Present Role of Thoracoscopy in the Diagnosis and Treatment of Diseases of the Chest

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Since thoracoscopy was originally described in 1910, the application has been limited mainly to the diagnosis and treatment of pleural disease. Recent advancements in endoscopic equipment and refinement of surgical techniques have expanded the application of this procedure. Using video thoracoscopic techniques in 70 patients over the past 9 months, we have been able to perform a variety of procedures previously accomplished by "open" techniques. These procedures include (1) wedge resections of pulmonary nodules in 21 patients, using endoscopic mechanical stapling devices; (2) excision of the pericardium and drainage of the pericardial space in 6 patients; (3) dorsal thoracic sympathectomy in 6 patients; (4) apical blebectomy and pleurodesis in 6 patients; and (5) lung biopsies for diagnosis of diffuse lung disease in 5 patients. Additional procedures performed include biopsy of hilar masses (3), biopsy of esophageal mass, excision of a mediastinal cyst, and the drainage of a spinal abscess. The remaining 20 procedures were performed for the diagnosis and treatment of pleural disease. There was no mortality associated with the procedure and morbidity was lessened, compared with standard thoracotomy procedures. The postoperative hospital stay after elective procedures performed in well patients averaged 3 days and was often as short as 1 day. Our experience indicates a markedly expanded role for thoracoscopy in the diagnosis and treatment of thoracic diseases with less postoperative morbidity.

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Advances in endoscopic surgical equipment and refinement of surgical techniques have expanded the role of thoracoscopy to include multiple procedures that previously could only be performed by open approaches [1–4]. Although thoracoscopy has been an established thoracic procedure for more than 80 years [5], its application has been limited to the diagnosis of pleural disease [6, 7]. The recent developments of video endoscopic equipment, instruments, and techniques have received wide application in other surgical specialties. General surgery, gynecology, urology, and orthopedic surgery have been revolutionized by this technology. This report describes the application of video endoscopic techniques to the management of intrathoracic disease and its present role in thoracic surgery.

Material and Methods

Video thoracoscopy was performed on 70 patients between December 1990 and September 1991. There were 38 male (54%) and 32 female (46%) patients ranging in age from 21 years to 78 years (median age, 54 years). The procedures performed included wedge resection of pulmonary nodules (21), diagnosis or treatment of pleural disease (20), pericardiectomy (6), sympathectomy (6), blebectomy/pleurodesis (6), "closed" lung biopsy (5), biopsy of a hilar mass (3), biopsy of an esophageal mass (1), excision of a mediastinal cyst (1), and drainage of a spinal abscess (1).

All procedures are performed under general endotracheal anesthesia with a double-lumen tube and arterial line monitoring. The patients are placed in the lateral position for all procedures and widely prepared to allow maximum flexibility for access and in case conversion to an open thoracotomy becomes necessary. Mechanical ventilation to the ipsilateral lung is discontinued and a partial pneumothorax is induced by carbon dioxide insufflation through an 18-gauge needle inserted in the fifth intercostal space. This is done to assure collapse of the lung away from the initial trocar insertion site. A 10-mm trocar (Surgiport; United States Surgical Corporation, Norwalk, CT) is then inserted through the seventh intercostal space to create access for the thoracoscope and camera. A 10-mm, 0-degree rigid telescope and camera (OTV-52, Olympus Corporation, Lake Success, NY) attached to a video monitor is then inserted (Fig 1). Exploratory video thoracoscopy is then performed to identify any pulmonary, pleural, or mediastinal pathology, and appropriate sites for additional trocar placement are selected. Most frequently, additional trocars are placed one interspace higher in the anterior and posterior axillary lines, and if necessary a fourth trocar is placed in the

