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Clinical Study

Clinical and radiographic results of balloon kyphoplasty for treatment of vertebral body metastases and multiple myelomas

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A R T I C L E   I N F O

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Multiple myeloma
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A B S T R A C T

Kyphoplasty is a minimally invasive procedure that is used to augment vertebral body strength. This technique has been commonly used to treat osteoporotic, vertebral body compression fractures. The technique was also used to augment painful metastatic vertebral fractures. The objective of this study was to review the clinical and radiological results after kyphoplasty in patients with vertebral body compression fractures due to spinal metastasis and multiple myeloma and to determine factors that may affect outcome. Thirty-one patients had 41 vertebral body fractures secondary to spinal metastasis or multiple myeloma. A kyphoplasty procedure was performed on 39 levels. The pain and neurological status were evaluated using the visual analogue scale (VAS) score and the American Spinal Injury Association classification scale scores, respectively. Radiological evaluations were used to measure vertebral body height loss (VBHL) and the segmental kyphosis angle before and after surgery. The major symptoms that patients presented with included pain (25 patients); and neurological deficit (four patients). Two patients presented with no symptoms because the metastases were found during cancer screening. The mean (±standard deviation [SD]) VAS score was 7.2 ± 2.2 before surgery and 1.6 ± 1.3 after surgery. The mean preoperative VBHL was 27.8 ± 11.3% for the thoracic spine and 27.7 ± 12.5% for the lumbar spine. VBHL values were reduced to 22.4 ± 10.0% and 18.4 ± 10.4% for the thoracic and lumbar spine after surgery, respectively. The segmental kyphosis angles decreased from 21.2 ± 11.4° to 17.0 ± 9.8° for the thoracic spine and from 15.3 ± 8.8° to 10.4 ± 7.2° for the lumbar spine after surgery. There was a correlation between the symptom duration and VBHL restoration rate. There was no correlation between the amount of injected polymethylmethacrylate and pain relief. We concluded that kyphoplasty is a safe and effective procedure for treating painful vertebral body fractures caused by metastasis and multiple myeloma. It can restore VBH and correct the kyphosis angle. While the increased amount of the injected PMMA led to its leakage, it did not contribute to restoration of the VBH or kyphosis correction. Therefore, one should avoid injection of excessive amounts of PMMA.

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1. Introduction

One-third of all cancer patients develop spinal metastases, of which 70% are located in the thoracic spine, 20% in the lumbar spine and 10% in the cervical spine. In 85% of patients, the metastases involve the vertebral body. Multiple spinal metastases are seen in 10% to 40% of patients. Breast, lung and prostate cancer represent about 50% of the primary sources for spinal metastases. The survival rate after diagnosis of spinal metastasis is high for patients with hormonally dependent cancers.

Pain is the major symptom for patients with spinal metastases. Progression of a spinal metastasis may result in vertebral body compression fracture, with a risk of spinal cord compression. Conventional therapies for painful spinal metastases include bedrest, bracing and radiation therapy. Radiotherapy may relieve pain; however, it cannot correct spinal deformity. Open surgical approaches can decompress and stabilize the spine and are associated with significant rates of morbidity and mortality. Vertebroplasty and kyphoplasty have been popular techniques used to relieve pain, restore the vertebral body height (VBH), and correct kyphosis.

Vertebroplasty was introduced in the mid-1980s, and kyphoplasty in the 1990s. Galibert et al. first introduced vertebroplasty using injections of a local anesthetic in 1987. Although vertebroplasty was primarily used in the treatment of vertebral angioma, it has become popular for treating painful osteoporotic vertebral body compression fractures. The publication of successful application of vertebroplasty and kyphoplasty for the treatment of osteoporotic vertebral body compression fractures allowed
spine health care specialists to apply these techniques to other pathologies.\textsuperscript{11–13} Lapras et al. were the first to publish the results of vertebroplasty for painful lumbar metastatic lesions.\textsuperscript{14} Kammelen et al. later reported 80% pain relief in 20 patients in a similar study.\textsuperscript{15} Recently Fournier et al. reported 84% pain relief in cancer patients after vertebroplasty and kyphoplasty.\textsuperscript{16}

The publication of reports on the effectiveness and safety of vertebroplasty and kyphoplasty radically changed the management of painful spinal metastases.\textsuperscript{17–20} Nevertheless, questions remain regarding the indications, techniques, biomaterials, optimum dosage of cement, cement leakage-related complications, and factors affecting outcome.\textsuperscript{21–25}

The aims of this study were: (i) to assess the safety and effectiveness of kyphoplasty in the management of patients with spinal tumors; (ii) to examine the radiological results of kyphoplasty; and (iii) to determine the effects of preoperative clinical and radiological parameters on postoperative outcome.

