Acta Orthop. Belg., 2017, **83**, 544-549

ORIGINAL STUDY

Comparison of acetabulum posterior wall fractures and fracture dislocations: dislocation does not affect clinical and radiological outcomes

Turan Bilge Kizkapan, Abdulhamit Misir, Erdal Uzun, Mustafa Ozcamdalli, Emre Yurdakul, Mahmut Argun

From the Erciyes University Department of Orthopedics, Turkey

The aim of this study was to compare radiological and clinical outcomes of posterior wall acetabulum fractures and posterior wall fracture dislocations. Data were including 52 acetabulum fractures and fracture dislocations. Twenty-six patients (%50) had posterior acetabulum fractures and fracture dislocations who were operatively treated. Radiographic evaluations were performed before and after the operation and at the last follow up. Clinical outcome evaluation was performed at the last follow up. Clinical and radiological outcomes were evaluated including Merle D'aubigne clinical assessment score and Matta' s radiologic measurement score. Brooker classification was used to measure heterotopic ossification. Both Merle D'aubigne and Matta scores were found higher in the acetabulum posterior wall fracture group. But there wasn't significantly difference of clinical and radiological outcomes between two groups (p > 0,05). Reduction quality and Matta radiologic scores were correlated significantly in 2 groups. Posterior dislocation may not negatively affect clinical and radiologic outcomes.

Keywords : acetabulum fracture ; posterior wall ; dislocation ; clinical and radiological outcomes.

Level of evidence: Level III Therapeutic

INTRODUCTION

Posterior wall fractures are the most common type of acetabulum fractures *(1,2)*. Judet first described operative treatment of this injury *(9)*. Anatomic reduction, rigid internal fixation and early mobilization are the mainstay management methods of acetabulum fractures. Posterior fracture dislocations are resulted from high-energy traumas. Treatment strategy is urgent reduction, internal fixation and early mobilization. Conservative treatment after reduction is an alternative treatment method *(19)*. Both posterior wall acetabulum fractures and posterior fracture dislocations are associated with degenerative arthritis, avascular necrosis, impingement, infection, sciatic nerve palsy, heterotopic ossification and chronic hip pain complications.

In this study we aimed to compare clinical and radiological outcomes of posterior wall acetabulum fractures and fracture dislocations.

■ Turan Bilge Kizkapan MD[1].
■ Abdulhamit Misir, MD[1].
■ Erdal Uzun, MD[2].
■ Mustafa Ozcamdalli, MD[3].
■ Emre Yurdakul, MD[4].
■ Mahmut Argun, MD[5].

[1]Baltalimani Bone and Joint Diseases Training and Research Hospital, Istanbul, Turkey; [2]Kayseri Training and Research Hospital, Kayseri, Turkey; [3]Ahi Evran University Training and Research Hospital, Kirsehir, Turkey; [4]Osmaniye State Hospital, Osmaniye, Turkey; [5]Erciyes University Faculty of Medicine Department of Orthopedics, Kayseri, Turkey.

Correspondence: Turan Bilge KIZKAPAN, Baltalimani Bone and Joint Diseases Training and Research Hospital, Department of Orthopedics, Rumeli Hisarı Caddesi No: 62 34470 Baltalimanı İstanbul TEL: +90 505 620 1662

E-mail : turanbilge.kizkapan@gmail.com

No benefits or funds were received in support of this study. The authors report no conflict of interests.

MATERIAL AND METHOD

Between 2006 and 2012, 52 consecutive patients with acetabulum fractures and fracture dislocations were treated in our clinic. After obtaining the approval of the local ethic committee, study was started. 26 patients met the inclusion criteria following: 1) Isolated posterior wall or posterior column fracture or posterior wall fracture dislocation treated surgically 2) At least 3 year follow up with accessibility to all radiographs, CT images and measurement scores 3) Patients had not any secondary surgery after primary fixation. Patients were divided into two groups as 13 with posterior wall acetabulum fractures and 13 with posterior fracture dislocations. In both groups, there were 12 men and 1 woman. Mean age was 44.07 (28-67) in the posterior acetabulum fracture group, and 38.2 (21-65) in the fracture dislocation group. Injury mechanisms were 1 fall from height and 12 motor vehicle accidents in the fracture group. There was 3 fall from height and 10 motor vehicle accidents in the fracture dislocation group.

