Slipped Capital Femoral Epiphysis in Ramathibodi Hospital

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Abstract

Slipped capital femoral epiphysis is rare in Asiatic Indonesian-Malays. Seven cases (9 hips) of this condition in Ramathibodi Hospital including five boys (average age, 12.5 years) and two girls (average age, 13 years) were reviewed. Most of the cases (4 out of 7) were acute on chronic and mild slips. No endocrine disorder was observed in all cases. All of the patients had a body weight above the mean of the normal population, four of which were obese. For the treatment, a single screw fixation including one case with cancellous and six cases with cannulated type were used. In the follow-up of average 2.5 years, six cases had satisfactory results. Avascular necrosis occurred in one case with mild and chronic slips in which a cancellous screw was used. It is concluded that obesity is the important factor related to the etiology in this study and probably is the same in other developing countries. The effect of a cancellous screw causing avascular necrosis is still questionable.

Slipped capital femoral epiphysis is an adolescent disorder in which there is an acute or gradual disruption through the physeal plate. Although the exact etiology is still unknown, several factors including obesity, mechanical abnormalities, physeal plate abnormalities and endocrine disorders are considered to be associated with this condition[1-7]. A recent study showed that slipped capital femoral epiphysis could affect all races[8]. However, the incidence in South East and East Asia is very low. Loder reported that the relative frequency of this disorder compared with the white population was only 0.5 for the Asiatic Indonesian-Malays (Japanese, Chinese, Filipino, Thai, Vietnamese).

The purpose of this review is to report the cases in Ramathibodi Hospital, the result of the treatment and to determine the possible etiologic factors.

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Table 1. Patient data on admission.

Case	Age (years)	Gender	Side	Duration of symptom	External rotation of the hip	Type of slip	Grade	Head shaft angle
1.	11.0	M	R/L	4 Mo	20°	C	mild/pre slip	27°
2.	13.4	M	R	3 Mo	25°	AC	mild	28°
3.	12.3	F	L	3 Mo	30°	AC	mild	31°
4.	13.8	F	R/L	2 Wk	40°	A	mild/pre slip	31°
5.	13.2	M	L	10 Mo	40°	C	mild	32°
6.	11.8	M	R	4 Mo	40°	AC	mild	34°
7.	13.4	M	L	6 Mo	35°	AC	mild	30°

A = acute, AC = acute on chronic, C = chronic
Mo = Month, Wk = Week

PATIENTS AND METHOD

Between 1990 and 1995, 7 patients (9 hips) were treated for slipped capital femoral epiphysis at Ramathibodi Hospital. The medical records and radiographic studies were reviewed. There were 5 boys (average age, 12.5 years) and 2 girls (average age, 13 years) giving a ratio of 2.5 to 1. Both hips were affected in 2 of 7 patients (28%). In 2 patients the right hips alone were affected, and in 3 the left (Table 1).

The body weight and height, the stage of puberty, the presentation and duration of symptoms, the degree of slip and the hormonal studies for endocrine disorder were reviewed for each patient.

Body mass index (BMI) and standard deviation score calculated from body wieght and height of the patients were used to determine the obesity.

The stage of puberty was determined in each patient by Tanner staging method[9].

According to the duration of symptoms the hips were classified as chronic (having symptoms for 3 weeks or more), acute (having symptoms for < 3 weeks), acute on chronic (having an exacerbation of symptoms on chronic cases), or asymptomatic (in a child with bilateral involvement in which the asymptomatic hip was diagnosed at the same time as the opposite side). For the bilateral simultaneous involvement, the hip with the longest duration of symptoms was considered to be the first affected hip.

The degree of slip was determined from the radiographs of the hips in anteroposterior and lateral views and classified as mild (< 1/3 displacement of the epiphysis on the metaphysis), moderate (1/3-1/2 displacement of the epiphysis on the metaphysis), and severe (displacement > 1/2 of the metaphysis width). A hip was designated as a pre-slip if there were symptoms of hip pain but without radiographic slippage, with or without physeal widening. The lateral head-shaft angle was measured on the frog leg lateral radiograph of the hips. Serial follow-up radiographs including the preoperative, postoperative, and follow-up studies were evaluated for physeal closure and the time to fusion was documented.

