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Original Article

Comparison of clinical and radiological outcomes after posterior acetabular fractures in patients younger and older than 40 years old

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Abstract

Aim: This study aimed to evaluate and compare the clinical and radiological outcomes of patients aged >40 years and ≤40 years old, who underwent open reduction internal fixation for posterior fracture and/or fracture dislocation of the acetabulum.

Material and Methods: A total of 52 patients who underwent surgical treatment for posterior acetabular fracture and/or fracture dislocation between June 2006 and October 2013 were included in this study. The patients were divided into the following 2 groups: group I, patients aged <40 years (n = 25; mean age, 31.1; mean follow-up period, 35.7 months) and group II, patients aged >40 years (n = 27; mean age, 53.3; mean follow-up period, 36.8 months). The Judet–Letournel classification system was used in the radiological classification of acetabular fractures. Clinical and radiological evaluations were performed using the modified Merle D'Aubigne evaluation score and the criteria developed by Matta, respectively. In addition, radiological evaluation for heterotopic ossification was performed according to the Brooker scoring system.

Results: No significant difference in the quality of reduction and clinical and radiological findings was found between the two groups (p>0.05). The modified Merle D'Aubigne clinical outcome distribution and the distribution of Matta radiological results in groups I and II did not differ significantly (p>0.05 and p>0.05, respectively). Moreover, no significant difference in the development of postoperative heterotopic ossification was observed between the groups (p>0.05).

Conclusion: Clinical and radiological outcomes are not significantly different between patients younger and those older than 40 years. Nevertheless, the clinical outcome scores are better in patients aged ≤40 years.

Keywords: Acetabulum; fracture; outcome; posterior; clinical; radiological

INTRODUCTION

Acetabular fractures, which account for only 2% of all fractures (1,2), have high morbidity and mortality rates because of the associated injuries (3). They are usually related to high-energy injuries, such as traffic accidents and fall from height. However, they may also be associated with low-energy injuries that could be attributed to osteoporosis, especially among the elderly (4,5). The posterior wall is the most common fracture site, accounting for 25% of acetabular fractures. Posterior wall and posterior column fractures are often caused by trauma force while the hip joint is flexed, frequently due to in-vehicle traffic accidents and falls from height (6).

The primary aim of operative treatment is to achieve functional, mobile, and painless hip joint throughout the patient's life (7,8). ORIF is the preferred treatment method for young patients to achieve the best results by providing anatomical fracture reduction and hip joint stability (9-11). The quality of articular reduction is extremely vital in determining good to excellent clinical and functional

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outcomes (12,13). The modified Merle D'Aubigne-Postel Score has been used extensively to assess the functional outcomes after acetabular fracture treatment (14,15).

Several studies examining the outcomes after the surgical treatment of acetabular fractures have been conducted (7,16,17). However, no direct study compared the functional and clinical outcomes between patients aged ≤40 and those aged > 40 years. Thus, this study aimed to evaluate and compare the clinical and functional outcomes following the surgical treatment of posterior acetabular fractures in patients younger than 40 years and those older than 40 years.

MATERIAL and METHODS

After obtaining the approval of the institutional ethics committee, clinical and radiological records of 254 patients with acetabular fractures, who underwent surgical treatment between 2006 and 2013, were evaluated. We included patients aged >18 years who had acetabular posterior wall or posterior wall and column fracture. Patients with anterior column and associated fracture or complex fracture (anterior wall, anterior column, transverse, anterior column/wall or hemitransverse, transverse and posterior wall, T-shaped, and both column fractures), degenerative arthritis of the hip joint, systemic inflammatory disease, history of surgical intervention, open fracture, or vascular injury on admission were excluded along with those who were conservatively treated. After applying the inclusion and exclusion criteria, 52 patients were included in this study. The patients were divided into 2 groups: group I, patients aged <40 years (n = 25) and group II, patients aged >40 years (n = 27). The Judet–Letournel radiological classification was used for the radiological classification of fractures.

A displacement of >2 mm, an unstable hip joint, and the presence of free fragment in the joint were surgical indications. The Kocher–Langenbeck approach was employed in the operations (18). The patients were followed-up with at postoperative 2 weeks, 6 weeks, 6 months, 1 year, and yearly thereafter. Physical examination and radiographic examinations were performed. The modified Merle D'Aubigne clinical assessment score was used in the clinical evaluation, and Matta's radiological measurement score was used in the radiological evaluation at the last follow-up visit. The Brooker scoring system was employed in the evaluation of heterotropic ossification.

