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REVIEW / DERLEME

# Segmental bronchial sleeve resections

*Segmental bronşiyal sleeve rezeksiyonlar*

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***ABSTRACT***

In recent years, with the widespread application of bronchial sleeve resection, many studies have shown that, compared to pneumonectomy, bronchial sleeve resections can preserve more lung parenchyma, improve quality of life of patients, and significantly reduce postoperative complications and mortality rates. In this review, we discuss bronchial segmental sleeve resections with variations in the light of literature data.

***Keywords:*** Pulmonary neoplasms, pulmonary resections, sleeve resections.

***ÖZ***

Son yıllarda bronşiyal sleeve rezeksiyonların yaygın olarak uygulanması ile birlikte, birçok çalışma pnömonektomiye kıyasla, bronşiyal sleeve rezeksiyonların akciğer parankimini koruyarak hastaların yaşam kalitesini iyileştirebileceğini ve ameliyat sonrası komplikasyonları ve mortalite oranlarını anlamlı düzeyde düşürebileceğini göstermektedir. Bu derlemede, literatür verileri eşliğinde bronşiyal segmental sleeve rezeksiyonlar ve çeşitleri tartışıldı.

***Anahtar sözcükler:*** Akciğer tümörleri, akciğer rezeksiyonları, sleeve rezeksiyonlar.

Bronchoplastic techniques are commonly used for surgical treatment of benign or low-grade malignant neoplasms to spare healthy lung parenchyma;[1] however, these techniques are currently used in malignant neoplasms when technically possible. In recent years, with the widespread application of bronchial sleeve resection, many studies have shown that, compared to pneumonectomy, bronchial sleeve resections can preserve more lung parenchyma for patients, provide a better quality of life, and significantly reduce postoperative complications and mortality.[2-6] Nearly 30 types of bronchial sleeve reconstructions have been reported in the literature, but segmental bronchial sleeve resections are very rare.[7]

First, we should remember the definition of bronchial sleeve resections. A bronchial sleeve lobectomy is a modification of a standard lobectomy in which a portion of the adjacent bronchus - usually the main stem bronchus - is removed along with the resected lung. The remaining distal bronchus - or bronchi - is anastomosed to the proximal bronchial stump to preserve the normal lung tissue distal to the resected lung.[8]

Although the aforementioned definition is clear, segmental bronchial sleeve resections are even more complicated. A descriptive definition could be "*segmental bronchial resection with or without lung parenchyma*."

We may classify bronchial segmental sleeve resections into two types, with parenchymal resection. Segmental resection alone is performed without parenchymal resection, as excellently described by Yavuzer et al.[1] Bronchial sleeve resections are sometimes performed together with neighboring lobectomy.

In this case, the operation becomes more complicated. Since the diameter of the segmental bronchial orifice is small, a discrepancy exists. Several techniques can be used in this situation. Since the middle lobe bronchus is smaller than others, it could be challenging to perform sleeve anastomosis for sleeve

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right lower lobectomy. We may consider the middle lobe bronchus segmental bronchus due to its diameter. In this chapter, sleeve resections related to the middle lobe will not be discussed.

As with all lung cancer surgeries, an intraoperative frozen-section pathology examination should be conducted for the resected lymph nodes whose positivity may affect the treatment and lead to the discovery of the tumor when necessary.

The classification of segmental bronchial is as follows:

1. Segmental bronchial sleeve resections without parenchymal resection.
2. Segmental bronchial sleeve resections with parenchymal resection.
3. Segmental bronchial sleeve resections with ipsilateral neighbor lobectomy.

*Segmental bronchial sleeve resections without parenchymal resection*

This type of resection is only performed in cases of benign tumors or carcinoid tumors. They should be 5 mm or less in diameter; otherwise, great tension occurs. The most optimal anatomic location is the basal segmental bronchus.

