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Differentiation between septic arthritis and transient synovitis of the hip in children with clinical prediction algorithms

Scott J. Luhmann
St. Louis Children's Hospital

Angela Jones
St. Louis Children's Hospital

Mario Schootman
Washington University School of Medicine in St. Louis

J. Eric Gordon
St. Louis Children's Hospital

Perry L. Schoenecker
St. Louis Children's Hospital

See next page for additional authors

Differentiation Between Septic Arthritis and Transient Synovitis of the Hip in Children with Clinical Prediction Algorithms

By Scott J. Luhmann, MD, Angela Jones, BS, Mario Schootman, PhD, J. Eric Gordon, MD, Perry L. Schoenecker, MD, and Jan D. Luhmann, MD

Investigation performed at St. Louis Children's Hospital, Washington University Medical Center, St. Louis, Missouri

Background: Differentiation between septic arthritis and transient synovitis of the hip in children can be difficult. Kocher et al. recently developed a clinical prediction algorithm for septic arthritis based on four clinical variables: history of fever, non-weight-bearing, an erythrocyte sedimentation rate of ≥40 mm/hr, and a serum white blood-cell count of >12,000/mm^3 (>12.0 × 10^9/L). The purpose of this study was to apply this clinical algorithm retrospectively to determine its predictive value in our patient population.

Methods: A retrospective review was performed to identify all children who had undergone a hip arthrocentesis for the evaluation of an irritable hip at our institution between 1992 and 2000. One hundred and sixty-three patients with 165 involved hips satisfied the criteria for inclusion in the study and were classified as having true septic arthritis (twenty hips), presumed septic arthritis (twenty-seven hips), or transient synovitis (118 hips).

Results: Patients with septic arthritis (true and presumed; forty-seven hips) differed significantly ($p < 0.05$) from patients with transient synovitis (118 hips) with regard to the erythrocyte sedimentation rate, differential of serum white blood-cell count, total white blood-cell count and differential in the synovial fluid, gender, previous health-care visits, and history of fever. If the four independent multivariate predictors of septic arthritis proposed by Kocher et al. were present, the predicted probability of the patient having septic arthritis was 59% in our study, in contrast to the 99.6% predicted probability in the patient population described by Kocher et al. Statistical analyses demonstrated that the best model to describe our patient population was based on three variables: a history of fever, a serum total white blood-cell count of >12,000/mm^3 (>12.0 × 10^9/L), and a previous health-care visit. When all three variables were present, the predicted probability of the patient having septic arthritis was 71%.

Conclusions: Although the use of a clinical prediction algorithm to differentiate between septic arthritis and transient synovitis may have improved the utility of existing technology and medical care to facilitate the diagnosis at the institution at which the algorithm originated, application of the algorithm proposed by Kocher et al. or of our three-variable model does not appear to be valid at other institutions.

Level of Evidence: Diagnostic study, Level I-1 (testing of previously developed diagnostic criteria in series of consecutive patients [with universally applied reference "gold" standard]). See Instructions to Authors for a complete description of levels of evidence.

An acutely irritable hip in a child presents a unique diagnostic challenge. There are multiple causes of hip irritability, such as septic arthritis, transient synovitis, Legg-Calvé-Perthes disease, fracture, slipped capital femoral epiphysis, inflammatory arthropathy, and tumors[1-5]. Usually the differential diagnosis can be defined on the basis of the patient's history, the findings on physical examination, and plain radiographs of the hip, and frequently septic arthritis and transient synovitis are left as the two most probable etiologies. However, at the time of early presentation, these two diagnoses have remarkably similar symptoms: spontaneous onset of progressive hip, groin, or thigh pain; limp or failure to bear weight; fever; and irritability[2-6]. The use of laboratory studies such as measurement of the erythrocyte sedimentation rate, serum white

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blood-cell count and differential, and C-reactive protein level can sometimes be helpful; however, there are no absolute values that definitively diagnose either of these conditions.

