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# Our Experience with Percutaneous Vertebroplasty and Kyphoplasty in Osteoporotic Spinal Fractures

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**ABSTRACT**

Osteoporotic vertebral fractures are a prevalent complication associated with osteoporosis and they are especially common in the elderly. Vertebroplasty and kyphoplasty are minimally invasive surgical techniques designed to address these fractures. These procedures aim to alleviate the pain, prevent the progression of kyphosis, and enhance the quality of life for patients. This study retrospectively examines 30 patients who underwent percutaneous vertebroplasty at Gazi Yaşargil Training and Research Hospital from January 2020 to December 2024.

The study involved 30 patients, whose pain levels assessed using the Visual Analog Scale before and after surgery. Changes in vertebral body height were also measured before and after the operation. All procedures were conducted under local anesthesia or sedation analgesia, with Polymethylmethacrylate cement injected at thoracic and lumbar levels. Statistical analysis was performed using SPSS software.

The average preoperative visual analog scale score was 7.68, which significantly decreased to 3.25 after operations ($p < 0.001$). Additionally, the mean vertebral body height increased from 10.19 mm before surgery to 11.54 mm after surgery ($p < 0.001$). These results suggest that vertebroplasty effectively reduces pain and restores vertebral height.

Percutaneous vertebroplasty is a viable treatment option for osteoporotic and pathological vertebral fractures. This technique effectively manages pain, enhances vertebral stability, and supports early patient mobilization. With meticulous application, the risk of complications is minimized.

**Keywords:** PMMA, Vertebral fracture, Vertebroplasty

## Introduction

Osteoporosis is a condition that leads to reduced bone density, causing fragile and weakened bones. It is characterized by a decrease in bone volume and thickness, which increases the likelihood of fractures, particularly in the hip, spine, and wrist (1, 2). This condition is common among older adults, with vertebral fractures being one of its most frequent complications (1). Vertebroplasty (VP) and kyphoplasty (KP) are minimally invasive surgical methods used to treat osteoporotic vertebral fractures (3, 4). These procedures aim to alleviate the pain, prevent kyphosis, improve the quality of life, and reduce morbidity and mortality (5). VP and KP are also utilized in cases involving metastatic tumors, hemangiomas, and other conditions requiring spinal reinforcement (6). The pain associated with fracture-related instability typically increases with movement and decreases with rest (7). Loss of height due to vertebral collapse can lead to instability and kyphosis, resulting in reduced mobility and respiratory issues (8). Addressing the pain and enabling patients' mobilization significantly improve their quality of life. VP and KP, performed transpedicularly, have become widely adopted techniques.

## Materials and Methods

This retrospective study evaluated 30 patients who underwent surgery at the Gazi Yaşargil Training and Research Hospital Neurosurgery Clinic between January 2020 and December 2024. Ethical approval was obtained (Gazi Yaşargil Training and Research Hospital Ethics Committee, approval date 19/04/2024, number 2024-6). Preoperative radiological images were reviewed, and patients' pain levels were assessed using the Visual Analog Scale (VAS). Informed consent was obtained following a preoperative briefing. Procedures were performed under local anesthesia or sedation analgesia. Patients were

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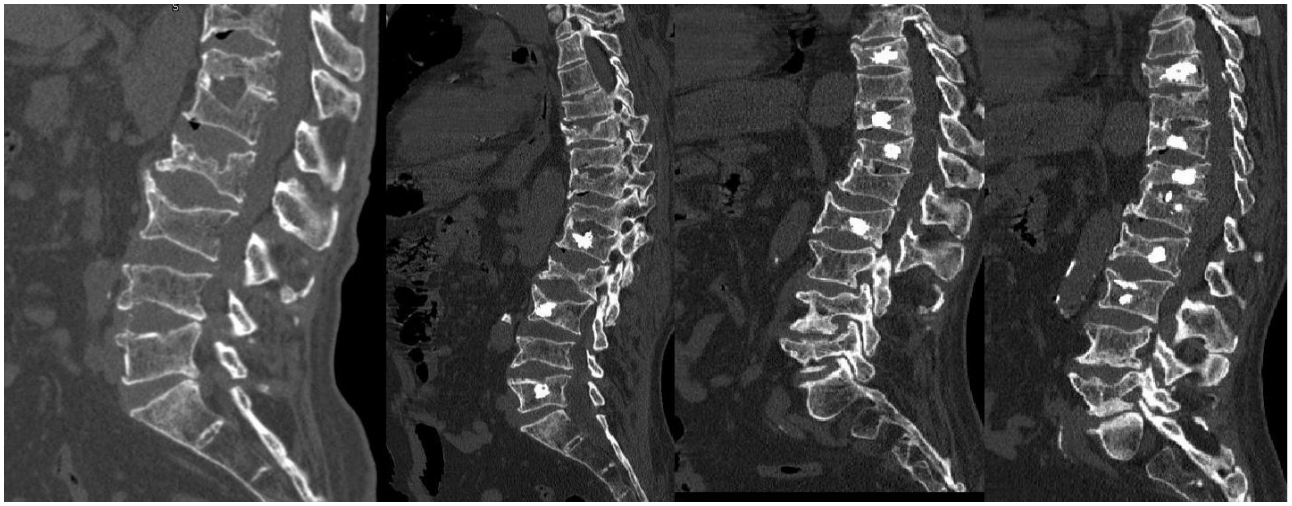

