Delayed-Onset Slipped Capital Femoral Epiphysis: Case Report of Association With Pituitary Tumor

Robert L. Brady, MD, and Andrew Price, MD

Abstract

Slipped capital femoral epiphysis (SCFE) is an affliction of the hip presenting in adolescent children. There are several theories regarding the pathological cause of SCFE. The hormonal milieu during adolescence, combined with a deficiency in the physeal area of the growth plate, has been postulated as a possible etiology for its specific onset. In atypical circumstances, the early or late onset of SCFE may occur in the setting of unusual hormonal influences. This hormonal imbalance may be secondary to an underlying endocrinopathy—for example, hypothyroidism or hypogonadism.

In this case, our patient presented with a clinically and radiographically unstable slip at the age of 22 years. His physical characteristics, along with confirmatory laboratory values and radiographs, indicated that the patient suffered from a disorder of delayed secondary growth. Subsequent thorough work-up revealed a large benign pituitary tumor that was causing severe panhypopituitarism.

This article describes the presentation, diagnostic work-up and treatment of our patient with a delayed-onset SCFE in the setting of a pituitary tumor.

Slipped capital femoral epiphysis (SCFE) is the most common pathological disturbance in the hip growth plate occurring during the adolescent stages. It affects approximately 2 cases per 100,000 adolescent children.[1] The average chronological age of affliction is 12.1 years ± 1.0 for girls, and 14.4 years ± 1.3 years for boys.[1] Some authors have stated that the skeletal age is more accurate than the chronological age, since the variability is lower when using the former measure.[2] The exact cause of SCFE is unknown. It is believed that the hormonal influences on the growth plate, in coordination with the growth spurt of puberty, weaken the physis. This destabilized physeal plate is unable to resist the shear forces placed across it and consequently fractures through its hypertrophic zone.

Disorders of the endocrine system can also cause SCFE, but at atypical ages. Hypothyroidism, growth hormone deficiency, and hypogonadism are the disorders that are frequently mentioned in this setting. Hypopituitarism is yet another disorder that is less frequently seen in adolescence and is much less commonly the cause of SCFE.

Our patient presented with an acute-on-chronic stable slip at the age of 22 years without any previous work-up for his clinically obvious delay of secondary growth characteristics. This case report describes our treatment for endocrine-related SCFE, details the importance of a thorough work-up, and presents short-term follow-up on our patient.

Case Report

A 22-year-old man presented to the emergency department with a complaint of severe pain on weight bearing of the left hip after sustaining a very minimal fall. At presentation the patient was unable to bear weight secondary to severe pain, and thus the slip was classified unstable. He also provided a history of mild left hip pain for approxi-

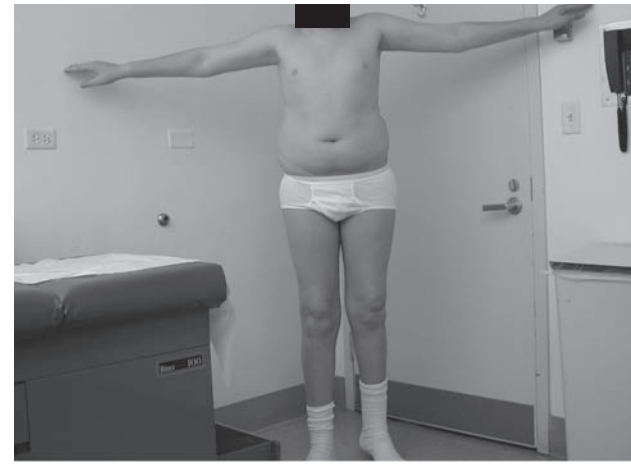

Figure 1. Photograph of patient at age 23. (Informed consent was obtained from patient for photograph.)

Dr. Brady is Attending, Department of Orthopaedic Surgery, Norwalk Hospital, Norwalk, Connecticut. At the time of manuscript submission, he was Resident, Department of Orthopaedic Surgery, St. Luke's–Roosevelt Hospital Center, New York, New York.

Dr. Price is Attending, Department of Orthopaedic Surgery, St. Luke's–Roosevelt Hospital Center, New York, New York; Associate Professor of Orthopaedic Surgery, Columbia University, New York, New York; Attending, Department of Orthopaedic Surgery, Hospital for Joint Diseases, New York, New York; and Clinical Associate Professor of Orthopaedic Surgery, New York University, New York, New York.

Address correspondence to: Robert L. Brady, MD, Coastal Orthopaedics, 40 Cross St, Suite 300, Norwalk, CT 06851.

