

Open Reduction and Internal Fixation of Posterior Acetabular Fractures in Young and Middle Aged Patients: A Prospective Study

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Received: 26-11-2022 / Revised: 30-12-2022 / Accepted: 30-01-2023

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Conflict of interest: Nil

Abstract

Background: Acetabular fractures are one of the most challenging fractures for an Orthopaedic Surgeon to manage. Even in the most experienced hands, the prognosis and outcome remains guarded sometimes. The purpose of the present study was to evaluate the outcome after operative treatment of posterior fractures of the acetabulum.

Methods: 24 patients who had been followed for a minimum of 1.5 years after operative treatment of an elementary posterior wall fracture of the acetabulum were included in the study. Functional outcomes were assessed with use of the Merle d'Aubigné score. The duration of follow-up ranged from 1.5 to 3 years (mean 2.3 years).

Results: The mean score was 15.12. (Standard Deviation, 2.43; Range, 9 to 18), indicating overall good-to-excellent clinical results. 75% of the patients achieved good or excellent results overall. The number of excellent to good results was 87.5% when the surgery was carried out within first 7 days. There was no incidence of Avascular Necrosis in this study.

Conclusions: The acetabular fractures are a result of high energy trauma with associated multiple injuries with 8.3 % patients having associated haemothorax, 8.3 % having pelvic/abdominal visceral injuries, 33% having fractures at other sites and 16% associated with head injuries. In 29% of cases, the injuries were associated with posterior dislocation of hip. Most affected age group was 20 – 30 years (37.5%) followed by 30 – 40 years (33%). RTA was the causative factor in 91% of the cases. There was a significant difference in outcome when surgery was done early (1 – 7 days) ($p = 0.0295$) and post-reduction incongruity was ≤ 1 mm ($p = 0.0447$).

Keywords: Acetabulum, Fractures, Hip Dislocation, Trauma, Multiple Trauma.

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Introduction

Fractures of the acetabulum remain one of the most challenging fractures for an Orthopaedic Surgeon to understand and treat. Most of the early descriptions were based on the AP skiagrams of the pelvis which led to the use of terms like “medial wall fracture” and “superior dome fracture” but they were neither descriptive (in terms of anatomy of fracture) nor prognostic (in terms of outcome) [1,2]. Fractures of the acetabulum were typically managed conservatively but it was recognized that the results will definitely be poor if the hip wasn't congruent [3]. It was not until Judet and Letournel made attempts to analyze the innominate bone anatomy which led to the change in views and better understanding of the acetabular fractures. Pre-operative planning and understanding the fracture geometry form the foremost important part in planning the surgical fixation of acetabulum [4]. Even the results of Surgical Fixation were dependant on the reduction achieved. Kebaish, Roy, and Rennie [5] demonstrated this same concept by comparing the reductions obtained by experienced pelvic trauma surgeons with those obtained by less experienced surgeons, who had a much lower rate of anatomical reduction. Rowe and Lowell [6] observed that conservative management of large fractures of the posterior wall of the acetabulum predisposes to hip osteoarthritis. The quality of acetabular fracture reduction is the single most important factor in the long-term outcome of these patients, and such surgery should be undertaken only by surgeons with sufficient experience [7]. The Patients with fracture reduced to one mm have less incidence of post traumatic arthritis as compared to those who are mal reduced by 2 – 3 mm [8,9]. It may not be possible to treat acetabular fractures at all centers, however the surgeon should be trained in diagnosing these injuries, their immediate management and identification of cases which need operative management and their referral to a

specialized centre. This study was done to assess the results of the operative management of fractures of the posterior wall of the acetabulum.

Material and Methods

The study was carried out in Central Institute of Orthopaedics Safdarjung Hospital New Delhi 2014-2017. The study included patients from age group of 20 – 50 years. The patients with suspected acetabular fractures were screened for any associated life-threatening injury. The patients were stabilized hemo-dynamically; associated injuries were managed as per priority and then subjected to further investigations. The patients were managed in the emergency with parenteral fluids and blood transfusions as required.

