

## SURGICAL APPROACH IN T4N0M0 (VERTEBRAL INVOLVEMENT) LUNG CANCER

### OMURGA TUTULUMU OLAN T4N0M0 AKCIĞER KANSERLERİNE CERRAHİ YAKLAŞIM

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#### **SUMMARY:**

Approximately five percent of the lung cancers involve the chest wall and spine by direct extension and remain localized at the time of diagnosis. T4 lesions invading the vertebra are considered inoperable. We reviewed a new evolution in the surgical treatment of lung cancer involving the vertebra (T4N0M0) and reported preliminary results of our approach.

Four patients with T4N0M0 (vertebral involvement) lung cancer underwent en bloc surgical resection of tumor at the Uludag University Faculty of Medicine between 1998 and 2002. Posterior stabilization, hemilaminectomy and osteotomy of the involved vertebral bodies below the corresponding pedicle were performed in the prone position and then in lateral position en bloc resection

were completed along with the lung resection (large wedge resection or lobectomy) and involved vertebral bodies.

Three of the patients died during the follow-up period at 6<sup>th</sup>, 8<sup>th</sup> and 14<sup>th</sup> postoperative months, respectively. The fourth patient is still in follow-up of 20 months.

Although T4N0M0 (vertebral involvement) lung cancers are considered inoperable, lung resection with hemivertebrectomy of the involved vertebra after neoadjuvant chemotherapy and radiotherapy is an alternative treatment in this type of lung cancers.

**Key words:** Lung cancer, vertebral involvement, vertebral osteotomy, hemivertebrectomy, pulmonary resection.

**Level of Evidence:** Case reports, Level IV

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**ÖZET:**

Akciğer kanserlerinin yaklaşık yüzde beşi direkt genişlemeyle göğüs duvarı ve omurgayı tutar ve tanı sırasında lokalize olarak devam eder. Omurgaya invaze olan T4 lezyonların inopere olduğu düşünülür. Omurgayı tutan (T4N0M0) akciğer kanserlerinin cerrahi tedavisinde yeni bir gelişmeyi özetleyerek bu yaklaşımın ilk sonuçlarını aktardık.

Uludağ Üniversitesi Tıp Fakültesi'nde 1998 ve 2002 yılları arasında T4N0M0 (omurga tutulum)'lu akciğer kanseri olan dört hastaya en blok cerrahi rezeksiyon yapıldı. Pron pozisyonda tutulan omurga cisimlerine ilgili pedikülün altından posterior stabilizasyon, hemilaminektomi ve osteotomi yapıldıktan sonra lateral pozisyonda akciğer rezeksiyonu (geniş

kama rezeksiyonu veya lobektomi) ve tutulan omurga cismi ile en blok rezeksiyon tamamlandı. Dört hastanın üçü ameliyat sonrası takip döneminde sırasıyla 6., 8. ve 14. aylarda öldü. Dördüncü hasta 20. ayda halen takiptedir.

Her ne kadar omurga tutulumu olan (T4N0M0) akciğer kanserlerinin inopere olduğu düşünülse de, neoadjuvan kemoterapi ve radyoterapi sonrası tutulan omurgaya hemivertebrektomi ile birlikte akciğer rezeksiyonu uygulaması bu tip akciğer kanserleri için alternatif bir tedavidir.

**Anahtar Kelimeler:** Akciğer kanseri, omurga tutulumu, vertebra osteotomisi, hemivertebrektomi, akciğer rezeksiyonu.

**Kanıt Düzeyi:** Olgu sunumu, Düzey IV

**INTRODUCTION:**

Approximately five percent of the lung cancers involve the chest wall and spine by direct extension and remain localized at the time of diagnosis. T4 lesions invading the vertebra are considered inoperable. Although there have been isolated reports of cures of these tumors by surgical resection combined with external radiation [5,6] or by the use of interstitial implants [4], the median survival remained less than a year with this approach [8]. Although a significant proportion of patients benefit from therapy, with 25 to 33 % being cured of localized tumors, more than half the patients fail locally with recurrent disease [2,9,13-15]. In such patients, unrelieved pain and ultimate cord compression remains a major cause of morbidity.

However, there are different opinions among surgeons with regard to optimizing locoregional control, which will influence curability and palliation. Although preoperative radiotherapy plus surgical resection has been the standard approach, various authors have promoted the use of "sandwich" (preoperative and postoperative) radiotherapy, postoperative radiotherapy alone or intraoperative brachytherapy combined with surgical resection to achieve better locoregional control and ultimately improve survival [7,12,16].

