

Original Research Article

Evaluation of the result of open reduction and internal fixation of transverse fracture of acetabulum by reconstruction plate and screws through Kocher-Langenbeck approach

S. K. Abdul Hakim*, M. Saidul Islam, M. Harun Are Rashid,
M. Murad Hossain, M. Mahmudul Hassan

Department of Orthopaedic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh

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*Correspondence:

Dr. S. K. Abdul Hakim,

E-mail: drskabdulhakimhimu@gmail.com

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ABSTRACT

Background: Acetabular fracture occurs from high-velocity injury and affects young, economically productive populations. Previously, treatment was inadequate, leaving patients with incapacitating pain and limited movement. Proper management in our setup is needed to save lives and minimize long-term complications. This study evaluated the outcome of open reduction and internal fixation of transverse acetabular fractures.

Methods: This prospective observational study was conducted at Dhaka Medical College Hospital from July 2017 to June 2019. A total of fifty patients with transverse fracture of acetabulum within 3 weeks of incidence were enrolled in this study. Radiological and functional outcomes were evaluated six months post-surgery using Matta's radiographic criteria and Merle d'Aubigne and Postel criteria. Effects of age, gender, hip dislocation, fracture displacement, reduction quality and trauma on surgery time were evaluated.

Results: Mean age was 36.2 ± 14.12 years. Male and female ratio was 48:2. Mean follow-up 8.5 ± 1.7 months, range 6-12 months. According to Matta's criteria, 24 patients had excellent, 8 good and 18 fair radiological outcomes. Per Merle d'Aubigne and Postel criteria, 20 patients had excellent, 10 good, 2 fair and 18 poor functional outcomes. Overall, 38 patients (76%) showed satisfactory and 12 patients (24%) unsatisfactory outcomes. Heterotrophic ossification occurred in 1 (4.0%) patient. 20 patients achieved anatomic (0, 1 mm) reduction, 3 achieved imperfect (2,3 mm) reduction and 2 achieved poor (>3 mm) reduction.

Conclusions: Open reduction and internal fixation of transverse acetabular fracture is a satisfactory treatment method.

Keywords: Acetabular fracture, Internal fixation, Open reduction, Transverse fracture

INTRODUCTION

Acetabular fractures are severe injuries typically resulting from high-energy trauma such as road traffic accidents or falls from height, predominantly affecting young and economically productive individuals.^{1,2} These fractures are complex due to the intricate anatomy of the acetabulum and its proximity to vital neurovascular structures, posing significant challenges for management.³ Historically, non-operative treatments resulted in poor functional outcomes, chronic pain and post-traumatic arthritis, leading to significant disability.⁴ Therefore, surgical intervention,

particularly open reduction and internal fixation (ORIF), has become the mainstay of treatment to restore hip joint congruity and function.⁵ The Kocher-Langenbeck approach is one of the most widely used posterior surgical approaches for acetabular fractures, offering excellent visualization of the posterior column and wall.⁶ Studies have demonstrated favorable radiological and functional outcomes with this approach when performed within three weeks of injury, minimizing the risk of complications such as heterotopic ossification and avascular necrosis.^{7,8} Matta emphasized that anatomic reduction is a critical determinant of long-term outcomes, as poor reduction

correlates strongly with post-traumatic osteoarthritis.⁹ Functional evaluation after open reduction and internal fixation has traditionally been performed using the Merle d'Aubigne and Postel scoring system, which assesses pain, mobility and walking ability.¹⁰ Multiple studies have reported satisfactory outcomes in 70–80% of patients treated with open reduction and internal fixation for transverse and associated posterior wall acetabular fractures.^{7,11} However, outcomes are influenced by various factors including fracture type, quality of reduction, timing of surgery and associated injuries.^{5,12} Despite global advances in surgical techniques, data on the outcomes of open reduction and internal fixation for acetabular fractures in resource-limited settings remain scarce. Gupta et al, noted that factors such as surgical expertise, access to imaging modalities and perioperative care significantly impact results in developing countries.¹³ Therefore, evaluating the effectiveness of open reduction and internal fixation through the Kocher-Langenbeck approach in such contexts is essential for improving patient care and guiding future practice. This study aimed to assess the radiological and functional outcomes of open reduction and internal fixation for transverse acetabular fractures using the Kocher-Langenbeck approach in a tertiary care hospital. By identifying key factors influencing outcomes, this research intends to contribute valuable insights into the optimization of acetabular fracture management in similar healthcare settings.

