Allograft Reconstruction for a First Metatarsal Giant Cell Tumor

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ABSTRACT

The authors present a case of a Filipino patient with a giant cell tumor of the first metatarsal which was treated with en bloc resection and allograft transplantation. At five years, limb-salvage and reconstruction achieved not only adequate oncologic control but also allowed retention of full pain free ambulatory status allowing the patient to return to school and work.

INTRODUCTION

Giant cell tumor (GCT) is an aggressive benign tumor most commonly affecting the distal femur, proximal tibia, and distal radius[1]. GCT of the foot while uncommon presents a therapeutic challenge.

Surgical options for patients with extremity GCT of the bone include intralesional resection and en bloc excision[2,4,5]. Seventy per cent of Filipino patients present with Campanacci Stage III lesions, where bony cortices are completely lysed[6]. This makes intralesional curettage impossible and leaves en bloc excision the only possible option. The resulting massive bone defect from an en bloc excision is then reconstructed with autografts, allografts, or synthetic bone material [1,4,7-12] .

Properly matched allografts provide not only a biologic scaffold for bone growth but also a replacement which best approximates the original bone. International and local literature cites large segment allografts have been shown to be an effective in bridging the bone defect [1,7,8,10-12].

A review of the English language orthopedic literature however reveals no earlier reports on the use of allograft for GCT of the first metatarsal.

In this report, the authors describe the results of a limb-salvage procedure with an allograft of the first metatarsal in a Filipino patient with GCT.

S. N., a 19 year-old female student presented with a gradually enlarging painful mass over the first metatarsal of the left foot . A year earlier an intralesional curettage with iliac crest bone grafting was performed. Seven months post surgery, there was tumor recurrence. On presentation, the patient bore w eight on her heel and could not wear shoes due to the size of the mass. Her foot had a large tender, fixed mass over the dorsomedial aspect (Fig.1). Radiographs showed a large, lytic, trabeculated lesion with neocorticalization involving the entire first metatarsal consistent with GCT (Fig 2).

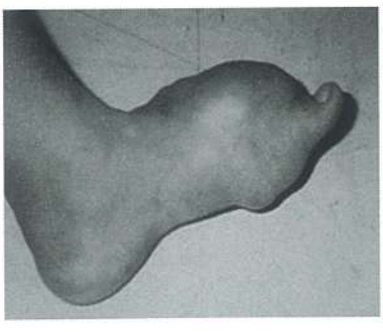

Figure 1. Photograph of a 19 year old female with giant cell tumor of the first metatarsal.

Figure 2. Radiographs showed a large, lytic, lesion with neocorticalization involving the entire first metatarsal consistent with GCT.

MRI of the foot revealed a contrast enhancing mass with a cystic/necrotic center involving the entire metatarsal six times the size of the adjacent metatarsal (Fig 3).

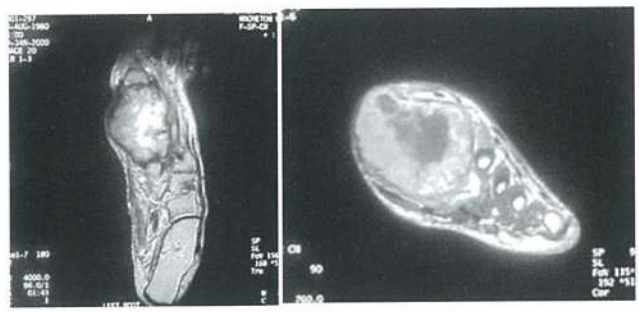

Figure 3. MRI of the foot revealed a contrast enhancing mass with a cystic/necrotic center involving the entire metatarsal six times the size of the adjacent metatarsal.