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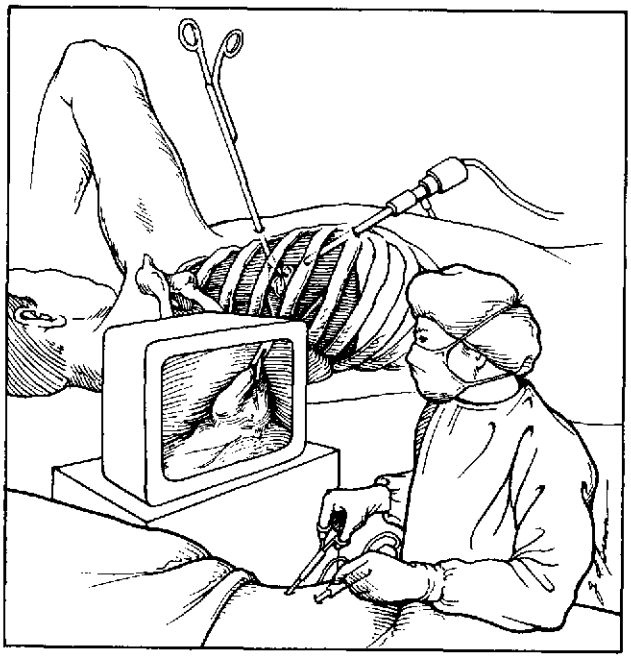

Fig 1. Schematic diagram of a video thoracoscopic procedure.

fourth intercostal space in the midaxillary line (Fig 2). If an endoscopic stapling device (Multifire EndoGIA; Auto Suture, United States Surgical Corporation) is to be used for pulmonary resection (27 patients), it is most frequently placed posteriorly through a 12-mm port in the auscultatory triangle. A constant positive pressure of up to 10 cm H_2O is maintained throughout the procedure to preserve total atelectasis of the lung. This greatly facilitates exposure of the thoracic cavity and visualization of the target pathology.

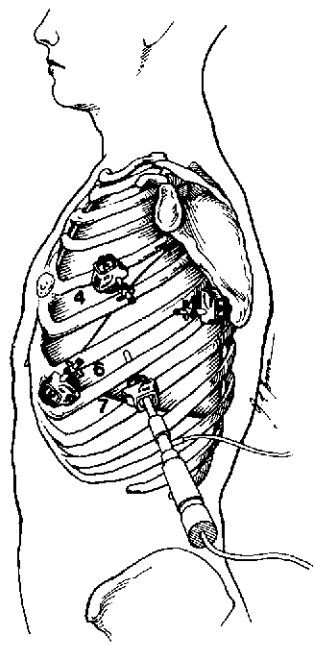

Fig 2. Typical trocar placement for many thoracoscopic procedures.

Upon completion of the procedure, a chest tube is inserted under direct visualization through one of the trocar sites only if an air leak or serious fluid accumulation in the pleural cavity is anticipated. The remaining trocar sites are closed with an absorbable suture.

Postoperatively, patients are returned to a hospital room and not routinely placed in an intensive care unit unless they were seriously ill preoperatively.

Results

There was no mortality associated with the procedure, although 2 patients with advanced malignancy died of progression of their disease 2 and 4 weeks postoperatively. There were no intraoperative complications, nor was emergency open thoracotomy required.

Postoperatively, care in an intensive care unit was not routinely required except in patients who were chronically ill or were in an intensive care unit preoperatively (8 patients) or in patients with limited pulmonary reserve (2 patients). Hospital stay in 60 elective patients who were not hospitalized preoperatively due to chronic or terminal illness averaged 3.4 days (range, 1 day to 8 days).

In the patients in whom chest tubes were used, the average time to removal of the chest tube was 3.2 days (range, 1 to 14 days). In the 9 patients who underwent sympathectomy or biopsy of hilar masses and in whom an air leak or fluid collection was not anticipated, chest tubes were not placed.

In the 9 patients who did not have chest tubes postoperatively, parenteral pain medication was required for greater than 48 hours in only 1 patient. Parenteral pain medication was seldom required after chest tube removal. In the 44 elective patients who underwent thoracoscopy only and did require chest tubes postoperatively, 6 patients required parenteral pain medication for more than 12 hours after chest tube removal.

Wedge Resection for Pulmonary Nodules

Twenty-one patients underwent wedge resection of pulmonary nodules. A total of 24 nodules were excised in the 21 patients. Three patients had known metastatic disease with a disease-free interval of at least 2 years and no other evidence of metastases. Six metastatic lesions were successfully excised in these patients.

