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Case 26-2015: A 9-Month-Old Girl with Recurrent Fevers

Jean E. Klig, M.D., Vandana L. Madhavan, M.D., M.P.H., Gleeson N. Rebello, M.D., and Randheer Shailam, M.D.

PRESENTATION OF CASE

Dr. Whitney B. Schutzbank (Pediatrics): A 9-month-old girl was admitted to this hospital because of recurrent fevers (with temperatures up to 40.6°C) during the previous 9 days.

The patient had a history of a pelvic kidney and had otherwise been well until approximately 2 months before this admission, in the early spring, when high fevers occurred daily for 5 days, stopped for 4 days, and then recurred for 4 to 5 days. On examination by her pediatrician, a slightly erythematous tympanic membrane was reportedly present, as were labial adhesions, which precluded collection of a urine specimen for analysis or culture. A 10-day course of amoxicillin–clavulanate was administered for possible otitis media or urinary tract infection, and the fevers resolved on the third or fourth day of treatment.

Nine days before this admission, fever (with temperatures up to 40.6°C) occurred at night, with no other localizing symptoms. The patient was seen by her pediatrician the following day. The evaluation included urinalysis and culture of a urine specimen that was obtained by means of catheterization; these tests were reportedly negative. The fever recurred during the next 4 days, despite alternating treatment with ibuprofen and acetaminophen, and then resolved. Two days before this admission, in the afternoon, the temperature rose again to 40.6°C, with associated irritability. The next day, the patient returned to the pediatrician's office. On examination, the pharynx was slightly erythematous; the remainder of the examination, including assessment of the tympanic membranes, was normal. Analysis of a urine specimen that was obtained by means of catheterization revealed 1+ blood and trace protein and ketones by dipstick. The pediatrician advised the family to take the patient to the emergency department the next day for further evaluation.

The parents reported that the patient had decreased oral intake; she drank only sips of breast milk and a rehydration solution with glucose and electrolytes. She did not have a cough, rhinorrhea, vomiting, diarrhea, or a rash. She was born after a full-term gestation. Ultrasonography that had been performed while the patient was in utero had revealed a pelvic left kidney; since birth, she had been monitored by a nephrologist. Her growth and development had been normal, and

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Table 1. Laboratory Data.

Variable	Reference Range, Age-Adjusted*	On Admission
Hematocrit (%)	33.0–39.0	30.1
Hemoglobin (g/dl)	10.5–13.5	9.7
White-cell count (per mm^3)	6000–17,500	19,500
Differential count (%)		
Neutrophils	17–49	56
Lymphocytes	67–77	38
Monocytes	4–11	6
Platelet count (per mm^3)	150,000–450,000	774,000
Mean corpuscular volume (μm^3)	70–86	80
Erythrocyte count (per mm^3)	3,700,000–5,300,000	3,770,000
Erythrocyte sedimentation rate (mm/hr)	0–20	111
Peripheral-blood smear description		2+ hypochromasia, large platelets
Sodium (mmol/liter)	135–145	134
Potassium (mmol/liter)	3.4–4.8	4.0
Chloride (mmol/liter)	98–106	97
Carbon dioxide (mmol/liter)	22.0–27.0	22.7
Plasma anion gap (mmol/liter)	3–15	14
C-reactive protein (mg/liter)	<8.0 for inflammation	159.3
Aspartate aminotransferase (U/liter)	9–80	129
Alanine aminotransferase (U/liter)	7–30	65
Lactate dehydrogenase (U/liter)	110–210	370

* Reference values are affected by many variables, including the patient population and the laboratory methods used. The ranges used at Massachusetts General Hospital are age-adjusted for patients who are not pregnant and do not have medical conditions that could affect the results. They may therefore not be appropriate for all patients.

she was crawling without difficulty during this illness. Her immunizations, including the influenza vaccination, were current; she had taken no medications before this illness and had no known allergies. She lived with her parents, older siblings, and a dog and two cats. She had no exposure to tuberculosis or sick contacts and had not traveled outside the country. Her father had Graves' disease, her mother had the polycystic ovary syndrome, her sister had had a urinary tract infection, and her brother had esophageal atresia and tracheomalacia.

