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Original Research Article

Evaluation of Functional and Radiological Outcomes Following Open Reduction and Internal Fixation (ORIF) of Acetabular Fractures: A Descriptive Observational Study at a Tertiary Care Centre in Jaipur, Rajasthan

Manohar[1], Kapil Dayma[2], S.K. Rawat[3]

[1]Resident Doctor, Department of Orthopaedics, SMS Medical College & Attached Hospitals, Jaipur, Rajasthan, India

[2]Senior Resident, Department of Orthopaedics, SMS Medical College & Attached Hospitals, Jaipur, Rajasthan, India

[3]Professor, Department of Orthopaedics, SMS Medical College & Attached Hospitals, Jaipur, Rajasthan, India

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Corresponding Author: Dr. Kapil Dayma

Conflict of interest: Nil

Abstract:

Background: Acetabular fractures are complex injuries that pose a significant challenge to orthopaedic surgeons. The incidence of these fractures continues to rise due to high-velocity road traffic accidents. Open reduction and internal fixation (ORIF) remain the standard of care for displaced acetabular fractures requiring surgical intervention. This study aimed to evaluate the functional and radiological outcomes of acetabular fractures treated by ORIF at a tertiary care centre.

Materials and Methods: This descriptive observational study was conducted at the Department of Orthopaedics, SMS Medical College, Jaipur. Forty patients with displaced acetabular fractures who underwent ORIF were included and followed up for a minimum of 12 months. Fractures were classified using the Letournel and Judet classification. Functional outcomes were assessed using the Modified Merle D'Aubigne and Postel clinical grading system. Radiological outcomes were evaluated using Matta's criteria for quality of reduction.

Results: The mean age was 50.3 years with male predominance (75%). Road traffic accident was the mode of injury in 90% of cases. Anterior column (30%) and posterior wall (25%) fractures were the most common types. Kocher–Langenbeck approach was used in 45% of patients. Anatomical reduction was achieved in 45% patients, imperfect in 40%, and poor in 15%. According to Modified Merle D'Aubigne score, 25% had excellent, 15% very good, 30% good, 15% fair, and 15% poor outcomes. Patients operated within 1–2 weeks had significantly better outcomes. Complications included post-traumatic arthritis (10%), heterotopic ossification (20%), wound infection (7.5%), and sciatic nerve palsy (5%).

Conclusion: ORIF of acetabular fractures yields satisfactory functional and radiological outcomes when performed with anatomical reduction, appropriate surgical approach, and timely intervention. Early surgery within 10–14 days, minimal initial displacement, and accurate reduction are the key determinants of favourable outcomes.

Keywords: Acetabular fracture, Open reduction internal fixation, Merle D'Aubigne score, Matta's criteria, Letournel classification, Functional outcome, Radiological outcome.

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Introduction

Acetabular fractures are still difficult fractures to manage and remain a challenge for many orthopaedic surgeons. The incidence of acetabular fractures continues to increase due to high-velocity road traffic accidents. [1] Literature from 1950–1960 offered conflicting recommendations regarding optimal care for acetabular fractures. Previously, there was no accepted fracture classification and fracture evaluation was tough with poor radiological knowledge. [2,10,31]

In 1964, Judet et al. provided more clarity regarding radiographic findings, a standard classification of acetabular fractures and outlined a proper plan of action. [3,4] With further studies by Letournel and Judet and by Matta, it was proved that to attain the best result, hip joint congruity and stability must be accompanied by a good anatomical reduction (<2

mm of residual displacement). [5,7,11] Hence, accurate intra-articular reduction of fracture fragments is of paramount importance.

The time interval between injury and surgery and the initial displacement of fracture fragments play a vital role in obtaining anatomical reduction. [11,14] Acetabular fractures need not be fixed on an emergency basis unless associated with irreducible hip dislocation, progressing neurological deficit, or vascular injury. [15] In general, fractures with hip instability, hip incongruity, and fractures with involvement of the superior weight-bearing dome require open reduction and internal fixation. [9,31] The surgery is complex and demanding even for experienced surgeons. [28]

Certain factors such as patient's age, fracture pattern, medical condition, and associated injuries should be considered before making management decisions.[31] The procedure is best executed by specialized surgeons who routinely care for such patients, and all orthopaedic surgeons should be able to diagnose the fracture and determine whether it requires surgical management.[12,13] The ultimate goal of treatment is to obtain a pain-free range of motion and stability of the hip joint to perform vocational and day-to-day activities without future degenerative changes. [9]

Therefore, the purpose of this study was to evaluate the functional and radiological outcomes of acetabular fractures treated by open reduction and internal fixation at a tertiary care centre.

