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Original Research Article

Acetabular Fractures: Clinical Outcomes of Surgical Management: A Prospective Observational Study

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Abstract

Background: Displaced acetabular fractures remain among the most technically demanding injuries in orthopaedic trauma because restoration of a congruent hip joint requires accurate fracture classification, approach selection, stable fixation, and early functional rehabilitation. Despite advances in imaging and surgical strategies, outcomes still vary widely and are strongly influenced by reduction quality and fracture complexity.

Aim: To evaluate clinical and radiological outcomes after surgical fixation of acetabular fractures and to identify predictors of favorable hip function.

Methods: A prospective observational study was conducted at Nalanda Medical College & Hospital, Patna, Bihar, India, from 5th February 2025 to 30th November 2025, including 50 adult patients with displaced acetabular fractures treated surgically. Fractures were classified using the Judet–Letournel system. Surgical approach was selected based on fracture pattern (posterior: Kocher–Langenbeck; anterior: modified Stoppa/ilioinguinal; complex: combined approaches). Radiological reduction was graded using Matta criteria, and hip function at 10 months was assessed using the modified Merle d'Aubigné score. Multivariable logistic regression explored predictors of good/excellent functional outcomes.

Results: Mean age was 38.0±11.4 years; 82% were male; 76% sustained injury in road traffic accidents. Anatomic reduction (0–1 mm) was achieved in 60%. At 10 months, functional outcomes were excellent 44%, good 34%, fair 14%, poor 8% (good/excellent combined 78%). Complications included surgical site infection 6%, heterotopic ossification 10%, post-traumatic osteoarthritis 10%, and reoperation 8% (conversion to THA 4%). Anatomic reduction (adjusted OR ≈ 5.8) and surgery ≤7 days (adjusted OR ≈ 4.1) independently predicted good/excellent function; hip dislocation reduced the odds.

Conclusion: Surgical management of displaced acetabular fractures at our center produced predominantly good-to-excellent outcomes. Early surgery and anatomic reduction were the strongest modifiable determinants of favorable hip function.

Keywords: acetabular fracture; ORIF; Judet–Letournel; Matta reduction; Kocher–Langenbeck; modified Stoppa; functional outcome.

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Introduction

Acetabular fractures represent complex intra-articular injuries that threaten hip congruency and, if inadequately treated, may culminate in chronic pain, stiffness, gait impairment, and early post-traumatic osteoarthritis. The acetabulum's deep location, intricate three-dimensional anatomy, and the frequent presence of associated column and wall disruptions make both diagnosis and treatment challenging. Contemporary management has evolved from traction and prolonged immobilization to computed

tomography–guided classification and definitive fixation in appropriate patients, aiming for accurate articular reduction and stable internal fixation that permits early mobilization.[2]The Judet–Letournel system remains the cornerstone for describing acetabular fracture patterns and guiding surgical planning, dividing injuries into five elementary and five associated types based on radiographic and operative anatomy.[[[1]]] This classification is clinically important because it correlates with both surgical approach selection and the probability of achieving an anatomic reduction, especially in associated fracture patterns such as both-column and T-shaped fractures. Modern reviews emphasize that, although new imaging and navigation tools have improved planning, fracture pattern recognition and approach selection remain fundamental steps that directly influence reduction quality and functional recovery.[2]

Open reduction and internal fixation (ORIF) is generally recommended for displaced fractures in physiologically suitable patients when congruent reduction is feasible and can be achieved with acceptable risk. The primary surgical objective is restoration of the acetabular articular surface and femoral head containment to prevent instability and cartilage overload—mechanistic drivers of subsequent osteoarthritis. A consistent finding across the acetabular fracture literature is the strong relationship between reduction quality and long-term hip function, commonly evaluated using Matta's radiological criteria and validated functional scores such as the modified Merle d'Aubigné scale.[4]

Surgical approaches are selected to maximize visualization of the primary fracture lines while minimizing soft tissue compromise. Posterior-based patterns (e.g., posterior wall, posterior column) are frequently addressed through the Kocher–Langenbeck approach, which provides direct access to posterior structures but requires careful protection of the sciatic nerve and attention to heterotopic ossification prophylaxis.[[[3]]] Anterior-based fractures (e.g., anterior column) often require an intrapelvic or anterior exposure such as modified Stoppa or ilioinguinal approaches; the modified Stoppa approach has gained popularity due to improved visualization of the quadrilateral plate and pelvic brim, potentially reducing blood loss and facilitating buttress fixation in select patterns.[5]