Endocrine disorder was assessed by physical examination and serum level of thyroid hormone (T4, FT4, TSH), cortisol, prolactin and insulin.

With regard to the treatment, all of the patients (7 cases) had either cancellous or cannulated screws fixation, one in each. Five out of 7 patients with acute and acute on chronic slips had one trial of closed reduction under general anesthesia prior to the fixation. The technique used in reduction was gentle traction of the extremity and internal rotation of the hip as much as possible to the normal position. The other 2 cases with chronic slips had *in situ* fixation of the screws.

At the time of the study the patients were recalled for clinical as well as radiographic evaluation of the hips. A Harris Hip Score was determined in each patient, based on pain, gait, function, deformity, and range of motion. Scores > 90 points were considered satisfactory[10].

RESULTS

The average age on first visit in girls (13 years, range 12.33 - 13.8 years) was higher than in boys (12.5 years, range 11 - 13.41 years).

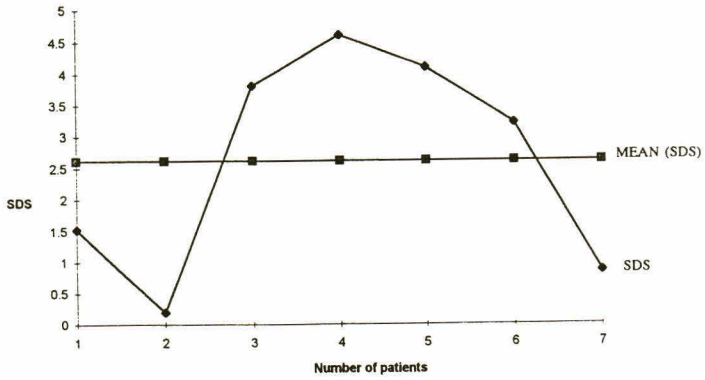

Fig. 1. Body mass index and standard deviation score in each patient. 4 cases were above the mean SDS (No. 3,4,5,6) and defined as obesity. 3 cases (No. 1,2,3) had the body weight above the mean and were defined as over weight.

Fig. 2. The patient was a 12 year-old girl with pain over the groin for 3 months and had acute symptoms for 2 weeks before admission. Anteroposterior radiographs of the hips reveal the sclerosis of the metaphyseal area. She was defined as acute on chronic slip.

By using the body mass index and standard deviation score, 4 cases (57%) were defined as obesity and 3 cases had body weights above the mean (+0.19 SD, +0.85 SD, +1.52 SD) of the population (Fig. 1).

According to the stage of puberty, all of the patients were in the pubertal period. In girls, both cases, the slippages occurred before menarche, whilst in boys, all were in the mid pubertal period.

None of the patients in this study had endocrine disorders.

The most common complaint from the patients was anterior thigh pain (6 cases). Only one case presented with limping and groin pain. The duration of symptoms ranged from 2 to 40 weeks. Most of the patients were with acute on chronic slips (4 cases) (Fig. 2). On physical examination, the various degrees of external rotation of the affected sides as well as the antalgic gait were noted in all cases. All of the patients had mild slips (Table 1). The hip on the opposite sides in the 2 cases with bilateral involvement were asymptomatic and found as pre-slip stages (Fig. 3). The average lateral head - shaft angle was 31 degrees (Fig. 4).

Closed reduction, performed in 5 cases with acute and acute on chronic slipping were successfull in all. The position of screw fixations were satisfactory in all patients (Fig. 5). There was no immediate post operative complication.

