

Diagnostic Imaging Pathways - Hip (Avascular Necrosis)

Population Covered By The Guidance

This pathway provides guidance for imaging patients with suspected avascular necrosis of the hip.

Date of review: August 2013

Date of next review: 2017/2018






Published: October 2013

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

Date reviewed: August 2013
Please note that this pathway is subject to review and revision

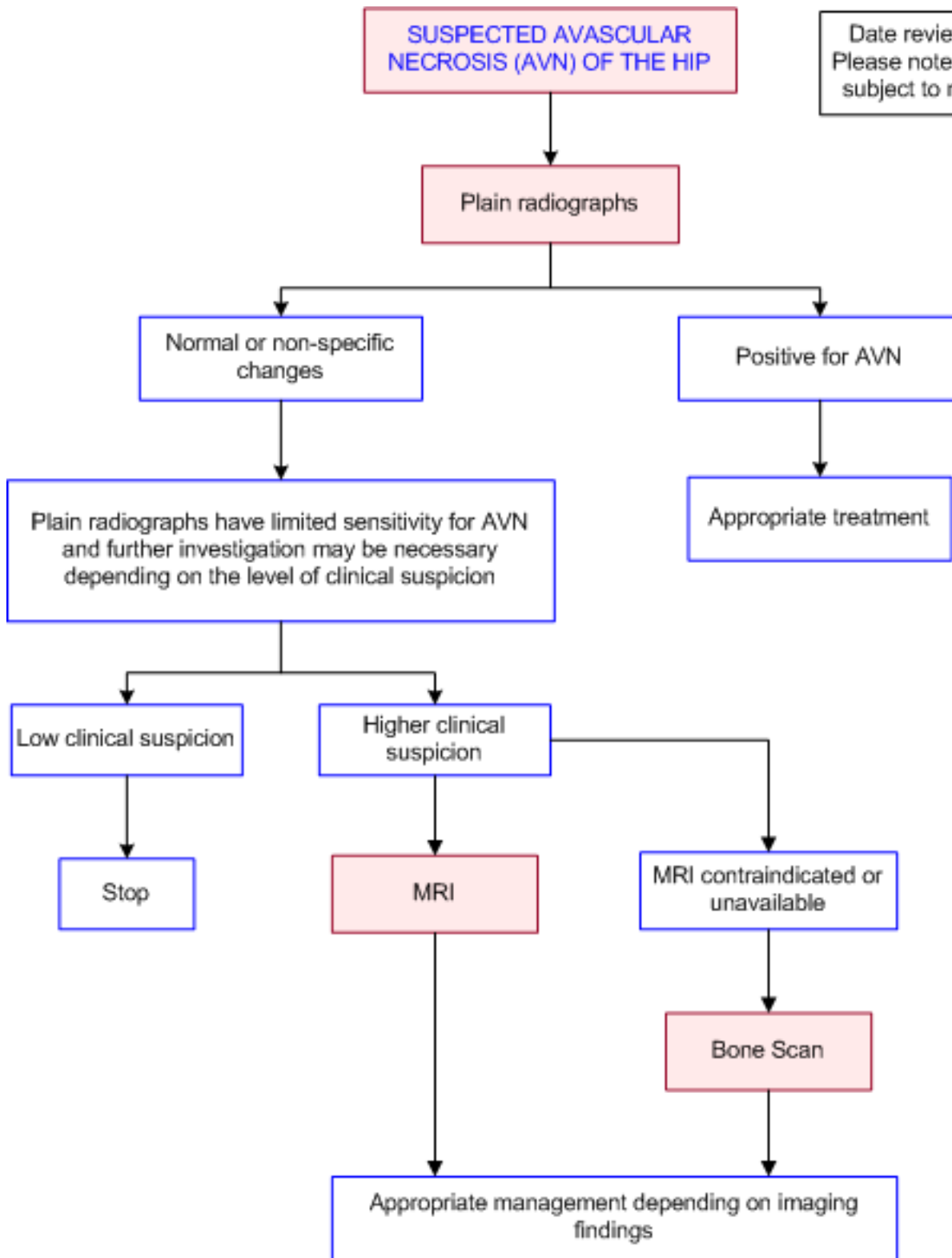


Image Gallery

Note: These images open in a new page



Image 1 (Plain Radiograph): Flattening of the left femoral head is consistent with avascular necrosis.

