Neurosurgical treatment of pathological fracture-dislocation of the spine

RICHARD G. PERRIN, M.D., AND KENNETH E. LIVINGSTON, M.D.

Division of Neurosurgery, The Wellesley Hospital, Toronto, Ontario, Canada

The treatment of 20 patients with symptomatic pathological fracture-dislocation of the spine is reviewed. The single most common primary disease was carcinoma of the breast (12 cases). Pain was the presenting symptom in 19 patients. At the time of surgery, six patients were weak but ambulatory, seven were bedridden, and three were paraplegic. The cervical spine (10 cases) was most frequently involved, followed by the thoracic region in six, and the lumbar segments in four. Treatment aimed at improving or preserving neurological function involved decompression of the cord (or cauda) with reduction of bone deformity and stabilization of the spine. Laminectomy decompression was performed in 18 cases. Posterior rib graft fusion was used to stabilize the spine in all patients with cervical, and in three with upper thoracic, pathological fracture-dislocation; Harrington rod instrumentation was used for lower thoracic and lumbar levels. All patients were considered for radiotherapy and/or chemotherapy. Ten patients are living, an average of 20 months following surgery. Among the remainder, the average survival was 5 months. Fourteen patients were ambulatory after surgery, four were improved, and two were unchanged. Twelve patients have achieved a "satisfactory" result (walking and continent 6 months after treatment), including the three who were paraplegic at the time of surgery.

Spinal metastases presenting as pathological fracture-dislocation of the spine may produce potentially devastating cord compression. Critical neurological sequelae can be avoided, and a satisfactory result can be achieved by urgent decompression of the cord and stabilization of the spine.

KEY WORDS • spine • metastasis • spinal cord compression • metastatic tumor • pathological fracture

Pathological fracture-dislocation of the spine is an ominous and potentially disastrous complication of systemic cancer. While the management of pathological fracture of the long bones is often considered and generally accepted, treatment of pathological fracture-dislocation of the spine has rarely been reported and is dismissed as "illogical." The purpose of this paper is to review our experience at the Wellesley Hospital, Toronto, concerning 20 patients who presented with pathological fracture-dislocation of the spine. This group is included in a series of 150 consecutive cases of neurosurgically managed symptomatic spinal metastases.

Summary of Cases

Clinical Material

The series included 18 women and two men, ranging in age from 30 to 74 years. The mean age was 47 years, with the distribution shown in Fig. 1. The single most common primary disease (Fig. 2) was carcinoma of the breast (12 cases). The thyroid and uterus were sites of primary disease in two cases each. Lymphoma, carcinoma of the lung, and squamous-cell carcinoma each accounted for a single case, and in one the primary disease was unknown.

Pain occurred in 19 patients, and was the earliest and most prominent symptom in each case. An associated radicular pain syndrome was documented in five cases, four of which involved cervical roots, and the remaining one occurred at T-1. Pain was particularly aggravated by movements about the involved segment. While pain had been present for as long as 1 year in one case, the average duration of pain preoperatively was 4.4 months. Impaired motor function followed the onset of pain in 16 cases. At the time of surgery, six patients were weak but ambulatory, seven were bedridden, and three were paraplegic (without clinically detectable voluntary movement). A sensory level was documented in 12 cases, and four...
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FIG. 1. Bar graph showing the age distribution in 20 patients with pathological fracture-dislocation. The mean age was 47 years.

FIG. 2. Bar graph showing the relative frequency of culpable primary neoplasms.

FIG. 3. The relative distribution of pathological fracture-dislocation is shown. The cervical segments were most frequently involved (10 cases). The thoracic spine was involved in six patients and the lumbar region in four cases.

demonstrated a Brown-Séquard syndrome. Another six patients showed radicular sensory impairment. In one patient, a previous cordotomy complicated assessment of sensory function.

Pathological fracture-dislocation most frequently involved the cervical segments (10 cases); the thoracic spine was involved in six patients, and the remaining four occurred in the lumbar region (Fig. 3).

In each case, the pathological fracture-dislocation was demonstrated on plain films (Figs. 4 and 5). Myelography showed a complete block in 12 patients, and an incomplete obstruction in two. Myelography was not performed in six cases, all with pathological fracture-dislocation of the cervical spine in whom the risks of the procedure were judged greater than the potential benefit.

