

An Assessment of Functional Outcome of Surgically Treated Acetabular Fractures

Rushan A. Khan^{1*}, Arvind B. Goregaonkar², Abhiraj R. Matre³, Pooja Baranwal⁴

¹Senior Resident, Department of Orthopaedics, Rajiv Gandhi Government Medical College & Chhatrapati Shivaji Maharaj Hospital Kalwa, Thane, Maharashtra India

²Prof and Head of Department, Department of Orthopaedics, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai, Maharashtra

^{3,4}Senior Resident, Department of Orthopaedics, Lokmanya Tilak Municipal Medical College and General Hospital, Sion, Mumbai, Maharashtra

Received: 20-03-2023 / Revised: 11-04-2023 / Accepted: 05-05-2023

Corresponding author: Dr Rushan A. Khan

Conflict of interest: Nil

Abstract:

Background: Acetabular fractures are commonly seen in young and active individuals enduring high energy trauma. Acetabular fractures result from indirect trauma, transmitted via the femur. They occur after a blow to the greater trochanter, to the flexed knee, or to the foot with the knee extended. If left untreated, displaced acetabular fractures can lead to the development of premature arthritis of the hip. Since 1964, after Judet and Letournel's research, operative management of such fractures has become the standard approach. **Materials and methods:** Single centre combined retrospective prospective study conducted in tertiary care centre in Maharashtra. Patients were treated for acetabular fractures using open reduction and internal fixation with plates and screws. Minimum follow up was done for 18 months. **Results:** The mean value of Harris Hip Score was 88.57 with significant P values showing that functional outcome was Good in patients treated with open reduction internal fixation at our institute. Excellent outcome – 56.7%, Good outcome – 16.7% and Fair outcome - 26.7%. 3.3% (1 patient) developed hip arthritis requiring total hip replacement.

Conclusion: Acetabular fractures involve weight bearing joints of the lower limb; hence they must be restored as much as possible. Despite the best attempts, malreduction and inadequate fixation of acetabular fractures can occur. In those cases, Total hip arthroplasty may be needed subsequently in fracture when primary fixation fails.

Keywords: Acetabulum, Pelviacetabular fractures, Post traumatic hip arthritis, Letournel, Judet, Kocher Langenbeck, acetabular fractures, Hip fractures.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Acetabular fractures are commonly seen in young and active individuals enduring high energy trauma, although in the last few decades, number of older individuals with acetabular fractures has increased. Acetabular fractures result from indirect trauma, transmitted via the femur. They

occur after a blow to the greater trochanter, to the flexed knee, or to the foot with the knee extended. If left untreated, displaced acetabular fractures can lead to the development of premature arthritis of the hip. In 1964, Judet, Judet and Letournel were the first to propose that open

reduction and rigid internal fixation of displaced fractures would lead to a better outcome than conservative treatment. Since then, operative management of such fractures has become the standard approach. The operative fixation of acetabular fractures is a major challenge to the trauma surgeon.[1] This is mainly because of requirement of skill and expertise in understanding the fracture anatomy, doing adequate exposure minimising blood loss, fixing the fracture anatomically and rigidly, and the significant risk of intraoperative complications of which the most dreaded are neurovascular complications. The decision to treat a fracture surgically, the surgical approach and the accuracy of reduction are strongly influenced by the surgeon's training and expertise. Factors known to influence outcome include a delay in surgical treatment, the fracture pattern, the patient's age, associated chondral damage to the femoral head and acetabulum, dislocation at the time of injury, associated neurovascular compromise as a result of the injury and its mechanism, and the patient's pre-existing comorbidities. [1]

Hence this study was conducted to assess the functional outcome of patients treated with open reduction and internal fixation for operative Acetabular fractures and to study the rate of conversion to Total Hip Arthroplasty for patients treated with open reduction internal fixation within 18 months.

Materials and Methods

This is a study of functional outcome in operative acetabular fractures using open reduction and internal fixation with plates and screws conducted in the department of Orthopaedics at our institute over 3 years after getting clearance from hospital ethical committee. During above mentioned period 30 patients were treated for acetabular fractures using open reduction and internal fixation with plates

and screws. The age group varied between 17 – 69 years among them 26 males and 4 females, right side was involved in 12 cases and left side involved in 18 cases. Minimum follow up was done for 18 months. All the required data for the study was collected from the patients after getting their appropriate consent during their stay in the hospital, during follow up at regular intervals and from the medical records.

