Spinal Metastasis with Spinal Canal Compression Treated by Surgically Controlled Vertebroplasty

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Objectives. Treatment of patients with spinal metastasis and spinal canal compression is complex. We evaluated surgically controlled vertebroplasty and laminectomy for treating patients and compared our results to those from other studies.

Methods. From February 2003 to February 2004, five patients with spinal metastasis and spinal canal compression were treated by combined vertebroplasty and decompressive laminectomy in our department.

Results. The surgical results were satisfactory. All patients regained neurologic function and axial pain improved. No surgical complications were found.

Conclusions. Limited laminectomy combined with surgically controlled vertebroplasty is a safe and effective method for treating patients with spinal metastases and epidural compression.

(Mid Taiwan J Med 2004;9:113-8)

Key words

metastasis, spinal tumor, vertebroplasty

INTRODUCTION

Metastatic disease of the spine is a significant cause of morbidity in patients with cancer. Pain is the most common symptom and is caused by mechanical instability due to the destruction of supporting spinal elements [1]. Neurologic dysfunction is another problem that can significantly alter a patient's quality of life by disrupting bowel and bladder functions and ambulatory ability [2]. The ultimate goal of treatment is to improve the patient's quality of life.

Percutaneous vertebroplasty is a simple, minimally invasive procedure that offers a remarkable therapeutic option for patients suffering from osteoporotic or tumor-related vertebral fracture and pain [3-5]. The technique consists of an image-guided injection of bone cement, most commonly polymethylmethacrylate (PMMA), into a fractured or ruptured vertebral body. This technique relieves pain [6] and restores bone biomechanical strength [6,7]. Percutaneous vertebroplasty provided significant pain relief in 75% to 90% of patients with vertebral collapse fractures caused by osteoporosis [4] and in 59% to 86% of patients with pathologic fractures secondary to malignancy [4,8,9]. Furthermore, the complication rate was lower in 2.7% to 5.4% of patients [9].

However, percutaneous vertebroplasty is contraindicated in patients who have spinal metastases and symptomatic epidural compression. Extravasation of cement into the spinal canal or displacement of tumor into the spinal canal as the cement is injected could worsen the neurologic symptoms [5,10].

Both surgically controlled vertebroplasty and open vertebroplasty may avoid this problem

Received : 10 April 2004. Revised : 7 May 2004.
Accepted : 19 May 2004.

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Table. Demographic data including sex/age, primary disease, involved vertebra, preoperative and postoperative pain scale, preoperative and postoperative neurogenic function

Patient no.	Sex	Age (yr)	Primary disease	Involved vertebra	VAS pain score (Pre/Post)	Frankel scale (Pre-op)	Frankel scale (Post-op)
1	F	73	Lymphoma	L4	8/3	C	D
2	F	61	Breast Ca	L3	8/3	C	D
3	F	65	Histiocytic sarcoma	T5, L4	8/4	D	E
4	M	61	Hepatoma	L5	8/3	C	E
5	M	58	Buccal carcinoma	T7, T11	8/3	C	E

VAS = visual analog scale, F = female, M = male.

[11]. We performed surgically controlled vertebroplasty and decompressive laminectomy in five patients who had spinal metastases with epidural compression and compared our results to those from other studies.

PATIENTS AND METHODS

Surgical Criteria and Patients

The indications for surgical intervention included spinal metastasis with acute neurologic deterioration, spinal instability due to osteolytic changed or pathologic compression fracture and axial pain, radioresistant disease or radiation therapy failure for symptoms relief, and uncertain diagnoses. From February 2003 to February 2004, five patients with spinal metastasis and spinal canal compression underwent surgically controlled vertebroplasty and decompressive laminectomy in our department. Demographic data including sex, age, primary disease, involved vertebra, preoperative and postoperative pain scale, and preoperative and postoperative neurogenic function were obtained. Axial pain was measured by the VAS pain scale and neurologic function was measured by the Frankel scale (Table).

Surgical Procedure

The patient was placed in a prone position under general anesthesia. Decompressive laminectomy of the lesion was performed first. The tumor was then partially removed transpedicularly. A T-shaped 5 mm needle (Stryker Corp) was inserted along the pedicle tract under fluoroscopic guidance. The needle's progression required frequent monitoring by a fluoroscope to ensure maintenance of its optimal location. The PMMA cement was prepared once needle placement was satisfactory. Twenty grams of PMMA polymer powder was mixed with 3 grams of barium sulfate for adequate fluoroscopic monitoring during delivery. The cement mixture was allowed to polymerize at room temperature until it had a paste-like consistency. The mixture was transferred to a 10 mL plastic syringe. Continuous fluoroscopic monitoring during injection prevented overflow and extension into the spinal canal or neural foramen. Injection was discontinued when the cement reached the posterior one-third of the vertebral body, or if epidural venous filling was noted. Upon completion of the vertebroplasty, the needle was removed and the wound was closed layer by layer.

