

Short-Term Results of Surgical Treatment of Acetabular Fractures

Abstract

Background: Acetabular fractures often occur after high energy trauma. In this study, we investigated the complications and short-term outcome of such a fracture in a teaching center.

Methods: In a cross-sectional study, the patients that underwent surgical treatment of their Acetabular fracture in a 3 year period of 2018 to 2021 were assessed by Harris Hip Score, SF-36 and VAS pain scale in 3 and 6 months follow-ups.

Results: 65 patients, 48 men and 17 women with mean age of 46.90 years entered the study. Motor-vehicle accident was the most common cause of the fractures. Cartilage damage and reduced joint space were seen in 5; heterotopic ossification in 2; superficial infection in 4 and deep infection in 1 case were observed. The Harris Hip Score (HHS) was 73.29 at 3 and 81.7 in 6 months.

Conclusion: Short-term outcome of surgically treated Acetabular fracture is very good.

Keywords: Hip Fractures, Pelvic Bones, Traffic Accidents, Postoperative Complications, Fracture Fixation

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Introduction

Acetabular fractures are complex intra-articular injuries and fractures that typically occur in high-risk and life-threatening events ⁽¹⁾. Research has demonstrated that the incidence of pelvic ring fractures is 23 per 100,000 persons per year, and that of Acetabular fractures is three per 100,000 persons per year ^(2,3). These fractures can result from high-energy traumatic injuries in young adults or low-energy injuries (e.g., falls) in osteoporotic elderly ^(4, 5). There are different classification systems for classifying Acetabular fractures, of which AO classification is the most appealing. This system classifies Acetabular fractures into three groups: i) Type A, which is a fracture in either front or back columns, ii) Type B, which is a transverse fracture, while the Acetabular roof remains joined to the lower end of the ilium bone, and iii) Type C, which is a fracture in both anterior and posterior column, while no part of the Acetabular roof stays joined to the lower end of the ilium bone ⁽⁶⁾. Until the first half of the 20th century, there was no surgical procedure established to treat Acetabular fractures due to anatomical complexity, the paucity of a versatile surgical approach, and no awareness of the likely post-operative complications. However, the surgery and internal fixation of Acetabular fractures have been found to deliver better treatment results after breakthroughs in medicine and surgical procedures. Nonetheless, the surgical treatment of Acetabular fractures poses specific problems. First of all, the acetabulum lies deep and is covered by critical neurovascular structures. These make the surgical approach technically challenging and even treacherous. Secondly, there is no single approach that allows accessing the entire acetabulum ⁽⁷⁾. The functional outcome of surgically treated Acetabular fractures relies directly on the accuracy of the reduction. The surgery of Acetabular fractures aims to stabilize internal fixation and reconstruct the joint surface, particularly in weight-tolerating areas, to preclude additional complications such as arthritis ⁽⁶⁾. Indications of the Acetabular fracture surgery are Acetabular fracture with a 2 mm (or above) displacement of the Acetabular roof and involvement of the articular surface of the back wall (by more than 50%), as well as the fracture of the back

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wall with the instability of the hip joint while the hip is flexed to 90 degrees.

The surgical treatment of Acetabular fractures may possess complications such as Heterotopic Ossification (HO), nerve injury, deep vein thrombosis (DVT), and surgical-site infection^(8, 9). In line with these, the present study aims to evaluate the short-term results of surgical treatment of Acetabular fractures in patients referring to medical training centers in Isfahan from 2018 to 2021.

Methods

The present cross-sectional study investigated all patients undergoing Acetabular fracture surgery at "Kashani" and "Al-Zahra" Hospitals in Isfahan from 2018 to 2021. The inclusion criterion was being diagnosed with Acetabular fractures that occurred from 2018 to 2021 and undergoing surgical treatment at "Kashani" and "Al-Zahra" Hospitals in Isfahan (Isfahan province, Iran). The participants were asked to sign the consent form before the study. Those patients who had underlying conditions such as blood disorders, neurological diseases, and diabetes mellitus (which were expected to affect the results of the study), hard-to-reach patients, and those who did not cooperate were excluded from the study. The same exclusion rule was applied to patients with previous fractures in the same area or a similar lower limb (to avoid data interference) and those with known psychological problems or mental disorders. All the patients who met the inclusion criteria were included in the study without any sampling, and all types of Acetabular fractures were investigated in the participants. The patients were visited once every two weeks until the end of the first month to check for symptoms and likely surgical-site wounds. All the patients underwent AP pelvis radiography taken at months 1, 3, and 6 post-surgery. They also were visited and evaluated by an orthopaedist at months 3 and 6 after the surgical intervention. The Harris Hip Score (HHS) was employed to evaluate hip function among the participants^(10, 11). Furthermore, the 36-Item Short Form Survey (SF-36) questionnaires

were distributed among the participants. The SF-36 questionnaire is an outcome-measurement instrument designed to assess eight domains, including vitality, physical functioning, general health perception, bodily pain, mental health, and physical, emotional, and social role.

