

The Limping Child

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Introduction

Limping is a common reason for children to present to the emergency department. The differential diagnosis includes a wide spectrum and can range from a splinter in the foot to a life-threatening tumour. While the large majority of childhood limps follow a benign course, it is very important not to miss serious pathology and to begin appropriate management for the underlying condition. A small proportion will give a history of injury but usually the limp is spontaneous in onset. Many patients will complain of pain from the hip, knee or elsewhere in the body. After appropriate investigation the large majority of limping children are discharged without further adverse event. In this article the following will be described: the epidemiology of the limping child, how to appropriately assess the patient and how to decide which patients should be referred for further treatment.

Epidemiology

Two per thousand children present to the emergency department with a limp each year. Sixty-three percent are boys with a mean age of 4 years. The limp is right sided in 54% and bilateral in 4%. Approximately one-third present on the day of onset and most (85%) within one week. 80% of children presenting with a limp complain of pain, 33% from the hip, 20% from the knee, 20% from the rest of the leg. The remainder are unable to localise the pain. A preceding illness, usually upper respiratory tract infection can be identified in 40% and 25% give a history of a previous limp. Approximately 75% are managed in the emergency department and discharged from further care. The remaining 25% require specialty referral and

on-going in-patient or out-patient care (1). The long list of differential diagnoses is given in table 1. However, a recent prospective review showed that 40% of children presenting with an acute atraumatic limp were diagnosed as having ‘irritable hip’ or transient synovitis of the hip and in about 30% no definite diagnosis was made – however all these patients recovered without intervention and had no subsequent problems (1).

Differential Diagnosis of the limping child		
Toddler (1-2)	Younger Child (3-8)	Older Child (9-15)
Transient synovitis	Perthes ‘condition’	Slipped upper femoral epiphysis
Toddler’s fracture	Transient synovitis	Trauma
Cerebral palsy	Septic arthritis	Septic arthritis
Septic arthritis	Osteo/rhabdomyelitis	Osteochondritis
Osteo/rhabdomyelitis	Limb-length inequality	Hip Dysplasia
Hip dysplasia	Cerebral palsy	Tarsal coalition
Inflammatory arthritis	Trauma (maybe occult)	Perthes ‘condition’
Discitis		
Malignancy (leukaemia, sarcomas)		
Non-accidental injury		

Table 1

Clinical Presentation

The limp will be obvious to those observing if the child is walking freely around. However, it may be necessary to ask the child to walk, possibly with the aid of his / her parents and it maybe that the young infant has simply ‘gone off his legs’ or is crawling in a different manner. The child in obvious severe pain should not be asked to weight bear. An acute limp implies an underlying pathology that causes disruption of the standard gait pattern. Gait can be divided into swing and stance phases: the swing phase forms 40 percent of the gait cycle, and the stance phase forms 60 percent. The most common form of limp, an antalgic gait, is caused by pain. To minimise weight bearing on a painful limb, the time in stance phase is shortened in the painful limb with a resultant increase in swing phase. Other

abnormal gait patterns are shown in table 2 and any of these can present acutely as a 'limping child'.

Abnormal Gait patterns in children
<ul style="list-style-type: none">• Antalgic• Trendelenberg• Proximal muscle weakness• Spastic• Short-limbed

Table 2

Clinical Assessment

History

The age of the child should be determined. The child or guardian should be questioned about the onset and duration of the limp and the association of the limp with pain. Any associated trauma should be determined. It is useful to ask if the limp is getting better, getting worse or staying the same. The severity of associated pain is important and weight bearing status should be documented. The older patient can localize a painful joint or focal area of pain, which is helpful in narrowing the differential diagnosis; however, referred pain patterns must also be considered (e.g., hip pathology causing knee pain and vice versa, back pathology causing hip or leg pain). The very young child can rarely verbalise the location of the discomfort. In younger children, it is useful to ask the carer if the child prefers to crawl or walk on his or her knees; a positive response to this question makes foot pathology more likely. Sometimes a child who has recently commenced independent mobility will simply regress to a non-walking status. A history of recent fever or other signs of infection should be determined. A recent upper

respiratory infection could be the instigating event to a septic process or raise the possibility of poststreptococcal reactive arthritis. It is also thought to be implicated in transient synovitis. A history of limp that appears worse in the morning suggests a rheumatologic process. Night pain, especially pain that wakes a child from sleep, is a worrisome indicator of a more serious pathology and steps should be taken toward rapid diagnosis. A family history should also be obtained for rheumatologic or neuromuscular diseases that may be inherited. The birth and developmental history should also be obtained (2).