Aim

To study the functional and radiological outcome of acetabular fractures treated by open reduction and internal fixation.

Materials and Methods

Study Design and Setting

This descriptive observational study was conducted in the Department of Orthopaedics at SMS Medical College, Jaipur. Patients with unstable acetabular fractures who underwent ORIF were prospectively studied with a minimum follow-up of 12 months.

Inclusion Criteria

Acetabular fractures with 2 mm or more displacement in the dome, roof arc measurements <45 degrees, posterior joint instability, and irreducible fracture-dislocations were included.

Exclusion Criteria

Patients aged <18 years and >70 years, non-displaced or minimally displaced fractures (<2 mm displacement in weight-bearing dome), roof arc angle >45 degrees, no femoral head subluxation on three views out of traction, secondary congruence in displaced both-column fractures, and patients medically unfit for surgery were excluded.

Pre-operative Planning

For all patients, X-ray pelvis with both hips (AP view, obturator oblique view, and iliac oblique view), axial CT, and 3D reconstruction were obtained. All fractures were classified according to the Letournel and Judet classification. [4,5]

Surgical Technique

Surgery was performed under spinal anaesthesia. The choice of surgical approach depended on the fracture type, elapsed time from injury, and the location of maximal displacement.[27] Three approaches were used: Kocher–Langenbeck (posterior) approach, ilioinguinal (anterior) approach, modified Stoppa's approach, and combined approaches when needed. [32,33,34] After exposing the fracture site, the fracture configuration was verified with C-arm. Fracture fragments were reduced using special clamps and ball-tipped spikes. Temporary fixation was achieved with 1.6 mm K-wires, followed by lag screw fixation with 3.5 mm cortical screws and buttress plating with contoured 3.5 mm reconstruction plates.

Post-operative Protocol

Prophylactic intravenous antibiotics were administered for seven days. Closed suction drains were used and removed on day 2. Indomethacin 25 mg three times daily was started from the second post-operative day and continued for 6 weeks for heterotopic ossification prophylaxis. [18,20] Patients were mobilized as soon as tolerated with toe-touch walking using walker/crutches at 6 weeks. Full weight-bearing was permitted after 3 months.

Follow-up and Outcome Assessment

Serial radiographs (AP view, obturator oblique, and iliac oblique views) were scheduled at 2 weeks, 3 months, 6 months, and 1 year. Radiological outcome was assessed using Matta's criteria: anatomical reduction (0–1 mm displacement), imperfect reduction (2–3 mm), or poor reduction (>3 mm). [6,11] Functional outcome was evaluated using the Modified Merle D'Aubigne and Postel clinical grading system, which assesses pain, walking ability, and range of motion, each carrying a maximum of 6 points (total 18). Results were graded as: Excellent (18), Very Good (17), Good (15–16), Fair (13–14), and Poor (<13). [9,22]

Statistical Analysis

Data was entered in Microsoft Excel and analysed using descriptive statistics. Continuous variables were summarized as mean and standard deviation, while categorical variables were expressed as frequencies and percentages.

Results

A total of 40 patients with acetabular fractures who underwent ORIF were studied with an average follow-up of 12 months (range: 6–18 months).

Table 1: Demographic and Clinical Characteristics of Study Population (n=40)

Parameter	Category	No. of Patients	Percentage (%)
Age (years)	<20	2	5
	21–30	4	10
	31–40	8	20
	41–50	4	10
	51–60	12	30
	61–70	10	25
Sex	Male	30	75
	Female	10	25
Side	Right	26	65
	Left	14	35
Mode of Injury	RTA	36	90
	Fall from Height	4	10

RTA = Road Traffic Accident

The majority of patients (55%) were above 50 years of age. Males predominated with a ratio of 3:1. Right side was involved in 65% of cases. Road traffic accidents accounted for 90% of injuries and fall from height for 10%.

