

Traumatic Epiphysiolysis of the Proximal Femur

Traumatická epifyzeolýza horního konce stehenní kosti

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ABSTRACT

PURPOSE OF THE STUDY

Several former studies show the treatment of slipped epiphysis of the femoral head (SEFH). Its reason is rather unknown. On the other hand the rare traumatic SEFH takes place due to a real accident. According to the literature these injuries are treated like chronic SEFHs. The aim of this study is to show the differences in pathology and treatment of an acute traumatic SEFH in relationship to the chronic SEFH.

PATIENTS AND METHODS

In 8 patients dislocated traumatic SEFHs were reduced anatomically and stabilized by the means of 3 to 4 Kirschner-(K-) wires or two cancellous screws. Each patient got a plaster-cast fixation for about 6 weeks of the ipsilateral hip and leg and was mobilized with two crutches and partial weight bearing for 12 weeks. The implants were removed 24 weeks after surgery. Four patients with not dislocated SEFHs were immobilized or mobilized with two crutches without weight bearing according to their pain sensation. The final examination of both groups took place 2 ½ to 15 years after the initial treatment.

RESULTS

Four patients primarily under 10 years of age showed no or minimal radiological signs of a dislocated femoral head and were without any further inconvenience – the suspected SEFHs revealed as hip contusions. 8 children aged 10 years or older at the time of trauma were treated by closed reduction and internal fixation. Complications occurred in three cases – one necrosis of the femoral head because of a perforating K-wire, one subtrochanteric femur fracture after implant removal of a prophylactically stabilized contralateral femoral head and one minimally dislocated femoral head after postoperative too early full weight bearing.

DISCUSSION

The traumatic SEFH is very different to the chronic one regarding the pathology and acute treatment. Technical challenges must be solved. Unilateral K-wiring or screwing for 24 weeks and reduced weight bearing for the first 12 weeks after surgery is a sufficient way of treatment of the traumatic SEFH.

CONCLUSIONS

In the case of a traumatic SEFH it needs to be reduced anatomically and stabilized by surgical means in the acute phase. A prophylactic stabilization of the opposite intact side is usually not required.

Key words: acute traumatic slipped epiphysis of the femoral head, no prophylactic stabilization.

INTRODUCTION

The slipped epiphysis of the femoral head (SEFH) is one of the most serious diseases of the femur during adolescence (1). Yet, it is a very rare disease and has an incidence of only 4–5 cases per 100 000 children and teenagers considering the whole life span (7, 12). Genetical predisposition and mechanical or hormonal imbalance are discussed as predisposing factors: obesity leading to chronic overloading of the epiphysis (5, 12), certain congenital abnormalities like partial or complete situs inversus or hypogonadism as an expression of a hormonal dysfunction on one hand or of weakness of the connective tissue on the other (11, 18). The different forms of SEFH are as follows: the insidious form so called epi-

physiolysis lenta (the chronic dissociation of the epiphysis of the femoral head) and the epiphysiolysis capitis femoris acuta (the acute dislocation and the traumatic dislocation of the epiphysis of the femoral head). The chronic dissociation of the epiphysis of the head of the femur can change into an epiphysiolysis capitis femoris acuta and also an acute form can change into a chronic form. The acute SEFH is a very rare entity and documented with only a few cases even in big trauma centers (2). The traumatic SEFH is accounted as an acute form as it is always preceded by a sudden trauma.

Due to physicians and parents don't get children's hip-pain serious, the possible damage is often underestimated and so precious time is lost before an adequate therapy is started. Thus the individual consequences for

a patient with an acute SEFH can be disastrous. If the SEFH is diagnosed or treated too late a malpositioned epiphysiys of the femoral head, even at a young age, leads to an increased abrasion of the hip joint and a painful coxarthrosis. A necrosis of the femoral head can also require a complex osteotomy procedure of the proximal femur or a total hip arthroplasty, irrespectively of the adopted therapy (8).

The impulse for this paper was the case of an adolescent with an acute SEFH. The initial diagnosis was done correctly. Yet the diagnostic period after the trauma was too long and no prophylactic means for preventing the slipping of the loosened epiphysis of the femoral head were undertaken during the time of diagnostic clarification.

