



Research Paper

Comparison of percutaneous vertebroplasty with and without interventional tumor removal for spinal metastatic tumor without epidural involvement



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ABSTRACT

Aim: To evaluate the efficacy of percutaneous vertebroplasty (PVP) combined with interventional tumor removal (ITR) in providing pain relief, reducing disability, and improving functional performance in patients with malignant vertebral compression fractures without epidural involvement.

Methods: Patients with malignant vertebral compression fractures (n=58) were treated with either PVP+ITR (n=31, group A) or PVP alone (n=27, group B). A 14 G needle was inserted into the vertebral body, and the tract was sequentially dilated with working cannulae. When the last working cannula had reached the distal pedicle of vertebral arch, ITR was performed with a marrow nucleus rongeurs inserted through the working cannula. Finally, cement was injected into the excavated vertebral body. Patients were followed up at 1, 3, and 6 months after the procedure, and every 6 months thereafter.

Results: The overall excellent and good pain relief rate during follow-ups was significantly better in group A than in group B (94% vs.56%; $p=0.002$). The average VAS, ODI, and KPS scores at 3 months, 6 months, 1-year, and > 1 year were all significantly lower in group A than in group B ($p < 0.05$). The mean cement filling volume and the stability of the treated vertebrae were significantly higher in group A than in group B ($p < 0.05$).

Conclusions: The combination of PVP+ITR is a safe and effective procedure, capable of providing significantly greater pain relief and vertebral stability than PVP alone in patients with malignant vertebral compression fractures.

1. Introduction

The spine is the most common site of skeletal metastases, being involved up to 40% of cases [1–3]. The tumors that most commonly metastasize to the spine are those of the lung, breast, prostate, and kidney [4]. Neoplastic invasion of the vertebral body can result in painful vertebral compression fractures, leading to disability and considerable morbidity [5].

The first approach for pain relief is pharmacotherapy with non-steroidal anti-inflammatory drugs (NSAIDs) and opioids. Nonresponsive cases are treated with radiotherapy which, however, requires 2–4 weeks to take effect and moreover does not achieve complete pain relief in most cases [6]. Its analgesic and antitumoral effects are limited by the toxicity risk to adjacent structures, and it does not prevent the progression of a pathologic fracture [7,8]. Open surgical procedures aimed at fracture stabilization or spinal cord decompression are rarely a realistic option in these patients because

of an unfavorable risk/benefit ratio [9,10].

Percutaneous vertebroplasty (PVP) is an effective method for reducing spinal pain in osteoporotic vertebral compression fractures and vertebral metastatic disease [11–22]. Furthermore operative time, blood loss, postoperative pain, and overall cost are all lower with PVP than with open surgery [23]. However, due to the problem of polymethyl methacrylate (PMMA) leakage, long-term pain relief and vertebral stabilization is not possible with PVP. To overcome this problem, we have used PVP in combination with interventional tumor removal (ITR) for better pain relief and improved stability in malignant vertebral compression fractures [24,25].

In this study, we compared the efficacies of PVP+ITR and PVP alone in patients with spinal metastatic tumor without epidural involvement, focusing on pain relief, stability of vertebral fractures, and PMMA leakage.

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2. Materials and methods

2.1. Patients

This study was approved by the university committee on human investigation, and informed consent was obtained from each patient. From October 2009 to June 2015, 69 patients with spinal metastatic tumor and malignant vertebral compression fractures without epidural involvement were recruited into the study.

Patients were eligible for recruitment into the study if they had: 1) malignant vertebral compression fractures and/or spinal metastatic tumor without epidural involvement (i.e., no break in the posterior

cortex on MRI imaging); 2) intractable pain, unresponsive to non-operative modalities such as radiation therapy, chemotherapy, and so on; 3) confirmed histological diagnosis; 4) height reduction in the vertebral body < 50%; and 5) at least one clinical and MRI follow-up ≥ 3 months after the initial treatment. Patients without symptoms of neurologic compression, or with allergy to PMMA, contraindication for MRI, poor overall condition, or short life expectancy (< 3 months), were excluded.

The enrolled patients (or their family members) were allowed to choose between the two approaches we provided: PVP+ITR (group A) or PVP alone (group B).

