Primary tumors of the abdomen and lungs are the most common sources of metastasis to the bones of the extremities. Prostate carcinomas rarely affect the bones of the lower extremity, making the literature on these cases extremely limited.

A review of the literature on metastatic tumors of the bone reveals only 17 cases, nine of which were confirmed histologically. Interestingly, in this case and in Gisserot et al genitourinary malignancies tended to be associated with metastasis to the feet, with predilection to the calcaneus and foot pain being suggestive of an occult carcinoma.

Sebag-Montefiore et al described a metastatic rectal carcinoma to the tarsals and fibula in a 48-year-old patient after 4 years of rectal carcinoma with bone metastasis to the pubic rami. Only after an open biopsy to the foot was a confirmation of moderately differentiated adenocarcinoma made. The treatment was local radiation therapy. A bone scan and plain radiographs showing diffuse osteopenic changes revealed the involvement of the tarsals and fibula. Continued radiotherapy was performed, but the patient ceased the treatment after a few months.

Previous reports reveal only limited or normal imaging sequences to this rare and unusual condition. Prostate cancer metastases are typically multifocal and usually involve the axial skeleton. Oh et al described a 1-year history of foot pain in an 82-year-old man after external beam radiation therapy for his prostate cancer. Initial magnetic resonance imaging (MRI) showed abnormalities consistent with osteomyelitis or edema of the cuboid. Bone biopsy confirmed focal staining positive for the prostate-specific antigen (PSA). The treatment was based on hormone ablation therapy, which improved foot pain.

Schwartz et al reported on a patient who had presented with prostate carcinoma metastases that were limited to the right foot. In this case, MRI demonstrated a normal marrow signal in the surrounding bones of the foot and increased vascularity of the foot.

In the case report presented here, the patient presented with leg, ankle, and foot pain, with an undiagnosed prostate carcinoma. Metastasis limited to the right lower extremity was confirmed by biopsy. Preoperative MRI and technetium-99m bone scan correlation in this case demonstrated a significantly abnormal marrow signal in the ankle, foot, and portions of the tibia, fibula, and femur.

**Case Report**

An 87-year-old male was referred to the UCSD Foot and Ankle Surgery Clinic (San Diego) with the chief complaint of ankle pain and a questionable history of ankle sprains. He was previously evaluated and treated for several months by his primary-care provider. He had a history of sciatica, arthritis, and vein ablation procedures. The patient noted intermittent pain to the right leg, ankle, and foot for the previous 2 to 3 years. During his visits to his primary-care physician for the previous 5 years, he had an elevated PSA with an enlarged nodule on the right side of the prostate. A biopsy in 2001 showed high-grade prostatic intraepithelial neoplasia and no signs of malignancy. He was started on Proscar (Merck & Co, Inc, Whitehouse Station, New Jersey). A second biopsy in 2002 was also negative, with a PSA of 22 ng/mL.

His past medical history included lung surgery with thoracotomy in 1986 because of asbestos expo-
sure and surgery to the right ear. He was not on any regular medication and denied any drug allergies. He had a family history of leukemia. The patient was retired and married with four children. He had recently quit smoking and used alcohol minimally.

Review of his systems revealed a stable weight without any major changes to his health. He denied any shortness of breath or cardiac symptoms but had some mild constipation and urination frequency.

Upon physical examination, he was alert, oriented, and in no apparent distress. His blood pressure was 131/71 mm Hg; his weight was 174 pounds, and his heart rate was 76/min. There were no enlarged lymph nodes felt in his neck, axillae, or inguinal region. There was no bony tenderness to his spine. His lungs were clear to inspection, percussion, and auscultation. His heart showed a regular rate and rhythm with no murmurs or gallops. His abdomen was soft, non-tender, and without any palpable masses. The rectal examination was normal. His prostate was very large, hard, and nodular. His right extremity revealed diffuse tenderness throughout the ankle and rearfoot, with varicose veins and mild-to-moderate edema about the distal leg, ankle, and rearfoot (Fig. 1). There were no wounds noted. Pulses were palpable to his dorsalis pedis and posterior tibial arteries with instantaneous capillary filling. Light touch sensation and deep tendon reflexes were normal, as was muscle strength (5/5). Gait examination revealed full heel-to-toe pattern without any limping, guarding, or gait assistance.

