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Total vertebrectomy (Th2) and dissection of the subclavian artery for a superior sulcus tumor invading the spine: A case report



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ABSTRACT

INTRODUCTION: Surgery for primary lung cancer invading the spine remains challenging. Here, we present a case of superior sulcus tumor (SST) with vertebral invasion, successfully resected with total vertebrectomy (Th2) and dissection of involved apical chest wall and the subclavian artery (SCA).

PRESENTATION OF CASE: A 62-year-old man was referred with the diagnosis of lung squamous cell carcinoma originating from left upper lobe (clinical stage IIIA/T4N0M0) involving the thoracic vertebrae (Th2) as well as the apical chest wall including three ribs (1st, 2nd and 3rd) and SCA. After induction concurrent chemo-radiotherapy, we achieved complete resection by three-step surgical procedures as follows: first, the anterior portion of involved chest wall including SCA was dissected through the trans-manubrial approach (TMA); next, the posterior portion of involved chest wall including ribs was dissected and left upper lobectomy with nodal dissection was performed through posterolateral thoracotomy; finally, total vertebrectomy (Th2) was performed through posterior mid-line approach.

DISCUSSION: This tumor was existence of anterior and posterior position in pulmonary apex region. So that, it is very important for complete resecting this complicated tumor to work out operation's strategy.

CONCLUSION: Surgery may be indicated for SST invading the spine, when complete resection is expected.

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1. Introduction

The treatment of patients with non-small cell lung cancer (NSCLC) with vertebral body invasion remains challenging and must be performed in highly selected patients in high-volume institutions [1]. Resection of advanced NSCLC in stage IIIA-T4 has been associated with high morbidity and mortality combined with disappointing long-term outcomes. Thus, the risk of surgical resection was not justified by the outcome for many years [2]. Therefore, patients with NSCLC invading the spine have been historically considered to have unresectable disease [3].

Abbreviations: CT, computed tomography; SST, superior sulcus tumor; SCA, subclavian artery; TMA, trans-manubrial approach; NSCLC, non-small cell lung cancer; CDDP, cisplatin.

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However, recent advances in surgical techniques as well as in perioperative care may improve the outcomes of lung cancer surgery with vertebrectomy. Therefore, select patients with a good prognosis may be treated surgery [1].

In our institution, we previously experienced one case that underwent total vertebrectomy (Th3) for lung cancer invading the spine and achieved a good prognosis [6]. According to this experience, we encouraged surgeons in our institution to consider vertebrectomy for patients with lung cancer.

In this study, we report a case that underwent total vertebrectomy of the second thoracic vertebra (Th2) and dissection of the subclavian artery for lung cancer invading the spine and subclavian artery.

1. Case presentation

A 62-year-old man was found to have squamous cell carcinoma of the antero-posterior apex of the left lung with invasion to the body of the second thoracic vertebra (Th2), adjacent rib (ribs 1–3) and subclavian artery, as shown by computed tomography (Fig. 1).

