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ORIGINAL ARTICLE

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Surgery in spinal metastasis without spinal cord compression: indications and strategy related to the risk of recurrence

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Abstract Surgery in patients presenting with vertebral metastasis without neural deficit is controversial. A series of 107 patients (54 female, 53 male) were operated on at a mean age of 58. The metastasis was the first manifestation of the cancer in seven cases. In 100 patients, the cancer had been diagnosed 30 months earlier (average). Vertebral pain was present in all cases, with associated radicular pain in 43 cases. Pyramidal irritation without neural deficit was present in seven cases. The mean preoperative Karnofsky index was 64.7%. The mean preoperative Tokuhashi score was 8.6. The surgical approach depended on the topography of the metastasis. Ninety-three patients were dead at review, with a mean survival of 8 months. Seventeen patients underwent further spinal surgery, for local recurrence in nine cases, and for another spinal localization in eight cases, after a mean interval of 8 months. Recurrence occurred at the same level in all seven patients presenting with neural deficit at recurrence. Among ten recurrences without neural deficit, two were observed at the same level and eight were observed on another level. Surgery in vertebral metastasis without neural deficit results in substantial functional improvement, but does not increase the duration of life. For kidney metastasis, total vertebrectomy must be performed because of the risk of recurrence. For thyroid metastasis, total vertebrectomy is a good alternative to increase the efficacy of iodotherapy. In other cases, for patients with good general status, surgery must be adapted to the location of the involvement.

Key words Spine · Metastasis · Surgery · Recurrence

Introduction

Pain is the most common symptom in patients presenting with spinal metastasis without neural compromise. Surgery, radiotherapy and vertebroplasty are all effective treatments alone or in combination. According to Boland et al. [1], early aggressive treatment may be considered to avoid cord compression. The aim of this study is to determine indications and strategy of surgical treatment related to the length of survival and to the risk of recurrence.

Materials and methods

One hundred and seven patients were operated on for spinal metastasis without spinal cord compression. There were 54 women and 53 men, with a mean age of 58 (range 29–87). Neoplasm was revealed by spinal metastasis in seven cases. In the other cases, neoplasm had been known about for a mean period of 30 months (range 0–288 months). The primary tumour was predominantly lung neoplasm (37 cases), followed by breast neoplasm (30 cases), unknown (9 cases), kidney (8 cases), digestive tract (6 cases), others (17 cases). There were only two cases of primary prostate neoplasm. Back pain was the main symptom in all cases, with radiculopathy in 43 cases. Pyramidal irritation (Babinski sign, hyper-re-

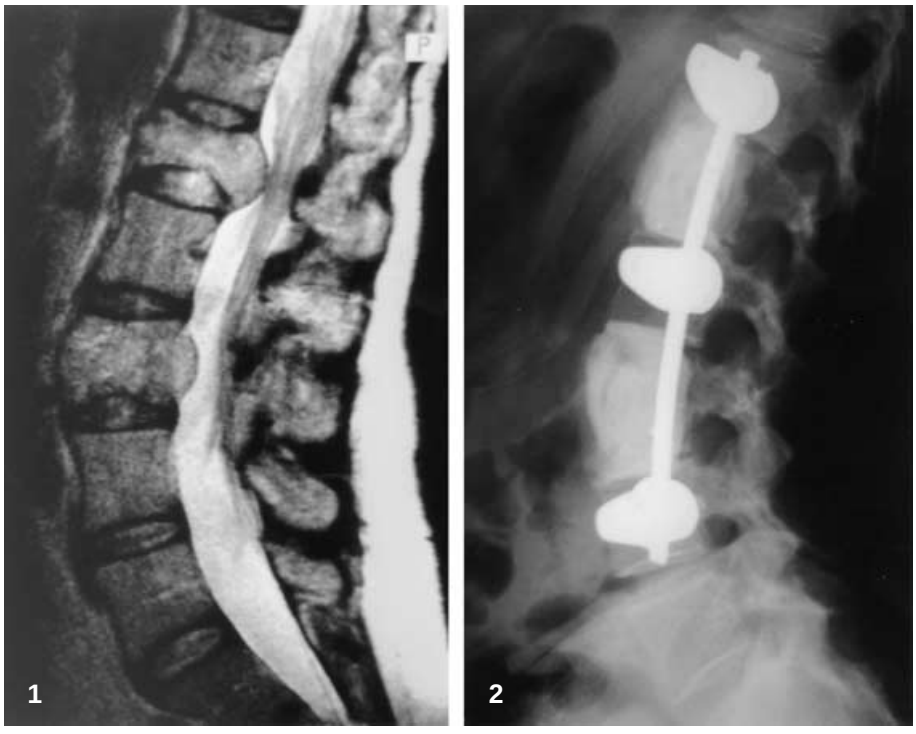


Fig. 1 Magnetic resonance (MR) image of a 48-year-old patient presenting with pyramidal irritation caused by metastasis of an unknown primary neoplasm with anterior epidural involvement at the L1 and L3 levels