**Image 1:** Postoperative computed tomography (CT) image of a patient who underwent vertebroplasty (VP)

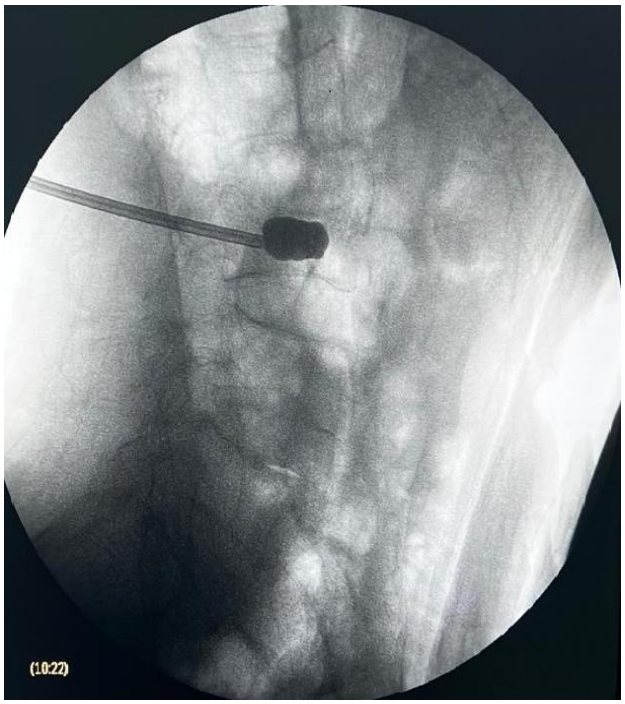


**Image 2:** Study balloon that is inflated within the spinal corpus by entering the cannula being monitored

positioned prone, and after establishing a sterile surgical field, anesthesia was administered. The level of vertebral collapse was determined using biplanar C-arm fluoroscopy (Image 2). Transpedicular procedures were performed, with 3 cc to 10 cc of cement injected depending on the level of collapse and vertebral body condition. (Image 1) The PMMA component ratio and mixture waiting time affected the cement fluidity. Extracted bone tissues were sent for pathological examination. VP aims to prevent collapse and stabilize micro-movements, while KP involves inflating a balloon within the vertebral body to restore height. Statistical analyses were conducted using SPSS, with a significance level $p<0.05$.

## Results

This study retrospectively analyzed patients with vertebral body fractures due to osteoporosis, spinal hemangiomas, osteolytic, and metastatic tumors. Among the 30 patients, 28 had osteoporotic vertebral body fractures, and 2 had pathological fractures. The mean age of the patients was 68.68 ± 10.51 years, with 64.3% female and 35.7% male. Fractures were most commonly observed in the thoracolumbar region. Percutaneous VP was performed on 2 patients with tumor-related vertebral compression fractures and 28 patients with osteoporotic fractures. Pain was the major symptom in all patients, with no significant neurological deficits observed (Table 1). The mean preoperative VAS score was 7.68 ± 0.77, which decreased significantly to 3.25 ± 1.11 postoperatively ($p<0.001$). Additionally, the mean vertebral body height increased from 10.19 ± 3.36 mm preoperatively to 11.54 ± 3.35 mm postoperatively with p-value smaller 0.001 (Table 2). The amount and distribution of cement were also significant, with 3 cc to 10 cc of PMMA cement injected. The risk of cement leakage increased with the amount applied and its fluidity characteristics. Clinical outcomes demonstrate that the VP procedure is effective in pain control and restoring vertebral stability.

