Case report

Prostate cancer bone metastases confined to the distal left lower limb

Monique Vekeria, MBBS, BSc (Hons), FRCR*, David Little, MBChB, FRCR, Richard, N Graham, MA (Cantab), BM BCh (Oxon), FRCR, Stewart, L Redman, MBBS, FRCR

Department of Radiology, Royal United Hospital, Combe Park, Bath, Avon. BA1 3NG.

Article history:
Received 7 May 2021
Revised 11 June 2021
Accepted 12 June 2021

Keywords:
Prostate cancer
Bone metastases
Biochemical recurrence

Abstract

Bone metastases from prostate cancer most commonly affect the axial and proximal appendicular skeleton with rare involvement of the distal limbs. We describe a case of multiple bone metastases confined to the left lower limb in a patient with biochemical recurrence of prostate cancer. Following an initial post-operative PSA rise, the patient received a course of salvage radiotherapy to the pelvis, however, the PSA level continued to rise and two consequent staging CT scans were negative for local recurrence and metastatic disease. Subsequent development of left ankle pain and swelling led the patient to present to his General Practitioner, which triggered a series of imaging investigations that revealed isolated left lower limb bone metastases. This case report highlights the need to consider peripheral limb bone metastases in patients with biochemical recurrence of prostate cancer, particularly in the setting of a negative staging CT scan and/or bone pain.

© 2021 The Authors. Published by Elsevier Inc. on behalf of University of Washington. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)

Clinical presentation

A 66-year-old gentleman was under surveillance for rising PSA levels following radical prostatectomy for prostate cancer. Post-operative histology revealed a prostatic adenocarcinoma with a Gleason score of 4+5=9, stage pT3a, with evidence of extracapsular extension, a positive circumferential margin and widespread vascular and perineural invasion. One month following prostatectomy, the PSA had risen to 0.4 ug/L, from an initial post-operative PSA level of 0.2 ug/L. This PSA rise was attributed to residual prostate bed tumor, in view of the aggressive histological tumor features, and the patient subsequently underwent a course of salvage radiotherapy to the pelvis.

Unfortunately, 2 months following the completion of radiotherapy to the pelvis, the patient was found to have a further PSA relapse, with a PSA level of 4.6 ug/L, and was started on a lutenising hormone-releasing hormone analogue. Two consecutive staging CT scans of the thorax, abdomen and pelvis failed to identify any local recurrence or distant metastases and 14 months later, the PSA had risen from 4.6 ug/L to 10.2 ug/L. Shortly after this, the patient presented to his GP with a swollen and painful left ankle, giving a history of a possible injury 2 months prior. Subsequent plain radiographs of the left ankle demonstrated aggressive sclerotic lesions within the distal left tibia and mid-foot which triggered a series of imag-
Radiology Case Reports 16 (2021) 2614–2619

2615

Fig. 1 – Frontal (A) and lateral (B) left ankle radiographs demonstrated sclerosis and a hair-on-end periosteal reaction affecting the distal tibia with further sclerosis seen within the mid-foot

Fig. 1 – Frontal (A) and lateral (B) left ankle radiographs demonstrated sclerosis and a hair-on-end periosteal reaction affecting the distal tibia with further sclerosis seen within the mid-foot

ing tests that eventually identified these lesions as the source of the rising PSA.

**Imaging findings**

Initial radiographs of the left ankle demonstrated an aggressive process affecting the distal left tibia and mid-foot (Fig. 1). The patient subsequently underwent a whole body bone scan (Fig. 2) with a contemporaneous SPECT-CT of the left ankle (Fig. 3). The bone scan demonstrated uptake within the distal left femur, proximal and distal left tibia and within the left ankle and foot, corresponding to sclerosis on CT. The SPECT-CT was helpful in identifying which bones of the ankle and foot were involved, showing tracer uptake within the distal left tibia and fibula, calcaneus, navicular, cuneiforms and second, third and fifth metatarsal heads, with sparing of the talus. Subsequent radiographs of the left knee and ankle were obtained which excluded pathological fractures that would also have been avid on bone scintigraphy (Fig. 4).

The aggressive, sclerotic and scintigraphically avid bone lesions were felt most likely to represent prostate cancer bone metastases, however, in view of the unusual skeletal distribution a CT-guided bone biopsy was performed in order to try to obtain a tissue diagnosis. Three 14-gauge core biopsies were taken from the distal left tibial lesion using a Bonopty coaxial bone biopsy set. The biopsy was technically difficult, due to increased bone density, and was non-diagnostic as the core samples taken were found to contain compacted bone fragments only. Biopsies of sclerotic bone lesions performed using similar equipment have been reported in the literature to have a diagnostic yield of between 55.9% and 82.7%[1,2]. A subsequent surgical biopsy was considered, however, it was felt that on balance the bone lesions were most likely to be prostate cancer metastases despite the unusual presentation and a further biopsy was not pursued.

**Differential diagnosis**

The differential diagnosis was that of multifocal aggressive sclerotic bone deposits which included osteoblastic metastases, osteomyelitis and primary bone malignancies. However, in the context of biochemical recurrence of prostate cancer
with no other primary malignancy identified on CT and no other signs of infection, prostate cancer metastases were the most likely diagnosis.

