

## Video-assisted Thoroscopic Surgery (VATS) Lobectomy

by Adam D. Fox, DO, and Thomas L. Bauer, MD

Video-assisted thoroscopic surgery (VATS) is a relatively new approach to pulmonary lobectomy (i.e., the surgical removal of a lobe of the lung). Today this minimally invasive surgical technique offers patients with early stage lung cancer the possibility of a more rapid, less painful recovery from surgery. The learning curve for this new technology is steep, however, and more research is needed comparing the efficacy of VATS with that of standard thoracotomy.

The use of VATS is a relatively new approach to pulmonary lobectomy. First described in the early 1990s, the procedure has gained momentum.<sup>1,2</sup> Advances in thoroscopic surgery have followed those in laparoscopic surgery. Initial VATS drainage procedures have evolved into more complicated thoracic procedures. The success of these procedures compared to open thoracotomy was obvious and accepted by the thoracic community as a definite improvement. Some of the benefits to patients included decreased postoperative pain, shorter hospital stay, earlier return to work, decreased mortality, decreased morbidity, and cosmesis (i.e., a cosmetically improved appearance compared with standard thoracotomy). The final advance to anatomic lobectomies with removal of the lymph nodes outside the lung (mediastinal) has been the most challenging. Attempts at VATS lobectomies, which have various definitions and techniques as described in the literature, have increased in the ensuing years since its initial description.

The exact description of a VATS lobectomy varies based on the institution and publication. A strict definition is a single port incision for the camera as well as a 5 cm utility incision. The ribs are not resected but the intercostal space (i.e., the space between the ribs) may be dissected for sufficient length to allow the specimen to be removed. Mediastinal lymphadenectomy (i.e., resection of the mediastinal lymph nodes) requires at least two mediastinal lymph node stations to be resected. For this procedure, the pulmonary veins, pulmonary artery branches, and bronchus are each individually divided with endoscopic staplers.

### Cautions

Although there are no specific criteria or definitions relating to the indications or contraindications for VATS lobectomy, some generalized principles can be stated. For the surgeon, the VATS lobectomy is without question more challenging than an open thoracotomy and lobectomy. The learning curve can be steep and long but is certainly achievable with

patience and cautious persistence. For surgeons learning to perform VATS lobectomies, it is best to transition by learning to use the necessary stapler and instruments through open lobectomy technique. In addition, the sequence of the dissection is slightly different for a VATS lobectomy versus open lobectomy. Practice use of the instrumentation and dissection sequence employed for VATS in the open lobectomy setting first to transition to performing VATS lobectomy. Attending a formal VATS lobectomy course is also incredibly valuable. Surgeon accreditation is a complex and complicated issue for each department, thoracic section, and institution.

Each institution should establish specific guidelines, requirements, and proctoring for the adoption of VATS lobectomy. These steps will ensure adequate preoperative preparation and education of the surgeons and prepare them for initial attempts at peripheral cancers without nodal involvement.

Initial cases would best be done for patients with small peripheral Stage I lung cancer. The indications to convert to open lobectomy should be simple and strictly followed. Difficulty making progress, anatomic variations, simple bleeding, and enlarged lymph nodes can make the initial attempts at a VATS lobectomy anxiety provoking and potentially dangerous. Once familiarity with incision placement and working with limited angle and new instrumentation is achieved then the contraindications to a VATS approach decrease and the complexity of the lobectomy can safely increase. In experienced centers, large tumors, hilar adenopathy (i.e., enlargement of the lymph nodes), prior surgery, and preoperative induction therapy do not prevent a VATS approach.

### The VATS Procedure

In brief, here is how the procedure works. First, general anesthesia using selective single lung ventilation (double lumen endotracheal tube) is initiated. The patient is then placed in a lateral decubitus position and the table is flexed, which allows for maximal separation of the rib space. Placement of port sites is somewhat variable but many surgeons place the scope through a port in the 7<sup>th</sup> or 8<sup>th</sup> intercostal space over the mid anterior axillary line. Once the camera is placed, an exam of the hemithorax is made for evidence that would preclude the procedure (invasion of chest wall, pleural metastasis, anatomic variations, etc). If there is no contraindication to proceeding, a 5 cm utility incision is placed on the anterior chest around the fourth interspace. Additional incisions can be made but are typically not necessary and simply add possible sources of additional postoperative pain. However, for the surgeon early in the learning curve, additional incisions may be very beneficial and increase safety of the procedure.

