Case Report

Bilateral Slipped Capital Femoral Epiphyses and Hormone Replacement

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Received: 30 May 2007 / Accepted: 12 December 2007
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Abstract A 24-year-old woman presented with an 11-year history of bilateral hip pain. Radiographs of the hips revealed severe bilateral slipped upper femoral epiphyses; the left side was more severely slipped than the right. While moving the hips under fluoroscopy we observed motion at the physes and reproduced the patient's pain; the motion confirmed the diagnosis of chronic slipped capital femoral epiphysis. Endocrinology tests showed hypothyroidism. After 1 year of thyroxin therapy, the patient's pain subsided and radiographs of the hips showed fusion of the physes. This case emphasizes the importance of screening for an endocrine disorder in patients with slipped capital femoral epiphysis particularly in adults and shows fusion can occur once the underlying endocrine abnormality is treated.

Introduction

Slipped capital femoral epiphysis (SCFE) occurs in two to three per 100,000 children and adolescents. It accounts for 0.5% of the total number of hip conditions encountered in childhood resulting in a limp [21]. Various procedures have

been described for treatment of chronic SCFE [6]. Although the association of SCFE with different endocrine abnormalities has been reported [3, 4, 8, 13, 15, 19, 28, 33, 38], to our knowledge, the effect of hormone replacement therapy on the fusion has not been documented. We believe this is the first report of chronic SCFE that fused after thyroxin therapy in a patient with hypothyroidism.

Case Report

A 24-year-old woman presented with an 11-year history of bilateral hip pain. She could walk approximately 20 m with the assistance of two elbow crutches. She complained of night pain and used opioid analgesics regularly. According to her mother, the patient had normal motor milestones. There was no history of complete inability to bear weight; however, the patient had a long history of partial weight-bearing with crutches. Menarche was at age 14 years. Since that age, she had always weighed between 47 and 50 kg. At the time of presentation, the patient was 147 cm tall and weighed 50 kg. She walked with a pronounced antalgic and Trendelenburg gait. The left leg was shorter than the right by 1 cm. The Trendelenburg test was positive on both sides. She had no fixed flexion deformity on either side. Hip examination showed a flexion of 90°, abduction of 10°, adduction of 30°, and external rotation in extension of 25° on both sides. Internal rotation in extension was 0° on the right and 10° on the left. A Harris hip score [37] of 36.5 was achieved by the patient.

Radiographs (Figs. 1, 2) showed the patient had severe bilateral slipped upper femoral epiphyses, worse on the left than the right. The slips were Grade III on both sides (displacement of the neck on the head greater than 50%). It was also obvious that the physes in both upper femurs had

Each author certifies that his or her institution has approved the human protocol for this investigation, that all investigations were conducted in conformity with ethical principles of research.

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not yet united. There was little joint space narrowing in the hips. Radiographs taken with the hips abducted showed movement at the physes. A technetium bone scan was obtained, which showed increased uptake at the proximal femoral physes and normal uptake elsewhere (Fig. 3). The bilateral chronic SCFEs were confirmed by moving the hips under fluoroscopy and showing movement at the physes and reproduced the patient's pain (Figs. 4, 5). In these images, the changes in the appearance of the lesser trochanter indicated some rotation was introduced along with adduction/abduction. Although the rotation could have resulted in a slightly different projection, we do not believe the difference in projection is large enough to account for the whole head-on-neck movement.

Laboratory tests revealed the patient had hypothyroidism, having a free thyroxin level less than 1.3 (normal, 9.7–25.7), a T3 level of 0.6 (normal, 1.1–2.2), a thyroid-stimulating hormone level of 842 (normal, 0.47–6.90), and a prolactin level of 2014 (normal, 83–527). The patient was referred to an endocrinologist and thyroxin treatment was started.

