Pinning the slipped and contralateral hips in the treatment of slipped capital femoral epiphysis

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Abstract

Purpose To describe and comment on the treatment of the slipped capital femoral epiphysis (SCFE) with pinning and to present the pros and cons of prophylactic pinning of the contralateral hip.

Summary Pinning the SCFE aims to fix the epiphysis and prevent further slipping. Some devices allow for further growth and remodeling of the femoral neck post-operatively. This results in maintained femoral offset and probably reduced risk of femoroacetabular impingement. There are currently no long-term follow-up studies showing less complications or better function than after in situ fixation.

The contralateral hip can be managed by prophylactic pinning or close follow-up with repeated radiographic examinations. Which of the methods is best is still controversial due to different opinions on the risk of bilateral SCFE, the consequences of a later contralateral slip and the risks of prophylactic pinning. Although research supports prophylactic pinning the child and the family’s preference is crucial.

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The goal when treating a slipped capital femoral epiphysis (SCFE) is to restore good long-term hip function using a technique that is as safe and simple as possible. Good long-term function means no pain and good range of motion and strength. A safe technique means as few complications as possible. Simple means a short learning curve, hospital stay, and rehabilitation period.

In situ pinning

There are many available fixation devices for SCFE. Some devices aim to fix the slipped epiphysis and to create fusion of the growth plate with threads on both sides of the growth plate. Other devices aim to allow for further growth in length of the femoral neck such as screws with threads in the epiphysis only, the Hansson hook pin or multiple pins. There are some advantages if the slipped epiphysis is fixated with a technique that allows for longitudinal growth post-operatively.

Longitudinal growth of the femoral neck after SCFE

The growth plate is weakest and most easily disrupted during periods of rapid growth. In most children sustaining SCFE, the slip occurs at the beginning of the pubertal growth spurt. At that age the average remaining growth in the length of the femoral neck is 10 mm to 15 mm. Shortening of the femoral neck results in reduced hip abductor force because of reduced femoral offset. Örtegren et al measured an average 16% increase in offset during the remaining growth period after fixation with the Hook pin (Fig. 1). Sariali et al showed that a 15% decrease in femoral offset leads to gait disturbance after hip arthroplasty. A reduced offset also results in increased joint reaction force during gait that may predispose the joint to osteoarthritis.

Remodeling after SCFE

Remodeling after SCFE takes place by bone resorption anterolaterally and bone deposition posteromedially (Fig. 2). In 1959, Billing and Severin published a radiographic analysis of SCFE in 63 children, in which they performed repeated radiographic examinations at short intervals. The authors concluded that “The absorption progresses so rapidly that even if the epiphysis has slipped 5 mm or 6 mm the tip of the metaphysis exposed may be completely absorbed in less than two months. Even in the case of a slipping angle of 40° or 50°, the protruding tip of the metaphysis may be completely smoothed off by absorption.”

Several studies have shown that the head–shaft angle decreases during remodeling. This decrease must be
created by asymmetric growth of the femoral neck growth plate (Fig. 2). This part of the remodeling process is facilitated by using a technique that allows for further longitudinal growth of the femoral neck.

After SCFE, the anterior prominence of the proximal femoral metaphysis can cause impingement on the acetabulum with injury to the articular cartilage. In hips with mild SCFE surgical resection of the metaphyseal prominence, either by open arthrotomy or by arthroscopy, has been advocated. In hips with moderate or severe slips some authors recommend open reduction with the modified Dunn technique through the surgical dislocation approach to achieve direct femoral epiphysis realignment. However, as described by Billing and Severin, the anterior metaphyseal prominence often disappears with remodeling. If the remaining growth of 10 mm to 15 mm is allowed, the notch also grows away from the acetabular margin.

**Long-term results**

Remodeling causes an improved range of hip motion during the post-operative period. In a 30-year follow-up study, Hansson et al analysed range of motion of the hip in 43 patients with SCFE treated with pinning in situ. They concluded that, “The loss of hip motion after fixation in situ is very small in the long-term perspective and hardly clinically relevant.”