Inclusion Criteria

1. All acetabular fractures resulting in unstable hip joint

Exclusion Criteria

1. Stable nondisplaced fractures
2. Stable and congruous but minimally displaced fractures
3. Intact and congruent acetabulum
4. Low anterior column fractures
5. Low transverse fractures
6. Both column fractures with secondary congruence
7. Wall fracture not compromising hip stability
8. Infirm patients unable to withstand surgery

Methodology

This was a combined retrospective and prospective study. All participated patients were selected on the basis of history, clinical examination and radiography.

- All fractures have been classified based on Letournel and Judet classification. These patients were followed up for an average period of 8 months.
- Only posterior wall and posterior column fractures were considered for the study because these fractures are more common than other fractures types.
- In acetabular fractures >25% of the fractures were posterior wall a 6-10% were posterior column fractures.
- Fractures were considered unstable when significant displacement >2mm

or >40% involvement of anterior or posterior wall of the acetabular fractures.

- All cases were treated with ORIF with Recon plate, cortical screws and cancellous screws. 60
- The approach chosen was Kocher-Langenbeck approach. All the cases were followed up and were analysed for functional outcome with Harris Hip Score.

Statistical Analysis: Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 22.0; SPSS Inc, Chicago).

Descriptive statistics such as mean and standard deviation (SD) for continuous variables, frequencies and percentages were calculated for categorical variables were determined. McNemar Test and Paired t Test were used for paired categorical and quantitative variables to find the association. Bar charts and Pie charts were used for visual representation of the analyzed data. Level of significance was set at 0.05.

Results

In this study 30 patients were studied between September 2019 to November 2021 out of which :

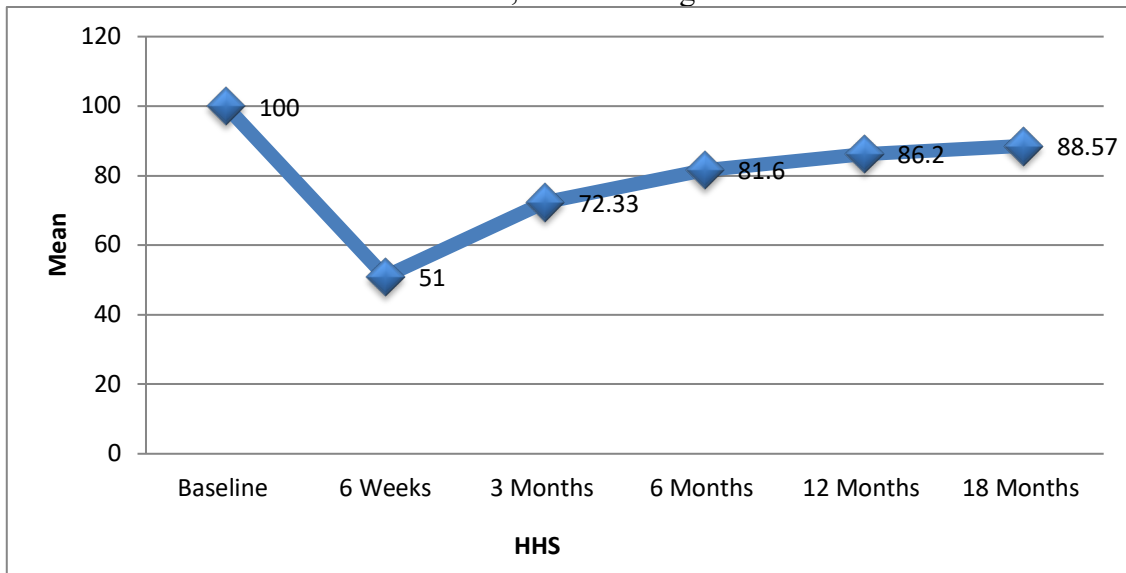
- 2 (6.7%) had isolated Anterior column fracture
- 2 (6.7%) had isolated Posterior column fracture
- 4 (13.3%) had Anterior and Posterior column fracture
- 3 (10%) had an Anterior column and Posterior wall fracture
- 8 (26.7%) had Posterior wall fracture
- 2 (6.7%) had Posterior column and posterior wall fracture
- 6 (20%) had Transverse fracture
- 3 (10%) had Posterior wall and Transverse fracture

