



Case Report / Olgu Sunumu

## Extended left pneumonectomy and left atrial reconstruction with autogenous graft in patient with T<sub>4</sub> lung cancer

*T<sub>4</sub> akciğer kanserli hastada genişletilmiş sol pnömonektomi ve otojen greft ile sol atriyal rekonstrüksiyon*

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### ABSTRACT

In selective patients with T<sub>4</sub> non-small cell lung cancer with the primary tumor invading the mediastinal organs, extended lung resection may contribute to long-term survival. Adequate patients should be given a chance for surgery if complete resection and required reconstruction can be achieved. In this article, we report a 63-year-old male patient with T<sub>4</sub> non-small cell lung cancer invading the left atrium. In the patient, we performed an extended left pneumonectomy with *en bloc* partial resection of the left atrium wall (4×2.5 cm) where the defect was repaired with pericardial patch via cardiopulmonary bypass. No severe complication developed postoperatively. The patient who was given adjuvant chemotherapy has been living for more than 10 years without disease.

**Keywords:** Cardiopulmonary bypass; locally advanced lung cancer; resection of left atrium.

T<sub>4</sub> lung cancer patients are a heterogeneous group consisting of locally advanced cancers. In T<sub>4</sub> disease with the primary tumor invading the mediastinal organs, selective patients may benefit from extended surgery achieving long-term survival. Complete surgical resection is the most successful method of treatment for T<sub>4</sub> N<sub>0-1</sub> M<sub>0</sub> non-small cell lung cancer (NSCLC) cases, but unfortunately only few of them can be treated surgically.<sup>[1]</sup> However, in some locally advanced NSCLC cases, complete resection can only be performed via cardiopulmonary bypass (CPB).<sup>[2]</sup>

### ÖZ

Primer tümörün mediastinal organları invaze ettiği T<sub>4</sub> küçük hücreli dışı akciğer kanserli seçilmiş hastalarda genişletilmiş akciğer rezeksiyonu uzun dönem sağkalıma katkı sağlayabilir. Eğer komplet rezeksiyon ve gerekli rekonstrüksiyon sağlanabilecek ise uygun hastalara cerrahi şansı tanınmalıdır. Bu yazıda, sol atriyumunu invaze eden T<sub>4</sub> küçük hücreli dışı akciğer kanserli 63 yaşında bir erkek hasta sunuldu. Hastaya kardiyopulmoner baypas eşliğinde sol atriyum duvarının (4×2.5 cm) *en blok* parsiyel rezeksiyonu yapıldı ve defektin perikardiyal yama ile tamir edildiği genişletilmiş sol pnömonektomi uygulandı. Ameliyat sonrası ciddi bir komplikasyon gelişmedi. Adjuvan kemoterapi verilen hasta 10 yıldan fazla süredir hastalısız yaşamaktadır.

**Anahtar sözcükler:** Kardiyopulmoner baypas; lokal ileri akciğer kanseri; sol atriyum rezeksiyonu.

Because of the rarity of successfully treated T<sub>4</sub> NSCLC patients, each case has significant importance for diagnostic and operational procedures.

### CASE REPORT

A 63-year-old male patient complaining from cough admitted to our clinic. Computed chest scan revealed a 110×55 mm left lung mass extending to the left lower lobe, and to the inferior pulmonary vein with extrinsic infiltration of left atrium wall (Figure 1). A written informed consent was obtained from the patient.

