Surgical techniques are usually learned during the course of a formal residency or fellowship program in a particular discipline. However, from time-to-time, a new technique is devised which is of significant interest to physicians who have already completed their formal training, and of potential benefit to a number of patients, that the technique “catches on” and is applied in daily practice. Such a phenomenon occurred in the late 1960s and early 1970s after the pioneering work of the Japanese to invent fiberoptic bronchoscopes. Before that, rigid bronchoscopy was largely within the domain of thoracic surgeons, otolaryngologists, and a few bronchoesophagologists. Then, after fiberoptic bronchoscopes became available, large numbers of pulmonary physicians and other specialists expressed a desire to learn how to use this new instrument. The problem arose as to how they might best learn.

For physicians who were in their pulmonary fellowships in those years, it was a simple matter of learning from their mentors. As time has passed, fiberoptic bronchoscopy has become an integral part of every training program in pulmonary diseases. In fact, some programs in thoracic surgery and otolaryngology now have difficulty in meeting adequate caseloads of bronchoscopic procedures to train their residents and assure competency. Of special concern is whether enough physicians (regardless of their specialty) will be trained in the use of a rigid bronchoscope for those situations which require its use rather than a flexible bronchoscope.

A similar situation exists at the present time as it pertains to training in laser bronchoscopy. The methods of dealing with the demand for training are very much like what was observed for fiberoptic bronchoscopy; physicians have a desire to learn a new technique after they have already completed formal training in a residency or fellowship program. Gradually, this will become a “non-issue,” as laser bronchoscopy becomes an integral part of many (but probably not all) approved residencies in pulmonary diseases, thoracic surgery, and otolaryngology. When considering the issue of training in laser bronchoscopy, it may help to see how physicians who had already completed their formal training years dealt with their needs/desires to learn how to use the fiberoptic bronchoscope.

One way was to attend a continuing medical education course with laboratory time for “hands-on” experience. Such courses would typically include didactic sessions to teach theory, indications and contraindications, anesthetic and operative techniques, specimen preparation and processing, management of complications, postoperative care, and a whole host of other information in a short (two to three day) course.

Some physicians who had already completed formal training would make arrangements with faculty members at teaching institutions to learn fiberoptic bronchoscopy in a preceptor type of fashion. Because the demand was so great within its membership, the American College of Chest Physicians, through its Section on Bronchology, solicited such arrangements from recognized authorities within the field of pulmonary medicine for preceptor training. Henry Ford Hospital was one such place where preceptor training in fiberoptic bronchoscopy was available, and over a course of three to five years, a few pulmonologists who had already completed their formal training years came here to learn fiberoptic bronchoscopy.

There were several problems in trying to conduct such training. First, practicing pulmonary physicians tend to be a busy lot, and the demands of other patient care issues often made it difficult to come to the teaching hospital on a regularly scheduled basis, even when the teaching institution was located in the same metropolitan area. Second, patients who required bronchoscopy at the teaching institution would be identified in variable numbers for a given day, which made it difficult for the practicing physician to know when adequate caseloads would justify time away from the practice to acquire the desired training and experience. Third, fellows in the training program at the teaching institution greeted such “outsiders” with
less than a warm welcome for performing the bronchoscopies under the tutelage of the faculty, as such arrangements would necessarily reduce their caseloads for similar training and experience. There were two other problems with such arrangements. In some institutions (and this is even more of a problem today), the medical bylaws and concerns regarding liability issues are such that an arrangement of this sort would not allow the preceptor any "hands-on" experience. The trainee could only function as an observer. By training in a nonformal way such as this, there is always the potential that the trainee may not become sufficiently adept at the procedure so as to assure optimal performance and application in practice, and the review mechanisms to correct any such deficiencies are much less effective than is possible in a structured residency training program.

