

Limp in children: Differentiating benign from dire causes

Key decision points in the stepwise approach presented here can make your investigation more efficient and productive.

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PRACTICE RECOMMENDATIONS

› Use radiographs to identify bone changes from disease (as well as fracture) when evaluating a limp. **C**

› Consider growth plate injuries as well as toddler's fracture; both may be radiographically occult and require immobilization for treatment. **C**

› Consider child abuse if the patient has an isolated mid-shaft tibial fracture. **C**

› Assess for fever, elevated sedimentation rate, elevated C-reactive protein, and leukocytosis when radiographs are unrevealing or when a patient has systemic symptoms associated with limp. These factors are predictors of septic arthritis. **B**

Strength of recommendation (SOR)

- A** Good-quality patient-oriented evidence
- B** Inconsistent or limited-quality patient-oriented evidence
- C** Consensus, usual practice, opinion, disease-oriented evidence, case series

A mother brings her 4-year-old son to the office because he has been limping. She isn't aware of a specific trauma. But the boy and his twin brother, while recovering from "colds," were rough-housing in their room when this son complained of pain. He is afebrile and points to his knee as the area of pain.

Although limping in children is common—the incidence is roughly 2 per 1000¹—it is never normal. It indicates pain, weakness, or structural abnormality.² Most cases result from trauma.¹ Limp usually resolves with little intervention and no sequelae. However, the differential diagnosis is broad and daunting (TABLE 1), and some causes of limp are associated with significant morbidity.

Helpful tips for your initial assessment

Many textbook authors have described some causes of limp as "painless." However, truly painless limp is rare, seldom acute, and usually the result of mechanical or neuromuscular disorders.¹ A more likely explanation for acute "painless" limp is that a young child with pain is unable to express pain or accurately identify its location. Further, the child may instinctively avoid painful positions or movements and, thus, may present only with decreased movement of an extremity or refusal to bear weight.³

With a child who has knee pain, remember the pediatrics maxim: "Knee pain equals hip pain,"³ underscoring the diagnostic difficulty with limp.

Also bear in mind that children of different ages tend to have different etiologies of limp (TABLE 2). For example, septic arthritis, osteomyelitis, and transient synovitis occur more commonly in children under 10 years. Legg-Calve-Perthes disease and leukemia are more common in children between the ages of 4 and 10. Slipped capital femoral epiphysis (SCFE) is more common in boys over the age of 11.

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**Salter-Harris
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TABLE 1
**Possible causes of limp
 in a child^{1-3,17}**

Traumatic/mechanical
Fractures, stress fractures
Muscle injuries
Sprains/strains
Contusions
Developmental dysplasia of the hip
Slipped capital femoral epiphysis
Tarsal coalition
Child abuse
Overuse injuries
Leg length discrepancy
Infectious
Septic arthritis
Osteomyelitis
Lyme disease
Psoas abscess
Diskitis
Inflammatory
Transient synovitis
Juvenile rheumatoid arthritis
Ankylosing spondylitis
Reiter syndrome
Lupus
Vascular
Legg-Calve-Perthes disease
Osteonecrosis
Hemoglobinopathies (sickle cell disease)
Neoplastic
Leukemia, lymphoma
Malignant/lytic tumors (Ewing sarcoma, osteogenic sarcoma, etc.)
Metabolic
Rickets
Hyperparathyroidism
Neuromuscular
Muscular dystrophy
Cerebral palsy
Peripheral neuropathy

Fracture

Fracture is a possibility across all age ranges, necessitating radiographs if suspected. Beyond detecting fractures, x-ray films can identify bony changes associated with disease (eg, Legg-Calve-Perthes disease, SCFE). Radiographs can also identify a clinically significant joint effusion at the hip.⁴ However, x-ray results may be falsely negative for some fracture types.

■ **Salter-Harris Type I fractures** are transverse fractures through the growth plate with epiphyseal separation from the metaphysis.⁵ Typical findings are a history of trauma and point tenderness over the epiphyseal plate. Type I fractures are radiographically occult, making the injury easy to mistake as a sprain. Nonetheless, growth plate injuries are common in children, requiring immobilization.

■ **Toddler's fracture** was first described as a spiral, oblique undisplaced fracture of the distal tibial shaft in children from 9 months to 3 years of age.⁶ It results from a rotational or twisting force through the tibia while the leg rotates internally on a planted foot.^{7,8} This is the most common tibial fracture in infants and young children.⁹ The incidence has been reported as 0.6 to 2.5 per 1000 pediatric visits.¹⁰ Accurate diagnosis is important because current treatment recommendations suggest a long leg cast for 3 to 5 weeks, followed by a short leg cast for a total of 6 weeks.¹¹

Despite being the most common tibial fracture, toddler's fracture is easily missed. Initial radiographs are only 53% sensitive.^{7,10} This implies that nearly 50% of children with tibial fracture will have an initially negative x-ray result. However, nearly 94% of children with a confirmed toddler's fracture have been unable to bear weight.¹² Evidence suggests that despite negative radiographs, patients with point tenderness over the tibia and an inability to bear weight should be treated for presumed toddler's fracture.¹²