Inclusion criteria were:

1. Primarily posterior acetabular (column or wall) fractures were included.
2. T fractures were included.
3. Age 20 – 50 years.
4. AMTS score of ≥ 6 .

Following fractures were excluded:

1. Primarily anterior column fractures with associated posterior column injuries.
2. Major Pelvic Injury.

The specific investigations involved included:

- **Skiagrams:**

1. Pelvis with both hips AP view (without traction).
2. Judet's views.

- **CT scan Pelvis with 3D reconstruction:**

35 patients who suffered posterior acetabular fractures and met the inclusion criteria reported to the emergency during the concerned period. 2 patients died because of irreversible shock. One patient had associated hemothorax and kidney rupture and the other had associated pelvic visceral

injury. Out of 33 patients, 2 patients refused surgery and were managed conservatively with traction for a period of 12 weeks. 5 patients had undisplaced fractures or chip fractures of the posterior wall and were managed conservatively. 2 patients were treated conservatively with acceptance of secondary congruence. All conservatively managed patients were put on skeletal traction with a Steinman pin. 24 patients were treated by Open reduction and internal fixation of the posterior acetabular fractures.

Kocher-Langenback Approach was used to assess the posterior wall of acetabulum in the surgery. Trochanteric osteotomy was made in 18 cases to increase exposure. Only Stainless steel screws (cortical/ cancellous) and recon plates were used. It was later fixed in place by tension band wiring. A third generation Cephalosporin along with Amikacin was used in the peri operative period. Patients were kept non weight bearing in skin traction for 3 weeks with active/ active assisted exercises starting 2nd to 3rd post operative day as tolerated by patient, followed by toe touch weight bearing and ambulation with crutches. The Partial Weight Bearing was started at 8 – 12 weeks to increase it to full weight bearing over a period of 6 – 12 weeks depending upon fracture pattern. The main indications for surgery were:

1. Displaced fractures of the posterior wall of acetabulum (> 2mm).
2. Roof Arc Measurement of <45°.

The patients were followed up with respect to clinical function and serial skiagrams. Merle d' Aubigne score was used to assess the clinical outcome. The radiographs were assessed in terms of displacement (loss of reduction), heterotrophic ossification and arthritic changes in hip joint (if any). The minimum follow up of 1.5 years was taken into consideration.

Observations

There were 17 males and 7 female patients. There was male preponderance. The male female sex ratio was 2.42:1. The mean age in males was 32.4 years and in females was 35.2 years. Overall mean age was 33.25 years. RTA was the causative factor in 22 of 24 (91%) cases and fall from height in 2 (9%) cases. Associated Injuries with posterior acetabular fractures are shown in table 1.

Various sub-types of posterior acetabular fractures in our study are shown in table 2. Indications for surgery were Displaced Fracture in 19 cases, unstable hip joint after reduction in 4 cases and retained intra articular fragment in one case. The distribution of number of patients operated during different periods is summarised in table no 3.

Results

Table 1: Showing associated injuries with posterior acetabular fractures.

Associated Injuries	Number
Haemothorax	2
Pelvic /Visceral Injuries	2
Fractures at other sites	8
Sciatic Nerve palsy	1
Dislocation of Hip	7
Head Injury	4

Table 2: Distribution of sub types of posterior acetabular fractures

Type of Fractures	Number
Single Large Post. Fragment	8
Communitied Post. Wall	15
Posterior Column fractures	14
T fractures	1

Table 3: Time wise distribution (number) of patients operated.

Injury Surgery Interval (in Days)	Number
1 – 7	8
8 – 14	12
15 – 21	3
22 – 28	1

Table 4: Grading of result as per radiological parameters.

Result	Displacement (in mm)	Number
Excellent	≤ 1	6
Good	2	16
Fair	3	1
Poor	>3	1

Table 5: Grading of result as per clinical score (Modified Merle d' Aubigné Score).