Mean follow up period was 5.34 (3-9) years in the posterior wall fracture group and 5 (3-7) years in the fracture dislocation group. In the fracture group 8 patients were treated with plate, 2 patients with screws and 3 patients with both plate and screws. In the fracture dislocation group 2 patients were treated with plate, 5 patients with screws and 6 patients with both plate and screws.

Mean length of stay for the posterior wall fracture group was 5.6 (3-13) days. It was 6.3 (4-13) days for the fracture dislocation group. Operation time after emergency service admission was 2.3 (1-6) days for the posterior wall fracture group and 1.7 (1-4) days for the fracture dislocation group.

At the presentation, all patients were evaluated radiographically with anterior-posterior, lateral, two 45 degrees oblique pelvis radiographies, (Judet views) *(14)* and CT images. CT evaluation was performed on 2 mm sections through the injured hip before and after closed reduction in the fracture dislocation group. Closed reduction was performed after radiographic evaluation under general anesthesia in the operative room settings. Hip was considered clinically unstable if there was dislocation or subluxation in fluoroscopic stress views *(7)*. The first CT image was obtained for accurate evaluation of the fracture pattern and the second CT examination was performed to determine reduction quality and evaluation of loose bodies inside the joint *(10)*. By using CT images, presence of more than %50 of the posterior wall involvement was an indication of surgery *(5)*. Non-concentric reduction, intra articular loose bodies and neurovascular compromise after closed reduction were other indications for surgery. All patients were placed in skeletal traction from the femoral condyles to prevent re-dislocation while waiting for surgery *(23)*. Deep venous thrombosis prophylaxis was started and continued until 8 weeks postoperatively. All patients were operated in hip extended and knee flexed prone position with Kocher Langenbeck approach. Posterior-superior mild femoral head impaction was observed and documented in 5 patients in the fracture dislocation group.

According to the Judet-Letournel classification *(9)*, 8 patients had posterior wall fracture and 5 patients had posterior column fracture in the posterior wall fracture group. 11 patients had posterior wall and 2 patients had posterior column fracture in the fracture dislocation group. After surgery, immediate fracture reduction graded as anatomic if displacement was 2 mm or less, imperfect if displacement was 2-5 mm and poor if displacement was more than 5 mm.

Radiologic assessment of the last follow up (3 to 9 years after postoperatively) was included anterior-posterior, lateral and Judet views of the pelvis for estimation of the degree of the possible osteoarthritis, femoral head osteonecrosis and heterotopic ossification. Heterotopic ossification was evaluated with Brooker classification system *(4)*. Steinberg classification system was used to evaluate and grade femoral head osteonecrosis on the plain radiographs *(19)*. Matta's radiologic assessment score was used for the analysis of the radiologic data outcomes as excellent, good, fair and poor *(14)*. Merle D'aubigne clinical assessment score was used for the analysis of the clinical data outcomes as excellent, good, fair and poor *(7)*. Data were analyzed using statistical software (IBM SPSS

Statistics for Windows, version 22.0, IBM Corp.) Descriptive statistics are presented as a mean, median, and standard deviation. Qualitative data were analyzed by chi-square test.

RESULTS

Follow up was ranged from 3 to 9 years in the posterior wall fracture group and 3 to 7 years in the fracture dislocation group. The age range of all patients at the time of the surgery was 23 to 62 with mean age of 39 (40.8 of men and 44 of women). The majority of posterior fracture dislocation patients were male and aged between 16 to 60 years.

Five patients (%38) had right and 8 patients (%62) had left side fracture in the posterior wall fracture group; 7 patients (%53) had right and 6 patients (%47) had left side fracture and dislocation in the fracture-dislocation group. Majority of patients were involved in traffic accidents in both groups (%84). The rest had a fracture or fracture dislocation as a result of fall from height (%16).

Associated injuries were: 2 patients had distal radius fracture, 1 had clavicle and 1 had thoracal spine fracture accompanied to the acetabulum fracture. One patient had fibula fracture, one had distal radius fracture, one had femur fracture and 1 had patella fracture accompanied to the acetabulum fracture dislocation.

The average duration between the injuries and close reduction was 4 hours to 1 day in the fracture dislocation group. The duration between the injury and the internal fixation was 1 to 6 days (mean: 2,3 days) in the posterior wall fracture group and 1 to 4 days (mean: 1,7 days) in the fracture dislocation group.