Fig. 2 Postoperative radiograph after anterior approach with L1–L3 corporectomy with reconstruction and osteosynthesis from T12 to L4

flectivity, spasticity) without neural deficit was present in seven cases. Walking was impossible because of pain in 18 cases. Fifty-two patients received high doses of morphinics. Plain radiographs were available in all cases. To determine the topography of the metastasis, computed tomography (CT) scans were obtained in 83 cases, magnetic resonance (MR) images in 37 cases and radionuclide images in 58 cases. The metastasis was cervical in 25 cases, thoracic in 49 cases, lumbar in 31 cases, and sacral in 2 cases. A single vertebra was involved in 72 cases, and more than one vertebra in 35 cases, with involvement of adjacent vertebrae in 18 cases. The mean pre-operative Karnofsky index [7] was 64.7% (range 30–100%). Thirty-eight patients presented with a Karnofsky index of 80% or more. Fifty-three patients presented with a Karnofsky index of between 50 and 70% and 16 patients presented with a Karnofsky index of 40% or less. The mean preoperative Tokuhashi score [18] was 8.6 (range 3–12). Sixty-three patients presented with a preoperative Tokuhashi score of 9 or more; 7 patients presented with a preoperative Tokuhashi score of 5 or less. The surgical approach depended on the topography of the metastasis according to Onimus et al. [10]: when the anterior or medial column were involved, an anterior decompression was performed; when the posterior column was involved, a posterior approach was performed and when the involvement was circumferential, a combined anterior and posterior approach was performed. An anterior approach with corpectomy and reconstruction (cement or prosthesis with anterior instrumentation) was performed in 67 cases (Fig. 1, Fig. 2). A posterior approach with stabilisation and/or decompression was performed in 33 cases; a combined anterior and posterior approach was performed in 7 cases.

Results were evaluated with special reference to the functional result and the length of survival related to the primary neoplasm and the risk of recurrence. Survival rate was analysed according to Kaplan-Meier.

Results

Postoperatively, pain was improved in 105 patients. Out of 52 patients who were preoperatively treated with high doses of morphinics, 11 died during the 1st postoperative month; morphinic medication was decreased in 11 patients and was suppressed in 30 patients. Five out of 18 non-walking patients died before the 2nd postoperative month without regaining walking ability. Mean Tokuhashi score was 7 for these patients.

Ninety-three patients were dead at review, with a mean survival of 8 months (range 0–72 months) (Fig. 3). Fourteen patients were still alive, with a mean 19 months follow-up (range 10–36 months). Mean survival for patients with lung neoplasm was 5.4 months. One patient presenting with a spinal metastasis from lung cancer at T12 (Fig. 4) was treated by anterior approach (Fig. 5). Recurrence was observed 9 months after surgery (Fig. 6). He was not dead at review, after a follow-up of 14 months (Fig. 7). Out of 30 patients with breast neoplasm, 9 were alive at review and 21 were dead; mean survival was 15 months. All nine patients with unknown neoplasm were dead, with a mean survival of 8 months. Patients with kidney neoplasm had a mean survival of 9 months. Patients with digestive tract neoplasm had a mean survival of 5.3 months.

Mean survival for patients with a Karnofsky index of 80% or more was 11.8 months. Mean survival for patients presenting with a Karnofsky index of 40% or less was 4.4 months. Mean survival for patients with a score be-

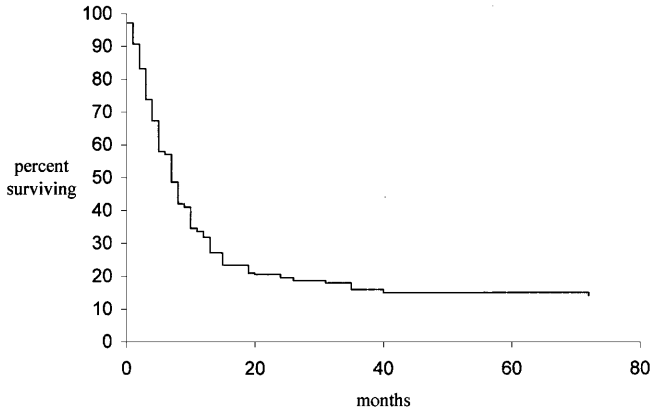


Fig. 3 Survival rate according to Kaplan-Meier

tween 50 and 70% was 7.3 months. Considering the Tokuhashi score, mean survival was 2 months when the score was 5 or less; it was 9.5 months when the score was between 5 and 9; it was 8 months when the Tokuhashi score was 9 or more.