The remaining 18 patients underwent thoracoscopy for the diagnosis of the indeterminate solitary pulmonary nodule (Table 1). In 7 patients, a benign diagnosis was obtained. Another 5 patients were found to have T1 N0 primary lung cancer and proceeded to have a muscle-sparing thoracotomy and lobectomy during the same procedure. One patient had unsuspected pleural metastases. In 3 patients, newly diagnosed pulmonary metastases were excised. In 2 patients early in our experience, we were unable to locate the pulmonary nodule by thoracoscopy and performed a video-assisted limited thoracotomy for localization. Subsequently, we have used a technique of preoperative needle localization under fluo-

Table 1. Results of Thoracoscopy in 18 Patients for Wedge Resection of Pulmonary Nodules[a]

Diagnosis	No. of Patients	Result
Benign	7	Excised
Primary lung cancer	5	Proceed to open lobectomy
New solitary metastasis	3	Excised
Unable to locate	2	Proceed to video-assisted thoracotomy
Lung cancer with unsuspected pleural	1	Excised and pleural biopsy

[a] The indication for operation was indeterminate solitary pulmonary nodule.

roscopic or computed tomographic guidance, similar to the technique used for localizing nonpalpable breast lesions, in those patients who have nodules that are not pleural-based or immediately subpleural. To excise the portion of lung, loops were used in 3 patients and the endoscopic stapler in 18 patients. A neodymium:yttrium-aluminum garnet laser was also used in 3 patients in addition to the stapler.

Pleural Disease

The indications for thoracoscopy in the 20 patients with pleural disease are shown in Table 2. Eleven patients had an indeterminate diagnosis after thoracentesis. Five patients also had nondiagnostic pleural biopsies preoperatively. The diagnosis was established in all 11 patients by thoracoscopy. Four other patients underwent thoracoscopy for the management of known malignant effusions. In these 15 patients, talc was used for sclerosis in 10, doxycycline in 3, and bleomycin in 2. The average follow-up is 3.6 months (range, <1 month to 7 months). Three patients have succumbed to progression of their disease without evidence of recurrence of effusion. Effusion has recurred only in 1 other patient in whom complete expansion of the lung and pleural symphysis could not be obtained at the time of thoracoscopy.

One patient with a pleura-based mass was diagnosed as having mesothelioma. Three patients underwent successful drainage of empyema and decortication of the lung. The duration of illness was less than 3 weeks. In the 1 patient who had symptoms for 5 weeks, a successful decortication could not be obtained by thoracoscopy.

Table 2. Indications for Thoracoscopy in 20 Patients With Pleural Disease

No. of Patients	Indication	Result	Procedure
11	Idiopathic pleural effusion	10: malignant	Biopsy and pleurodesis
		1: Benign	Biopsy and pleurodesis
4	Recurrent malignant pleural effusion	. . .	Pleurodesis
4	Empyema	. . .	Drainage and decortication in 3, open decortication and biopsy in 1
1	Pleural mass	Mesothelioma	Biopsy

Pericardiectomy

Excision of the pericardium was performed in 6 patients. All patients had cardiac tamponade, which was relieved by pericardiocentesis before the procedure. A wide excision of the pericardium both anterior and posterior to the phrenic nerve was performed. All patients had effusive, nonconstrictive pericarditis. Four patients had chronic inflammatory pericarditis and 2 had malignant pericardial effusions. There was no serious morbidity despite the gravity of the illness in these patients. One patient died due to progression of her malignancy 4 weeks postoperatively. In the remaining 5 patients there has been no recurrence in an average follow-up of 4.3 months.

Sympathectomy

Excision of the dorsal sympathetic trunk was performed in 6 patients. Five patients had reflex sympathetic dystrophy and 1 had hyperhidrosis of the upper extremity. All patients had repeated relief of symptoms by stellate ganglion block preoperatively. Initially, the trunk was excised to include the inferior third of the stellate ganglion. Because 2 patients suffered a Horner's syndrome (one transient and one permanent), we, subsequently, have limited the extent of our excision. We now excise the trunk from the inferior border of the stellate ganglion to the T3 or T4 ganglion. Five of the 6 patients had immediate and total relief of preoperative symptoms with no serious surgical pain.

