

Percutaneous Osteoplasty for the Management of a Femoral Head Metastasis: a Case Report

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Percutaneous osteoplasty (POP) as a technical extension of percutaneous vertebroplasty (PVP) has been used to treat malignant disease that affects the skeletal system. POP has demonstrated good outcome for pain relief and functional improvement. Few studies have reported on the efficiency of POP to treat malignancies located in the femoral head. We designed a pilot study with the use of POP to treat intractable pain caused by a femoral head metastatic tumor in a 43-year-old man. During the follow-up period, the patient experienced sustained pain relief and improvement of quality of life that persisted for more than three months.

Index terms :

Percutaneous vertebroplasty
Percutaneous osteoplasty
Femoral head
Metastatic tumor

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Percutaneous vertebroplasty (PVP) is a safe and effective procedure for the treatment of osteolytic vertebral metastases. In recent years, percutaneous osteoplasty (POP), as a technical extension of PVP, has been used as a method for the treatment of osteolytic lesions due to a malignancy in the skeletal system, including the acetabulum, sacrum, pubis, ischium, humerus and femur (1-8). POP has been demonstrated to be highly efficient to provide pain relief and functional improvement. Nevertheless, there are few reports on the use of POP for femoral head osteolytic lesions. Furthermore, the effectiveness of POP for the treatment of these lesions is not well known. In this report, we present a patient with osteolytic lesions of the femoral head due to a lung cancer who experienced sustained pain relief and improvement in quality of life following POP.

CASE REPORT

A 43-year-old man developed unremitting pain in the lower back and the right leg, which especially increased while walking. Subsequently, the patient was admitted to our hospital. The patient received bed rest for more than one month. Magnetic resonance (MR) and emission computed tomography (ECT) images demonstrated the presence of L3, S2 and S3 vertebral lesions that were metastatic tumors. Computed tomography (CT) images demonstrated the presence of metastatic tumors that involved the right acetabulum and the femoral head (Fig. 1) that were associated with lung cancer (as determined by surgical pathology). Based on these clinical findings, the patient was diagnosed with multiple metastatic bone tumors. The patient received radiation therapy and experienced pain relief for one month. However, the patient experienced recurrent pain and the pain had seriously affected sleep and the daily activities of the patient. The pain was insensitive to drug administration. Furthermore, side effects of opiate use such as effects on the gastrointestinal tract, had become apparent. Due to the short life expectancy of the patient, a surgical procedure was not

performed. Consequently, a percutaneous procedure was considered due to the potential ability to provide prompt pain relief and functional improvement. The patient was informed about the possible benefits and risks of the treatment. Written informed consent was obtained from

the patient and his family.

Following detailed analyses of the lesions and adjacent structures, we developed a modified procedure for the treatment of the case. First, PVP was performed on the L3 lesion, and subsequently backache was alleviated. Second,

