

Does This Patient Have a Torn Meniscus or Ligament of the Knee?

EBEM Commentators

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SYSTEMATIC REVIEW SOURCE

This is a rational clinical examination abstract, a regular feature of the Annals' Evidence-Based Emergency Medicine (EBEM) series. Each features an abstract of a rational clinical examination review from the *Journal of the American Medical Association* and a commentary by an emergency physician knowledgeable in the subject area.

The source for this rational clinical examination review abstract is: Solomon DH, Simel SL, Bates DW, et al. The rational clinical examination: does this patient have a torn meniscus or ligament of the knee? Value of the physical examination. *JAMA*. 2001;286:1610-1620.

The Annals' EBEM editors assisted in the preparation of the abstract of this rational clinical examination review, as well as selection of the Evidence-Based Medicine Teaching Points.

OBJECTIVE

To review and summarize the accuracy of the clinical examination for the diagnosis of meniscal or ligamentous knee injuries.

DATA SOURCES

The authors conducted a search of English literature using the MEDLINE and HealthSTAR databases through December 31, 2000. Keywords included "knee," "physical examination," "internal derangement," "anterior cruciate ligament," "posterior cruciate ligament," "medial collateral ligament," "lateral collateral ligament," and "meniscus." References from selected articles were manually searched for additional entries.

STUDY SELECTION

Studies were included if they generated primary data comparing the performance of the physical examination of the knee with arthroscopy, arthrotomy, or magnetic resonance imaging. Data about the accuracy of examination techniques

not available in a primary care setting, ie, examination under general anesthesia, were excluded.

DATA EXTRACTION AND ANALYSIS

Two of the authors graded each article for its methodologic quality using a standardized scoring system (DHS, JLS).¹ Sensitivity, specificity, and likelihood ratios were calculated in the usual manner from data abstracted from each article. In studies in which only injury-proven patients were selected for inclusion (no normal patients), calculation of specificity and likelihood ratios was not possible. Where applicable, pooled likelihood ratios were calculated using a random-effects model to provide more conservative estimates.

MAIN RESULTS

No articles were identified that adequately assessed the accuracy of the physical examination in detecting medial collateral ligament or lateral collateral ligament lesions.

Twelve studies involving 804 patients reported on the properties of unique physical examination maneuvers in the detection of anterior cruciate ligament injuries: the anterior drawer test, the lateral pivot shift test, and the Lachman tests. Of these, 8 studies restricted enrollment to patients with proven anterior cruciate ligament lesions, precluding calculation of specificity and likelihood ratios.

For the detection of anterior cruciate ligament injury, 3 other studies reported data for a composite or "general examination," in which all aspects of the medical history and physical examination were combined in an unspecified and possibly variable manner to formulate a holistic clinical impression. The authors report that criteria for positive and abnormal examinations were frequently not clear, and reproducibility was rarely reported in source articles. Sensitivities and specificities of the "general examination" range between 0.62 and 1.0 and 0.56 and 1.0, respectively, with summary positive and negative likelihood ratios of 25.0 (95% confidence interval [CI] 2.1 to 306) and 0.04 (95% CI 0.01 to 0.48).

Results for individual physical examination maneuvers are summarized in the [Table](#).

Table. Summary of test characteristics for common ligamentous knee injuries.

Physical Exam Maneuver	No. of Studies (No. of Patients)	Level of Evidence	Sn, %	Sp, %	+LR (95% CI)	-LR (95% CI)
ACL						
General examination	3 (428)	1, 1, 4	82	94	25.0 (2.1-306)	0.04 (0.01-0.48)
Anterior drawer*	9 (664)	4, 4, 4, 1, 4, 4, 4, 4, 4	62	67	3.8 (0.7-22)	0.3 (0.05-1.5)
Lachman [†]	7 (607)	4, 1, 1, 4, 4, 4, 4	84	100	42 (2.7-651)	0.1 (0-0.4)
Lateral pivot shift [†]	5 (316)	2, 4, 4, 1, 4	38	n/a	n/a	n/a
PCL						
General examination	2 (274)	1, 1	91	98	21 (2.1 - 205)	0.05 (0.01-0.5)
Posterior drawer [†]	2 (99)	4, 4	55	n/a	n/a	n/a
Meniscus						
General examination [§]	5 (594)	4, 4, 4, 1, 4	77	91	n/r	n/r
Joint line tenderness	4 (424)	1, 4, 4, 4	79	15	0.9 (0.8-1.0)	1.1 (1.0-1.3)
McMurray	4 (424)	1, 4, 4, 4	53	59	1.3 (0.9-1.7)	0.8 (0.6-1.1)
Apley [†]	1 (80)	1	16	n/a	n/a	n/a

Sn, Sensitivity; Sp, specificity; +LR, positive likelihood ratio; -LR, negative likelihood ratio; ACL, anterior cruciate ligament; PCL, posterior cruciate ligament; n/a, not applicable; n/r, not reported.

*In the only study that produced level 1 evidence, the sensitivity of the anterior drawer test was 18%. Only 3 studies included patients who had negative disease test results and thus could produce specificity and LRs.

[†]LR based on a single study of 41 patients producing level 4 evidence.

[†]No studies produced specificity/LRs.

[§]Summary LRs not reported.

