Percutaneous anterolateral balloon kyphoplasty for metastatic lytic lesions of the cervical spine

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Abstract The purpose of our report is to describe a new application of kyphoplasty, the percutaneous anterolateral balloon kyphoplasty that we performed in two cases of metastatic osteolytic lesions in cervical spine. The first patient, aged 48 years, with primary malignancy in lungs had two metastatic lesions in C2 and C6 vertebrae. Patient's complaints were about pain and restriction of movements (due to the pain) in the cervical spine. The second patient, aged 70 years, with primary malignancy in stomach, had multiple metastatic lesions in thoracolumbar spine and C3, C4 and C5 vertebrae without neurological symptoms. The main symptoms were from cervical spine

with severe pain even in bed rest and systematic use of opiate-base analgesis. The preoperative status was evaluated with X-rays, CT scan, MRI scan and with Karnofsky score and visual analogue pain (VAS) scale. Both patients underwent percutaneous anterolateral balloon kyphoplasty via the anterolateral approach in cervical spine under general anaesthesia. No clinical complications occurred during or after the procedure. Both patients experienced pain relief immediately after balloon kyphoplasty and during the following days. The stiffness also resolved rapidly and cervical collars were removed. VAS score significantly improved from 85 and 95 preoperatively to 30 in both patients. Karnofsky score showed also improvement from 40 and 30 preoperatively to 80 and 70, respectively, at the final follow-up (7 months after the procedure). Fluoroscopy-guided percutaneous anterolateral balloon kyphoplasty proved to be safe and effective minimally invasive procedure for metastatic osteolytic lesions of the cervical spine, reducing pain and avoiding vertebral collapse. Experience and attention are necessary in order to avoid complications.

Keywords Cervical spine · Kyphoplasty · Osteolytic lesions · Metastatic lesions

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Introduction

The management of metastatic osteolytic lesions in cervical spine remains controversial. In patients suffering from malignancies, major procedures may be contraindicated and conservative treatment could fail. Percutaneous balloon kyphoplasty (PBK) is a well-established minimally invasive surgical treatment for osteoporotic and osteolytic vertebral compression fractures. This procedure usually

provides significant pain relief and stabilizes the vertebral body.

The purpose of our report is to describe a new application of kyphoplasty, the percutaneous anterolateral balloon kyphoplasty that we performed in two cases of metastatic osteolytic lesions in cervical spine.

Case reports

Between December 2007 and February 2008, we performed two balloon kyphoplasty procedures in cervical spine in two patients suffering from metastatic lesions. The first patient was a 48-year-old male with metastatic lesions of the body of C2 and C6 vertebrae, secondary to metastatic lung cancer. The patient had undergone lobectomy, chemotherapy and local radiotherapy for the primary lesion.

The second patient was a 70-year-old male with multiple metastatic vertebral lesions (C3, C4, C5 and thoracolumbar spine), secondary to an inoperable gastric carcinoma.

Both patients suffered from progressive severe neck pain over a period of 2 months. They were initially treated with opioids, anti-inflammatory medications and rigid neck collars. Despite the intense conservative therapy they had inadequate pain relief. At the time of presentation, clinical examination demonstrated limited range of motions in cervical spine (due to the pain) without neurological deficits (normal strength in all muscle groups and normal sensation). Both patients were evaluated by means of Karnofsky score (40 and 30, respectively) and visual analogue pain scale (VAS) (85 and 95, respectively).

Both patients underwent X-rays, CT scan and MRI scan preoperatively. The initial cervical spine X-ray images showed mild collapse of C2 and C6 vertebral bodies in the first patient and also of C3 and C5 vertebrae in the second patient. Thin-section CT scan revealed osteolytic lesions involving vertebral bodies (Fig. 1a, b). Cervical spine magnetic resonance imaging (MRI) scan showed osteolytic destruction of the vertebral bodies associated with mild

compression fractures that presented as slight hypointensity on T1-weighted (T1-W) images and hyperintensity on T2-weighted (T2-W) images (Fig. 2a, b).

The procedure

Both patients were informed in detail about the indications of the procedure, the risks and benefits of balloon kyphoplasty versus conservative management and were asked to sign a consent form. They received general anaesthesia in the supine position on a radiotransparent operative table. Both patients received three doses of antibiotic (750 mg of cephalosporin) prophylactically. The operation area—with the neck slightly extended—was sterilized with povidone iodine and draped.

