

Diagnostic Imaging Pathways - Soft Tissue Mass

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with a soft tissue mass.

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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

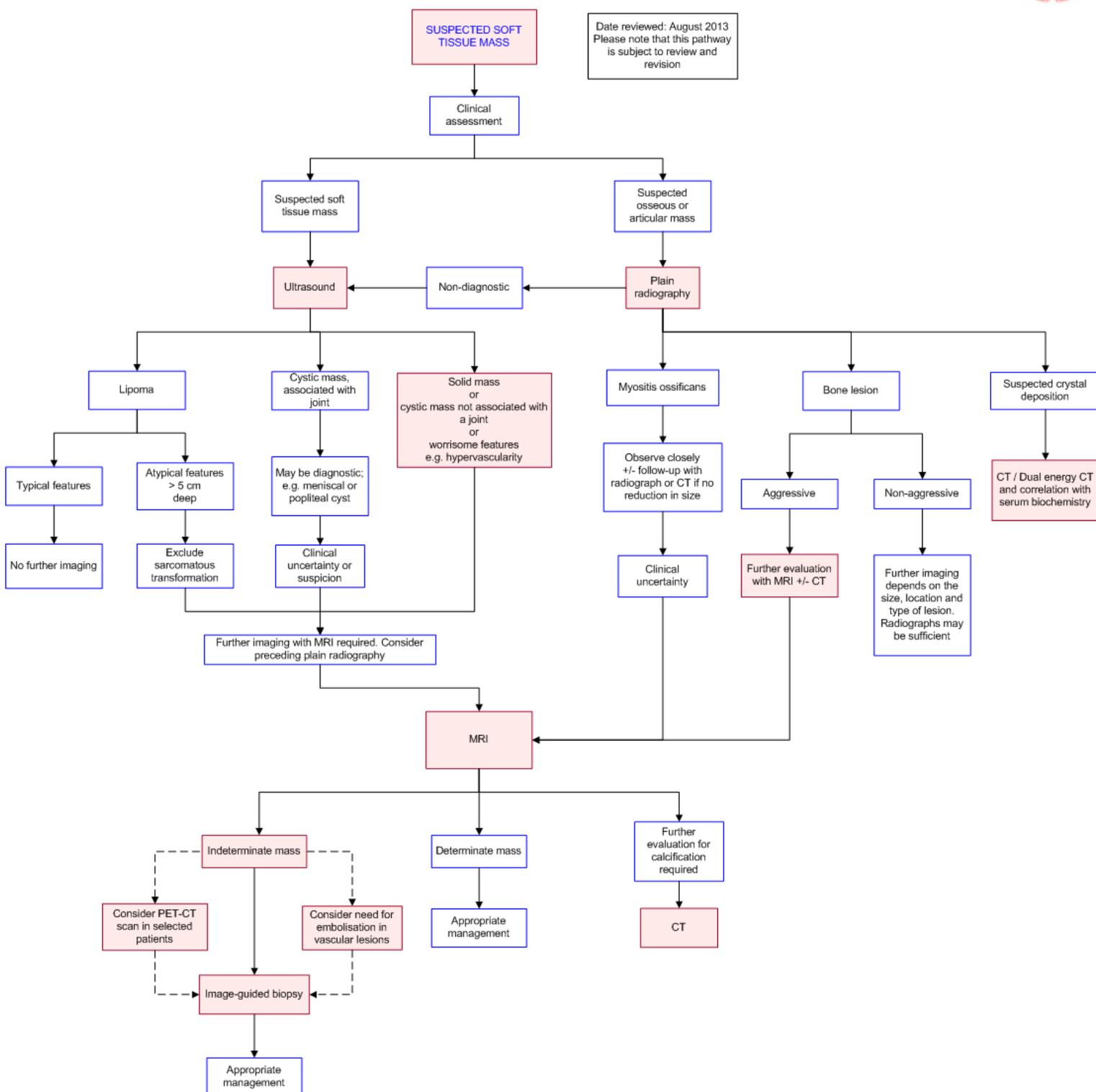


Image Gallery

Note: These images open in a new page

1

Soft Tissue Haemangioma

Image 1 (Plain Radiograph): Punctate calcifications are present in the region



of the right wrist and distal forearm (arrowheads), consistent with a soft tissue haemangioma.