Blebectomy and Pleurodesis

Six patients underwent thoracoscopy for spontaneous pneumothoraces from apical blebs or bullous disease. Three patients had apical blebs and 3 had type I or type II bullae. In 4 patients, stapling of the blebs or bullae was performed with the EndoGIA stapler, and pleurodesis with either doxycycline or talc. In 2 early patients, Surgities (United States Surgical Corporation) were used to ligate the blebs. There were no complications in the 3 patients with apical blebs. Two of the patients with spontaneous pneumothoraces due to ruptured bullae required a more extensive procedure. Reoperation was performed in 1 and an immediate open procedure in the other because of inadequate control of the air leak from the ruptured bullae.

Lung Biopsy for Diffuse Lung Disease

Five patients had a thoracoscopic wedge resection performed for the diagnosis of diffuse parenchymal disease. A diagnosis was obtained in all patients. The endoscopic stapler was used to perform the wedge resection. The procedure was well tolerated by all patients including 2

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patients who were mechanically ventilated preoperatively. There were no prolonged postoperative air leaks in any patient, and chest tubes were removed within 24 hours in the patients not ventilator dependent. In the 3 patients who were ambulatory before biopsy, hospital stay averaged 3 days (range, 2 to 4 days).

Additional Procedures

Three patients had thoracoscopy for the diagnosis of hilar disease. The biopsy of unilateral hilar lymphadenopathy yielded sarcoidosis in 2 patients. The third patient had a bronchogenic carcinoma of the right hilum with metastasis to a vertebral body. Two bronchoscopies were nondiagnostic before thoracoscopy. The thoracoscopy was performed to obtain a tissue diagnosis.

In addition, 1 patient with acquired immunodeficiency syndrome underwent thoracoscopy for biopsy of a distal esophageal mass suspected to be lymphoma. Repeated esophagoscopy preoperatively was nondiagnostic. Esophagitis from cytomegalovirus was ultimately diagnosed.

A large pericardial cyst was drained and completely excised from the left side of the chest in a young woman without difficulty. Also, a T10-T11 intervertebral disc space abscess due to enterococcus was successfully drained.

Comment

One of the advantages of thoracoscopy is the less invasive nature of the procedure. The major cause of morbidity in all thoracotomies, even limited and muscle-sparing procedures, is the incision and associated spreading of the ribs [8]. Thoracoscopy is capable of providing access to the thoracic cavity by a less morbid approach, yet in our limited experience does not compromise the adequacy of the procedure. In addition, because of video technology, lighting sources, and magnification, visualization is generally superior to that in open procedures. With rapid improvements in endoscopic instrumentation and surgical ability, the facility with which thoracoscopic surgical procedures can be performed increases. Despite our short experience, a number of procedures including sympathectomy, pericardiectomy, and blebectomy can often be performed more simply and more expeditiously than by standard open techniques. A number of issues do need to be addressed. Although it is our subjective impression that postoperative pain and pulmonary dysfunction are less after thoracoscopy, these have not been objectively studied. In addition, the cost of the procedure has not been closely analyzed. Although there are substantial benefits of shortened hospitalization and more rapid return to work, this is at least partially offset by increased expenditure for equipment and endoscopic instrumentation.

Based on our early experience with thoracoscopy, and the results we report here, we believe the following conclusions are warranted. Thoracoscopy may become the preferred procedure for the definitive diagnosis of idiopathic exudative pleural effusions that have eluded less invasive attempts at diagnosis as well as for the management of known malignant pleural effusions. It appears as if the more complete drainage of the pleural space and attainment of pleural symphysis with thoracoscopy can decrease the rate of recurrence. In addition, large quantities of tissue can be easily obtained for receptor assay analysis and for the definitive diagnosis of the undiagnosed pleural-based mass. Empyemas can also be approached and decortication performed thoracoscopically except when the duration of the process has been longer than 3 to 4 weeks, when the decortication should be done by open techniques.

Thoracoscopy may also become the preferred approach for lung biopsy for the diagnosis of diffuse parenchymal lung disease, which has been performed previously by open lung biopsy. In addition, apical blebectomy and pleurodesis for recurrent pneumothorax or persistent bronchopleural fistula and pericardiectomy for effusive, nonconstrictive pericarditis may be best approached thoracoscopically. Thoracoscopy also may offer substantial advantages for the more complete staging of hilar and mediastinal disease in the setting of adjuvant therapy for left-sided lung cancers and esophageal cancer. Excision of mediastinal cysts may also be optimally approached thoracoscopically.

