PICTORIAL ESSAY OF RADIOLOGIC FINDINGS FOLLOWING PALLIATIVE TREATMENT FOR BONE METASTASES

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Abstract

Bone is one of the most common sites of cancer metastases. Bone metastasis can lead to a variety of symptoms such as pain, bone fracture, and spinal cord compression that adversely affect patient quality of life. To prevent or ameliorate these symptoms, patients with bone metastasis are often treated palliatively with surgery, chemotherapy, radiation therapy or a combination of therapies. Imaging plays a vital role in enabling the diagnosis, treatment, and monitoring of bone metastases. Following treatment there are many common radiologic findings. The cases will illustrate typical imaging appearances, responses of the tumors to treatment and also radiographic changes to the surrounding tissues secondary to treatment.

Objective

In this pictorial essay, we aim to illustrate some of the common radiologic findings following palliative treatment for bone metastases.

Methods

Examples of tumors on radiographs, computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine such as bone scans, and positron emission tomography (PET) from patients presenting with bone metastases are shown.

Results

Figure (1). Sagittal CT images of the lumbar spine in a patient with metastatic renal cell carcinoma to the lumbar spine. Figure (1)a. There is an osteolytic lesion in the posterior aspect of the L1 vertebral body (white arrowhead). Figue (1)b. Following 6 months treatment with Pazopanib there is some reconstitution of the bone in the metastatic focus (white arrow).

Figure (2). Coronal T1W images of the right femur in a patient with metastatic thyroid cancer. Figure (2)a. Initial MRI demonstrates a large subtrochanteric lesion (white arrowhead). Figure(2)b. Following treatment, there has been significant improvement with near complete reconstitution of normal marrow signal.

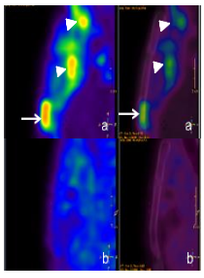


Figure (3).PET imaging of patient with Hodgkins lymphoma with metastatic bone involvement in the distal sternum. Figure(3)a. Extensive mediastinal lymph node activity (arrowheads) and sternal activity (white arrow). Figure (3)b. Following radiation and chemotherapy, no residual activity is present in the mediastinum or sternum.

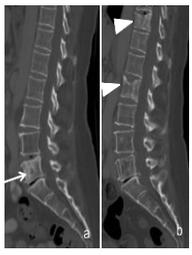
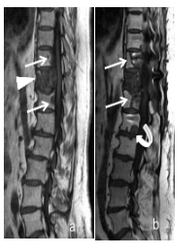


Figure (4). Progressive metastatic disease despite treatment. Sagittal reformatted CT images of the lumbar spine in a patient with metastatic breast carcinoma treated with Exemestane. Figure(4)a. demonstrates a mixed lytic and sclerotic metastatic focus in the L5 vertebral body (white arrow). Figure (4) b. 8 months later on treatment the patient has developed new lesions at T11 and L2 (white arrowheads) with pathologic fractures.



Figure(5) Sagittal T1W images of the lumbar spine 4 months apart following radiation treatment and surgery. Figure (5)a. Initial image demonstrates dominant metastatic lesion in T11 vertebral body (arrowhead) and smaller lesions in the T10 and T12 vertebral bodies (white arrows). Figure (5)b. Following radiation and surgery show progression in the lesions in the T10 and T12 vertebral bodies and new lesion in the L1 vertebral body (curved arrow)

Figure (6). T1W sagittal image of the lumbar spine in a patient who has had previous radiation treatment. Arrow delineates the edge of the radiation field. The radiated vertebral levels cranial to the arrow demonstrate fatty replacement and increased T1W signal. Caudal to the radiation field the signal in the vertebral bodies is of normal hematopoietic marrow and therefore demonstrates relative decreased T1W signal.

Figure (7) Sagittal PET image of the spine demonstrating decreased activity on PET in the radiation field. The margins of the radiation field are indicated (white arrows).

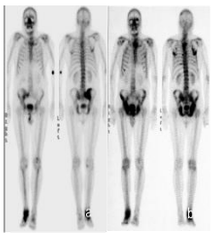


Figure (8).Flare response to chemotherapy. Patient with metastatic breast carcinoma to bone. Figure(8)a. Baseline bone scan demonstrates increased activity predominantly in the pelvis. Figure(8)b. 3 months after chemotherapy, there is increased activity within the pelvis and multiple new areas in the ribs and spine.

Figure (9). Flare AP pelvis in a patient with metastatic breast carcinoma. Figure (9) a. Diffuse mixed lytic and sclerotic metastatic foci throughout the pelvis and proximal left femur (arrowheads indicating some of the lesions) Figure(9) b. 3 months after chemotherapy there is increased size and number of sclerotic lesions in keeping with a flare response.