Examination

The physical examination should initially observe the gait, determining which abnormal pattern as described above is present. If the examiner is uncertain if a limp is present, listening to the sound of the feet hitting the floor may reveal an asymmetric cadence. In a Trendelenburg gait, the torso shifts over the pathologic limb. This gait pattern is commonly seen in older adults with arthritis of the hip, although it also occurs in any condition causing hip inflammation or hip muscle weakness, including Perthes' disease and transient synovitis. A child who walks stiffly may be attempting to reduce pain in the spine, such as that occurring in discitis (2).

The general condition of the patient should next be assessed. The patient with true septic arthritis will appear unwell, will resist any movement of the affected joint and hold it in the position in which the joint is under least tension (slightly flexed, abducted and externally rotated for the hip). Documentation of the temperature is essential.

The affected lower limb should be assessed and compared with the contralateral side. All joints should be assessed for full range of motion passively and actively and be palpated for tenderness and warmth. Loss of range of motion will help localise the site of pathology. The knee examination should include ballotment of the patella to identify an effusion or haemarthrosis. While infection or inflammation of the knee or ankle joint may be readily apparent from swelling, tenderness, warmth and erythema, the hip joint is not as easily visualised. Careful

examination of the hip is therefore very important in a child whose site of pathology is not unequivocally localised, because hip pathology often results in vague pain and many hip conditions require emergency treatment. Loss of internal rotation is a sensitive indicator of hip pathology. Every child lacking a clear explanation for a limp should be placed prone, with the knees flexed and the ankles falling away from the body (Figure 1) to look for a difference in internal rotation between the hips. It is important that the pelvis be kept flat on the table, or the difference in internal rotation between the two sides may not be appreciated.



Figure 1 Assessment of internal rotation – note reduced internal rotation on left

Restriction of adduction with the hip in 90 degrees of flexion is also a sensitive indicator of inflammatory conditions (figure 2) (3).



Figure 2 Restriction of adduction in flexion is indicative of inflammatory hip conditions.

The Galeazzi test is performed by putting the child in a supine position and bringing the ankles together and toward the buttocks with the hips and knees flexed at 90 degrees. The test is positive when the knees are at different heights, suggesting a leg-length discrepancy. Measurement of thigh and calf circumference can reveal atrophy (more than 1 to 2 cm of difference between sides) in a patient with any hip or knee condition that has limited function for more than one to two months. In a slipped capital femoral epiphysis, the examiner will observe obligate external rotation of the involved lower extremity when the hip is flexed.

The spine, pelvis and abdomen should always be assessed in the limping child. Observe the child bending forward to identify an asymmetric turning of the spine during flexion, a sign of spinal cord pathology. Limited spinal flexion accompanied by a stiff posture and local tenderness is suggestive of discitis. The FABER test (consisting of hip flexion, abduction and external rotation) causes pain in the sacroiliac joint, indicating inflammation or infection here. This test is performed by placing the ipsilateral ankle on the contralateral knee in the supine patient and then providing gentle downward pressure on the knee

Similarly, a neurological examination should be completed. Inspection of the feet may demonstrate clawing of the toes or cavus foot deformity, which are red flags for an underlying neurological condition, especially if either condition is unilateral.

Investigations

In any case where infection or inflammation is suspected blood investigations to include a full blood count with differential, erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) level should be taken. The CRP becomes elevated earlier than the sedimentation rate and is considered more sensitive for an infectious process (2). Blood cultures should be also be taken in any cases suspicious of infection. Lyme titres should be taken if risk factors are present and serum rheumatoid factor, antinuclear antibody and HLA typing should be considered if relevant, particularly in light of a longer history.

Plain radiographs are usually the first radiographic studies ordered. If an area of pathology is localized by examination or history, anteroposterior and lateral views are indicated because a single view often misses pathology that is obvious in the second view. The pelvic films should be examined for femoral head fragmentation (Perthes), joint space widening (sepsis, Perthes) and structural abnormalities (hip dysplasia). With particular relevance to the hip, anteroposterior and frog-lateral views are necessary because the pathology is frequently best seen on lateral views. A frog lateral x-ray of the hips is mandatory if slipped upper femoral epiphysis is to be excluded in older children. Any areas of trauma should be radiographed and particular attention should be paid to physeal injuries.

Ultrasonography is useful in identifying fluid in the hip joint and is much more sensitive than plain films at detecting an effusion. This should be performed in any patient with a history or examination suggesting hip sepsis and is useful in patients where the limp cannot be localised, to exclude fluid in the hip. CT, MRI and bone scan are also very useful at delineating pathology further but have more specific indications and are usually requested following consultation with a paediatric orthopaedic specialist.

Diagnosis

Injuries from trauma are usually obvious from the history and radiographs will normally reveal any associated fracture. Appropriate treatment should be instituted for these, if necessary in consultation with a paediatric orthopaedic specialist. It is important to be alert to the possibility of non-accidental injury at all times and this is covered further below. The large majority of acute limps that present are however atraumatic. Studies have shown that the most common diagnoses are transient synovitis of the hip or indeed undetermined, as shown in table 3.

