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ORIGINAL ARTICLE

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Surgical treatment for myeloma of the bone

A retrospective analysis of 22 cases

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Abstract In a retrospective study, 22 patients treated surgically for solitary or multiple myeloma between 1980 and 1993 were analysed. The main complaint was pain. A fracture was observed in 7 cases and motor-sensory impaired neurology due to spinal compression in 3. Apart from incisional biopsies, tumour resections, reductions (with and without stabilization by osteosynthesis) and endoprotheses were performed either at the extremities or on the spine. In addition, radiation and chemotherapy were included in the therapeutical concept. Early mobilization was achieved in all cases, and the 5-year survival rate (Kaplan-Meier method) was 48%. The results presented in this study demonstrate that a variety of surgical interventions can be of importance in the treatment of myeloma of the bone, ranging from biopsy or even curative resections in selected cases to endoprosthetic replacement. Thus, good functional results can be achieved and maintained over often long survival times.

Introduction

Myeloma is a primary and systemic neoplasm representing a malignant proliferation of plasma cells. It is the most common primary malignant bone tumour, accounting for more than half of the almost 2000 cases of malignant bone tumours diagnosed at the Mayo Clinic between 1964 and 1975 [10]. Several types of the disease can be differentiated, most commonly multiple myeloma and less commonly solitary plasmacytoma of bone or extramedullary plasmacytoma [4]. Myeloma generally occurs in patients over 40 years of age, the majority being between 50 and 70 years. In a large survey, male patients predominated with 59% [4]. Surgical intervention is necessary when complications have arisen or to prevent complications arising, but also as primary therapy in localized, resectable solitary plasmacytomas [1, 2, 5, 6, 13]. Since the survival time can vary from less than 1 month to more than 120 [14, 15], a significant number of patients undergo operative treatment during the course of the disease.

The purpose of this study was to review the cases treated in our department with regard to presenting symptoms, diagnostic investigations, extent of surgical inter-

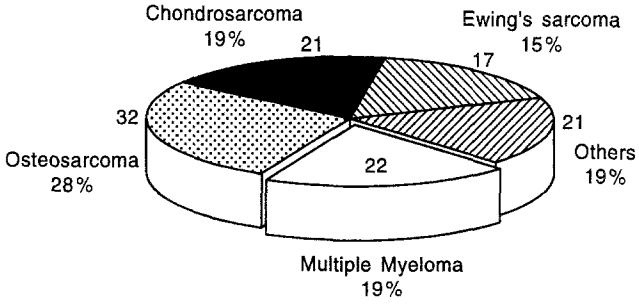
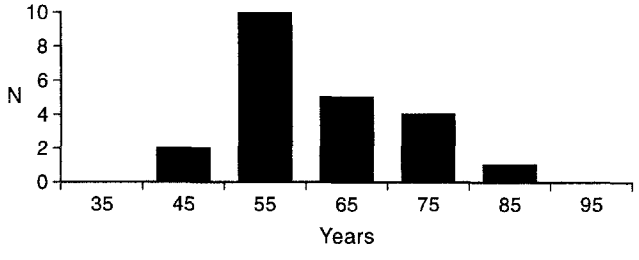


Fig. 1 Incidence of patients surgically treated for primary malignant bone tumours at the Ludwig Maximilians University Munich, Klinikum Großhadern, Orthopaedic Department



	All	Men	Women
Average:	61.9 Y	57.3 Y	62.3 Y
Median:	59.2 Y	59.1 Y	60.6 Y

Fig. 2 Age distribution of 33 patients with solitary and multiple myeloma of bone

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Table 1 Radiological investigations performed with results

Investigation	Result
X-ray investigation	
22 / 22 (100%)	Pathological
Isotope bone scans	
20 / 15 (75.0%)	Pathological
3 (15.0%)	Conspicious
2 (10.0%)	Normal
Computed tomography	
15 / 15 (100%)	Pathological
Magnetic resonance imaging	
6 / 6 (100%)	Pathological
Angiography	
4 / 4 (100%)	Pathological

Table 2 Dissemination of disease in the follow-up group

Solitary localizations
$n = 13$ (59%)
3 Bone marrow aspiration negative
6 Bone marrow aspiration positive
4 Aspiration not performed

Multiple lesions
$n = 9$ (41%)
1 Bone marrow aspiration negative
6 Bone marrow aspiration positive
2 Aspiration not performed

vention, complications, survival time and influence on the quality of life.