The average follow-up period was 2.5 years (range 1.7-5 years). The average time of physeal fusion was 12.5 months (range 9-14 months). The average Harris Hip score was 95 points (range 85 - 100 points). Six patients had satisfactory results at follow-up (Table 2). Avascular necrosis occurred in 1 patient (14%) who had mild, chronic slips and bilateral involvement. This was determined from the radiographs on the first hip (right side) 6 months after the operative fixation with a cancellous screw. Twelve months later he had severe

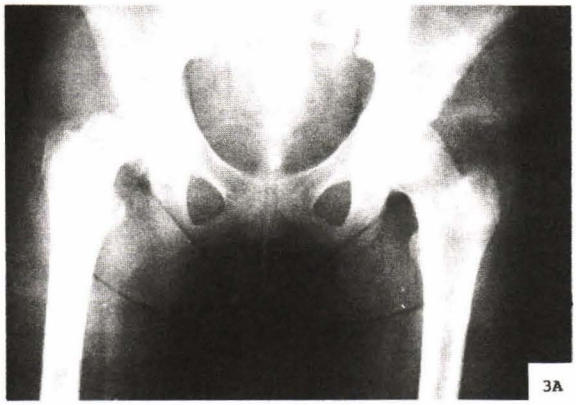

Fig. 3. (A) Anteroposterior and (B) lateral radiographs of both hips show mild and acute slip of the right and pre-slip stage of the left hip.

Fig. 5. (A) Anteroposterior and (B) lateral radiographs show the fixation of both hips of the patient in Fig. 3 with single cannulated screws in the central part of physis.

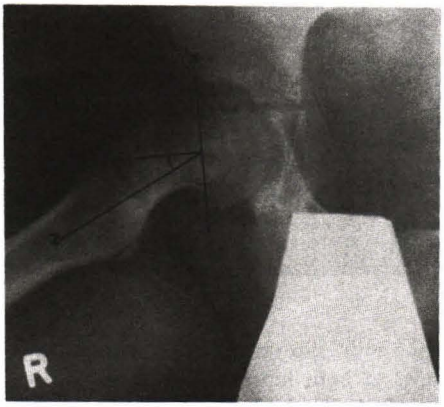

Fig. 4. The lateral head shaft angle is created by the intersection of a line drawn along the femoral shaft (Z) and a line (Y) perpendicular to a line drawn along the epiphyseal edge (X).

pain in the groin. The penetration of the screw was noted and it had to be removed. After the follow-up period of 5 years although the pain persisted around the right hip with ambulation, he could independently maintain normal daily activitiy (Fig. 6).

DISCUSSION

In this report we presented a small group of patients with slipped capital femoral epiphysis in Ramathibodi Hospital. The patients' profile including the ages, the stage of puberty and sex distribution is typical for this condition and was similar to previously reported studies[1-5,8,11].

Loder in 1996, reported an international multicenter study with large database that the incidence of slipped capital femoral epiphysis in Asians when compared with the whites, the blacks

Table 2. Patient data on follow-up and results.

Case	Follow-up (years)	Close reduction	Head shaft angle	Physeal fusion (months)	Harris hip scores (point)	Complication
1.	5.0	No	27°	9	85	AVN
2.	1.8	Yes	25°	12	93	none
3.	2.2	Yes	30°	12	97	none
4.	2.5	Yes	28°	14	100	none
5	2.0	No	31°	14	94	none
6.	1.7	Yes	32°	12.5	100	none
7.	2.4	Yes	30°	14	98	none

