A child who limps often presents a diagnostic challenge. The differential diagnosis is extensive. Although the most common cause is trauma, awareness of other potential causes is important. The age of the child and the pattern of the gait help narrow the differential diagnosis. In most cases, a diagnosis can be made from the history and physical examination. If the diagnosis is not obvious after a careful clinical evaluation, plain radiographs provide an excellent means of screening for fracture, joint effusion, lytic lesions, periosteal reaction, and avascular necrosis. Other tests should only be ordered when indicated.


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ETIOLOGY

The differential diagnosis is extensive, and only the common or important causes are discussed (Box 1). Information on rare entities can be found in standard pediatric textbooks.

Trauma

Trauma is by far the most common cause of acute limp in children (Barkin et al., 2000). Trauma may induce limping as a result of fracture, sprain/strain, and contusion. Fractures are more common than are sprains and ligamentous strains in very young children (Sty, Wells, & Smith, 1988). Child abuse should be suspected if the nature or degree of the child’s injury does not fit the history given. In children older than 10 years, the most common cause of limping is ankle sprain (Sty et al.). Overuse syndromes are caused by microtrauma; examples of overuse syndromes are stress fracture, Osgood-Schlatter disease, shin splints, Sever’s disease, and chondromalacia patellae. Overuse syndromes are very common in school-aged children engaged in competitive sports activities.

Orthopedic/Mechanical Causes

Legg-Calvé-Perthes disease, or avascular necrosis of the femoral head, occurs primarily in children between the ages of 4 and 8 years, with a male to female ratio of 5:1 (Sty et al., 1988). The affected patient may complain of pain in the hip or the medial aspect of the ipsilateral knee that is often aggravated by exercise.

A slipped capital femoral epiphysis is caused by dislocation of the femoral head from its neck and shaft at the level of the upper epiphyseal plate. The condition typically affects obese adolescent boys. Black children are more predisposed to slipped capital femoral epiphysis than are White children (Clark, Little, 1997). The characteristic pain occurs in the affected hip and/or the medial aspect of the ipsilateral knee. Limping is the most common symptom (Connolly & Treves, 1998). Obligatory external rotation of the hip with flexion is characteristic.

The benign hypermobility syndrome is a common cause of evening limb pain, which may result in a limp. The condition can be detected by checking for hyperextension and laxity of the joints.

Chondromalacia patellae is common in adolescents. The condition is a result of misalignment of the patella in the femoral groove, producing abnormal shear forces on the patellar cartilage. The pain is usually retropatellar and aggravated by stair climbing.

Developmental dysplasia of the hip is more common in breech deliveries (Alexander, FitzRandoph, & McConnell, 1987). The female to male ratio is 8:1 (Alexander et al.). Despite careful screening in the neonatal period, some cases remain undetected until the time walking commences. When developmental dysplasia of the hip appears at walking age, the child has a Trendelenburg gait, decreased hip abduction, and thigh pistoning. In bilateral cases the child has a lordotic, swaying, “drunken sailor” (waddling) gait that is pathognomonic (Lawrence, 1998).

Leg length discrepancy of greater than 3% may cause a limp (Barkin et al., 2000). When the discrepancy is greater than 5.5%, the compensatory gait is often manifested by toe-walking on the side of the shorter limb (Song, Halliday, & Little, 1997).

Infections

Toxic synovitis is most likely a viral synovitis or postviral reactive arthritis (Sherry, 1999). It is the most common cause of limp with hip pain in children aged 3 to 10 years (Hart, 1996). The affected hip is usually held flexed, abducted, and externally rotated (Hart, 1996). The child does not appear systemically ill. The condition is invariably unilateral and self-limited.

Osteomyelitis is most common in children 3 to 12 years of age and is most often caused by Staphylococcus aureus. The infection usually occurs by hematogenous spread. Osteomyelitis usually involves the metaphysis of the long bone and is associated with tenderness, redness, warmth, and swelling over the lesion, as well as systemic signs, such as fever and toxicity. The organisms causing septic arthritis are basically the same as those causing osteomyelitis. Septic arthritis is the most common cause of severe monarticular pain (Sherry, 1999), with the hip being the most common site of infection (Wang, Wang, Yang, Tsai, & Liu, 2003). The affected joint is often erythematous, swollen, and tender.

Diskitis is an inflammatory disease of the intervertebral disk space that occurs almost exclusively in children (Clark, 1997). The affected joint is often erythematous, swollen, and tender.
The pain often radiates to the legs, causing a limp or refusal to bear weight. Exquisite tenderness is noted when the involved vertebrae are palpated.