The necessity of expedient, accurate diagnosis is well documented. Transient synovitis, a self-limited problem without known long-term sequelae, is treated nonoperatively with oral analgesics and observation[5-7]. In contrast, septic arthritis of the hip requires emergent surgical drainage with the concomitant use of intravenous antibiotics[8-10]. Unlike transient synovitis, septic arthritis of the hip can be associated with serious complications, including osteonecrosis of the capital femoral epiphysis, proximal femoral and/or pelvic osteomyelitis, chondrolysis, systemic sepsis, and osteoarthritis of the hip joint[8-12]. Early diagnosis is crucial, as overall outcomes are better when appropriate surgical and medical treatment are initiated early in the disease process[8-12].

Because no single test is available to diagnose septic arthritis of the hip, a clinical prediction algorithm based on a combination of factors may facilitate diagnosis[2,3,13,14]. One such algorithm was reported by Kocher et al.[2], who identified four important diagnostic variables associated with septic arthritis of the hip: a history of fever, non-weight-bearing on the affected limb, an erythrocyte sedimentation rate of ≥40 mm/hr, and a serum white blood-cell count of >12,000/mm^3 (>12.0 × 10^9/L). The presence of each of these independent multivariate predictors had a cumulative effect such that when all four variables were identified the child had a 99.6% chance of having septic arthritis of the hip. Application of such a clinical prediction algorithm ideally would allow judicious treatment, thereby limiting the sequelae associated with a missed or late diagnosis of septic arthritis while avoiding unnecessary operative interventions and antibiotics. The purpose of this study was to evaluate the clinical prediction algorithm proposed by Kocher et al. when used at our center.

Materials and Methods

A retrospective study was performed to identify all patients who had undergone a hip arthrocentesis for the diagnostic workup for an acutely irritable hip at our tertiary care children's hospital between January 1, 1992, and December 31, 2000. The study was approved by our institutional review board. A total of 263 patients underwent a hip arthrocentesis during the study period. All evaluations included a history, physical examination, and laboratory studies, with a complete blood-cell count with differential, measurement of the erythrocyte sedimentation rate, and blood cultures. Additional serum analyses, such as measurements of the C-reactive protein level and testing for antinuclear antibody titers and rheumatoid factor, were performed on the basis of the physician's preference and the clinical presentation. Plain radiographs of the pelvis and the proximal part of the femur were made for all patients and were evaluated for the presence of fractures or other osseous lesions. If septic arthritis was a possible diagnosis, the patient underwent an ultrasound examination of both hips to look for hip joint effusion. If an effusion was documented, arthrocentesis was performed under fluoroscopic guidance in the radiology or operating suite, with arthrographic confirmation of the intra-articular position of the needle; ultrasound was not utilized for needle-positioning at the time of arthrocentesis during the study period. Patients were excluded from the study if no synovial fluid could be obtained with the arthrocentesis. Analysis of synovial fluid included a white blood-cell count and differential, Gram stain, and culture. After evaluation, patients with the diagnosis of transient synovitis were treated with oral analgesics. Patients with the diagnosis of septic arthritis underwent emergent surgical drainage of the hip joint and were started on empiric intravenous antibiotics.

Medical records were reviewed for patient age, gender, disease history (duration of symptoms, previous health-care visit, recent antibiotic therapy and reason for the therapy, fever, and weight-bearing status), clinical findings (body temperature), radiographic findings, ultrasound findings, results of the arthrocentesis (amount and appearance of the aspirate), laboratory studies (measurement of the erythrocyte sedimentation rate, serum white blood-cell count with differential, white blood-cell count with differential in the synovial fluid, and results of cultures of blood and synovial fluid), treatment, and complications. Weight-bearing status was determined from the clinical history. Fever was defined as an oral temperature of ≥38.5°C during the week prior to the evaluation or at the emergency room visit. A previous health-care visit was defined as any evaluation of the irritable hip by a health-care provider during the present illness.