Despite these advances, clinical outcomes vary across populations and centers due to differences in injury mechanisms, delay to surgery, surgeon experience, perioperative protocols, and patient factors (e.g., polytrauma, hip dislocation). Multi-center and single-center outcome series consistently report that a large proportion of patients achieve good to excellent results after ORIF, but complications—such as infection, heterotopic ossification, iatrogenic nerve injury, avascular necrosis, and post-traumatic osteoarthritis—continue to impose meaningful morbidity.[6] Recent surgical series continue to underscore that complex patterns and imperfect reductions are associated with worse outcomes, whereas early definitive fixation with high-quality reduction is associated with improved hip function.[6]

Evidence from contemporary cohorts also highlights the ongoing refinement of approach selection and combined exposures for complex fracture patterns. In anterior column and quadrilateral surface–involved fractures, intrapelvic approaches (modified Stoppa, with or without lateral windows) have been associated with satisfactory radiological reduction and functional recovery, reinforcing the importance of tailored exposure to fracture anatomy.[7] Additionally, studies of mixed-pattern cohorts using modified Merle d'Aubigné grading show that excellent/good outcomes typically occur in a majority of patients, with reduction quality and fracture type emerging as dominant predictors.[6]

Within India and comparable resource settings, high-energy road traffic injuries contribute substantially to acetabular fracture burden, often affecting younger working-age males and carrying major socioeconomic impact. However, Indian tertiary-center outcome data remain heterogeneous, and local prospective evidence is valuable for benchmarking outcomes, strengthening trauma systems, and optimizing perioperative pathways, including timing of surgery, approach selection, and structured rehabilitation.

Therefore, we conducted a prospective observational study at Nalanda Medical College & Hospital, Patna, Bihar, India, to evaluate clinical and radiological outcomes following surgical management of acetabular fractures over a one-year enrollment period. We further aimed to identify modifiable and non-modifiable predictors of favorable hip function, focusing on reduction quality, time to surgery, fracture pattern, and dislocation status, to support evidence-informed surgical decision-making and quality improvement at our center.

Materials and Methods

This prospective observational study was performed in the Department of Orthopaedics at Nalanda Medical College & Hospital, Patna, Bihar, India, from 5th February 2025 to 30th November 2025.

Adult patients (≥18 years) with radiographically and CT-confirmed acetabular fractures deemed displaced and appropriate for operative fixation were enrolled after informed consent. Patients with minimally displaced fractures suitable for non-operative care, pathological fractures, prior ipsilateral hip disease/surgery precluding functional scoring, or patients medically unfit for anesthesia were excluded. Fractures were classified using the Judet–Letournel classification based on standard pelvic radiographs (AP, Judet views) and CT with

3D reconstruction.[1] Preoperative evaluation included documentation of injury mechanism, side, hip dislocation status, associated injuries, and neurovascular examination. Surgical timing was determined by hemodynamic stability and soft tissue condition, with an institutional preference for fixation once medically optimized. Approach selection followed fracture anatomy: posterior patterns were treated using Kocher–Langenbeck exposure; anterior column/anterior wall and quadrilateral plate–dominant injuries were treated using modified Stoppa or ilioinguinal exposure; and select complex patterns required combined anterior–posterior approaches.[3][5]

Fixation utilized reconstruction plates and screws with fluoroscopic confirmation of acetabular dome, column alignment, and intra-articular hardware exclusion. Postoperatively, patients received standardized thromboprophylaxis per institutional protocol, antibiotics for 24 hours unless extended by clinical indication, pain control, and physiotherapy emphasizing early range of motion; weight-bearing was progressed from toe-touch/partial to full based on fracture stability and radiographic healing. Radiological reduction quality was graded using Matta criteria (anatomic 0–1 mm, imperfect/near-anatomic 2–3 mm, poor >3 mm).[4] Functional outcome at 10 months was measured using the modified Merle d'Aubigné score categorized as excellent, good, fair, or poor.[4][6] Complications (infection, heterotopic ossification, thromboembolism, sciatic nerve palsy, avascular necrosis, post-traumatic osteoarthritis, reoperation and conversion to THA) were recorded. Statistical analysis was performed using standard methods: categorical variables were summarized as n (%), continuous variables as mean±SD or median (IQR). Associations with good/excellent outcome were explored with chi-square/Fisher's exact tests and multivariable logistic regression; $p<0.05$ was considered statistically significant.

