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Management of spinal cord compression from metastatic malignant disease remains unsatisfactory. Results of surgical decompression are at best less than those of radiation therapy alone. However, new surgical approaches now focus on removing the anterior-situated tumor tissue which produces neural compression in about 85% of the cases. The results of these procedures that allow removal of the ventrally compressing tumor show significant improvement in the management of patients with spinal epidural disease. We review the surgical strategy of these new approaches and the attendant results. (Henry Ford Hosp Med J 1989;37:37-40)

Emergency surgical intervention to prevent the irreversible neurologic sequelae of spinal cord compression is common in patients with cancer. Spinal cord compression, which occurs in approximately 5% of patients with systemic cancer, is caused by metastatic erosion of the osseous spine with vertebral body collapse and bony subluxation or by intraspinal growth of soft tissue tumor. In such cases of spinal cord deformity, decompression of neural structures is mandatory to preserve neurologic function. However, the efficacy of surgical decompression in these circumstances has been disputed. Several investigators have shown that surgical decompression produces no additional benefit compared to radiation therapy (1,2). Unfortunately, radiation therapy preserves and restores neurologic function in only 45% to 50% of patients. Results of a new approach to surgical decompression, which is tailored to the specific anatomical location of the offending pathology, are superior to those reported previously. We are encouraged by the efficacy of this alternative surgical approach in managing patients with neural compression secondary to metastatic involvement of the osseous spine. Two illustrative cases are included in this report along with a review of the relevant literature.

Case Reports

Case 1

A 57-year-old white male presented with midthoracic back pain in May 1987. Neurologic examination was normal, except for tenderness on percussion of the midthoracic spine. Studies to evaluate the cause of hematuria disclosed a large renal mass, and the patient was admitted for nephrectomy. However, by the time of admission a partial Brown-Sequard syndrome was present with a sensory level at T4. Roentgenograms showed erosion of the pedicles at T4, and metrizamide myelography revealed a high-degree block to the flow of contrast at T4 (Fig 1). Computed tomography demonstrated a predominantly ventral location of the tumor with spinal cord compression (Fig 2). Spinal cord compression was presumed to be secondary to the renal cancer which had metastasized to the spine. Because of the extreme vascularity of these tumors, preoperative embolization of the tumor's vessels was performed (Fig 3). Over the next three days the patient's neurologic status deteriorated until he could not walk without assistance. Neurologic examination revealed the patient's bilateral motor power to be 3 on a scale of five (Table 1). On August 6, 1987, the T4 vertebral body along with much of the surrounding tumor was removed. A transthoracic approach allowed removal of the vertebral body while preserving much of the intact posterior elements. The tumor was a metastatic adenocarcinoma consistent with a renal primary tumor. The spine was fused with methylmethacrylate and metal rods (Fig 4). The patient's neurologic status improved dramatically within 24 hours of surgery, and he was ambulatory with a walker three months later.

Case 2

A 78-year-old Filipino male had prostate carcinoma diagnosed in July 1987 and had had midback pain since January 1987. Neurologic examination in August 1987 showed proximal lower extremity weakness. A myelogram revealed a complete block to the flow of contrast at T6. The patient refused surgery and was treated with radiation therapy. Over the next five days the patient's condition deteriorated, and a Brown-Sequard syndrome developed. By then the patient was no longer ambulatory, and motor power was 3 on a scale of five. On August 20, 1987, a transthoracic approach was used to resect the T6 vertebral body along with the surrounding tumor in the epidural space. The patient was ambulatory with a cane three months later.

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Fig 1—Anteroposterior view of myelogram demonstrating complete block to the flow of contrast at the midthoracic spine.

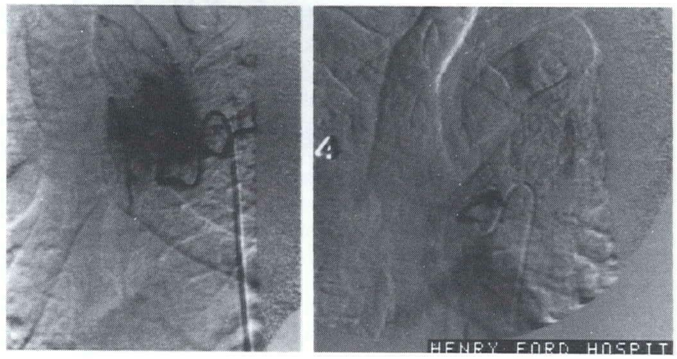

Fig 3—Preembolization spinal angiogram demonstrating the vascular nature of the tumor (left); postembolization angiogram demonstrating occlusion of all major vascular supply (right).

