Advances in thoracic surgery: emphysema and simultaneous bronchial carcinoma

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Introduction

Lung volume reduction surgery (LVRS), first described by Brantigan in 1957, has recently been reintroduced and refined as a treatment option in the management of severe disabling pulmonary emphysema [1, 2]. This surgical approach to emphysema lung disease allows resection of the most impaired and non-functional lung tissue, with improvement of respiration mechanics and enhancement of the lung’s elastic recoil and compliance [3, 4]. The method has shown promising short-term results with substantial improvement of dyspnoea, exercise tolerance, quality of life and pulmonary function in carefully selected patients; this has been observed in some recent controlled trials comparing LVRS with medical treatment [5–9]. However, despite widespread use of the procedure and the rapid progress of the technique, some aspects are still controversial or incompletely elucidated. The aim of this article is to summarise some of the recent data about patient selection criteria and surgical technique, with particular emphasis on the role of LVRS in lung cancer surgery and on the unilateral VATS approach.

Key words: pulmonary emphysema; lung cancer; surgery; unilateral LVRS

Selection criteria for LVRS

Indiscriminate use of LVRS should be avoided, and appropriate patient selection by rigorous assessment is mandatory [10, 11]. LVRS should be considered a palliative procedure to be offered only to a minority of patients with severe emphysema [11].

Assessment for LVRS is based on (a) general, (b) functional and (c) imaging features. These criteria, currently applied in most institutions, are summarized in Table 1. Clinical criteria include age, which is arbitrarily cut off at 75 years, smoking cessation and absence of general or local contraindications for surgery. Functional criteria play an essential role in patient selection. Relevant results in this respect recently emerged from a preliminary report of the National Emphysema Treatment Trial: a significantly impaired outcome with high postoperative mortality and little functional benefit in survivors has been observed in patients with DLCO <20% in combination with FEV1 <20% predicted [12]. Morphological criteria, mainly established by high resolution CT scan and ventilation-perfusion lung scintigraphy (fig. 1), are useful tools in determining a heterogeneous pattern of emphysema and identifying target areas of non-functional lung parenchyma for resection [13, 14]. Imaging features are considered important predictors of postoperative functional outcome [10, 11, 15]. In heterogeneous emphysema with upper lobe predominance LVRS has a better and longer-lasting effect than in homogeneous emphysema [15]. This was recently emphasised in a retrospective analysis by Kotloff et al., who de-
fined the apical perfusion fraction as the percentage of total lung perfusion to the apical third of both lungs [16]. A significantly better postoperative functional improvement was observed in patients with marked apical hypoperfusion and an apical perfusion fraction of <10%.

To better define the lung areas and the amount of tissue to be resected, the preoperative morphological criteria need further refinement. This may be accomplished by assessing regional lung function, possibly obtained by superposition of ventilation-perfusion scintigram and high-resolution CT scan.

The incidence of solitary pulmonary nodules in emphysema patients

Among the clinical criteria, poor medical condition and non-thoracic malignancy have generally been considered contraindications for surgery [11]. In addition, candidates for LVRS are at high risk of developing lung cancer, and preoperative assessment may lead to the incidental discovery of pulmonary nodules, as shown in figure 2 [17–19]. On preoperative imaging or histological analysis of the surgical specimen Hazelrigg and co-workers identified at least one pulmonary nodule in 39.5% of 281 patients undergoing LVRS [17]. 78 nodules were resected, 17 were malignant and 13 cases of non-small-cell lung cancer (NSCLC) were observed.

McKenna et al observed a nodule in 51 (16%) of 325 patients evaluated for LVRS and 11 NSCLC were identified [18]. Only 3 patients were treated by formal lobectomy and wedge resections were carried out in the remaining 8 cases. Pigula described 10 similar cases undergoing nodule resection in conjunction with LVRS [19].

The incidence of lung cancer in emphysema patients

Non-small-cell lung cancer (NSCLC) is nowadays treated by anatomical lung resection (lobectomy or pneumonectomy), and procedures of lesser extent such as wedge or segmental resections carry a significantly higher risk of local recurrence [20]. The simultaneous presence of emphysematous lung disease and cancer is a not infrequent and vexing clinical problem. Anatomical lung resection would normally be considered a prohibitively high risk for these patients because of poor underlying pulmonary function. However, traditional operability criteria for lung cancer have somewhat changed with growing experience of LVRS. It has been shown that patients with NSCLC and severe emphysema considered inoperable because of poor lung function may not only undergo lobectomy safely but may even have increased pulmonary function after resection. This is primarily due to an effect of LVRS related to tumour resection. LVRS criteria may therefore be extended and applied to selected patients presenting with lung cancer associated with severe em-
the neoplasm is located in the target area for LVRS [18, 19, 22]. In our experience 10 patients have undergone surgery in this setting. In 7 cases the neoplasm was located in target areas for LVRS and these patients underwent lobectomy (fig. 3). Improved lung function was seen after cancer resection combined with LVRS. In the remaining 3 cases the lesion was in a part of the lung not considered for LVRS and the patients underwent segmental resection combined with upper lobe LVRS (fig. 4). A favourable postoperative outcome was observed in all the cases. Nevertheless, further studies are required to determine the value of this concept in terms of long-term functional outcome and cancer-related survival.
Surgical technique

First performed by sternotomy, LVRS was then accessed by VATS, which is now considered as the technique of choice. Whether LVRS should be performed as a unilateral or bilateral simultaneous procedure is still controverted. To date no randomised prospective study has compared unilateral versus bilateral LVRS. Several studies have shown a better clinical and functional outcome after the bilateral procedure than after the unilateral approach [25–27]. McKenna et al. reported a better functional outcome after bilateral thoracoscopic LVRS and noticed lower 1-year mortality compared with unilateral LVRS [23]. These results contrast with those of Kotloff et al. [26], who reported an increase in hospital mortality and postoperative respiratory failure in patients treated by simultaneous bilateral LVRS. Similarly, Serna and co-workers described better results after bilateral LVRS with significantly higher 2-year survival [27]. Naunheim et al. found no difference in survival between bilateral and unilateral LVRS [28]. Our experience with a systematic unilateral VATS approach since 1996 has shown no mortality, tracheostomy or prolonged intensive care unit stay after LVRS. Significant clinical and functional benefit was noticed in 28 patients during a follow-up which lasted at least 2 years [29]. Only 2 patients, both with alpha-1-antitrypsin deficiency, underwent contralateral surgery during the observation period. LVRS should be considered a purely palliative procedure and, in consequence, the least aggressive approach should be chosen that will result in an acceptable quality of life, which need not necessarily be reflected in pulmonary function measurements. In addition, after the unilateral procedure LVRS can be repeated on the contralateral side if required; however, the published results after staged bilateral LVRS are scant and controversial. Pompeo et al. reported a better clinical outcome after staged bilateral than after simultaneous bilateral LVRS [30]. Although a simultaneous bilateral approach may lead to better immediate functional results than a unilateral procedure, the subsequent decline and loss of pulmonary function during the postoperative period is also more pronounced after bilateral than unilateral procedures. An annual decline of 260 ml vs 100 ml respectively has been reported [31]. This aspect needs to be investigated in a properly conducted prospective study investigating the value of LVRS in emphysematous patients, patient selection and the best surgical approach.

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