

Extended Chest Wall Resection and Reconstruction in the Setting of Lung Cancer



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KEYWORDS

• Lung cancer • Chest wall resection • Reconstruction • Thorax

KEY POINTS

- En bloc, complete resection is mandatory.
- Defects less than 5 cm can be managed without large reconstruction.
- Larger anterior chest and sternal defects frequently need rigid prosthesis.
- With the wide range of reconstruction techniques available, materials should be selected to provide the best functional and cosmetic outcome.
- Involvement of multidisciplinary team, including plastic surgery and spine surgery when appropriate, is important.

INTRODUCTION

Chest wall resection and reconstruction remains a significant clinical dilemma in the setting of lung cancer. Although these lesions represent less than 10% of operable lung cancer in most series, the clinical challenges surrounding treatment of these lesions is significantly increased.¹ The addition of a chest wall resection to the surgical treatment of lung cancer magnifies the need for thorough staging and operative planning. The main determinants of survival after resection of these lesions are nodal involvement and completeness of resection.^{1,2} The main factors attributed to the chance of postoperative morbidity include the size of the chest wall resection, extent of concomitant pulmonary resection, age, and underlying pulmonary function.¹⁻³

Preoperative Diagnosis and Staging

Obtaining a tissue diagnosis of lesions that involve both the lung and chest wall simultaneously is important. Understanding the type of primary lung cancer and ruling out primary chest wall tumors that invade the lung help form the initial treatment plan. Imaging modalities such as computed tomography (CT) and 18-Fluoro-deoxyglucose positron emission tomography (FDG-PET) scanning assist in formulating a clinical stage of disease and are useful tools in the early stages of clinical decision making. Brain imaging is included in the preoperative evaluation of these patients given the higher likelihood of metastases in these locally advanced cancers.

Nodal staging is paramount in these patients. Given the locally advanced nature of these

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tumors, the chances of nodal involvement are also increased and significantly affect survival. The incidence of N2 nodal disease ranges from 15% to 21% in large series of T3 lung cancer.^{1,2,4} The impact of N2 disease on overall survival is significant. The 5-year survival rate of node-negative patients is on average 40%. The overall survival rate of N2 disease ranges from 6% to 17%. This radical difference in survival rates suggests that great effort should be used in determining the nodal status of these patients. The technique of nodal evaluation has not been specifically studied in these patients; however, the routine use of surgical mediastinoscopy is our preferred technique.

Neoadjuvant Therapy

The only setting in which neoadjuvant therapy has been found to be beneficial is in regard to pancoast tumors. The important initial study by Rusch and colleagues⁵ showing the benefit of neoadjuvant chemoradiotherapy in increasing the likelihood of obtaining negative margins in this subset of lung cancer patients established neoadjuvant chemoradiotherapy as the standard of care in patients with pancoast tumors. These findings should not be extrapolated to the treatment of other lung cancers that invade the chest wall, and en bloc resection should be considered the primary modality of treatment.

Most chest wall resections are performed because of malignancy, with the 3 main causes being primary chest wall tumors, non-small cell lung cancer (NSCLC), and breast cancer.⁶⁻⁸ Perioperative mortality rates range from 2% to 7% with higher rates of morbidity. Inadequate reconstruction of extended chest wall resections has the potential to result in sternal instability or flail chest with subsequent respiratory compromise.

Preoperative Planning

Although mesh, methyl methacrylate, and soft tissue flaps have been used for the bulk of reconstruction, new therapeutic options developed in recent years continue to expand the available techniques for reconstruction. Titanium bars, bone autografts, and cryopreserved allografts are just a few of the novel techniques being applied to reconstruction of the chest wall.

When evaluating patients for potential chest wall resection, the surgeon must ensure that the underlying lesion has been adequately managed. Details of lesion-specific management are beyond the scope of this article. CT or magnetic resonance imaging is often adequate to determine the extent of tumor involvement. Standard preoperative work

should be performed to ensure the patient will tolerate the operation.

Careful assessment of imaging studies will find the extent and detailed location of the tumor. A multidisciplinary approach to management of the resection and reconstruction may be necessary. The spinal surgery department should be consulted when the planned area to be resected encroaches the vertebrae. For larger lesions that will potentially require a myocutaneous free flap, plastic surgery should also be involved in operative planning to assist with coverage. Postoperatively, the primary surgeon will undoubtedly work closely with the surgical intensivist for optimal postoperative management.

There are many approaches to managing chest wall lesions. This article addresses key principles of resection of malignant tumors of the chest wall and the myriad of options for reconstructing these defects.

RESECTION AND SURGICAL TECHNIQUE

Surgical Technique

The location and size of the tumor will obviously dictate the surgical plan and approach. Preoperative imaging with CT is generally adequate to determine the extent of both the lung and chest wall resection required to remove the tumor. Occasionally, magnetic resonance imaging can help in providing information on encroachment into the vertebrae, which may require assistance and preoperative planning with spinal surgery. It is rare to observe a lung cancer that breaches the skin surface, and these findings should lead to a thorough evaluation of the initial diagnosis. Dodoli and colleagues report the need for muscle flap transfer in only 3 of 309 cases (1%).² If it is anticipated that a large skin surface will need to be resected, it is helpful to obtain consultation with a plastic surgeon.

Positioning and Incision

Most lung cancers with chest wall invasion can be approached via a thoracotomy in the lateral decubitus position. The exception to this is anterior pancoast tumors for which an anterior approach may be beneficial. The incision and interspace through which the thoracotomy is made should be carefully planned so as not to disrupt the tumor. This is done by carefully viewing the CT scan to determine the available interspaces. Alternatively, the use of video-assisted thoracoscopy has been described to aid in the decision-making part of this process. The video-assisted approach can also be used to inspect the pleura and look for signs of more advanced disease.⁹

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