

Suspected/Diagnosis - MM / Plasmacytomas

- X-ray skeletal series
- Bone disease is the most frequent feature of multiple myeloma (MM), occurring in approximately two thirds of patients at diagnosis and in nearly all patients during their disease. ¹ Imaging is a key part of the evaluation of all patients with suspected MM. And plays a very important role in the management of MM.² First, it is necessary for detection of lytic bone lesions, which represent a marker of disease-related end-organ damage and are traditionally used to diagnose MM and to establish the need for immediate therapy.³

Initial Work-Up/Staging - MM / Plasmacytomas

- Whole-body low-dose skeletal CT (CPT® 76497)
 - MRI Bone Marrow Blood Supply (CPT® 77084)
 - MRI Spine without contrast
 - MRI Pelvis without contrast
 - MRI Spine without and with contrast
 - MRI Pelvis with and without contrast
 - CT Contrast
 - PET/CT (CPT® 78815 or CPT® 78816)
-
- The detection of bone and bone marrow lesions is crucial in the investigation of multiple myeloma and often dictates the decision to start treatment. Cross-sectional imaging (i.e., CT, PET/CT, and MRI) is preferred because these modalities are more sensitive than plain radiographs for the detection of most skeletal lesions in MM.
 - Whole body low dose CT can be used as a baseline assessment of bone involvement. CT is quick, convenient, relatively sensitive, and cost effective in this scenario. WBLDCT was introduced to detect osteolytic lesions in the whole skeleton, with high accuracy, no need for contrast agents, and twofold to threefold lower radiation dose exposure compared with standard CT.^{6,7} Low-dose whole-body CT has increased sensitivity compared with conventional skeletal survey in the detection of bone disease, which can reveal information leading to changes in therapy and disease management that could prevent or delay the onset of clinically significant morbidity and mortality as a result of skeletal-related events.⁸
 - (18F-FDG PET/CT) imaging could identify sites of extra medullary disease (EMD), which represent an unfavorable prognostic feature, and it helps to accurately differentiate between solitary plasmacytoma (SP) and MM, as well as

to predict the risk of early progression from smoldering MM (SMM) to active disease. This is more sensitive than CT for the detection of extra medullary disease. The combination of functional imaging with positron emission tomography (PET) plus morphological assessment with CT makes this technique the most effective in identifying potential sites of EMD.⁹

- When whole-body MRI is unable to be performed, the use of 18F-FDG PET/CT is mandatory to confirm a suspected diagnosis of solitary plasmacytoma and to distinguish between smoldering and active multiple myeloma. 10 NCCN 2024 guidelines recommend whole body FDG-PET/CT for the evaluation of solitary extra osseous plasmacytoma.¹¹
- MRI is the elective imaging technique to assess the degree of BM PC infiltration, even before bone destruction is present, owing to its ability to visualize large volumes of BM.¹² MRI is highly sensitive for the detection of bone and bone marrow focal lesions and predictive of progression. Unlike CT and PET/CT, MRI can detect focal bone lesions that are not yet lytic (i.e., without advanced cortical bone destruction). Up to half of patients without other evidence of end-organ damage with normal plain films may demonstrate tumor-related lesions on MRI.^{13, 14}
- Whole body diffusion weighted MRI (DW-MRI) - Also known as MRI Bone Marrow Blood Supply CPT 77084 is a non-contrast study that covers from the vertex to the heels. Diffusion-weighted magnetic resonance imaging (DWI or DW-MRI) is the use of specific MRI sequences as well as software that generates images from the resulting data that uses the diffusion of water molecules to generate contrast in MR images. This produces images where the contrast between tissues is based on differences in the motion of water at a cellular level. As cellularity in marrow increases secondary either to disease or increased hematopoietic tissue, the amount of free water increases. The capability of WB DW-MRI to demonstrate both focal and diffuse marrow infiltration throughout the whole skeleton makes this extremely useful as a subjective tool for monitoring disease status and assessment of response.¹⁵ NCCN 2024 guidelines recommend Whole-body MRI (or FDG-PET/CT if MRI is not available) is the first choice for initial evaluation of solitary osseous plasmacytoma.¹¹
- Residual focal lesions detected by either FDG-PET/CT or MRI have been shown to be of adverse prognostic significance.¹⁶⁻¹⁹

Restaging/Recurrence – MM / Plasmacytomas

- CT of any previously involved area
- MRI of any previously involved area
- MRI Spine without and with contrast
- MRI Spine without contrast
- Whole-body low-dose skeletal CT scan (CPT® 76497)
- MRI Bone Marrow Blood Supply (CPT® 77084)
- PET/CT (CPT® 78815 or CPT® 78816)

Surveillance – MM / Plasmacytomas

- Whole-body low-dose skeletal CT (CPT® 76497)
- MRI Bone Marrow Blood Supply (CPT® 77084)

