

The Role of Vertebroplasty in Steroid-Induced Vertebral Osteoporotic Fractures

Ayman M Ismail, MD. †, Hossam Eldeen Mohamed Gad, MD. ††

†Neurosurgical Department, Faculty of Medicine, Zagazig University Hospital, Al Sharqia, Egypt.

††Orthopedic Department, Kafr El-Sheikh University Hospital, Kafr El-Sheikh, Egypt.

ABSTRACT

Background Data: Glucocorticoid-induced osteoporosis is a well-known significant health problem worldwide that causes morbidity and mortality. Glucocorticoid-induced vertebral compression fracture is one of the most common types of osteoporotic fractures associated with significant morbidities such as severe agonizing pain, limited mobility, and spinal deformity. Percutaneous vertebroplasty (PV) can be performed in the treatment of refractory back pain in these cases of osteoporotic vertebral fractures (OVFs) without significant complication when conservative treatment fails.

Purpose: To evaluate the clinical and radiographic outcomes of thoracolumbar OVFs treated with PV in adult osteoporotic patients with long-term corticosteroid therapy.

Study Design: Retrospective clinical case series.

Patients and Methods: Twenty-eight patients with painful steroid-induced OVFs underwent vertebroplasty in 61 vertebral levels. Inclusion and exclusion criteria were applied. Preoperatively, all patients were subjected to intensive diagnostic workups, including history taking and clinical and radiological examinations, such as CT scan and MRI. The procedure was guided by C-arm and considered complete when the unfilled area was less than 25% of the vertebral body height in the lateral radiograph. Visual Analogue Scale (VAS) and Oswestry Disability Index (ODI) were used to assess pre- and postoperative back pain and functional status of our patients.

Results: Seventeen patients (60.71%) were males and eleven patients (39.28%) were females. The mean age was 57 ± 5.04 (range, 49–68) years. The mean follow-up of the patients was 38.42 ± 11.16 (range, 24–60) months. Overall, 61 levels were reported including 10 patients (39%) with a single level and 18 patients (61%) with two levels or more as follows: two levels in eight patients, three levels in six patients, four levels in three patients, and one patient with five levels. The most common affected region was the thoracolumbar junction (T11, T12, and L1) in 38.69%. Back pain VAS decreased from 7.29 ± 1.04 before vertebroplasty to 3.25 ± 0.75 one week after vertebroplasty, 1.68 ± 0.66 at 12 months postoperatively, and 3.11 ± 1.13 at final follow-up 24 months postoperatively ($p < 0.001$). ODI improved from 40.82 ± 12.32 (range, 14–66) preoperatively to 16.68 ± 3.19 (range, 10–24) at 12 months postoperatively and 20.92 ± 4.66 (range, 10–30) at final follow-up 24 months postoperatively ($p < 0.001$).

Address correspondence and reprint requests: Hossam M. Gad, MD.

Orthopedic Department, Faculty of Medicine, Kafr El-Shiekh University Hospital, Egypt.

E-mail: hossgad@gmail.com

Submitted: May 15th, 2020.

Accepted: June 26th, 2020.

Published: July, 2020.

The article does not contain information about medical device(s)/drug(s).

No funds were received in support of this work.

The authors report no conflict of interest.

Conclusion: This study suggests that fast and substantial pain relief and quality of life improvement could be achieved after percutaneous vertebroplasty in most patients of glucocorticoid induced osteoporotic vertebral fractures. These improvements could be maintained up to one year, however this effect decline with time due to the progressive nature of the underlying disease.

(2020ESJ209)

Keywords: Osteoporotic vertebral fractures (OVFs); Glucocorticoids; Vertebroplasty; Thoracolumbar spine.

INTRODUCTION

Glucocorticoid-induced osteoporosis is a well-known significant health problem worldwide leading to morbidity and mortality. Glucocorticoid-induced vertebral compression fracture (G-OVF) is a common type of osteoporotic fractures associated with significant morbidities such as severe pain, limited mobility, and spinal deformity.¹ The pathogenesis of steroid-induced osteoporosis is complex, including reduced bone formation and increased bone resorption. The fracture risk in cases of OVFs is mainly related to time and dosage of glucocorticoids (i.e., the higher the dosage and the longer the treatment, the greater the risk).²³

Primary osteoporotic vertebral compression fracture affects mainly the elderly and postmenopausal women,³³ whereas G-OVF affects men more frequently and the affected age group is relatively younger.³⁹ The main presenting symptom in patients with G-OVFs is back pain which is associated in most cases with limited daily activity and kyphotic deformity; however, vertebral height loss is the main radiological sign.³⁵

Patients with glucocorticoid osteoporosis, such as chronic obstructive pulmonary disease, rheumatoid arthritis, and leprosy, cannot tolerate bracing.³⁵ Regardless of the use of corticosteroids, the inflammation itself has a harmful effect on bone remodeling by increasing bone resorption and decreasing the formation. Rheumatoid arthritis alone doubles the vertebral fractures.²⁴ The risk of fractures is increased up to 2.6 and the global prevalence of vertebral fractures in patients receiving long-term glucocorticoids has been reported to be 37%.^{35,36}

Percutaneous vertebroplasty (PV) was introduced in 1987 by Gailbert and Diamond for the treatment of large spinal hemangioma. It is an image-guided minimally invasive procedure through which the polymethylmethacrylate (PMMA) cement is injected into the fractured vertebra.⁷ The surgical metallic fixation of the osteoporotic spine with long-term use of glucocorticoids has usually failed because of poor bone quality and comorbidities that preclude prolonged anesthesia.^{23,39} VP should be considered in patients who suffer from severe persistent pain despite adequate conservative treatment for at least three weeks.²³

This study aims to evaluate clinically and radiographically thoracolumbar OVFs treated with VP in adult osteoporotic patients with long-term use of corticosteroid therapy.

