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ORIGINAL ARTICLE

Clinical outcome of surgically treated displaced acetabular fractures with central dislocation using combined anterior and medial plating

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ABSTRACT

Aim Acetabular fractures are complex articular fractures with a big challenge for orthopaedic surgeons. Surgically managed displaced fractures carry favourable outcomes, especially if the articular surface is reduced accurately. This study aims to assess the clinical outcomes of surgically fixed displaced acetabular fractures with central dislocation using combined anterior and medial plating.

Methods We have retrospectively evaluated sixteen patients, who had surgically managed displaced acetabular fractures with central dislocation at our institute. All patients underwent open reduction and internal fixation using combined anterior and medial plating via the Kocher-Langenbeck, the ilioinguinal, or the Stoppa approach. The functional outcome was assessed using the Harris Hip score.

Results Our study includes sixteen patients (12 males, 4 females) with a mean age of 35 years (range: 15-53 years). The mean follow-up was 7.8 years (range: 5-13 years). Functional outcomes were good to excellent in 12 (80%) patients and fair in 3 (20%) patients. At the final follow-up, the solid union had been achieved in all fractures, the mean HHS was 88.84 ± 7.61.

Conclusion Early reduction and surgical fixation of displaced acetabular fractures with central dislocation using combined anterior and medial plates appear to have good clinical outcomes.

Keywords: acetabular, bone, plates, displaced fractures

INTRODUCTION

Acetabular fractures are fractures of the acetabulum, which is a part of the pelvis that forms the socket of the hip joint. Displaced acetabular fractures with central dislocation refer to fractures that involve the central portion of the acetabulum and result in displacement of the femoral head (the ball-shaped end of the thigh bone) out of the acetabulum (1–3).

Surgical treatment of displaced acetabular fractures with central dislocation often involves the use of internal fixation, which involves the use of screws, plates, and/or rods to hold the bone fragments in place while they heal. One surgical technique that has been used for this purpose is the combined anterior and medial plating, in which screws and plates are used to fix the bone fragments in place from both the front and the side of the acetabulum (4,5).

Management of displaced acetabular fractures is among the most challenging fractures because of the complicated structure of the pelvis, the close relation to vital structures, and the requirement to restore good anatomic reduction of the hip articular surface. Young and productive populations sustain most acetabular fractures because they are more susceptible to high-energy traumas and road traffic accidents, so conserving the native

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functional hip joint is challenging in these cases to preserve life quality (3).

Although many factors, such as pre-existing comorbidities, are implicated in the clinical outcomes, the quality of articular reduction appears to be the foremost one (3,6,7). Surgical fixation of displaced acetabular fractures became the mainstay of management about sixty years ago since Judet et al. and Letournel et al. have published their work. They classified acetabular fractures based on bicolumnar support (8,9). Judet divided acetabular fractures into five elementary and five associated patterns. However, a large proportion of acetabular fractures could not be classified by this system (10). In general, approaches to fix acetabular fractures are divided into anterior approaches (Ilioinguinal or Stoppa), posterior approach (Kocher-Langenbeck), extensile approach (Extended iliofemoral), and combined approaches (11,12). There is an ongoing debate regarding the comprehensive classification of acetabular fractures associated with central hip dislocation. Moreover, there is a lack of consensus regarding optimal surgical approaches, and outcomes in acetabular fractures with central hip dislocation (13). The aim of this study was to investigate the clinical outcomes of using combined anterior and medial plating for the fixation of displaced acetabular fractures with central dislocation.

PATIENTS AND METHODS

Patients and study design

This retrospective cohort study was conducted at the Orthopaedic Department of King Abdullah University Hospital, Jordan University of Science and Technology, in Irbid north Jordan. This study reviewed a total of sixteen patients with displaced acetabular fractures with central dislocation that were presented to our institution between 2013 and 2021. They were surgically treated by the same pelvic surgeon using combined anterior and medial plates. Cases were reviewed retrospectively through documented clinical notes and imaging. Anatomical reduction and rigid surgical fixation as soon as possible were our target to restore early functional status.

Ethical approval for this study was obtained from the Institutional Review Board (IRB) Committee before conducting the study (protocol code GM7601, IRB Approval number 43/152/2022, Date 25/10/2022). The study was performed in accordance with the principles of the Declaration of Helsinki, 1975.