METHODS

This prospective observational study was conducted at the Department of Orthopaedic Surgery, Dhaka Medical College Hospital, Dhaka, Bangladesh, from July 2017 to June 2019. Fifty patients with clinical and radiological evidence of transverse fracture of the acetabulum of both genders were admitted to hospitals and underwent open reduction and internal fixation during study period are included in this study.

Inclusion criteria

Age 21 to 80 years. Transverse fracture and associated fractures of the acetabulum (T type, transverse posterior wall, anterior column posterior hemi transverse, etc). Operations done within 3 weeks.

Exclusion criteria

Active or latent infection. Open fracture. Debilitated patients- Hypertension, DM, COPD, LVH etc.

Data collection and study procedure

Ethical approval for this study was obtained from the Ethical Review Committee of Dhaka Medical College, Dhaka, Bangladesh. Written informed consent was obtained from all participants or their legal guardians after explaining the study objectives, procedures, potential risks and benefits. Patients aged 21–80 years presenting with

transverse or associated acetabular fractures within 3 weeks of injury were included. Exclusion criteria were open fractures, active or latent infection and severe comorbidities (e.g., uncontrolled hypertension, diabetes, COPD). Data were collected using a standardized case record form capturing demographic details, clinical history, radiographic findings, surgical details and postoperative outcomes. Preoperative imaging included X-rays and CT scans of the pelvis. Surgery was performed using the Kocher-Langenbeck approach by experienced orthopedic surgeons. Postoperative care included standardized protocols for analgesia, thromboprophylaxis, physiotherapy and follow-up. Outcomes were assessed at 6 months post-surgery using Matta's radiographic criteria and the Merle d'Aubigne and Postel functional score. Data analysis was conducted using SPSS version 22. Descriptive statistics, chi-square tests and proportion tests were applied, with a significance level set at $p < 0.05$.

RESULTS

Table 1 summarizes the demographic data of the study participants. Most patients (76%) were between 20–40 years of age, with a mean age of 36.2 ± 14.12 years. The majority were male (96%), resulting in a male-to-female ratio of 48:2. Service holders constituted the largest occupational group (52%), followed by businessmen (32%), students (8%), farmers (4%) and housewives (4%).

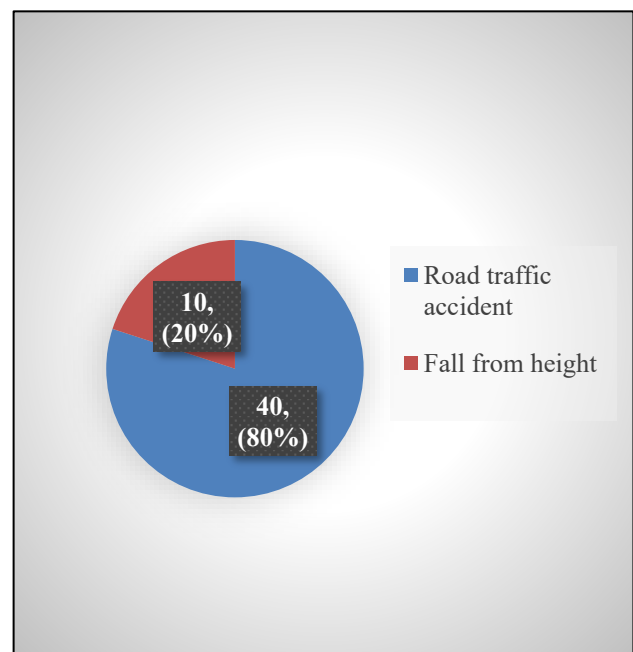


Figure 1: Distribution based on the mode of injury.

Figure 1 illustrates that 80% of fractures resulted from road traffic accidents, while 20% occurred due to falls from height, highlighting high-energy trauma as the predominant mechanism of injury. Figure 2 shows the distribution of fracture displacement among the patients. Most fractures (76%) had minimal displacement (< 20 mm), while 24% demonstrated gross displacement (> 20 mm).

mm). Figure 3 depicts the associated fracture patterns observed in the study. Posterior wall fractures were the most common (48%), followed by isolated transverse fractures (36%), T-type fractures (8%) and anterior column fractures (8%).

