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Long-term pain relief effects in four patients undergoing percutaneous vertebroplasty for metastatic vertebral tumor

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Abstract We reviewed long-term pain relief in four patients undergoing percutaneous vertebroplasty (PVP) for lumbar or back pain due to metastatic vertebral tumors. The patients received anesthesiological palliative care with analgesics until their death after PVP. Pain intensity, the presence or absence of recurrence of pain, changes in dosage of analgesics given before and after PVP, and complications associated with PVP were evaluated. A numerical rating scale (NRS) from 0 (no pain) to 10 (worst pain imaginable) was used to measure pain. The patients were three men and one woman (mean age, 58 years). PVP was performed in five vertebrae (one thoracic and four lumbar). The NRS scores on moving before PVP were 10, 8, 10, and 10. After PVP, NRS decreased to 0, 3, 5, and 0, respectively, within 72 h. No recurrence of pain in the treated area occurred until death in any of these patients. The dosages of analgesics given were decreased in two cases, but no changes were made in the other two cases. There were no complications associated with PVP. Percutaneous vertebroplasty is a safe and effective treatment for long-time pain relief in patients with metastatic vertebral tumors.

Key words Cancer pain · Metastatic vertebral tumor · Pain management · Percutaneous vertebroplasty

Introduction

Percutaneous vertebroplasty (PVP) is a minimally invasive, radiologically guided interventional procedure for treatment of pain caused by vertebral compression fracture due to metastatic vertebral tumor. This technique consists of insertion of a needle percutaneously into the affected vertebral body and injection of polymethylmethacrylate (PMMA) bone cement [1,2]. In Japan, Baba et al. [3] first reported the use of PVP for treatment of a patient with a metastatic vertebral tumor derived from lung cancer in 1997. However, there have been few reports of long-term effects of PVP for metastatic vertebral tumor in Japan. Here, we describe the long-term results of PVP for metastatic vertebral tumors in four patients given continued anesthesiological palliative care until death.

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Case reports

Table 1 shows patient demographics and PVP data. PVP was conducted with the patient in the prone position under local anesthesia with a needle for bone biopsy (Bone Biopsy Needle, 12 gauge, Hakko, Chikuma, Japan; Osteo-Site bone biopsy needle sets, 11 or 13 gauge, Cook, Bloomington, IN, USA). With the aid of computed tomography (CT) (Interventional Angio-CT, Toshiba, Tokyo, Japan) fluoroscopic guidance, the needle was inserted by the unilateral transpedicular approach into the affected vertebral body. Injections of about 3 ml of PMMA (Osteobond, Zimmer, Warsaw, IN, USA) into the thoracic vertebra and 5 ml of PMMA into the lumbar vertebra were scheduled. During the injection, we checked on the CT fluoroscope for leakage of PMMA out to the vertebral body. When leakage of PMMA was observed, the injection was stopped and the procedure ended.

We evaluated pain intensity, presence or absence of recurrence of pain, changes in dosage of analgesics given before and after PVP, and complications associated with PVP. A numerical rating scale (NRS) from 0 (no pain) to 10 (worst pain imaginable) was used to measure pain [4]. In addition, radiation therapy was conducted when the NRS score did not decrease to below 2 after PVP.

Table 2 shows the clinical results after PVP. In all cases, the NRS decreased within 72 h. In two cases,

Table 1. Patient data

Case no.	Age (yr)	Sex	Original cancer	Vertebral body on which PVP was performed	Amount of PMMA used during PVP (ml)	Complications of PVP
1	69	M	Mandibular	L2	7.5	None
2	52	M	Gastric	L2 and L5	2 and 6	None
3	60	M	Hepatic	L5	3	None
4	54	F	Colon	Th12	1.5	None

PVP, percutaneous vertebroplasty; PMMA, polymethylmethacrylate

Table 2. Clinical results before and after PVP

Case no.	NRS before PVP	NRS after PVP	NRS after radiation	Changes in dosage of analgesics	Recurrence of pain in the treated area	Weeks from PVP to death
1	10	0	—	Decreased	None	13
2	8	3	2	Decreased	None	10
3	10	5	—	No change	None	18
4	10	0	—	No change	None	14

NRS, numerical rating scale; PVP, percutaneous vertebroplasty

the NRS decreased to zero after PVP. In Case 2, the NRS decreased further after radiation therapy. No recurrence of pain in the treated area was recognized before the death of the patient. There were no complications associated with PVP. The dosages of analgesics given were decreased in two cases (Cases 1 and 4), but no changes were made in the other two cases (Cases 2 and 3).