AVN = Avascular necrosis

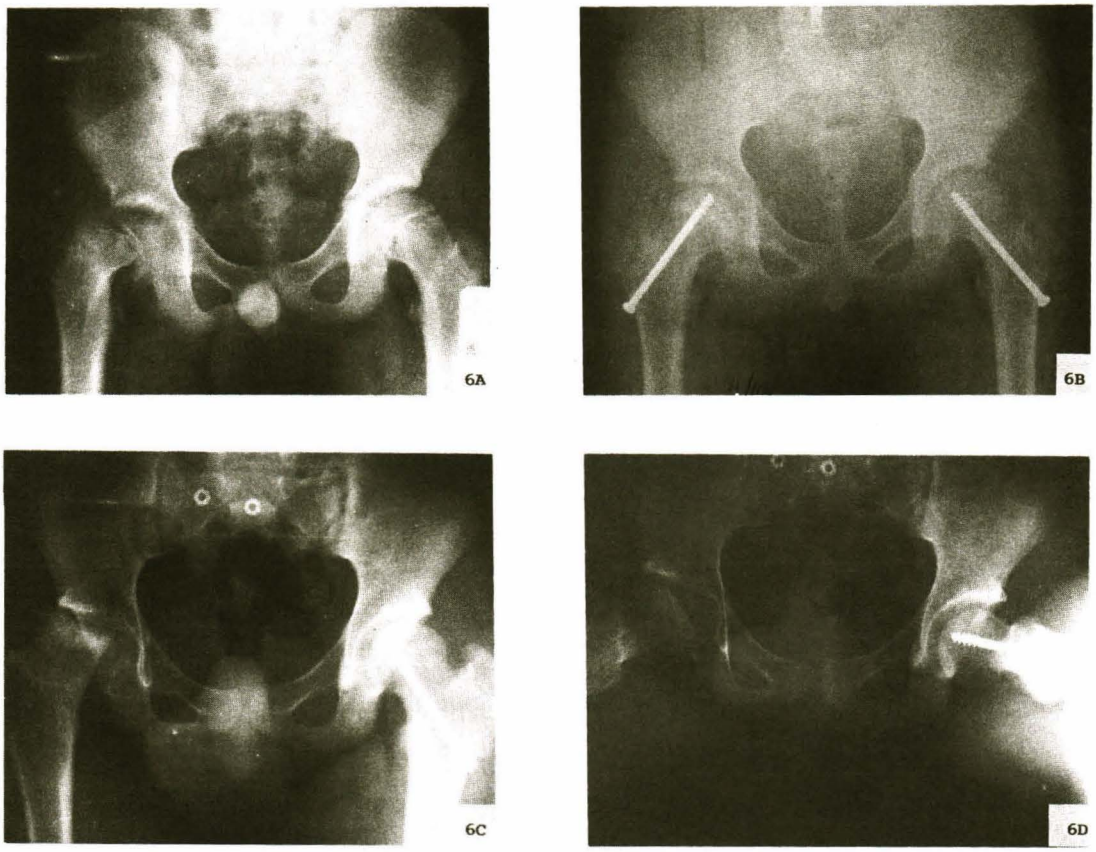

Fig. 6. (A) Anteroposterior radiography of both hips showing the mild slip on the right side and pre-slip stage of the left hips. (B) showing the position of screws of both hips. (C) Anteroposterior and (D) lateral radiographs shows the collapse of femoral head of the right side as the result of avascular necrosis.

and the Polynesians, is very low. For the Thai children he used two references to support his work, one with 3 cases from Lerdsin General Hospital in 1990 and the other from personal communication. We could not find any other reports of this condition in the Asian or Thai literature. In this circumstance we postulated that there are probably 2 possibilities. First the condition is extremely rare as mentioned by Loder and second it was just underdiagnosed. The cause of the latter is probably due to the clinical presentation of the condition. The commom complaint of pain over the medial or anterior of the thigh, as mentioned in the literature[12,13] presented in almost all of our patients may mask the disease and lead to the diagnosis of a knee problem.

Although the etiology of slipped capital femoral epiphysis is unknown, several authors have suggested that obesity is the most important factor as it increases the mechanical shear forces on the physis[12,14-17]. In our study we could not find any correlated factors such as endocrine disorder or hormonal imbalance except the weight status of the patients. All of them had body weight above the mean and 4 out of 7 cases (57%) were defined as obese. Our results supported the previous findings particularly the recent review of Aronsson [12]. The obesity as found in over 50 per cent of our patients was likely to be the most important causative factor for slipped capital femoral epiphysis in this study and perhaps in Thai children. We agreed with the report of Loder in 1996 that in terms of race, it was rare to find slipped capital femoral epiphysis in the Asiatic Indonesian-Malays including Thais. However, as this country is changing from an agricultural basis into an industrial one, the pattern of diet is also influenced by the western style of living with the introduction of fast food and high calorie diets. This may have direct effects on the weight status of the future children and eventually the number of the cases will be increased. We expect that the same problem will occur in other developing countries where previously this condition was rare.