We decided to improve the position of the femoral heads in relation to the necks and hold them in position by Dunn's procedure [6], but the patient did not return for the surgery and attempts to contact her failed. Almost a year later, we succeeded in locating the patient and asked her to attend our outpatient clinic, where we found her to have improved dramatically. Although she was still taking analgesics (tramadol), she now only occasionally had night pain in her hips. She could walk unaided without an antalgic gait. The Trendelenburg test was positive on the right side but delayed for 5 seconds on the left side. On the right side, abduction/adduction was 15°/15°, internal rotation/external rotation in flexion was 10°/20°, range of motion was flexion/extension 100°/0°, and internal rotation/

Fig. 1 An anteroposterior radiograph of the pelvis shows severe bilateral Grade III slipped upper femoral epiphyses, worse on the left side than on the right.

Fig. 2 An anteroposterior radiograph of the pelvis with hips abducted shows apparent movement between the epiphyses and the neck of the femur.

Fig. 3 A technetium bone scan shows greatly increased isotope uptake at the proximal femoral physes.

external rotation in extension was 0°/50°. On the left side, flexion/extension was also 100°/0°, there was fixed adduction of 10°, internal rotation/external rotation in flexion was 0°/40°, and internal rotation/external rotation in extension was 0°/80°. There was no true leg length discrepancy but an apparent discrepancy of 1 cm attributable to the fixed adduction of the left side. The lumbar spine and neurologic examinations were normal. The Harris hip score was 52. Radiographs showed the upper femoral physes had fused (Fig. 6). A CT scan of the hips (Fig. 7) confirmed the physes had united bilaterally. On the CT scan, on the left side, there appeared to be either osteonecrosis or arthritis. We interpreted the findings as a degenerative cyst because in osteonecrosis the increased

Fig. 4A–B The pseudarthroses were confirmed by screening the hips in (A) adduction and (B) abduction using an image intensifier. Slight displacement appears in abduction.

density is more extensive over a large area of the femoral head; in this case, the density increases were limited to the periphery of the hypodense lesion, which we believed was more suggestive of a degenerative cyst.

Discussion

Although the cause of SCFE remains unclear, endocrine conditions such as an alteration in testosterone or estrogen levels [37], 1,25-dihydroxyvitamin D [15], hypothyroidism [8, 28, 38], growth hormone deficiency [19, 28], growth hormone treatment [3], panhypopituitarism, hypogonadism [19, 28], juvenile hypothyroidism [13], pituitary gigantism [28, 33], Down syndrome [4], and renal failure have been mentioned as contributory factors. Slipped capital femoral

Fig. 5A–B The pseudarthroses were confirmed by screening the hips in (A) adduction and (B) abduction using an image intensifier. Greater than 50% of the left femoral neck is in contact with the head in abduction, which reduces to less than 50% in adduction.

epiphysis is seen in patients who have had radiation therapy [18] or are without clinical evidence of an endocrinopathy [22].

For severe SCFE cases, treatment is difficult and controversial because of the substantial deformity of the femoral head and complications such as osteonecrosis and osteoarthritis. Osteonecrosis and chondrolysis, the most frequent and devastating complications, seem to be related to the severity of the slip and the type of treatment [5]. In this case, there was no sign of osteonecrosis or chondrolysis. Osteonecrosis more commonly is associated with the acute slips when the lateral epiphyseal vessels are disrupted. In chronic slips, osteonecrosis can occur because of treatment [35]. Osteonecrosis clearly is related to an

Fig. 6A–C (A) An anteroposterior radiograph of the pelvis and lateral radiographs of the (B) right and (C) left hips show apparent fusion of both proximal femoral physes.

impeded blood supply to the femoral head and to severely slipped, unstable acute slips. Improperly placed fixation devices also may play a role in the development of osteonecrosis [16, 20].

