

**Acute Trauma to the Knee  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
1. Verma A, Su A, Golin AM, O'Marrah B, Amorosa JK. A screening method for knee trauma. <i>Acad Radiol</i> 2001; 8(5):392-397.	10	214	Prospectively evaluate the efficacy of a single conventional radiograph of the knee in the detection of signs of knee fractures in adults with acute knee trauma.	Single lateral view has sensitivity of 100% (95% CI = 94.3, 100) and probability of not having a fracture if lateral view is normal (NPV) was 100%. This would reduce need for additional radiographs by 67%.	2
2. Stiell IG, Greenberg GH, Wells GA, et al. Derivation of a decision rule for the use of radiography in acute knee injuries. <i>Ann Emerg Med</i> 1995; 26(4):405-413.	15	1,047 patients 127 patients examined by 2 physicians	Prospectively administered survey in two emergency departments to derive a sensitive decision rule for selective use of radiographs in acute knee injuries.	One or more of the following variables would have led to a 28.0% relative reduction in the use of radiograph (68.6%-49.4%): age 55 years or older, tenderness at fibular head or patella, inability to flex to 90°, and inability to bear weight both immediately and in the emergency department (4 steps). Decision rule is not validated prospectively and has not undergone an implementation trial.	2
3. Stiell IG, Wells GA, McDowell I, et al. Use of radiography in acute knee injuries: need for clinical decision rules. <i>Acad Emerg Med</i> 1995; 2(11):966-973.	10 and 15	1,967 retrospective review 1,040 prospective study 120 patients examined by 2 physicians	Two-stage study of adults with acute knee injuries: 1. To study efficiency of the current use of radiograph in acute knee injuries. 2. To assess clinicians estimate of probability of a knee or patellar fracture and to determine the potential for decision rules to improve efficiency.	1. Of 74.1% patients having a radiograph for an acute knee injury, only 5.2% had a fracture. Of 1,727 knee and patella radiographs ordered, 92.4% were negative for fracture. 2. Experienced physicians predicted the probability of fracture to be 0 or 0.1 for 75.6% of patients. ER physicians order radiographs for patients with acute knee injuries, even though they can determine between fracture and non-fracture cases and expect most of the radiographs to be normal.	1
4. Weber JE, Jackson RE, Peacock WF, Swor RA, Carley R, Larkin GL. Clinical decision rules discriminate between fractures and nonfractures in acute isolated knee trauma. <i>Ann Emerg Med</i> 1995; 26(4):429-433.	15	242	Prospective survey of emergency department patients over a 7-month period to develop criteria that optimize clinical decisions making in the use of radiography in patients over age 17, with isolated injuries within previous 24 hours.	Patients able to walk without limping and patients having had a twist injury without effusion had not experienced a fracture. Sensitivity for detecting fracture was 1.0 and specificity was .337. Prospective validation needed.	2
5. Fishwick NG, Learmonth DJ, Finlay DB. Knee effusions, radiology and acute knee trauma. <i>Br J Radiol</i> 1994; 67(802):934-937.	10	60	To evaluate radiographs with arthroscopic findings; if normal examination excluded pathology.	Radiographs do not reliably assess internal derangement of the knee.	3
6. Saxena AC, Norris RL, Finstuen K, et al. The role of knee radiographs in the emergency department: a prospective study [abstract]. <i>Ann Emerg Med</i> 1992; 21:658.	10	616	Prospective study to determine the role of knee radiographs in the emergency department.	Vast majority of knee radiographs are normal. Radiographs altered patient management in 8.3% of cases. Unsuspected fractures were discovered in 1.6% of patients. Radiographs were normal in 5.2% of patients in whom fractures were clinically suspected.	2

