

Slipped Upper Femoral Epiphysis : A Review of Epidemiology and Outcome of Treatment

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Abstract : A retrospective study of 14 patients (19 hips) with slipped capital femoral epiphysis from 1990 to 2002. There were four girls (average age, 12 years) and ten boys (average age, 12.5 years), of which 8 were Malays and 6 Indians, with an average body mass index of 26.1. Left hip (11 hips) was involved more than right hip (8 hips). There were five patients with bilateral hip involvement. Most hips were stable and of moderate severity. The *in situ* cannulated screw fixation was the most commonly applied treatment and was associated with lower rate of complications. Based on the Iowa hip score, most patients had satisfactory results (excellent or good). Avascular necrosis and chondrolysis rate was 31.6%.

Introduction

Slipped capital femoral epiphysis is an adolescent disorder characterised by displacement of the capital femoral epiphysis. Its etiology remains unknown, though associated factors such as obesity, endocrine disorder and mechanical abnormalities are known to increase the risk. The incidence is estimated at 2 cases per 100,000 population. A review of the literature shows studies ranging from epidemiological studies to studies on treatment modalities and complications. A recent study by Loder (1996) showed that slipped capital femoral epiphysis could affect all races. However he reported lower incidence of 0.5 per 100,000 population for Asiatic-Indonesian-Malays (Japanese, Chinese, Filipino, Thai, Vietnamese). This is in line with the reported incidence in Asia of 0.2 per 100,000 in eastern Japan by Ninomiya et al (1976) and also in Thailand by Mulpruek et al (1997).

In the literature there is a known predilection for males who are affected at an older age. The age is clearly associated with the event of puberty. Obesity has a definite association as it causes a higher shear stress over the physis of femur (Loder et al 1996). The stability of the slip is a good indicator for the outcome of the condition³⁾⁴⁾. Currently the single *in situ* percutaneous cannulated screw fixation is the most used method (Aronson et al 1997). The most devastating complications are avascular necrosis and chondrolysis of the of femoral head, these complications would result in early osteoarthritis of the hip in these patients (Carrey et al 1991).

Purpose

Our review is to compare the demographical, clinical and treatment characteristics of patients with the available literature.

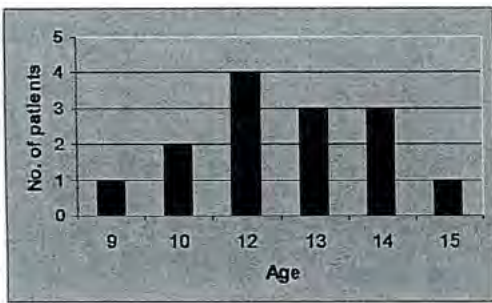


Fig. 1. Age distribution.

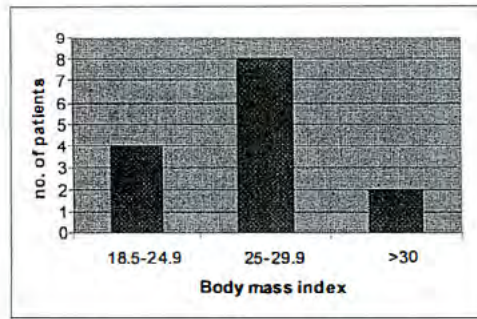


Fig. 2. Distribution of body mass index.

Table 1. Distribution based on stability of slip.

Stability of the hip	No of hips	%
Stable hip	13	68.4%
Unstable hip	6	31.6%

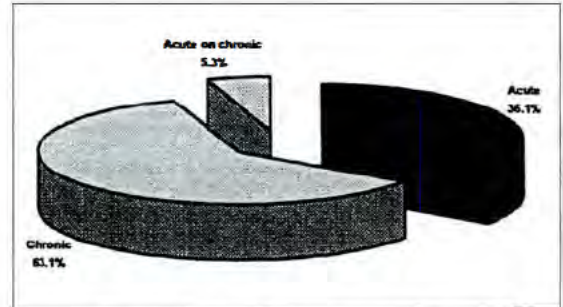


Fig. 3. Distribution type of slip.