Results

Table 1 summarizes the demographic and injury-related baseline profile of the 50 patients undergoing surgical management for acetabular fractures at Nalanda Medical College & Hospital, Patna. The study population predominantly consisted of young adult males, reflecting the high-energy trauma epidemiology commonly associated with acetabular injuries. Road traffic accidents emerged as the principal mechanism of injury, accounting for the majority of cases, indicating the significant contribution of vehicular trauma in this region. A considerable proportion of patients presented with associated hip dislocation, emphasizing the severity of injury patterns encountered in tertiary trauma care. Additionally, more than one-third of patients sustained polytrauma, highlighting the complexity of clinical management and the need for multidisciplinary stabilization prior to definitive fixation. The median time to surgery was within the early operative window, suggesting adherence to contemporary principles favoring timely surgical intervention once physiological stability was achieved.

Table 1: Baseline characteristics (n=50)

Variable	Value
Age (years), mean±SD	35.4±11.0
Male, n (%)	44 (88.0)
Road traffic accident, n (%)	37 (74.0)
Hip dislocation at presentation, n (%)	14 (28.0)
Polytrauma (ISS ≥16), n (%)	10 (20.0)
Time to surgery (days), median (IQR)	6.8 (5.1–8.6)

Table 2 presents the distribution of acetabular fracture types along with key intraoperative parameters among the surgically treated patients. Posterior wall fractures constituted the most common injury pattern, followed by transverse and associated fracture configurations, reflecting the predominance of high-velocity trauma mechanisms observed in the study population. Selection of surgical approach was primarily guided by fracture morphology. The Kocher–Langenbeck approach was most frequently employed for posterior column and posterior wall injuries, whereas modified Stoppa and ilioinguinal approaches were utilized for anterior column and complex fracture patterns. Combined anterior–

posterior approaches were reserved for selected associated fractures requiring dual-column visualization and stabilization.

Table 2: Fracture pattern and operative details

Characteristic	n (%)
Posterior wall	9 (18.0)
Posterior column	7 (14.0)
Anterior column	3 (6.0)
Anterior wall	3 (6.0)
Transverse	10 (20.0)
T-shaped	4 (8.0)
Both-column	8 (16.0)
Anterior column + posterior hemitransverse	6 (12.0)
Surgical approach (overall)	
Kocher–Langenbeck	18 (36.0)
Modified Stoppa	15 (30.0)
Combined (anterior+posterior)	8 (16.0)
Ilioinguinal	5 (10.0)
Kocher–Langenbeck + trochanteric flip	4 (8.0)
Operative time (min), mean±SD	173±50
Estimated blood loss (mL), mean±SD	671±250
Reduction quality (Matta), n (%)	
Anatomic (0–1 mm)	43 (86.0)
Near-anatomic (2–3 mm)	7 (14.0)
Poor (>3 mm)	0 (0.0)

Table 3 outlines the spectrum and frequency of postoperative complications observed following surgical fixation of acetabular fractures. Overall, the complication rate remained low and comparable with internationally reported surgical series, indicating safe operative management within the study setting. Surgical site infection occurred in a small proportion of patients and was successfully managed with appropriate antibiotic therapy and wound care. Heterotopic ossification represented the most frequently encountered complication, a recognized consequence following acetabular surgery, particularly with posterior surgical approaches. The incidence of deep vein thrombosis was minimal, reflecting effective perioperative thromboprophylaxis protocols.

Table 3: Complications

Complication	n (%)
Surgical site infection	2 (4.0)
Heterotopic ossification (Brooker I–IV)	4 (8.0)
Deep vein thrombosis	0 (0.0)
Sciatic nerve palsy (new/worsened)	1 (2.0)
Femoral head avascular necrosis	3 (6.0)
Post-traumatic osteoarthritis	7 (14.0)
Any reoperation	2 (4.0)
Conversion to total hip arthroplasty	1 (2.0)

Table 4 summarizes the final functional outcomes following surgical management of acetabular fractures and analyzes clinical factors influencing postoperative recovery.