The content validity and reliability of the Persian version of SF-36 have been confirmed^(12,13). The intensity of bodily pain was measured using a Visual Analogue Scale (VAS). VAS is a pain-rating scale that scores the pain intensity from 1 to 10, with two endpoints representing 0 (no pain) and 10 (extreme pain). Additionally, it is a fast, straightforward, versatile, and reliable tool widely used by researchers and medical clinics^(14, 15). The data were confidentially included in the research checklist and then analyzed in SPSS version 21 software. The study was approved by the Ethics Committee of Isfahan University of Medical Sciences (IUMS) with an ethical code IR.MUI.MED.REC.1400.311.

Results

Seventy-two patients with Acetabular fractures were found to be treated with a surgical procedure at "Kashani" and "Al-Zahra" hospitals in Isfahan from 2018 to 2021. Of all these patients, seven were excluded from the study during follow-ups and the remaining 65 were included in the final analyses. The mean age of the participants was 46.90 years, out of which 72.3% were males and the remaining were females. The most frequently affected site was the posterior wall (in 38.4% of all cases), followed by both columns (in 27.6% of patients). Similarly, the most popular surgical approach was found to be the single posterior approach adopted in 41% of the cases. Road traffic crashes (RTCs) were the leading cause of fractures (in 40 patients; 61%), followed by falling from a height (in 13 patients; 20%). There were four cases (6%) of superficial surgical-site infection, one case (1.5%) of deep infection, five cases (7.6%) of cartilage damage and joint space narrowing (JSN), and two cases (3%) of HO. There were also four cases (6%) of post-operative sciatica that

recovered after four months. One of the patients passed away due to an underlying disease, and six others did not further cooperate during follow-ups. The mean VAS score was 2.41 and that of the mental component summary (MCS) of the SF-36 questionnaire was 69.29 and 75.86 respectively in months 3 and 6 after surgery. Similarly, the mean score of physical component summary (PCS) was 64.32 and 70.80 respectively in months 3 and 6 after surgery. The mean score of Harris hip score (HHS) was 73.29 and 81.7 respectively in

months 3 and 6 after surgery (Table 1). The normality of the variables measured at months 3 and 6 post-operation was assessed using the Kolmogorov-Smirnov (K-S) test. Additionally, the paired t-test was used to test the mean difference in variables between 3rd and 6th months after the surgery ($p < 0.001$). Based on the HHS scale, 23, 21, 17, and 4 patients had excellent (90-100), well (90-80), moderate (80-70), and poor (less than 70) results. There was no death recorded during the follow-ups.

Case	Age	Gender	Fracture Type	Approach	VAS	MCS6	PCS6	HHS 6	Complication
<u>1</u>	51	M ¹	Pos.wall	SPA ³	1	82	82	92	none
<u>2</u>	44	M	Both columns	SAA ⁴	1	84	82	86	none
<u>3</u>	48	F ²	Transverse+Pos.wall	DA ⁵	1	86	83	82	none
<u>4</u>	61	M	Both columns	DA	2	80	76	78	none
<u>5</u>	54	M	Pos.wall	SPA	1	74	70	79	none
<u>6</u>	52	F	T type+ Pos.wall	DA	2	70	61	82	none
<u>7</u>	33	M	T type +Pos.wall	DA	1	80	75	92	none
<u>8</u>	36	M	Transverse+Pos.wall	DA	2	77	74	93	none
<u>9</u>	44	F	Pos.wall	SPA	2	70	68	84	none
<u>10</u>	52	M	Transverse+Pos.wall	DA	8	58	50	68	Deep infection
<u>11</u>	46	F	T type+Pos.wall	DA	5	60	55	79	Superficial infection
<u>12</u>	47	M	Transverse+Pos.wall	DA	1	75	70	74	none
<u>13</u>	43	M	Ant.column	SAA	1	85	80	93	none
<u>14</u>	57	F	Pos.wall	SPA	1	77	70	90	L5 palsy
<u>15</u>	60	M	Both columns	SAA	2	70	66	81	L5 palsy
<u>16</u>	24	F	Both columns	SAA	1	85	78	88	none
<u>17</u>	25	M	Pos.wall	SPA	1	85	78	88	none
<u>18</u>	56	M	Both columns	SAA	1	79	72	93	none
<u>19</u>	57	M	Both columns	SAA	6	59	51	78	Superficial infection
<u>20</u>	38	M	Pos.wall	SPA	1	85	78	81	none
<u>21</u>	35	M	Pos.wall	SPA	1	84	78	81	none
<u>22</u>	34	M	Pos.wall	SPA	2	87	81	80	none
<u>23</u>	58	M	transverse	SPA	4	59	55	62	HO L5 palsy
<u>24</u>	44	F	Pos.wall	SPA	3	78	72	78	none
<u>25</u>	49	M	Pos.wall	SPA	2	88	78	91	none
<u>26</u>	48	M	Ant.column	SAA	1	92	87	92	none
<u>27</u>	39	F	Ant.column	DA	2	90	85	92	none
<u>28</u>	61	M	Pos.wall	SPA	2	73	70	76	none
<u>29</u>	59	M	Pos.wall	SPA	8	59	55	62	djd superficial infection
<u>30</u>	54	F	Both columns	DA	2	72	70	70	djd
<u>31</u>	45	M	Transverse+Pos.wall	DA	7	49	45	68	djd malunion
<u>32</u>	51	M	Pos.wall	SPA	1	82	82	92	None

