



# Efficiency of Direct Reduction of Kyphoplasty in Osteoporotic Vertebra Fractures and Pain Management

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## Abstract

**Objective:** Evaluation of impacts of deformity corrections achieved by kyphoplasty approach in osteoporotic vertebra fractures on recurrence of pain.

**Materials and methods:** 25 segments of a total of 20 patients to whom kyphoplasty had been successfully carried out in Gaziantep State and Gaziantep American Hospitals due to painful osteoporotic vertebra compression fractures between 2001-2004 years were recruited into the study. Percent of deformity corrections at the sagittal plane had been assigned and evaluated with pre- and postoperative radiograms. The corrected group of the cases was comprised of 12 segments with a correction rate  $\geq 80\%$  (10 patients), whilst considering the remaining 13 segments with a correction rate of  $\leq 79\%$  (10 patients) as the non-corrected group. All the patients were undertaken a VAS score preoperatively, 3rd hour, 3rd and 6th months, postoperatively as well as Oswestry Disability Index (ODI) preoperatively, and at 6th month postoperatively.

**Results:** Radiological findings were determined to be compatible with clinical evidence. The degree of pain was seriously reduced within the first 24 hours in all cases. A statistically significant ( $p < 0.05$ ) reduction in VAS score as well as decrements in Oswestry Disability Index ( $p = 0.02$ ;  $t = 2.234$ ) in the corrected group, supported the hypothesis that recurrent pain is related with the subsequent adjacent vertebral micro fractures and the pain relief could be achieved following a successful correction.

**Conclusion:** Sagittal corrections achieved by adequacy of the reduction following a balloon kyphoplasty decrease the recurrence of pain.

## Introduction

Kyphoplasty is the percutaneous treatment of osteoporotic spine fracture with minimally invasive method. The procedure greatly reduces fracture morbidity in the elderly population in terms of ending bed rest and reducing the need for analgesics.

Balloon kyphoplasty provides direct correction of the fractured vertebral segment. Correction of anatomy becomes possible after injection of PMMA cement. Kyphoplasty reduces pain by detecting the fracture. However, we observed that some of our patients who underwent kyphoplasty for osteoporotic spine fractures or

osteolytic tumors had persistent and recurrent back pain for a while. The cause of adjacent vertebral fracture is usually due to the axial strength of the bone and the overflow of cement into the disc space. Residual pain may be associated with microfractures. The kyphotic effect on each spinal segment increases the rotational moment. Thus, axial and rotational forces increase the frequency of fractures in the vertebral body.

Reaching the vertebral body by transpedicular route, providing direct reduction of the fracture with the elevator effect of the balloon,

creating a cavity and fixing it with the injection of filling material equal to the measured cavity volume without pressure [1]. Direct fracture reduction is not possible in the surgical treatment of spinal fractures. Kyphoplasty offers the surgeon the advantages of direct correction and cavity creation. While percutaneous vertebroplasty delivers the filling material with pressure, complications of cement leaking occur, this rate is quite low in kyphoplasty [2].

The reduction provides the correction of sagittal balance and the reduction of new fracture formation due to the momental loading of the center of gravity [3].

Anatomical restoration reduces the loads on the spinal column and can protect the microstructure of the vertebrae from new fractures. Antiresorptive therapy reduces the possibility of encountering new fractures in the patient whose osteoporosis is perhaps diagnosed with a spinal fracture [2].

DUE TO THE RECENTLY INCREASING RATE OF LONG BONE FRACTURES, WE PREFER ANABOLIZANT TREATMENTS INSTEAD OF ANTIRESORPTIVE TREATMENTS.

## Materials and Methods

20 patients who underwent kyphoplasty in Gaziantep State Hospital and Gaziantep American Hospital between 2001 and 2004 were included in the study at 25 levels. The mean age was 66 years between 55 and 82 years. Cases with cement leakage, noncontiguous and complicated cases were excluded from the study. The mean follow-up period was 1 year and 4 months, and VAS pain analysis and Oswestry disability index were applied to all patients before the intervention, at the third hour after the procedure, and at the following 3rd and 6th months. All patients were mobilized within 3 hours postoperatively.

Ten patients and 12 patients were included in the corrective group with a correction above 80%, 10 patients with a correction of 79% and below and 13 levels were included in the noncorrective group, and their VAS scores were compared with the doubled student-t test. Oswestry disability indices were compared statistically.