A marginal excision of the first metatarsal was planned. A longitudinal incision over the first ray was fashioned. This included a generous ellipse incorporating the previous incision over the anteromedial aspect of the first metatarsal.The dorsalis pedis was identified and protected. An en bloc excision was done leaving a defect of the entire first metatarsal. Reconstruction utilized a metatarsal freeze

Figure 4. Radiograph made immediately after en bloc excision, reconstruction with metatarsal allograft, and internal fixation with 0.062 K-wires.

dried allograft augmented with a bicortical iliac crest bone craft wedged into a trough created in the middle of the allograft. The allograft construct was fixed to host bone using K-wires (Fig 4).

Final histopathologic diagnosis was giant cell tumor with secondary aneurysmal bone cyst component .

Three months after surgery, pins were pulled out and a short leg cast applied. The patient was allowed partial weight bearing.

Five months after surgery, radiographs showed beginning union at both ends of the allograft. She was at this time allowed full weight bearing. Throughout this time the patient did not report any pain or tenderness on ambulation and she was able to pursue her college studies.

Solid allograft-host bone fusion was noted at seven months at which time the cast was removed.

One year after surgery, she ambulated without pain, support, or gait alteration The patient noted only minimal soreness on long walks with high heeled shoes. It was also at this time that she finished college, graduating cum laude in Interior Design

Two and a half years after tumor resection, radiographs continue to show solid allograft-host bone fusion with no signs of tumor recurrence (Fig 5). Her only complaint was slight limitation on toe off. She has been able to achieve full, pain-free ambulation without support. At five years post surgery, she is a working woman and remains satisfied with both oncologic control and the excellent cosmetic and functional result allowing her to walk and wear shoes without restriction (Fig 6).

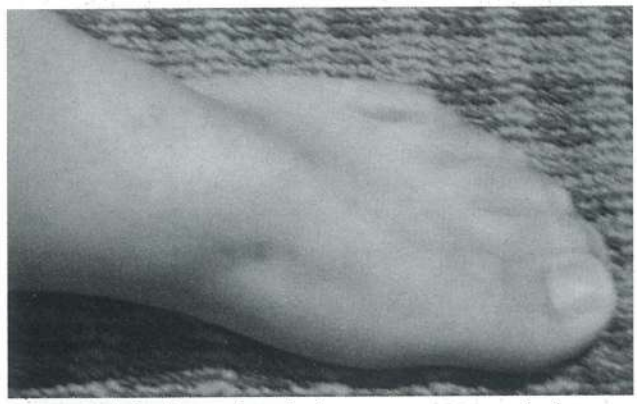

Figure 6. A. Radiograph made three years postoperatively. B. Photograph showing excellent cosmetic result of surgery.

Figure 5. Radiograph made two and a half years postoperatively. The patient was active and worked full time with no restrictive symptoms

GCT of the hands and feet are uncommon. In the foot prevalence of GCT of the foot ranges from 2.0% to 8.2% [1-3,5,6,9].

GCT that occurs in the foot appear to represent a distinctive more aggressive form of tumor and occur more often in a younger patient population similar to our case. Furthermore, they are more commonly multifocal, and associated with a higher risk for local recurrence and pulmonary metastasis[3]. These factors necessitate a more aggressive form of treatment this resulting defect can be reconstructed using autogenous, allographic, or synthetic bone graft material.

Almost all reports on GCT of the foot use autograft for reconstruction. Szendroi used a massive iliac crest graft to reconstruct a case of GCT of the midfoot[3]. There has only been one report of allograft reconstruction in the foot. Muscolo reported a case of the calcaneus chondrosarcoma which was

reconstructed with an allograft[13]. Long term follow-up showed excellent functional result.

In our patient, a matched metatarsal allograft was utilized to reconstruct the osseous defect. An autograft could have bridged the defect, but it would not have been possible to duplicate the metatarsal anatomy. The allograft's anatomic configuration provided a scaffold which not only preserved themedial longitudinal arch but also ensured appropriate weight transfer during ambulation. Since the allograft was well matched to her original metatarsal, this reconstruction resulted in an excellent cosmetic result.

