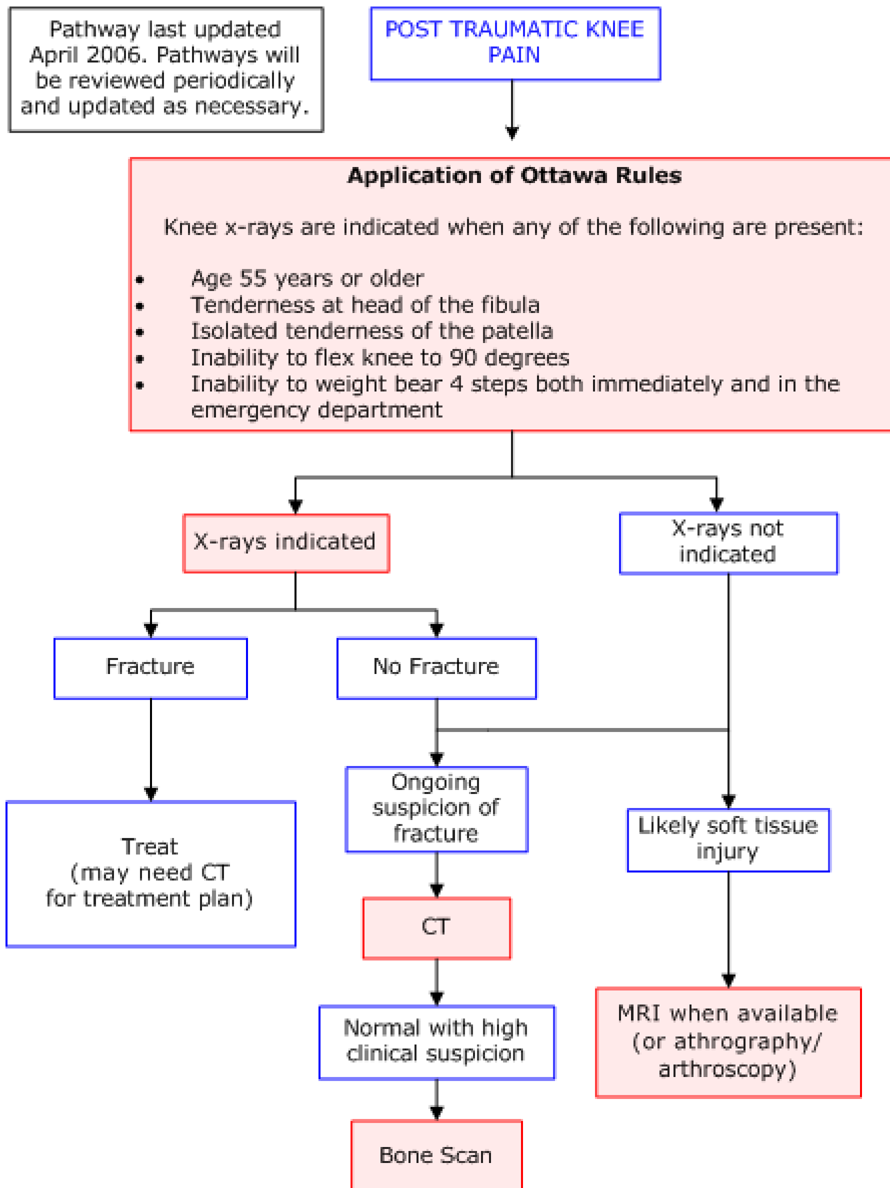

CLINICAL DECISION RULES FOR PLAIN RADIOGRAPHY IN ACUTE KNEE INJURY

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

Ottawa knee rules: 1-4

- Order radiography of the knee 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

Copyright © 2007 Department of Health Western Australia

4. Inability to flex knee to 90 degrees
5. Inability to walk four weight-bearing steps immediately after the injury and in emergency department.

- A recent meta-analysis of six studies evaluating 4,249 patients showed a sensitivity of 98.5% with five studies reporting a sensitivity of 100%. 33

Pittsburgh decision rules: 6

- Characteristics of patients who should undergo radiography after knee trauma: Blunt trauma or a fall as mechanism of injury plus either of the following:
  1. Age younger than 12 years old or older than 50 years
  2. Inability to walk four weight-bearing steps in the emergency department.
- 99% sensitive and 60-79% specific for the diagnosis of knee fractures. 5,6

According to studies published by Bauer 7 **and Weber** 8**:**

- Clinically significant fracture can be excluded in patients older than 18 years old who can walk without limping or if there was a twisting injury to the knee and no joint effusion.

PLAIN RADIOGRAPHY

- Initial imaging modality of choice for evaluation of post-traumatic knee pain or instability. 9
- Four views (antero-posterior, lateral and both obliques) may detect subtle fractures or bony avulsions caused by detachments of the cruciate or collateral ligaments and can confirm the direction of dislocation. 9-11

ARTHROGRAPHY

- 50-75% overall accuracy in the diagnosis of ligament and meniscal injuries of the knee. 12-14
- Has been largely replaced by MRI.
- Limitations: examination is limited to the surface evaluation of the meniscus.
- Disadvantages: invasive, intra-articular injection of contrast media, ionising radiation and potential complications.