2. Materials and methods

The charts of 31 patients with spinal metastasis (41 fractures and 49 metastases) were reviewed. A kyphoplasty procedure was performed under sedoanalgesia on 39 fractures from the 31 patients.

Preoperative and postoperative clinical and radiological parameters were reviewed (Table 1). All patients were contacted before completion of the study.

Pain severity was assessed using a visual analogue scale (VAS) score. The neurological status was evaluated using the American Spinal Injury Association (ASIA) scale.

Radiological evaluations were carried out on plain thoracic and lumbosacral radiographs and MRI. Postoperative imaging was performed using plain radiographs and thoracic and lumbar CT scans. The number of metastases was determined by MRI using T1-weighted, T2-weighted and diffusion MRI.

In order to detect the vertebral body height loss (VBHL), the expected height of the fractured vertebra was determined. The expected height of the fractured vertebra \( D \) was accepted as the average of the height of the vertebral bodies above \( A \) and below \( B \) the fractured vertebra:

\[
D = \frac{A + B}{2}
\]

(1)

The height of the fractured vertebra \( C \) was then measured and the VBHL was calculated using the following formula:

\[
\text{VBHL} = \left( \frac{D - C}{D} \right) \times 100
\]

(2)

The restoration rate of VBH was determined by:

\[
100 - \left( \frac{\text{postoperative VBH} \times 100}{\text{preoperative VBH}} \right)
\]

(3)

The segmental kyphosis angle, the angle formed by the intersection of lines parallel to the superior endplate of the upper vertebra and the inferior endplate of the lower vertebra, was determined from plain radiographs.\textsuperscript{26,27}

The fracture types, vertebral body posterior wall integrity and evidence of epidural tumor extension were evaluated by MRI and CT scans. Vertebral body fractures were classified as wedge or biconcave.\textsuperscript{28}

For statistical analysis using the Statistical Package for the Social Sciences for Windows version 16.0 software (SPSS, Chicago, IL, USA), the non-parametric test, and Wilcoxon signed rank tests were used. Significance was determined by \( p \) values \( < 0.05 \).

3. Results

There were 17 female and 14 male patients, aged 35 to 78 years (mean: 62.0 years) who had 41 fractures: 22 patients with single level (54.8%); eight with 2 level (25.8%); and one patient with a 3 level fracture (9.6%). There were 49 levels of metastases including: single level in 19 patients (61.2%); 2 level in nine patients (29.0%), and one patient each with 3, 4 and 5 level metastases (3.2%).

The primary pathology was gastric cancer in seven patients (22.5%), breast cancer in six (19.3%), lung cancer in four (12.9%), multiple myeloma in six (19.3%), mesothelioma, lymphoma and colorectal cancer in two patients each (6.4%), and pancreatic cancer and seminoma in one patient each (3.2%).

3.1. Clinical parameters

The major symptoms observed included pain in 25 patients (80.6%) and neurological deficits in four patients (12.9%). Two patients had no symptoms because their metastases were found during cancer screening. The mean symptom duration was 64.5 days (range: 30–180 days) in 29 symptomatic patients. The mean preoperative VAS score was 7.2 ± 2.0 (range: 1–10).

There was no correlation between symptom duration and the VAS score \((p > 0.05; \text{Table 2})\), or between the preoperative VAS score and preoperative VBH \((p > 0.05; \text{Table 3})\).

Complete pain relief was attained in all patients. The mean postoperative VAS score was reduced to 1.6 ± 1.3 (range: 0–3; \( p < 0.001 \)). The postoperative VAS score was 3 in nine patients (29.0%), 2 in seven patients (22.5%), 1 in five patients (16.1%) and 0 in 10 patients (32.2%).

