Radiology Case Reports

Volume 4, Issue 4, 2009

Tumoral calcinosis mimicking recurrent osteosarcoma

Jonelle M. Petscavage, MD and Michael L. Richardson, MD

We report a case of a tumoral calcinosis mimicking the appearance of recurrent osteosarcoma of the left femur and tibia in a 29-year-old woman with a history of osteosarcoma and chronic renal failure. Both processes can appear radiographically and histologically similar. Due to loosening of the orthopedic hardware, our patient underwent surgical revision and biopsy. We review the imaging appearances of both entities as well as the underlying mechanism of tumoral calcinosis secondary to renal disease. We also discuss how PET and CT imaging can aid in differentiation of these processes and possibly prevent surgical biopsy in other cases.

Case report

Our case is a 29-year-old woman with a 12-year remote history of osteogenic sarcoma of the left distal femur and proximal tibia, which was treated with chemotherapy, surgical resection, knee joint arthrodesis, and allograft placement. Over a recent four-month period, the patient complained of increasing left lower extremity pain and swelling. Radiographs of the orthopedic hardware showed loosening around the proximal and distal interlocking screws, backing out of both of the distal interlocking screws, and persistent nonunion of the allograft (Fig. 1). Additionally, there were new round, almost lobular-appearing, amorphous soft-tissue calcifications in the lateral soft tissues of the proximal thigh (Fig. 2) and adjacent to both distal interlocking screws (Fig. 3).

These findings were initially of concern because of the possibility of recurrent osteosarcoma. However, the patient had also undergone dialysis for end-stage renal disease secondary to type 1 diabetes, which raised the question of tumoral calcinosis due to her chronic renal disease. One

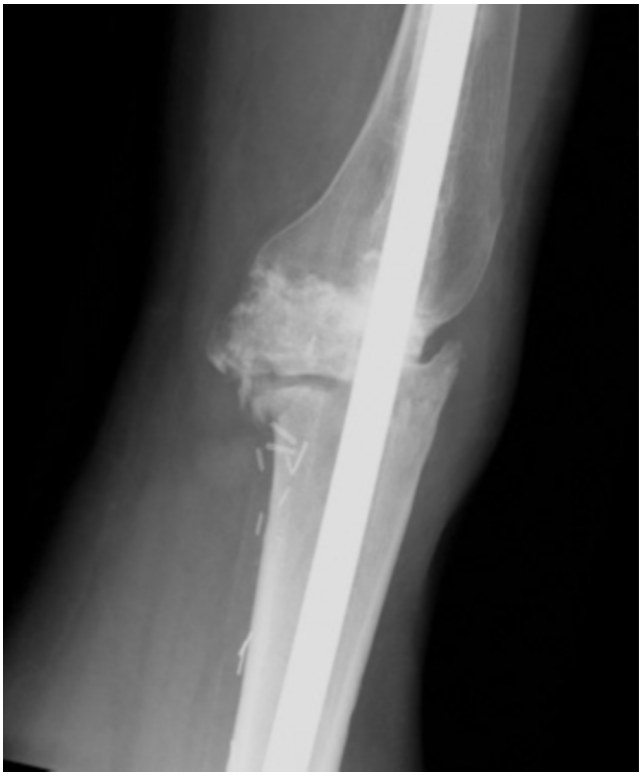

Figure 1. 29-year-old woman with tumoral calcinosis. Lateral radiograph of the left knee demonstrating an intramedullary rod bridging the left femur and left tibia with nonunion of allograft centrally.

Citation: Petscavage JM, Richardson ML. Tumoral calcinosis mimicking recurrent osteosarcoma. Radiology Case Reports. [Online] 2009;4:336.

Dr. Petscavage and Dr. Richardson are in the Department of Radiology, University of Washington, Seattle WA, USA.

Competing Interests: The authors have declared that no competing interests exist.