Patients and methods

A total of 22 patients, 14 men and 8 women, were surgically treated between 1980 to 1993 for solitary plasmacytoma or multiple myeloma (Fig. 1). All were over 40 years of age (Fig. 2), and 12 (55%) of them died during the observation period. A detailed retrospective analysis of the patients' records and a telephone survey of the survivors were carried out.

X-ray investigations were carried out routinely, isotope bone scans in 20 of 22 cases, and in more recent years computed tomography (CT) and magnetic resonance imaging (MRI) were frequently performed (Table 1). An angiographical evaluation was only carried out in solitary lesions with unknown histology when curative surgery appeared possible.

In addition to routinely performed blood analysis, immune serum and urine electrophoresis were performed in 21 cases, and iliac bone marrow aspiration in 16 cases (Table 2).

Depending on localization and tumour size, surgical treatment was performed: biopsy, resection, stabilization or endoprosthetic replacement (Table 3).

Results

Symptoms, localization and diagnosis

The main complaint was pain in all cases. However, 7 (32%) presented with fractures and 3 (14%) with neurological symptoms. The length of the history of symptoms

Table 3 Localization, treatment and survival in patients with myeloma

Patient	Age at intervention (years)	Sex	Localization of intervention	Surgical treatment	Other treatment	Bone marrow aspiration	Living	Survival (months)
W. H.	43	M	Spine	Biopsy	Radiation/chemotherapy	Negative	Yes	56
B. H.	54	M	Pelvis	Biopsy	Radiation		Yes	33
S. J.	72	M	Pelvis	Biopsy	Radiation	Positive		19
H. E.	58	M	Pelvis	Biopsy	Radiation/chemotherapy			18
W. M.	66	F	Fibula	Resection	Radiation	Negative	Yes	41
G. T.	76	F	Femur	Endoprosthesis	Radiation/chemotherapy			4
M. E.	55	M	Femur	Endoprosthesis	Radiation	Positive	Yes	9
E. G.	63	M	Femur	Endoprosthesis	Radiation		Yes	3
S. G.	67	M	Spine	Polster-Brinkmann	Radiation/chemotherapy	Positive		34
M. L.	48	M	Spine	Polster-Brinkmann	Radiation	Positive		82
E. H.	59	M	Spine	Polster-Brinkmann	Radiation			63
G. E.	53	F	Spine	Polster-Brinkmann	Radiation	Negative		112
P. A.	59	F	Spine	Polster-Brinkmann	Chemotherapy	Positive		28
K. R.	65	M	Spine	Stabilization	Radiation	Positive	Yes	25
H. K.	51	F	Femur	Endoprosthesis	Radiation/chemotherapy	Positive		15
D. H.	59	F	Femur	Endoprosthesis	Chemotherapy	Positive		54
B. O.	69	M	Femur	Osteosynthesis	Radiation/chemotherapy	Positive		18
K. E.	77	M	Multiple	Osteosynthesis	Chemotherapy	Positive	Yes	2
E. H.	60	M	Spine	Polster-Brinkmann	Radiation	Positive		22
K. I.	62	F	Femur	Osteosynthesis	Chemotherapy	Positive		76
S. E.	81	F	Spine	Harms-Cage	Radiation/chemotherapy		Yes	12
P. G.	72	M	Spine	Stabilization	Chemotherapy	Negative	Yes	40