Result	Merle d' Aubigné Score	Number
Excellent	18	4
Good	15-17	14
Fair	12-14	4
Poor	3 - 11	2

Table 6: Association of time interval between surgery with the clinical result.

Result Duration	Total (n = 24)	Excellent	Good	Fair	Poor
1 – 7 days	8	3	4	1	0
8 – 14 days	12	1	8	2	1
15 – 21 days	3	0	2	1	0
22 – 28 days	1	0	0	0	1

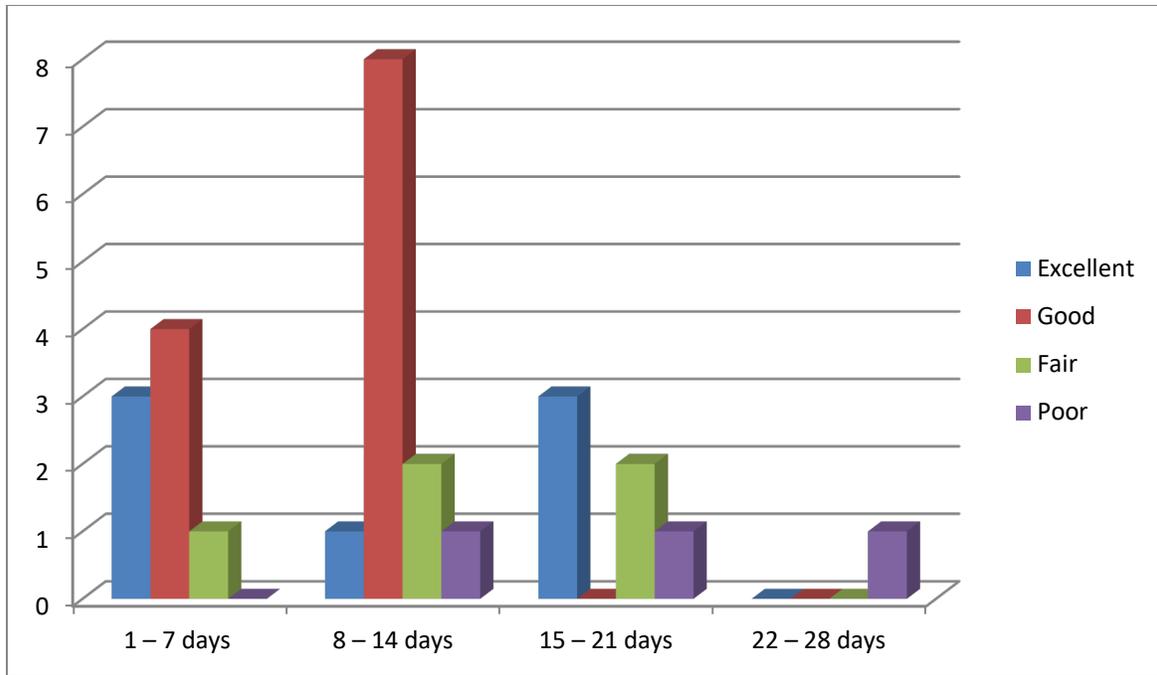


Figure 1: A comparative chart showing the distribution of results based on the Injury – Surgery Interval (x= interval in days, y = number of patients).



Figure 2: Showing fracture of posterior wall of acetabulum.

