Annals of Clinical Oncology and Cancer Research
Case Report

Presentation of Extensive Metastatic Radius Cancer to the Emergency Department as a Pathologic Fracture: Review of Pathobiology, a Medical Case, and Potential Options for Surgical Management

Arjavon Talebzadeh MD[1], Nojaye Talebzadeh[2*], Francis Nordstrom ARNP[1], Daniel Cobau DO[1]

[1]HCA Florida Orange Park Hospital

[2]Princeton University

Citation: *Arjavon Talebzadeh, Nojaye Talebzadeh, Francis Nordstrom, Daniel Cobau. Presentation of Extensive Metastatic Radius Cancer to the Emergency Department as a Pathologic Fracture: Review of Pathobiology, a Medical Case, and Potential Options for Surgical Management. Annal Clini Onco Canc Res. 2026;2(6):1-8. DOI: https://doi.org/10.5281/zenodo.21134579*

Received Date: 28 June, 2026; **Accepted Date:** 01 July, 2026; **Published Date:** 03 July, 2026

[*]**Corresponding author:** Nojaye Talebzadeh, Princeton University

ABSTRACT

This paper describes the case of an older gentleman with known metastatic prostate cancer to his left radius who presented for sudden-onset atraumatic left forearm pain. This case report speculates about potential options for management and reviews some of the existing literature on primary and metastatic radius cancer. This case also served as a unique opportunity to compare the sunbursting appearance of osteosclerotic metastatic bone cancer on x-ray to its appearance on ultrasound.

Keywords: Cancer; Pathobiology; Bone

INTRODUCTION

Bone is often described as the 3rd most common site of cancer metastasis in adult patients after the lungs and liver.[1] Metastatic bone disease is far more common than primary bone cancers in the adult population, while primary bone cancers like osteosarcoma are more common in adolescents.[2] About 90% of patients with advanced prostate cancer (the most common cancer in adult males) die with bone metastases.[3]

Breast, prostate, and other primary cancers like renal cell carcinoma tend to seed more commonly in the axial skeleton in sites such as the thoracic spine, pelvis, sternum rather than the long bones of the appendicular skeleton.[4,5] However, when they do, it is generally around the red marrow rich sites of the proximal epiphyses of large bones such as the femur or humerus. Cortex-rich long bones such as the radius, ulna, or fibula are less commonly implicated and have relatively fewer well-described options for surgical management as compared to the femur or humerus.[6]

The case report presented here is an example of a patient with advanced metastatic prostate cancer and speculates about potential options for surgical management.

Review of Pathobiology

Multiple hypotheses exist to describe the pathobiology of osteoblastic and osteolytic bone metastases.[7,8] Stephen Paget's "seed in soil" hypothesis presumes that tumor cells can only settle and proliferate in a compatible microenvironment.[8] Sinusoidal capillaries with large gaps and thin connective tissue envelopes make it mechanically easier for cancer cells to reach tissues like the bone marrow. However cancer cells must undergo genetic mutations to be compatible with bone tissue to express the right markers to enter bone tissue by diapedesis and be drawn in by chemokines expressed by bone tissue. Cancer cells may undergo phenotypic conversion from an active to a dormant but mobile state in the epithelial-to-mesenchymal transition. Once in the bone tissues, a series of paracrine signals between the native cells and cancer cells occurs. These may enable the cancer cells to enter a more active state whether they compete with local bone marrow for space and proliferate. Depending on the cytokines and other proteins, exosomes or microRNAs expressed, the tight physiologic balance between osteoblast-mediated bone deposition and osteoclast-mediated bone resorption is disturbed in one direction.[7,8] The scale is thus tipped in favor of either osteoblastic metastatic sclerosis or osteolytic loss of density. In osteolytic cancers such as breast cancer and multiple myeloma, the vicious cycle hypothesis proposes that local release of parathyroid hormone-related peptide (PTHrp) triggers local osteoblasts to express RANKL thus activating osteoclasts and promoting release of calcium and phosphate.[7] Additional factors are released and ligands or receptors expressed in said vicious cycle propagating further osteolytic activity.

CASE REPORT

A 70 year old male with a history of stage 4 prostate cancer with known metastases to his brain, left scapula, and radius presented to the emergency department for sudden onset right mid forearm pain while driving. Patient states he was making a turn on a car ride to the grocery store when he suddenly felt a sharp pain localized to his mid- to distal radial shaft. He denied any history of recent trauma.

The patient stated that he had been off of chemotherapy for 7 months, never underwent prostate surgery nor had radiation. His additional medical history was generally noncontributary: pulmonary embolism on Eliquis, non-insulin-dependent type 2 diabetes mellitus, hyperlipidemia.

