Management of Painful Spinal Lesions Caused by Multiple Myeloma Using Percutaneous Acrylic Cement Injection


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Background and purpose: Spinal lesions with marked destruction are common site of morbidity in patients with multiple myeloma causing serious clinical symptoms. The aim of the study was to evaluate the therapeutic benefit of percutaneous vertebroplasty (PVP) in treating vertebral body lesions in patients suffering from multiple myeloma.

Materials and methods: Twenty nine patients (55 vertebral bodies) were treated after complete diagnostic evaluation, preparation and obtaining informed consent. Needle position and acrylic material injection was performed under fluoroscopic guidance.

Results: Average visual analogue score dropped from 7.8 before to 2.3 after the intervention. Soft tissue leak was present at 9 treated levels, small epidural cement collection at 5, venous leak at 4 and intradiscal leak at 3 levels without any clinically manifest complications. The effects of PVP were stable in all of the patients at 12 months follow-up. Subjective outcome scores collected through follow-up showed improvement of +1.45 in pain, + 1.15 in ambulation and + 1.23 in medication use. There were recurrence of back pain in 9 patients at non-treated levels due to the new lesions.

Conclusion: In our series, PVP of painful lesions caused by multiple myeloma provides immediate and long-term pain relief. The procedure is safe and, despite of the present leakage of cement, may be performed on outpatient basis.

Key words: percutaneous vertebroplasty, back pain, multiple myeloma

INTRODUCTION

Multiple myeloma is a tumor of b-cell origin. It is estimated that the bones are involved at presentation in 70% to 100% of patients. The resorption of bone is caused by stimulating osteoclasts via osteoclast-activating factors. Spinal lesions with marked destruction are common site of compression fractures in patients with multiple myeloma due to osteoporosis which results from both the molecular pathophysiology of the disease and frequent use of corticosteroids in the medical management of the disease. Conservative treatment includes analgesic medication, radiotherapy and cytotoxic drugs. Surgical management generally involves vertebrectomy and fixation. The effects of conservative treatment are limited and surgical procedures are connected with significant postoperative morbidity and mortality. In the past several years, the technique of percutaneous acrylic cement injection – percutaneous vertebroplasty (PVP) has been developed for the treatment of painful osteolytic vertebral lesions. The aim of our study was to evaluate the therapeutic benefit of PVP in treating vertebral body lesions in patients suffering from multiple myeloma.
All of the patients were using oral analgesics on a four to six hour schedule and in 8 of them parenteral pain killers were necessary as well (Table 2.).

Patients with intense, deep pain and imaging evidence of vertebral destruction were selected for PVP. All patients were previously examined by MR of the spine using standard T1w, T2w and STIR sequences. Routine laboratory tests, systemic, neurological and cardiologic examinations were performed. The patients were examined by the interventional radiologist in prone position using firm manual compression on the vertebras at diseased levels. The increase in pain during that maneuver was a strong predictor of the efficacy of PVP. Finally, symptomatic levels were identified by correlating the clinical data with magnetic resonance imaging findings of marrow signal changes consistent with compression fractures.

After obtaining the informed consent of the patient the evaluation questionnaire was filled. The pain was evaluated with a verbal version of the visual analog scale in the range: 1 = none, 10 = worst. Ambulation was evaluated with a five-point scale: 1=normal, no pain, 2=normal, with pain, 3=limited, with pain, 4=wheelchair, and 5=bedridden.

<table>
<thead>
<tr>
<th>Ambulation (n=29)</th>
<th>Before vertebroplasty</th>
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</tr>
</thead>
<tbody>
<tr>
<td>bedridden=5</td>
<td>3(10.4%)</td>
<td>1(3.4%)</td>
</tr>
<tr>
<td>wheelchair = 4</td>
<td>19(65.5%)</td>
<td>1(3.4%)</td>
</tr>
<tr>
<td>limited, with pain=3</td>
<td>4(13.8%)</td>
<td>5(17.3%)</td>
</tr>
<tr>
<td>normal, with pain=2</td>
<td>2(6.9%)</td>
<td>12(41.4%)</td>
</tr>
<tr>
<td>normal, no pain =1</td>
<td>1(3.4%)</td>
<td>10(34.5%)</td>
</tr>
<tr>
<td>Main score</td>
<td>3.7</td>
<td>2.0</td>
</tr>
</tbody>
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The level of medication usage was determined as one of the following: a) none, b) nonsteroidal anti-inflammatory drugs, c) oral narcotic therapy or d) intravenous narcotic therapy.

The procedures were performed under local anesthesia and conscious sedation. One gram of antibiotic was administered intravenously for infection prevention.

The PVP procedures were performed in a prone position of the patients, on the angiography table. An 11-gauge or 13-gauge needle (Mendec spine needle, TECRES S.p.a., Verona, Italy) was advanced into the vertebral body using down-the-barrel technique and transpedicular approach as the option of choice. Intercostovertebral approach was used as an alternative in 7 levels. Bilateral needle placement was performed in 39 and single needle puncture in 16 vertebral bodies. Beveled type needles were preferred. Under fluoroscopic control, the tip of the needle was positioned on the junction between anterior quarter of vertebral body (lateral projection) and the posterior. If monopedicular approach was used the tip was placed in the midline.