Although several theories have been proposed, no agreement has been reached regarding the etiology or the pathogenesis of chondrolysis [36]. Chondrolysis, or cartilage necrosis, can occur in untreated slips but often is associated with spica cast immobilization or penetration of the internal fixation screws into the joint space [35]. The higher incidence (28%–50%) of chondrolysis in black patients suggests a genetic predisposition [24, 32, 34, 39]. Because chondrolysis can occur in treated and untreated hips, an immune mechanism has been postulated [20]. A report by Carney et al. [7] on 31 untreated cases of SCFE with an average followup of 41 years showed only one case of chondrolysis occurred, which was in a mild slip; osteonecrosis also occurred in one case [7]. Relative stability of the SCFE and lack of pinning or reduction may

explain why our patient was at less risk for having osteonecrosis or chondrolysis develop.

Various osteotomies have been described for treatment of severe SCFE, such as transtrochanteric anterior rotational osteotomy [15], intertrochanteric osteotomy [1, 9, 15, 17, 27, 30], and Dunn's procedure [11, 26, 31]. Dunn described the technique of cuneiform osteotomy of the femoral neck for severe chronic slips when the physes are still open. In this procedure, the bony beak and the neck are shortened, and the osteotomy surfaces are opposed and fixed by three threaded pins. Fish described another technique for severe slips where the osteotomy is made distal to the physis, and the epiphysis is fixed to the femoral neck with three or four pins [6].

There is no widely accepted treatment protocol for SCFE. We initially considered in situ pinning followed by a later valgus flexion derotation osteotomy, if required. However, we considered the slips too severe for osteotomy to be successful and the risk of osteonecrosis too high.

Fig. 7A–B (A) Transverse and (B) coronal CT scans confirm bilateral proximal femoral physal union.

Other options included gradual distraction to reduce the slips [25] and bilateral THAs. We decided the best option would be Dunn's procedure because of its ability to reposition the head with minimal risk of osteonecrosis. We decided not to do an urgent operation because the chronicity of symptoms showed clearly the blood supply above the growth plate must have been very well established and osteonecrosis was unlikely, so the patient was put on the waiting list for the operation.

Because fusion resulted in a substantial improvement in symptoms and function, the patient understandably did not wish to have surgery. Owing to fusion with the epiphyses markedly displaced, we suspect progressive degenerative changes likely will ensue in the future.

Because the patient did not have surgery, we could not obtain a specimen to confirm the diagnosis, thus whether the patient had chronic SCFE with or without pseudarthrosis was uncertain. In any case, biopsy specimens rarely are obtained for patients with SCFE. Regardless, our patient showed replacement of the deficient hormone can promote fusion. However, we believe the fact that fusion can take place after initiation of thyroxin therapy does not preclude surgery in these cases as the fusion may take a

long time and further slipping can occur. On the contrary, we believe the observation of fusion on hormones suggests pinning should be performed first as fusion induced by hormones could hinder optimal reduction.

The only other possibility is spontaneous fusion of a pseudarthrosis (rather than SCFE), which, to our knowledge, has not been reported and so we considered it unlikely. The probable mechanism of such effect is that thyroxine stimulates transglutaminase activity in articular chondrocytes [29] and skeletal tissues, which itself correlates with chondrocyte differentiation. This process leads to cartilage calcification and could result in cross-linking of the mineralizing matrix, which is implicated in bone development and formation [2, 23]. Additionally, thyroid hormone stimulates terminal differentiation of epiphyseal growth plate chondrocytes promoting mineralization [14], stimulates matrix metabolism in articular chondrocytes [12], and reverts the skeletal development and maturation defects attributable to hypothyroidism [10].

This report shows fusion of SCFE can occur once the underlying endocrine abnormality is treated and, if surgery is indicated, we believe it should be performed before initiation of hormone replacement therapy, which may hinder proper surgical reduction.

Acknowledgment We gratefully acknowledge the assistance of Dr. Fernando Cesani-Vazquez, Associate Professor of Radiology at The University of Texas Medical Branch in Galveston, TX, in the preparation of this manuscript.

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