



Imaging studies

Bone disease is a common symptom of multiple myeloma: 70%–80% of patients are found to have bone disease at diagnosis.

For these patients, and for those who develop bone disease in the course of their myeloma, imaging studies are helpful to assess the amount and distribution of myeloma lesions within the bone marrow as well as the presence of a potential pathologic fracture.

Repeated imaging is indicated if pain or nerve compression are likely induced by bone lesions, and to exclude extramedullary disease. Ask your doctor which imaging studies might be helpful for monitoring your myeloma. Hematologist-oncologists have a number of available options for imaging studies, including the following:



X-rays

CT or CAT scans

MRI studies

PET scans

PET-CT scans

You can learn more about each of these imaging studies below:

X-rays

X-rays of the whole body were the standard of care for diagnosing and assessing myeloma-related bone damage for many years. More sensitive studies are now recommended due to the limitations of X-rays.

The limitations of X-rays include the following:

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WITHDRAW CONSENT

X-rays are not a sensitive study for focal lesions in the bone marrow.

The appearance of a lytic lesion on an X-ray does not change following therapy, even if there is no longer any active myeloma there.

X-ray provides low visualization of the spine and pelvis.

X-rays cannot accurately depict the cause of lesions in myeloma.

Because whole-body X-ray (WBXR) requires 20 separate films, the study is time-consuming.

MRI (Magnetic Resonance Imaging)

Magnetic resonance imaging (MRI) is a non-invasive study that uses magnetic energy and radio waves, not radiation, to produce a detailed two- or three-dimensional image of structures inside the body. MRI scans map the location of water and fat in the body and produce detailed spatial images.

Why are MRIs useful for diagnosing and monitoring multiple myeloma?

MRIs can image early focal lesions in the bone marrow. Because an MRI creates images of soft tissue, it can show small clumps of myeloma in the bone marrow, plasmacytomas, and compression of the spinal cord by these masses.

The best setting for MRI is early in diagnosis. MRI is highly sensitive for the detection of focal lesions before bone destruction occurs. In a large comparative study of X-ray and MRI, 52% of patients had normal-appearing whole-body X-rays, but they had focal lesions that were apparent on MRIs. The [IMWG guidelines on MRI \(/node/1572\)](#) state that because MRI is a more sensitive study than X-ray for focal lesions (before the appearance of lytic bone lesions), all smoldering multiple myeloma patients should undergo

whole-body MRI (WBMRI) or

spine and pelvic MRI if WBMRI is unavailable.

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Claustrophobic patients can't undergo an MRI.

There is approximately a 9-month or longer lag time before an MRI will look normal after an area of myeloma has been successfully treated and is no longer active, leading to a high false-positive rate. The IMWG guidelines therefore state that the use of MRI "for the follow-up of patients, before or after different therapies, in the absence of clinical indications is not recommended."

Treatment for myeloma will interfere with MRI results. If possible, myeloma patients should not start treatment before a scheduled MRI.

The MRI scanning technique that is best for myeloma (with diffusion-weighted imaging) has not been standardized and is not widely available

CT or CAT Scan (Computerized Axial Tomography)



Computed tomography (CT) scan, sometimes called computed axial tomography (CAT) scan, is a radiological study that uses X-ray technology to create a cross-sectional, three-dimensional image of the inside of the body. It is a more precise study than X-ray and can provide clear, detailed images of bone.

CT allows for the detection of small bone lesions that are not detectable by plain X-rays.

In 20%–25% of patients with negative X-ray studies, whole-body CT will detect destructive bone lesions.

CT can detect soft tissue masses that are not visible on X-ray.

CT provides a more comprehensive assessment of fracture risk and the stability of collapsed vertebrae than X-ray.

How are whole-body low-dose CTs (WBLDCTs) used in myeloma patients?

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The advantages of whole-body low-dose CT scans in myeloma:

WBLDCT is faster and more convenient than whole-body X-rays.

WBLDCT uses two to three times less radiation than conventional CT.

WBLDCT does not require the use of contrast agents.

In 2017, the IMWG published a study (<https://www.nature.com/articles/bcj201778>), concluding that whole-body CT, either alone or as part of a PET-CT protocol, should be considered the current standard for the detection of osteolytic lesions in myeloma. Then, In 2018, the IMWG published its recommendations (</node/1793>) for acquisition, interpretation, and reporting of WBLDCT in patients with myeloma and other plasma cell disorders, thus establishing international protocol standards for this imaging study that can be followed by radiologists everywhere. By 2019, the IMWG published guidelines (</node/2325>) on optimal use of imaging methods at different disease stages.



The limitations of CT scans:

Like MRI, CT cannot be used for treatment monitoring because bone lesions in myeloma regress slowly or not at all, even in patients in complete remission.