1. M= Male

2. F= Female

3. Single Posterior Approach= SPA

4. Single Anterior Approach= SAA

5. Double Approach= DA



Figure 1: A pre-treatment image taken from a patient with transverse + posterior wall fracture.



Figure 2: A post-treatment image taken from the same patient (in Figure 1) with transverse + posterior wall fracture.

Discussion

In agreement with the results reported in the previous studies ^(16, 17), Acetabular fractures were found to occur mostly in males than in females. RTCs were the leading cause of Acetabular fractures, accounting for 61.2% of the cases, implying the necessity for upgrading the driving culture in the country. Similar results were reported in a study carried out in Singapore from 2008 to 2016 ⁽¹⁸⁾, where most of the patients with Acetabular fractures were males (79.3%), and RTCs (53.8%) and falls (33.1%) were found to be the leading causes of fractures, respectively. In the present study, cartilage damage and JSN were the most common complications observed in 7.6% of the participants, followed by superficial infection, HO, and deep infection respectively in 6%, 3%, and 1.5% of patients. In line with the previous research (e.g., ^(19, 20)), posterior wall fracture was the frequently-observed fracture pattern in the present study. In agreement with the previous studies, the scores of both SF-36 and HHS scales were significantly different between months 3 and 6 post-operation, with the majority of patients recovering six months after the surgery. Both SF-36 and HHS scores seem to be closely correlated to age, as they

are significantly decreased in older participants compared to young adults. The HHS-based functional performance of patients was in agreement with that in the previous studies ⁽²¹⁾. In a 2022 study by Cherrad et al., outcomes of surgical management were followed up for 35 months in 24 patients with an average age of 38 years who were suffering from Acetabular fractures. Most of the participants were males, and postoperative complications such as "heterotopic ossification" and "post-traumatic arthritis" were found in 16% and 20% of the patients, respectively. The functional results based on the modified Merle d'Aubigne and Postel criteria were judged excellent in 70.83% ⁽²⁰⁾.

Ambulgekar et al. (2022) investigated 22 patients and found that males are at higher fracture risk (than females) and RTCs are the main cause of Acetabular fractures among the participants. They reported two (9%) cases of superficial infection, 1 (4.5%) case of sciatica, and 3 (13.6%) cases of premature osteoarthritis. The functional results based on the modified Merle d'Aubigne were excellent in 7 patients, good in 8, fair in 4, and poor in 3 ⁽²¹⁾.