PATIENTS AND METHODS

We retrospectively reviewed the medical records of all subacute cases of OVFs due to long-term use of steroid therapies that underwent operations in the Orthopedic Department, Kafr El-Sheikh University Hospital, and Neurosurgery Department, Zagazig University Hospital, between January 2012 and December 2017. We traced 28 patients with painful OVFs who underwent VP at 61 levels with complete clinical and radiological data. The mean follow-up of the patients was 38.42 ± 11.16 (range, 24-60 months). Inclusion criteria for the current study were as follows: (1) patients recently diagnosed with OVFs due to long-term therapy of corticosteroids and failed medical treatment for 3–6 weeks with persistence of pain; (2) confirmed cases of osteoporosis by Dual Energy X-ray

Absorptiometry (DEXA) with T-score of -2.5 or less; (3) patients with preoperative pain intensity according to Visual Analogue Scale (VAS) ≥ 5 ; (4) levels from T5 down to L5, and patients with incomplete data. On the other hand, exclusion criteria included the following: (1) patients with G-OVFs for more than three months; (2) patients with infection, coagulopathies, tumor, or trauma; (3) those who had a neurological deficit.

Relative contraindications included improved cases on conservative treatment with VAS less than 5, vertebral body collapse more than 75%, posterior vertebral wall destruction involvement (for fear of cement leakage), and any level above T5 because image guidance is difficult due to shoulder shadow, making the procedure unsafe with the risk of cement leakage and neurological deficit, the smaller targets are more difficult to cannulate accurately, and the risk of neurologic damage from needle placement or PMMA migration increases.

Preoperatively, routinely, an intensive diagnostic workup was performed in all patients. It included medical history, clinical assessment including VAS for the back pain and ODI for functional status, and radiological examination such plain radiographs, CT scan, and MRI. MRI thoracolumbar spine was essential for diagnosing recent fractures (vertebral edema), excluding malignant lesions, and detecting canal compromise.

Surgical Technique

Patients were placed prone on a radiolucent table, and the procedure was performed under local anesthesia and sedation. Under C-arm guidance in anteroposterior (AP) and lateral views, a large Jamshidi needle, typically 10 or 11 G for lumbar and 8 G for thoracic vertebra with a beveled tip, was used to puncture the fractured vertebra through the pedicles. The needle moves parallel to the superior and inferior edges of the pedicle or in a slightly descending course through the pedicle. The needle was advanced toward the anterior third of the vertebral body under fluoroscopic guidance; it needed 5 to 7 minutes to mix the radiopaque

cement to be ready and inject into the vertebral body using small 1 cc insulin syringes or a cement gun under continuous fluoroscopic monitoring (Figures 1 and 2).

In most cases, between 3 to 4 mm cement has been used (3 to 4 insulin syringes) per level. The procedure was terminated immediately if cement reached the posterior quarter of the vertebral body or if significant leakage into the disc space occurred. If the unfilled area was more than 25% of the vertebral body height in the lateral radiograph, another needle was inserted from the contralateral side with the needle aiming at the unfilled area. The procedure was considered complete when the unfilled area was less than 25% of the vertebral body height in the lateral radiograph. Skin closure was done using single sutures (Figure 3).

Postoperatively, following PVP, the patient was kept in the supine position in bed for 4 hours and after that, could ambulate with assistance and a postoperative X-ray was performed. The patient was observed and discharged on the same day.

Postoperative Outcome Evaluation

Clinical Assessment. All patients were evaluated at our outpatient clinic at 1 week, 6 weeks, 6 months, 1 year, and 2 years postoperatively or as recommended in complicated patients. Overall back pain and functional status (quality of life) were assessed with VAS and ODI, respectively, and any neurological or systemic complications were reported.

Radiological Evaluation. Postoperative plain radiographs and CT-scans were used to measure the anterior vertebral height of cemented vertebrae, the quantity of bone cement used, cement extravasation, and new level vertebral fractures.

Statistical Analysis

Collected data were statistically compared using tests from the Statistical Package for the Social Sciences (SPSS) program version 17 (Chicago, Illinois, USA). Analysis of Variance (ANOVA) test was used and p value ≤ 0.05 is considered significant.

RESULTS

Twenty-eight patients, with 61 levels, were retrospectively included in this study. Seventeen patients (60.71%) were males and 11 patients (39.28%) were females. The mean age was 57 ± 5.04 (range, 49–68) years. Ten patients (39%) had a single level and 18 patients (61%) had two levels or more (2 levels in 8 patients, 3 levels in 6 patients, 4 levels in 3 patients, and 5 levels in 1 patient) (Table 1). Treated levels were distributed nonuniformly from T5 to L5, and 24 (39.33%) of the 61 fractures occurred at the thoracolumbar junction (T11 to L1) (Table 2). The patient with the affected five levels was contagious and managed in consecutive sessions. The mean cement volume was 3.58 ± 0.557 mm (range, 3–5.8 mm) cement per vertebra.

Sixteen patients (57%) had previously sustained at least one fragility fracture, and 43% were actively receiving osteoporosis treatment (primarily oral bisphosphonates) at the time of entry into the study. All patients had previously received systemic steroid medications for at least 6 months, and 61% were currently taking steroids.

