The Other Lung—Revisited

In a 1974 editorial entitled, "The Other Lung,"1 Dr. David Bates commented upon two unsuccessful single lung transplants for emphysema reported in the New England Journal of Medicine.2 The report, by Stevens and coworkers, presented sequential ventilation and perfusion data following lung transplant in two patients with severe emphysema related to alpha,-antitrypsin deficiency. The patients, ages 37 and 39, survived for ten and 26 days, respectively. Using regional ventilation and perfusion scans, the authors documented progressive increase in perfusion to the transplanted lung with concomitant fall in the volume and the relative ventilation to the transplanted lung. Approximately 70 percent of the blood flow ultimately went to the transplanted lung, whereas the ventilation and volume of this lung fell to 30 percent of the total. Under these circumstances, the authors concluded that the transplanted lungs "function largely as physiologic shunts."

Bates, in his editorial, opined that the mismatch in ventilation and perfusion resulted not as a consequence of rejection, but "as a result of the competition between the two lungs for ventilation." He suggested that the experience of Stevens and others "points possibly to the desirability of attempting a bilateral simultaneous lung transplantation so that ventilation and perfusion of both the transplanted lungs can be well balanced after surgery." His comments were indeed visionary and in the past year, we have reported our initial success with en bloc bilateral lung transplantation in patients with chronic obstructive pulmonary disease.3

Like Bates, we worried that unilateral lung replacement for chronic obstructive lung disease might lead to overexpansion of the native lung and crowding of the transplanted lung in addition to a significant ventilation-perfusion mismatch due to the loss of elastic recoil in the competing "other lung." Our review of the literature revealed approximately ten cases of single lung transplantation for obstructive lung disease between 1963 and 1983. In virtually all cases, there was compression or significant atelectasis of the transplanted lung. However, in 1972, Veith et al4 reported improved gas exchange and function, despite radiographic evidence of mediastinal shift and disproportionate ventilation to the native lung, following single lung transplantation in a 53-year-old ventilator-dependent emphysema patient.

In this issue of Chest (see page 738), we report our initial success with single lung transplantation for emphysema, a procedure undertaken after preliminary reports of success by two other groups.5-6 Our patient, a 60-year-old man, was first considered for the double lung transplant procedure. We initially felt that this was his only option, but were concerned by the increased risk of this procedure in patients over age 50 years. In applying the single lung transplantation procedure to emphysema patients, we were less concerned by the potential "wasted ventilation" of the native lung than by the potential inability of the transplanted lung to fully expand. The results in our initial case, and similar excellent results with a second patient, require rethinking of our previous concerns. It is now apparent that the transplanted lung can, under favorable circumstances, expand to its full capacity and provide excellent lung function for the recipient. The donor lung, regardless of size, will not fill the entire hemithorax vacated by the markedly overexpanded emphysematous lung. In this setting, some compensatory shift of the mediastinum and elevation of the diaphragm are, in fact, appropriate, if not desirable. Normal expansion and ventilation of the transplanted lung depends upon maintenance of normal compliance in that lung. We attribute success with single lung transplantation for emphysema, at least in part, to improved methods of lung preservation and immunosuppression to prevent rejection, and suspect that the early unfavorable experience related, at least in part, to decreased lung compliance related to poor preservation, rejection, or infection.

Single lung transplant for emphysema has numerous advantages. Unlike the double lung transplant procedure, single lung transplant can generally be performed without the use of cardiopulmonary bypass, simplifying logistics and eliminating the risks of operative hemorrhage from heparinization. Donors with one injured lung may still furnish a single lung suitable for transplant, and donors with two satisfactory lungs can provide for two recipients. We have, in fact, successfully employed this technique, using each lung for a separate emphysema patient.

Though gratified with the early results, it is too soon to draw firm conclusions as to the role of single lung
transplant for emphysema. Potential disadvantages may become evident over a longer period of time, including compromised pulmonary function, potential for pulmonary infection in the native lung, or even an increased potential for malignancy in the remaining lung of an immunosuppressed individual with a long history of heavy smoking. All of these potential problems could conceivably be addressed by subsequent contralateral pneumonectomy following successful single lung transplantation. The double lung transplant, to date, has produced excellent lung function and exercise tolerance, but has been associated with increased risk of postoperative ischemic airway complications. Recent technical modifications to the procedure, with separate right and left bronchial anastomosis instead of the tracheal anastomosis, appear to have resolved this problem considerably.

In our own program, we continue to utilize double lung transplantation for emphysema patients under the age of 50, and to utilize single lung transplantation for emphysema patients over the age of 50, or in patients who are at increased risk due to right heart dysfunction.

Lung transplantation remains in its infancy, but now appears to have the same potential for success as has been achieved with other major organ transplants. Two types of lung transplants are now available for patients with end-stage emphysema. Additional time and experience will be required before the relative merits and risks of each procedure can be defined for this group of patients.

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**Enticements for Fruitless Bronchoscopy**

*That temptation that doth goad us on*

—Shakespeare

This issue (see page 710) includes Sen and Walsh's pithy summary of the use and misuse of fiberoptic bronchoscopy (FOB). Their opinions are judicious, buttressed by published data, and tempered by the fact that they receive no reimbursement for bronchoscopy. Most papers on FOB present data on patients who undergo bronchoscopy for established indications. We know little or nothing about how bronchoscopy is applied in the community. No one has examined randomly selected, community-based samples in different states. This was done for upper gastrointestinal endoscopy. The authors concluded that 28 percent were done for equivocal or inappropriate indications.

A survey of bronchoscopic practice in Britain showed that bronchoscopy increased from 15,000 in 1974 to 40,000 in 1988 despite little financial incentive. In the United States the need for scrupulous professionalism is evident when, in the Phoenix metropolitan area, one-fifth as many physicians do FOB as did them in England in 1983. Bronchoscopists in Michigan, Illinois, California, and the District of Columbia earn $400 to $500 for FOB. Hospital charges increase the typical cost to $1,480 for outpatient FOB in Illinois and $2,500 for FOB (without laser) in the operating room in Michigan.

Otolaryngology textbooks justify triple endoscopy—laryngoscopy, bronchoscopic procedures, and esophagoscopy—for patients with a nonlocalizing chest film and either unexplained vocal cord paralysis or malignancy in a cervical lymph node. General anesthesia is used. This is hard to rationalize when the chest film shows a primary cancer in the left lung or when a patient free of esophageal or pulmonary symptoms presents with leukoplakia of a vocal cord.

When the need for bronchoscopy is weighed, the epidemiologic circumstance, history, and physical findings are pivotal. Where overuse of CT and magnetic resonance imaging causes skills in physical diagnosis to atrophy, there is an increase in ill-advised bronchoscopy. Many patients with delayed-resolution pneumonia or lung abscess have bronchoscopy done because their physicians feel anxious until any possibility of a proximal obstructing cancer is excluded. This occurs because physicians have too little confidence in the history and physical examination. The physician contributes to the ambiguity of a radiology report by giving the radiologist skimpy clinical information. The radiologist defensively includes the off-chance of postobstructive pneumonia or cavitary neoplasm. His report prepares the way for an unnece-