Similar phenomena are taking place now with regard to training in laser bronchoscopy. At present, few physicians have been trained as a natural part of their residency/fellowship programs, so the majority of physicians who wish to become involved in performing laser bronchoscopy must begin by attending a laser bronchoscopy course. Before attending a laser bronchoscopy training course, it is well to consider what the anticipated volume of laser bronchoscopy might be, and how the equipment will be funded and amortized. All laser equipment is expensive, and a system of sharing the equipment with physicians and surgeons in a variety of disciplines is advisable. Estimating laser bronchoscopy volume in a given practice or at one hospital requires knowledge of other qualified or aspiring laser bronchoscopists in one's geographic locale. If a physician then decides to embark upon additional training after considering all these issues, the logical starting point is with a continuing medical education course. Some physicians attend laser bronchoscopy courses simply for the purpose of educational enhancement, but the majority of course attendees have an expressed interest to satisfy local hospital credentialling requirements to begin performing laser bronchoscopy.

The absolute volume of laser bronchoscopy is but a small fraction of the total number of bronchoscopies for all reasons, so the amount of experience will necessarily also be much less for laser bronchoscopy. Moreover, I would suggest that the complexity of the procedure is considerably greater for laser bronchoscopy than it is for diagnostic or other therapeutic bronchoscopy, so the skills tend to take longer to learn and give rise for greater potential misadventures. What avenues are open to assure the best possible training for all who want or need to acquire this training, and at the same time provide patients with the most competent care we as a profession can deliver?

There is the temptation to try to devise a minimum set of initial training recommendations and credentialling requirements to perform these procedures. As a profession, I think we owe ourselves and our patients more than to set minimum standards. A similar approach was ultimately chosen by the Inter-Society Commission for Heart Disease Resources as it published recommendations for cardiac surgery programs. The same Commission published optimal resource guidelines for radiologic facilities for conventional x-ray examination of the heart and lungs, catheterization-angiographic laboratories, cardiovascular surgical operating rooms and intensive care units, ultrasonic examination of the heart, and implantable cardiac pacemakers. Whereas many of these procedures and methods of delivering care are far more complex than laser bronchoscopy, some of them are similar in magnitude and scope. Before proposing guidelines for credentialling in laser bronchoscopy, it is appropriate to consider training methods.

**INITIAL LASER BRONCHOSCOPY TRAINING FOR THE PHYSICIAN BEYOND HIS/HER FORMAL TRAINING YEARS**

As best possible, the prospective course attendee should determine the content of the course. For laser courses generally (not specific for laser bronchoscopy), the American Society for Laser Medicine and Surgery has proposed a statement regarding Standards of Practice which refers to training:

Hospital privileges are, and must remain, the responsibility of the hospital governing board. Those requesting privileges to use lasers shall meet all the standards of the hospital with regard to board certification, board eligibility, special training, ethical character, good standing, judgment, indications for application, etcetera. In addition, the following laser training and experience is recommended:

1. The applicant should review the pertinent literature and audiovisual aids, and should attend laser training courses devoted to teaching of laser principles and safety. These courses should include basic laser physics, laser-tissue interactions, discussion of the clinical specialty field, and hands-on experience with lasers. Such course or courses should be a minimum of 8 to 10 hours.

2. The individual should have spent time with an experienced operator in the specialty area involved. Such time may consist of several brief visits or a more prolonged stay, with a minimum of 6 to 8 hours of observation and hands-on applications of the laser in the outpatient or hospital setting as appropriate to the procedures in which the training is conducted.

3. The applicant should do only those procedures that he or she is capable of doing by conventional means, and initially, do simple procedures.

4. The applicant should establish a means to work closely with the biomedical engineering personnel.

NOTE: The standards and practice committee of the American Society for Laser Medicine and Surgery advises that these criteria are to be reevaluated every two years. Younger investigators are encouraged to obtain formal training in their residency.

During the years 1984 to 1986, we offered four courses in laser bronchoscopy at Henry Ford Hospital. Each course lasted 2 to 2½ days. The didactic material
was presented during morning sessions, and consisted of the following topics:
1. Overview of Lasers in Medicine
2. Laser Physics and Tissue Interaction
3. CT Scans and Other Radiographic Techniques in Preoperative Patient Assessment
4. YAG Laser Bronchoscopy
5. CO₂ Lasers for Larynx, Trachea and Main Bronchi
6. Argon and Tuneable Lasers with the Bronchoscope
7. Local Anesthetic Techniques
8. General Anesthetic Techniques
9. Rigid vs Flexible Bronchoscopy
10. Contraindications and Complications
11. Setting Up Laser Bronchoscopy in the Community Hospital
12. Nursing Responsibilities; Administrative Functions
13. Interdisciplinary Use for Lasers—The Need for a Cooperative Program
14. Marketing Strategies and Reimbursement Issues