The preoperative mean anterior vertebral body height was 17.22 ± 2.10 and increased to 17.57 ± 2.80 one month postoperatively;

Table 1. Number of vertebral segments affected per patient.

Level affected	Number			Total number
Single level	10 patients (10 levels)			28 patients (61 levels)
Multiple levels	2 levels	8 patients	18 patients (51 levels)	
	3 levels	6 patients		
	4 levels	3 patients		
	5 levels	1 patient		

the difference was statistically insignificant ($p = 0.408$). Pain assessed by the VAS significantly decreased from 7.29 ± 1.04 before vertebroplasty to 3.25 ± 0.75 one week after surgery ($p < 0.001$) and improved to 3.11 ± 1.13 at the final follow-up (Table 3) ($p < 0.001$). ODI improved significantly from 40.82 ± 12.32 (range, 14–66) preoperatively to 25.64 ± 5.22 (range, 16–36) postoperatively ($p < 0.0001$) and 20.92 ± 4.66 (range, 10–30) at the final follow-up ($p < 0.0001$) (Tables 4 and 5).

Asymptomatic cement extravasation was seen in 7 levels (11, 47%). Four of the 7 leaks were in adjacent disc spaces, and each leak had been anticipated preoperatively based on the recognition of endplate disruption as seen on preoperative CT. Two small leaks in the anterolateral segmental vein were detected intraoperatively but did not embolize or preclude the completion of the procedure. Another small ventrolateral soft-tissue leak was detected on scans made a week postoperatively. No cement leak was symptomatic. There were no significant relationships between cement extravasation and the quantity of cement used, the number of levels augmented, and other locations (thoracic or lumbar) ($p > 0.05$ for all comparisons). No serious complications were reported in this study, except for one case of wound infection and another case of postoperative radiculopathy, both relieved by medical treatment.

Table 2. Demographics of the most common region.

Level	Single	Multiple	Total	%
T5	1	4	5	8.19%
T6	-	1	1	1.63%
T7	1	3	4	6.55%
T8	1	3	4	6.55%
T9	-	1	1	1.63%
T10	1	5	6	9.83%
T11	1	6	7	11.47%
T12	1	8	9	14.75%
L1	1	7	8	13.11%
L2	1	3	4	6.55%
L3	1	4	5	8.19%
L4	1	4	5	8.19%
L5	-	2	2	3.27%
Total	10 levels	51 levels	61 levels	100%

Table 3. Pain assessed by Visual Analogue Scale (VAS) and function by Oswestry Disability Index (ODI).

Parameters	Preoperative	1 week postop	6 weeks postop	6 months postop	12 months postop	24 months postop
VAS*	7.29 ± 1.04 (5–9)	3.25 ± 0.75 (2–5)	3.17 ± 0.77 (2–6)	2.21 ± 0.57 (1–3)	1.68 ± 0.66 (1–3)	3.11 ± 1.13 (1–5)
ODI**	40.82 ± 12.32 (14–66)	25.64 ± 5.22 (16–36)	NA	NA	16.68 ± 3.19 (10–24)	20.92 ± 4.66 (10–30)

