The Present Status of Endoscopic Thoracic Surgery

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Abstract

Video-assisted thoracic surgery (VATS) is a major revolution in thoracic surgery. The procedure is performed under general anesthesia with double lumen endotracheal intubation for separate control of each lung. Operative ports should be placed carefully, avoiding damage to the intercostal vessels and nerves. The video technique can be used efficiently for the following indications: pneumothorax, resection of pulmonary nodules, biopsies of lung, pleura and mediastinal structures, resection of mediastinal tumors, management of empyema, and hemostasis and suture of lacerations after trauma. Indications for esophageal procedures include esophagomyotomy, fundoplication, and resection of benign lesions. Repair of esophageal perforation can be done at an early stage. Major resections of pulmonary and esophageal cancer are a matter of controversy. The apparent advantage of diminished pain is offset by spread of malignant cells and potential damage to the resected specimen with loss of important information concerning pathology. Complications of VATS are few and include prolonged air leak, dysrhythmia, respiratory failure and bleeding. VATS has become an inseparable part of thoracic surgery and should be included in the basic training of every thoracic surgeon (Adv Clin Exp Med 2007, 16, 4, 473–477).

Key words: thoracoscopy, thoracic surgery, video-assisted thoracic surgery.

The thoracoscopic approach to thoracic surgery can be traced back to 1910, when Jacobaeus did the first diagnostic procedure in the pleura using a cystoscope [1]. Since then, thoracoscopy has been used both diagnostically and therapeutically, initially for the division of pleural adhesions as a prerequisite for therapeutic pneumothorax in patients with tuberculosis, and later for sympathectomy [2], vagotomy [3], lung biopsy, and the treatment of empyema [4]. The introduction of video techniques brought a significant breakthrough in endoscopic thoracic surgery [5], making it immensely popular within a short time. This was accompanied by two highly undesirable side effects: the uncontrolled proliferation of inadequately trained “minimally invasive” surgeons and...
an increase in the incidence and severity of complications [6]. In order to correct this flaw, a number of prerequisites must be fulfilled before a thoracic operation without opening the chest is attempted:

1. The physician performing the procedure must have experience in open thoracic surgery. In any video procedure the view is two-dimensional, which makes the operation more difficult. An operation started as thoracoscopic may have to be converted to an open thoracotomy, either for completion of the procedure or for the treatment of complications, and the person performing the video operation must be able to carry it out to the end. It should be clear that thoracoscopy is not a starting point for thoracic surgery. It is the other way around. One must learn open thoracic surgery first, and only then proceed to video-assisted thoracic surgery (VATS).

2. There must be a team of experienced anesthesiologists.

3. A complete infrastructure must be available, with the possibility of preoperative assessment of cardiovascular and pulmonary function, evaluation of any possible risks, and adequate postoperative care.

4. Only instruments specially designed for thoracoscopic surgery must be used. The use of tools designed for laparoscopy and improperly modified for thoracic procedures is unacceptable.

All video-assisted thoracic procedures are routinely performed under general anesthesia with double-lumen endotracheal intubation. Separate ventilation of each lung is essential, and VATS must not be attempted without it. Carbon dioxide is insufflated to create a pressure of 1–3 mm Hg to keep the lung collapsed. Higher pressure should be avoided, as this may lead to a harmful reduction in venous return and to mediastinal shift, impairing ventilation of the contralateral lung. In patients with emphysema there may be some difficulty in collapsing the lung. However, this can be overcome by occasional suction on the endotracheal tube, and in most cases complete lung collapse will be achieved.

For most procedures a 2-cm incision is made in the seventh intercostal space, just below the angle of the scapula. If possible, the pleural cavity should be explored with a finger to determine the presence of adhesions. At this stage the initial view of the pleura is projected on the video screen. One or two additional cannulas can now be inserted, depending on the type and site of the lesion and the type of operation. The location of operative ports should be carefully planned to be used either at thoracotomy (should conversion become necessary) or for the placement of pleural drains at the end of the procedure. During insertion of the ports one must avoid damage to the ribs and to intercostal vessels and nerves, which could result in bleeding or intercostal neuralgia. It is better to insert additional ports than to struggle with those that were poorly placed. Tissues must be handled gently, avoiding lung tears that might cause bleeding and postoperative air leaks. At the end of the procedure, a tube drain should be placed in the pleural cavity.