Three separate diagnostic groups were established on the basis of the criteria of Kocher et al.[2]: true septic arthritis, presumed septic arthritis, and transient synovitis (Table I). The diagnosis of true septic arthritis (twenty patients; twenty hips)

TABLE I Definitions of the Diagnostic Groups of Kocher et al.[2]

Group	Diagnostic Criteria
True septic arthritis	Bacterial growth on synovial fluid culture, or bacterial growth on blood culture and synovial fluid white blood-cell count of ≥50,000/mm^3 (≥50.0 × 10^9/L)
Presumed septic arthritis	Synovial fluid white blood-cell count of ≥50,000/mm^3 (≥50.0 × 10^9/L) with no growth on synovial fluid or blood culture
Transient synovitis	Synovial fluid white blood-cell count of <50,000/mm^3 (<50.0 × 10^9/L), no growth on synovial fluid or blood culture, resolution of symptoms with no intravenous antibiotics or surgery, and no further development of disease

TABLE II Univariate Analysis: Septic Arthritis Compared with Transient Synovitis

Variable	Septic Arthritis (N = 47)*	Transient Synovitis (N = 118)*	P Value
Age *(mo)*	63.4 ± 45.7	63.7 ± 31.8	0.96
Male gender *(%)*	54	73	0.02
Duration of symptoms *(days)*	3.9 ± 3.0	3.8 ± 9.0	0.85
History of fever *(%)*	72	35	<0.0001
Recent antibiotic use *(%)*	32	18	0.06
Non-weight-bearing *(%)*	81	69	0.16
Temperature *(°C)*	37.3 ± 0.9	37.0 ± 0.8	0.22
Erythrocyte sedimentation rate *(mm/hr)*	36.7 ± 15.8	20.5 ± 14.9	<0.0001
Peripheral white blood-cell count *($\times 10^9$/L)*	14.0 ± 4.9	13.5 ± 26.0	0.84
Peripheral neutrophils *(%)*	69 ± 14	62 ± 15	0.01
Peripheral lymphocytes *(%)*	21 ± 12	28 ± 14	0.004
Peripheral monocytes *(%)*	7 ± 3	6 ± 3	0.30
Peripheral basophils *(%)*	2 ± 4	1 ± 2	0.34
Synovial fluid white blood-cell count *($\times 10^9$/L)*	85.2 ± 53.6	4.9 ± 7.6	<0.0001
Synovial fluid neutrophils *(%)*	84 ± 19	66 ± 26	<0.0001
Synovial fluid lymphocytes *(%)*	6 ± 9	12 ± 16	<0.0001
Synovial fluid monocytes *(%)*	10 ± 10	26 ± 23	<0.0001
Synovial fluid basophils *(%)*	7 ± 6	3 ± 3	0.22
Left hip involved *(%)*	52	40	0.2
Prior health-care visit *(%)*	63	45	0.04

*The values for continuous variables are given as the mean and standard deviation.

was assigned when there was bacterial growth on culture of synovial fluid or both bacterial growth on culture of blood and a white blood-cell count of ≥50,000 cells/mm^3 (≥50.0 × 10^9/L) in the synovial fluid. The diagnosis of presumed septic arthritis (twenty-six patients; twenty-seven hips) was assigned when there was no growth on culture of synovial fluid or blood but the white blood-cell count in the synovial fluid was ≥50,000 cells/mm^3 (≥50.0 × 10^9/L). The diagnosis of transient synovitis (117 patients; 118 hips) was assigned when there was no growth on culture of synovial fluid or blood, the white blood-cell count in the synovial fluid was <50,000 cells/mm^3 (<50.0 × 10^9/L), the symptoms resolved without intravenous antibiotics or surgical intervention, and there was no further development of disease as reported in the medical records.