On examination, the patient was alert, had flushed cheeks, and did not have signs of sepsis. The temperature was 38.1°C, the pulse 166 beats per minute, the respiratory rate 40 breaths per minute, and the oxygen saturation 100% while she was breathing ambient air; the remainder of the examination was normal. The posterior oropharynx could not be visualized. Blood levels of glucose, ferritin, total protein, albumin, globulin, total and direct bilirubin, alkaline phosphatase were normal, as were results of renal-function tests; other test results are shown in Table 1. Urinalysis revealed 1+ ketones and 1+ occult blood by dipstick, with 0 to 2 white cells and red cells, few bacteria, and few squamous cells per high-power field and amorphous crystals. Specimens of blood and urine, which were obtained by means of catheterization, were cultured. Screening of the nasal secretions for respiratory viruses was negative.

Dr. Randheer Shailam: Frontal and lateral chest radiographs (Fig. 1A and 1B) show mild pulmonary hyperinflation and mild interstitial opacities, without a focal air-space opacity; these findings are consistent with reactive airway disease, or bronchiolitis. There is no evidence of focal consolidation, pleural effusion, or pneumothorax. Ultrasound images of the kidneys (Fig. 1C and 1D) show that the right kidney (7.2 cm in length, in the renal fossa) and the left kidney (4.7 cm in length, in the left lower quadrant) have a normal appearance. There is no evidence of pyelonephritis, perinephric-fluid collection, abscess, hydronephrosis, or bladder abnormality.

Dr. Schutzbank: In the emergency department, the temperature rose to 40.0°C. The patient was admitted to the hospital. Examination revealed pharyngeal injection without exudate, a palpable left inguinal lymph node (1 cm in diameter), and normal femoral pulses. The remainder of the examination was unchanged. Ceftriaxone and acetaminophen were administered, and crystalloid solution was infused. A tuberculin skin test was performed. On the first hospital day, the maximum temperature was 39.2°C. Approximately 22 hours after presentation, a new symptom developed and additional diagnostic tests were performed.

DIFFERENTIAL DIAGNOSIS

EMERGENCY-MEDICINE PERSPECTIVE

Dr. Jean E. Klig: All the discussants are aware of the diagnosis in this case. This previously healthy