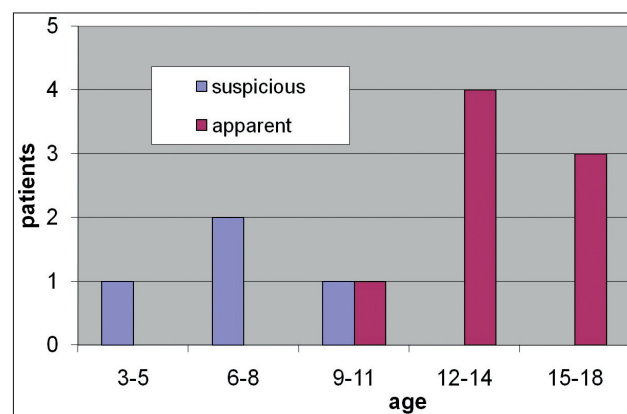
PATIENTS AND METHODS

During a 15 year period of observation (November 1993 to November 2008) 571 (209 female, 362 male) patients with painful hip injuries were treated in a level one hospital – out of these 12 patients (4 female and 8 male) with suspicious traumatic SEFH were treated. The youngest patient was 4 years and 5 months, the oldest 18 years and 4 months old.

One patient showed not more than a slightly widened epiphyseal plate on the X-rays. Three other patients were without any pathological findings on the X-rays – the diagnosis was done only by clinical investigation. These four patients (2 female, 2 male) without or with only minimal pathological findings of SEFH on the radiographs were treated conservatively. The 8 patients (2 female, 6 male) with clear radiologic findings of a SEFH were operated. 3 to 4 Kirschner- (K-) wires were used in 7 patients each. In one case two cancellous screws were inserted. All 8 patients were operated on the day of admission. Plaster-cast fixation lasted usually 6 weeks, we demanded partial weight-bearing with crutches till full weight bearing for 12 weeks after the operation, and implant removal was aimed for 24 weeks after the first operation.

The average age of the patients with suspicious SEFH was 6 years and all not older than 9 years. Those undergoing an operation were between 10 and 18 years old,

Fig. 1. Age distribution of SEFH. Those undergoing an operation were between 10 and 18 years old



showing the peak at 13 years, shortly before puberty. The age distribution is shown in Fig. 1.

The patients were asked to return for follow up examinations after a period of 2½ to 15 years after the initial treatment. All patients could be reexamined. They were asked about the accident, the course of the disease, their present symptoms and what kind of physical exercise they were able to do. The clinical examination included special analysis of walking pattern, pelvic obliquity, possible difference of length of the legs in weight bearing position, range of motion, neurologic and muscular deficits, pain, circulatory disorders, and radiographic changes.

RESULTS

All four patients with suspicious SEFH were free of symptoms not later than 4 weeks after the start of the treatment. No further treatment was necessary nor they had any findings in further investigations after several years – the diagnosis was probably a contusion of the hip joint respectively. A 6-year and 2 month-old boy primarily showed a conspicuous radiologic result. This was radiologically clarified during the reexamination 3 years later. He was free of symptoms. The initial widening of the epiphyseal plate on the left side couldn't be detected any longer (Fig. 2a, b).



Fig. 2a-b. Anteroposterior view of a slightly widened epiphyseal plate of the left femoral head (a). 3 years later no conspicuous findings are evident (b).

Regarding the 8 patients who were operated in no case an open reduction was required. Three patients suffered from complications. In the case of an 11-year-old boy the intact right side was prophylactically stabilized. After removal of the osseous ingrown K-wires a subtrochanteric femoral fracture occurred at this side. The prophylactically K-wiring of the intact side and the implant removal were done in a local hospital. After admission at our department the subtrochanteric fracture was successfully stabilized using a 135 degrees angle blade plate. Later the plate was removed without any complications (Fig. 3a-c). This patient eventually stopped having troubles. A 10-year old-girl showed a fully developed avascular necrosis of the femoral head because of primary the left head penetrating tips of K-wires. It was treated with an intertrochanteric rotation-flexion-valgus osteotomy procedure according to Imhäuser (6, 16) and prophylactically K-wiring of the intact right side (Fig. 4a-c). This patient was never free of symptoms and complained about lasting pain. Because of this she could not be mobilized more than a short walking distance. As far as the third patient, an 18-year old-male, is concerned the postoperative X-rays showed a distally dislocated capital femoral epiphysis on the right side in spite of an intraoperatively anatomically reduced and by K-wires fixed SEFH because of accidentally too early full weight bearing after the ope-

ration (Fig. 5a-c). This patient told about mild pain in the relevant hip joint when walking for a long time or when lifting heavy weights.

