Cement leakage into the posterior spinal canal during balloon kyphoplasty: a case report

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ABSTRACT

We report a case of cement leakage into the posterior spinal canal due to inadvertent pedicle perforation during balloon kyphoplasty. The leakage was corrected immediately without any sequelae. Features seen on radiography and the minimally invasive procedure used for removal are described. The postoperative radiographs of 100 consecutive patients treated with balloon kyphoplasty were subsequently reviewed. Only one patient had a similar leakage but had no neurological complications.

Key words: bone cements; fractures, compression; spinal canal

INTRODUCTION

Balloon kyphoplasty and vertebroplasty are minimally invasive percutaneous techniques using acrylic cement to stabilise osteoporotic vertebral compression fractures. Balloon kyphoplasty also restores vertebral height and lessens spinal deformity by injecting the cement (polymethyl methacrylate [PMMA]) into a cavity created in the fractured bone by insertion and inflation of a special balloon.\(^1^,\(^2^\)\) Cement leakage can occur in adjacent discs, and anterior, lateral, and posterior to the vertebral body. Leakage is procedure dependent and has been described as high as 25% in balloon kyphoplasty.\(^3^,\(^4^\)\) The high incidence of cement leakage and its associated neurological complications led some to suggest changing the percutaneous approach to an open procedure.\(^5^\) The leakage rate in balloon kyphoplasty is much lower than that seen in vertebroplasty.\(^6^\) We report a case of intra-operative cement leakage into the spinal canal during balloon kyphoplasty and a review of the intra-operative and postoperative radiographs of 100 balloon kyphoplasties for signs of leakage.

CASE REPORT

In November 2005, a 76-year-old woman underwent balloon kyphoplasty of the T11 and T12 vertebrae...
for spontaneous osteoporotic vertebral compression fractures. She had another osteoporotic fracture 3 weeks later at L1 (Fig.1) and underwent a further balloon kyphoplasty using two 20-mm balloons. During surgery, the Jamshidi needle perforated the pedicle medially, and the working channel was inserted too deeply (>2 cm) into the vertebral body. The mal-position was corrected immediately and the working channel was re-inserted 4 to 5 mm anterior to the posterior vertebral margin.

Two balloons were inserted and inflated to 3 ml each with a maximum pressure of 85 PSI using an image intensifier. Because of the earlier pedicle perforation, cement viscosity specifications were followed strictly. The balloons were removed and the cement injected under image intensifier. Leakage of cement into the posterior spinal canal was noted and the injection stopped immediately. The leak was self-contained and formed a distinct ‘plane shape’. With the working channel in situ, the leakage was visualised using oblique radiographs (Fig. 2).

The spinal canal was immediately decompressed using a lateral approach. The pedicle was exposed by making a 3-cm incision followed by blunt transmuscular dissection. The entry canal for the working channel was widened with a rongeur until the cement was seen. The cement was located in the spinal canal adjacent to the dura mater (Fig. 3) and was removed transpedicularly without damaging neural structures (Fig. 4). A radiograph and a computed tomographic scan confirmed its complete removal (Fig. 5).

The total operating time was 65 minutes; cement removal alone took 15 minutes, with most time spent

Figure 1 Radiographs showing an osteoporotic fracture of the L1 and previous balloon kyphoplasty of the T11 and T12 vertebrae.

Figure 2 Anteroposterior and oblique views from the intra-operative image intensifier showing a ‘plane-shaped’ posterior cement leakage.

Figure 3 Intra-operative photograph showing the cement in the spinal canal (arrow) and the dura mater (arrowhead).

Figure 4 The 2-cm long cement leakage.
on locating and documenting the leakage. The patient was able to mobilise immediately, with a Visual Analogue Scale score of 3 at day 2; she recovered without any neurological deficits.

**DISCUSSION**

We considered that the leakage was due to the pedicle perforation or deep insertion of the working channel into the vertebra. To evaluate this mistake, we reviewed radiographs of 100 consecutive balloon kyphoplasties between 2003 and 2004 for signs of posterior leakage. Only one such case, which was not diagnosed during the operation, was identified (Fig. 6). This patient showed no postoperative or long-term neurological complications.

In the 100 balloon kyphoplasties reviewed, the overall leakage rate was 31%. Most leakages were anterior and superior; only 2% were posterior. Most (>80%) leakages were below 3 mm (Table). Leakage rates for balloon kyphoplasty were reported to be as high as 25% (mean, 8%) and for vertebroplasty from 31 to 96% (mean, 40%). The rate is higher in patients with neoplasms with severe vertebral collapse. Our rate, 31%, was high because 24 of the patients had vertebra plana or neoplastic destruction of the vertebrae. Scoliotic deformation and poor-quality osteoporotic pedicles increase the risk of inadvertent pedicle perforation.

In the case report, we decided to remove the cement immediately, via a transpedicular approach, to avoid the extra anaesthesia and surgery required for wider exposure (complete hemilaminectomy or laminectomy). The posterior interspinous ligament and contralateral facet joint remained intact and segmental stability assured. The cement removal alone took only 15 minutes as the cement was extracted by widening the pedicle from the inside.

The postoperative Visual Analogue Scale score of 3 is consistent with other balloon kyphoplasties. It is argued that cement removal was not necessary as there was no evidence of neurological complications, but possible neurological consequences have been reported, despite the risk of leakage after balloon kyphoplasty being minimal.

Alertness to abnormalities in radiological images is necessary to enable intra-operative cement removal. Oblique images help reveal any leakage. As balloon kyphoplasty is usually performed under general anaesthesia, intra-operative cement removal does not further complicate the problem. Most studies recommend general anaesthesia, especially in cases carrying a high leakage risk such as tumours, vertebra plana, or severe fractures.

**CONCLUSION**

Balloon kyphoplasty is a safe technique for stabilising

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**Table**

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<tr>
<td>Disc superior</td>
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<tr>
<td>Disc inferior</td>
<td>9</td>
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<tr>
<td>Lateral</td>
<td>5</td>
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<tr>
<td>Anterior</td>
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<td>Posterior</td>
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<td>Overall</td>
<td>31*</td>
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* Multiple sites possible
vertebral body fractures and restoring the vertebral height. Both our patients with posterior cement leakage had no neurological deficits. Nonetheless, careful intra-operative monitoring is necessary and immediate intervention can be performed easily. Cement removal in our case was quick and easy and did not require an additional open procedure. Further research to define the risk factors for pedicle perforation and cement leakage is needed to help formulate selection criteria for surgery.

REFERENCES