Case 1

A 69-year-old man was referred to us because of severe lumbago. He had undergone surgery to remove a mandibular tumor 15 months previously. Metastatic bilateral neck lymph nodes had been removed 6 months previously. He had complained of severe lumbago caused by L2 metastases and could not walk well. The patient also had lung and mediastinal lymph node metastases, but these did not cause clinical symptoms. Oral pentazocine hydrochloride (75 mg per day) combined with loxoprofen sodium (180 mg per day) did not improve the pain. PVP to L2 was scheduled.

After PVP (Fig. 1), the NRS decreased from 10 to 0, and the patient could walk easily. The oral pentazocine hydrochloride dose was decreased, and then the drug was stopped completely. The patient was very satisfied with the results and stayed at home until the development of dyspnea due to massive pleural effusion caused by lung metastases 12 weeks after PVP. The lumbar pain in the L2 area did not recur before the patient's death.

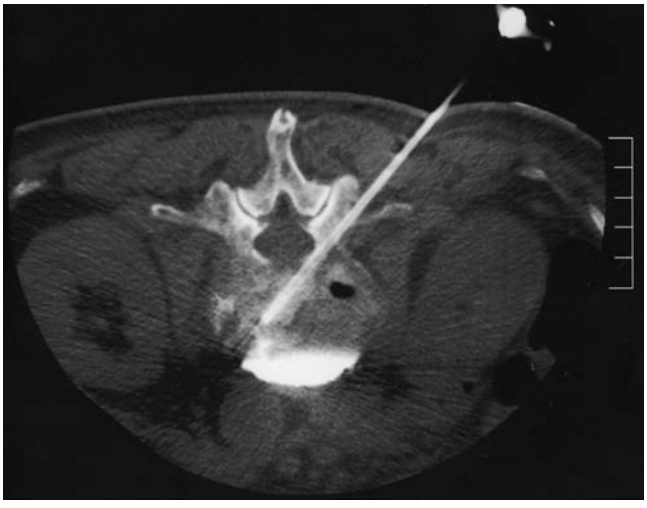

Fig. 1. Computed tomography (CT) during percutaneous vertebroplasty (PVP) in Case 1 showing the puncture needle and bone cement injected into the L2 vertebral body

Case 2

A 52-year-old man was referred to us because of severe lumbago. He had undergone total gastrectomy for advanced gastric cancer 2 months previously. The patient could not walk well due to lumbar pain caused by L2 and L5 metastases. There were multiple bone metastases, including the skull, right humerus and scapula, the left 6th and 7th costa and pelvis, and peritonitis carcinomatosa. Oral morphine sulfate (40 mg per day) with lornoxicam (12 mg per day) did not improve

Fig. 2. Lumbar x-ray during PVP in Case 2 showing the puncture needle and bone cement injected into the L2 vertebral body

Fig. 3. Lumbar x-ray during PVP in Case 2 showing the puncture needle and bone cement injected into the L5 vertebral body

the pain and caused vomiting and nausea. PVP to L2 and L5 was scheduled.

After PVP (Figs. 2 and 3), the lumbago decreased and the patient could walk easily. Morphine sulfate was decreased to 20 mg per day. Additional radiation therapy (36 Gy to L2 and L5) further decreased the lumbago. However, peritonitis carcinomatosa, other bone metastases, and skin metastases worsened and caused abdominal pain and general malaise 3 weeks after PVP. Although the lumbar pain in the treated area did not recur, the dosage of morphine was gradually increased until the patient's death.