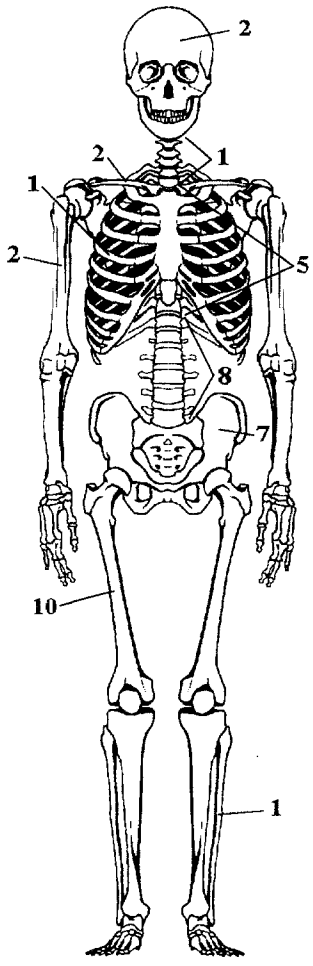


Fig. 3 Skeletal distribution of lesions (including multiple lesions)

Fig. 4 Resection of a solitary fibula plasmacytoma; patient is still disease-free 4 years after operation

varied from 4 to 422 days with complaints mostly spanning several months (average 165, median 141 days).

Most of the lesions were localized in the spine, pelvis or proximal extremities, according to the regions of haematopoetically active bone marrow. Peripheral localizations were only seen in two cases (solitary peripheral, only one) (Fig. 3). A solitary localization was seen in 13 patients (59%), but of these only 3 (13%) proved to be negative on bone marrow aspiration.

Positive isotope bone scans were found in only 75% of the investigations performed. Pathological changes in immune serum electrophoresis were seen in 19/22 cases (86%) and in immune urine electrophoresis in only 7/20 cases (35%).

Surgery

In four cases, open biopsies were taken (one spinal and three pelvic). Of these, the stability of the affected bone was not compromised to an extent requiring surgical stabilization, which permitted radiation treatment.

One wide resection (Fig. 4) of a fibular lesion was performed for a solitary plasmacytoma, without reconstruction.

Curettage and cemented osteosynthetic stabilization (Fig. 5) were carried out in three cases. One of these had disseminated disease and underwent several osteosyntheses of the long bones and the clavicula. Resection combined with decompression by laminectomy and a stabilizing vertebral osteosynthesis were performed in two cases (Fig. 6).

In seven cases vertebral prostheses were implanted following tumour resection (Fig. 7). Reconstruction of resectional defects in the extremities was performed in five cases using five endoprostheses, four at the hip joint and one knee endoprosthesis. At the proximal femur, a trochanter-replacing prosthesis with preservation and fixation of the gluteal muscle loop was used (Fig. 8). One conventional prosthesis was employed with partial tumour resection, osteosynthetic reconstruction and a cemented acetabulum followed by radiation because of a huge femoral tumour in an elderly patient.

Complications

We observed one surgical complication (a pathological fracture) during prophylactic osteosynthesis, and five

cases with postoperative complications (pneumonia, myocardial infarction, ileus and two cases of thromboembolism), none of which was fatal. One fracture of the femur diaphysis occurred after osteosynthesis of the proximal bone, due to tumour progression at the distal plate end, and required revision osteosynthesis.