On the basis of the study parameters, three groups of patients were excluded from the original series of 263 patients. One group of forty-six patients (forty-six hips) was excluded because no synovial fluid could be obtained at the time of the arthrocentesis despite ultrasound confirmation of an effusion. Transient synovitis was the diagnosis in twenty-six of these patients; osteomyelitis, in five patients; cellulitis, in five; septicemia, in four; myositis, in two; abscess, in two; and sickle cell disease and trauma in one patient each. A failure to obtain fluid despite intra-articular placement of the needle indicates that there was a very small amount of fluid within the hip. Septic arthritis did not develop in any of these excluded patients. Another group of patients, of thirty-six children (thirty-six hips), was excluded from the analysis on the basis of their final diagnosis. A malignant tumor was diagnosed in seven of these patients; rheumatological disease, in five; osteomyelitis, in five; sickle cell crisis, in three; Legg-Calvé-Perthes disease, in three; immunocompromise, in three; a gunshot wound, femoral fracture, and postoperative infection in two patients each; and cellulitis, phlebitis, dermatomyositis, and systemic sepsis in one patient each. A third group, of eighteen patients (eighteen hips), was excluded because the white blood-cell count in the synovial fluid was <50,000 cells/mm^3 (<50.0 × 10^9/L) but the patients were treated with intravenous antibiotics and/or surgical drainage. Overall, 100 patients in the above three groups were excluded, leaving 163 patients with 165 hips who satisfied the inclusion criteria.

Univariate analyses were performed with the use of the two-sample Student t test for continuous variables and the Fisher exact test for categorical variables. The group with septic arthritis was compared with the group with transient synovitis. Multiple logistic regression was performed to identify the most parsimonious model of independent predictors on the basis of two criteria: first, a p value of 0.05 for the likeli-

hood ratio test of a model with and a model without a variable and, second, clinically important changes in parameter estimates of variables included in a multivariate model. Adjusted odds ratios and 95% confidence intervals were calculated on the basis of the logistic regression models. The probability of septic arthritis was estimated for each combination of independent predictors included in the logistic models. A receiver operating characteristic curve was constructed to assess the diagnostic performance of each set of independent predictors included in the models. All statistical analyses were performed with Statistical Analysis System (SAS) software (version 8.02; SAS Institute, Cary, North Carolina). P values of <0.05 were considered to be significant.

Results

Of the 163 patients (165 hips), 110 were boys and fifty-three were girls. The left hip was involved in seventy patients; the right hip, in ninety-one; and both hips, in two. Of the hips with septic arthritis (twenty with true septic arthritis and twenty-seven with presumed septic arthritis), only twenty (43%) had bacterial growth on culture of synovial fluid and/or blood. Of the twenty hips with true septic arthritis, seventeen (85%) had growth on synovial fluid culture and no growth on blood culture and three (15%) had no growth on synovial fluid culture but did have growth on blood culture. Organisms isolated on culture of synovial fluid and blood included coagulase-negative Staphylococcus (seven hips, 35%), *Staphylococcus aureus* (six hips, 30%), *Streptococcus viridans* (four hips, 20%), *Haemophilus influenza* Type b (two hips, 10%), and *Pseudomonas aeruginosa* (one hip, 5%). Gram stain analysis identified an organism in nine hips (45%) with true septic arthritis: seven of the seventeen with positive findings on synovial fluid culture and two of the three with positive findings on blood culture. One hip with presumed septic arthritis (4%) had a positive finding on Gram staining of synovial fluid but no growth on culture of blood or synovial fluid.

Univariate analysis demonstrated significant differences ($p < 0.05$) between the forty-seven hips with septic arthritis and the 118 hips with transient synovitis with regard to ten measures (Table II): erythrocyte sedimentation rate; peripheral percentages of lymphocytes and neutrophils; total white blood-cell count and percentages of lymphocytes, neutrophils, and monocytes in the synovial fluid; male gender; a previous health-care visit; and a history of fever. Univariate analysis demonstrated significant differences ($p < 0.05$) between the twenty hips with true septic arthritis and the twenty-seven hips with presumed septic arthritis with regard to four factors: age, duration of symptoms, white blood-cell count in the synovial fluid, and temperature (Table III). There were no other significant differences between the two groups.