Surgical technique and follow-up

In the Kocher–Langenbeck approach, patients were placed in the lateral decubitus or prone position with the hip extended and the knee flexed. The incision started at the spinal iliac posterior superior, extending over the greater trochanter along the shaft of the femur (12–20 cm distally) (19) while ipsilateral knee is flexed to 90° flexion to decrease the tension on the sciatic nerve. After dissection of the trochanteric bursa, the raphe between the upper one-third and lower two-thirds of gluteus maximus muscle was palpated. The dissection was proceeded in this interval. Short external rotators were released after tagging. In the presence of isolated posterior wall fractures, no additional dissection was performed. Obturator internus was elevated if posterior column is fractured or palpable exposure of quadrilateral plate is needed.

After fracture reduction, a 3.5-mm reconstruction plate and cannulated screws were used for internal fixation. Fractures involving the posterior column were treated by placing the shaped plate on the pelvic rim, with compression screws extending to the posterior column. Weight bearing was restricted at least 6 weeks postoperatively. Full weight bearing was allowed at the third postoperative month.

Thromboembolic prophylaxis was performed because pelvic, acetabular, and hip fractures were risk factors for venous thromboembolic events. Indomethacin at a dose of 75 mg per day for 6 weeks was administered as prophylaxis for heterotopic ossification.

Complications of the approach included deep infection (2–5%), sciatic nerve paralysis (3–5%), and heterotopic ossification (8–25%). The incidence of venous thromboembolic events after acetabular and pelvic fractures has been reported to be up to 61%. In this group, 2% of deaths due to pulmonary embolism were reported in those without prophylaxis. Avascular necrosis due to abductor arm limp (superior gluteal artery or nerve) or circulatory disruption of the femoral head (medial femoral circumflex artery) may also occur if neurovascular structures are not dissected carefully (18,20-23).

Statistical analysis

Mean, standard deviation, highest and lowest median, frequency, and ratio were used in the descriptive statistics of the data. The Kolmogorov–Smirnov test, Mann–Whitney U test, and Chi-square test were used to analyze the distribution of the variables, independent quantitative data, and qualitative data, respectively.

The SPSS 22.0 (IBM Corp., Armonk, NY, USA) program was used in the analyses. Significance level was set at 0.05.

RESULTS

Patient demographics are summarized in Table 1. All patients with posterior fracture dislocation underwent closed or open reduction on the same day.

The mean length of hospital stay was 3 days (1–7 days) for group I and 4 days (2–9 days) for group II ($p>0.05$). Eight patients (15.38%) required intensive care treatment postoperatively. According to Judet- Letournel classification, 20 patients (80%) had posterior wall fracture and 5 patients (20%) had posterior column fracture in group 1. However, 23 patients (85.2%) had posterior wall fracture and 4 patients (14.8%) had posterior column fracture in group 2 ($p>0.05$). The mean time from injury to surgery was 2.1 ± 2.3 days in group 1 and 2.0 ± 1.9 days in group 2 ($p>0.05$).

Table 1. Patient demographics in two groups

	Group I	Group II
Male	24 (%96)	23 (%85.1)
Female	1 (%4)	4 (%14.9)
Mean age	31.1	53.3
Mean follow-up	35.7	36.8
Right acetabulum	56%	55%
Left acetabulum	44%	45%
Traffic accident	84%	74%
Fall from height	16%	26%
Posterior fracture dislocation	8 (%32)	4 (%14.8)
Posterior fracture dislocation posterior wall	7 (%87.5)	4 (%100)
Posterior fracture dislocation posterior column	1 (%12.5)	0%

The modified Merle D'Aubigne's clinical outcome distribution did not differ significantly between groups I and II ($p>0.05$). Similarly, the distribution of Matta's radiological results did not differ significantly between the groups ($p>0.05$) (Table 2).

In the postoperative period, only 1 superficial infection was observed in group I (4%), which healed with debridement and intravenous antibiotic treatment. No infection was found in any of the group II patients. Postoperative deep vein thrombosis (DVT) had developed in 3 patients (11%) in group II. No postoperative DVT was noted in any of the patients in group I. Ten (40%) patients in group I and 7 in group II had additional injuries (26%) (Table 3).

Avascular necrosis was not observed in any of the patients at the last follow-up. However, preoperative sciatic nerve paralysis was observed in 2 patients (8%) in group I and 1 patient (3.7%) in group II. Postoperative sciatic nerve injury did not develop in any of the patients.

