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Internal hemipelvectomy and reconstruction with a megaprosthesis

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Abstract We treated nine consecutive patients by internal hemipelvectomy and reconstruction with custom-made megaprosthesis between 1990 and 1997. Four had a primary malignant bone or soft tissue tumour, one a recurrent benign giant cell tumour, three solitary metastatic bony lesions, and one a pelvic defect secondary to multiple revision procedures after total hip replacement. After a mean follow-up period of 62 (40–102) months five patients were still alive, including four of the eight patients with tumours. Three patients died as a result of the malignant disease, and one died of an infection related to the surgical treatment after 10–41 months. In two patients removal of the prosthesis was required due to infection, and six patients suffered various complications. One patient had an excellent outcome.

Résumé Nous avons traité neuf malades consécutifs avec hémipelvectomie interne et reconstruction par megaprostheses faites sur mesure entre 1990 et 1997. Quatre patients avaient une tumeur maligne osseuse ou des parties molles, un avait une récidive d'une tumeur à cellules géantes, trois des lésions métastatiques osseuses isolées et un une perte de substance pelvienne dûe à de multiples révisions de prothèse totale de la hanche. Àprés un suivi de 62 (40–102) mois cinq malades vivaient encore dont quatre des huit malades avec tumeur. Trois malades sont morts à cause de la maladie maligne, et un est mort d'une infection secondaire à la chirurgie, les quatres dans un délai de 10 à 41 mois. Pour deux malades, l'ablation de la prothèse a été nécessaire à cause d'une infection et six autres ont eu des complications diverses. Un malade avait un excellent résultat.

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Introduction

Limb salvage with improved postoperative function is an intrinsic goal of bone tumour surgery [12]. In the past, large pelvic tumours were treated curatively or palliatively by external hemipelvectomy and amputation of the lower limb. Salvage of a functional leg in these cases may require reconstruction of much of the pelvis, with autogenous bone graft, allograft, compound osteosynthesis, or a saddle prosthesis [6, 10, 13, 18, 19]. These procedures are associated with a high incidence of complications and limited function of the limb. Currently, the optimal treatment for large defects of the pelvis remains controversial. Internal hemipelvectomy and reconstruction with a custom-made alloplastic endoprosthetic pelvic replacement was introduced in an attempt to improve the outcome [3, 11]. In this retrospective study nine patients treated with hemipelvectomy and reconstruction with a megaprosthesis were analysed with respect to complications and the function of the implant.

Patients and methods

Between May 1990 and April 1997 nine patients underwent megaprosthetic replacement of a pelvic defect (Table 1). The mean age of the patients was 50 (15–78) years at the time of surgery. There were six women and three men. Four had a primary malignant bone or soft tissue tumour, one a recurrent giant cell tumour, three metastatic lesions of the pelvis, and one a large pelvic defect after multiple revisions of a total hip prosthesis. They were treated with partial or total hemipelvectomy and reconstruction by computer-aided designed prostheses (Howmedica, Kiel, Germany). In seven of the eight tumour cases the intention of treatment was curative with tumour-free resection margins and without metastatic disease. In one case (carcinoma of the cervix) only palliative treatment was possible because of lymph node metastasis. Two patients received chemotherapy and two combined radio- and chemotherapy. Two patients declined the recommended radiotherapy.

Relevant data were obtained from the medical records, radiographs, and outpatient interview. Yearly follow-up examination included inflammatory laboratory parameters and computed tomography (CT) of the chest, abdomen, and pelvis. For patients with malignant disease radioisotope bone scans were also performed. The follow-up was calculated from the time of surgery to the last

Table 1 Patients treated with internal hemipelvectomy and reconstruction with a megaprosthesis between 1990 and 1997. *C* curative, *P* palliative