and all these patients were treated with open reduction and internal fixation using plates and screws. Out of 30 patients, 13.3% (4) were female and 86.7% (26) were male patients. The gender did not have any relationship with the radiological or functional outcome. But the male gender was more commonly affected probably due to higher exposure of males to road traffic accidents in our country. The mean age in our study was 37.8 years. The age range of patients was between 17-69 years. The age of the patient was not associated with accuracy of reduction in the study. The patients were taken up for surgery as early as within 3 weeks time. 28 out of 30 patients were operated between 0-14 days. 2 out of 30 patients were operated between 14-21 days. The mean time interval between injury and surgery was 11.1 days. The accuracy of reduction was not found to be statistically related with timing of surgery. This may be due to the fact that all the patients in our study were operated within 3 weeks of injury. In our study all patients but 1 were operated by Kocher-Langenbeck approach and 1 was operated by combined Iliioinguinal and Kocher-Langenbeck approach. The functional outcome of surgery was assessed using Harris Hip Score. The mean value was 88.57 (SD = 8.07) with significant P values (Table 1) showing that functional outcome was Good in patients treated with open reduction internal fixation at our institute. 56.7% (17) patients had an excellent functional outcome, 16.7% (5) patients had a good outcome and 26.7% (8) patients had a fair outcome. Hence, patients having a satisfactory outcome (Excellent/Good) were 73.33% (22). (Table 2) The Harris Hip Score showed a significant improvement between 6 weeks to 3 months of post-operative follow up. 1 patient out of 30 had at end of 18 months developed significant arthritic changes in the hip which required a Total Hip replacement procedure.

Table 1: Distribution of study subjects according to HHS (N=30)

HHS	Mean (SD)	Mean Difference	P Value
Baseline	100.0 (0.00)	-	-
6 Weeks	51.00 (8.51)	49.00	<0.001*
3 Months	72.33 (9.58)	27.66	<0.001*
6 Months	81.60 (9.70)	18.40	<0.001*
12 Months	86.20 (8.54)	13.80	<0.001*
18 Months	88.57 (8.07)	11.43	<0.001*

Paired t Test, P Value *Significant



Graph 1: Distribution of HARRIS HIP Score

Table 2: Distribution of Study Subjects according to the HHS Interpretation (N=30)

HHS	No.	Percent
Excellent	17	56.7
Fair	8	26.7
Good	5	16.7

The radiological outcome was assessed using Matta Radiological scoring criteria. After 18 months of follow up 53.3% (16) patients had an excellent outcome with an anatomical and congruent hip joint. 43.3% (13) patients had a good outcome with mild arthritic changes. 3.3% (1) patient

had a poor outcome with extensive femoral head collapse requiring Total Hip Arthroplasty subsequently.

But the radiological outcome scores were found to be statistically insignificant according to P value. (Table 3)

Table 3: Distribution of study subjects according to MRS (N=30)

MRS	Excellent	Fair	Good	Poor	P Value
Baseline	30 (100.0)				-
6 Weeks	16 (53.3)	1 (3.3)	13 (43.3)		<0.001*
3 Months	16 (53.3)	1 (3.3)	13 (43.3)		<0.001*
6 Months	16 (53.3)	1 (3.3)	13 (43.3)		<0.001*
12 Months	16 (53.3)	1 (3.3)	13 (43.3)		<0.001*
18 Months	16 (53.3)		13 (43.3)	1 (3.3)	<0.001*

