**Original Article**

Multiple-level Percutaneous Vertebroplasty for Osteoporotic spinal fractures

*Ahmed Elsayed*
Department of Neurosurgery, Cairo University, Egypt

**ARTICLE INFO**

Received:
4 February 2014

Accepted:
29 March 2014

**Key Words:**
Percutaneous vertebroplasty
Osteoporotic spinal fractures
Disability

**INTRODUCTION**

Percutaneous Vertebroplasty had showed a global importance as an effective procedure used to treat painful vertebral compression fractures. Primary conservative treatment of osteoporotic vertebral compression includes bracing, pain medications, and rehabilitation. Percutaneous Vertebroplasty was initially used for the treatment of malignant vertebral neoplasms and haemangiomas. Later it was applied for treatment of painful vertebral compression fractures not responding to conservative treatment either single or multiple level fractures. The duration of injected fractures ranges from several weeks to several months or longer for unhealed fractures. Percutaneous Vertebroplasty is considered a minimally invasive procedure in elderly cases with multiple comorbidities. The procedure is done by Cannulas passed through the pedicles into the vertebral body in which cement is injected to provide augmentation and support. The technique is image-guided. Types of cement include polymethylmethacrylate (PMMA) which is most widely used and calcium phosphate cements. Cement injection can involve single or multiple vertebral levels.

Percutaneous Vertebroplasty is a relatively safe technique with low incidence of complications as the leakage of cement into the neural canal or a vessel was low. The incidence of these complication as well as improvement vary from series to another. In this study we are trying to assess the safety and efficacy of this procedure in treatment.

**PATIENTS & METHODS**

This prospective series included 12 adult patients; 9(75%) females and 3(25%) males with mean age of 65.1 years (varied from 59 to 72 years), the procedure was done in Neurosurgery Department, Cairo university hospitals from 2011 to 2013. All patients included in this study. Spinal magnetic resonance imaging (MRI)and x-ray was done to all patients. All of patients had multiple–level Osteoporotic spinal fractures. These patients were treated by percutaneous Vertebroplasty. The clinical outcome was assessed pre and post injection using the Roland–Morris Disability Questionnaire (RDQ) and the visual analogue scale. Follow-up was performed direct postoperatively in first 24 hours and every 6month until 18month period. Results: All patients showed immediate significant improvement in disability score on Roland–Morris Disability scale and pain scores after the intervention (p< 0.001). This improvement, on both scales, was persistent throughout the follow up period. Conclusions: Treating multiple-level osteoporotic spinal compression fractures by Percutaneous Vertebroplasty is considered an effective method to improve clinical outcomes regarding pain and mobility of these patients.

© 2014 Egyptian Journal of Neurosurgery. Published by MEDC. All rights reserved
didn’t show clinical improvement with medical treatment and physiotherapy. Patients clinically presented mainly with pain and disability. Pain was assessed pre- and post-injection on visual analogue scale (VAS). Higher scores indicated more severe pain and limitation of mobility. Pre-procedural disability was assessed through the Roland–Morris Disability Questionnaire (RDQ) (on a scale of 0 to 24, with higher scores indicating greater disability). All patients underwent personal history taking, general and neurologic examinations and all were neurologically free.

Radiological investigation included preoperative spine MRI to exclude old fractures (no edema) or neoplasms and plain spinal X-ray. (Fig 1, 2)

Fig. (1): T2-weighted MRI revealing newly unhealed osteoporotic vertebral compression in D12 and L2

Fig. (2): Preoperative and postoperative lateral plain x-ray showing multi-level percutaneous Vertebroplasty

Under fluoroscopic guidance, a twelve or thirteen gauge needle was introduced thorough the pedicle of the desired levels at same time. The needle was introduced till the central part of the vertebra in the lateral fluoroscopic view. A Barium dye was injected through the needles to detect any leakage from defects in the injected vertebral body into the vessels or the epidural space which if occurred will be an indication to abort the procedure. The cement was prepared then mixed with barium dye. The barium dye made the cement
more radiopaque. The cement was injected till the posterior aspect of the vertebra is filled or till the occurrence of extra-osseous extravasation as in the epidural space or the intervertebral disk. If the vertebra was not sufficiently injected another needle is introduced through the other pedicle and the procedure is repeated (Fig. 3).

All patients were assessed postoperatively by full neurological examination, VAS, RDQ and plain x-ray. The patient was followed up direct postoperatively and every 6 month for 18 months.

For comparing categorical data, McNemar test was performed. p values less than 0.05 was considered statistically significant. All statistical calculations were done using computer program SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

The study included 12 patients received percutaneous vertebroplasty in the period from 2011 to 2013. All cases had multi-level injection of cement. Total number of injected levels to all patients included in this study was 48 levels. Levels of vertebral fractures were dorso-lumbar between T8 and L5. Six cases had 4 levels injection, four cases had 3 levels and two cases had 6 levels injection.