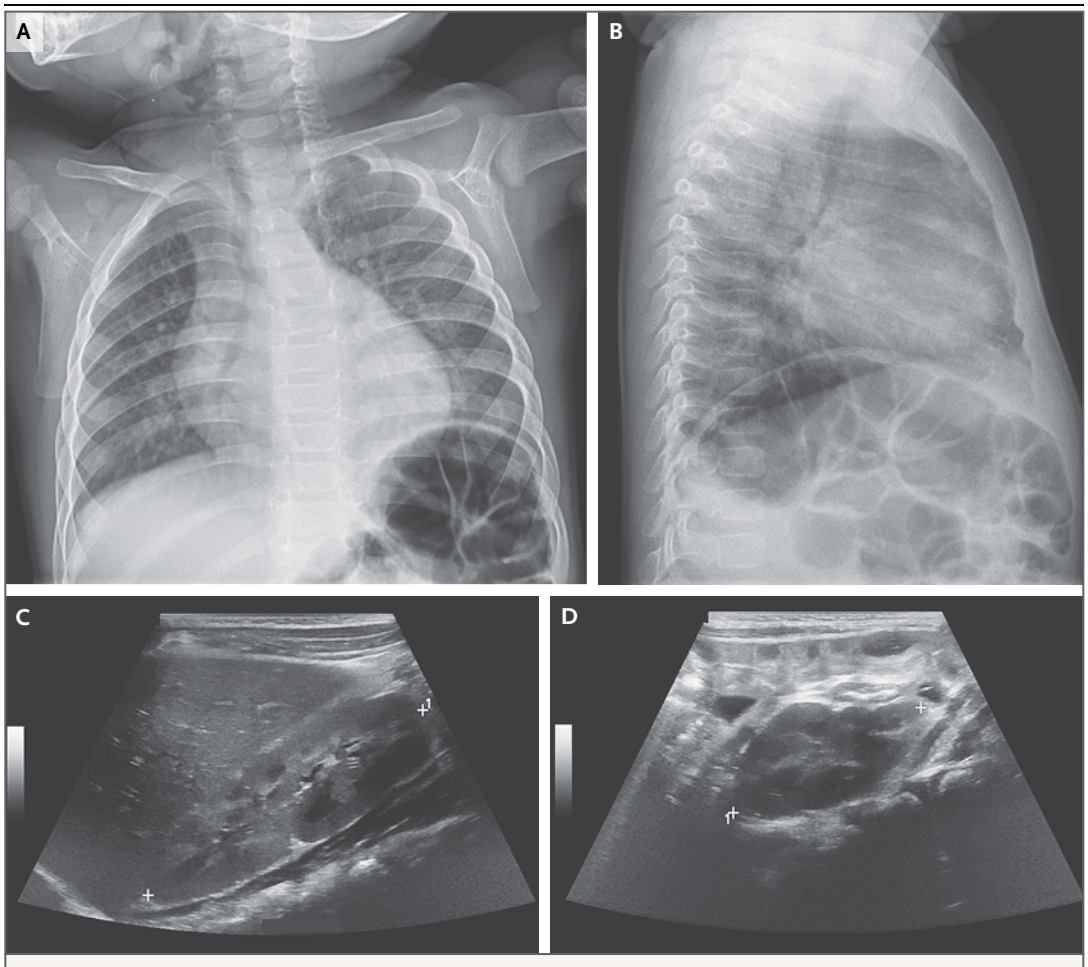

Figure 1. Imaging Studies Obtained in the Emergency Department.

Frontal and lateral chest radiographs (Panels A and B, respectively) show mild pulmonary hyperinflation and mild interstitial opacities. Ultrasound images of the abdomen and pelvis (Panels C and D, respectively) show that the right kidney has a normal appearance and location and that the left kidney, located in the pelvis, is ectopic but otherwise normal.

9-month-old girl with a known pelvic kidney presented to the emergency department with recurrent high fevers, as well as decreased oral intake, fussiness, and persistent clinging to her mother. The clinical assessment included prompt evaluation of the ABCs (airway, breathing, and circulation), with concurrent investigation and synthesis of salient findings on the history and physical examination.[1] Since the patient's condition was stable, her initial treatment consisted of antipyretic agents and an intravenous bolus of normal saline for rehydration, which were administered as baseline laboratory tests were performed.

Important elements of the history were recurrent and variable fevers over the past 2 months, a decline in oral intake during the 2 to 3 days before admission, and gradual behavior changes, including being less playful between episodes of fever and clinging to her mother on presentation to the emergency department. The patient had always been interactive at routine visits to the pediatrician's office, so this clingy behavior in the emergency department reflected a marked shift from baseline. The physical examination was notable for a lack of specific findings other than an appearance of mild-to-moderate illness and a preference to rest in her mother's arms with her legs flexed up toward her torso. She had a fever, tachycardia, tachypnea, mild poste-

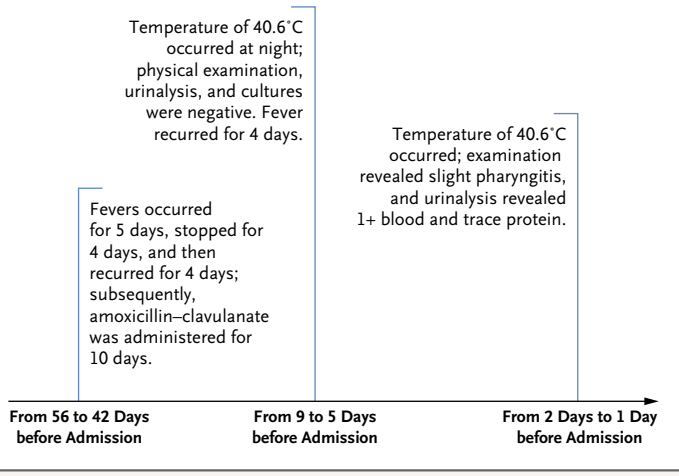

Figure 2. Clinical Timeline before Admission.

rior oropharyngeal erythema, and a few palpable small lymph nodes in her neck and groin.

Timeline of Illness

In order to construct a differential diagnosis for this patient, one may consider a timeline of the patient's presentation (Fig. 2) and any potential limits to clinical interpretation. The episodes of fever started in early spring and recurred for almost 2 weeks before she was seen by her pediatrician; the fevers stopped within a few days after treatment with oral antibiotic agents was initiated, and then she remained afebrile for nearly 4 weeks. The fevers recurred for a 4-day period during the week before the current admission and then resolved without specific treatment. She remained afebrile for 3 days, but the fevers resumed in the 48 hours before her arrival at the emergency department.

The nearly 4 weeks of symptom quiescence was either part of a longitudinal progression of a single process (possibly with missed low-grade fevers) or a period of wellness that ended with a new febrile illness in the week before this admission. Given the expanded symptoms that developed on presentation to the emergency department, the 3 days without fever that occurred just before presentation were most likely a turning point during which her illness progressed.

There were some potential limitations to the clinical interpretation. The child was preverbal and variably cooperative with the physical examination, leaving some elements to serial observation. The mother was distraught from managing weeks of fever symptoms and provided the history from recall, thereby possibly omitting details. Finally, the antibiotic treatment had preceded the 4 weeks without symptoms, which could contribute to an atypical presentation or partially treated source of infection.

