

Carinal Pneumonectomy



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KEYWORDS

• Carina • Pneumonectomy • Lung cancer • Surgery

KEY POINTS

- Lung carcinoma can on occasion extend to involve the carina.
- Resection of the carina combined with a pneumonectomy can be considered a curative option.
- Success of these complex procedures is based on careful selection of patients, judicious use of multimodality therapies, and expert multidisciplinary care.

INTRODUCTION

Resection of the carina along with a lung is often fraught with mystery because even high-volume thoracic surgical centers infrequently perform this procedure. However, just like the resection of any other part of the lung, a well-conducted carinal surgery follows 3 principles: good exposure, maintenance of oxygenation while the airways are open, and creation of a tension-free anastomosis. When these principles guide planning and are achieved, carinal surgery is no more difficult than any other lung surgery. As resection of the carina is always performed as part of a curative treatment of a malignancy, the universal oncologic axiom must also be respected: surgery must be able to remove all of the tumor and its surrounding lymph node drainage. If this seems impossible, surgery should not be contemplated. Surgery of the carina is, therefore, contraindicated in patients with tumors requiring the resection of more than 5 cm of the trachea and those who have histologically verified mediastinal nodal metastasis (N2 or N3 disease). A carinal pneumonectomy should also never be attempted as a palliative maneuver; palliation is best attempted with endoluminal therapies. The objective of this article is to review

the indication, conduct, and pitfalls of carinal pneumonectomy (**Fig. 1**).

DIAGNOSIS AND PREOPERATIVE EVALUATION

Staging

In the preoperative evaluation of patients with a tumor involving the carina, the surgical team must obtain a thorough knowledge of the extension of the tumor in the airways, ascertain the extent of nodal disease, and confirm the absence of metastatic disease.

All candidates for carinal resection need a bronchoscopy to map the tumor location (**Figs. 2–4**). Biopsies of the normal-looking mucosa proximal to the tumor mass must also be taken to determine the amount of tracheal resection necessary to remove the entire tumor.¹ This point is particularly true of tumors that tend to spread beyond the visible boundaries of the tumor, such as salivary gland tumors of the airways (**Figs. 5 and 6**). All patients must also have a PET-CT scan and an MRI study of the brain to rule out distant metastatic disease. Endobronchial ultrasound is the favored method to verify nodal status, whereas mediastinoscopy is reserved for

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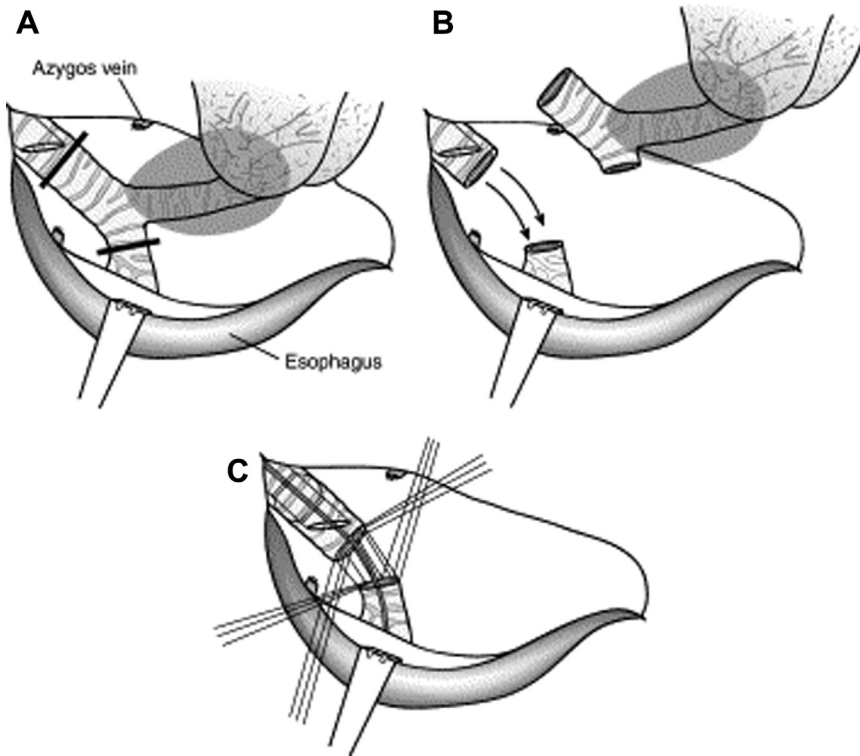


Fig. 1. (A) Mobilization of the carina and transection of the lower trachea and left main bronchus. (B) Transection of the trachea and left main bronchus. (C) Airway continuity being restored. (From Deslauriers J, Gregoire J, Jacques LF, et al. Sleeve pneumonectomy. *Thorac Surg Clin* 2004;14:185; with permission.)

the time of surgery to reverify the nodal status and help with the mobilization of the trachea.

Functional Assessment of Patients

Carinal resection can be associated with life-threatening complications, such as malignant arrhythmias, pulmonary embolization, acute respiratory distress syndrome (ARDS), and pneumonia.

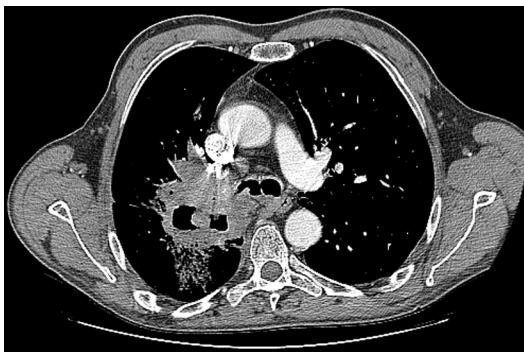


Fig. 2. Axial CT scan image of a squamous cell carcinoma of the right mainstem bronchus and carina in a 60-year-old man. The patient received systemic induction therapy with carboplatin and docetaxel. Subsequently, he underwent a right sleeve carinal pneumonectomy.

Therefore, the preoperative assessment must include an extensive functional evaluation to ascertain whether patients are likely to survive complications and the physiologic effects of missing one lung. As part of this evaluation, the authors perform a pulmonary function test, split ventilation perfusion scan, and oxygen consumption test. Because the aorta may need to be mobilized or cannulated as part of the procedure, the authors look for and document calcifications of the aorta. The presence of a porcelain aorta contraindicates a midline approach. If extracorporeal membrane oxygenation (ECMO) is planned, the cannulas are best positioned in the groin in order to avoid manipulation of the aorta, which could dislodge plaques.

Patients should stop smoking and have good nutritional status before the surgery if possible. The treatment of postobstructive pneumonia before surgery is also crucial. Endobronchial stenting and drainage to facilitate the treatment of sepsis may need to be considered.

SURGICAL PLANNING

Planning the Incision

The carina can be resected from the front via a sternotomy, from the right via a right thoracotomy,

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