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7. Seaberg DC, Jackson R. Clinical decision rule for knee radiographs. <i>Am J Emerg Med</i> 1994; 12(5):541-543.	15	201 retrospective 133 prospective	Retrospective chart review and prospective validation study to develop a decision rule for ordering knee radiographs in patients with acute knee injuries.	<ul style="list-style-type: none"> <li>Logistic regression analysis: Fall or blunt trauma mechanism yielded sensitivity of 92%, specificity of 57%, false-negative rate of 0.9%. The addition of inability to ambulate and age (less than 12 or older than 50 years of age) yielded a sensitivity of 92% with a specificity of 63%.</li> <li>Prospective study: Combination of a fall or blunt trauma with either inability to ambulate or age less than 12 years and older than 50 years was 100% sensitive with a specificity of 79%.</li> <li>Number of radiographs could be reduced by 78% with decision rule.</li> </ul>	2
8. Neubauer T, Wagner M, Potschka T, Riedl M. Bilateral, simultaneous rupture of the quadriceps tendon: a diagnostic pitfall? Report of three cases and meta-analysis of the literature. <i>Knee Surg Sports Traumatol Arthrosc</i> 2007; 15(1):43-53.	11	28 cases analyzed from among 105 identified	To ascertain the review of the English and German literature retrieved 105 cases of bilateral, simultaneous quadriceps tendon rupture and in 32 patients (30.5%) the correct diagnosis was established with delay.	A direct association between the rate of risk factors and the rupture form was not seen (P=0.5). Overall diagnostic delay lasted 64.7 days on an average (traumatic ruptures 67.7 days/spontaneous ruptures 58.7 days) with this period being longer than 2 weeks in 51.9% and longer than 3 months in 33.3% of patients. The correct diagnosis of bilateral quadriceps tendon rupture was established in 60.7% (n=17/28) by history and clinical examination alone.	3
9. Stiell IG, Greenberg GH, Wells GA, et al. Prospective validation of a decision rule for the use of radiography in acute knee injuries. <i>JAMA</i> 1996; 275(8):611-615.	15	Convenience sample of 1,096 of 1,251 adults 124 patients examined by 2 physicians	Prospectively administered survey in two emergency departments to validate previously derived decision rule for the use of radiography in patients with acute knee injury.	Decision rule has sensitivity in 1.0 for identifying clinically important fractures. Physicians correctly interpreted the decision rule in 96%. The potential relative reduction in the use of radiograph was estimated to be 28%. The probability of fracture, if the decision rule was “negative” was estimated to be 0%. Prospective validation shows decision rule to be 100% sensitive.	1
10. Bachmann LM, Haberzeth S, Steurer J, ter Riet G. The accuracy of the Ottawa knee rule to rule out knee fractures: a systematic review. <i>Ann Intern Med</i> 2004; 140(2):121-124.	11	11 studies (6 involving 4,249 adult patients were used for analysis) 2 reviewers	Articles were included if they reported enough information to determine the sensitivity and specificity of the Ottawa knee rule for detecting fractures confirmed either radiologically or in combination with follow-up.	<ul style="list-style-type: none"> <li>Sensitivity was 98.5%.</li> <li>Specificity was 48.6%.</li> <li>Negative likelihood ratio was 0.05.</li> </ul>	2

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11. Jackson JL, O'Malley PG, Kroenke K. Evaluation of acute knee pain in primary care. <i>Ann Intern Med</i> 2003; 139(7):575-588.	11	217 studies reviewed	Meta-analysis to determine the role of radiologic procedures in evaluating common causes of acute knee pain: fractures, meniscal or ligamentous injuries, osteoarthritis, and pseudogout.	Among the five decision rules for deciding when to use radiographs in knee fractures, the Ottawa knee rules (injury due to trauma and age >55 years, tenderness at the head of the fibula or the patella, inability to bear weight for 4 steps, or inability to flex the knee to 90°), have the strongest supporting evidence. A careful physical examination should be sufficient to decide whether to refer patients with potential meniscal and ligament injuries, and we prefer clinical criteria rather than radiographs for evaluating osteoarthritis. We do not recommend using radiographs to diagnose pseudogout.	2
12. Jenny JY, Boeri C, El Amrani H, et al. Should plain X-rays be routinely performed after blunt knee trauma? A prospective analysis. <i>J Trauma</i> 2005; 58(6):1179-1182.	15	138 (1 <sup>st</sup> stage) 178 (2 <sup>nd</sup> stage)	Prospective analysis to determine if number of radiographs could be reduced without sacrificing diagnostic performance by applying the Ottawa rules to patients presenting with knee trauma.	Ottawa rules allowed decreasing the number of radiographs performed after a knee trauma by 35% with sensitivity for a knee fracture detection of 100%.	2
13. Matteucci MJ, Roos JA. Ottawa Knee Rule: a comparison of physician and triage-nurse utilization of a decision rule for knee injury radiography. <i>J Emerg Med</i> 2003; 24(2):147-150.	15	134	Compare application of the Ottawa knee rules by triage nurses and physicians.	Radiographs were ordered on all patients. Four fractures (3%) were detected. No fractures were missed by physicians or nurses.	2
14. Ketelslegers E, Collard X, Vande Berg B, et al. Validation of the Ottawa knee rules in an emergency teaching centre. <i>Eur Radiol</i> 2002; 12(5):1218-1220.	15	261	Prospective patient survey to determine the value of the Ottawa knee rules when applied by users with different levels of clinical training.	Ottawa knee rules had sensitivity and NPV of 1.00. Variable degree of medical competence of the users did not alter the accuracy of the rules. Application of the rules would have reduced knee radiography requests by 25%.	2
15. Shepherd L, Abdollahi K, Lee J, Vangsness CT, Jr. The prevalence of soft tissue injuries in nonoperative tibial plateau fractures as determined by magnetic resonance imaging. <i>J Orthop Trauma</i> 2002; 16(9):628-631.	13	20	Prospective clinical study to determine the incidence of meniscus tears and complete ligament disruption in nondisplaced and minimally displaced tibial plateau fractures as determined by MRI.	90% MRI diagnosed significant injuries to the soft-tissues, including 80% with meniscal tears, and 40% with complete ligament disruptions.	3