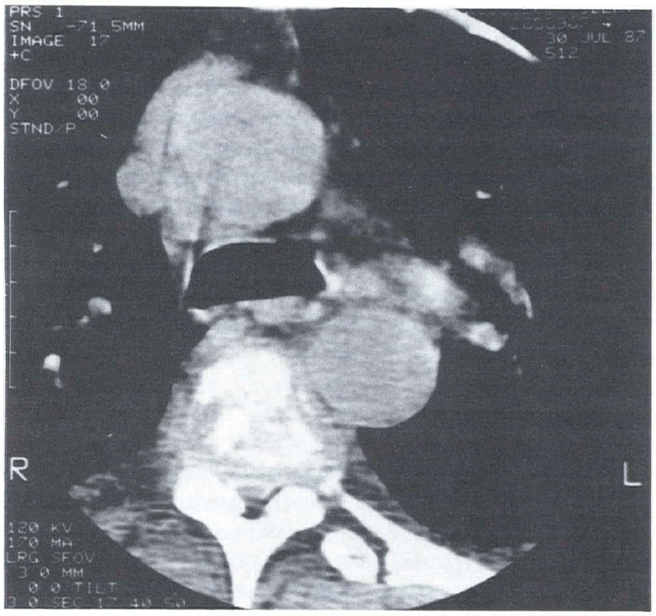

Fig 2—Postmyelogram computed tomography scan demonstrating soft tissue invasion of spinal elements predominantly anterior to the spinal cord.

Discussion

While physicians frequently encounter metastatic disease to the spine in patients with cancer, many are not aware of the higher success rate of the new surgical strategies which allow removal of the tumor tissue from the spinal cord and nerve roots. Black (3) reported that each year approximately 5% of patients with cancer develop spinal metastases, and as more effective therapies result in a prolonged life expectancy for cancer patients, the incidence of spinal metastases in the United States will exceed the 18,000 annual cases noted in 1975. In a randomized, controlled, prospective study, Young et al (2) compared the results of decompressive laminectomy to radiation therapy. Using the ability to walk as a measure of treatment outcome, they reported that 45% of patients were ambulatory after surgery combined with radiation therapy, whereas 54% were ambulatory when treated by radiation therapy alone. This analysis was not skewed to include a higher than usual incidence of radiosensitive tumors and accurately documented the pretreatment neurologic status. Based on these reports, many physicians believed that radiation therapy represented the optimal primary mode of therapy for spinal metastases unless a patient 1) had received previous radiation therapy, 2) was deteriorating rapidly, 3) had a radioresistant tumor type, 4) lacked a primary diagnosis, 5) had spinal instability or deformity with compression, or 6) was deteriorating during radiation treatment (1,3).

While posterior decompressive laminectomy allows "more room" for the spinal cord, 85% of spinal epidural metastases are situated ventral to the spinal cord and nerve roots. Although laminectomy can remove the "pinching" effect on these neural elements, the ventral compressive effects are largely unchanged, which may explain the relatively poor results of surgical decompression. Removal of these intact posterior elements may result in the development of further skeletal abnormalities, thereby complicating the original process. Tarlov et al (4-6) experimentally examined the clinical and pathological effects of an epidurally implanted inflatable balloon in the spinal canal of dogs and assessed the effects of acute and subacute spinal cord compression. The greater the magnitude and duration of the compressive force, the poorer the clinical and pathological outcome. These effects were noted in both acute and subacute compression. The damage to the spinal cord was worse in the imme-

Table 1
Numerical Grading of Muscle Power

0	No evidence of contractility
1	Slight contractility—no joint motion
2	Full range of motion with gravity eliminated
3	Full range of motion against gravity
4	Full range of motion against gravity with some resistance
5	Full range of motion against full resistance

Table 2
Indications for Surgical Intervention in Medically Suitable Surgical Candidates

Pathological fracture/dislocation causing compression
Ventral compression without primary diagnosis
Relapse after radiation therapy
Deterioration during radiation therapy
Nonradiosensitive tumor

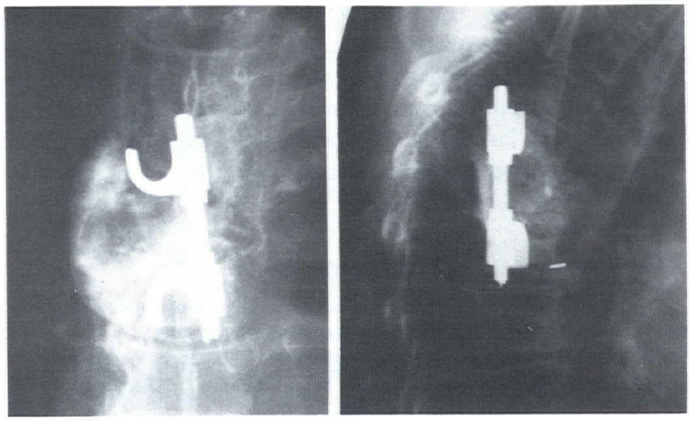

Fig 4—Postoperative anteroposterior radiograph demonstrating the fusion construct (left); postoperative lateral radiograph demonstrating the fusion construct (right).

diate vicinity of the compression site and was characterized by rarefaction and cavitation progressing to complete spinal cord destruction with fibrous replacement (4-6). Ushio et al (7) noted that the spinal cord adjacent to the site of compression demonstrates a markedly decreased vascularity and steroid-responsive vasogenic edema. These observations suggest that therapy should be focused directly on the site of compression.

