

Septic Arthritis in Emergency Department Patients With Joint Pain: Searching for the Optimal Diagnostic Tool

EBEM Commentator Contact

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SYSTEMATIC REVIEW SOURCE

This is a rational clinical examination abstract, a regular segment of *Annals'* Evidence-Based Emergency Medicine (EBEM) series. Each segment 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 is: Margaretten M, Kohlwes J, Moore D, et al. Does this adult patient have septic arthritis? *JAMA*. 2007;297:1478-1488. 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

This article reviews the diagnostic value of various aspects of medical history, physical examination, laboratory, and radiographic findings in emergency department (ED) patients with suspected septic arthritis.

DATA SOURCES

The authors conducted a comprehensive MEDLINE search from 1966 to January 2007 for articles relevant to diagnostic accuracy of components of clinical examination, as well as simple diagnostic investigations performed on patients suspected of having septic arthritis. Once articles were retrieved, their reference lists were manually searched for pertinent studies.

STUDY SELECTION

Studies were included if they contained original data and described the accuracy and precision of clinical or laboratory data in diagnosing septic arthritis in patients with a swollen or painful joint. Articles were excluded if they did not include a reference standard test for the evaluation of septic arthritis. Synovial fluid culture is considered a reference standard test for diagnosing septic arthritis; however, because of the wide range

of reported sensitivities, the authors also considered other measures such as positive Gram's stain result, positive blood culture result, microscopic evidence of pus in aspirated fluid, and response to antibiotics as alternative criterion standards.

DATA EXTRACTION AND ANALYSIS

One author independently screened searched titles for relevance, and 3 authors independently reviewed and abstracted data for possible inclusion. Differences were resolved by consensus. Evidence quality was assessed with a 2-tiered system, first assessing individual "study quality" using criteria such as consecutive versus nonconsecutive samples, inclusion of subjects with and without disease, and presence of reference standards. Second, a "level-of-evidence" designation was assigned according to sample size, use of blinding and independence of assessors, use of reference standards, consecutiveness of samples, and populations with and without disease.

Likelihood ratios with 95% confidence intervals were calculated for each of the signs and symptoms that are used to distinguish septic arthritis from other causes of acutely swollen or painful joint and combined across studies with a random effects model.

MAIN RESULTS

The authors reported prevalence, risk factors, symptoms, signs, and the accuracy of laboratory tests in diagnosing septic arthritis. They reviewed 14 articles representing 6,242 adult patients who presented to rheumatology clinics or EDs or were hospitalized with this diagnosis. The prevalence was derived from 2 studies that were prospective and enrolled patients with acutely swollen joints. The range of prevalence was 8% to 27%. The likelihood ratios for different clinical and laboratory features useful for diagnosing septic arthritis according to the reviewed studies are presented in [Table 1](#).

CONCLUSIONS

There is no evidence that medical history and physical examination alone can sufficiently rule out nongonococcal septic arthritis. Increase of synovial fluid WBC count and

Table 1. Likelihood ratios for risk factors, physical examination features, and laboratory values for diagnosing septic arthritis.

Variables	+LR (95% CI)	-LR (95% CI)	Sensitivity, %
Risk factors			
Age >80 y	3.5 (1.8–7.0)	0.86 (0.73–1.00)	19
Diabetes mellitus	2.7 (1.0–6.9)	0.93 (0.83–1.00)	12
Rheumatoid arthritis	2.5 (2.0–3.1)	0.45 (0.32–0.72)	68
Recent joint surgery	6.9 (3.8–12.0)	0.78 (0.64–0.94)	24
Hip or knee prosthesis	3.1 (2.0–4.9)	0.73 (0.57–0.93)	35
Skin infection	2.8 (1.7–4.5)	0.76 (0.60–0.96)	32
Hip or knee prosthesis and skin infection	15.0 (8.1–28.0)	0.77 (0.64–0.93)	24
HIV-1 infection	1.7 (1.0–2.8)	0.47 (0.25–0.90)	79
Physical examination			
Fever	0.67 (0.43–1.0)	1.7 (1.0–3.0)	46–57
Joint pain	NR	NR	85
Joint edema	NR	NR	78
Sweats	NR	NR	27
Rigors	NR	NR	19
Synovial laboratory values			
WBC >100,000 μ l	28 (12–66)	0.71 (0.64–0.79)	13–40
WBC >50,000 μ l	7.7 (5.7–11)	0.42 (0.34–0.51)	50–70
WBC >25,000 μ l	2.9 (2.5–3.4)	0.32 (0.23–0.43)	63–88
PMN >90%	3.4 (2.8–4.2)	0.34 (0.25–0.47)	57–92
Low glucose	3.4 (2.2–5.1)	0.58 (0.44–0.76)	38–64
Protein >3 g/dL	0.90 (0.61–1.3)	1.1 (0.76–1.60)	48–50
LDH >250 units/L	1.9 (1.5–2.5)	0.10 (0.00–1.60)	100

