Extended Sleeve Resection for Lung Cancer

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KEYWORDS

• Bronchoplasty • Arterioplasty • Venoplasty • Pneumonectomy • Complication
• Chemoradiotherapy

KEY POINTS

- The bronchoplastic procedure is feasible but not always a common procedure.
- Extended sleeve resection is feasible for avoiding pneumonectomy.
- Adjustment of caliber discrepancy in bronchial anastomosis is a key for success.
- Concomitant vascular reconstruction is frequent, and thoracic surgeons should prepare for the procedure.

INTRODUCTION

Pneumonectomy is one of the most invasive procedures for patients with lung cancer. To avoid pneumonectomy, some institutes perform a lung-preserving procedure named broncho-vascular sleeve resection.[1] The classic bronchoplastic procedure including reconstruction of pulmonary artery for non–small cell lung cancer (NSCLC) has been established, and the short- and long-term outcomes are better than pneumonectomy. The bronchoplastic procedure usually requires anastomosis of the proximal main bronchus and distal intermedius or lobar bronchus and is technically demanding. However, it is required for thoracic surgeons to anastomose distal segmental bronchi; this extended sleeve resection (ESL) was first reported in 1999.[2] The definition of ESL is resection of more than one lobe using the bronchoplastic procedure.[2,3] In Japan, the bronchoplastic procedure is not always tried for avoiding pneumonectomy; the pneumonectomy to sleeve ratio is 1.1:1.0 in Japan versus 1.0:2.4 in the author's institute.[4] The feasibility of ESL was reported from several institutes.[2,3,5,6] In this article, the author's experience with ESL in 26 patients with centrally located NSCLC and surgical outcome is discussed.

CLASSIFICATION OF EXTENDED SLEEVE RESECTION

Originally Okada and colleagues[2] reported 3 types of ESL, whereas Berthet and colleagues[3] reported 4. Type A ESL denotes resection of the right upper lobe, the middle lobe, and the superior segment of the lower lobe, resulting in a preserved right lower lobe or the basal segment. Anastomosis in type A ESL is between the right main bronchus and the right lower bronchus or right basal bronchi. Type B denotes resection of the left upper lobe and the superior segment of the lower lobe, resulting in a preserved left basal segment. Anastomosis should be done between the left upper bronchus and left basal segmental bronchi. Type C denotes resection of the lingular segment and the left lower lobe, resulting in a preserved left superior segment of the upper lobe. Anastomosis is between the left main bronchus and the left superior segmental bronchi. Type D, originally reported by Berthet and colleagues,[3] denotes resection of the right middle and lower lobe, resulting in a preserved right upper lobe. Anastomosis is made between the right main bronchus and the right upper lobe bronchus. Each proximal bronchus in ESL is the main bronchus; all distal bronchi are segmental bronchi, except type D in which the distal

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bronchus is the right upper bronchus. The shape of the bronchus should be understood by every thoracic surgeon who tried to perform ESL for thoracic malignancy. The cut end of all proximal bronchi have a horseshoe shape, whereas all distal bronchi do not. This point means the distal bronchi are easy to be extended for adjustment of caliber discrepancies between proximal and distal bronchial stumps (see later discussion in detail).

FREQUENCY AND INDICATIONS OF EXTENDED SLEEVE RESECTION

Bronchial sleeve resections were performed in 427 patients who had lung cancer in 2014 in Japan. This number represents 1.2% of all resected lung cancer cases and is considered to be rare. The pneumonectomy to sleeve ratio was 1.1:1.0 in Japan, and bronchoplasty is a kind of rare operative mode. Among them, the extended sleeve would be much rarer than the classic sleeve, though the accurate number is unknown. Okada and colleagues[2] reported 15 (9.6%) ESLs out of 157 sleeves between 1985 and 1997, and Chida and colleagues[5] reported 23 (42.0%) ESLs out of 55 sleeves between 1997 and 2007. Berthet and colleagues[3] performed 27 (26.0%) ESLs out of 101 sleeves between 2006 and 2013, and the author's institute had 26 (21.0%) out of 126 sleeves between 2008 and 2016. The proportion of each type is not the same, depending on the institute (Table 1).

INDICATIONS OF EXTENDED SLEEVE RESECTION

The preoperative assessment included physical examination, chest roentgenogram, bronchoscopy, thoracic, abdominal and cerebral computed tomography (CT), and 18F-fluorodeoxyglucose PET. Cerebral CT would be replaced with cerebral MRI. If N3 or M1 existed, surgical indication is not generally approved. If N2 disease is suspected, histologic diagnosis using endobronchial ultrasonic biopsy or mediastinoscopy is indicated. Whenever N2 is confirmed histologically, induction treatment using chemotherapy or radiochemotherapy is used before surgery. The author does not hesitate to perform the bronchoplastic procedure even after high-dose radiotherapy; the author has performed 3 carinal pneumonectomies after 60 Gy of radiation or 8 sleeve lobectomies after radiation, including 6 high-dose radiation. ESL of type D was actually performed after 45 Gy of chemoradiation as a conversion surgery. Whenever pneumonectomy is indicated intraoperatively, the author tries to perform sleeve resection, including ESL if R0 resection is possible. Concomitant reconstruction of the pulmonary artery and/or vein does not exclude the indication of ESL. Tolerance for pneumonectomy should always be confirmed before performing ESL.

Table 1
Reports on extended sleeve resection

Author	Year	Number	Type A	Type B	Type C	Type D	Complications	Mortality	CP
Okada et al,[2] 1999	1985–1998	15	6	4	5	—	Thrombosis in PV in type A	0	1
Yamamoto et al,[6] 2008	1986–2006	20	5	8	7	—	Necrosis of the lung in type A	0	1
Chida et al,[5] 2009	1997–2007	23	2	4	10	6	ARDS in type A Bronchial stenosis in type B Bronchial fistula in type C	0	NS
Berthet et al,[3] 2013	2006–2013	27	16	7	2	2	Bronchial stenosis in type B Thrombosis in PA in type A	0	0
The author's institute	2008–2016	26	5	3	13	5	Thrombosis in PV in type A and C Bronchial fistula in type A	0	3

Abbreviations: ARDS, acute respiratory distress syndrome; CP, completion pneumonectomy; NS, not specified; PA, pulmonary artery; PV, pulmonary vein.