There was a significant difference between preoperative and postoperative VAS scores \((p < 0.05; \text{Table 4})\).

There was a significant difference between the preoperative and postoperative VAS scores in patients with moderate preoperative pain (VAS score < 7) and severe preoperative pain (VAS score > 7; \( p < 0.05; \text{Table 5})\).

The preoperative ASIA scale score was D in 11 patients (35.4%), and E in 20 patients (64.6%). The postoperative ASIA scale score was E in 30 patients (96.8%), and D in one patient (3.2%).

3.2. Radiological parameters

The vertebral body fractures were classified as wedge fractures at 20 levels (48.8%) and biconcave at 21 levels (51.2%).

The vertebral body posterior wall was minimally damaged at 15 levels (38.5%) and was intact at 24 levels (61.5%). Epidural extension was absent from 21 levels (67.7%). Minimal spinal canal inva-

<table>
<thead>
<tr>
<th>Clinical parameters</th>
<th>Radiological parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, gender</td>
<td>Number of metastases</td>
</tr>
<tr>
<td>Symptomatology</td>
<td>Type of fracture</td>
</tr>
<tr>
<td>Symptom duration</td>
<td>Vertebral body posterior bone integrity</td>
</tr>
<tr>
<td>Pain severity</td>
<td>Evidence of epidural tumor extension</td>
</tr>
<tr>
<td>Neurological status</td>
<td>Vertebral body height loss</td>
</tr>
<tr>
<td></td>
<td>Segmental angulation rate</td>
</tr>
<tr>
<td></td>
<td>Vertebral body height restoration rate</td>
</tr>
</tbody>
</table>

Table 1 The studied clinical and radiological parameters in patients with vertebral body metastasis

<table>
<thead>
<tr>
<th>Symptom duration (days)</th>
<th>Preoperative VAS (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–60 ((n = 22))</td>
<td>7.0 ± 2.3</td>
</tr>
<tr>
<td>&gt;60 ((n = 9))</td>
<td>7.8 ± 2.1</td>
</tr>
<tr>
<td>( p &gt; 0.05 )</td>
<td></td>
</tr>
</tbody>
</table>

SD = standard deviation.
Table 3
The relationship between preoperative vertebral body height loss (VBHL) and visual analogue scale (VAS) score

<table>
<thead>
<tr>
<th>Preoperative VBHL</th>
<th>Preoperative VAS (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–25% (n = 7)</td>
<td>7.0 ± 2.3</td>
</tr>
</tbody>
</table>
| >25% (n = 14)     | 7.3 ± 2.0                    | p > 0.05

SD = standard deviation.

Table 4
A comparison (mean ± standard deviation) of preoperative (Pre) and postoperative (Post) visual analogue scale (VAS) scores

<table>
<thead>
<tr>
<th></th>
<th>Pre VAS</th>
<th>Post VAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic</td>
<td>7.0 ± 1.6</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Lumbar</td>
<td>7.3 ± 2.7</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Total</td>
<td>7.2 ± 2.2</td>
<td>p &lt; 0.05</td>
</tr>
</tbody>
</table>

SD = standard deviation, VAS = visual analogue scale.

Table 5
A comparison (mean ± standard deviation) of postoperative (Post) visual analogue scale (VAS) scores between patients with VAS score of less than, and more than, 7

<table>
<thead>
<tr>
<th>VAS range</th>
<th>Pre VAS</th>
<th>Post VAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–7 (n = 13)</td>
<td>5.4 ± 2.4</td>
<td>1.6 ± 1.1</td>
</tr>
</tbody>
</table>
| 8–10 (n = 18) | 8.5 ± 0.7 | 1.3 ± 1.2 | p < 0.05

Table 6
A comparison (mean ± standard deviation) of pain relief in patients with and without epidural tumor extension

<table>
<thead>
<tr>
<th>Epidural tumor extension</th>
<th>Preoperative VAS (mean ± SD)</th>
<th>Postoperative VAS (mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent (n = 29)</td>
<td>7.4 ± 2.2</td>
<td>1.3 ± 1.4</td>
</tr>
</tbody>
</table>
| Present (n = 10)         | 7.0 ± 1.8                     | 2.0 ± 1.1                    | p > 0.05

SD = standard deviation, VAS = visual analogue scale score.