Table 2. Type of treatment.

Type of treatment	No. of hips	No of patients
CMR with Screw fixation	3(15.8%)	3
<i>In situ</i> Knowles pins fixation	3(15.8%)	2
<i>In situ</i> cannulated screw		
Single screw	8(42.1%)	7
Two screws	3(15.8%)	2
No treatment	2(10.5%)	1

Materials and Method

Between 1990 and 2002, 20 patients were treated for slipped capital femoral epiphysis at the Department of Orthopaedic and Traumatology, University Kebangsaan Malaysia. Cases were identified from the surgeon's and hospital's admission record.

Six patients were excluded due to inability to contact them because of incomplete documentation. Case notes and radiographs were reviewed. All patients recalled for review but only 10 returned for follow-up. The four patients who were unable to return were reviewed by telephone and questionnaire posted to them.

The Iowa Hip Score was used to assess

patient on function, deformity, gait, pain and range of motion to determine outcome.

The records were reviewed for data on sex, bilaterality, age of onset of symptoms, associated endocrine disorder, type and duration of symptoms, stability of the slips, treatment and complications. The Body Mass Index (BMI) was based on the height and weight of patients on presentation. The BMI are classified as underweight (less 18.5), normal weight (18.5-24.9), overweight (25-29.9), and obese (over 30). The complications reviewed included avascular necrosis, chondrolysis and any deformity such as coxa vara.

The slip was classified as unstable if the child had pain and is unable to walk even with

crutches' and stable when walking and weight bearing was possible, with or without crutches. According to the duration of symptoms, the hips were classified into chronic (symptoms > 3 weeks), acute (symptoms < 3 weeks) and acute on chronic (relapse of symptoms of a chronic case).

The severity of the slip was graded by measuring the difference of the head shaft angle of both sides on the lateral view. The slip is classified mild if the measured difference was less 30 degrees, moderate if between 30 and 50 degrees, and severe when more than 50 degrees.

The hip joints (cartilage space) were measured to determine the presence of joint narrowing, a difference of 2 mm or more between the two sides indicates chondrolysis. In the case of bilateral patient, chondrolysis was defined as a joint space of 3 mm or less. The diagnosis of avascular is based on the classical description on the radiological changes.

Results

A total of 14 patients with 19 hips were studied. There was 4 girls and 10 boys with an average age of 12 and 12.5 years respectively at presentation. The youngest boy at presentation was 9 compared to 10 for girls. The average follow-up from the onset of symptoms was 4.4 years with range of 0.3 to 12 years. The age of presentation ranges from 9 years to 15 years (Fig. 1). The majority of cases were Malays with 8 (57.1%), the other 6 were Indians and no Chinese.

The average body mass index is 26.5, which are overweight (Fig. 2) with a range from 22.3 to 37.1. Only one patient had associated endocrine abnormality, and he had panhypopituitarism secondary to a craniopharyngioma tumor

Table 3. Complications

Complications	No. of hips
Major	
Avascular necrosis	5
Chondrolysis	1
Minor	
Coxa vara	7
Limping gait	8
Reduced int. rotation	14
Broken guide wire	2
Hip pain	6
Screw misplacement	1
Increased ext. rot. as hip flexed	16

and developed bilateral slipped capital femoral epiphysis 3 years after his tumor.

The most common presenting symptom was hip pain with limping affecting 9 patients (64.3%). The other 5 patients (35.7%) had anterior thigh or knee pain. All 14 patients claim preceding traumatic event.

Majority of the cases, 13 hips (68.4%) were stable slips while 6 hips (31.6%) were unstable due to inability to weight bear due to pain (Table 1). The average duration of symptoms was 13.8 weeks with a range from 1 to 78 weeks. Twelve hips (61.3%) were chronic slips, six hips (36.1%) were acute and one hip (5.3%) was acute on chronic (Fig. 3).