DOI: 10.2484/rcr.v4i4.336

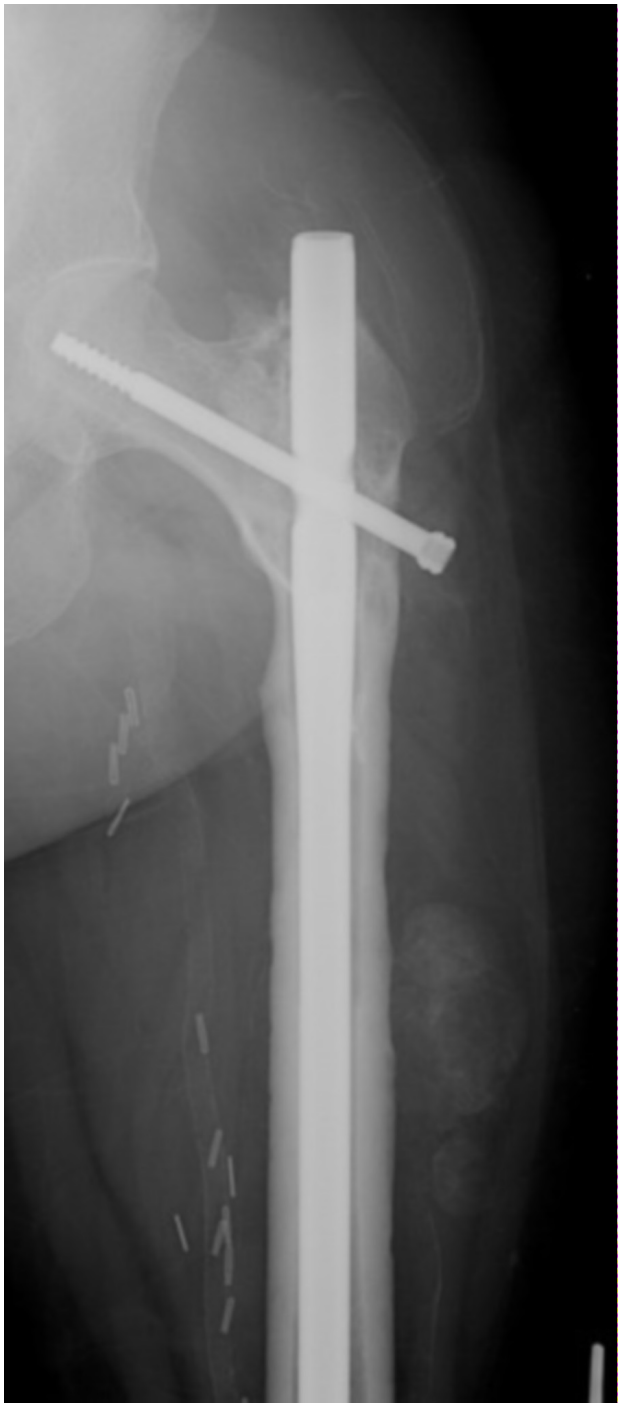

Figure 2. 29-year-old woman with tumoral calcinosis. Anteroposterior radiograph of the left proximal femur demonstrating replacement of the femoral shaft by allograft, bridged by an intramedullary nail with a proximal interlocking screw. Lobular-appearing, amorphous soft-tissue calcifications appear in the soft tissues lateral to the femoral shaft.

week later, the patient underwent surgical excision and biopsy of the soft tissues as well as hardware revision.

The initial pathology report interpreted this bone formation as residual osteosarcoma. However, this was re-evaluated following an interdisciplinary meeting involving orthoaedic oncologists, a musculoskeletal radiologist, pathologists, and a radiation oncologist. The final report described devitalized bone, fibroblastic giant-cell proliferation, mineralized material, and metal debris, without evidence of osteosarcoma. Thus, these prominent calcifications were concluded to represent a combination of callus formation and tumoral calcinosis secondary to renal disease.

