

EDITORIAL

Surgical lung volume reduction for severe pulmonary emphysema – a new review series

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Chronic obstructive lung disease (COPD) is one of the most prevalent diseases in industrialized nations and is accompanied in its advanced stage by pulmonary emphysema. Although pharmacotherapy has limited potential in improving lung function, comprehensive pulmonary rehabilitation may ameliorate the patients' exercise performance and quality of life. In addition, smoking cessation slows down the decline of forced expiratory volume in one second (FEV₁) that is a characteristic aspect of COPD, and long-term oxygen therapy prolongs the life of a subgroup of patients who have a certain degree of hypoxaemia at rest.

A final option for selected patients with disabling dyspnoea due to emphysema is unilateral or bilateral lung transplantation. This has been available for over a decade [1]. The procedure immediately restores lung function up to normal levels for the price and disadvantage of continuous and life-long immunosuppression. A small subgroup of patients with bullous disease, *i.e.* giant bullae, which compress adjacent parts of the lung, experience beneficial effects with often dramatic improvements of their lung function after bullectomy. This type of surgery is well established and has been successfully performed over many years.

Lung volume reduction surgery (LVRS), originally proposed by BRANTINGAN *et al.* [2], and revived by COOPER *et al.* [3], has become a new therapeutic option for patient who are either too old for lung transplantation (>65 yrs) or for younger persons as a "bridging procedure" with the intention of deferring transplantation.

Since over five years have passed since the first patients underwent LVRS [3] it is appropriate to review in a series of articles starting in this issue the pertinent aspects of this novel procedure, which has the potential to serve as a palliative treatment in appropriately selected patients. However, many important aspects of LVRS are still unclear and remain to be investigated further. Consequently, this type of surgery should be restricted to groups who enrol their patients in sound prospective scientific studies and are willing to obtain close and as much as possible complete follow-up on patients, lung function and survival.

The physiology of pulmonary emphysema has been thoroughly studied by numerous investigators over the past half century. The introduction of LVRS has provided a unique opportunity to look closely at various functional aspects of advanced COPD before and after a profound

surgical intervention, applying classical physiological methods and eventually more current research tools. Observing the impact of severe mechanical alterations on pulmonary mechanics, gas exchange and cardiac function during anaesthesia for LVRS has taught us much about the perioperative management of patients with less extreme conditions. However, the goal of such physiological investigations is to gain insight into the mechanisms of how LVRS improves the function of patients, and more importantly to enable the elaboration of criteria for an optimal selection of patients with the potential to benefit objectively from LVRS. These aspects are extensively described in a first article by DECRAMER and coworkers [4] that opens a series of four papers, which will deal with the pertinent clinical, functional and surgical aspects of LVRS.

COOPER *et al.* [3], who also pioneered lung transplantation, introduced LVRS by using median sternotomy. This surgical approach enables bilateral resections to be performed and provides good access to the upper lobes, which are predominantly involved in smoker's emphysema. Nonanatomical excision is performed with stapling devices and is aimed at the most diseased parts of the lung. It became obvious that the results obtained through the use of a laser as a method for shrinking of the lung were disappointing. Bilateral stapler resection leads to larger functional improvements than unilateral resection, although unilateral resection is accompanied in many cases by sufficient symptomatic improvements in the patient and leaves an opportunity to undergo resection of the opposite lung later in the patient's course. The potential advantages of videoendoscopic approaches for LVRS have been investigated by numerous groups with extensive experience in this particular field of thoracic surgery, and the functional results obtained by this approach are reported to be comparable to those with median sternotomy [5, 6]. These and other aspects, *i.e.* the resection of lung cancer in patients with far advanced emphysema as well as cardiac surgery performed as a combined procedure with LVRS, will be extensively discussed in the review by KLEPETKO [7].

Through our own and by the experience of many other groups it has become clear that LVRS not only ameliorates health-related quality of life and reduces shortness of breath but also improves lung function and exercise capacity in many of carefully selected emphysema patients, to a degree, that clearly exceeds a placebo effect or even the efficacy of comprehensive pulmonary rehabilitation alone [5, 8]. LVRS is a palliative intervention, which may be offered as a therapeutic option to highly compliant patients who were not helped by best prior medical therapy. The impact of LVRS on survival seems of secondary consi-

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deration in this population of desperate patients. Nevertheless, it is of importance to gather information on the long-term survival (arbitrarily >6 months) in this selected group with advanced pulmonary emphysema, since it would be inappropriate to expose patients, particularly those without any relevant benefit from LVRS, to the risk of premature death as a remote consequence of the procedure. These and other features will be addressed by a review on short-term and long-term functional results by TESCHLER *et al.* [9].

Most selection criteria, *i.e.* criteria for the inclusion and exclusion of patients for LVRS, which are applied today are rather arbitrary since they have not been prospectively validated. They are based on pathophysiological considerations (*e.g.* presence of considerable pulmonary hyperinflation), sound clinical reasoning (*e.g.* various contra-indications) and inferred from retrospective analyses of the correlation between various preoperative variables and functional outcome. The selection of patients who might profit from LVRS at a justifiable perioperative risk is a synoptical process, in which the various functional, anatomical and extrapulmonary aspects of the individual patient have to be taken in consideration.

An inherent goal of LVRS is to target the resection and to remove preferentially those parts of the emphysematous lung that are most destroyed and hence do not contribute to gas exchange but contribute to the lung mechanical impairment. There is growing evidence that the consideration of morphology and distribution of emphysema, as assessed by chest computed tomography scan, may better predict postoperative functional outcome than the assessment of baseline pulmonary function alone. In many patients with severely symptomatic emphysema, no clear-out target areas for resection are discernible, *i.e.* the emphysema is homogeneous. Nevertheless, even in these patients considerable functional improvement may be obtained by LVRS [10]. The methods used for the assessment of the individual emphysema morphology and its role in the planning of surgery and prediction of outcome will be discussed in a last paper of this series [11].

References

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