

Case Report

Étude de cas

MALIGNANT GIANT CELL TUMOUR OF THE DISTAL FEMUR TREATED BY EXCISION, ALLOGRAFTING AND LIGAMENTOUS RECONSTRUCTION: AN 18-YEAR FOLLOW-UP

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Extensive osteoarticular allografts have been used for knee reconstruction, but because of their composite nature and the technical difficulty of the procedure, complication and failure rates have been high. There are few records of long-term results in the literature. In this report, a 19-year-old man with a large aggressive giant cell tumour of the left distal femur was treated in 1976 by en bloc resection, massive femoral allografting and ligamentous reconstruction. Follow-up after 18 years showed no recurrence of the tumour, excellent incorporation of the graft and good knee function, which allowed the patient to work 9 hours a day on his feet without pain.

On a utilisé des allogreffes ostéoarticulaires importantes pour reconstruire des genoux, mais à cause de leur nature composite et de la difficulté technique que pose l'intervention, les complications et les taux d'échec ont été élevés. Les écrits contiennent peu de mentions de résultats à long terme. Dans ce rapport, un homme de 19 ans atteint d'une grosse tumeur agressive à cellules géantes à la face distale gauche du fémur a été traité en 1976 par résection en bloc, allogreffe fémorale massive et reconstruction ligamentaire. Après 18 ans, le suivi n'a indiqué aucune récurrence de la tumeur, une excellente assimilation de la greffe et un bon fonctionnement du genou, ce qui permettait au patient de travailler 9 heures par jour debout sans ressentir de douleur.

Massive osteoarticular allografts have been used to reconstruct the knee joint after resection of tumours of the distal femur or proximal tibia. Because of the composite nature of these large grafts and the complexity of the surgical technique, complications are common and the failure rate is high. Few long-term results have been published.

We report an 18-year follow-up of a patient who received an allograft for a malignant giant cell tumour of the distal left femur.

CASE REPORT

A 19-year-old man was seen in the emergency department in 1976 with a painful, swollen left knee as a result

of a fall. Radiographs showed an expansile, lytic defect of the left lateral femoral condyle and distal metaphysis measuring 7 × 6 × 5 cm (Fig. 1). A slight irregularity of the articular surface contour was consistent with a fracture.

The provisional diagnosis was a giant cell tumour. Chest radiographs and a lung scan appeared normal. A

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bone scan showed a hot spot in the left lateral femoral condyle. Arteriography revealed hypervascularization and arteriovenous communications in the lesion.

Management was planned in close collaboration with the radiologist and the pathologist. A tissue specimen obtained by open biopsy confirmed the diagnosis of a malignant giant cell tumour, Lichtenstein grade II — borderline.¹ The tumour had destroyed the lateral metaphyseal and epiphyseal cortices and extended into the soft tissues.

At a departmental conference 12 days after the man's admission, at which the pathologist and radiologist were present, different treatment modalities were discussed. We believed that curettage and grafting were inappropriate because of the degree of cortical destruction and fracture of the left lateral condyle. After careful consideration of the patient's youth and desire to conserve leg and knee movement, we decided to follow the technique recommended by Parrish in 1966:² excision of the tumour and replacement by a bone graft from a fresh cadaver as soon as available. (In 1968

at this hospital Lepine had performed a successful en bloc resection of the lower end of the left femur and replacement with a homologous graft for a giant cell tumour, using the technique described Parrish.² The patient was a 23-year-old woman who was 3 months pregnant.^{3,4})

Twenty-one days after the patient's admission, an allograft was obtained from the cadaver of a 28-year-old man who had died of multiple injuries received in a car accident. He was healthy, noninfected and was approximately the same size as the patient.

With the consent of the appropriate hospital and provincial authorities, we removed the allograft according to Parrish's technique. The graft was stripped of all soft tissue and stored in a sterile container at -29°C for 24 days. To forestall expansion of the tumour, we excised en bloc the patient's left lateral femoral condyle under antibiotic coverage, cutting the femur 9 cm above the joint line with the radiologist's assistance. The resection included the biopsy scar and a margin of

healthy tissue all around; the upper half of the lateral ligament and capsule were also removed. The anterior cruciate ligament was preserved. After excision of the tumour, the space was filled with molded methylmethacrylate cement and the leg placed in a cast.