There is a little risk of local recurrence in such tumors, and lymphatic dissection, including the lymphatic pool of the relevant segment, should be performed next to the mediastinum. Such small lesions within the segment bronchus can be treated successfully with endoscopic interventions using various methods.[9]

Proper lung mobilization is crucial to the success of segmental bronchial sleeve resection. If possible, the anastomosis is covered with vital tissue. However, since there is no lung loss, the aerated parenchyma covers the anastomosis by providing the best external support. Leak control is performed at the end of the anastomosis. A strong manual ventilation is performed, once at a water pressure of approximately 20 to 25 cm after the anesthesia team is aspirated the involved side to control the anastomotic passage.

As a result of the first and only ventilation of the resected segment bronchus, patency is controlled, and stenosis is ruled out in one step. Repeated ventilations with a lower volume ventilate the involved segment, but this does not rule out anastomotic stenosis. Segmentectomy or even lobectomy may be unavoidable, if the relevant segment remains atelectatic and does not ventilate well.

In cemental segmental sleeve resections, 4/0 or 5/0 Vicryl sutures or polypropylene can be used as suture material. The use of absorbable propylene may be an appropriate choice. Nonetheless, such segmental sleeve resections are not preferred and cannot be performed currently. The reason for this is the infrequent occurrence of the appropriate indication and the potential high morbidity associated with the procedure (Figure 1).

As with all sleeve resections, anastomosis control can be performed with the help of a fiberoptic bronchoscope at the end of the anastomosis. In cases where there is insufficient aeration, this is particularly important. To prevent edema in the anastomosis line, steroid-containing inhalers and nebules should be used early in the postoperative period.

**Segmental bronchial sleeve resections with parenchymal resection**

In this type of sleeve resection, the segmental bronchus is removed together with the relevant parenchyma by making a sleeve into the bronchus from which it emerges. The most commonly performed procedure, superior sleeve segmentectomy, is the best example. Herein, the lower lobe superior segment is removed by making a sleeve from the intermediate bronchus on the right and the lower lobe entrance on the left, and the proximal bronchus is anastomosed to the basal segment bronchi. While performing