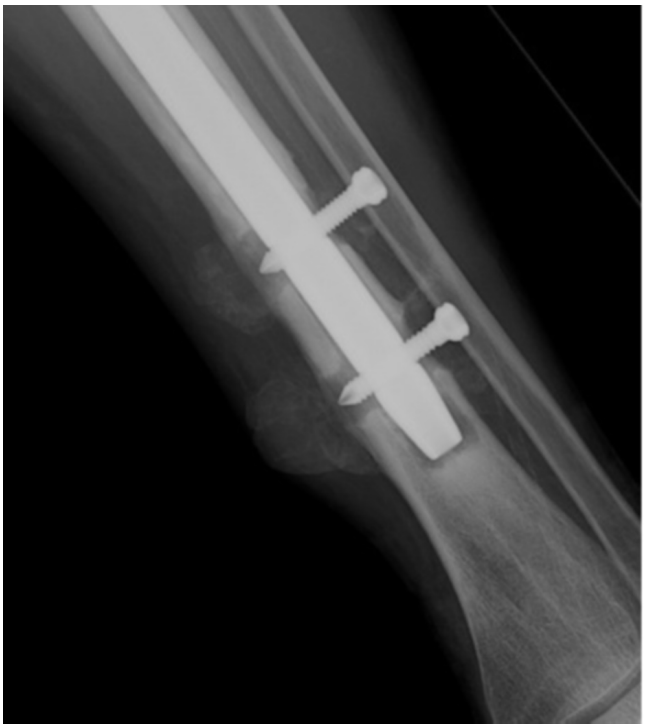

Figure 3. 29-year-old woman with tumoral calcinosis. Anteroposterior radiograph of the left distal tibia and fibula demonstrating an intramedullary nail with distal interlocking screws. These screws have loosened and backed out several millimeters. In addition, lobular-appearing, amorphous soft-tissue calcifications appear in the soft tissues medial to both distal interlocking screws.

Discussion

Osteosarcoma is the most common primary bone malignancy in the adolescent age group, and the second most common primary bone tumor in all age groups (1). Peak prevalence occurs in children and adolescents at age 0 to 24 years, while a secondary peak of osteosarcoma occurs in the elderly (ages 60 to >85 years) due to malignant transformation of Paget disease or some other benign bone process (2). Recurrence rates tend to be low, ranging between 4% to 10% (3-5). However, once osteosarcoma has

recurred locally, the 5- and 10-year survival rates are only 29% and 10%, respectively (6). Since most recurrences occur within the first few years of treatment, close followup imaging is key. There are no consensus guidelines for radiographic followup, although recommendations similar to the following are usually reported: CT scanning of the chest, plain-film radiography of the reconstructed extremity, and serial physical examinations every three months for the first two years after treatment, at least every six months from the second through the fifth years, and subsequently on a yearly basis (7).

Imaging features of recurrent conventional osteosarcoma are very similar to those of primary osteosarcoma (8), including fluffy, cloud-like opacities within the medullary cortex, and soft-tissue mineralized masses. Osseous or soft-tissue bone formation or both have been seen in recurrences (9). These mineralized soft-tissue masses can be radiographically and pathologically difficult to distinguish from heterotopic ossification or tumoral calcinosis, as it was in our case. Tumoral calcinosis can arise as an idiopathic process (possibly familial) or in association with renal disease, as in our patient.

Tumoral calcinosis secondary to chronic renal disease presents with peri-articular/juxta-articular calcified soft-tissue masses. This process has a prevalence of 0.5% to 1.2% in patients on hemodialysis (10, 11). The underlying etiology is primarily believed to be due to secondary hyperparathyroidism in combination with vitamin D deficiency (12, 13). In renal disease, the kidneys cannot produce enough 1, 25 – dihydroxy-vitamin D3, and this (combined with decreased glomerular filtration of phosphate) results in hypocalemia. The parathyroid glands respond by increased secretion of parathyroid hormone (PTH). The end result is an elevated calcium-phosphate product, resulting in calcium deposition in the soft tissues (12). When the resulting soft-tissue calcification is fine and speckled, it is usually referred to as "metastatic calcification" (14, 15). When the calcification occurs in dense peri-articular masses, the term "tumoral calcinosis" is often used.