Using various instruments through the ports, the lung can be manipulated so that, not only can the lung be visualized from different angles, but it is possible to palpate the lung through the utility incision. Dissection can be performed using standard surgical principles with thoracoscopic instruments. The dissection around the pulmonary vessels and bronchus is essentially the same as in the open thoracotomy. Endoscopic staplers are used to divide the vessels and the bronchus. The fissures are completed with an endoscopic stapler. Finally, the lung is placed in a durable bag and removed through a utility site.

Many case series have been published for VATS major lung resections. The literature demonstrates that the procedure is done in multiple countries by multiple groups. Complications included a prolonged air leak, arrhythmias, pneumonia, bronchial stump leak, respiratory failure, and blood transfusion. The morbidity and mortality rates from retrospective reviews demonstrate a frequency and occurrence of complications that are the same or less than after open thoracotomy.<sup>3-6</sup>

Multiple advantages have been shown using the VATS approach. Studies have demonstrated that patients will have decreased pain compared with the open approach. This includes decreased chest wall pain and need for breakthrough pain medications or intercostal blocks. While this last benefit has been born out in several studies, it has been found to be conferred only in the immediate postoperative period. By one year the advantage seems to be gone. Additional advantages include decreased sleep disturbances, better preservation of pulmonary function (vital capacity, FVC, and FEV1),<sup>7</sup> earlier return to activities (2.5 months vs. 7.8 months),<sup>8</sup> better shoulder function, better cosmesis, and cost effectiveness.<sup>9</sup>

## Caveats

Several reasons exist for the less than universal acceptance of the procedure.

Bleeding from major vessels without easy access to the structures was an initial concern but it has not been borne out in the literature. While the problem seems to occur infrequently, a sponge stick at the ready will allow for initial control should this problem occur. Generally, the reports of major bleeding were from early experiences and stapler failure was the cause. With experience and newer instruments this bleeding does not seem to be much of an issue any longer. The primary concern among reluctant surgeons is that *should* an injury occur, control and correction are quite challenging.

Additionally, the adequacy of the procedure as a cancer operation has been questioned. Several institutional experiences have demonstrated that a comparable extent of nodal dissection can be accomplished with VATS compared to the open procedure.


Recurrence or tumor implantation along the site of resection has been questioned, but the use of wound protectors seems to make this a non issue.

Finally, cost effectiveness has been questioned as well. While the surgery itself may be more expensive than an open technique that does not use staplers, the overall cost is lower because of the shorter hospital stay and less painful hospital course.

Ultimately, a cancer operation is considered "successful" if a survival benefit is conferred. Unfortunately,

no randomized, prospective studies on VATS lobectomy have been performed. Such studies will have to be undertaken in order to ultimately answer this important question. Several studies have tried to address possible reasons for an etiology behind an improvement seen in the VATS lobectomy population. A carefully screened patient population is one possibility. The possibility of a more positive immune response after VATS lobectomy has also been suggested. Lower levels of inflammatory cytokines, reduced level of TNF (tumor necrosis factor), and enhanced cell mediated immunity have all been demonstrated.<sup>10-11</sup>

Despite initial skepticism, based on our program's experience with VATS lobectomy, we have found no comparison between a VATS lobectomy and even a limited thoracotomy lobectomy. The patients clearly mobilize more rapidly postoperatively, with markedly improved pulmonary function. Additionally, patients are more willing and able to leave the hospital earlier and clearly have less pain on the initial postoperative visits. Approximately 50 percent of patients will be off routine narcotic use at their two week postoperative visit.

While the procedure is also without question more challenging and anxiety provoking for the surgeon, the suggestions outlined in this article should help transition interested surgeons to this technique. The question can be asked: is the greater complexity of the procedure really worth the surgeons' time and angst? If we are dedicated to providing the best care with the least impact to our patients, the answer is clearly yes, but only when the surgeons are ready to prepare for the challenge. 

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