Eur J Pediatr (2010) 169:143–148
DOI 10.1007/s00431-009-1025-x

REVIEW

Clinical practice

The hip from birth to adolescence

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Received: 27 May 2009 / Accepted: 24 June 2009 / Published online: 1 September 2009

Abstract Hip problems in children are relatively rare but usually serious, potentially causing lifelong disability. Early diagnosis and treatment is, therefore, mandatory. The aim of this review is to discuss the most frequent diseases of the hip from birth to adolescence. The different affections are relatively closely related to age periods. After birth and in infancy, developmental dislocation of the hip (DDH) and septic arthritis are more prominent. DDH is not always present at birth and should regularly be checked for in the first 6 months of life. Septic arthritis is an emergency and should be adequately treated within 4 days of the beginning of the infection with open drainage of the hip. Transient synovitis and Legg–Calvé–Perthes disease (LCPD) are mostly found between 4 and 10 years of age. Transient synovitis is the most frequent hip disorder in that age group. It is a self-limiting noninfectious effusion in the joint without serious consequences. Differential diagnosis with septic arthritis should, however, be made. LCPD is an idiopathic avascular necrosis of the hip causing flattening and deformity of the femoral head, depending on the extent of the necrosis. Treatment by containment is aimed at favoring the remodeling of the deformed femoral head. Finally, between the age of 10 and 15 years, slipped capital femoral epiphysis (SCFE) should be the preferential diagnosis, especially in the limping obese boy. SCFE is an inferior and posterior displacement of the proximal epiphysis of the femur in the growth plate. It should be treated as an emergency with a screw fixation.

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Keywords Diseases of the hip in children · DDH · Septic arthritis · Transient synovitis · LCPD · SCFE

Introduction

Most hip problems in children are relatively rare, but may cause lifelong disability when missed or ill-treated.

The hip is a deep-seated articulation and problems may either remain hidden for some time or go undiagnosed. In the infant, it is often the mother or the nurse who observes the first signs of an affection of the hip, as there are asymmetry of skin creases or pain when changing diapers. In the older child or adolescent, a limp is the most important sign pointing to a possible hip problem. Limping is rarely caused by a foot or knee problem. Every limping child has a right to a hip radiograph.

Important in dealing with diseases of the hip is knowledge of the epidemiology. Most affections are more prominent at certain ages, and practically absent at other age periods. A diagnosis is sometimes made by thinking in the right direction and subsequently performing the appropriate technical examinations. In the newborn and infant, hip dislocation and septic arthritis are the most frequent problems. In the age group of 4 to 10 years, we should mainly consider a diagnosis of transient synovitis or Legg–Calvé–Perthes disease (LCPD). In the older age group, up to 15 years of age, our attention should go to the possibility of a slipped capital femoral epiphysis (SCFE).

Most conditions are age-related:
Infant: hip dislocation and septic arthritis
4 to 10 years: transient synovitis and LCPD
10 to 15 years: SCFE

Developmental dislocation of the hip

In the orthopedic literature, the classical terminology of "congenital dislocation of the hip (CDH)" has been replaced by developmental dislocation of the hip (DDH). This is not just a question of terminology, but draws the attention to the fact that a dislocation of the hip is not always present at birth, but can develop over a period of several weeks or months from instability to frank dislocation; hence the importance of a repeated hip exam in the first 6 months of life. This exam can be performed in the monthly visits at the child welfare clinics present in most countries. DDH covers in fact different developmental stages of the disease, from acetabular dysplasia to subluxation and dislocation. Dislocation of the hip has an incidence of 1 to 2 per 1,000 of living births. Girls are, on average, four times more affected than boys. One percent of all dislocations are still missed [1, 10].

Diagnosis

Classical clinical signs of DDH are limited hip abduction and asymmetrical thigh skin creases (Fig. 1). These signs are present in all grades of DDH, from dysplasia to dislocation, and are often observed by the mother. One should, therefore, never neglect the remarks of the mother. Bilateral slightly limited abduction and asymmetrical skin creases can, however, be physiological in 25% of cases.