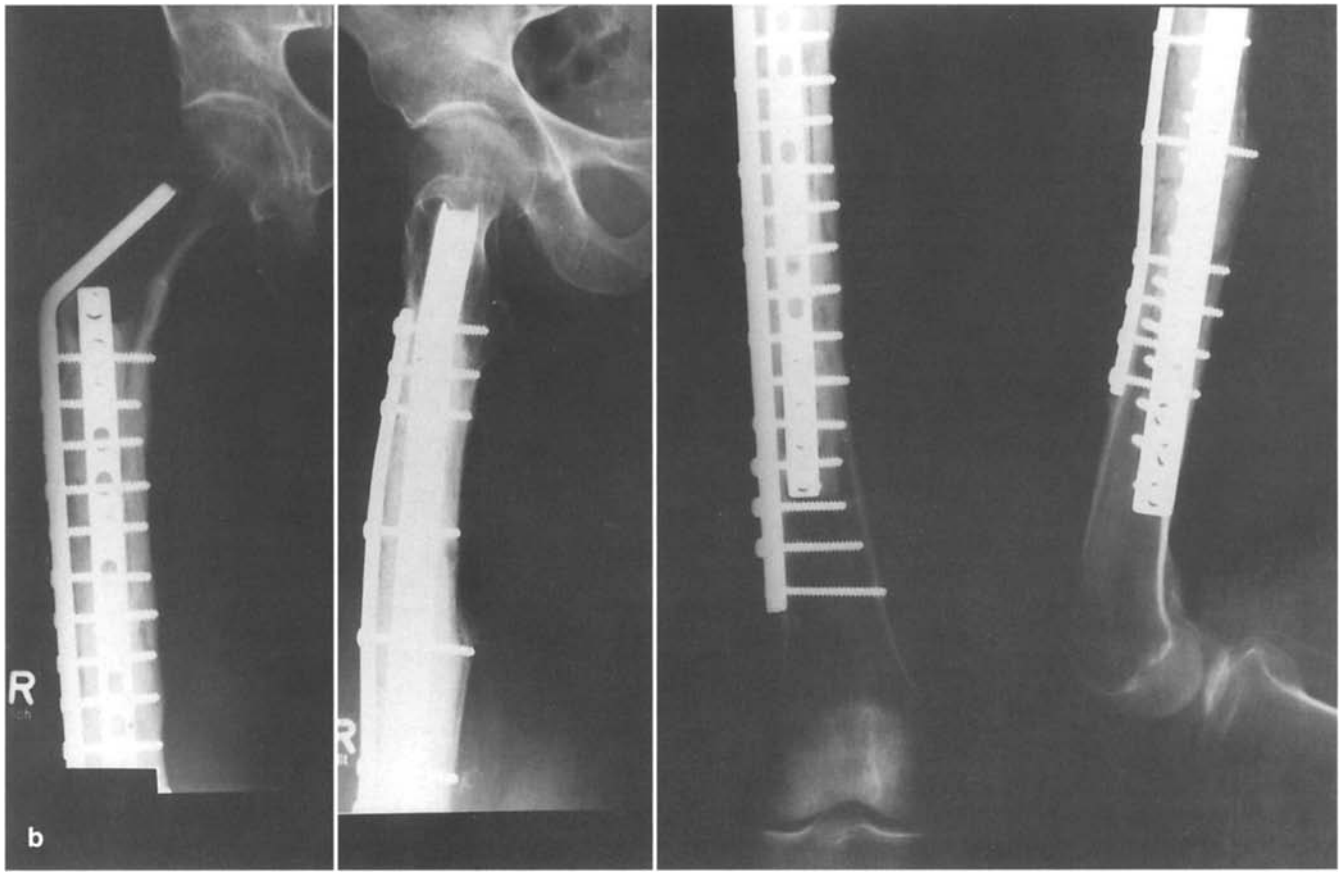
Postoperative result

Postoperative radiation was planned depending on the general condition of the patient, as chemotherapy was part of the therapeutical concept in disseminated disease (Table 3). Early mobilization was achieved in all cases. In the three cases with clinical neurological presentation, the symptoms resolved completely. Two of the three presumed cases of solitary myeloma (bone marrow aspiration negative) showed a progression of the disease; one is still free of any signs of progression after 4 years. The survival rate is shown in Fig. 9.

Discussion

The suspected diagnosis of multiple myeloma is mainly based on immuno-electrophoretical examinations. In our