Table 2: Distribution of Fracture Types and Surgical Approaches (n=40)

Fracture Type (Letournel)	No. of Patients	(%)	Commonest Approach
Anterior Column	12	30	Ilioinguinal
Posterior Wall	10	25	Kocher–Langenbeck
Transverse	8	20	Combined/KL
Both Column	6	15	KL/Extended Stoppa
Posterior Wall and Column	2	5	Kocher–Langenbeck
Ant. Column + Post. Hemitransverse	2	5	Combined

KL = Kocher–Langenbeck

Anterior column fractures were the most common type (30%), followed by posterior wall fractures (25%), transverse fractures (20%), both column fractures (15%), posterior wall and column fractures (5%), and anterior column with posterior hemitransverse fractures (5%). The Kocher–Langenbeck approach was the most commonly used (45%), followed by ilioinguinal approach (30%), combined approach (15%), and Stoppa approach (10%).

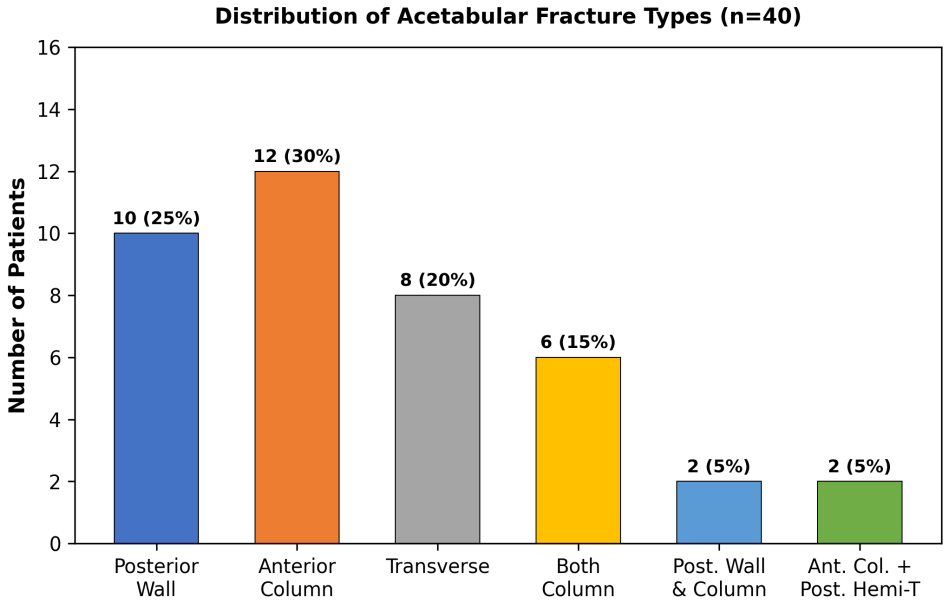

Figure 1: Distribution of Acetabular Fracture Types (n=40)

Table 3: Quality of Fracture Reduction Based on Matta's Criteria (n=40)

Quality of Reduction	Displacement	No. of Patients	Percentage (%)
Anatomical	0–1 mm	18	45
Imperfect	2–3 mm	16	40
Poor	>3 mm	6	15

Anatomical reduction (0–1 mm) was achieved in 18 patients (45%), imperfect reduction (2–3 mm) in 16 patients (40%), and poor reduction (>3 mm) in 6 patients (15%). Patients who were operated within 1–2 weeks of injury had a higher rate of anatomical reduction compared to those operated later. Patients with initial fracture displacement <10 mm had better reduction quality and radiological outcomes. [11,24,25]

Table 4: Functional Outcome Based on Modified Merle D'Aubigne and Postel Score (n=40)

Clinical Grading	Score	No. of Patients	(%)	Cumulative Satisfactory
Excellent	18	10	25	
Very Good	17	6	15	
Good	15–16	12	30	70% (Good–Excellent)
Fair	13–14	6	15	
Poor	<13	6	15	

According to the Modified Merle D'Aubigne and Postel scoring system, 10 patients (25%) had excellent outcome, 6 patients (15%) very good, 12 patients (30%) good, 6 patients (15%) fair, and 6 patients (15%) poor outcome. Overall, 70% of patients had good to excellent functional results. The functional outcome score ranged from 8 to 18 (maximum 18). Poor results were mainly attributed to post-traumatic arthritis, imperfect reduction, and improper post-operative mobilization due to polytrauma.

