Percutaneous transpedicular vertebroplasty with PMMA: operative technique and early results
A prospective study for the treatment of osteoporotic compression fractures

Introduction

The technique of percutaneous vertebral cement augmentation with poly(methylmethacrylate) (PMMA) was first introduced as an augmentation procedure for the treatment of vertebral angiomas by Galibert et al. in 1987 [9]. Following encouraging early clinical results, particularly with respect to pain relief, indications for PMMA augmentation were extended and comprise at present the treatment of metastatic osteolytic bone disease, myeloma, and, more recently, osteoporotic compression fractures of the spine as well [6, 8, 11, 18]. Biomechanical studies have shown significant increases in stability parameters following augmentation with PMMA and also calcium phosphate cements [1, 3, 15, 16, 17]. Clinical experiences, however, are still sparse.

This study reports our technique and experience with percutaneous transpedicular vertebroplasty in the treatment of patients suffering from severe disabling focal back pain due to osteoporotic insufficiencies and vertebral compression fractures.

Abstract

Vertebroplasty-percutaneous cement augmentation of osteoporotic vertebrae is an efficient procedure for the treatment of painful vertebral fractures. From a prospectively monitored series of 70 patients with 193 augmented vertebrae for osteoporotic and metastatic lesions, we analysed a group of 17 patients suffering from back pain due to osteoporotic fractures. The reinforcement of 45 vertebral bodies in these patients led to a significant and lasting pain reduction ($P < 0.01$). The presented technique is useful, as, in one session, at least four injections can be performed when required, allowing the prophylactic reinforcement of adjacent vertebrae as well. The use of a low-viscosity poly(methyl methacrylate) (PMMA) in combination with a non-ionic liquid contrast dye provides a reliable and safe procedure. Extraosseous cement leakage was seen in 20% of the interventions; however, none of them had clinical sequelae.

Key words
Vertebroplasty · PMMA · Osteoporosis · Augmentation

Materials and methods

Operative technique

The presented technique allows four injections to be carried out in one session under local anaesthesia, i.e. either four vertebrae unipedically or two vertebrae bipedically.

Patients are placed in a prone position on a radiolucent operating table. An i.v. line is established with an anaesthetist on standby, continuously monitoring the vital signs. Following fluoroscopic localisation of the levels to be augmented, we analyse a group of 17 patients suffering from back pain due to osteoporotic fractures. The augmentation of 45 vertebral bodies in these patients led to a significant and lasting pain reduction ($P < 0.01$). The presented technique is useful, as, in one session, at least four injections can be performed when required, allowing the prophylactic reinforcement of adjacent vertebrae as well. The use of a low-viscosity poly(methyl methacrylate) (PMMA) in combination with a non-ionic liquid contrast dye provides a reliable and safe procedure. Extraosseous cement leakage was seen in 20% of the interventions; however, none of them had clinical sequelae.

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order to enhance the radiographic visibility, a non-ionic liquid contrast dye is added to the cement during the mixing procedure (Iopamiro 300, Bracco, Milan, Italy) in the ratio of 10 cc of contrast dye per one portion of PMMA. The material is filled into 2-cc standard syringes.

Two minutes into the cement curing, filling of the vertebral bodies is commenced under continuous fluoroscopic control in the lateral view (Fig. 1d). The cement remains injectable for the following 2 or 3 min. The simultaneous filling of two vertebral bodies is possible. The flow of the cement must be monitored very carefully, and should behave like a “growing cloud” (Fig. 2). Cement leaks posteriorly into the spinal canal and anteriorly through the nutritional vessels must particularly be avoided. The maximum amount of cement to be injected is determined during the procedure, as with any cement extrusion the filling is stopped. However, in these cases the needle position can be slightly altered, which may allow further filling with less liquid cement. In cases of normal filling (“growing cloud”) the augmentation is stopped with visible filling of the entire vertebral frame. Prior to withdrawal of the needles, the material should be allowed to fully cure to avoid dragging of cement into the soft tissues.

Additional analgesia may be needed either during placement of the K-wires and needles or, particularly, during the injection of cement, which sometimes is felt as regional low back pain. In these cases i.v. administration of morphine (Rapifen = alfentanilhydrochloride) also helps the patients to maintain the prone position for the required 45–60 min of the entire procedure.

Patients
At present, our prospectively monitored series contains 70 patients with 193 augmented vertebrae treated for osteoporosis and metastatic lesions of the lumbar and thoracic spine. The paper presented here analyses the first 45 percutaneous vertebroplasties for osteoporotic fractures, with a minimum follow-up of 1 year (Table 1, Table 2). This includes 17 consecutive patients, 15 women and 2 men, aged 50–86 years (mean 74 years). All patients were suffering from disabling back pain refractory to conservative treatment for at least 4 weeks, including analgesics, physiotherapy, and braces in three cases. Most of the patients had initially been treated at other institutions, and were referred because of persistent pain. All patients had radiographic evidence of progressive or new vertebral compression fractures. This was related to the exacerbation of pain after a minor trauma (simple fall, sitting down suddenly). Further, during physical examination, in our patients the region of pain seemed equivalent to the radiological changes. However, the exact clinical determination of a painful level is difficult. Twelve patients showed fractures due to age-related osteoporosis, three patients had received long-term oral steroids for chronic conditions,