Fig. 5 a, b Cementation and osteosynthetic fixation 6 1/2 years after operation



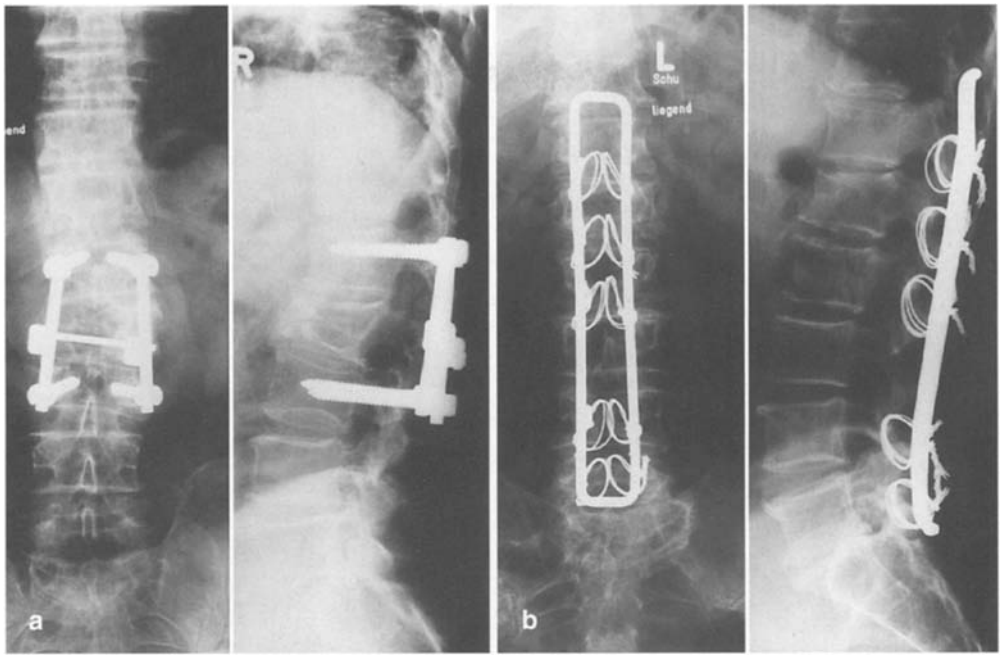


Fig. 6 a, b Hemilaminectomy and posterior stabilization with transpedicular fixation L1–3, hemilaminectomy and posterior stabilization with Luque rectangle L1–S1 in another patient (multiple osteolyses)