Patient states that he had been developing progressive swelling of his left forearm for at least the last 6 to 8 months and had not thought much of it, denying any pain prior to the episode prompting his ER visit. As demonstrated in (Figure 1), the patient had very apparent fusiform swelling of his entire left forearm extending from wrist to elbow. The patient was only significantly tender to the area at the mid to late radial shaft as he had previously described. His neurovascular examination of his left and right arm were equivocal with similar grip strength bilaterally.

Figure 1: Comparison of the patient's left and right forearms. Tenderness was localized to the left distal shaft just proximal to epiphysis.

An x-ray series was obtained demonstrating extensive sclerotic changes of the left radius with adjacent soft tissue edema as shown in (Figure 2). A subtle short oblique fracture around the site of least density is appreciable at the distal ⅓ of the radial shaft – correlating with the site of tenderness on the patient's physical examination. A formal DVT ultrasound study was requested as well, revealing a large hypoechoic mass at the mid forearm (Figure 3) and extensive cortical irregularity of the radius along the whole shaft (Figure 4).

Figure 2: AP and lateral portable X-ray films of the left forearm demonstrating extensive sunbursting and osteosclerotic changes. A slight short oblique fracture with adjacent hypodense defect is appreciated about ⅔ distally along the radial shaft correlating to the site of the pathologic fracture.

Figure 3: Ultrasound image showcasing a large hypoechoic mass in the sagittal plane of the patient's left forearm

Figure 4: Representative ultrasound images demonstrating metastatic bone sunbursting in the sagittal plane of the patient's left forearm. It is very easy to appreciate the irregularity of the bone cortex.

Ultimately, the patient was admitted to the internal medicine service while hematology-oncology and hand surgery followed peripherally. The decision was ultimately made by the patient and his family not to pursue further interventions, and he had committed to hospice.

DISCUSSION

In patients with metastatic bone cancer or primary bone cancer, it is important to assemble a team of both medical personnel and support to ensure an optimal outcome for the patient–regardless of the decision made by the patient and/or his/her caregiver(s).[10] Regarding medical personnel, the patient's primary care provider, a hematologist-oncologist, an orthopedic surgeon with oncologic training, and a radiation oncologist are among those who should be involved in the coordination of care. It is also important to never forget to include the patient and family as they are the ones to be most impacted by decisions made by the medical team. Primary aims should be to improve mobility and limit pain.

Pathologic fractures are among the feared complications in patients with primary or metastatic bone disease.[6] Pathologic fractures fall under a greater umbrella label of "skeletal-related events:" These include intractable pain; spinal cord compression and radiculopathy from mass effect; hypercalcemia of malignancy and its associated complications; and more. There exist multiple clinical criteria that can be used in cancerous bone lesions to presume an impending pathologic fracture such as the Harrington criteria, the Mirel classification, and CT-based structural rigidity analysis.[6] The Harrington criteria was created for the proximal femur and includes four parameters: lesion size (>2.5 cm), involvement of cortical bone (>50%), presence of pain after chemotherapy, and presence of lesser trochanteric fracture.

Unfortunately, among patients with primary or secondary bone cancer, pathologic fractures are a common way that these lesions are first picked up.[2] These limit the therapeutic or palliative surgical options available to patients. Many patients (including children, adolescents, and adults) with cancerous bone lesions can present with a classical story of chronic progressive dull musculoskeletal pain with a potentially palpable or visible deformity. However, the exam or story may not correlate to the severity of the lesion's metastatic potential. Thus it is important to presume a patient with a pathologic lesion is assumed to have a primary bone cancer until proven otherwise. Waiting too long to act on such a lesion can have disastrous outcomes, converting what could have been an exchange of tumour for hardware to a limb amputation.

If risk of pathologic fracture is relatively low a patient may be able to forgo surgery and limit treatment to treatments such as antiresorptive drugs, radiotherapy, and/or chemotherapy.[4,10] Bisphosphonates are antiresorptive drugs that act as hydroxyapatite analogues, impairing osteoclast activity and survival: These include zoledronate for use in solid tumors and multiple myeloma and ibandronate in breast cancer. Denosumab also reduces osteoclast activity and is not nephrotoxic. The trade-off of radiotherapy is that it is a risk factor for pathologic fracture. Most metastatic bone disease, metastatic multiple myeloma, and osteosarcoma have potential to respond to chemotherapy and/or radiation. Notably, the exceptionally rare chondrosarcoma can only be definitively managed with surgical excision and does not respond to either chemotherapy or radiotherapy.[2] Resection and curettage may be the only viable options available to such patients.

When considering surgical options for pathologic fracture in a patient with metastatic bone disease, the physicians responsible must consider the location of the lesion, the number or size of the lesions, and the patient's remaining life expectancy.[6,10] As a general principle, patients undergoing palliative surgeries for pathologic fractures should undergo less invasive procedures or avoid them altogether if their remaining life expectancy is short. The goal is to get the patient to ambulate as soon as possible and maintain a good quality of life. More invasive procedures can be considered if the patient is expected to live greater than 6 months. These are among the many considerations when considering surgery for pathologic fractures that have already occurred or are assumed to be impending.