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16. Frobell RB, Lohmander LS, Roos HP. Acute rotational trauma to the knee: poor agreement between clinical assessment and magnetic resonance imaging findings. <i>Scand J Med Sci Sports</i> 2007; 17(2):109-114.	13	159	To determine the incidence of anterior cruciate ligament (ACL) injuries in the general population; the pathology associated with a knee sprain verified by MRI; and the agreement between clinical findings and MRI.	The annual incidence of MRI verified ACL injuries were 0.81/1,000 inhabitants aged 10-64 years. 56% (n=89) of those included had sustained an ACL injury of whom 38% had an associated medial meniscus tear. There was a poor agreement between initial clinical antero-posterior laxity and MRI verified presence of an ACL tear (kappa=0.281). Every second patellar dislocation was diagnosed as a ligament injury. Findings indicate that the incidence of ACL injuries is higher than previously described. Study also shows that the first clinical exam after an acute knee trauma has low diagnostic value.	2
17. Chissell HR, Allum RL, Keightley A. MRI of the knee: its cost-effective use in a district general hospital. <i>Ann R Coll Surg Engl</i> 1994; 76(1):26-29.	15	175 patients 79 had arthroscopy	Cost analysis to evaluate the relative costs of MRI, arthroscopy and conservative treatment.	MRI allows a non-invasive and accurate means of visualizing the knee joint and allows the surgeon to reserve arthroscopy for patients who would definitely benefit from it.	2
18. Kaplan PA, Dussault RG. Magnetic resonance imaging of the knee: menisci, ligaments, tendons. <i>Top Magn Reson Imaging</i> 1993; 5(4):228-248.	12	N/A	Review MRI of the knee: menisci, ligaments, tendons.	Overall accuracy of MRI can reach approximately 94% and can effectively replace arthroscopy for evaluation of meniscal and ligament tears.	4
19. White LM, Schweitzer ME, Deely DM, Morrison WB. The effect of training and experience on the magnetic resonance imaging interpretation of meniscal tears. <i>Arthroscopy</i> 1997; 13(2):224-228.	13	30 patients 10 reviewers	To evaluate effects of exposure and training in MRI interpretation for meniscal pathology.	<ul style="list-style-type: none"> <li>• For reviewers with 4 or more years of training and 3 months of formal MRI experience: accuracy (range 78%-88%), sensitivity (range 79%-88%), and specificity (range 72%-94%) results were high, and intraobserver agreement was moderate to high (range 0.49-0.77).</li> <li>• Accuracy (range 63%-82%), sensitivity (range 58%-79%), and specificity (range 58%-72%) results of reviewers with less experience and training were lower, with higher intraobserver variability.</li> <li>• Experience and training are important for accurate and reliable MRI interpretation.</li> </ul>	2
20. De Smet AA, Tuite MJ. Use of the "two-slice-touch" rule for the MRI diagnosis of meniscal tears. <i>AJR</i> 2006; 187(4):911-914.	10	174	Review medical records of patients who had MRI and knee arthroscopy to determine if using the "two-slice-touch" rule increases PPV for diagnosing meniscal tear and to compare sensitivity and specificity using fast spin-echo imaging with previously reported studies.	The "two-slice-touch" rule increases PPV for diagnosing meniscal tear, and this was statistically significant for the lateral meniscus. Accuracy with fast spin-echo imaging was comparable to that reported in previous studies with spin-echo imaging.	2