+LR, Likelihood ratio of a positive test; CI, confidence interval; -LR, likelihood ratio of a negative test; NR, not reported; PMN, polymorphonuclear leukocytes; LDH, lactate dehydrogenase.

percentage of polymorphonuclear cells seems to be the most useful diagnostic indicator of septic arthritis while waiting for the Gram's stain and culture test results.

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COMMENTARY

Septic arthritis is a clinical entity that, if not diagnosed and treated in a timely fashion, can have devastating sequelae, including destruction of the joint. The relatively high incidence of this disease in the United States (2 to 5 cases per 100,000 population)¹ underscores the importance of rapid diagnosis and treatment. Unfortunately, making the diagnosis can be difficult despite the availability of clinical and laboratory data. Identifying the presence of key risk factors can raise the suspicion of septic arthritis. According to the data presented, age greater than 80 years, a history of diabetes mellitus or rheumatoid arthritis, skin infection, joint prosthesis, and recent joint surgery in the medical history increase the likelihood of septic arthritis. Unfortunately, the remaining medical history and physical examination findings are not as helpful. Although joint pain was found to have reasonable sensitivity (85%), other symptoms and findings such as fever, rigors, and joint edema were not as sensitive. These factors alone are not powerful

enough to change the probability of septic arthritis in any given patient.

It is the evaluation of the synovial fluid that will have the greatest effect in the determination of diagnosis of septic arthritis. Observing an increased WBC count or high percentage of polymorphonuclear cells in the synovial fluid will significantly increase the likelihood of septic arthritis and may change the acute treatment of the patient, including lowering the threshold for admission, orthopedic consultations, and antibiotic therapy. Recent data published by Li et al² reiterate the need to access the joint fluid because their data appear to confirm that patients with septic arthritis consistently have increased synovial fluid WBC counts. Patients with a crystal arthropathy may have similar findings, and although existence of concomitant diseases is uncommon, the presence of crystals does not rule out septic arthritis.³

Because arthrocentesis is a simple procedure frequently performed by emergency physicians, and because of the wealth of useful information it can provide, one should have a low threshold to perform this procedure in a patient with an acutely swollen joint.

TAKE-HOME MESSAGE

Existing evidence suggests that physical examination and medical history results are not adequate for establishing the presence or absence of septic arthritis. Synovial fluid analysis appears to be the most useful diagnostic tool in cases in which the diagnosis is under consideration, and emergency physicians

should therefore have a low threshold for performing this procedure.

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EBEM TEACHING POINT

Reference Standards and Proxy Outcome Measures.

Trials investigating the performance of a new diagnostic modality are increasingly popular in clinical research. In such studies, the test under investigation is applied to individuals suspected of having the disease of interest. Test accuracy is assessed by comparing the test's results with the results of a "reference standard" (formerly called a "criterion standard"). A reference standard test should be as close as possible to definitively diagnostic for the disease, eg, biopsy, surgery, autopsy, angiography.

In some cases, definitive diagnosis is not feasible, and "proxy" outcomes are used instead. Proxy outcomes are those that can stand in place of the physiologic or anatomic diagnosis and include clinical outcomes measured on long-term clinical follow-up, such as mortality, hospital readmission rate, or quality of life measures. Pulmonary embolism studies, because of the risks associated with pulmonary angiography, often use clinical follow-up as a proxy outcome measure, whereas studies of outpatient asthma treatment, because of difficulty in quantifying degree of anatomic disease, often use hospital admission or quality of life measures as proxy outcomes.⁴

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