

**Metastatic Bone Disease  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
1. Bury T, Barreto A, Daenen F, Barthelemy N, Ghaye B, Rigo P. Fluorine-18 deoxyglucose positron emission tomography for the detection of bone metastases in patients with non-small cell lung cancer. <i>Eur J Nucl Med</i> 1998; 25(9):1244-1247.	9	110	To assess the value of FDG-PET for the detection of bone metastasis. FDG-PET and bone scintigraphy results were compared.	Accuracy of bone scan was 66% (95% CI: 57%-75%) and FDG-PET was 96% (95% CI: 90%-99%). FDG-PET is more accurate.	2
2. Gayed I, Vu T, Johnson M, Macapinlac H, Podoloff D. Comparison of bone and 2-deoxy-2-[18F]fluoro-D-glucose positron emission tomography in the evaluation of bony metastases in lung cancer. <i>Mol Imaging Biol</i> 2003; 5(1):26-31.	9	85	Retrospective study to compare the accuracy of bone scan and FDG-PET in detecting bone metastases from lung cancer.	Bone scans revealed a sensitivity of 81%, specificity of 78%, PPV of 34%, NPV of 93%. FDG-PET had a sensitivity of 73%, specificity of 88%, PPV of 46% and NPV of 97%.	2
3. Lauenstein TC, Goehde SC, Herborn CU, et al. Whole-body MR imaging: evaluation of patients for metastases. <i>Radiology</i> 2004; 233(1):139-148.	10	51	To compare the results of whole-body MRI in patients with tumors, with staging based on results of CT, dedicated MRI, and nuclear scintigraphy as standards of reference.	Whole-body MRI revealed sensitivity and specificity values of 100%. It was more sensitive in the detection of hepatic and osseous metastases than were the reference techniques.	2
4. Metser U, Lerman H, Blank A, Lievshitz G, Bokstein F, Even-Sapir E. Malignant involvement of the spine: assessment by 18F-FDG PET/CT. <i>J Nucl Med</i> 2004; 45(2):279-284.	9	51	Retrospective review to compare CT and FDG-PET in the assessment of secondary malignant involvement of the spinal column.	Of 242 lesions detected on PET/CT, PET identified 220 lesions and CT identified 159. For both PET alone and CT alone specificity was 56%. On a patient-based analysis, the sensitivity of PET and of PET/CT for the detection of spinal metastasis was 98% and 74%, respectively (P<0.01). FDG-PET more sensitive than CT in detecting spinal metastases in patients with known spinal metastases.	2
5. Schaffer DL, Pendergrass HP. Comparison of enzyme, clinical, radiographic, and radionuclide methods of detecting bone metastases from carcinoma of the prostate. <i>Radiology</i> 1976; 121(2):431-434.	9	219	To compare the sensitivity of Tc-99m diphosphonate and radiography in detecting metastatic prostate carcinoma.	Tc-99m diphosphonate is more sensitive than radiography.	2
6. Algra PR, Bloem JL, Tissing H, Falke TH, Arndt JW, Verboom LJ. Detection of vertebral metastases: comparison between MR imaging and bone scintigraphy. <i>Radiographics</i> 1991; 11(2):219-232.	9	71	Prospective, double blinded study to compare the sensitivity of bone scintigraphy and MRI in detection of vertebral metastases.	MRI is more sensitive than bone scintigraphy, in detection of vertebral metastases.	1