Fig. 1 Asymmetrical skin creases

In subluxation and dislocation of the hip, important signs are the Ortolani and Barlow maneuvers. In the Ortolani maneuver, the reducibility of a dislocated hip is tested by abducting the hip progressively under light traction and exerting an anteriorly directed force on the greater trochanter. The test is positive when a clear jump of the dislocated hip over the lateral margin of the acetabulum is felt (Fig. 2). Note that the Ortolani test is not a mere "click." Clicks around the hip are usually caused by soft tissues. The Barlow test is the reversed maneuver by which the unstable hip is dislocated by adducting the hip and exerting a light posteriorly directed force. Important to note is that the Ortolani and Barlow tests do not remain positive.

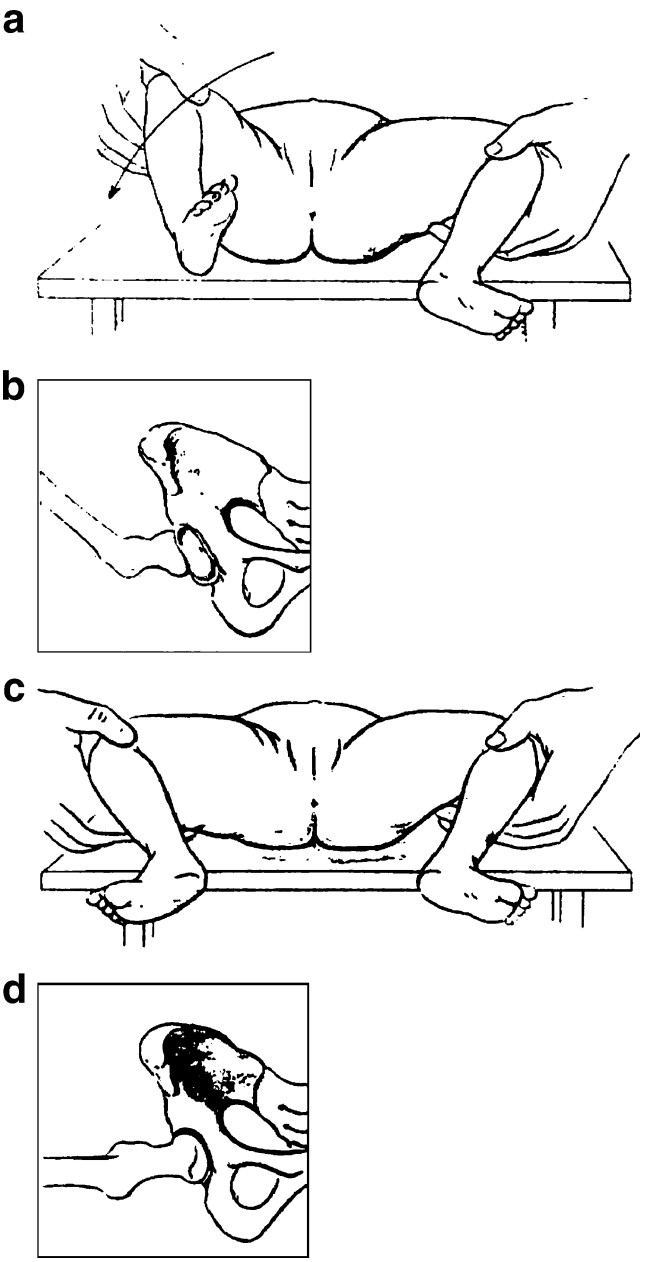

Fig. 2 Test of Ortolani

Approximately 6 weeks after dislocation, the hip is usually irreducible and the tests become negative, despite the presence of a dislocation. Finally, a shortening of one leg can be a sign of subluxation or dislocation of the hip.

Imaging techniques

As a general rule, one should use sonography of the hip during the first 3 to 4 months of life in suspected cases of DDH. In some countries, all newborns receive a sonograph of the hip; it is, however, not the place here to discuss the pros and cons of these programs. Only after the age of 4 months a radiograph of the hips is meaningful. The further ossification of the femoral head and acetabulum allows then a better evaluation and measurement of a possible deformity.

