



# Video-Assisted Thoracoscopic Carinal Resection and Reconstruction in A Case of Primary Tracheal Tumor

## Primer Trakeal Tümör Olgusunda Video Yardımlı Torakoskopik Cerrahi ile Karinal Rezeksiyon ve Rekonstrüksiyonu

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### ABSTRACT

Tracheal tumors located in the carina are quite rare. Resection and reconstruction of carinal tumors are technically more challenging due to their locations. The most commonly preferred method is right posterolateral thoracotomy. In this study, a case of carinal resection and reconstruction performed using video-assisted thoracoscopy is presented. According to our knowledge, this case is the first video thoracoscopic carina resection and reconstruction performed in Turkey.

**Keywords:** Video-assisted thoracoscopic surgery, carinal resection, carinoplasty

### ÖZ

Karina yerleşimli primer trakeal tümörler oldukça nadir görülür. Yerleşim yeri itibarıyla karinal tümörlerin rezeksiyonu ve rekonstrüksiyonu teknik açıdan çok daha zordur. Sıklıkla tercih edilen yaklaşım yöntemi, sağ posterolateral torakotomidir. Çalışmamızda, video yardımcı torakoskopik karina rezeksiyon ve rekonstrüksiyonu yapılan olgu sunulmuştur. Sunulan olgu Türkiye’de gerçekleştirilen ilk başarılı Video yardımcı torakoskopik cerrahi ile karina rezeksiyonu ve rekonstrüksiyonudur.

**Anahtar Kelimeler:** Video yardımcı torakoskopik cerrahi, karinal rezeksiyon, karinoplasti

## Introduction

Carinal resection is usually performed concurrently with lung parenchymal resection when primary lung cancer invades the carina. Isolated carinal resection is defined as the resection of only the tracheal bifurcation without lung parenchymal resection and is indicated in cases of primary tracheal tumors located in the carina. It was first described by Abbott et al.<sup>1</sup> in 1950. Subsequently, Barclay et al.<sup>2</sup> described the technique of end-to-end anastomosis of the right main bronchus to the trachea and end-to-side anastomosis of the left main bronchus to the trachea in carinal resections. In the following years, the Double-barrel<sup>3</sup> and Miyamoto<sup>4</sup> and Yamamoto<sup>5</sup> described techniques in which the left main bronchus was anastomosed

end-to-end to the trachea, and the right main bronchus or intermediate bronchus was anastomosed end-to-side to this anastomotic line. This technique has been reported to have advantages such as not requiring a new anastomotic hole that would disrupt tracheal blood flow, leaving neocarina open as a result, distributing tension in three different directions along the anastomotic line to minimize tension<sup>5</sup>. The authors also believe that this method is safer. Therefore, this anastomotic technique was chosen in this study.

Carinal resections are technically challenging operations and are more challenging to perform with video-assisted thoracoscopic surgery (VATS). The authors would like to present this case, which is the first in Turkey to their knowledge. The permission for the study was obtained from the approval

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**Received:** 12.05.2024 **Accepted:** 12.07.2024



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was obtained from the Non-Interventional Clinical Research Ethics Committee of Ethics Committee of Tekirdağ Dr. İsmail Fehmi Cumalıoğlu City Hospital (approval number: 97, date: 19.04.2024). The informed consent form was obtained from the patient.