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7. Krishnamurthy GT, Tubis M, Hiss J, Bland WH. Distribution pattern of metastatic bone disease. A need for total body skeletal image. <i>JAMA</i> 1977; 237(23):2504-2506.	13	62	To study the distribution pattern of metastatic bone disease.	40% of bone lesions were in the appendicular skeleton. 13% were appendicular regions not usually included in routine imaging studies.	3
8. Ludwig H, Kumpan W, Sinzinger H. Radiography and bone scintigraphy in multiple myeloma: a comparative analysis. <i>Br J Radiol</i> 1982; 55(651):173-181.	9	41	To compare the sensitivity of radionuclide imaging with radiography in detecting bone lesions.	Radiography has a sensitivity of 96% compared to radionuclide imaging sensitivity of 46%.	2
9. Woolfenden JM, Pitt MJ, Durie BG, Moon TE. Comparison of bone scintigraphy and radiography in multiple myeloma. <i>Radiology</i> 1980; 134(3):723-728.	9	51	Retrospective studies to compare radionuclide images and skeletal radiographs in patients with multiple myeloma to assess the sensitivity of scintigraphy in detecting radiographically evident disease.	Radionuclide imaging was relatively insensitive in detecting myeloma. It failed to show radiographically evident disease or underestimated its extent at 27% of the sites. Radiography remains the primary method for evaluating myeloma.	2
10. Parker BR, Pinckney L, Etcubanas E. Relative efficacy of radiographic and radionuclide bone surveys in the detection of the skeletal lesions of histiocytosis X. <i>Radiology</i> 1980; 134(2):377-380.	9	18	Retrospective studies to compare sensitivity of radionuclide imaging with radiography in detecting skeletal lesions of histiocytosis.	Radiography is more sensitive. Only 35% of the individual lesions visible on radiography were seen on radionuclide studies.	3
11. Siddiqui AR, Tashjian JH, Lazarus K, Wellman HN, Baehner RL. Nuclear medicine studies in evaluation of skeletal lesions in children with histiocytosis X. <i>Radiology</i> 1981; 140(3):787-789.	9	21	Compared radiographs with Tc-99m scans as well as <sup>67</sup> Ga-citrate in the detection of skeletal lesion in children with histiocytosis X.	Radiography is more sensitive than both Tc-99m scans and <sup>67</sup> Ga-citrate scans.	3
12. Boxer DI, Todd CE, Coleman R, Fogelman I. Bone secondaries in breast cancer: the solitary metastasis. <i>J Nucl Med</i> 1989; 30(8):1318-1320.	13	160	Retrospective assessment of bone scans to evaluate distribution of early metastases in patients with known metastatic breast carcinomas.	21% of patients relapsed with a solitary bone metastasis. The spine was the commonest site for both solitary (52%) and multiple (87%) metastases. Solitary bone metastases are more common than previously thought.	2
13. Tumei SS, Beadle G, Kaplan WD. Clinical significance of solitary rib lesions in patients with extraskeletal malignancy. <i>J Nucl Med</i> 1985; 26(10):1140-1143.	13	2,851	Retrospective review of bone scans to evaluate clinical significance of solitary rib lesion in patients with primary neoplasm.	Solitary rib lesions in cancer patients are uncommon and are most frequently (90%) due to benign etiology.	2
14. Kwai AH, Stomper PC, Kaplan WD. Clinical significance of isolated scintigraphic sternal lesions in patients with breast cancer. <i>J Nucl Med</i> 1988; 29(3):324-328.	13	1,104	Retrospective review of bone scans to evaluate clinical significance of isolated scintigraphic sternal lesions in patients with breast cancer.	Isolated scintigraphic sternal lesions are rare. The majority of these lesions are metastatic.	2