Because of the less invasive nature of thoracoscopy and decreased morbidity compared with standard approaches, the role of the procedure appears to have expanded in a number of clinical situations. Thoracoscopy may play a larger role in the diagnosis of the indeterminate pulmonary nodule because of the high diagnostic accuracy and the avoidance of thoracotomy for benign disease. An expanded role is also possible for the expeditious diagnosis of pulmonary metastases to initiate systemic therapy and in selected patients for excision of isolated metastases, when an appropriate and substantial disease-free interval exists. There also may be a more prominent role for thoracoscopy in wedge resection of peripheral T1 N0 primary lung cancers after adequate staging in patients with poor pulmonary reserve (forced expiratory volume in 1 second <1.0 L). Because of the avoidance of postthoracotomy pain in patients with sympathetic dystrophy, surgical sympathectomy by the thoracoscopic approach may assume a larger role in the clinical management of these difficult patients.

Although a number of other procedures can successfully be performed thoracoscopically, the role of the procedure in the management of these diseases is not yet clearly defined. Those situations include esophagomyotomy for achalasia, the excision of esophageal leiomyomas, and the management of specific spinal diseases including disc space abscesses, protruding discs, and undiagnosed vertebral body metastases. Also yet to be defined are the role of thoracoscopy in the management of blunt and penetrating trauma, pericardial patch placement for implantable defibrillators, and the management of bullous lung disease causing compression.

In this rapidly evolving field, we anticipate that the ultimate role of thoracoscopy in the management of

diseases of the chest will soon become further defined. From our early experience, we expect that the impact of thoracoscopy on the practice of thoracic surgery may be as profound as the performance of laparoscopic cholecystectomy has been in the general surgery field.

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DISCUSSION

DR JOSEPH LoCICERO (Boston, Massachusetts): I want to thank Dr Mack for providing me with a copy of his manuscript. I would like to compliment him and his group on their careful prospective analysis of this early experience and for sharing with us all of the speculations they have about the potential applications of this technology to our present armamentarium. As one gains more and more experience with this, one realizes that there are many other possible applications in addition to those that we have traditionally used in the past.

I would like to ask two specific questions of Dr Mack. First, you use CO_2 insufflation at the beginning of your procedures, and this adds some degree of potential for complications. I would like you to expand on that. Do you think that it is necessary? Second, this is the first collected series of many to come using a totally endoscopic technique, but occasionally, as you have mentioned, these incisions need to be expanded to an open thoracotomy, either to perform a definitive procedure or to find the pathology in those cases where it has not been locatable. Have your previous thoracoscopic incisions limited your ability to perform limited muscle-sparing incisions?

DR MACK: Thank you for your comments, Dr LoCicero. Regarding CO_2 insufflation, we selectively use it as part of our procedure, although a number of centers do not. We believe that CO_2 insufflation enhances the resorptive atelectasis that occurs by either a bronchial blocker or a double-lumen tube and hastens the collapse of the lung. In addition, because good endoscopic lung retractors do not exist yet, CO_2 insufflation causes a more complete atelectasis of the lung, and in such procedures as pericardectomy and procedures on the esophagus the addition of CO_2 insufflation helps move the lung out of the way. Also, if substantial amounts of electrocautery or laser are used and a buildup of smoke or plume occurs in the chest, CO_2 insufflation helps evacuate this easier and helps recollapse the lung when any suction is placed within the thoracic cavity. We have not had complications associated with CO_2 insufflation. Early in our experience, in our first 6 patients, we monitored blood pressure and venous return carefully with arterial lines and Swan-Ganz catheterization and found that we could safely insufflate up to a pressure of 8 to 10 cm H_2O without causing any major shift in the mediastinum.

Regarding your second question about the compromise of potential thoracotomy incisions by the thoracoscopic incisions, our initial incision, which is almost always in the midaxillary line, does go through the serratus muscle that we mobilize for muscle-sparing incisions. If we anticipate that a thoracotomy is a possibility, we try to plan our second and third trocar placements so that they do not go through muscle that we will be mobilizing for a muscle-sparing thoracotomy.

DR JAMES W. MACKENZIE (New Brunswick, NJ): Dr Mack, I would like to commend you and your colleagues for your early recognition of the importance of thoracoscopy and an excellent series, very well presented. Like Dr LoCicero I wondered a little bit about your insistence on using CO_2 insufflation. I think you have gone a long way toward answering some of my concerns. I still have a bit of reservation that perhaps in some of the high-risk patients the positive pressure within the thorax might cause respiratory problems.