*Pre- versus all postoperative $p < 0.000$

**Pre- versus all postoperative $p < 0.000$

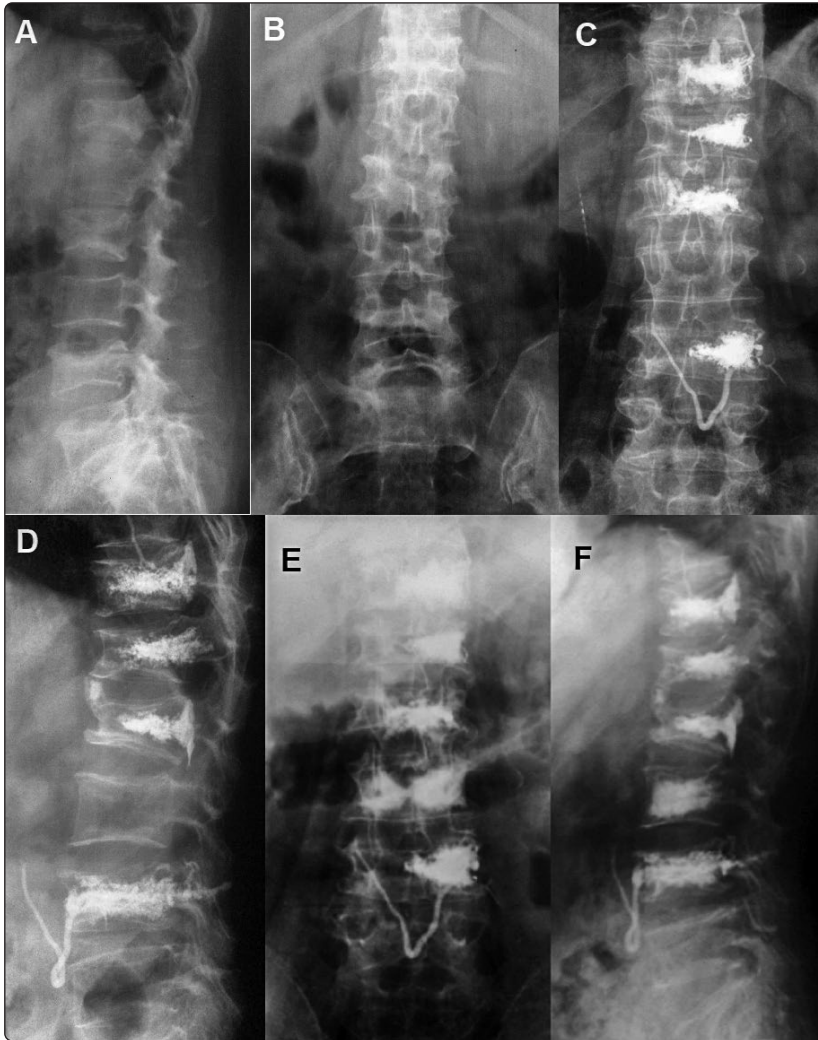


Figure 1. A 54-year-old female with chronic rheumatoid taking glucocorticoid medications had OVFs of different levels with severe pain and did not respond to conservative treatment for 4 weeks. (A,B) X-ray lateral and AP views of the lumbosacral spine revealed 4 OVFs (D12, L1, L2, and L4). (C,D) X-ray AP and lateral views of the same patient showed vertebroplasty with unilateral segmental vessel embolization at L4 with no adverse effects. (E,F) X-ray AP and lateral views one year later with continuous glucocorticoid medication, she came complaining of severe LBP opposite L3, and we did another vertebroplasty for L3.

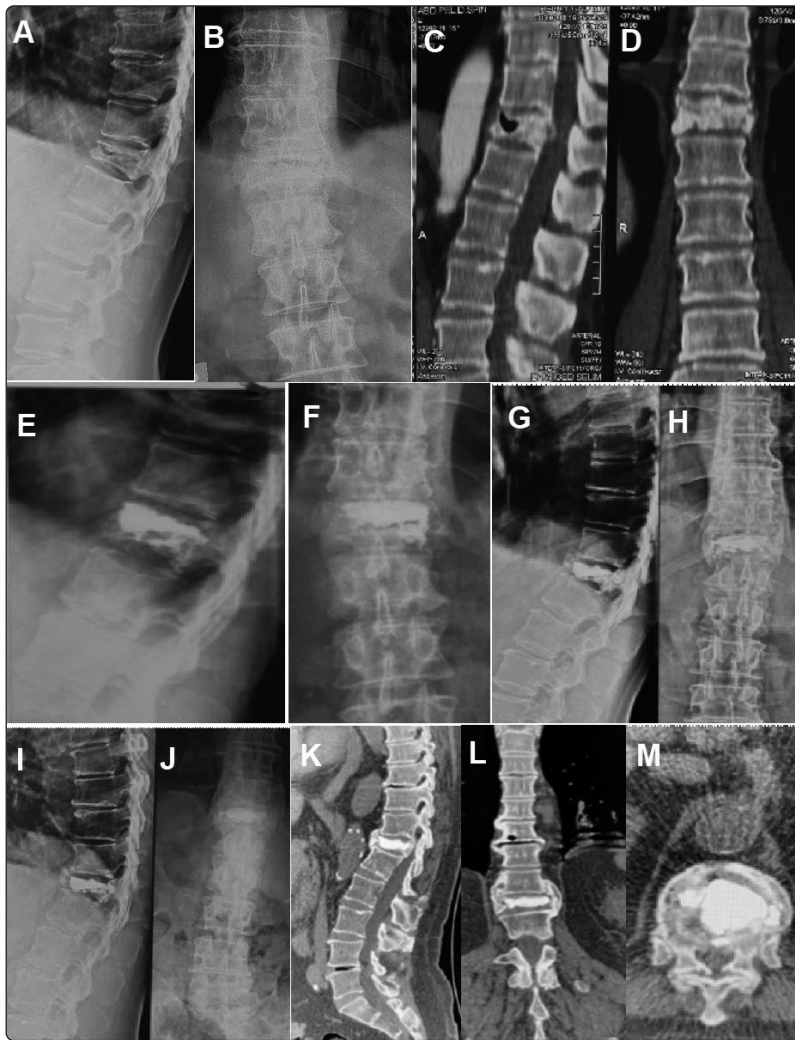


Figure 2. A 64-year-old glucocorticoid-dependent male patient with chronic asthmatic bronchitis developed OVF in T12 and vertebroplasty has been conducted with 5-year follow-up. (A,B) X-ray AP and lateral views of the thoracolumbar spine revealed OVF of T12. (C,D) CT for the same patient after one month of medical treatment with severe pain and he became bedridden. (E,F) X-ray AP and lateral views immediately after VP for T12. (G,H) X-ray AP and lateral views at one-year follow-up after VP for T12. (I,J) X-ray AP and lateral views at five-year follow-up after VP for T12. (K,L,M) CT scanning of the same patient at five-year follow-up after VP for T12.



Figure 3. A 58-year-old lady with long-term use of glucocorticoid treatment for leprotic lesions developed OVF opposite T8 and medical treatment with rest for 2 months was applied and then she developed further severe pain following minor trauma in the same area when MRI was performed to show three levels of OVFs, for which we conducted VP. (A) X-ray lateral view of the dorsal spine revealed OVF of T8. (B,C) MRI sagittal view of the patient 2 months later with 3 levels affected T8-T9-T10. (D,E) X-ray anteroposterior and lateral views of the dorsal spine after VP of these levels.