Causes of Prolonged Fever in Children

The differential diagnosis in the emergency department focused on the common causes of prolonged fever in children, including infectious and noninfectious entities.[2] Infectious causes are more common overall and include urinary tract infections and related complications, osteomyelitis, cat scratch disease, Epstein–Barr virus (EBV) infection, and Lyme disease. The patient's history of a pelvic kidney and her older sister's history of urinary tract infections made a similar infection or complication seem plausible. Laboratory testing revealed elevation of acute inflammatory markers, including the white-cell count, platelet count, erythrocyte sedimentation rate, and C-reactive protein level; these findings raise further suspicion of an infectious cause. Chest radiographs, renal ultrasound images, and nasal swabs for viruses were all negative. Mild elevation of hepatic aminotransferase levels was noted, possibly suggesting a systemic viral infection, such as EBV.[3] Similar elevation of lactate dehydrogenase levels could be a result of infection-related cell turnover.

The differential diagnosis in the emergency department was further narrowed on the basis of these laboratory findings; urinary tract infections and related complications, osteomyelitis, EBV infection, and Lyme disease were considered to be the most likely possibilities. A complication of urinary tract infection, such as an upper urinary tract disease or abscess related to the pelvic kidney, remained a major concern. Subclinical osteomyelitis (particularly in a long bone) was also a concern given the patient's age, her tendency to cling to her mother, and the absence of point tenderness and painful, limited joint motion on physical examination.[4]

The patient was treated with an initial dose of intravenous ceftriaxone because she had persistent tachycardia (even when she was afebrile and had been fully rehydrated with intravenous fluids) and elevated inflammatory markers, which we thought could reflect bacteremia or

potential early sepsis. She was admitted to the inpatient service for serial reassessments and further imaging studies.

INFECTIOUS-DISEASE PERSPECTIVE

Dr. Vandana L. Madhavan: The differential diagnosis of recurrent fevers in children can be divided into four broad categories. These include multiple discrete viral or bacterial infections (e.g., bronchiolitis, gastroenteritis, otitis media, or pneumonia), an untreated or partially treated infection, an underlying inflammatory noninfectious process, or a periodic fever syndrome (e.g., familial Mediterranean fever, the PFAPA [periodic fever, aphthous stomatitis, pharyngitis, and adenitis] syndrome, TRAPS [the tumor necrosis factor receptor–associated periodic syndrome], or the hyper-IgD syndrome).

Recurrent Fevers versus Fever of Unknown Origin

One consideration in this case is whether the patient had recurrent fevers or fever of unknown origin. While the terms are often used interchangeably, and the differential diagnosis is similar for both, there are specific definitions for fever of unknown origin. In 1961, fever of unknown origin was defined as a temperature of greater than 38.3°C (101°F) "on several occasions," a duration of illness of greater than 3 weeks, and no cause of fever despite 1 week of inpatient investigation.[5] Over subsequent decades, there have been amendments to the definition and proposals for different categories. Although there is no single generally accepted definition, a working definition would include a temperature of greater than 38.3°C (101°F), a duration of illness of at least 1 week, and a negative initial outpatient or inpatient evaluation, which includes history taking, physical examination, and routine laboratory testing.[6-8] The differential diagnosis of fever of unknown origin is broad (Table 2). A systematic review of 18 studies performed between 1950 and 2010 involving children who were evaluated for fever of unknown origin showed that half had infections, fewer than 10% had collagen vascular disease or malignant tumors, and almost one quarter had no diagnosis.[10]

This patient had recurrent nonperiodic fevers over a period of 2 months. Although she does not meet the criteria for a diagnosis of fever of unknown origin, the full differential diagnosis for recurrent fevers should be considered, especially the most common causes. The most common and treatable diagnoses are infections. Malignant tumors should also be ruled out during the inpatient admission. Evaluation can continue in an outpatient setting. The periodic fever syndrome is a diagnosis of exclusion; a more detailed diary of the fever and other symptoms

