

A comparison of varus and valgus slipped capital femoral epiphysis: A case series

James B. Meiling, W. Paul Bowman, Matthew E. Mayfield

ABSTRACT

Introduction: Slipped capital femoral epiphysis is an emergent pediatric hip disorder. It typically presents as varus slip, a posterior and inferior displacement of the proximal femoral epiphysis on the femoral metaphysis. Very rarely, it is valgus slip, a posterior and lateral displacement. This case series describes three patients with slipped capital femoral epiphysis and compares the differentiating factors observed in varus and valgus slips. **Case Series:** Case 1 is an 11-year-old obese boy with pain for several months due to left unilateral varus slipped capital femoral epiphysis, who received ipsilateral in situ pinning and prophylactic pinning in the contralateral hip. Case 2 is a 12-year-old obese boy with acute pain who had right unilateral varus slipped capital femoral epiphysis, received in situ pinning, and has suspected left hip pre-slippage. Case 3 is an 11-year-old non-obese girl with acute pain

revealing simultaneous bilateral valgus slipped capital femoral epiphysis, who underwent in situ pinning twice because of hardware complications. **Conclusion:** The cases and current literature show that varus slips occur more often in males, while valgus slips occur more in females. Body mass index seems to show little indication in predicting the type of slip. Typically, varus slips present unilaterally and can become sequential bilateral slips, whereas valgus slips are more likely to present as simultaneous bilateral slips. Recognizing the different clinical types of slips is important because swift treatment of this emergent hip disorder depends on the immediate recognition and quick actions of orthopedic surgeons.

Keywords: Pediatric, Slipped capital femoral epiphysis, Valgus

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INTRODUCTION

Slipped capital femoral epiphysis (SCFE) is an uncommon emergent [1] hip disorder where two portions of the proximal femoral head, the epiphysis and

metaphysis, become dangerously displaced at the growth plate [1–3]. Pediatricians are often the first to see patients with SCFE; therefore, their immediate recognition of this crisis is crucial. SCFE primarily affects adolescents between the ages of ten to sixteen years, who are male, obese, and/or African American, although it can occur in either gender and in any weight-class or ethnicity [1]. Typically, SCFE presents with generalized hip pain, referred knee pain, limping, and limited range of motion with the leg externally rotated and extended [1, 3]. This condition needs to be promptly surgically repaired to avoid irreversible damage to the femur [1].

SCFE primarily occurs when the proximal femoral epiphysis displaces posteriorly and inferiorly on the femoral metaphysis, known as a varus slip [1–3]. On rare occasions the proximal femoral epiphysis will displace posteriorly and laterally, causing a valgus slip [3]. This case series includes three cases of SCFE, the first two being varus slips and the third a valgus slip, in order to present the significant differentiating factors observed between varus slips versus valgus slips.

CASE SERIES

Case 1

An 11-year-old Caucasian boy presented with left thigh pain beginning three weeks earlier after running. Six months previously, he had severe acute pain in his upper left thigh and groin regions that had been diagnosed as muscle strain. The boy had a body mass index (BMI) of 26.8 (98th percentile), which is classified as obese on the BMI scale for children. There was no complaint of ankle, knee or hip pain. The left leg showed hamstring tenderness and tightness, no redness or swelling, and full range of motion of both hip and knee. An external rotation limp gait was noted. He was diagnosed with left lower extremity injury.

Two months later, he presented with a progressively worsened limp and continued pain. He had increased pain with walking. Left greater trochanter tenderness was noted upon palpation. The boy showed limited range of motion, with abnormal flexion, internal rotation, and external rotation. Plain X-rays of the pelvis showed displacement and poor alignment of the left femoral head on the femoral neck, specifically a varus slip (Figure 1) – left unilateral SCFE. The patient underwent surgical insertion of a single 6.5 mm stainless steel cannulated screw into the left hip (in situ pinning).

Due to the patient's young age and obesity, the physician discussed the possibility of prophylactically pinning the contralateral right hip to prevent slipping in the future. Three months after the left hip SCFE surgery, the right hip was pinned using the same procedure. Both hips healed well; he regained full range of motion.

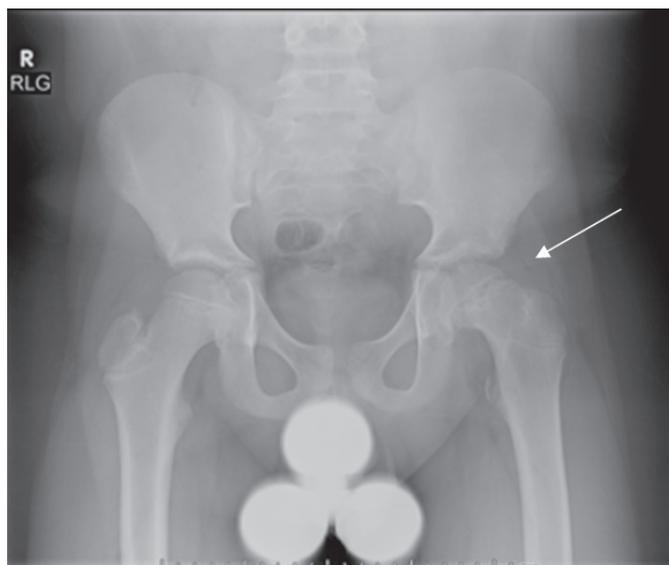


Figure 1: Varus slipped capital femoral epiphysis located on the left femur. The image depicts a plain X-ray of the pelvis prior to in situ pinning of the left hip. (Case 1)