CONCLUSIONS

Although limited studies do not support the individual knee examination maneuvers, the composite knee examination appears to be reasonably sensitive and specific, with the ligamentous examination more reliable than the meniscal examination. Therefore, the evaluation of a suspected ligamentous or meniscal knee injury (internal derangement) should include an ordered history and physical examination; an 18-element approach is suggested. In experienced hands, such an examination can obviate the need for expensive imaging.

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COMMENTARY: CLINICAL IMPLICATION

The acutely injured knee is an important presentation in emergency practice. The role of the emergency physician is first to exclude the life- and limb-threatening conditions of knee dislocation, closed or open fracture, and neurovascular injury. Afterward, an extensor (quadriceps) tendon rupture must be ruled out. Having verified the absence of a condition requiring urgent evaluation, the emergency physician frequently encounters the task of excluding an injury to the ligaments or menisci, which, if successful, would leave the patient with a benign knee injury. The distinction is consequential because patients with benign knee injuries may be discharged with routine follow-up, whereas those with ligamentous or meniscal

injuries will benefit from prompt referral to a musculoskeletal specialist. In addition, referral to physiotherapy and routine measures for managing pain and inflammation are necessary for such patients.² An approach to the diagnosis of ligamentous and meniscal injury is therefore of interest to the emergency physician, the foundation of which is an appreciation of the usefulness of the historical and physical examination elements that compose such an approach.

In this installment of the *JAMA* rational clinical examination series, the authors found that the accuracy of physical examination maneuvers to assess medial collateral ligament and lateral collateral ligament integrity has not been studied and that available literature does not support the use of any single maneuver to rule in or rule out lesions of the anterior collateral ligament, posterior collateral ligament, or menisci. The general or composite examination, however, was sufficiently sensitive and specific to reliably diagnose these injuries in study patients.

The study data and resulting conclusions carry important limitations, especially when applied to the emergency setting. First, the studies are small and are underpowered, resulting in wide CIs. The majority of study patients were evaluated for chronic knee complaints, which are more amenable to examination than the acutely injured knee treated in the emergency department (ED). Second, orthopedic surgeons carried out the physical examination in these studies rather than emergency physicians. Although other research has validated the precision and reliability of some knee examination signs elicited by emergency physicians,³ similar research has not yet validated precision and reliability among orthopedic surgeons in knee examination. These specialists not only perform many more knee examinations than an

emergency physician but also benefit from correlating their physical examination with definitive studies or procedures. These limitations serve to overestimate the sensitivity and specificity of individual and composite tests so that the reported values represent the upper limit of accuracy emergency physicians can expect from their own examination.

In conclusion, the available literature demonstrates at best moderate utility of orthopedic surgeon examination in patients referred for knee evaluation in the subacute phase after injury and does not validate the importance of internal derangement testing in the emergency setting. Therefore, the ED evaluation of the acutely injured knee consists of 4 steps. First, neurovascular integrity is assessed by examining the foot for strength, sensation, and quality of the distal pulses.² Next, the possibility of an occult knee dislocation is addressed by performing a gross inspection of knee architecture and stability while the mechanism of injury and severity of coexisting injuries are considered.⁴⁻⁶ Afterward, rupture of the extensor tendon is ruled out by having the patient extend the knee against gravity.^{7,8} Finally, fracture is excluded by radiographs after the application of an accepted clinical decision instruments such as the Ottawa or Pittsburgh knee rules.⁹⁻¹² No physical examination maneuver designed to test the ligaments or menisci is sufficiently accurate to direct treatment of the injured knee, but a comprehensive physician examination as performed by an experienced physician may occasionally affect referral decisions for the patient who is capable of tolerating examination.

TAKE HOME MESSAGE

Though available literature is incompletely applicable to the emergency setting, studies indicate that no physical examination maneuver is sufficiently accurate to reliably rule in or rule out ligamentous or meniscal knee injuries, and a low threshold for specialist referral is appropriate. Future research more specific to emergency practice may afford greater discriminatory power; until then, the emergency physician should adopt an organized approach to exclude more dangerous knee derangements.

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EBEM TEACHING POINT

SpPin and SnNout. Likelihood ratios are considered advantageous when compared to sensitivity and specificity because they are uniquely qualified to change a clinician's pretest probability to a posttest probability and hopefully allow

a decision threshold to be crossed. However, when the properties of a given test approach very high levels of either sensitivity or specificity, the test result can also be considered to efficiently drive clinical decisionmaking. These concepts have been described as the ability of a test to either "rule in" (SpPin) or "rule out" (SnNout) disease.

In the setting of a highly specific (Sp) test yielding a positive (P) test result, the clinician can be assured that the diagnosis being pursued has been ruled in. For example, an unenhanced abdominal computed tomography scan performed in the setting of suspected renal colic and showing 1 or more obstructing ureteral stones is a specific test, and a positive result rules in the diagnosis. Similarly, an enzyme-linked immunosorbent assay d-dimer assay performed in the setting of a low pretest probability for venous thromboembolism is a highly sensitive (Sn) test, which, if negative (N), effectively rules out venous thromboembolism. SpPin and SnNout are not without their limitations¹³; however, they remain useful tools for incorporating diagnostic test performance into clinical practice.

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