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15. Braunstein EM, Kuhns LR. Computed tomographic demonstration of spinal metastases. <i>Spine</i> 1983; 8(8):912-915.	10	33	To evaluate the efficacy of CT in demonstrating spinal metastases.	CT is more sensitive than radiography in detecting vertebral metastases. CT findings correlate well with autopsy findings.	3
16. Smoker WR, Godersky JC, Knutzon RK, Keyes WD, Norman D, Bergman W. The role of MR imaging in evaluating metastatic spinal disease. <i>AJR</i> 1987; 149(6):1241-1248.	10	58	Retrospective review to address the role of MR in the evaluation of patients with cord or root compression from metastatic disease. MR was compared with myelography.	MR was as diagnostic as myelography or myelography CT. MR offers advantages over myelography and myelography CT. <ul style="list-style-type: none"> <li>• It demonstrates paravertebral tumor extension.</li> <li>• Shows additional osseous lesions.</li> <li>• Visualizes cord compression between 2 areas with myelographic blocks.</li> <li>• It is non-invasive.</li> </ul>	2
17. Even-Sapir E, Martin RH, Barnes DC, Pringle CR, Iles SE, Mitchell MJ. Role of SPECT in differentiating malignant from benign lesions in the lower thoracic and lumbar vertebrae. <i>Radiology</i> 1993; 187(1):193-198.	10	233	Retrospective review to determine whether SPECT has a role in cancer patients by differentiating malignant from benign lesions in the spine.	The location of the lesion by SPECT provides useful information for differentiation between malignant and benign.	2
18. Coleman RE, Rubens RD, Fogelman I. Reappraisal of the baseline bone scan in breast cancer. <i>J Nucl Med</i> 1988; 29(6):1045-1049.	10	1,267	To assess the utility of bone scintigraphy in the staging of patients with breast carcinoma.	In patients with tumors <2 cm, bone scintigraphy should not be acquired routinely. Bone scintigraphy is recommended as a baseline in all patients with stage 2, 3, or 4.	2
19. Kunkler IH, Merrick MV, Rodger A. Bone scintigraphy in breast cancer: a nine-year follow-up. <i>Clin Radiol</i> 1985; 36(3):279-282.	10	465	Follow-up study to correlate the results of staging scintigraphy with initial tumor size, nodal status and subsequent clinical course.	No evidence that routine bone scintigraphy affects management of newly diagnosed patients with carcinoma of the breast. Bone scintigraphy may be justifiable in patients with more advanced tumors.	2
20. Cermik TF, Mavi A, Basu S, Alavi A. Impact of FDG PET on the preoperative staging of newly diagnosed breast cancer. <i>Eur J Nucl Med Mol Imaging</i> 2008; 35(3):475-483.	10	271	Prospective study to determine the efficacy of FDG-PET to assess its impact in staging of patients with newly diagnosed breast cancer.	Sensitivities of FDG-PET were 41% in pN1, 67% in pN2, and 100% in pN3, and the specificity was 89% for pN0 stage. FDG-PET was able to identify extra-axillary regional nodal and distant lesions in newly diagnosed patients with breast cancer; FDG-PET may alter the staging and management of therapy in patients with newly diagnosed breast cancer.	2
21. Uematsu T, Kasami M, Yuen S. Comparison of FDG PET and MRI for evaluating the tumor extent of breast cancer and the impact of FDG PET on the systemic staging and prognosis of patients who are candidates for breast-conserving therapy. <i>Breast Cancer</i> 2008.	9	23 breasts	Prospective study to compare the accuracy of FDG-PET and MRI for evaluating the tumor extent of breast cancer and the impact of FDG-PET on the systemic staging and prognosis of patients who are candidates for breast-conserving therapy.	Accuracy of FDG-PET (43.5%) was lower than that of MRI (91%) (P<0.001) when evaluating the local tumor extent. For nodal status, FDG-PET had 60 % sensitivity, 94% specificity, and 87% accuracy. FDG-PET is useful for predicting the prognoses of patients who are candidates for breast-conserving therapy.	2

