Introduction

Most osteoarthritis (OA) of the young adult hip is secondary to paediatric or developmental hip disorders. Besides Developmental Dysplasia of the hip and Perthes disease, slipped capital femoral epiphysis (SCFE), the displacement of the epiphysis from the metaphysis, is amongst the most common disorders of the young and adolescent hip. There is a correlation between the severity of slippage and the long-term outcome in affected patients with less favourable outcome for the more severe slips [1–3].

The aetiology of SCFE is complex and multi-factorial. Affected patients are generally between the ages of 11 and 15 years. There is evidence that the mean age of onset has decreased during the last part of the twentieth century, possibly because of a decrease in the age of puberty. Boys are affected almost twice as often as girls and at a later age and approximately in the same pubertal period. The incidence is reported to be about 4–5 per 1,00,000 for all patients in pre-puberty and puberty with a significant variation among different populations. There is a higher incidence in groups with higher mean body-weight with the left hip slightly more often affected than the right [4].

A possible hereditary factor in the etiology of SCFE remains controversial [5–7]. Several endocrine, systemic and immunological factors lead to an alteration of the cellular components and matrix at the growth-plate resulting in physeal biomechanical instability of the femoral head [8–10].

In addition to obesity, there are other mechanical factors that may to contribute to the development of SCFE: the angle of the epiphysis during puberty has an oblique plane which leads to higher shear forces at the epiphysial-metaphyseal junction. These shear forces can be further increased by a reduced anteversion of the femoral neck [11], a decreased neck-shaft angle and a deep acetabulum [12, 13].

Classification

Clinically, SCFE is classified according to the duration of symptoms (acute, acute-on-chronic, chronic), the ability to bear weight (stable, unstable) and radio-morphologically according to the severity of the slip (Table 1). The distinction between mechanically stable and unstable slips is most important, since the risk of osteonecrosis is much higher in the unstable group.

Acute slips are those with sudden onset of severe symptoms which prevent walking or bearing weight on the affected leg. Radiographs show variable epiphysial displacement with no evidence of bone healing or remodelling. Chronic slips are characterized by a gradual or intermittent onset and symptoms of more than 3 weeks duration. Radiographs show some bone healing and remodelling of the femoral neck. The acute-on-chronic slip is defined as having a sudden onset of severe symptoms with radiographic signs of remodelling of the proximal femur and, if reducible, only the degree of the acute slip can be reduced by gentle closed manipulation. Our own data suggest that the chronic form is found in about 75% of cases, the acute slip in about 10% and the acute-on-chronic slip is observed in nearly 15% [14].

Loder et al. [15] proposed a classification of stable and unstable SCFE by clinical parameters, mainly the ability to bear weight. If the femoral physis is grossly unstable or if the patient is unable to weight-bear then this is considered an unstable SCFE, which is associated with a high rate of avascular necrosis (AVN). Currently, this is the preferred method of clinically classifying SCFE.
Radiologically, a slip of less than 30° is considered to be grade I, between 30 and 60° grade II and of more than 60° grade III [16]. Some authors prefer to differentiate between grade II and III at an angle of 50° [17]. The severity of the condition may also be determined by measuring the percentage of the slip in relation to the width of the femoral neck [18]. There are inter- and intra-observer errors as well as differences in measured angles because the radiographic technique and projection which are significantly dependent on the positioning of the leg.

**Clinical Signs and Symptoms**

The most frequently presenting complaint is groin, thigh or knee pain associated with a limp. The pain associated with stable SCFE may be due to any or all of the following:

(a) Intracapsular hematoma,
(b) Effusion,
(c) Ischemia “compartment syndrome of the bone”,
(d) Synovitis and muscular imbalance depending on the pathological biomechanics. Although most SCFE patients have groin pain, symptoms may also be referred to the knee, and either isolated knee pain or a painless limp may be the only presenting symptom. Green et al. report a 2½ month delay and a 52% incidence of apparent missed diagnosis for SCFE in a review of 102 patients [19]. Pain is usually intermittent and gradual in onset. Some patients describe episodes of trauma in the recent past.

Physical examination most often reveals mild pain on movement with limited internal rotation and abduction. Flexion of the hip usually results in obligatory external rotation of the hip because of anterior metaphyseal impingement on the acetabular rim. This phenomenon is referred to as Drehmann’s sign (Fig. 1). In severe slips the flexion may be limited to 60° or less because of impingement caused by the anterior prominence of the femoral neck.

The incidence of bilateral SCFE has been reported as 79% by Hägglund et al. [5] and as 59% by Jerre [20] at follow-up. Both groups, however, found bilateral SCFE at the time of the first clinical presentation in only 23% and 8–27%, respectively. These data underline the importance of frequent follow-up examination of the contralateral hip or simultaneous prophylactic treatment of the unaffected hip.

![Fig. 1 Drehmann's sign: while the non-affected hip can be flexed normally (a), flexion of the affected hip (b, c) results in obligatory external rotation because of anterior metaphyseal impingement on the acetabular rim](image-url)