J Neurosurg 53:741–748, 1980

Treatment of spinal epidural metastases

Randomized prospective comparison of laminectomy and radiotherapy

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Metastases to the spinal epidural space with compression of the spinal cord or cauda equina are commonly encountered by physicians in a variety of clinical fields. In the recent past, decompressive laminectomy followed by radiotherapy was thought to be the best available treatment. More recently, radiotherapy alone has been advocated as an alternative treatment mode with a similar rate of effectiveness. This study compares laminectomy followed by radiotherapy to radiotherapy alone in the treatment of spinal epidural metastases in a randomized, prospective clinical trial. No significant difference was found in the effectiveness of the two treatment methods in regard to pain relief, improved ambulation, or improved sphincter function. Patients with an incomplete myelographic block fared well regardless of treatment, and those with a complete block fared poorly. Because of the limited size of this study and because of certain unforeseen design defects, the results are suggestive but not conclusive. Suggestions are made for a future randomized, prospective multicenter study that would conclusively answer the perplexing question as to the most efficacious method for treating spinal epidural metastases.

KEY WORDS • **spinal cord compression** • **spinal cord tumor** • **laminectomy** • **radiotherapy** • **dexamethasone** • **metastatic tumor**

METASTASES from malignant tumors to the spinal epidural space with compression of the spinal cord or cauda equina are common clinical problems. Barron, *et al.*,[1] estimated that spinal epidural metastases develop in up to 5% of all patients with malignancies. Black[2] estimated that 18,000 new cases of spinal epidural metastases occur each year in the United States. For years, laminectomy was the only effective treatment for this problem. When effective radiotherapy (RT) became available, the two modes of treatment were combined.[9,14,23,35–38] Subsequently, it was suggested that RT alone might be an effective means of treatment.[6,11,17,21,22,24,26,27,29–31] Several retrospective studies[4,14,19,32,37] indicated that the combination of laminectomy and RT was the most effective treatment for this problem. However, a recent large retrospective study[13,19] indicated no significant difference in outcome when RT alone was compared to the combination of laminectomy and RT. Significant design defects in all published studies make reliable conclusions based on their data impossible.

This report describes the results of the first attempt of which we are aware to compare laminectomy plus RT to RT alone in the treatment of spinal epidural metastases, using a randomized prospective protocol. Although the number of patients in the study is limited, the results may be meaningful as a preliminary step in identifying certain problems that must ultimately be addressed in answering the perplexing ques-

tion of the most effective treatment of spinal epidural metastasis.

Clinical Material and Methods

Treatment Groups

The study was prospective in nature, and patients were assigned to treatment on a random basis by reference to a table of random numbers. Informed consent was obtained from all participants. All patients entering the study were required to meet the following criteria: 1) a tissue diagnosis indicating a malignant tumor not of central nervous system origin; 2) the presence of one or more of the following clinical signs or symptoms: a) motor weakness, b) loss of sensation, c) loss of sphincter function, d) spinal or radicular pain (this clinical criterion alone was not considered acceptable); and 3) the presence of an extradural lesion or extradural block demonstrated by myelogram that correlated with the clinical presentation. All myelograms were carried out with Pantopaque. In cases of complete block, contrast material was instilled above and below the lesion to accurately define its rostral and caudal extent.

Specific criteria for exclusion of patients were also established prospectively. Individuals with more than one demonstrable lesion who had previous RT to the area of spinal epidural metastasis or whose general medical status was too poor to permit surgery were excluded from the study. Patients meeting the above criteria who gave informed consent and who did not exhibit any criterion for exclusion were immediately randomly designated to one of two treatment groups as follows:

Group I: Laminectomy plus Radiotherapy. Patients in Group I underwent decompressive laminectomy on an emergency basis. Bone removal was carried out at least one vertebral level above and one level below the lesion. Any dorsal or lateral tumor was excised, but a ventrally located tumor was not pursued. Following the immediate postoperative period (usually 7 days), a course of megavoltage RT was given, with a total dose of 3000 rads given in 10 divided doses over approximately 14 days. Fields were calculated to extend one vertebral level above and one below the lesion. Treatments were delivered to a single posterior field, and the doses were calculated at a depth of 5 cm. All patients received an initial loading dose of 12 mg dexamethasone at the time of randomization. This was continued postoperatively at a dosage of 4 mg every 6 hours until RT was completed.