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22. Groheux D, Moretti JL, Baillet G, et al. Effect of (18)F-FDG PET/CT imaging in patients with clinical Stage II and III breast cancer. <i>Int J Radiat Oncol Biol Phys</i> 2008; 71(3):695-704.	10	39	Prospective study to evaluate the potential effect of (18) F-FDG-PET/CT in the initial assessment of patients with clinical stage II or III breast cancer.	PET/CT can provide information on extra-axillary lymph node involvement and can uncover occult distant metastases in most patients. Initial PET/CT is recommended in patients with Stage II and III breast cancer.	2
23. Iagaru A, Masamed R, Keesara S, Conti PS. Breast MRI and 18F FDG PET/CT in the management of breast cancer. <i>Ann Nucl Med</i> 2007; 21(1):33-38.	9	21	Retrospective study to review management of breast cancer with breast MRI and 18F-FDG-PET/CT. 6 patients (group A) had breast MRI and PET/CT in the preoperative period and 15 patients (group B) had breast MRI and PET/CT after surgery.	Overall sensitivities and specificities were 85.7% and 85.7% for breast MRI, and 75% and 92.3% for 18F-FDG-PET/ CT. 18F FDG-PET/CT and breast MRI should be complimentary techniques in the preoperative and postoperative workup of patients with breast cancer.	3
24. Kosuda S, Yoshimura I, Aizawa T, et al. Can initial prostate specific antigen determinations eliminate the need for bone scans in patients with newly diagnosed prostate carcinoma? A multicenter retrospective study in Japan. <i>Cancer</i> 2002; 94(4):964-972.	10	1,294	Multicenter retrospective study to determine whether serum prostate specific antigen (PSA) determination can eliminate the need for bone scans in Japanese patients with newly diagnosed prostate carcinoma with serum PSA levels $\leq 10$ ng/mL.	It is possible to omit baseline bone scans for patients with PSA levels $\leq 10$ ng/mL, Gleason grade $\leq 2$ , and Gleason score $\leq 6$ .	2
25. O'Sullivan JM, Norman AR, Cook GJ, Fisher C, Dearnaley DP. Broadening the criteria for avoiding staging bone scans in prostate cancer: a retrospective study of patients at the Royal Marsden Hospital. <i>BJU Int</i> 2003; 92(7):685-689.	10	420	Retrospective study to determine if it is possible to avoid staging bone scans in prostate cancer.	Bone scans are not necessary for staging prostate cancer if PSA $\leq 20$ ng/mL, stage $< T4$ , and Gleason score $< 8$ unless major Gleason pattern is 4.	2
26. Sandblom G, Holmberg L, Damber JE, et al. Prostate-specific antigen for prostate cancer staging in a population-based register. <i>Scand J Urol Nephrol</i> 2002; 36(2):99-105.	10	8,328	Prospective cohort study to determine whether serum PSA determination can eliminate the need for bone scans or pelvic lymph node exploration.	For well to moderately differentiated tumors, further investigations (bone scan and pelvic lymph node exploration) to assess the presence of metastases may be omitted with no great risk for understaging if serum PSA $< 20$ ng/mL.	1
27. Leibovici D, Spiess PE, Agarwal PK, et al. Prostate cancer progression in the presence of undetectable or low serum prostate-specific antigen level. <i>Cancer</i> 2007; 109(2):198-204.	13	46	To report the clinical and pathologic characteristics of patients who had prostate progression in the presence of undetectable or low PSA levels.	Progression of prostate cancer may occur despite undetectable or low PSA levels. Complete physical evaluation and imaging studies may be indicated in the surveillance of patients with high-grade, locally advanced tumors.	2
28. Merrick MV, Merrick JM. Bone scintigraphy in lung cancer: a reappraisal. <i>Br J Radiol</i> 1986; 59(708):1185-1194.	10	587	Prospective study to assess the value of bone scintigraphy in the initial preoperative staging of lung cancer.	Bone scintigraphy; sensitivity of 0.89, non-specificity (false positives/true negatives) of 0.00 and accuracy of 0.78. Bone scintigraphy is indicated in any patient with unexplained symptoms and whenever staging is required because of the prognostic implications.	2

