Concomitant Lung Cancer Resection and Lung Volume Reduction Surgery

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• Lung volume reduction surgery • Emphysema
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Early-stage non–small cell lung cancer is best treated by complete anatomic resection. Patients who have resectable lung cancer but associated advanced emphysema are often precluded from surgery because of severe respiratory limitation. For these patients, alternative treatment strategies, including radiation therapy with or without chemotherapy, are considered less than optimal and yield comparatively poor results. Furthermore, conventional radiation therapy may lead to the same degree of reduction in pulmonary function as surgical resection. Stereotactic body radiation therapy has been proposed as an alternative local treatment option for high-risk patients who have early-stage lung cancer and is undergoing evaluation. Patients who have severely limited pulmonary function represent a management problem for the radiation oncologist and for the surgeon. This dilemma is further compounded for surgeons by the lack of a precisely definable point at which the risk-to-benefit ratio for resection becomes unfavorable, particularly in light of improvements in the anesthetic, surgical, and postoperative treatment of patients who have advanced emphysema.

Certain highly selected patients who have clinically resectable lung cancer and severe respiratory limitation due to emphysema may have an acceptable operative risk and functional improvements by combining a suitable cancer resection with lung volume reduction surgery (LVRS).[1–20] This combination would provide the best treatment of early-stage lung cancer while being a palliative treatment of the symptoms of emphysema. Several groups have evaluated their experience of combined lung cancer resection and LVRS and have reported beneficial early and long-term results.[1–20] This article provides a review in this area and recommends surgical strategies in this group of patients who have concomitant lung cancer and severe emphysema.

PATIENT EVALUATION AND SELECTION

Most groups follow a specific institutional protocol in the patient evaluation and selection process for concomitant surgery.[1,7,9,12,13] These are not too dissimilar among the different groups, however. Assessment for the suitability of LVRS

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includes history, physical examination, pulmonary function tests with lung volumes, arterial blood gas analysis (at rest on room air), chest radiograph, standardized CT of the chest, radionuclide ventilation-perfusion lung scan, 6-minute walk test, and dyspnea scale, such as the Medical Research Council dyspnea scale or other types. Systemic spread of lung cancer disease was additionally evaluated by CT of the abdomen and pelvis, brain CT, and positron emission tomography–CT scan. Details of the selection process for lung volume reduction have been reported.[21–28] Marked hyperinflation of the chest and adequate regional distinction in the destruction pattern of emphysema to provide target areas of useless lung accessible to surgical resection were critical selection criteria in all patients.[21–28] Patients who are offered concomitant surgery are highly selected and must fulfill the criteria set out for both LVRS and cancer surgery.[29,30]

Various methods have been reported to determine suitability for pulmonary resection in patients who have moderate to severe respiratory limitation.[1,3–6,9,12,19] Korst and colleagues[4] noted an improvement or minimal loss of pulmonary function following lobectomy for the treatment of non–small cell lung carcinoma in 13 patients who had a forced expiratory volume in 1 second (FEV_1) of less than or equal to 60% of predicted value and an FEV_1/forced vital capacity (FVC) ratio of less than or equal to 0.6. They used a chronic obstructive pulmonary disease (COPD) index, a scoring system combining these two parameters, which helped to identify patients who may have only a limited reduction or even an improvement of pulmonary function following lobectomy. Carretta and coworkers[5] reported a subgroup of 10 patients in whom a higher radiologic visual assessment of emphysema severity in the affected lobe correlated to an unchanged or even an increase of pulmonary function following a lobectomy. The radiologic visual assessment used a scoring system that is a sum of the grading score of emphysema seen on chest radiograph and chest CT scan. Edwards and colleagues[6] extended the selection criteria for lobectomy to patients who had a predicted postoperative FEV_1 of less than 40% if the tumor was resectable, in whom the target lobe was both emphysematous and contributed to less than 10% of overall perfusion, and who had evidence of hyperinflation on radiologic assessment. Despite these various reported methods, no single test has been found to best define the patients who will and will not tolerate resection. Instead, these investigations, together with the physical condition of the patient and the surgeon's experience, help to select patients suitable for combined surgical resection.

The patients judged suitable for surgery are enrolled in a preoperative pulmonary rehabilitation and smoking cessation program lasting 6 to 8 weeks. Patients are then reassessed the week before surgery by an interval history, physical examination, and investigations. In selected patients who are assessed to be in suitable physical condition at the time of initial evaluation, surgery may be considered without additional pulmonary rehabilitation. Patients who are offered concomitant surgery are highly selected and must satisfy the strict criteria set out for both LVRS and cancer surgery.

INTRAOPERATIVE SURGICAL STRATEGIES

Various intraoperative strategies have been used to perform the combined surgery. The decision to perform either a wedge resection or a lobectomy depends on the size and location of the tumor and the distribution and severity of the emphysema. Lobectomy is generally not performed in patients who have severe emphysema unless there is a heterogenous distribution of emphysema and the tumor is located within a destroyed, virtually functionless lobe. If the tumor is in the middle lobe and there are suitable target areas for LVRS in other lobes, then a middle lobectomy may be performed in conjunction with ipsilateral or bilateral LVRS. If the tumor is located in the best-preserved lobe other than the middle lobe, then either a wedge resection is performed or the patient is considered not to be a suitable candidate. An ipsilateral or contralateral LVRS is added to the cancer resection if there is a suitable target area for LVRS such that the resection would be expected to result in a likely improvement in the patient's postoperative pulmonary function. The type of combined surgery therefore depends on the location of the lung cancer and the distribution and severity of the emphysema. These strategies are combined with the standard systematic lymph node staging for lung cancer.

A flexible bronchoscopy with bronchial washings for gram stain and culture is performed at the beginning of the procedure, which helps to guide postoperative antibiotic management if the patient develops postoperative chest infection. If thick sticky mucus is encountered during bronchoscopy, this should be suctioned out. The presence of sticky mucus alerts the surgical team and lowers the threshold for consideration of flexible bronchoscopy or mini-tracheostomy for suctioning of secretions during the postoperative period.