The pathological report confirmed the presence of a tumour mass 8 cm long in the left femoral condyle with destruction of the cortex. The histologic diagnosis was aggressive giant cell tumour, Lichtenstein grade II.¹

Seven weeks after the operation, the allograft was placed in a solution of neomycin 1% and bacitracin 500 000 u/L. The next day the cement spacer was removed and the lateral condylar allograft was custom fitted and fixed with 5 cortical wires. The anterior cruciate ligament was reconstructed anatomically and the limb again immobilized in a long leg cast.

Postoperatively, the patient followed a rehabilitation program and at 10 months was given a brace with progressive weight bearing. At 30 months because of varus instability the lateral



FIG. 1. Anteroposterior radiograph of the patient's left knee joint on admission in 1976. The lesion has destroyed the lateral cortex and has invaded the soft tissues. There is a fracture of the subchondral bone. Note the lack of calcification and the absence of periosteal reaction.



FIG. 2. Photographs of the patient's legs in 1995, 18 years after grafting. Alignment and length are normal and the range of movement is 0° to 70° . The quadriceps muscle has atrophied.



collateral ligament of the left knee was reconstructed with a segment of biceps tendon.

After 6 years the patient returned to work as a manual labourer. He had no pain. Radiographs showed no evidence of recurrence or narrowing of the joint space.



FIG. 3. (Top) Anteroposterior (standing) and (bottom) lateral radiographs made 18 years after grafting. There is uniform sclerosis of the left lateral femoral condyle and no recurrence of the tumour. The articular space of the lateral compartment is well preserved. The subchondral bone of the distal femur and patellofemoral joint, however, is somewhat irregular, consistent with early degenerative arthritis.

In 1995, we examined the patient again, 220 months after grafting (Figs. 2 and 3). He had a normal gait and worked 9 hours a day, standing on his feet with no discomfort. He could walk unlimited distances and was able to skate, play badminton and ride a bicycle. There was 4 cm of quadriceps atrophy of the left thigh. The left knee had a circumference of 37 cm and the right knee 38 cm. Flexion of the left knee was to 75° and of the right knee to 130°. Extension of the left knee was 0°, and the right knee 0°.

In full extension there was a small varus movement of 5°. The left knee had no effusion but there was some crepitus in the lateral compartment. There was no anteroposterior instability. The pivot shift and the Lachman test both gave negative results.

A technetium-99m bone scan showed slight hyperactivity of the lateral femoral condyle on the late flow. The gallium bone scan appeared normal.

A radiograph made 18 years after grafting showed a uniform sclerosis of the left lateral femoral condyle and no recurrence of the tumour. The articular space of the lateral compartment was well preserved. The subchondral bone of the distal femur and the patellofemoral joint were somewhat irregular, consistent with early degenerative arthritis (Fig. 3 [standing]). Laboratory analysis showed that the total blood cell count, sedimentation rate, protein electrophoresis and immunoelectrophoresis were normal. There was no alteration of the immune system.⁵ Clinical function, according to the grading of Mankin, Gebhardt and Thomford,⁶ was between good and excellent.

Applying the criteria of Enneking and associates,⁷ we obtained the following results: no pain 5, function of the extremity 5, emotional acceptance 5, walking ability 5, gait 5, use of mechanical support 3 to 4, yielding a

functional result of 28 to 29.

Because the patient had a slight instability in varus of the left knee, we recommended that he discontinue badminton and figure skating and that he wear an orthosis while at work.