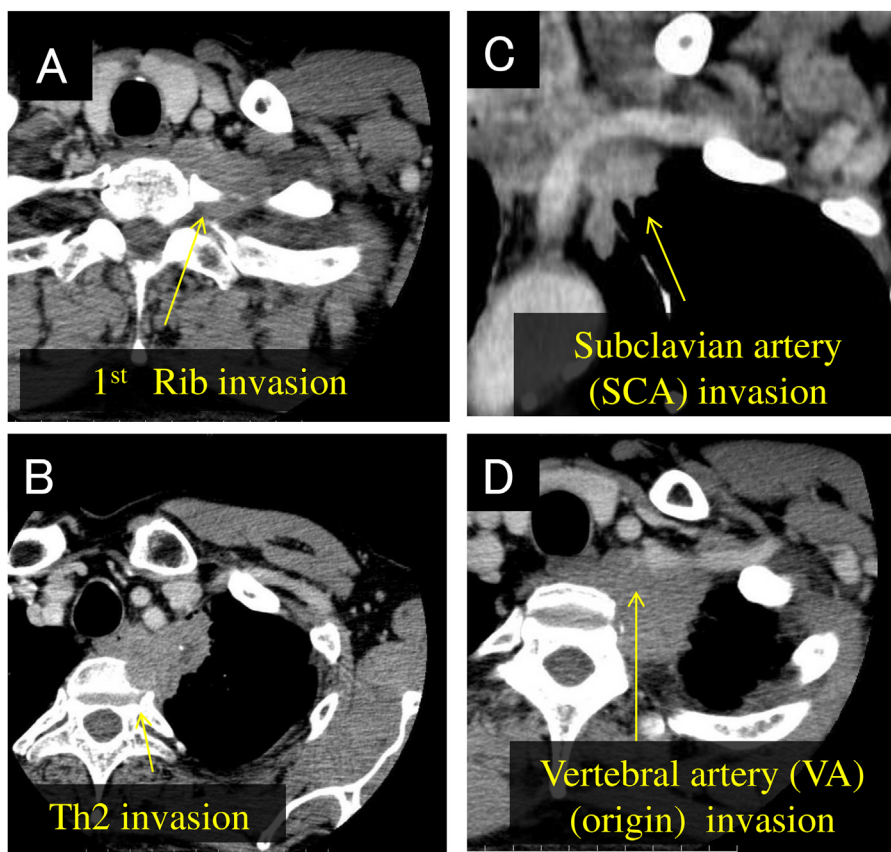


Fig. 1. Computed tomography of the chest showing the localization of this tumor. (A and B) This tumor was 1st Rib and Th2 invasion. (C and D) This tumor was subclavian artery (SCA) and vertebral artery (VA) invasion.

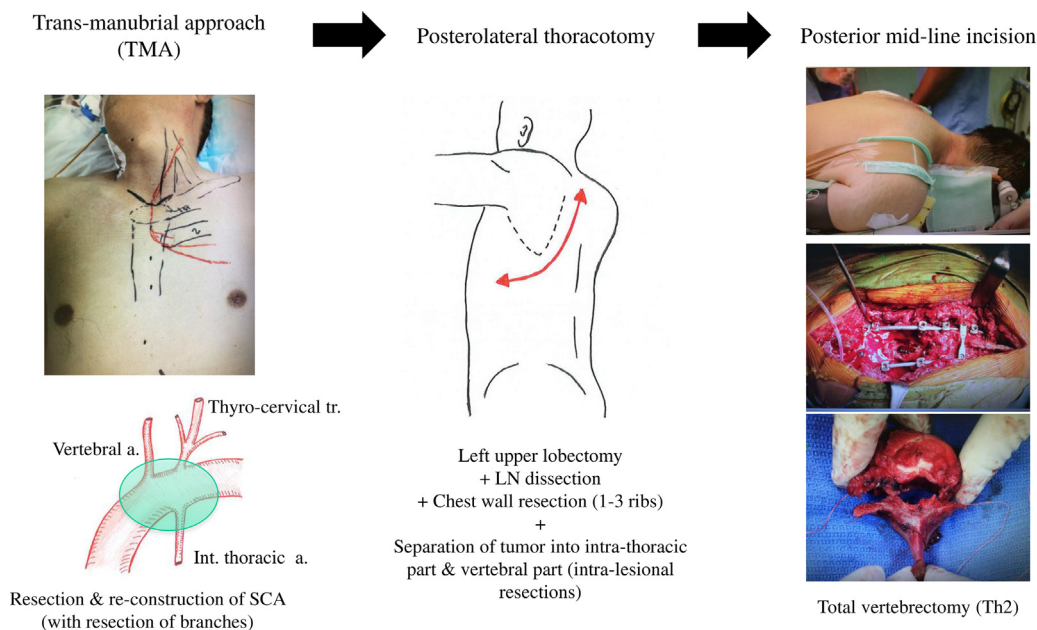


Fig. 2. This figure shows strategy of this surgery.

We performed TBLB and made the diagnosis of squamous cell carcinoma of the lung. Pretreatment TNM staging was stage-IIIa(c-T4N0M0). Induction chemotherapy with cisplatin (CDDP) and TS-1 and radiotherapy (total 50 Gy) obtained a slight decrease in the tumor size and incomplete pain relief. After restaging confirmed a persistent yc-T4N0M0 tumor, complete resection was planned.

The surgical procedure included four steps. The diagram of the surgery is shown in Fig. 2.

First, the transmanubrial approach allowed us to obtain tumor-free margins of the anterior cervical structures. The tumor surrounded the left subclavian artery. Therefore, we dissected the subclavian artery, which was reconstructed with an artificial artery

(Gore-Tex® expanded polytetrafluoroethylene graft, 8 mm in diameter), together with wedge resection in the left upper lobe. The left vertebral artery and left transverse cervical artery was also dissected. The anterior wound was temporary closed.

In the second step, classic posterolateral thoracotomy allowed us to obtain tumor-free margins in the section of the chest wall (ribs 1–3). The tumor was adherent to the esophagus. Thus, we dissected the adventitia of the esophagus and performed left upper lobectomy. We were unable to perform en bloc resection, therefore, intralesional resections were performed. Thoracotomy was temporary closed.

In the third step, a posterior midline incision was made with the patient in the prone position by a spine surgeon. Th2 total vertebrectomy (edicolotomy and en block laminectomy) was then performed. The intervertebral disks of superior and inferior to the involved vertebral body were resected. A titanium mesh case in conjunction with bone grafting and ventral osteosynthesis was subsequently performed after total vertebrectomy.

All vertebrectomies were performed by one orthopedic surgeon. A pathological examination confirmed complete margin-free resection of the lung cancer invading the chest wall and vertebral body.