Table 2. Merle D' Aubigne and Matta scores of Group 1 and 2

		Group 1 (Age ≤ 40)		Group 2 (Age 40)		p
		n	%	n	%	
Merle D'Aubigne Clinical score	Moderate	4	16%	7	26%	0.556
	Good	15	60%	16	59%	
	Excellent	6	24%	4	15%	
	Worse	0	0%	1	4%	
Matta Radiological score	Moderate	3	12%	8	30%	0.068
	Good	13	52%	11	41%	
	Very good	9	36%	7	26%	

Table 3. Additional Injuries of two groups

Group I Additional injuries	Patients	%	Group II Additional injuries	Patients	%
Fibula fracture	2	8	Tibial fracture	2	28.5.
Femoral fracture	1	4	Sacroiliac separation	1	14.2.
Distal radius fracture	4	16	Sacrum fracture	1	14.2.
Trochanter major fracture	1	4	Clavicle fracture	1	14.2.
Patella fracture	1	4	Calcaneal fracture	1	14.2.
Clavicle fracture	1	4	Lumbar vertebral fracture	1	14.2.
Total	10	40		7	%25.9

Of the 3 patients who developed preoperative sciatic nerve paralysis, 2 had nerve healing within 6 and 8 months, whereas no improvement was observed in 1 patient.

Postoperative heterotopic ossification developed in 4 patients (16%) in group I and 5 patients (18.5%) in group II (Brooker type I in 7 patients and Brooker type III in 2 patients). Moreover, 1 patient (group II) with Brooker type III heterotopic ossification had undergone trochanteric osteotomy, and 1 patient (4%) in group I and 2 patients (7.4%) in group II had posterior fracture dislocation during trauma. None of the patients required surgical treatment for heterotopic ossification.

No significant difference in the development of postoperative heterotopic ossification was found between the groups (p>0.05) (Table 4).

In the last radiological examinations, the narrowing and sclerosis rate was 12% (3 patients) in group I and 25.9% (7 patients) in group II (p>0.05). Clinical outcomes and range of motion parameters were not significantly different between patients with and without narrowing and sclerosis (p>0.05).

Table 4. Brooker Classification of two groups

Brooker Classification				
Stage	**Group I**	**Group II**	**Women**	**Man**
I	3	4	2	5
II	_	_	_	_
III	1	1	_	2
IV	_	_	_	_
Total	4	5	2	7

DISCUSSION

Acetabular fractures are typically caused by high-energy indirect traumas, and traffic accidents are the most common cause (50–70%). These fractures may be present in 50% of concomitant systemic and other orthopedic injuries (24). Consistent with the literature, acetabular fractures due to high-energy trauma were observed in this study. The patients had traffic accidents (group I, 21 [84%]; group II, 20 [74%]) and fell from height (group I, 4 [16%]; group II, 7 [26%]).

Accurate classification and evaluation of acetabular fractures are possible with pelvic anteroposterior radiographs, standard oblique radiographs (obturator and iliac oblique), and computed tomography images (13). The work of Judet and Letournel started the anatomical classification of acetabular fractures, which is currently accepted and used by most studies on acetabular fractures (25). In this study, the Judet–Letournel classification system was employed because it is commonly used and could be easily understood.

In the largest study to date on the risk factors associated with secondary hip osteoarthritis after acetabular fracture reported by Tannat et al., patient age, femoral head lesion, and posterior wall involvement were found to be significantly associated with secondary osteoarthritis (12). In our study, the rate of joint narrowing and sclerosis was 12% in group I and 25.9% in group II. None of the patients had lesions on the femoral head. Moreover, in our study, despite the narrowing of the joint cavity and sclerosis, which started in the early period in some patients based on radiologic evaluation during the follow-up, and contrary to the radiological appearance, the patients exhibited no pain or functional deficit in the early period.

Surgery should not be delayed for more than 10 days if subluxation is noted after reduction or a free fragment is detected in the joint; a delay of more than 10 days could complicate the reduction. Thus, most surgeons prefer operating on the second and eighth posttraumatic days (26). In our study, the operations were performed on the first and ninth days, and reduction was relatively more difficult in patients with surgery delayed by >5 days.

The advantages of the prone position were easier fracture reduction because of the weight of the hip, better visualization of the soft tissues, easier traction, easier quadrilateral surface palpation, and greater sciatic notch clamping (10,13,18,24). The disadvantage of the prone position was that surgical dislocation of the hip by trochanteric osteotomy could not be performed or converted into an extensile approach (18,27). The lateral decubitus position is more familiar to most orthopedic surgeons because of arthroplasty surgery and easy adaptation. A special traction table is not needed for this, and there is always a chance to return to surgical dislocation and extensile approach if desired (10,13,27).

In our clinic, the Kocher–Langenbeck approach was performed in the lateral decubitus position in all fractures, with the hip extended and the knee flexed. This approach is often used for isolated posterior wall and posterior column fractures and provides a good field of view of the posterior column and retroacetabular surface.

In the study of Lehmann et al., which included 1375 patients, nerve paralysis was observed in 4% of the patients before hospitalization and in 7% after discharge.

