Injury, Int. J. Care Injured 44 (2013) 1092–1096

Contents lists available at SciVerse ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Surgical treatment of impending and pathological fractures of tibia

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ARTICLE INFO

Article history:
Accepted 4 April 2013

Keywords:
Tibia
Metastasis
Pathological fractures surgical treatment
Survival

ABSTRACT

Advances in adjuvant and neoadjuvant therapies have improved the prognosis of cancer patients leading to an increasing incidence of bone metastases and consequent long bone fractures. In the present study the authors consider the indications and the different surgical options of treatment of tibial pathological lesions. 13 patients (14 lesions, 6 pathological fractures), treated according to histotype and lesion localisation, were retrospectively evaluated. Using generic outcome instruments such as the Eastern Cooperative Oncology Group (ECOG) and Quality of life questionnaire of European Organization for Research and Treatment of Cancer (QLQ-C30) pain, mobility and use of analgesics were evaluated before and after surgery. In all patients, mechanical stabilisation of the osteolytic lesion was achieved. There were no pathological fractures, and no implant mechanical failure. All patients reported pain relief, with a relevant reduction in the amount of analgesics used. Surgical treatment of tibial metastases has to be decided taking into consideration the histotype, localisation of the metastases and life expectancy. The treatment has to be all-encompassing in a solitary lesion in patients with a good prognosis but less invasive in plurimetastatic patients with poor prognosis. Acquisition of good mechanical stability is crucial for a successful outcome.

Introduction

Approximately 50% of patients affected by cancer eventually develop a secondary localisation of the primary tumour to the skeleton, which is considered the third site of cancer metastasis after lung and liver.[20] The most commonly affected skeletal sites are the spine and the pelvis, followed by the femur and the humerus.[9,22] Advances in adjuvant and neoadjuvant therapies have improved the prognosis of cancer patients leading to an increasing incidence of bone metastases and consequent long bone fractures.[23,24]

The improvement in life expectancy of cancer patients has led to a more frequent involvement of the tibia lately. Tibia metastases are quite rare and generally represent the expression of a more advanced illness. The initial symptoms of a metastasis located at the tibia is usually pain due to segmental mechanical instability.[4,10] Chemotherapy, radiotherapy, pain relief and diphosphonates are the most indicated strategies when life expectance is short and in the absence of a fracture.[17] An actual or impending tibial pathological fracture would have an impact on the patients' quality of life: in this case, standard treatment usually consists of pain relief and mechanical stabilisation of the tibial fracture, to allow for early weight bearing and ambulation, leading to a consistent improvement in the quality of life.[3]

Surgical options for the impending or actual pathological fracture of tibial metastases range from simple curettage to wide resection of the lesion: in particular, treatment should take into consideration primary tumour histotype, site and size of the tumour mass and overall life expectancy.[5,23] Hereby, we report our retrospective analysis on patients with actual or pending tibial fractures managed at our institution, and reviewed in terms of surgical strategy, quality of life and return to function.

Patients and methods

From 1998 to 2009, 254 patients were treated at our institution for metastatic lesions involving the appendicular skeleton. Of these, we electively reviewed patients with lesions involving the tibia and managed surgically. The current analysis excluded lesions occurring in children and/or patients with primary bone neoplastic lesions. In total 13 patients (8 males) with a median age of 70 years (range 56–76) met the inclusion criteria. There were a total of 14 secondary metastatic lesions (one patient affected by kidney cancer had both tibias involved). Primary neoplastic sites included, breast ($n = 2$), kidney ($n = 3$), lymphoma ($n = 3$), bladder ($n = 1$), urothelial carcinoma ($n = 2$), myeloma ($n = 1$), colon ($n = 1$) and thyroid ($n = 1$) (Table 1).

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http://dx.doi.org/10.1016/j.injury.2013.04.001

Table 1
Details of histotype, localisation of the treated tibial lesions and presence of a complete or impending fracture.

Histotype	Localisations	Fractures
2 breast	Diaphyseal	Fracture
3 kidney (in 2 patients, 1 bilateral)	Metaphyseal, distal, diaphyseal	Impending, fracture, fracture
3 lymphoma	2 metaphyseal, 1 distal	Impending, fracture
1 bladder	Distal	Fracture
2urothelial carcinoma	Diaphyseal, metaphyseal	Impending
1 myeloma	Diaphyseal	Impending
1 colon	Diaphyseal	Fracture
1 thyroid	Metaphyseal	Impending

Five lesions were located at the metadiaphysis, 5 at the proximal metaepiphysis, and 4 at the distal tibia. In 8 cases the authors observed an impending fracture whereas another 6 cases patients come to our attention from the emergency department for a complete fracture of the tibia, occurred after a low energy trauma. All lesions had an extension of more than 2.5 cm in length and a substitution of more 50% of at least one cortex. Indications to surgery were considered a complete or impending fracture, presence of intractable pain unresponsive to opioids, complete inability to walk for pain and more than 3 months of life expectancy.

In all patients low dose heparin (4000 U.I. enoxaparin sodium) was administered for 30 days postoperatively. Prophylactic antibiotics, third generation cephalosporin, was administered intraoperatively and 4 days after surgery. Biopsy was performed in all cases. All but the patients with renal cell carcinoma underwent adjuvant chemotherapy and radiotherapy, while patients with renal cell carcinoma underwent immunotherapy, as usual.

