TECHNICAL NOTE

Anterolateral kyphoplasty in the management of cervical spinal metastasis

B. Blondel a,b, T. Adetchessi a, J. Demakakos b, G. Pech-Gourg a, H. Dufour a, S. Fuentes a,∗

a Neurosurgery Department, la Timone Hospital, 264, rue Saint-Pierre, 13005 Marseille, France
b Spine Division, Hospital for Joint Diseases, 301 East 17th Street, New York, NY 10003, USA

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KEYWORDS
Cervical spine; Kyphoplasty; Spinal metastasis; Minimal invasive

Summary Management of spinal metastasis is still controversial and must take into account various parameters. The aim of this study is to report the technical feasibility of a less invasive anterior cervical balloon kyphoplasty for vertebral body reinforcement. Six consecutive patients with an osteolytic cervical metastasis, without neurologic compromise, and for whom a curative treatment was not indicated, were retrospectively reviewed. All patients underwent balloon kyphoplasty through a small anterolateral cervicotomy. Evaluation of the technique outcomes was clinical and radiologic with a systematic CT-scan. During the follow-up period (6 months average), neurologic examination was normal in all cases with reduced cervical pain and without reported loss of motion of the cervical spine. A cement leakage was noticed in two cases without clinical consequences. This less invasive procedure was feasible and provided satisfactory preliminary results. It can therefore be a valuable alternative in selected cases where a curative treatment is not indicated.

Level of evidence: Level IV retrospective observational study.
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Introduction

Surgical management of cervical spinal metastasis can vary from a complete resection to a single neurologic decompression or vertebral body reinforcement in the case of palliative treatment.

In some specific cases, lytic lesions can lead to vertebral body destruction without neurologic deficit and in order to prevent neurological deterioration, a bony reinforcement needs to be achieved. Among the different strategies available, it seems reasonable to choose the more efficient and less invasive for these patients with frequent comorbidities. Cement injection techniques can be interesting alternatives and since its initial description [1], have became increasingly popular [2–4]. In order to prevent the risk of cement leakage, kyphoplasty was then introduced with high satisfactory results in pain management for lumbar metastasis [5–7]. According to these outcomes, indications of
kyphoplasty have been diversified and combined with other minimal invasive procedures [8]. But like any other surgical procedure some risks are associated with kyphoplasty, cement leakage being one of the most important. According to Ryu et al. [9], this risk is higher above T5 and is related to the volume of injected cement. To minimize these risks at the cervical level, an anterior approach associated with a balloon kyphoplasty may be a valuable solution in order to reinforce the damaged vertebral body and for cervical pain relief.

Patients and methods

Study design

Six consecutive patients were retrospectively reviewed (level IV retrospective observational study). Patients were included, after informed consent, when presenting one cervical metastatic lytic lesion between C2 and C7, without neurologic deficit on the initial clinical evaluation. Cement bone reinforcement was done when the cervical lesion was destructive enough to present a risk for the spinal cord by destabilization of the spine and for whom a curative treatment was not indicated. Patients presenting an abnormal neurologic examination, a spinal cord compression or an involvement of the posterior wall of the vertebral body on radiographic evaluation were not considered as candidates for this procedure.

Surgical procedure

Each patient was informed of risks and benefits of the procedure. All the procedures were performed under general anesthesia in the supine position on a radiolucent table. A double control by AP and lateral C-arm was used every time. Approach was a right cervicotomy after a 2 cm skin incision, and once the vertebral body was exposed, the kyphoplasty cannula was introduced through the body cortex under anteroposterior and lateral guidance. A 10 mm kyphoplasty balloon (Kyphon, Medtronic, Minnesota) was then introduced, inflated then deflated in order to create a cavity for cement injection. High viscosity PMMA cement was subsequently injected slowly in the vertebral body under fluoroscopic guidance. When a cement leakage was noticed, injection was immediately stopped.

Conventional wound closure was done without drainage, and no collar or orthosis was prescribed. In one case, a patient was presenting an axis lytic lesion responsible for a pathological fracture and this procedure was therefore preceded by insertion of an anterior screw in order to avoid a displacement of the dens fracture.

Clinical and radiologic evaluation

All patients had a normal neurologic evaluation preoperatively. Subsequent examinations were performed postoperatively and before discharge. Cervical pain was evaluated pre and postoperatively using the Visual Analogic Score.

Figure 1 Preoperative sagittal T1-weighted MRI showing metastatic lesion of the axis, without neurologic compression.

Radiologic evaluation included a cervical CT-scan and MRI in preoperative course in order to confirm the diagnosis, have a precise evaluation of bony lesions, and determine the risk of cement leakage. MRI confirmed the absence of neurological compromise (Fig. 1).

During the postoperative period, a CT-scan was performed the day after surgery in order to verify the absence of leakage and cement disposition in the vertebral body. Further radiographic examinations were adapted to patient condition and evolution of the metastatic disease.

Results

Clinical evaluation

Six patients (three men and three women) with a mean age of 63.5 years (46–73) were included. The involved vertebra was the axis in four cases, C4 and C5 in one case respectively. The cervical lesion was a lytic metastasis, related to breast cancer in two cases, lung cancer in one case, kidney cancer one case and to multiple myeloma in the last two cases. The surgical procedure was uneventful for all the patients and estimated blood loss was always below 200 mL.