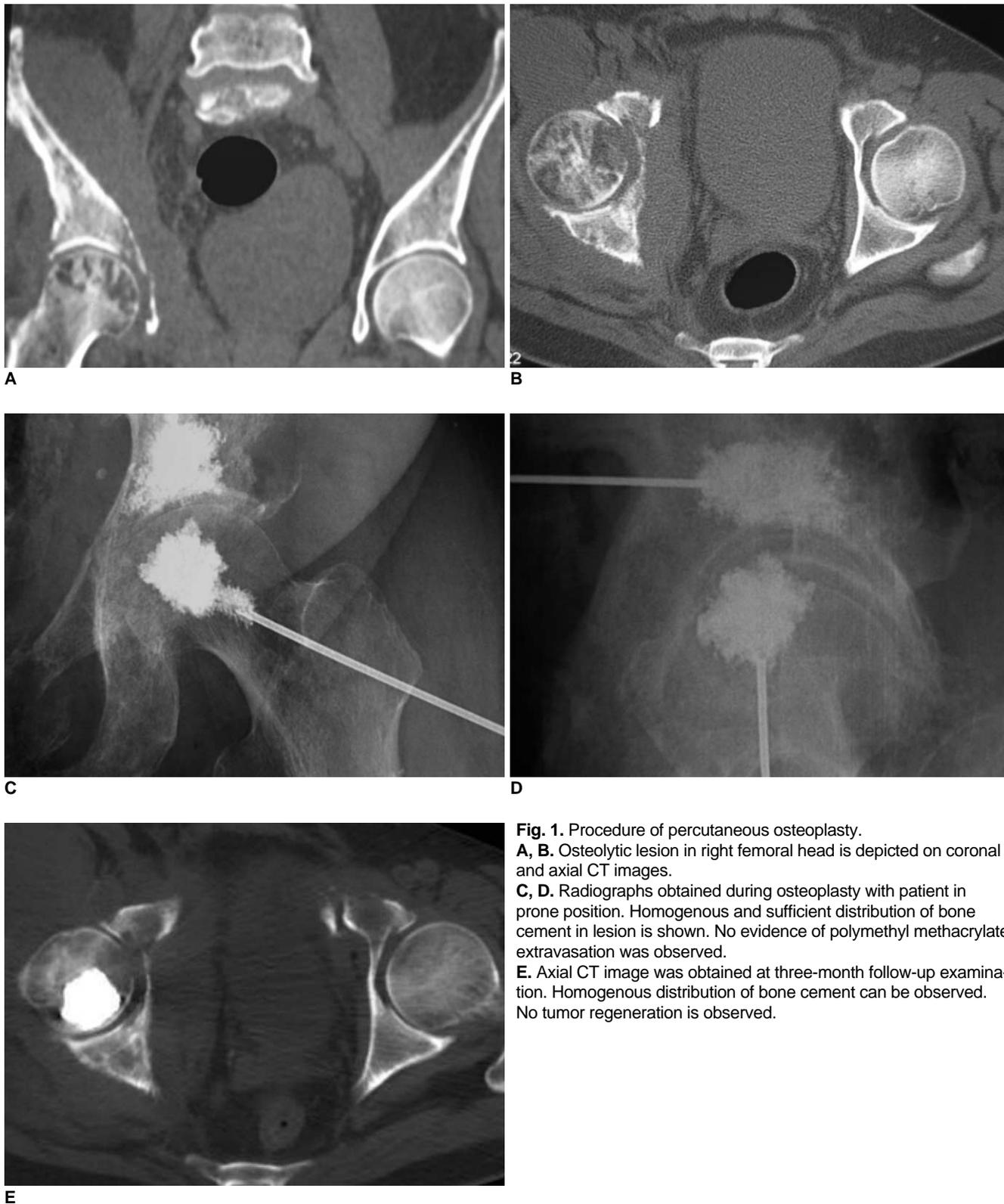


Fig. 1. Procedure of percutaneous osteoplasty.
A, B. Osteolytic lesion in right femoral head is depicted on coronal and axial CT images.
C, D. Radiographs obtained during osteoplasty with patient in prone position. Homogenous and sufficient distribution of bone cement in lesion is shown. No evidence of polymethyl methacrylate extravasation was observed.
E. Axial CT image was obtained at three-month follow-up examination. Homogenous distribution of bone cement can be observed. No tumor regeneration is observed.

nine days later, POP was performed on the right acetabulum and femoral head. Prior to the performing the procedure, it was essential to review the radiology films of the patient to avoid causing injury to important vessels and nerves. We administered local anesthesia to the patient and placed the patient in the prone position on the uniplane digital subtraction angiography (DSA, AXIOM Artis dTA, Siemens, Erlangen, Germany) operating table. A fluoroscope draped with a sterile sleeve was positioned to allow an anteroposterior (AP) view. A small dermatotomy incision was made with a scalpel blade. Thereafter, a bone puncture needle (13 G, Cook, Bloomington, IN) was used; the needle penetrated the neck of the upper portion of a femur lever attached to the femur flank along the femur neck axis (Fig. 1C, D). We adjusted the cephalopod and left-right angle according to positions depicted on sagittal and axial images until the needle attained the lesion, as seen for all fluoroscopy projections. After removal of the needle, commercially available polymethyl methacrylate (PMMA) (Simplex P, Stryker Howmedica Osteonics, East Rutherford, NJ) was carefully injected into the lesion under continuous fluoroscopic monitoring via lateral and AP projections in order to ensure adequate lesion filling and to avoid PMMA leakage. When bone cement appeared at the neck of the femur cerebral cortex edge, injection was ceased. A total of 5 ml PMMA was injected into the right femur head. Post-procedural fluoroscopic observations showed optimal filling of the lesion with no evidence of PMMA extravasation (Fig. 1C, D). Subsequently, we used a bone puncture needle to penetrate the right acetabulum. For successful penetration, 6 ml of PMMA was injected into the acetabulum. Immediate post-procedural X-ray photographs demonstrated good distribution of cement in the lesion and there was no evidence of PMMA extravasation (Fig. 1C, D). Blood pressure, an electrocardiogram and pulse oximetry waveforms of the patient were monitored and were observed to be steady during the procedure.