Treatment

A mere dysplasia of the acetabulum is best treated by an abduction brace; at present, mainly a Pavlik harness (Fig. 3). The brace is worn day and night at the beginning to decrease in time to night and nap time, until sonographic or radiologic parameters are normalized.

Double diapers are not an abduction brace and should not be used as such. Subluxation and dislocation of the hip can initially also be reduced by a brace, but if the hip is not reduced after 2 weeks of brace treatment, it should be abandoned. Closed or open reduction under general anesthesia is then indicated, followed by immobilization in a hip spica for 6 weeks. The always present remaining acetabular dysplasia should further be treated by an abduction brace. In older children, the dysplasia sometimes does not correct fully and an acetabuloplasty should be performed around the age of 4 or 5 years [4].

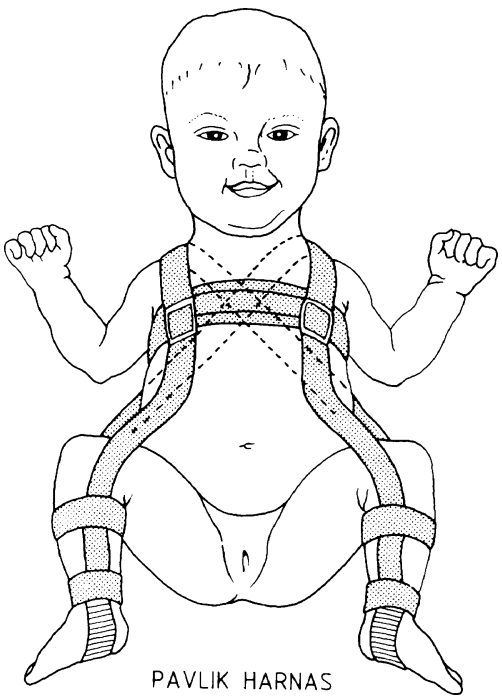

Fig. 3 Pavlik harness

Complications

Avascular necrosis of the femoral head is a possible complication of the reduction. The incidence lies around 10% to 20% and shows different grades of severity. Especially immobilization in full abduction or over abduction is prone to produce avascular necrosis. Treatment is disappointing and mainly symptomatic [6].

-A dislocation of the hip is not always present at birth
-Pay attention to the remarks of the mother.
-Radiographs during the first 3 or 4 months are usually irrelevant.
-Double diapers are no alternative for an abduction brace.

Septic arthritis of the hip

Early diagnosis and treatment of septic arthritis of the hip is of utmost importance. A missed infection can destroy the hip. Especially in newborns, the infectious parameters are not always evident. The infant is either very sick in cases of septicemia, directing intervention toward lifesaving acts, or shows only slight infection signs as limited temperature rise and irritability. In both cases, the first attention is not directed towards the hip. In such cases, one should be alerted by an irritable hip or limited and painful range of motion. A sonogram shows the effusion in the hip but does not differentiate between pus and a sterile reactive effusion.

The state of the art treatment in a suspected septic arthritis of the hip consists of a puncture of the hip, followed by an open drainage if pus is found. This should be performed by an experienced person who can as well do the puncture as the open drainage, since no time should be lost.

After taking specimens for culture, the infection should first be treated blindly in the following way:

– The neonatus: a third generation cephalosporin + aminoglycoside against group B streptococcus and gram-negatives.
– Under 4 year of age: oxacillin + third generation cephalosporin against *Staphylococcus aureus*, *Haemophilus influenzae* (less frequent thanks to vaccination),

Streptococcus pyogenes, *Streptococcus pneumoniae*, and *Kingella kingae*.

– Older than 4 year of age: oxacillin against *Staphylococcus aureus*.

When results of the culture are known, the antibiotic therapy should eventually be adapted.

Treatment with open drainage should be performed within 4 days to avoid a septic necrosis of the femoral head with disastrous consequences [5].

