



UNILATERAL APPROACH FOR HEMIVERTEBRECTOMY IN TREATMENT OF LUNG CANCER WITH VERTEBRA INVASION

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Received: 6th April, 2017.
Accepted: 2nd July, 2017.

ABSTRACT

Purpose: The aim of the study is to show the results of hemivertebrectomy with only unilateral approach in treatment of lung cancer with vertebra invasion

Material and Method: Ten patients with an average age of 59 (49-65) years with lung cancer with thoracal vertebra invasion were operated between 2008 and 2015. Biopsy was performed in all patients for diagnosis. The diagnosis of the patients was, non-small cell carcinoma in seven patients, squamous cell carcinoma in two patients and adenocarcinoma in one patient. Chemotherapy and 60 GyRT radiotherapy were given before surgery. Unilateral thoracal spine exposure was used for vertebra resection after limited laminectomy and root sacrifice.

Results: In patients who undergone vertebral resection, the resected segments were between T2 and T5. Mean resected vertebrae count was 3 (2-4) and mean corpus resection extent was 40.5% (30-69). Mean follow-up duration of the patient was 24 months (8-84). 1 year survival rates of the patients included were 70%, while 5-year survival rates were 10 %.

Conclusion: In treatment of lung cancer with spine invasion, it is possible to achieve clear surgical margins. Due to lack of the enough strength to prevent deformity from unharmed anatomic structure, strong instrumentations are necessary.

Keywords: Lung Cancer; Hemivertebrectomy; Enbloc resection

Level of Evidence: Retrospective clinical study, Level III

INTRODUCTION

In tumor surgery, achieving a wide resection with clear margins is the main goal. In NSCLC treatment, an intra-lesion or incomplete tumor resection is associated with a poor prognosis⁽⁴⁾. While spine involvement in NSCLC patients with was considered a poor prognostic factor and a contraindication to surgery, surgical treatment is now possible with combined surgical procedures involving vertebral resections^(3,5-6,8-9,11-12). A review by Collaud et al. reported 3, 5, 10 year survival rates of 57 %, 43 %, and 27 %, when vertebral resection was included in the procedure⁽¹⁾. The osteotomy can be partial, semi or total, depending on the extent of the invasion in the vertebrae^(3,6,12). Although bilateral instrumentation is often advised for stabilization after vertebrectomy, there are

also studies against it^(3,9-10). In this study, we aim to present our cases of NSCLC with vertebral invasion, who were treated with partial vertebrectomy without rigid fixation using a unilateral posterior spine approach.

PATIENTS AND METHOD

We reviewed 10 patients undergoing concomitant lung and vertebral resection for NSCLC tumor between 2008 and 2015. Patients with no distant metastasis, pathological mediastinal lymph node involvement and spine involvement were not included. Pre-op evaluations of the patients consisted of routine Thorax X-rays, Thin-slice CT and thorax and spinal MRI with IV contrast in order to determine the extent of the spine invasion (Figure-1).



Figure-1. The MRG evaluation of the patient with lung cancer invading spine. Coronal (a) and axial (b) T2 weighted MRG showed vertebral invasion of the upper thoracic mass.

PET-CT scans were performed to assess the distant metastases. Patient with medullary invasion or more than 20 % invasion in the vertebral corpus in their MRI scans and patients who have had more than 4 vertebral resections were excluded.

All patients who were included received chemotherapy and radiotherapy prior to surgery. Surgical planning was done after 60 Gy of radiotherapy. All patients were operated in a standard manner by the same spinal and thoracic surgery teams. Prior to the operation patients had lymph node biopsy under mediastinoscopy done and surgery was performed if the invasion status was negative. As the first step in the operation spinal surgeons performed a longitudinal incision 2 cm lateral to the midline from C7-T6 with the patient in the prone position and the paravertebral muscles were separated from the posterior bony structures subperiostally with cautery. After fluoroscopic check, laminectomy was performed just lateral to the spinous processes with a high-speed Burr. Laminectomy area was expanded using

a Kerrison Ronger to reach the roots. The roots were cut after ligation with 3/0 suture.