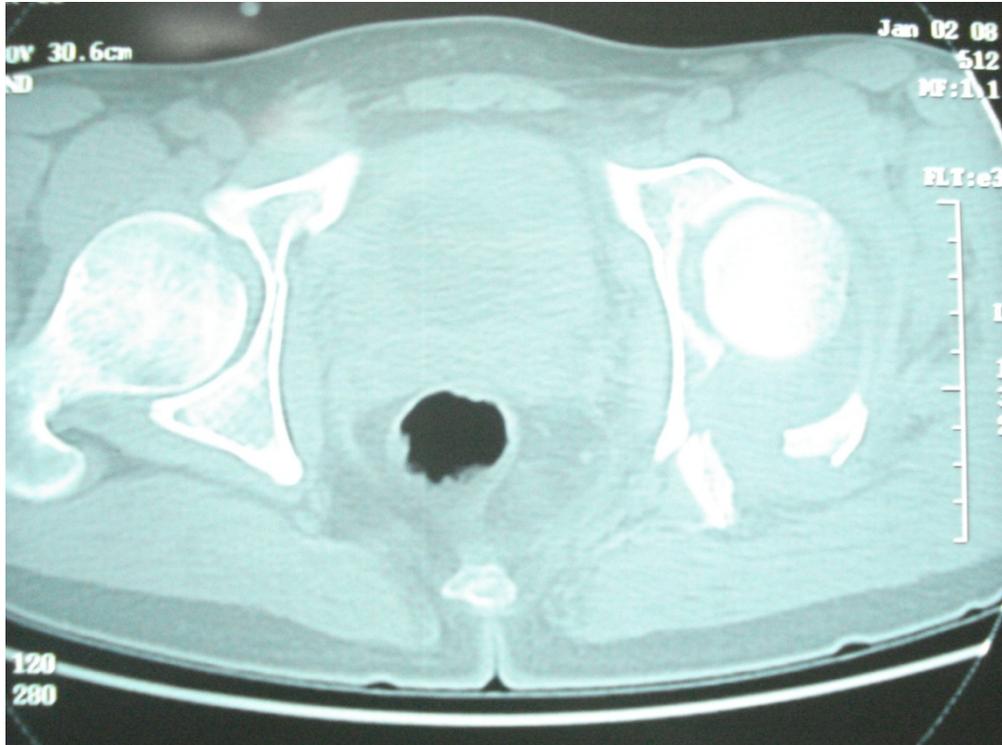


Figure 3: CT Scan of same patient.



Figure 4a: Immediate Post Operative Skiagram (AP view)



Figure 4b: Immediate Post Operative Skiagram (Obturator view)



Figure 5a: Flexion at hip at 24 months.



Figure 5b: Abduction at hip at 24 months.



Figure 5c: Showing good power of hip muscles at 24 months.

The radiological Grading of Result was done in immediate post operative period according to the following criteria shown in table no. 4. The Clinical Grading of Result was done by the Modified Merle d' Aubigné Score. The mean score was 15.12. The result is shown in table no 5. The following table depicts the association of time interval between surgery

and with the clinical result (table 6 and fig 1): There were few complications which were superficial infection in 2 cases, OA in two cases, Heterotrophic Ossification in one case and post operative loss of reduction in one case. However there was no case of iatrogenic sciatic nerve palsy in our series.

Discussion

The acetabular fractures are a result of high energy trauma with associated multiple injuries. In 29% of cases, the injuries were associated with posterior dislocation of hip. Males were involved more than females. The male female sex ratio was 2.42:1. Most affected age group was 20 – 30 years (37.5%) followed by 30 – 40 years (33%). RTA was the causative factor in 91% of the cases. 25% of patients achieved excellent reduction, 66% cases achieved good reduction where as 4.1% cases achieved fair and poor reduction each.

Clinically, 16.6% cases achieved excellent result, 58.3% cases achieved good result, 16.6 % cases achieved fair result and 8.3% cases had poor result. Of the 8 cases operated in 1 – 7 days interval 37.5% cases achieved excellent result, 50% cases achieved good result and 12.5% achieved fair result. No patient operated early achieved poor result. Of the 12 cases operated in the 8 – 14 days interval 8.3% achieved excellent result, 66.6% patients achieved good result, 16.6% achieved fair result and 8.3% achieved poor result. Of the 3 cases operated in the 15 – 21 days interval none of the patient achieved excellent result, with 66.6% cases achieving good result and 33.3% cases achieving fair result. The only case operated after 21 days had poor result. The patient had poor radiological reduction. The statistical difference between the clinical outcome of patients operated in first 7 days compared to those of operated after 7 days was significant. Based on this it can be safely said that those patients who are operated within 7 days have a better clinical outcome that those operated 7 days ($p = 0.0295$). The statistical difference between the clinical outcome of patients with post reduction incongruity ≤ 1 mm was significant as compared to those who had post reduction incongruity > 1 mm ($p = 0.0447$). Therefore, we conclude that early surgery (within 7 days) and excellent post reduction congruity (≤ 1 mm

