Lung Volume Reduction Surgery for Pulmonary Emphysema

Pulmonary emphysema is the major cause of pulmonary disability resulting in complaints of exertional dyspnea during daily activities. The predominant physiological abnormalities of emphysema are chronic airway obstruction, hyperinflation of the lung, decrease of lung elastic recoil, ventilation-perfusion mismatch, and impaired gas exchange. As a consequence, patients with severe emphysema have a markedly impaired quality of life, despite optimum medical treatment and management.

Brantigan and Mueller (1) started a surgical approach to benefit patients with generalized emphysema by resecting peripheral emphysematous lung tissue. Significant clinical improvements were reported, the due to the unacceptably high mortality rate of 18%, the procedure was abandoned.

More than 30 years later of Brantigan's work, surgical treatment of pulmonary emphysema has received renewed attention. In 1991, Wakabayashi et al (2) revived interest in surgery for diffuse bullous emphysema with a report of 22 patients who underwent “thoracoscopic carbon dioxide laser bullectomy.” They reported the increases in forced expired volume in one second (FEV₁0), forced vital capacity (FVC) and maximum exercise tolerance by treadmill test. In 1995, Cooper et al (3) began work on lung volume reduction surgery (LVRS) for 20 patients with severely hyperinflated lung suffering from diffuse heterogeneous pulmonary emphysema. They also demonstrated improvement of dyspnea and functional impairment after LVRS. Following these studies, several studies have reported improvements in dyspnea and pulmonary function (4–8). Sciurba et al (4) suggest that an improvement in elastic recoil of the lung might be one of the important physiologic mechanisms for the improvement in airflow obstruction after LVRS. Gelb et al (5) also showed that improvements in static lung recoil pressure are correlated with a post-operative increase in maximum expiratory flow.

LVRS for carefully selected advanced pulmonary emphysema patients may provide significant improvements in dyspnea and pulmonary function, such as expiratory airflow, lung volume, mechanical properties of lung, pulmonary diffusing capacity and exercise tolerance (3–5, 8–10). Recently, improvements of respiratory muscle function were also demonstrated after LVRS for patients with advanced pulmonary emphysema (7). Fujimoto et al (10) reported that LVRS may result in the increase in diaphragmatic functions and an improved breathing pattern in severe pulmonary emphysema patients from dynamic magnetic resonance imaging (MRI) findings of diaphragmatic configuration and movement. They showed also that the exercise performance assessed by the 6-min walk distance and dyspnea score improved after surgery (10).

These studies (4, 5, 8–10) suggest that LVRS improves the airflow limitation, gas exchange and thoracic movement as the result of a decrease in hyperinflation of the lung following the resection of higher-compliance area in emphysema patients.

See also p 119.

Although the basic mechanism responsible for the clinical and functional improvements are not well known yet, physiological mechanisms which brought improvement after surgical treatment for severe pulmonary emphysema should be further investigated and discussed. Moreover, studies are needed to evaluate the long-term effectiveness of the surgical treatment in comparison with medical treatment and management.

Minoru Yoshida, MD
Respiratory Medicine, Internal Medicine,
School of Medicine, Fukuoka University,
7-45-1 Nanakuma, Jonan-ku, Fukuoka 814-0180

References