In addition to these didactic presentations, there were two laboratory sessions, each of which was four hours long. At one of the courses, we had an optional third laboratory session. Technical and support personnel were part of the team at each laboratory session. At least one CO₂ laser was set up at one station, but most of the stations were devoted to continuous wave YAG lasers. Representatives from the laser vendors and bronchoscope manufacturers were also present. They would typically explain the power/water requirements for each laser, the instrumentation panel, calibration and operating features of each laser, and reinforce safety issues.

The faculty, in conjunction with vendor representatives, would continue with a demonstration of laser interaction with various materials at which the laser energy could be applied, such as a tongue depressor, fruit, and pieces of meat of different consistencies. Through such demonstrations and subsequent opportunities to fire the lasers at these same objects, the course attendees were taught how to operate the lasers and what to expect with different power settings, duration of laser impulses, and tissues of different colors and composition.

Next would come simulation of laser bronchoscopy with a canine animal model. In an effort to maximize the practical experience offered, we attempted to limit the number of physicians around any one “station” to four, accompanied by a faculty member to supervise this practical phase of training. Even with a ratio such as this, it usually was not possible to offer any one course attendee more than two hours of actual time practicing laser bronchoscopy at such a course.

Efforts were made to demonstrate use of the CO₂ laser with a suspension laryngoscope for laryngeal disorders, as well as through a (rigid) CO₂ laser bronchoscope for tracheal lesions. Other canine animal models were created by inserting a muscle flap into the lumen of the trachea through an incision in the anterior tracheal wall, to mimic a tumor within the trachea. Both rigid and flexible bronchoscopes would be used, the latter through large bore plastic endotracheal tubes. The importance of avoiding discharge of the YAG laser energy onto the plastic endotracheal tube or inside the flexible bronchoscope was emphasized as a fire hazard. Other safety issues, such as meticulous cleansing of the tip of the quartz fiber and keeping it free from blood or mucus, were also stressed. Opportunities to practice both flexible laser bronchoscopy and rigid laser bronchoscopy, with special emphasis on the latter, would constitute the majority of time in the laboratory. Closed circuit television systems were adapted to the bronchoscope so that the faculty could coach and criticize the course attendee as he or she practiced on the canine model.

Approximately half the course attendees would be in the animal laboratory at any one time. The other half would be shown videotapes of laser bronchoscopy, with a faculty member supervising many such sessions and with opportunities to review much of what had been presented in the earlier didactic presentations. Interactive case presentations gave course attendees the opportunity to participate in management decisions over such issues as how to evaluate and prepare patients for laser bronchoscopy, as well as proper selection of patients, anticipation and management of complications, and the like.

Although this is a fairly detailed description of the courses in laser bronchoscopy offered at Henry Ford Hospital, it does not differ substantially from laser bronchoscopy courses conducted elsewhere.

Problems Encountered During and After Laser Bronchoscopy Courses

Typically, the greatest interest and concern of the course attendees was to practice use of the rigid bronchoscope, as the majority of course attendees did not have prior training or experience with it. Faculty members most often emphasize that a large proportion of laser bronchoscopy should be done through rigid bronchoscopes and with a general anesthetic in humans, although there are reports that local anesthesia and flexible bronchoscopes are acceptable alternatives and may even be preferable for the majority of patients with obstructing bronchogenic carcinomas. Even those practitioners of laser bronchoscopy who take the latter stance state that physicians performing laser bronchoscopy need to have the skills to use the rigid bronchoscope as well.
If this recommendation has merit, and I think it does, this creates a very real dilemma for most physicians who attend laser bronchoscopy courses. The majority of thoracic surgeons and otorhinolaryngologists in practice come with some skills in the use of rigid bronchoscopes. This is not typically true for practicing pulmonary physicians, who have been taught only how to use flexible bronchoscopes in their fellowship training programs. It is simply not possible during the course of a two-day laser bronchoscopy course to learn how to use a rigid bronchoscope well and use it safely in humans. Moreover, it is far easier to insert a rigid bronchoscope into an anesthetized canine model than it is to bronchoscope a human subject, even with general anesthesia and muscle paralysis. Another problem is that the canine tumor models used in laser bronchoscopy courses do not bleed as much as real tumors during laser bronchoscopy in humans, so the course attendee may get a false sense of security that ablating tumors is less fraught with problems than is true in humans. Moreover, with the tumor model just described, it is nearly impossible to simulate one technique of ablating tumors by using the laser at low power settings to “photocoagulate” the tumor, followed by “coring out” the bulk of the tumor with the rigid bronchoscope and/or removing large chunks of the tumor, as is often the way such tumors are debulked in humans (the laser, therefore, is often simply an adjunct to facilitate tumor removal when this technique is chosen).