The four independent multivariate predictors determined by Kocher et al.[2] (Table IV) were tested for their ability to differ-

TABLE III Univariate Analysis: True Septic Arthritis Compared with Presumed Septic Arthritis

Variable	True Septic Arthritis (N = 20)*	Presumed Septic Arthritis (N = 27)*	P Value
Age *(mo)*	52.4 ± 35.1	78.7 ± 54.8	0.03
Male gender *(%)*	50	60	0.49
Duration of symptoms *(days)*	4.3 ± 3.5	3.4 ± 2.0	0.02
History of fever *(%)*	69.2	76.5	0.60
Recent antibiotic use *(%)*	22.2	45.0	0.10
Non-weight-bearing *(%)*	74.1	93.3	0.13
Temperature *(°C)*	36.9 ± 0.7	37.9 ± 1.0	0.01
Erythrocyte sedimentation rate *(mm/hr)*	35.4 ± 17.0	38.7 ± 13.9	0.50
Peripheral white blood-cell count *($\times 10^9$/L)*	14.9 ± 5.1	12.8 ± 4.3	0.15
Peripheral neutrophils *(%)*	70.9 ± 12.8	66.6 ± 15.2	0.31
Peripheral lymphocytes *(%)*	20.3 ± 11.3	22.9 ± 14.1	0.51
Peripheral monocytes *(%)*	6.2 ± 2.9	7.8 ± 4.1	0.14
Peripheral basophils *(%)*	1.9 ± 4.0	2.3 ± 3.9	0.81
Synovial fluid white blood-cell count *($\times 10^9$/L)*	99.3 ± 55.9	61.4 ± 40.8	0.02
Synovial fluid neutrophils *(%)*	85.0 ± 19.8	83.0 ± 18.6	0.76
Synovial fluid lymphocytes *(%)*	5.2 ± 9.9	6.5 ± 8.5	0.72
Synovial fluid monocytes *(%)*	9.3 ± 9.1	11.3 ± 11.4	0.58
Left hip involved *(%)*	46.4	60	0.35
Prior health-care visit *(%)*	57.1	72.2	0.30

*The values for continuous variables are given as the mean and standard deviation.

TABLE IV Multivariate Analysis: Septic Arthritis Compared with Transient Synovitis

Model/Multivariate Predictors	Likelihood Ratio	P Value	Odds Ratio	95% Confidence Interval
Kocher et al.[2]				
History of fever	1.2	0.01	3.3	1.3-8.6
Non-weight-bearing	–0.7	0.3	0.5	0.2-1.5
Erythrocyte sedimentation rate	0.8	0.09	2.3	0.9-5.9
Peripheral white blood-cell count	1.3	0.005	3.5	1.5-8.4
Three-variable				
History of fever	1.0	0.03	2.6	1.1-6.2
Peripheral white blood-cell count	1.5	0.0006	4.6	1.9-10.9
Prior health-care visit	1.2	0.007	3.4	1.4-8.3

TABLE V Algorithm for Probability of Septic Arthritis

Model	Hosmer-Lemeshow Goodness-of-Fit	Area Under Receiver Operating Curve	Predicted Probability of Septic Arthritis*
Kocher et al.[2]	$x^2 = 6.81$, $p = 0.3382$	0.799	59.1%
Three-variable	$x^2 = 1.13$, $p = 0.9802$	0.771	71.0%

*Probability of diagnosis of septic arthritis if all variables in model are positive at presentation.

entiate between septic arthritis (true and presumed) and transient synovitis in our population. Two of the variables, non-weight-bearing status and erythrocyte sedimentation rate, had a p value of >0.05 and a confidence interval including 1; therefore, they did not contribute to the model. The algorithm was tested to determine the predicted probability of a patient having septic arthritis in the presence of all four presenting variables (Table V), and it was found to be only 59% in our patient population, which was much lower than the 99.6% value in the patient population of Kocher et al. The Hosmer-Lemeshow goodness-of-fit test showed a fit of $p = 0.3382$.

With use of our patient database, several logistic regression models were constructed and tested for their ability to predict septic arthritis. The best model for our patient population consisted of three variables: a history of fever (≥38.5°C), a peripheral white blood-cell count of >12,000/mm^3 (>12 × 10^9/L), and a previous health-care visit (Tables IV and V). The Hosmer-Lemeshow goodness-of-fit test indicated a good fit ($p = 0.9802$). This model improved the predicted probability of septic arthritis from 59% based on the Kocher et al.[2] criteria to 71% based on our three-variable model.