Methods

Fractures were classified according to the Judet et al. (9) and Letournel et al. (14) classification system using conventional radiographs (anterior-posterior pelvis and oblique views) and computed tomography with 3D reconstruction. Only closed displaced central fractures with dislocation with more than 2 mm displacement were included. Prophylactic enoxaparin as prevention of venous thromboembolism started for all patients upon admission and continued for 30 days after surgery. After anaesthesia induction, a prophylactic dose of cefazolin was given and continued for two days. Indomethacin was given as a prophylactic of heterotopic ossification. Fractures were approached either by Kocher-Langenbeck, the ilioinguinal approach (15), or Stoppa approach (11). The chosen approach was based on the fracture pattern and soft tissue status. Following fracture exposure, open reduction and accurate articular surface congruency was achieved by placing the femoral head at the acetabulum and restoration of all five anatomical radiographic lines of the hip joint then internal fixation using combined anterior 3.5 mm contoured reconstruction plates and medial pre-contoured quadrilateral plates. Intraoperative fluoroscopy and postoperative radiographs confirmed the results. Patients visited the outpatient clinic regularly postoperatively at six weeks, three months, six months, one year, and then every year with good clinical assessment and conventional radiographs on each visit. Computed tomography was only conducted when complications were suspected. At the final follow-up, functional outcomes were assessed using the Harris Hip Scoring system (HHS), which depends on four parameters which are: pain (forty-four points), function (forty-seven points), range of motions (five points), and deformity absence (four points). Normal HHS is 100, scores < 70 are poor, 70-79 are fair, between 80-89 are good, and > 90 are excellent (16).

Statistical analysis

Case characteristics were summarized using descriptive statistics, including the mean (SD), or median (minimum-maximum) for continuous variables.

RESULTS

Sixteen patients were included (12 males, four females) with a mean age of 35 years (range: 15-53 years). The mean follow-up was 7.8 years (range: 5-13 years). A road traffic accident was the cause of the fracture in 13 (81.25%) patients. The right acetabulum was involved in 11 (68.75%) and the left one in five (31.25%) patients. Most of them were simple fractures, 10 (62.50%), while six (37.50%) patients had associated fractures. Fractures distribution was as follows: five transverse acetabulum fractures, five anterior column fractures, four both column fractures, one transverse with posterior wall acetabular extension fracture, and one T-shaped acetabular fracture. Transverse and anterior column acetabular fractures were the most common, followed by both column fractures. Twelve (75%) fractures were operated upon within the first week. The mean (SD) time to surgery was 5.88 (3.64) (range 1-12) days. The mean (SD) hospital stay was 11.66 (6.39) (Range 5-28) days (Table 1). The mean (SD) HHS score was 88.84 (7.62) points.

Table 1. Demographic and preoperative characteristics of 16 patients

Variable	Value
Mean age (years) ±SD	37.2±13.05
	Number of patients
Gender: male/female	24/6
Side: right/left	11/5
Mechanism of injury	
Traffic accident	13
Fall from height	3
Fracture Pattern	
Simple	11
Associated	5
Mean time to surgery (days) ±SD	5.9±4.71
Mean hospital stay ± SD (days)	11.9±6.40

Functional outcomes using HHS were classified good to excellent in 12 (80%), excellent in eight (53.33%), good in four (26.66%), and fair in three (20%) patients. Based on age groups, all patients between 15-24 years were classified excellent. Two patients classified fair were in the age group 25-34 years, and one in the age group 35-44 years. Two patients in the age group 45-54 years were classified as good, and two were classified as excellent (Table 2).

No patients had a poor HHS score. Complications were limited. Only two (12.50 %) patients had superficial surgical site infections treated successfully with intravenous antibiotics. One (6.25%) patient died from saddle pulmonary embolism and another one (6.25%) had post-traumatic osteoarthritis. Most patients underwent an ilioinguinal approach, 10 (62.5%), four patients underwent a Kocher-Langenbeck approach, one patient underwent a Stoppa approach, and one patient had a minimally invasive ilioinguinal approach (Figure 1,Figure 2).

DISCUSSION

Open reduction and internal fixation are the standard surgical modality for acetabular fractures with displacement (17). It is related to the fact that reduction quality and reconstruction of the articular surface is the most crucial factor in reducing complications (18), so stable and accurate anatomical reduction is the aim of pelvic surgeons to reduce complications (19). Outcomes and complications are affected by modifiable and non-modifiable factors. Patient age, fracture pattern, mechanism of injury, femoral head injury, and sciatic nerve damage are non-modifiable factors. In contrast, the quality of reduction and fixation, the timing of surgery, and surgical approach selection are modifiable (20).