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21. Ghanem I, Abou Jaoude S, Kharrat K, Dagher F. Is MRI effective in detecting intraarticular abnormalities of the injured knee? <i>J Med Liban</i> 2002; 50(4):168-174.	9	217	Validity of MRI in detecting intra-articular abnormalities in patients who sustained an injury of their knee, by comparing its findings to those of arthroscopy.	MRI was 95.39% and 99.08% accurate for anterior and posterior cruciate ligament ruptures respectively, 85.25% and 90.78% for medial and lateral meniscal tears respectively, and 91.24% for injury of the articular cartilage.	2
22. Magee T, Williams D. 3.0-T MRI of meniscal tears. <i>AJR</i> 2006; 187(2):371-375.	9	100 patients 2 reviewers	Retrospective study to evaluate the sensitivity and specificity of 3.0-T MRI compared with arthroscopy in the detection of meniscal tears.	MRI of the knee at 3.0-T is sensitive (96%) and specific (97%) compared with arthroscopy in the detection of meniscal tears. Findings at 3.0-T compare favorably with results at 1.5-T or lower field strength.	2
23. Oei EH, Nikken JJ, Verstijnen AC, Ginai AZ, Myriam Hunink MG. MR imaging of the menisci and cruciate ligaments: a systematic review. <i>Radiology</i> 2003; 226(3):837-848.	11	29 articles	To systematically review and synthesize published data on the diagnostic performance of MRI of the menisci and cruciate ligaments and to assess the effect of study design characteristics and magnetic field strength on diagnostic performance.	Higher magnetic field strength modestly improves diagnostic performance, but a significant effect was demonstrated only for ACL tears.	2
24. Vaz CE, Camargo OP, Santana PJ, Valezi AC. Accuracy of magnetic resonance in identifying traumatic intraarticular knee lesions. <i>Clinics</i> 2005; 60(6):445-450.	10	300	Patients with a clinical diagnosis of traumatic intra-articular knee lesions underwent prearthroscopic MRI to evaluate its diagnostic accuracy in identifying traumatic intra-articular knee lesions.	<ul style="list-style-type: none"> <li>• Medial meniscus: sensitivity 97.5%, specificity 92.9%, PPV 93.9%, positive negative value 97%.</li> <li>• Lateral meniscus: sensitivity 91.9%, specificity 93.6%, PPV 92.7%, positive negative value 92.9%.</li> <li>• ACL: sensitivity 99.0%, specificity 95.9%, PPV 91.9%.</li> <li>• Posterior cruciate ligament: sensitivity 100%, specificity 99%, PPV 80.0%.</li> <li>• Articular cartilage: sensitivity 76.1%, specificity 94.9%, PPV 94.7%.</li> <li>• MRI is satisfactory for all except for articular cartilage lesions.</li> </ul>	2
25. George J, Saw KY, Ramlan AA, Packya N, Tan AH, Paul G. Radiological classification of meniscocapsular tears of the anterolateral portion of the lateral meniscus of the knee. <i>Australas Radiol</i> 2000; 44(1):19-22.	9	50	To compare MRI with arthroscopy for anterolateral meniscal pathology.	MRI is sensitive if interpretation is performed with understanding of anatomy.	3
26. Sanders TG, Paruchuri NB, Zlatkin MB. MRI of osteochondral defects of the lateral femoral condyle: incidence and pattern of injury after transient lateral dislocation of the patella. <i>AJR</i> 2006; 187(5):1332-1337.	13	25	To determine the incidence and location of lateral femoral condyle osteochondral injuries after transient lateral dislocation of the patella.	Osteochondral defects of the lateral femoral condyle are common sequela injuries after transient lateral dislocation of the patella. A significant number of osteochondral injuries involve the midlateral weight-bearing portion more posterior than would be expected.	3

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27. Alioto RJ, Browne JE, Barnhouse CD, Scott AR. The influence of MRI on treatment decisions regarding knee injuries. <i>Am J Knee Surg</i> 1999; 12(2):91-97.	10	85	To examine whether MRI findings would provide information that was useful for treatment of knee injuries. Three surgeons completed a questionnaire.	MRI useful only for other than ACL evaluation. MRI is useful for the decision-making process when the pathology involves the menisci or chondral surfaces. MRI changed treatment plan of the orthopedist in 18% of patients and resulted in the prolongation of symptoms in 4%.	3
28. Mori R, Ochi M, Sakai Y, Adachi N, Uchio Y. Clinical significance of magnetic resonance imaging (MRI) for focal chondral lesions. <i>Magn Reson Imaging</i> 1999; 17(8):1135-1140.	10	35	Examine focal chondral lesions of the femoral surface of the tibiofemoral joint to determine the clinical value of MRI. Full-thickness defects were detected prospectively (93%) with conventional MRIs initially administered for observation reference of ligaments and menisci.	Routine MRIs are sufficient in detecting severe chondral lesions. Optimized images are useful in facilitating the recently developed therapeutic approaches and follow-up studies for articular cartilage defects.	3
29. Muellner T, Nikolic A, Kubiena H, Kainberger F, Mittlboeck M, Vecsei V. The role of magnetic resonance imaging in routine decision making for meniscal surgery. <i>Knee Surg Sports Traumatol Arthrosc</i> 1999; 7(5):278-283.	9	149	To identify role of MRI vs arthroscopy for meniscal pathology. Patients were examined clinically and by MRI. Group A (n=62) had arthroscopic surgery and group B (n=87) treated conservatively.	No significant difference existed between two groups with regard to gender (P=0.1), injury pattern (P=0.44), or period between injury and first clinical exam (P=0.5). MRI signal alterations were higher in group A than in group B (P=0.001). In acutely injured patients MRI helps to establish an accurate diagnosis, and in cases of positive MRI findings in a symptomatic patient, the surgeon should not wait 4-6 weeks but should immediately recommend surgery.	2
30. 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. <i>Arthroscopy</i> 1998; 14(2):171-175.	9	61 knees	Prospective study to compare MRI and clinical findings with arthroscopy.	MRI twice the accuracy and predictive value of clinical examination for meniscal tears. MRI and clinical findings are valuable to decrease number of diagnostic arthroscopies.	2
31. Rappeport ED, Wieslander SB, Stephensen S, Lausten GS, Thomsen HS. MRI preferable to diagnostic arthroscopy in knee joint injuries. A double-blind comparison of 47 patients. <i>Acta Orthop Scand</i> 1997; 68(3):277-281.	9	47	Double-blind set-up to compare low field MRI with arthroscopy for diagnosing accuracy of meniscal tears and ACL injuries.	<ul style="list-style-type: none"> <li>• Accuracy rates of MRI for evaluating medial meniscus, lateral meniscus and ACL were 77%, 91% and 96%, respectively with arthroscopy as gold standard.</li> <li>• Accuracy of arthroscopy was 74%, 91% and 96% with MRI as gold standard.</li> <li>• MRI found the indication for treatment in 18/21 patients who were treated at the arthroscopy. MRI low field is valuable and cost-effective to reduce negative diagnostic arthroscopies.</li> </ul>	2