DISCUSSION

Glucocorticoid-induced OVs are one of the most common types of osteoporotic fractures in clinical practice but have received little attention. It has been estimated that up to 17% of OVs in the population can be attributed to the chronic oral corticosteroids use, even at small doses as low as 2.5 mg per day.⁶ One of the most possible side effects of the usage of glucocorticoids is the trabecular bone mass loss.^{11,28}

Back pain at different intensities is the main presenting symptom in all patients of G-OVs. Mild-to-moderate degree of pain in cases of acute vertebral osteoporotic fracture can be relieved by bed rest, bracing, analgesics, anti-osteoporotic drugs (bisphosphonates or denosumab), and anabolic drugs as tripartite (Forteo);^{23,38} however, advanced cases with compression fractures mostly need intervention.²³ PV should be considered in patients who suffer from severe persistent pain even after at least three weeks of conservative treatment.^{1,23}

Twenty-eight patients (17 males and 11 females) with 61 vertebral levels were treated with PV. The mean age was 62.50 ± 7.09 years, which is consistent with the literature reporting that patients of osteoporotic spine due to long-term use of corticosteroid therapy treated with PV were significantly younger and more likely to be males compared to those with primary osteoporosis.^{23,30} Severe persistent back pain was the main presenting symptom in all patients in the current study; the pain was assessed using VAS which was significantly ($p < 0.001$) decreased from a mean of 7.29 ± 1.04 preoperatively to a mean of 3.17 ± 0.77 6 weeks postoperatively, which is in agreement with most studies addressing the same issue.^{23,30}

Although in this study, a significant decrease of VAS was observed at the final follow-up at 24 months compared to preop VAS value, we reported a significant increase of VAS value at the final follow-up compared to that at 12 months; this final increase of VAS was mainly due to the

nature of secondary osteoporosis, maintenance of corticosteroids in high dose, and the newly developed vertebral compression fractures during the two-year follow-up.

The efficacy of vertebroplasty in OVs in relieving pain and improving the functional status has been discussed in many studies with reported effectiveness up to 90%.²³ The mechanisms of pain relief following PV include the following: stopping vertebral micromotion which could be achieved by cement injection and stabilization of microfractures^{20,40} and cement polymerization process, which can lead to a high temperature sufficient to cause protein denaturation, cell necrosis, and nerve ablation.^{5,13}

In this study, ODI improved significantly from a mean of 40.82 ± 12.32 (14–66) preoperatively to a mean of 16.68 ± 3.19 (10–24) at 12 months postoperatively and 20.92 ± 4.66 (10–30) two years postoperatively ($p < 0.000$), consistent with other similar studies.²³

Although PV has a successful overall outcome in the literature, it is associated with some local and systemic complications with an overall rate of $< 1\%$ in those osteoporotic fractures.³ The most common complications are cement leakage beyond the vertebral body margins, into vascular and surrounding structures, new levels of vertebral compression fractures, pulmonary distress, and infection.¹⁷ Patients with steroid-induced OVs experienced the same degree of significant pain relief and complications after PVP as those not receiving corticosteroids.²³

Cement Leak

In clinical practice, leakage is more common and frequent in pathological osteolytic vertebral fractures, and mostly the cement leak noticed in steroid-induced osteoporotic OVs is local and asymptomatic^{16,30}; however, it could be serious in cases of extravasation into the vertebral canal or the neural foramen in large volume causing cord or nerve root compression.^{18,38}

Many factors are controlling the percentage of cement leak during VP, such as the volume and viscosity of the cement, vertebral bone status, the

pressure used, and even the operator. Jima et al.¹⁴ reported cement leak in 8% of PVP procedures in cases of VCFs, while Yang et al.⁴⁰ noticed an overall higher percentage of cement leakage up to 36.44%.

In this study, asymptomatic cement extravasation was seen in 7 of the 61 levels treated (11.49%), which is comparable to other series²³ with a reported cement leakage rate of 13.51% into the disc space and the paravertebral tissue. Four of the 7 leaks were in adjacent disc spaces and two small leaks into an anterolateral segmental vein, detected intraoperatively but did not embolize the operation, and the procedure was finished smoothly. Another small anterolateral soft-tissue leak was detected on the postoperative scan. No cement leak was symptomatic or serious.

In general, the presence of cortical disruption, the amount of PMMA bone cement and its viscosity are important independent risk factors for the occurrence of cement leak^{13,18} but severe vertebral fracture with marked height loss and the presence of vertebral clefts are specific risk factors for intradiscal cement leak.³¹

The mean volume of the injected cement was 3.58 ± 0.557 ml (range, 3–5.8 ml), and this correlated with most studies reporting that a volume of about 3 ml of cement was enough to alleviate the associated pain.^{19,25}

Hitwatashi et al.¹⁰ found that the volume of the injected cement may also be important when discussing the leakage; the more the volume, the more the risk of leakage, especially with low-viscosity cement. Although low-viscosity cement is good for spreading into the trabecular bone, the risk of extravasation is high. In contrast, higher-viscosity cement forms a more solid mass with more trabecular disruption but reduces leakage incidence; therefore, cement with doughy consistency and medium viscosity is recommended. Still, in cases of severe types of fractures with cortical disruption, the high viscosity one is the solution to minimize cement leak.⁴⁰ Intradiscal cement leakage should be avoided because there is an association between

adjacent level compression and intradiscal cement leak.^{12,29}

New Vertebral fracture

The occurrence of new OVF's in patients of steroid-induced vertebral fractures was discussed widely; some clinical studies^{11,24,36} reported an increased incidence of new OVF's following vertebroplasty and others^{15,23} stated that the rate is the same without a difference.

Koch et al.²³ and others^{9,15} reported that patients with G-OVF's experience levels of pain relief and development of new fractures after PV similar to those with primary osteoporotic vertebral fractures. There was another study²⁸ stating that adverse effects on bone are mainly due to underlying autoimmune or inflammatory disorders. The previous results support the use of PV to treat OVF's unresponsive to conservative management in patients receiving long-term corticosteroid therapy.