Tumoral calcinosis has been referred to by several alternative names in the literature, including pseudotumor calcinosis, uremic tumoral calcinosis, and secondary tumoral calcinosis (16). Indeed, the features of idiopathic tumoral calcinosis and secondary forms are indistinguishable both radiographically and histologically (17). Imaging features include lobular, amorphous, cystic soft-tissue calcifications, usually in a peri-articular location (7, 9, 18). The masses increase in size over months to years in patients with renal failure (19). Characteristic CT patterns include cystic collections with fluid calcium levels and calcified rims and/or multilobulated masses with uniform calcification (13, 20). On MRI, the calcifications are low signal on all sequences. However, a rim of high T2 signal due to foreign body granulation reaction has been reported (21, 22).

Both recurrent osteosarcoma and secondary tumoral calcinosis of renal disease radiographically may present as mineralized amorphous soft-tissue masses. In our case, due to the hardware loosening, surgical revision of the intramedullary nail was already planned. Thus, soft-tissue biopsy and excision of the calcified masses at the same time as the revision was deemed the best treatment course. CT or MRI was not performed in our patient, given potential artifacts from orthopedic hardware. However, in patients without hardware, cross-sectional imaging could help differentiate the two entities and prevent surgical biopsy. Although a recent meta-analysis showed sensitivity, specificity, and accuracy of 91%, 85%, and 88% for PET diagnosis of primary osteosarcoma (23), and multiple papers have shown similar or even higher sensitivity and specificity of PET compared to CT and MRI for tumor recurrence (24), benign conditions can also demonstrate high FDG-18 uptake (25). Thus, areas of PET uptake need to be correlated with other imaging features and clinical history.

Ultimately, our case demonstrates that benign processes such as callus formation, heterotopic ossification, and tumoral calcinosis can appear similar to and be radiographically indistinguishable from tumor recurrence. Understanding the characteristic imaging features of the entities as well as remembering the value of CT, MRI, and PET is important in preventing unnecessary biopsies and choosing appropriate treatment.

References

1. Manasater BJ, May DA, Disler DG. *Musculoskeletal imaging: The requisites*. 3rd Edition. Mosby. Philadelphia PA. 2007.
2. Mirabello L, Troisi RJ, Savage SA. Osteosarcoma Incidence and survival rates from 1997 to 2004. *Cancer* 2009; 115(7): 1531-1543. [PubMed]
3. Grimer RJ, Taminiau AM, Cannon SR. Surgical outcomes in osteosarcoma. *J Bone Joint Surg Br* 2002; 84: 395-400. [PubMed]
4. Ferrari S, Briccoli A, Mercuri M, et al. Postrelapse survival in osteosarcoma of the extremities: prognostic factors for long-term survival. *J Clin Oncol* 2003; 21: 710-715. [PubMed]
5. Chi SN, Conklin LS, Qin J, et al. The patterns of relapse in osteosarcoma: the Memorial Sloan-Kettering experience. *Pediatr Blood Cancer* 2004; 42: 46-51. [PubMed]
6. Nathan SS, Gorlick R, Bukata S, etal. Treatment algorithm for locally recurrent osteosarcoma based on local disease-free interval and the presence of lung metastasis. *Cancer* 2006;107:1607-1616. [PubMed]
7. Wittig JC, Bickels J, Priebat D, Jelinek J, Kellar-Graney K, Shmookler B, Malawer MM. Osteosarcoma: a multidisciplinary approach to diagnosis and treatment. *Am Fam Physician*. 2002 Mar 15;65(6):1123-32. [PubMed]
8. Murphey MD, Robbin MR, McRae GA, Flemming DJ, Temple HT, Kransdorf MJ. The many faces of osteosarcoma. *Radiographics*. 1997 Sep-Oct;17(5):1205-31. [PubMed]
9. Campanacci M, Laus M. Local recurrence after amputation for osteosarcoma. *The Journal of Bone and Joint Surgery* 1980; 62B (2):201-7 [PubMed]

