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Factors affecting the results of treatment in traumatic dislocation of the hip

Travmatik kalça çıkığında tedavi sonucunu etkileyen faktörler

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Amaç: Konservatif veya cerrahi yöntemlerle tedavi edilen travmatik kalça çıkıklı olgularda geç dönem izlem sonuçları ve bu sonuçları etkileyen prognostik faktörler değerlendirildi.

Çalışma planı: Travmatik kalça çıkığı nedeniyle 30 hastanın (27 erkek, 3 kadın; ort. yaş 35; dağılım 16-69) 15'i kapalı, 15'i açık redüksiyonla tedavi edildi. Çıkığa en sık yol açan neden trafik kazaları (%80) idi. Kapalı redüksiyon grubunda 10 hastada posterior, ikisinde anterior, üçünde merkezi çıkık vardı; bunların sekizi izole çıkık, yedisi kırıklı çıkık idi. Açık redüksiyon grubunda 14 hastada posterior, birinde merkezi çıkık görüldü. Bunların beşinde yalnızca kalça travması, 10'unda birden fazla travma vardı. Cerrahi tedavi altı olguda ilk 24 saat içinde; dokuz olguda 5-21. günler arasında yapıldı. Posterior çıkıklar için Thompson-Epstein, femur başında kırık varsa Pipkin; merkezi çıkıklar için Judet; anterior çıkıklar için Epstein sınıflandırması kullanıldı. Sonuçlar Matta'nın klinik ölçütlerine göre değerlendirildi. Ortalama izlem süresi 49 ay (dağılım 16-84 ay) idi.

Sonuçlar: Kapalı redüksiyon grubunda 11 olguda (%73.3) yeterli (çok iyi veya iyi), dört olguda (%26.7) yetersiz (orta veya kötü) sonuç elde edildi. Bu grupta tüm izole çıkıklarda ve posteriora kırıklı çıkığı olan üç olguda sonuç yeterli idi. Açık redüksiyon grubunda dokuz olguda (%60) yeterli, altı olguda (%40) yetersiz sonuç elde edildi. Bu grupta posterior çıkıklı dokuz olguda yeterli, beşinde yetersiz sonuç alındı. Merkezi travmatik kalça çıkıklı tüm olgularda sonuç yetersiz bulundu. Kapalı redüksiyon grubunda kırıklı çıkıklı bir olguda femur başı avasküler nekrozu, dört olguda dejeneratif artrit gelişti. Açık redüksiyon grubunda altı olguda dejeneratif artrit görüldü; bunların ikisinde avasküler nekroz saptandı.

Çıkarımlar: Çalışmamızda, kapalı veya açık redüksiyonla tedavi edilen travmatik kalça çıkıklarında prognozu etkileyen faktörlere ışık tutucu bulgular elde edildi.

Anahtar sözcükler: Kalça çıkığı/fizyopatoloji/tedavi; kalça kırığı; kalça eklemi/patoloji; prognoz; tedavi sonucu; manyetik rezonans görüntüleme; bilgisayarlı tomografi.

Objectives: We evaluated the long-term results of conservative and surgical treatment and the effect of prognostic factors on these results in patients with traumatic dislocation of the hip.

Methods: The study included 30 patients (27 males, 3 females; mean age 35 years; range 16 to 69 years) with traumatic hip dislocations. The most common cause was traffic accidents (80%). Fifteen patients underwent closed reduction for posterior (n=10), anterior (n=2), and central (n=3) dislocations, of which eight were isolated and seven were fracture dislocations. Open reduction was performed in 15 patients with posterior (n=14) and central (n=1) dislocations. Of these, five patients had isolated hip trauma and 10 patients had multiple trauma. Surgery was performed within the first 24 hours (n=6) or between five and 21 days (n=9). Posterior, central, and anterior dislocations were classified according to the Thompson-Epstein, Judet, and Epstein classification systems, respectively. The Pipkin classification was also used for dislocations with femoral head fractures. The results were evaluated according to the criteria proposed by Matta. The mean follow-up was 49 months (range 16 to 84 months).