Common causes of acute atraumatic limp

40%	Transient synovitis of hip
30%	No cause found
4%	Infection (1.5% osteomyelitis)
2%	Perthes
<1%	SCFE
<1%	Tumour

Table 3

Following the assessment strategy outlined above should help determine the diagnosis and appropriate treatment of rest, analgesia and early active mobilisation can be advised if transient synovitis is confirmed. It is however the job of the assessing clinician to exclude the important, sinister causes of an acute limp in a child. Hip sepsis is not uncommonly encountered and malignancy often presents in an acute setting. A delay in diagnosis can be limb or life threatening and certainly devastating in certain processes that cause a limp. Table 4 outlines the diagnoses not to be missed and stratifies these according to age. The section that follows briefly describes the diagnosis of each of these. However, if there is

any doubt, consultation with a paediatric orthopaedic specialist should be requested.

Diagnosis not to be missed in the child with a limp		
Toddler (1-2)	Younger Child (3-8)	Older Child (9-15)
Missed developmental dysplasia of the hip (DDH)	Perthes “condition”	Slipped upper femoral epiphysis
Malignancy (leukaemia, Sarcomas)		
Non-accidental injury		
Infection		

Table 4

Infection

Septic arthritis and osteomyelitis are the most common of the sinister causes of a limp in a child. In the hip it is often difficult to differentiate this from a transient synovitis but this is extremely important as catastrophic avascular necrosis of the femoral head can occur with sepsis unless surgical decompression is performed urgently. The clinical appearances of both are similar. Clinical evaluation is most important and the child with the septic joint is usually recognizable to the experienced clinician. The child is usually unwilling to move around the bed and will hold the leg completely still. Kocher’s criteria suggest four parameters that can be used to predict the likelihood of septic arthritis of the hip (pyrexia, elevated ESR > 40mm/hr, increased WBC > 12,000/mm³, inability to weight bear). The number of positive parameters correlates with the probability of septic arthritis – Zero parameters: 0.2%; One parameter: 3.0%; Two parameters: 40.0 %; Three

parameters: 93.1%; Four parameters 99.6% (4). CRP and ultrasound are now also very helpful but the presence or absence of an effusion is not diagnostic. If there is any suspicion, a paediatric orthopaedic consultation should be requested. Failure to treat septic arthritis effectively within 1 - 3 days leads to a poor outcome but it is best to institute treatment within hours where appropriate. This involves surgical drainage of the joint and intravenous antibiotics for a prolonged period. Osteomyelitis is becoming less common but similarly should be considered. The white cell count, CRP and ESR are usually elevated and imaging with MRI or USS can display the infection. Radiographs are often normal in the early stage and again treatment with resuscitation and intravenous antibiotics should be undertaken.

Malignancy

Bone tumours and leukaemia are rare (<0.5%) causes of a limp in a child but should be ruled out as quickly as possible. The red flags for diagnosing tumours are constant pain which progressively and steadily get worse. Night pain is a worrisome feature. Systemic symptoms are common, particularly with blood borne tumours. Swellings should be searched for and characterised. Blood and radiographic investigations are mandatory and early referral to a paediatric orthopaedic specialist for detailed imaging with MRI should be instituted. Hip tumours often present as knee or thigh pain and must always be considered in patients with these complaints.

Non-accidental injury

A high index of suspicion without offensive consultation techniques should be adopted if there are any concerns about non-accidental injury (NAI). An inconsistent history, a delay in presentation, an atypical injury for the age and additional or previous injuries such as burns are all red flags for NAI. There are specific bony injuries which suggest NAI and these should be searched for. Most

institutions have specialist personnel who deal with any suspected case of NAI and they should be consulted as soon as possible if there is any doubt. It is important to note that 50% of children who are subjected to NAI will suffer further episodes and 15% may die as a result

Hip dysplasia

Developmental dysplasia of the hip can present as an acute limp if it is missed in earlier infancy. Suggestive features are the presence of an 'odd gait' for some time; there is usually a leg length difference and limited hip abduction. Risk factors can be determined from the parents. A radiograph of the pelvis is usually diagnostic – figure 3. Urgent out-patient consultation with a paediatric orthopaedic specialist is necessary.