Group II: Radiotherapy Alone. Patients in this group received 400 rads per day for the first 3 days. Subsequently, 1800 rads was administered in seven equally divided doses delivered over approximately 14 days. Ports, field size, and dosage were calculated as for Group I patients. As with surgical treatment, initiation of RT was considered an emergency, and therapy was begun within 1 to 2 hours of the completion of myelography.

Patients in this group also received 12 mg of dexamethasone, followed by 4 mg every 6 hours until the conclusion of RT. When treatment was concluded, dexamethasone was tapered and then discontinued.

TABLE 1

Primary tumor in 29 cases of spinal epidural metastases

Primary Tumor	Group I	Group II
breast tumor	5	1
lung tumor	2	3
prostate tumor	1	3
melanoma	1	2
sarcoma	3	1
lymphoepithelioma	1	0
lymphoma	3	2
thyroid tumor	0	1
total	16	13

Evaluation Procedure

Thorough neurological evaluation was carried out prior to treatment. For the purpose of comparing efficacy of treatment, three aspects of the neurological status were considered, namely, pain relief, motor performance, and sphincter function.

Pain relief was assessed by comparing utilization of narcotic analgesics before and after treatment. Evaluation of motor performance was based solely on the patient's ability to walk independently. A patient was considered ambulatory if he or she could take steps alone, even if a cane or walker was required. Sphincter function was evaluated in regard to the patient's need for indwelling catheterization. All patients were followed at regular intervals after treatment until death. Survival time following treatment was recorded.

Results

Twenty-nine patients were admitted to the study. Sixteen patients were treated by laminectomy followed by RT (Group I), and 13 were treated by RT alone (Group II). Table 1 describes the tumor types treated. The patients' ages ranged from 19 to 70 years (mean 53.8 years) in Group I, and 34 to 83 years (mean 63.8 years) in Group II. Survival in Group I ranged from 4 to 117 weeks (mean 27.5 weeks), and in Group II from 1 to 83 weeks (mean 23.4 weeks).

Motor Performance

Motor performance is illustrated in Table 2. Three of six patients (50%) in Group I and all five patients (100%) in Group II who were ambulatory prior to treatment remained so in the immediate posttreatment period. By 4 months after randomization, three of six patients (50%) in Group I and three of five

TABLE 2

Motor performance in 29 cases of spinal epidural metastases

Results	Group I			Group II		
	Total Treated	Ambulatory No.	Ambulatory Percent	Total Treated	Ambulatory No.	Ambulatory Percent
immediate results						
ambulatory	6	3	50	5	5	100
not ambulatory	9	4	44	6	2	33
paraplegic	1	0		2	0	
at 4 months						
ambulatory	6	3	50	5	3	60
not ambulatory	9	3	33	6	2	33
paraplegic	1	0		2	0	

TABLE 3

*Sphincter function in 29 patients with spinal epidural metastases**

Results	Group I			Group II		
	Total Treated	No Catheter No.	No Catheter Percent	Total Treated	No Catheter No.	No Catheter Percent
immediate results						
no catheter	8	6	75	10	6	60
catheter	8	1	12.5	3	1	33
at 4 months						
no catheter	8	5	62.5	10	5	50
catheter	8	1	12.5	3	1	33

*Sphincter function was evaluated by the necessity to place a Foley catheter.