Table 2. Differential Diagnosis of Pediatric Fever of Unknown Origin.*

Infection	**Collagen vascular disease**
Bacterial	Juvenile idiopathic arthritis
Abscess (hepatic, pelvic, perinephric, subdiaphragmatic)	Polyarteritis nodosa
Bartonella henselae infection	Systemic lupus erythematosus
Brucellosis	**Malignant tumor**
Endocarditis	Hodgkin's disease
Leptospirosis	Leukemia
Mastoiditis (chronic)	Lymphoma
Osteomyelitis	Neuroblastoma
Pyelonephritis	**Other**
Sinusitis	Diabetes insipidus (central or nephrogenic)
Salmonellosis	Ectodermal dysplasia
Tuberculosis	Factitious fever
Tularemia	Familial dysautonomia
Viral	Granulomatous colitis
Adenovirus	Hemophagocytic lymphohistiocytosis
Arboviruses	Infantile cortical hyperostosis
Cytomegalovirus	Kawasaki's disease
Hepatitis viruses	Kikuchi–Fujimoto disease
Enteroviruses	Pancreatitis
Epstein–Barr virus	Periodic fever syndrome
Chlamydial	Reaction (drug fever, serum sickness)
Lymphogranuloma venereum	Sarcoidosis
Psittacosis	Thyrotoxicosis
Rickettsial	
Q fever	
Rocky Mountain spotted fever	
Fungal	
Blastomycosis (nonpulmonary)	
Histoplasmosis (disseminated)	
Parasitic	
Malaria	
Toxoplasmosis	
Toxocariasis (visceral larva migrans)	

* Data are adapted from Palazzi and Feigin.[9]

would be beneficial. Multiple discrete illnesses remained possible, and routine diagnostic tests were performed, as noted.

Because of the patient's personal and family history, there was a specific focus on a possible urinary tract infection, but evaluation for this condition was again unrevealing. During her last two episodes of fever, the evaluations included urinalyses of samples obtained by means of bladder catheterization; the tests were negative for leukocytes and nitrites, and she did not receive any antibiotic therapy. Notable findings on admission included elevation of the peripheral-blood leukocyte count, hepatic aminotransferase levels, erythrocyte sedimentation rate, and C-reactive protein level, and a chest radiograph was suggestive of bronchiolitis. Most of these findings could be consistent with a viral illness and prompted additional viral studies. However, elevation of both inflammatory markers suggested an underlying process of longer duration. The patient was therefore appropriately admitted for continued observation and serial examination.

The decision to start empirical antibiotic therapy is a point of debate, and clinical judgment could justify either decision. The patient was an infant who was clearly ill, with abnormal laboratory findings and a family history of urinary tract infection. Routine blood and urine cultures had already been performed. However, she was fully immunized and was not a member of a high-risk population, and there was a risk of possibly masking an underlying infection.

On the first hospital day, the maximum temperature was 39.2°C. Approximately 22 hours after presentation, the patient's mother noted that the patient was kicking only her right leg during placement of an intravenous catheter. Orthopedic consultation was requested.

Dr. Gleeson N. Rebello: On examination, the patient was irritable and appeared very ill. She had palpable diffuse fullness in the left groin, with erythema of the overlying skin. The left leg was externally rotated; the hip and knee were flexed, with no kicking, and the toes were warm and well perfused. The hip's range of motion was tested, with concerted efforts to distract and calm the patient while gently attempting to move her left hip in multiple directions. She had marked restriction of all passive motion and no active motion in her left hip joint.

Septic Arthritis of the Hip

Dr. Madhavan: The patient's inability to move her left leg, in addition to her high fevers and laboratory findings, make acute septic arthritis of the left hip the leading clinical diagnosis. Features that can help in distinguishing septic arthritis from toxic synovitis in children are an inability to bear weight, fever, and elevations of the erythrocyte sedimentation rate (>40 mm per hour) and white-cell count (>12,000 per cubic millimeter).[11] Although these criteria are not reliable in nonambulatory patients, this child met three of the four criteria and had a 93% probability of septic arthritis. The importance of clinical judgment cannot be overemphasized in this setting; it has been said that "the gold standard for septic arthritis should be the index of suspicion of an experienced clinician."[12] Imaging studies of the hips were requested.

Dr. Shailam: Radiographs of the pelvis that were obtained in the frontal and "frog lateral" views (Fig. 3A and 3B) show widening of the left hip-joint space, with inferior and lateral displacement of the proximal left femur relative to the acetabulum; these findings are suggestive of a joint effusion. There is no evidence of osteomyelitis. The right hip appears to be normal. These findings are confirmed on an ultrasound image of the left hip (Fig. 3C), which shows a moderately sized effusion of the left hip joint and capsular distention; these features can be seen in patients with toxic synovitis and septic arthritis.

DR. JEAN E. KLIG'S DIAGNOSIS

Occult bacterial infection, most likely a perinephric abscess or subclinical osteomyelitis.

DR. VANDANA L. MADHAVAN'S DIAGNOSIS

Acute septic arthritis of the left hip.