Indications for endoscopic procedures are as follows.

## Pneumothorax

Pneumothorax is one of the most common indications for VATS. Usually, excision of emphysematous bullae and subpleural blebs will have to be done, along with pleurodesis. Air leaks must be sought, particularly at the apex of the lung. If the leak is not easily found, warm saline is injected into the chest and the anesthetist inflates the lung. If air bubbles appear, the leaking area is grasped and a stapler is placed across the base of the leak and fired [7]. Instead of using a stapler, the leaking area can be ligated with endoloops and excised. Pleural abrasion or partial excision of pleura is usually done in order to aid in the formation of adhesions. Adhesions can also be created by insufflation of talc. The solid adhesions caused by talc prevent pneumothorax very effectively. However, one must remember that talc from different sources may have different chemical composition. Talc is a natural mineral, a rock mined in various geographic areas, and may be contaminated with asbestos. Asbestos is a known carcinogenic agent and has been implicated in the etiologies of mesothelioma and bronchogenic carcinoma. Medicinal talc used for pleurodesis must be free of asbestos. Pure talc, free of asbestos, does not cause cancer. The talc used in this hospital is produced according to the requirements of the British Pharmacopoeia and is guaranteed to be asbestos-free. For additional safety, talc intended for medicinal use should be tested in an electron-microscopic laboratory [8, 9]. Two grams of talc are sufficient for complete pleurodesis and should be sprinkled lightly over the entire lung surface. Larger amounts of talc can result in excessive pleural fibrosis. Furthermore, instances of acute respiratory deficiency syndrome (ARDS) have been reported when more than 10 grams of talc was insufflated into the pleural space [10].
Biopsies of Lung, Pleura, and Mediastinum

After exploration, a wedge biopsy of the lung is taken using a stapler. For biopsy of pleural or mediastinal lesions, the use of biting forceps with a cutting edge is recommended. For hemostasis, this department uses electrocoagulation.

Resection of Pulmonary Nodules and Mediastinal Tumors

A pulmonary nodule is identified by means of inspection and instrumental palpation, then grasped with forceps inserted through a second port. Through a third incision the endo-GIA stapler is inserted and fired as many times as needed to achieve complete resection of the nodule, with some normal lung tissue around it. The lung is then allowed to expand.

For resection of a mediastinal tumor, the mediastinum is thoroughly investigated. Ring forceps and other grasping instruments are used for traction, electrocoagulation, and gentle pushing for dissection. If the tumor cannot be recovered through a port incision, an additional minithoracotomy can be made for manipulation by hand.

Thoracoscopic Management of Empyema

Empyema in the fibrinopurulent stage requires thorough debridement. Adhesions should be divided and loculations broken until all closed spaces are eliminated. The pleural cavity is thus converted into one space. Any remaining “peel” should be dissected off the lung surface to enable its complete expansion. The presence of air leaks is checked by flushing the space with a sufficient amount of warm saline while the anesthesiologist inflates the lung. At the end of the procedure, all remaining liquid is evacuated and drainage tubes are placed in the most dependent position.

Management of empyema by VATS in the organizing stage with fibrous tissue firmly adherent to the lung has been attempted in the past. However, this is a difficult procedure, with inadequate result as a rule. It is the present author’s firm conviction that at this stage an open decortication is indicated, not VATS [11–13].

Thoracoscopy for Trauma

All blood and blood clots should be flushed out using warm saline and suction. Following evacuation of blood, the pleural cavity is thoroughly inspected to identify bleeding points and lacerations of the lung parenchyma and diaphragm. Bleeding points are electrocoagulated or clipped. Lacerations are usually sutured, but can be approximated with clips. Closure of diaphragmatic tears must be meticulous and should be done with patience. Hurried closure of lacerations invites future diaphragmatic hernia with possible incarceration [14].

