Recurrence Metacarpal Enchondroma Treated With Strut Allograft: 14-year Follow-up

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abstract

Enchondroma of the hand is a common lesion with a recurrence rate of up to 13.3% after curettage and bone grafting. Pathologic fractures often occur. Although allograft bone chips are widely used in the surgical treatment of enchondroma, the use of structural allograft bone has not been reported before. This case report presents a recurrent enchondroma of the fifth metacarpal with pathologic fracture in a 13-year-old girl who had 2 previous interventions and 2 more interventions for other enchondromas in the same hand. These interventions consisted of curettage and autogenous iliac crest bone grafting. The metacarpal diaphysis was resected and reconstructed with an intercalary freeze-dried strut allograft fibular bone segment to avoid further donor graft site morbidity. At 14 years of follow-up, the patient had full range of motion of the hand, with no symptoms, and the allograft bone had been incorporated completely, with no recurrence of the tumor. With strut allograft bone, healing occurs by creeping substitution at its ends that is limited to a few millimeters. Limited vascularization also occurs on the allograft surface, leaving most of the allograft segment devoid of vascularity and leading to the complications seen in massive bone allografts. However, because of their thin cortices and decreased total volume, smaller bone allografts show higher rates of osteointegration and revascularization. In selected cases, a strut allograft bone may be considered a suitable material for long-term reconstruction of the hand after enchondroma excision, especially in young patients, who have increased healing potential compared with older patients.

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Enchondroma is a common benign intramedullary cartilaginous bone tumor that usually occurs in small tubular bones and is usually found incidentally on radiographs obtained for other reasons.\(^1,2\) Enchondromas are generally asymptomatic, but may expand, and sometimes appear as pathologic fractures. Enchondroma is the most common primary bone tumor of the hand, occurring in the phalanges and metacarpals.\(^1,3\) A recurrence rate of up to 13.3% after curettage and bone grafting was reported,\(^3,4\) and patients with a recurrent lesion have a higher rate of complications.\(^3\) This report describes a recurrent enchondroma of the fifth metacarpal with pathologic fracture in a 13-year-old girl who had 2 previous interventions and 2 more interventions for other enchondromas in the same hand. These interventions consisted of curettage and autogenous iliac crest bone grafting.

The lesion was treated with resection of the metacarpal diaphysis and reconstructed with strut allograft fibular bone.

**CASE REPORT**

A 13-year-old, right-hand–dominant girl presented with pain and swelling in the right hand of 3 months’ duration. She had a history of surgical intervention for an enchondroma of the fifth metacarpal 5 years earlier that consisted of curettage and autogenous iliac bone grafting. The lesion recurred, and the same procedure was repeated 2 years later (3 years before the current case). The same procedure was performed for enchondromas of the middle phalanx of the fourth digit and the proximal phalanx of the fifth digit 5 years before the current case. Histopathologic reports from previous surgeries showed findings consistent with enchondromas. Radiographs showed an expansive, well-demarcated, rounded radiolucent mass in the fifth metacarpal, with cortical thinning and pathologic fracture, shortening of the proximal phalanx of the fifth digit, and a radiolucent area in the middle phalanx of the fourth digit (Figure 1A). Magnetic resonance imaging scan showed a 23×18×16-mm expansive cartilaginous matrix of lobules with septae that have hyperintense signal intensity in the fifth metacarpal with pathologic fracture (B).

Figure 1: Posteroanterior (left) and oblique (right) radiographs showing an expansive radiolucent mass in the fifth metacarpal, with cortical thinning and pathologic fracture and a radiolucent area in the middle phalanx of the fourth digit, 3 years after the second curettage and autogenous iliac bone grafting (A). A T1-weighted coronal magnetic resonance image showing a 23×18×16-mm expansive cartilaginous matrix of lobules with septae that have hyperintense signal intensity in the fifth metacarpal with pathologic fracture (B).

The patient was operated on under general anesthesia. A dorsal incision was made, and resection of the fifth metacarpal diaphysis was performed, with the metacarpal head and the metatarsal base left in situ. The 4-cm–long intercalary defect was reconstructed with a freeze-dried strut allograft fibular bone segment that was split longitudinally into 2 pieces, with 1 piece transfixed with a Kirschner wire (Figure 2A). Histologic examination showed findings consistent with an enchondroma. The Kirschner wire was removed at 2 months, and at 4 months the patient had full range of motion of the hand and was symptom-free. When examined 14 years postoperatively, at the age of 27 years, the patient had full function of the hand, with no symptoms. Radiographs showed excellent incorporation of the allograft bone, with no recurrence of the tumor. The bone graft had become cylindrical, and a medullary canal had developed (Figures 2B-C). A radiolucent area in the middle phalanx of the fourth digit persisted without progression.