## Discussion

The primary goal in treating compression fractures is to reduce the pain, prevent kyphosis, and

**Table 1:** Demographic Data and Collapse Levels of Patients

| | | Mean | Std. Dev. | Median | Range |
|---|---|---|---|---|---|
| Age | | 68,68 | 10,51 | 68,00 | 38,00 |
| T Score | | -2,36 | ,75 | -2,30 | 2,70 |
| | | | N | % | |
| Sex | M | | 10 | 35,7% | |
| | F | | 18 | 64,3% | |
| The Level of Compression | L1 | | 6 | 21,4% | |
| | L2 | | 2 | 7,1% | |
| | L3 | | 2 | 7,1% | |
| | L4 | | 5 | 17,9% | |
| | T12 | | 12 | 42,9% | |
| | T6 | | 1 | 3,6% | |

**Table 2:** Statistical significance value of the 'preoperative-postoperative' comparison according to the Wilcoxon test

| | Mean | Std. Dev. | Median | Range | *p. |
|---|---|---|---|---|---|
| PRE-OP VAS | 7,68 | ,77 | 8,00 | 3,00 | 0,001 |
| POST-OP VAS | 3,25 | 1,11 | 3,00 | 4,00 | |
| PRE-OP CORPUS HEIGHT | 10,19 | 3,36 | 10,43 | 15,82 | 0,001 |
| POST-OP CORPUS HEIGHT | 11,54 | 3,35 | 11,25 | 16,20 | |

*Significance value between "before and after the operation" according to the Wilcoxon test

improve the quality of life through a minimally invasive procedure (9). VP and KP are safe methods when performed with appropriate indications and techniques, although complications such as morbidity and mortality may occur. They can be performed under local or general anesthesia, which is advantageous. Causes of spinal fractures other than osteoporosis include primary or metastatic cancer, high-energy trauma, and hemangiomas (10). Aebli et al. demonstrated that intravertebral PMMA cement use can lead to thermal necrosis due to elevated intravertebral temperatures (11). Song et al. showed that KP is effective in correcting vertebral deformities and reducing the pain in vertebral body fractures resistant to medication (12). VP or KP are low-risk procedures that significantly reduce pain and enhance physical mobility (13). However, large series studies indicate that short-term efficacy is more significant for osteoporotic fractures, while efficacy is limited for oncological fractures (14). Approximately 25% of postmenopausal women in the United States are affected by vertebral compression fractures, with complications also observed in elderly men (15). Felsenberg et al. observed that most fractures treated with VP or KP develop on an osteoporotic basis (16). Yaltırık et al. found that kyphoplasty is significantly more effective in correcting kyphosis angle (17). In our study, significant pain reduction was observed in 30 patients treated with VP or KP, as measured by VAS scores. The significant difference between preoperative and postoperative VAS values indicates the effectiveness of VP or KP procedures in reducing pain. In our study, parallel to the literature, it was observed that VAS values decreased significantly, vertebral corpus height increased, patients' comfort increased significantly and no re-fracture occurred. Another complication of vertebroplasty and kyphoplasty is new fractures in the adjacent segment. In the study conducted by Trout et al., the risk of new fractures in the vertebra adjacent to the vertebra to which VP was applied was found to be 4.6 times higher than in other vertebrae (18). In another study, it was reported that the cause of new fractures in the adjacent segment after VP was the cement leaking into the disc space (19). In a study conducted by Kızmazoğlu et al., adjacent segment fractures were detected in 5 patients in long-term VP follow-ups and it was reported that 4 of them had cement leakage into the disc space during the first procedure (20). No fractures or cement leakage was detected in our patients. Limitation: Due to the lack of regular health insurance records and general studies on the

subject, death data are insufficient in the field of epidemiology, disability, mortality, risk factor distribution and their clinical relationships. Taking the necessary preventive health measures is extremely important for the society. We conducted a retrospective, single-center study. We recommend that multicenter studies be conducted, and studies with more cases will be conducted in the future.

The findings of this study demonstrate that VP is an effective method for treating osteoporotic and pathological vertebral fractures, providing significant contributions in terms of pain control, restoring vertebral height, and improving quality of life. However, it is crucial to carefully manage the techniques and materials used during the procedure to minimize the risk of complications.

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