

## Surgically treated fractures of the acetabulum; clinical and radiological results of eighty-three patients

Fractures of acetabulum

Ahmet Mert<sup>1</sup>, Burçin Karlı<sup>2</sup><sup>1</sup>Department of Orthopedics and Traumatology, 25 Aralık State Hospital<sup>2</sup>Department of Orthopedic Surgery, Gaziantep University Hospital, Gaziantep, Turkey

### Abstract

**Aim:** The aim of our study was to examine the clinical outcomes and radiological results of acetabular fractures that were followed up and treated in our clinic. **Materials and Methods:** The age, gender, accompanying injuries, fracture mechanisms, Judet-Letournel fracture classification, surgical incision and complications of patients admitted to our clinic with acetabular fracture were recorded. Patients with open fractures of the acetabulum, those who were not operated with an ilioinguinal approach, and those who were followed up conservatively were excluded from the study. All patients were evaluated according to the Matta scoring system and Modified Merle d'Aubigné Criteria.

**Results:** The study included 83 patients who were followed up and treated for acetabular fracture and who were operated with ilioinguinal incision, posterior approach (Kocher-Langenbeck) and combined surgical approaches. The reduction was anatomical in 67 (80.7%) patients, fair in 12 (14.4%) and poor in 4 (4.8%) patients according to the Matta Reduction Criteria. According to the Modified Merle d'Aubigné Criteria, 46 (55.4%) patients had an excellent clinical outcome, 26 (31.3%) patients had a good clinical outcome, 7 (8.4%) patients had a fair clinical outcome, and 4 (4.8%) patients had a poor clinical outcome. There was a significant correlation between the obtained radiological results and clinical outcomes ( $p < 0.001$ ). In the analysis performed by age, it was found that the clinical outcomes of the patients over 45 years of age were statistically worse than those of the patients under 45 years of age ( $p = 0.05$ ). It was found that there was a significant correlation between reduction quality assessment performed on the postoperative radiographs of the patients and the clinical outcome ( $p < 0.001$ ).

**Discussion:** Acetabular fractures are difficult to treat; ensuring anatomical reduction should be the primary goal, and this may be reflected in clinical outcomes and radiological results of patients.

### Keywords

Acetabulum fracture; Pelvis; Multitrauma; Ilioinguinal

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Corresponding Author: Ahmet Mert, Değirmişem Mahallesi, Maraşal Fevzi Çakmak Blv. No:38, 27090 Şehitkamil, Gaziantep, Turkey.

E-mail: rparldar@yahoo.com P: +90 5079914462

Corresponding Author ORCID ID: <https://orcid.org/0000-0001-5111-2051>

## Introduction

Acetabular fractures are difficult to deal with compared to other orthopedic traumas. Anatomical restoration and reconstruction of the joint line is one of the cornerstones of treatment. It has been reported that fractures, where anatomical reduction can be achieved well during operation, have much better clinical outcomes [1]. The ilioinguinal approach, an anterior surgical approach, described by Judet and Letournel has been the main approach in surgeries involving the anterior part of acetabular fractures for years [2-3]. In the literature, anatomical reduction rates have been shown to be 45-74% in patients undergoing surgery after the ilioinguinal approach [4-5]. At the same time, acetabular fractures involve not only the anterior part, but can also present to the emergency department as fractures requiring posterior approaches. Kocher-Langenbeck (K-L) approach is recommended for the reduction and internal fixation of fractures of both anterior and posterior columns in treating transverse with or without posterior wall fractures of the acetabulum [6]. In some cases, acetabular fractures cannot be adequately treated with the use of anterior or posterior approaches alone, and in such a case, combined procedures are preferred. In addition, acetabular fractures are caused by high-energy injuries and may be accompanied by other organ and system injuries. In the literature, it is seen that acetabular fractures are accompanied by lower extremity fractures in approximately 36% of cases [7].

The aim of our study was to demonstrate the clinical and functional outcomes of acetabulum fractures in patients who were admitted to our clinic with different injury mechanisms and treated with the ilioinguinal, Kocher-Langenbeck approach, and combined approaches.

## Material and Methods

The study was approved by Gaziantep University Institutional reviewer board. Informed consent form was received from the patients. The study included 83 patients who were followed-up and treated in our clinic for acetabular fracture between 2009-2015. This study was a single-center study. The age, gender, accompanying injuries, fracture mechanisms, Judet-Letournel fracture classification, surgical incision, and complications of patients were recorded. Patients with open fractures of the acetabulum, those who were not operated with an ilioinguinal approach, and those who were followed up conservatively were excluded from the study.