Results: Following closed reduction, the results were satisfactory (very good or good) in 11 patients (73.3%, all isolated dislocations and three posterior fracture dislocations) and unsatisfactory (moderate or poor) in four patients (26.7%). Following open reduction, nine patients (60%) with posterior fracture dislocations had satisfactory and six patients (40%) had unsatisfactory outcome. The results were unsatisfactory in all the central dislocations. One patient developed avascular necrosis of the femur head and four patients developed degenerative arthritis following closed reduction. Degenerative arthritis was seen in six patients after surgical treatment, two of whom also had avascular necrosis.

Conclusion: Our data may provide insight into the factors affecting the prognosis of traumatic hip dislocations treated by closed or open reduction.

Key words: Hip dislocation/physiopathology/therapy; hip fractures; hip joint/pathology; prognosis; treatment outcome; magnetic resonance imaging; tomography, X-ray computed.

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Traumatic dislocation of the hip (THD) is a considerable injury. It occurs as a high-energy trauma, generally a traffic accident inside or outside a car. There are accompanying injuries such as soft-tissue trauma including vessel and nerve injury, acetabulum and femoral head fracture and injury at any other side of the body. THD is classified as anterior, posterior or central. Isolated anterior and posterior dislocations are treated by closed reduction. In anterior and posterior fracture-dislocations and in central dislocations, surgical treatment is usually recommended.

In this study, patients with THD treated by closed or open reduction and the factors affecting prognosis were evaluated.

Patients and method

Between the years 1996-1999, 30 patients with THD (3 women, 27 men; mean age 35, range 13-69 years) were evaluated. Etiology was traffic accident in 24, fall from a height in 3, fall from a swing in one, epileptic seizure in one, electric shock in one. The dislocation type was posterior in 24, central in 4 and anterior in 2 patients. 29 patients were admitted directly to our hospital. One patient was sent to our hospital after the hip was reduced. The duration between the dislocation and closed reduction was less than 24 hours in 29 patients. The time passed for closed to open reduction ranged from one to 21 days according to the patient's general status and preoperative preparation. The classification systems used were Thompson-Epstein (TE) for posterior dislocations, Pipkin (P) if there was a femoral head fracture, Judet (J) for central dislocations, Epstein (E) for anterior dislocations (Table 1).[1]

There were ten posterior, two anterior and three central dislocations in 15 patients treated by closed reduction. Eight of ten posterior dislocations were TE1, one TE4, one TE5-P1; one of the anterior dislocations was E2A, the other one was E2B; three central dislocations were J3A, J3B and J4A. There were eight isolated hip dislocations and seven fracture-dislocations. In seven fracture-dislocations, one posterior lip fracture (TE1), one anterior column fracture (TE4), two femoral head fracture (TE5/P1, E2B), three anterior and posterior column fracture were detected. There were nine isolated hip trauma and six polytrauma (3 upper extremity, 2 lower extremity, 1 head, 2 pelvic trauma).

There were 14 posterior and one central dislocation in 15 patients treated by open reduction. Fourteen posterior dislocations were classified as two TE1, four TE2, three TE3, three TE4, two TE5/P1. The central dislocation was J2B. There was one soft-tissue interposition, the others were fracture-dislocations. Fourteen fracture-dislocations were distributed as one posterior lip fracture (TE1), eight posterior wall fractures (4 TE2, 3 TE3, 1 TE4), two anterior column fracture (TE4), one posterior column fracture (TE4), two femoral head fracture (TE5/P1), one anterior and posterior column fracture (J2B). Intraarticular fragments were detected in seven cases. Of these seven cases, one TE1, two TE2, 2 TE4, 2 TE5 fracture-dislocations were determined. There were five isolated hip trauma, 10 polytrauma (9 lower extremity, 4 upper extremity, 3 head, 1 cervical, 1 thorax, 2 pelvic trauma, 2 nerve lesion) in patients treated by open reduction. Of the six knee trauma, two were lateral collateral ligament injuries, two tibial plateau fractures, one femoral condyle fracture and one patella fracture.