Initial Work-Up/Staging – LCA-POEMS

- CT Chest with contrast (CPT® 71260)
- CT Abdomen and Pelvis with contrast (CPT® 74177)

References:

1. Terpos E, Berenson J, Raje N, Roodman GD. Management of bone disease in multiple myeloma. *Expert Rev Hematol.* 2014; 7(1): 113-125
2. Zamagni E, Cavo M. The role of imaging techniques in the management of multiple myeloma. *Br J Haematol.* 2012; 159(5): 499-513
3. Kyle RA, Rajkumar SV. Multiple myeloma. *N Engl J Med.* 2004; 351(18):1860-1873
4. Hillengass J et al: Whole-body computed tomography versus conventional skeletal survey in patients with multiple myeloma: a study of the International Myeloma Working Group. *Blood Cancer J.* 2017 Aug 25; 7(8):e599. doi: 10.1038/bcj.2017.78. PMID: 28841211; PMCID: PMC5596388
5. Rajkumar SV, Dimopoulos MA, Palumbo A, et al. International Myeloma Working Group updated criteria for the diagnosis of multiple myeloma. *Lancet Oncol.* 2014; 15(12): e538-e548
6. Pianko MJ, Terpos E, Roodman GD, et al. Whole-body low-dose computed tomography and advanced imaging techniques for multiple myeloma bone disease. *Clin Cancer Res.* 2014; 20(23):5888-5897
7. Ippolito D, Besostri V, Bonaffini PA, Rossini F, Di Lelio A, Sironi S. Diagnostic value of whole body low-dose computed tomography (WBLDCT) in bone lesions detection in patients with multiple myeloma (MM). *Eur J Radiol.* 2013; 82(12):2322-2327
8. Hillengass J et al: International myeloma working group consensus recommendations on imaging in monoclonal plasma cell disorders. *Lancet Oncol.* 2019 Jun; 20(6):e302-e312. doi: 10.1016/S1470-2045(19)30309-2. Erratum in: *Lancet Oncol.* 2019 Jul; 20(7):e346. PMID: 31162104
9. Lu YY, Chen JH, Lin WY, et al. FDG PET or PET/CT for detecting intramedullary and extra medullary lesions in multiple myeloma: a systematic review and meta-analysis. *Clin Nucl Med.* 2012; 37(9):833-837
10. Cavo M et al: Role of 18F-FDG PET/CT in the diagnosis and management of multiple myeloma and other plasma cell disorders: a consensus statement by the International Myeloma Working Group. *Lancet Oncol.* 2017 Apr; 18(4):e206-e217. doi: 10.1016/S1470-2045(17)30189-4. PMID: 28368259
11. NCCN Guidelines Version 3.2024 – Multiple Myeloma

12. Dimopoulos MA, Hillengass J, Usmani S, et al. Role of magnetic resonance imaging in the management of patients with multiple myeloma: a consensus statement. *J Clin Oncol*. 2015; 33(6):657-664
13. Walker R, Barlogie B, et al. Magnetic resonance imaging in multiple myeloma: diagnostic and clinical implications. *J Clin Oncol*. 2007 Mar 20; 25(9):1121-8. doi: 10.1200/JCO.2006.08.5803. Epub 2007 Feb 12. PMID: 17296972
14. Ailawadhi S et al: Extent of disease burden determined with magnetic resonance imaging of the bone marrow is predictive of survival outcome in patients with multiple myeloma. *Cancer*. 2010 Jan 1; 116(1):84-92. doi: 10.1002/cncr.24704. PMID: 19862816.
15. Messiou C, Kaiser M. Whole body diffusion weighted MRI--a new view of myeloma. *Br J Haematol*. 2015 Oct; 171(1):29-37. doi: 10.1111/bjh.13509. Epub 2015 May 26. PMID: 26013304; PMCID: PMC4737237.
16. Walker R, Barlogie B, Haessler J, et al. Magnetic resonance imaging in multiple myeloma: diagnostic and clinical implications. *J Clin Oncol* 2007; 25:1121-1128.
17. Bartel TB, Haessler J, Brown TL, et al. F18-fluorodeoxyglucose positron emission tomography in the context of other imaging techniques and prognostic factors in multiple myeloma. *Blood* 2009; 114:2068-2076.
18. Zamagni E, Nanni C, Mancuso K, et al. PET/CT improves the definition of complete response and allows to detect otherwise unidentifiable skeletal progression in multiple myeloma. *Clin Cancer Res* 2015; 21:4384-4390.
19. Moreau P, Attal M, Caillot D, et al. Prospective evaluation of magnetic resonance imaging and [(18)F]fluorodeoxyglucose positron emission tomography-computed tomography at diagnosis and before maintenance therapy in symptomatic patients with multiple myeloma included in the IFM/DFCI 2009 trial: Results of the IMAJEM study. *J Clin Oncol* 2017; 35:2911-2918.