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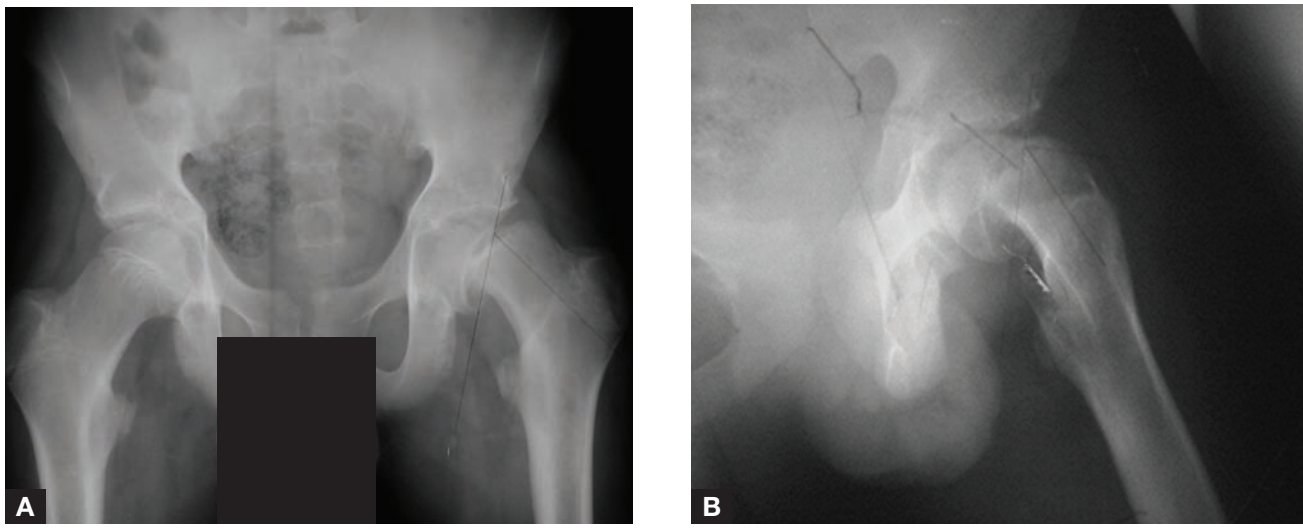

Figure 2. (A) Anteroposterior and (B) frog-leg lateral radiographs of pelvis and left hip, demonstrating severe slip of left hip.

mately 1 month, which categorizes his presentation as an acute-on-chronic variant. There was no report of right hip pain.

Clinically, our patient stood 178.8 cm and weighed 75.2 kg, resulting in a body mass index (BMI) of 23.67 kg/m^2 (Figure 1). On physical exam, he demonstrated absence of facial and body hair and an immature phallus and gonads, and he lacked the appearance of a typical male adolescent. His voice was soft spoken and lacked the normal pubertal drop in pitch. The patient denied any family history of similar physical characteristics.

Anteroposterior and frog-leg lateral views of the pelvis and hip indicated a severe slip of >50% of the left hip (according to the Southwick anteroposterior angle) and a normal-appearing right hip (Figure 2). Initial laboratory tests included a complete blood count, basic chemistries, prothombin and partial thromboplastin time, serum testosterone, thyroid releasing hormone, and thyroid-stimulating releasing hormone. The results of these tests indicated a significantly low testosterone level and mildly decreased thyroid hormones.

The patient was admitted and underwent in-situ percutaneous pinning of the left hip. Postoperatively, the patient had an uneventful and expeditious recovery and was discharged on postoperative day 5 with instructions for toe-touch weight-bearing status on the left hip and follow-up with both the pediatric orthopedic clinic and endocrine clinic.

Despite the patient's intermittent follow-up, he progressed to full weight bearing on the left lower extremity at 6 weeks. Discussions were held with the patient throughout

