Diagnostic Imaging Pathways - Bone Pain

Population Covered By The Guidance

This pathway provides guidance for imaging patients with bone pain. There are links to other pathways for imaging patients with suspected bony metastases, myeloma, soft tissue masses, low back pain or joint pain in various joints.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

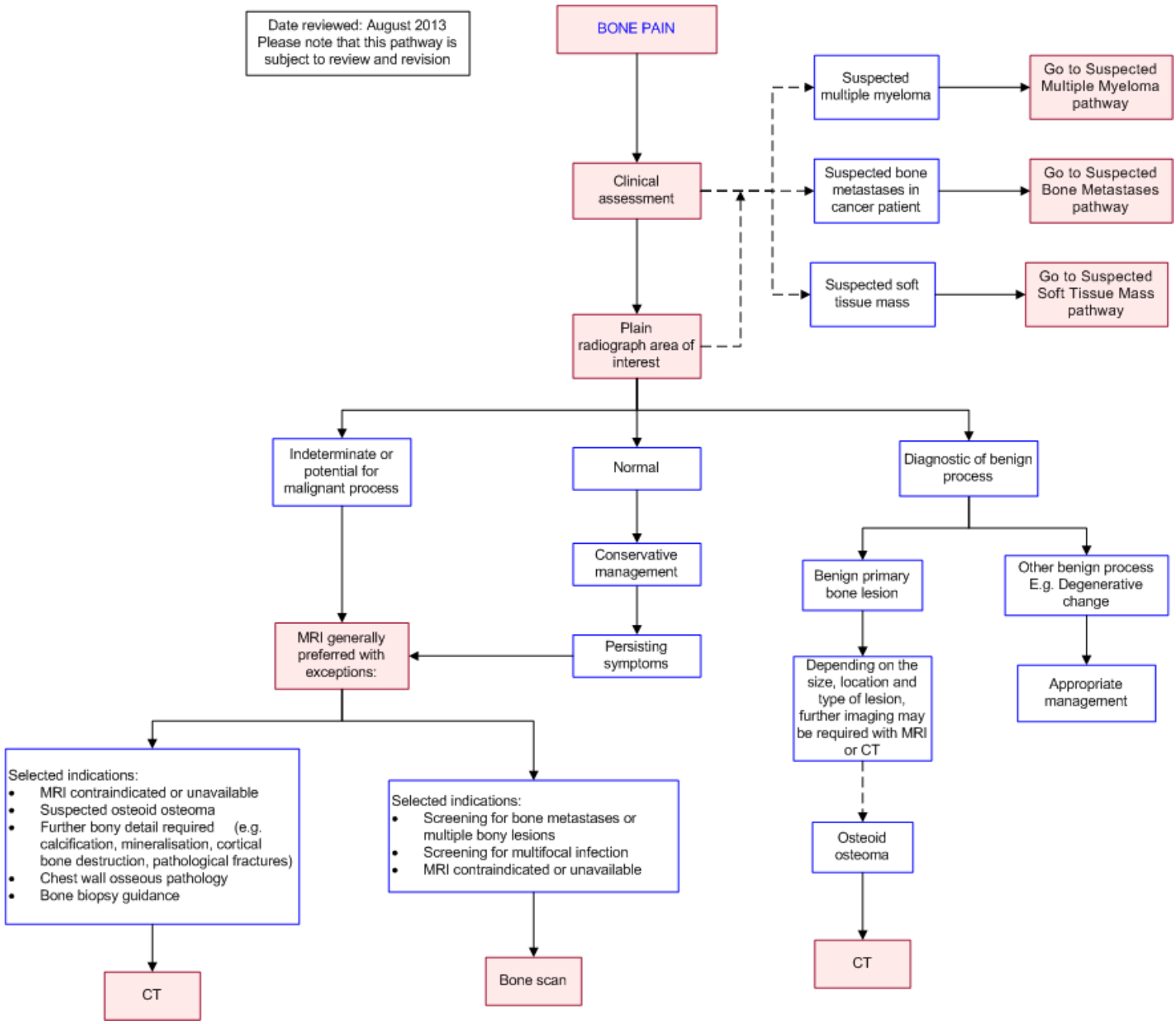

Image Gallery

Pending clarification of consent

Teaching Points

- Plain radiography of the symptomatic area is the initial investigation of choice for bone pain or suspected primary bone lesion. Most primary bone tumours are benign, but primary malignant bone tumours are an important cause of cancer morbidity and mortality in young people
- Advanced imaging modalities provide complimentary information to each other
- MRI is generally the advanced imaging modality of choice to further characterise radiograph findings or to further investigate persisting localised symptoms after a normal radiograph