CT is not as sensitive as MRI in detecting lesions outside the bone marrow (extramedullary disease) or in the vertebrae and pelvis.

CT is an expensive study.

Even in low-dose format, CT uses an increased level of radiation as compared to X-ray or to MRI, which doesn't use radiation at all.

PET or PET-CT Scans

Positron emission tomography (PET) scanning is a "real-time" study that shows where, and to what extent, cancer cells are actively dividing in the body.

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metabolism can indicate areas of active cancer cell division. This scan covers the whole body. It is very sensitive in detecting potential tumor activity. It is measured in units of Standardized Uptake Value (SUV).

The advantages of PET scans

PET-CT is a highly accurate and valuable imaging technique used in diagnosis, therapy assessment, and prognosis of myeloma. It combines PET scan with CT in areas where there is high uptake of FDG. It provides information both about past damage and current myeloma activity, thus enabling the doctor to study changes over time. Because of its sensitivity and its ability to detect disease in areas outside the bone marrow, PET-CT has been included along with specialized testing of the bone marrow biopsy specimen to establish MRD-negative status following treatment.

PET scans can:



Assess metabolic response to therapy. PET-CT is the preferred imaging study in this setting.

Assess the status of patients with non-secretory myeloma, whose disease cannot be monitored with standard blood and urine tests.

Detect lytic bone lesions at diagnosis as a baseline test before therapy.

Predict progression-free survival (PFS) and overall survival (OS). Three or more PET-positive lesions are an independent predictor of poorer PFS and OS.

The disadvantages of PET scans

They are time-consuming and expensive.

Because areas of infection and inflammation can also take up FDG, PET scans can produce false-positive readings for cancer.

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slowing down the entry of glucose into tumor cells. PET studies used to determine the effect of treatment should not be performed until after the patient has been off dexamethasone for 2–3 weeks, and before the patient starts the next cycle of dexamethasone.

In the U.S., the Centers for Medicare and Medicaid Services (CMS) currently covers the cost of one FDG PET scans. The CMS allows private health insurers who function as local Medicare contractors to decide whether or not to cover further PET scans, depending on each patient's particular medical problem.

Doctors who wish to support the need for additional PET scans can do so based on the following justifications:



Disease recurrence

Non-secretory disease

Concern about infection or a second primary malignancy (SPM)

Bone Densitometry, or Bone Density Testing

Bone density testing is useful for monitoring the effects of bisphosphonate therapy on the bones of patients who have diffuse thinning (osteopenia or the more severe condition, osteoporosis) of the outer bone cortex. It is not a useful test in assessing myeloma bone disease.

Another bone-related test that is not useful in myeloma is the nuclear bone scan. Myeloma causes bone loss resulting in lytic lesions, which do not show up on a nuclear bone scan.

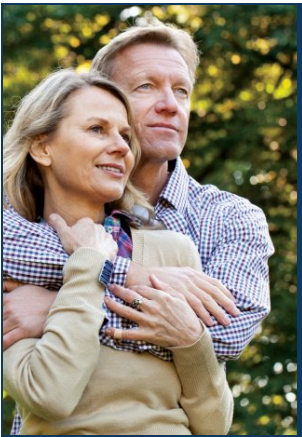
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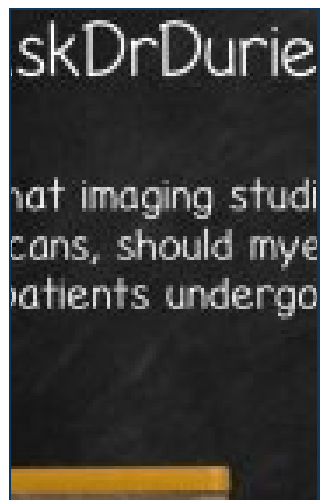
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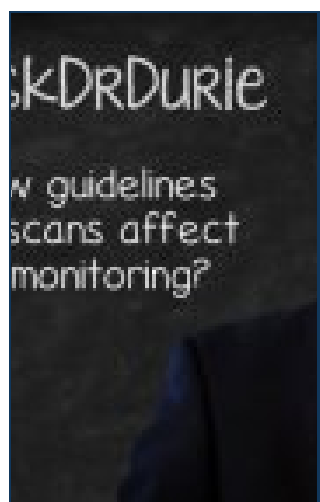
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What imaging studies, or scans, should myeloma patients undergo?

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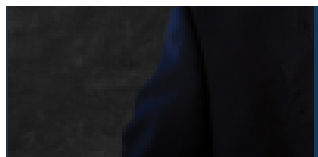


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Additionally, the content on this page is medically reviewed by myeloma physicians and healthcare professionals.

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