Table 7
A comparison (mean ± standard deviation) of the preoperative (Pre) and postoperative (Post) radiological parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pre</th>
<th>Post</th>
<th>p level</th>
</tr>
</thead>
<tbody>
<tr>
<td>VBHL (thoracic)</td>
<td>27.8 ± 1.3</td>
<td>22.4 ± 10.0</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>VBHL (lumbar)</td>
<td>27.7 ± 12.5</td>
<td>18.4 ± 10.4</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>VBHL (total)</td>
<td>27.8 ± 11.4</td>
<td>20.2 ± 10.3</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Kyphosis angle (thoracic)</td>
<td>21.2 ± 11.4°</td>
<td>17.0 ± 9.8°</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Kyphosis angle (lumbar)</td>
<td>15.3 ± 8.8°</td>
<td>10.4 ± 7.2°</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Kyphosis angle (total)</td>
<td>18.0 ± 10.3°</td>
<td>13.4 ± 9.0°</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Restoration (thoracic)</td>
<td>21.5 ± 18.9°</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Restoration (lumbar)</td>
<td>36.7 ± 28.0°</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SD = standard deviation, VBH = vertebral body height loss.

Table 8
The relationship between symptom duration and vertebral body height (VBH) restoration rate (mean ± standard deviation)

<table>
<thead>
<tr>
<th>Symptom duration (days)</th>
<th>VBH restoration rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–60 (n = 22)</td>
<td>34.3 ± 27.0</td>
</tr>
<tr>
<td>&gt;60 (n = 9)</td>
<td>16.9 ± 9.3</td>
</tr>
</tbody>
</table>

Table 9
The relationship between preoperative (Pre) visual analogue scale (VAS) range and vertebral body height (VBH) restoration rate (mean ± standard deviation)

<table>
<thead>
<tr>
<th>Pre VAS range</th>
<th>VBH restoration rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–7 (n = 13)</td>
<td>28.1 ± 19.9</td>
</tr>
<tr>
<td>8–10 (n = 18)</td>
<td>25.0 ± 24.1</td>
</tr>
</tbody>
</table>

There was no correlation between preoperative VAS score and the VBH restoration (p > 0.05; Table 9).

In 15 patients, 5 mL of PMMA was injected, and more than 6 mL was injected in 24 patients. There was no correlation between the amount of injected PMMA and pain relief (p > 0.05; Table 10).

There was also no correlation between the amount of injected PMMA and VBH restoration rate, or between the amount of injected PMMA and kyphosis correction rate (p > 0.05; Table 11).

3.3. Assessment of cement leakage

Asymptomatic polymethylmethacrylate (PMMA) leakage was observed at 13 levels (33.3%). There was minimal epidural leakage at four levels (12.9%), minimal leakage into the upper intervertebral disc at two levels (6.4%), minimal leakage into the lower intervertebral disc at four levels (12.9%), and leakage into the paravertebral muscles at three levels (9.6%).

There was a correlation between the amount of injected PMMA and cement leakage in the thoracic vertebrae (p < 0.05) but not with the lumbar vertebrae (p > 0.05; Table 12).

4. Discussion

The results of this study confirmed that patients with spinal metastases and myeloma can adequately tolerate kyphoplasty. Kyphoplasty provided statistically significant improvement in pain severity, vertebral body height and segmental kyphosis. The results obtained in our study are, in general, consistent with previously published studies.
Since the main indications for vertebroplasty and kyphoplasty include pain and vertebral body compression fractures, most studies have focused on results related to these symptoms and signs.

### 4.1. Pain relief

Pain is a major symptom of spinal metastasis and multiple myeloma. There is a lack of information about the relationship between pain and other symptoms and signs. This study revealed no correlation between pain and other signs and symptoms including symptom duration, VBHL, epidural tumor extension, and tumor progression.20

Pain relief has been reported to be affected by the type of disease (osteoporosis vs. tumor), type of procedure (vertebroplasty vs. kyphoplasty), the extent of the tumor, and the aggressiveness of the indications (procedure use in relatively and absolutely contraindicated patients).