**DISCUSSION**

Enchondroma, a hamartomatous deposition of hyaline cartilage cells that persists throughout development, is the most common primary bone tumor of the hand.\(^3\) Up to 70% of enchondromas occur in the hand, and the metacarpals are the second most frequent site involved, after the proximal phalanges.\(^1\) Enchondromas are usually solitary, but they can present as multiple lesions and are discovered radiographically, usually incidentally or after a pathologic fracture.\(^1,4\) Some lesions recur and cause local bony destruction after treatment, and a small number can transform into chondrosarcomas.\(^2,5\) Traditionally, symptomatic enchondromas are treated with curettage and grafting with autogenous or allogeneic bone or synthetic bone substitutes.\(^3,4\) Cor-
ticocancellous allograft bone chips are widely used and have been shown to be comparable to autogenous bone.\textsuperscript{3,4} Diaphyseal resection and reconstruction with autogenous fibular;\textsuperscript{5} corticocancellous iliac crest segment;\textsuperscript{7} ulnar;\textsuperscript{8} and tibial\textsuperscript{9} bone grafts have been reported. To the best of the authors’ knowledge, the use of structural allograft bone has been reported only once, and it was in the form of osteoarticular allograft replacement of the proximal interphalangeal joint.\textsuperscript{10}

However, there is no standardized algorithm for surgical treatment of this tumor. It is not clear whether grafting after curettage is necessary or whether the type of graft used affects healing, complications, recurrence, and malignant transformation.\textsuperscript{11} Recent studies showed that the choice of graft has no effect on time to healing, range of motion, recurrence, complications, or malignant transformation.\textsuperscript{3,4} However, postoperative complications are an issue. In a series of patients followed over 16 years, a postoperative complication rate of 23% was reported.\textsuperscript{5} In another series, although patients without a pathologic fracture had a postoperative complication rate of 12%, those with a pathologic fracture had a complication rate of 20%.\textsuperscript{3} The current patient belonged to this group, with recurrence and pathologic fracture occurring after 2 surgeries consisting of curettage and autogenous iliac bone grafting.

The timing of treatment when there is a pathologic fracture is also not clearly defined. In 1 study, primarily treating an enchondroma in the presence of a pathologic fracture, there was no change in the outcomes compared with lesions treated after fracture union.\textsuperscript{5} Naturally, patients treated after fracture union had additional periods of immobilization. The outcomes were the same in another study; however, the complication rate was higher when patients were treated in the presence of a pathologic fracture.\textsuperscript{12}

The current patient was treated with resection of the metacarpal diaphysis and reconstruction with structural allograft bone, both to avoid donor site morbidity and to prevent a second recurrence by resecting all pathologic bone (wide resection), instead of curettage (intralesional resection). This strategy proved to be effective because the patient had complete recovery, with no recurrence. The patient also did not have deformity or pathologic fracture or malignant degeneration of the lesion. The strut bone graft served both mechanical and biologic functions. However, allograft bone is not free of complications. Although the use of allograft bone offers an unlimited amount of bone, decreased operative time, and lack of donor site morbidity, potential problems include disease transmission, graft fracture, nonunion of the allograft-host junction, and high cost. However, compliance with guidelines for tissue banks and the use of properly prepared and handled musculoskeletal allografts decreased the transmission of blood-borne pathogens to almost zero,\textsuperscript{13} and the last documented case of human immunodeficiency virus transmission from bone graft occurred in 1985.\textsuperscript{14}

When a strut allograft bone is used, healing occurs by creeping substitution at its ends. However, this is limited to a few millimeters of the allograft. More, but still limited, vascularization also occurs on the allograft surface from the adjacent muscle bellies, leaving most of the allograft segment devoid of vascularity and leading to the complications seen in massive bone allografts. However, because of their thin cortices and decreased total volume, smaller bone allografts show higher rates of osteointegration and revascularization, with fewer long-term complications.\textsuperscript{10}

Consequently, in selected cases, a strut allograft bone may be considered a suitable material for long-term reconstruction of the hand after enchondroma excision, especially in young patients, who have increased healing potential compared with older patients.

\textbf{REFERENCES}


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