All other patients had very good and good results without any pain and nearly no destructive signs in radiographs (Table 1).

There were no further signs of traumatic SEFH in children younger 10 years. The age of the children with apparent SEFH was beyond 10 years. The seriousness and absolute energy of the traumas did not differ much considerably ranging from mere tumbling (in a mole-hole) with massive obesity to a fall from great height of a normal weight child. The indirect relation of bodyweight to the energy of the trauma is striking – the higher the bodyweight the lesser was the acceleration or deceleration which finally led to a traumatic SEFH.

DISCUSSION

The differences of distribution between genders are explicable by the higher risk willingness of male adolescents. Thus they are also more prone to accidents. Further assertions are difficult to make as there are too few patients.

From the morphological point of view an acute and a chronic SEFH are two different conditions. The traumatic SEFH shows a sudden dissociation and separa-

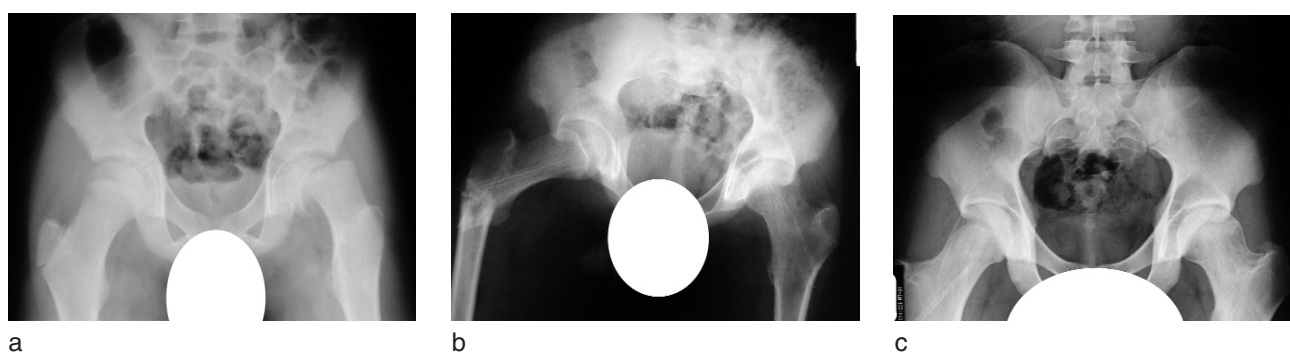


Fig. 3a-c. Anteroposterior view of a SEFH on the left side and an intact hip joint on the right side (a). Subtrochanteric femoral fracture on the right side after prophylactically K-wiring and removal of the K-wires. Note the elongated right femoral neck. After K-wiring and removal of the K-wires the SEFH on the left side has healed in anatomical position (b). After stabilizing the right sided subtrochanteric femoral fracture using a 135 degrees angle blade plate and consecutive implant removal the subtrochanteric femoral fracture has healed in anatomical position (c).