Posterolateral incision was performed in all cases treated by open reduction. Screw fixation was applied in nine cases, plate and screw fixation in two, intraarticular fragment excision in seven. Skin traction was used for three weeks after closed or open reduction. In isolated dislocations, partial weight bearing was allowed with crutches after three weeks and total weight bearing after six weeks. In fracture-dislocations, patients ambulated with crutches without weight-bearing for three weeks; loaded partially after six weeks and fully after three months.

The most common etiological agent, the effect of the duration between THD and reduction of the hip and closed reduction to open reduction to the final outcome, the relationship between age and dislocation type or final outcome, the most common accompanying injuries to THD, the effect of the fracture type to prognosis in fracture-dislocations, type of fracture-dislocations that had a benefit from surgery and the criteria that determine

the prognosis were evaluated. The mean follow-up period was 49 months (range 16-84 months).

Results

The most common etiology leading to THD was traffic accident (24/30, 80%); 75 percent was inside-car, 25 percent outside-car accident.

The duration between THD and closed reduction was less than 24 hours in 14 cases. One patient who refused treatment and left hospital voluntarily had open reduction directly after 43 days.

Surgical treatment was performed within 24 hours in six cases and 5 to 21 days in nine. The result was unsatisfactory in three patients treated within less than 24 hours. Suprisingly, it was satisfactory in one patient treated within 21 days.

The result was satisfactory in all patients who had isolated THD in the closed reduction group. THD was isolated in all adolescent cases.

The most common injury accompanying THD is knee injury.[2] In the current study, the rate of having another extremity injury and knee injury was 53.3% (16/30) and 23.3% (7/30) respectively.

Surgical treatment was applied to the patients who had non-concentric reduction, loose body in the joint and unstable hip after closed reduction. As a criterion for concentric reduction, it was checked out whether the distance between the teardrop and the most medial part of the femoral head in the comparative hip X-rays was equal or not. In five cases, comparative hip CT scan examination after reduction showed that the femoral head was not concentrically placed in the acetabulum. It was found that there were loose bodies in the joint in four cases and there was soft-tissue interposition in one case. In posterior THD cases that had posterior wall fractures, sta-

Table 1. Classification of THD

Anterior	Epstein		
	Type 1 Superior	1A	Simple
		1B	Femoral head fracture
		1C	Acetabular fracture
	Type 2 Inferior	2A	Simple
		2B	Femoral head fracture
		2C	Acetabular fracture
Posterior	Thompson-Epstein	Type 1	Simple or a small fracture
		Type 2	One-part fracture of the posterior wall
		Type 3	Comminuted fracture of the posterior wall
		Type 4	Fracture of the acetabular floor
		Type 5	Femoral head fracture
	Pipkin	Type 1	Fracture caudad to fovea centralis
		Type 2	Fracture cephalad to fovea centralis
		Type 3	1,2+fracture of the femoral neck
		Type 4	1,2,3+acetabular fracture
Central	Judet	Type 1	Non-displaced
		Type 2	Inner wall fracture
		2A	Femoral head concentrically reduced under acetabular dome
		2B	Femoral head not concentrically reduced under acetabular dome
		Type 3	Superior dome fracture
		3A	Regular acetabular dome and congruous with femoral head femoral head
		3B	Irregular acetabular dome and incongruous with femoral head
		Type 4	Burst fracture= all acetabular structure damaged
		4A	acetabular dome and femoral head, congruent
		4B	acetabular dome and femoral head, incongruent

bility test was performed after closed reduction. The hip was considered unstable if it dislocated spontaneously at 90 degrees flexion and 20 degrees adduction.