The patients were evaluated with X-ray and pelvic CT at their first admission to the emergency department. Skeletal traction was applied to all patients on the side of acetabular fracture. The patients' follow-up was performed with standard anterior-posterior pelvic radiographs and Judet radiographs (Judet view). The ilioinguinal surgical incision was used in all patients as an anterior intrapelvic approach. The Kocher-Langenbeck approach was used for fixation of fractures involving the posterior acetabulum in patients with an additional injury. The quality of the reduction was checked by taking intraoperative fluoroscopy images of all patients. All operations were performed by the same surgeon. In the follow-up of the patients, the additional surgery requirement for acetabular fracture was recorded.

The patients started passive in-bed exercise to the extent that

they could tolerate on the first postoperative day. All patients were mobilized using crutches without stepping on their feet for early mobilization after surgery. They were forbidden to load their fractured side for two months. Low-molecular-weight heparin treatment was administered for deep vein thrombosis prophylaxis so as to be completed to one month postoperatively. The clinical evaluations of the patients were performed according to the Modified Merle d'Aubigné Criteria, while radiological evaluations were performed using the Matta's radiological staging system [8].

## Statistical Analysis

The categorical data were expressed as numbers and percentages, while the numerical data were expressed as mean and standard deviation. The Shapiro-Wilk test was used for testing the normality of numerical data. The relationship between categorical variables was analyzed with the Chi-square test. The SPSS 22.0 software package was used for the analyses. For all analyses, a p-value of <0.05 was considered statistically significant.

## Results

The study included 83 patients who were followed-up and treated for acetabular fracture and who were operated with ilioinguinal incision, posterior approach (Kocher-Langenbeck), and combined surgical approaches. Sixty-seven patients were female, and 16 were male. The mean age was 34.6 (15-86 years) years, and the mean follow-up period was 33.3 months (8-85 months). The mean time to surgery was 5.6 days (1-26 days). Thirty-eight of the patients had one or more fractures accompanying acetabular fracture (45.7%) (Figure 1). When the mechanism of fractures the patients was analyzed, it was found that 33 patients had fractures due to a non-vehicle traffic accident (39.8%), 29 had fractures due to falls from height (34.9%), 16 had fractures due to an in-vehicle traffic accident (19.3%), 4 had fractures as a result of a heavy object falling (4.8%), and 1 had a fracture as a result of an assault (1.2%).

When the fracture configurations were analyzed according to the Judet-Letournel classification, the most common fracture type was found to be anterior column fracture with 16 (19.2%) patients. Anterior column fracture was followed by posterior wall fracture with 15 (18%) patients, and double column acetabular fracture with 12 (14.4%) patients, T-type fracture with 11 (13.7%) patients, transverse+posterior wall fracture with 10 (12.5%) patients, anterior wall fractures with 6 (7%) patients, transverse fracture with 5 (6%) patients, anterior column + posterior hemitransverse fracture with 4 (5%) patients, and posterior column fracture with 3 (3.7%) patients. The least common fracture type was the combined fracture of the posterior wall and posterior column, in addition to anterior fractures. There were no bilateral acetabulum fractures.

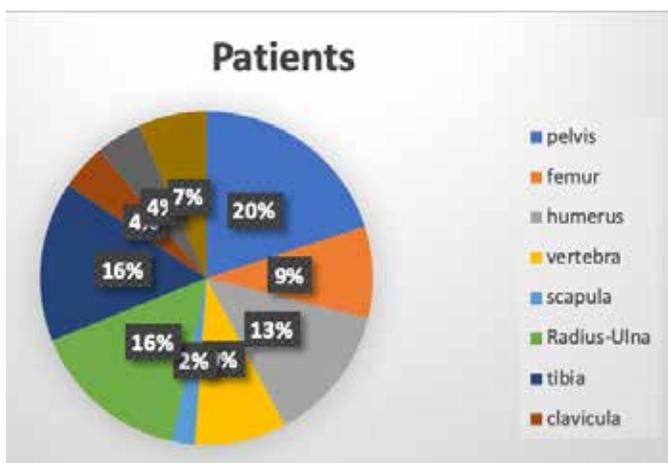
When the surgical intervention of the patients was analyzed, 38 (45.7%) of 83 patients were operated with an anterior ilioinguinal approach alone, while the Kocher Langenbeck surgical approach alone was preferred for 27 (32.5%) patients. The surgery of 18 patients with complex fractures (21.6%) was performed by combining the ilioinguinal approach with the Kocher-Langenbeck approach. Reduction was anatomical in 67 (80.7%) patients, fair in 12 (14.4%) and poor in 4 (4.8%)

patients according to the Matta Reduction Criteria.