They reported that the risk of nerve paralysis is doubled in patients with acetabular posterior wall and column fractures, who underwent the Kocher–Langenbeck approach (28). In our study, we did not assess for intraoperative somatosensory evoked potentials. Nonetheless, to protect the sciatic nerve, we aimed to keep the hip extended and the knee flexed during the operation, and we carefully isolated the sciatic nerve and inserted the retractor; no postoperative sciatic nerve injury was observed.

The highest infection rate in acetabular fractures is reported to be 19%; however, in most studies, the infection rate is between 4% and 5% (29). Letournel and Judet reported postoperative infection in 56 patients (4.2%) in their study (13). In our study, the infection rate was 5.8%, which is consistent with that in the literature.

Orthopedic surgeons have developed a combined protocol for prophylaxis against DVT. Pulsatile mechanical prophylaxis is used in all patients from the day of admission Low-molecular-weight heparin (LMWH) is administered within 12 h after the patient has been stabilized (30). In our study, LMWH was started within 12 h after stabilization of the patients. Postoperative DVT developed in 3 patients (11%) in group II, whereas group I patients had no postoperative DVT.

Avascular necrosis, which is another late complication, usually correlates with the extent of posterior dislocation. The rate of this complication increases in cases with delayed reduction and in some cases with arthrosis (31). In our study, 12 acetabular fractures with posterior dislocation were treated immediately in the emergency department. Thus, no avascular necrosis occurred in both groups.

Moreover, heterotopic ossification occurs in all major hip surgeries and in complicated acetabular fractures operated with wide exposures. Although heterotopic ossification is common, it rarely causes functional disorders requiring surgical excision (32). Firoozabadi et al. applied the Kocher-Langenbeck approach to acetabular fractures in 312 patients, and none of the patients received indomethacin prophylaxis. However, 38 of these patients had Brooker III and IV heterotopic ossification. They found that the most important risk factor for the occurrence of heterotopic ossification is mechanical ventilatory support (33). In our study, prophylaxis treatment was not performed in all of the 52 patients. Heterotopic ossification was observed in 4 (16%) patients in group I and 5 (18.5%) patients in group II; nevertheless, none of the patients required surgical excision. The Kocher–Langenbeck approach was used in all patients with heterotopic ossification. Moreover, no patient with heterotopic ossification had a history of postoperative follow-up in the intensive care unit.

Furthermore, an important late complication of acetabular fractures is osteoarthritis. The occurrence of arthritis could be attributed to the amount of residual displacement after reduction as well as the damage caused by trauma or subsequent collapse of the joint cartilage. Multi-part fracture, localization, and age over 40 years have been shown to be additional predisposing factors in the literature (34). In our study, radiological signs of osteoarthritis were noted in 1 patient in group II (3.7%), whereas no radiological signs of osteoarthritis were found in group I.

Most authors report that clinical outcomes are often better than radiographic results. Although radiographic arthritis findings begin prominent earlier, the patient's complaints appear later than this. However, there is no significant difference in long-term follow-up durations (35). In this study, 12% of patients in group I and 25.9% in group II had no early clinical pain despite the narrowing of the joint space and sclerosis.

Outcomes of surgical treatment of acetabular fractures are closely related to reduction quality, operation time, surgical team experience, and patient age (36). In our study, no significant difference in reduction quality and clinical and radiological findings between patients aged <40 years and those aged >40 years was observed.

Letournel et al. (17) reported a clinical surgical success rate of 84%. Ridder et al. (8) reported a clinical surgical success rate of 75%. Liebergall et al. (36) reported that they achieved a clinical success rate of 77%. In the study by Asik et al. that included 240 patients with acetabular fractures, long-term clinical evaluation after surgery, with an average of 11 years of follow-up, showed that 80% had good and excellent, 5% had moderate, and 15% had poor outcomes. In the same study, 66.7% had good and excellent, 44% had moderate, and 15% had poor radiological assessment results (37). According to Matta, obtaining an anatomical reduction in patients aged >40 years is more difficult. The chance of achieving clinically excellent and good results is 68% among those aged >40 years and 81% among those aged <40 years (10).

In our study, the rate was very good and clinically good in 84% of group I and 74% of group II patients for the clinical evaluation and in 88% of group I and 70% of group II patients for radiological assessment.

Papadakos et al., in their study of 71 patients with an average age of 67 years, including 573 acetabular fractures, showed a high incidence of such fracture type and indicated that more difficult treatment decisions should be made and that treatment is technically more challenging (38).

In our study, the Merle D'Aubigne clinical outcome distribution did not differ significantly between groups I and II ($p>0.05$). The distribution of Matta radiological results also showed no significant difference between the groups ($p>0.05$).

Relatively small number of patients and multiple surgeons that performed operations are the limitations of this study.

CONCLUSION

In conclusion, clinical and radiological outcomes are not different between patients younger and older than 40 years. However, the clinical outcome scores are better in patients aged <40 years.

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