I had one other simple question. I note that you did not routinely insert an intrathoracic tube at the conclusion of your procedures. I wonder if you could say a little bit more about how you make the selection and if on any of the occasions you have had to put a tube in postoperatively. I enjoyed the presentation very much.

DR MACK: Thank you for your comments. Our common practice now in terms of CO_2 insufflation is that we use it to begin the procedure to expedite collapse of the lung, and then if the lung is not in the way for the remainder of the procedure, we do not continue CO_2 insufflation. We have become less aggressive with the use of chest tubes as time goes on. Because a less invasive incision is being used, the causes of postoperative pain are becoming increasingly well defined, and it appears that the chest tube is a significant cause of morbidity postoperatively. In situations where we do not anticipate an air leak, in other words, if we have not done a procedure on the lung, or if it is not a procedure done for pleural effusion, we do not use chest tubes. For instance, for sympathectomy or mediastinal or hilar node dissections, we routinely do not use chest tubes. Total reexpansion of the lung by the anesthesiologist is watched, and we evacuate the pleural cavity totally of air before closure of the incisions.

DR PETER C. PAIROLERO (Rochester, MN): I too appreciated this excellent presentation, and I stand to raise a point that seems so obvious. We cannot lose sight of the fact that diagnosis and therapy are at opposite ends of the management spectrum, and just because we have the ability to adequately diagnose a lesion

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does not necessarily translate into adequate treatment. This is especially true when dealing with neoplasm.

As you have so nicely demonstrated, those patients who were found to have primary lung cancer required thoracotomy with formal resection. Only careful long-term follow-up will resolve these issues of therapy. Until these data are available, we must be certain that this early enthusiasm to avoid thoracotomy does not result in reduced long-term survival compared with thoracotomy.

DR MACK: I thank Dr Pairolero for his comments. I would like to emphasize that it is our belief that only the approach has changed, that is, the method of getting in and out of the chest, and that the adequacy of the procedure has not changed. We do not believe that we have had to compromise any of the procedures to accomplish it by this technique, and we wholeheartedly agree with Dr Pairolero's comments.

There is also a significant concern we have that this method will follow the precedent of angioplasty in cardiology. On that note The Society has been very supportive of setting up a national study group to address in a controlled manner the study of multiple issues in thoracoscopy before widespread application.

DR RAYMOND A. DIETER, JR (Glen Ellyn, IL): I enjoyed Dr Mack's presentation very much. When I was a resident we were told these were bad techniques and they were not safe. About 2 years ago, after we went into private practice, we began using thoracoscopic techniques. And purely on a diagnostic basis, we have done 79 such procedures, of which 62 yielded carcinoma and another several either tuberculosis or blastomycosis on biopsy and culture. With this type of "band-aid surgery," as the gynecologist or the lay public now call this technique, and with the interest of the modern manufacturers—the commercial individuals who develop the equipment (and that's a key for all of us; the equipment is very helpful)—we have gone on to therapeutic areas. I would like to ask one or two questions and make a comment.

Regarding the CO_2 concern, we have successfully used it in about 80% of our patients over these past 20 years. Our questions deal with the pleural process. First, do you think you are going to short-circuit your workup with the future of pleural effusion and with the availability of this? Second, do you believe that the indications for pneumothoraces or subpleural processes will now be changed because of this technique?

DR MACK: I think both of those situations are very relevant and very pertinent to address. Indeed, the national Video-Assisted Thoracic Surgery Study Group's first protocol that will be initiated April 1 will be precisely addressing the first area that you mention. Patients will be randomized between tube thoracostomy with a slurry of talc installation versus thoracoscopy to answer the question of whether thoracoscopy is better at dealing with effusions.

In regard to the second question, our indications for treatment of apical blebs and spontaneous pneumothorax are the same as they have always been. In other words, our indication for a surgical approach is recurrent pneumothorax or persistent first-time pneumothorax. There has been a trend already toward the use of thoracoscopy for the first-time pneumothorax. We do not believe this is appropriate at the present time and believe that this needs to be addressed in a study group setting before this procedure can be recommended in that setting or before the present indications change.