RESULT

All patients regained neurologic function, and axial pain improved (VAS scale from 8 to 3). No surgical complications were found (Table).

Illusive Case

A 51-year-old man with buccal Ca T4N2M0 s/p R/T experienced acute lower back pain and paraparesis after radiotherapy. Pre-operative neurologic function was a C on the Frankel Performance Scale. Weakness in both lower limbs and muscle power were grade 2 on admission. Pain intensity was an 8 on the Visual Analog Scale. A T7 osteolytic lesion and compressive fracture with cord compression was noted by magnetic resonance imaging (MRI); metastasis was suspected (Figure A).

He underwent radiotherapy for spinal lesion, but the symptoms persisted. We then performed surgical decompressive laminectomy and surgically controlled vertebroplasty. Post-

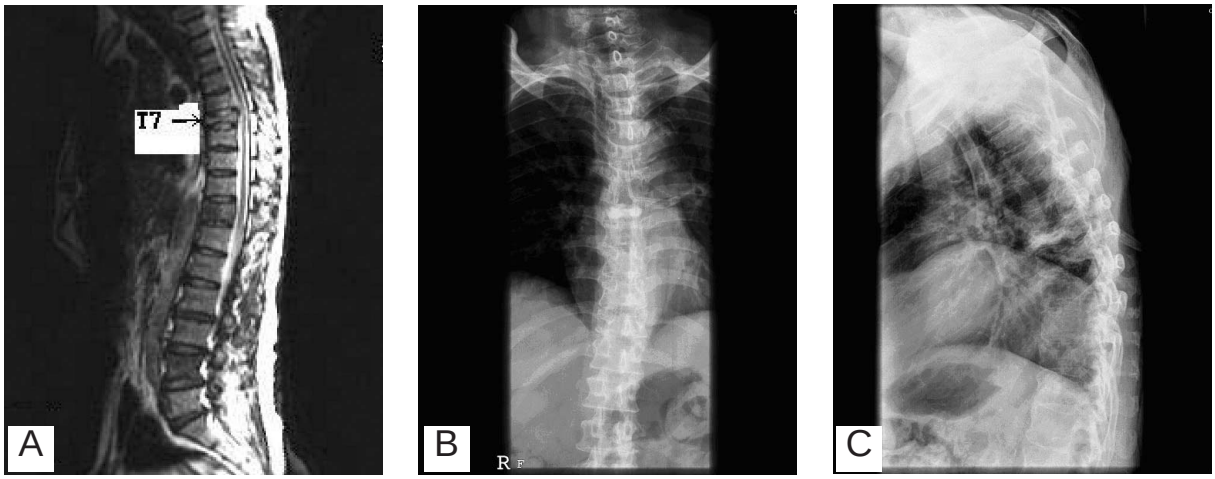

Figure. A: An metastatic tumor with compression fracture in the T7 body and compression of the cord are evident in this T1-weighted magnetic resonance (MR) image. B, C: The polymethylmethacrylate (PMMA) cement in the T7 vertebral body is evident on this T-spine X-ray.

operatively, the patient's neurologic deficits improved from C to E on the Frankel scale, muscles in both lower limbs were grade 5, and the intensity of back pain decreased from an 8 to a 3 on the Visual Analog Scale. X-ray image revealed PMMA cement in T7 vertebral body (Figures B, C). The patient was discharged without incident.

DISCUSSION

Destructive vertebral lesions are a common source of morbidity in patients with metastatic disease. Approximately 30% of patients with various neoplastic conditions develop symptomatic spinal metastases during the course of their illness [12]; pain is the chief complaint [13-15]. Neurologic dysfunction is another common symptom. The treatment of spinal metastasis is palliative and the ultimate goal of treatment is to improve the overall quality of life. Successful treatment of patients with spinal metastases requires understanding the extent to which these physical symptoms affect quality of life. Treatment is multifactorial, consisting of medications and radiotherapy. Hormone therapy, cytotoxic drugs, and bisphosphonates are increasingly being used to treat certain tumor types [16]. However, none of these modalities are uniformly effective in relieving pain or improving ambulatory status. Surgery is indicated only if the anticipated improvement in quality of life outweighs the risks. The goals of surgical intervention are pain control and either preservation or restoration of neurologic function, including ambulatory capacity and bladder continence.

Selection criteria for surgical intervention are not rigid, and the treatment plan for patients with metastatatic tumors remains highly individualized. General indications for surgical intervention (including tumor resection and spinal reconstruction) include 1) radioresistant disease, 2) spinal instability, 3) spinal cord compression by bone or disc fragments, 4) acute or progressive neurologic deterioation, 5) previous radiation exposure of the spinal cord, and 6) uncertain diagnosis.

