METASTATIC RENAL CELL CARCINOMA OF BONE: INDICATIONS AND TECHNIQUE OF SURGICAL INTERVENTION

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ABSTRACT

Purpose: We describe the efficacy of surgical excision of metastatic renal cell carcinoma of bone for achieving local tumor control, pain control and functional outcome with emphasis on the indications and techniques of surgical intervention as well as oncological outcome.

Materials and Methods: Between 1980 and 1997 we performed surgery on 45 patients (56 lesions) with metastatic renal cell carcinoma of bone. Indications for surgery were solitary bone metastasis, intractable pain, or impending or present pathological fracture. Surgery involved wide excision in 29 cases, marginal excision with adjunctive liquid nitrogen in 25 and amputation in 2.

Results: None of the patients had significant bleeding intraoperatively. Mean hospital stay was 9.8 days, during which there was no flap necrosis, deep wound infection, nerve palsy or thromboembolic complication. Postoperatively pain was significantly relieved in 91% of patients, while 89% achieved a good to excellent functional outcome, and 94% with metastatic lesions of the pelvic girdle and lower extremities were ambulatory. Local recurrence developed in only 4 of the 56 lesions (7.1%), including 3 after marginal resection. Survival was more than 2 years in 22 patients (49%) and more than 3 in 17 (38%).

Conclusions: Surgical excision is safe and reliable for restoring mechanical bone stability, relieving pain and providing good function in most patients with metastatic renal cell carcinoma who meet the criteria for surgical intervention. Relatively prolonged survival in these cases justifies considering surgical intervention when feasible.

KEY WORDS: kidney; carcinoma, renal cell; neoplasm metastasis; bone

Renal cell carcinoma is characterized by a lack of early warning signs, which results in a high proportion of cases of locally advanced disease or metastasis at diagnosis. This disease metastasizes via the lymphatic or venous routes, and the lung parenchyma, bone, liver and brain are the most common sites of metastases. Radiographic techniques, such as ultrasonography, computerized tomography (CT) and magnetic resonance imaging, detect asymptomatic renal cell carcinoma more frequently and at a lower stage of disease, when tumors may be resected with curative intent or metastatic dissemination is in the early stage. As a result, fewer than 20% of patients with renal cell carcinoma have overt metastasis at the initial presentation.

Renal cell carcinoma is resistant to chemotherapy and radiation therapy. However, 10% to 20% of patients achieve a complete or partial response to interferon, interleukin-2 or each therapy with a durable response of greater than 2 years in 5% or less. In patients with localized disease surgical resection of the primary tumor remains the mainstay of therapy.

Metastatic renal cell carcinoma of bone is often associated with disabling pain and mechanical failure of the skeletal structure due to pathological fracture (fig. 1). Although metastasis to bone represents an advanced stage of the underlying disease, it may be associated with relatively prolonged survival. However, reports of survival conflict, indicating a rate of less than 15% to more than 50%. Therefore, indications for surgical intervention and the appropriate extent of surgery remain controversial. Some groups recommend minimal intervention because of the mere presence of metastatic disease, while others advocate wide excision of metastatic lesions because of the unresponsiveness of renal cell carcinoma to noninvasive measures, such as chemotherapy and radiation therapy, and the possibility that survival may be relatively prolonged in treated patients. Existing reports on the surgical management of metastatic renal cell carcinoma of bone have limited value since they are based only on a small number of patients or fail to mention the surgical technique and its effect on local tumor control. We retrospectively analyzed the records of 45 patients surgically treated for metastatic renal cell carcinoma of bone, emphasizing the indications and techniques of surgical intervention, and focusing on local tumor control as well as functional and oncological outcome.

MATERIALS AND METHODS

Between 1980 and 1997 we performed surgery in 23 men and 22 women (56 lesions) 39 to 92 years old (median age 60) with metastatic renal cell carcinoma of bone. All participating surgeons had trained together and they used the same indications for surgery, and techniques of resection and reconstruction. Bone metastasis was solitary in 11 cases and multiple in 34. Mean interval from the primary diagnosis of renal cell carcinoma to the detection of metastatic disease was 14.7 months (median 7.5, range 0 to 30). There was metastatic disease at presentation in 15 cases. Because patients were referred to our institutions from various oncology centers, treatment given before referral was not uniform. Two patients who presented with multiple bone metastases

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were given interferon-α and 11 lesions were managed by radiation therapy, including 7 solitary tumors and 4 associated with multiple bone metastases.

Indications for surgery were a solitary bone metastasis in 11 cases, intractable pain in 24 and impending or pathological fracture at presentation in 21. Impending and pathological fractures were grouped as a single indication because each represents mechanical skeletal failure. Figure 2 and table 1 show the anatomical sites and indications for surgery of the 56 lesions. In 7 patients with 2 or more metastatic lesions that met the criteria for surgical intervention the neoplasms clinically presented in metachronous fashion, and so simultaneous surgical intervention was not required.

Wide excision, consisting of en bloc removal of the tumor with a cuff of normal bone and soft tissue with or without skeletal reconstruction, was done when bone destruction was extensive or there was a solitary bone metastasis. Marginal excision with cryosurgery, consisting of curettage with adjuvant freezing of the tumor cavity with liquid nitrogen, was performed when the circumferential rim of cortex remaining after tumor removal was sufficient to ensure mechanically stable reconstruction. We applied liquid nitrogen to extend further the margins of resection after curettage. Amputation was done when there was massive tumor extension to the soft tissue with invasion of the major neurovascular bundle of the extremity.

Preoperatively all patients underwent staging studies, including plain x-ray and CT of the affected bone, CT of the chest and bone scan. Selective arterial embolization of the lesion was performed with the intent to decrease intraoperative blood loss质16 1 day preoperatively in all patients except those who were candidates for amputation.

