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Systemic Medications in Chronic Obstructive Pulmonary Disease: Use and Outcomes **97**

Nicolas Roche

Inhaled therapy remains the cornerstone of chronic obstructive pulmonary disease pharmacologic care, but some systemic treatments can be of help when the burden of the disease remains high. Azithromycin, phosphodiesterase-4 inhibitors, and mucoactive agents can be used in such situations. The major difficulty remains in the identification of the optimal target populations. Another difficulty is to determine how these treatments should be positioned in the global treatment algorithm. For instance, should they be prescribed in addition to other antiinflammatory agents or should they replace them in some cases? Research is ongoing to identify new therapeutic targets.

Critical Analysis of the National Emphysema Treatment Trial Results for Lung-Volume-Reduction Surgery **107**

Joseph J. Platz and Keith S. Naunheim

The National Emphysema Treatment Trial compared medical treatment of severe pulmonary emphysema with lung-volume-reduction surgery in a multiinstitutional randomized prospective fashion. Two decades later, this trial remains one of the key sources of information we have on the treatment of advanced emphysematous lung disease. The trial demonstrated the short- and long-term effectiveness of surgical intervention as well as the need for strict patient selection and preoperative workup. Despite these findings, the key failure of the trial was an inability to convince the medical community of the value of surgical resection in the treatment of advanced emphysema.

Analysis of Recent Literature on Lung Volume Reduction Surgery **119**

Daniel P. McCarthy, Lauren J. Taylor, and Malcolm M. DeCamp

Publication of the National Emphysema Treatment Trial (NETT) in 2003 established lung volume reduction surgery (LVRS) as a viable treatment of select patients with moderate to severe emphysema, and the only intervention since the availability of ambulatory supplemental oxygen to improve survival. Despite these findings, surgical treatment has been underused in part because of concern for high morbidity and mortality. This article reviews recent literature generated since the original NETT publication, focusing on physiologic implications of LVRS, recent data regarding the safety and durability of LVRS, and patient selection and extension of NETT criteria to other patient populations.

Technical Aspects of Lung Volume Reduction Surgery Including Anesthetic Management and Surgical Approaches 129

Philippe H. Lemaitre, Bryan Payne Stanifer, Joshua R. Sonett, and Mark E. Ginsburg

As palliative treatment, lung volume reduction surgery can be offered to a selected subset of chronic obstructive pulmonary disease patients. Careful adherence to established inclusion and exclusion criteria is critical to achieve good outcomes. The evolution of surgical techniques toward minimally invasive approaches has improved outcomes. The fully extrathoracic access combining a subxiphoid incision with subcostal port placement allowed a further decrease in perioperative pain, which favors spontaneous respiratory drive and early postoperative mobilization. Less aggressive resections and better match for size of the hemithorax have contributed to a short-term reduction in morbidity and continued improvements in cardio-pulmonary function.

Alpha₁-antitrypsin Disease, Treatment and Role for Lung Volume Reduction Surgery 139

Nathalie Foray, Taylor Stone, and Peter White

Chronic obstructive pulmonary usually is subcategorized into 2 groups: chronic bronchitis and emphysema. The main cause of chronic bronchitis and emphysema is smoking; however, alpha₁-antitrypsin also has been seen to cause emphysema in patients who are deficient. As symptoms and lung function decline, treatment modalities, such as lung volume reduction surgery, have been used in individuals with chronic obstructive pulmonary disease and upper lobe predominant emphysema. This article analyzes multiple published series where lung volume reduction surgery has been used in individuals with alpha₁-antitrypsin deficiency and their overall outcomes.

Postoperative Air Leaks After Lung Surgery: Predictors, Intraoperative Techniques, and Postoperative Management 161

Travis C. Geraci, Stephanie H. Chang, Savan K. Shah, Amie Kent, and Robert J. Cerfolio

Postoperative air leak is one of the most common complications after pulmonary resection and contributes to postoperative pain, complications, and increased hospital length of stay. Several risk factors, including both patient and surgical characteristics, increase the frequency of air leaks. Appropriate intraoperative tissue handling is the most important surgical technique to reduce air leaks. Digital drainage systems have improved the management of postoperative air leak via objective data, portability, and ease of use in the outpatient setting. Several treatment strategies have been used to address prolonged air leak, including pleurodesis, blood patch, placement of endobronchial valves, and reoperative surgery.