DR LOYDE H. ROMERO (Medford, MA): We have also used video-assisted thoracoscopy to perform procedures on the chest. What we are pursuing is lobectomy.

We have performed experimental studies on cadavers. The scope that we have used is a bivalved thoracoscope. It is placed through a 2-inch intercostal incision. It has two fiberoptic light cables, which provide superior lighting. You have direct visualization with normal depth perception, normal tissue coloration, and three-dimensional viewing. The scope also acts as a retractor. The two blades are placed in the fissure between the upper and lower lobes. You separate the blades and get retraction of the fissure and directly approach the pulmonary vessels and bronchus. The vessels are isolated using thoracoscopic surgical techniques.

We use the EndoGIA to staple and divide the pulmonary artery to the lower lobe. Right under the artery is the bronchus to the left lower lobe. We take the bronchus with a TA stapling device and then the vein with a TA stapling device. The fissure is opened using the electrocautery.

The left lower lobe can be delivered through a 2-inch incision rather readily. Now, we have done this on every lobe in cadavers and we have done it successfully performing left lower lobectomy in pigs. I believe that the procedure has to be done as safely by this method as by the open technique.

DR C. FREDERICK KITTLE (Chicago, IL): I have enjoyed Dr Mack's presentations both yesterday and today. They are very fine and properly reflect both his pioneering efforts and his enthusiasm for this procedure that will prove to be so beneficial to all of us. It probably also establishes a record for being the only scientific paper that I have seen that has been given twice at any single meeting. However, I am concerned about one of the indications, and that is, the procedure of pericardiectomy. If we consider the usual subxiphoid pericardiectomy, the time that it takes, the adequacy of the procedure, and the lack of any appreciable postoperative morbidity, I seriously wonder whether or not a pericardiectomy by a thoracoscopic route offers any advantage. So I would like to ask Dr Mack whether thoracoscopic pericardiectomy is merely an exploratory effort to see what could be done or whether he considers this a preferred method, and if so, in what instances.

DR MACK: I thank Dr Kittle for his kind comments. In regard to re-presentation of the paper, The Society told me they were going to make me keep re-presenting it until I got it right.

In regard to the pericardiectomy issue, our standard approach for the last 8 years has been a limited left anterior thoracotomy for performing pericardiectomy. We, in our own experience, abandoned the subxiphoid approach a number of years ago because of recurrences, and since then the limited left anterior thoracotomy has been our standard approach. We went to the thoracoscopic approach instead of the left anterior thoracotomy and found that the visualization was superior and the extent of pericardiectomy that we could perform was better. I have had no experience with the subxiphoid approach over the last 8 years.

DR SHAHROKH MANSOORI (Bloomfield Hills, MI): I greatly enjoyed the presentation and I congratulate Dr Mack and others who contribute so much to the art of thoracoscopic surgery; however, it seems that this procedure is becoming like a brush fire and catching us all. Perhaps it is time for some restraint, because most of these operations can be done as safely and effectively in the standard way, which is also less costly. I believe many of the thoracoscopic procedures that were mentioned in the last couple of days could be categorized as such. Just

yesterday I observed slides from a procedure in which the lobe was pulled out through a 2-inch incision. Not too many thoracic surgeons have the privilege of having Houdini or David Copperfield as an assistant in the operating room. I believe at this point that thoracoscopic lobectomy is contraindicated.

DR MACK: We could not agree with Dr Mansoori more. Indeed, both The Society of Thoracic Surgeons and the American Association for Thoracic Surgery have taken the lead in terms of addressing the issue of thoracoscopy in the practice of thoracic surgery. There is a combined committee under the direction of Martin McKneally from Toronto that is attempting to standardize the education process of thoracic surgeons in this new technique. In addition, there is a subcommittee that has been formed to have a national cooperative study under the direction of Dr Joe LoCicero from Harvard.

We do not want to repeat the experience of angioplasty and believe that some restraint and some controlled investigation of this procedure is warranted before the overenthusiastic application of it occurs. There are a number of protocols that have been submitted to the combined committee, and we are hopeful that within the next couple of months (I believe there are 18 centers involved right now) we can answer some of these questions in a scientific manner and help determine the true role of thoracoscopy in the present practice of thoracic surgery.