Before 1950, this tumor was uniformly fatal [10]; however, with earlier clinical diagnosis, recent

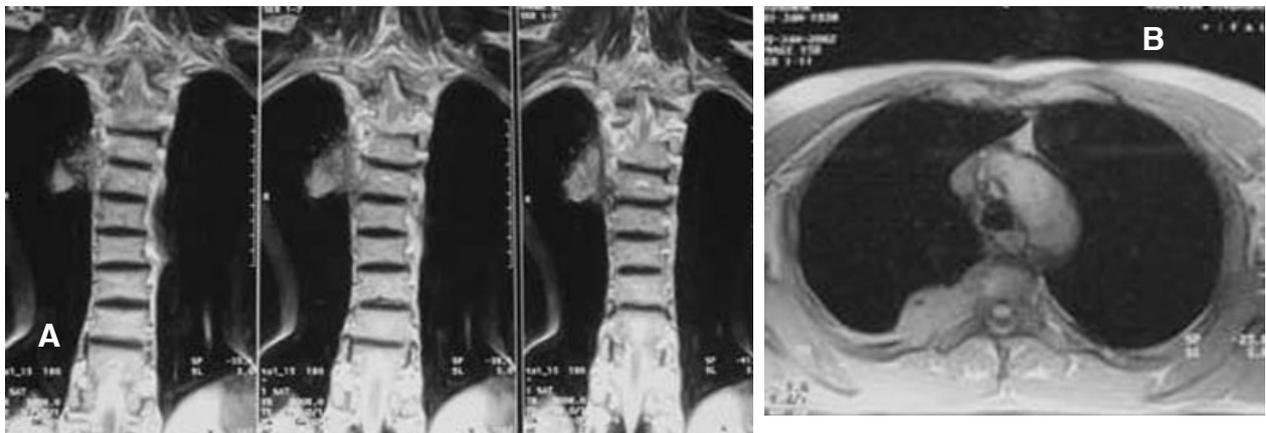
advances in imaging of the chest, and more aggressive surgical and combined modalities of therapy, the prognosis of this tumor has significantly improved.

We reviewed a new evolution in the surgical treatment of lung cancer involving the vertebra (T4N0M0) and reported preliminary results of our approach.

**MATERIALS AND METHODS:**

Four patients with T4N0M0 (vertebral involvement) lung cancer underwent en bloc surgical resection of tumor at the Uludag University Faculty of Medicine between 1998 and 2002. All patients were male with a mean age of 57 years (range; 46 to 66).

Preoperative staging was performed using chest roentgenogram, computed tomography, magnetic resonance imaging, and bronchoscopy where indicated (Figure-1). The distribution of the extent of the disease was assessed according to the TNM classification of the American Joint Committee on Cancer [1]. In this context, T4 is a tumor of any size that invades any part of the mediastinum, great vessels, or vertebral body. N0 refers to absence of involvement of regional lymph nodes and M0 represents the absence of distant metastases.



**Figure 1.** Preoperative coronal (A) and axial (B) MRI images of the fourth patient who has lung cancer with thoracic 4-5 involvement.

We strive to obtain a preoperative histological diagnosis in all patients using sputum cytology, bronchoscopy, or percutaneous transthoracic needle biopsy.

Posterior stabilization, hemilaminectomy and osteotomy of the involved vertebral bodies below the corresponding pedicle were performed in the prone position and then in lateral position en bloc resection were completed along with the lung resection (large wedge resection or lobectomy) and involved vertebral bodies (Figure-2). All patients had frozen sections performed intraoperatively, to determine freedom of the resected margins from residual tumor. In addition, dissection of the mediastinal lymph nodes has been performed routinely during lung resections.

Neoadjuvant chemotherapy in two patients whereas combin=d radiotherapy and chemotherapy in the other two patients were applied prior to surgery. Involved vertebral levels were T 1-2, T 3-4, T 3-6 and T 4-5 for each patient respectively. All patients completed the postoperative radiotherapy and chemotherapy regimes 6 weeks after the surgery.

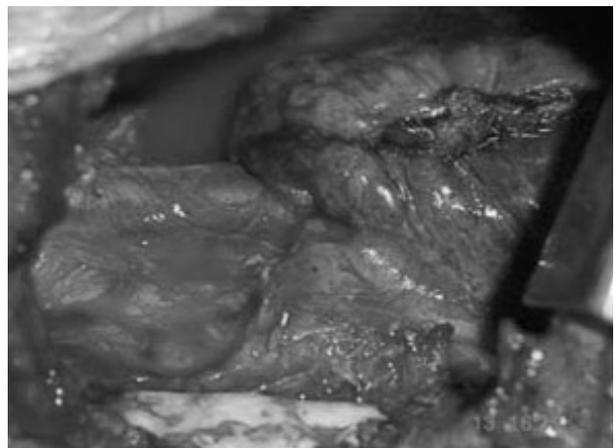
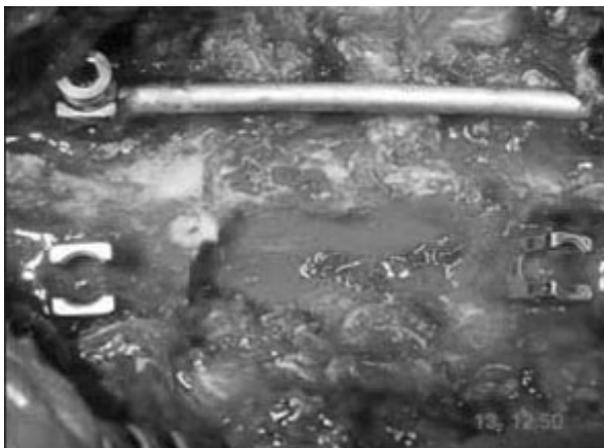
Patients were then seen every 1 to 2 months in our follow-up examinations and they were evaluated in terms of recurrence.