Patient’s clinical outcomes regarding Pain which was assessed pre- and postoperatively showed that Mean pain score of the patients before the procedure was 5.8 that showed significant improvement after percutaneous vertebroplasty. The immediate postoperative pain score dropped to 1.6 (SD0.52) (p< 0.001). Improvement of pain continued at interval of 18 month with mean score of 1.8 (SD0.54) (p< 0.001). (Fig 4)

Disability was assessed by comparing the pre- and postoperatively Roland–Morris Disability Questionnaire (RDQ) scores. After intervention, clinical results showed significant improvement of disability at all points of follow-up from direct postoperatively to 18 month compared to pre-injection score (p< 0.001). Scores on the Roland Morris Disability Scale are shown in Fig 5.
Fig. (5): Mean disability score over the study period

There was no major adverse effect after the intervention apart from one case presented with transient fever after the procedure and needed one day hospital stay. No extra-osseous extravasation as in the epidural space or the intervertebral disk, cement embolus to epidural vein or rib fracture was reported in this study.

**DISCUSSION**

Percutaneous Vertebroplasty is worldwide considered an effective minimally invasive treatment for osteoporotic vertebral compression. It stabilizes and strengthens the vertebral body. 17

Initially it was used in cases with single-level osteoporotic compression fractures. Later after the procedures has proven its efficacy and became widely used, it was applied to cases with multiple vertebral levels. Injection of the cement into multiple level fractures can be done in the same session.1,13 This prospective study which included 12 adult patients was aimed to evaluate the clinical results after multiple-level Percutaneous Vertebroplasty for treatment of osteoporotic spinal fractures regarding pain and disability. In this study we used Barium opacified PMMA bone cement which is the most common bone substitute that showed marked rigid vertebral augmentation.2

Obtained clinical outcome was assessed using two frequently applied Questionnaires (RDQ, VAS). Patients with painful osteoporotic vertebral fractures showed improvement of pain after percutaneous vertebroplasty. Pain scores showed significant reduction compared to pre-procedural scores. This was reported direct post-procedural (p< 0.001) and also was reported at the end of follow up interval on 18 month. This improvement was also achieved by L.A. Gray et al., whose series included 101 patients who underwent multiple vertebroplasty procedures with 2-years follow-up period. He mentioned that Mean pain with or without activity showed improvement directly one week after the intervention and at 2-year follow-up.

Regarding disability assessed by Roland–Morris Disability Questionnaire (RDQ) with higher scores indicating greater disability, this study proved significant improvement of disability after the procedures. There was a decrease of Roland–Morris score directly after the intervention from 18.4 pre-intervention to 10.1 and also all through follow-up (p< 0.001). David F. Kallmes et al.8 reported in his series which was conducted on 68 patients who received percutaneous Vertebroplasty for one and more levels that immediate Roland–Morris Disability score showed improvement after the intervention. It was reduced from 16.6 to 7.8 and continued more reduction later in the follow-up.

The results of this study reveals that multiple levels Vertebroplasty can provide favorable outcome and pain relief as single level Vertebroplasty.14 Other reporting series indicates that multiple levels Vertebroplasty is an effective treatment for vertebral compression fractures, regardless of the severity or extent of disease as well as many other reporting series.10

We achieved vertebral filling by cement through unilateral transpedicular approach if the contralateral filling is obtained or through bilateral approach. Ann K. Kim et al.4 mentioned that unipedicular approach allows filling of both vertebral halves and if not, bipediculate vertebroplasty is applied with no statistically significant difference in clinical outcome between both approaches.

In this study preoperative MRI was used to exclude cases with old healed fractures or vertebral compression fractures caused by neoplasms or haemangiomas. None
of the cases in this study had old fractures (more than one year).

Evaluation of clinical outcome of the intervention started directly postoperative as the benefits of vertebral augmentation occur within the early period after the procedure as mentioned in many series. Improvement in pain intensity occurred direct post-intervention and continued along follow-up compared to pre-intervention. Significant differences (expressed by P value) were reported between pain and disability scores before and directly after procedure and at the end of follow-up.

Regarding safety and efficacy of the procedures in this study, we achieved clinical benefit with minimal complications as in other studies that proved percutaneous Vertebraloplasty provides safe and efficient functional outcome.15-18

In this study, one non-critical complication was recorded. It occurred in only one patient presented with transient fever after the intervention which needed one day hospital stay. In David F. Kallmes et al.,8 series he reported that one patient had an injury to the thecal sac during the procedure and was hospitalized. Other studies mentioned complications as extravasation of the cement in the epidural space or the intervertebral disk, nerve root irritation, hemorrhage, rib fracture, cement embolization to epidural vein and infection.17

CONCLUSIONS

Percutaneous Vertebraloplasty is an effective treatment for multiple-level osteoporotic spinal compression fractures. It achieves a favorable clinical outcome and good results with minimal complications.

REFERENCES
18. Tohmeh AG, Mathis JM, Fenton DC, Levine AM, Belkoff SM: Biomechanical efficacy of unipedicular versus bipedicular vertebroplasty for

Egyptian Journal of Neurosurgery