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32. Suarez-Almazor ME, Kaul P, Kendall CJ, Saunders LD, Johnston DW. The cost-effectiveness of magnetic resonance imaging for patients with internal derangement of the knee. <i>Int J Technol Assess Health Care</i> 1999; 15(2):392-405.	15	241	Retrospective cohort study in 3 clinics to evaluate the use of arthroscopy among patients with internal derangement of the knee, and to estimate cost-effectiveness of MRI.	MRI is cost-effective in reducing arthroscopy in patients with internal derangement of the knee.	2
33. Weinstabl R, Muellner T, Vecsei V, Kainberger F, Kramer M. Economic considerations for the diagnosis and therapy of meniscal lesions: can magnetic resonance imaging help reduce the expense? <i>World J Surg</i> 1997; 21(4):363-368.	9	823	To evaluate MRI as a cost savings diagnostic tool for meniscal tears compared with arthroscopy.	Overall values for MRI of the medial and lateral menisci combined were: accuracy 96%, PPV 93%, NPV 98%, sensitivity 96%, and specificity 90%. MRI is accurate and cost effective as a diagnostic tool for meniscal pathology.	2
34. Carmichael IW, MacLeod AM, Travlos J. MRI can prevent unnecessary arthroscopy. <i>J Bone Joint Surg Br</i> 1997; 79(4):624-625.	9	324 arthroscopy 66 MRI	Retrospective study to compare MRI with arthroscopy for diagnostic purposes in the practice of four orthopaedic consultants.	MRI is valuable to reduce costs compared with diagnostic arthroscopies.	2
35. Elvenes J, Jerome CP, Reikeras O, Johansen O. Magnetic resonance imaging as a screening procedure to avoid arthroscopy for meniscal tears. <i>Arch Orthop Trauma Surg</i> 2000; 120(1-2):14-16.	9	41	To evaluate role of MRI as a screening tool for meniscal tears compared with arthroscopy.	Sensitivity, specificity, PPV and NPV for MRI for the medial meniscus were 100%, 77%, 71% and 100%, respectively, while the values for the lateral meniscus were 40%, 89%, 33% and 91%, respectively. Accuracy for MRI of the medial and lateral menisci combined was 84%. There is a high predictive value for negative MRI; therefore, MRI is useful to exclude patients from unnecessary arthroscopy.	2
36. Munshi M, Davidson M, MacDonald PB, Froese W, Sutherland K. The efficacy of magnetic resonance imaging in acute knee injuries. <i>Clin J Sport Med</i> 2000; 10(1):34-39.	10	23	Prospective double-blind study to determine efficacy of MRI in acute knee injuries using arthroscopy as gold standard.	Sensitivity and specificity for MRI of the knee were 90% and 67% for detecting any ACL injury, 50% and 86% for detecting medial meniscal tears, and 88% and 73% for detecting lateral meniscal tears. Prospective use of MRI of the knee could have prevented 22% of diagnostic arthroscopic procedures.	2
37. Nikken JJ, Oei EH, Ginai AZ, et al. Acute peripheral joint injury: cost and effectiveness of low-field-strength MR imaging--results of randomized controlled trial. <i>Radiology</i> 2005; 236(3):958-967.	8	507	Patients were randomized to either radiography alone or radiography followed by short MRI examination. Purpose was to determine if the short MRI examination performed with low-field-strength dedicated MRI is effective and cost saving compared with radiography alone in patients with recent acute traumatic injury of the wrist, knee, or ankle.	Compared with radiography, MRI in patients with acute wrist or ankle injuries is neither cost saving nor effective in expediting diagnostic workup nor improving quality of life. In patients with knee injuries, a short MRI shortens the time to completion of diagnostic workup, reduces the number of additional diagnostic procedures, improves quality-of-life in the first 6-weeks, and may reduce costs associated with lost productivity.	1