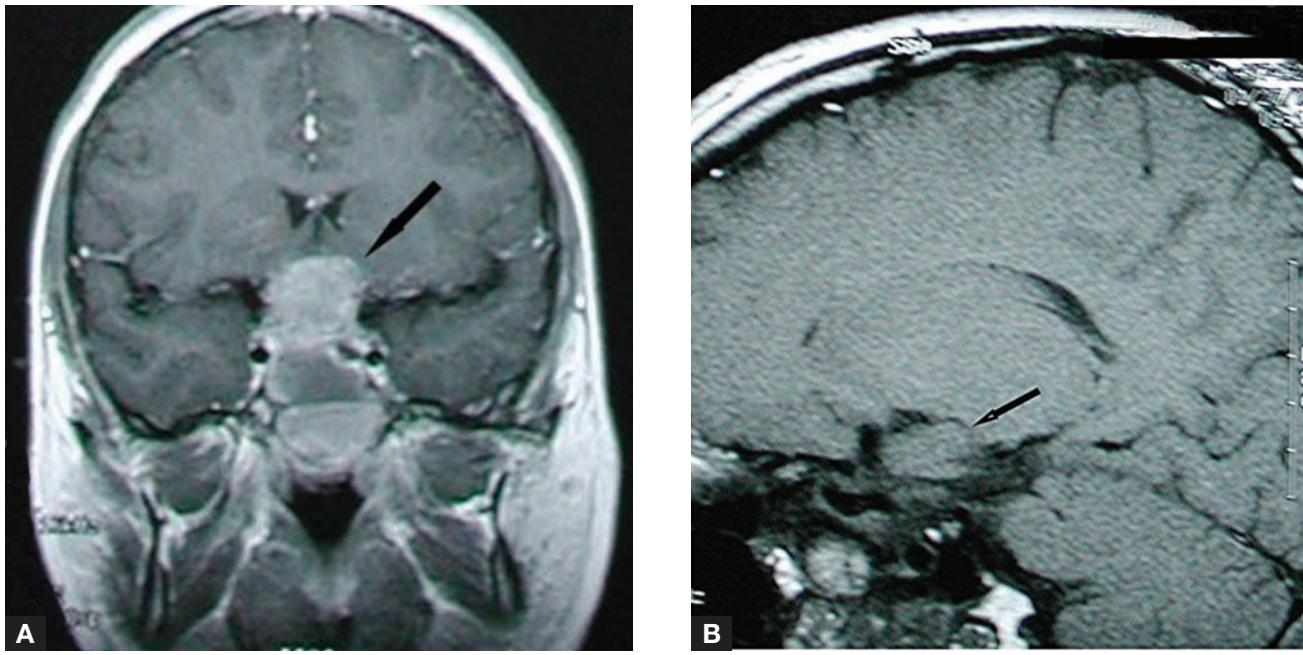

Figure 3. (A) Anteroposterior and (B) sagittal magnetic resonance imaging of brain, demonstrating 2.6 x 2.5 x 5.5-cm suprasellar pituitary tumor (black arrows).

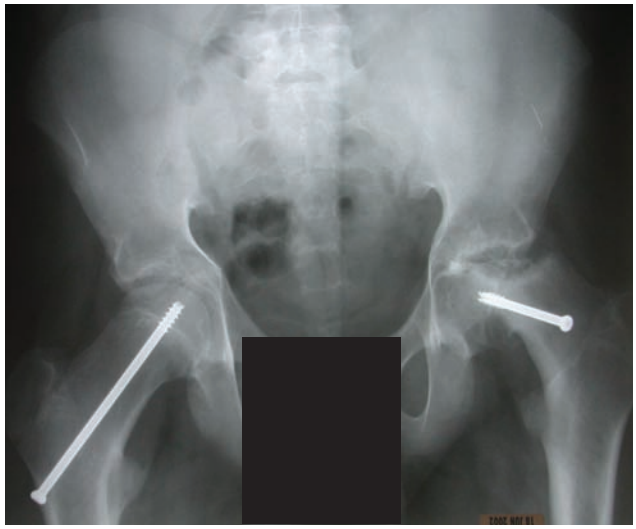

Figure 4. Anteroposterior radiograph of pelvis, demonstrating avascular necrosis of left femoral head with anterolateral collapse.

his progress regarding the high incidence of bilateral slips in the setting of endocrinopathy. Three months after the initial surgery and when the patient was tolerating full weight bearing on the left hip without assistance, he underwent prophylactic pinning of the asymptomatic right hip.

Initial work-up of this patient's obvious endocrinopathy diagnosed severe hypogonadism and hypothyroidism. More intensive investigation of laboratory values and radiograph confirmed a diagnosis of severe panhypopituitarism that had resulted in hypogonadotropic hypogonadism, hypothyroidism, adrenal hypofunction, diabetes insipidus, growth hormone deficiency, and osteoporosis. The patient also demonstrated symptoms of neuromuscular irritability. Bone age was determined to be 14 years, according to the standards of Greulich and Pyle. Subsequent computed tomography and magnetic resonance imaging of the brain revealed a 2.6 x 2.5 x 5.5 cm suprasellar lesion within the pituitary (Figure 3). Through a transsphenoidal approach, partial resection of the lesion was performed by neurosurgery. Final pathology of the mass was a benign craniopharyngioma.

In order to treat his multiple endocrinopathies, the patient received hormone replacement therapy in the form of androgens, cortisol, and thyroid hormone. Desmopressin acetate (DDAVP) tablets were prescribed for a short period for symptoms of urinary urgency at night. He was also prescribed vitamin D and calcium for evidence of early osteoporosis. At 1-year follow-up from the initial presentation and after 7 months of medical management, our patient felt subjectively that his overall health was better. Symptoms of daily fatigue abated, along with his nocturia and neuromuscular irritability. The patient's weight and BMI increased to 88.9 kg and 27.86 kg/m^2, respectively. He underwent a subsequent reoperation after medical management for complete resection of the remaining tumor, without consequence.