Treatment

Treatment was aimed primarily at improving or preserving neurological function, and involved decompression of the cord with reduction of the bone deformity and stabilization of the spine. Skeletal traction was used to achieve realignment in those patients with cervical or upper thoracic pathological fracture-
dislocation. Traction was applied by means of skull tongs, and was generally associated with clinical improvement. These patients were maintained in traction during surgery on a Stryker frame.

Laminectomy decompression was performed in 18 cases. At surgery there was usually evidence of gross destruction of the bone involving laminae and pedicles at the level of fracture-dislocation. In most cases, the cord appeared less displaced and distorted by tumor mass than in those patients with symptomatic spinal compression due to extradural tumor but without pathological fracture-dislocation. After adequate decompression about the posterolateral circumference of the cord, it was often possible to remove a good portion of the cancerous vertebral body from in front of the cord. A tissue diagnosis was established in each case, confirming the presence of metastatic tumor.

Posterior rib graft fusion was used to stabilize the spine in all patients with cervical, and in three with upper thoracic, pathological fracture-dislocation. Care was taken to abrade the contiguous surfaces of rib strut and laminae before securing the graft in place. Rib graft fixation was achieved with heavy wires that had been passed beneath the laminae at two levels above and two levels below the involved segment (Fig. 4 right). Pathological fracture-dislocation involving the lower thoracic and lumbar levels was adequately reduced and stabilized using Harrington rod instrumentation. Surgery was performed in collaboration with colleagues in the Division of Orthopedics at the Wellesley Hospital (Fig. 5 right). All patients were considered for radiotherapy and/or chemotherapy in consultation with oncologists at the Princess Margaret Hospital (Regional Cancer Treatment Centre, Toronto).

Results of Treatment

Complications during the immediate postoperative period included pneumonia in one case and respiratory decompensation in a second patient. Both recovered with appropriate medical measures.

One patient died during the early postoperative period, 18 days after surgery, of disseminated disease. Ten patients are living an average of 20 months following surgery. Among the remainder, the average survival after operation was 5 months. Fourteen patients were ambulatory following surgery, four demonstrated improved motor function, and two were unchanged. Twelve patients have achieved a "satisfactory" result (walking and continent 6 months after treatment), including the three patients who were paraplegic at the time of surgery. Fourteen of the 19 patients who presented with back or neck pain were relieved of pain following treatment.

There have been two late stabilization failures. A 47-year-old woman with metastatic carcinoma of the thyroid, who enjoyed a satisfactory result from laminectomy and posterior rib graft fusion for pathological fracture-dislocation at T-5, presented 2 years later with increasing kyphosis. A second posterior rib graft fusion was unsuccessful, and her spine was subsequently stabilized with Harrington rod instrumentation. She continues to manage her household 5 months following the last procedure.

A 52-year-old woman with metastatic breast cancer, who was initially managed with laminectomy decompression and Harrington instrumentation for pathological fracture-dislocation at T-12, presented 7 months later with recurring back pain. Examination revealed extension of disease to adjacent vertebrae and deterioration in realignment achieved during the initial surgery. The Harrington rods had become loose. A second procedure was then undertaken and anterior spinal fusion performed via the transthoracic route. She is able to walk 3 months following surgery.

Discussion

Skeletal metastases occur in about one-quarter of patients with systemic cancer; the spine is most commonly involved. It has been estimated that one in 10 patients with skeletal metastases develop pathological fractures. When the spinal column is involved, vertebral destruction by metastatic tumor can be sufficiently severe to cause pathological fracture-dislocation. The threat to functional integrity of the spinal cord (or cauda) posed by the extradural tumor mass is then compounded by instability of the spinal....
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column. While the management of pathological fractures involving the long bones has frequently been discussed and is generally accepted,\textsuperscript{9,12-14} the treatment of pathological fracture-dislocation of the spine has rarely been reported and is poorly understood.

