Percutaneous Vertebroplasty for Osteoporotic Vertebral Body Compression Fractures

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ABSTRACT

BACKGROUND: Vertebral compression fractures are the most common fractures in osteoporosis. They have significant impact on quality of life, survival rates, and carry increased socioeconomic costs. Vertebroplasty is a minimally invasive procedure that aims at stabilizing the fractured vertebral body and alleviating pain. We aimed to evaluate bipedicular percutaneous vertebroplasty in the treatment of severe osteoporotic vertebral body compression fractures with this study.

MATERIAL AND METHODS: A total of 70 percutaneous vertebroplasties were performed on 35 patients (all females). All patients gave a history of localized back pain not responding to treatment by NSAIDs and anti-resorptive drugs. The vertebral collapse was evaluated by routine X rays and CT scan for the involved levels. Bilateral transpedicular cement injection was performed under direct fluoroscopic control. The follow up of pain improvement was subjectively recorded based on the visual analogue scale. Functional evaluation of patients was with the Oswestry score.

RESULTS: The mean age of the patients was 60.11 years. There was statistically significant improvement of postoperative visual analogue score and Oswestry score (P < 0.05). The post-injection vertebral height was significantly improved after follow up (P < 0.05). There were no major complications. Cement leakage occurred to the adjacent disc in two cases (6.7%) and to the paravertebral soft tissues in four patients (3.3%).

CONCLUSION: Percutaneous vertebroplasty is a minimally invasive and successful approach to the treatment of painful compression fractures associated with osteoporosis.

KEY WORDS: Compression fractures, Minimal invasive, Osteoporosis, Vertebroplasty

INTRODUCTION

The first percutaneous vertebroplasty was performed in Europe in 1984 and reported in the literature in 1987. (1) Numerous modifications in patient evaluation and procedural technique have been made afterwards to better define the appropriate patient population, to decrease surgery time, and to optimize overall patient care. The primary indication for vertebroplasty is the treatment of painful, osteoporotic compression fractures that have not responded to medical therapy. (3) The duration of symptoms prior to vertebroplasty is a point of controversy. While some centers recommend a period of six to twelve weeks of non-operative treatment, other centers perform early vertebroplasty for patients with osteoporotic fractures. Other points of controversy include the type of cement used, unipedicular versus bipedicular injection and the method of postoperative evaluation of patients. (4, 5, 6) While most published reports depend on pain improvement to assess the efficacy of vertebroplasty techniques, few reports describe the functional outcome of these techniques. In this article we present the functional outcome of percutaneous bipedicular vertebroplasty for 35 patients with osteoporotic compression fractures.
MATERIAL and METHODS

This is a retrospective case series study on 35 patients with osteoporotic compression vertebral body fractures treated by 70 percutaneous vertebroplasties. The inclusion criteria of patients were the persistence of pain for more than six weeks in spite of medical treatment (including NSAIDS, dorsolumbar support, anti-resorptive drugs) and the presence of vertebral collapse in one or more vertebrae as detected by plain radiographs. We excluded patients with a neurological deficit or presence of retropulsed fragment(s) on CT scan.

All patients were basically evaluated by history taking and clinical examination. Evaluation of the vertebral collapse was with routine x rays including the affected region and the other spinal levels to evaluate other levels with impending collapse. Computerized tomography for the involved levels was performed aiming exclusion of retropulsed fragments. A bleeding profile was obtained for all patients to exclude bleeding tendencies.

All patients received local anesthesia. They were placed in the prone position. Before the patient was draped, lateral fluoroscopy of the target level was performed to ensure that the patient was lying in a true lateral position. Accurate visualization of the posterior vertebral wall during cement injection was the key for the avoidance of complications. The needle was inserted under fluoroscopy in the anteroposterior and lateral projections. Cement injection was also performed under direct fluoroscopic control. Bilateral transpedicular injection was done routinely. The average amount of injected bone cement was 3.5 mL (range 2 - 5.2 mL). We used a large-caliber trocar needle, 11 gauge, for the thoracic spine and 8 gauge for the lumbar spine, with a length of 10–15 mm.