In the long-term follow-up X-ray examination, avascular necrosis was evaluated by the femoral head asphericity, collapse or sclerosis. In closed reduction group with fracture-dislocation of the hip, radiological finding of AVN was not detected in any patients except one. This exception had femoral head sclerosis and impaction and accepted as AVN.

In the closed reduction group, four cases had degenerative arthritis. In one of these cases, an indentation fracture of the femoral head occurred during the initial trauma. The others were central dislocations and the main pathology was the comminuted fracture of the acetabular cartilage.

In the open reduction group, degenerative arthritis was detected in the cases classified as TE3, TE4 and central dislocation (n=6). One TE4 classified case had no degenerative arthritis and the final result was good. It was found that this case had a non-displaced anterior column fracture. In the open reduction group, two patients who had degenerative arthritis had also accompanying AVN signs.

The result was evaluated according to the clinical criteria proposed by Matta (Table 2) [3] and found to be satisfactory (excellent and good) in 11 (73.3%), unsatisfactory (fair and poor) in four (26.7%) cases in the closed reduction group; satisfactory in nine (60%) and unsatisfactory in six (40%) cases in the open reduction group.

The result was satisfactory in eight cases with isolated anterior or posterior dislocation treated by closed reduction. In three cases with posterior fracture-dislocation, two of them had extra-articular fractures (posterior lip and anterior column fracture) and one of them had a non-displaced femoral head fracture. It was concluded that the result was satisfactory in isolated hip dislocation and fracture-dislocation that did not compromise joint integrity and if the reduction was performed within the first 24 hours of the initial trauma.

In closed reduction group, when the patients having unsatisfactory results were examined, it was realized that the X-rays were misinterpreted in one case and the unsatisfactory result was due to an overlooked compression fracture of the femoral head. The other three patients had central dislocations with anterior and posterior column fractures, who were treated by skin traction, skeletal traction and lateral traction respectively.

Of the 15 cases treated surgically, nine had a satisfactory and six had an unsatisfactory result. In posterior dislocation cases, nine had a satisfactory, five had an unsatisfactory result. One case with a central dislocation had an unsatisfactory result. In regards to dislocation type, all of the cases classified as TE1, TE2 and TE5/P1 had a satisfactory result. On the other hand, all of the cases classified as TE3, two cases classified as TE4, one case classified as J2B had an unsatisfactory result.

In all of the cases with central dislocation of the hip, the result was unsatisfactory if the patients were treated by non-operative (n=3) or operative (n=1) methods.

Table 2. Clinical evaluation system proposed by Matta

Clinical evaluation	
Pain	
None	6
Slight or intermittent	5
After walking, but resolves	4
Moderate but able to walk	3
Severe, prevents walking	2
Walking	
Normal	6
No cane but slight limp	5
Long distance with cane or crutch	4
Limited even with support	3
Very limited	2
Unable to walk	1
Range of motion (%)	
95-100	6
80-94	5
70-79	4
60-69	3
50-59	2
<50	1
Clinical score	
Excellent	18
Good	15-17
Fair	13-14
Poor	<13

Discussion

Approach to a patient with THD has to be like the approach to a polytraumatized patient. In patients with THD, it is common to see internal organ and other musculoskeletal traumas. The examination of three body cavity (head, thorax and abdomen), four extremities and spine should be made carefully.

It was reported that 79% of the cases with THD were posterior, 19% central, 2% anterior.[4] In this study, it was 80% (24/30), 13% (4/30) and 7% (2/30) respectively.

In THD, X-ray examination of pelvis is required before reduction. As an urgent investigation, 45 degrees oblique iliac and obturator X-ray exam (Judet) is sufficient to point out whether there is an accompanying fracture of the femoral head, neck, acetabulum or not.[5,6] After reduction, it is appropriate to obtain a CT scan to evaluate the accompanying fractures in detail, designate reduction sufficiency (joint congruency), find out whether any surgical treatment is indicated or not and estimate prognosis.[7] This study proposes that a CT scan is required after reduction when there is an accompanying fracture to THD. Intraarticular fragment, type and size of the posterior wall fracture of the acetabulum can be detected by this method.