Traditionally, slipped capital femoral epiphysis has been classified according to either the duration of symptoms or the degree of the slips. Loder et al recently revised the classification into "stable" and "unstable" slips[18]. This new method of classification was later modified by Kallio et al in 1993 based on sonographic visualization and radiographic changes of the proximal femur[19]. We did not use this classification because 2 of our cases were diagnosed some years before the new classification. Due to the small number of patients we had to use the same method of evaluation. The results were slightly different from the literature that most of our cases (57%) were acute on chronic[2,8,11]. All of them had mild slips.

The goal of treatment of slipped capital femoral epiphysis is to stabilize the epiphysis, thereby preventing further slippage, and to promote premature epiphyseal fusion. Reduction of the slip as suggested only in acute or acute on chronic slips[20], was performed in only 5 cases. Avascular necrosis occurred in 1 case with chronic slip and without reduction of the hip. This complication could be either the result of trauma in the acute stage or in the process of internal fixation.

For the fixation, it has been widely accepted that a single cannulated screw placed in the center of the femoral head is adequate for treating any stage of slipped capital femoral epiphysis[21-26]. In this study, a single 6.5 -mm cancellous screw fixation was used in one case and a single 6.5 -mm cannulated screw in 6 cases. The latter group (6 out of 7 cases or 85%) had an excellent outcome with an average time to physeal fusion of 12.5 months. Avascular necrosis occurred in one patient when a single cancellous screw was used. For the technique of fixation, in comparing between cancellous and cannulated screw, the former is probably more destructive. There is no guide wire on placing the screw. The cannulation not only allows for the use of a guide - wire to effect the exact placement of the screw, but also gives more stability as the size of the screw is larger. Although there is no comparative study of the outcome between these two types of screws we suggest for surgical fixation, the cannulated screw should be used.

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ศูนย์การเจริญเติบโตของกระดูกต้นขาเคลื่อนหลุด: การศึกษาย้อนหลัง โรงพยาบาลรามาธิบดี

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ภาวะที่ศูนย์การเจริญเติบโตของหัวกระดูกต้นขาเคลื่อนหลุด พบได้น้อยในประชากรแถบเอเชียตะวันออกและเอเชียตะวันออกเฉียงใต้ ได้ทำการศึกษาย้อนหลังในผู้ป่วยเด็กวัยรุ่น 7 ราย (9 ข้อ สะโพก) เป็นเด็กชาย 5 ราย (อายุเฉลี่ย 12.5 ปี) และเด็กหญิง 2 ราย (อายุเฉลี่ย 13 ปี) ส่วนใหญ่ (4 ใน 7 ราย) เป็นการเคลื่อนแบบเล็กน้อยและ acute on chronic ทั้ง 7 ราย ไม่พบความผิดปกติของต่อมไร้ท่อ แต่ผู้ป่วยทุกรายมีน้ำหนักตัวเฉลี่ยสูงกว่าค่าเฉลี่ยของเด็กปกติ 4 ใน 7 ราย เป็นเด็กอ้วน ได้ทำการรักษาโดยการผ่าตัดใส่สกรู 1 ตัว ในแต่ละข้อสะโพก โดยใช้แบบ cancellous 1 ราย และแบบ cannulated 6 ราย จากการติดตามผลการรักษาเฉลี่ย 2.5 ปี 6 รายที่ใช้สกรูแบบ cannulated ให้ผลดีทั้งหมด พบภาวะแทรกซ้อนคือหัวกระดูกต้นขาตายใน 1 ราย ที่ใช้สกรูแบบ cancellous สรุปว่าภาวะอ้วนเป็นสาเหตุสำคัญในการเกิดโรคนี้ ส่วนผลของการใช้สกรูต่อการเกิดภาวะแทรกซ้อนยังไม่ชัดเจน

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