



Multiport and uniportal VATS sleeve resections

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Background

The video-assisted approach has evolved to the gold standard for lung resection in early-stage non-small cell lung cancer (NSCLC) in recent years. Not only, because of the reduced morbidity and mortality of the minimally invasive approach, but even more since it has become evident that patients benefit from better overall survival (OS) when operated by video-assisted thoracoscopic surgery (VATS) (1). It is therefore a logical consequence that the indications for VATS have been extended also to patients with locally advanced NSCLC, showing the same short-time benefits of the minimally invasive approach and at least similar disease-free and OS compared to thoracotomy so far (2).

In addition, the number of access ports in VATS approaches have been reduced to only one single incision without rib spreading—i.e., uniportal VATS, which allowed for a further reduction in postoperative morbidity and length of stay (3). Even with such a limited access to the thoracic cavity, complex lung resections such as bronchial sleeve resections have been shown to be feasible. Since the first report of a uniportal sleeve lobectomy in 2013 by Gonzalez-Rivas *et al*. (4), reports on minimally invasive sleeve resections of larger series of patients have appeared in the international literature, confirming the benefits of the minimally invasive approach for patients, for both, multiport (5, 6) as well as uniportal VATS approaches (7).

Technical aspects

The basic surgical technique for bronchial and/or vascular sleeve resections is similar to the one for standard VATS lobectomy. However, the key issue during sleeve resections is finally the confirmation of tumour-free margins, which is

often done by frozen section analysis. The second critical part of such procedures is then the creation of an air-tight bronchial and/or blood-tight vascular, tension-free anastomosis.

Chest wall incision

As for standard uniportal lobectomies, an anterior approach with an incision in the fifth intercostal space is made. This approach is suitable for most sleeve-cases, except for right upper sleeve lobectomies, for which an access in the fourth intercostal space usually allows better exposure of the anastomotic site (especially a better view on/inside the distal bronchial stump) and a better angle for suturing. This is true for both, uniportal, as well as multiport approaches. The additional insertion of a disposable wound protector helps in keeping the camera clean as well as allowing the threads and knots to run smoothly through this incision.

Bronchial reconstruction

Since bronchial reconstruction is a technically demanding procedure, which is not necessarily made easier by a smaller incision and a conversion from a natural 3D to a video-optic 2D image of the anastomotic site, some important tips and tricks are indispensable when aiming for a smooth and safe procedure.

Suture technique

The standard anastomotic technique known from open surgery with interrupted sutures for the bronchial part and a running suture for the membranous part of the bronchus

is not quite suitable for minimally invasive approaches. Main issue here is that the chest wall incision(s) is(are) much smaller, which highly increases the tendency for the threads to get entangled and furthermore results in a suboptimal exposure of the anastomotic site once the interrupted sutures are placed but not yet tied. Therefore, most surgeons prefer either one single running suture for the whole anastomosis or two separate threads (especially for left sided upper lobe sleeves), one after the other, for completion of the 'lower' and then the 'upper' part of the anastomosis (8).

Thread

When choosing a running suture, one should prefer a monofilament suture, either absorbable [i.e., poly-p-dioxanone (PDS)] or a non-absorbable [i.e., polypropylene (Prolene)] suture in order to allow the thread to run smoothly through the tissue. Although most surgeons use absorbable suture material because they want to avoid remnants of suture material and thread granulomas, in our experience the non-absorbable thread runs smoother through the tissue and usually no suture granuloma formation is seen, when using a running suture. Depending on the suture technique, either one single long thread (e.g., 90 cm) armed with two needles or two separate threads, each armed with one single needle can be used. Another useful recent development are barbed threads (e.g., absorbable 3-0 and 4-0 V-LocTM), which allow suturing without the need for knot tying and, even more important, which keep the applied suture tension without loosening (9).

Instruments

The limitation of the given direction of the instruments entering the thoracic cavity through one single incision (or 2–3 optional other incisions in case of multiport VATS) can, at least partially, be overcome by using a needle holder with a curved tip. The curved tip allows for a much greater flexibility concerning the angle at which the needle is positioned in a stable position in the needle holder.

Another adjunct, which improves visualization of the surgical site and certainly helps to prevent the occasional entangling of threads is the use of a 3D video-optical platform. Not only when using a robotic platform (6), but also during 'conventional' thoracoscopy 3D visualization may improve not only precision, but also safety of the

procedure by restoring the surgeon's 'natural' 3D vision.

Vascular anastomosis

The vascular anastomosis, for example during double-sleeve resections, is generally performed after the bronchial anastomosis. On one hand because the bronchus is best exposed with the pulmonary artery (PA) being still divided, and on the other hand because after the bronchial anastomosis is done, the tension on the PA is usually completely reduced. For the vascular suture a running monofilament suture (polypropylene 5-0) is used.

For proximal and distal control of the pulmonary artery either vascular clamps, deployable bulldog clamps, or tourniquets can be used (10). The clear advantage of tourniquets is that they do not occlude the access incision as opposed to the vascular clamps, and threads cannot get caught in the device as can be the problem when using deployable bulldog clamps (11).

Conclusions

With recent developments of new tools as well as techniques for minimally invasive lung resections, indications for VATS and especially uniportal VATS have been extended to more complex surgical procedures such as bronchial and even bronchovascular sleeve resections.

There are some important tips and tricks, which might facilitate these procedures and let more patients benefit from the advantages of a minimally invasive approach.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

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