After the roots were cut medulla spinalis were retracted medially and oblique osteotomies in the axial plane were performed. Osteotomy was advanced to just before the anterior cortex without a complete osteotomy trying to mimic a green-stick fracture. After the osteotomy the newly achieved movement in the osteotomy line was tested with 2 wide osteotomies and the posterior approach was concluded after bleeding control.



Figure-2. Postoperative CT showed amount of resection. Green circle show vertebra enlargement and red arrow show the oblique osteotomy line.

During the posterior approach the contralateral paravertebral muscles and the spinous process were left intact including the associated subcutaneous tissues to protect the stability. In the second stage of the surgery the thoracic surgery team performed thoracotomy on the patients in lateral decubitus position continuing the existing posterior incision and performed lung superior pole resection including the costae.

RESULTS

Average age of the patients included in the study was 59 (49-65) and all patients were male. The diagnosis of the patients was non-small cell carcinoma in seven patients, squamous cell carcinoma in two patients and adenocarcinoma in one patient.

In patients who undergone vertebral resection, the resected segments were between T2 and T5. Mean resected vertebrae count was 3 (2-4) and mean corpus resection extent was 40.5 % (30-69) (Figure-2).

In all patients' lamina and facet, joints of the contralateral side were preserved including spinous processes.

Mean follow-up duration of the patient was 24 months (8 - 84) 1 year survival rates of the patients included were 70 %, while 5-year survival rates were 10 %. Histopathological investigation showed clear surgical margins and none of the patients had local recurrence however two of 10 patients had distant metastasis (Table-1).

One-year survival rates of the patients included were 70 %, while 5-year survival rates were 10 %.

During the follow-up revision, surgery due to instability was not needed for any patient. 2 patients developed compression fractures due to osteoporosis during follow-up. The patient with a 70% compression fracture in the anterior column of T5 developed kyphosis in the upper thoracic vertebra (Figure-3).

Other patient had compression fracture of T4 involving 50% of anterior column however it did not cause any instability. In the follow-up of patients who had undergone unilateral approach, thoracic curves with an average Cobb angle of 11° (6°-16°).

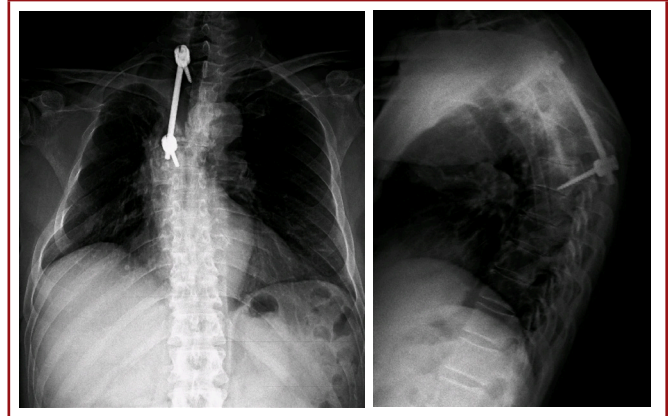


Figure-3. N.B., 61 years old man with lung cancer. The postoperative CT showed T5 compression fracture that have more resected and osteoporotic vertebra corpus. There is no neurological problem or pain related the kyphosis.

Table-1. The distribution of the patients.