-Infectious signs are not always evident.

-Puncture and open drainage are mandatory.

Transient synovitis or irritable hip

A transient synovitis is a self-limiting effusion of the hip in children, mainly between 4 and 10 years of age. It is the most frequent cause of limping and pain around the hip in that age group. The *etiology* is unknown, but it is more frequent after a viral infection of the upper respiratory tract or gastrointestinal system.

Symptoms include limping, limited abduction and rotation, and variable degrees of pain. Important is a normal serology, absence of fever, and normal radiographs. A sonogram shows the effusion. After 8 to 10 days, the symptoms and the effusion disappear gradually, without sequelae. If the symptoms linger on for more than 2 weeks, a new radiograph is indicated to exclude a LCPD. Symptoms are sometimes very acute with much pain; in these cases, a differential diagnosis with septic arthritis should be made by a puncture.

Treatment is symptomatic with a few days rest and if needed an antiphlogistic. If limited range of motion is important, a few days of traction might be indicated. We advocate an X-ray control after 6 to 8 weeks to exclude LCPD, which sometimes shows similar early symptoms [8].

-The most likely diagnosis in a limping child between 4 and 10 years is transient synovitis.

-The most important differential diagnosis is a septic arthritis.

Legg–Calvé–Perthes disease

This affection consists of an idiopathic avascular necrosis of the hip in children between mainly 4 and 10 years of age and three to five times more frequent in boys [7, 9]. Initial clinical *symptoms* are nonspecific and resemble those of a transient synovitis with limping and limited range of motion. Pain is usually not a major problem.

The *etiology* is unknown. The disease runs a course of several months up to 2 years or more. Initially, symptoms are only clinical with, after some weeks, early radiological signs of necrosis in the femoral head. The necrosis can be partial or total with ensuing fragmentation and flattening of the femoral head (Fig. 4).

In contrast with necrosis of the hip in adults, in children, revascularization and recalcification and remodeling take place. The final result of the remodeling is proportional to the extent of the necrosis. The larger the extent of the necrosis, the more chances of a persistent deformity of the femoral head with early osteoarthritis as a consequence in the more severe cases. The younger the child, the better the prognosis.

Modern *imaging techniques* make it possible to visualize the necrotic area in great detail, but most classification and follow-up systems are still based on ordinary radiographs. During the first weeks of the disease, radiographs can remain normal; in these cases, magnetic resonance imaging or technetium scan can detect early signs of necrosis. To follow the revascularization process, a technetium scan is indicated.

Treatment is disappointing and can only be directed as much as possible towards a preservation of the roundness of the femoral head. To prevent further flattening of the femoral head during the initial necrotic phase, the child is often immobilized in a wheelchair during up to 6 months. “Containment” is the term used to indicate different further methods of treatment. Containment means a concentric position of the femoral head in the acetabulum to try to influence the shaping of the femoral head during the phase of revascularization. Containment can be achieved by abduction bracing during several

Fig. 4 LCPD of the left hip showing extensive necrosis, subluxation, and flattening of the femoral head

months. Recently, however, this method of treatment has been gradually abandoned, since no definitive containment can be achieved. Attention is focused at more definitive solutions by surgical means. Reorientation osteotomies of the femoral head and acetabulum or augmentation plasties of the acetabulum are now the treatment of choice [7].

Surgical treatment, however, is only indicated in the child "at risk." The child "at risk" is usually older than 6 or 7 years with an extent of necrosis more than 50% to 75% of the femoral head and with clinical signs of limited range of motion. The younger child with limited necrosis often needs no treatment after an initial phase of supportive treatment.

Note that treatment does not influence the extent of the necrosis nor the revascularization process. It only intends to prevent too much deformity and to delay possible early osteoarthritis of the hip.

- Early symptoms of LCPD are unspecific and resemble transient synovitis.
- The disease is self-limiting, but ends potentially with deformation of the femoral head.
- "Containment" is the treatment of choice.