DISCUSSION OF MANAGEMENT

INITIAL ORTHOPEDIC MANAGEMENT

Dr. Rebello: Because of the presence of fluid in the hip joint on imaging studies and the findings on general and local clinical examination, we decided to perform an emergency arthrotomy of the patient's left hip. Septic arthritis is a pediatric

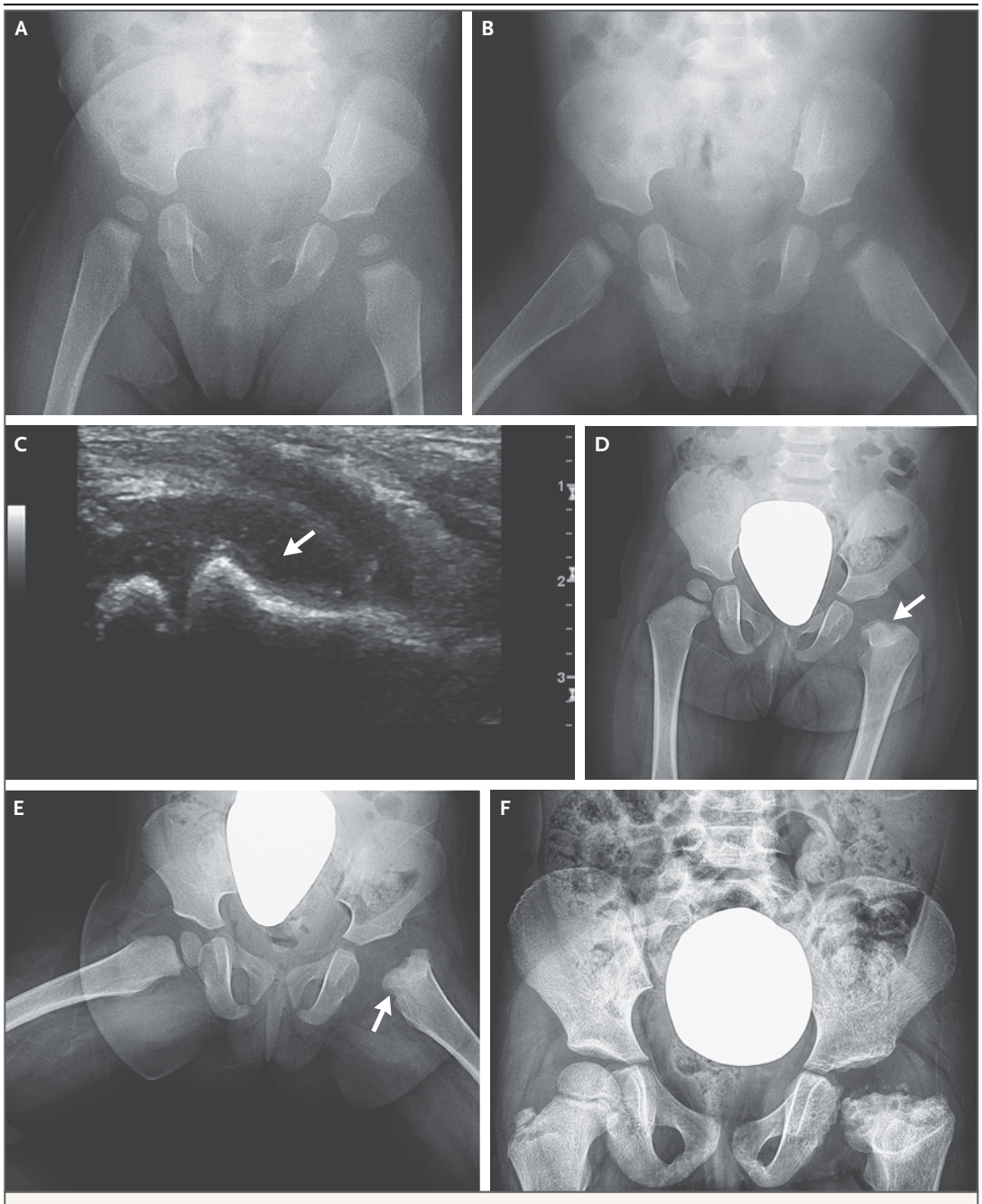

Figure 3. Imaging Studies of the Pelvis and Hips.