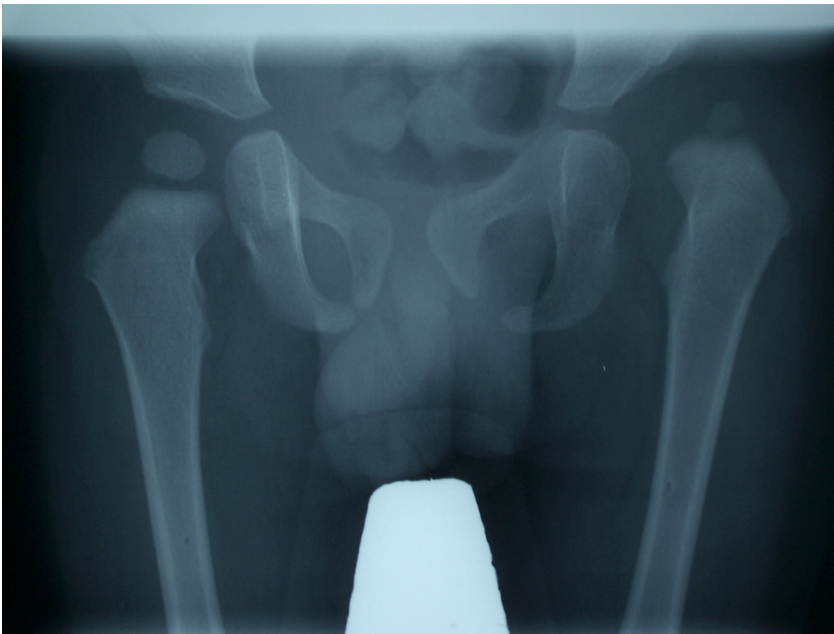


Figure 3 Left dysplastic hip in an infant presenting with a limp

Perthes condition

Idiopathic avascular necrosis of the upper femoral epiphysis (Perthes condition) often presents with a mild limp after a minor injury. The patient is usually between

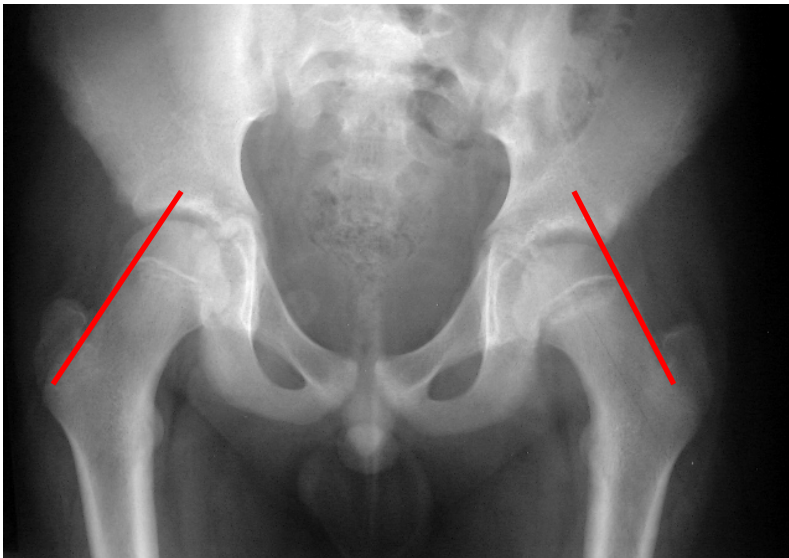
3 to 9 years old, is systemically well and often gives a history of an intermittent limp for several weeks or months. Examination will reveal limited range of movement in the affected hip. Radiographs are normally diagnostic - figure 4 - but changes can be subtle and difficult to determine in the early stages of Perthes. Again, urgent out-patient paediatric orthopaedic consultation is required.



Figure 4 AP (left) and frog lateral (right) of Perthes condition

Slipped upper femoral epiphysis (SUFE)

In SUFE, the femoral neck subluxes away from the epiphysis which can result in a severely altered geometry of the hip and sometimes catastrophic avascular necrosis. This is usually an adolescent condition, more common in boys and the overweight. Rarely, children as young as six or seven can be affected and endocrinopathies such as hypothyroidism or hypogonadism can predispose to SUFE. The presentation can be acute, chronic or acute-on-chronic. A limp is common and sometimes associated with inability to weight bear. Examination will show a shortened, externally rotated limb but findings can be subtle – often asymmetric internal rotation is the only finding (see figure 1). Bilaterality should be suspected and the diagnosis is confirmed radiographically. As mentioned the frog-lateral view is paramount as the diagnosis is often missed on the AP view - figure 5. Urgent paediatric orthopaedic referral is called for and surgical intervention is normally required.



Antero-posterior view



Frog lateral view

Figure 5 Antero-posterior (AP) and frog lateral of SUFE. The red lines on the AP view represent 'Klein's lines' – this is drawn along the superior aspect of the femoral neck – normally it should pass through the epiphysis. Here it does not on the left,

giving the diagnosis of SUFE. This helps to make the diagnosis on the AP view as findings are often subtle. The diagnosis is more obvious on the frog-lateral view

References

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