All patients were allowed to partial weight bearing 3 months postoperatively. Full weight bearing was started 4 to 6 months postoperatively.

Radiographic outcomes

According to the radiological evaluation postoperatively, reduction quality of posterior wall fracture group was measured as anatomic in 10 patients, imperfect in 1 patient and poor in 2 patients. In the fracture dislocation group, it was anatomic in 8 patients, imperfect in 3 patients and poor in 2 patients.

By using Matta's radiologic grading system scores at the last follow up, 2 patients has excellent, 9 patients had good and 2 patients had poor scores in the posterior wall fracture group. In the fracture dislocation group, 4 patients had excellent, 4 patients had good, 2 patients had fair and 3 patients had poor score.

Excellent to good radiographic outcomes (%84,6) were obtained in the majority of patients of the posterior wall fracture group when anatomic reduction was achieved ($p < 0,05$). In the fracture dislocation group these outcomes were lower (%61,5) ($p < 0,05$). There was a direct correlation between poor reduction and fair and poor radiological outcomes. (Table 1)

Clinical outcomes

According to the Merle D'aubigne scoring system *(7)* the clinical score was excellent in 3 cases, good in 8 cases and fair in two cases of posterior wall fracture group. In the fracture dislocation group Merle D'Aubigne clinical score was excellent in 3 cases, good in 7 cases and fair in 3 cases.

Excellent to good clinical outcomes were obtained (%84.6) in the majority of patients of posterior wall fracture group when anatomic reduction was achieved ($p < 0,05$). In the fracture dislocation group these outcomes were lower (%76.9) ($p > 0,05$). (Table 2)

ROM difference of the treated hip was compared for supine and prone flexion, abduction, adduction, external and internal rotation between posterior wall fracture group and fracture dislocation group. The difference in the range of extension was 5 degrees, whereas flexion was 5 degrees, abduction was 10 degrees and adduction was 0 degree. The internal and external rotation difference between two groups was 15 degrees and 5 degrees, respectively. The full weight bearing time ranged from 16 to 24 weeks postoperatively in both groups.

Patient satisfaction

We evaluated the patient satisfaction by asking walking ability and presence of pain. Eleven of the thirteen patients (%84) in the posterior wall fracture group were able to walk without pain while eight of the thirteen patients (%61) in the fracture

Table I.— Matta radiological scores of two groups

Posterior Fracture Group			Posterior Fracture Dislocation Group		
	n	%		n	%
Excellent	3	23	Excellent	3	23
Good	8	62	Good	7	54
Fair	2	15	Fair	3	23
Bad	0	0	Bad	0	0

Table II.— Merle d'Aubigne clinical scores of two groups

Posterior Wall Fracture Group			Posterior Fracture Dislocation Group		
	n	%		n	%
Excellent	2	15.3	Excellent	4	30.7
Good	9	69.2	Good	4	30.7
Fair	0	0	Fair	2	15.3
Bad	2	15.3	Bad	3	23.3

dislocation group were able to walk without pain. Two patients (%16) in the posterior wall fracture group had mild pain while walking but without crutches. 3 patients (%23) in the fracture dislocation group had mild pain while walking but without crutches. Also, 2 patients (%16) had moderate pain while walking and using crutches. Only these two patients dissatisfied with the procedure.

Complications

Preoperatively, 2 patients had sciatic palsy in the fracture dislocation group. Post operatively, 1 patient in the posterior wall fracture group had sciatic nerve palsy. We followed all three patients conservatively with drop foot brace and full recovery was observed in 2 patients. One patient had no recovery. This patient refused to get any additional surgery.

One patient in the fracture dislocation group was stayed in the intensive care unit for 5 days and heterotopic ossification was developed in this patient (Brooker type 3). Also, heterotopic ossification was developed in 2 patients of the fracture dislocation group who were not stayed in the intensive care unit (one Brooker type 1 and one Brooker type 4). In the posterior wall fracture group, 1 patient had heterotopic ossification (Brooker type 1). In the fracture dislocation group 1 patient was developed superficial wound infection post operatively. This infection was controlled with antibiotic therapy. Despite given medical and mechanical thrombosis prophylaxis, 1 patient in the posterior wall fracture group and 3 patients in the fracture dislocation group was developed deep venous thrombosis 3 to 4 weeks after surgery. All 4 patients were hospitalized and immediate medical anticoagulation regimen was started. One week later, all patients were discharged and then we haven't seen any embolus or repeated thrombosis.