Case 2

A 12-year-old Caucasian boy presented with acute cramping and burning pain in his right hip after trauma during a basketball game. His right hamstrings were kicked which subsequently led to him falling multiple times, leading to a newly-developed limp. He had a BMI of 26.1 (97th percentile); he was obese. Upon examination, the right hip pain was exacerbated by flexion, with pain localizing in the right groin. No bruising or swelling was present. Plain X-rays of the bilateral hips showed a possible right varus SCFE (Figure 2), which led to immediate surgical in situ pinning of the right hip.



Figure 2: Slight varus slipped capital femoral epiphysis located on the right femur. The image depicts a plain X-ray of the pelvis prior to in situ pinning of the right hip. (Case 2)

Two months later, he returned complaining of acute non-traumatic hip pain on the contralateral left side. Left lateral thigh tenderness was noted upon palpation. Plain X-rays showed no trace of fracture, no dislocation, and normal alignment. He had possibly strained a muscle during therapy, but still showed no signs of slippage. The pain continued over the next month, resulting in the development of an antalgic gait to avoid pain while walking. He was suspected pre-slip that is not currently visible on plain X-ray, but may further develop into left SCFE.

Case 3

An 11-year-old Caucasian girl presented with right hip pain following in situ pinning of bilateral SCFE at another hospital, occurring two days previously. She had presented with occasional right knee pain. She had a BMI of 20.9 (82th percentile). Plain X-rays revealed bilateral valgus SCFE (Figure 3). She underwent bilateral in situ pinning with a large screw in each hip joint to prevent further slipping. She rapidly developed right hip pain one day post-surgery. Plain X-rays showed retained hardware in her right hip, a screw through the pelvis adjacent to the joint.

The second procedure, performed at our hospital, included surgical dislocation of the right hip to remove the retained screw from the pelvis and re-pinning of her bilateral SCFE. A single fixation screw was placed on both sides, traversing the proximal femoral physes. The right side had three additional screws oriented transversely through the lower margin of the greater tuberosity and proximal femur for increased stability.

One year and eight months out of surgery she began experiencing increasingly progressive right hip pain,

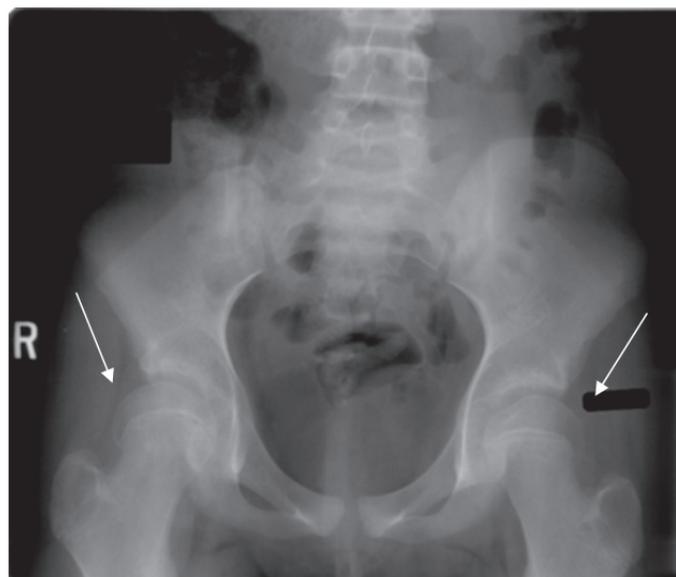


Figure 3: Bilateral valgus slipped capital femoral epiphysis located on both femurs. This condition occurred simultaneously on the left and right hips. The image depicts a plain X-ray of the pelvis prior to in situ pinning of either hip. (Case 3)

pinpointed to the tip of the greater trochanter on the lateral aspect of her right hip. It was suspected to be due to hardware irritation. All hardware was removed from the right hip and the post-operative evaluation showed resolution of pain.

DISCUSSION

The vast majority of SCFE cases present as a posterior and inferior slip of the proximal femoral epiphysis on the femoral metaphysis, a varus slip [1–3]; however, in rare cases the proximal femoral epiphysis slips posteriorly and laterally, causing a valgus slip [3]. Since its first documentation by Müller in 1926 [4], valgus SCFE still remains very uncommon, approximating 1-2% of all SCFE cases [2].