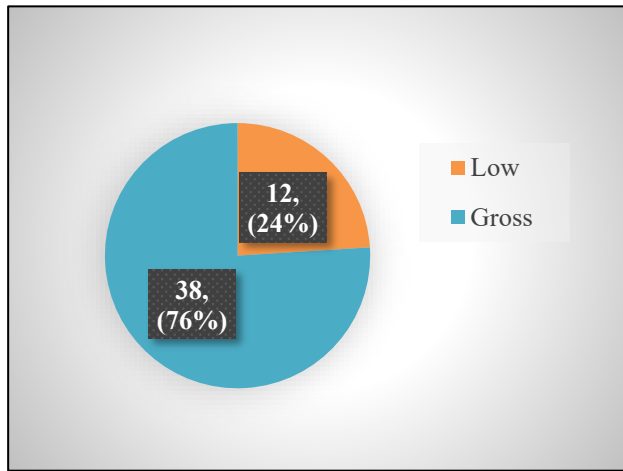


Figure 2: Displacement of fracture fragments.

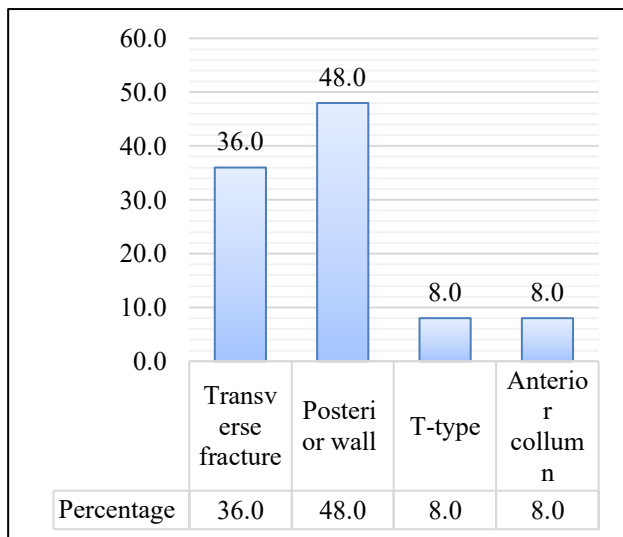


Figure 3: The associated fracture types.

Figure 4 presents the quality of fracture reduction based on postoperative assessment. Anatomical reduction was achieved in 80% of patients, while 12% had imperfect and 8% had poor reduction. Table 2 shows the relationship

between the quality of reduction and radiological outcomes using Matta's criteria. Patients with anatomical reduction had better radiological outcomes compared to those with imperfect or poor reduction, although the difference was not statistically significant ($p>0.05$). Table 3 demonstrates the correlation between reduction quality and functional outcomes based on the Merle d'Aubigne and Postel score. Anatomical reduction was associated with a higher proportion of satisfactory functional results, but the difference was not statistically significant ($p>0.05$).

Table 4 presents radiological outcomes at six months post-surgery. Excellent results were observed in 48% of patients, good results in 16% and fair results in 36%, with no poor radiological outcomes reported. Table 5 summarizes functional outcomes six months after surgery. Excellent outcomes were achieved in 40% of patients, good in 20%, fair in 4% and poor in 36%. Satisfactory outcomes (excellent and good) were seen in 76% of patients, while 24% had unsatisfactory results. Table 6 shows the relationship between surgical timing and functional outcome. Patients operated on within the first week had the highest rate of satisfactory outcomes, while delayed surgery (second and third week) was associated with a higher proportion of unsatisfactory results, although the difference was not statistically significant ($p>0.05$).