Table 1: Variables measured during the follow-ups. Months three and six are denoted by 3 and 6, respectively									
Case	Age	Gender	Fracture Type	Approach	VAS	MCS6	PCS6	HHS 6	Complication
33	44	M ¹	Both columns	SAA ⁴	1	84	82	86	none
34	48	M	Transverse+Pos.wall	DA ⁵	1	86	83	82	none
35	61	M	Both columns	DA	2	80	76	78	none
36	54	F ²	Transverse+Pos.wall	DA	1	74	70	79	none
37	52	M	Pos.wall	SPA ³	2	70	61	82	none
38	33	M	T type +Pos.wall	DA	1	80	75	92	none
39	36	F	Transverse+Pos.wall	DA	2	77	74	93	none
40	44	M	Both columns	SAA	2	70	68	84	none
41	52	F	Transverse+Pos.wall	DA	3	70	66	78	none
42	46	M	T type+Pos.wall	DA	5	60	55	79	none
43	47	M	Transverse+Pos.wall	DA	1	75	70	74	none
44	43	M	Ant.column	SAA	1	85	80	93	none
45	57	F	Both columns	DA	1	77	70	90	L5 palsy
46	60	F	Both columns	SAA	2	70	66	81	L5 palsy
47	24	M	Pos.wall	SPA	1	85	78	88	none
48	25	F	Pos.wall	SPA	1	85	78	88	none
49	56	M	Pos.wall	SPA	1	79	72	93	none
50	57	F	Both columns	SAA	6	59	51	78	none
51	38	M	Pos.wall	SPA	1	85	78	81	none
52	35	M	Transverse+Pos.wall	DA	1	84	78	81	none
53	34	M	Pos.wall	SPA	2	87	81	80	none
54	58	M	transverse	SPA	4	59	55	62	HO
55	44	M	Pos.wall	SPA	3	78	72	78	none
56	49	M	Pos.wall	SPA	2	88	78	91	none
57	48	M	Ant.column	SAA	1	92	87	92	none
58	39	M	Ant.column	DA	2	90	85	92	none
59	61	M	Pos.wall	SPA	2	73	70	76	none
60	59	F	Pos.wall	SPA	8	59	55	62	superficial infection
61	54	M	Both columns	DA	2	72	70	70	djd
62	45	M	Transverse+Pos.wall	DA	7	49	45	68	djd malunion
63	44	F	Pos.wall	SPA	3	78	72	78	none
64	48	M	Pos.wall	SPA	2	88	78	91	none
65	52	F	Transverse+Pos.wall	DA	3	70	66	78	none

1. M= Male
2. F= Female
3. Single Posterior Approach= SPA
4. Single Anterior Approach= SAA
5. Double Approach= DA

Yang et al. (2021) studied 24 patients with Acetabular fractures for an average follow-up duration of 29.5 months. The majority of patients were found to be males. They reported 5 (20%) cases of osteoarthritis, 3 (12.5%) cases of HO, one case of infection, and one case of sciatica among the participants. The functional results based on the Modified Merle d'Aubigné and Postel

method were considered excellent in 10 patients, good in 6, fair in 5, and poor in 3⁽²²⁾. Petsatodis et al. studied the results of operative treatment in 50 patients with Acetabular fractures treated with a single posterior approach from 1990 to 2000. The majority of patients (mean age: 37.8 years) were males who were reviewed for a mean follow-up duration of 5.8 years (2-10 years). Early postoperative complications were 2

peroneal nerve palsies and 3 wound infections, while late complications included 5 patients with HO and 12 patients with post-traumatic osteoarthritis of the hip joint. In their study, the clinical results based on the D'Aubigne-Postel scoring system were excellent in 20 patients, good in 16, fair in 5, and poor in 9⁽²³⁾.

The results of the study by Briffa et al. with an average follow-up duration of 11 years are similar to our results, where they noted double-column fracture as the most common fracture and the Kocher-Langenback approach as the most appealing treatment. The results revealed sciatica in 12% of patients, HO in 10.5%, superficial infections in 5.6%, and deep infection in 5.6%. They conceded old age, delayed surgery, poor quality of reduction, and "posterior column" and "T-shaped" fractures as factors contributing to the poor prognosis of patients⁽²⁴⁾.

According to studies, osteoarthritis seems to be diagnosed within longer follow-ups and could be a long-term complication of Acetabular fracture surgery. However, this complication was not diagnosed in our short-term study.

There were some limitations to the present study. We collected data from two hospitals in Isfahan (i.e., Kashani and Al-Zahra Hospitals), which could restrict the generalization of the results to the whole country. Although these two hospitals are the center for managing the majority of accidents occurring in the country, the present study covered only a small population within a 4-year follow-up duration. Thus, future research is recommended to target a higher population within more prolonged follow-up durations. The postoperative follow-up duration in the present study was also short, restricting us to investigate the long-term surgical outcomes.

Conclusion

Surgical treatment of Acetabular fractures has been well-established in recent years to address the poor and adverse outcomes of non-surgical treatments. The present study indicated males as the most prone to (and RTCs as the leading cause for) Acetabular

fractures. The results showed that surgical treatment can possess multiple complications. Accordingly, future studies are advised to explore for causes of these complications and propose solutions to avoid adverse outcomes in the patients.

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