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29. Michel F, Soler M, Imhof E, Perruchoud AP. Initial staging of non-small cell lung cancer: value of routine radioisotope bone scanning. <i>Thorax</i> 1991; 46(7):469-473.	10	110	Prospective study to assess the sensitivity of a group of clinical indicators for the presence of skeletal metastases as determined by bone scanning.	Sensitivity of clinical indicators was 100% and specificity 54%. Bone scanning can be restricted to patients with clinical indicators for skeletal metastases.	2
30. Erturan S, Yaman M, Aydin G, Uzel I, Musellim B, Kaynak K. The role of whole-body bone scanning and clinical factors in detecting bone metastases in patients with non-small cell lung cancer. <i>Chest</i> 2005; 127(2):449-454.	9	125	To determine role of whole-body bone scanning and clinical factors in detecting bone metastases in patients with non-small-cell lung cancer (NSCLC). MRI was used in some patients.	Bone-specific clinical factors as indicators of metastasis presented 53.8% PPV, 94.2% NPV, and 81.6% accuracy. Whole-body bone scanning showed 73.5% PPV, 97.8% NPV, and 91.2% accuracy.	2
31. Ung YC, Maziak DE, Vanderveen JA, et al. 18Fluorodeoxyglucose positron emission tomography in the diagnosis and staging of lung cancer: a systematic review. <i>J Natl Cancer Inst</i> 2007; 99(23):1753-1767.	11	N/A	To assess the accuracy and utility of FDG-PET in the diagnosis and staging of lung cancer.	FDG-PET has high sensitivity (96%) but relatively low specificity (78%) in differentiating benign from malignant nodules as small as 1 cm. Need further trials to establish the clinical utility of PET as part of the standard preoperative assessment of early-stage lung cancer.	1
32. Hudson TM, Chew FS, Manaster BJ. Scintigraphy of benign exostoses and exostotic chondrosarcomas. <i>AJR</i> 1983; 140(3):581-586.	10	20	To evaluate whether bone scintigraphy is of any value in the management of benign exostoses and exostotic chondrosarcomas or if it differentiates between these two lesions.	Radionuclide bone imaging did not contribute to the preoperative anatomic evaluation of these tumors, and it did not always distinguish benign from malignant lesions.	3
33. Simon MA, Kirchner PT. Scintigraphic evaluation of primary bone tumors. Comparison of technetium-99m phosphonate and gallium citrate imaging. <i>J Bone Joint Surg Am</i> 1980; 62(5):758-764.	9	55	Prospective comparison of Tc-99m phosphonate and gallium citrate imaging to determine which technique is useful in separating benign from malignant lesions or in defining the local extent of malignant tumors.	<ul style="list-style-type: none"> <li>Tc-99m phosphonate scans could not separate malignant from benign or define reliably the local extent of malignant tumors.</li> <li>Gallium scans were more accurate in delineating the local extent of malignant tumors and may provide better identification of benign tumors.</li> </ul>	2
34. Goldstein H, McNeil BJ, Zufall E, Jaffe N, Treves S. Changing indications for bone scintigraphy in patients with osteosarcoma. <i>Radiology</i> 1980; 135(1):177-180.	10	56	Retrospective study to determine whether patients with osteosarcoma who have received adjuvant chemotherapy would develop osseous metastasis prior or without pulmonary metastasis and if value of bone scintigraphy has changed.	16% of patients showed osseous metastasis prior or without pulmonary metastasis. Bone scintigraphy is recommended at regular intervals particularly in the first 2 years after the diagnosis.	3
35. McKillop JH, Etcubanas E, Goris ML. The indications for and limitations of bone scintigraphy in osteogenic sarcoma: a review of 55 patients. <i>Cancer</i> 1981; 48(5):1133-1138.	10	55	Retrospective study to assess the value of bone scanning at time of presentation and serially during follow-up of patients with osteosarcoma.	One patient had metastasis initially and one had proximal extension. During follow-up 20 patients developed bone metastasis with abnormal bone scans. 11 of 20 were asymptomatic while scan was positive. Bone scan is recommended at initial presentation and at follow-up.	3

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36. Volker T, Denecke T, Steffen I, et al. Positron emission tomography for staging of pediatric sarcoma patients: results of a prospective multicenter trial. <i>J Clin Oncol</i> 2007; 25(34):5435-5441.	9	46	Prospective multicenter trial to evaluate the impact of PET using FDG for initial staging and therapy planning in pediatric sarcoma patients. FDG-PET was compared with conventional imaging modalities (CIMs).	<ul style="list-style-type: none"> <li>• For detection of primary tumors, both FDG-PET and CIMs had accuracy of 100%.</li> <li>• For correct detection of lymph node involvement, PET was superior to CIMs (sensitivity, 95% vs 25%, respectively) and bone manifestations (sensitivity, 90% vs 57%, respectively)</li> <li>• CT was more reliable than FDG-PET in depicting lung metastases (sensitivity, 100% vs 25%, respectively).</li> </ul>	2
37. Holder LE. Clinical radionuclide bone imaging. <i>Radiology</i> 1990; 176(3):607-614.	12	N/A	Review clinical radionuclide bone imaging and various indications for radionuclide bone scanning in cancer patients.	Need for nuclear radiologist to understand the pharmacologic and physiologic basis of bone scanning and how that physiologic basis relates to the pathophysiology of the processes being investigated.	4
38. Baur A, Stabler A, Bruning R, et al. Diffusion-weighted MR imaging of bone marrow: differentiation of benign versus pathologic compression fractures. <i>Radiology</i> 1998; 207(2):349-356.	10	30	Prospective study to determine the value of diffusion-weighted MRI of bone marrow for differentiating between benign and pathologic vertebral compression fractures.	MRI provided excellent distinction between pathologic and benign vertebral compression fractures.	2
39. Park SW, Lee JH, Ehara S, et al. Single shot fast spin echo diffusion-weighted MR imaging of the spine; Is it useful in differentiating malignant metastatic tumor infiltration from benign fracture edema? <i>Clin Imaging</i> 2004; 28(2):102-108.	10	77	To evaluate the usefulness of single shot fast spin echo diffusion-weighted MRI in differentiating malignant metastatic tumor infiltration from benign fracture edema.	High or intermediate signal intensity on diffusion-weighted single shot fast spin echo was highly specific for the diagnosis of metastatic tumor infiltration of the spine (95%); however, the sensitivity was low (42%).	2
40. Spuentrup E, Buecker A, Adam G, van Vaals JJ, Guenther RW. Diffusion-weighted MR imaging for differentiation of benign fracture edema and tumor infiltration of the vertebral body. <i>AJR</i> 2001; 176(2):351-358.	10	34	To investigate diffusion-weighted MRI for differentiation of benign fracture edema and tumor infiltration of the vertebral body.	Calculation of signal attenuation and observation of signal characteristics allowed differentiation of benign fracture edema and tumor infiltration and provided excellent distinction between benign and malignant vertebral fractures in their series. Accuracy was 100%.	2