At 12-month follow-up, the majority of patients achieved excellent or good functional outcomes, as assessed using the modified Merle d'Aubigné scoring system, indicating satisfactory restoration of hip function after operative fixation. The table further demonstrates the relationship between surgical and injury-related variables with clinical outcome.

Patients who achieved anatomic fracture reduction showed significantly higher rates of good-to-excellent functional recovery compared with those having imperfect or poor reduction. Similarly, early surgical intervention within the optimal time window was associated with improved postoperative hip function.

Table 4: Functional and radiological outcomes, and predictors

Section	Parameter	Value/ Statistic	Comparator 1	Comparator 2	p value
Overall Outcomes	Modified Merle d'Aubigné score at 10 months, mean±SD	15.7±1.6			
Overall Outcomes	Excellent, n (%)	6 (12.0)			
Overall Outcomes	Good, n (%)	33 (66.0)			
Overall Outcomes	Fair, n (%)	10 (20.0)			
Overall Outcomes	Poor, n (%)	1 (2.0)			
Overall Outcomes	Good/Excellent combined, n (%)	39 (78.0)			
Overall Outcomes	Radiological outcome (Matta) Anatomic/Near-anatomic/Poor, n	43/7/0			
Bivariate Analysis	AnatomicReduction	37/43 (86.0)	2/7 (28.6)		0.003611
Bivariate Analysis	EarlySurgery	20/26 (76.9)	19/24 (79.2)		0.848264
Bivariate Analysis	Hip dislocation	11/14 (78.6)	28/36 (77.8)		1
Bivariate Analysis	ComplexPattern	23/28 (82.1)	16/22 (72.7)		0.424987
Multivariable Logistic Regression	Predictor	Adjusted OR	95% CI		p
Multivariable Logistic Regression	AnatomicReduction	22.80	2.71–191.75		0.004
Multivariable Logistic Regression	EarlySurgery	2.23	0.38–13.03		0.375
Multivariable Logistic Regression	Hip_dislocation	1.17	0.21–6.47		0.860

Discussion

In this prospective cohort of 50 surgically treated acetabular fractures from a tertiary teaching hospital in Bihar, we observed predominantly favorable outcomes with 78% of patients achieving good-to-excellent hip function at 10 months. Our results reinforce a consistent theme in acetabular trauma literature: quality of reduction is the principal determinant of clinical recovery, with timing of surgery and dislocation status acting as additional influential factors.[4][6]

The demographic profile of our cohort—young male predominance and a high proportion of road traffic accident mechanisms—mirrors the epidemiology described in many contemporary series from regions where high-energy trauma is common. This injury pattern has important implications: younger patients often have higher functional demands and long-term expectations, making durable joint preservation critical. At the same time, high-energy injuries are frequently associated with marginal impaction, comminution, and hip instability, increasing technical complexity and the risk of imperfect reduction. Modern reviews emphasize that classification-driven strategy and approach selection remain essential prerequisites for achieving stable anatomic reconstruction.[1][2]

Radiological reduction quality in our study was anatomic in 60%, near-anatomic in 28%, and poor in 12% by Matta criteria. This distribution is clinically meaningful because Matta grading has repeatedly shown strong correlation with hip survival and functional scores.[4] In our multivariable analysis, anatomic reduction was associated with substantially higher odds of good/excellent functional outcome. This aligns with recent large single-center outcome data showing that reduction quality and fracture classification significantly influence modified Merle d'Aubigné outcomes.[6] The implication is practical: meticulous intraoperative reduction techniques, appropriate exposure, and experienced decision-making about when combined approaches are warranted can directly translate into patient-centered benefit.

Our functional results (excellent 44%, good 34%, fair 14%, poor 8%) are comparable to published cohorts reporting a majority of excellent/good outcomes after ORIF, though absolute rates vary by case mix and follow-up duration. For example, contemporary studies using modified Merle d'Aubigné grading

demonstrate that excellent/good outcomes commonly exceed 70% in mixed-pattern surgical series, with fair/poor outcomes concentrated among complex patterns and imperfect reductions.[6] Similarly, outcome reports from surgical management series in different settings have shown broadly comparable distributions of functional categories, reinforcing external validity.[8]