## CASE REPORT

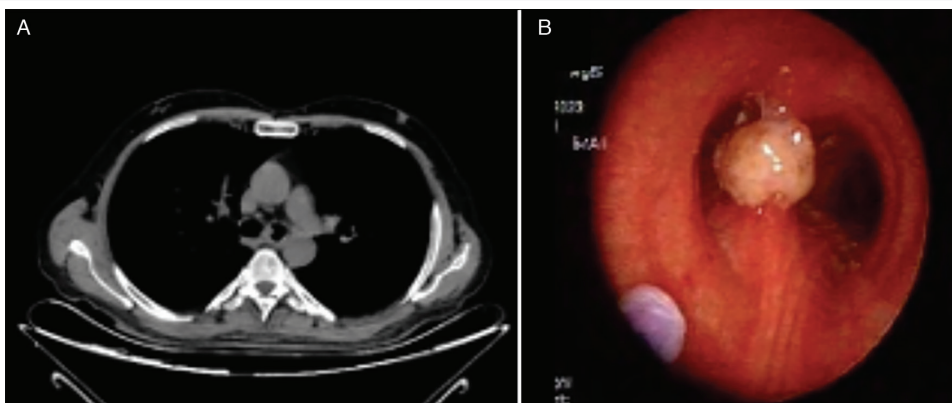
A 66-year-old male patient presented to our clinic with a complaint of cough like hemoptysis that started two months ago. He had a smoking history of 70 pack-years. A 1 cm lesion was observed on the carina in the chest computed tomography scan (Figure 1A). The positron emission tomography assessment reported the lesion's maximum standardized uptake value as 1.8. Fiberoptic bronchoscopy examination revealed a mass on the carina (Figure 1B), and a punch biopsy was performed. Pathological examination of the lesion reported squamous cell carcinoma.

After achieving single-lung ventilation with single lumen intubation by using a bronchial blocker on the right side, in the left lateral decubitus position, a 2 cm camera port incision was made into the thorax at the 7<sup>th</sup> intercostal space (ICS) along the midaxillary line. Subsequently, a 3 cm utility incision was made from the 4<sup>th</sup> ICS along the midaxillary line towards the anterior axillary line, and a wound retractor was inserted. In the case where carinal resection/reconstruction was planned, the azygos vein was initially sacrificed and divided with an endovascular stapler. To ensure proper exposure, azygos vein stumps were secured posteriorly to the chest wall and anteriorly to the mediastinal pleura. After being suspended with tape by turning the trachea and right main bronchus, the left main bronchus was exposed through blunt and sharp dissections (Figure 2A).

The endobronchial blocker was deployed, and the endotracheal tube was pulled back from the trachea to the proximal carina.

The right main bronchus was cut with a scalpel distal to the carina. Two 2/0 absorbable sutures were placed for traction purposes at the distal end of the left main bronchus, and it was cut distal to the carina (Figure 2B). At this stage, a no. 5 spiral endotracheal tube was inserted through the utility incision, intubating the left main bronchus (Figure 2C). The endotracheal tube was then connected to the newly established external circuit. Finally, the trachea was cut with a scalpel at the level of the carina. The specimen was removed from the chest.

After the surgical margins were reported as tumor-free with pathological examination of the frozen section, the anastomosis was initiated. At this stage, the patient's head was abducted to reduce tension at the anastomotic site. The left main bronchus was anastomosed to the trachea using a continuous end-to-end technique with 3/0 Prolene sutures (Figure 2D). During the anastomosis, the endotracheal tube in the left main bronchus was intermittently removed, and suturing was completed. Before completing the anastomosis, approximately a 1 cm gap was left for the anastomosis of the right main bronchus. At this stage, the endotracheal tube in the trachea was pushed distally, achieving intubation of the left main bronchus, and the external circuit was secured. Subsequently, to calibrate the gap left for the right main bronchus, a piece of cartilaginous ring was excised from the trachea using a scalpel. The right main bronchus was sutured to the trachea-anastomosis line of the left main bronchus in an end-to-side fashion using continuous technique with 3/0 prolene. The cuff of the endotracheal tube in the left main bronchus was lowered, and leakage control in the suture lines was performed with a small amount of physiological saline spilled into the thoracic cavity. To reduce tension on the anastomotic site, no additional release maneuvers were required, except for the liberation of the inferior ligament.