A 69 YEAR-OLD FEMALE WITH MULTIPLE MYELOMA. SAGITAL MR IMAGE SHOWS SIGNAL CHANGES DUE TO ACUTE LESIONS OF AFFECTED VERTEBRAL BODIES D10, L1 AND L2, THAT WERE COLLAPSED AND VERY PAINFUL.
The cement was prepared in the application system (Mendec spine kit, TECRES, S.p.a., Verona, Italy) and after 60-120 seconds injection started. The injection was terminated when the degree of vertebral body filling was estimated to be adequate or if leakage into surrounding structures was observed. In case of early venous leak, the needle was slightly repositioned and, after 30 seconds delay, injection continued.

Patients were observed at radiology dept. for two hours and then transferred to the ward or discharged home for 24-hours bed rest. Postprocedural assessment was done after 24 hours, one week, three months, six months and one year. The same questionnaire as used before the intervention was used for postinterventional evaluation.

Subjective outcome scores were collected through the follow-up and compared with preoperative status for pain, ambulation and medication used: +2 indicates total improvement, +1 some improvement, 0 no change, -1 worse (Table 3.).

RESULTS
Total of 55 diseased vertebral bodies (17 dorsal and 38 lumbar) in 29 patients were treated. In 5 patients 3 vertebral bodies were injected during the same procedure, in 16 of them 2 and in the 8 only one. No more then 3 vertebral bodies were treated at the same time. In all of the patients procedures were done under local anesthesia and conscious sedation.

Mean amount of injected cement per vertebral body was 3.4 ml. There were no clinically manifest complications. Soft tissue leak was present at 9 treated levels, small epidural cement collection at 5, venous leak at 4 and intradiscal leak at 3 levels.

Average VAS score after the intervention was 2.3 in our patients group. One week after the intervention 10 of them were completely pain free, there were significant pain reduction in 17, no changes in 2 and none of the patients experienced worsening of the symptoms (Figure 1).

Six and 12 month follow-up are available in all patients. The effects of PVP were stable in all of them. There were recurrence of back pain in 9 patients at non treated levels due to the new lesions.

FIGURE 3.
UNDER FLUOROSCOPIC GUIDANCE, 11 GAUGE NEEDLES WERE PLACED INTO VERTEBRAL BODIES D10 AND L1 USING LEFT TRANSSPEDICULAR, AND INTO VERTEBRAL BODY L2 USING RIGHT TRANSSPEDICULAR APPROACH. AP PROJECTION SHOWS THAT THE NEEDLE TIP IS IN THE MIDLINE OF ALL TREATED VERTEBRAL BODIES.

FIGURE 4.
LATERAL PROJECTION SHOWS THE NEEDLE TIPS IN THE ANTERIOR THIRD OF THE VERTEBRAL BODIES.
Surgical interventions based on spine stabilization with or without vertebrectomy may be performed when there is only one site of the disease which is most frequently not the case because of multifocal nature of the disease.

Radiotherapy alone or associated with surgery or medication, may give partial or complete relief of pain in more than 90% of patients.9

The technique of PVP has widened the indication spectrum and is used for treating aggressive hemangiomas, metastases and myelomatous lesions of the spine.5,6,9,10

Pain relief is the most important advantage of PVP in myeloma patients. This pain is frequently resistant to conventional treatment. Cortet et al.11 performed PVP in 29 patients with metastases and 8 with multiple myeloma finding excellent pain relief. Significant pain relief was achieved in our patients group (average VAS score from 7.8 before PVP to 2.3 after the intervention).

The analgesic effect of cement injection could be explained by several factors: in situ immobilization of bone microfractures, vascular, chemical and thermal forces. So, mechanical forces and induced inflammatory reaction probably can explain initial clinical improvement.12

It is more difficult to explain these effects on short and mid term follow up because of the associated radiation therapy.9,13 The important fact is that no other therapy compromised the effects of PVP.

The aim of PVP is not to make an attempt to restore lost vertebral height or correct the resultant spinal deformity and that was not the aim in our patients as well. Kyphoplasty is a relatively new technique for cement augmentation of the vertebra which is reported to restore lost vertebral height in 56%.13

**TABLE 2**

<table>
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<td>None</td>
<td>1(3,4%)</td>
<td>10(34,5%)</td>
</tr>
<tr>
<td>NSAID</td>
<td>21(72,4%)</td>
<td>17(58,7%)</td>
</tr>
<tr>
<td>Oral narcotic</td>
<td>3(10,4%)</td>
<td>1(3,4%)</td>
</tr>
<tr>
<td>Intravenous narcotic</td>
<td>4(13,8%)</td>
<td>1(3,4%)</td>
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</tbody>
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**FIGURE 5.**

AP RADIOGRAPHY OBTAINED AFTER CEMENT INJECTION SHOWS GOOD FILLING OF THE CENTRAL PARTS OF THE VERTEBRAL BODIES AT EACH TREATED LEVEL.

