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Case Reports and Series

Primary Intraosseous Malignant Peripheral Nerve Sheath Tumor of the Medial Cuneiform: A Case Report and Review of the Literature

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ABSTRACT

Peripheral nerve sheath tumors (benign and malignant) usually arise in the soft tissues and are unusual in bone. Intraosseous peripheral nerve sheath tumors are usually benign and constitute approximately 0.2% of all bone tumors. Intraosseous malignant peripheral nerve sheath tumors (MPNSTs) are uncommon and usually result from secondary invasion. Only a few cases of primary intraosseous MPNSTs have been reported in published studies, and these were localized mostly in the mandible (approximately 50%) or maxilla, spine, and, occasionally, in the appendicular skeleton. To the best of our knowledge, we report the first case of primary intraosseous MPNST involving a midtarsal bone (medial cuneiform). The patient was a 62-year-old female who presented with pain and tenderness but without swelling. Imaging revealed nonspecific findings, and the preoperative computed tomography-guided biopsy findings were consistent with MPNST. The patient was treated with neoadjuvant radiotherapy, followed by wide local excision and allograft reconstruction. At the final follow-up examination (24 months), the graft had been incorporated without evidence of local recurrence or distant disease. The patient with primary intraosseous MPNST of the medial cuneiform described in the present report presented with nonspecific clinical and radiologic findings. Thus, a high index of suspicion and histopathologic examination, including immunohistochemistry, are necessary for an accurate diagnosis.

Peripheral nerve sheath tumors include both benign and malignant tumors and usually arise in the soft tissues. Intraosseous peripheral nerve sheath tumors are usually benign and constitute approximately 0.2% of all bone tumors (1,2). Intraosseous malignant peripheral nerve sheath tumors (MPNSTs) are rare forms of cancer (2) and usually result from secondary invasion from adjacent soft tissues. Only a few cases of primary intraosseous MPNST have been reported in published studies (3). They arise most frequently in the mandible (approximately 50%) or maxilla (2,4–8), spine (6,9–13), and, occasionally, in the appendicular skeleton (Table). In the appendicular skeleton, intraosseous MPNSTs most frequently affect the bones of the upper extremity (humerus, ulna, metacarpal, and phalanx), and involvement of the bones of the lower extremity is rare (1). We report a case of primary intraosseous MPNST involving the medial cuneiform, which, to the best of our knowledge, is the first known case report of primary intraosseous MPNST involving a midtarsal bone. The present case illustrates, for foot and ankle surgeons, the importance of remembering the possibility of unusual tumors that can arise in the foot.

Case Report

A 62-year-old female presented with a 4-month history of pain localized to the medial aspect of the right midfoot. The initial radiographs of the foot were unremarkable. She was initially treated by a foot and ankle surgeon with arch support for a presumed diagnosis of posterior tibial tendonitis. She was subsequently evaluated and treated with an immobilizing walker and activity modification. Physical therapy was not helpful, and nonsteroidal anti-inflammatory medicines offered only partial relief. Thereafter, she was referred to our musculoskeletal oncology service because of persistent pain that worsened with activities. She had had no antecedent trauma. Her

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Table
Previously reported cases of primary intraosseous malignant peripheral nerve sheath tumor involving the appendicular skeleton

Investigator	Age (y)/Sex	Site	Presentation	Treatment	Follow-up
Lesic et al (1)	48/Female	Femoral head and neck	Groin pain, without NF-1	Radical resection, cemented bipolar hemiarthroplasty	No recurrence at 4 y
Terry et al (2)	26/Male	Proximal metadiaphysis of femur	Pain and swelling, with NF-1	Resection and allograft with bipolar hemiarthroplasty	NR
Kendi et al (3)	29/Male	Proximal ulna	Growing, painless mass, ulnar nerve sensory symptoms, with pain later, without NF-1	Marginal excision, vascularized fibular graft	Local recurrence; lung metastases at 2 y, patient died in third year
Bullock et al (4)	28/Male	Distal femur	Pain and swelling, without NF-1	Curettage	Recurrence in 15 mo, lung metastases
Iwama et al (16)	76/Male	Distal phalanx of fifth toe	Swollen, painful toe, without NF-1	Ray amputation	Local recurrence in 1 y, with multiple lung metastases later
Wesche et al (17)	3 Lesions in 3 children aged 6 to 13 y	Femur Calcaneus Distal phalanx of thumb	Without NF-1	NR	NR
Hirokawa et al (18)	50/Male	Proximal phalanx of index finger	Pain and swelling, without NF-1	Resection of index finger	NR
Guthert (23)	20/Male	Humerus	Pain, without NF-1	NR	NR
Bose et al (24)	28/Male	Ulna	Without NF-1	NR	NR
Peers (25)	55/Male	Ulna	Without NF-1	Resection	Well at 20 mo
Mirra (26)	NR	Sternum	With NF-1	NR	NR

Abbreviations: NF-1, neurofibromatosis 1; NR, not reported.

medical history was significant for ulcerative colitis and fibrocystic disease of the breast. Medications, allergies, family history, social history and the review of systems were unremarkable. On physical examination, she was a fair-skinned female with tenderness over the right medial cuneiform and no palpable mass or overlying skin changes. She had full active and passive range of motion in the ankle and foot, and her lower extremity neurovascular examination findings were normal.

