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Diagnostic Imaging Pathways - Knee Pain (Post Traumatic)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult trauma patients with a suspected knee injury. The pathway incorporates the validated Ottawa Knee Rules.

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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

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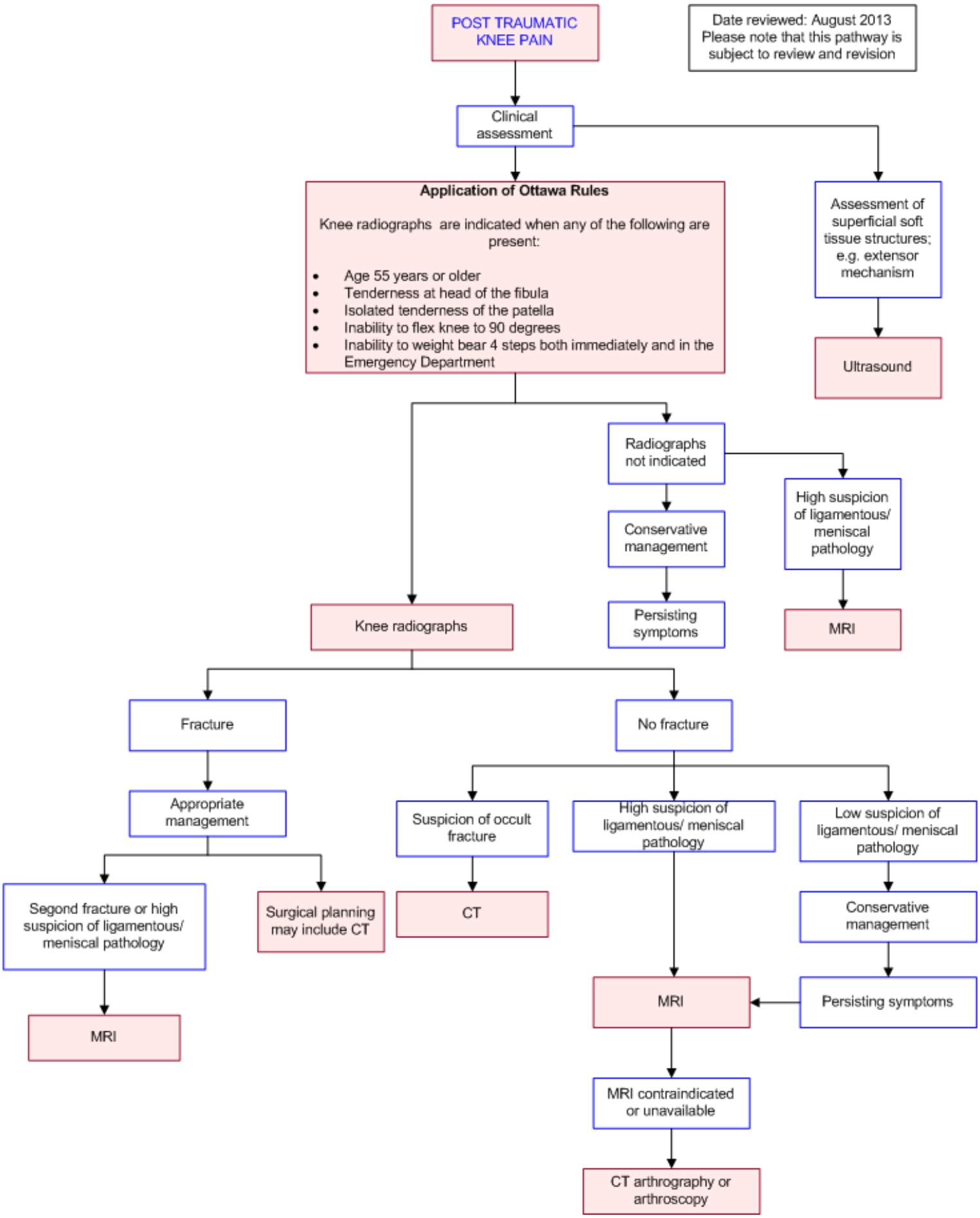

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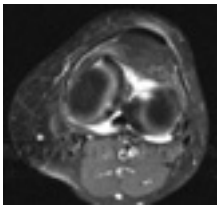
Image Gallery

Note: These images open in a new page

1a

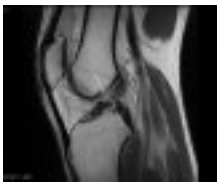


Medial Meniscal Injury

Image 1a and 1b (Magnetic Resonance Imaging): Axial and sagittal images demonstrating a bucket handle tear in the medial meniscus.

1b

2



Anterior Cruciate Ligament Rupture

Image 2 (Magnetic Resonance Imaging): Sagittal proton density image demonstrating an acute rupture of the mid substance of the anterior cruciate ligament (ACL) (arrows).