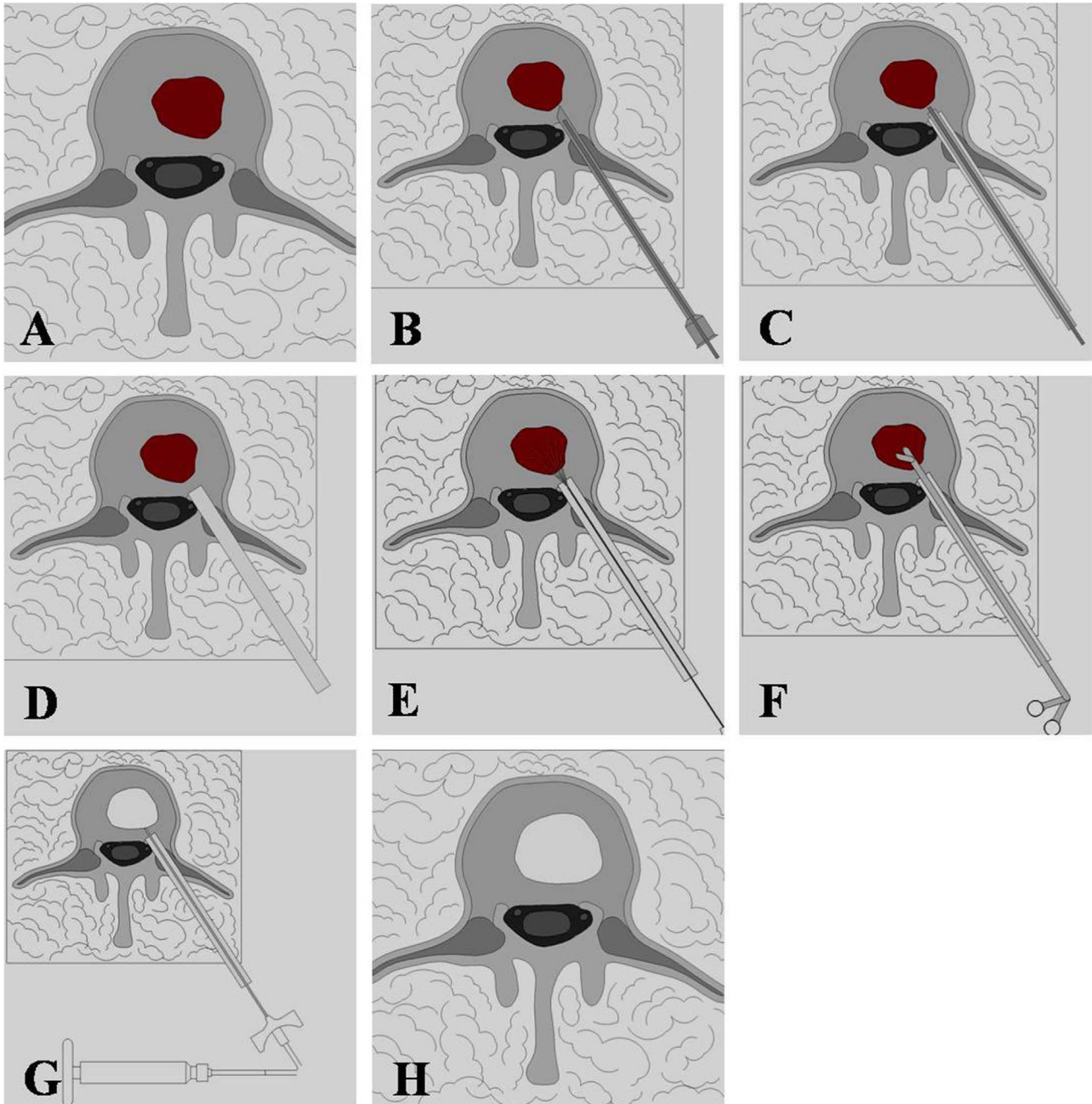


Fig. 1. Diagrams show the steps of PVP and ITR. (A) Malignant spinal tumor within the vertebral body. (B) A 14 G needle and a guidewire are inserted at the intended site of entry until the tip reached the center of the vertebral body under fluoroscopic monitoring. (C) Dilatation of the tract is performed by a sequential working cannula, and then a trepan is inserted through the last working cannula (5 mm in diameter) and cut the pedicle of vertebral arch slowly until the last working cannula reached the distal pedicle of vertebral arch. (D) The last working cannula is inserted into vertebral body. (E) Tumors were ablated with a radiofrequency needle inserted through the working cannula. (F) ITR was performed with a marrow nucleus rongeurs inserted through the working cannula. (G) PMMA was injected into the extirpated vertebral body under continuous fluoroscopic monitoring with the bone puncture needle inserted through the working cannula. (H) Tumor was removed with PMMA left in the extirpated cavity.

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