Atypical Presentation of Multiple Myeloma (MM) as Disseminated MM with Osteopenia and Compression Fractures

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Introduction

- Multiple myeloma (MM) is a neoplasm of plasma cell origin which produces a monoclonal immunoglobulin. Plasma cells, derived from B-cells are created in bone marrow and when over produced, can lead to extensive bone damage. Workup for this cancer includes monoclonal protein assay from urine samples performed with nephelometric quantitation. Serum light chains must also be detected in all patients. Other diagnostic techniques include bone marrow aspiration or biopsy.

- Overall, MM, is a rather uncommon cancer representing only 1-2 percent of all cancers. It is more commonly seen in men and African Americans, and in patients with the average age at diagnosis of 65 to 74 years old. Risk factors for this neoplasia include patients already diagnosed with monoclonal gammopathy of uncertain significance or MGUS, as well as exposure to Agent Orange, a herbicide utilized during the Vietnam War.

- Diagnosis of MM with end-organ damage is based a distinctive pathology in the majority of cases, described as CRAB Criteria which include:
  - **C**alcium: hypercalcemia, due to the attack and paraprotein destruction of bone
  - **R**enal Failure: most commonly caused by the excessive concentration of proteins secreted by the neoplastic cells
  - **A**nemia: replacement of bone marrow causes inhibition of normal red blood cell production.
  - **B**one Lesions: “punched out” lytic lesions are classic findings which further leads to elevated calcium levels

- In some rarer cases; however, MM may present in a unique fashion presenting as a disseminated form with global osteopenia causing secondary vertebral compression fractures.

Case Report

- A 59-year-old man presents to his primary care physician with new-onset back pain. He has a history of multiple myeloma and is currently on chemotherapy; he also has an unrelated history of hyperplastic polyps which were resected two years prior to this current presentation

- Initial MRI of the lumbar spine found no evidence of acute fractures. However, there was evidence of multilevel disc degeneration with desiccation, or disc dehydration, at L1-2, L45, as well as L5-S1. Two months following, the patient presents again with severe back pain with spasms. This time a whole-body PET and unenhanced CT scan were performed. Abnormal findings included diffuse osteopenic transformations of axial skeletal systems predominantly in the thoracic, lumbar, and sacral regions. The key abnormalities in the PET scan which helped make the diagnosis of disseminated disease pattern is the diffuse metabolic activity seen throughout the skeletal system. This metabolism was also a specific finding seen in the lower thoracic through the upper lumbar spine. There were no isolated findings of lytic lesions, proving this to be an irregular presentation of this disease.

- Further MRI studies weeks later, revealed loss of vertebral body height in multiple thoracic vertebral segments: T3 through T12, further evidence of bone metabolism. There is also a T1-weighted hypointense lesion of L1, due to lower fat content in the disc.

Imaging

- The primary sites affected on the skeletal system include the vertebral column, ribs, skull, pelvis, and femora, with an initial lytic lesion being the main finding. Though in cases such as this, imaging becomes very important to detect atypical presentations as displayed below in Figures 1 and 2.

- According to the 2014 Guidelines on MM, the initial imaging should be that of a skeletal survey usually that of a lateral radiograph of the skull with an anteroposterior (AP) and lateral view of the spine. MRI is the the gold-standard imaging modality especially in patients already diagnosed with MM, but with risk of cord compression. PET and CT scanning allows for imaging of isolated bone lesions. Use of PET in this case showed the development of metabolism taking place within the mid-lower spine. When used in combination, a full body MRI with PET scan showed a specificity and positive prideceve value of 100%.

- Figure 1, is a sagittal T2 STIR image. STIR imaging is fluid sensitive, and uses inversion recovery to suppress fat, which would otherwise also be T2 bright. This makes it particularly sensitive for detection of marrow edema within bone. In this image, the mildly bright signal within the T12, L1, L3, and L4 vertebral bodies is compatible with edema. There is also superior endplate compression involving L4, of less than 25%. Lack of signal intensity overall, shows the chronic effects of the patient’s long-standing multiple myeloma.

- Figure 2, is a T1 post-contrast fat saturation image. Fat saturation supresess fat signal, which would otherwise also be T1 bright. This makes it particularly sensitive for detection of pathologic enhancement. Such enhancement can be seen within a lower thoracic vertebral body. Mild, multilevel thoracic compression deformities are also seen.