- CT is useful to further define bony anatomy and in suspected osteoid osteoma and bone biopsy guidance
- Nuclear medicine studies are useful in suspected multifocal osseous pathology (e.g. bony metastases, osteomyelitis), metabolic bone disease and inflammatory arthropathy.
- If lesion diagnosis is uncertain and management will be altered, bone biopsy can be considered after review by a musculoskeletal tumour surgeon, taking into account lesion accessibility and patient comorbidities

Red Flags: Clinical Assessment in Bone Pain

- 'Red flags' that prompt imaging include signs and symptoms suggestive of malignancy, infection, fracture or certain rheumatological, metabolic or neurological conditions
- A patient with symptoms suggestive of bone cancer or sarcoma should have specialist referral. A history of increasing, unexplained or persistent bone pain, particularly pain at rest (especially if not in the joint), an unexplained limp, or a mass/swelling arising from any bone should be investigated urgently 1
- In older patients metastases, myeloma or lymphoma, as well as sarcoma, should be considered 1

Plain Radiography

- Initial imaging modality of choice for patients with localised bone pain to screen for tumours and tumour-like conditions 2
- If radiographic features are definitively benign, further imaging may not be necessary unless further anatomic information is required, there is concern of secondary complications (such as pathological fracture) or surgery is contemplated 2
- If multiple myeloma is suspected a radiographic skeletal survey is more sensitive than bone scintigraphy 3 and still considered the gold standard initial imaging modality to detect osteolytic lesions 4
- A patient with persistent pain after conservative management should have further imaging despite normal radiographs, as substantial bone mineral content loss has to occur before changes become radiographically apparent

Magnetic Resonance Imaging (MRI)

- MRI can further evaluate indeterminate or potentially malignant findings on radiography or bone scan, providing superior contrast resolution, anatomical detail and assessment of bone marrow and soft tissue involvement 5-10
- It is the localised advanced imaging modality of choice for suspected osteomyelitis, primary or secondary bone tumour, occult stress or pathological fracture and soft tissue mass that may be associated with bone pain
- Allows definition of bone tumour size and local intraosseous and extraosseous extent, and is useful in the assessment of tissue characteristics, vascularity and necrosis 11-14
- Limitations
    - Longer scanning time and respiratory movement artefact mean MRI is not as well suited to depicting the thoracic wall. 6 CT is better suited
    - Contraindicated in the presence of a ferromagnetic substance; e.g. pacemaker, aneurysm clip, cochlear implant, ocular foreign body, spinal cord stimulator and some stent materials

Computed Tomography (CT)

- Alternative if MRI is contraindicated or unavailable
- Superior to MRI in revealing cortical integrity and the extent of structural destruction. 6,8 Useful for further evaluation of matrix mineralisation, calcification, cortical or periosteal involvement and pathological fractures 2,10,13
- More accurate than MRI in detecting the characteristic nidus of osteoid osteoma, a benign tumour which usually affects the long bones, particularly the proximal femur and tibial shaft, 15,16 although the use of dynamic gadolinium-enhanced MRI improves nidus conspicuity compared to CT, especially at atypical sites 17,18
- Useful for further evaluation of rib pathology after abnormal radiograph or bone scan 19,20
- Dual energy CT may be used to noninvasively diagnose and monitor gouty tophi or calcium crystal deposits by analysis of the chemical composition of the scanned materials 21
- Useful in guiding needle biopsy

Bone Scintigraphy

- Nuclear medicine studies are useful in multifocal osseous pathology (e.g. bony metastases, osteomyelitis), metabolic bone disease and inflammatory arthropathy. 22 Technetium-99 (99mTc) accumulates at sites of elevated bone turnover
- Initial imaging modality of choice in detecting bone metastases, regardless of presence of symptoms
- Advantages
    - Allows total body survey 23
    - Sensitive
- Limitations
- Non-specific; radiographic correlation and further anatomic characterisation with MRI or CT is often required
- Some lytic bone metastases may not show increased uptake on bone scan, 3 and are better detected by metabolic scans such as FDG-PET because they have a high glucose metabolism 24 or anatomical assessment with CT or MRI

Positron Emission Tomography (PET)

- Can identify metabolically active skeletal metastases that may or may not have detectable structural destruction
- Its use in staging and follow up evaluation is increasing for a number of malignancies, including Ewing sarcoma family tumours 25
- However, it is associated with high radiation exposure and cost 8

References

Date of literature search: June 2013

The search methodology is available on request. Email

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. Download the document

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