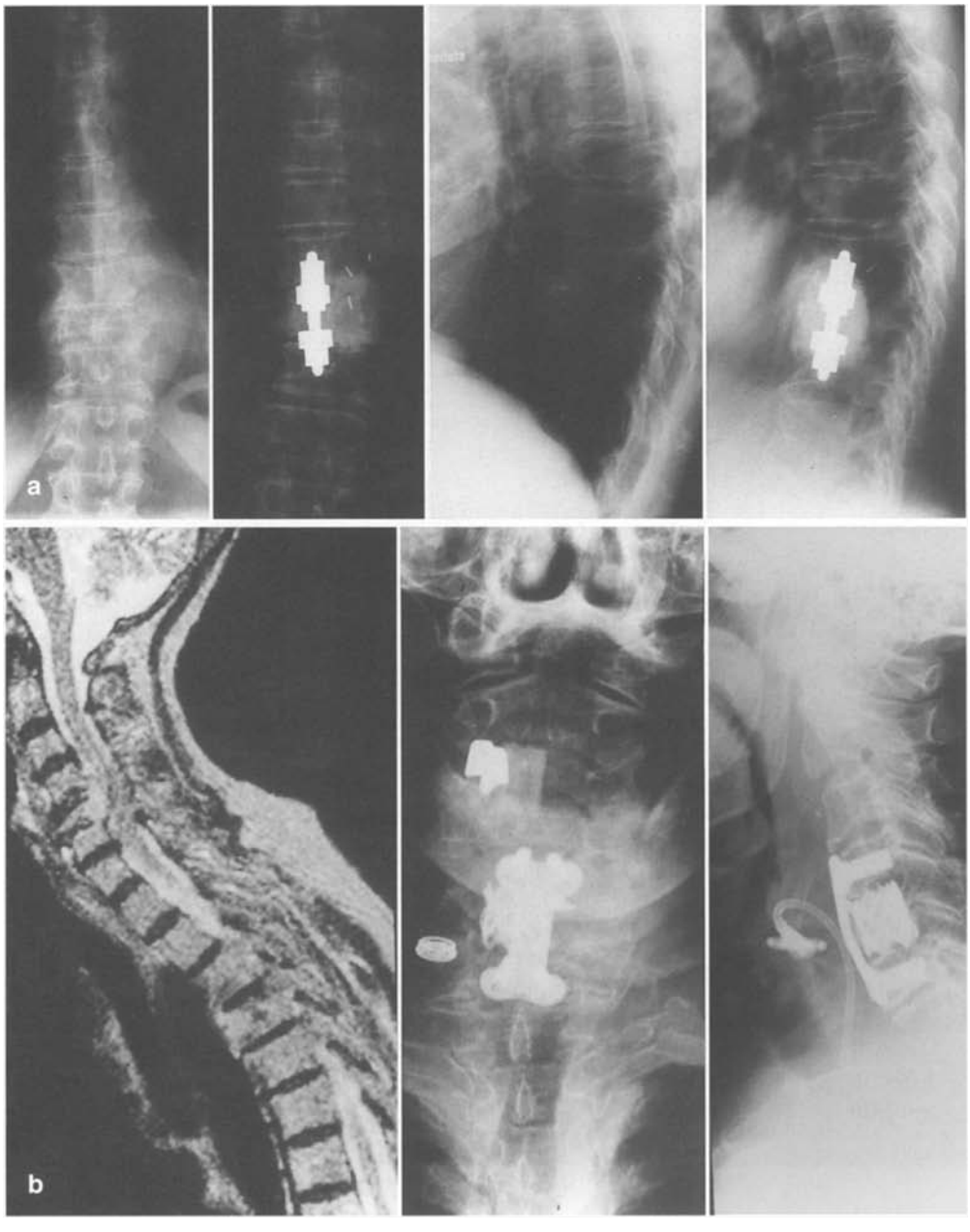


Fig. 7 a, b Polster-Brinkmann endoprosthesis of T10, Harms cage endoprosthesis of C5 in a second patient

Fig. 8 Osteolysis of the coxal femur end, trochanter-replacing endoprosthesis type Harlaching

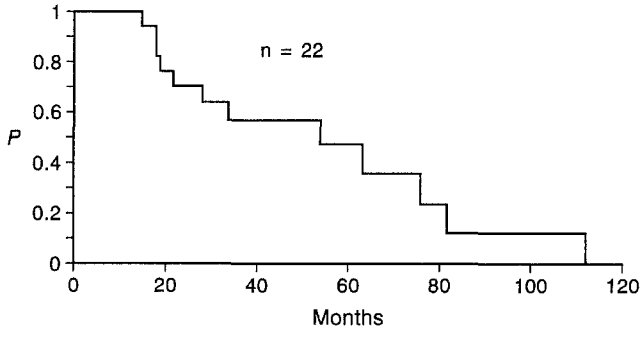


Fig. 9 Overall survival rate in patients with myeloma of bone (Kaplan-Meier method)

group of patients, only 14% showed no pathological signs with serum immuno-electrophoresis. These patients, all of them with solitary lesions, were treated as if a malignant tumour of unknown origin was suspected and underwent extensive radiological investigations. Although normal radiographs showed the osteolytic lesions, they were non-specific, especially for vertebral tumours. MRI scans [7, 16], however, revealed the true extent of the disease and also lesions that were not suspected radiographically.

The isotope scan, routinely performed with technetium-99m methyl diphosphonate, does not always show all osteolytic lesions but often describes formerly unrecognized suspicious areas. Therefore, in addition, we now prefer the more sensitive bone marrow isotope scan.

The mean time interval between the onset of symptoms and diagnosis is often very long, and in many cases sudden events such as a fracture or neurological symptoms require treatment without waiting for the histological confirmation.

In our survey, three patients presented with unknown bone tumours without any serological signs of multiple myeloma, which could only be diagnosed by a biopsy. Anyway, even with a strong suspicion of multiple myeloma, a histological confirmation should be sought before commencing radiation therapy.