Complications of allograft use include infection, fracture, and non-union [14-17]. Our patient is five years postoperative and to date shows no complications from her surgery.

The patient, as a result of her reconstruction, has been able to pursue her previous activities and ambulates without any pain. Using the International Society of Limb Salvage criteria for functional evaluation, the patient has an excellent rating based on patients unrestricted lifestyle, emotional acceptance, unlimited walking ability, and normal gait. Just as importantly, the markedly improved aesthetic appearance of her foot has boosted not only her self image but also her confidence in dealing with her peers. Today, she works as a professional and is actively engaged in work and recreation without limitation.

In summary, a Filipino patient with a giant cell tumor of the first metatarsal was treated with en bloc resection and allograft transplantation. At five years, limb-salvage and reconstruction achieved not only adequate oncologic control but also allowed retention of full pain free ambulatory status allowing the patient to return to school and work.

REFERENCES

1. Szendroi M. Giant-cell tumor of bone. J Bone and Joint Surg [Br] 2004;86-B:5-12.
2. Blackley H.R., Wunder J.S., Davis A.M., et al. J Bone and Joint Surg [Am] 1999; 81-A:811-820.
3. Szendroi M., Antal I., Pelaky G. Mid-foot reconstruction following involvement of five bones by giant cell tumor. Skeletal Radiol 2000; 29:664-7.
4. Gitellis S., Mallin A., Piasecki P., et al. Intralesional excision compared with en bloc resection for giant cell tumors of bone. J Bone and Joint Surg [Am] 1993; 75-A:1648-55.
5. Campanacci M, Baldini N, Bariani S, et al. Giant cell tumor of bone. J Bone and Joint Surg [Am] 1987;59-A:106-14.
6. Wang, EHM; and Lansang EP. Giant cell Tumor : Treatment Results (unpublished report).
7. Clohisy D., and Mankin H.S. Osteoarticular allograft for reconstruction after resection of a musculoskeletal tumor in the proximal end of the tibia. J Bone and Joint Surg [Am] 1994 ;76-A;549-554.
8. Kocher M., Gebhart, M., and Mankin, H. Reconstruction of the distal aspect of the radius with use of an osteoarticular allograft after excision of a skeletal tumor. J Bone and Joint Surg [Am] 1998;80-A:407-419.
9. Pals, S. and Wilkins, R. Giant cell tumor of bone treated by curettage, cementation, and bone grafting. Orthopedics. 15:703-708, 1992.
10. Campbell, CJ and Akbarnia, BA: Giant-cell tumor of the radius treated by massive resection and tibial bone graft. J Bone and Joint Surg 1975; 57A:982-986.
11. Musculo, DL; Ayerza, MA; Calabrese, ME; and Gruenberg, M: The use of a bone allograft for reconstruction after resection of giant cell tumor close to the knee. J Bone and Joint Surg 1993; 75A:1656-1662.
12. Pho, RW: Malignant giant cell tumor of the distal end of the radius treated by a free vascularized fibular transplant. J Bone and Joint Surg 1981; 63A:877-884.
13. Musculo, DL; Ayerza, MA; et al: Allograft reconstruction for chondrosarcoma of the talus. J Bone and Joint Surg 1993; 75A: 134-136.
14. Gaines, ST: Infection in bone allografts, Incidence, nature, and treatment. J Bone and Joint Surg 1988;70A: b1430-b1431.
15. Lord, CF; Gebhart, MC; Tomford, WW; and Mankin, HJ: Infection in bone allografts, Incidence, nature, and treatment. J Bone and Joint Surgery 1988;70A: 369-376.
16. Thompson, RC; Pickvance, EA; and Garry, D: Fractures in large segment allografts. J Bone and Joint Surg 1993;75A: 1663-1673. Tomford, WW; Starkweather, RJ; and Goldman, MH: A study of the clinical incidence of infection in the use of banked allograft bone. J Bone Joint Surg 1981; 63A: 244-248