MAGNETIC RESONANCE IMAGING

- Investigation of choice for evaluation of post-traumatic knee pain or instability, when available. 15

Copyright © 2007 Department of Health Western Australia

- High accuracy in detection of:
    1. Meniscal tears 16,17
    2. Cruciate ligament tears 16-18
    3. Collateral ligamentous injuries 19
    4. Bone bruises 20,22
    5. Osteochondral defects 21,22
    6. Chondromalacia patellae as well as less common pathologies
- Cost-effective in reducing the number of diagnostic arthroscopies. 23-25
- Advantages: non-invasive, no ionising radiation, superior soft tissue contrast, ability to demonstrate both intra-articular and extra-articular abnormalities, multiplanar imaging and no anatomical restrictions to access.
- Limitations:
    - Decreased diagnostic accuracy in patients with multiple injuries of the knee. 19,26
    - Limited availability and high expense.

COMPUTED TOMOGRAPHY

- Comparable accuracy to that of MRI for the assessment of tibial plateau fractures. 27
- Useful in looking for loose bodies and retro-patellar problems.
- Multi-slice CT arthrography has a high diagnostic accuracy in detection of anterior cruciate ligament tears and associated meniscal lesions and articular cartilage pathology. 28
- Some institutions are using multi-slice CT arthrography as an alternative to MRI because of its limited availability. 28

BONE SCAN

- Can be used to detect radiographically occult post-traumatic bone injuries. 29
- Used extensively to assess chronic knee pathology. 30
- Focal increased uptake is noted at sites of bone repair such as in fracture sites, torn menisci, bone infarctions and avulsions of ligamentous insertions. 29-32
- Limitations: non-specific, and inferior in defining anatomical extent of injury.

REFERENCES

1. Stiell IG, Greenberg GH, Wells GA, et al. **Derivation of decision rule for the use of radiography in acute knee injuries.** Ann Emerg Med 1995;26:405-13. (Level II evidence). Click here to view reference

Copyright © 2007 Department of Health Western Australia

2. Stiell IG, Greenberg GH, Wells GA, et al. **Prospective validation of a decision rule for the use of radiography in acute knee injuries.** JAMA 1996;275:611-5. (Level I/II evidence). Click here to view reference
3. Stiell IG, Wells GA, Hoag RH, et al. **Implementation of the Ottawa knee rule for the use of radiography in acute knee injuries.** JAMA 1997;278(23):2075-9. (Level I/II evidence). Click here to view reference
4. Emparanza JI, Aginaga JR. **Validation of the Ottawa knee rules.** Ann Emerg Med 2001;38(4):364-8. (Level II evidence). Click here to view reference
5. Seaberg DC, Yealy DM, Lukens T, et al. **Multicenter comparison of two clinical decision rules for the use of radiography in acute, high-risk knee injuries.** Ann Emerg Med 1998;32:8-13. (Level II evidence). Click here to view reference
6. Seaberg DC, Jackson R. **Clinical decision rule for knee radiographs.** Am J Emerg Med 1994;12:541-3. (Level II evidence). Click here to view reference
7. Bauer SJ, Hollander JE, Fuchs SH, et al. **A clinical decision rule in the evaluation of acute knee injuries.** J Emerg Med 1995;13(5):611-5. (Level II/III evidence)
8. Weber JE, Jackson Re, Peacock WF, et al. **Clinical decision rules discriminate between fractures and nonfractures in acute isolated knee trauma.** Ann Emerg Med 1995;26:429-33. (Level II/III evidence)
9. Potter HG. **Imaging of the multiple-ligament-injured knee.** Clinics Sports Medicine 2000;19(3):425-41.
10. Gray SD, Kaplan PA, Dussault RG, et al. **Acute knee trauma: how many plain film views are necessary for the initial examination?** Skeletal Radiology 1997;26:298-302. (Level II/III evidence)
11. Delzell PB, Schils JP, Recht MP. **Subtle fractures about the knee: innocuous-appearing yet indicative of internal derangement.** AJR 1996;167:699-703. (Pictorial essay)
12. Kulthanan T, Noiklang P. **Arthrography and arthrotomy of the knee in sports injuries.** Br J Sp Med 1993;27(2):87-9. (Level III evidence)
13. Bonamo JJ, Shulman G. **Double contrast arthrography of the knee, a comparison to clinical diagnosis and arthroscopic findings.** Orthopaedics (PCM) 1988;11:1041-6.
14. Selesnick FH, Noble HB, Bachman DC, et al. **Internal derangement of the knee: diagnosis by arthrography, arthroscopy, and arthrotomy.** Clin Orthop 1985;198:26-30. (Level III/IV evidence)
15. Kaplan PA, Dussault RG. **Magnetic resonance imaging of the knee: menisci, ligament, tendons.** Top Magn Reson Imaging 1993;5(4):228-48.
16. Munk B, Madsen F, Lundorf E, et al. **Clinical magnetic resonance imaging and arthroscopic findings in knees: a comparative prospective study of meniscus, anterior cruciate ligament and cartilage lesions.** Arthroscopy 1998;14(2):171-5. (Level II/III evidence)
17. Fischer SP, Fox JM, Del Pizzo W, et al. **Accuracy of diagnoses from magnetic resonance imaging of the knee: a multicenter analysis of one thousand and fourteen patients.** J Bone Joint Surg 1991;73-A(1):2-10. (Level II/III evidence)