Discussion

The physiologic response to an early bacterial infection can be quite variable and can even result in serum markers of inflammation within the normal range of values[15,16]. Diagnosis of an infected hip is especially difficult in the early phase, and there is no single serum analysis that can serve as a definitive test[15]. Only bacterial growth on culture of synovial fluid can definitively establish the diagnosis of septic arthritis, and culture results usually are not available when the patient presents for evaluation and treatment[17]. Furthermore, previous studies have demonstrated that, even in a definite case of septic arthritis, the laboratory values can be in the normal range: up to 21% (eight of thirty-eight hips)[3] can have a normal erythrocyte sedimentation rate, 12.5% (one of eight hips)[13] to 58% (fifteen of twenty-six hips)[14] can have a normal body temperature, and 25% (two of eight hips)[13] to 74% (twenty-eight of thirty-eight hips)[3] can have a normal peripheral white blood-cell count[5,8,13-15].

Because there is no single definitive test, several multifactorial algorithms have been proposed to minimize the need for ultrasonography and the painful interventions of arthrocentesis and surgical drainage. Del Becarro et al.[3] recommended that all patients with an irritable hip be considered for diagnostic hip arthrocentesis when there is no identifiable source and the erythrocyte sedimentation rate is ≥20 mm/hr or the oral temperature is ≥37.5°C. The combination of an elevated erythrocyte sedimentation rate and a high body temperature identified 97% (thirty-seven) of thirty-eight cases of septic arthritis of the hip in their population. Eich et al.[13] concluded that a rectal temperature of ≥38°C, an erythrocyte sedimentation rate of ≥20 mm/hr, and a C-reactive protein level of ≥20 mg/dL (≥200 mg/L) are the most important parameters for differentiation. If two of these factors were present and ultrasound showed a hip effusion, there was a sensitivity of 100% and a specificity of 89% for septic arthritis. Beach[18] advocated a scoring system utilizing the factors of hip pain on physical examination, tenderness, a fever of ≥38°C, and an erythrocyte sedimentation rate of ≥20 mm/hr. Beach found a low chance of infection in hips with no or one finding, whereas a hip with two or more findings had a high risk of having an infection and should undergo ultrasonographic evaluation and arthro-

centesis if an effusion was detected.

Kocher et al.[2] identified four variables as having a predictive value for septic arthritis: a history of a fever of ≥38.5°C, an erythrocyte sedimentation rate of ≥40 mm/hr, non-weight-bearing status, and a peripheral white blood-cell count of >12,000 cells/mm^3 (>12.0 × 10^9/L). The extremely significant adjusted odds ratios for these four factors, 14.4 to 38.6, was strong evidence that these factors were highly effective in differentiating septic arthritis from transient synovitis.

Clinical prediction algorithms must be generalizable, and our hope was to confirm these findings in our population. However, when the model of Kocher et al.[2] was applied to our patient population, it did not perform as well (predictive value, 59%) as it did in their patient population (predictive value, 99.6%). Analysis of our data determined that a three-variable model performed optimally but achieved only a 71% predicted probability when all three variables were present. We were unable to detect a difference in weight-bearing status, which was an important predictor in the study by Kocher et al. This is admittedly difficult to assess in a retrospective study, but it seems that children with an acutely painful hip cannot or will not bear weight regardless of the etiology of their condition.

We found several significant differences between our patients with septic arthritis and those with transient synovitis. In general, the children with septic arthritis appeared to be more acutely ill with leukocytosis as reflected in both the serum and the synovial fluid analyses, they had a higher average erythrocyte sedimentation rate, and higher percentages had a prior health-care visit and a history of fever. Thus, it seems that septic arthritis produces a more toxic-appearing clinical picture more quickly than does transient synovitis.