| Patients | Gender | Diagnosis | Age | Radiotherapy | Resection Level | Resection Segment | Resection Ratio | Complication | Follow-up | Scoliotic curve |
|----------|--------|-----------|-----|--------------|-----------------|-------------------|-----------------|--------------------------------|-----------|-----------------|
| AA | Male | N-SCC | 65 | 60 GyRT | T2-T5 | 4 | 40,00 % | None | 10 | 10 |
| EE | Male | N-SCC | 49 | 60 GyRT | T3-T6 | 4 | 36,00 % | Drainage | 84 | 13 |
| MH | Male | N-SCC | 61 | 60 GyRT | T2-T3 | 2 | 50,00 % | None | 14 | 8 |
| VP | Male | SCC | 61 | 60 GyRT | T2-T3 | 2 | 33,00 % | None | 18 | 12 |
| NB | Male | N-SCC | 61 | 60 GyRT | T3-T5 | 3 | 42,00 % | Drainage/T5 fx (anterior 70 %) | 16 | 6 |
| CŞ | Male | N-SCC | 58 | 60 GyRT | T2-T4 | 3 | 30,00 % | None | 12 | 16 |
| ÖH | Male | SCC | 68 | 60 GyRT | T2-T4 | 3 | 32,00 % | None | 8 | 10 |
| EG | Male | N-SCC | 57 | 60 GyRT | T2-T4 | 3 | 49,00 % | None | 57 | 11 |
| MB | Male | N-SCC | 60 | 60 GyRT | T2-T4 | 3 | 36,00 % | None/T4 fx (anterior 50 %) | 14 | 15 |
| İÖ | Male | Adenoca | 53 | 60 GyRT | T2-T4 | 3 | 34,00 % | Drainage | 13 | 7 |

DISCUSSION

While vertebral invasion was considered a poor prognostic factor in NSCLC patients, with combined surgical treatments 3 year survival rates were reported around 57 %^(1-6,8-9,11-12). According to Grunnenwald et al, with new advances in chemotherapy, distant metastasis can now be taken under control and surgical treatment can lead to better results than radiotherapy⁽⁷⁾. The

main parameter determining the success of the surgery is achieving a tumor-free margin. In a study, Collaud et al have reported 5-year survival rates of 80 % in cases treated with wide resection, whereas 35 % in cases treated without wide resection⁽¹⁾.

Surgical resections are routinely performed as 3 (57 %) or 4 (23 %) levels in the upper thoracic region. Vertebral resections are 70 % of the time just posterior approach and hemivertebrectomy

following laminectomy, while they can also be partial without a laminectomy⁽²⁾. In our study, the average number of vertebral segments upon which hemivertebrectomy was performed was found to be 3.2. While the immediate mortality rate of these operations are reported between 17 and 40 %, in our study the mortality rate was found to be 0 %. In our study, three of 10 patients had prolonged wound drainage and collections and therefore required prolonged hospital stay. This was similar to the case series with 2-phase surgeries.

After en bloc surgical resection, all patients were found to have tumor free margins under histopathological evaluation.

While different surgical treatments are reported, surgical approaches are also different. Yokomise et al have reported achieving wide resection using a single incision (posterolateral thoracotomy) and position⁽¹²⁾. They did not suggest an adjunct procedure involving the spine; however, Mazel and Grunenwald suggested 2-phased surgical approach. During the posterior approach they suggest bilateral mobilization of the paravertebral muscles and posterior instrumentation^(6,9). Fadel et al similarly recommend performing vertebral stabilization after partial vertebral resection⁽³⁾. In the literature, it has been reported in series by Grunenwald and Fadel that following spinal instrumentation mechanical failure can develop^(2-3,6-7,9-10). Yokomise et al on the other hand did not report spinal instability development even though spinal instrumentation was not performed⁽¹²⁾.

In our study, partial vertebrectomies were performed using a unilateral paravertebral approach. Because the contralateral paravertebral region and spinous processes are unharmed, posterior ligamentous complex and some anterior longitudinal ligament are preserved. Initially we believe that because these structures are intact, osteotomy is stable in itself. However, the results of our patients showed that, this type of surgery also unharmed posterior structure have not enough stability to prevent kyphosis due to compression fracture at the weakest vertebrae and deformity. Hence the posterior structure not have enough strength to prevent further deformity, the strong posterior instrumentation are needed after this kind of surgery

Hemivertebrectomy in cases of lung cancers with vertebral invasions using a posterior unilateral approach achieves a clear surgical margin. Due to lack of the enough strength to prevent deformity from unharmed anatomic structure, strong instrumentations are necessary.

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