Patient No.	Gender	Age at Surgery (years)	Diagnosis	Intention of treatment	Follow-up (patient)	Follow-up (prosthesis)	Months since surgery	Staging[a]	Surgical margins
1.	M	55	Chondrosarcoma °II	C	Free of tumour	No loosening, no infection	42	IIB	Wide
2.	F	15	Primitive neuroectodermal tumour	C	Died after 21 months by tumour progression	No loosening, no infection	21	IIB	Marginal
3.	F	28	Recurrent giant cell tumour	C	Free of tumour	External hemipelvectomy after 2 months due to infection	46	3	Wide
4.	F	45	Chondrosarcoma °II	C	Died after 41 months by tumour progression	Loosening of prosthesis	41	IIB	Wide
5.	M	66	Chondrosarcoma °II	C	Free of tumour	Chronic infection of prosthesis	40	IIB	Wide
6.	F	78	Loosening of total hip prosthesis with pelvis defect	C		External hemipelvectomy after 4 months due to infection	102	–	–
7.	F	41	Metastasis of breast cancer	C	Alive with tumour	Chronic infection and loosening of prosthesis	84		Wide
8.	F	48	Metastasis of cervix cancer	P	Died after 10 months by tumour progression	No loosening, no infection	10	–	Marginal
9.	M	72	Metastasis of hypernephroma	C	Free of tumour	Died after 19 months due to infection of prosthesis and general sepsis	19	–	Marginal

[a] According to Enneking [7]

outpatient review (for survivors) or death. The medium follow-up for survivors was 62 (40–102) months and 22 (10–41) months for the deceased patients.

Results

Survival

Five patients were still alive at the most recent follow-up. Of the eight patients with tumour four were still living and three were tumour free. Surgery in these patients had been performed 40, 42, and 46 months previously. One patient was alive with active disease 84 months after surgery. Of the four patients with tumour who died, three died of tumour 10, 21, and 41 months after surgery. The fourth died as a result of multiple organ failure caused by infection around the prosthesis 19 months after surgery. There was no case of local recurrence. The patient treated with hemipelvectomy and pelvic reconstruction with a megaprosthesis because of loosening of a total hip prosthesis is still alive 102 months after surgery; however, this patient required an external hemipelvectomy 4 months after implantation due to infection.

Complications

Three patients suffered from a postoperative thrombosis and two from a palsy of the femoral nerve. Two wound revisions were necessary due to haematoma. In one patient a compartment syndrome required further surgery, and, in another, dislocation of the hip required a closed reduction. There were two cases of implant loosening. Five patients developed an infection around the prosthesis and were treated with local debridement and antibiotics. One patient was cured with this treatment; another

Fig. 1 X-ray of the pelvis of a 48-year-old patient with a metastatic lesion from carcinoma of the breast 7 years after internal hemipelvectomy and implantation of a megaprosthesis with obvious loosening due to chronic infection

Fig. 2 X-ray of the pelvis of a 58-year-old patient with a chondrosarcoma II of the pelvis 3 years after internal hemipelvectomy and implantation of a megaprosthesis. No signs of loosening in an active patient with good function

will need antibiotic treatment for life because of chronic infection. One patient died as a result of the infection. In two cases removal of the prosthesis with hemipelvectomy and amputation of the leg were required because of uncontrollable infection. The prosthesis remained in seven patients (Table 1). The four patients who died suffered various complications including infection and loosening of the prosthesis, and they gained only limited functional benefit from the prosthesis. Three patients are still alive with the prosthesis, but one has multiple metastases and loosening of the components (Fig. 1). Another is free of tumour but has chronic infection. An excellent outcome was seen in only one patient who is tumour-free after 42 months with good function (Fig. 2).

Discussion

The main aim in tumour surgery is adequate resection of the lesion [7, 14]. In cases of pelvic tumours this may mean sacrifice of the lower limb. Improved survival rates associated with new adjuvant therapies require new surgical techniques, which ensure adequate function of the limb. When reconstructing large pelvic defects there are many techniques that allow good function of the salvaged limb. Implantation of megaprostheses after internal hemipelvectomy has been used since 1978 to reconstruct the defect produced by total resection of the ilium, including the acetabular area, according to the grading system described by Dunham (Type IIA or C) [5]. Recently this technique has been improved by planning the resection and the construction of the prosthesis using three-dimensional CT or MRI. Several papers have reported limited, but acceptable to good, function after implantation when using these techniques. Others have reported poor function or cases requiring secondary external hemipelvectomy because of the development of complications [2, 8, 21]. It appears that the overall outcome of this surgical treatment is determined by the development of complications, which include neurological deficits and infection or loosening of the prosthesis.