Upon returning to the home practice after attending a laser bronchoscopy course, few physicians have access to animal laboratories to continue practice on such models before beginning to perform laser bronchoscopy in humans. Regardless of whether additional experience with a canine model can be acquired, it is difficult within a local community practice to convince one’s colleagues (such as a thoracic surgeon or otorhinolaryngologist) to teach and supervise the training of a flexible bronchoscopist with the necessary caseload to become proficient in rigid bronchoscopy.

Pulmonary physicians, therefore, usually must choose between not applying what they have learned at such a course or performing laser bronchoscopy only through flexible bronchoscopes. To learn what actually happened as laser bronchoscopy course attendees returned to their home practices for this and other issues, I decided to survey physicians who attended courses we conducted.

Questionnaires were mailed to 127 course attendees approximately one year after the last one was conducted (October 1986), which was an average of 24.5 months after completing the laser bronchoscopy courses. Responses were received from 67 (55 percent). The results of that questionnaire survey are displayed in Tables 1 to 3.

Table 1 — Equipment Available and Experience of Course Attendees (n = 67)

<table>
<thead>
<tr>
<th></th>
<th>At Time Course Was Held</th>
<th>At Time Survey Conducted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Hospital possesses YAG laser</td>
<td>28 (42%)</td>
<td>39 (58%)</td>
</tr>
<tr>
<td>Current laser bronchoscopy experience of course attendee</td>
<td>11 (16%)</td>
<td>56 (84%)</td>
</tr>
</tbody>
</table>

The data in Table 1 suggest that most laser bronchoscopy course attendees practice in hospitals that already own or plan to acquire YAG lasers soon after the physician attends such a course. On some occasions, the decision to purchase a laser comes at the behest of a hospital administrator who is interested in maintaining an advantage for high-tech visibility in a competitive marketplace (personal communications from several laser bronchoscopy course attendees). Many times, of course, it is one or a few enthusiastic physicians who persuade their hospital leaders for similar reasons.

The data from Table 1 also suggest that most physicians seek formalized training before attempting a new procedural skill, and that many physicians decide against (or are prevented from) performing laser bronchoscopy even after attending a formal training course. The information available does not permit analysis of how decisions are made to acquire lasers, and whether a system for sharing expensive laser equipment was developed, etc. Also not apparent from the data are whether other wavelengths (CO2, argon-pumped tuneable dye) were developed along with YAG laser bronchoscopy.

The third recommendation from the guidelines proposed by the American Society for Laser Medicine and Surgery is that course attendees “...should initially do simple cases.” This creates a real dilemma as one begins laser bronchoscopy, because most pa-

Table 2 — Technical Aspects of Laser Bronchoscopy Chosen by Course Attendees Who Were Performing Laser Bronchoscopy Upon Return to Their Home Practices (n = 30*)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of bronchoscope used</td>
<td></td>
</tr>
<tr>
<td>Flexible</td>
<td>9 (30%)</td>
</tr>
<tr>
<td>Rigid</td>
<td>8 (27%)</td>
</tr>
<tr>
<td>Both</td>
<td>12 (40%)</td>
</tr>
<tr>
<td>Type of anesthesia</td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>4 (13%)</td>
</tr>
<tr>
<td>General</td>
<td>26 (87%)</td>
</tr>
<tr>
<td>Location where laser bronchoscopy performed</td>
<td></td>
</tr>
<tr>
<td>Special Procedures</td>
<td>7 (23%)</td>
</tr>
<tr>
<td>Operating Room</td>
<td>22 (73%)</td>
</tr>
</tbody>
</table>