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38. Jain AS, Swanson AJ, Murdoch G. Haemarthrosis of the knee joint. <i>Injury</i> 1983; 15(3):178-181.	13	120 knee injuries	Study on haemarthrosis of the knee joint.	Occurrence of anterior cruciate damage was 17% and that of crack fracture was 29%.	2
39. Jones JR, Allum RL. Acute traumatic haemarthrosis of the knee: expectant treatment or arthroscopy? <i>Ann R Coll Surg Engl</i> 1989; 71(1):40-43.	13	50	Prospective study of patients with acute traumatic haemarthrosis of the knee to examine the place of examination under anesthesia and arthroscopy in a district general hospital.	Significant injuries could not be diagnosed reliably on initial clinical examination.	2
40. Maffulli N, Binfield PM, King JB, Good CJ. Acute haemarthrosis of the knee in athletes. A prospective study of 106 cases. <i>J Bone Joint Surg Br</i> 1993; 75(6):945-949.	13	106	Prospective study of athletes with acute haemarthrosis of the knee.	<ul style="list-style-type: none"> <li>Acute traumatic haemarthrosis indicates a serious ligament injury.</li> <li>Arthroscopy is needed to complement careful history and clinical examination.</li> </ul>	2
41. McNally EG, Nasser KN, Dawson S, Goh LA. Role of magnetic resonance imaging in the clinical management of the acutely locked knee. <i>Skeletal Radiol</i> 2002; 31(10):570-573.	10	42	Explore prospectively the hypothesis that MRI of the acutely locked knee can alter surgical decision-making.	Sensitivity 96%, specificity 100%, accuracy 98%. MRI should precede arthroscopy in this clinical setting.	2
42. Grevitt MP, Taylor M, Churchill M, Allen P, Ryan PJ, Fogelman I. SPECT imaging in the diagnosis of meniscal tears. <i>J R Soc Med</i> 1993; 86(11):639-641.	10	60	To evaluate the usefulness and accuracy of SPECT radionuclide scan to detect a meniscal tear.	A crescentic pattern of uptake on the transaxial view was 77% sensitive and 74% specific for an accuracy of 76%. When combined with increased activity in the adjacent femoral condyle, sensitivity rose to 90% for an accuracy of 84%.	2
43. Ryan PJ, Reddy K, Fleetcroft J. A prospective comparison of clinical examination, MRI, bone SPECT, and arthroscopy to detect meniscal tears. <i>Clin Nucl Med</i> 1998; 23(12):803-806.	9	100	To prospectively compare SPECT with arthroscopy and MRI for meniscal pathology detection. MRI and SPECT findings blinded to other information.	With arthroscopy as gold standard, sensitivity, specificity, PPV, and NPV of MRI were 80%, 71%, 84%, and 71%, respectively and that of SPECT were 84%, 80%, 88%, and 76%, respectively. SPECT is a suitable alternative to MRI to detect meniscal tears.	1
44. Even-Sapir E, Arbel R, Lerman H, Flusser G, Livshitz G, Halperin N. Bone injury associated with anterior cruciate ligament and meniscal tears: assessment with bone single photon emission computed tomography. <i>Invest Radiol</i> 2002; 37(9):521-527.	9	94	To assess the role of SPECT by comparing its results with those from arthroscopy, MRI, or both.	There was considerable concordance between SPECT results and those of other modalities so authors suggest that bone SPECT is valuable in acute knee trauma for assessment of ACL, meniscal tears, or both and for detection of associated bone injury.	2
45. Ptasznik R, Feller J, Bartlett J, Fitt G, Mitchell A, Hennessy O. The value of sonography in the diagnosis of traumatic rupture of the anterior cruciate ligament of the knee. <i>AJR</i> 1995; 164(6):1461-1463.	10	37	Prospective study to determine value of US in diagnosing an ACL tear in patients with recent traumatic hemarthrosis of the knee; no bone abnormalities on radiograph.	US was 91% sensitive and 100% specific, PPV was 100% and NPV was 63%. US is a useful and inexpensive method.	2

