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Clinical Study

# Percutaneous transpedicular vertebroplasty with polymethyl methacrylate for pathological fracture of the spine

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ABSTRACT

We aimed to evaluate the safety and therapeutic efficacy of percutaneous transpedicular vertebroplasty (PVP) using polymethyl methacrylate (PMMA) in patients with symptomatic metastatic spine lesions. We included 31 patients in this retrospective study who were treated with PMMA from 2003 to 2005 for intractable pain due to metastatic spine lesions. The types of cancer (and numbers of patients) included: lung cancer (9), breast cancer (7), gastrointestinal (GI) tract cancers (5), hepatobiliary malignancies (3), and other types of cancer (7). All patients received vertebroplasty, resulting in 41 treatments (16 in thoracic, 25 in lumbar spine). Preoperative and postoperative visual analog scale (VAS) scores for pain were measured in all patients. Image studies including contrast-enhanced MRI were performed in all patients. Results showed characteristic metastatic lesions. Suspicious lesions were further confirmed as malignant by a bone scan, a positron emission tomography (PET) scan, and pathological exam. Vertebroplasty resulted in complete or partial pain relief in 29 patients (95%), and provided no pain relief in 2 patients (5%). The mean preoperative VAS score of 8.9 (±0.93) was higher than the mean postoperative VAS score (2.6 ± 1.71). Metastatic spine lesions were most common in lung and breast cancer patients and these lesions were located more often on segments T12 to L2 (53.6%). Patients with malignancy of hepatobiliary origin did not show improvement in pain scores as dramatically as patients with other types of malignancies, although only a few cases were included in this study. No patients experienced worsening of symptoms or suffered from vertebroplasty complications. We conclude that vertebroplasty is a safe, effective, and simple treatment for the management of intractable spinal pain due to metastases.



## 1. Introduction

Metastatic spinal lesions are usually asymptomatic, and pain is only caused by vertebral body collapse, either through peridural compression or from instability of the vertebral elements.[1] Patients with such pain usually ask for help; typically, the metastatic spine disease is diagnosed at that time. Collapse of the vertebral body is usually a sign of a pathological compression fracture. Such fractures, if they compress the spinal cord or nerve root, can cause pain, numbness, weakness, sensory deficits, neurological claudication, fecal or urinary incontinence and hyper-reflexia. They should be treated with decompressive surgery as soon as possible.[2] Pathological compression fractures that do not compress the spinal cord or nerve root only cause pain but they are often also treated with decompressive surgery. If patients have severe systemic disease or they desire a less aggressive treatment and lower complication rates, then percutaneous transpedicular vertebroplasty (PVP) is another choice for treating pathological compression fractures that do not cause neurological deficits.[3] Typically, PVP is done with the patient under intravenous general anesthesia in the prone position, and a C-arm intraoperative X-ray image intensifier is used to localize the puncture site. Then a bone marrow needle is used to puncture the vertebral body. Radiocontrast tracing (for example, with Isovist; Schering, Berlin, Germany) is used to detect leakage into the vessels.[4] Finally, bone cement is mixed and injected into the vertebral body.

Recent studies show that PVP can be considered in patients with spinal metastases that have led to pathological compression fractures without neurological deficits and that radiotherapy (R/T) should be performed afterwards in patients who undergo this procedure. PVP might also be considered in patients with spinal metastasis without vertebral collapse even if only painful symptoms are present, and again R/T should be performed afterwards. PVP is a minimally invasive alternative to open surgery.[5–8] We wanted to investigate whether PVP could reduce pain effectively in our patients with vertebral body collapse. The expected therapeutic outcomes of PVP for patients with painful pathological fractures of the metastatic spine can be classified as: (i) pain relief; (ii) improvements in daily life functions; and (iii) complications.[9,10]

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## 2. Methods

Between 2003 and 2005, this study included 31 patients (Table 1) with painful pathological compression fractures who received treatment with PVP. There were 12 men and 19 women, with a mean age of 67 years (range 37–84 years). Patients were almost equally distributed in the subgroups aged 60–70 years and 70–80 years. The three most frequent types of cancers showing spinal metastases were those of the lung (33%), breast (23%) and gastrointestinal (GI) tract (13%; Fig. 1).

Among 42 vertebral body procedures, most were between T12 and L2 (52%), most commonly at the L2 level (26%; Fig. 2).

The criteria for applying PVP were: (i) intractable pain; (ii) vertebral body deformity; (iii) presence of a radiation-resistant tumor; (iv) a confirmed histological diagnosis; and (v) absence of a neurological deficit in the patient. All treated patients met at least one of

**Table 1**
Patients (12 males and 19 females of mean age 67 years) treated with percutaneous transpedicular vertebroplasty for vertebral body metastasis with collapse.