The importance of the time passed between the initial trauma and closed reduction as a cause of AVN was emphasized by many previous studies [5,8-16] It is accepted that closed reduction should be performed within the first 12-24 hours.[8,9] Nowadays, this duration is reduced to 6 hours.[10] On the other hand, AVN was reported in THD cases treated by closed reduction even within the first 6 hours.[11] It was found that more than one reduction trial[17] and trauma severity[12,18] were also associated with poor result. In this study, all but one case had reduction within the first 24 hours even if there was an accompanying fracture to THD. In all cases, closed reduction was performed under general anesthesia; so the possibility of having secondary trauma to the femoral head and acetabulum was minimized during reduction.

The primary indications for surgical treatment in THD were reported to be instability after reduction, [19,20] failure of closed reduction because of an intraarticular fragment or soft- tissue interposition or sciatic nerve palsy after closed reduction.[10,21] Hip stability after reduction was defined differently. There were authors who defined stability not only by clinical means but also by radiological terms as well. According to Yang and Cornwall[22], range of motion (ROM) of hip should be full after reduction and there also should be no dislocation at any degree of ROM; if not, there was clinical instability and surgical treatment should be undertaken. According to Keith at all (23), any dislocation that occured at 90 degrees flexion and 20 degrees adduction after reduction meant clinical instability and surgery was indicated. In THD with posterior wall fracture, it is controversial whether the size of the fragment affects stability or not. Vailas at all. [24] informed that the hip was stable if the fracture affected 25% or less of the acetabulum. Fractures affecting 25-50% of the acetabulum should be considered according to the rupture of the joint capsule; if the joint capsule was ruptured, surgery was required. We proposed that clinical and radiological criteria should be considered in cojunction to detect hip stability. In THD with posterior fracture-dislocation, even if there is clinical stability, surgical treatment is the first choice of treatment if CT scan of the hip joint shows that the fracture of the posterior aspect of the acetabulum affects the joint surface.

Surgical treatment of the acetabulum fractures has to be performed within the first ten days after trauma.[25] It can be postponed till three weeks if the general status of the patient is serious. It was reported that reduction of this kind of fractures were difficult after three weeks.[3,25,26] Matta at all [27] informed that the result would be better if the femoral head and acetabulum were congruent and if there was 3mm or less displacement of the fractured fragment after reduction. In this study, all of the acetabular fractures were fixed within the first three weeks after trauma and this had no negative effect on the result in the long-term follow-up.

Accompanying femoral head fracture to THD is rare (6-16 %). There are different opinions about the radiological evaluation, classification and surgical techniques for this kind of THD. Pelvis anteroposterior (AP) view, AP and oblique (Judet) views of the affected hip and CT scan of pelvis should be taken routinely for radiological evaluation.[28] MRI can be added to these radiological studies to find out an

indentation fracture or subchondral contusion of the femoral head [29]; however CT is superior to MRI to evaluate intraarticular fragments. In this study, pelvis AP view was taken before reduction and CT examination was performed if there was an accompanying fracture to THD in all patients. It is reported that the risk of having an indentation or transchondral fracture of the femoral head after an anterior THD is high.[30, 31] The prognosis of such patients is significantly worse than those patients with posterior THD. One case in this study was misinterpreted as an isolated anterior THD and the indentation fracture of the femoral head was not noticed after reduction. In the follow-up, the amorphous shape of the femoral head became evident and degenerative arthritis pursue; the result was unsatisfactory. As a conclusion, we propose that pelvis AP view and hip oblique views before reduction should be taken and if there is an accompanying fracture to THD after reduction, pelvis CT examination should be done in every THD patient. On the other hand, in cases with anterior THD, CT examination after reduction should be performed whether there is an accompanying fracture to THD on conventional X-ray or not.