Seventeen patients (15.8%) underwent further spinal surgery, for local recurrence in nine cases (8.4%) and for another spinal localization in eight cases (7.4%), after a mean interval of 8 months. The primary neoplasm was lung in four cases, breast in four cases, kidney in four cases, miscellaneous in four cases and unknown in one case. At first surgery, mean Tokuhashi score was 8.6 and mean Karnofsky index was 64.7%. Mean survival after surgery for recurrence was 4.45 months. Recurrence occurred at the same level in all seven patients presenting with neural deficit. Among ten recurrences without neural deficit, two were observed at the same level and eight were observed at another level. For recurrence with neurologic deficit, mean survival was 2.6 months; for non-neurologic recurrence, mean survival was 6.1 months.

Local recurrence occurred in six cases after anterior approach (8.9%) and in three cases after posterior approach (9.1%). Local recurrence was not observed after a combined approach.

Discussion

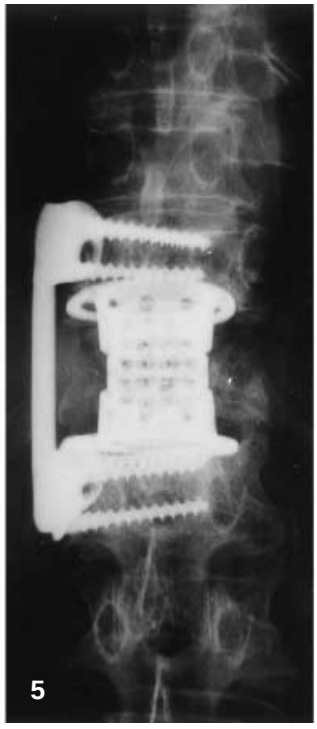
Surgery in vertebral metastasis without neural deficit results in substantial functional improvement, but does not

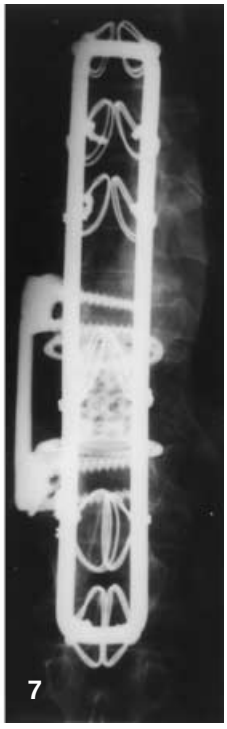
Fig. 4 Patient presenting with dorsal pain caused by a metastasis of T12 on MRI from a primary lung neoplasm

Fig. 5 Postoperative radiograph after anterior approach with a vertebral prosthesis and osteosynthesis from T11 to L1

Fig. 6 MR image of the case in Fig. 5 taken 9 months postoperatively shows recurrence at the same level with involvement of the posterior arch and recurrence at T2, T8, T9 and the posterior arch of T10

Fig. 7 Patient presenting with pyramidal irritation without neural deficit; reoperation was considered. Postoperative radiograph after posterior approach with T12 laminectomy and osteosynthesis from T7 to L2 because of the involvement of the posterior arch of T10. The second procedure allowed functional restoration





increase the duration of life. Mean survival varies according to the primary neoplasm. According to Nazarian et al. [9], lung metastasis has a bad prognosis, with a mean survival rate of 6 months, as was observed in our study. However, a wide variation between individuals in duration of survival can be observed, and that should be taken into account when considering treatment. Six patients out of 37 with lung primary neoplasm had a mean survival of more than 12 months in our study. According to Nazarian et al. [8], 12% of patients presenting with spinal metastasis have a survival of more than 5 years. Primary prostatic neoplasm was not frequent in this study, which concerned non-neurologic spinal metastasis, perhaps because the bone densification present in prostatic metastasis gives a better stability to the spine [11].

For non-neurologic patients, the Karnofsky index has proved to be more effective than the Tokuhashi score as a basis for surgical decisions. In our study, we found no difference concerning the duration of life when the Tokuhashi score was more than 5. According to Nazarian et al. [9], survival is longer when the Karnofsky index is above 70%, as was confirmed in our study. When the Tokuhashi score is more than 5, the Karnofsky index should be evaluated.

