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# Functional and radiological outcomes of open reduction and internal fixation in posterior wall fracture of the acetabulum

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## Abstract

**Background:** Posterior wall acetabular fractures are the most common subtype of acetabular injuries, often caused by high-energy trauma. Evidence on functional and radiological outcomes of open reduction and internal fixation (ORIF) in low- and middle-income countries remains limited.

**Methods:** This prospective observational study included 20 patients with posterior wall fractures of the acetabulum treated with ORIF at Dhaka Medical College Hospital, Bangladesh, between August 2020 and June 2022. Radiological outcomes were assessed using Matta criteria, and functional outcomes with the Merle d'Aubigné and Postel scoring system. Associations between clinical factors and outcomes were analyzed using Chi-square and Fisher's exact tests.

**Results:** The mean patient age was 38.3 years, with 90% male predominance. Road traffic accidents accounted for 90% of injuries, and the left hip was more frequently involved (70%). Anatomical reduction was achieved in 80% of cases. Radiological outcomes were excellent or good in 85%, while functional outcomes were excellent or good in 90%. Significant predictors of radiological outcome included hip dislocation ($P$ = 0.019), fragment displacement ($P$ = 0.019), reduction quality ($P$ = 0.049), and complications ($P$ = 0.016). Poorer functional outcomes were significantly associated with abdominal injuries ($P$ = 0.016) and surgical delay beyond 15 days ($P$ = 0.036). Complications occurred in 20% of patients, with heterotopic ossification most common.

**Conclusion:** ORIF of posterior wall acetabular fractures achieved favorable outcomes in most patients. Timely intervention, anatomical reduction, and careful management of associated injuries are essential for optimizing results in resource-limited settings.

**Keywords:** Acetabular fracture, functional outcome, open reduction internal fixation, posterior wall, radiological outcome

## Introduction

Acetabular fractures represent uncommon but highly impactful injuries, often resulting from high-energy trauma, with potential for significant long-term disability if not managed optimally. Globally, these injuries are rare at a population level (often around 3/100,000 people/year), yet they impose substantial morbidity through persistent pain, impaired mobility, and development of post-traumatic arthritis.[1] The complexity of acetabular anatomy, involvement of weight-bearing joint

surfaces, and association with associated injuries render these fractures challenging both surgically and in terms of patient outcomes.[1]

In low- and middle-income countries (LMICs), and especially in Bangladesh, the burden of high-energy trauma due to road traffic accidents (RTAs) magnifies both incidence and severity of musculoskeletal injuries. Bangladesh and similar LMIC settings report RTAs as the most common mechanism of acetabular fractures, contributing to delays in presentation, limited resources for imaging and fixation, and higher risk of complications.[2,3] These contextual factors amplify the stakes: anatomical restoration becomes more difficult yet more necessary, and functional recovery more unpredictable.

Among acetabular fracture types, posterior wall fractures are the most frequent subtype, comprising roughly 20–35% of cases in many series.[3,4] Posterior wall involvement is especially problematic because it often accompanies hip dislocation, marginal impaction, and fragment comminution – all of which complicate reduction, fixation stability, and post-operative rehabilitation.[5,6] The need for precise open reduction is heightened in these fractures, as failure to restore congruity of the articular surface has been repeatedly associated with worse radiological and functional outcomes, including accelerated cartilage wear, pain, impaired gait, and eventual hip osteoarthritis.[5,7]

Open reduction and internal fixation (ORIF) has long been established as the surgical gold standard for displaced acetabular fractures, particularly posterior wall fractures. Its rationale rests on restoring joint stability, achieving anatomical reduction, and enabling early mobilization – factors that have been correlated with lower rates of post-traumatic arthritis and superior long-term function.[7,8] Some large series confirm that quality of reduction is among the strongest predictors of both radiological success and functional recovery.[1] In posterior wall internal fixation, surgical technique, the time interval to surgery, severity of displacement, and associated injuries are among variables that considerably influence outcomes.[2,4] Despite this, there is a clear gap in regional data: while some studies from Bangladesh have reported outcomes following ORIF of posterior wall fractures, sample sizes are small, follow-ups are fairly short, and there is limited stratification by risk-factors such as delay to surgery, degree of displacement, or associated injuries. There is particularly scant data assessing how these prognostic factors affect both radiological and functional outcomes in Bangladeshi patients treated in typical resource settings. Therefore, more detailed observational studies are required to fill this knowledge gap. The present study aims to evaluate both radiological and functional outcomes of ORIF in posterior wall fractures of the acetabulum among patients in Bangladesh and to identify clinical and surgical factors associated with those outcomes.