*Not all questions were answered by each respondent
patients who present with a need for this service have recurrent bronchogenic carcinoma. They have already exhausted other modalities of treatment and have high-grade obstruction of their central airways. The majority of them do not have a simple polypoid lesion which can be removed with the help of a laser in 30 to 45 minutes of operating time. As a consequence, the beginning laser bronchoscopist is usually confronted with a patient in fairly severe respiratory distress with a large tumor, often with markedly distorted landmarks in the airways. Added to this are the time requirements of other aspects of an individual's practice, whether it is in the office for scheduled patients or running a busy hospital practice, particularly with critical care responsibilities. Few physicians are in large group practices to allow translocation of these other responsibilities for several hours and on short notice, as patients who require laser bronchoscopy often need this service quickly.

The data from Table 2 indicate that 67 percent of physicians who attended the laser bronchoscopy courses we conducted utilize rigid bronchoscopes as they perform these procedures, at least with some of their cases, and they do so in operating rooms with general anesthetics. Thus, the majority of physicians who begin laser bronchoscopy after attending such courses are able to overcome whatever resistance may exist to get into operating rooms and obtain support from anesthesiologists for their cases. This indicates that the lasers are likely shared by users other than for just laser bronchoscopy, but there are some physicians who appear to be relegated to performing such cases in special procedure rooms or with local anesthetics. The magnitude of the latter problem may be greater than is apparent from the percentages displayed, because responses were not received from all physicians to whom the questionnaires were mailed.

The most important data which were obtained from the questionnaire survey are displayed in Table 3. When analyzing these data, it is important to remember that they represent the experience of physicians two years after they attended our laser bronchoscopy courses. The most disconcerting information in these data are the infrequency with which laser bronchoscopy is done by physicians who have attended our courses. For all but six who responded to the questionnaire, the frequency of performing such cases averages not more than one procedure every three months! It is difficult to believe that such procedures are being done as skillfully as would be true, if the physicians doing them had more frequent occasions to hone such skills. The selection of patients, at least by virtue of the location of the lesions (trachea and main stem bronchi, for the most part) seems appropriate. Not evident, however, is whether the lesions were intraluminal in all cases, or whether some patients with largely extrinsic compression of their airways, poor general functional status, or lengthy “bottleneck” benign stenoses might have been included. Interestingly, all patients who had segmental lesions approached for laser resection were done by graduates of our courses who reported total experience <25 cases. Although the overall complication rate seems reasonable, it is higher than has been true in reports from larger series. The true complication rate encountered by our course attendees may be higher than is evident from the responses reported, as it is likely that persons who had done a small number of cases with complications might not have responded to the questionnaire. A higher complication rate is typical when one begins performing new procedures, or when the frequency of performing those procedures remains low.

**Proposals to Improve Training and the Ongoing Practice of Laser Bronchoscopy**

At the present time, in my opinion, there are enough physicians in the United States who have completed continuing medical education courses in laser bronchoscopy and are applying what they have learned in their practices. Centers which have offered two- to three-day laser bronchoscopy courses should strongly consider discontinuing this type of course, as we have done.

Hospitals where laser bronchoscopies are done should, through their laser and credentialing committees, annually review the experience of physicians performing laser bronchoscopy. This should include the development of caseload criteria to renew a physician’s privileges to continue laser bronchoscopy, as well as a critical review of benefit to the patients

**Table 3—Experience with Laser Bronchoscopy of Course Attendees After Course Attendance (n=30)**

<table>
<thead>
<tr>
<th>Number of laser bronchoscopies performed</th>
<th>1-5 Cases</th>
<th>6-25 Cases</th>
<th>&gt;25 Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12 (40%)</td>
<td>12 (40%)</td>
<td>6 (20%)</td>
</tr>
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<table>
<thead>
<tr>
<th>Location of lesions treated*</th>
<th>Trachea or main stem bronchi</th>
<th>Lobar bronchi</th>
<th>Segmental bronchi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>522 (82.5%)</td>
<td>102 (16.1%)</td>
<td>9 (1.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complications encountered*</th>
<th>Postop infections from necrosis</th>
<th>Massive bleeding</th>
<th>Pneumothorax</th>
<th>Arrhythmia</th>
<th>Respiratory failure</th>
<th>Fire (minor)</th>
<th>Metal tip lost</th>
<th>Mediastinitis</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

| Total                                    | 22                              |                 |             |           |                   |             |               |             |
|                                        | (3.8%)                          |                 |             |           |                   |             |               |             |
| Fatalities*                              | 4                               |                 |             |           |                   |             |               |             |
|                                        | (0.6%)                          |                 |             |           |                   |             |               |             |

*n = 633 cases.
and the complications incurred.

