Newly developed compression fractures after percutaneous vertebroplasty: comparison with conservative treatment

Keigo Chosa · Akira Naito · Kazuo Awai

Abstract

Purpose. The aim of this study was to investigate the incidence and timing of subsequent fractures in patients treated with and without percutaneous vertebroplasty (PVP).

Materials and methods. We reviewed 794 patients who underwent 1500 PVPs with polymethylmethacrylate (PMMA) at our institution between January 1999 and December 2009. We also reviewed 349 patients with vertebral fractures who underwent conservative treatment without PVP between October 1999 and December 2009 and compared the incidence and timing of subsequent fractures in the two groups.

Results. Among the 794 patients treated by PVP, 171 (21.5%) suffered 336 new vertebral fractures. Among the patients not treated by PVP, 82 (23.5%) presented with 154 new fractures. There was no statistically significant difference ($P = 0.46$). Among the PVP-treated patients, one-half of new fractures occurred at a level adjacent to the treated level, and they occurred significantly sooner than nonadjacent level fractures (log-rank test, $P < 0.01$).

Conclusion. PVP did not increase the incidence of new compression fractures compared with conservative treatment, but half of the new fractures at the adjacent vertebral bodies occurred sooner.

Key words Percutaneous vertebroplasty · Polymethylmethacrylate · Subsequent compression fracture · Osteoporosis

Introduction

According to the literature, there are 700,000 spinal compression fractures per year secondary to osteoporosis in the United States. In all, 80% of them occur in women, and 25% of all postmenopausal women suffer spinal compression fractures.1,2 These fractures are typically treated conservatively with a maximum of 12 weeks of bracing and external orthoses, analgesics, physical therapy, and medical therapy for osteoporosis. However, many elderly patients suffer chronic pain and develop progressive kyphotic deformities that impair their mobility and reduce their quality of life.

Percutaneous vertebroplasty (PVP) was first described in France by Galibert for the treatment of a case of aggressive hemangioma at the level of C2.3 It is now used in patients with osteolytic lesions due to bone metastases, aggressive hemangiomas, and multiple myeloma and in patients with medically intractable debilitating pain resulting from osteoporotic vertebral fractures.4 It is also effective in patients with painful vertebral fractures. Experimental studies and preliminary clinical results suggest that it can strengthen the vertebral bodies and increase mobility.3

Despite biomechanical and clinical studies, it remains unclear whether PVP increases the risk of new vertebral fractures,6,7 or if it can prevent additional fracture in the injected or other vertebrae. Therefore, we performed a retrospective study of the incidence and timing of subse-
quent fractures in patients previously treated with and without PVP.

Materials and methods

Study population

The institutional review board approved the study. All patients provided written informed consent. We reviewed 794 patients who had undergone 1500 PVPs with polymethylmethacrylate (PMMA) at our institution between January 1999 and December 2009. We reviewed their records to identify the incidence of incident fractures and the vertebral levels treated. We defined incident fractures as those that were newly diagnosed following vertebroplasty or other treatment on the basis of magnetic resonance imaging (MRI) or radiographic findings. The findings were that a vertebral body showed a reduction of vertebral height on radiography or bone marrow edema on MRI. They were designated as either adjacent or nonadjacent to the vertebral level most recently treated by vertebroplasty. The findings of initial-level fractures were that a vertebral body showed a reduction of vertebral height on radiography compared with the first diagnosis of compression fracture or bone marrow edema on MRI. The time of diagnosis of incident fractures was determined by the date of confirmatory imaging studies.

We also reviewed 349 patients with vertebral fractures, most of whom, based on the advice of their orthopedist, had undergone conservative treatment without vertebroplasty between October 1999 and December 2009.

Patients have at least a year clinical follow-up after PVP. Patients visit our institution at 3, 6, 12, 18, and 24 months after PVP and undergo plain radiography of thoracic and lumbar vertebrae. MRI is also performed as necessary. Otherwise, patients with vertebral fractures who undergo conservative treatment visit our institution at 1–3 months after diagnosis of vertebral fractures and undergo plain radiography of thoracic and lumbar vertebrae or MRI. In both groups, we excluded patients who had <30 days of clinical follow-up.

Percutaneous vertebroplasty

Percutaneous vertebroplasty was typically performed on patients with refractory back pain due to an acute or subacute vertebral compression fracture of the thoracic or lumbar spine as diagnosed by MRI (Figs. 1, 2). The procedure was performed under local anesthesia. Patients were monitored by electrocardiography (ECG), their oxygen saturation status, and their blood pressure.

Patients were placed in the prone position on the table. A 13-gauge bone biopsy needle (Ossiris; Hakko, Nagano, Japan) was inserted percutaneously into the anterior third of the vertebral body using the unilateral transpedicular approach under computed tomography.

![Fig. 1. A 78-year-old woman had low back pain. A Lateral plain radiograph shows multiple compression fractures of the lumbar vertebrae. She underwent conservative treatment. B Lateral plain radiograph acquired 77 days later shows a reduction in L2 vertebral height and a nonunion deformity. Her low back pain persisted. C T2-weighted magnetic resonance imaging (MRI) (sagittal view) obtained before vertebroplasty shows bone marrow edema and an intravertebral vacuum cleft at L2. D Lateral plain radiograph acquired during percutaneous vertebroplasty (PVP) shows the puncture needle and polymethylmethacrylate (PMMA) injected into the L2 vertebral body. E Post-PVP lateral plain radiograph. The patient is free of low back pain, and her quality of life is improved.](image-url)