10. Eisenberg B, Tzamaloukas AH, Hartshorne MR, Listrom MB, Arrington ER, Sherrard DJ. Periarticular tumoral calcinosis and hypercalcemia in a hemodialysis patient without hyperparathyroidism: a case report. *J Nucl Med*. 1990;31:1099-1103. [PubMed]
11. Franco M, Van Elslande L, Passeron C, et al. Tumoral calcinosis in hemodialysis patients: a review of three cases. *Rev Rhum Engl Ed.* 1997;64:59-62. [PubMed]
12. Robert D, Jorghetti V, Leclerg M, et al. Does vitamin K excess induce ectopic calcifications in haemodialysis patients. *Clin Nephrol* 1985; 24(6): 300–4. [PubMed]
13. Lawrence RA, Ozener C, Kilic S, Akoglu E. Tumoral Calcinosis in Chronic Renal Failure: Two case reports. JIAS 1994; 7 (2):106-110. url: http://docs.google.com/gview?a=v&q=cache:T_sJ4uJbd70J:www.medicaljournal-ias.org/7_2/Lawrence.pdf+Tumoral+Calcinosis+in+Chronic+Renal+Failure+:+Two+Case+Reports&hl=en&gl=us Last access 9/7/09
14. Yeh SM, Hwang SJ, Chen HC. Treatment of severe metastatic calcification in hemodialysis patients. *Hemodialysis International* 2009; 13:163–167 [PubMed]
15. Jevtic V. Imaging of renal osteodystrophy. *Eur J Radiol*. 2003 May:46(2):85-95. [PubMed]
16. Olsen KM, Chew FS. Tumoral calcinosis: pearls, polemics, and alternative possibilities. *Radiographics*. 2006 May-Jun; 26(3):871-85. [PubMed]
17. Gordon LF, Arger PH, Dalinka MK, Coleman BG. Computed tomography in soft tissue calcification layering. *J Comput Assist Tomogr* 1984;8:71–73 [PubMed]
18. Chew FS, Bui-Mansfield LT, Kline MJ. *Musculoskeletal imaging*. Philadelphia, PA: Lippincott, Williams & Wilkins; 2003:472-473.
19. Girard CJ, Wasserman PL, Lenchik L. Secondary tumoral calcinosis with intraosseous penetration. *Radiology Case Reports*. [Online] 2009;4:213.
20. Martinez S, Volger JB, Harrelson JM, Lyles KW. Imaging of tumoral calcinosis: new observations. *Radiology*. 1990;174:215-222. [PubMed]
21. Durant DM, Riley LH III, Burger PC, McCarthy EF. Tumoral calcinosis of the spine: a study of 21 cases. *Spine* 2001; 16: 740–5. [PubMed]
22. Hodnett P, Moore M, Kinsella S, Kelly D, Plant WD, Maher MM. Radiological features of progressive tumoral calcinosis in chronic renal failure. *Australasian Radiology* 2007; 51(S1): B115-B118 [PubMed]
23. Bastiaannet E, Groen H, Jager PL, etal. The value of FDG-PET in the detection, grading, and response to therapy of soft tissue and bone sarcoma: a systematic review and meta-analysis. *Cancer Treat Rev*. 2004;30:83-101. [PubMed]
24. Brenner W, Bohuslavizki KH, Eary JF. PET imaging of osteosarcoma. *Journal of Nuclear Medicine* 2003;44(6):930-942 [PubMed]
25. Okuyama C, Kubota T, Matsushima S, Ushijima Y, Nishimura T. Intense F-18 FDG Accumulation in idiopathic tumoral calcinosis. *Clinical Nuclear Medicine*. 2009;34(4):230-232 [PubMed]