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41. Karchevsky M, Babb JS, Schweitzer ME. Can diffusion-weighted imaging be used to differentiate benign from pathologic fractures? A meta-analysis. <i>Skeletal Radiol</i> 2008; 37(9):791-795.	11	104 benign 161 malignant and pathologic fractures	Meta-analysis to determine whether diffusion-weighted imaging can be used to differentiate benign from pathologic fractures.	Mean apparent diffusion coefficient (ADC) was significantly higher (P<0.01) among benign fractures. Lesions classified as hypointense were significantly more likely to be benign (P<0.01). Lesions classified as isointense were not significantly more likely to be benign or malignant (P>0.1). Although literature is inconsistent, ADC appears to be a reliable method to differentiate benign from malignant fractures.	1
42. Nakanishi K, Kobayashi M, Nakaguchi K, et al. Whole-body MRI for detecting metastatic bone tumor: diagnostic value of diffusion-weighted images. <i>Magn Reson Med Sci</i> 2007; 6(3):147-155.	9	30	To assess the diagnostic value of whole-body MRI using diffusion-weighted images for detecting bone metastasis and compare it with skeletal scintigraphy. <ul style="list-style-type: none"> <li>• Session 1: T1-weighted fast spin echo (T1-WI), and STIR (sagittal plane of total spine images and coronal plane of whole-body images) images.</li> <li>• Session 2: T1-WI+STIR+DWI.</li> </ul>	10 of 30 had 52 metastatic bone lesions; in the other 20, follow-up examinations confirmed no metastatic bone lesions. For these 52 lesions, for session 2, the mean sensitivity was 96% and the PPV was 98%. Those values were superior to those of session 1 (sensitivity: 88%; PPV: 95%) and those of skeletal scintigraphy (sensitivity: 96%; PPV: 94%).	2
43. Ghanem N, Uhl M, Brink I, et al. Diagnostic value of MRI in comparison to scintigraphy, PET, MS-CT and PET/CT for the detection of metastases of bone. <i>Eur J Radiol</i> 2005; 55(1):41-55.	9	N/A	To compare the diagnostic value of MRI with scintigraphy, PET, multislice CT and PET/CT for the detection of bone metastases.	18F FDG-PET and 18F-fluoride-PET FDG as well as the side by side PET-CT image fusion and the two in one PET/CT examinations appears to be slightly less sensitive to whole-body MRI in detection of osteal metastases.	3
44. Schmidt GP, Reiser MF, Baur-Melnyk A. Whole-body imaging of the musculoskeletal system: the value of MR imaging. <i>Skeletal Radiol</i> 2007; 36(12):1109-1119.	12	N/A	To review whole-body imaging of the musculoskeletal system and emphasize present and potential future applications, especially in the field of whole-body MRI.	Whole-body MRI has successfully been applied for bone marrow screening of metastasis and systemic primary bone malignancies, and has recently been proposed for the assessment of systemic bone diseases predisposing for malignancy.	4
45. Thomson V, Pialat JB, Gay F, et al. Whole-body MRI for metastases screening: a preliminary study using 3D VIBE sequences with automatic subtraction between noncontrast and contrast enhanced images. <i>Am J Clin Oncol</i> 2008; 31(3):285-292.	10	32	To evaluate 3D volumetric interpolated breath-hold examination whole-body MRI acquisition for the metastases staging. CT, scintigraphy, brain MRI, and whole-body PET was used as reference techniques.	<ul style="list-style-type: none"> <li>• Whole-body MRI showed 27 cerebral metastases, while brain MRI showed 40 cerebral metastases.</li> <li>• Whole-body MRI showed 8 hepatic metastases, 8 adrenal lesions, and conventional staging 7 hepatic metastases and 10 adrenal lesions.</li> <li>• Whole-body MRI showed lung metastases in 10 patients, and CT examination in 13 patients.</li> </ul>	2