All the clinical laboratory studies, including the comprehensive metabolic panel, complete blood count with differential, erythrocyte sedimentation rate, C-reactive protein, thyroid panel, serum and urine protein electrophoresis, serum calcium, phosphorous, and alkaline phosphatase were normal. Anteroposterior (Fig. 1*A*), oblique (Fig. 1*B*), and lateral (Fig. 1*C*) radiographs of the right foot revealed no abnormalities, except for a subtle area of osteopenia in the medial cuneiform. Magnetic resonance imaging of the right foot without contrast revealed a lesion in the medial cuneiform measuring 2.1 × 1.7 × 1.7 cm that was heterogeneous and displayed intermediate signal intensity on T_1-weighted images and hyperintensity on fat-suppressed T_2-weighted and short tau inversion recovery-weighted sequences (Fig. 2). Computed tomography (CT) revealed a large marrow-based abnormality with low attenuation involving most of the medial cuneiform with destruction of the anteroinferior cortex. No matrix calcification or new bone formation was observed (Fig. 3). Fluorodeoxyglucose positron emission tomography/CT showed a lytic lesion within the right medial cuneiform with a standardized uptake value of 20.8, likely representing a hypermetabolic condition (Fig. 4), with no additional fluorodeoxyglucose-avid areas throughout the skeleton. Examination of the preoperative CT-guided biopsy specimen revealed MPNST on immunohistochemistry (S-100, cytokeratin, HMB-45, melan-A, MITF1, SMA, desmin, CD23, CD35, c-kit, and CD34).

The patient received 50 Gy of neoadjuvant radiotherapy, followed 2 weeks later by wide local excision and reconstruction. The surgery was performed with the patient in the supine position under spinal anesthesia. An ipsilateral thigh tourniquet was used after exsanguination by elevation (no compression) of the extremity. A dorsal approach medial to the tibialis anterior tendon was used. The tumor was resected en bloc, with a cuff of grossly normal tissue all around. The resection included the whole of the medial cuneiform and the distal portion of the navicular, medial margin of the middle cuneiform, a segment of the first metatarsal base, and the adjacent corner of the second metatarsal and the surrounding soft tissues. No local (topical) adjuvant therapy was used. Definitive reconstruction was done at the same sitting, using a freeze-dried fibular strut allograft bridging the navicular and the

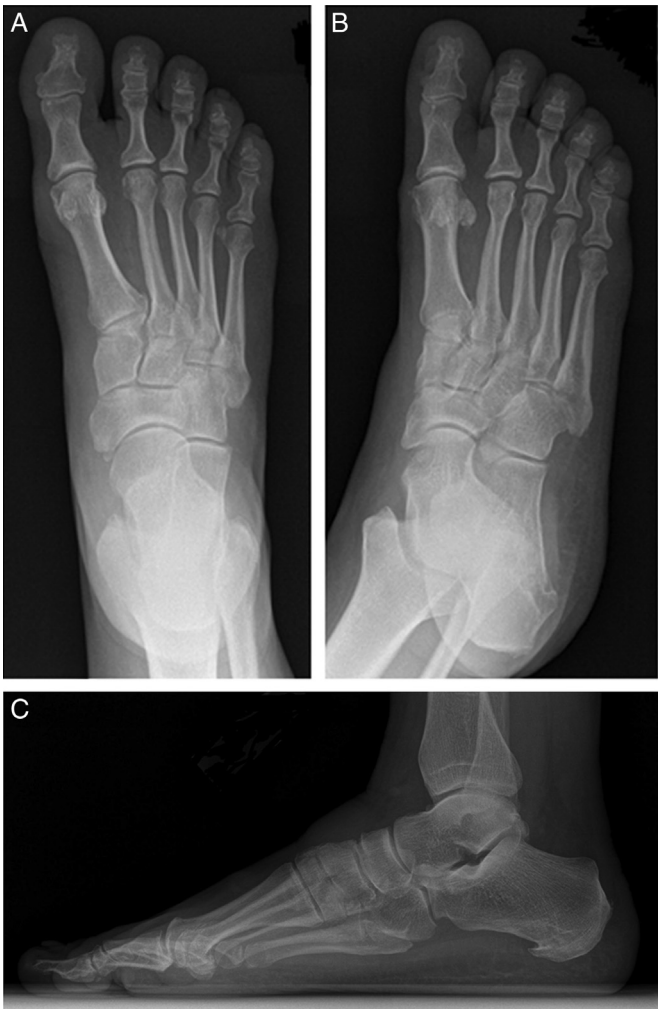

Fig. 1. Anteroposterior (*A*), oblique (*B*), and lateral (*C*) radiographs of the right foot revealing no obvious abnormality, except for a subtle area of osteopenia of the medial cuneiform.