An evaluation was performed on the pelvic x-rays taken at the last follow-up of the patients based on the Matta's Radiological Staging System. According to the Matta's Radiological Staging System, 59 (71%) patients had an excellent outcome, 11 (13.2%) patients had a good outcome, 5 (6%) patients had a fair outcome, and 8 (9.6%) patients had a poor outcome. According to the Modified Merle d'Aubigné Criteria, 46 (55.4%) patients had an excellent clinical outcome, 26 (31.3%) patients had a good clinical outcome, 7 (8.4%) patients had a fair clinical outcome, and 4 (4.8%) patients had a poor clinical outcome. After statistical analysis, it was found that there was a significant correlation between reduction quality assessment on the postoperative x-rays of the patients and clinical outcomes ( $p < 0.001$ ). No patient underwent total hip arthroplasty during the follow-up period.

All patients were classified according to the Matta Radiological Scoring System based on the radiographic findings obtained in their last follow-ups. There was a significant correlation between the obtained radiological results and clinical outcomes ( $p < 0.001$ ). In the analysis performed by age, it was found that the clinical outcomes of patients aged over 45 years were statistically worse than those of patients under 45 years of age ( $p < 0.05$ ).

Union was achieved in all 83 patients analyzed. Postoperative peroneal nerve injury was observed in 5 patients who underwent posterior intervention. All of these improved during follow-ups. In 1 patient who underwent anterior ilioinguinal surgery, wound infection was observed by the 5th postoperative day. The patient healed with debridement and antibiotherapy.



**Figure 1.** Accompanying Fractures

## Discussion

In our study, we analyzed the results of fracture analyses, radiological results and clinical outcomes, as well as additional injuries of 83 patients presented to our clinic with acetabular fractures. In our study, we achieved an anatomical reduction in 80.7% of the patients and excellent clinical outcomes in 55.4% of the patients.

There are many negative predictive factors that affect the results of acetabular fractures. These can be defined as such factors as non-anatomical reduction, femoral cartilage lesion, marginal impaction, delayed reconstruction, and keeping

the dislocated hip for more than 6 hours [1-9, 10,11]. Almost all types of acetabular fractures were included in our study. Furthermore, the results were evaluated based on Matta's radiological scoring system.

If a good restoration of the hip joint is not achieved after acetabular fractures, patients may require hip arthroplasty in the future. In the literature, it is reported that the requirement for total hip replacement increases by 25 times after acetabular fractures [12]. No patient underwent total hip arthroplasty during the follow-up period in our study. However, as the follow-up duration prolongs, we think that the patients with poor outcomes may require arthroplasty.

In our study, an ilioinguinal approach was preferred for acetabular fractures requiring anterior fixation. The clinical outcomes of the patients were reported to be good as a result of the fixation of the anterior wall, column, and even both columns with the ilioinguinal approach [13-14]. We used the ilioinguinal approach for anterior acetabular fracture fixation in 45 of 83 patients who participated in our study.

Acetabular fractures are also a problem for elderly patients. There are some authors recommending arthroplasty for elderly patients whose anatomical reduction cannot be achieved [15]. It has also been reported that acetabular fractures have poor outcomes in elderly patients [16]. Although the mean age of our patients in the study was low, we statistically determined that the outcomes of our patients over 45 years of age were worse than those of the patients under 45 years of age. And this shows that the outcomes of acetabular fractures are not very satisfactory with increasing age.

Patients with additional injuries were also included in our study. The complication rates, prolonged length of stay and re-admissions increase in patients with additional injuries accompanying acetabular fracture [17]. We did not compare the results of both groups, and we think that this may be the subject of another study. Also, patients with open fractures were not included in our study. Additional injuries were not classified, for example, whether the additional tibial fracture lengthened the hospital stay or increased complications, we do not know. In the literature, it is indicated if there is an additional fibula fracture with a tibial fracture that could affect the healing time [18], but in our study, we only investigated whether the patients had additional injuries or not.

Also, fractures around the pelvis like femur proximal fractures were not evaluated if these fractures affect the results. A study that comparing of two implants that can be used for proximal femoral fractures shows that proximal femoral fractures have problems in the healing process [19]. Thus, if these problems occur, the results can be changed.

Our study had some limitations. Firstly, our patients were heterogeneous. Thus, we did not evaluate a single fracture group. Our study included all types of acetabular fractures. Secondly, our study contained retrospective data. Although having a large number of patients was an advantage, patients could be grouped separately. Patients with additional injuries were included in the study; and, it is not clear how they affected the outcomes. Thirdly, the results of both the anterior and posterior approaches, as well as combined approach results were evaluated together. All of them could be evaluated separately,

and their results could be compared among themselves.

Acetabular fractures are difficult to treat and are accompanied by additional injuries; however, when anatomical reduction can be achieved, these fractures have satisfactory results. We believe that our study will contribute to the literature by demonstrating the outcomes of acetabular fractures thanks to a broad patient profile.

#### Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

#### Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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#### Conflict of interest

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