Pictorial review of Multiple Myeloma on whole body MRI and PET-CT.

Z. Haque, S. Alam, T. Ashraf
Department of Radiology, Pilgrim Hospital
United Lincolnshire Hospitals NHS trust, UK

Introduction:
Multiple myeloma (MM) is a neoplastic disorder of plasma B cell, characterised by bone marrow infiltration and overproduction of monoclonal immunoglobulins [1]. It is a common malignancy in patients above 60 (70% of cases are diagnosed between ages 50 and 70) with a male predominance (M:F 2:1) [5]. The disease evolves from an asymptomatic premalignant stage: monoclonal gamopathy of undetermined significance (MGUS), over smuggling multiple myeloma (SMM), to symptomatic MM with end-organ damage [2,3].

Conventional radiographs were used to be the gold standard [6], however with recent advancement, magnetic resonance imaging (MRI), low dose multi detector computed tomography (MDCT) and FDG positron emission tomography (FDG-PET-CT) play an important role in assessing lytic bone lesions, early bone marrow infiltration as well as initial staging of the disease, detection of complications, and assessing patient's response to treatment [7]. We are presenting a pictorial review of few cases of multiple myeloma in which we encountered in our department in a six-month period.

Case-1: Plain radiograph of skull demonstrates multiple punched out lytic lesions. CT scan of hemispherical spine shows a large expansile lytic lesion in sacrum and few smaller lesions in L5 and L3 vertebral which are better appreciated in subsequent MR images in T1 weighted and STIR sequence.

Case-2: MRI of bilateral region shows large expansile lesions involving L5 and L3 vertebral with associated hypointense in T1-weighted and hyperintense in STIR images. FDG-PET of the same patient demonstrates intense FDG uptake suggesting metabolically active lesion.

Case-3: An elderly male patient presented with swelling in left parietal region. MRI with contrast reveals an enhancing expansile mass involving left parietal skull with surrounding soft tissue component which showed increased FDG uptake in PET scan.

Case-4: CT scan of an elderly patient shows multiple lytic lesions of variable sizes in the pelvis. MRI was not performed due to patient's noncompliant. FDG-PET scan demonstrates intense uptake in the lesions of left and mid iliac bone.

Case-5: Whole body MRI shows multiple T1 hyperintense and STIR hypointense lesions in spine and pelvis.

Image techniques:
Plain radiography demonstrates lytic lesions in the bone at presentation. Lytic lesions become apparent on conventional radiography when 30–50% of the bone mineral density is already lost [9]. Its high false-negative rate of 30–70% leads to significant underestimation in diagnosis and staging of patients with multiple myeloma [7-9]. CT has a higher sensitivity than plain radiography at detecting lytic bone lesions [5]. CT demonstrates punched-out lytic lesions, expansile lesions with soft tissue masses, diffuse osteoporosis, fractures, and rarely, osteosclerosis [11]. It is mainly used in cases where MR is contraindicated or patient unable to lie inside MR scanner MRI is the most sensitive imaging modality at detecting diffuse and focal metabolic activity. The number and pattern of lesions detected on MRI correlates very well with treatment outcome and overall survival [10]. It is important to note that MRI predominantly reflects marrow infiltration, which may or may not be associated with bone destruction. Multiple sequences are being used in identifying focal or diffuse bone involvement in multiple myeloma and these imaging appearances mainly related to whole body MRI and PET-CT which we encountered in our department in a six-month period.

Case-6: Follow-up CT scan of a multiple myeloma deposit in the right iliac bone shows significant regression of the lesion following treatment.

NICE guideline (updated October, 2018):

Imaging for people with suspected myeloma: 1.1.005 imaging to all people with a plasma cell disorder suspected to be myeloma, 1.3.2 Consider whole body MRI as first line imaging. 1.3.3 Consider whole body low dose CT as first line imaging if whole body MRI is unsuitable or the person declines it. 1.3.5a Do not use isotope bone scans to identify myeloma related bone disease in people with a plasma cell disorder suspected to be myeloma. Imaging for people with newly diagnosed myeloma: 1.4.4 For people with newly diagnosed myeloma or smoldering myeloma who have not had whole body imaging with 1 of the following: consider whole body imaging to assess for myeloma related bone disease and extra medullary plasmacytomas with one of MRI, CT or FDG PET-CT. 1.5 For guidance is in imaging for people with suspected spinal cord compression, see the NICE guideline on metastatic spinal cord compression. 1.3.8 Consider baseline whole body MRI with or without FDG PET-CT for people who have non-secretory myeloma or suspected or confirmed soft tissue plasmacytomas and have not already had either of these tests.

Case-9: PET-CT shows multiple focal of intran and extranodular metabolic activity.

References:

Case-8: Abnormal signal change noted on T2-weighted as evidenced by low T2 and STIR hyperintensity suggesting multiple myeloma deposit. The lesion shows FDG uptake in PET scan.

Conclusion:
Imaging plays an important role in diagnosing multiple myeloma. Radiographic skeletal survey is recommended for all patients with suspected multiple myeloma and advanced imaging for those having normal radiographic findings. MRI whole body imaging and PET/CT provide valuable complimentary information helping us assess not only morphological disease activity, but also functional disease activity, response to treatment as well as tailoring treatment modalities to individual patients.