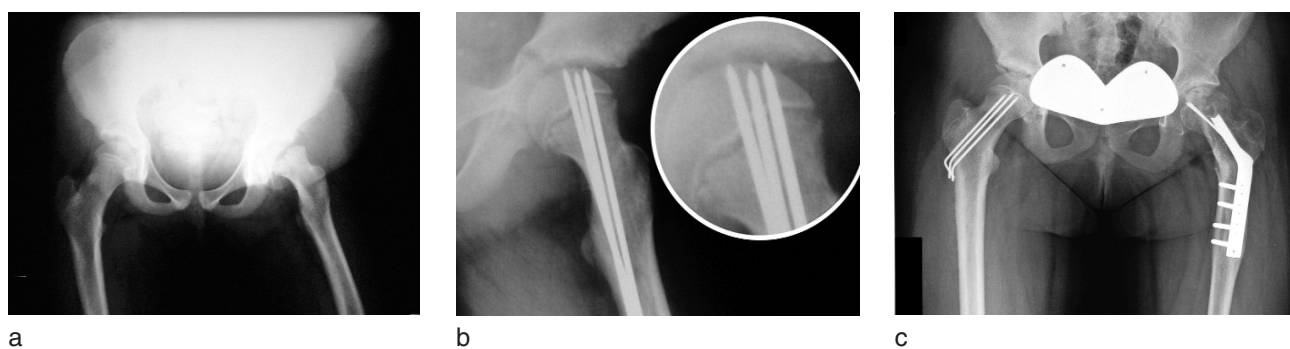


Fig. 4a-c. Anteroposterior view of a SEFH on the left side and an intact hip joint on the right side (a). Axial view of the left hip joint after anatomical reduction and K-wiring of the SEFH. The tip of at least one K-wire is penetrating the femoral head (b). Anteroposterior view after left sided intertrochanteric rotation-flexion-valgus osteotomy procedure according to Imhäuser and prophylactically K-wiring of the intact right side (c).

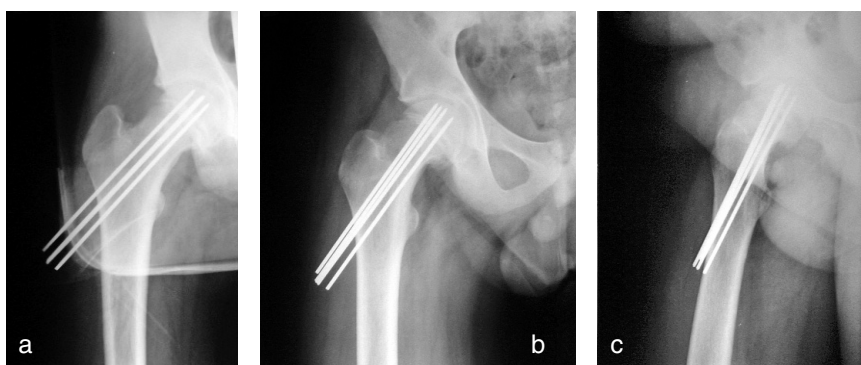


Fig. 5a-c. Anteroposterior view of an anatomically reduced and by K-wires fixed SEFH of the right side (a). Anteroposterior and axial views of the distally dislocated capital femoral epiphysis on the right side 4 days postoperatively (b). Anteroposterior view after removal of the K-wires showing the malpositioned femoral head on the right side (c).

tion of the femoral head at the epiphysis. As the epiphyseal plate is located under the articular cartilage of the femoral head, the articular cartilage breaks in the area of the epiphyseal plate. Pieces of cartilage and bone are dislocated into the hip joint space with dramatic consequences. These fragments and the incongruent surface-level of the femoral head can quickly develop a destructive potential onto the cartilaginous surface of the hip joint. The concomitant hematoma in the hip joint space can cause a sudden rise of pressure in the joint and consequently stop the blood supply of the femoral head.

The treatment of an acute SEFH has to be regarded an emergency and it has to be performed immediately.

It is highly probable that the hematoma in the hip joint space causes a rise of the intraarticular pressure which might lead to a minor perfusion of the femoral head (1, 3). A „kinking“ of the dorsal blood vessels of the capsule of the hip joint can be caused by the malpositioned epiphysis of the femoral head, too. So any delayed treatment endangers the femoral head and rises the risk of an avascular necrosis (19). It is important to note that a closed reduction of a SEFH cannot be undertaken even only a few days after the trauma. Coagulated blood as well as agglutination due to fibrin and granulation tissue quickly turn a primarily loose SEFH into a fixed malposition of the epiphysis of the femoral head. If the reduction of the femoral head is not successfully achieved,