patients (60%) in Group II remained ambulatory. In Group I, four of nine patients (44%) who were not able to walk before treatment were able to do so immediately after treatment. In Group II, two of six such patients (33%) could walk immediately following treatment. By 4 months, these figures had decreased to three of nine patients (33%) in Group I, and two of six patients (33%) in Group II. No patient who was paraplegic in either group became ambulatory after treatment. Considering the same figures another way, six of 16 patients (38%) in Group I could walk before treatment and seven patients (45%) were ambulatory immediately after treatment, for a net gain of 7% in rate of ambulation. In comparison, five of 13 patients (38%) in Group II were ambulatory pretreatment and seven (54%) were ambulatory immediately after treatment, for a net gain of 16% in rate of ambulation. If we examine the results 4 months following treatment in relation to the number of survivors, we find that six of nine survivors (66%) were ambulatory in Group I, and five of six survivors (83%) were ambulatory in Group II. The differences between groups are not statistically significantly different either immediately following treatment or at 4 months. All statistical evaluations in this report utilized the chi-square comparison of proportions in two independent samples.[33]

Sphincter Function

Table 3 illustrates the effect of the two treatment methods on maintenance of sphincter function. Six of eight patients (75%) in Group I and six of 10 patients (60%) in Group II who were able to void without a catheter prior to treatment continued to do so after treatment. Only one of eight patients (12.5%) in Group I and one of three patients (33%) in Group II, who required an indwelling bladder catheter before treatment, no longer required catheterization after treatment. Overall, eight of 16 patients (50%) in Group I required a catheter before treatment and 10 (63%) required a catheter following treatment, for a net deterioration of 13% in sphincter function. In Group II, three of 13 patients (23%) required a catheter prior to treatment and six (46%) required a catheter 1 month following treatment, for a net deterioration of 23% in sphincter function. If we examine the results 4 months after treatment in relation to the number of survivors, we find that five of nine (56%) survivors in Group I were able to void without a catheter, and five of six (83%) survivors in Group II were able to do so. The differences between groups are not statistically significantly different, either immediately posttreatment or at 4 months.

Pain Relief

Fourteen of 16 patients (88%) in Group I and 12 of 13 (92%) in Group II had significant pain before treatment, as judged by use of narcotic analgesics. Following treatment, these figures dropped to 50% (a net improvement of 38%) in Group I, and to 46% (a net improvement of 46%) in Group II.

Influence of Myelographic Block

Although considerable attention has been directed to factors such as tumor type, rate of progression of neurological deficit, severity of deficit, and spinal level of the lesion, little recognition has been given to the presence of myelographic block as a prognostic factor in evaluating outcome of treatment of spinal epidural metastases. In reviewing our records, we noted that 22 patients had complete myelographic blocks (15 of the 16 patients in Group I and seven of the 13 in Group II). This difference in incidence of myelographic block in the two groups is statistically significant ($p < 0.01$), and indicates that in spite of randomization, the incidence of complete myelographic block was unequally represented in the two treatment groups. We compared the outcome in the groups with and without myelographic block regardless of type of treatment, and the results are illustrated in Tables 4 and 5.

The results in patients without myelographic block

TABLE 4

Effect of myelographic block on prognosis in 29 patients with spinal epidural metastases: motor performance

Results	No Block			Block		
	Total Treated	Ambulatory No.	Ambulatory Percent	Total Treated	Ambulatory No.	Ambulatory Percent
immediate results						
ambulatory	4	4	100	7	4	57
not ambulatory	3	2	67	12	4	33
paraplegic	0	0		3	0	
at 4 months						
ambulatory	4	3	75	7	2	29
not ambulatory	3	1	33	12	4	33
paraplegic	0	0		3	0	

are excellent, both in terms of ambulation and sphincter function. For instance, all patients without a myelographic block who were ambulatory before treatment remained so after treatment (Table 4). In addition, two of three nonambulatory patients could walk after treatment. Thus, six of seven patients (86%) without myelographic block and only eight of 22 patients (35%) with myelographic block were ambulatory following treatment. This difference is statistically significant ($p < 0.025$). By 4 months after treatment, all four (100%) surviving patients without block were ambulatory, whereas only six of 11 (54%) surviving patients with complete block could walk. Although these figures are very suggestive, they are not significantly different ($p < 0.1$), due in part to the small numbers involved. In addition, all paraplegic patients manifested complete myelographic blocks, and none benefited from treatment. A similar pattern was noted for sphincter function, that is, patients without a myelographic block fared considerably better (Table 5). Immediately following treatment, all patients without block were catheter-free, whereas only seven of 22 (32%) with a complete block were catheter-free. This difference is statistically significant ($p < 0.005$). The results at 4 months support this trend (that patients without block did better than patients with blocks), although the results are not statistically significant. Thus, five of seven patients (71%) with incomplete block and only seven of 22 (32%) with a complete block remained catheter-free. In terms of pain relief, there was no difference between narcotic usage in patients with or without complete myelographic block. Both groups showed a decrease of approximately 50% in the rate of narcotics intake for pain relief.