2



Avascular Necrosis of the Left Femoral Head

Image 2 (Magnetic Resonance Imaging): MRI images of avascular necrosis demonstrating flattening and sclerosis of the superior articular surface of the left femur (arrow). Cortical fragmentation and marrow oedema are present within the femoral head.

3



Avascular Necrosis of Bilateral Femoral Heads

Image 3 (Magnetic Resonance Imaging): Coronal T1 imaged showing bilateral avascular necrosis of differing age.

4



Avascular Necrosis of the Femoral Head

Image 4 (H&E, x2.5): Histological section showing the features of avascular bone necrosis. There is necrosis of the bony trabeculae with empty lacunae and almost complete absence of haemopoietic marrow elements.

Teaching Points

- Avascular necrosis refers to death of bone and marrow cells due to interruption of the blood supply, with resultant mechanical failure and often joint destruction
- Initial imaging is with plain films
- If there is ongoing clinical suspicion with normal plain film radiography, MRI is the most accurate imaging modality
- Nuclear scintigraphy is a reasonable alternative to MRI

Avascular Necrosis (AVN) of the Hip

- AVN refers to death of bone and marrow cells due to interruption of their blood supply, with resultant mechanical failure and often joint destruction
- A number of traumatic and non-traumatic factors can cause AVN [1](#)
- Traumatic
 - Femoral neck fracture
 - Hip dislocation
- Non-traumatic
 - Corticosteroid use
 - Alcohol use
 - Systemic Lupus Erythematosus
 - Collagen storage disorders
 - Chemotherapy

- Radiotherapy
- Pregnancy
- The disease may involve both femoral heads in up to 72% of patients [2,3](#)

Plain Radiographs

- Initial study of choice for suspected avascular necrosis (anteroposterior (AP) and frog-leg views). [4](#), [5](#) Consider AP pelvis as part of initial investigation as condition may be bilateral
- When standard radiographs demonstrate the classic changes of osteonecrosis (crescent sign or articular collapse) further diagnostic imaging is unwarranted, unless knowledge of asymptomatic AVN in the opposite hip is clinically important [5](#)
- Advantages: inexpensive and readily available
- Limitations: insensitive for detecting early changes [6](#)

Magnetic Resonance Imaging

- Most accurate imaging modality for detection and staging of suspected avascular necrosis, with a reported 88-100% sensitivity and 72-87% specificity [6-11](#)
- Indicated in patients with clinically suspected radiographically occult avascular necrosis [4](#)
- Advantages
 - Superior soft tissue contrast
 - Ability to detect bone marrow changes, including inflammatory and reactive hyperaemic changes, enables early detection of disease [12](#)
 - Offers more specific diagnosis in patients with hip pain of uncertain aetiology [11](#)
 - Allows assessment of the lesion size and location, which are shown to relate to prognosis and need for treatment. [13-16](#) MRI can be used to predict future collapse [17](#)
 - Offers more specific diagnosis in patients with hip pain of uncertain aetiology [18,19](#)
- Disadvantages
 - Not as accurate as CT in evaluating subchondral fracture [20,21](#)
- Recent studies are evaluating the use of an abbreviated MRI examination for its time and cost saving potential [19,22](#)

Three-Phase Bone Scan

- Superior to plain radiographs but inferior to MRI for early detection of avascular necrosis [6,12](#)
- Approximately 75% sensitive and specific for avascular necrosis [7,8](#)
- Useful screening modality if the site of pathology has not been localised
- Improved accuracy with the addition of SPECT [23](#)
- Limitations
 - Poor spatial resolution
 - Lacks specificity [7](#)

Computed Tomography (CT)

- CT is superior to MRI and radiography for detecting subchondral fractures of the femoral head in AVN [20](#)
- May have a role in surgical planning for either osteotomy or joint replacement [24](#)

References

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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