Resection arthrodesis of the knee in the treatment of tumours – a long-term follow-up

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Summary. *Limb salvage operations using large custom-made prostheses have become the treatment of choice for juxta-articular tumours at the knee. Resection-arthrodesis has been used since the 1920s and offers a satisfactory long term solution for young active patients. The good functional results after this procedure in 9 patients is presented here. This method should still be considered in selected cases.*

Résumé. *Le traitement des tumeurs juxta articulaires par amputation ou resection-arthrodèse est tombé en disgrâce ces 15 dernières années. La Chirurgie de conservation du membre, l'utilisation de méga-prothèses souvent personnalisées, d'allo-greffes massive, sont devenues à la mode. En fait, les résultats éloignés sont incertains, particulièrement ceux de la longévité de ces méthodes chez des malades jeunes et donc exigeants. La résection-arthrodèse selon Juvara a été déjà présentée vers 1920 et modifiée par Merle D'Aubigné. Elle offre une solution durable aux problèmes tumoraux juxta-articulaires du genou chez le sujet jeune et actif. Nous présentons ici les résultats éloignés de 9 résections tumorales et réparations selon Juvara chez des sujets jeunes, avec un recul de 10 à 20 ans.*

Introduction

The treatment of malignant or aggressive tumours at the knee by resection-arthrodesis has been used for many years [6, 9, 11]. During the last 10 to 15 years the method has been abandoned in favour of limb and joint salvage procedures using large

custom-made prostheses, sometimes together with massive allografts [1, 5, 7, 8, 13]. There is, however, some doubt about the longevity of these prostheses [2]. The incidence of complications is high. The results of revision operations are disappointing, and may be followed by amputation. Successful resection-arthrodesis provides a durable, functional and stable limb.

We report the results of a follow up of more than 10 years of patients with tumours at the knee treated by resection-arthrodesis.

Patients and methods

The records of 9 patients who had juxta-articular malignant or aggressively benign tumours at the knee were retrospectively reviewed. There were 2 women and 7 men, 18 to 55 years of age at the time of operation. They were treated by a modification of Juvara's resection-arthrodesis.

The operations were carried out between October 1976 and January 1986 at our institution and were reviewed annually. The preoperative diagnoses were: osteosarcoma 2; chondrosarcoma 2; recurrent giant cell tumour 4, and clear cell sarcoma in 1.

The indication for resection-arthrodesis was loss of bone of more than 8 cm after resection in young or active patients who wanted to be physically active.

The tumour was in the proximal tibia in 6 patients, one with a pathological fracture, and in the distal femur in 3. One patient with a recurrent giant cell tumour had undergone curettage and bone grafting on 3 occasions. None of the patients with malignant tumours had any evidence of lung or other metastases.

Operative technique

This followed Juvara's description [6] as modified by Merle d'Aubigne in 1966 [10]. A long anteromedial approach was made to the distal half of the femur and proximal tibia, followed by identification and displacement of the neurovascular bundle. Wide resection was confirmed by frozen sections. The unaffected bone, either femur or tibia, was divided longitudinally and rotated through 180°, upwards or downwards, and fixed with screws. A long intramedullary nail was inserted

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into the femur and tibia, and auto- and allograft bone grafts were added. The limb was immobilised in a full length cast for 3 months. Weightbearing was begun at 6 weeks and was fully resumed within 3 to 4 months of the operation.

Results

The average operating time was $3\frac{1}{2}$ h (range 3 h to $5\frac{1}{2}$ h and the average blood loss 2300 ml (range 1750 ml to 3800 ml).

There were clinical and radiological signs of union at an average of 19 weeks (range 16 to 22 weeks) after operation. Infection in one patient resolved after intravenous antibiotic therapy and debridement of the wound. Two patients completed a course of chemotherapy after their operation.

All the patients resumed walking and eventually returned to their previous occupations: farmers 4; clerks 2; mechanic 1, and housewife 2 (Figs. 1, 2).

Shortening was from 3.5 cm to 6 cm and was compensated for by special shoes with inserts.

Fig. 1a, b. Case 1. A man, 18 years of age, with an osteosarcoma of the proximal tibia. **a** before operation; **b** after 13 years

Fig. 2a, b. Case 2. A man, 37 years of age, with an aggressive recurrent giant cell tumour of the tibia. **a** before operation; **b** after 19 years; the intramedullary has been removed

Fig. 3a, b. Case 3. A housewife, 55 years of age with recurrence of a chondrosarcoma of the tibia. **a** before operation; **b** recurrence in the fused knee after 18 months

Apart from a noticeable limp, none of the patients complained of major difficulties or pain during activity. They did, however, have the usual inconveniences of an arthrodesis of the knee when rising from a chair, climbing high stairs, getting in and out of motor cars, or when using public transport.

One patient with a chondrosarcoma had a local recurrence after 15 months and an above-knee amputation was performed (Fig. 3).

Two patients died during the follow up period; one, 55 years of age, with a chondrosarcoma died

Table 1. Patients treated by resection arthrodesis of the knee

Patient No.	Age	Sex	Diagnosis	Location of tumour	Preoperative occupation	Length of follow-up	Complication	End results
1	18	M	Osteosarcoma	Proximal tibia	Clerk	13 y	Infection	NED ^a , clerk
2	37	M	Giant cell tumour	Proximal tibia	Mechanic	19 y	–	NED; mechanic
3	55	F	Chondrosarcoma	Proximal tibia	Housewife	29 m	Local recurrence	Died
4	22	M	Osteosarcoma	Proximal tibia	Farmer	23 m	Lung metastasis	Died
5	42	F	Chondrosarcoma	Distal femur	Housewife	16 y	–	NED; Housewife
6	32	M	Clear cell sarcoma	Distal femur	Farmer	11 y	–	NED; Farmer
7	49	M	Giant cell tumour	Proximal tibia	Clerk	10 y	–	NED; Clerk
8	26	M	Giant cell tumour	Distal femur	Farmer	15.5 y	–	NED; Farmer
9	19	M	Giant cell tumour	Proximal tibia	Farmer	17 y	–	NED; Farmer

^a NED = no evidence of disease

29 months after operation, and the other, 18 years of age at the time of operation, died 23 months later from an osteosarcoma of the proximal tibia.

The remaining patients are alive and well with no evidence of disease or metastases (Table 1).

Discussion

Limb salvage procedures need large and expensive implants; none provide sufficient joint stability or durability which is important in occupations demanding strenuous activity. The term functional limb salvage should be related to individual functional requirements. Arthrodesis makes these activities possible despite certain inconveniences [3, 10].

Merle d'Aubigne's modification of Juvara's resection-arthrodesis is relatively simple and has few complications. Wide resection, stable fixation by an intramedullary rod, correct alignment and sufficient auto- and allogenic bone grafts are the main requirements for a successful outcome.

Union, together with the ability to walk, is achieved within months and the long term results were good in our patients. Most of their operations were carried out before CT and MRI were available, and before the era of adjuvant and neoadjuvant protocols for chemotherapy. The results in 3 out of 5 of our patients with malignant disease, who are alive without recurrence or metastases, is similar to that of current reports. This is probably because resection-arthrodesis makes it easy to achieve wide surgical margins without compromise.

This type of resection-arthrodesis remains a method of treatment to be considered in certain patients with tumours at the knee.

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