**FIGURE 6.**

LATERAL VIEW SHOWS SMALL VENTRAL EPIDURAL CEMENT LEAK AT LEVEL L1. NO NEUROLOGICAL COMPLICATION RESULTED. EXCELLENT PAIN RELIEF.

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It is only to be expected that to have an important effect on pain we should fill the vertebra as much as possible with cement. In fact it is difficult to correlate precisely vertebral filling with success\textsuperscript{14,15}. The degree of lesion filling varied because of variations in distribution of acrylic cement within diseased vertebral body. The average amount in our patients was 3 ml. This is in accordance with the reported results where the absence of an important link between relief of the pain and the amount of cement has not been established. On the contrary, in some patients, despite what appeared to be insufficient lesion filling, excellent clinical and functional results were obtained\textsuperscript{16}. Destruction of vertebral body in multiple myeloma may be very extensive and include vertebral cortex. We do not consider that situation as contraindication for PVP except if there is compression on spinal cord or nerves which is larger than 1/3 of AP diameter of spinal canal. In all other cases it is possible to manipulate the needle during injection and to control the injection. For that reason it is better to use beveled tip needles in such patients because with needle rotation it is possible to change the direction of the injection. Also, in our experience, it is much easier if needle rotation it is possible to manipulate the needle during injection that it is noticed early. In these patients the injection should be stopped for 30 seconds giving the cement time to become more viscous, the needle slightly repositioned and the injection continued. Intradiscal leak should be avoided because it may cause radicular pain. In our patients it was present at 3 treated levels (5.8%) (Figures 2,3,4,5,6). The principal risk of PVP is the leak into the spinal canal or foramina which may lead to compression and possible thermal damage. It may be seen in 11-73% of neoplastic lesions\textsuperscript{16}. In our series mild epidural leak was seen at 9.09% and was clinically silent. Open surgical decompression in combination with vertebroplasty or surgically controlled PVP has been advocated by some workers to overcome the difficulty of leakage in vertebroplasty\textsuperscript{18}. The absence of significant neurological complications rate in our series as well as in others make this maneuvers unnecessary. The insertion of thick viscous cement into a performed cavity during kyphoplasty has been reported to result in a lower rate of cement extravasation in patients with osteoporotic vertebral compression fractures\textsuperscript{19}. Dudeny et al.\textsuperscript{14} reported only 4% of cement extravasation on 55 treated levels using kyphoplasty. Nevertheless, the patients with burst type of fracture with retropulsed bone are not candidates for PVP.

**CONCLUSION**

In our patients series, PVP of painful lesions caused by multiple myeloma provided immediate and long-term pain relief. The procedure is safe and, despite of the present leakage of cement, may be performed on outpatient basis. It can be combined with other therapeutic modalities.

**SYMMARY**

**KONTROLA BOLNIH LEZIJA KIČME PROUZROKOVANIH MULTIPLIM MIELOMOM PRIMENOM PERKUTANO APLIKOVANOG AKRILNOG CEMENTA**

Podaci i cilj rada: spinalne lezije sa izraženom destrukcijom kosti su česta lokacija u bolesnika sa multiplim mielomom što dovodi do ozbiljnih kliničkih simptoma. Cilj ove studije je evaluacija terapijskog efekta perkutane vertebroplastike (PVP) u tretmanu leziija pršljenstkih tela u bolesnika obolelih od multiplog mieloma. Bolesnici i metode: Dvadeset devet bolesnika (55 pršljenstkih tela) tretirano je nakon kompletne dijagnostičke obrade, pripremi i obezbedjenja pristanka na intervenciju. Pozicioniranje igle i ubrizgavanje akrilnog cementa vršeno je pod kontrolom fluoroskopije. Rezultati: Prošćena vrednost vizuelno analognog skora smanjena je sa 7,8 pre na 2,3 posle intervencije. Curenje cementa u mека tkiva bilo je prisutno na 9 tretiranih nivoa, manje epiduralne količine cementa na 5, pojava cementa u pervertebralnim venama u 4 te u intervertebral-
nim diskusima u 3 nivoa bez kliničkih manifestacija. Efekti PVP su bili stabilni u periodu praćenja od 12 meseci. Subjektivna procena ishoda intervencije pokazala je poboljšanje od 1,45 (bol), 1,15 (pokretljivost) i 1,23 (korišćeni lekovi). Bol u ledjima se ponovo javio u 9 bolesnika usled pojave novih lezija na nivoima koji nisu tretirani.

Zaključak: U našoj seriji, PVP bolnih lezija uzrokovanih multiplim mielom obezbedila je neposredno i dugotrajno obezboljavanje. Procedura je sigurna a, uprkos prisustvu cementa, može biti izvodjena u ambulantnih bolesnika.

Ključne reči: perkutana vertebroplastika, bol u ledjima, multipli mijelom

REFERENCES