The procedure was performed under fluoroscopic guidance via the right anterolateral approach. A small incision of 2 mm was made anterolaterally at the medial point where we felt the carotid pulse. The sternocleidomastoid and the carotid sheath were retracted laterally with the left hand and by feeling the airway with the right hand a pin (Blunt Guide pin, Kyphon Inc) was introduced under fluoroscopy control. At the first contact the pin slipped laterally to the vertebral body and was reintroduced until we feel a creaking (like egg-shell) of the anterior vertebral body cortex. Then we continued with the osteo introducer stylet (Blunt KyphX Osteo Introducer Stylet, Kyphon Inc) the cannula (Cannula Kyphon Inc) and the precision drill (KypheX precision drill, Kyphon Inc). A 10-mm balloon (Kyphon Xpander Inflatable Bone Tamp Kyphon Inc) was then placed into the bone through the cannula and inflated/deflated to create a cavity inside the vertebral body until reduction of the collapsed vertebral body height was obtained (Fig. 3a, b). The PMMA bone cement (KyphX HV-R™, High-Viscosity, Radiopaque, Kyphon Inc) was prepared in a cement mixer (Kyphon Mixer, Kyphon Inc) in room temperature, and 2 ml cement injected in each vertebral body, under continuous control in the lateral and AP projection.

Fig. 1 CT scan of the cervical spine of both patients, showing osteolytic lesions of C2 and C5 vertebral bodies, respectively

Fig. 2 Preoperative MRI scans revealed the metastatic lesions in cervical spine

Fig. 3 Postoperative lateral X-rays

Results

Both patients tolerated the procedure well and no clinical complications occurred during or after the procedure (Figs. 3a, b, 4a, b). There were no neurological problems related to the treated levels. We had clinically asymptomatic cement leakage in one level laterally to C-2 vertebral body (Fig. 5). Both patients experienced pain relief immediately after balloon kyphoplasty and during the following days. The stiffness also resolved rapidly and cervical collars were removed.

VAS score significantly improved from 85 and 95 preoperatively to 30 in both patients. Karnofsky score showed

also improvement from 40 and 30 preoperatively to 80 and 70, respectively, at the final follow-up (7 months after the procedure).

Discussion

Severe neck pain is a common problem in patients with metastatic lesions in cervical spine and usually causes restriction of motions in cervical spine. Conservative treatment with opioids, anti-inflammatory medications, radiation and rigid neck collars provide often inadequate pain relief. It is a general accepted fact that in patients with

Fig. 4 CT scans postoperatively, showing the good distribution of acrylic cement within the vertebral bodies

Fig. 5 CT scan of C2 after kyphoplasty. Limited cement leakage laterally without clinical consequences

malignancies major operations are frequently contraindicated due to limited life expectancy and the significant concomitant comorbidities [3, 8, 12].

PBK is a minimally invasive method for the treatment of pain related to osteoporotic vertebral compression fractures, vertebral metastases, myeloma and aggressive haemangiomas [1, 3]. It is less aggressive procedure than any other open surgical procedure in the cervical spine avoiding arthrodesis or fixation that may reduce the range of motion in cervical spine and giving the patient the ability to discharge from hospital few hours after the procedure [14].

To our knowledge, PBK via the right anterolateral approach for osteolytic metastatic lesions in cervical spine has never been reported. There are only three reports in the literature about the use of balloon kyphoplasty in cervical spine [2, 8, 18]. Monterumici et al. [8] described the transoral kyphoplasty for tumours in C-2 vertebra in three cases. Zapalowicz et al. [18] reported balloon kyphoplasty applied to a C-7 haemangioma. Fransen and Collignon [2] described direct anterolateral balloon kyphoplasty for a painful C-2 osteolytic malignant lesion, but authors performed a minimal invasive approach after a 2-cm skin incision and not a truly percutaneous approach.

We prefer the right anterolateral approach over the transoral approach due to the less frequent complications. The main complications of the transoral approach are infections, and less usually other complications as pharyngeal wound breakdown, meningitis, vertebral artery

injuries and cerebrospinal fistulas [6, 8, 10, 13, 16]. This method usually requires the assistance of otolaryngologist and is limited to the upper cervical spine [8, 10, 16].

The transpedicular approach is particularly very difficult and risky due to the width of the cervical pedicles and the proximity of the vertebral arteries.

Vertebroplasty has been also used in osteolytic lesions in cervical spine [4, 7, 10, 11, 13, 17]. The complication rate for balloon kyphoplasty is significantly lower than that for vertebroplasty. Low rates of cement extravasation in balloon kyphoplasty support the hypothesis that injection of high-viscosity cement into a previously formed cavity is safer than the injection of low-viscosity liquid cement into the vertebral body [5, 9, 15]. In our patients we had cement leak in one level, laterally to C-2 without clinical sequences.

Our patients had a good result regarding pain and functional status. Thermal and chemical effects of the acrylic cement in combination with strengthening and stabilization of the vertebral body are the advantages of the balloon kyphoplasty in osteolytic lesions [12].

Conclusions

Fluoroscopy-guided percutaneous anterolateral balloon kyphoplasty seems to be a safe, quick and effective minimally invasive procedure for metastatic osteolytic lesions of the cervical spine, reducing pain and avoiding vertebral collapse. This new application of kyphoplasty is a challenging approach with low complication rate and feasible in a centre where many PBK are carried out.

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