Fundamentals of Standard Sleeve Resection

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KEYWORDS

• Bronchoplasty • Sleeve lobectomy • Lung cancer

KEY POINTS

- Standard sleeve resection (SSR) refers to the circumferential excision of a portion of main bronchus in continuity with a lobectomy in order to avoid pneumonectomy.
- By avoiding pneumonectomy, surgery becomes possible in patients with compromised pulmonary function while also benefiting those with more normal pulmonary physiology.
- The procedure is most commonly indicated for the surgical treatment of malignant neoplasms located at the origin of the right upper lobe bronchus.
- Operative mortality after SSR is low and in the range of 2% to 3% as opposed to 5% to 6% after pneumonectomy.
- Quality of life and long-term survival after SSR are also better than what is observed after pneumonectomy.

INTRODUCTION

Although, the sleeve resection is not performed very often in the treatment of bronchogenic non–oat cell carcinoma, it remains an important option to be mastered by a thoracic surgeon. The author wishes to review some aspects of the history, indications, techniques, and results of this relatively difficult intervention. Because of the work from many experienced thoracic surgeons from all over the world, we have the chance to access a well-documented literature on this topic.

Definition

A sleeve lobectomy refers to a resection of a circumferential portion of a main bronchus with concomitant lung resection. It differs from the less complicated bronchoplastic resection whereby there is simply a reconstruction of the orifice of the bronchus. In this article, the author focuses only on bronchial sleeve resection. The author does not touch on sleeve resection of the pulmonary vascular system.

History

When reviewing the evolution of sleeve resection, one will find a progressive evolution since the first attempt in the late 1940s. It was developed as an alternative to pneumonectomy. Often considered by the average surgeon as a difficult operation, its standardization has made its use more familiar to most thoracic surgeons. Sleeve lobectomy has been adapted along the years to the newest technologic innovations. Developing the ability and experience of surgeons with minimally invasive surgery has brought this technique to another level of expertise.

The Pioneer Days

The first cases of surgeons attempting to perform a bronchotomy to spare lung parenchyma were reported in the 1930s.

In the 1940s and 1950s when thoracic surgery was progressively developing, several surgeons

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had the ingenuity and curiosity to spare the lung parenchyma when a benign lesion was blocking a bronchus (Price-Thomas,[1,2] D'Abreu and MacHale,[3] Gebauer[4]). The technique was later adapted for the treatment of lung cancer by Allison[5] in 1955, Paulson and Shaw[6] in 1956, and Johnston and Jones[7] in 1959. They confirmed the feasibility of sleeve resection for lung carcinoma in the early days of bronchoplastic surgery.

The Confirmatory Period of Feasibility

After the report in the early 1970s of Jensik and colleagues[8] in North America and Naef and Schmid de Gruneck[9] in Europe about the long-term results of low-grade tumor treated by sleeve lobectomy, the road was opened to use the technique for the treatment of lung carcinoma. In 1978, Bennett[10] reported a series of 96 patients treated by sleeve lobectomy with a 5-year survival of 34%. In 1979, the Toronto group introduced the concept of using the procedure for compromised patients.[11]

It was followed by a series of patients reported by Faber and colleagues[12] and Jensik and colleagues[13] in the early 1980s. Their experience combined with Vogt-Moykopf and colleagues[14] and Deslauriers and colleagues[15] in 1986, and Tedder and colleagues[16] confirmed the safety and advantage of this sparing lung operation for the benefit of patients' quality of life. In the early 1990s (1994), Khargi and colleagues[17] made a serial measurement of the pulmonary function to prove the objective value of the implanted lung lobes. Gaissert and colleagues,[18] after a study of 72 patients, came to the conclusion that the sleeve was the procedure of choice for both fit patients as well as for those with limited pulmonary reserve.[18]

The Modern Period: Mastery of the Technique

The sleeve technique became adopted by many groups of renowned thoracic surgeons all around the world, believing the technique has to be offered to patients as often as possible to avoid a pneumonectomy. In 1999, Massard and colleagues[19] from France presented their results for a 20-year period with good results for stage 1 and 2 diseases. In 2003, Ferguson and Lehman[20] from Chicago delivered a study on the quality of life and survival. During that period, Deslauriers and colleagues[21] presented one of the largest series of sleeve lobectomy patients and demonstrated a better survival than with a pneumonectomy. In a study comparing pneumonectomy with sleeve resection, Ludwig and colleagues[22] found the last technique appropriate for patients with critical lung reserve. Yildizeli and colleagues[23] reported a large series from France with low mortality and morbidity. Park and colleagues[24] reported a comparison of pneumonectomy and sleeve lobectomy in 424 patients with good lung function. The sleeve lobectomy seems to be the appropriate surgical option for the benefit of quality of life without compromising survival.[24] After all these confirmatory reports, it became evident that sleeve lobectomy has become an inescapable option in the armamentarium of the thoracic surgeon.

The High-Tech Period

The video-assisted thoracoscopic surgery (VATS) procedure was developed in the 1990s and popularized gradually in the 2000s.[25] It is now a technique well accepted by thoracic surgeons. It has to be used according to specific indications for the treatment of lung cancer. Progressively, thoracic surgeons are becoming more familiar with the technique. The first sleeve lobectomy with endoscopic bronchial anastomosis was reported in 2002 by Santambrogio and colleagues[26] for a mucoepidermoid carcinoma of the left lower bronchus.

To date, there are 20 or more reports. Most reports are individual cases. In 2013, Yun Li[27] reported 15 patients who underwent sleeve lobectomy. Mahtabifard and colleagues[28] and Nakanishi[29] and Zhou and colleagues[30] also reported their initial experience, which proves the feasibility using 2 to 4 incisions. The development of that approach remain slow because of the challenge and difficulties of such an approach.[31] However, Gonzales-Rivas and colleagues[32] were the first to report a uniportal video-assisted bronchial sleeve lobectomy. Robotic sleeve lobectomy popularized by Cerfolio[33] is another advance in the performance of that intervention. The author is beginning to see reports of sleeve bronchoplasty performed with concomitant arterial sleeve.[34,35]

INDICATIONS

At the beginning, the idea of using sleeve lobectomy was to preserve as much lung parenchyma as possible in those cases with low-grade carcinoma or carcinoid and for those with benign bronchial stenosis.

It became evident that sleeve lobectomy could be performed to help patients with lung cancer and poor pulmonary reserve to undertake a curative surgical treatment.[11]

Today the surgeon will even choose to perform a sleeve lobectomy in someone with good pulmonary function instead of a pneumonectomy, more so if it is on the right side to reduce the chance