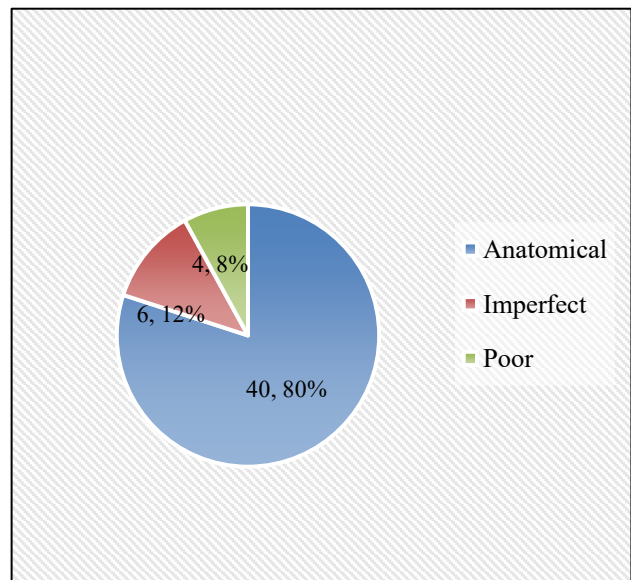


Figure 4: The quality of the reduction of transverse fracture.

Table 1: Demographic characteristics of the study population (n=50).

Characteristics	Frequency	%
Age group (in years)	20-40	38
	41-60	8
	61-80	4
Gender	Male	48
	Female	2
Occupation	Business	16
	Student	4

Continued.

Characteristics	Frequency	%
Service	26	52.0
Farmer	2	4.0
Housewife	2	4.0

Table 2: Association between Quality of reduction of transverse fracture with radiological outcome.

Quality of reduction of transverse fracture	Frequency	Radiological outcome			P value
		Excellent	Good	Fair	
Anatomical	40 (80.0)	18 (36.0)	18 (36.0)	4 (8.0)	0.058
Imperfect	6 (12.0)	0 (0.0)	2 (4.0)	4 (8.0)	
Poor	4 (8.0)	0 (0.0)	4 (8.0)	0 (0.0)	
Total	50 (100.0)	18 (36.0)	24 (48.0)	8 (16.0)	

Table 3: Association between the Quality of reduction of transverse fracture with functional outcome.

Quality of reduction of transverse fracture	Frequency	Functional outcome		P value
		Satisfactory	Unsatisfactory	
Anatomical	40 (80.0)	34 (68.0)	6 (12.0)	0.099
Imperfect	6 (12.0)	2 (4.0)	4 (8.0)	
Poor	4 (8.0)	2 (4.0)	2 (4.0)	
Total	50 (100.0)	38 (76.0)	12 (24.0)	

Table 4: Distribution of the study subjects by radiological outcome (According to Matta radiographic criteria 6 months after operation).

Radiological outcome	Number of patients	%
Excellent	24	48
Good	8	16
Fair	18	36
Total	50	100

Table 5: Functional outcome according to Merle d'Aubigne and Postel scores 6 months after operation (n=50).

Functional outcome	Frequency	Percentage	Outcome		Z-proportion test
			Satisfactory	Unsatisfactory	
Excellent	20	40	38 (76.0%)	12 (24.0%)	Z= 2.3 p=0.021
Good	18	36			
Fair	2	4			
Poor	10	20			
Total	50	100			

Table 6: Difference in outcome from day of injury to surgery time (n=50).

Weeks	Satisfactory	Unsatisfactory	P value
	(n=42)	(n=8)	
1 st week	12 (28.6)	0 (0.0)	0.458
2 nd week	24 (57.1)	6 (75.0)	
3 rd week	6 (14.3)	2 (25.0)	
Total	42 (100.0)	8 (100.0)	

DISCUSSION

This study demonstrated that open reduction and internal fixation (ORIF) using the Kocher-Langenbeck approach is an effective method for treating transverse acetabular

fractures, with 76% of patients achieving satisfactory functional outcomes and 48% showing excellent radiological results at six months. These findings are in agreement with previous studies that have highlighted the importance of anatomic reduction and early surgical

intervention in determining favorable outcomes. The demographic characteristics of our study population, with a mean age of 36.2 years and male predominance (96%), are consistent with the epidemiology reported in the literature. Giannoudis et al and Kreder et al emphasized that acetabular fractures primarily affect young males due to their increased exposure to high-energy trauma, particularly road traffic accidents.^{1,2} Similarly, in our study, 80% of cases were caused by road traffic accidents, while 20% resulted from falls from height, which mirrors the findings of Meena et al and Gupta et al.^{5,12} This pattern underlines the role of socioeconomic and environmental factors, including high-speed driving, limited enforcement of road safety measures and occupational risks, particularly in developing countries.