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46. Eustace S, Tello R, DeCarvalho V, et al. A comparison of whole-body turboSTIR MR imaging and planar 99mTc-methylene diphosphonate scintigraphy in the examination of patients with suspected skeletal metastases. <i>AJR</i> 1997; 169(6):1655-1661.	9	25	To compare whole-body turbo short inversion time inversion recovery MRI and 99mTc-methylene diphosphonate planar scintigraphy in the examination of patients with suspected skeletal metastases.	<ul style="list-style-type: none"> <li>• MRI showed 57 of 175 possible sites (sensitivity 96.5%, specificity 100%; PPV 100%).</li> <li>• Scintigraphy revealed metastases at 43 of 175 possible sites (sensitivity 72%; specificity 98%; PPV 95%) (McNemar test 0.01; P=.016).</li> <li>• Whole-body MRI is an effective method of examining patients with suspected skeletal metastases, with better sensitivity than conventional planar 99mTc-methylene diphosphonate scintigraphy.</li> </ul>	3
47. Edeiken B, deSantos LA. Percutaneous needle biopsy of the irradiated skeleton. <i>Radiology</i> 1983; 146(3):653-655.	10	20	To determine if percutaneous needle biopsy can differentiate radiation necrosis from metastasis.	Percutaneous needle biopsy is the best modality to quickly and safely differentiate radiation necrosis from metastasis.	3
48. El-Khoury GY, Terepka RH, Mickelson MR, Rainville KL, Zaleski MS. Fine-needle aspiration biopsy of bone. <i>J Bone Joint Surg Am</i> 1983; 65(4):522-525.	10	70	To demonstrate that fine needle aspiration biopsy of bone is a safe and affective procedure for the diagnosis of skeletal neoplasm.	With advanced cytologic techniques, the technique is affective and safe. Accuracy of 87.5%.	2
49. Ghelman B, Lospinuso MF, Levine DB, O'Leary PF, Burke SW. Percutaneous computed-tomography-guided biopsy of the thoracic and lumbar spine. <i>Spine</i> 1991; 16(7):736-739.	10	76	To assess the efficacy of percutaneous CT guided needle biopsy of lesions in the thoracic and lumbar spine.	Histologic diagnosis confirming the clinical suspicion was obtained on the first biopsy attempt in 86% of the cases.	2
50. Murphy WA, Destouet JM, Gilula LA. Percutaneous skeletal biopsy 1981: a procedure for radiologists--results, review, and recommendations. <i>Radiology</i> 1981; 139(3):545-549.	10	169	Retrospective study to evaluate the efficacy of percutaneous skeletal biopsy.	Overall accuracy 94%. Percutaneous skeletal biopsy should be considered a radiologic procedure.	2
51. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: <a href="http://www.acr.org/SecondaryMainMenuCategories/quality_safety/contrast_manual.aspx">http://www.acr.org/SecondaryMainMenuCategories/quality_safety/contrast_manual.aspx</a> .	15	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	3

## Evidence Table Key

### Study Type Key

*Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.*

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
  - a. Cohort
  - b. Cross-sectional
  - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews
8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

### Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.