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Limb Salvage in Secondary Chondrosarcoma of the Metatarsus

Amit Sharma, MBBS [1], Lalit Maini, MS [2]

[1] Postgraduate Student in Orthopaedics, Department of Orthopaedics, Maulana Azad Medical College, Delhi, India
[2] Professor, Department of Orthopaedics, Maulana Azad Medical College, Delhi, India

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ABSTRACT

Malignant transformation of metatarsal osteochondroma into chondrosarcoma is a rare entity. The most optimal line of treatment, salvage procedure or amputation, continues to be debated. Both of these treatments have varied in popularity. We report the case of a 24-year-old male with chondrosarcoma secondary to differentiation of an osteochondroma in the second and third metatarsals. Wide resection of the tumor mass and reconstruction of the second and third metatarsals was performed using a simple and biologic approach. This was accomplished with an autologous nonvascularized fibular graft to reconstruct the longitudinal arch of the foot. The foot was successfully salvaged, with good anatomic, functional, and aesthetic results. At 1 year postoperatively, the patient was able to walk without any orthotic devices and had returned to his routine work. No evidence of local recurrence or metastasis was observed.

Chondrosarcoma is the third most common primary malignant neoplasm of the bone. It has been observed that two thirds arise without any pre-existing benign lesion and have been referred to as primary chondrosarcomas (1,2). Primary chondrosarcoma is a tumor of adulthood and old age, with the peak incidence in the fifth to seventh decades of life.

However, chondrosarcomas that are superimposed on pre-existing benign cartilaginous neoplasms, such as enchondroma or osteochondroma, are referred to as secondary chondrosarcomas. They constitute about one third of all chondrosarcomas. Secondary chondrosarcoma arising from osteochondroma usually occurs in a relatively younger age group. The mean age at diagnosis has been reported to be 34.9 years (3,4).

The incidence of secondary chondrosarcoma is rare in the foot. Instead, secondary chondrosarcoma has a predilection for flat bone, with pelvis being the most common site, followed by the femur and shoulder girdle (3,4). The present case was a 24-year-old male with chondrosarcoma of the second and third metatarsals secondary to differentiation of an osteochondroma that was treated with wide excision of the tumor and reconstruction of the foot.

Case Report

A 24-year-old male was admitted in our hospital with complaints of swelling in the left foot for the previous 16 months (Fig. 1*A*) and associated with pain for the past 6 months. The patient described the nature of the pain as constant and mild that increased with weight-bearing. The amount of swelling also increased during the 16-month period. He denied any history of trauma, erythema, or sensory changes to the foot. He also reported multiple nodular swellings in the leg and thigh that had been present since childhood. These swellings were, however, asymptomatic and had had a constant size for the previous 5 to 7 years. A review of the patient for any systemic illness was negative.

On local physical examination, a bilobed swelling was palpated on the dorsum of the left foot with a size of around 4 cm × 3 cm. The swelling was firm to hard in consistency and was firmly adherent to the underlying bone; the overlying skin was normal and was not adherent to the swelling, and no veins were dilated.

Plain radiography revealed a lobulated outgrowth with considerable cortical destruction, endosteal scalloping, and punctate calcification involving the second and third metatarsals. It mainly involved the distal and dorsal aspects of the foot (Fig. 1*B*). Noncontrast-enhanced computed tomography of the foot was suggestive of a large heterogeneous swelling arising from the second and third metatarsals showing punctate cartilaginous calcification with osteolytic areas (Fig. 2*A*). The extent of the swelling was up to the mid-diaphysis of the second and third metatarsal, excluding the base of the metatarsals (Fig. 2*B*). Magnetic resonance imaging was suggestive of an expansile destructive lesion involving the second and third

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Address correspondence to: Amit Sharma, MBBS, E–31, Radha Kunj, Brij Vihar, Ghaziabad, Uttar Pradesh 201011 India.
E-mail address: dramite31@gmail.com (A. Sharma).

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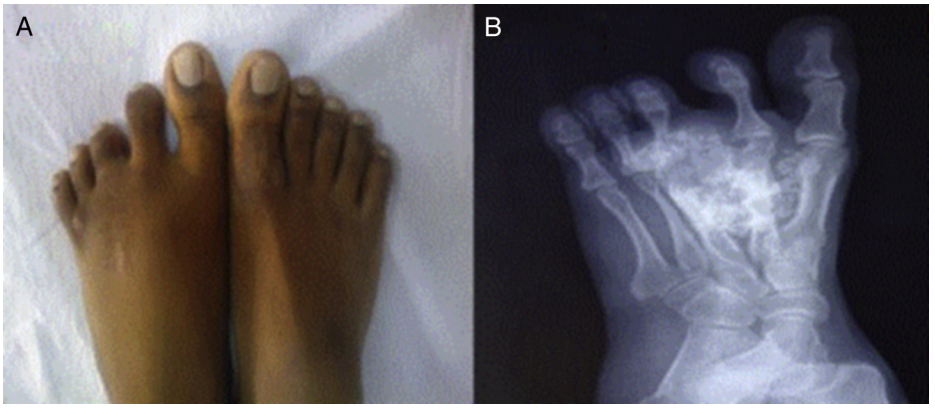

Fig. 1. (*A*) Preoperative clinical photograph. (*B*) Preoperative anteroposterior radiograph.

metatarsal, measuring 5.4 × 4.3 × 4.0 cm, with a hypointense signal on the T_1-weighted images (Fig. 2*C*) and a hyperintense signal on the T_2-weighted images (Fig. 2*D*). The workup for metastasis, which included computed tomography of the chest and abdomen and a bone scan, was negative.