**Neuromuscular Disorders**

Neuromuscular disorders such as myositis, muscular dystrophy, cerebral palsy, peripheral neuropathy, and reflex sympathetic dystrophy are known causes of limping in childhood (Dietz, Mathews, & Montgomery, 1990).

**Rheumatic Diseases**

Children with systemic lupus erythematosus, juvenile rheumatoid arthritis, juvenile dermatomyositis, and Henoch-Schönlein purpura may have limping as a presenting feature (Robson & Leung, 1994).

**Hematologic Disorders**

Children with hemophilia may have limp pain/limping as a result of bleeding into the tissues and joints. Vasocclusive episodes in sickle cell anemia also can cause a child to limp.

**Neoplastic Diseases**

Neoplasms are an uncommon cause of limping, but they must be considered so the diagnosis is not overlooked. Osteoid osteoma and osteochondroma are benign tumors of the bone that may manifest with limp pain or a limp. Malignant bone tumors include Ewing sarcoma and osteosarcoma. Systemic neoplasms that may cause limping include leukemia and metastatic neuroblastoma (Tuten, Gabos, Kumar, & Harter, 1998).

**Intra-abdominal Disorders**

Abdominal pathology such as appendicitis, pelvic inflammatory disease, and psoas abscess may cause irritation and inflammation of the iliopsoas or obturator internus muscle, which may lead to hip/thigh pain and associated stooped gait disturbance (Barkin et al.).

**Conversion Disorders**

Limping has been reported to occur with conversion disorders in adolescents (Quane, Chambers, & Synderman, 1995). Usually the gait is bizarre, the symptoms and signs are inconsistent, and there often is a preceding triggering psychosocial event (Renshaw, 1995).

**Children with hemophilia may have limp pain/limping as a result of bleeding into the tissues and joints.**

**Sex.** Developmental dysplasia of the hip is more common in girls, whereas Legg-Calvé-Perthes disease and slipped capital femoral epiphysis are more common in boys (Clark, 1997; Sty et al., 1998).

**Chronicity of the limp.** An acute onset of a limp suggests trauma or infection. A gradual onset with progression of the limp suggests a neuromuscular disorder, Legg-Calvé-Perthes disease, slipped capital femoral epiphysis, rheumatic disease, or malignancy. A chronic limp is often mechanical or psychogenic in nature.

**Recent trauma or strenuous exercise.** A history of recent trauma should be sought but may be difficult to obtain in very young children. On the other hand, obvious trauma in the absence of a consistent history raises the question of child abuse. Limping after strenuous activity suggests a musculoskeletal etiology.

** Associated symptoms.** If pain is associated with the limp, its exact location and character should be explored. Pain is usually severe and consistently reproducible or localized in fractures, dislocations, osteomyelitis, and septic arthritis (Lawrence, 1998). One must bear in mind that referred pain is not uncommon in children; as a result, hip pathology may present as knee pain and pain from the lower back can be referred to the lateral thigh (Lawrence). A painful limp without localization or with migratory bone pain is seen in patients with sickle cell disease or leukemia (Kost, 2000). Limping with bilateral leg pain localized to the calf muscles suggests myositis (Kost). Muscle pain is more aching in nature, whereas nerve pain is often described as burning or tingling in nature. Increasing pain with joint motion suggests a joint problem. Severe pain out of proportion to the history of injury suggests reflex sympathetic dystrophy. A painless limp may result from limb length discrepancy, developmental

**CLINICAL EVALUATION**

A detailed history and a complete physical examination are of utmost importance in the evaluation of a child with limping.

**History**

**Age of onset.** Whereas trauma and infections are common in all age groups, certain conditions occur more often at specific ages (Box 2) (Leet & Shaggs, 2000). Developmental dysplasia of the hip and congenital limb length discrepancy usually present in children younger than 3 years (Leet & Shaggs). From 4 to 10 years of age, toxic synovitis and Legg-Calvé-Perthes disease are especially common, whereas during adolescence, slipped capital femoral epiphysis and overuse syndromes should be considered.

**BOX 2 Causes of limping in children at different ages**

**Birth to 3 years**
- Septic arthritis
- Osteomyelitis
- Fractures
- Developmental dysplasia of the hip
- Congenital limb length discrepancy

**Ages 4 to 10 years**
- Septic arthritis
- Osteomyelitis
- Toxicsynovitis
- Fractures
- Legg-Calvé-Perthes disease
- Juvenile rheumatoid arthritis
- Leukemia

**Ages 11 to 18 years**
- Sprains/fractures
- Slipped capital femoral epiphysis
- Osgood-Schlatter disease
- Overuse syndromes
- Tumors
- Osteomyelitis
dysplasia of the hip, or a neuromuscular disease.