When the general status is not good (Karnofsky index under 40% or Tokuhashi score of 5 or less), palliative treatments other than surgery must be considered. Radiotherapy must be considered for patients with a poor general status [6, 16] or when surgery is ineffective from a technical point of view, as in the upper cervical spine [1]. However, radiotherapy does not correct spinal instability, and its efficacy is delayed. According to Resbeut et al. [13], its effectiveness decreases after some months. Radiotherapy may be effective following surgical treatment, as it can reduce pain when the tumour is not completely removed [13]. Postoperative radiotherapy did not decrease the risk of local recurrence in our study: five out of nine patients presenting with local recurrence received postoperative radiotherapy. No local recurrence was observed when total vertebrectomy was performed, in spite of the local contaminations during surgery. In these cases, radiotherapy is perhaps unnecessary and should be reserved for cases of local recurrence. Percutaneous transpedicular vertebroplasty with CT is useful in association with radiotherapy [3] in patients with a poor general status.

Vertical involvement must be taken into account before considering surgery: if only one vertebral body is involved (involvement of the posterior cortex or pathologic fracture), anterior surgery is more effective, because resection and stabilisation may be adapted to the metastatic topography and osteosynthesis can be limited to the adjacent levels. However, anterior surgery alone may result in local recurrence, and in simple vertebral involvement a combined approach may be discussed, the posterior approach making it possible to complete the vertebrectomy and to perform a short instrumentation. In cases with multiple vertebral involvement, a posterior approach is more appropriate, because it allows for an extended instrumentation. According to Roy-Camille [14], the instrumentation should be extended three levels above and three levels below the metastasis. Harrington [4] distinguishes between five categories of spinal metastasis patient before considering surgery:

1. No significant neurologic involvement
2. Involvement of bone without collapse or instability
3. Major neurologic impairment without significant involvement of bone
4. Vertebral collapse with pain resulting from mechanical causes of instability, but with no significant neurologic compromise
5. Vertebral collapse or instability combined with major neurologic impairment

According to Harrington, only categories 4 and 5 require surgery. However, this classification does not take in account the general status and the primary tumour. In cases of primary thyroid tumour, surgery is always indicated for maximal removal of bone lesions, and to allow iodotherapy to be effective [15]. According to Taneichi et al. [17], surgery should also be considered when the risk of impending collapse is considerable: more than 50–60% involvement of the vertebral body with no destruction of adjacent structures, or 25–30% involvement with costo-vertebral joint destruction in the thoracic spine; and 35–40% involvement of vertebral body or 20–25% involvement with posterior elements destruction in the thoracolumbar and lumbar spine. Some patients presenting with class 2 according to the Harrington classification should therefore be considered for surgery according to Taneichi and colleagues. In addition, involvement of the posterior cortex of the vertebral body with posterior protrusion or tumoral invasion of the canal without neurologic deficit, but with high neurologic risk, is an argument for surgery.

Risk of recurrence after surgical treatment is not well established in the literature. According to Nazarian et al. [9], local recurrence occurred in 80 out of 720 patients (11%) operated on for spinal metastasis, and recurrence at another spinal level occurred in 16.5%. According to Pointillard et al. [12], local recurrence occurred most commonly in breast neoplasm (26.8%), followed by kidney neoplasm (19.5%) and lung neoplasm (19.5%). These figures are consistent with our results, except for cases of kidney neoplasm, in which local recurrence occurred in four cases out of eight. Surgery in kidney metastasis should be as radical as possible, because of the higher risk of recurrence.

Local recurrence is often associated with neurologic involvement. Surgical treatment should be adapted to the topography of the metastasis. Bridwell et al. [2] observed local recurrence in 6 out of 19 cases of spinal metastasis (31.6%) treated by posterior decompression. According to

Hertlein et al. [5], no local recurrence was observed when surgery was performed according to the metastatic localization. Local recurrence occurred in 8.4% in our study after an appropriate approach, and was identical for anterior and posterior approaches. In patients with a good general status (Karnofsky index > 70%), and where the primary neoplasm is not responsive to adjuvant therapy, a combined approach should also be considered to avoid local recurrence.

In cases of local recurrence without neurologic deficit, surgery may be an alternative to palliative radiotherapy, because duration of life is longer than when neurologic deficit is present. Neurologic deficit with local recurrence is rarely caused by instability of the spine, but most often by tumour compression. There is no instability in these cases, because of the stabilisation performed during the first surgery. Palliative radiotherapy is a good alternative when the Tokuhashi score is low and when the general status of the patient is poor.

Conclusion

Surgery in vertebral metastasis without neural deficit results in substantial functional improvement, but does not increase the duration of life. For patients with a good general status, surgery should be considered according to the vertical and horizontal topography of the metastasis, the aim being to decrease the risk of local recurrence and neurologic compromise. In cases of metastasis from kidney or thyroid neoplasm, total vertebrectomy is a good alternative to avoid local recurrence, especially if a single vertebra is involved. For patients with poor general status, vertebroplasty and/or radiotherapy should be discussed.

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