Numerous studies in the literature suggest a higher rate of new vertebral fractures after vertebroplasty in G-OVF's compared to those not using steroids.^{11,24,30,36} Syed et al.³⁶ reported that the rate was twice that of patients not taking steroids and others studies stated that the incidence of newly developed vertebral fractures increased by approximately 30%–50% in patients using corticosteroids for more than 3 months, which is consistent with the rate in our study indicating that new vertebral fractures developed in 39% of the patients. Steinbuch et al.³⁵ demonstrated that the increased rates of symptomatic new vertebral fractures were closely associated with higher dosages, longer durations, and continuous usage of glucocorticoids rather than the procedure of vertebroplasty; Kaji et al.¹⁶ observed that the risk of fractures for the same bone mineral density (BMD) was higher in G-OVF's than in postmenopausal or senile osteoporosis.

Due to the nature of secondary osteoporosis and the maintenance usage of large doses of corticosteroids in our patients, it is expected to find new vertebral compression fractures in a high percentage during the follow-up and we also

reported a mild increase of the VAS value and ODI at final 24-month follow-up after they were being decreased at 12 months postoperatively (VAS was 1.68 ± 0.6 and 3.11 ± 1.13 at 12 months and 24 months; ODI was 16.89 ± 3.15 and 21.20 ± 0.914 at 12 and 24 months postoperatively, resp.).

Moreover, the effects of PV to the adjacent nonaugmented levels in patients with G-OVFs were also discussed in detail. Some clinical studies^{8,26} reported an increased rate of new OVFs after vertebroplasty due to the pressure created by the stiffness of the cemented vertebrae on the adjacent ones and others^{22,31} demonstrated that there was no relation and excluded PV from the risk factors for new OVFs and they developed with conservative treatment. The mechanical effects of vertebroplasty on injured and adjacent vertebrae may also be influenced by the characteristics of the treated spine, such as BMD, the type, fracture severity, and disc degeneration.²² Therefore, PV is not a risk factor for new osteoporotic vertebral compression fracture, which occurs even with conservative treatment.²²

In summary, vertebroplasty is generally a safe and effective procedure to control pain associated with fractures of the spinal column. Many complications can occur and are likely to pass underreported or without serious effect. Proper technique can minimize the risk of PMMA migration. The learning curve should be moderately quick and safe if physicians familiarize themselves with these axioms. Due to the progressive nature of the disease, the effect of PV decline with time in patients with G-OVFs.

Large prospective, randomized, controlled studies with long-term follow-up are important and warranted for proper evaluation of the procedure for G-OVFs and to report any possible complications from cement-bone junction reaction, new and recurrent vertebral fractures. Minimizing PV complications depends on the following factors: good selection of the patients, good learning curve, high radiologic resolution, and proper cement polymerization state.

CONCLUSION

This study suggests that fast and substantial pain relief and quality of life improvement could be achieved after percutaneous vertebroplasty in most patients of glucocorticoid induced osteoporotic vertebral fractures. These improvements could be maintained up to one year, however this effect decline with time due to the progressive nature of the underlying disease.

REFERENCES

1. Adami G, Saag KG: Glucocorticoid-induced osteoporosis: 2019 concise clinical review. *Osteoporosis International* 30:1145–1156, 2019
2. Cao L, Yang S, Jiang M, Lin B, Yin X, Zhong N, et al: Clinical analysis of vertebroplasty in the treatment of vertebral compression fractures. *Int J Clin Exp Med* 11(4):3786–3792, 2018
3. Chandra RV, Meyers PM, Hirsch JA, Abruzzo T, Eskey CJ, Hussain MS, et al: Vertebral augmentation report of the standards and guidelines committee of the society of Neuro Interventional surgery. *J Neuro Interven Surg* 6:7–15, 2014
4. Chen D, An ZQ, Song S, Tang JF, Qin H: Percutaneous vertebroplasty compared with conservative treatment in patients with chronic painful osteoporotic spinal fractures. *J Clin Neurosci* 21(3):473–477, 2014
5. Deramond H, Wright NT, Belkoff SM: Temperature elevation caused by bone cement polymerization during vertebroplasty. *Bone* 25:17S21S, 1999
6. Donnan PT, Libby G, Boyter AC, Thompson PH: The population risk of fractures attributable to oral corticosteroids. *Pharmacoepidemiol Drug Saf* 14:177–186, 2005