Teaching Points

- Most people who present with acute knee injuries have soft tissue rather than osseous injuries, and where fracture is present there is often accompanying soft tissue injury 1,2
- Ottawa Rules in acute knee injury in adults: initial plain films of the knee are indicated when any of the following factors are present 3-7
    - Age ? 55
    - Tenderness at the head of the fibula
    - Isolated tenderness of the patella
    - Inability to flex knee to 90 degrees
    - Inability to walk 4 weight bearing steps
- MRI is useful for the detection of ongoing knee instability following trauma to the knee, as it is able to accurately delineate the soft tissues of the joint
- CT has a lesser role in the assessment of post traumatic knee pain, though it is useful in demonstrating subtle bony injury and loose bodies within the knee joint and for pre-operative planning

Clinical Decision Rules for Radiography in Acute Knee Injury

- Two main validated clinical decision rules defining the guidelines for the appropriate use of radiographs in acute knee injuries are

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Ottawa Knee Rules (OKR) 3-7

- Radiography of the knee is indicated in adults if any of the following factors are present
    1. Age 55 years or older
    2. Tenderness at head of fibula
    3. Isolated tenderness of patella
    4. Inability to flex knee to 90 degrees
    5. Inability to walk four weight-bearing steps (defined as any weight transfer during walking) immediately after the injury and in the Emergency Department
- Exclusion criteria: Age 7 days prior to presentation, recent injuries being re-evaluated, and patients with altered levels of consciousness, paraplegia or multiple injuries
- A recent meta-analysis of six studies evaluating 4,249 patients showed a pooled sensitivity of 98.5% and pooled specificity 48.6% 7
- Implementation of the OKR in a 1-year controlled trial of 4 Emergency Departments resulted in 26% reduced radiograph use (versus 1% in control group) without adverse consequences from overlooked fractures 6

Pittsburgh Decision Rules (PDR) 8

- The Pittsburgh rule advises radiographs if
    1. Age 50 years with a fall or injury involving a direct blow or mechanical force
    2. Age 12-50 years with a fall or trauma and inability to walk four full weight-bearing steps in the Emergency Department
- Exclusion criteria: Knee injuries sustained >6 days prior to presentation, patients with only superficial lacerations and abrasions, history of previous surgeries or fractures on the affected knee, and those being reassessed for the same injury
- The PDR has a reported 99% sensitivity and 60-79% specificity for the diagnosis of knee fractures 8,9

- The Ottawa rules have been more extensively investigated in both cohort studies and randomised controlled trials of clinical implementation 6,7
- The Pittsburgh knee rule appears more specific than the Ottawa rule without losing sensitivity and therefore may lead to less unnecessary radiography 10
- Randomised control trials are necessary to definitively answer this question. Both can satisfactorily exclude fracture

Other predictive criteria

- Weber et al (1995) developed a non-validated clinical decision rule that excluded fractures in adults who could walk without limping or if there was a twisting injury to the knee and no joint effusion; omitting radiographs in these instances would reduce radiograph use by 29% without missing fractures 11
- Bauer et al (1995) developed a non-validated clinical decision rule that excluded fractures in the absence of inability to weight-bear or presence of effusion or ecchymosis; omitting radiographs in these instances would reduce radiograph use by 39% without missing fractures 12

Plain Radiography

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- Initial imaging modality of choice for evaluation of post-traumatic knee pain or instability 13,14
- Baseline views are anteroposterior (AP) and lateral; the addition of bilateral oblique views adds sensitivity but not specificity or overall diagnostic accuracy for fracture detection 15
- If the lateral view is normal in the setting of acute trauma a fracture is unlikely 16

Magnetic Resonance Imaging

- If history, examination and initial imaging studies are inconclusive or intra-articular and ligamentous injuries are suspected, MRI is preferred. 13,14 MRI significantly affects the clinical decision-making process and can often prevent unnecessary knee arthroscopy 17-22
- High accuracy in detection of
    - Meniscal tears 20,21,23-25
    - Cruciate ligament tears 20,21,23-25
    - Collateral ligamentous injuries 26,27
    - Osseous and chondral lesions, including occult fractures and dislocations, bone marrow oedema or ‘bone bruise’ and articular cartilage lesions. 28-33 MRI is relatively less accurate in detecting articular cartilage lesions due to lower sensitivity, but a high specificity (97-99% and high negative predictive value (97-98%) make it suitable for the exclusion of cartilage lesions 24,34
- Advantages
    - Superior soft tissue contrast and ability to demonstrate both intra-articular and extra-articular abnormalities in a non-invasive test with no ionising radiation
- Limitations
    - Decreased diagnostic accuracy in patients with multiple injuries of the knee 26
- A brief MRI in selected patients with acute knee injury without a fracture on radiography may reduce costs and potentially increase effectiveness 35

Computed Tomography and Arthrography

- CT, with its superior spatial resolution, is useful in acute knee trauma in 2
    - Severely injured patients where diagnostically sufficient radiographs are difficult to attain
    - Complex knee injuries to reveal fracture anatomy
    - Cases where fracture is suspected but radiographs are negative
    - The assessment of tibial plateau fractures, where it has comparable accuracy to MRI. 33 Along with MRI can improve surgical planning 36
- CT arthrography has a high diagnostic accuracy in detection of articular cartilage pathology and meniscal lesions but is limited by its invasiveness and use of ionising radiation. In practice, arthroscopy is a more useful tool for managing meniscoligamentous injuries than for diagnosing them. 36 It is useful where MRI is unavailable of contraindicated 37

Ultrasonography

- While MRI is diagnostically superior, ultrasound is useful to quickly and inexpensively visualise superficial soft tissue structures and has the advantage of a dynamic evaluation of the knee in active and passive motion
- Useful in the rapid evaluation of tendon lesions, joint effusions, bursitis, and cysts 38
- Accuracy assessing meniscus, ligamental injury and cartilage damage varies widely between users

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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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