**Outcome, follow up**

Following targeted radiotherapy to the left tibial deposits, there was an initial significant PSA drop, from 55.7 ug/L to 7.5 ug/L, and the patient described an improvement in symptoms. In the absence of a diagnostic biopsy, the drop in PSA observed following targeted radiotherapy to the distal left lower limb was felt to be confirmatory of these lesions being bone metastases from prostate cancer.

However, eventually the symptoms worsened and there was a further PSA relapse, with the PSA rising to 32 ug/L. A repeat whole body bone scan performed at this time demonstrated a mixed response to treatment (Fig. 5). A further course of radiotherapy to the left leg was considered but it was felt that the time interval between courses would be too short. Thus, the patient was continued on their regular LHRH analogue with the addition of Abiraterone but the PSA continued to rise and a further staging CT scan was negative.

---

*Fig. 2 – Anterior (A) and posterior (B) planar images from a whole body bone scan. There are avid foci within the left distal femur, proximal and distal tibia, ankle and foot. No tracer uptake is seen elsewhere in the skeleton.*
Discussion

Prostate cancer usually metastasises via a haematogenous route and demonstrates a predilection for red marrow within the axial skeleton, including the ribs, spine and pelvis [3]. Although very rare [3], isolated prostate cancer metastases have previously been described within the distal appendicular skeleton, including solitary deposits within the tibia [4], calcaneus [5,6] and radial head[7]. In cases where a solitary atypical metastasis is identified, a biopsy may be indicated to ensure an alternative bone lesion is not missed.

In 2016, McCarthy et al. described a solitary metastasis in the calcaneus of a man who had previously received radical treatment for prostate cancer[5]. After developing biochemical recurrence, the patient went on to have a negative staging CT and a continual rise in PSA levels despite changes in therapy. The calcaneal metastasis was discovered after the patient presented to clinic complaining of foot pain and swelling. This prompted investigation with a bone scan that showed avid uptake within the left foot. Corresponding radiographs demonstrated bony abnormality within the left calcaneus. A biopsy of the calcaneal lesion confirmed metastatic prostate cancer and the patient went on to receive local radiotherapy with a subsequent symptomatic improvement[5].

The sequence of events described by McCarthy et al.[5] is very similar to that described in our case report. Both cases highlight the need to consider atypical peripheral skeletal metastases in the setting of biochemical recurrence, particularly when local recurrence or metastatic disease is not de-
Fig. 5 – Anterior (A) and posterior (B) planar images from a follow-up whole body bone scan demonstrated a mixed response to treatment. There was reduced uptake within the proximal and distal left tibia. However, there was an increased uptake within the foot and new small avid foci were seen within the proximal and middle left tibial shaft.

It is particularly important to have a high index of suspicion for atypical metastases when, as in our case, the patient has an initial high-grade malignancy with histological risk factors for biochemical recurrence, such as extracapsular extension and a positive circumferential margin[8].

Learning points

- Bone metastases from prostate cancer can rarely be confined to a distal limb.
- Atypical sites of metastatic disease should be considered when investigating biochemical recurrence, particularly in the setting of a negative staging CT scan.
• The workup for biochemical recurrence should include direct patient questioning about musculoskeletal symptoms to facilitate the detection of unusual metastatic sites.
• Early bone scintigraphy is key to identifying and treating peripheral skeletal metastases.
• In cases where bone scans show unusual patterns of metastatic disease, contemporaneous plain films should be acquired to allow for future problem solving.
• Biopsy of atypical metastases is likely to be necessary in order to confirm the diagnosis.

Informed consent

Written informed consent was obtained from the patient for publication of this case report, including accompanying images.

Declaration of Competing Interest

None.

REFERENCES

[1] Cohen M, McMahon C, Kung J, Wu J. Comparison of battery-powered and manual bone biopsy systems for core needle biopsy of sclerotic bone lesions. Am J Roentgenol 2016;206(5):83–6.
[2] Kihira S, Koo C, Lee A, Aggarwal A, Pawha P, Doshi A. Reduction of radiation dose and scanning time while preserving diagnostic yield: a comparison of battery-powered and manual bone biopsy systems. AJNR Am J Neuroradiol 2020;41(3):387–92.
[3] Bagi C. Skeletal implications of prostate cancer. J Musculoskelet Neuronal Interact 2003;3(2):112–17.
[4] Barkow U, Weissbach L, Strohmeier A, Schoder H, Friedrich M. Solitary metastasis of prostate cancer in the tibia. Aktuelle Radiol 1994;4(6):274–6.
[5] McCarthy MT, Ibrahim H, Aibdeen Z, Hodnett PA, Mulcahy E, Osman N. Prostate cancer metastasis to calcaneus: a solitary lesion at an atypical site, dormant for more than 10 years. JRSM Open 2016;7(10):2054270416660934.
[6] Agrawal S, Irvine A, Money-Kyrle J, Ellis BW. Isolated calcaneal metastasis from prostate cancer. Ann R Coll Surg Engl 2008;90(3):W7–9.
[7] Ansari MS, Nabi G, Aron M. Solitary radial head metastasis with wrist drop: a rare presentation of metastatic prostate cancer. Urol Int 2003;70(1):77–9.
[8] Jiang W, Zhang L, Wu B, Zha Z, Zhao H, Jun Y, et al. The impact of lymphovascular invasion in patients with prostate cancer following radical prostatectomy and its association with their clinicopathological features. Medicine (Baltimore) 2018;97(49):e13537.