Surgical management of fractures as soon as possible appears to have an essential role in having better functional and radiographic outcomes. In our study, all patients were operated on within twelve days; ten of them were operated within only seven days. Delayed fixation is related to more complex anatomical reduction due to scar tissue formation between bony fragments and early callus (21,22). Mear et al. study of 424 acetabular fractures showed that achieving anatomic reduction was significantly better in fractures operated within eleven days than in fractures treated beyond that (23). A study of 207 patients whose surgery was delayed beyond twenty-one days showed a decrease in good to excellent outcomes (24). Johnson et al. have studied 259 patients operated on within twenty-one days; a significant difference between patients who were operated on within fourteen days and beyond that; patients who had operations within 14 days of injury had better outcomes (25). However, Madhu et al. found a significant difference in operations after five and ten days for associated fractures for radiological and functional outcomes, respectively (22). Our patients were operated on early; this might have a role in the good outcome according to HHS with an average of 88.24 we obtained.

Younger patients have more favourable outcomes, according to Liebergall et al and Matta et al. According to the authors, patients younger than forty had statistically better outcomes (3,25,26). Getting older increases the likelihood of osteoporotic bone, which contributes to difficult reduction. In our study, only four patients were

Table 2. Functional outcome according to age groups using Harris Hip Scoring (HHS) system*

Age groups (years)	No of patients	Excellent	Good	Fair	Poor
15-24	2	2	0	0	-
25-34	6	3	1	2	-
35-44	2	1	0	1	-
45-54	4	2	2	0	-
55-61	1	0	1	0	-
Total	**15**	**8 (53.3%)**	**4 (20%)**	**3 (20%)**	**0**

*The mean (SD) HHS score was 88.84 (7.62) points
Normal: 100, poor: <70, fair: 70-79, good: 80-89, excellent: >90

Figure 1. X-ray of a 39-year-old female patient with HHS of 97.5 showing excellent outcome. A) before operation at presentation (AP view); B) seven months post-operation (AP view,); C) lateral view at the same visit (King Abdullah University Hospital, 2017)

Figure 2. X-ray of 70-year-old male patient at with HHS of 87.1 showing good outcomes. A) a patient before operation at presentation (AP view); B) on one-year post-operation (AP view) (King Abdullah University Hospital, 2018)

above the age of forty. The oldest one was fifty-three years old, and none of them had osteoporosis. All fractures were reduced anatomically with satisfactory radiological reduction and good outcomes.

The clinical outcome of surgically treated displaced acetabular fractures with central dislocation using combined anterior and medial plating has been studied in several reports (27); this surgical technique is associated with good to excellent clinical results in the majority of cases, with low rates of complications, such as infection and nonunion. Combined anterior and medial plating can result in satisfactory pain relief, improvement in mobility and function, and good long-term outcomes for patients with this type of fracture (28).

In our study, one patient with satisfactory reduction had post-traumatic osteoarthritis secondary to articular cartilage damage; no one had osteonecrosis. Osteoarthritis is the most common late complication of displaced acetabular fractures (19). Since indomethacin was given to all patients prophylactically, none of them had heterotopic ossification postoperatively (16,29). Although prophylactic cefazolin was given, two patients had superficial surgical sites infection, which were treated successfully with intravenous (IV) antibiotics.

The clinical outcome of surgically treated displaced acetabular fractures with central dislocation using combined anterior and medial plating will depend on several factors, including the severity of the injury, the patient's age and overall health, and the quality of the surgical repair. In general, acetabular fractures that are treated surgically tend to have better outcomes than those that are not treated surgically, although there can be risks and complications associated with surgery (1,2). Different fracture patterns result in various outcomes due to variable anatomical reduction results. Most of the elementary fractures (96%) were reduced anatomically. On the other hand, only 64% of associated fractures had an anatomical reduction, which resulted in worse outcomes in Matta's study (25). This may not always be applicable; according to a study of 810 patients with acetabular fractures treated surgically, anterior wall fractures had the worst survivorship because many other factors play a role in the outcome (6). In our study, all patients with associated fractures had good to excellent outcomes (80%) and only three patients had fair outcomes.

Our study has some limitations including its retrospective design, small sample number, and lack of a control group. Further research is needed to fully understand the

risks and benefits of combined anterior and medial plating for the treatment of displaced acetabular fractures with central dislocation.

Early satisfactory reduction and rigid surgical fixation of displaced acetabular fractures with central dislocation using combined anterior and medial acetabular plates showed favourable functional outcomes. Good to excellent clinical outcomes were achieved in 80% of patients. Early surgical fixation within two weeks from injury correlates with good clinical outcomes. The complications rate in our study was acceptable. A larger sample may be needed for more accurate results.

Our study is the first to our knowledge to explore the clinical outcomes of using combined anterior and medial plating for the fixation of displaced acetabular fractures with central dislocation. While previous studies have investigated surgical management techniques for acetabular fractures, the specific approach of combined anterior and medial plating for this type of fracture is relatively less explored. Our findings showed the efficacy and potential benefits of this approach in achieving favourable functional outcomes.

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TRANSPARENCY DECLARATION

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