The operative treatment of multiple myeloma generally means prevention or treatment of fractures and neurological symptoms [9, 12]. Kivioja et al. [9] demonstrated no local recurrence in a survey of 33 patients after using adequate surgery and postoperative radiotherapy. One has to take into consideration that surgery in multiple myeloma is nearly always palliative. Only a few selected cases of solitary plasmacytoma of the peripheral extremities offer the chance for surgical cure. However, a generalization of the disease first becomes evident sometimes years after the intervention [3]. In a large survey [5] of 46 patients with solitary plasmacytoma, only 25% survived disease-free for more than 10 years. The median time of progression was 18 months, with a developing multiple myeloma in 54%. In these cases, the diagnostic procedures should include a preoperative bone marrow aspiration biopsy. If the diagnosis of solitary plasmacytoma is confirmed, a radical resection should be performed.

Spinal lesions should be treated early to prevent neurological symptoms developing. Although full recovery is not always possible, sufficient pain-free mobilization can be achieved in many cases [8, 11].

Chemotherapy alone is not sufficient for significant bony defects (Fig. 10). Radiation therapy using higher doses (30–45 Gy) may stop local progression but does not

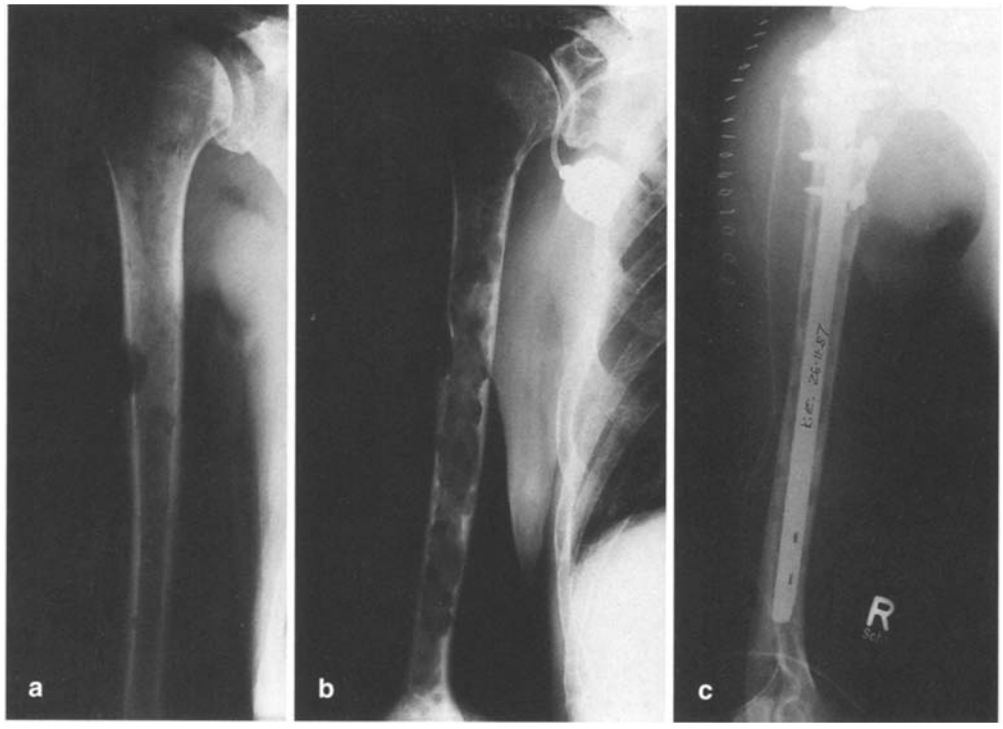


Fig. 10 Patient with disseminated plasmacytoma despite chemotherapy with Endoxan 2/85 (**a**) and 11/87 (**b, c**) (preoperative/postoperative)

initially increase the stability of the bone. Whenever weight-bearing bones are affected, early fixation (before a fracture occurs) followed by radiotherapy should be carried out. Stabilization, or resection with stabilization, of vertebral lesions gives pain relief and allows early mobilization. In combination with radiotherapy, no local recurrence was observed among the patients in our study. In cases of tumour-induced neurological symptoms, immediate surgical decompression is recommended.

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