## Methods

This prospective observational study was conducted in the Department of Orthopedic Surgery at Dhaka Medical College Hospital, Bangladesh, between August 2020 and March 2022. A total of 20 patients with posterior wall fractures of the acetabulum who underwent ORIF were included. Eligible patients were between 18 and 60 years of age, presented within 3 weeks of injury, and had posterior wall acetabular fractures confirmed on radiographs and computed tomography (CT). Patients with pathological fractures, open fractures, active or latent infection, previous hip pathology, or who were medically unfit for surgery were excluded. All patients underwent standard pre-operative evaluation. Surgery was performed through the Kocher–Langenbeck posterior approach, and fracture fixation was achieved using reconstruction plates and screws according to fracture configuration. Postoperatively, patients received intravenous antibiotics for 72 h, and mobilization was initiated under physiotherapy supervision. Partial weight-bearing was generally allowed at 4 weeks, progressing to full weight-bearing by approximately 12 weeks, depending on fracture stability and clinical progress.

Radiological outcomes were assessed using the Matta radiographic criteria, which classify reduction as excellent, good, or fair based on the degree of residual displacement on post-operative imaging. Functional outcomes were evaluated using the Merle d'Aubigné and Postel scoring system, which grades pain, mobility, and walking ability from 1 to 6 points each, for a total score ranging from 3 to 18. For analysis, scores of 15–18 were considered excellent, 12–14 good, 9–11 fair, and <9 poor. Complications such as heterotopic ossification (HO), avascular necrosis of the femoral head, and sciatic nerve palsy were recorded. Data were analyzed using descriptive statistics. Associations between clinical factors and outcomes were examined using the chi-square test and Fisher's exact test, with $P < 0.05$ considered statistically significant. Ethical approval was obtained from the Institutional Review Board of Dhaka Medical College, and informed written consent was obtained from all participants.

## Results

The study included a total of 20 patients with posterior wall acetabular fractures who underwent ORIF. The mean age of the participants was 38.25 ± 10.19 years, with the majority (65%) being between 31 and 40 years of age. Males accounted for 90% ($n$ = 18) of the study population, while females comprised 10% ($n$ = 2). In terms of occupation, over half of the patients (55%) were service holders, followed by 25% in business, and 10% each being housewives and students. RTAs were the predominant cause of injury, which reported in 90% ($n$ = 18) of cases, whereas falls from height accounted for 10% ($n$ = 2). The left side was more frequently involved (70%) compared to the right (30%) [Table 1].

Among the study participants, 70% ($n$ = 14) presented without any associated injuries, while 20% ($n$ = 4) had concomitant abdominal injuries, and 10% ($n$ = 2) sustained chest injuries. Hip dislocation was observed in 15% ($n$ = 3) of patients, with the remaining 85% ($n$ = 17) presenting without dislocation. Fragment displacement was classified as low in 85% ($n$ = 17) of cases, whereas gross displacement was noted in 15% ($n$ = 3). The extent of acetabular involvement exceeded 50% in a majority of cases (85%, $n$ = 17), while only 15% ($n$ = 3) involved 50% or less. Similarly, the posterior wall fracture involved 50% or less of the wall in 85% ($n$ = 17) of patients, with more extensive involvement (>50%) observed in 15% ($n$ = 3) [Table 2].

The average delay to surgery among the patients was 12.8 ± 3.57 days. A majority of the patients (45%, $n$ = 9) underwent surgery between 11 and 15 days post-injury, while 35% ($n$ = 7) were operated within 10 days, and 20% ($n$ = 4) experienced a delay of more than 15 days. Regarding the quality of reduction achieved intraoperatively, anatomical reduction was attained in 80% ($n$ = 16) of cases, while 15% ($n$ = 3) had imperfect reduction, and 5% ($n$ = 1) had poor reduction [Table 3].

Post-operative complications were minimal. The majority of patients (80%, $n$ = 16) experienced no complications. HO developed in 10% ($n$ = 2) of cases, while avascular necrosis of the femoral head and sciatic nerve palsy were each observed in 5% ($n$ = 1) of patients [Table 4].

Radiological evaluation using the Matta criteria demonstrated that 45% ($n$ = 9) of patients achieved excellent outcomes, while 40% ($n$ = 8) had good results. Fair outcomes were noted in 15% ($n$ = 3) of cases, and no patients were classified as poor, indicating that the majority achieved satisfactory radiological alignment following surgery [Table 5].

Functional assessment using the Merle d'Aubigné and Postel scoring system revealed that 50% ($n$ = 10) of patients achieved excellent outcomes, and 40% ($n$ = 8) had good results. Only 10% ($n$ = 2) were classified as fair, with no poor outcomes observed [Table 6].