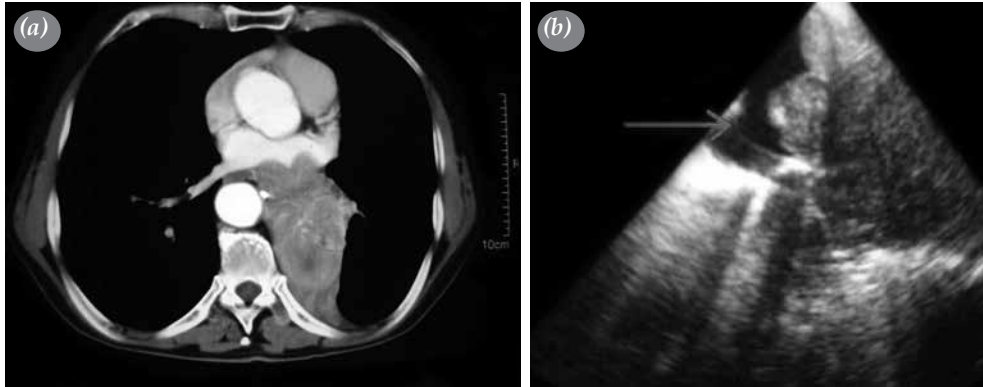
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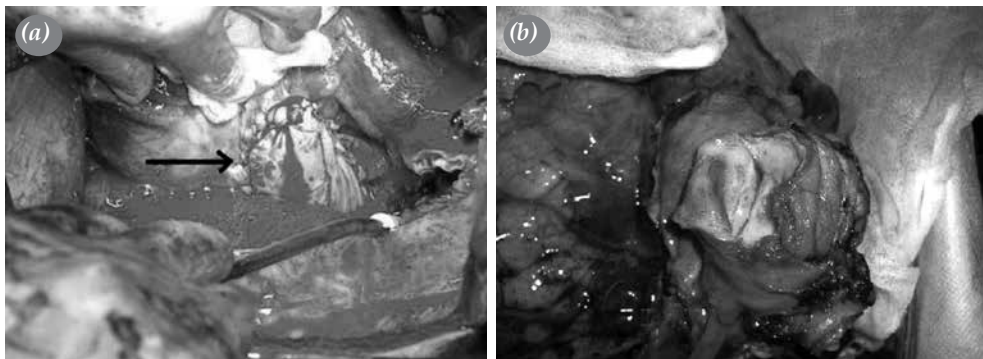


**Figure 1.** (a) Computed chest scan revealed a 110×55 mm left lower lobe mass extension, extrinsic infiltration of left atrium wall. (b) Preoperative transesophageal echocardiography examination: tumor that invaded posterolateral wall of left atrium did not extend to internal surface of atrium.

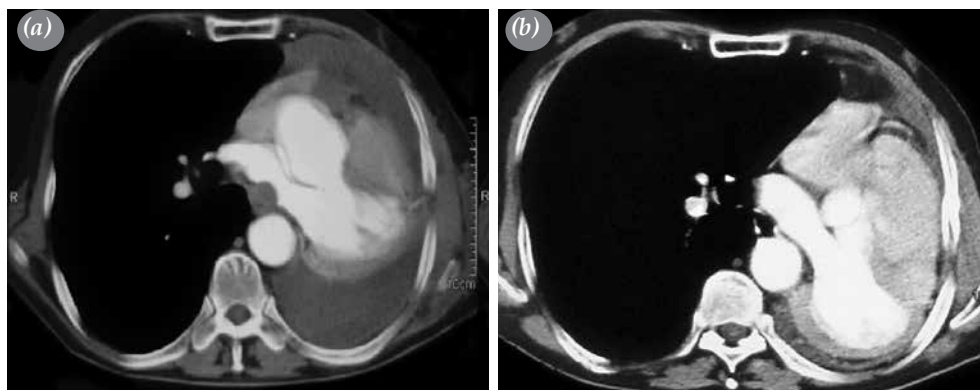
The case was evaluated for radical resection. For functional evaluation, transesophageal echocardiography (TEE) and coronary arteriography were performed. In the TEE evaluation, the tumor invaded the posterolateral wall of left atrium, but did not extend to the internal surface of the atrium (Figure 1). Extended left pneumonectomy with partial resection and reconstruction of the left atrium were planned for the patient using CPB for safe R<sub>0</sub> surgery.

The case was operated in May 2005. For the operation, after 3 mg/kg heparin was applied intravenously, patient's venous catheterization was achieved through right femoral vein in supine position, and the patient was then turned to right lateral decubitus position, and left posterolateral thoracotomy was performed. Pericardium was dissected. A wide portion of pericardium was resected. The removed pericardium tissue was treated with 2% glutaraldehyde solution to use as an autologous graft. After cannulation of

ascending aorta, cardiopulmonary bypass was initiated. Left main pulmonary artery was closed and dissected intrapericardially using autosuture TA 30 (Covidien Ltd., Mansfield, MA, USA). Patient's body temperature was dropped to 32°C. Ascending aorta was cross-clamped. Cardiac arrest was maintained by antegrade cold blood cardioplegia. The left atrium wall which was invaded by the tumor was resected with having the left superior and inferior pulmonary vein inlets inside the resection margin. A sump was readied for each right pulmonary vein inlet for vein drainage. Main bronchus was stapled and cut. Left pneumonectomy was completed. Atrial defect was repaired with a 6×4 cm ellipsoid autologous pericardial patch using 3/0 polypropylene (Figure 2). The patient was heated again. Cross-clamp was removed. Heart beat spontaneously. The patient was decannulated after heparin neutralization with protamine infusion. After decannulation of the vessels, a radical ipsilateral mediastinal lymph node dissection was also performed. Three units of



**Figure 2.** (a) Perioperative view after pericardial reconstruction of left atrium: atrial defect was repaired with a 6×4 cm ellipsoid autologous pericardial patch. (b) Tumor specimen macroscopic image.