In the last follow up 2 patients had mild degenerative arthritis in the posterior wall fracture group. Also, 3 patients had mild degenerative arthritis, 1 patient had femoral head avascular necrosis (Steinberg stage 4b) and 1 patient had pincer type impingement in the fracture dislocation group.

DISCUSSION

In our comparative study, we found that radiographic and clinical outcomes were associated with articular reduction quality. If displacement was 2 mm or less, both radiological and clinical outcomes were excellent or good in the two groups. Patients with residual articular displacement greater

than 2 mm had markedly decreased satisfactory results in both posterior wall acetabulum fracture and posterior fracture dislocation groups.

There are several studies in the literature showed us the success of the operative treatment of acetabulum posterior wall fractures and fracture dislocations. With good articular reduction, Matta *(14)* reported %82 good to excellent results. The adequacy of surgical reduction will determine the long-term outcome of surgically managed posterior hip dislocations associated with posterior wall acetabulum fracture *(15)*. Some authors reported up to %30 unsatisfactory radiologic and clinical results after surgical treatment *(18-23)*. Poor outcomes and development of rapid degenerative arthritis are associated with greater than 2 mm residual step-off *(11)*. Tornetta *(21)* reported patients with posterior dislocations or multiple injuries have worse prognoses than patients with anterior dislocations or without multiple injuries. However, in a short mean follow up study of Moed *(16)* reported excellent clinical and radiologic outcomes in the majority of patients with posterior wall fracture dislocations underwent surgical treatment. Adequacy of reduction will determine long-term outcomes. This study showed that dislocation did not affect short-term outcomes in the posterior fracture dislocation group in addition to reduction quality.

Incidence of posttraumatic degenerative arthritis after acetabulum fracture has been reported to range from %12 to %57 *(23)*. Degenerative osteoarthritis was the most common major complication in both groups. Two patients (%15,3) with posterior wall fracture and 3 patients (%23) with posterior wall acetabulum fracture dislocation had mild osteoarthritis. Arthritis was detected 5 and 7 years after injury in the posterior wall fracture group. However, this time was 3, 4 and 4,5 years after injury in the fracture dislocation group.

Osteonecrosis of the femoral head is a major complication associated with dislocation of the hip that affects %10 to %25 of the patients *(22)*. In context, some authors defend the relationship between development of osteonecrosis and direct impact of injury *(15)*. The others were emphasized the role of duration between injury and reduction of the dislocated hip *(8,17)*. In our study, only one patient had osteonecrosis of the femoral head in the fracture dislocation group. In this patient, dislocated hip could be reduced 16 hours after injury. Osteonecrosis was detected 3 years after initial reduction and internal fixation. Brav et al. *(3)* reported osteonecrosis 2 years after injury. However, Cash et al. *(6)* reported osteonecrosis 8 years after posterior hip dislocation. This shows the necessity of the long-term follow up to detect probable osteonecrosis in the posterior hip displacement patients. In their MRI study, Maini et al. *(13)* showed that complete tears of obturator externus and/or pirformis muscles are a strong predictor of future development of AVN of the femoral head. MRI examination may be useful in prediction of femoral head osteonecrosis.

The present study has some limitations of small sample size, follow up period, and retrospective character. These may show some of these factors may play a role in the long term sequela. Also,

To our knowledge, this is the first study comparing short term clinical and radiologic outcome measures of surgically treated posterior wall acetabulum fractures and posterior wall acetabulum fracture dislocations.

