

Vertebroplasty for the Treatment of Compression Fractures in the Upper and Middle Thoracic Spine

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= Abstract =

Background: Vertebroplasty that is performed in the upper and middle thoracic spine presents technical challenges that are different from those in the lower thoracic or lumbar region due to the small pedicle size and angular severity for thoracic kyphosis. We report the results of percutaneous vertebroplasty and review its effectiveness in treating intractable osteoporotic compression fractures in the upper and middle thoracic spine.

Methods: Patients who underwent vertebroplasty due to painful osteoporotic compression fractures at T3–T8 were retrospectively analyzed. The compression rate, volume of injected cement, clinical outcome (VAS score) and complications were analyzed.

Results: Forty-three vertebral bodies from 41 patients (32 females and 9 males, age from 64 to 78 years old) underwent vertebroplasty. The mean compression rate improved from 35% to 17%. Bipedicular injections of bone cement were performed at 3 levels of 2 patients, and unipedicular injections were performed in 40 levels of 39 patients. The mean VAS score prior to surgery was 7.7, which improved to 2.4 within 48 hours after surgery, and the mean VAS score after 6 months was 1.5, which was significantly lower. All patients recovered uneventfully, and the neurological examination revealed no deficits. Cement leakage to the adjacent disc (9 levels) and paravertebral soft tissues (10 levels) developed. However, there were no significant complications related to the procedure such as a pneumothorax or pulmonary embolism.

Conclusions: Transpedicular vertebroplasty is a safe and effective treatment for the upper and middle thoracic regions, and has a low complication rate. (Korean J Pain 2005; 18: 142–145)

Key Words: osteoporotic compression fracture, thoracic region, vertebroplasty.

INTRODUCTION

Percutaneous vertebroplasty has become an established technique for the treatment of painful osteoporotic compression fractures.¹⁻⁶⁾ The perceived technical difficulty of upper and middle thoracic vertebroplasty as compared with thoracolumbar or lumbar junction vertebroplasty may relate to the relatively small size of pedicles in the thoracic region, the severe angle of approach secondary to thoracic kyphosis and risk for pneumothorax. We herein report our experience with percutaneous vertebroplasty to review the effectiveness for the treatment of

painful osteoporotic compression fractures in the middle and upper thoracic spine.

MATERIALS AND METHODS

Among the patients who underwent the vertebroplasty between T3 and T8 for osteoporotic compression fractures from February 2000 to June 2003, 41 of them followed up for longer than one year were selected as the population pool. Vertebroplasty of upper and middle thoracic spine was performed on total of 41 patients and 43 vertebral bodies. Among 41 patients, 32 of them were females where 9 were males cases.

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Table 1. Incidence of Operated Compressed Vertebral Body

Vertebral level	Number of cases (%)
T3	2 (4.6)
T4	3 (6.9)
T5	7 (16.2)
T6	9 (20.9)
T7	10 (23.2)
T8	12 (27.9)

Their age was from 64 to 78 years old, and the mean age was 72.9 years old. We excluded the patients who had the cancer history or who were performed with transpedicular biopsy due to suspicion of spinal metastasis from our study. For all patients, simple radiographs were taken and bone marrow densitometry and T-spine magnetic resonance imaging (MRI) were performed to assess their osteoporotic degree. Percutaneous vertebroplasty was performed on the patients who had acute compression fractures accompanying osteoporosis without neurological deficit and severe tenderness in the compression fractured area, which showed the low signal intensity in the T1-weighted MRI. The posterior cortex of vertebral body was evaluated by thoracic-spine computed tomography (CT), and the cases with the defect mentioned above were excluded from the study.

The degree of compression fractures was measured by the shortening of the anterior vertebral height based on the posterior side of the identical vertebra. The improvement of the degree of pain was assessed by the VAS score (without pain was 0 point, and the worst imaginable pain was 10 point). Walking degree was classified as non-ambulatory state that required bed rest or a wheel chair, assisted ambulatory state refers to requiring a cane or a walker, and full ambulatory state refers to being able to walk without getting help from others.

Statistical analysis of pre- and post-operative scores for the severity of pain and mean injected cement volume for each level were performed using Chi-square & paired t-test, and P value less than 0.05 was considered as statistically significant.

RESULTS

Fractured vertebral bodies were involved from levels T3 to T8. The number of level T3 was 2 cases, the number of level T4 was 3 cases, the number of level T5 was 7 cases, the number of level T6 was 9 cases, the number of level T7 was 10 cases and the number of level T8 was 12 cases (Table 1). The mean percentage of compression was 35% (range, 15–50%). Bipedicular injections were used in 2 cases (4.6%), and

Table 2. VAS Score after Vertebroplasty according to Time

Time	VAS score
Preoperative	7.7
48 hours later	2.4*
6 months later	1.5*

*: $P < 0.05$ compared to preoperative VAS.

Table 3. Complications Observed on Radiographs

Pattern of bone cement leakage	Number of cases (%)
Paravertebral	10 (23.2)
Adjacent disc	9 (20.9)
Venous (pulmonary embolism)	0 (0)

unipedicular injections were used in 41 cases (95.4%).

For all levels, the mean volume of injected cement was 2.4 ± 2.0 ml. The mean volume of injected cement at T3–T6 was less than that at T7–T8 (2.4 ± 1.5 versus 3.6 ± 2.1 ml, respectively [$P < 0.05$]). The mean VAS score prior to the surgery was 7.7 where it improved to 2.4 within 48 hours of post-surgery, and the VAS score after 6 months was 1.5, which were statistically significantly decreased ($P < 0.05$) (Table 2). In regard to the improvement of pain, 93.3% of patients was improved mainly within 2 weeks. Forty-eight hours after vertebroplasty, fully ambulated cases were 21 cases (51.3%), 13 cases (31.7%) were able to walk with the assistance from others, and 7 cases (17%) were difficult to walk even after the procedure. However, after 6 months, 32 cases (78%) were able to walk freely by themselves, and 9 cases (22%) were able to walk with the assistance from others.

