New ideas - Thoracic oncologic

Intrapericardial approach via median sternotomy for hilar non-small cell lung cancer invading the main pulmonary artery

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Abstract

We describe a successful resection of the main pulmonary artery (MPA) using an intrapericardial approach via a median sternotomy in a patient with large hilar non-small cell lung cancer (NSCLC) invading the left MPA and Botallo’s ligament. This approach was able to provide a good operative view even for the large hilar tumor, with easier and safer resection of the MPA, unlike the anterolateral or posterolateral approach. This approach is a useful option for easy, safe and complete surgical resection in patients with NSCLC invading the MPA.

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Keywords: Intrapericardial approach; Median sternotomy; Hilar NSCLC; Invasion to main pulmonary artery

1. Introduction

Patients with locally advanced non-small cell lung cancer (NSCLC) should be given aggressive multidisciplinary therapy in a manner that maximizes the chance of long-term cure while minimizing the overall risks of treatment [1, 2]. Surgery for locally advanced NSCLC is still considered to be technically difficult, despite improvements in perioperative care and surgical techniques.

In patients with large hilar NSCLC invading the main pulmonary artery (MPA) and Botallo’s ligament, an anterolateral or posterolateral approach cannot provide a good operative view for easy and safe resection of the pulmonary artery. However, an intrapericardial approach via a median sternotomy visualizes the MPA from the opposite side of a large hilar tumor, facilitating a good operative view for resection of the MPA. Here, we describe successful resection of the MPA using an intrapericardial approach via a median sternotomy in a patient with large hilar NSCLC invading the left MPA.

2. Patient

A 60-year-old man with squamous cell carcinoma was transferred to our institution for surgery. Chest computed tomography (CT) revealed a 40-mm mass shadow invading the carina, left MPA, Botallo’s ligament, and hilar lymph node no. 10 without mediastinal lymph node swelling. Therefore, the clinical staging was diagnosed as c-T4N1M0, Stage IIIA. To obtain a sufficient surgical margin, induction chemoradiotherapy was initially performed (carboplatin + Docetaxel: two courses, radiation therapy: 50 Gy).

Two months later, chest CT before surgery revealed that the maximum size of the mass shadow had decreased to 35 mm, and that the invasion into the carina had disappeared. However, invasion into the left MPA and Botallo’s ligament remained (Fig. 1). Therefore, an intrapericardial approach via a median sternotomy was selected in order to obtain a good operative view, because the large hilar tumor might have prevented good visualization of the MPA via a posterolateral approach.

After the pericardium had been opened at the midline, the left MPA was exposed. Dissection and exposure of the left MPA advanced progressively toward the distal site (Fig. 2). After resection of the Botallo’s ligament, the left MPA was resected by using a mechanical stapler after obtaining a sufficient surgical margin intrapericardially. The superior and inferior pulmonary veins intrapericardially, and the left main bronchus inside the pleural cavity, were resected using the mechanical stapler. After dissection of the hilar and mediastinal lymph nodes, the operation was completed. Then no. 10 lymph node was resected with the left lung parenchyma, and the no. 8 lymph node was dissected after the left lung parenchyma was removed from the thorax.

The patient had an uneventful recovery. Unfortunately, subaortic lymph node metastasis (suspected direct invasion) was observed. Therefore, the pathological staging was revised to p-T4N2M0, Stage IIIB.

3. Comment

Anterior axial and posterolateral thoracotomy for NSCLC are considered to be standard approaches for general
Fig. 1. Findings of preoperative chest computed tomography. A 40-mm mass shadow indicates invasion to the left main pulmonary artery and Botallo’s ligament (arrows; tumor).

Fig. 2. Findings of preoperative 3D-computed tomographic angiography of the pulmonary artery. During the operation, dissection of the left main pulmonary artery progressed in the direction shown by the arrow.

However, neither can provide a good operative view in patients with large hilar tumors, because the tumor blocks any view of the MPA and carina. Additionally, forcible traction of the lung parenchyma may tear the MPA because of tumor invasion into the MPA and Botallo’s ligament.

However, an intrapericardial approach via a median sternotomy provides a good operative view even in patients with large hilar tumors, and allows easier and safer resection of the MPA. With this procedure, we were able to view the MPA from the opposite side of the large hilar tumor, giving good surgical access for resection of the left MPA. If the MPA tears, the patient’s safety may be jeopardized due to massive bleeding. Therefore, to minimize this bleeding risk, easier and safer resection of the MPA using an intrapericardial approach via a median sternotomy is a useful option for patients with large hilar NSCLC invading the MPA and Botallo’s ligament.

Several previous reports have indicated the advantages of the intrapericardial approach via a median sternotomy in patients with hilar lung cancer invading the MPA [3–6]. Sanli et al. [6] employed this approach in nine patients with tumors invading the MPA, and reported no operative mortality. Similarly, our use of this approach in the patient yielded successful outcomes.

The prognosis of locally advanced NSCLC without mediastinal lymph node involvement is relatively good. Yildizeli et al. reported that the five-year overall survival of patients with T4 NSCLC without mediastinal lymph node involvement who underwent complete surgical resection was 43% [1]. Additionally, Yang et al. demonstrated that T4 NSCLC patients with pulmonary great vessel involvement had better survival rates than other T4 subgroups [2]. These results strongly support the use of surgical resection as the primary treatment for patients with NSCLC invading the MPA, whenever complete resection is thought to be technically feasible and the patient’s condition is compatible with the extent of the planned surgery.

References

**eComment: Extended resections for primary lung cancer with oncological principles**

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Intrapericardial approach via median sternotomy for centrally-located primary lung cancer can be an alternative option to dissect the main pulmonary artery, especially for the left side. As Igai and Yokomise [1] mention, this technique has already been used by surgeons and presented in different journals [2].

According to oncological principles, there are some important issues that need to be discussed for this case.

1. Before induction chemoradiotherapy, mediastinal staging has to be evaluated not only with chest computed tomography (CT) but also with positron emission computed tomography, and invasive mediastinal staging should be considered if there is a suspicion for N2 disease. On the other hand, because there was a risk of tumor progression during chemoradiotherapy, carinal sleeve pneumonectomy with main pulmonary artery patch plasty on cardiopulmonary bypass without chemoradiotherapy could have been a surgical option for this patient [3].

2. It is known that the patients who have T4 tumor with N2 disease have poor prognosis. Thus, after induction chemoradiotherapy, mediastinal re-evaluation has to be done with standard-extended mediastinoscopy, especially before this kind of extended resection. In this case, CT-scan after induction chemoradiotherapy also revealed pathologic left paratracheal (aortico-pulmonary) lymph node.

3. As mediastinoscopy or bilateral mediastinal lymph node dissection via median sternotomy were not performed in this case, we still have no idea about upper mediastinal N2 status.

As a conclusion, an intrapericardial approach to hilar lung cancer via median sternotomy is technically a feasible surgical procedure which provides extensive operative view with safe dissection of major vascular structures. Extended resections in selected patients with primary lung cancer can be performed to ensure better prognosis only under the guidance of oncological principles.

**References**