His lab findings revealed the following: PSA 70 ng/mL, albumin 3.4 g/dL, white blood cell count 4.9 μL, hemoglobin 13.1 g/dL, hematocrit 38.3%, platelet count 191,000 μL, creatinine 1.3 mg/dL, alkaline phosphatase 360 U/L, sedimentation rate 27, international normalized ratio 1.0, and otherwise normal electrolytes and liver function tests. His serum protein electrophoresis was normal.

Radiographic findings of the ankle, foot, pelvis, and lumbosacral images revealed diffuse osteopenia in the rearfoot, multilevel degenerative disease, and no signs of any fractures or dislocations (Fig. 2). The patient was followed up with an MRI evaluation (Figs. 3 and 4), which revealed multifocal marrow infiltrating process affecting the bones of the midfoot, rearfoot and ankle, and leg. No soft-tissue masses were identified in association with these marrow abnormalities. A subsequent technetium-99m methylene diphosphonate injection (MDP) bone scan (Fig. 5) revealed multifocal areas of increased tracer uptake involving the right foot, proximal and distal right tibia and fibula, mid-tibia shaft, and distal femoral metaphysis and small focal increased uptake overlying the left mandible, which may represent the dental process. These areas correlated with extensive abnormal marrow signal. A computed tomography scan of the abdomen was then ordered; it revealed that the prostate gland was asymmetrically enlarged, with the right lobe greater than the left. A heterogeneously mildly enhancing mass was also seen within the right lobe of the prostate, which was suggestive of prostate cancer.

The patient then underwent core biopsy of the rearfoot in the calcaneus following the MRI findings. Two 7-mm full bicortical core samples were obtained through a lateral approach. The biopsy revealed metastatic prostate carcinoma, with immunohistochemical stains showing positive PSA and prostate-specific acid phosphatase (Figs. 6 and 7) and negative cytokeratin 7 and cytokeratin 20. Immunohistochemical stains after decalcification showed positive PSA and prostate-specific acid phosphatase. Sections of the bone showed malignant cells in marrow spaces,
The patient then received radiation therapy with androgen deprivation, Lupron (Tap Pharmaceutical Products, Inc, Lake Forest, Illinois), and Casodex (AstraZeneca Wilmington, Delaware) 50mg, concurrent with palliative radiotherapy. He improved his condition with decreased pain level in his right extremity over the next 3 to 6 months. He was scheduled for monitoring of his PSA levels and radiotherapy protocols monthly or until undesirable adverse side effects prevented continuation of treatment, as per historical literature protocols.10

Discussion

Compared with the case reports by Gisserot et al., Oh et al., and Schwartz et al., this case report is unique; it documents the clinical history along with an impressive MRI, bone scan, and confirmatory bone biopsy. As in Oh et al., an abnormal bone scan is followed by a plain film or MRI, but in this case initial plain films and MRI demonstrated the lesions characteristic of a metastatic process. The initial clinical presentation of diffuse pain in the extremity seems to correlate with previous reports, as this patient did not have any other history except for an enlarged prostate gland.

Currently, the pathogenesis of these distal metastatic lesions remains obscure, and the literature hypothesizes that there might be a spread through the venous system, trauma, or thermodynamic changes.11

which exhibited a glandular pattern. The malignant cells showed focal positivity for PSA. These immunohistochemical findings supported the diagnosis of metastatic prostatic adenocarcinoma.

Intraoperative cultures revealed no organisms in the gram stain smear, no growth in aerobic, anaerobic, fungal, and acid fast cultures; and no colony growth in 8 weeks.

Figure 3. T1-weighted magnetic resonance image: multifocal marrow infiltrating process affecting the bones of the midfoot, rearfoot and ankle, and leg.

Figure 4. T2-weighted magnetic resonance image: multifocal marrow infiltrating process affecting the bones of the midfoot, rearfoot and ankle, and leg.

Figure 5. Technetium-99m methylene diphosphonate injection (MDP) bone scan revealed multifocal areas of increased tracer uptake.

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The literature is extremely limited on this type of case report and the long-term sequelae, and with limited case reports available, it is difficult to ascertain the incidence and long-term results. It is important to be aware and have a high index of suspicion of unusual sites of metastases in patients with unusual MRI with diffuse pain.

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References