Fever suggests an infectious or inflammatory process. Recurrent fever, rash, and joint pain suggest juvenile rheumatoid arthritis. Patients with occult malignancy may have a history of low-grade fever, weight loss, and malaise. Unexplained bruising in the lower extremities, joint pain, and abdominal pain suggest Henoch-Schönlein purpura (Robson & Leung, 1994). A deterioration of gait or loss of acquired motor skills is suggestive of a neuromuscular disease.

Precipitating or relieving factors. Morning stiffness and a limp that is worse in the morning suggest juvenile rheumatoid arthritis. A limp that worsens with activity suggests soft tissue strain, stress fracture, benign hypermobility syndrome, or overuse injury. The pain of osteoid osteoma is relieved by aspirin. Pain that worsens throughout the day is typical of muscle fatigue.

Past health. Significant illnesses such as juvenile rheumatoid arthritis and leukemia should be noted.

Family history. A family history of hemophilia or sickle cell disease suggests the corresponding disorder.

Physical Examination

General. The child’s weight, height, and vital signs (especially temperature) should be determined. Poor growth may indicate a chronic disorder such as a neuromuscular disorder or rheumatic disease. Fever indicates an underlying infection or inflammation. The patient’s shoes should be examined for unusual wear, asymmetry, and point of initial foot strike (Barkin et al.). The patient’s feet should be checked for foreign bodies and calluses.

Musculoskeletal examination. Observing the gait pattern is important because it often gives clues to the underlying diagnosis. This observation should be done with the child walking barefoot and wearing as little clothing as possible. The musculoskeletal examination should include evaluation for skin color, warmth, tenderness, soft tissue/joint swelling, joint laxity, muscle strength, range of motion, and symmetry. The limb lengths should be measured from the patient’s anterior superior iliac spine to the medial malleolus. Point tenderness over a bone may indicate a fracture or osteomyelitis. Tenderness over the anterior aspect of the tibial tubercle points to Osgood-Schlatter disease. Muscle atrophy suggests a neuromuscular disorder. Hyperextensibility of joint is seen in the benign hypermobility syndrome. Stiffness of the joints is characteristic of chronic joint inflammation. A stiff, tender spine suggests diskitis (Leet & Shaggs, 2000). A positive FABER test (hip flexion, abduction, and external rotation), performed by placing the ipsilateral ankle on the contralateral knee and applying gentle downward pressure on the ipsilateral knee, signifies sacroiliac joint pathology (Leet & Shaggs).

Neurologic examination. Sensation, deep tendon reflexes, and spasticity should be assessed. Hyperreflexia and spasticity raise the suspicion of cerebral palsy. Tightness of the hamstring muscles with a limited straight-leg raise is suggestive of a spinal problem (Lawrence, 1998).

Associated signs. Ecchymosis and puncture wounds suggest that trauma is the cause of the limp. A midline defect, mass, dimple, or hairy patch along the iliac tubercle points to Osgood-Schlatter disease. Muscle enzymes such as creatine phosphokinase should be ordered if myositis is suspected.

Radionuclide bone scintigraphy is much more sensitive for detecting occult fracture, osteomyelitis, diskitis, avascular necrosis, bone infarct, and neoplasm (Arsonson, Garvin, Seibert, Glasier, & Tursky, 1992; Connelly & Treves, 1998; Lawrence, 1998; Sherry, 1999). Ultrasound is helpful in detecting joint effusion or abscess (Barkin et al., 2000; Meyers & Thompson, 1997). Computed tomography scan is an excellent imaging modality for cortical bone (Kost, 2000). A CT scan also is useful in defining intrapelvic problems and spinal pathology (Dabney & Lipton, 1995). Magnetic resonance imaging is useful in diagnosing diskitis and spinal cord tumor (Barkin et al., 2000).

A complete blood cell count with differential, erythrocyte sedimentation rate, and C-reactive protein are indicated when an infection is suspected. The complete blood cell count also will give clues to the diagnosis of hemoglobinopathy, chronic infection, and malignancy. Blood cultures should be performed in children with osteomyelitis or septic arthritis. Children with an infection associated with a joint effusion may require arthrocentesis for definitive diagnosis (Sty et al., 1998). Tests of muscle enzymes such as creatine phosphokinase should be ordered if myositis is suspected.

MANAGEMENT

Treatment should be directed to the underlying cause. If the child complains of moderate to severe pain, analgesics such as acetaminophen, nonsteroidal antiinflammatory drugs, or codeine should be considered.

SUMMARY

Limping in children is never normal. Physicians providing care to children need to be knowledgeable regarding the diagnosis and management of limping. A systematic approach should include a thorough history and physi-
cal examination, and, if necessary, appropriate imaging studies and laboratory testing. A timely diagnosis will result in a more optimal outcome.

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