One interesting finding in our review was the significant effect of a previous health-care visit on the prediction algorithm. We previously reported that 33% (twenty-one) of sixty-four children with septic arthritis had been seen by health-care professionals prior to the definitive diagnosis and 30% (nineteen) had been treated previously with antibiotics[19]. In the current study, 63% (twenty-nine) of the forty-seven hips in patients with septic arthritis had been evaluated previously by a health-care provider compared with 45% (forty-seven) of the 118 hips with transient synovitis. Considering the other findings in this analysis (elevated erythrocyte sedimentation rate, fever, and leukocytosis), the effect of a previous health-care visit may be a measure of the caregiver's opinion of the child's condition. The more toxic appearing the condition, the more likely the caregiver is to bring the child in for evaluation of the irritable hip.

The frequency of transient synovitis in our study was much greater than that in the study by Kocher et al.[2] (72% and 51%, respectively). Admittedly, our threshold for hip ultrasonography and arthrocentesis is low, as a result of the known difficulty of diagnosing septic arthritis clinically and the availability and accuracy of hip ultrasonography[20-22]. Ideally, the 118 patients with transient synovitis in this study would not have undergone ultrasonography and secondary arthrocentesis if we had been able to better differentiate between these two disease processes with use of peripheral serum and/or blood analyses and plain radiographs. Ultimately, minimizing the pain and distress associated with unnecessary arthrocentesis and surgical drainage is an important goal of the diagnostic algorithm.

The workup for an irritable hip at our institution consists of a thorough history and physical examination along with plain radiographs of the hip and laboratory studies, including a complete blood-cell count with differential, measurement of the erythrocyte sedimentation rate and C-reactive protein level, and blood cultures. If there is a clinical suspicion of septic arthritis of the hip, patients undergo an ultrasound examination of both hips to identify an effusion. Hip joint arthrocentesis is routinely performed, typically in the radiology department with arthrographic or ultrasound confirmation of the intra-articular position of the needle, for all patients with a documented effusion. Synovial fluid obtained at arthrocentesis is sent to the laboratory for a cell count and differential, Gram stain, and culture. The decision regarding treatment is based on all of the collected information. In general, a white blood-cell count of ≥50,000/mm^3 (≥50.0 × 10^9/L) in the synovial fluid and a positive Gram stain are the strongest indications to proceed with surgical irrigation and débridement. However, as evidenced by the eighteen patients who were excluded from this analysis because of a synovial fluid white blood-cell count of <50,000/mm^3 (<50.0 × 10^9/L) but still treated with surgical irrigation and débridement, the decision to manage an irritable hip surgically is based on the evaluation of all of the information collected during the diagnostic process.

The use of a validated clinical prediction algorithm for septic arthritis of the hip should be able to decrease utilization of health-care resources, minimize the use of painful procedures and unnecessary treatments, and optimize patient outcome. However, in our patient population, we were unable to confirm the utility of the clinical prediction algorithm developed by Kocher et al.[2]. On the basis of the low predictive probability of the best model that we could develop, we will continue to use hip ultrasonography and arthrocentesis as adjunctive diagnostic modalities in the evaluation of the irritable hip. Because of the low annual rates of septic arthritis of the hip, the development of a valid clinical prediction algorithm may best be accomplished in a prospective, multicenter study. The generalizability of the algorithm developed by Kocher et al. or of our algorithm is unknown and it is likely that neither is valid; thus, both should be applied with caution at other institutions. ■

Scott J. Luhmnann, MD
Angela Jones, BS
J. Eric Gordon, MD
Perry L. Schoenecker, MD
Jan D. Luhmann, MD
St. Louis Children's Hospital, One Children's Place, Suite 4S20 (S.J.L., A.J., J.E.G., and P.L.S.) and Suite 4S50 (J.D.L.), St. Louis, MO 63110.
E-mail address for S.J. Luhmann: luhmanns@msnotes.wustl.edu

Mario Schootman, PhD
Division of Health Behavioral Research, Department of Pediatrics and

Internal Medicine, Washington University School of Medicine, 4444 Forest Park, Suite 6700, St. Louis, MO 63110

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