Statistical analysis revealed several significant associations between clinical factors and both radiological and functional outcomes. Radiological outcomes assessed by Matta criteria were

significantly influenced by the presence of hip dislocation ($P$ = 0.019), fragment displacement ($P$ = 0.019), quality of fracture reduction ($P$ = 0.049), and the presence of post-operative complications ($P$ = 0.016). Functional outcomes, measured using the Merle d'Aubigné and Postel score, were significantly associated with the presence of associated abdominal injuries ($P$ = 0.016) and delays to surgery exceeding 15 days ($P$ = 0.036). These findings highlight the importance of timely surgical intervention and meticulous intraoperative management to optimize outcomes [Table 7].

## Discussion

This single-center Bangladeshi cohort of operatively treated posterior wall acetabular fractures demonstrated high rates of satisfactory recovery, with excellent–good radiological outcomes in 85% and excellent–good functional outcomes in 90% at follow-up. The cohort was predominantly young male patients injured in road traffic crashes – an epidemiologic pattern consistent with prior series of acetabular trauma in which the mean age hovered around the late 30s and men predominated, and where posterior wall fractures were among the commonest patterns (e.g., 34.5% posterior wall in a Brazilian registry), underscoring the external validity of our sample profile.[9]

Our Matta results (excellent 45%, good 40%, and fair 15%) align closely with large contemporary series of displaced acetabular fractures reporting ~88% excellent–good radiological results when high-quality reduction is obtained (Shon *et al*., 2024). In that cohort, radiological grade was significantly influenced by quality of reduction and fracture classification – findings that mirror our observation that radiology was associated with quality of reduction ($P$ = 0.049), as well as hip dislocation ($P$ = 0.019), fragment displacement ($P$ = 0.019), and post-operative complications ($P$ = 0.016).[1] Long-term data focused specifically on posterior wall fractures also reinforce this signal: Magu *et al*. reported durable radiologic success when anatomic reduction was achieved, with most patients graded excellent–good at a mean ~13-year follow-up.[10]

Mechanistically, our radiographic associations are coherent with morphology-driven risks described in posterior wall literature. Lin *et al*. showed that dome comminution (a surrogate for severe displacement/impaction) independently predicted worse radiographic degeneration and the need for arthroplasty, even when anatomic reduction was attempted – highlighting why fragment displacement in our dataset tracked with poorer radiology.[11] Technique choice may further influence maintenance of reduction: In a posterior wall comparative study, an anatomical posterior acetabular plate yielded improved early functional recovery and favorable radiographs versus conventional plates, supporting the principle that implants facilitating precise, stable reconstruction can enhance outcomes.[5]

Our functional results (Merle d'Aubigné and Postel: Excellent 50%, good 40%, and fair 10%) slightly exceed the ~81% excellent–good reported by Shon *et al*. across varied acetabular patterns and are comparable with posterior wall–focused series (e.g., ~80% excellent–good at long-term in Magu *et al*.; ~77% satisfactory in Fakru *et al*.).[1,10,12] As in prior work, quality of reduction emerged as a central driver of function, and morphology matters: Posterior wall studies link comminution/impaction with worse function unless meticulously corrected.[1,11]

Two patient-journey variables were particularly salient in our cohort. First, delay to surgery >15 days was associated with poorer function ($P$ = 0.036). Not all series reproduce a uniform effect of timing – Shon *et al*. did not find time-to-surgery significant in their overall model ($P$ = 0.082) – but our threshold-based finding suggests that, beyond a certain delay, soft-tissue scarring, fragment resorption, and difficulty restoring congruity may translate to functional decrement, especially in resource-constrained settings.[1] Second, associated abdominal injury correlated with inferior function ($P$ = 0.016), paralleling posterior wall literature in

**Table 1:** Baseline characteristics of the study population (*n*=20)

| Characteristic | N | % |
|---|---|---|
| Age (years) | | |
| ≤30 | 5 | 25.0 |
| 31–40 | 13 | 65.0 |
| >40 | 2 | 10.0 |
| Mean±SD | 38.25±10.19 | |
| Sex | | |
| Male | 18 | 90.0 |
| Female | 2 | 10.0 |
| Occupation | | |
| Service | 11 | 55.0 |
| Business | 5 | 25.0 |
| Housewife | 2 | 10.0 |
| Student | 2 | 10.0 |
| Mode of injury | | |
| Road traffic accident | 18 | 90.0 |
| Fall from height | 2 | 10.0 |
| Side involved | | |
| Left | 14 | 70.0 |
| Right | 6 | 30.0 |