Radiographs of the pelvis that were obtained in the frontal and "frog lateral" positions (Panels A and B, respectively) show inferior and lateral displacement of the ossification center of the left femoral head, a finding that indicates widening of the joint space. An ultrasound image of the left hip (Panel C) shows a joint effusion (arrow) and capsular thickening and distention. Follow-up radiographs of the pelvis that were obtained in the frontal and frog-lateral positions (Panels D and E, respectively) at 19 months of age (10 months after discharge) show gradual resorption of the ossification center of the left femoral head, as well as a shortened, widened, sclerotic, irregularly marginated proximal left femoral metaphysis and neck (arrows) and mild widening of the left joint space. A follow-up frontal radiograph of the pelvis (Panel F) that was obtained at 3 years 10 months of age shows similar findings, with progressive ossification along the superior margin of the proximal left femur; the right hip appears to be normal.

orthopedic emergency. Early diagnosis and expedited treatment are critical for a satisfactory outcome. Although bone has the ability to repair itself, articular and epiphyseal cartilage does not. In addition to the effect of the infection on the child's general health, there is a risk of considerable damage to the joint. Potent proteolytic enzymes are released in the joint directly from the bacteria and host tissue (i.e., synovial cells and chondrocytes) in response to the infection; these enzymes destroy the hyaline cartilage. Some studies have shown that cartilage destruction begins within 6 to 8 hours after bacterial colonization.[13-16]

An incision was made in the patient's left groin crease while she was under general anesthesia, and an anterior approach was used to access the left hip joint. On opening the capsule of the joint, a large amount of thick pus was found that was sent for Gram's staining and culture. The cartilage on the femoral head appeared pale, but there were no erosions. Approximately 9 liters of saline were used to irrigate the joint. After thorough irrigation and débridement, the incision was closed over a drain, and a hip abduction brace was applied.

INFECTIOUS-DISEASE MANAGEMENT

Dr. Madhavan: In the laboratory report, the synovial fluid was described as orange and turbid, with 75,200 nucleated cells (90% neutrophils, 2% lymphocytes, 4% monocytes, and 4% macrophages), a pH of 7.44, a glucose level of 2 mg per deciliter (0.1 mmol per liter), and a protein level of 4.9 g per deciliter. The leukocyte count of greater than 50,000, neutrophil percentage of greater than 75%, elevated protein level, and low glucose level are all highly suggestive of septic arthritis. Because this patient lived in Eastern Massachusetts, it should be noted that neither her clinical presentation (with fever and involvement of the hip rather than the knee) nor her laboratory data (with markedly elevated white-cell counts in both blood and synovial fluid) supported an evaluation for Lyme arthritis.

The microbiologic features of septic arthritis can vary depending on age, immunization history, possible exposures, and the presence of chronic conditions. Methicillin-susceptible *Staphylococcus aureus* (MSSA) and methicillin-resistant *S. aureus* (MRSA) are the most common causes in all age groups. Of the types of streptococci, group B streptococcus is most common in infants younger than 3 months of age, group A streptococcus is most common in infants older than 3 months of age, and *Streptococcus pneumoniae* is most common in infants older than 3 months of age who are not immunized. *S. pyogenes* would be more likely in this patient than *S. agalactiae* or *S. pneumoniae* because of her age and immunization status, respectively. The gram-negative bacillus *Kingella kingae* is increasingly identified in patients with septic arthritis who are between 3 months and 3 years of age. *Neisseria gonorrhoeae*, *Haemophilus influenzae*, salmonella species, and more unusual organisms (e.g., other gram-negative bacilli, brucella, and *Mycobacterium tuberculosis*) are unlikely in this patient, given her demographic characteristics and exposure history.[8]

Gram's staining of the synovial fluid revealed no organisms. Aerobic and anaerobic cultures had no growth. After the arthrotomy, empirical ceftriaxone was continued at a daily dose of 75 mg per kilogram of body weight, and vancomycin was added, at a dose that was adjusted upward to therapeutic levels, ultimately reaching 120 mg per kilogram per day. This regimen covered MSSA, MRSA (given the >10% prevalence of MRSA isolates in the area), streptococci, and gram-negative bacilli, including *K. kingae*. Because of concern about myelosuppression, the regimen was switched to daptomycin at a dose of 6 mg per kilogram per day on hospital day 8. On the same day, she had a new fever; she underwent repeat arthrocentesis on hospital day 10. Gram's staining and culture of synovial fluid were again negative. On hospital day 12, after defervescence, the patient was discharged home, where she completed a 6-week course of parenteral antibiotic therapy. She then completed another 6-week course of oral amoxicillin–clavulanate (90 mg per kilogram per day of the amoxicillin component). A typical antibacterial course includes 2 to 4 weeks of parenteral therapy followed by an additional 2 to 4 weeks of oral therapy, for a total of 4 to 8 weeks of treatment. This patient required a longer duration of parenteral therapy and a longer total duration of therapy because of the extent of disease in her joint.[8]

SUMMARY

In summary, the patient had septic arthritis of the hip without an identified pathogen, which occurs in over 50% of cases, even without previous antibiotic treatment. She probably had distinct mild infections 2 months before admission and a separate, more acute and severe onset of infection immediately before admission. She may have had bacteremia during the first fever peak, with seeding of her left hip, and then had subsequent development of focal symptoms. The cause may have been MSSA or group A streptococcus (from nasopharyngeal colonization) that preferentially seeded the left hip because of previously unnoticed trauma and subsequent mild damage.

