

Clinical Study

# Percutaneous balloon kyphoplasty for the treatment of very severe osteoporotic vertebral compression fractures: a case-control study

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## Abstract

**BACKGROUND CONTEXT:** Controversy exists regarding percutaneous balloon kyphoplasty (PBK) in patients with a very severe osteoporotic vertebral compression fracture (vsOVCF).

**PURPOSE:** The study was conducted to investigate the clinical and radiological outcomes of PBK for the treatment of vsOVCF compared with those of non-vsOVCF.

**STUDY DESIGN/SETTING:** This is a retrospective, case-control study.

**PATIENT SAMPLE:** A total of 167 consecutive patients (210 vertebral bodies) who underwent PBK for OVCF between March 2010 and January 2015 were assessed.

**OUTCOME MEASURES:** Visual analog scale (VAS) scores for back pain, Korean Oswestry disability index (K-ODI) scores, vertebral body height variations, and kyphotic angles were evaluated preoperatively, postoperatively, and 1 year after treatment.

**MATERIALS AND METHODS:** Patients in the non-vsOVCF group (anterior vertebral compression of more than two-thirds on plain radiograph) who had undergone PBK were compared with those in the non-vsOVCF group (compression between 30% and two-thirds). Clinical and radiological outcomes were compared. In addition, complications were evaluated.

**RESULTS:** In total, 31 patients (33 vertebrae) in the vsOVCF group and 136 patients (177 vertebrae) in the non-vsOVCF group were treated with PBK. Both groups had significant postoperative improvements in the clinical and radiological outcomes (VAS score, K-ODI score, vertebral body height variation, and kyphotic angle). There was no difference regarding the VAS score and the K-ODI score between the two groups at the final follow-up ( $p > .05$ ). The cement leakage occurred frequently in the vsOVCF group (26 vertebrae, 78.8%) than in the non-vsOVCF group (92 vertebrae, 52.0%), the difference was statistically significant ( $p < .05$ ). But there was no case that showed neurologic complication or pulmonary embolism caused by cement leakage. The incidence of recollapse was significantly higher in the vsOVCF group (five vertebrae, 15.2%) than in the non-vsOVCF group (seven vertebrae, 4.0%) ( $p < .05$ ). The incidence of an adjacent segment fracture (vsOVCF group, 6 vertebrae, 18.2%; non-vsOVCF group, 21 vertebrae, 11.9%) was not significantly different ( $p = .320$ ).

**CONCLUSIONS:** Percutaneous balloon kyphoplasty is a safe and effective procedure for the treatment of vsOVCF. © 2017 Elsevier Inc. All rights reserved.

**Keywords:** Clinical outcome; Complications; Osteoporosis; Percutaneous balloon kyphoplasty; Radiological outcome; Vertebral compression fracture

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## Introduction

Osteoporotic vertebral compression fractures (OVCFs) are one of the most common complications of osteoporosis, causing severe pain, restricting activity, lowering the quality of life, and also increasing the incidence of systemic complications and mortality [1,2].

Percutaneous balloon kyphoplasty (PBK) is a minimally invasive operation that involves inserting and inflating a balloon inside the vertebral body that has been damaged by the OVCF

and then injecting cement into the void of the vertebral body [3,4]. This technique has the advantage of reducing cement leakage during surgery and may eliminate pain and restore vertebral body height immediately after surgery [5].

However, there are a limited number of studies on PBK performed in patients with a very severe osteoporotic vertebral compression fracture (vsOVCF). [3,5–10] Very severe osteoporotic vertebral compression fractures are defined by a reduction of two-thirds or more in the expected vertebral body height [11]. In patients with a vsOVCF, PBK requires advanced surgical techniques because the compression rate of the vertebral body is so severe, and some authors have argued that a vsOVCF is a relative contraindication for PBK and instead recommend conservative treatment [12]. However, others recommend either corpectomy with anterior fusion or posterior arthrodesis for patients with a vsOVCF [13,14].

We previously reported height restoration after PBK in patients with OVCF with rheumatoid arthritis [8] and hypothesized that PBK in patients with vsOVCF would recover appropriate vertebral body height and kyphotic angle and then improve clinical outcomes. We therefore conducted a comparative analysis of the clinical and radiological outcomes of PBK performed in patients with vsOVCF and in patients without vsOVCF.

## Materials and methods

The present study investigated the patient records of 167 consecutive patients (210 vertebral bodies) who underwent PBK for OVCF at Hanyang University Hospital between March 2010 and January 2015. All patients were followed up for a minimum of 12 months (range 12–48 months).