Fig. 4. CT after PVP in Case 3 showing bone cement injected into the L5 vertebral body

Case 3

A 60-year-old man, diagnosed as having hepatic cancer 3 years previously, was referred to us for pain management. He had right lumbar and lower limb pain due to L5 and sacral metastases and could not walk well. The tumor of the sacrum had widely invaded the sacral nerves, causing lower limb pain. The patient had other metastases to the bilateral scapulae, thoracic vertebrae (Th3, 6, and 9), and pelvis. Oral morphine sulfate (40 mg per day) combined with loxoprofen sodium (120 mg per day) did not improve the pain. PVP to L5 was scheduled.

Before treatment, it was explained to the patient that PVP of L5 was expected to alleviate the lumbago but not decrease the lower limb pain, because PVP cannot improve the pain associated with tumor invasion into the sacral nerves. After PVP (Fig. 4), the lumbago was alleviated and the patient could sit and walk easily. However, since the lower limb pain remained as expected, the NRS decreased only from 10 to 5, and the patient was not satisfied with the results. The dosage of morphine was not decreased. The patient refused additional radiation therapy. Although lumbar pain did not recur in the treated area, the dosage of morphine was gradually increased until the patient's death.

Case 4

A 54-year-old woman was referred to us for pain management. She had undergone colectomy for sigmoid colon cancer 10 years previously. Retroperitoneal lymph node metastases, liver metastases, and L3 and L4 metastases had subsequently been removed. The patient had severe back pain caused by Th12 metastases and could not sit. She also had other metastases to the right clavicle and peritonitis carcinomatosa. Oral morphine sulfate (20 mg per day) combined with loxoprofen sodium (120 mg per day) did not improve the pain. PVP to Th12 was scheduled.

PVP was conducted with the patient in the lateral position because she could not remain in the prone position due to pain. After PVP, the pain disappeared completely and she could sit easily. However, several days after PVP, she complained of lumbar pain at other sites, which was caused by recurrence of L3 and L4 metastases. Massive pulmonary effusion caused dyspnea 2 weeks after PVP. The dosage of morphine was gradually increased until the patient's death.

Discussion

PVP alleviated the lumbar or back pain due to metastatic vertebral tumors in all cases and improved the patients' activity so that they could sit and walk easily. Its effects continued until death in all patients, with no recurrence of pain in the treated area. PVP plus radiation therapy [5] further alleviated pain, as in Case 2.

The dosages of analgesics given after PVP were decreased in Cases 1 and 2. Analgesics were stopped completely in Case 1, because the patient, who had small metastases except in the L2 vertebral body, reported that his daily activity was satisfactorily improved.

On the other hand, morphine dosage was not reduced in Cases 3 and 4. These patients already had multiple metastases in other organs or bones. Although PVP decreased the pain in the treated area and improved the patients' activity, pain in other areas appeared soon after PVP, and the dosage of morphine could not be reduced in these patients.

Complications associated with PVP include epidural puncture, hemorrhage, infection, neuralgia, and disorder due to cement leakage [1]. Pulmonary embolism and spinal cord damage caused by leakage of cement into the vessels or spinal canal have been reported as severe complications of PVP [6–9].

In the present cases, there were no complications associated with PVP. We performed PVP with CT fluoroscopy, which enabled detection of cement leakage almost in real time [10]. When cement leakage was observed, the procedure was stopped to prevent complications. PVP was stopped after injection of 2 ml and 1.5 ml of PMMA in Cases 2 and 4, respectively, because leakage of cement was detected. Although the injection volume was far below schedule in these cases, good pain relief was obtained. No correlation was reported between the injection volume of PMMA and pain relief [1, 10]. When leakage of cement is detected, further injection should be stopped to prevent complications.

In summary, we described long-term pain relief in four patients undergoing PVP for metastatic vertebral tumors. PVP decreased severe pain in the treated pain area and improved daily activity, and neither recurrence of pain in the affected area nor complications occurred. PVP is a safe and effective treatment for long-term pain relief.

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