The quality of fracture reduction has long been recognized as the cornerstone of successful acetabular fracture management. In this study, anatomical reduction was achieved in 80% of cases and was associated with improved functional and radiological outcomes. Although the statistical correlation was not significant, the clinical relevance is undeniable and aligns with Matta's findings, who demonstrated that patients with residual displacement greater than 2 mm had a higher risk of developing post-traumatic arthritis.⁹ Similarly, Magu et al, reported that anatomical reduction resulted in significantly better functional and radiological outcomes compared to imperfect or poor reductions.⁸ Our results also support the view of Bogdan et al, who stressed that an accurate surgical approach tailored to the fracture pattern, along with meticulous reduction techniques, improves the quality of reduction and subsequent outcomes.¹³

The functional assessment in our study was conducted using the Merle d'Aubigne and Postel scoring system, which has been widely used in acetabular fracture research. We observed that 40% of patients achieved excellent and 20% good functional outcomes, comparable to the findings of Alexa et al, who demonstrated similar functional recovery rates using the Kocher-Langenbeck approach and Ebraheim et al, who reported satisfactory results in 75% of their patients.^{7,11} These outcomes reinforce the principle that successful restoration of hip joint congruity leads to improved postoperative mobility, reduced pain and enhanced long-term function.

The relationship between radiological and functional results in our study further supports previous findings. Although 48% of patients had excellent radiological results, only 40% achieved excellent functional scores, which reflects the influence of other factors such as soft tissue injury, associated fractures and postoperative rehabilitation. Meena et al, noted a moderate correlation between radiological and functional outcomes, highlighting that while anatomical reduction is critical, patient-specific variables and postoperative care also play an important role in final functional recovery.⁵ The timing of surgery is another significant factor influencing outcomes. Our data revealed that patients who underwent

surgery within the first week of injury demonstrated better functional results compared to those operated on in the second or third week. This finding is supported by Johnson et al who advocated for early intervention to prevent complications such as femoral head avascular necrosis and joint stiffness.¹⁴ Early surgery also allows for easier fracture reduction before soft tissue contracture and hematoma organization make the procedure technically challenging.

The Kocher-Langenbeck approach, used in all cases in this study, has been well-documented as a safe and effective posterior approach for transverse acetabular fractures, particularly when associated with posterior wall involvement. Alexa et al, and Zhang et al, both reported favorable radiological and functional results using this approach.^{7,15} Its advantages include direct visualization of the posterior column and wall, the ability to achieve stable fixation and the potential for early mobilization. However, as noted by Eckardt et al, the success of this approach depends on the surgeon's familiarity with the anatomy and careful handling of soft tissues to minimize complications such as heterotopic ossification and sciatic nerve injury.¹⁶

Comparative analysis with other studies suggests that socioeconomic and healthcare system differences may partly explain the variation in results. Gupta et al, highlighted that in developing countries, factors such as delayed hospital presentation, limited access to advanced imaging and perioperative care constraints may negatively affect outcomes compared to high-income settings.¹² Despite these challenges, our results demonstrate that satisfactory outcomes are achievable with appropriate surgical expertise and adherence to established principles of fracture management.

In summary, our findings reaffirm the critical role of anatomic reduction, early surgical intervention and the Kocher-Langenbeck approach in optimizing outcomes for transverse acetabular fractures. These results are consistent with previous literature and contribute to the growing body of evidence supporting open reduction and internal fixation as a reliable method for restoring function and hip joint congruity in this challenging injury.

This study has several limitations. The follow-up period was short, which may have restricted the assessment of long-term outcomes. The small sample size and use of a non-randomized sampling method could introduce bias. Additionally, as a single-center study, the results may not accurately represent the broader population of patients with acetabular fractures in the country.

CONCLUSION

Open reduction and internal fixation of transverse acetabular fractures using the Kocher-Langenbeck approach is an effective treatment method, yielding satisfactory functional and radiological outcomes in the majority of cases. However, delayed surgery and

suboptimal reduction were associated with poorer results. Future studies with larger sample sizes, multicenter participation and longer follow-up are necessary to better evaluate late complications such as post-traumatic osteoarthritis and avascular necrosis.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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