incongruity) are the two main determinants for the clinical outcome. There was no incidence of Trochanteric nonunion in our study. Two patients had developed OA at the end of 18 months follow up. But they were being managed on analgesics. The patient with Sciatic Nerve Injury had recovery of nerve injury over a period of 3 months. No incidence of AVN was noticed in our series.

The absence of AVN in our series can be explained by the fact that all posterior acetabular fractures with associated posterior dislocation were reduced within 6 hours of Injury. One patient had developed heterotrophic ossification which was Grade II (according to Brooker et.al [10] but the patient had mild pain and very little compromise in function. Thus, early surgery and the quality of reduction are two very important determinants of the outcome of the acetabular fractures. In our study 91% of patients, adequate reduction could be achieved. This is comparable to the percentage of adequate reduction rates of Letournel (73%) [11] and Matta (90%) [12] 75% of the cases had good to excellent result in our series which is comparable to the reports of Kebaish et.al. (74%) [5] Goulet et.al. (77%) [13] and Lim et.al. (70%) [14].

References

1. Carnesale PG, Stewart MJ, Barnes SN. Acetabular disruption and central fracture-dislocation of the hip. A long-term study. *J Bone Joint Surg Am* 1975;57(8):1054-1059.
2. Pennal GF, Davidson J, Garside H, et al. Results of treatment of acetabular fractures. *Clin Orthop* 1980;(151):115-123.
3. Rowe C. Prognosis of fractures of the acetabulum. *J Bone Joint Surg Am* 1961;43A (30).
4. Judet R, Judet J, Letournel E. Fractures of the acetabulum: Classification and

- surgical approaches for open reduction. Preliminary report. *J Bone Joint Surg Am* 1964; 46:1615-1646.
5. Kebaish AS, Roy A, Rennie W: Displaced acetabular fractures: long-term follow-up. *J Trauma* 1991; 31:1539
 6. Rowe CR, Lowell JD, Prognosis of fractures of acetabulum. *J. Bone and joint surgery* 1961; 43 A (1): 30 - 59.
 7. Matta JM, Merritt PO: Displaced acetabular fractures, *Clin Orthop Relat Res* 1988; 230:83.
 8. Letournel E, Judet R. Fractures of the acetabulum, 2nd ed. Berlin: Springer-Verlag, 1993.
 9. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. *J Bone Joint Surg Am* 1996;78(11):1632-1645.
 10. Brooker AF, Bowerman JW, Robinson RA, Riley LH Jr. Ectopic ossification following total hip replacement: incidence and a method of classification. *J. Bone and Joint Surg Am.* 1973 Dec; 55(8):1629-1632.
 11. Letournel E and Judet R. Fractures of acetabulum, edited by R.A. Elson. New York, Springer, 1993.
 12. Matta JM. Fractures of acetabulum: Accuracy of reduction and clinical results in patients managed operatively within three weeks after injury. *J. Bone and Joint Surg. Am.* 1996 Nov; 78(1): 1632-1645.
 13. Goulet JA, Bray TJ. Complex acetabular fractures. *Clin Orthop Relat Res.* 1989 Mar;(240):9–20.
 14. Lim HH, Tang CL, S Krishnamoorthy. Operative treatment of acetabular fractures. *Singapore Med J* 1994. Vol 35, 173-176.
 15. Bassi JL, Dattal C, Mahindra P, Singh N. Open reduction and internal fixation of posterior wall acetabular fractures: a study of 45 cases. *J. Orthopaedics* 2007;4(1)e17.