The analgesic effects and complication rates of vertebroplasty and kyphoplasty have been reviewed in a small number of meta-analyses. Gill et al.31 reviewed 21 published studies including 14 vertebroplasty (91,046 patients) and seven kyphoplasty (263 patients) series. They reported that the difference in early pain relief between the two treatment types was not significant. Similar results were also reported by others.25,32,33 However, all these studies reported that kyphoplasty produced a more positive profile of pain relief within and without spinal epidural tumor extension after the procedure. Analysis of the results of this study revealed no significant differences between postoperative VAS scores in patients with and without epidural tumor extension (p > 0.05). This study revealed that injecting a larger amount of PMMA tended to provide a better, but statistically insignificant, amount of pain relief (p > 0.05).

### 4.2. Deformity and correction

Loss of VBH in both osteoporotic and metastatic vertebral fractures results in kyphosis, and the resultant forward displacement of the center of gravity appears to increase the risk of subsequent vertebral fractures at adjacent levels.28,37 This study revealed mean VBHL of 27.8 ± 11.3% and 27.7 ± 12.5% for the thoracic and lumbar vertebrae, respectively. The preoperative kyphosis angles were 21.2 ± 11.4° and 15.3 ± 8.8° for the thoracic and lumbar spine, respectively. The increased degrees of VBHL and angulation for thoracic vertebrae may be due to natural thoracic kyphosis.

Kyphoplasty not only restores VBH effectively, but may also correct deformity and, subsequently, the center of gravity.16,38,39 To some extent, vertebroplasty may also restore VBH.40–42 However, kyphoplasty provides better VBH restoration. Most of the height gained after kyphoplasty occurs in the midbody, and greater correction over longer regions of the spine can be achieved with multilevel kyphoplasty procedures and is proportional to the number of levels addressed.20

Height restorations of 0–90% and angular corrections of 0–180° have been reported after vertebroplasty and kyphoplasty for metastases and myelomas.16,27,30,43–46 These results are commonly less satisfying than those reported for osteoporotic fractures.16,27,40,45,47,48

The lack of a standard measurement technique and the presence of magnification-related errors make comparison of results

### Table 10

A comparison of preoperative (Pre) and postoperative (Post) pain relief by visual analogue scale (VAS) scores (mean ± standard deviation) and amount of injected polymethylmethacrylate (PMMA)

<table>
<thead>
<tr>
<th>PMMA (mL)</th>
<th>Lumbar</th>
<th>Thoracic</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre VAS</td>
<td>Post VAS</td>
<td>Pre VAS</td>
</tr>
<tr>
<td>3–5</td>
<td>8.7 ± 0.9</td>
<td>2.2 ± 1.5</td>
<td>6.6 ± 2.0</td>
</tr>
<tr>
<td>6–9</td>
<td>6.9 ± 2.9</td>
<td>1.2 ± 1.4</td>
<td>7.1 ± 1.3</td>
</tr>
</tbody>
</table>

### Table 11

A comparison of the amount of injected polymethylmethacrylate (PMMA) and vertebral body height (VBH) restoration rate (mean ± standard deviation, SD), and between the amount of PMMA injected and kyphosis correction rate (KCR) (mean ± SD)

<table>
<thead>
<tr>
<th>PMMA (mL)</th>
<th>VBH restoration rate</th>
<th>KCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3–5 (n = 15)</td>
<td>31.1% ± 29.1%</td>
<td>3.5 ± 2.0°</td>
</tr>
<tr>
<td>6–9 (n = 24)</td>
<td>29.0 ± 23.9%</td>
<td>4.6 ± 3.9°</td>
</tr>
</tbody>
</table>

\( p < 0.05 \) \( p > 0.05 \)

### Table 12

A comparison of a small number of meta-analyses with multilevel kyphoplasty procedures and is proportional to the number of levels addressed.20

Since the main indications for vertebroplasty and kyphoplasty include pain and vertebral body compression fractures, most studies have focused on results related to these symptoms and signs.