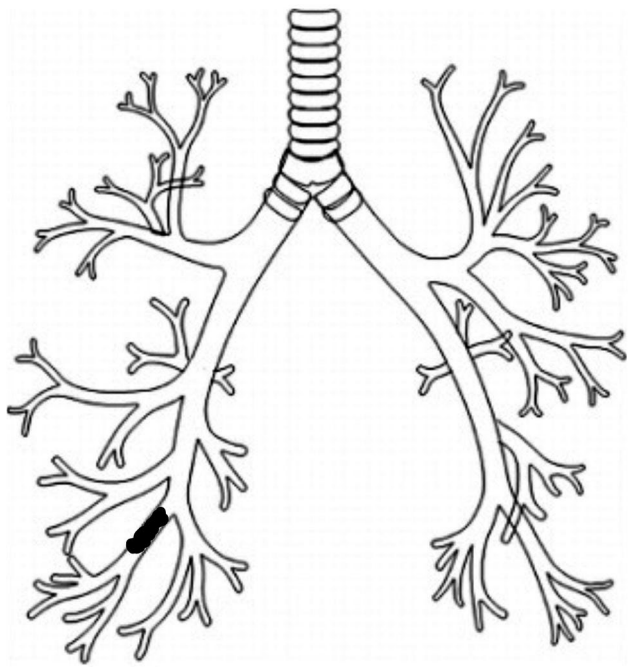

**Figure 1.** Segmental resection of segment bronchus.

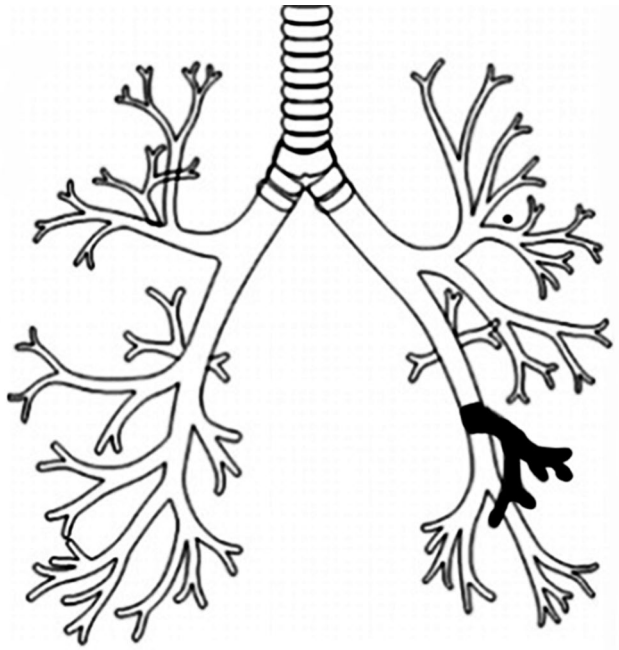

**Figure 2.** Segmental resection of segment bronchus with its parenchyma.

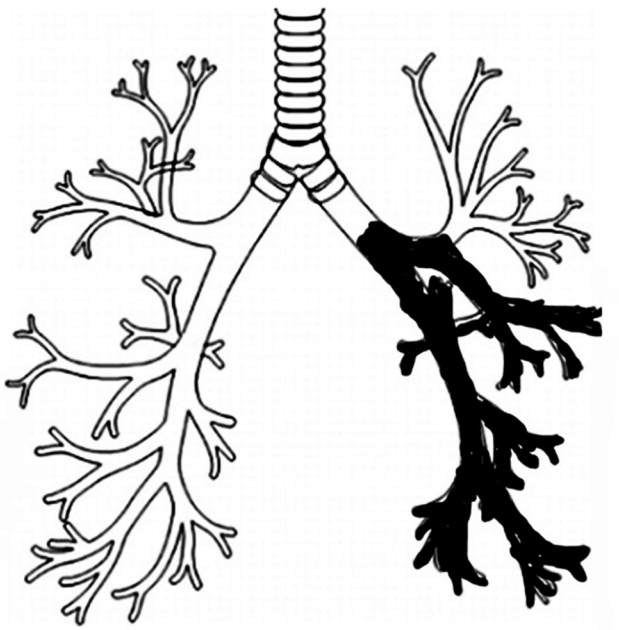

**Figure 3.** Left lower lobectomy plus neighboring segmental resection and anastomosis of segment bronchus to the main bronchus.

anastomoses, propylene or Vicryl 4/0 can be used. In narrow anastomoses, absorbable propylene may be advantageous. The membranous face can be sutured with individual sutures; the cartilaginous face can be sutured with continuous sutures, or the entire

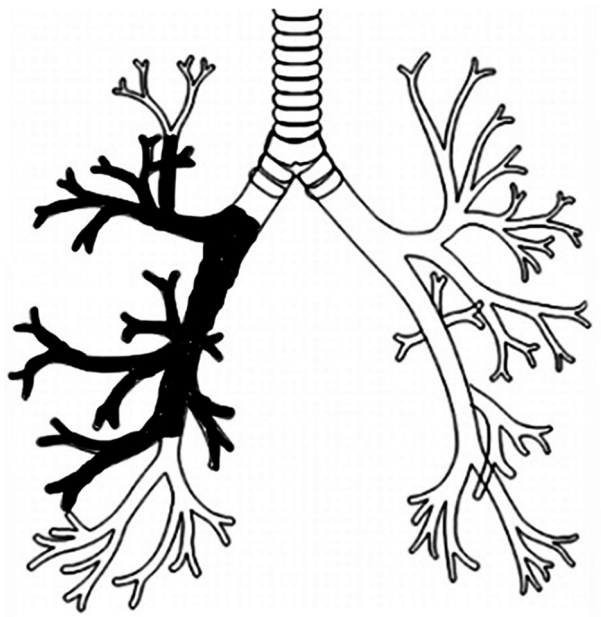

**Figure 4.** Right upper lobectomy plus neighboring segmental resection and anastomosis of segment bronchus to the main bronchus.