TABLE 5

Effect of myelographic block on 29 patients with spinal epidural metastases: sphincter function

Results	No Block			Block		
	Total Treated	No Catheter No.	No Catheter Percent	Total Treated	No Catheter No.	No Catheter Percent
immediate results						
no catheter	5	5	100	13	7	54
catheter	2	2	100	9	0	0
at 4 months						
no catheter	5	4	80	13	7	54
catheter	2	1	50	9	10	0

Complications

No specific complications, such as wound infection or dehiscence, cerebrospinal fluid leakage, or meningitis, occurred following surgery. Likewise, no specific complications directly related to the RT were observed. There were no deaths within 4 weeks of randomization in the surgical series (Group I), whereas a mortality rate of 24% was noted in Group II within 4 weeks of randomization. These deaths were related to rapid progression of the underlying disease process and not to the RT *per se*. Later than 4 weeks after randomization, the slope of the survival curves for the two groups was nearly identical.

Discussion

The size of this study does not allow us to provide a definitive answer to the question of whether radiotherapy (RT) alone or surgery plus RT is the better method of treating spinal epidural metastases. However, our results do demonstrate that a randomized prospective study of this problem is feasible. Furthermore, the study illustrates certain pitfalls and prognostic factors that heretofore have received little attention and that should be addressed in future definitive studies. A comparison of our results with several recently published series is of interest.

A recent retrospective analysis of a large group of patients with spinal epidural metastases treated by surgery plus RT or RT alone was provided by Gilbert, *et al.*[13] These authors concentrated almost exclusively on ambulation as a measure of treatment outcome. A comparison of their results with those of the present study shows that 46% of their patients compared with 45% of ours were ambulatory after surgery plus RT, whereas 49% of their patients and 54% of ours were ambulatory after RT alone. The differences between the two treatment groups are not statistically significant in either study and represent a remarkable similarity in final outcomes. Livingston and Perrin[19] reported that 58 of a group of 100 patients were ambulatory following surgical treatment of spinal epidural metastases. Cobb, *et al.*,[7] in a small, nonrandom, retrospective series, compared patients with spinal epidural metastases from breast carcinoma who were treated by laminectomy or RT. He found an am-

TABLE 6

Summary of ambulation pre- and posttreatment in five series

Authors & Year	Ambulation		Percent Improvement
	Pre-treatment	Post-treatment	
surgery + RT*			
White, *et al.*, 1971	19%	37%	+18
Cobb, *et al.*, 1977	35%	50%	+29
Gilbert, *et al.*, 1978	34%	46%	+12
Livingston & Perrin, 1978	29%	58%	+29
Young, *et al.*, 1980	38%	45%	+ 7
mean			+16
RT alone*			
Cobb, *et al.*, 1977	50%	67%	+17
Gilbert, *et al.*, 1978	34%	49%	+15
Young, *et al.*, 1980	38%	54%	+16
mean			+16

*RT = radiotherapy.

bulation rate of 46% after surgery and 63% after RT. White, *et al.*,[36] reported an ambulation rate of 37% following laminectomy with or without subsequent RT in a large series of spinal epidural metastases from a variety of primary sites.