DISCUSSION

In 1976, the American Association of Tissue Banks (AATB) began the process of setting up standards for regulating the use of grafts and allografts.⁸ We based our treatment of this case, which began in 1976, on an instructional course lecture of the American Academy of Orthopaedic Surgeons presented by Parrish.² US health authorities began reporting cases of AIDS in 1981, and currently the AATB has established a policy concerning HIV screening for grafts and allografts.⁸

From an overview of the literature, it seems that this report is unusual in that our patient is one of the few who were able to return to a physically active job, in this case work as a manual labourer.

Surgery in patients with giant cell tumour can be delayed until the optimal grafting material is available. Bell and colleagues discussed the options available for the reconstruction of the extremity after resection of giant cell tumour at the knee.⁹ They developed a program utilizing fresh osteochondral allografts for patients who required resection and reconstruction for giant cell tumours, with follow-up from 3 to 15 years. Of 16 cases, they obtained acceptable results in 13, and no patient with a transplanted joint has needed revision for degenerative articular changes. The major advantage of fresh over cryopreserved osteoarticular allografts is that joint degeneration may be forestalled. Screening all donors for the risk of disease transmission, especially lethal viral infections, remains

an ongoing concern.

O'Donnell and Mankin, in presenting 60 cases of patients with giant cell tumours, provided an excellent overview of the early literature on the subject and the various methods of treatment.¹⁰ Their study emphasized the necessity for long-term follow-up and the theoretical advantage of using cement over bone grafting.

Gitelis and associates,¹¹ reporting on 40 cases of giant cell tumour managed between 1976 and 1990, noted better functional results after intralesional procedures than after en bloc resection. In 1976, our patient was treated with the close cooperation of the pathologist and the radiologist because the tumour involved the left external femoral condyle and destroyed the lateral metaphyseal and epiphyseal cortices and extended into the soft tissues. For a young patient, in 1976, cure of the disease was the primary goal, and with the consent of the patient and his parents, we followed Parrish's technique, modified by a temporary replacement of the left lateral femoral condyle with methylmethacrylate before inserting the allograft.

CONCLUSIONS

In this case the tumour was large and aggressive. Curettage would have been uncertain and would have left the distal femur structurally weak. The only alternative was en bloc resection and reconstruction with an allograft.

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References

1. Lichtenstein L. *Bone tumours*. 4th ed. St. Louis: CV Mosby; 1972.
2. Lepine E. Tumeur à cellules géantes de l'extrémité inférieure du fémur :

un cas de résection totale et remplacement par homogreffe. *Union Med Can* 1972;101:1800-4.

3. Lepine E. Giant cell tumour of the femur: en bloc resection and replacement with homologous graft. *Can J Surg* 1981;24:83-4.
4. Parrish FF. Treatment of bone tumours by total excision and replacement with massive autologous and homologous graft. *J Bone Joint Surg [Am]* 1966;48:968-90.
5. Friedlaender G. Bone allografts: the biological consequences of immunological events. *J Bone Joint Surg [Am]* 1991;73:1119-22.
6. Mankin HJ, Gebhardt MC, Tomford WW. The use of frozen cadaveric allografts in the management of patients with bone tumors of the extremities. *Clin Orthop North Am* 1987;18:275-89.
7. Enneking WF, Dunham W, Gebhardt MC, Malawar M, Pritchard DJ. A system for the functional evaluation of reconstructive procedures after surgical treatment of tumors of the musculoskeletal system. *Clin Orthop* 1993;286:241-6.
8. American Association of Tissue Banks. *AATB information alert*. McLean (VA): The Association; 1993; 3.
9. Bell RS, Davis A, Allan DG, Langer F, Czitrom AA, Gross AE. Fresh osteochondral allografts for advanced giant cell tumors at the knee. *J Arthroplasty* 1994;9:603-9.
10. O'Donnell RJ, Mankin HJ. Recurrence of giant cell tumors of the long bones after curettage and packing with cement. *J Bone Joint Surg [Am]* 1994;76:1827-33.
11. Gitelis S, Mallin BA, Piasecki P, Turner F. Intralesional excision compared with en bloc resection for giant-cell tumors of bone. *J Bone Joint Surg [Am]* 1993;75:1648-55.