In our series eight of nine patients suffered from one or more complications and seven required further surgical procedures because of deep infection, haematoma, or dislocation of the prosthesis. In two cases removal of the prosthesis and amputation of the lower limb was required because of uncontrollable infection. In only one case was there a stable, well-functioning prosthesis without complications or progression of tumour. This patient was treated in January 1997 but required further surgery 4 months later and has thereafter been free of complications. One patient died of sepsis after the implantation of the prosthesis. The high incidence of complications has been previously reported. Wirbel et al. reported 17 cases of megaprosthetic replacement of the pelvis with ten deep infections, six dislocations of the hip, and two secondary external hemipelvectomies [21]. Bruns et al. treated 15 patients by hemipelvectomy and endoprosthetic pelvic replacement and reported two nerve palsies, one loosening of the prosthesis, two infections, and two secondary external hemipelvectomies [2]. Rechl et al. reported better results, with an incidence of complications of 42% in 47 patients with endoprosthetic pelvic reconstruction and two cases of secondary removal of the implant and external hemipelvectomy [16]. In our opinion haematoma caused by extensive resection and large prosthetic components is the main reason for the high incidence of infection. Patients

with infection needed several further procedures with long periods in hospital. Our findings confirm that the main advantages of this form of treatment may only be psychological, especially when one considers the limited life expectancy of the patients with malignant tumours. In our series four of eight patients with tumour died 23 months after surgery due to metastatic disease, even though three had been treated curatively. A fifth patient died of complications 19 months after surgery, and two derived no benefit from the prosthetic implantation as they later required secondary external hemipelvectomy. The indications for reconstruction of the pelvis with megaprosthesis are controversial. Dahmen et al. consider that this approach is indicated in patients with a primary malignancy of the pelvis or hip with a low risk of metastasis [4]. Gradinger et al., however, describe the use of this method in palliative situations because of the opportunity of limb salvage and short rehabilitation [8]. In our series rehabilitation and hospitalisation are long because of the many associated complications. Therefore, our data do not support these views, especially for patients with a short life expectancy.

Several other techniques of reconstruction have been described, including resection arthroplasty of the hip, arthrodesis, saddle prosthesis, allografts, and autoclaved or irradiated autografts [1, 6, 9, 13, 17, 19]. Windhager et al. compared reconstruction with a saddle prosthesis, iliofemoral coaptation, custom-made megaprosthesis, allograft, pseudarthrosis, and arthrodesis. They concluded that biological reconstructions such as iliofemoral and ischiofemoral arthrodesis or coaptations provide satisfactory results after resection of small tumours, and that homologous bone grafts should be used in patients who have tumours but do not need chemotherapy [20]. Porsch et al. treated a 12-year-old patient with a Ewing's sarcoma of the ilium with an ischio-pubo-femoral arthrodesis using autogenous fibula with good to excellent results with regard to pain, stability, complications, and acceptance [15].

In our opinion reconstruction of the pelvis with a megaprosthesis may be indicated as curative treatment for primary tumours with a low risk of metastasis and thus an associated long life expectancy. Only in these cases does the advantage of limb salvage outweigh the disadvantages of the complications and the long hospitalisation. If complete removal of the ilium is not necessary to obtain wide margins, a technique associated with fewer complications, such as arthrodesis, is recommended [2]. In patients with a short life expectancy who have uncontrollable pain, an external hemipelvectomy is recommended. This procedure requires a shorter hospitalisation and has fewer complications than an internal hemipelvectomy with megaprosthetic reconstruction.

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