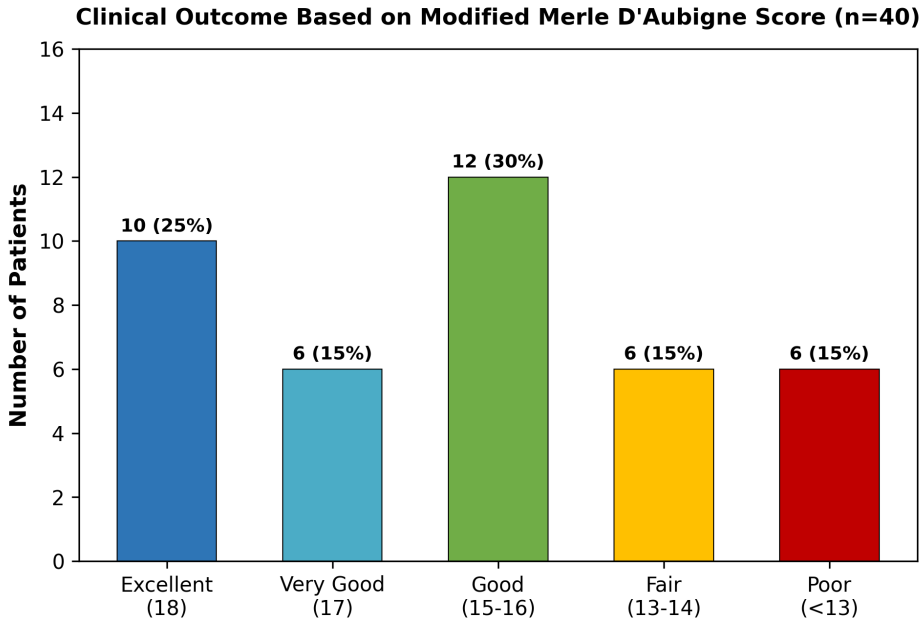

Figure 2: Clinical Outcome Based on Modified Merle D'Aubigne Score (n=40)

Table 5: Relationship Between Time to Surgery and Clinical Outcome (n=40)

Time to Surgery	Excellent	Very Good	Good	Fair	Poor
1–2 weeks (n=18)	8	4	4	2	0
2–3 weeks (n=13)	2	2	5	2	2
>3 weeks (n=9)	0	0	3	2	4

Patients operated within 1–2 weeks had the best outcomes with 66.7% achieving excellent or very good results, compared to 30.8% in the 2–3 weeks group, and 0% in the >3 weeks group. This finding is consistent with the recommendation that surgery should not be delayed beyond 15 days for elementary fractures and 10 days for associated types. [3]