Pipkin classification is usually used for THD with femoral head fracture. The most important handicap of this classification is that it does not cover the femoral head fractures accompanying to anterior or central dislocations. This handicap is resolved by the classification system developed by Brumback at all.[32] Pipkin classification was used in the current study.

In THD with femoral head fracture, surgery is needed if there is an intraarticular fragment after reduction. In cases with anatomic and concentric reduction, traction for 6 weeks is recommended.[13] The surgical options (fixation or excision), timing for surgical treatment and type of the surgical incision used are all controversial. Many authors propose that bony fragments which are less than one third of the femoral head can be excised, especially when the femoral head fracture is caudal to fovea centralis.[13,33,34] It is also proposed that fractures cephalad to fovea centralis should be fixed rigidly (with Herbert or cannulated screws) when they are on the weight-bearing area of the joint surface .[31,35,36] In the current study, all the femoral head fractures were seen in posterior THD, all of them were small intraarticular fragments (P1) and all were excised. One of the anterior THD patients had indentation fracture of the femoral head. No femoral head fracture was detected in central dislocations.

In THD with posterior wall fracture, the indication for surgical treatment is determined according to clinical and radiological criteria. Clinical instability is defined as dislocation of the hip at any range of motion.[26] It is called radiological instability when there is a fracture affecting more than 50% of the posterior wall of the acetabulum.[23,24,37] In this study, clinical instability was evaluated initially and surgery was decided if the hip dislocated in the 0-90 degrees flexion interval. Radiologically, if there was a posterior wall fracture affecting joint surface on CT scan, surgical treatment was selected to obtain an anatomic reduction and to scatter the joint forces per unit area properly, as the joint returned to its previous structure. It is reported that prognosis of THD with posterior wall fracture is positively influenced by surgery if anatomic reduction is achieved.[3]

It is reported that the probability of having AVN of the femoral head after THD is 6-40%.[8,34,38] Degenerative arthritis can pursue AVN in long-term follow-up. According to Epstein, X-ray examination should be done every three months in the first year follow-up of the THD patients; after the first year it should be repeated every six months. AVN is observed by looking for the density changes in the femoral head, impaction of the femoral head on the weight-bearing area. Degenerative arthritis is evaluated by narrowing of the joint space, osteophytes between the femoral neck and head. Epstein reported AVN and degenerative arthritis rate as 13.4% and 23.2% in the whole study group, 18% and 35% in fracture-dislocation of the hip and 5.3% and 17% in the primary open reduction group respectively. He concluded that the decrease of the complication rate in the primary open reduction group was because the hip joint was debrided and all the small fragments and debris material were cleared away. He pointed out that reduction should be performed within 24 hours and more than one reduction trial should be avoided.[8] Jacob at all [21] reported the AVN rate as 9.1% and degenerative arthritis rate as 38.2%. They emphasized that AVN developed when reduction was performed after 24 hours. Hougard and Thomsen (14) found AVN rate to be 4.8% if the hip

was reduced within 6 hours and 52.9% if it was reduced after 6 hours. They also proposed that the grade of dislocation was another risk factor for AVN. In this study, we didn't detect any radiological finding pertaining to AVN in closed reduction group with isolated THD. It was the same in the fracture-dislocation cases except one. This exception who had femoral head sclerosis and collapse was considered to be AVN. In the closed reduction group, AVN and degenerative arthritis rate was 6.7% (1/15) and 26.7% (4/15) respectively. In the open reduction group, degenerative arthritis was not seen in TE1, TE2, TE5/P1 cases; on the other hand, TE3, TE4 and central dislocation cases all developed degenerative arthritis. One TE4 case had a non-displaced anterior column fracture, degenerative arthritis didn't pursue and this case had a satisfactory result. In the open reduction group with degenerative arthritis, there were two patients who had AVN signs. One of them had primary open reduction after 43 days from the initial trauma, the other one was the eldest patient of the whole study group. In the open reduction group, AVN and degenerative arthritis rate were 13.3% (2/15) and 40% (6/15) respectively. In the whole study group, it was 10% (3/30) and 33.3% (10/30) respectively. We conclude that duration for reduction, grade of dislocation and age of the patient are important criteria in the development of AVN and degenerative arthritis.