Table 6 illustrates results from four series[7,13,19,36] that have appeared in the literature within the past 9 years and the present series. The precentages given have been taken directly from the papers cited, or have been calculated on the basis of the data given in the reports. Of greatest importance in these reports is the percentage improvement in ambulation, since it takes into account both the patients who became ambulatory and those who lost ambulation. The mean percentage improvement obtained from the five series comparing surgery plus RT and RT alone is identical (16%). These studies were selected for illustration because they represent results within the last decade and because sufficient data were present in each paper to provide figures suitable for comparison. Many other papers did not present data that would allow such a comparison.[5,8,11,14,17,24,35] Furthermore, many studies are now somewhat outdated due to subsequent advances in chemotherapy and RT, and are impossible to compare with current results.[3,18,23,15] Many flaws of significant proportions are present, even in the four studies included in Table 6 and in the present study.

The major objection to past studies is that they were not randomized nor prospective. The value and need for randomized and prospective clinical trials that adhere to established standards,[10,12] to evaluate treatment methods in neurosurgery, has recently been stressed.[15] Due to the lack of randomization, patients treated by RT or surgery in all past reports are not comparable. Thus, in the series of Gilbert, *et al.*,[13] only 28% of the patients underwent surgery. Specific criteria for patients entering their study were not used, and therefore the surgical and RT groups differ significantly. For instance, patients were treated surgically because of an uncertain diagnosis, because of failure of prior RT, and because of rapid progress of symptoms. The basic treatment mode used by Gilbert, *et al.*,[13] was RT, but even in their study, selection was used in that all patients with lymphomas received RT, as did all paraplegic patients. Likewise, the surgical and RT groups of Cobb, *et al.*,[7] are difficult to compare because the treatments were not standardized. For instance, 12 of 28 surgical patients received no postoperative RT, although seven of these 12 had received RT to the appropriate area a mean of 16 months prior to surgery.

Attempting to compare results from different series is even more hazardous because of the lack of clearly stated evaluation criteria. Only series that report ambulation percentages in a clear-cut manner can be compared. Many studies used terms such as "satisfactory" or "improved" to evaluate results, and do not define these categories further, or they combine several aspects of neurological function to obtain their overall evaluation. Other studies consider small improvements in motor power or sensation of a nonfunctional degree to represent significant changes. Thus, in spite of a large number of published reports, the question as to the relative efficacy of laminectomy versus RT in regard to motor performance is unresolved.

Significant bone destruction, with resulting spinal instability and deformity (usually anterior angulation and kyphosis), may be a factor related to the effectiveness of various treatments of motor function disturbances in patients with spinal epidural metastases.[2] Kyphotic deformity with spinal cord angulation and neural compression cannot be treated effectively by RT alone. Laminectomy, on the other hand, may actually increase the degree of instability and angulation by removing posterior support, and is ineffective in treating either ventrally located tumor tissue or posterior displacement of vertebral bodies resulting from direct destruction of bone or ligaments. In such instances, operative procedures involving vertebral body excision and/or internal fixation with wire, rods, or methyl methacrylate have been suggested.[2,19,38] Skeletal traction for reduction and temporary stabilization of cervical dislocation or instability, and external immobilization by means of the halo apparatus, may also be useful in such situations. Recognition of vertebral destruction and spinal instability as a significant factor determining response of motor disabilities to treatment is important for the clinical management of patients with spinal epidural metastases, and should be considered in the design of future studies to assess the relative efficacy of alternative treatment methods.

Some authors refer to pain relief as a criterion for success in the treatment of spinal epidural metastases. Cobb, *et al.*,[7] indicated that 46% of patients initially

treated by surgery were relieved of radicular pain, whereas 72% of initially irradiated patients had such relief. Livingston and Perrin[19] reported that 70 of 100 surgically treated patients were relieved of pain. In neither report is the method of analysis of effectiveness of pain relief described. Dunn, *et al.*,[9] utilizing criteria identical to those used in the present report, indicated that only 20% of their patients treated by a combination of surgery and RT were able to discontinue narcotics for pain relief. In some reports, pain relief is included with other criteria in an overall assessment of the effectiveness of treatment. Surprisingly, Gilbert, *et al.*,[13] made no comment as to pain relief in their large retrospective series. The present report indicates that effective pain relief was provided to about 50% of patients by laminectomy plus RT or RT alone as judged by abolition of the need for narcotic analgesics. A comparison of the effectiveness of the two treatment methods as to speed of onset of pain relief, degree of relief, and long-term effectiveness would be desirable but is not provided by the literature nor by the present report.