Compared to the forearm, there is more robust literature describing surgical options for pathologic fracture in metastatic bone disease of the femur and humerus.[6] These large bones are more commonly implicated in secondary metastasis, because prostate, breast, and other cancers tend to home to bone rich in red marrow such as the spine, pelvis, and proximal.[4,5] Strangely, our patient had a history of bony metastases to his left radius and scapula–both of which are quite atypical locations for the reasons described previously. An option for both pre-existing and impending pathologic fractures of cancerous femoral or humeral diaphyses is an intramedullary nail regardless of expected lifespan.[6] While not load-bearing like other potential options (and instead load-sharing), the intramedullary nail can be placed under fluoroscopy with relatively small incisions percutaneously. Lag screws or helical blades could then be applied proximally. Another option is plating with one or more plates and augmenting with cement. This may require greater dissection yielding more potential postoperative pain,

but it would be advantageous if the lesion is larger and thus easier to visualize with this approach. Prosthetic reconstructions such as endoprostheses are a third potential option for diaphyseal pathologic fractures. Historically these devices were much more expensive. These provide the advantage of immediate mobility but incur a high risk of significant post-operative pain and given the need for attachment and reattaching multiple muscles.

The first case series investigating surgical treatment of metastatic forearm bone disease by Sebghati and Tsagozki attempts to investigate our question of interest in a retrospective study of 30 patients from 1986 to 2020.[10] Nearly all patients treated with osteosynthesis in the study were treated with plates (19/20) generally with cement augmentation. Only 1 of 30 received an intramedullary nail. The remaining 10 patients were treated with either segmental excisions (5/10), curettage (3/10), or amputation (2/10). Only 5 complications were noted, and 2 of them (failure of osteosynthesis and infection) occurred in the same patient. Data from this study regarding functional outcomes were quite limited.

In the instance of the patient presented, most surgical options would likely have been unfavorable given the advanced nature of his disease. If he had opted for surgical intervention prior to his fracture, perhaps plating with curettage and cement augmentation could have been an option of consideration. Regardless, the data on surgical intervention in metastatic forearm bone cancer are quite limited and still debatable.

CONCLUSION

Surgical options for pathologic fracture in metastatic bone disease of the forearm have quite limited data. Regardless, clinicians managing a patient with an impending or already-existing pathologic fracture need to consider the patient's wants and their expected life-span prior to committing to a treatment option. Additionally, the appearance of sunbursting on ultrasound can clearly demonstrate the cortical irregularity of a long bone afflicted by primary or metastatic bone cancer. Perhaps ultrasound could be considered as an adjunct tool perioperatively in patients with metastatic long bone disease to determine the course of surgical intervention.

REFERENCES

1. Hernandez RK, Wade SW, Reich A, Pirolli M, Liede A, Lyman GH. Incidence of bone metastases in patients with solid tumors: Analysis of oncology electronic medical records in the United States. BMC Cancer. 2018;18(1):44.
2. Jason L Ferguson, Sean P Turner. Bone cancer: Diagnosis and treatment principles. Am Fam Physician. 2018;98(4):205–213.
3. Wang M, Xia F, Wei Y, Wei X. Molecular mechanisms and clinical management of cancer bone metastasis. Bone Res. 2020;8(1):30.
4. Tsukamoto S, Mavrogenis AF, Kido A, Errani C. Current overview of treatment for metastatic bone disease. Curr Oncol. 2021;28(5):3347–3372.

5. Casimiro S, Ferreira AR, Mansinho A, Alho I, Costa L. Mechanisms of bone metastases: Challenges and opportunities for targeted therapy. Genes (Basel). 2021;12(11):1765.
6. Errani C, Mavrogenis AF, Cevolani L, Spinelli S, Piccioli A, Rosa MA, et al. Treatment of pathological fractures of the long bones. EFORT Open Rev. 2016;1(5):136–145.
7. Boussios S, Cooke D, Hayward C, Kanellos FS, Tsiouris AK, Chatziantoniou AA, et al. Mechanisms of osteolytic and osteoblastic skeletal lesions. Int J Mol Sci. 2021;22(3):992.
8. Weerakkody Y, Bell D, Knipe H, et al. Mixed lytic and sclerotic bone metastases. *Radiopaedia.org*. Updated 2023.
9. Spratt DE, Beeler WH, de Moraes FY, et al. Metastatic bone disease: Early referral for multidisciplinary care. Cleve Clin J Med. 2022;89(7):393–403.
10. Miller BJ, Gao Y, Duchman KR. Outcome of surgical treatment for metastatic bone disease of the forearm. Cancer Rep (Hoboken). 2021;4(5):e1408.