Complications Following Carinal Resections and Sleeve Resections

Luis F. Tapias, MD, Harald C. Ott, MD, Douglas J. Mathisen, MD*

KEYWORDS

• Carinal resection • Sleeve resection • Bronchopleural fistula • Airway anastomosis
• Airway stenosis

KEY POINTS

- Careful patient selection is important for the success of carinal and sleeve resections.
- Attention to established technical issues is fundamental, including preservation of bronchial blood supply, proper tension-free anastomotic technique correcting size mismatch, and buttressing with vascularized tissue.
- Prevention of complications by means of adequate surgical technique is critical; once complications appear, their management is difficult.
- Bronchoscopic evaluation before discharge is useful for the early identification of potential anastomotic problems.
- Aggressive management of complications adhering to established principles should be implemented as soon as the diagnosis is made.

INTRODUCTION

Lung-sparing bronchoplastic resection and reconstruction of the tracheobronchial tree, with and without resection of lung parenchyma, may be required and is a valid therapeutic option for patients with centrally located malignancies. Resection of the carina or main bronchi may be necessary in cases in which standard pneumonectomy or lobectomy, respectively, would not achieve complete tumor resection. Resection of the carina is most frequently performed along with a right pneumonectomy,[1] whereas bronchial sleeve resections are most frequently associated with an upper lobectomy.[2] One of the earliest reports on carinal resection was described by Belsey in 1950 and involved the lateral resection of the distal trachea and carina followed by reconstruction with a free fascial graft reinforced by stainless steel wire.[3] Likewise, Price Thomas described the performance of sleeve lobectomies as early as in 1952 for the treatment of tuberculosis and lung cancer.[4]

Historically, sleeve lung resections were generally regarded as an alternative to pneumonectomy in patients with poor cardiopulmonary reserve. However, lung-sparing procedures have shown to be beneficial in patients without cardiopulmonary limitations,[5] and must be favored over pneumonectomy whenever anatomically feasible. Therefore, sleeve lung resections have been increasingly used for patients with centrally located malignancies regardless of pulmonary function. Evidence points toward equivalent oncologic outcomes with improved survival and quality of life after sleeve resections compared with pneumonectomy.[6,7] Even though these surgical techniques have been described in the literature for

Division of Thoracic Surgery, Department of Surgery, Massachusetts General Hospital, Harvard Medical School, 55 Fruit Street, Blake 15, Boston, MA 02114, USA
* Corresponding author.
E-mail address: dmathisen@mgh.harvard.edu

Thorac Surg Clin 25 (2015) 435–447
http://dx.doi.org/10.1016/j.thorsurg.2015.07.003
1547-4127/15/$ – see front matter

more than 60 years, recent advances in anesthetic techniques, as well as improved patient selection and postoperative care have lead to acceptable rates of postoperative morbidity and mortality, making this a valid therapeutic option in patients with involvement of the central airways.

Carinal and sleeve lung resections represent true challenges for thoracic surgeons. These patients require careful and thorough evaluation, strict attention to technical details in the operating room, a keen understanding of the principles of resection and reconstruction of the tracheobronchial tree, and dedicated postoperative care. These procedures hold great potential for significant postoperative morbidity given their impact on cardiopulmonary physiology and the risk for development of anastomotic complications.[8] Here, we aim to summarize key aspects to be considered when performing carinal or sleeve resections, and when dealing with postoperative complications.

INDICATIONS AND CONTRAINDICATIONS

Indications

Carinal resections and bronchoplastic procedures are most commonly indicated for the surgical treatment of centrally located tumors involving the orifice of the lobar bronchus or extending into intermediate or main bronchi or the carina. Most frequently, these are non–small cell lung cancers (NSCLC), particularly squamous cell carcinomas. However, they are also useful in the surgical treatment of centrally located low-grade malignancies, such as carcinoid tumors and salivary type tumors (eg, mucoepidermoid carcinoma and adenoid cystic carcinomas). Additionally, bronchoplastic procedures can be applied to treat benign stenosis, particularly of the mainstem bronchi, of traumatic, infectious, or idiopathic etiologies.[9]

In the case of carinal resections, a right carinal pneumonectomy is the most frequent procedure, especially in patients with NSCLC originating from the right upper lobe orifice and extending into the lateral aspect of the carina and lower trachea. The tumor length should not exceed 4 cm of trachea, as this poses anatomic limits to resection. Alternatively, carinal resections may be indicated when there is involvement of the bronchial margin after a standard pneumonectomy.

Sleeve lobectomy is indicated when tumors are located at the origin of the lobar bronchus, but do not infiltrate the remaining lobes to justify a pneumonectomy. Additionally, it may be indicated when there is direct infiltration from metastatic peribronchial nodes or a positive bronchial margin. Sleeve lobectomy is still indicated in the presence of positive N1 nodes, as it is associated with lower morbidity and mortality as well as comparable long-term results when compared with pneumonectomy.[6,7] Some conditions involve only the mainstem bronchus, including low-grade neoplasms (eg, carcinoid tumors, mucoepidermoid carcinomas, fibrous histiocytomas, and adenoid cystic carcinomas) and benign stenosis of infectious (eg, histoplasmosis), inflammatory, traumatic, iatrogenic, or idiopathic etiologies.[9] The same surgical principles hold for these bronchoplastic procedures as for sleeve lobectomy: careful technique, adjustment for size discrepancy, avoidance of devascularization, avoidance of excessive tension, and the use of pedicled vascularized tissue flaps.

Contraindications

Absolute contraindications are related to poor surgical candidacy due to significant medical comorbidities, very low predicted postoperative pulmonary function, or extensive local invasion of the tumor precluding reconstruction. The presence of mediastinal lymph node involvement (N2 disease or greater) is considered a relative contraindication given the poor long-term results obtained in these patients. The need for resection and reconstruction of vascular structures (ie, superior vena cava or pulmonary artery) is not considered a contraindication.

Special Situations

There are a few important special situations to carinal surgery and sleeve resections that deserve mention:

- Chronic use of corticosteroids: This can lead to impairment of airway anastomotic healing. Ideally, patients should be weaned from steroids at least 2 to 4 weeks before surgery. If necessary, coring out the obstructing tumor is beneficial until such time as resection can be done.
- Anticipated need for prolonged postoperative mechanical ventilation: Positive-pressure ventilation can put stress on the airway anastomosis. Additionally, the need for postoperative mechanical ventilation has been strongly associated with postoperative morbidity.[10] The anesthetic plan should include every effort to permit extubation at the end of the procedure.
- Neoadjuvant therapy: Patients who have received neoadjuvant therapy, particularly radiation, are at a higher risk for anastomotic complications due to relative tissue ischemia. These patients should receive an anastomotic