Sleeve Lobectomy, Segmentectomy, and Thoracoscopy in the Management of Carcinoma of the Lung

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In patients with lung cancer, the goals of limited resection procedures of the lung and major airways are to provide an adequate cancer operation while preserving functioning lung tissue. Discussed in this article are sleeve lobectomy, an alternative to pneumonectomy in patients with cancer in a lobar orifice; segmentectomy or wedge resection, an alternative to lobectomy in those with a peripheral lung cancer; and thoracoscopy, an alternative to open thoracotomy for various chest malignancies.

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Limited resections of the lung and major airways are surgical procedures that preserve functioning lung tissue and provide an adequate cancer operation. The definition of limited resection reflects alternatives to contemporary surgical standards. Sleeve lobectomies provide an alternative to pneumonectomy in patients presenting with cancer in a lobar orifice. Segmentectomy or wedge resection provides an alternative to lobectomy in patients with a peripheral lung cancer. The development of thoracoscopy has provided an alternative to open thoracotomy in select patients with chest malignancies.

SLEEVE LOBECTOMY

Sleeve lobectomy procedures were first performed in the 1950s to avoid pneumonectomy in patients with compromised pulmonary function. In most cases, sleeve resections are done in patients with lung cancer in a lobar orifice. The lobe is resected en bloc with a portion of the common airway (Fig 1). Lung continuity is restored by reconstructing the transected airway. Sleeve resection requires the following: (1) adequate resection of the primary tumor as documented by intraoperative frozen section; (2) reconstruction of the airway by meticulous end-to-end technique with absorbable or monofilament suture; and (3) wrapping of the anastomosis with pleura or comparable vascularized tissue.

According to a review of several large retrospective series, the most common site for sleeve resection is the right upper lobe (75%). Postoperative morbidity and mortality for sleeve lobectomy range from 2% to 11%. Acute complications of sleeve lobectomy include anastomotic dehiscence (0% to 6%) and persistent bronchopleural fistulas (0% to 7%). A lethal complication of sleeve resection is a bronchovascular fistula (0% to 5%). Bronchovascular fistulas are thought to result from chronic inflammation or infection. The routine placement of vascularized tissue between the bronchial anastomosis and the pulmonary artery has significantly decreased the incidence of bronchovascular fistulas.

The most common late complication of sleeve resection is bronchial stenosis (incidence as high as 18%). The use of improved suture material has decreased the incidence of bronchial healing complications. Bronchial dilatation with stenting has been advocated as one approach in the management of these patients.

The primary physiologic derangement after sleeve lobectomy is transection of bronchial lymphatics. Although the lymphatics recanalize in several weeks, sleeve lobectomy may increase the risk of infection and volume of lung water in the immediate postoperative period. Impaired gas exchange has been reported in animal models, however, no significant functional differences between sleeve lobectomy and standard lobectomy have been reported in humans.

Both treatment groups show gradual improvement in lung function over 12 months.

The overall 5-year survival rate in patients with a T2N0 tumor undergoing sleeve lobectomy ranges from approximately 45% to 71%; patients with T2N1 disease have a reported 5-year survival of approximately 35% to 49%. Although these data reflect retrospective series, the overall stage-matched survival is comparable to that achieved with anatomic lobectomy. Bennett and Abbey Smith reported a potential benefit of the lung-preserving procedure: a second primary lung cancer developed in 6 of 27 patients who lived more than 5 years after sleeve lobectomy. Especially in patients who develop a contralateral second primary lung cancer, previous sleeve lobectomy may have preserved sufficient lung tissue to permit a resection of the second primary cancer.

SEGMENTECTOMY OR WEDGE RESECTION

Lung-preserving operations for peripheral lung cancers are segmentectomy or wedge resection. A segmental resection involves the individual ligation of the segmental artery and isolation and suture closure of the segmental bronchus. In contrast, a wedge resection is the complete excision of a tumor using a nonanatomic technique that does not isolate the artery or bronchus. Segmentectomy and wedge resection have been proposed as alternatives to anatomic lobectomy in patients with peripheral non-small-cell lung cancer.
Segmentectomy has been applied to stage I and II non-small-cell lung cancers as a compromise operation in patients with impaired lung function and as a lung-preserving operation in those with synchronous or metachronous lung cancer. It is also considered the procedure of choice in selected patients with a peripheral stage I lung cancer. To minimize the risk of local recurrence, segmentectomy is contraindicated in patients with evidence of multicentric or satellite lesions.11

Retrospective studies of segmentectomy have suggested that survival results are comparable to those achieved with standard lobectomy. Complications of segmentectomy include prolonged air leaks (5% to 16%) and a higher rate of local recurrence (11%).1216 In contrast to segmentectomy, the complication and survival rates of wedge resection have been variable, possibly because patients are more ill and because of limitations in accurately staging the N1 nodal station.17

Results from a randomized trial of limited resection in peripheral stage I lung cancer patients were recently presented by the Lung Cancer Study Group.18 Patients with peripheral T1 lung cancers were randomly assigned to either limited resection or standard lobectomy. The lesions were not visible by bronchoscopy and N1 nodes were sampled intraoperatively. Although no significant difference in survival was observed, the incidence of local recurrence was 2.7-fold greater in the limited resection group. These results suggest that limited resection should be reserved for patients with compromised lung function or those requiring resection of multiple lesions.

THORACOSCOPY

Thoracoscopy provides an alternative to open thoracotomy for patients with a variety of intrathoracic diseases. Although thoracoscopy has been used in thoracic surgery for more than 50 years, previous applications were generally limited to the biopsy of pleural masses or treatment of effusions and empyemas. More recently, thoracoscopy has been used both diagnostically and therapeutically in the lung and mediastinum. These technical advances resulted primarily from improved video technology and instrument development.2021

In the absence of pleural adhesions, thoracoscopy permits visualization of the entire visceral and parietal pleural surfaces. The lung parenchyma can be examined and directed biopsies performed. In addition, mediastinal masses and lymph nodes can be visualized and biopsied.

The technique of thoroscopic surgery requires a general anesthetic for control of the airway. In most cases, a double lumen endotracheal tube is placed, and the patient is maintained on single-lung ventilation. The concavity of the chest permits manipulation of the lung from anterior, posterior, and lateral access ports. This permits "triangulation" of the lesion and more efficient manipulation and visualization of the lung and mediastinal structures.

In contrast to open thoracotomy, thoroscopic resections are significantly less painful, produce minimal respiratory compromise, and require a shorter hospital stay. The access ports or incisions are small and cosmetically acceptable to most patients. In most cases, chest tubes are removed in the recovery room after lung re-expansion has been documented by chest radiography.

Current indications for thoroscopic surgery include the diagnosis of pleural, pericardial, mediastinal, or lung parenchymal disease. Biopsy procedures in critically ill patients with markedly abnormal lungs requiring aggressive ventilatory support are accomplished with the standard open thoracotomy technique. Thoroscopic surgery is performed routinely to treat bullous lung disease and pericardial effusions and to resect peripheral lung nodules and some mediastinal masses.

With a limited incision, the thoracoscope can also be used to facilitate anatomic pulmonary or mediastinal resection. These so-called video-assisted thoracic surgeries have many of the practical benefits of thoracoscopy including shortened hospital stay and better postoperative pulmonary function.

CONCLUSION

A variety of surgical techniques are currently available for the treatment of lung cancer. In carefully selected patients, these techniques permit adequate resection of the lung while preserving functioning lung tissue.
REFERENCES

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