For the initial 2 years postoperatively patients were evaluated every 3 months with physical examination, plain x-ray and chest CT, semiannually for an additional 3 years and annually thereafter. An orthopedic oncologist analyzed the clinical records and operative reports. The histopathological diagnosis, results of staging studies, type of surgery, complications, local tumor recurrence rate, and oncological and functional outcome were determined. Functional evaluation was done according to the American Musculoskeletal Tumor Society system质17 which assigns a numerical value to pain,
function and emotional acceptance of the upper and lower extremities; hand positioning, dexterity and lifting ability of the upper extremities; and supports, walking and gait in the lower extremities. Results are based on the most recent followup in each case.

RESULTS

Between 1980 and 1997 we performed surgery for 56 metastatic bone lesions of renal cell carcinoma in 45 patients, including wide excision in 29, marginal excision with cryosurgery in 25 and amputation in 2. Three lesions for which marginal resection was performed were treated with adjuvant radiation therapy. There was no significant intraoperative bleeding, defined as a loss of more than 600 cc of blood from a lesion of the extremities or 1,200 cc from a pelvic lesion, and no flap necrosis, deep wound infection, nerve palsy or thromboembolic complication. In 2 cases (4.4%) superficial wound infection was managed satisfactorily nonoperatively. Mean hospital stay was 9.8 days (median 8, range 6 to 21). After hospital discharge 32 of 34 patients (94%) with metastatic renal cell carcinoma of the pelvic girdle and lower extremities were ambulatory and 2 (6%) were wheelchair bound.

Postoperatively 41 patients (91%) had significant pain relief. Function was estimated to be good or excellent in 40 patients (89%), moderate in 2 (4%) and poor in 3 (7%). No difference in pain control or function was noted in those who underwent wide excision or marginal excision with cryosurgery. Four lesions (7.1%) recurred, including 3 after marginal excision with cryosurgery and 1 after wide excision. Radiation therapy was administered for 2 lesions but the remaining 2 were not treated because recurrence was an asymptomatic and preterminal event.

Table 2 shows patient survival according to the indication for surgical intervention. The number of patients in each subgroup was too small to allow valid statistical analysis. However, it seems that those with a solitary metastasis at presentation had better survival, since 73% lived more than 3 years after surgery but only 25% with intractable pain and 28% with impending or pathological fracture at presentation survived that long. Overall 29 patients (64%) lived more than 1, 22 (49%) more than 2 and 15% 5 years postoperatively.14

The oncological objective of excising metastatic renal cell carcinoma of bone is the achievement of local tumor control. Patient survival is determined by metastatic disease at other sites, inherent biological behavior of the tumor and tumor response to adjuvant treatment modalities. Therefore, the rate of local recurrence is the most appropriate criterion by which to evaluate the oncological adequacy of resection margins.

The advantage of marginal excision with cryosurgery around a weight bearing joint is that the joint surface is preserved and not replaced by a prosthesis. The initial application of cryosurgery for managing metastatic bone cancer is attributed to Marcore and Miller, who treated a 48-year-old man with painful metastatic lung carcinoma to the proximal humerus that was resistant to radiation therapy.13 Their technique involved wide incision, thorough curettage of the tumor cavity and repetitive exposure of the curetted area to temperatures less than −20°C by liquid nitrogen instillation. They advocated this method as a physical adjuvant in the hope of decreasing the high rate of local recurrence after curettage, avoiding the need for extensive resection and reconstruction. Their patient had complete pain relief after treatment. Liquid nitrogen was soon used with surgery for various bone tumors. In 1977 Marcore et al presented their series of 12 patients treated with cryosurgery for metastatic renal cell carcinoma of bone.22 Most patients were referred with advanced disease. However, none of the 4 patients who survived more than 2 years after surgery had local disease recurrence. In 1982 Marcore summarized 17 years of experience with managing bone tumors by cryosurgery.20 He reported on 20 patients with metastatic renal cell carcinoma of bone, including 5 with a solitary bone metastasis. Of the latter group local tumor control was achieved in 4 cases, while in 1 local recurrence was due to a technical error during cryosurgery. In our series marginal excision with the adjunct use of cryosurgery failed to achieve local tumor control in 3 of 25 patients (12%). Wide excision resulted in better local control since only 1 of 29 patients (3%) who underwent this procedure had local recurrence.

Grant and deKernion recommended palliative orthopedic intervention in any patient with a life expectancy of more than 2 months.21 Due to the expected survival associated with metastatic renal cell carcinoma of bone Smith et al concluded that most survive long enough to benefit from a palliative orthopedic procedure.14 Although wide excision of a bone tumor is usually curative, it may also be successful for palliation of a resectable bone lesion that meets the criteria for surgical intervention, including intractable pain and impending or present pathological fracture, even in a case that seems oncologically hopeless. This approach is even more promising for managing metastatic renal cell carcinoma of bone because a significant percent of these patients live a few years after clinical presentation. As in our series, excising metastatic renal cell carcinoma of bone is associated with a short hospital stay, good pain control and functional outcome as well as tolerable morbidity. Wide excision may achieve

Table 2. Indications for surgical intervention and patient survival after excision of renal cell carcinoma metastatic to bone

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better local tumor control than marginal excision with adjuvant cryosurgery.

CONCLUSIONS

Surgical excision may locally control metastatic renal cell carcinoma of bone, relieve pain and allow good function in most patients who present with intractable pain and impending or present pathological fracture. Wide excision achieves better local tumor control than marginal excision with cryosurgery. We believe that the relatively prolonged survival of these patients justifies considering wide excision when possible.

REFERENCES