## Results

Radiological findings were found to be compatible with clinical results. Pain intensity decreased significantly in all cases in the first 24 hours. Among the patients whose VAS scores decreased significantly in the first 24 hours, the residual pain in the corrective group was statistically significantly reduced by VAS analysis ( $P < 0.05$ ). The decrease in the ODI index ( $p = 0.02$ ,  $t = -2.234$ ) supports the hypothesis that the pain is due to microfracture in the adjacent vertebra and that good reduction reduces recurrence. detected.

The VAS score, which was  $7.9 \pm 0.3$  preoperatively in the corrosive group, decreased to  $2.2 \pm 0.3$  postoperatively, and was  $2.5 \pm 0.9$  within 6 months. ( $p < 0.05$ ). The decrease in the Oswestry disability index was also statistically significant in the same group ( $p = 0.02$ ,  $t = -2.234$ ). Oswestry disability was detected preoperatively  $88 \pm 2\%$ , post-treatment corrosive group  $40 \pm 1.2\%$  early postoperatively,  $42 \pm 0.6\%$  at 6 months. Although the noncorrective group was close to the early postoperative oswestry corrective group, it was

observed to be  $45 \pm 0.6\%$  at the sixth month with the contribution of social life, travel and pain degree scores. The development and recurrence of pain were significantly reduced in the corrosive group. On the other hand, in the noncorrective group, the VAS score and Oswestry disability index values were preoperative:  $7.9 \pm 0.3$ , early postoperative  $2.6 \pm 0.3$ , and 6th month  $4.5 \pm 0.7$ , respectively. Although there was no significant difference between the two groups in the early postoperative VAS scores ( $p > 0.05$ ), the difference was significant at the 3rd and 6th months postoperatively. There was no mortality in our series. All patients were mobilized on the same day and discharged within the first 4 days.

## Discussion

Kyphoplasty is a safe and effective option in the treatment of osteoporotic spine fractures and osteolytic spine tumors. The aim of the treatment is to correct the fracture, to provide the spine anatomy and to reduce the pain, which is closely related to the spinal biomechanics.

It is possible to regain spinal height. The incidence of cement leakage is reduced in kyphoplasty compared to other percutaneous vertebroplasty. In this respect, it is an appropriate treatment option for osteoporotic spinal compression fractures. Recent studies suggest that the high disc pressure in the kyphoplasty-applied segment compared to the adjacent segments is a factor that increases the occurrence of new fractures. However, it could not show a direct cause-effect relationship [4].

When the kyphoplasty protocol is combined with medical antiresorptive treatments, a significant reduction in the incidence of fractures has been found [5]. Some biomechanical studies suggest that cement augmentation creates non-elastic loading in the adjacent segment that increases loading [6]. Therefore, it is more important to evaluate the adjacent spine fracture in the first two months. In this period, antiresorptive therapy still maintains bone stock well below the desired level.

However, with reference to the multi-segment spine unit study of Villarraga et al., retrospective studies have shown that adjacent segment loading after kyphoplasty is less than the force to cause fracture [7]. In other words, it is not significant to blame the increase in stress and tensile forces on adjacent segment fractures. The underlying real reasons (osteoporosis, tumor, metabolic) that reduce the mechanical transport of the bone should be questioned rather than surgical treatment as the cause of the fracture [8].

## Conclusion

While this study blames microfractures as the cause of recurrent or residual pain, it shows that restoration of spine shape and providing sagittal balance regulates physiological loads, and patients supported by antiresorptive therapy complain of less recurrent pain at the rate of spinal mechanics correction.

Osteoporotic vertebral compression fractures cause significant impairment and mortality. In the surgical treatment of these fractures, it should be aimed to minimize the patient's pain, prevent kyphosis and achieve better living conditions in a minimally invasive way. For this purpose, balloon kyphoplasty provides

direct correction in the fractured vertebral segment and reduces pain by detecting the fracture. However, we observed that some of our patients who underwent kyphoplasty for osteoporotic spine fractures had persistent and recurrent back pain. In our study, we found that the VAS score was maintained at a low level in the late controls in the group in which we achieved deformity correction more effectively, whereas this score increased in the noncorrective group. From this point of view, we suggest that deformity correction has an important place in pain control.

Kyphoplasty prevents the formation of new fractures to the extent that it provides sagittal balance. With the use of biomechanically compatible materials as filling material, adjacent segment fractures will also decrease in the first two months.

### Acknowledgment

None.

### Conflict of Interest

No conflict of interest.

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