Esophageal Procedures

These can be divided into three groups. The first comprises clearly indicated VATS operations, such as fundoplication, esophagomyotomy for achalasia, and resections of benign lesions (e.g. leiomyomas) [15, 16]. The video approach for these indications offers unquestionable advantages over conventional open thoracotomy. Excessive trauma and pain are avoided and time and cost are saved while the purpose of operation is not compromised.

The indications in the second group are relative and include early perforations of the esophagus. Using the video or the open approach depends on the stage of the perforation and the amount of damage to the esophagus. Perforation with minimal damage caused by endoscopic manipulation or by a foreign body can be managed within the first 24 hours using the video approach. Beyond this early period, and for perforations involving excessive damage, open thoracotomy with wide drainage is necessary and VATS should not be attempted.

The third group involves VATS resections of the esophagus, particularly for cancer. These operations have been recommended by several groups of surgeons [17, 18]. However, this group of procedures is highly controversial and, in the present author’s opinion, video-assisted operation is out of place. At present, multi-institutional clinical trials are underway to evaluate the endosurgical staging of carcinoma of the esophagus, and VATS should not be considered the standard approach until those trials are completed [19].

Pulmonary Resections for Cancer

The most controversial point concerns the use of VATS for therapeutic resections of lung cancer.
Studies conducted by Landreneau and associates in the United States [20] and by Monson in the United Kingdom have shown that one year after the operation there was no difference in pain between open thoracotomy and VATS. In addition, the short-term benefits of less pain might be at the price of long-term problems. These include recurrence of cancer on account of a less radical non-anatomic wedge resection or incomplete nodal staging [21] and spreading malignant cells while struggling to remove the specimen through a port-hole incision [22]. There are more and more reports on chest wall tumor implants [23] and on major bleedings [24], which could be easily avoided had the chest been open from the beginning. Also, of course, while the specimen is being removed through the port-hole, usually by force, it can be seriously damaged, frequently with loss of important information about its pathology. To prevent all these scenarios, the “half-open” technique has been developed, which means a small thoracotomy, but then the advantages of thoracoscopic surgery can hardly be recognized. The question thus comes to mind: Is it really important to resect a lobe without the routine thoracotomy incision? Should one trade less short-term pain for more serious long-term problems? Indeed, there are some clear-cut contraindications to video-assisted lobectomy, and they include T3 tumors, endo-bronchial tumor seen at bronchoscopy, positive cervical mediastinoscopy, centrally located tumors, and lobar and hilar nodes adherent to pulmonary vessels. In any case, the video-assisted lobectomy should be limited to stage I non-small-cell bronchogenic carcinoma [25].

Video-assisted lobectomy can be done for benign lesions, such as bronchiectasis, if fissures are complete and the anatomy is favorable. There are obvious advantages to the utility, safety, and versatility of video-assisted lobectomy, but they should not obscure the potential hazards of summarily substituting it for every lobectomy. Some are better done the open way.

The author concludes that VATS presents a number of advantages, but also some disadvantages compared with standard thoracotomy. The advantages include size of the incision, less interference in pulmonary function, less immediate postoperative pain, and avoidance of operative scar. The patient’s mobilization is earlier and hospitalization time shorter. However, the possibility of palpation is lost and the potential for spread of malignant cells increased. Difficulty with retrieval of large specimens may cause damage to the specimen with loss of important information about its pathology. Although VATS is considered a minimally invasive procedure, the trauma caused to the organs operated on is the same as in open thoracotomy. Complications of VATS are few and include prolonged air leak, dysrhythmia, respiratory failure, bleeding, infection, and pleural effusion.

In conclusion, VATS has been shown to be a safe, extremely useful, and progressive method, applicable both diagnostically and therapeutically. Its pendulum is swinging both ways, sometimes perhaps too far. However, it has already been established as an integral part of thoracic surgery and should be included in the basic training of every thoracic surgeon.

References

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