**Figure 1. A)** The tumor was observed on the level of carina in computed tomography. **B)** A mass on the carina was observed with fiberoptic bronchoscopy

Finally, tissue adhesive was applied to the anastomotic line, and the ends of the azygos vein were sutured together to cover the anastomotic area. No additional support tissue was brought to the anastomotic site. Bilateral lung expansion was observed, and there was no leakage at the anastomotic site. Neocarina was visualized with fiberoptic bronchoscopy examination before extubating. After placing the patient in the supine position, the patient's chin was sutured to the manubrium sterni with 2 0/0 silk sutures to prevent hyperextension. The patient was extubated in the operating room. Head flexion was maintained during the first week. Chin sutures were removed at the end of the first week, but neck extension was restricted for one more week. The patient, whose right chest tube was removed on the 2nd day of the operation, was discharged on the 7th day of the operation. The final pathology result reported negative surgical margins for squamous cell carcinoma. The patient is living a healthy life at the postoperative 6th month.

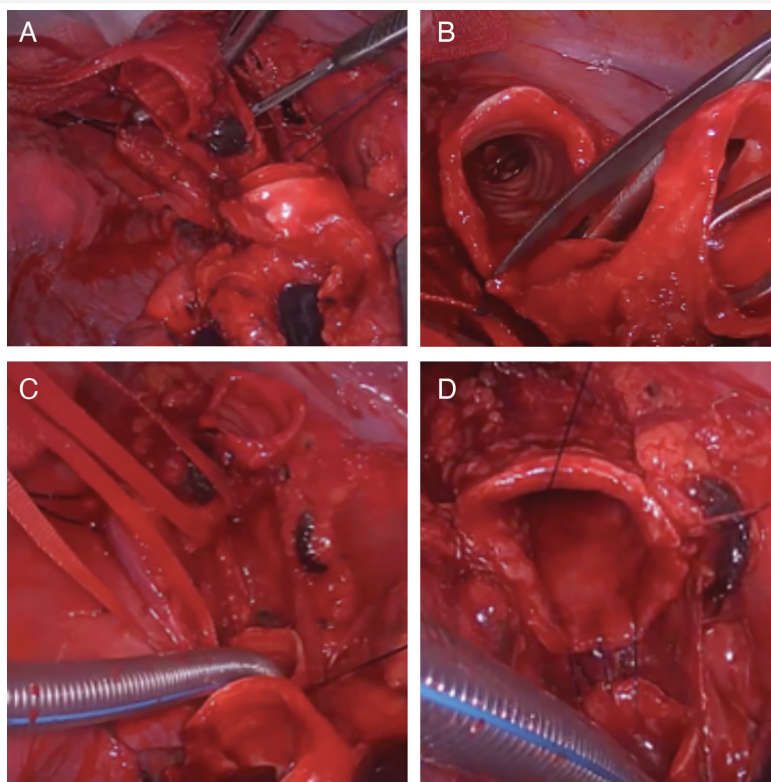
### DISCUSSION

Carinal resections are technically challenging operations. The preferred approach has long been the right posterolateral incision and, less frequently, median sternotomy<sup>6</sup>. The first