At the end of the procedure patient was transferred on a stretcher for observation. The main points that were monitored included new chest pain, back pain, and neurological symptoms and signs. Patients were then discharged and encouraged to initially use non-steroidal anti-inflammatory drugs. Post-injection plain x-rays and CT were obtained for study purposes. (Figure 1A-C)

The follow-up of pain improvement was subjectively recorded based on the visual analogue scale while functional evaluation of patients was with the Oswestry score. This was done along the regular follow-up intervals of three, six, twelve and twenty-four months. In addition to the initial immediate post-operative pain improvement the patients received analgesia for their residual pain during the follow-up period, and we created a protocol for the analgesics to be used to minimize variations in results. Patients without contraindications for diclofenac sodium received 100 mg of the sustained release form (Olfen® S.R 100 mg capsule) given at the time of maximal pain intensity. Those with a contraindication for diclofenac sodium received lornoxicam (Xefo® 8mg) twice a day. None of the patients needed additional doses other than the used protocol.

RESULTS

The study was performed on 35 patients with osteoporotic compression fractures of the vertebrae. The

Figure 1: (A) osteoporotic fracture of second lumbar vertebra, (B) AP view of bipedicular injection with bone cement, (C) Lateral view.
mean follow-up period of the patients was 18.4 months. The mean age of the patients was 60.11 years. An injection was performed for lumbar fractures in seven patients (20%) and for dorsal fractures in twenty patients (57.2%) while eight patients had dorsolumbar fractures (22.8%). The average preoperative vertebral height was 38.9% while the average post-injection vertebral height was 41%. There was a statistically significant improvement of the visual analogue score (VAS) and Oswestry score after follow-up (P < 0.05). The mean preoperative VAS was 8.2 while the mean postoperative VAS was 3.4. The mean preoperative Oswestry score was 72.8 while the mean postoperative Oswestry score was 32.6. Table 1

Cement leakage occurred to the adjacent disc in two cases (6.7%) Figure 2C and to the paravertebral soft tissues in four patients (3.3%) Figure 3C.

**DISCUSSION**

Percutaneous PMMA injection into the vertebral body is an effective treatment for pain caused by osteoporotic spinal fractures. Short-term clinical results of vertebroplasty are generally excellent but long-term data for patients are lacking. Tohmeh et al. (6) conducted a biomechanical study comparing unipedicular and bipedicular direct PMMA needle injection. Bipedicular injection of 10 mL (5 mL per side) improved vertebral

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*Figure 2: (A) plain X-ray of osteoporotic fracture L3, (B) corresponding MRI, (C) X-ray following injection with intradiscal and canal leakage without recorded complication, (D) CT after injection.*
strength significantly (P ≤ 0.05) more than a unipedicular injection of 6 mL; however, the unipedicular PMMA injection improved vertebral strength to a significantly (P ≤ 0.05) greater degree than that of the unfractured osteoporotic vertebrae. Both injection techniques restored the stiffness of fractured vertebrae to pre-fracture values equally well. Jensen et al (1) reported on 29 patients who underwent percutaneous vertebroplasty to manage osteoporotic vertebral body compression fractures. Two patients had complete resolution of back pain immediately after vertebro-plasty. Twenty-six patients (90%) described pain relief and improved mobility within 24 hours of treatment.

All patients who had required parenteral narcotics tolerated reduction to oral medications. Three patients had no significant pain relief and were continued on pre-treatment medical regimens. The results of our cases managed by bipedicular injection are close to other compared studies in pain improvement. For more accurate functional evaluation we used, in addition to the VAS, the Oswestry functional score providing more comprehensive idea about the improvement not only in pain but also the function. Two main types of response were noticed during the follow-up of our patients; the first group of patients (12 patients) showed marked initial pain reduction at the immediate post-operative period which extended steadily throughout the follow-up period without further deterioration or improvement. This group included six patients with thoracolumbar collapse, four patients with lumbar collapse and two patients with thoracic collapse. The other response pattern was progressively improving pain after the initial improvement with the maximally progressive time of improvement at the first three-month follow-up period. The improvement decreased but there was still pain reduction until a point of stability without change of pain intensity was reached in this group of 23 patients consisting of 18 thoracic, three lumbar and two thoracolumbar collapse cases. Some recent reports have described new compression fractures after vertebroplasty (2, 7). However, none of our patients had re-fracture of injected vertebral bodies during follow-up.

**CONCLUSION**

Percutaneous vertebroplasty is a minimally invasive and successful approach for the treatment of painful compression fractures associated with osteoporosis.

![Figure 3: A) Plain X-ray showing marked osteoporotic collapse of L1, (B) MRI of same patient, (C) X-ray following injection with minimal leakage at paraspinal soft tissues.](image-url)
REFERENCES


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