Left hip was the more commonly involved than the right hip (11 to 8 hips). The slip was unilateral in 9 patients (64.3%) and bilateral in 5 patients (35.7%). Of the 5 bilateral cases, only 1 patient presented with synchronous slips. The remaining 4 cases had intervals ranging from 12 to 64 weeks interval between slips with an average of 40 weeks. In the unilateral slip, six of nine cases involved the left hip. The difference in lateral-head shaft angle ranged from 14 to 90 degree. The average was 47.5 degrees.

Internal fixation was performed in 13 cases with total of 17 hips (Table 2). One patient with bilateral slip refused surgery. The average Iowa Hip Score was 82.8 points. (range of 48-96



Fig. 4. Radiograph showing severe bilateral slipped capital femoral epiphysis.



Fig. 5. Postoperative radiograph, close reduction of left hip was done prior to fixation.



Fig. 6. MRI image showed a viable left femoral head despite more severe slip.

points). Four patients had excellent result, five good, three fair and one poor.

The complications were grouped into major and minor complications (Table 3). Major complications are avascular necrosis and chondrolysis. Avascular necrosis was seen in 5 hips (5 patients). Two patients had bilateral slips. Radiological changes on plain radiography appeared on average at 9.6 months after treatment.

Chondrolysis was noted in only one patient. Patient had a moderate, stable and chronic slip and was treated with 2 *in situ* cannulated screws. Screw penetration of screw was noted on follow up at 2 months. Minor complications include reduced range of motion particularly internal rotation with 12 hips and increased external rotation of a flexed hip with 16 hips. Others were coxa vara 7 hips, limping 8 hips and painful hip 7 hips.

Case

12-year-old girl presented with bilateral knee and anterior thigh pain and inability to walk after a fall at school. One-month post trauma, the pain moved to the hip and plain radiograph of pelvis showed severe bilateral slipped capital femoral epiphysis (Fig. 4). The lateral head-shaft angle of the left was 90 degree and 75 degree on the right. Closed reduction and can-

nulated screw fixation of the left hip and *in situ* cannulated screw fixation on right hip was done (Fig. 5). A preoperative magnetic resonance imaging of both hips showed bilateral hip effusion (Fig. 6). No evidence of avascular necrosis was found in the left femoral head though the degree of displacement was more severe.

Discussion

Slipped capital femoral epiphysis is an uncommon condition in Malaysia as shown in our study where only 20 patients were reported over 13 years. This is consistent with the study by Mulpruek et al (1996) reporting seven cases and Ninomiya et al (1976) giving an average incidence of 0.7 per 100,000 population. Dreghorn et al (1983) from Glasgow, Scotland, performed a 12 years review from 1972 to 1983 reporting 77 patients with 97 hips. The above results and ours support the conclusion made by Loder (1996) through an international multicentre study that the incidence of the condition in whites, blacks and Polynesians were higher than in Asians. The absence of Chinese patients is also consistent with the study by Loder (1996) that showed Chinese children are much less affected than the general Indonesian-Malay group. What is more interesting is the fact that the Chinese constitute 30% of our population, further study on this finding is warranted for

future studies.

Our study revealed typical features of slipped capital femoral epiphysis like the higher preponderance of boys (71.4% to 28.6%), of the left hip to right hip (57.9% versus 42.1%) and older average age in boys (12.5 years versus 12 years) correlating well with series by Boyer et al (1981), Carney et al (1991), Dreghorn et al (1993) and Loder et al (1993).

Obesity has a definite association with the development of slipped capital femoral epiphysis as evident from Arronson et al (1992), Mulpruek et al (1996) and Loder (1993). The majority of our patients were overweight too and the conclusion by Mulpruek et al (1996) would be appropriate for our context as our population is quite similar in our diet.