### Table 13

Comparison of pain relief rate reported in the literature after vertebroplasty and kyphoplasty performed for spinal metastasis and myeloma

<table>
<thead>
<tr>
<th>Year</th>
<th>No. patients</th>
<th>No. levels</th>
<th>Pathology</th>
<th>Procedure</th>
<th>Pain relief (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>199626</td>
<td>37</td>
<td>40</td>
<td>29 Met + 8 MM</td>
<td>PVP</td>
<td>75</td>
</tr>
<tr>
<td>199626</td>
<td>37</td>
<td>52</td>
<td>Met</td>
<td>PVP</td>
<td>73</td>
</tr>
<tr>
<td>199711</td>
<td>37</td>
<td>40</td>
<td>29 Met + 8 MM</td>
<td>PVP</td>
<td>97.3</td>
</tr>
<tr>
<td>200336</td>
<td>56</td>
<td>97</td>
<td>35 Met + 21 MM</td>
<td>65 PVP +</td>
<td>84</td>
</tr>
<tr>
<td>200337</td>
<td>32</td>
<td>87</td>
<td>24 Met + 8 MM</td>
<td>32 KP</td>
<td>75</td>
</tr>
<tr>
<td>200337</td>
<td>21</td>
<td>27</td>
<td>Met</td>
<td>PVP</td>
<td>90</td>
</tr>
<tr>
<td>200436</td>
<td>50</td>
<td>50</td>
<td>36 Met + 14 MM</td>
<td>PVP</td>
<td>82</td>
</tr>
<tr>
<td>200618</td>
<td>14</td>
<td>19</td>
<td>10 KP + 6 MM</td>
<td>10 PVP</td>
<td>100</td>
</tr>
<tr>
<td>Current study</td>
<td>31</td>
<td>41</td>
<td>25 Met + 6 MM</td>
<td>KP</td>
<td>100</td>
</tr>
</tbody>
</table>

KP = kyphoplasty, Met = metastasis, MM = multiple myeloma, PVP = percutaneous vertebroplasty.
among different series difficult. For instance, the apparent magnitude of height restoration varied nearly four-fold, depending on the reporting method. Therefore, reports on improvement in VBH and kyphotic angle should be interpreted with some caution, as studies have used non-standardized radiographic measurement methods. In this study, VBH was measured with respect to the estimated height of the involved vertebral body. Using this technique, significant VBH restoration was observed (p < 0.05 for thoracic and lumbar vertebrae).

This study also showed that there was a correlation between the preoperative symptom duration and VBH restoration rate. Patients with a symptom duration of less than 60 days showed better VBH restoration than those with a longer duration of symptoms. Therefore, for maximal VBH restoration, a specific kyphoplasty procedure can be recommended during the early stages of the disease.

This study failed to show a correlation between VBH restoration and other parameters such as preoperative VAS score, postoperative VAS score and the amount of injected PMMA. The lack of a correlation between postoperative pain relief and VBH restoration has been reported. Based on the results presented here, it can be concluded that a good, analgesic outcome does not require injection of an excessive amount of PMMA or complete VBH restoration.

4.3. Cement leakage

Cement leakage is the most common complication of vertebroplasty and kyphoplasty. Two major causes of cement leakage are insufficient polymerization of the PMMA cement and excessive injection of cement. It is well-known that cement leakage is more common in vertebroplasty than in kyphoplasty. Furthermore, the incidence of cement extravasation with kyphoplasty and vertebroplasty for metastatic lesions is much higher than that associated with osteoporotic fractures. This may be attributed to the cortical destruction associated with metastatic lesions. The rate of cement leakage reportedly ranged between 8.6% and 10% However, the rate may be even higher, at 37.5% in one study and 72.5% in another. The rate of cement leakage in our study was 33.3% and occurred most commonly in the thoracic vertebrae, suggest that lesser amounts of cement should be injected. The smaller size of the thoracic vertebrae indicates that there is less space available for cement and hence maintaining optimal intravertebral pressure is required for strength.

5. Conclusion

The results of this study indicate that kyphoplasty is an effective procedure for restoring VBH, correcting spinal deformity, and providing pain relief in patients with spinal fractures secondary to metastasis and multiple myeloma. This study demonstrated better VBH restoration in patients with symptom duration less than 60 days. We conclude that for maximal postoperative VBH restoration, kyphoplasty should be performed in the early stages of the disease.

The lack of a correlation between the amount of injected cement and postoperative pain relief, in addition to the likelihood that cement leakage was due to excessive injection of cement, suggests that small amounts of PMMA (<5 mL) can adequately relieve pain.

References