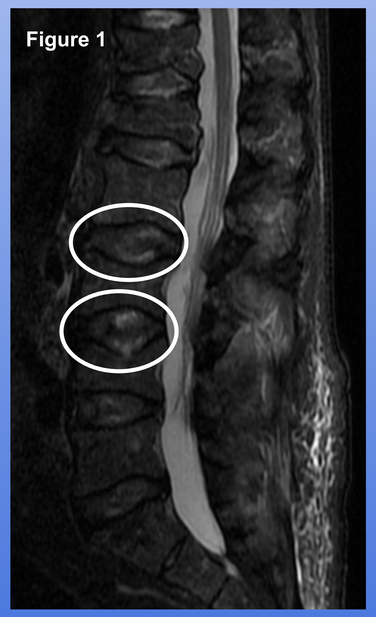
Figure 1

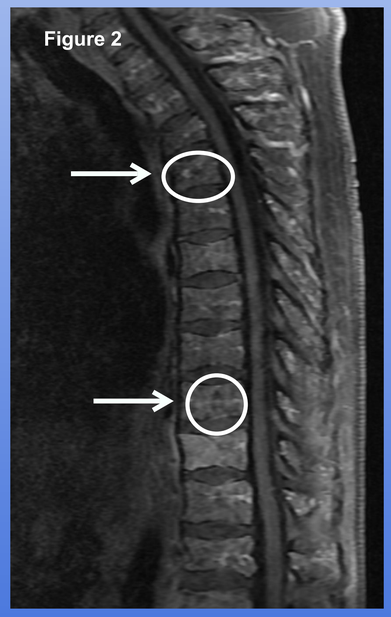
Figure 2

Discussion

- The majority of MM cases exhibit classical lytic or radiolucent bone degradation. These lesions affect only parts of the skeleton, mainly the spine, skull, and long bones. The higher concentration of lesions is also correlated to a worsened prognosis, exemplifying a disseminated or global transformation. Figures 3-5 exemplify these usual lytic lesions. Table 1 compares of the two forms of MM.

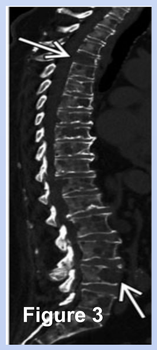
Figure 3

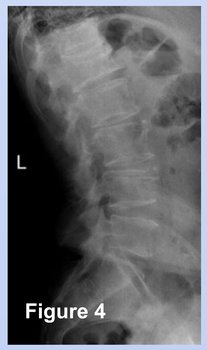

Figure 4

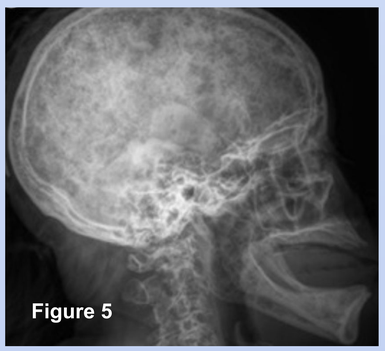
Figure 5

Table 1: Comparison of Typical and Atypical Presentation of Multiple Myeloma

Presentation	Key Symptoms	Lesion Type	Age
Typical Presentations	• Generalized bone pain • Fatigue • Anemia	Lytic “punched out” lesions (67% patients)	Older than 60 years old, with median age of 70 years old
Atypical Presentations	• Persistent, severe back pain with spasms • Extradural Spinal Cord Compression • Fatigue • Anemia	secondary vertebral compression fractures and bone metabolism, due to concurrent osteopenia. (20% patients)	Younger patients in their 20s-50s.

- Another unusual presentation in this case is the age of the patient. Usually MM presents in an older population, this patient is only 59 years old. It has been found, however, with immediate treatment, upon diagnosis: younger patients with MM have an average of a 10 year survival rate compared to those over age of 65 years of age who tend to have 4-6 years of survival. This difference is primarily due to the metabolism taking place in the bones which have more effect in older patients who already have weaker bones as well as due to the more aggressive treatment approach taken with those patients.

- Overall, early diagnostic imaging and radiological modalities are vital to distinguishing the presentation of MM, especially in patients such as this who display abnormal characteristics of this rare neoplasm.

References

Bansal, Isha & Kakare, Onkar & Jadhav, NIkhil & Koranne, Abjhijeet & Patil, R & Sharma, Shimpa. (2018). An Interesting Case of Compression Fracture diagnosed to be Multiple Myeloma. doi:10.36106/gjra

Chretien ML, Hebraud B, Cances-Lauwers V, et al. Age is a prognostic factor even among patients with multiple myeloma younger than 66 years treated with high-dose melphalan: the IFM experience on 2316 patients. *Haematologica*. 2014;99(7):1236-1238. doi:10.3324/haematol.2013.098608

Kyle RA, Gertz MA, Witzig TE, et al. Review of 1027 patients with newly diagnosed multiple myeloma. *Mayo Clin Proc*. 2003;78(1):21-33. doi:10.4065/78.1.21

Mosebach J, Thierjung H, Schlemmer HP, Delorme S. Multiple Myeloma Guidelines and Their Recent Updates: Implications for Imaging. Leitlinien zum multiplen Myelom und ihre aktuellen Anpassungen: Konsequenzen für die Bildgebung. *Rofo*. 2019;191(11):998-1009. doi:10.1055/a-0897-3966

Sidhu G, Homsi Y. Severe Lytic Bone Lesions in Multiple Myeloma. *Am J Med Sci*. 2019;357(4):e11-e12. doi:10.1016/j.amjms.2018.12.006