Carney et al evaluated 124 patients with SCFE after an average of 41 years. Wensaas et al evaluated 66 patients after an average of 38 years. We examined 172 patients on average 28 years after nailing/pinning. All these long-term follow-up studies concluded that, regardless of the severity of the slip, pinning in situ provided the best long-term function and delay of degenerative arthritis, with a low risk of complications. However, in the child with an unstable SCFE, urgent hip joint aspiration followed by closed reduction and pinning seems to reduce the risk for short-term complications such as avascular necrosis.

**Prophylactic pinning**

Children with unilateral SCFE are at risk of later contralateral slipping. The contralateral hip can be managed by prophylactic pinning or close follow-up with repeated radiographic examinations. There are different opinions about which management is best. The decision whether to pin or to observe is usually based on the following three questions:

1. **How high is the risk of bilateral SCFE?**

The magnitude of the risk of slipping in the contralateral hip varies between reports, probably because different
radiographic techniques and methods of follow-up have been used. The reported frequency from primary admission through the remaining growth period ranges from 21% to 40%.[21–25] Most reports do not disclose whether both hips were routinely examined radiographically until growth plate closure of both hips or whether the contralateral hip was examined only after symptoms were reported. The highest reported frequencies of bilateral SCFE have been reported when both hips were examined after growth plate closure with a radiographic technique that can detect signs of former SCFE. Using these techniques, the reported incidence of bilateral SCFE is 42% to 65%.[21,24,25]

2. What are the consequences of a later contralateral slip?
In a mean 33 year (16 to 66) follow-up of 260 patients treated for SCFE in Sweden, 159 (61%) had signs of bilateral SCFE,[21] and 22 of these had bilateral SCFE at the primary admission. Seventeen (53%) of the 32 contralateral slips diagnosed during adolescence showed osteoarthrosis, and 28 (27%) of the 104 asymptomatic slips diagnosed at follow-up showed osteoarthrosis. In a study by Jensen et al[24] four of 16 contralateral slipped hips diagnosed at an average age of 36 years (22 to 44) at follow-up showed osteoarthrosis.

3. What are the risks of prophylactic pinning?
Complications reported after prophylactic pinning include avascular necrosis, femoral fracture, infection, and implant pain.[26,27] The magnitude of these risks for complication depends on several factors such as the type of osteosynthesis, the surgeon’s experience, and the quality of the X-ray equipment.

The answers to these three questions must be considered when deciding on the management—to pin or to observe. Two decision analysis models have been published.[28,29] The authors constructed a decision tree with analysis of the probabilities and utilities for different scenarios based on a literature review of many earlier published papers. Schultz et al[28] concluded that “when pooled data are used to predict probabilities of sequential slip, treatment of the contralateral hip with prophylactic pinning is beneficial to the long-term outcome for that hip.” Kocher et al[29] concluded that “when the probability of contralateral slip exceeds 27% or when reliable follow-up is not feasible, pinning of the contralateral hip is favored.”

In addition to the above advantages and disadvantages of the two management options, there is one crucial factor—the patient’s preference. If the contralateral hip is prophylactically pinned, the child can be informed that there is no risk of later SCFE and he or she can participate in sports as usual. If the contralateral hip is followed with repeated examinations, the child must be informed that there is a risk for contralateral slip during the remaining years of growth. This might create anxiety and could limit the child’s physical activities during adolescence.

There are currently no long-term follow-up studies showing fewer complications or better function than after in situ fixation, regardless of the degree of slipping. However, in an unstable SCPE epiphysis, hip joint aspiration followed by closed reduction and pinning seems favourable. Pinning with a technique that allows for growth and remodeling has several advantages. If the surgeon is confident with the technique and has consent from the family, prophylactic pinning of the contralateral hip is recommended.

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