Complications observed on radiographs were cement leakage to the adjacent disc (9 cases) and paravertebral soft tissues (10 cases) (Table 3). But pulmonary embolism, other new neurological deficits, and pneumothorax were not developed (Fig. 1).

DISCUSSION

With the increased rate of aging populations, patients with osteoporotic compression fractures in the vertebral body are increased as well, and thus, quality of life is lowered.^{1,7)} Particularly, 15–33% of over 50 years old women with osteoporosis was experienced compression fractures.^{4,8-10)} In our study, the patients who underwent the procedure were mostly women (76.2%), and their mean age was 72.9 years. In old populations, if the vertebral bodies are fractured, they can not lead

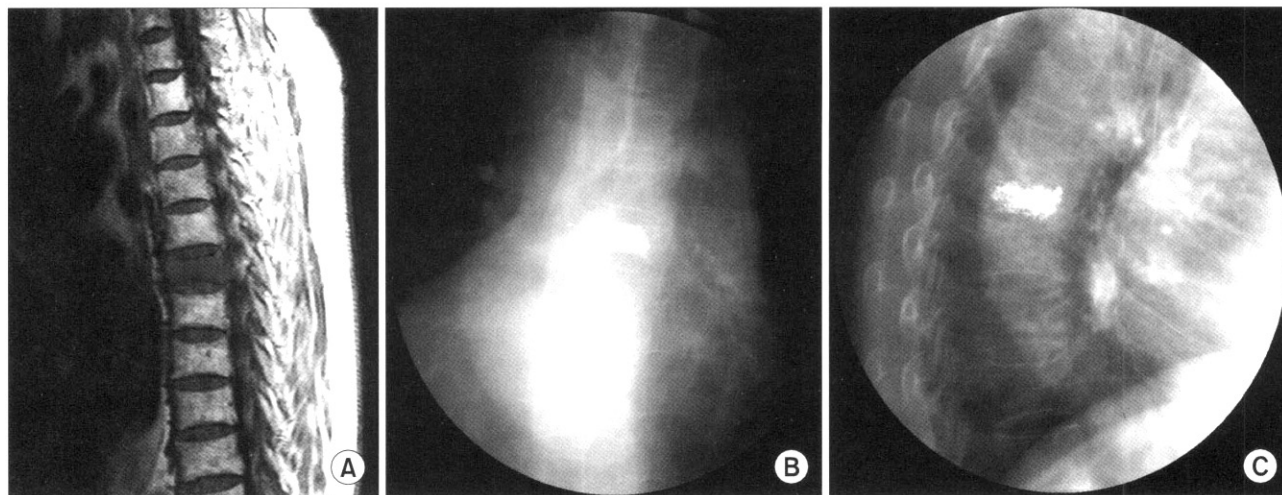


Fig. 1. Images in a 83-year-old woman with T5 compression fracture. (A) Sagittal T1 weighted MR image shows low signal intensity meaning compression fracture. (B, C) Simple X-rays obtained after methylmethacrylate injection show complete filling of T5 vertebral body without any leakage.

daily life by themselves, which affects quality of life substantially. Percutaneous vertebroplasty using polymethylmethacrylate (PMMA) has been introduced for the treatment of the vertebral angioma initially, and subsequently it has been used in the treatment of vertebral malignant tumors or osteoporotic compression fractures.^{1,3,4,7)} But, most cases of vertebroplasty have occurred in the lower thoracic spine and thoraco-lumbar spine. Upper and middle thoracic vertebroplasty may pose special challenges considering the relatively small pedicle size, risk of pneumothorax, and severe angulation from kyphosis that are not present in thoracolumbar and lumbar procedures.

This study confirms the ease and safety of percutaneous vertebroplasty in the middle and upper thoracic regions. Vertebroplasty was achieved outstanding relief of pain in this cohort; a strong trend for decreasing medication was also noted. Although needle placement was challenging in cases of severe thoracic kyphosis, strict adherence to craniocaudal angulation with the lateral side and slight obliquity to the anteroposterior side was facilitated by rapid treatments in every case. No cases of pneumothorax occurred. Our study demonstrates that PMMA leakage into the adjacent disc or paravertebral soft tissue is not uncommon. But the patients did not have side effects from the leakage of the small amounts of PMMA into disc or paravertebral soft tissues. This series confirms the safety and effectiveness of middle and upper thoracic percutaneous vertebroplasty.

The clinical results in this series are similar to those of numerous previous case series of percutaneous vertebroplasty.¹⁻⁸⁾ Previous studies did not focus specifically on mid- and upper thoracic compression fractures. Our data suggest that the excel-

lent results achieved with lower thoracic and lumbar vertebroplasty can also be achieved in the upper and middle thoracic region. We also noted no case of pedicle fracture when using the larger 11-gauge needle. We prefer the larger needle, because it is substantially easier to position than the thinner 13-gauge needle. The use of smaller diameter needles is not indicated, because middle and upper thoracic vertebroplasty can be safely performed using 11-gauge needle.

Although our study demonstrates successful results, the clinical course and management of the upper and middle thoracic lesion will have to be analyzed with larger series and with longer follow up periods.

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