| Patient no. | Gender | Age (years) | Spinal level | Associated spinal level | Origin | Preop. symptom duration | Preop. VAS score | VAS score 1 week postop. | VAS score 6 months postop. | VAS score 12 months postop. | Biopsy | MRI | Bone scan |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | M | 37 | T3 | | Lung ca | 2 months | 9 | 2 | 2 | 3 | 1 | 1 | 1 |
| 2 | M | 70 | T12, L1 | S1 | Lung ca | 3 months | 8 | 3 | X | X | 1 | 1 | X |
| 3 | M | 57 | L2 | | Lung ca | 3 weeks | 10 | 1 | 1 | X | 1 | 1 | 1 |
| 4 | F | 79 | T11 | | Lung ca | 3 months | 10 | 2 | 2 | 2 | 0 | 1 | 1 |
| 5 | F | 77 | T12 | | Lung ca | 5 months | 6 | 1 | 1 | 1 | X | 1 | 1 |
| 6 | M | 64 | L3 | | Lung ca | 6 months | 9 | 2 | X | X | 1 | 1 | 1 |
| 7 | M | 56 | L3, 4 | | Lung ca | 1 months | 8 | 2 | 2 | 2 | 0 | 1 | X |
| 8 | M | 65 | T7, 8 | | Lung ca with brain metastasis | 2 months | 8 | 1 | 1 | X | 1 | 1 | 1 (PET) |
| 9 | F | 59 | T12 | | Lung ca with brain metastasis | 5 months | 10 | 6 | 6 | X | 0 | 1 | 1 |
| 10 | F | 83 | L5 | | Lung ca with liver metastasis | 3 months | 9 | 2 | 2 | 2 | 0 | 1 | 0 |
| 11 | F | 40 | T12 | T11–12 | Breast ca | 3 months | 9 | 2 | X | X | 1 | 1 | 1 |
| 12 | F | 59 | T12, L2 | | Breast ca | 2 months | 10 | 5 | 8 | X | 1 | 1 | X |
| 13 | F | 65 | L3 | | Breast ca | 1.5 months | 10 | 2 | 2 | X | 1 | 1 | 1 |
| 14 | F | 49 | T9 | | Breast ca | 1 months | 9 | 1 | 2 | X | 1 | 1 | X |
| 15 | F | 73 | T11, L1 | T10 | Breast ca | 2 months | 8 | 3 | 6 | X | X | 1 | 1 |
| 16 | F | 72 | T9 | | Breast ca | 2 months | 8 | 3 | 3 | 3 | X | 1 | 1 |
| 17 | F | 50 | L1, L2 | | Breast ca | 3 months | 8 | 1 | 1 | X | 1 | 1 | 1 |
| 18 | F | 77 | L2 | T12 | Liver ca | 3 weeks | 9 | 3 | 9 | X | X | 1 | 1 |
| 19 | F | 61 | L2 | | Cholangiocarcinoma | 1 months | 9 | 3 | 3 | X | 1 | 0 | 0 |
| 20 | F | 74 | L1, 3 | L5 | Cholangiocarcinoma | 2 months | 10 | 5 | 8 | X | X | 1 | 1 |
| 21 | M | 69 | L2 | L1–3 | Colon ca | 1 months | 9 | 2 | 2 | 2 | 1 | 1 | X |
| 22 | M | 75 | T12, L1 | | Colon ca | 2 months | 10 | 2 | 2 | 2 | 0 | 1 | 1 |
| 23 | F | 77 | T12, L2 | T7, L3–4 | Rectum ca with lung metastasis | 1 week | 10 | 1 | 1 | 1 | 0 | X | X |
| 24 | F | 83 | T9, 10 | T7, 10, 12 L1 | Stomach ca | 1 week | 8 | 2 | 1 | X | X | 0 | 1 |
| 25 | M | 59 | L2 | C6 | Renal cell ca | 1 months | 9 | 2 | 2 | 2 | 1 | 1 | 1 |
| 26 | F | 70 | L2 | | Thyroid ca. | 2 months | 10 | 8 | 8 | X | 1 | X | 1 |
| 27 | F | 84 | T11 | | Cervical ca | 2 weeks | 9 | 1 | 1 | 1 | 0 | 0 | 1 |
| 28 | F | 61 | L5 | | Multiple myeloma | 1 months | 8 | 6 | 6 | X | X | 1 | X |
| 29 | M | 70 | L5 | L3, S1 joint | Pancreatic ca | 3 weeks | 9 | 3 | 3 | X | 1 | 1 | 1 |
| 30 | M | 81 | L4 | | Prostate ca | 3 months | 9 | 2 | 2 | 2 | 0 | 1 | X |
| 31 | M | 70 | L1, L2 | | Primary unknown | 1 week | 9 | 2 | 2 | X | 1 | 1 | 1 |

C = cervical, ca = cancer, F = female, L = lumbar, M = male, PET = positron emission tomography, Postop = postoperative, Preop. = preoperative, S = sacral, T = thoracic, VAS = visual analog scale. X = data not available, commonly because the patient had died. Metastatic lesions were diagnosed by MRI, biopsy or bone scan/positron emission tomography (PET), or a combination of these modalities as shown in the three right hand columns as performed (1) or not performed (0).

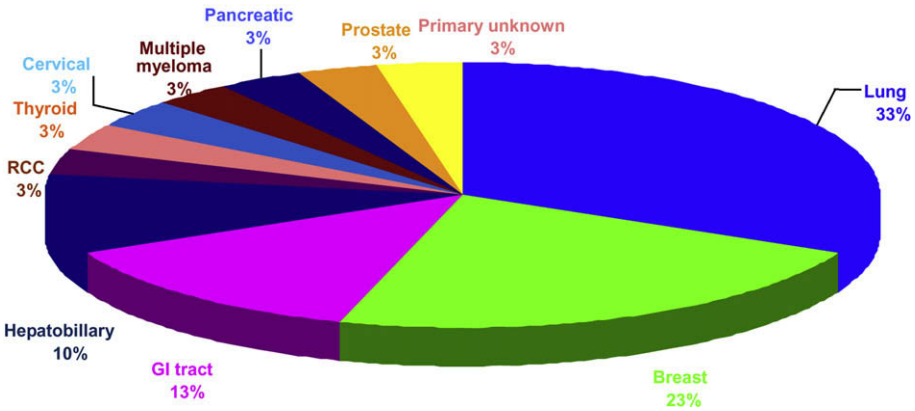


**Fig. 1.** The three most frequent types of cancers among these 31 patients with spinal metastases were those of the lung (33%), breast (23%) and gastrointestinal (GI) tract (13%). The other types of cancers causing treated metastases are shown. RCC = renal cell carcinoma. This figure is available in colour at www.sciencedirect.com.