Immediate and delayed postoperative neurological examinations were normal in all cases and mean length of hospitalization was 2 days (1–5).

Pain relief was observed immediately after the procedure and mean VAS cervical pain decreased from 80 (60–100) preoperatively to 20 (0–30) on the day of discharge and at last follow-up. Based on clinical examinations, no clinically visible cervical loss of motion was observed nor reported by patients.

Mean follow-up was 10 months (6–20) and during this period, no complication related to the procedure was noted. Two patients died from an evolution of the metastatic disease during the observation period.
Radiographic evaluation

Based on the postoperative CT-scan, filling of the vertebral body with cement was judged satisfactory in every case (Figs. 2 and 3). For the patient with an associated axis screw insertion, positioning of the implant was correct. Concerning the two patients with the lower cervical procedure, no leakage was noted. Two patients out of the four treated for an axis lytic lesion showed cement leakage without clinical consequence. One was in the disc below while the other one was posterior to the C2 vertebral body (Fig. 4). Series data on levels, procedures and cement leakage are summarized in Table 1.

Table 1 Summary of procedures levels and cement leakage.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Gender</th>
<th>Level</th>
<th>Procedure</th>
<th>Cement leakage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Male</td>
<td>C2</td>
<td>Kyphoplasty</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Male</td>
<td>C2</td>
<td>Kyphoplasty</td>
<td>Disc below</td>
</tr>
<tr>
<td>3</td>
<td>Female</td>
<td>C2</td>
<td>Kyphoplasty</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>C2</td>
<td>Kyphoplasty + anterior screw</td>
<td>Posterior</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>C5</td>
<td>Kyphoplasty</td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Female</td>
<td>C4</td>
<td>Kyphoplasty</td>
<td>No</td>
</tr>
</tbody>
</table>

Discussion

Management of patients with spinal metastasis is complex, requires a multidisciplinary approach, and surgical procedures are still controversial. When a curative treatment is not indicated and in the absence of neurologic deficit, surgery will have two main objectives: stabilize the spine and relieve cervical pain. In such cases, due to frequent comorbidities and a limited life expectancy, major surgical procedures may be avoided. Therefore, balloon kyphoplasty can be a valuable alternative.

Such percutaneous procedures have been previously described with more than 90% of pain relief for lumbar metastasis [2–4,10] and a potential for faster recovery than conventional surgery due to minimal muscle damage. Concerning cervical spine, the situation is different due to the increased risk of cement leakage and the
difficulty of a conventional posterior approach. Previous authors have reported results of vertebroplasty in osteolytic cervical lesions [11–13] and a high rate of leakage is noted even if there were no clinical significance. More recently, cervical kyphoplasty has been reported in different case reports [14–16] using various techniques. Surgical approaches vary for axis treatment; some authors have described percutaneous procedures [11,13,16] via an anterolateral access [17] or using a transoral approach [18,19]. The transoral route is the most direct but is associated with more infectious complications [20,21] and cement leakage in prevertebral tissues. On the other hand, using an anterolateral percutaneous approach decreases infectious risk but can lead to a higher risk of vascular and nervous lesions. In our experience, we prefer to utilize a small right anterolateral cervicotomy (2 cm average) in order to decrease the risk of infection for these fragile patients [20]. Additional support for this approach is the reduction of neurologic and vascular risk using a small open incision in contrast to a truly percutaneous kyphoplasty, which will also, require use of general anesthesia. This procedure was indicated in patients with cervical metastasis but without spinal cord compression visible on an MRI and without involvement of the posterior wall of the vertebral body on a CT-scan. Furthermore, during the procedure, we recommend the use of high viscosity and radio-opaque cement in order to secure the injection and to decrease the risk for leakage. Patients with multi-level cervical involvement may be treated on two contiguous levels by the same incision, however we do not have experience on such cases and therefore recommend this procedure for mono-level metastasis.

In our experience, this procedure gave a quick and important pain relief, stable in time without neurologic defects, offering the possibility to start quickly during postoperative course an oncologic therapy. Patients were satisfied with the clinical results and in most cases were discharged from the hospital the day after surgery. Radiologic evaluations showed satisfactory reinforcement of vertebral bodies in all the cases. While there were two cases with leakages these were without clinical significance. This lower rate of leakage, in contrast with vertebroplasty, supports the use of a balloon kyphoplasty in order to inject high viscosity cement in a pre-formed cavity. However, longer follow-up will be needed in order to confirm stability in the time of the results. Furthermore, this technique is not designed to replace conventional curative surgery whenever possible.

Like every technique specific attention must also be paid to the irradiation of the surgeon and the patient [22,23]. Furthermore, a multidisciplinary approach for these palliative patients is always necessary for an optimal therapy.

Conclusions

Cervical kyphoplasty was technically feasible, with satisfactory initial clinical results. It has therefore, for us, a good potential for the management of patients with cervical metastasis for whom conventional surgery is not indicated, in order to prevent vertebral collapse and neurologic disorders.

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

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References