At 2-year follow-up, his right hip was totally asymptomatic. His left hip, however, demonstrated radiographic signs of avascular necrosis (Figure 4). In addition, both femoral epiphyses were closed along with all other growth plates throughout his skeleton, demonstrating skeletal maturity. The symptoms related to his endocrinopathy had practically abated with hormone replacement.

Discussion

The patient who first presents with SCFE in postadolescence must be thoroughly evaluated. Endocrinopathy is the most common cause of SCFE in these cases. Isolated hypothyroidism and hypogonadism are the 2 most prevalent disorders leading to SCFE at atypical times.[3] Hypothyroidism tends to occur in the preadolescent stages, whereas hypogonadism predominates in postadolescence. Although much less common, hypopituitarism may lead to both a hypothyroid and a hypogonadic state, as well as to other endocrine disorders.

Although panhypopituitarism is relatively rare in the adolescent population, its presence must be investigated thoroughly. The most common cause of hypopituitarism in this setting is a tumor placing pressure on the gland and thus reducing the secretion of its hormones. Craniopharyngiomas represent approximately 80% to 90% of pituitary gland tumors in patients from 5 to 14 years old and in those older than 50 years and have bimodal peaks of incidence.[4] These are benign tumors that exhibit a mass effect on the pituitary gland and its nearby structures. At the time of diagnosis, approximately 80% of patients with a craniopharyngioma will have evidence of one or more endocrine disorders. The presence of deficiencies in growth hormone (75%), gonadotropin (40%), adrenocorticotropic hormone (25%), and thyroid stimulating hormone (25%) will determine the manifestation of endocrine dysfunction. In addition to the above deficiencies, patients may also present with hyperprolactinemia (20%) and much less commonly with posterior pituitary dysfunction resulting in diabetes insipidus (9%–17%).[5]

The cause of SCFE in the hypogonadic patient has not been clearly established. It is hypothesized that the presence of the hormone estrogen is vital to closure of the physis. Thus, a lack of estrogen may lead to a prolonged open physis and decreased resistance to shear forces on the hip. Testosterone may also play a role, if only in relation to estrogen as a ratio. In addition, hypogonadic patients tend to be overweight, which places more shear forces on the already compromised physis.

A combination of socioeconomic factors and benign neglect led to our patient presenting late in the setting of his tumor and endocrine dysfunction. Clearly a deficiency in the patient's secondary growth characteristics resulted from his hypogonadism. As we've shown, it is imperative to elicit a diagnosis in patients presenting with a previously undiagnosed endocrinopathy.

There is an extremely high incidence of bilateral SCFE in the setting of endocrinopathy. It has been reported in

100% of these patients in some studies.[6] Therefore, prophylactic pinning of the contralateral hip is recommended in order to avoid much of the complications and morbidity associated with an acute slip. The timing of prophylactic pinning is controversial and certainly not standardized throughout the orthopedic community. In our experience, patient rehabilitation is more easily tolerated when prophylactic pinning is delayed until the patient is able to bear weight on the primarily affected extremity.

In our patient's case, the large size of the tumor and the long duration of compression on the pituitary gland completely destroyed the gland's function. The patient will, therefore, require lifelong hormone replacement. Furthermore, we can conclude that it was the hormone replacement therapy that contributed to the closure of the open physes.

In conclusion, educating the patient and the family, close observation, and medical management are vital to the comprehensive treatment of this condition.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.

Letters to the Editor

The journal welcomes Letters to the Editor. Letters are not peer reviewed. Opinions expressed in letters published here do not necessarily reflect those of the editorial board or the publishing company and its employees.

Are Competitive Sports Becoming Too Competitive?

I read with great interest Dr. Bill Grana's most insightful guest editorial entitled "Are Competitive Sports Becoming Too Competitive?," which appeared in the June 2009 issue of *The American Journal of Orthopedics* (Grana WA. Are competitive sports becoming too competitive? *Am J Orthop*. 2009;38(6):277-278).

Dr. Grana's insight is particularly timely in this day of "win at all costs" philosophy. He is correct in his suggestion that we ought to step back and give more consideration for the total development of the growing person. The decisions being made for young athletes can at times be unwittingly made without due consideration of the status of both their immature bodies and their emotional well-being. The child and young adolescent also need to have a life outside of sports. As Dr. Grana points out, we overemphasize the need for absolute victory/winning when alternatively fulfilling athletic achievement for the young person can also be realized through participation itself, which can at times be just as important as winning. Bill Grana is recognized as a national leader in orthopedic surgery, both as an innovative surgeon and an educator. For those who haven't read his editorial, I suggest they do so.

Perry Schoenecker, MD
St. Louis, MO