A patient's gender and type of SCFE, whether varus or valgus, might be correlated [2]. In the three presented cases, the two varus cases were both males while the valgus case was a female. These findings are consistent with the literature. In the retrospective studies of Shank et al [3] and Loder et al [2], both found that varus SCFE usually occurs in males [1–3]; however, valgus SCFE has a higher incidence in females [2, 5].

A patient's BMI and the type of SCFE that occurred, either varus or valgus, might be related. A majority (81%) of SCFE cases occur in adolescents who are obese [6], meaning above the 95th percentile according to their age, weight, and height [1, 7]. Obesity plays a role in the increased sheer forces on the proximal femur and can lead to epiphyseal instability, increasing the risk of slippage [8]. The characteristics of the patients in Case 1 and 2 (Table 1) are both consistent with these findings. On the other hand, Case 3 already atypical due to its valgus nature – becomes even more unique as it presents in a normal-weighted female and not the expected obese female. Loder et al found similar results that the valgus slip patients had a lower BMI as compared to the varus slip patients [2]. That being said, the valgus slip average BMI was 27.6 and the varus slip average BMI was 31.9, so while the valgus slip BMI was lower, both averages were still within the obese range for children and teens [2]. Shank et al found no difference in BMI between their varus slip and valgus slip patients [3]. In Japan, Noguchi and Sakamaki found that in normal and underweight individuals, SCFE was more prominent in females than in males [9].

SCFE can present as unilateral or as bilateral, either sequential or simultaneous cases. Cases 1 and 2 both showed obese boys with varus unilateral SCFE. While Case 1 had a prophylactic surgery of the asymptomatic contralateral hip, Case 2 did not and the boy now has a symptomatic contralateral hip, indicating possible sequential pre-slippage. These two cases help to pose a question that in what circumstances should a physician prophylactically pin the asymptomatic contralateral hip to avoid progression into sequential SCFE? Having

Table 1: Significant factors from each of the three previously presented cases

	Case 1	Case 2	Case 3
Gender	Male	Male	Female
Body mass index (Weight Class)	26.8 (Obese)	26.1 (Obese)	20.9 (Normal)
Unilateral slip vs. Bilateral slips	Unilateral	Unilateral	Bilateral
Solitary vs. Sequential vs. Simultaneous	Solitary	Possibly Sequential	Simultaneous

SCFE at a younger age [10] and pre-operative and/or post-operative obesity seems to increase the risk of the person having contralateral slipping later in life [11]. Baghdadi et al found that 15% of patients that underwent in situ pinning for unilateral SCFE had contralateral slipping later in life [12]. Surgery is never without risk; hence, the reason why there is continued controversy over asymptomatic contralateral pinning, which can sometimes lead to avascular necrosis, peri-implant fracture or symptomatic hardware [13].

Case 3 presented with a normal-weighted female having simultaneous bilateral valgus SCFE. It has already been discussed that valgus SCFE possibly occurs more often in females than in males [2, 5], so do bilateral cases occur more often in valgus SCFE or varus SCFE? Both Koczewski and Shank et al agreed that patients with a valgus slip had a decreased risk of a contralateral slip [3, 5]. On the other hand, Loder et al found that patients who had a valgus slip were more likely to have a bilateral valgus slip [2]. These findings are largely dependent on the sample size used, especially because some of these samples were very limited, leading to varied results. In addition, both Loder et al. [2] and Shank et al. [3] found that it is more likely for a varus slip to develop into sequential bilateral varus SCFE and bilateral valgus slips usually develop simultaneously. Future studies might look at whether females or males have increased risk for bilateral SCFE and whether this bilateral SCFE is sequential or simultaneous.

CONCLUSION

In summary, SCFE is an adolescent hip disorder that can be classified as either a varus or valgus slip. Valgus SCFE can occur in either gender, although it seems more common in females, and BMI did not seem to be a significant factor. Varus SCFE commonly presents as unilateral SCFE with the potential to progress to sequential bilateral SCFE, while valgus SCFE is more likely to present as simultaneous – rather than sequential – bilateral SCFE. Further investigation would

help in solidification of these prognostic risk factors and associated presenting symptoms. Recognizing the different clinical types of slipped capital femoral epiphysis, both varus and valgus slips, is important because swift treatment of this emergent hip disorder depends on the immediate recognition by pediatricians and quick actions of orthopedic surgeons.

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Author Contributions

James B. Meiling – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

W. Paul Bowman – Substantial contributions to conception and design, Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Matthew E. Mayfield – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Critical revision of the article, Final approval of the version to be published

Guarantor of Submission

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Consent Statement

Written informed consent was obtained from the patient for publication of this study.

Conflict of Interest

Authors declare no conflict of interest.

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