Lung Reduction Surgery

Great Expectations and a Cautionary Note

A variety of surgical procedures have been designed with the idea of reducing breathlessness and improving exercise tolerance in patients with emphysema. These have included tracheostomy, autonomic denervation, pneumoperitoneum, chostochondrectomy, thoracoplasty, and bullectomy among others. Lung reduction surgery (reduction pneumoplasty) is the latest to receive a great deal of attention. Reduction pneumoplasty was first performed by Dr. Otto Brantigan and coworkers in the 1950s on 33 patients suffering from severe emphysema. The operation consisted of removing approximately 20 to 30% of the volume of one lung through a standard thoracotomy incision. The technique was abandoned because of frequent and prolonged postoperative airleaks. Dr. Joel Cooper and his colleagues at Washington University have ingeniously overcome this problem by employing a staple, sheathed in bovine pericardium, which effectively seals the edges of the remaining lung. Additionally, Dr. Cooper uses a sternum-splitting approach so as to operate on both lungs at the same procedure. Unpublished preliminary data on 20 patients were presented at the American Association of Thoracic Surgery meeting in April 1994, and an abstract summarizing data on 24 patients was presented at the American College of Chest Physicians meeting in November 1994. Marked improvement in both symptoms and pulmonary function was observed as lung volumes diminished approximately 12-25%, and FEV₁ improved nearly 100%; carbon dioxide retention diminished, and oxygenation increased to a sufficient extent that many patients were able to discontinue oxygen supplementation. The patients also judged their quality of life as being improved. Follow-up data were available for a mean period of approximately 6 months postoperatively. Of note, no data were available for 6-min walk test or dyspnea scores.

The mechanisms by which reduction pneumoplasty results in these improvements are unknown at this time. Possibilities include a beneficial effect on the mechanical function of the musculoskeletal component of respiratory system, increased effective elastic recoil of the lung, and/or changes in cardiopulmonary interdependence. Hyperinflation puts the respiratory muscles at a mechanical disadvantage. Both the diaphragm and intercostal muscles likely do not function optimally because functional residual capacity (FRC) in the emphysematous patient is far above normal. Accordingly, a reduction in FRC might allow improved function of the respiratory muscles. The hyperinflation that accompanies emphysema also results in an increase in the volume of the chest wall and an increased work of breathing due to an augmented inspiratory elastic load. Reducing the total lung capacity, as was seen in the patients reported by Dr. Cooper and his colleagues, might reduce this elastic load. In addition, resection of diseased lung may increase the effective elastic recoil of the lung tissue that remains following pneumoplasty. Increases in airway tethering and driving pressure likely account for the improvement in expiratory flow, as suggested by Brantigan et al² in their original work and observed by Cooper and colleagues in their patients. Reduction of lung volumes might also ameliorate the restrictive effects of lung hyperinflation on cardiac filling.

Studying the potentially beneficial effects of reduction pneumoplasty might provide information pertinent to the underlying pathophysiologic processes of emphysema, in particular the manner in which mechanical derangement leads to symptomatic and functional impairment. The procedure is, in essence, an “experiment in reverse,” as changing part of the pathologic process of emphysema provides an opportunity for important investigations about this common, disabling disease.

The risks of reduction pneumoplasty have not yet been clarified. In addition to operative and 30-day postoperative mortality data which are presently not available, the effects of the procedure on the course of the emphysema in the remaining lung tissue are also unknown. Accordingly, longer-term data are critical before reduction pneumoplasty is accepted as standard therapy for patients with emphysema.

As can be expected, the lay press has publicized the operation with enthusiasm. The possibility of restorative surgery is extraordinarily appealing both to physicians and to many of the approximately 1.6 million Americans with emphysema. We have re-
ceived numerous inquiries from patients and primary care providers concerning the procedure. Many physicians are dismayed when first learning of the procedure from their patients (as a result of the stories in the lay press) when published scientific manuscripts are, to date, lacking. Undoubtedly, this scenario has been repeated at medical centers throughout the United States, and likely in other parts of the world as well. Based on informal discussions at this year’s American Thoracic Society and American College of Chest Physicians meetings, it appears that the operation is already being offered at many centers, some going so far as stating explicitly that it is not an experimental procedure. We strongly concur with Dr. Norman Edelman, Scientific Consultant to the American Lung Association, who asserts that reduction pneumoplasty “... must still be regarded as a research procedure and... must be done in a larger number of patients and with better controls before [it] could become any standard part of emphysema therapy,” (communication to American Lung Association local chapter on a new surgical research project; N. Edelman; April 26, 1994).

We submit that all patients undergoing reduction pneumoplasty should be enrolled in experimental protocols for the following reasons: (1) the long-term efficacy of the procedure (ie, >6 months) is not known; (2) the mortality relating to the operation is also unknown and cannot be determined by the small number of patients reported by Dr. Cooper et al; (3) the effect of the procedure on the progression of emphysema is unknown; and (4) the potential cost to society is enormous given the number of patients who suffer from this debilitating disease. Most importantly, potential candidates for reduction pneumoplasty should be specifically informed that the operation has yet to be described in the medical literature and that the procedure must be considered experimental at this time.

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Sepsis Clinical Trials

Don Quixote Revisited

Don Quixote was written in early 17th century Spain during the Baroque period where parody, exaggeration, intensity, and elaboration were rampant. Don Quixote, a 50-year-old man goes mad. He is knighted by an innkeeper and quickly adds Sancho Panza as his squire. In subsequent adventures, he attacks windmills that he thinks are giants. He then goes to find the imaginary Dulcinea. Eventually, he returns home and returns to his senses.

In sepsis, we have had a similar quixotic adventure with a simplistic and elementary understanding of the pathogenesis of sepsis. We tilted at windmills by trying to block “evil humors” with magic potions, ie, monoclonal antibodies to endotoxin, monoclonal antibodies to tumor necrosis factor (TNF), and interleukin-1 antagonists. We are now searching for the imaginary “magic bullet” without even a semblance of a homogeneous patient population under the categoric definition “sepsis syndrome.” I hope we will return home to our senses as did Don Quixote.

The ACCP/SCCM consensus conference1 was the first step in our return to sanity. In that document, an entity was described that was felt to characterize a systemic inflammatory response that often accompanies sepsis. This entity was dubbed the systemic inflammatory response syndrome (SIRS). This description was meant to be extremely sensitive so that patients were not excluded with an early systemic inflammatory response. An attempt was made to delineate a more homogeneous population by grading the magnitude of the systemic inflammatory response by severity of illness stratification. The study group reviewed the application of hospital mortality risk estimation to a group of 519 hospital ICU admissions using severity of illness scoring system. The risk distribution of the 308 (59%) patients meeting the criteria for sepsis syndrome was not substantially different from that for the 211 (41%) patients who did not fulfill the criteria. However, when using the SIRS definition, the same 519 patients had a primary clinical diagnosis of sepsis identified as 96.9% (503 of 519). This was critical because it included more patients who were at risk.1 Therefore, one could include a larger population of patients and then exclude those with different predicted mortalities and then presumably study a more homogeneous patient population. Guidelines for the conduct of clinical trials were also promulgated in the ACCP/SCCM document.

In the issue of Chest (see page 522), Drs. Sibbald