Several surgical series have reported on the removal of the ventral epidural compression. While these studies are clinical reports, the results are superior when assessed according to the patient's ambulatory status. Siegel and Siegal (8) tabulated the standard indications for surgical intervention, to which we add "pathological fracture/dislocation" (Table 2). Their surgical approach was tailored according to the tumor's location within the spinal canal: posteriorly located lesions decompressed by laminectomy, and anteriorly located lesions decompressed by tumor-vertebral body resection (Fig 5). Siegal and Siegal's (8) results from using an anterior surgical approach on 61 patients were superior. Preoperatively 28% were ambulatory, 51% paraparetic, and 21% paraplegic; bowel and bladder dysfunction was present in 49% of the patients. Postoperatively 80% were ambulatory, 18% paraparetic, and 2% paraplegic; 93% of patients had normal sphincter control. Transient neurologic worsening occurred in only one patient. The operative mortality and morbidity were 11% and 7%, respectively.

Sundaresan et al (9) reviewed 101 consecutive patients with metastatic involvement of the spine who were treated with vertebral body resection. Preoperatively 90% had severe localized back pain and 45% were nonambulatory. Postoperatively 85% experienced a marked relief in pain and 78% were ambulatory. In a subgroup of 51 of these patients, 15 (60%) of the 25 patients who were not ambulatory preoperatively were ambulatory after surgery (10). This result is superior to that achieved by radiation therapy alone. In reporting his experience with 52 patients, Harrington (12) noted convincing improvement attributable to surgery.

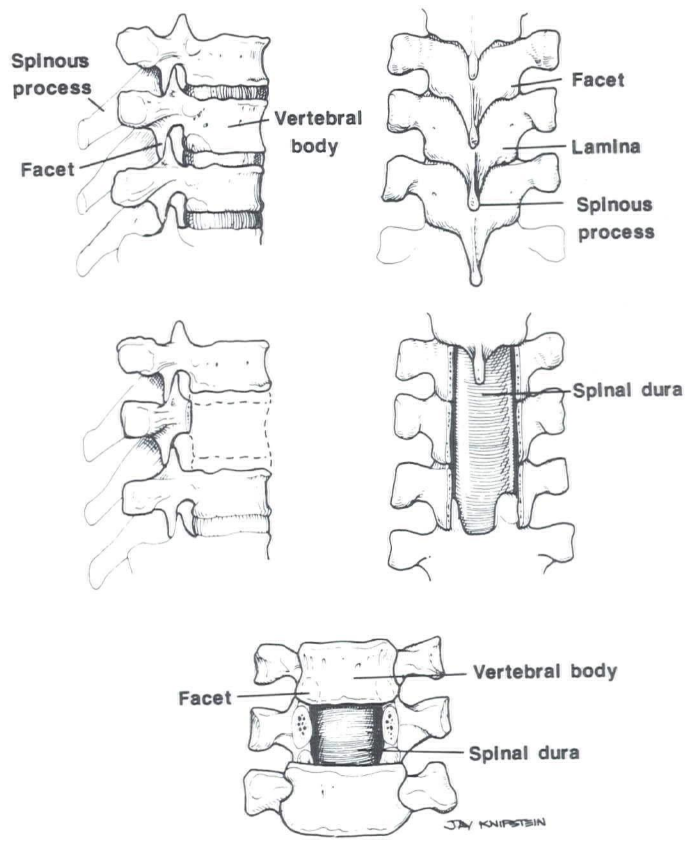

Fig 5—Lateral view (upper left) of the normal spine. Posterior view (upper right) of the normal spine. Dashed line (middle left) depicts the tissue removed by anteriorly directed surgery. Posterior view (middle right) of the spinal dura after decompressive laminectomy. Ventral view (bottom) of the spinal dura after anteriorly directed surgery.

These studies suggest that the outcome of surgery for spinal cord compression secondary to epidural metastatic compression is not as bleak as previously reported. While there is room for considerable improvement, the results of treating this condition noted over the last decade compel further study of the problem by using these new surgical alternatives.

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