2



Myxoid Liposarcoma

Image 2 (Magnetic Resonance Imaging): Myxoid liposarcoma of the right buttock.

3a



Myxoid Liposarcoma

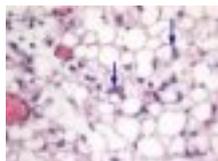
Image 3a: Resection of a large soft tissue liposarcoma showing a circumscribed fatty mass, well demarcated from the surrounding fat.

3b



Image 3b (H&E, x2.5) and 3c (H&E, x25): Histological sections of a myxoid liposarcoma showing sheets of multivacuolated lipoblasts with atypical nuclei (blue arrows) and interspersed arborising thin-walled vessels.

3c



Teaching Points

- The percentage of soft tissue masses that are malignant is small, but delay in diagnosis at presentation is a significant cause of morbidity for tumours such as sarcoma
- Initial evaluation of a soft tissue mass is clinical
- Ultrasound is an important initial imaging technique to rapidly confirm the presence of a soft tissue mass and may be diagnostic for classical appearances of some soft tissue lesions, such as cysts and lipomas
- Radiographs are useful to identify osseous or mineralising lesions presenting as an apparent soft tissue mass and complement advanced imaging modalities
- MRI is superior in the assessment of a soft tissue mass
- If a soft tissue mass doesn't demonstrate tumour-specific features on MRI, or cannot be characterised as a benign entity, the patient should undergo biopsy to exclude malignancy, taking into account lesion accessibility and patient comorbidities [2](#)

Lesion Characterisation

- Features that suggest a possible malignant lesion include
 - Size >5cm
 - Deep lesion
 - Firm consistency
 - Solid or mixed structure

- Large, deep lipomatous masses can be diagnosed with a MRI. Most other lesions, particularly those >4cm, will require histological evaluation with biopsy to confirm the diagnosis

Ultrasound

- Ultrasound is often used as a first imaging technique to confirm or exclude the presence of a soft tissue mass due to high negative predictive value, availability, low cost and ability to visualise multiple coexisting masses [3](#)
- Useful in distinguishing
 - Cystic from solid masses
 - Anatomical relationships to adjoining structures, e.g. communication with the joint
 - Vascularity of lesions (using colour or power Doppler)
- One prospective German study categorised tumour groups based on patterns of echotexture (homogenous hyperechoic, homogenous hypoechoic, heavily inhomogeneous) and vascularity to detect soft tissue sarcomas and aggressive benign lesions with a reported 94.4% sensitivity, 79.7% specificity and 89.7% accuracy [4](#)
- Vascularity on doppler ultrasound alone is of limited value in differentiating benign from malignant tumours [5](#)
- For some benign soft tissue masses (e.g. lipomas, cysts, abscesses and foreign bodies), ultrasound findings may be sufficient to obviate the need for further imaging [3](#)
- An indeterminate study or prompts further study with MRI
- Promising as a rapid clinical and imaging triage tool of clinically suspicious soft tissue masses, allowing prompt patient reassurance or effective fast tracking to MRI +/- biopsy [6](#)

Plain Radiography

- Non-specific in soft tissue lesion diagnosis and should be considered a useful adjunct to interpretation with other modalities, including MRI or ultrasound, in most situations
- May be assessed for [1](#)
 - Involvement of skeletal structures, indolent or aggressive remodelling of bone
 - Soft tissue mineralisation or ossification. e.g. Mature ossification in soft tissue, characteristic zonal patterns of mineralisation (myositis ossificans), phlebolith cluster or punctuate calcifications (haemangioma), hazy calcification (gout)
 - Distortion of tissue planes
 - Radiolucent fatty areas
 - Radiolucent foreign bodies
- Useful to track development of myositis ossificans, however MRI or CT may still be needed to evaluate extent of soft tissue injury [7](#)
- Plain radiography of the symptomatic area is the initial investigation of choice for bone pain or suspected primary bone lesion [8](#)
- If radiographic features are of a definitively benign bone lesion, 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 [8](#)