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46. Gebhard F, Authenrieth M, Strecker W, Kinzl L, Hehl G. Ultrasound evaluation of gravity induced anterior drawer following anterior cruciate ligament lesion. <i>Knee Surg Sports Traumatol Arthrosc</i> 1999; 7(3):166-172.	9	60	Prospective analysis to compare accuracy of US evaluation of clinical tests with KT-1000 measurements.	Results from US correlated with KT-1000 ( $r=0.46$ ). Based on a minimum intra-individual difference of 5 mm in the US measured anterior drawer, the sensitivity of the test in group A resulted in 0.96, and specificity 0.98. Described technique is reproducible, painless and easy to perform in order to evaluate acute ACL tears using US device. Reproducibility is similar to KT-1000 device. Recommends this technique in cases of acute ACL tears and in follow-up of ACL repair.	2
47. Bonnefoy O, Diris B, Moinard M, Aunoble S, Diard F, Hauger O. Acute knee trauma: role of ultrasound. <i>Eur Radiol</i> 2006; 16(11):2542-2548.	9	48	Prospective review of patients with conventional radiography, US, and CT to determine the diagnostic accuracy of high spatial resolution US in the detection of lipohearthrosis of the knee and to evaluate this sign as criteria of intra-articular fracture.	<ul style="list-style-type: none"> <li>The sensitivity, specificity, PPV, NPV of US for the diagnosis of lipohearthrosis was 97%, 100%, 100% and 94%, respectively, compared with 55%, 100%, 100% and 55% with radiographs.</li> <li>Using lipohearthrosis as criterion of fracture, the sensitivity, specificity, PPV and NPV of US for early detection of intra-articular knee fractures was 94%, 94%, 97% and 89%, respectively, compared with 84%, 88%, 93% and 75% with radiographs.</li> </ul>	2
48. Wicky S, Blaser PF, Blanc CH, Leyvraz PF, Schnyder P, Meuli RA. Comparison between standard radiography and spiral CT with 3D reconstruction in the evaluation, classification and management of tibial plateau fractures. <i>Eur Radiol</i> 2000; 10(8):1227-1232.	9	42 fractures	Prospective study to compare diagnostic efficiency of radiography and spiral CT exams with 3D reconstructions in the evaluation, classification and management of tibial plateau fractures.	Fractures were underestimated with radiography in 18/42 cases (43%). Spiral CT 3D reconstructions, and precise preoperative information, the surgical plans based on radiographs were modified and adjusted in 13 cases among 22 (59%). Spiral CT 3D reconstructions give a better and more accurate demonstration.	2
49. Mustonen AO, Koskinen SK, Kiuru MJ. Acute knee trauma: analysis of multidetector computed tomography findings and comparison with conventional radiography. <i>Acta Radiol</i> 2005; 46(8):866-874.	9	415 images from 409 patients	To evaluate MDCT by comparing findings from MDCT to those from the primary knee radiographs for patients presenting with acute knee trauma.	Overall sensitivity of radiography was 83%, while NPV was 49%. In severely injured patients, diagnostically sufficient radiographs are difficult to obtain, and therefore a negative radiograph is not reliable in ruling out a fracture. MDCT is a fast and accurate exam and is recommended in patients with tibial plateau fractures or complex knee injuries in order to evaluate the fracture adequately.	2

**Acute Trauma to the Knee  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
50. Mui LW, Engelsohn E, Umans H. Comparison of CT and MRI in patients with tibial plateau fracture: can CT findings predict ligament tear or meniscal injury? <i>Skeletal Radiol</i> 2007; 36(2):145-151.	9	41	Trained radiologist retrospectively reviewed films of patients admitted to emergency department to: 1) To determine the accuracy of CT in the evaluation of ligament tear and avulsion in patients with tibial plateau fracture, and, 2) to evaluate whether the presence or severity of fracture gap and articular depression can predict meniscal injury.	CT demonstrated torn ligaments with 80% sensitivity and 98% specificity. Only 2% of ligaments deemed intact on careful CT evaluation had partial or complete tears on MRI. ROC analysis demonstrated no clear threshold for gap or depression that yielded a combination of high sensitivity and specificity. In the acute setting, CT offers high sensitivity and specificity for depicting osseous avulsions, as well as high NPV for excluding ligament injury. However, MRI remains necessary for the preoperative detection of meniscal injury.	2
51. Fleiter TR, Mervis S. The role of 3D-CTA in the assessment of peripheral vascular lesions in trauma patients. <i>Eur J Radiol</i> 2007; 64(1):92-102.	12	N/A	Review roles of diagnostic angiography and CTA in a trauma center.	3D-CTA with multislice CT can be used to replace the diagnostic angiography in patients with blunt or penetrating extremity injuries.	4
52. Rieger M, Mallouhi A, Tauscher T, Lutz M, Jaschke WR. Traumatic arterial injuries of the extremities: initial evaluation with MDCT angiography. <i>AJR</i> 2006; 186(3):656-664.	10	87	Retrospectively assess the accuracy of MDCT angiography as the initial diagnostic technique to describe arterial injury in patients with extremity trauma. Presence of arterial involvement was examined prospectively by a radiologist and retrospectively by two independent radiologists.	MDCT angiography yielded high accuracy in detection and characterization of traumatic arterial injuries and in recognizing an underlying dissection. Prospective sensitivity and specificity were 95% and 87%, respectively, and retrospective sensitivity and specificity were 99% and 87%, respectively. MDCT angiography provides significant and reproducible technique for the detection and characterization of arterial injuries.	2
53. Dennis JW, Jagger C, Butcher JL, Menawat SS, Neel M, Frykberg ER. Reassessing the role of arteriograms in the management of posterior knee dislocations. <i>J Trauma</i> 1993; 35(5):692-695; discussion 695-697.	10	37 patients (38 injuries)	Retrospective study to determine the accuracy of physical exam to assess popliteal artery injury following posterior knee dislocation.	Physical examination alone predicted the need for surgical intervention with 100% accuracy based on hard signs of vascular injury (ie, absent pulses, distal ischemia, active and bleeding, bruit/thrill).	3
54. Yu JS, Goodwin D, Salonen D, et al. Complete dislocation of the knee: spectrum of associated soft-tissue injuries depicted by MR imaging. <i>AJR</i> 1995; 164(1):135-139.	13	17 patients 3 reviewers for MRI	Retrospective study to determine spectrum of injuries depicted on MRI in patients following a knee dislocation and to determine if there is a predictive factor for popliteal artery and nerve injury.	Extensive disruption of the ligaments and soft tissues that stabilize the knee, including the popliteal artery, result from a dislocation. Recognition of injury pattern enables precautionary observations for ischemic changes.	3