Figure(10). Flare response to treatment. Coronal reformatted CT images of a hip in a patient with diffuse metastatic breast carcinoma. Figure(10) a. Pre treatment shows very subtle marrow soft tissue density in the acetabulum and proximal femur (arrows). Figure (10) b. 2 months post chemotherapy shows increased sclerosis in the acetabulum and femur which could be misinterpreted as progression of disease but represents a positive response to treatment with reactive sclerosis (arrowheads).

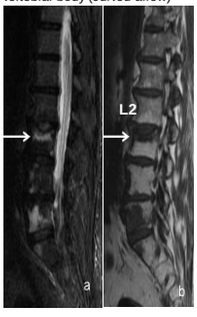


Figure (11). Patient with metastatic melanoma. Figure (11) a. Sagittal STIR and Figure (11) b. Sagittal T1W MR images. She received radiation therapy to her lumbar spine. Note the fatty change in the marrow caudal to L2 on the T1W image. Insufficiency fracture in the radiated bone of the superior endplate at L3 (white arrow) with depression of the endplate and linear abnormal signal paralleling the endplate.

Figure (12). Figure(12) a. axial CT image Figure (12) b. 3D CT image. Patient has an osteolytic metastatic lesion in the right femoral neck with cortical destruction posteriorly (white arrows) at high risk for pathologic fracture. Figure(12) c. Radiograph shows the postoperative appearance of a prophylactic cemented hemiarthroplasty.

Figure(13). Patient with metastatic breast carcinoma. Figure(13) a. There is a large osteolytic lesion in the proximal femoral shaft (white arrowhead) with significant cortical permeation and destruction at very high risk of fracture. Figure(13) b. Intramedullary rod placement for fracture prophylaxis. A fracture (white arrow) developed during placement of the rod confirming the fragility of the femur secondary to the metastatic

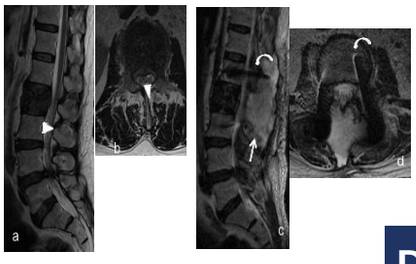


Figure (14).Patient with metastatic lung cancer to L2. Figure (14) a. Sagittal and b. Axial T2W image demonstrates marrow replacement at L2 with extraosseous soft tissue posterior to the vertebral body and mild canal compromise (arrowheads). Figure(14) c. Sagittal T2W and d. Axial T2W images following posterior decompression and instrumentation. Large post-operative seroma/hematoma in the laminectomy (arrow) and posterior instrumentation(curved arrow).

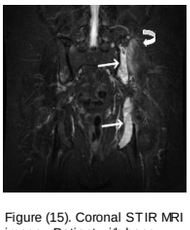
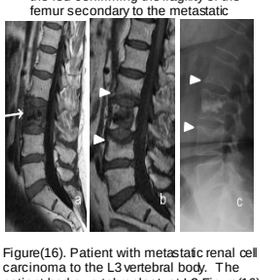


Figure (15). Coronal STIR MRI image. Patient with bone metastasis in the left ilium and ischium (white arrows) underwent radiation therapy. Feathery increased T2W signal in the left gluteal muscles (curved arrow) secondary to radiation changes.



Figure(16). Patient with metastatic renal cell carcinoma to the L3 vertebral body. The patient had a vertebroplasty at L3 Figure(16) a. Sagittal T1W image demonstrates the very low signal cement in the L3 vertebral body metastatic focus (straight arrow). Figure(16) b. 4 months post vertebroplasty. Sagittal T1W image depicts new endplate fractures in the inferior aspect of L2 and superior aspect of L4 (arrowheads). Figure(16) c. lateral radiograph demonstrating the same endplate fractures (arrowheads).

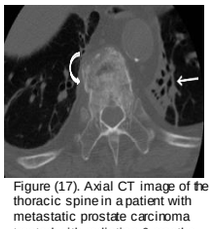


Figure (17). Axial CT image of the thoracic spine in a patient with metastatic prostate carcinoma treated with radiation 6 months ago. Fibrosis and bronchiectasis in the adjacent lung with a discrete lateral border corresponding to the radiation field in the adjacent lung (white arrow). Diffuse sclerotic metastatic lesion in the adjacent vertebral body. (curved arrow).

Discussion

Following treatment for bone metastases with surgery, chemotherapy or radiotherapy, there are various responses of the tumors themselves as well as the surrounding tissues. Various imaging modalities can illustrate this.

Conclusion

Imaging plays an integral part in diagnosis of bone metastases and follow-up after treatment. Knowledge of the tumor response, appearance of treatment material, changes in the surrounding tissues and complications on various imaging modalities is important to properly further manage these cancer patients.