ADDITIONAL ORTHOPEDIC MANAGEMENT

Dr. Rebello: At a follow-up visit with the patient at 3 years 10 months of age, the patient's mother reported that she was physically active and healthy but that her left leg tended to "give out" and she fell frequently. On examination, she walked and ran with a painless, short-limbed Trendelenburg's gait (characterized by dropping of the pelvis on the unaffected side and leaning toward the affected side when bearing weight); her left leg was in external rotation and had limited internal rotation of the hip joint.

Dr. Shailam: Radiographs of the pelvis that were obtained when the patient was 19 months of age (Fig. 3D and 3E), 10 months after discharge, show resorption of the ossification center of the left femoral head, as well as mild widening of the left joint space and a shortened, widened, sclerotic, irregularly marginated proximal left femoral metaphysis and neck. A study performed when the patient was 3 years 10 months of age (Fig. 3F), shows findings similar to those seen at 19 months of age, with progressive ossification along the superior margin of the proximal left femur.

Dr. Rebello: The capital physis and the triradiate cartilage, which is the growth plate of the acetabulum, were clearly damaged by this child's infection. Capsular distention, which occurs as a result of the effusion, coupled with muscle spasm, which occurs as a result of pain, can lead to a pathological dislocation of the joint and necessitate the application of a brace. Increased intra-articular pressure, which occurs as a result of the pus accumulation, can lead to avascular necrosis of the femoral head. All these features can lead to limb-length discrepancy, proximal femoral deformity, acetabular dysplasia, and joint stiffness (which were seen in this case) and may lead to degenerative arthritis in the long term.[17-20]

Options for future orthopedic management include a trochanteric epiphysiodesis (ablation of the trochanteric growth plate) to prevent trochanteric overgrowth, which causes abductor insufficiency. A valgus femoral osteotomy — which involves distally reattaching the trochanter to correct proximal femoral varus deformity with trochanteric advancement — is another option to improve the mechanics of the hip joint. When the patient is closer to reaching full skeletal maturity, a contralateral distal femoral epiphysiodesis (ablation of the distal femoral growth plate) should be performed to equalize leg length. Total hip replacement is a procedure that will be warranted if she has pain regardless of attempts to perform hip salvage through osteotomies. The child is currently being monitored, with no active intervention, but there is a high likelihood that she will require reconstructive procedures in the future.

Dr. Nancy Lee Harris (Pathology): Are there questions for any of our discussants?

A Physician: In a fully immunized child older than 6 months of age who does not appear to have sepsis, what is the justification for the use of empirical antibiotics?

Dr. Klig: The decision to provide empirical antibiotic coverage in this case was challenging, and your point is important. In emergency medicine, we rely heavily on variations in status that are observed over time. During the several hours that this patient was in the emergency department, she went from looking moderately ill to looking better and then back to looking moderately ill. There can be a very brief interval between the point at which a child appears to be only moderately ill and the point at which serious deterioration occurs. The decision to administer antibiotics in this case was based on the patient's variable clinical picture. For a child such as this one, who teeters toward the edge of worsening illness with persistent tachycardia (with or without fever), guidelines recommend consideration of anti-

biotics. However, in general, avoiding empirical antibiotic coverage is the way to go, if possible.

Dr. Madhavan: This may be an unsatisfying answer, but it does depend on a case-by-case evaluation. We could not confirm that this child did not have sepsis. She was quite ill and different from her baseline, with abnormal laboratory data. Blood and urine cultures were performed, and empirical antibiotics were administered.

FINAL DIAGNOSIS

Septic arthritis of the hip.

This case was presented at the postgraduate course "Primary Care Pediatrics," directed by Drs. John P. T. Co, Peter T. Greenspan, Ronni L. Goldsmith, Janice A. Lowe, and Ronald E. Kleinman and sponsored by the Harvard Medical School Department of Continuing Education.

No potential conflict of interest relevant to this article was reported.

Disclosure forms provided by the authors are available with the full text of this article at NEJM.org.

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