Several authors have attempted to delineate the factors that are most important in determining surgical success [17,18]. Tomita et al proposed a novel surgical strategy for the treatment of patients with spinal metastases based on three factors: 1) grade of malignancy, 2) visceral metastases, and 3) extraspinal bone metastases [17]. Tokuhashi et al devised a preoperative evaluation of patients with metastatic spinal tumors [18]. According to their report, laminectomy should only be performed on patients with a poor prognosis and a life expectancy of less than 3 months; furthermore, En bloc resection with vertebrectomy and 360

reconstruction should be performed on patients with a life expectancy of more than 6 months. Surgical approaches to the spine may be broadly categorized into anterior, posterior, and combined approaches; the approach depends on the extent of the tumor and the patient's condition. Fournal et al [14] combined an anterior-posterior approach with pedicle screw fixation in the management of malignant spinal disease. Of their patients, 47% regained neurologic function, and 87% reported reduced axial pain. Similarly, patients in another series regained partial neurologic function and experienced pain relief [19].

However, patients with a short life expectancy cannot tolerate major surgery. Minimally invasive procedures such as endoscopy and percutaneous vertebroplasty may be more appropriate for those patients. In an attempt to reduce the morbidity associated with traditional thoracotomy, endoscopically assisted techniques have been combined with vertebrectomy and spinal cord decompression to treat patients with thoracic spinal metastases. Percutaneous vertebroplasty and kyphoplasty have been adopted to address axial pain in patients who are not candidates for surgery because of limited functional capacity, short life expectancy, or multiplelevel spinal disease.

However, these procedures are most clearly indicated in patients with well-localized disabling axial-type pain secondary to neoplastic thoracic or lumbar vertebral body fracture or collapse without evidence of epidural disease. Fournal et al [13] performed percutaneous vertebroplasty in patients who had spinal metastases with painful vertebral body fractures; 84% of the patients experienced pain relief. Patients with spinal metastases and epidural compression were excluded from their study because of the possible risk of cement leakage and subsequent neurologic symptoms [13]. The rates of cement leakage reportedly range from 30% to 60% [20]. To overcome the cement leakage problems in percutaneous vertebroplasty, Wenger and Markwalder [11] advocated performing either surgically controlled vertebroplasty or open vertebroplasty on osteoporosis patients. Currently, no method is available for treating patients who have spinal metastases with epidural compression.

In this study, surgically controlled vertebroplasty combined with decompressive laminectomy was performed to treat metastatatic spinal tumor with epidural compression. The potential problems associated with percutaneous vertebroplasty can be avoided by decompressive laminectomy and open X-ray fluoroscopic monitoring. Cement vertebroplasty provides enough spinal stability and relieves axial pain. Compared to traditional operations (vertebrectomy, reconstruction with cage, or PMMA bone cement and stabilization with pedicle screws), surgically controlled vertebroplasty with decompressive laminectomy is less invasive. The operative time is shorter, and there is less surgical trauma. Additional advantages over traditional operative techniques include: 1) active decompression to restore neurologic function, 2) spine stabilization by vertebroplasty to relieve axial pain, and 3) minimally invasive procedure. Although 70% of patients regain neurologic function and are relieved of axial pain after radiotherapy, it takes a few days before improvement is noticeable. In acutely paraparetic patients who are otherwise medically fit, urgent surgical decompression should always be considered first.

The surgical results in this study were satisfactory and were comparable to those achieved by traditional operations. All patients experienced significant pain relief immediately after the operation, and all regained neurologic function. No complications were noted in our patients. We evaluated the surgical results from five patients in this study; therefore, determining the surgical outcomes in a larger number of patients is necessary before additional conclusions can be drawn.

Limited laminectomy combined with surgically controlled vertebroplasty was a safe and effective method for treating patients with spinal metastases and epidural compression.

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外科控制式椎體成形術在轉移性脊椎腫瘤併脊髓腔壓迫病人的應用

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目的 對於轉移性脊椎腫瘤併脊髓腔壓迫病人的處理是複雜的。我們評估採用外科控制式椎體成形術和椎板減壓術處理這類病人。

方法 從2003年2月至2004年2月，共五個轉移性脊椎腫瘤併脊髓腔壓迫的病人，在我們部門接受治療。

結果 手術結果相當令人滿意，所有病人都恢復神經功能，且椎體的疼痛也都改善。

結論 從我們的經驗得知，外科控制式椎體成形術合併椎板減壓術，對於轉移性脊椎腫瘤併脊髓腔壓迫病人的處理，乃是一安全而有效的方法。（中台灣醫誌 **2004;9:113-8**）

關鍵詞

轉移性，脊椎腫瘤，椎體成形術

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收文日期：2004年4月10日　　修改日期：2004年5月7日

接受日期：2004年5月19日