Value of a Multidisciplinary Team Approach to Treatment of Emphysema 171

Sean C. Wightman and Robert J. McKenna Jr

Lung volume reduction surgery can significantly improve quality of life for properly selected patients who are symptomatic despite maximal medical management for emphysema. This requires a well-constructed multidisciplinary team (including transplant) to evaluate and treat these patients.

Life Expectancy and Rate of Decline After Lung Volume Reduction Surgery 177

Sowmyanarayanan Thuppal, Nicholas Lanzotti, Bradley Vost, Traves Crabtree, Stephen Markwell, Benjamin Seadler, Nisha Rizvi, Justin Sawyer, Kyle McCullough, and Stephen R. Hazelrigg

Lung volume reduction surgery (LVRS) patient selection guidelines are based on the National Emphysema Treatment Trial. Because of increased mortality and poor improvement in functional outcomes, patients with non–upper lobe emphysema and low baseline exercise capacity are determined as poor candidates for LVRS. In well-selected patients with heterogeneous emphysema, LVRS has a durable long-term outcome at up to 5-years of follow-up. Five-year survival rates in patients range between 63% and 78%. LVRS seems a durable alternative for end-stage heterogeneous emphysema in patients not eligible for lung transplantation. Future studies will help identify eligible patients with homogeneous emphysema for LVRS.

Bronchoscopic Valve Treatment of End-Stage Chronic Obstructive Pulmonary Disease 189

Traves D. Crabtree

Endobronchial valve therapy has evolved over the past decade, with demonstration of significant improvements in pulmonary function, 6-minute walk distance, and quality of life in patients with end-stage chronic obstructive lung disease. Appropriate patient selection is crucial, with identification of the most diseased lobe and of a target lobe with minimal to no collateral ventilation. Endobronchial valve therapy typically is utilized in patients with heterogeneous disease but may be indicated in select patients with homogeneous disease. Morbidity and mortality have been lower than historically reported with lung volume reduction surgery, but complications related to pneumothoraces remain a challenge.

Lung Volume Reduction Surgery in Patients with Homogeneous Emphysema 203

Walter Weder, Laurens J. Ceulemans, Isabelle Opitz, Didier Schneiter, and Claudio Caviezel

Randomized controlled trials have demonstrated that lung volume reduction surgery (LVRS) improves exercise capacity, lung function, and quality of life in patients with heterogenous emphysema on computed tomographic and perfusion scan. However, most patients have a nonheterogenous type of destruction. These patients, summarized under “homogeneous emphysema,” may also benefit from LVRS as long they are severely hyperinflated, and adequate function is remaining with a diffusing capacity of the lungs for carbon monoxide greater than 20% and no pulmonary hypertension. Surgical mortality is low when patients are well selected.

Economic Considerations of Lung Volume Reduction Surgery and Bronchoscopic Valves 211

Janani Vigneswaran, Seth Krantz, and John Howington

Chronic obstructive pulmonary disease is a challenging disease to treat, and at advanced stages of the disease, procedural interventions become some of the only effective methods for improving quality of life. However, these procedures are often very costly. This article reviews the medical literature on cost-effectiveness of lung volume reduction surgery and bronchoscopic valve placement for lung volume reduction. It discusses the anticipated costs and economic impact in the future as technique is perfected and outcomes are improved.

Future Treatment of Emphysema with Roles for Valves, Novel Strategies and Lung Volume Reduction Surgery

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Simran Randhawa and Bryan Meyers

Although there are multiple pharmacologic and nonpharmacological options to alleviate symptoms of emphysema, none of these treatment modalities halts disease progression. The expanding disease burden has led to development of innovative therapeutic strategies that also aim to induce lung volume reduction. Bronchoscopic lung volume reduction originated in 2001 and has continued to grow rapidly ever since. This article discusses more recent developments in bronchoscopic and novel interventions and speculates on how these novel strategies may impact the future of lung reduction interventions.