7. Galibert P, Deramond H, Rosat P, Le Gars D: Preliminary note on the treatment of vertebral angioma by percutaneous acrylic vertebroplasty. *Neurochirurgie* 33:166–168, 1987
8. Hassan K, El-Sharkawi M: Chronic painful osteoporotic vertebral compression fractures of thoracolumbar spine: percutaneous vertebroplasty versus conservative management among Egyptian patients. *Egy Spine J* 14:4–14, 2015
9. Heo DH, Chin DK, Yoon YS, Kuh SU: Recollapse of previous vertebral compression fracture after percutaneous vertebroplasty. *Osteoporos Int J* 20:473–480, 2009
10. Hiwatashi A, Moritani T, Numaguchi Y, Westesson PL: Increase in vertebral body height after vertebroplasty. *AJNR Am J Neuroradiol* 24:185–189, 2003
11. Hiwatashi A, Westesson PL: Patients with osteoporosis on steroid medication tend to sustain subsequent fractures. *AJNR Am J Neuroradiol* 28:1055–1057, 2007
12. Hiwatashi A, Ohgiya Y, Kakimoto N, Westesson PL: Cement leakage during vertebroplasty can be predicted on preoperative MRI. *American Journal of Roentgenology* 188(4):1089-1093, 2007
13. Hyeun SK, Sung HK, Chang J, Seok WK, Sung ML, Ho S: The role of bone cement augmentation in the treatment of chronic symptomatic osteoporotic compression fracture. *J Korean Neurosurg Soc* 48:490–495, 2010
14. Jim AY, Salas VM, Loschiavo RG: Management of painful osteoporotic vertebral compression fractures: vertebroplasty and kyphoplasty. *Operative Techniques in Orthopedics* 13(3):222–226, 2003
15. Kao FC, Hsu YC, Wu CH, Wang CB, Tu YK, Liu PH: Use of corticosteroids is not associated with repeated vertebroplasty or kyphoplasty within one year after the surgery in patient older than 50 years: *Acta Orthopaedica et Traumatologica Turcica* 51:459–465, 2017
16. Kaji H, Yamauchi M, Chihara K, Sugimoto T: The threshold of bone mineral density for vertebral fracture in female patients with glucocorticoid-induced osteoporosis. *Endocr J* 53:27–34, 2006
17. Kallmes DF, Comonthstock BA, Heagerty PJ, Turner JA, Wilson DJ, Diamond TH, et al: A randomized trial of vertebroplasty for osteoporotic spinal fractures. *N Engl J Med* 361:569–579, 2009
18. Kaufmann TJ, Jensen ME, Ford G, Gill LL, Marx WF, Kallmes DF: Cardiovascular effects of polymethylmethacrylate use in percutaneous vertebroplasty. *Am J Neuroradiol* 23:601–604, 2002
19. Kaufmann TJ, Trout AT, Kallmes DF: The effects of cement volume on clinical outcomes of percutaneous vertebroplasty. *AJNR Am J Neuroradiol* 27:1933–1937, 2006
20. Kim AK, Jensen ME, Dion JE, Schweickert PA, Kaufmann TJ, Kallmes DF: Unilateral transpedicular percutaneous vertebroplasty: initial experience. *Radiology* 222:737–741, 2002
21. Kim BS, Hum B, Park JC, Choi IS: Retrospective review of procedural parameters and outcomes of percutaneous vertebroplasty in 673 patients. *Interv Neuroradiol* 20:564–575, 2014
22. Klazen CAH, Venmans A, de Vries J, Van Rooij WJ, Jansen FH, Blonk MC, et al: Percutaneous vertebroplasty is not a risk factor for new osteoporotic compression fracture result from VERTOS 11. *AJNR Am Neuroradiol* 31:1447–1450, 2010
23. Koch CA, Layton KF, Kallmes DF: Outcomes of patients receiving long-term corticosteroid therapy who undergo percutaneous vertebroplasty. *AJNR Am J Neuroradiol* 28:563–566, 2007

24. Lems WF, Jahangier ZN, Jacobs JW, Bijlsma JW: Vertebral fractures in patients with rheumatoid arthritis treated with corticosteroids. *Clin Exp Rheumatol* 13:293–297, 1995
25. Liebschner MA, Rosenberg WS, Keaveny TM: Effects of bone cement volume and distribution on vertebral stiffness after vertebroplasty. *Spine (Phila Pa 1976)* 26: 1547–1554, 2001
26. Lin EP, Ekholm S, Hiwatashi A, Westesson PL: Risk factors of new compression fractures in adjacent vertebrae after percutaneous vertebroplasty. *Acta Radiol* 45:440–445, 2004
27. Linville DA: Vertebroplasty and kyphoplasty. *South Med J* 95:583–587, 2002
28. Migita K, Iwanaga N, Imadachi S, Jiuchi Y, Izumi Y, Yoshika Tsuji Y, et al: Incidence of symptomatic vertebral fractures among newly diagnosed autoimmune diseases initiating glucocorticoid therapy. *Medicine* 94:e875, 2015
29. Mirovsky Y, Anekstein Y, Shalmon E, Blankstein A, Peer A: Intradiscal cement leak following percutaneous vertebroplasty. *Spine* 31:1120–1124, 2006
30. Naganathan V, Jones G, Nash P, Nicholson G, Eisman J, Sambrook PN: Vertebral fracture risk with long-term corticosteroid therapy—prevalence and relation to age, bone density, and corticosteroid use. *Arch Intern Med* 160:2917–2922, 2000
31. Nieuwenhuijse MJ1, Bollen L, van Erkel AR, Dijkstra PD: Optimal intravertebral cement volume in percutaneous vertebroplasty for painful osteoporotic vertebral compression fractures. *Spine (Phila Pa 1976)* 37(20):1747–1755, 2012
32. Omid-Kashani F, Samini F, Hasankhani EG, Kachooei AR, Toosi KZ, Golhasani-Keshtan F: Does percutaneous kyphoplasty have better functional outcome than vertebroplasty in single level osteoporotic compression fractures? A comparative prospective study. *Journal of Osteoporosis* 18:1–5, 2013
33. Philips FM: Minimal invasive treatment of osteoporotic vertebral compression fractures. *Spine* 28(s):45–53, 2003
34. Sallam H, Galal AF, Rashed A: Menopause in Egypt: past and present perspectives. *Climacteric* 9(6):421–429, 2006
35. Steinbuch M, Youket TE, Cohen S: Oral glucocorticoid use is associated with an increased risk of fracture. *Osteoporosis Int* 15: 323–328, 2004
36. Syed MI, Patel NA, Jan S, Shaikh A, Grunden B, Morar K: Symptomatic refractures after vertebroplasty in patients with steroid-induced osteoporosis. *AJNR Am J Neuroradiol* 27:1938–1943, 2006
37. Theodorou DJ, Theodorou SJ, Duncan TD, Garfin SR, Wong WH: Percutaneous balloon kyphoplasty for the correction of spinal deformity in painful vertebral body compression fractures. *Clin Imaging* 26:1–5, 2002
38. Venmans A, Klazen CA, Lohle PN, Van Rooij WJ, Verhaar HJ, De Vries J, et al: Percutaneous vertebroplasty and pulmonary cement embolism: results from VERTOS II. *AJNR Am J Neuroradiol* 31(8):1451–1453, 2010
39. Wong PYS, Mok CC: Management of glucocorticoid-related osteoporotic vertebral fracture. *Osteoporosis and Sarcopenia* 6:1–7, 2020
40. Yang CT, Hou SM, Hou CH, Lin FL, Lin CC, Yang RS: Does the complication rate and treatment effect of balloon Kyphoplasty and vertebroplasty differ in countries or specialties of operators? *Formosan Journal of Musculoskeletal Disorders* 2:79–84, 2011