Spinal metastases causing cord or cauda equina compression produce signs and symptoms that constitute a characteristic clinical syndrome.\textsuperscript{1,4,5,11} The clinical features resulting from pathological fracture-dislocation of the spine are similar to those related to compression of the cord or cauda. Local back or neck pain is the presenting symptom. Pain is particularly aggravated by movement about the involved segment, and is reduced by immobilization, consistent with the underlying mechanical instability of the spine. Weakness usually occurs after the onset of pain and will progress relentlessly unless treated. Symptoms may be improved by preoperative traction designed to reduce spinal malalignment.

While symptomatic spinal metastases most commonly involve the thoracic segments,\textsuperscript{11,16} pathological fracture-dislocation shows predilection for the cervical spine. The lack of supporting thoracic structure, wide range of movement, and dependent position of the head can be expected to render the cervical spine particularly vulnerable to fracture forces and more susceptible to dislocation.

In the present series, recovery or preservation of neurological function was achieved with a combination of skeletal traction and surgical decompression. Documented clinical improvement with preoperative skeletal traction suggests that the underlying pathophysiology in this disorder may involve both distortion of the dural sac and its contents due to spinal malalignment as well as compression of the cord by tumor. Skeletal traction alone, with consequent spinal realignment produced only incomplete reversal of the neurological deficit. Subsequent laminectomy with decompression of the spinal cord and roots was then undertaken to promote further recovery of neurological function. Laminectomy, with removal of as much tumor as readily accessible, is particularly important when the cord has already received the maximum therapeutic radiation dose, or when the culpable tumor is radioresistant.

Contrary to opinion expressed elsewhere,\textsuperscript{4} spinal stabilization is a key consideration in the management of this disorder. Previous isolated case reports concerning stabilization of pathological fracture of the spine have dealt primarily with 1) the surgical approach (anterior or posterior) and 2) techniques for spinal stabilization (materials, such as acrylic, and devices).\textsuperscript{5} Comparison review of these cases led to the conclusion that one approach was not clearly superior over the other.\textsuperscript{4} In our experience, posterior decompression is preferred over the anterior approach. Wide laminectomy gives direct access to tumor, which is most often laterally situated and allows decompression of the nerve roots and dural sac beyond its equator. The posterior approach permits easy extension of the decompression over several segments (as is often required). In our series, reduction and stabilization of the spine were suitably maintained with posterior rib graft fusion in those patients with upper thoracic or cervical involvement. Posterior rib strut fixation at two levels above and two levels below the decompressed segments provides immediate spinal stabilization. Lower thoracic and lumbar instability was dealt with in collaboration with our orthopedic colleagues using Harrington instrumentation across the adequately decompressed segments. Posterior decompression and stabilization involves a standard technique applicable throughout the length of the spine.

Two patients required repeat spinal fusion. In one case, pathological fracture-dislocation at T-5 (primary thyroid) was initially managed with laminectomy decompression and posterior rib graft fusion. After 2 years of vigorous activity, the patient presented with increasing kyphosis which was not amenable to a second posterior rib graft fusion, and was subsequently managed with Harrington rod instrumentation. In the second case, pathological fracture-dislocation at T-12 (primary breast cancer) had initially been managed with laminectomy decompression and Harrington rod stabilization. Seven months after the initial surgery, the patient presented with increasing kyphosis related to extension of the tumor to the adjacent vertebrae and with loosening of the Harrington rod. In this case, the situation was managed with anterolateral, transthoracic anterior decompression of the vertebral body and bone graft interposition. Both patients continue to be ambulatory 5 and 3 months, respectively, following the last procedure.

All patients in this series were referred from the Regional Cancer Treatment Centre, Princess Margaret Hospital, Toronto. The combined expertise of surgical and oncological disciplines contributed to optimal management of these patients. No patient in the present series was worse as a result of surgery, and 15 patients were improved after treatment. Twelve have achieved a satisfactory result (continent and walking 6 months after treatment), including the three patients with no clinically detectable voluntary movement below the involved level at the time of surgery. Each of the 10 patients who have died succumbed to disseminated disease, not as a complication of spinal cord compression.

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References


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Address reprint requests to: Richard G. Perrin, M.D., Division of Neurosurgery, The Wellesley Hospital, 160 Wellesley Street, East, Toronto, Ontario, Canada M4Y 1J3.