**Figure 3.** (a) Control thorax computed tomography examination in early postoperative period. (b) Control thorax computed tomography examination at 43<sup>rd</sup> postoperative month.

erythrocyte suspension and two units of fresh frozen plasma were infused during the operation.

In the postoperative sixth day, the patient was discharged from the hospital. The pathological specimen was reported as a 9×8×6 cm sized tumor located on 4×2.5 cm sized atrium wall, corresponding to a stage IIIA (T<sub>4</sub>N<sub>1</sub>M<sub>0</sub>) squamous cell carcinoma. The internal surface of the atrium and the surgical borders were intact (Figure 2). Adjuvant chemotherapy was administered and the patient is still alive after 10 years without evidence of recurrent disease (Figure 3).

## DISCUSSION

Because T<sub>4</sub> lung cancers are generally unresectable, nonsurgical therapy is the primary choice of treatment. However, some locally advanced NSCLCs such as tumors with left atrium invasions may be resectable in selected cases.

Although five-year survival rate in locally advanced high-grade lung cancers is approximately 7%, some higher rates have been reported in selected T<sub>4</sub> cases (30% by Martini, 23-40% by Tsuchiya and Fukuse), depending on the resection's completeness.<sup>[2,3]</sup> In incompletely resected T<sub>4</sub> cases, the five-year survival rate was only 14%.

In surgically treated T<sub>4</sub> NSCLC patients with left atrial extension, the operation can be performed without the need of cardiopulmonary bypass using atrial clamp technique.<sup>[4,5]</sup> Additional risk factors for this technique are tumor embolization with atrial clamp technique,<sup>[1,2]</sup> bleeding and incomplete resection risk due to clamp dislocation.<sup>[5]</sup>

However, some of the patients having extensive left atrial infiltration or tumor extension into the left atrial

lumen require CPB to achieve complete resection.<sup>[4]</sup> Dartevelle *et al.*<sup>[6]</sup> stated that CPB is mandatory for a safe procedure in resection of tumors invading the left atrium to avoid any tumor embolism and to have tumor-free resection margins.

Only a few T<sub>4</sub> cases were operated with CPB (0.1% of all thoracic resections).<sup>[3]</sup> Langer *et al.*<sup>[4]</sup> used CPB in only 20 of their 375 patients. Similarly, Dartevelle *et al.*<sup>[6]</sup> also used CPB in 13 of their 388 cases in 30 years of T<sub>4</sub> resection experience. In our case, complete resection would not be possible without CPB, because of the reconstruction requirement due to large atrium wall defect.

In their study, Langer *et al.*,<sup>[4]</sup> stated that they applied neoadjuvant therapy to a minority of their patient group. Our preference was not to apply neoadjuvant therapy because of the probable increase in any further morbidity and mortality risk.

Operative approach can be midsternotomy, clamshell or other thoracotomy incisions.<sup>[4]</sup> Although aorta is the best choice, femoral artery can be suitable for arterial cannulation in some patients.<sup>[5]</sup> Mostly right atrium, caval veins, pulmonary artery and femoral veins are used for venous catheterization.<sup>[1,4,5]</sup> In our case, we preferred left posterolateral thoracotomy, ascending aorta for arterial cannulation, and right femoral vein for venous cannulation in preparation of CPB. Left posterolateral thoracotomy provided an excellent exposure, while venous catheterization through the pulmonary artery would be a better choice.

It is well-known that duration of CPB affects mortality and morbidity negatively. The average CPB durations were reported as 87-140 minutes. In our case, CPB and cross-clamp durations were 64 and

47 minutes, respectively, and no major complications were observed.

The mortality rate of extended pneumonectomies for T<sub>4</sub> lung cancer (5%-18%) is higher than standard pneumonectomy (5.4%). The mortality rate of resections in which CPB was used in various series is between 7% and 15%.<sup>[3,6]</sup>

Although there are synthetic grafts and bovine pericardium as other alternatives for atrium wall reconstruction, we used autologous pericardial patch in our case. Synthetic materials were not preferred because of the infection risk which can occur in the pneumonectomy pouch. In our case, the patient's autologous pericardial patch fitted exactly with the atrial wall defect, and no leakage was observed from the sutured area.

In conclusion, despite the high probability of postoperative complications, surgeons having suitable facilities should not hesitate to perform an extended lung and cardiac resection with cardiopulmonary bypass if complete resection is possible in patients with locally advanced non-small cell lung cancer.

#### **Declaration of conflicting interests**

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