Tab. 1. Characteristics of the operatively treated patients

Pat.	Gender	Age at accident	Trauma	Adipositas	Side	Implants	Weeks to implant	Last examination	Disorders, pain	X-ray reposition	X-ray results and pathologic findings	Trendelenburg sign	Complications
1	m	14 y	fall	–	sin.	4 K-wires	24	03 y 10 mo	free of complaints	anatomic	no pathologic findings	neg.	
2	m	11 y	fall	–	sin.	3 K-wires	97	07 y 10 mo	free of complaints	nearly anatomic	minimal deformity of head	neg.	fracture after implant removal on the contralateral side after prophylactic pinning
3	w	10 y	fall from horseback	+	sin.	3 threaded K-wires	6	02 y 02 mo	moderate persisting pain, average pain after 15min walk	anatomic	partial head necrosis, acetabular bulking status post Imhaeuser-osteotomie	pos.	perforating K-wires needs early implant removal
4	m	18 y	distortion of leg at work	++	dext.	4 threaded	21	08 y 12 mo	average pain after 30 min walk	~4mm dislocation	head deformity, joint gap narrowing	pos.	full weight bearing on the 4th postoperative day, overweight
5	w	11 y	fall at inline-skating	+	dext.	2 spongiotic screws	6	04 y 04 mo	free of complaints	anatomic	no pathologic findings	neg.	
6	m	13 y	tumble	++	sin.	4 K-wires	27	06 y 08 mo	moderate pain after heavy physical work	anatomic	cystformation (3mm diameter) cranial part of the head	neg.	
7	m	16 y	overwhelmed with heavy object	–	sin.	4 threaded K-wires	28	14 y 03 mo	free of complaints	anatomic	no pathologic findings	neg.	
8	m	13 y	tumble	++	sin.	3 threaded K-wires	25	11 y 03 mo	free of complaints	anatomic	no pathologic findings	neg.	

+ > 90 percentile

++ >97 percentile

ved in the event of an acute SEFH, one has to expect a quick destruction of the joint due to the incongruence of the joint's surfaces.

If the conventional X-ray diagnosis leaves any doubts, the concerned leg imperatively needs to be mobilized with reduced weight bearing in order to prevent a secondary slipping of the epiphysis of the femoral head. Afterwards an MRI of the concerned hip joint is urgently required as under these circumstances its sensitivity is superior to conventional radiographs (9, 15).

A traumatic SEFH was only noticed in children from the age of 10 onwards. If a SEFH is suspected even without radiological findings, children under the age of 9 years only need to rest for some days in order to get rid of symptoms. It is highly probable that the diagnosis of a SEFH is wrong.

In the acute event of a dislocated SEFH the reduction is easily attained through an abduction and inner rotation of the concerned hip joint. The procedure can be performed using a fracture table. By using 3 to 4 K-wires the stabilization of the epiphysis of the femoral head is achieved. Alternatively one can use cancellous screws with or without washers. The length of the implant should show an excess length at the lateral femoral cortical bone. Otherwise the later removal of the implant might get difficult and complications could occur. In case of an acute SEFH it is not advised to stabilize the opposite side prophylactically as long as the trauma was adequate (i.e. fall from a great height) and the patient is not overweight. This is the opposite of the treatment of a chronic SEFH which usually presents on both sides (14). Concerning the aftertreatment of an acute SEFH it is advised to apply a plaster cast fixation of the hip joint for 6 weeks and to mobilize the patient with partial weight bearing of the side of the operated leg for about 12 weeks. The implants are normally removed 24 weeks after the operation.

If the reduction of a SEFH is inadequate complications are to be expected. As seen with one of our patients technical challenges have to be solved (4, 10). By all means it has to be avoided that the implants perforate the articular cartilage of the femoral head (13). Because of this reason (17), too, a one sided stabilization is regarded as sufficient in the case of a traumatic SEFH. As shown in our patients a SEFH of the opposite side is not to be expected.

CONCLUSIONS

The traumatic dislocation of the epiphysis of the femoral head differs essentially from the chronic dissociation. In the case of a traumatic SEFH it needs to be reduced anatomically and stabilized by surgical means in the acute phase. A prophylactic stabilization of the opposite side is usually not required.

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