Professional societies, such as the American College of Chest Physicians, should develop and publish guidelines for training and competency in laser bronchoscopy, much as they did for endoscopy and fiberoptic bronchoscopy. While organizations such as the American Board of Internal Medicine have not sought to dictate the number of times a procedure must be done to assure competency, they have indicated a desire that procedures should be applied for the patient's benefit. Others have suggested a probationary period (three to six months) under the supervision of a trained laser-experienced bronchoscopist in order to acquire the necessary experience in the performance of laser procedures.

The Inter-Society Commission for Heart Disease Resources was far more explicit in addressing the issue of caseload criteria, stating that, "A new cardiac surgical program should reasonably expect to attain an annual rate of 75 pump-assisted procedures within one year, and 200 such procedures within three years of initiation. Within a defined geographic area, the establishment of additional cardiac surgical units should be discouraged until hospitals already providing satisfactory services are operating at these acceptable levels. . . . New cardiac surgical services should not be established if they will interfere with the level of efficiency of existing units." This commission went on to discuss the issues of caseloads in greater detail; the development and maintenance of clinical proficiency; the need for initial response time for emergencies; efficient and economical use of personnel and facilities; unproductive competition; and the qualifications of professional staff.

The reader should not think that such guidelines are intended for cardiac surgery alone; the Inter-Society Commission also published annual caseload guidelines for cardiac catheterizations by hospitals (300 per year) and physicians (150 per year), and even for implantable cardiac pacemakers (50 implantations per year per hospital, and 25 new and five or more replacement pacemakers per year per physician). In my opinion, the latter caseload recommendations are appropriate for laser bronchoscopy (50 per year per hospital, and 25 per year per physician). Others might argue that only surgeons should do laser bronchoscopy, or that such procedures should be done only in a large academic or referral center. I would resist such arguments, but I do feel that any physician or hospital group which wants to begin laser bronchoscopy must be held to some caseload criteria and review of outcome/complications after an initial probationary period so as to assure quality care for patients.

These or other guidelines might be developed for laser bronchoscopy by professional societies such as the American College of Chest Physicians and the American Thoracic Society. The alternative is far less desirable: placement of constraints by government agencies and third-party payors.

Directors of training programs where laser bronchoscopy is practiced should not attempt to train every member in their postdoctoral programs to perform laser bronchoscopy. Instead, individuals should be selected on the basis of demonstrated excellence in procedural skills. They should then be taught and given ample opportunity to learn how to perform rigid bronchoscopy well. If such individuals then express interest in learning to perform laser bronchoscopy, and they express intentions to stay with programs that have adequate caseloads, they should continue to acquire training and skills in laser bronchoscopy during their final years of training.

Hospitals and physicians currently performing low volumes of laser bronchoscopies should critically examine the need to continue this activity, and consider stopping if volumes do not increase over the next one to two years. Hospitals and physicians who continue performing laser bronchoscopy should strive for full services in this area, with all three major wavelengths (CO₂, YAG, and argon-pumped tunable dye) whenever possible.

New wavelengths and modifications of existing procedural techniques may find application through carefully conducted clinical research, provided there is an adequate caseload at such centers to do so.

REFERENCES
6 Parsonnet V, Furman S, Smyth NPD, Bilitch M. Optimal resources for implantable cardiac pacemakers. Circulation 1983; 68:227-244


Cavaliere S, Foccoli P, Farina PL. Nd:YAG laser bronchoscopy: a five-year experience with 1,396 applications in 1,000 patients. Chest 1988; 94:15-21

Brutinel WM, Cortese DA, McDougall JC, Gillio RG, Bergstrahl EJ. A two-year experience with the neodymium-YAG laser in endobronchial obstruction. Chest 1987; 91:159-65