### RESULTS:

The distribution of the predominant cell types of the tumors was as follows: 3 adenocarcinoma and 1 squamous cell carcinoma.

Pulmonary wedge resection was performed in 3 patients and lobectomy in 1 patient. There were no major complications such as respiratory insufficiency or great vessel injury in any patient. However, 2 patients had recurrence of pain during follow-up. Pain control was achieved with epidural narcotics administration and with parenteral morphine derivatives.

Three of the patients died during the follow-up period at 6<sup>th</sup>, 8<sup>th</sup> and 14<sup>th</sup> postoperative months respectively. The fourth patient suffered implant failure due to loosening in the postoperative 8th month, implant removal was performed as the fusion was complete and deep wound infection was detected during surgery. Necessary debridement and intravenous antibiotics were used and infection was resolved



**Figure 2.** Posterior stabilization, hemilaminectomy and osteotomy of the involved vertebral bodies below the corresponding pedicle were performed in the prone position (A) and then in lateral position en bloc resection were completed along with the lung resection (large wedge resection or lobectomy) and involved vertebral bodies (B).

completely 4 weeks postoperatively. The patient is still in follow-up of 20 months.

The cause of death was metastatic spread of the disease in one patient and local recurrence and related respiratory insufficiency in two patients.

#### **DISCUSSION:**

Superior sulcus tumor refers to a primary cancer that occurs in the apex of the lung and that frequently invades the upper 2 or 3 ribs, the vertebral bodies, and the lower part of the brachial plexus, the subclavian vessels, and the stellate ganglion. It is characterized clinically by pain around the shoulder and down the arm, Horner syndrome, and atrophy of the muscles of the hand, and presents as roentgenographic evidence of a small homogenous shadow of the extreme apex, with local rib destruction and often vertebral infiltration.

The management of superior sulcus tumor has evolved over the past 50 years<sup>[3]</sup>. Despite the early misgivings suggesting that superior sulcus tumors invading the spine were incurable, a combination of preoperative radiotherapy and en bloc resection of the tumor with involved vertebra has been shown to provide patients the possibility of being completely cured of their tumor. It is thought that preoperative radiotherapy increases resectability<sup>[7]</sup>. The addition of intraoperative brachytherapy or postoperative external radiation should augment locoregional control and possibly improve 5-year survival<sup>[7]</sup>.

Although there have been isolated reports of cures of these tumors by surgical resection combined with external radiation or by the use of interstitial implants, 5-year survival rates from different reports are approximately %20<sup>[2,6,8,11]</sup>.

Combined radiosurgical treatment offers a valuable therapeutic option in the management of patients with lung cancer invading vertebral body. Survival rates after radical operation are satisfactory. It may be difficult to establish preoperatively whether the operation will be radical. Most of the authors agree to operate on these patients because, even if a poor outcome may be anticipated in case of residual tumor, most patients have an improvement in the pain after the intervention, with a considerable impact on their quality of life.

Factors that had been found to be associated with a poorer prognosis were reported as positive margins and N2 disease and vertebral body involvement<sup>[2]</sup>. In another report<sup>[3]</sup>, the poor prognosis was associated with the extent of the disease, especially with nodal involvement (N2 and N3) and Horner syndrome. Involvement of the ribs and vertebrae could not be demonstrated to indicate a poor prognosis by the univariate and multivariate regression analyses<sup>[2,3]</sup>.

Despite the relative improvement in survival of patients with T4N0M0 lung cancer treated with combined preoperative radiation and operation, there is still high incidence of local recurrence, between 25% and 70%<sup>10,15</sup>. Ginsberg et al.<sup>[7]</sup> studied 69 patients with complete resections and with negative margins after preoperative irradiation; the first sign of recurrence was locoregional in two thirds of the cases. In addition, there was a high incidence of metastases to the brain (40-80%) and to bone. Concurrent chemotherapy and irradiation seek to improve the irradiation sensitivity effect of chemotherapy. This combined chemoradiation seems to improve local control rates.

The multimodality combination of preresectional chemoradiation therapy offers several advantages. The preresectional delivery

of a chemotherapeutic agent is not adversely affected by the alteration in regional blood flow that accompanies surgical scar or radiation therapy. If effective, the therapy will improve respectability, will down stage the original extent of the disease, and decrease the risk of tumor dissemination during surgical resection. It will also act as a radiosensitizing agent, enhancing local control, as well as, control of systemic disease by treating micrometastases<sup>[3]</sup>.

Although T4N0M0 (vertebral involvement) lung cancers are considered inoperable, lung resection with hemivertebrectomy of the involved vertebra after neoadjuvant chemotherapy and radiotherapy is an alternative treatment in this type of lung cancers.

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