McNemar Test, P Value *Significant

Discussion

This study is about open reduction and internal fixation of the operative acetabular fractures. Fractures of the posterior wall of the acetabulum are the most common fracture pattern followed by posterior column fractures. A posterior approach to the acetabulum is preferred using a Kocher-Langenbeck approach is the one commonly used. For anterior column or both column fractures, also, a Kocher Langenbeck approach is used with indirect reduction of the anterior column. For certain anterior column fractures, and those in which an indirect reduction of anterior column cannot be obtained, Ilioinguinal approach is also undertaken. The most important is correlation between the reduction of the fracture and functional outcome. It is possible even with difficult patterns of fractures to achieve good satisfactory outcome when a good reduction was done. Acetabular fractures pose a major challenge to surgeons due to the complex anatomy and requirement of skill in exposing and fixing them. It is extremely important to reduce any fracture involving the articulating surface of a weight bearing joint in order to decrease morbidity and maintain a good quality of life. Acetabular fractures are commonly seen in active young age group due to high energy trauma. Conservative treatment of these injuries had very little success in reducing the fracture. This leads to the need for open reduction and internal fixation of acetabular fractures in indicated cases. In our study of 30 cases our mean Harris Hip Score was 93.43 with statistical significance, which indicates an excellent outcome for surgically treated acetabular fractures.

Several factors which will affect the outcome of these fractures are classified into 2 groups:

1. Surgeon dependent variable
2. surgeon independent variables

Surgeon dependent variables: are timing of surgery, experience of surgeon, approach, quality of reduction and fixation.

Surgeon independent variables are mechanism of injury, damage to femoral head, sciatic nerve injury, dislocation, fracture pattern, age and co-morbidities.

The mean age group in this study was 37.8 years as most of the patients were young or middle aged. Hence the impact of age on functional outcome cannot be substantiated. In our study, no patient had heterotopic ossification, which may or may not be due to prophylactic Indomethacin. This could not be substantiated in our study.

Avascular necrosis: of the head of femur which is a dreaded complication preventing a favourable functional outcome, was found in 1 patient (3.3%). In literature its incidence varies from 3-52%. The reason for incidence being on the lower side in our study may be a shorter follow up time. If a longer follow up of at least 10 years is carried out, perhaps the incidence would have been higher.

The use of single exposure even for both column fractures with indirect reduction of the opposite column is currently recommended as the morbidity associated with extensile approach was found to be very high. The opposite column fracture can be treated with the help of image intensifier, traction and also with the help of Judet fracture table.

In our study, there was a left sided predominance compared to right side. The functional outcome of the study was assessed using Harris Hip score at immediate POD 1, 6 weeks, 3 months, 6 months, 1 year and 18 months. All the patients were operated after assessing the radiograph of pelvis with both hips, Judet views, CT scan with 3D reconstruction and intra operative reduction with c – arm. We found that open reduction and internal fixation of operative acetabular fractures

reduced the hospital stay and was consistent with satisfactory clinical results.

At our institute 56.7% (17) patients had an excellent functional outcome, 16.7% (5) patients had a good outcome and 26.7%

(8) patients had a fair outcome. A total of 73.33% (22/30) patients had a satisfactory outcome. The results are at par with literature and other standard studies. (Table 4)

Table 4: Comparison between outcomes of different studies

Author	Satisfactory (Excellent/Good) results
Matta et al (1986) ²	70% satisfactory
Mayo (1994) ³	75% satisfactory
Fica et al (1998) ⁴	68% satisfactory
Deo et al (2001) ⁵	74% satisfactory
Madhu et al (2006) ⁶	76% satisfactory
Our study	73.33% satisfactory