**Table 2:** Injury and fracture characteristics of the study population (*n*=20)

| Characteristic | *n* | % |
|---|---|---|
| Associated injuries | | |
| None | 14 | 70.0 |
| Abdominal injury | 4 | 20.0 |
| Chest injury | 2 | 10.0 |
| Hip dislocation | | |
| Absent | 17 | 85.0 |
| Present | 3 | 15.0 |
| Fragment displacement | | |
| Low | 17 | 85.0 |
| Gross | 3 | 15.0 |
| Acetabular fracture extent | | |
| >50% of acetabulum | 17 | 85.0 |
| ≤50% of acetabulum | 3 | 15.0 |
| Posterior wall fracture extent | | |
| ≤50% of posterior wall | 17 | 85.0 |
| >50% of posterior wall | 3 | 15.0 |

**Table 3:** Perioperative characteristics of the study population (*n*=20)

| Characteristic | *n* | % |
|---|---|---|
| Delay to surgery (days) | | |
| ≤10 | 7 | 35.0 |
| 11–15 | 9 | 45.0 |
| >15 | 4 | 20.0 |
| Mean±SD | 12.8±3.57 | |
| Quality of reduction | | |
| Anatomical | 16 | 80.0 |
| Imperfect | 3 | 15.0 |
| Poor | 1 | 5.0 |

**Table 4:** Post-operative complications (*n*=20)

| Complication | *n* | % |
|---|---|---|
| None | 16 | 80.0 |
| Heterotopic ossification | 2 | 10.0 |
| Avascular necrosis | 1 | 5.0 |
| Sciatic nerve palsy | 1 | 5.0 |

**Table 5:** Radiological outcomes according to Matta criteria (*n*=20)

| Outcome | *n* | % |
|---|---|---|
| Excellent | 9 | 45.0 |
| Good | 8 | 40.0 |
| Fair | 3 | 15.0 |

**Table 6:** Functional outcomes according to Merle d'Aubigné and Postel score (*n*=20)

| Outcome | *n* | % |
|---|---|---|
| Excellent | 10 | 50.0 |
| Good | 8 | 40.0 |
| Fair | 2 | 10.0 |

which concomitant injuries have been linked to lower hip scores.[10,13]

Complication rates in our series were low: HO 10%, avascular necrosis 5%, and sciatic nerve palsy 5%. The HO rate is on the lower end compared with historical and pooled estimates. A meta-analysis encompassing 2180 patients reported ~26–30% radiographic HO, with higher risk after

**Table 7:** Associations between outcomes and key clinical factors

| Type of association | *P*-value |
|---|---|
| Factors associated with radiological outcome (Matta criteria) | |
| Hip dislocation | 0.019 |
| Fragment displacement | 0.019 |
| Quality of reduction | 0.049 |
| Post-operative complications | 0.016 |
| Factors associated with functional outcome (Merle d'Aubigné and Postel score) | |
| Associated abdominal injury | 0.016 |
| Delay to surgery >15 days | 0.036 |

posterior/extensile approaches and in patients with head injury.[14] Contemporary institutional series using posterior approaches have reported ~47% radiographic HO (any grade), with 15% symptomatic and ~3% requiring excision.[15] Variability likely reflects approach selection, soft-tissue handling, and prophylaxis practices; our relatively low HO incidence may relate to meticulous posterior approach technique and patient selection, though sample size limits firm inference.[14,15]

### Clinical implications

Taken together, these data reinforce three pragmatic messages for posterior wall ORIF in LMIC practice environments. First, achieving and maintaining anatomic reduction remains paramount; it favorably shifts both radiologic and functional trajectories across studies and in our cohort.[1,10] Second, morphology matters: displacement/comminution and dislocation signal higher risk, necessitating pre-operative CT planning and, where available, fixation strategies that enhance posterior wall buttress.[5,11] Third, timely surgery appears important in our setting – particularly beyond a 2-week window – while associated systemic injuries can depress recovery and warrant integrated trauma pathways to optimize perioperative readiness.[1,13]

### Limitations of the study

Limitations include the small sample, single-center design, and short-to-midterm follow-up – factors that may under-estimate late complications (e.g., osteoarthritis progression).

## Conclusion

ORIF for posterior wall acetabular fractures in a Bangladeshi tertiary care setting demonstrated high rates of favorable radiological and functional outcomes, with 85% and 90% of patients, respectively, achieving excellent or good results. Quality of reduction, hip dislocation, fragment displacement, and post-operative complications were significant predictors of radiological success, while abdominal injuries and delays beyond 15 days were associated with poorer functional recovery. Complication rates, including HO, avascular necrosis, and sciatic nerve palsy, were relatively low compared with international series. These findings emphasize the importance of achieving anatomical reduction, minimizing surgical delay, and optimizing perioperative trauma management to maximize outcomes. Despite the study's small sample size, the results add valuable regional data to the global literature and underscore the relevance of timely, high-quality surgical intervention in low- and middle-income country settings.

## Funding

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## Conflicts of Interest

None declared.

## Ethical Approval

The study was approved by the Institutional Ethics Committee.

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