The patient experienced considerable pain relief and functional enhancement, and the patient was able to walk with the aid of crutches on the following day. The patient was evaluated prior to and following the procedure for reduction of pain intensity using a numerical rating scale (NRS) with scores ranging from 0 (no pain) to 10 (worst pain imaginable) (9). The NRS score decreased from 8 to 2 within 48 hours following POP. CT scans acquired three months following the procedure revealed a stable femur head with no further tumor growth and an unchanged location of the instilled cement (Fig. 1E). The patient has continued to be pain-free without medication and has experienced no limitations in activity.

DISCUSSION

Metastatic cancer is the most common malignant disease that affects the skeletal system. Many of the affected patients endure severe pain and require a high dose of opiates for pain relief. Femoral head osteolytic metastases frequently cause severe pain on walking; minor movement can induce a pathological fracture in patients diagnosed with these types of metastases. Because of the disease, most patients are restricted to bed rest throughout the day that not only affects the quality of life but also increases the chance of the development of bedsores and pneumonia and significantly shortens survival time. The first goals of treatment for a metastasis should be the alleviation of pain and prevention of pathological fractures, which are especially important in patients with femoral head metastatic lesions, to avoid lower limb dysfunction. There are several types of therapies available for the treatment of these lesions. Many patients with metastases usually do not have the opportunity to undergo surgery. Normally administered treatments for this condition include radiation therapy, chemotherapy and hormone therapy. However, the results of these treatments are not satisfactory; especially, none of these treatment options can correct femoral head instability. POP is a minimally invasive, low-cost treatment option for selected patients with painful metastatic femoral head lesions. POP may increase the intraosseous stability of the femoral head in patients with osteolytic lesions and resistance to fracture.

During the follow-up period, the patient experienced marked pain relief, improvement in walking and functional recovery. We consider that POP is an effective, minimally invasive local therapy that can be performed for the treatment of femoral head metastatic lesions, and we recommend that the procedure can be used as an alternative for the treatment of lesions resistant to medication or radiotherapy.

Moreover, the combination of POP with radiotherapy and chemotherapy indicates a good prospect for the treatment of metastases.

Currently, the mechanism by which pain relief is achieved in patients with metastatic lesions treated with bone cement injections is not sufficiently clear. The injection of bone cement may aid in the stabilization of microfractures, reduce thermal damage and may reduce cytotoxicity in bones. Furthermore, the antineoplastic effect of bone cement may play a significant role in treating osteolysis (10, 11).

Based on the experience gained with this case, we were able to discover the considerable potential value of POP for the treatment of osteolytic metastases in the femoral

head. In addition, we recommend the application of this procedure as an alternative treatment for lesions resistant to medication or radiotherapy. This technique is similar to PVP and consists of inserting a puncture needle to the femoral head and the injection of PMMA into metastatic lesions. However, based on a careful analysis of preoperative imaging in patients to determine head cortical bone integrity or for the destruction of a very small lesion, the choice of the needle position should not be too high and the needle should be preferably placed at the upper margin of the femoral neck level to allow viscous bone cement to be slowly injected under fluoroscopy.

Although good results were obtained with this case, to the best of our knowledge, this is the only report that has described the application of POP for metastases treatment. Therefore, further experience and studies in the future are warranted to elucidate indications for surgery, surgical puncture position, the amount of time required for injection of bone cement and associated complications.

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