الملخص العربي

دور رأب العمود الفقري في كسور هشاشة عظام الفقرات التي يسببها الستيرويد

البيانات الخلفية: هشاشة العظام المستحثة بالجلوكوكورتيكويد هي مشكلة صحية كبيرة معروفة في جميع أنحاء العالم قد تسبب الاعتلال والوفاة. الكسر الانضغاطي الفقري الناجم عن الجلوكوكورتيكويد هو أحد أكثر أنواع كسور هشاشة العظام شيوعًا والتي ترتبط بأمراض كبيرة مثل الأمراض المسببة للألم الشديد ، ومحدودية الحركة ، وتشوه العمود الفقري. ان إجراء جراحة رأب العمود الفقري عن طريق الجلد يمكن استخدامه بكفاءة وفعالية في حالات G-VFs لعلاج آلام الظهر المقاومة دون مضاعفات كبيرة عندما يفشل الحل التحفظي ولا يمكن إجراء التثبيت بواسطة المسامير.

الغرض: التقييم السريري والإشاعي لكسور العمود الفقري الصدري و القطني التي يتم علاجها عن طريق جراحة رأب العمود الفقري عن طريق الجلد في مرضى هشاشة العظام البالغين الذين يعانون من أمراضهم العلاج لها بالكورتيكوستيرويد لفترة طويلة.

تصميم الدراسة: سلسلة الحالات السريرية بأثر رجعي.

المرضى والطرق: خضع ثمانية وعشرون مريضاً يعانون من كسور بالفقرات نتيجة هشاشته مستحثة باستخدام الستيرويد لعملية رأب العمود الفقري في واحد وستين مستوى من مستويات العمود الفقري. تم تطبيق معايير التضمين والاستبعاد. قبل الجراحة ، يتم إجراء الفحوصات التشخيصية المكثفة في جميع المرضى بما في ذلك التاريخ والفحص السريري والإشعاعي والمسح المقطعي. في بعض الأحيان ، يتم إجراء التصوير بالرنين المغناطيسي للعمود الفقري الصدري والقطني لفحص العظام. وتتم الإجراءات الموجهة بواسطة السي آر إم لتحديد درجة الحشو المقبولة. و قد تم اعتبار الإجراء مكتملاً عندما كانت المساحة الخالية أقل من 25% من ارتفاع الجسم الفقري في الصورة الأشعاعية الجانبية.

النتائج: سبعة عشر مريضاً من الذكور (60.71%) و 11 مريضاً من الإناث (39.28%) متوسط العمر (57±5.04) 49-68 سنة مع واحد وستين مستوى متأثراً ، عشرة مرضى (39%) بمستوى واحد وثمانية عشر مريضاً (61%) بمستويين أو أكثر على النحو التالي (مستويان في ثمانية مرضى ، ثلاثة مستويات في ستة مرضى ، أربعة مستويات في ثلاثة مرضى ومريض واحد فقط بخمس مستويات). كانت المنطقة المصابة الأكثر شيوعًا هي المنطقة الصدرية القطنية (T11,T12,L1) في (38.69%) ، انخفض الألم الذي تم تقييمه بواسطة VAS بشكل ملحوظ ($P<0.001$) من متوسط $VAS:7.29 \pm 1.04$ قبل رأب العمود الفقري إلى متوسط $VAS 3.25 \pm 0.75$ أسبوع واحد بعد جراحة العمود الفقري ، والمتوسط $1.68 + 0.66$ - في 12 شهرًا بعد الجراحة) ، ومتوسط 3.11 ± 1.13 في المتابعة النهائية بعد 24 شهرًا بعد الجراحة. في الدراسة الحالية ، تحسن مؤشر أوزويستري ODI بشكل ملحوظ من متوسط ODI قبل العملية: 40.75 ± 12.35 الى متوسط 16.89 ± 3.15 بعد الجراحة في 12 شهرًا بعد الجراحة و 21.20 ± 0.914 في النهاية بعد 24 شهرًا بعد الجراحة ($P<0.000$ مهم للغاية)

الخلاصة: تم ملاحظة تخفيف الآلام بشكل سريع وكبير وتحسين جودة الحياة بوضوح بعد جراحة رأب الفقرات (PV) ، وتم الحفاظ على هذه التحسينات لمدة تصل إلى عام واحد في معظم الحالات بعدها تقل كفاءه العلاج لتطور المرض. يمكن إجراء PV بكفاءة وفعالية في حالات كسور هشاشة العظام التي يسببها الستيرويد لعلاج آلام الظهر الشديدة دون مضاعفات كبيرة.