Finally, we performed omentum resection to cover the thoracic cavity resected area and reconstructed the chest wall. The chest wall was reconstructed using a double layer of polypropylene mesh (Bard Mesh, C.R. Bard Inc., Karlsruhe, Germany) with the patient in the neutral lateral position after placement of a chest tube. The mesh was sutured to the ribs and thoracotomy was closed. The operative time was 33.3 h and intraoperative bleeding was 6640 ml.

Pathologically, complete resection was achieved. The pathological diagnosis was yp-T4N0M0 squamous cell carcinoma, and the histologic response for evaluating the tumor response to induction therapy was two (E2).

The patient was discharged from our hospital 87 days after surgery. The major postoperative complication was laryngeal recurrent nerve paralysis.

Unfortunately, the patient developed local recurrence 10 months after surgery. He underwent chemoradiation and has had no distant metastasis 12 months after surgery.

3. Discussion

This case report had next important points.

First, the existence of the tumor was unique. The tumor existed in the anterior and posterior position of the pulmonary apex region and invaded the subclavian artery and Th2 vertebra body. Thus, it was challenging to completely resect the invading tumor.

Second, the operative strategy was critical for complete resection of the tumor. Principally, en bloc resection of the tumor with the lung, chest wall and vertebrae would be ideal. However, in this case it was difficult to perform en bloc resection, therefore, we performed intralesional resections. We first conducted an anterior procedure due to the transmanubrial approach; then performed thoracotomy; and finally performed dorsal release due to the posterior midline incision. We selected this strategy after judging the resectability of the tumor. If we had initially performed a posterior procedure (total Th2 vertebrectomy), then we would not have been able to estimate invasion of the anterior tumor.

Third, a major postoperative complication occurred. The patient developed laryngeal recurrent nerve paralysis after surgery. Although the reason was unclear, we speculated that the long operative time in the prone position with a double lumen tube was related to this complication. Therefore, it may be necessary to select a single lumen tube when performing an operation with the patient in the prone position.

Local control, including surgical resection, is a significant prognostic factor in the therapy of superior sulcus tumors [4]. Incomplete resection and sublobar resections were associated with an inferior survival, and the author recommended that patients aged >70 years should be selected very carefully for radical resection for NSCLC invading the spine [2]. Taken together, complete resection including vertebrectomy for lung cancer invading the spine may be a useful procedure. However, the indications for this surgery are critical, e.g., N0 disease and patient age <70.

In the present study, the patient developed local recurrence. He had received preoperative induction chemoradiation therapy, therefore, this therapy may not be recommended for lung cancer patients with tumors invading the vertebra. The use and regimen of induction and/or adjuvant therapy remain unclear.

Additionally, the optimal operative strategy remains unknown, for instance the sequence of thoracotomy and vertebrectomy. A greater accumulation of cases may help to answer these questions.

4. Conclusion

A strategic surgical approach is important to achieve complete resection for “extensive” SST invading the spine. Surgery may be indicated for SST invading the spine, when complete resection is expected.

Conflict of interest statement

Soichi Oka and other co-authors have no conflict of interest.

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Ethical approval

We got ethical approval from ethical committee of University of Occupational and Environmental health, Japan.

Consent

We had informed consent from this patient for writing this paper.

Authors contribution

Soichi Oka: Study design, writing.
 Hiroki Matsumiya: Other.
 Syuichi Shinohara: Other.
 Taiji Kuwata: Other.
 Masaru Takenaka: Other.
 Yasuhiro Chikaishi: Other.
 Ayako Hirai: Other: Other.
 Naoko Imanishi: Other.
 Koji Kuroda: Other.
 Hidetaka Uramoto: Study design.
 Eiichiro Nakamura: Other.
 Fumihiko Tanaka: Study design.

Guarantor

Fumihiko Tanaka.

References

- [1] H. Yokomise, M. Gotoh, T. Okamoto, et al., En bloc partial vertebrectomy for lung cancer invading the spine after induction chemotherapy, *Eur. J. Cardio-Thoracic Surg.* 31 (2007) 788–790.
- [2] J. Schirren, T. Donges, M. Melzer, R. Schonmayr, M. Eberlein, S. Bolukbas, En bloc resection of non-small-cell lung cancer invading the spine, *Eur. J. Cardio-Thorac. Surg.* 40 (2011) 647–655.
- [3] T.R. DeMeester, M. Albertucci, P.J. Dawson, S.M. Montner, Management of tumor adherent to the vertebral column, *J. Thorac. Cardiovasc. Surg.* 97 (1989) 373.
- [4] R. Komaki, C.F. Mountain, J.M. Holbert, et al., Superior sulcus tumors: treatment selection and results for 85 patients without metastasis (M0) at presentation, *Int. J. Radiat. Oncol. Biol. Phys.* 19 (1990) 31–36.
- [6] T. Kuwata, H. Uramoto, H. Ohtomo, E. Nakamura, F. Tanaka, Total vertebrectomy for non-small cell lung cancer, *Case Rep. Oncol.* 5 (2012) 267–270.

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