Another confusing aspect of toddler's fracture is that the causative injury is often considered insignificant by parents—eg, tripping, falling from a modest height, or a twisting motion.^{7,8} These events may occur countless times during the average day of a

TABLE 2

Common causes of limp according to child's age¹

<3 years	3-10 years	11-18 years
Foreign body	Legg-Calve-Perthes disease	Juvenile arthritis
Osteomyelitis	Osteomyelitis	Slipped capital femoral epiphysis
Septic arthritis	Septic arthritis	Trauma (physeal fracture)
Toddler's fracture	Transient synovitis	Tumor
Transient synovitis	Trauma (physeal fracture)	
Tumor	Tumor	

toddler. Often parents do not witness the injury and are unable to describe the mechanism of injury.⁷

■ **When to suspect child abuse.** When a child presents with fracture after an unwitnessed trauma and the story does not match the injury pattern, consider child abuse. With tibial fractures, the location of the fracture can help distinguish a result of abuse from a toddler's fracture. Toddler's fracture is classically described as a distal tibial fracture. In contrast, a midshaft tibial fracture often suggests child abuse.^{8,13} In a small retrospective study of 37 children diagnosed with toddler's fracture, 4 midshaft tibial fractures were found.⁸ Child abuse was confirmed in 2 of these cases.⁸ However, other authors, including Dr. Dunbar in his sentinel article,⁶ assert that toddler's fracture may occasionally extend into the midshaft of the tibia. Consequently, a midshaft tibial fracture is not pathognomonic for child abuse. But the diagnosis should be considered. Perform a careful examination for other signs of abuse or neglect, and do not hesitate to report suspected child abuse to the proper local and state authorities.¹⁴

Transient synovitis vs septic arthritis

A child who limps or refuses to bear weight on a limb often has associated symptoms of acute illness. In these cases, or when radiographs have ruled out apparent abnormalities such as Legg-Calve-Perthes disease, SCFE, and fracture, consider septic arthri-

tis or transient synovitis (FIGURE). Both may present with limp and fever as well as pain, decreased range of motion, bone tenderness, swelling, and warmth.¹⁵

■ **Transient synovitis** is the most common cause of hip pain in children up to 10 years of age, with a 3% risk of occurrence through childhood.^{16,17} Its cause is unclear, but many experts have proposed a viral agent.¹⁷ Transient synovitis universally resolves without sequelae in 1 to 2 weeks. Therefore, prescribe rest and nonsteroidal anti-inflammatory drugs (NSAIDs) for symptomatic relief, and reassure parents.¹⁶

■ **Septic arthritis**, although often similar in presentation to transient synovitis, requires hospitalization, operative drainage, and parenteral antibiotics.¹⁸ A delay in diagnosis is associated with poor outcome, including osteonecrosis, growth arrest, permanent loss of joint function, and sepsis.^{3,18}