Surgical strategy was planned taking into account several factors, including size and site of the lesion, histology, and the presence of visceral metastasis. Patients with multiple metastasis and a tibial metadiaphyseal localisation were treated by the insertion of an unreamed static intramedullary locked nail (Fig. 1a and b). Lesions at the proximal tibia were treated by intralesional piecemeal removal, and void filling with bony cement. In one patient the insertion of 2 Rush nails across the bone cement was used to obtain a stiffer construct. In one patient with metastasis of breast cancer, cement loaded with doxorubicine was used. In two locations at the proximal tibia secondary to thyroid and urothelial metastatic disease, a modular prostheses (Mutars® System, Implantcast, Germany) was implanted. In the patient with metastasis by thyroid and kidney carcinoma, neoadjuvant embolisation was performed to reduce intraoperative bleeding and ease an accurate tumour resection. The latter patient (urothelial) had a contemporary involvement of the metaepiphyseal fibula and the proximal tibia as well: in this patient, before the implant of knee prosthesis, a wide proximal fibular and tibial resection including peroneal nerve was performed (Fig. 2a–c).

In the involvement of the distal tibia, treatment was differentiated according to the histotypes and the overall prognosis (life expectancy) of the patient. In a case with a bladder primary tumour and metastatic diffusion, treatment was curettage and cement with metal pinning. In another patient, where kidney was the primary tumour, distal tibial metaepiphyseal diffusion of the metastatic lesion was treated by the insertion of a locked anterograde intramedullary nailing, while the gap was filled with cement as already described[13] (Fig. 3a and b).

All patients were clinically evaluated before and periodically after surgery with regard to pain, mobility, general condition, quality of life using the Eastern Cooperative Oncology Group (ECOG),[2] Quality of life questionnaire of European Organization for Research and Treatment of Cancer (QLQ-C30).[1] Moreover, the type and amounts of analgesic drugs taken to control the pain pre- and post-operatively were recorded.

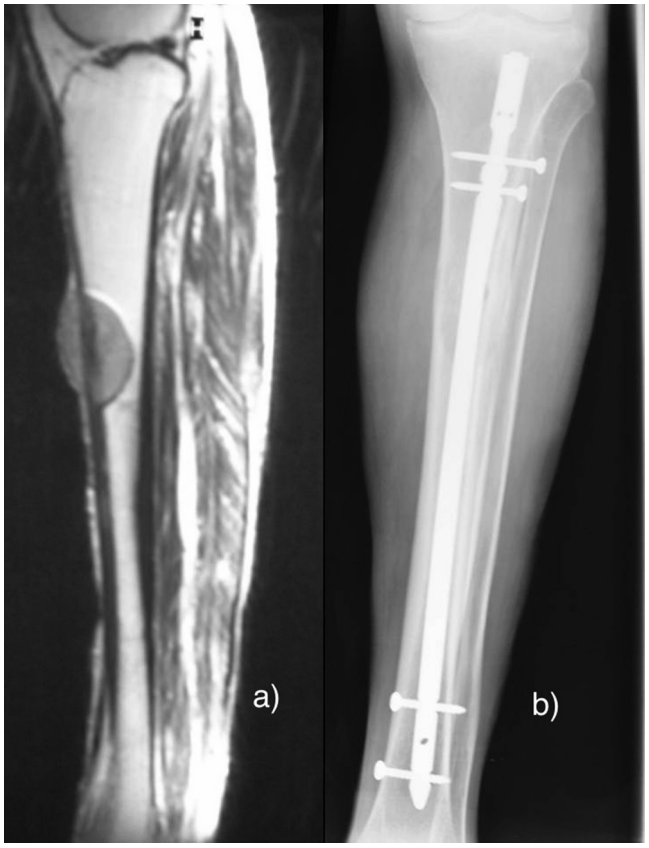

Fig. 1. (a) MRI sagittal cut illustrating a tibial metadiaphyseal tumour localisation; (b) AP radiograph showing stabilisation of he lesion with the insertion of an unreamed static intramedullary locked nail.

Descriptive statistics were calculated. The results obtained were analysed using the χ^2 test and verified with Fisher's exact test. Significance was set at $P < 0.05$.

Results

In all patients, mechanical stabilisation of the osteolytic lesion and of the pathological fracture was achieved. There were no pathological fractures after surgery and no implant failures. Partial weight bearing with 2 crutches was allowed 4 days postoperatively, except for the patient affected by bladder carcinoma with distal tibia lesion in which emptying and filling with cement and pins was performed, and in patients treated with modular prostheses in which weight bearing was allowed 5 days after surgery. Two patients transiently reported an increased pain together with fever in the immediate postoperative 48 h. One patient operated on a diaphyseal lesion presented with local tumour relapse that extended to the distal metaphysis of the tibia that required radiotherapy.

Nine patients had evident synchronous visceral localisations at time of surgery. The average survival time observed was different according to different histotypes. In 6 patients it was approximately 6 months, in the haematological lesions it was 23 months and in a kidney lesion it was 5 years (Table 2). A significant overall improvement of the quality of life span of the patients was recorded, and 12 out of 13 patients were able to return to their pre-lesional activities of daily living (Figs. 4 and 5). The ECOG index