Surprisingly, little attention has been directed at improved urinary sphincter function as a criterion of success in the treatment of spinal epidural metastases. Most often this factor has been combined with motor function in obtaining an overall assessment of treatment effectiveness or has not been used as a criterion to judge treatment effectiveness. Dunn, *et al.*,[9] reported that 82% of their patients with bowel or bladder function intact maintained this function after treatment with surgery and RT. However, only 13% of their patients with sphincter paralysis regained function after treatment. Brady, *et al.*,[4] reported that if sphincter paralysis was present for 24 hours, recovery did not occur regardless of the treatment utilized. In this study, normal bladder sphincter function was preserved in 75% of patients treated by surgery plus RT and in 60% of patients treated by RT alone. These differences are not statistically significant; however, they suggest the need for further study of this specific aspect of the treatment of spinal epidural metastases. Similar to the reports of Brady, *et al.*,[4] and Dunn, *et al.*,[9] recovery was poor in our patients with pretreatment sphincter dysfunction requiring indwelling catheterization, regardless of the method of treatment. Of great importance in this regard is the relationship of the degree of myelographic block to success in the treatment of sphincter problems in spinal epidural metastasis. Thus, all of our patients with an incomplete block were able to void normally after treatment, regardless of the type of treatment, whereas only 29% with a complete block could void normally after treatment.

An additional factor that must be considered in the comparison of any treatment modes relates to the incidence of complications. The present series contains no surgical complications in an admittedly small number of surgically treated patients. Operative mortality in reported series ranges from 3% to 9%.[5,25,32,35,36] Reports of mortality following RT are uncommon. In our patients, the operative mortality was zero, whereas 24% of patients treated by RT died within 4 weeks of randomization. Such figures reflect the fact that patients with spinal epidural metastases are often systemically ill with diffuse metastatic malignant disease, and that mortality after RT or surgery usually relates to the basic disease process. Morbidity in surgically treated series, however, continues to be significant.

Such problems as wound infection, wound dehiscence, epidural hematoma, cerebrospinal fluid fistula, meningitis, and instability are related to poor tissue quality, the presence of residual invasive tumor in soft tissue, and bone destruction. Even the excellent surgical series of Livingston and Perrin[19] included a 10% morbidity rate. The morbidity for patients treated by RT is unknown; immediate cimplications seem insignificant, but the potential for later complications such as radiation-induced myelopathy is uncharted. Since the life expectancy of most patients with spinal epidural metastases is limited, this factor may not be of great significance. Nevertheless, patients with lymphomas and carcinomas of the breast and prostate, among others, may have prolonged life expectancies. No instances of morbidity related to RT were identified in our study. Deterioration in neurological function was accounted for by the methods used to evaluate outcome, and was not considered a "complication."

Corticosteroids were given in both treatment groups, in doses of 16 mg per day of dexamethasone. Confirmation of the potential effectiveness of corticosteroids has been obtained independently in a laboratory model of spinal epidural metastases.[28,34] Marshall and Langfitt[20] have suggested that large corticosteroid doses, as large as 40 mg or more per day, may produce marked improvement in neurological function in patients with spinal epidural metastases. They administered high-dose corticosteroids and RT as the initial treatment in 29 such patients. Seventeen patients who failed to respond to this treatment subsequently underwent laminectomy. Prior to treatment 17% of patients were ambulatory, whereas at discharge 50% were ambulatory, representing an impressive improvement of 32% in the rate of ambulation; however, several factors require consideration in evaluating these results. First, no control group is available for comparison, and second, 10 of their 20 patients had an incomplete myelographic block and, as pointed out in the current study, were likely to do well with any form of therapy. In spite of these defects, the report of Marshall and Langfitt[20] describes a potential alternative treatment method for patients with spinal epidural metastases, which must be considered in any future analysis of the problem.