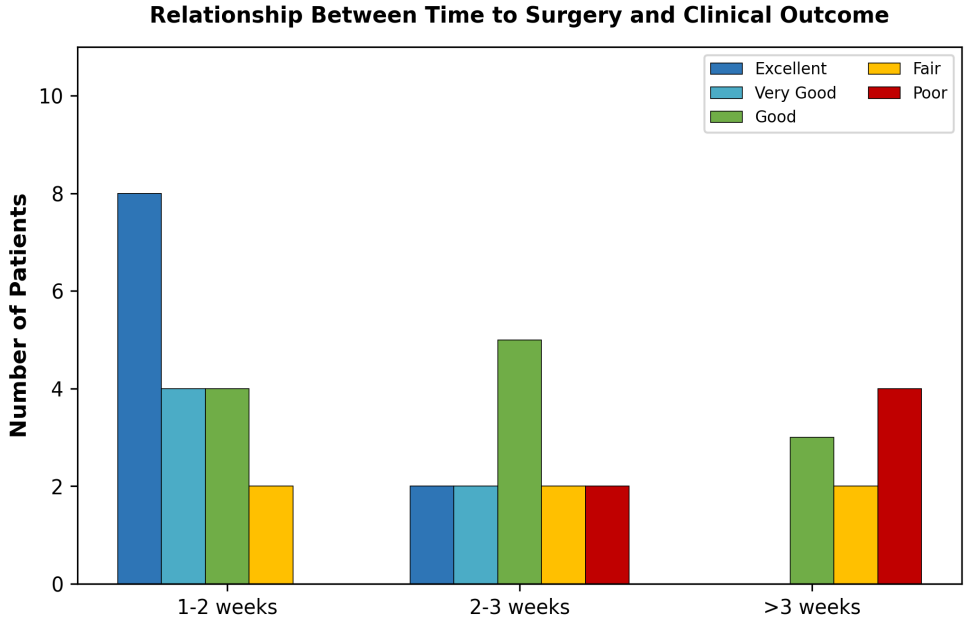

Figure 3: Relationship Between Time to Surgery and Clinical Outcome

Complications

Post-traumatic arthritis developed in 4 patients (10%), of whom one required total hip replacement. Heterotopic ossification was observed in 8 patients (20%), which was reduced compared to 53% reported by Alonso et al., attributable to prophylactic indomethacin treatment. [20,21] Wound infection occurred in 3 patients (7.5%) managed with antibiotics. Sciatic nerve palsy occurred in 2 patients (5%), which was lower than the 8% reported by Giannoudis et al. and 8.3% by Swiontkowski et al. No patients had intra-operative complications. The average operative time was 164 minutes (range: 120–230 minutes) and average blood loss was 1,012 ml.

Discussion

Treatment of acetabular fractures remains a complex task for orthopaedic surgeons due to lack of technical expertise and inadequate infrastructure. [23,31] Reduction of acetabular fractures is challenging because when both columns are involved, visualization and reduction through a single approach is difficult and may necessitate a combined approach.

In our study, the average age group was 50–55 years, which is comparable with the study by Swiontkowski et al. on complex acetabular fractures. Males dominated over females with the majority of fractures occurring on the right side in the form of road traffic accidents. It was demonstrated in our study that ORIF after attaining anatomic reduction followed by early mobilization preserves joint function, as described by Matta. [11] A good quality clinical result was achieved with accurate anatomical reduction. [11,24,25] Pennal et al. reported that the quality of clinical result depends directly on the quality of reduction achieved when ORIF is performed.

In our study, we used the Kocher–Langenbeck approach in 18 patients (45%) and the ilioinguinal approach in 12 patients (30%). In 6 patients (15%), a combined approach was required due to inadequate exposure. We were able to achieve satisfactory reduction in 85% of cases using either a single or combined approach. An ideal approach should allow visualization of both column and joint surface with minimal morbidity.

The infection rate in our study was 7.5%, which may be attributed to longer duration of surgery, and is comparable with 5.6% reported by Suzuki et al. and 4% by Mayo et al. Patients who were treated early had better outcomes, and those treated within 1–2 weeks had better reduction, comparable to the study by Giannoudis et al. where the mean time delay was 8.9±2.3 days. Initial displacement of fracture fragments was another important factor; patients with <10 mm displacement had better reduction and radiological results.

Age of the patient did not have a significant effect on the outcome in our study. We used single exposure in the majority of patients and reduced the opposite column by indirect methods, which reduced morbidity considerably. Heterotopic ossification was observed in 20% of our patients compared to 53% in the study by Alonso et al., and this was contained by prophylactic treatment with indomethacin for 6 weeks. [18,20] Sciatic nerve palsy occurred in 5% of our patients, which was lower than 8% reported by Giannoudis et al. and 8.3% by Swiontkowski et al.

In our study, anterior column and posterior wall fractures had better outcomes while transverse fractures had poorer outcomes. However, Marwin M. Tile reported that transverse fractures have the best functional outcome.[9] The surgical approaches used had comparable operative times and blood loss to other studies by Matta et al., Reinert et al., and Helfet et al. [11] We observed that the length of follow-up is critical and with longer follow-up, arthritis is more likely to develop even in perfectly reduced fractures.

Conclusion

From our study we conclude that complex acetabular fractures treated by open reduction and internal fixation yield satisfactory functional outcomes. X-rays and CT imaging are essential in pre-operative evaluation of fractures. A good pre-operative planning is crucial for selecting the appropriate surgical approach and achieving fracture reduction. Surgery should not be delayed beyond 10–14 days from injury for optimal fracture reduction. The functional outcome depends upon accurate fracture reduction and stable fixation, which facilitates early rehabilitation and produces satisfactory outcomes. Complications associated with surgical approaches such as infections, heterotopic ossifications, and DVT can be reduced by proper soft tissue handling, appropriate antibiotics, and prophylactic treatment.

Limitations

This study has limitations including a relatively small sample size, single-centre design, and the absence of a control group for comparison. Different fracture subtypes were managed with different surgical approaches, making direct comparison difficult. Longer follow-up studies with larger sample sizes and multi-centre design are needed to further validate these findings.

Source of Funding

None.

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