REFERENCES

1. **Aho AJ, Isberg UK, Katevuo VK**. Acetabular posterior wall fracture. 38 cases followed for 5 years. *Acta Orthop Scand* 1986 ; 57 : 101-5.
2. **Baumgaertner MR.** Fractures of the posterior wall of the acetabulum. *J Am Acad Orthop Surg* 1999 ; 7: 54-65.
3. **Brav EA.** Traumatic dislocation of the hip. Army experience and results over a twelve-year period. *J Bone Joint Surg Am* 1962 ; 44 : 1115-1134.
4. **Brooker AF, Bowerman JW, Robinson RA, Riley LH Jr.** Ectopic ossification following total hip replacement. Incidence and a method of classification. *J Bone Joint Surg Am* 1973 ; 55: 1629-32.
5. **Calkins MS, Zych G, Latta L, Borja FJ, Mnaymneh W.** Computed tomography evaluation of stability in posterior fracture dislocation of the hip. *Clin Orthop Relat Res* 1988 ; 227 : 152-63.
6. **Cash DJ, Nolan JF.** Avascular necrosis of the femoral head 8 years after posterior hip dislocation. *Injury* 2007 ; 38 : 865-7.
7. **d'Aubigné, RM, Postel M.** Functional results of hip arthroplasty with acrylic prosthesis. *J Bone Joint Surg Am* 1954 ; 36-A : 451-75.

8. **Hougaard K, Thomsen PB.** Traumatic posterior dislocation of the hipprognostic factors influencing the incidence of avascular necrosis of the femoral head. *Arch Orthop Trauma Surg* 1986 ; 106 : 32-5.
9. **Judet R, Judet J, Letournel E.** Fractures of the acetabulum: classification and surgical approaches for open reduction. *J Bone Joint Surg Am* 1964 ; 46 : 1615-46.
10. **Keith JE Jr, Brashear HR Jr, Guilford WB.** Stability of posterior fracture-dislocations of the hip. Quantitative assessment using computed tomography. *J Bone Joint Surg Am* 1988 ; 70: 711-4.
11. **Kreder HJ, Rozen N, Borkhoff CM et al.** Determinants of functional outcome after simple and complex acetabular fractures involving the posterior wall. *J Bone Joint Surg Br* 2006 ; 88: 776-82.
12. **Liang MH, Cullen KE, Larson MG et al.** Effects of reducing physical therapy services on outcomes in total joint arthroplasty. *Med Care* 1987 ; 25 : 276-85.
13. **Maini L, Kumar S, Batra S, Gupta R, Arora S.** Evaluation of the muscle morphology of the obturator externus and piriformis as the predictors of avascular necrosis of the femoral head in acetabular fractures. S*trategies Trauma Limb Reconstr* 2016 ; 11: 105-11.
14. **Matta JM.** Fractures of the acetabulum: accuracy of reduction and clinical results in patientsmanaged operatively within three weeks after the injury. *J Bone Joint Surg Am* 1996 ; 78: 1632-45.
15. **Mitsionis GI, Lykissas MG, Motsis E et al.** Surgical management of posterior hip dislocations associated with posterior wallacetabular fracture: a study with a minimum follow-up of 15 years. *J Orthop Trauma* 2012 ; 26: 460-5.
16. **Moed BR, WillsonCarr SE, Watson JT**. Results of operative treatment of fractures of the posterior wall of the acetabulum. *J Bone Joint Surg Am* 2002 ; 84-A : 752-8.
17. **Sahin V, Karakaş ES, Aksu S, Atlihan D, Turk CY, Halici M.** Traumatic dislocation and fracture-dislocation of the hip: a long-term follow-up study. *J Trauma* 2003 ; 54: 520-9.
18. **Saterbak AM, Marsh JL, Nepola JV, Brandser EA, Turbett T**. Clinical failure after posterior wall acetabular fractures: the influence of initialfracture patterns. *J Orthop Trauma* 2000 ; 14 : 230-7
19. **Sen RK, Veerappa LA.** Long-term outcome of conservatively managed displaced acetabular fractures. *J Trauma* 2009 ; 67: 155-9.
20. **Tornetta, P.** Displaced acetabular fractures: indications for operative and nonoperativemanagement. *J Am Acad Orthop Surg* 2001 ; 9: 18-28.
21. **Tornetta P 3rd, Mostafavi HR.** Hip Dislocation: Current Treatment Regimens. *J Am Acad Orthop Surg* 1997 ; 5: 27-36.
22. **Upadhyay SS, Moulton A, Burwell RG.** Biological factors predisposing to traumatic posterior dislocation of the hip. A selection process in the mechanism of injury. *J Bone Joint Surg Br* 1985 ; 67: 232-6.
23. **Wolf H, Wieland T, Pajenda G, Vécsei V, Mousavi M.** Minimally invasive ilioinguinal approach to the acetabulum. *Injury* 2007 ; 38: 1170-6.