alternative to standard lobectomy or PN can be taken by the surgeon based on such multiple intraoperative findings. In every case, the primary oncologic purpose is the complete resection of the tumor with free resection margins. This is a crucial point because the incidence of microscopic infiltration of the bronchial margins has strong implication when analyzing the anastomotic complication and local recurrence rate. The authors who reported a high incidence of anastomotic

leak in their published SL series often are the same who reported an increased rate of positive margins on frozen section.

In particular on the right side, a SL should be always considered in order to avoid PN. Truly pneumonectomy, particularly on the right side, is a disease in itself, causing severe impairment of cardiopulmonary function and quality of life after surgery (6). This is even more true after neoadjuvant treatment; therefore, in this subset of patients an open approach should be preferred.

Important technical issues that pertain difficult bronchial reconstructions can be addressed by an open approach. When considering technical aspects, size discrepancy of the bronchial stamps, proximity to the PA, and poor exposure of the mediastinal side of the anastomosis and, sometimes, its proximity to the lobe segmental division are the main issues. For these main reasons, a careful technique is required; we and other authors prefer an open approach than VATS. In this setting, open surgery allows a more precise placement of the stitches keeping the sutures well organized so to correct even large bronchial caliber discrepancy, to preserve all the segmental bronchi and to avoid bronchial torsion (4).

We all have seen videos and pictures of VATS sleeve at meetings; fewer have seen any picture or data on long term results.

In recent years, new successful techniques have been developed that pertain, in particular, the reconstruction of the PA and the prevention of major complications; these have proven to be useful providing good results (7,8).

It is our experience that when some kind of PA reconstruction is needed, the dissection of the vessel and the fissure is always extremely difficult. The alternative among PA reconstruction, pneumonectomy, or irresectability is always an issue. If it has been demonstrated that easy and straightforward reconstructions can be made by VATS (9,10), this certainly does not apply to the majority of circumstances.

In some patients after sleeve resection of the PA an excessive distance between the two vascular stumps may result. This condition could produce a high tension on the anastomosis. Such technical situation may occur in those cases requiring resection of a long segment of the PA without associated bronchial sleeve resection, because the lobar bronchus is not involved. In these cases, the vascular reconstruction cannot be performed by a direct end-to-end anastomosis and a prosthetic conduit interposition is required.

Although the need for a vascular conduit is not a frequent condition, a very interesting novel alternative for conduit reconstruction is represented by the use of superior pulmonary vein of the resected upper lobe when the extra-parenchymal portion of this vessel is free from tumour. Every time, PA reconstruction requires a very careful technique and some tricks. In particular, 2 opposite conditions must be avoided for the final success of the reconstruction: lengthening of the reconstructed PA, which may cause kinking of the vessel, impaired blood flow and therefore thrombus formation, and tension on the anastomosis. In particular on the right side, tension release can be improved by opening the pericardium around the inferior pulmonary vein (7,8).

Postoperative morbidity and mortality data from recent studies report overall better results for patients undergoing SL with respect to pneumonectomy, thus indicating that, although bronchovascular reconstructions are surgical procedures technically more complex when compared with standard major lung resections, improved outcome can be achieved with increased experience in reconstructive techniques (11).

An accurate and complete preoperative staging is essential in combination with careful surgical technique and adequate perioperative management in bronchial and vascular reconstructions. The preservation of lung parenchyma has been indicated by some authors as the possible cause of a theoretically increased risk for loco-regional recurrence after SL, but the few studies reporting an higher local recurrence rate are those including SL performed in patients with an advanced nodal status (N2). This is supported by the studies analysing risk factors for recurrence; they show that the nodal status and T stage are the only negative predictive factors, independently of the type of operation performed (6,11,12).

Precision, judgment and outcome improvement are the key words that lead the clinical practice in the treatment of resectable centrally located lung cancer in order to achieve the goal of a good patient survival with a good patient quality of life. This strategy has favoured the development of those novel techniques that have made bronchovascular reconstructions oncologically reliable, and more feasible and safer than in the past extending resectability and further reducing PN (11). These skills should be in the paraphernalia of a mini-invasive and lung-sparing interested modern surgeon.

In this era, bronchovascular reconstructions are still the best surgical option for the treatment of centrally located

lung cancer to provide the best with the least.

In conclusion, the final question a modern surgeon must ask himself is: am I doing the best for the patient at the lower cost?

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