anastomosis can be sutured continuously. Herein, the difference in diameter between both bronchi determines the patency of the anastomosis and the anastomosis technique. If anastomotic tension is considered, two traction sutures can be placed on the sides of the cartilaginous face. At the end of surgery, anastomosis passage is checked with a single and powerful manual ventilation, and general leakage control is, then, performed. Fiberoptic bronchoscopy may be performed peri- or postoperatively, if necessary. If the resected bronchus length is long, the segment mouths are separated from each other distally, single sutures are placed on the median face, and it is turned into a single lumen in the form of a double barrel (Figure 2). The trick in this process is not to leave corners while combining segments. The corners that may occur may cause leaks in the anastomosis.

This intervention can be performed in tumor cases within the segmental bronchus, which requires more bronchial sleeves. Since there is a limited macroscopic safety limit, the surgical specimen must be sent to the frozen section.

### Segmental bronchial sleeve resections with ipsilateral neighbor lobectomy

These types of resections are extended resections. Additionally, they may also be deemed necessary preoperatively, as previously planned. It is difficult

to perform a simple sleeve lobectomy, when the tumor involves multiple lobes. Thus, expanded sleeve resections may be necessary.[7] The aforementioned technique can be applied, if the orifices of the remaining segment or segments after the other lobe segment is resected are suitable for anastomosis. In addition to left upper lobectomy, right upper lobectomy or lower lobe superior segment resection is the most common and appropriate example (Figures 3 and 4). Anastomosis is made between the main bronchus and the basal segments. Various forms of such reactions according to their lobar and segmental distributions have been described in detail by Qu et al.[7] For such an extended resection indication, "*indication should not be confused with appetite*," as stated at the beginning of the article. The success of this technique depends on a number of factors. The main factor is the diameter mismatch. We observe a significant difference, if we consider the diameter of the main bronchus to be approximately 12 mm and the diameter of the basal segment to be 8 mm. It is possible to remedy this problem by performing membranoplasty on the membranous aspect of the main bronchus. The diameter of the main bronchus can be reduced by three to four, with an average of three to four stitches, each consisting of more constricting stitches, followed by a small constricting suture approximately 6 mm from the incision line. In addition, the bronchial circumference can be extended by 1 to 2 mm by cutting the distal end minimally 1 to 2 mm obliquely on the horizontal axis. Performing such a technique requires the expertise of a qualified individual.

The tension would likely be high for this type of sleeve resection due to the length of the removed bronchial segment. Therefore, lateral traction sutures may be helpful.

It is also essential to consider the condition of the pulmonary artery after a long bronchial segment. The artery accompanying the bronchus can fold and kink here. This may necessitate pulmonary artery sleeve resection, which can be a more complicated procedure. It is helpful to recognize beforehand that such a surgical procedure may be needed, both preoperatively and preoperatively.

Compared to sleeve lobectomy, all types of bronchial segmental sleeve resections may increase the risk of postoperative complications. These specific complications are early or late air leakage fistula, structure formation, and stenosis. Therefore, postoperative management is of utmost importance. If anastomosis is risky, steroid inhalers and fiberoptic bronchoscopic tracheobronchial cleaning may be recommended.

Complications such as atelectasis, pneumonia, and respiratory failure may also occur. In selected cases, segmental bronchial sleeve resections may follow neoadjuvant chemotherapy. Neoadjuvant radiotherapy can complicate surgical procedures. Furthermore, this type of sleeve resection should only be performed by experienced surgeons and should never be confused with appetite and indications.

In conclusion, segmental bronchial sleeve resection expands the surgical indications for lung cancer, avoids pneumonectomy, and improves the quality of life of patients, especially for those with central NSCLC. Despite it needs a high technique and also more complicated, it is still a safe and feasible surgical procedure.

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