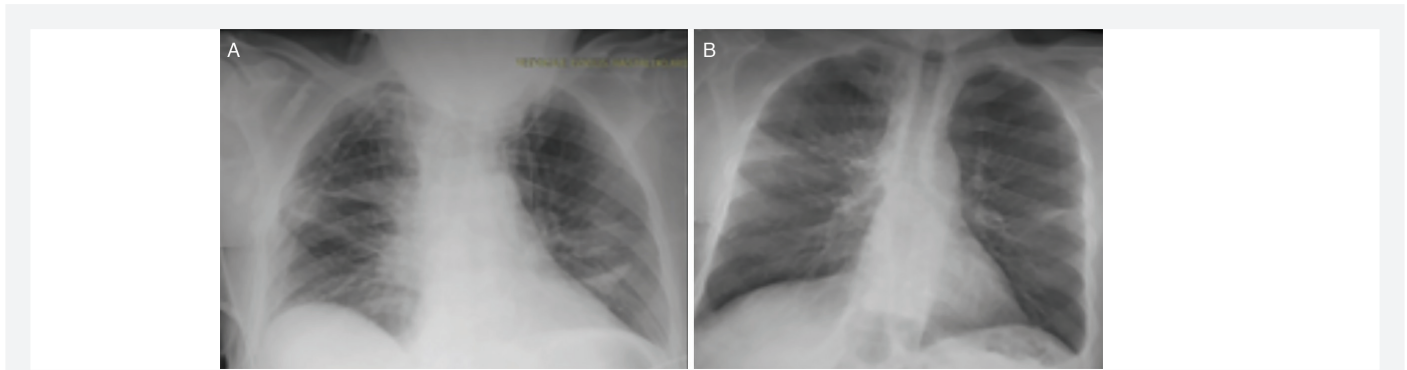
carinal resection with VATS was performed by Nakanishi in 2013<sup>7</sup>. In the following years, cases with a "larger case series" have been reported<sup>8</sup>. With the development of the uniportal approach, Diego et al.<sup>9</sup> first described uniportal approach in carinal resection in 2016.

Squamous cell carcinoma and adenoid cystic carcinoma are the most common primary tumors of the trachea and are the main indicators of carinal resection. Provided that the disease is not metastatic and resection is completed, surgical treatment is significantly superior to palliative treatment in terms of survival. When preoperative intubation cannot be conducted due to an obstructing lesion at the carina level, the lesion can either be removed with rigid bronchoscopy and an endotracheal tube can be placed, or veno-venous bypass can be initiated. In studies, it is recommended to perform VATS sleeve after 20 sleeve with open surgery and 200 lobectomy with VATS<sup>10</sup>.

Centrally located non-small-cell lung cancers encompassing the carina or distal trachea is relatively rare and regardless of tumor size, classified as locally advanced T4 stage disease. Such patients are associated with a poor prognosis. The difficulty of tracheal anastomosis requires high surgical skills; therefore, this method can be performed by experienced thoracic surgeons in



**Figure 2.** A) After the right main bronchus was cut, the left main bronchus was released and cut. B) Cutting the trachea above the level of the carina. C) Ventilation of the left main bronchus with an endo-tracheal tube. D) Starting an anastomosis between the left bronchus and the trachea



**Figure 3.** A) Chest radiography on the first day after surgery. B) Chest radiography on the second week after surgery

a few centers. In the study conducted by Pan et al. in 2023, the mortality rate was 10.81%. Mortality rates ranging from 8.3% to 20% have been reported in the literature<sup>11</sup>.

In this case, a biportal approach was chosen. In VATS carinal resections, high-frequency jet ventilation with the patient intubated is a frequently preferred approach to facilitate surgery during anastomosis. However, due to the absence of this equipment in the hospital, during the operation, the end-blocker-assisted intubation technique was used.

## CONCLUSION

As a result of the increasing use of VATS and its adaptation to extended resections, the use of VATS in extended resections has become widespread. It was observed that surgical trauma was less and postoperative recovery was faster with VATS. Considering these reasons, VATS can also be performed in extended surgical procedures in clinics with high thoracoscopy experience.

## Ethics

**Ethics Committee Approval:** The approval was obtained from the Non-Interventional Clinical Research Ethics Committee of Ethics Committee of Tekirdağ Dr. İsmail Fehmi Cumalıoğlu City Hospital (approval number: 97, date: 19.04.2024).

**Informed Consent:** The informed consent form was obtained from the patient.

## Authorship Contributions

Surgical and Medical Practices: M.M., Concept: M.Ü., A.Ç., Design: V.E., M.Ü., D.K., Data Collection or Processing: D.K., Analysis or Interpretation: M.Ü., Literature Search: V.E., Writing: M.Ü.

**Conflict of Interest:** No conflict of interest was declared by the authors.

**Financial Disclosure:** The authors declared that this study received no financial support.

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