Magnetic Resonance Imaging (MRI)

- Preferred advanced imaging modality for evaluation of soft tissue masses due to superior soft tissue contrast. It is used to evaluate soft tissue masses that are not adequately characterised on ultrasound or plain radiography
- Comparable detection of cortical bone involvement to CT9-12 with the advantage of determination of extent of marrow involvement [13](#)
- Aids in tumour characterisation and staging, detection of neurovascular involvement, identification of tumour necrosis and preoperative planning [1,2,9,11,14-21](#)
- One prospective study of MRI in 548 consecutive patients with soft tissue tumours and soft tissue tumour-like lesions reported [19](#)
 - High accuracy in the differentiation of malignant from benign lesions (93% sensitivity, 82% specificity and 85% accuracy)
 - High specificity and accuracy in phenotype characterisation but poor and moderate sensitivity in malignant and benign lesions respectively (better in lesions of fatty origin, worse in fibrous tumours)
 - Poor correlation between specific MRI diagnosis and histological result - the proposed MRI diagnosis was only correct 50% of the time, highlighting the importance of progression to biopsy in indeterminate masses

Computed Tomography (CT)

- Role has largely been replaced by MRI, but may be useful in
 - Assessing patients where radiography does not adequately show the pattern of mineralisation [22,23](#)
 - Where MRI is not available or when patients are unable to have an MRI for technical reasons
 - May be the preferred imaging modality with tumours in the abdominal or chest wall where motion artefact can create suboptimal imaging with MRI [9,17](#)
- 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 [24-26](#)
- Although MRI is widely accepted as being superior to CT in the evaluation of soft tissue tumours, one study of 133 patients with primary soft tissue tumours reported no significant difference between CT and MRI in determining tumour size and involvement of surrounding structures [10](#)

Positron Emission Tomography (PET)

- May have a complementary role in the assessment of soft tissue masses in diagnosis, grading, biopsy planning, staging, restaging and evaluating response to therapy
- FDG-PET/CT has a reported 80% sensitivity, 68.4 specificity and 75% diagnostic accuracy in differentiating malignant from benign soft tissue tumours compared to surgical biopsy as the gold standard, although there were many false positive and false negative lesions [27](#)
- A recent metaanalysis with methodological limitations reported a pooled 91% sensitivity, 85% sensitivity and 88% diagnostic accuracy of FDG-PET in the detection of sarcomas. FDG-PET was able to discriminate between sarcomas and benign tumours and low and high grade sarcomas, but there is a lack of studies that assess its ability to differentiate between benign tumours and low grade sarcomas [28](#)
- Benz et al (2010) demonstrated a correlation with sarcoma grade and 18F-FDG uptake by PET, which has implications for sarcoma grading and biopsy planning to increase diagnostic yield [29](#)
- FDG-PET and PET/CT have a pooled sensitivity 96% (91-99%) and pooled specificity 92%

(87-96%) in the diagnosis of Ewing sarcoma family tumours on recent metaanalysis, superior to bone scintigraphy and MRI in detection of osseous metastases [30](#)

- PET scanning has a high radiation dose. It has been used mainly for evaluating metastatic disease and follow-up of treated lesions. [7](#) It may be useful in determining sites with highest biological activity for biopsy

Arteriography

- With the increasing utilisation of MRI and MRA, the role of arteriography in evaluating soft tissue tumours has diminished [7,31](#)
- Allows pre-operative or therapeutic embolisation of highly-vascular tumours with materials such as haemostatic sponges, and foam particles [31](#)

Biopsy

- If a soft tissue mass doesn't demonstrate tumour-specific features on MRI, or cannot be characterised as a benign entity, the patient should undergo biopsy to exclude malignancy, taking into account lesion accessibility and patient comorbidities [2](#)
- There is a paucity of evidence as to when a biopsy of a soft tissue mass is indicated. In the absence of evidence-based data, a biopsy is suggested whenever a mass has biologic activity and further medical or surgical treatment will be based on that result [32](#)

References

Date of literature search: March 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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