Our review had one patient with endocrine deficiency i. e. panhypopituitarism secondary to craniopharyngioma tumor. Clinically he was obese and he developed bilateral slip three months apart. Prophylactic pinning was advised but was declined by the parents. Our opinion based on this experience would be to advice prophylactic pinning in all such patients.

There were five patients (35.7%) in our study with initial presentation of anterior thigh or knee pain consistent with reports by Carney et al (1991) and Dreghorn et al (1983) giving figures of 13% to 37%. Matava et al (1999) concluded the initial presentation of anterior thigh or knee pain lead to higher rate of missed diagnosis and inappropriate treatment and causing more severe slip to occur. This situation is clearly also evident in our review in two patients where diagnosis was delayed by one year in one patient and two months in another.

The use of stability of slip as the classification has gained popularity and becoming widely

accepted. Loder et al (1993) concluded that this classification it gives prognostic indication for future development of avascular necrosis. Our result demonstrated 10 patients with 13 hips (71.4%) were stable slip while other 4 patients with 6 (28.6%) were unstable slip but only one patient but all patient with unstable hips had subsequently avascular necrosis. This support the use of this classification for slipped capital femoral epiphysis.

In our series, the prevalence of bilaterality was 37%. Previous authors have reported the prevalence varying between 25% to 61%. The average interval between the two slips in bilateral cases was 0.7 years compared to 1.3 years reported by Hagglund et al (1988) and 1.2 years by Dreghorn et al (1983).

The goals of treatment are basically to prevent further epiphyseal displacement and avoid complications, so as to maintain adequate hip function. The mode of treatment reviewed included 11 hips with in situ screw fixation with a single, three with close reduction and screw fixation and three with Knowles pin fixation. Knowles pin was used in patients before cannulated screws and fluoroscopy were introduced. The two patients had excellent results consistent with those reported by Schonecker et al (1997) in 23 of 28 hips (82%). The Knowles pin fixation is shunned due to technical problem during removal.

The hip score of in situ screw fixation was excellent in two hips (20%), good in seven hips (70%) and fair in one (10%). This is comparable with Aronson et al (1992) who reported excellent or good result of 70%. Position and number of screw did not seem to matter as evident by a patient who had a good score despite poor position with two screws. Of the 11 hips with in

situ cannulated screw fixation one had avascular necrosis and one with chondrolysis. Despite these complications (20%) we still believe that this treatment method is still the best as one case had MRI evidence of avascular necrosis prior to surgery and chondrolysis was seen in a case early in the review.

Closed reduction was performed in three hips which slips were severe and unstable in order to obtain better placement of screw. Two of three hips (66.7%) developed avascular necrosis but these might have present prior to treatment as they were severe slips. More intriguing is the third case that also had severe slip but had no avascular necrosis on MRI scan. We are following the patient up as she was one of the last seen in our series. We believe that reduction has a role in the severe slip but should be gentle. Currently there is renewed interest in the reduction of hips with severe slips.

The major complication of avascular necrosis of the femoral head occurred in five hips (26.3%). All but one had no pre-treatment evidence of avascular necrosis. Our rate is higher than reported by Kennedy et al (2001) with 14% (4 of 27 hips), Ratley et al (1998) with 15% (4 of 26 hips), Mulpruek et al (1996) with 14% (1 of 7 hips), Carney et al (1991) with 12% (19 of 155 hips) and Dregghorn et al (1987) reported a rate of 7% (7 of 97 hips). This could be due to the fact that our series had more severe slips compared to theirs.

CONCLUSION

Slipped capital femoral epiphysis is generally a rare condition in Malaysia as shown by a total of 20 cases over 12 years. It is an adolescent hip disorder with children around puberty mainly affecting boys. Obesity is a definite

associated factor and an underlying endocrine disorder is seen in about 10% of cases. Cases with unilateral slip with underlying endocrine anomaly should have prophylactic pinning on the contra lateral side. The stability of slip is a good indicator on outcome especially the potential for the development of avascular necrosis. The preferred method of fixation is a single *in situ* cannulated screw fixation and the used of reduction should be judicious.

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