Slipped capital femoral epiphysis

SCFE is an inferior and posterior slipping or gliding of the femoral head or epiphysis in the growth plate. It is typically seen between the ages of 10 and 15 years and three times more frequent in boys, more so in obese boys.

The *etiology* is unknown, but mechanical and endocrinological factors seem to play a role in the prepubertal period with a relative insufficiency of the growth plate.

Symptoms are again atypical with limping and pain, sometimes related to a trauma, which might be coincidental or even caused by the slipping. Typical is an increased external rotation versus internal rotation of the hip on clinical exam.

The *diagnosis* is, however, often missed and it takes, on average, 3 months before the correct diagnosis is made. Limping and pain around the hip are frequently dismissed as muscle strain following sport activities or minor trauma. Symptoms can disappear for 2 or 3 weeks, so that further examinations are deemed unnecessary.

SCFE should, however, be seen as an emergency and treated as such. The rule of thumb should, therefore, be: "An obese boy between 10 and 15 years who limps, has a SCFE, until proven otherwise." Confirmation of the diagnosis is made by two radiographs: an anteroposterior and a Lauwenstein (abduction–external rotation) view of both hips (Fig. 5) because an SFCE can be bilateral in 20% to 60% of cases. Once the diagnosis is confirmed, the child should be forbidden to bear weight any more on the affected leg or legs to avoid any worsening of the slip.

The definitive *treatment* of choice is surgical, by a screw fixation of the epiphysis without reduction, to prevent any further downward gliding and worsening of the deformity [2].

The *prognosis* depends on the degree of slippage of the epiphysis. This explains the acute character of diagnosis and treatment. On the long term, osteoarthritis can develop in the affected hip and more so in cases with a severe slip.

Complications in the short term are chondrolysis and avascular necrosis and can both be idiopathic or iatrogenic. Forceful reduction can cause avascular necrosis. Screw penetration into the joint can cause chondrolysis with thinning of the articular cartilage and pain and stiffness of the hip. Treatment of both complications is disappointing and mainly symptomatic [3].

-An obese boy between 10 and 15 years of age, who limps, has a skipped capital femoral epiphysis
-SCFE should be treated as an emergency.
-A screw fixation of the epiphysis is the treatment of choice.

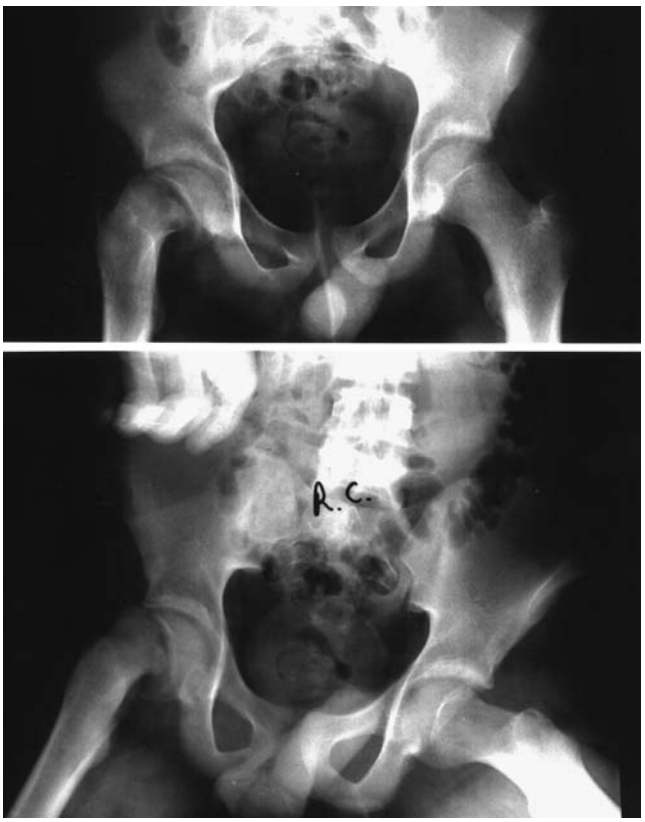

Fig. 5 SCFE of the right hip, anteroposterior and Lauwenstein views

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