



Prognostic Factors and Comparison of Conservative Treatment, Percutaneous Vertebroplasty, and Open Surgery in the Treatment of Spinal Metastases from Lung Cancer

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■ **BACKGROUND:** Spinal metastases from lung cancer could result in life-threatening consequences. Few studies report the prognostic factors and compare different treatments in patients with spinal metastases from lung cancer.

■ **METHODS:** From 2005 to 2014, we retrospectively reviewed and studied 140 patients with spinal metastases from lung cancer according to different treatments. To estimate overall survival and identify prognostic factors for survival, the Kaplan-Meier method and Cox regression analysis were adopted. In addition, the Kaplan-Meier method was used to compare different treatments for overall survival.

■ **RESULTS:** All patients in a conservative group and a percutaneous vertebroplasty group died at a median survival time of 7 months for both groups. As for patients in the open-surgery group, 42 patients died at a median of 11 months, and 7 patients who were still alive at the time of this study were followed for a median of 29 months. Multivariate analysis suggested that better survival was significantly associated with American Spinal Injury Association grade D/E on admission, American Spinal Injury Association grade E after surgery, Eastern Cooperative Oncology Group performance status 1–2, and adjuvant radiation therapy in all 3 groups. In addition, Kaplan-Meier analysis showed that the overall survival rate of the open-surgery group (14.3%) was better than that of conservative group (0%) and the percutaneous vertebroplasty group (0%).

■ **CONCLUSIONS:** A better overall survival outcome might be achieved by a series of comprehensive and individualized treatments and personalized treatment.

INTRODUCTION

According to the latest cancer statistics, lung cancer, followed by stomach, esophageal, and liver cancers, is the most common cancer in China.¹ It is reported that approximately 40% of patients with advanced lung cancer present with bone metastases, and the spine is the most involved site.² Metastatic spinal cord compression (MSCC) from lung cancer causes intractable pain, disability, and incontinence, which bring a negative quality of life in the terminal stage of the disease.³

Currently, multidisciplinary comprehensive therapy is indispensable during the treatment of metastatic spinal tumors, and providers of this therapy include surgeons, radiation oncologists, and medical oncologists. In recent years, the prognostic factors associated with survival in patients with MSCC have been comprehensively analyzed, and the outcomes of surgical management have been well described.^{4–7} However, most studies have not separated patients with spinal metastases from lung cancer in general nor have they conducted a comparison among conservative management, percutaneous vertebroplasty (PVP), and open surgery. Tang et al.⁸ performed a retrospective study of 116 patients with MSCC from lung cancer treated with surgery, but

Key words

- Conservative treatment
- Lung cancer
- Percutaneous vertebroplasty
- Prognostic factor
- Spinal metastases
- Surgery
- Survival analysis

Abbreviations and Acronyms

- ASIA:** American Spinal Injury Association
CI: Confidence interval
ECOG-PS: Eastern Cooperative Oncology Group performance status
HR: Hazard ratio
MSCC: Metastatic spinal cord compression

PVP: Percutaneous vertebroplasty

VAS: Visual analog scale

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Table 1. Demographic Characteristics of Patients in Different Groups

	Group A	Group B	Group C	F/ χ^2	P Value
Age (years)	62.21 ± 10.33	62.81 ± 12.85	58.06 ± 10.37	2.49	0.09
Gender: male/female	33/14	29/15	29/20	1.30	0.52
Smoking history: yes/no	16/31	11/33	12/37	1.34	0.51
Histologic type: squamous cell carcinoma/adenocarcinoma	27/20	24/20	24/25	0.71	0.70
ECOG-PS: 1 or 2/3 or 4	20/27	21/23	25/24	5.22	0.07
No. of vertebrae involved: single/multiple	30/17	23/21	33/16	3.64	0.16
Other bone involved: yes/no	20/27	20/24	10/39	4.52	0.10
ASIA grade on admission: D or E/A, B or C	20/27	21/23	29/20	5.19	0.08
SINS: ≤12/>12	28/19	32/12	33/16	5.63	0.06

ECOG-PS, Eastern Cooperative Oncology Group performance status; ASIA, American Spinal Injury Association; SINS, Spinal Instability Neoplastic Score.

there was no conservative control group. Lee et al.⁶ analyzed the survival outcomes of patients with spinal metastases according to surgery and conservative treatment, but spinal metastases from lung cancer was not set as a separate group in the study.

Consequently, in an attempt to provide some useful information about the different treatments of spinal metastases from lung cancer, we performed a retrospective study of 140 patients with spinal metastases from lung cancer treated with 3 different methods.

METHODS

One hundred and forty patients with spinal metastases from lung cancer who received treatment in our department from 2005 to 2014 were enrolled in our study. Inclusion criteria incorporated the following assessments: age ranging from 20 to 75 years; intractable pain with neurologic dysfunction; single segment involved, or 2 or 3 adjacent segments involved; imaging-proven and pathology-proven lung metastases (adenocarcinoma or squamous cell carcinoma); and Tomita scores of 7 or lower. The exclusion criteria were as follows: visceral metastases; surgery only for pathologic biopsy; poor general condition without tolerance of surgery; death within 1 month after surgery because of surgical complications; pathology proved other metastases; Tomita scores of 8 or higher.

We divided these cases into 3 groups by treatment modality: group A was composed of patients treated by conservative modality; group B was treated by PVP + adjuvant therapy; and group C was treated by open surgery (total en bloc spondylectomy or total piecemeal spondylectomy) + adjuvant therapy. Conservative treatment includes chemotherapy, target therapy, radiation therapy, and bisphosphonate treatment. Adjuvant therapy includes the aforementioned therapies. The surgical strategy was primarily based on the Tomita scoring system,⁹ with the final treatment chosen by the patients themselves in conjunction with their families based on their financial situation and the patient's tolerance for different treatments (Table 1).

All procedures performed in studies involving human participants were approved by the ethics committee of Xinqiao Hospital, Third Military Medical University, and complied with the Declaration of Helsinki. Patients' electronic medical records and imaging studies were reviewed and analyzed thoroughly. Imaging data included a chest radiograph, computed

Table 2. Results of Univariate Analysis of the Clinical Factors Affecting Prognosis (Group A)

Factor	No. of Patients	P Value
Age: ≤60 years/>60 years	18/29	<0.01
Gender: male/female	33/14	0.16
Smoking history: yes/no	16/31	0.42
Histologic type: squamous cell carcinoma/adenocarcinoma	27/20	0.23
ECOG-PS: 1 or 2/3 or 4	20/27	<0.01
No. of vertebrae involved: single/multiple	30/17	0.01
Other bone involved: yes/no	20/27	0.01
ASIA grade on admission: D or E/A, B or C	20/27	<0.01
Interval from cancer diagnosis to development of motor deficits: ≤15 days/>15 days	23/24	<0.01
SINS: ≤12/>12	28/19	0.06
Adjuvant chemotherapy: yes/no	15/32	<0.01
Adjuvant radiation therapy: yes/no	27/20	<0.01
Bisphosphonate treatment: yes/no	24/23	<0.01
Target therapy: yes/no	6/41	<0.01

ECOG-PS, Eastern Cooperative Oncology Group performance status; ASIA, American Spinal Injury Association; SINS, Spinal Instability Neoplastic Score.

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