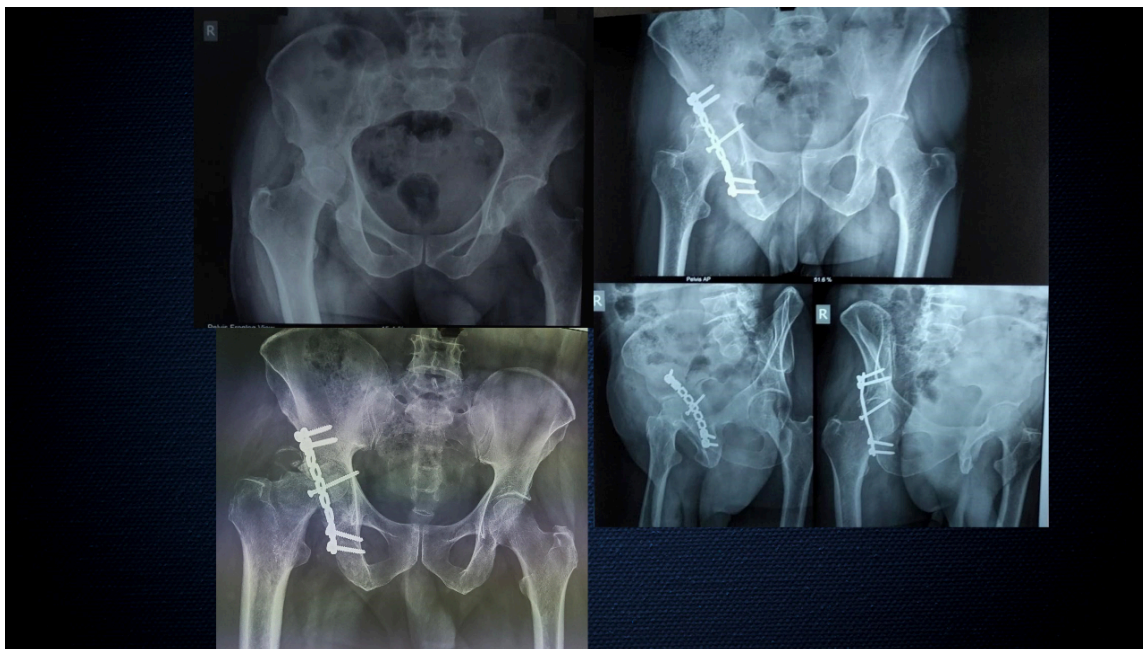


Figure 1: One 55 year old male with Right Posterior Wall fracture with Posterior Hip Dislocation developed AVN at 1 year follow up after anatomical reduction and fixation of acetabular fracture

Limitations of this study include:

1. A short follow up: A long term follow up of at least 5 years would have been made the study more significant to study the post traumatic arthritis and avascular necrosis.
2. A larger study group would have rendered the study more statistically significant
3. Exclusion of newer techniques percutaneous screw fixation and navigation: These newer techniques allow for lesser soft tissue stripping

and minimise blood loss, which may in turn increase chances of a favourable outcome.

Conclusion

The main aim of the study is open reduction an internal fixation of operative acetabular fracture which gives accurate reconstruction of the articular surface to a satisfactory functional outcome which is widely accepted since the conservative management of acetabular fracture consistently produce poor results. Fractures of the acetabulum are increasing

in frequency due to an increase in road traffic accidents. These fractures involve weight bearing joints of the lower limb; hence they must be restored as much as possible. Despite the best attempts, malreduction and inadequate fixation of acetabular fractures can occur.

In those cases, Total hip arthroplasty may be needed subsequently in fracture when primary fixation fails. Therefore, pelvic-acetabular surgery involves a long learning curve and the key to success is the understanding of the anatomy of the fracture, preoperative planning, approach and accuracy of reduction in acetabular fractures. The objective of the open reduction and internal fixation of the acetabulum was to produce a functional, painless, mobile joint which gives excellent and good results which reduces the chances of Avascular necrosis and Secondary arthritis of the hip. In addition, it is important for the surgeons to explain the risk of surgery and possible outcome to the patients particularly when the waiting period for surgery is more than 3 weeks.

References

1. N. Briffa, R. Pearce, A. M. Hill, M. Bircher. Outcomes of acetabular fracture fixation with ten years' follow-up J Bone Joint Surg [Br] 2011;93-B:229-36
2. Matta JM, Mehne DK, Roffi R. Fractures of the acetabulum: early results of a prospective study. Clin OrthopRelat Res.1986 Apr;(205):241-250.
3. Mayo KA. Open reduction and internal fixation of fractures of the acetabulum. Results in 163 fractures. Clin OrthopRelat Res. 1994 Aug;(305):31-7.
4. Fica G, Cordova M, Guzman L, Schweitzer D. Open reduction and internal fixation of acetabular fractures. Int Orthop. 1998;22(6):348-51.
5. Deo SD, Tavares SP, Pandey RK, El-Saied G, Willett KM, Worlock PH. Operative management of acetabular fractures in Oxford. Injury. 2001 Sep;32(7):581-6.
6. Madhu R, Kotnis R, Al-Mousawi A, Barlow N, Deo S, Worlock P, Willett K. Outcome of surgery for reconstruction of fractures of the acetabulum. The time dependent effect of delay. J Bone Joint Surg Br. 2006 Sep;88(9):1197-203.