OVCFs were diagnosed in patients who complained of back pain or lower back pain, had a history of low-energy trauma and tenderness in the thoracolumbar region according to the physical examination, and manifested compression of the vertebral body on plain radiograph. Patients with an OVCF were further examined by magnetic resonance imaging or bone scan to confirm an acute fracture, and bone mineral density (BMD) was then calculated using dual-energy x-ray absorptiometry (DXA) to confirm osteoporosis. Patients who experienced discomfort in everyday life because of pain even after undergoing conservative treatment for three weeks or longer, and with a confirmed vertebral body compression rate of 30% or higher on plain radiograph were selected for the PBK procedure. For patients aged 80 years or older, PBK was performed in patients with a vertebral body compression rate of 30% or higher without the requirement of a previous conservative treatment (Figs. 1 and 2). Korean National Health Insurance covers PBK when the compression rate is 30% or higher or patients are aged 80 years or older. So we set the previously mentioned indications of PBK.

Patients with either a vertebral fracture caused by high-energy trauma or a pathologic fracture caused by infection or tumor were excluded, and patients who had a fracture 3 months before the diagnosis were also excluded.

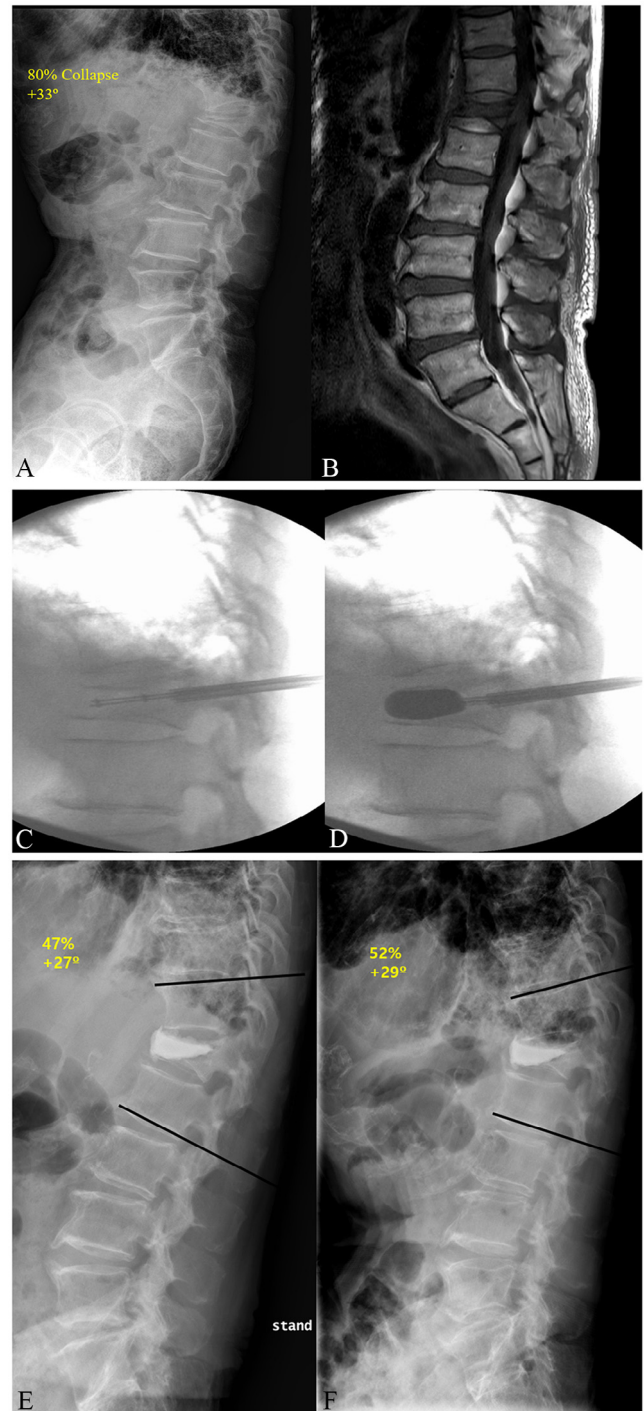


Fig. 1. Eighty-eight-year-old male patient who was admitted to our hospital after he slipped down. (A) Plain lateral radiograph shows the osteoporotic vertebral compression fracture of the L1 vertebra with 80% severe collapse and 33° local kyphosis. (B) T1 sagittal magnetic resonance imaging shows an acute recent fracture of the L1 vertebra. (C) Intraoperative fluoroscopy shows a Jamshidi needle (guide pin) inserted in the L1 vertebra. (D) A percutaneous balloon tamp was inflated and reduced the collapse of the vertebral height. Immediate postoperation (E) and 1-year follow-up (F) lateral plain radiograph. The body height and the kyphotic angle improved and remained stable 1 year after the operation.

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