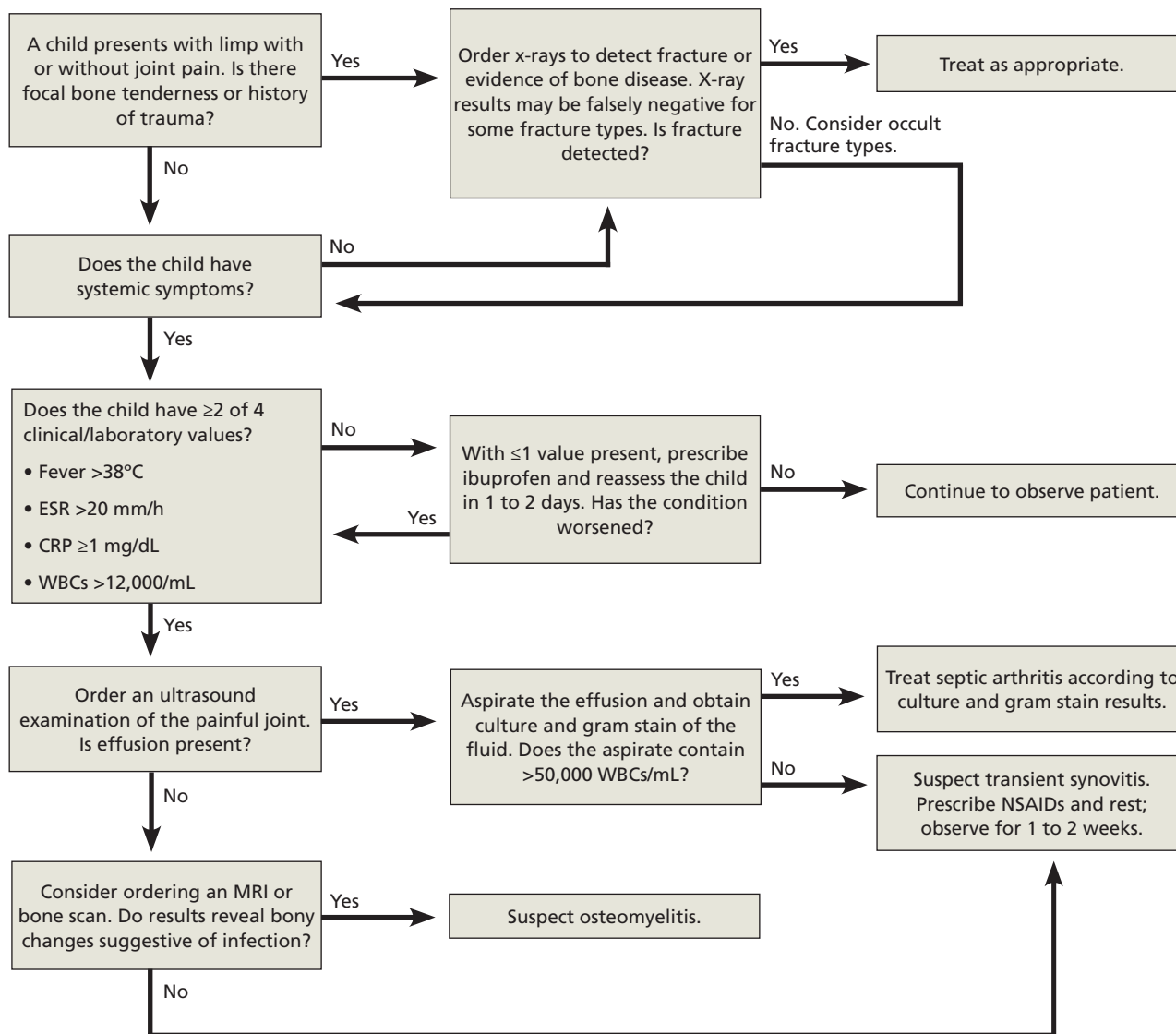
Several studies have shown children with septic arthritis usually appear more acutely ill than those with transient synovitis.^{4,18-21} They are described as toxic-appearing, and have leukocytosis, a high erythrocyte sedimentation rate (ESR), and a high fever.¹⁹ However, no single marker or specific laboratory value consistently identifies septic arthritis. Many studies have been performed in an effort to identify a collection of factors, or an algorithm, that can predict the probability of septic arthritis.

Fever, an elevated ESR, and leukocytosis are independent multivariate clinical predictors for septic arthritis. The prediction algorithm published by Jung et al is the only study



A midshaft tibial fracture may be an indication of child abuse.

FIGURE
Diagnostic algorithm for pediatric limp^{3,4,6,8-12,15}



CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; MRI, magnetic resonance imaging; NSAIDs, nonsteroidal anti-inflammatory drugs; WBCs, white blood cells.

to have included C-reactive protein (CRP) as a predictive factor,⁴ which happens to be an excellent independent predictor of septic arthritis. Specifically, with a normal CRP <1 mg/dL, the probability of a patient *not* having septic arthritis is 87%.²²

While no predictive algorithm has been conclusively validated, the fact that the same clinical and laboratory predictors are

consistently identified can be useful. Simply, if a patient presents with joint pain and 2 or more of the 4 predictors, septic arthritis must be fully evaluated. The presence of 2 of 4 predictors suggests a risk of septic arthritis between 10% and 40%.^{4,18,20} A single predictor is associated with a risk of 1% to 10%.^{4,18,20} Yet, you must interpret these clinical predictors in light of the full clini-

cal picture, as septic arthritis is still possible in patients with only 1 predictor. Such possibilities require cautious management and close follow-up.

With 2 of 4 predictors present, suspect septic arthritis and order an ultrasound of the affected joint. If effusion is present, aspirate the joint. Some authors suggest that all patients with hip pain should undergo ultrasound, and that those with a joint effusion should undergo aspiration.¹⁵ However, joint aspiration, particularly of the hip, can be associated with multiple complications and should be avoided if possible.²² Effusion is also possible with transient synovitis and noninfectious causes of joint pain, but the aspirate will have a negative culture and normal gram stain findings. Ultrasound has been shown to be 100% accurate in predicting the presence of effusion.²³

How the opening case resolved

The boy avoided weight-bearing on the affected leg, but had no focal bone tenderness. Moving the hip, but not the knee, reproduced pain. Radiographs were negative for fracture or changes typical of Legg-Calve-Perthes disease. He was afebrile in the office, but the mother described a fever at home. The child appeared ill, but stable. We decided to obtain a blood sample.

Results for CRP, ESR, and white blood cell count were normal. With this information, we reassured the mother that the diagnosis was likely transient synovitis. We advised a weight-appropriate dose of ibuprofen and scheduled a follow-up appointment for 2 days later. **JFP**

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Children with septic arthritis usually appear more acutely ill than those with transient synovitis.

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