It is reported that the most frequent accompanying trauma to THD is knee trauma.[2] In the current study, there were seven (23.3%) cases with knee trauma. All the patients with THD presenting to the emergency room should be carefully evaluated for knee region trauma both clinically and radiologically; it should be kept in mind that fractures and ligament injuries can be overlooked.

Sciatic nerve palsy can frequently be added to THD (in adults 10-15%), [15,18,39-42] (in children 0-5). [43-46] It is seen less frequent in children, because THD can happen with low-energy trauma in children. In this study, sciatic nerve palsy was not detected in any of the three adolescent patients. Of the remainder 27 adult patients, there were two sciatic nerve palsy (one of them sciatic, the other one fibular) (2/27, 7.4%).

The long-term results of THD are mostly affected by direction of dislocation and severity of the trauma. The risk factors for coxarthrosis in anterior THD are transchondral fracture, indentation fracture with more than 4mm collapse and osteonecrosis.[47] In this study, one of the two cases of anterior THD had an indentation fracture that developed coxarthrosis. The risk factors for posterior THD are high-energy trauma, unable to achieve concentric reduction, duration between the initial trauma and reduction and osteonecrosis.[16-48] In this study, all central dislocation, TE3 and TE4 cases that were treated surgically developed coxarthrosis. It was concluded that it was inevitable to have coxarthrosis after central dislocations not only if they were treated non-surgical but also by surgical methods as well. The long-term results of surgical treatment were unsatisfactory in TE3 and TE4 cases that had comminuted fracture of the posterior wall or floor of the acetabulum and all of these cases developed degenerative arthritis. In one of the TE4 cases, the fracture of the floor of the acetabulum was not displaced and the result was satisfactory. Two cases with a small fracture of the femoral head (TE5/P1) had a satisfactory result after fragment excision and degenerative arthritis was not seen in the long-term follow-up of these patients. As one case of anterior THD developed degenerative arthritis, it was reasonable to look for indentation fracture of the femoral head in such patients. Therefore, we recommend taking CT scan of the hip after reduction of anterior THD.

It was observed that in the adolescent patients (age under 18 years), THD occurred as a pure dislocation and there were no complications if closed reduction was performed within 24 hours. It should be remembered that there could be an impaction fracture of the femoral head in anterior THD and these cases should be evaluated by CT scan. It was concluded that comparative CT examination was also useful when concentric reduction could not be obtained after reduction or if there was a posterior wall or femoral head fracture accompanying THD. Stability test after reduction should be applied to every patient (especially the one who has posterior wall fracture) and played an important role to determine the treatment modality.

In summary, it was proposed that TE1 group of posterior THD could be regarded as a pure disloca-

tion, the inability to reduce the hip could be attributed to soft-tissue interposition or intraarticular fragment and the result was satisfactory with non-surgical or surgical treatment. In TE2 group, it was observed that the result would be satisfactory with prompt surgical intervention and osteosynthesis of the fracture. TE5 cases with femoral head fracture P1 had a satisfactory result after excision of the fragment. Fragment size was less than 1cm in all of the cases and it was determined that excision did not exert any negative influence on the final outcome. As posterior wall fractures were comminuted in TE3 group, anatomic reduction could not be achieved. All cases developed degenerative arthritis and the result was unsatisfactory. In TE4 group, the result was determined by the displacement of the fracture of the acetabular floor. If it was displaced, the result would be unsatisfactory; if not, it would be satisfactory. In central dislocations with anterior and posterior column fractures, the result was unsatisfactory both by non-surgical and surgical methods.

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