**Acute Trauma to the Knee  
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Strength of Evidence
55. Abou-Sayed H, Berger DL. Blunt lower-extremity trauma and popliteal artery injuries: revisiting the case for selective arteriography. <i>Arch Surg</i> 2002; 137(5):585-589.	10	53 injuries in 52 patients over 20-year period	Retrospective cohort study to see if mandatory angiography is required for patients with blunt lower-extremity trauma.	Angiography is unnecessary in the routine evaluation of the patient with blunt lower-extremity trauma who presents with a normal neurovascular examination result and can be used selectively for patients with diminished pulses who lack associated indications for mandatory operative exploration.	2
56. Barnes CJ, Pietrobon R, Higgins LD. Does the pulse examination in patients with traumatic knee dislocation predict a surgical arterial injury? A meta-analysis. <i>J Trauma</i> 2002; 53(6):1109-1114.	11	116 studies reviewed 7 met inclusion criteria	Systematic review to evaluate the diagnostic accuracy of pulse examination in detecting surgical arterial lesions associated with knee dislocation.	Findings suggest that the isolated presence of abnormal pedal pulses on initial examination of patients with knee dislocations is not sensitive enough to detect a surgical vascular injury. Algorithm is presented for the evaluation of these patients.	2
57. Cole BJ, Harner CD. The multiple ligament injured knee. <i>Clin Sports Med</i> 1999; 18(1):241-262.	12	N/A	To evaluate management of multiple injured knee ligaments.	MRI helpful to define ligamentous pathology.	4
58. Lonner JH, Dupuy DE, Siliski JM. Comparison of magnetic resonance imaging with operative findings in acute traumatic dislocations of the adult knee. <i>J Orthop Trauma</i> 2000; 14(3):183-186.	9	10	Retrospective analysis to determine accuracy of MRI vs clinical examination under anesthesia for knee dislocation.	MRI useful for defining ligamentous injuries post knee dislocations but clinical examination under anesthesia is more accurate.	3
59. Rubin DA, Kettering JM, Towers JD, Britton CA. MR imaging of knees having isolated and combined ligament injuries. <i>AJR</i> 1998; 170(5):1207-1213.	9	340 injured knees in 338 patients	Prospectively examined injured knees by MRI with arthroscopic correlations.	For MRI, sensitivity and specificity for diagnosing ligament tears were 94% and 99%, respectively, when no or one ligament was torn and 88% and 84%, respectively, when two or more supporting structures were torn. For knees with multiple ligament injuries, diagnostic specificity of MRI for ligament tears decreases, as does the sensitivity for medial meniscal tears.	1
60. Potter HG, Weinstein M, Allen AA, Wickiewicz TL, Helfet DL. Magnetic resonance imaging of the multiple-ligament injured knee. <i>J Orthop Trauma</i> 2002; 16(5):330-339.	9	21	Retrospective search was performed to evaluate MRI and MRA in detecting soft tissue, neurovascular, and bony injury after multiple ligament knee injury, including knee dislocation.	6 patients had both conventional angiograms and MRA with 100% agreement between the studies. MRI is an accurate method of assessing soft tissue, osseous, and neural damage after knee dislocation.	3

## Evidence Table Key

### Study Type Key

*Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.*

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
  - a. Cohort
  - b. Cross-sectional
  - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews
  
8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

### Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.