Copyright © 2007 Department of Health Western Australia

18. Ha TPT, Li KCP, Beaulieu CF, et al. **Anterior cruciate ligament injury: fast spin-echo MR imaging with arthroscopic correlation in 217 examinations.** AJR 1998;170:1215-9. (Level III evidence)
19. Rubin DA, Kettering JM, Towers JD, et al. **MR imaging of knees having isolated and combined ligament injuries.** AJR 1998;170:1207-13. (Level II/III evidence)
20. Kapelov SR, Teresi LM, Bradley WG, et al. **Bone contusions of the knee: increased lesion detection with fast spin-echo MR imaging with spectroscopic fat saturation.** Radiology 1993;189:901-4. (Level II/III evidence)
21. Potter HG, Linklater JM, Allen AA, et al. **Magnetic resonance imaging of articular cartilage in the knee.** J Bone Joint Surgery 1998;80-A(9):1276-84. (Level III/IV evidence)
22. Mink JH, Deutsch AL. **Occult cartilage and bone injuries of the knee: detection, classification and assessment with MR imaging.** Radiology 1989;170:823-9. (Level IV evidence)
23. Ruwe PA, McCarthy SM. **Cost-effectiveness of magnetic resonance imaging of the knee.** MRI Clinics of North America 1994;2(3):475-9. (Level II/III evidence)
24. Bui-Mansfield LT, Youngberg RA, Warme W, et al. **Potential cost savings of MR imaging obtained before arthroscopy of the knee: evaluation of 50 consecutive patients.** AJR 1997;168:913-8. (Level II evidence). Click here to view reference
25. Vincken PWJ, ter Baak BPM, van Erkell AR, et al. **Effectiveness of MR imaging in selection of patients for arthroscopy of the knee.** Radiology 2002;223:739-46. (Level II evidence). Click here to view reference
26. De Smet AA, Graf BK. **Meniscal tears missed on MR imaging: relationship to meniscal tear patterns and anterior cruciate ligament tears.** AJR 1994;162;905-11. (Level III evidence)
27. Kode L, Lieberman JM, Motta AO, et al. **Evaluation of tibial plateau fractures: efficacy of MR imaging compared with CT.** AJR 1994;163:141-7. (Level IV evidence)
28. Van de Berg BC, Lecouvet FE, Polivache P, et al. **Anterior cruciate ligament tears and associated meniscal lesions: assessment at dual-detector spiral CT arthrography.** Radiology 2002;223:403-9. (Level II/III evidence)
29. Giammarile F, masciocchi C, Barile A, et al. **Three-phase radionuclide bone imaging and magnetic resonance imaging detection of occult knee fractures in athletes.** Eur J Nucl Med 1994;21(6):493-6. (Level III evidence)
30. Mooar P, Gregg J, Jacobstein J. **Radionuclide imaging in internal derangements of the knee.** Am J Sports Med 1987;15:132-7. (Level II/III evidence)
31. Ryan PJ, Reddy K, Fleetcroft J. **A prospective comparison of clinical examination, MRI, bone SPECT, and arthroscopy to detect menisceal tears.** Clin Nucl Med 1998;23(12):803-6. (Level II evidence)
32. Marks P, Goldberg JA, Vezina EC, et al. **Subchondral bone infarctions in acute ligamentous knee injuries demonstrated on bone and magnetic resonance imaging.** J Nucl Med 1992;33:516-20. (Level II/III evidence)

Copyright © 2007 Department of Health Western Australia

33. Bachmann LM, Haberzeth S, Steurer J, ter Riet G. **The accuracy of the Ottawa knee rule to rule out knee fractures: a systematic review.** Ann Intern Med 2004; 140:121-4. (Level I evidence) Click here to view reference

FURTHER READING

1. Kaufman D, Leung J. **Evaluation of the patient with extremity trauma: an evidence based approach.** Emerg Med Clinics North America 1999;17(1):77-95.
2. Boden BP, Pearsall AW, Garrett WE Jr, et al. **Patellofemoral instability: evaluation and management.** J Am Acad Orthop Surg 1997;5:47-57.

Website

For more information go to www.imagingpathways.health.wa.gov.au

Copyright

© Copyright 2007, Department of Health Western Australia. All Rights Reserved.

This web site and its content has been prepared by The Department of Health, Western Australia. The information contained on this web site is protected by copyright.

Legal Notice

Please remember that this leaflet is intended as general information only. It is not definitive and The Department of Health, Western Australia can not accept any legal liability arising from its use. The information is kept as up to date and accurate as possible, but please be warned that it is always subject to change.