The current study is deficient because the importance of a complete myelographic block on posttreat-

ment performance was not recognized prior to randomization. Patients with an incomplete block consistently fared better than those with a complete block. For instance, 85% of patients with an incomplete block were ambulatory after treatment, whereas only 36% of those with a complete block could walk. Furthermore, not a single ambulatory patient with an incomplete block lost the ability to walk immediately following treatment, whereas 43% of ambulatory patients with a complete block lost the ability to walk after treatment. In addition, all patients with incomplete blocks were able to urinate without an indwelling catheter, whereas only 32% of patients with complete block were catheter-free.

The length of myelographic block may also be a factor of prognostic significance. Of 18 patients in this study with a complete myelographic block extending over one to two spinal segments, 44% were ambulatory and/or maintained urinary control without catheterization after treatment. Conversely, of four patients with myelographic blocks extending over four to seven segments, none was ambulatory and all required urinary catheterization after treatment. Although the numbers are small, they suggest that patients with spinal block extending over more than two vertebral segments may fare poorly regardless of treatment method. It is impossible to compare our results with previous reports since this factor has not been carefully reported in the past.

The significance of myelographic block as a prognostic factor has occasionally received comment in past literature reports;[16] however, quantification of its importance has not been available previously. There were no significant differences in outcome in this study between patients treated by the combination of surgery and RT or RT alone. The surgical group, however, was unfavorably weighted with complete myelographic blocks, and conceivably, if appropriate randomization were carried out to balance the incidence of myelographic block, an advantage in favor of surgical treatment might be demonstrated.

There is general agreement that tumor histology is crucial as a predictor of outcome in the treatment of spinal epidural metastases.[2,9,13] Metastases from pulmonary carcinomas generally respond poorly to all forms of therapy.[2,32] Conversely, spinal epidural metastases from carcinomas of the breast and prostate and lymphomas respond considerably more favorably.[13,32] It has, in fact, been suggested that response to treatment of spinal epidural metastases is substantially determined by tumor histology rather than by the method of treatment chosen.[13] Future comparisons of the various treatments of spinal epidural metastases should ensure that treatment groups are balanced in terms of tumor histology. Probably most valuable of all would be a comparison of treatments with separate randomization for each histological type, although this may be impractical in other than a multicenter study.

In spite of deficiences, the present study has much to recommend it. Most importantly, it was prospective and randomized, delineated specific criteria for inclusion and exclusion of patients, and clearly stated its criteria for judging efficacy of treatment. These important elements should be included in future studies if conclusions are to have statistical validity. In this regard, it appears that only a multicenter study will provide sufficient numbers of patients within a reasonable time period to answer the perplexing question as to the most effective treatment of spinal epidural metastases. Even large cancer centers see only 50 to 60 cases of spinal epidural metastases per year, and when specific criteria are applied, some of these patients will be excluded. Thus, a single center is unlikely to accumulate sufficient patients within a reasonable time frame for analysis.

Conclusions

1. The current study, although limited in size, is the only randomized prospective analysis of the relative efficacy of surgery plus RT versus RT alone in the treatment of spinal epidural metastases. It demonstrated no statistically significant difference in effectiveness of the two treatment methods in regard to pain relief, motor performance, or sphincter function.
2. The importance of the presence or absence of myelographic block as a prognostic factor is emphasized. Patients without myelographic block showed excellent response to either surgery plus RT or RT alone, and emphasize the importance of early diagnosis of spinal epidural metastases.
3. The study demonstrates that a randomized prospective analysis of the treatment of spinal epidural metastases is possible. It provides an example of a possible study design and points out several potential pitfalls. Available published studies, because of design defects, are of limited usefulness in evaluating the relative efficacy of surgery and RT in the treatment of spinal epidural metastases.
4. Spinal epidural metastasis is a commonly encountered clinical problem for which the best treatment is unknown. A properly designed multicenter study could provide an answer to this problem in a relatively short period of time.

Acknowledgments

The authors wish to thank Lucia Miller and Donna Brown for secretarial support in preparing this manuscript. We also thank Drs. Robert King, Luciano Modesti, and Charles Hodge for referring patients for inclusion in this study. In addition, Mrs. Karen June provided invaluable assistance with patient protocols and follow-up review.

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