The patient then underwent definitive operative management. En bloc tumor mass resection was performed by resecting the second and third metatarsals, leaving their base in place (Fig. 3*A*). The level of resection was decided in accordance with the criteria for wide resection. Thus, the bases of the metatarsals were left in place rather than resecting their full length. This served 2 benefits. It primarily preserved the midtarsal joint, avoiding the inevitable instability of the foot, which might have occurred after resecting the full metatarsals. Moreover, the chance of better uptake of the fibular graft when fixed to metatarsal base than to cuneiform bone (considering the anatomy) was also a consideration while operating.

Intraoperatively, the tumor consisted of a well-encapsulated irregular mass of cartilaginous tissue measuring 5.5 cm × 4.5 cm × 3.5 cm. The specimen was white and firm, with intermittent soft gelatinous areas. After resection, evaluation of the resected tissue was done using immediate frozen section analysis, which showed clear tissue margins. Next, definitive management for the defect left in the foot was undertaken (Fig. 3*B*). The defect was reconstructed using a similar length of a nonvascularized fibular graft from the ipsilateral side (Fig. 3*C*). Proper care was taken while harvesting the fibular graft to avoid the slightest threat of tumor spread. The instruments used to resect the tumor mass were put aside, and a new set was used for fibular graft extraction. Fixation of the fibular graft in the foot was achieved with Kirschner wires (Fig. 4*A*). After fixation, the Kirschner wires were bent to minimize the risk of migration. The findings of the definitive histopathologic examination were suggestive of osteochondroma with secondary chondrosarcoma.

Postoperatively, marginal superficial necrosis of the skin flaps occurred that healed satisfactorily with antibiotics and wound dressings. A below-the-knee plaster cast with a window was applied. The patient was not allowed to bear weight for 2 months. After 2 months, the patient was allowed partial weightbearing using a foot orthosis. The progress was closely observed, with follow-up visits every 2 weeks. The Kirschner wires were removed at 4 months postoperatively after radiologic evidence of graft uptake was observed. During this period, the patient continued mobilizing with partial weightbearing using a foot brace. At 6 months postoperatively, full weightbearing was allowed using the brace.

After 1 year of follow-up, radiographic evidence showed the graft had been incorporated (Fig. 4*B*), and the brace was no longer required. Clinically, the patient was maintaining a normal gait and his day-to-day activities without any orthotic support, and the foot appeared normal in contour (Fig. 4*C*).

Discussion

Osteochondroma is the most common “benign tumor” of the skeleton. They represent 35% of all benign tumors and 10% to 15% of all bone tumors (5). Most of these have been diagnosed in patients younger than 20 years old. A marked predilection for males exists, with a male-to-female ratio of 3:1 (6). It usually arises from the long bones, most commonly around the knee (40% of cases), with the distal femur (20% to 25%) more common than the proximal tibia (15% to 20%) (5,7). The risk of chondrosarcoma in a solitary osteochondroma has been reported to be 2% to 7% and 5% to 25% for multiple hereditary exostoses (8,9). Patients with Ollier’s disease and Maffucci syndrome have a 25% to 30% risk of developing chondrosarcoma (10–12).

Chondrosarcoma is a malignant tumor with pure hyaline cartilage differentiation. It is the most common malignant tumor into which an

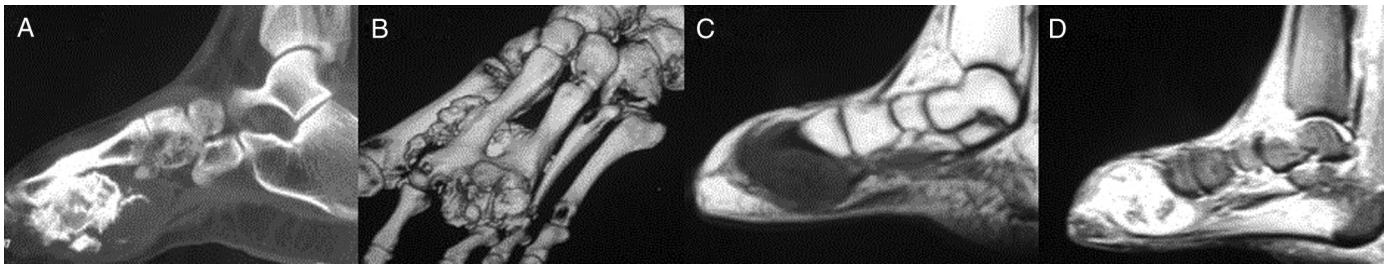

Fig. 2. (*A*) Preoperative computed tomography scan, sagittal view. (*B*) Preoperative computed tomography scan (3-dimensional reconstruction) demonstrating the tumor extent. (*C*) Preoperative sagittal T_1-weighted magnetic resonance imaging scan. (*D*) Preoperative sagittal T_2-weighted magnetic resonance imaging scan.