

Pulmonary Resection After Pneumonectomy



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KEYWORDS

• Lung cancer • Recurrence • Pneumonectomy • Wedge resection • Surgery

KEY POINTS

- Limited lung resection for second primary lung cancer after pneumonectomy is a worthwhile procedure in appropriately selected patients that carries a low operative risk and allows for long-term survival, with a 5-year survival rate of up to 63%.
- Operations for metachronous cancers have a survival benefit that approximates the expected survival for primary lung cancer.
- The prognosis is poor for patients with N2 status and for those treated with a second surgery less than 2 years after the first procedure.
- Careful selection of potential candidates for remaining lung surgery is mandatory, with special attention given to cardiopulmonary reserve and lung cancer extension to achieve optimal early postoperative results and a long-term beneficial effect.
- Wedge resection with negative margins is the preferred procedure for peripheral tumors. Central tumors are best treated with segmentectomy.
- With the exception of middle lobectomy, lobectomy should be avoided because of its negative impact on cardiopulmonary reserve and outcomes.

INTRODUCTION

Second primary lung cancer is defined as a single lung lesion occurring after a prior resection. The risk of the development of second primary lung cancer in patients who survived after surgical resection of non-small cell lung cancer (NSCLC) is estimated to be 1% to 2% per patient per year.¹ This incidence has increased in recent years because of longer survival after resection of primary lung cancers and the widespread use of early detection tools, such as chest computed tomography (CT) and positron emission tomography (PET), during the postoperative follow-up. However, differentiating a second primary lung cancer from

a metastatic lung cancer can be challenging, especially when a similar histology is found or if the recurrence is diagnosed relatively soon after the primary cancer. As the most referenced criteria for the definition of secondary primary lung cancers, Martini and Melamed's² indicators have been widely used by the medical community to help in such cases. Briefly, the criteria to diagnose a second primary lung cancer is indicated by a tumor-free interval of at least 2 years and a second cancer in a different lobe, lung, or origin from an area of carcinoma in situ, in the absence of other extrapulmonary or common lymphatic metastases.

The treatment of second primary lung cancer remains controversial because patients have

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already undergone surgery and new alternatives, such as stereotactic radiations and percutaneous ablations, have been available for the past few years. However, it has been demonstrated that surgical resection could achieve satisfactory long-term survival with a low mortality rate in selected patients. Several investigators have reported a 5-year survival ranging from 23% to 60% after the resection of second primary lung cancers, with 0% to 5.8% postoperative mortality rate comparable with the first procedure.³⁻⁶ One should emphasize that approximately two-thirds of patients experiencing second primary lung cancer could benefit from the surgery; the remaining one-third may not be eligible candidates for surgery because of advanced disease, comorbidities, or limited pulmonary reserve.⁷

Despite the evidence that resection can achieve good oncologic outcomes with acceptable morbidity, surgical options have not been widely extended to patients who previously underwent pneumonectomy. Indeed, less than 100 cases have been reported in the literature to date, showing a 5-year survival of approximately 40% provided a limited resection was performed.⁸⁻¹² Specialists often do not consider subsequent additional lung resection after pneumonectomy for 2 reasons. First, pneumonectomy has a significant negative impact on pulmonary reserve and puts patients in a high-risk subgroup for lung resection. Second, surgical options are limited for stages higher than stage I given the fact that only sublobar resections can be safely performed.

The purpose of the authors' review is to report the early and long-term results of subsequent resection for lung cancer after pneumonectomy and to put it in perspective with the results of new increasing methods recently added to the field (stereotactic radiation and percutaneous ablation).

SELECTION OF PATIENTS FOR RESECTION

Defining good candidates for lung cancer resection after pneumonectomy remains a challenging clinical decision based on the evaluation of the benefit/risk ratio. The functional status of patients will impact the risk of the resection, whereas the lung cancer extension will impact the benefit of the procedure. Preoperative testing, such as pulmonary function tests and PET/CT, could help in evaluating the cardiopulmonary reserve and the tumoral extension.

Functional Status Evaluation and Cardiopulmonary Reserve

It is well established that patients who underwent a pneumonectomy have a limited cardiopulmonary

reserve that could be similar to patients with chronic obstructive pulmonary disease with impaired lung function. Segmentectomy or extended wedge resection (with margins of 1 cm or equal to the tumor diameter) with hilar and mediastinal nodal evaluation is suggested by the American College of Chest Physicians and the Society of Thoracic Surgeons as a safe and effective alternative to lobectomy in high-risk patients with stage I NSCLC.¹³ As a consequence, candidates for a second lung resection after pneumonectomy should have diagnosed clinical stage I NSCLC because a sublobar resection is the only feasible option. It has been described in the literature that additional lobectomy after pneumonectomy leads to increased postoperative mortality and worse long-term survival¹⁴⁻¹⁶ with the exception of middle lobectomy after left pneumonectomy.¹⁷ However, lobectomies after pneumonectomy were totally abandoned in the early 1990s; patients with stage I disease requiring a lobectomy because of its central position were deemed inoperable.

Even with limited resection, the negative impact of sublobar resection on pulmonary reserve in single-lung patients is comparable with the pulmonary impact achieved after lobectomy in patients with both lungs. Hence, careful evaluation of this reserve is required before making the decision to operate. The forced expiratory volume (FEV₁) and diffusing capacity of lung for carbon monoxide (DLCO) results accurately predict morbidity and mortality following major lung resection. Predicted postoperative (ppo) FEV₁ and ppoDLCO values less than 40% are useful to identify higher risk patients that may not benefit from the surgery. In this population, the assessment of peak oxygen consumption with exercise could be a better way to accurately evaluate the risk. In patients with ppoFEV₁ and/or ppoDLCO less than 40%, major resection was well tolerated if the peak oxygen consumption (\dot{V}_{O_2}) was greater than 10 mL/kg/min.¹³

The cardiac reserve assessment is also paramount. Because of the previous resection, the pulmonary vascular bed is reduced and additional lung resection may result in a dramatic increase in pulmonary artery pressure and right heart failure. Cardiac echography is a useful tool to screen any right heart dysfunction or pulmonary artery pressure elevation before the surgery. Right heart dysfunction and pulmonary hypertension are considered as absolute contraindications to resection.

In addition, health-related functional status and quality-of-life and comorbidity assessments are important for the treatment of single-lung patients with stage I NSCLC.

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