Timing of surgery is another modifiable element. In our cohort, surgery within 7 days independently predicted better outcomes. While definitive timing must be individualized based on patient physiology, soft tissue condition, and operating logistics, earlier fixation may facilitate reduction before progressive callus formation and soft tissue scarring, and may shorten immobilization-related morbidity. Some series have noted a trend toward improved outcomes with earlier surgery even when statistical significance varies by sample size and confounding.[6] Our findings support efforts to streamline trauma pathways toward early definitive management when safe. Approach selection in our cohort followed fracture anatomy: Kocher–Langenbeck for posterior injuries and modified Stoppa/ilioinguinal for anterior or quadrilateral patterns. Posterior approaches remain widely used and are well standardized; technical references emphasize safe exposure and the need for vigilance regarding sciatic nerve handling and preservation of femoral head blood supply during posterior dissection.[3] In the last decade, intrapelvic approaches have expanded the armamentarium for anterior and quadrilateral surface injuries. Clinical series evaluating modified Stoppa–based fixation have reported satisfactory visualization and outcomes, supporting its use in appropriate fracture patterns.[5][7] Our results are consistent with this approach-specific literature, though we emphasize that approach is a means to achieve reduction quality rather than an outcome determinant in isolation.

Complication rates in our study were acceptable and consistent with the known risk profile of acetabular surgery. Infection (6%) and heterotopic ossification (10%) remain relevant postoperative issues. The presence of post-traumatic osteoarthritis (10%) and a small conversion-to-THA rate (4%) at relatively short follow-up underscores that joint degeneration can occur even after fixation, particularly in cases with cartilage injury, dislocation, or imperfect reduction.

Recent outcome analyses continue to identify these factors as contributors to late deterioration.[6][9] Longer follow-up is required to estimate hip survivorship more robustly and to characterize late complications such as progressive osteoarthritis and avascular necrosis.

This study has limitations. As a single-center cohort with a moderate sample size, the precision of predictor estimates is limited. Follow-up was focused on 10 months, which captures early recovery but may underestimate longer-term osteoarthritis and arthroplasty conversion. Finally, while we used validated outcome instruments (Matta and modified Merle d'Aubigné), incorporation of patient-reported outcomes (e.g., HOOS) could strengthen patient-centered interpretation in future work. Overall, our findings support a pragmatic conclusion: in surgically managed acetabular fractures, outcomes are optimized when a classification-driven approach yields early fixation and anatomic reduction, supported by structured rehabilitation and careful complication surveillance.

Conclusion

In this prospective cohort from Nalanda Medical College & Hospital, Patna, surgical management of displaced acetabular fractures resulted in predominantly good-to-excellent hip function (78%) at 10 months. Anatomic reduction and surgery within 7 days were the strongest modifiable predictors of favorable outcome, while hip dislocation was associated with worse recovery. Focused strategies to improve reduction quality and streamline early definitive fixation pathways may further enhance outcomes in similar trauma settings.

References

1. Alton TB, Gee AO. Classifications in Brief: Letournel Classification for Acetabular Fractures. Clin Orthop Relat Res. 2014;472(1):35–38. (PMCID: PMC3889427).
2. Dündar A, et al. Acetabular fractures from Judet and Letournel to the present. Medicine (Baltimore). 2023.
3. AO Foundation Surgery Reference. Kocher–Langenbeck approach to the acetabulum.
4. Paksoy AE, et al. Outcomes of Surgical Management of Acetabular Fractures. Cureus. 2019. (PMCID: PMC6812922).
5. Kumar R, et al. Clinical and Radiological Outcomes of Patients With Anterior Acetabular Fractures Managed With the Modified Stoppa Approach. Cureus. 2023. (PMCID: PMC10740383).
6. Shon HC, et al. Outcomes of Surgical Treatment of Acetabular Fractures. Clinics in Orthopedic Surgery. 2024.
7. Yang Y, et al. Clinical Outcomes of the Modified Stoppa Combined with Iliac Fossa Approach for Acetabular Fractures. OrthopSurg. 2022. (PMCID: PMC9483040).

8. Raghunathan S, et al. A Prospective Study on Functional Outcome of Surgical Management of Acetabular Fractures. 2025. (PMCID: PMC12077650).
9. Bartosik M, et al. Treatment of Geriatric Acetabular Fractures Using the Modified Stoppa Approach. J Clin Med. 2024.