



STUDY OF FUNCTIONAL OUTCOME AFTER SURGICAL MANAGEMENT OF ACETABULAR FRACTURES

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ABSTRACT

Background: Acetabular fractures are intricate injuries often caused by high-energy trauma, and their frequency is on the rise in developing countries due to an increase in motor vehicle accidents. Surgical intervention has become the favoured approach for treating displaced fractures to achieve precise anatomical alignment, stable hip joints, and improved functional results. In this prospective study conducted within an institutional setting, we aimed to assess the functional and radiological outcomes of surgical management in 31 patients with displaced acetabular fractures who underwent open reduction internal fixation (ORIF). **Methods:** This study encompassed patients above 18 years of age who had displaced acetabular fractures leading to hip joint incongruence, were suitable for surgical procedures, and were under 65 years old. The research was conducted between October 2019 and December 2021. Various types of acetabular fractures were included based on predefined criteria, whereas patients with medical contradictions, severe osteoporosis, significant displacement of fractures, immobility, and localized infections were excluded. Surgical fixation methods employed a range of plate types, screws, and clamps chosen according to the fracture patterns. Follow-up evaluations were carried out for an average of 6 months. **Study Outcome:** Out of the 31 patients, the majority belonged to the 20-29 age group, with a predominance of male participants. Road traffic accidents emerged as the most frequent cause of injury. Right-sided acetabular fractures were more prevalent than left-sided fractures. Simple fractures were the most common, predominantly manifesting as posterior wall fractures. The Kocher-Langenbeck approach was predominantly utilized. A limited number of postoperative complications were observed, including instances of avascular necrosis, implant failure, deep infection, and deep vein thrombosis. The Modified Harris Hip Score was employed to evaluate outcomes, revealing that most patients attained excellent or favourable results. **Conclusion:** Surgical management of displaced acetabular fractures via open reduction internal fixation offers accurate restoration of the articular surface, resulting in satisfactory to excellent functional outcomes. This approach reduces the risk of avascular necrosis and hip osteoarthritis. Proficiency in understanding fracture anatomy, meticulous preoperative planning, and appropriate selection of approach and reduction techniques are paramount for achieving successful outcomes. The study underscores the significance of timely surgery and comprehensive patient counseling concerning surgical risks and potential outcomes.

KEYWORDS : Acetabular fractures, surgical management, open reduction internal fixation, functional outcome, radiological outcome, complications, Modified Harris Hip Score, avascular necrosis, osteoarthritis

INTRODUCTION

Acetabular fractures are intricate injuries frequently resulting from high-energy trauma. While relatively uncommon, their prevalence is on the rise in developing countries, likely attributed to an increase in motor vehicle accidents.¹ The incidence rate of acetabular fractures is approximately 3 patients per 100,000 per year,² contributing to 10% of all pelvic fractures.³ Surgical intervention is favoured for high-energy fractures that lead to hip instability or disrupt weight-bearing, while conservative methods may suffice for displaced fractures or those involving non-weight-bearing areas in elderly patients.⁴ The intricate anatomical characteristics, concurrent severe injuries, and potential enduring complications pose challenges to treatment planning.^{5,6}

Historically, acetabular fractures were managed conservatively; however, surgical approaches gained prominence after the groundbreaking work by Judet and Letournel in 1964.⁷ Their research underscored the significance of achieving anatomical alignment and classifying acetabular fractures, enabling informed treatment decisions based on empirical evidence. The principal objective of operative treatment is to restore anatomical alignment, facilitating a pain-free, mobile, and stable hip.

The acetabulum, housing the hip joint's cartilage that articulates with the femoral head, possesses a complex structure consisting of anterior and posterior columns. Trauma to the acetabulum is typically indirect, resulting from forces transmitted from the femur to the hip joint. The specific fracture patterns observed depend on the hip joint's orientation during the injury.⁸ The primary function of the pelvic bones is to distribute weight, and multiple factors impact the long-term outcomes of surgical intervention. These factors encompass age, fracture patterns, condition of the femoral head, presence of intra-articular osteochondral

fragments, time elapsed since the injury, local complications, and associated injuries.⁹ Unfavourable outcomes can result from conditions such as hip joint arthritis, avascular necrosis of the femoral head, and heterotopic ossification, even after a successful fracture reduction. The surgeon's skill and chosen approach also significantly influence the final result.¹⁰

Technological advancements such as Computed Tomography (CT scan), advanced surgical training, and heightened patient expectations have elevated surgical fixation to the established standard for treating displaced acetabular fractures.¹¹ The surgical intervention provides advantages like enhanced visualization of articular surfaces, improved fracture alignment, efficient removal of loose fragments, and expedited recovery of joint mobility.¹² This study seeks to identify the determinants influencing the ultimate outcome of surgical management, including age, fracture patterns, femoral-head condition, presence of intra-articular osteochondral fragments, time since injury, local complications, associated injuries, and the surgeon's proficiency and approach. By dissecting these variables and assessing surgical outcomes, this research aims to contribute valuable insights for refined treatment strategies and enhanced patient results in cases involving displaced acetabular fractures.

METHODOLOGY

This prospective institutional-based study aimed to evaluate the outcomes of open reduction internal fixation (ORIF) in patients with displaced acetabular fractures. The study was conducted from October 2019 to December 2021 and included 31 patients aged above 18 years, comprising both males and females.

The study enrolled individuals ranging from 18 to 65 years of

age who exhibited displaced acetabular fractures exceeding 2mm and hip joint incongruence. This encompassed both uncomplicated elementary fractures as well as associated displaced fractures, primarily involving the anterior column, weight-bearing dome, or exhibiting comminution of the articular surface. Additionally, patients demonstrating an unstable hip joint or concurrent proximal femoral neck injuries such as femoral neck or trochanteric fractures were included in the study. Conversely, patients aged 65 years and above, those with displaced fractures measuring less than 2mm, medical conditions contraindicating surgery, multisystem injuries rendering them unsuitable for surgical intervention, severe osteoporosis impeding fracture fixation, undisplaced posterior wall fractures, posterior column fractures with displacement less than 2mm, non-ambulatory patients, and individuals with local infections were excluded from the study.

Study Design And Setting:

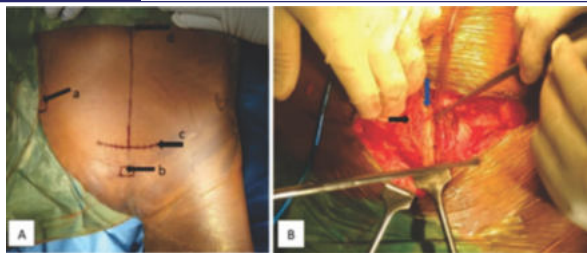
This prospective study was carried out within the Orthopaedics Department at a tertiary healthcare facility spanning a duration of 26 months.

Fixation Materials:

The surgical fixation utilized various materials, including reconstruction plates of size 3.5mm and 4.5mm (simple + locking), anatomical plates, 6.5mm and 4mm cancellous screws, 4.5mm cortical screws, 3.5mm cortical screws, king-tong reduction clamps, pointed reduction clamps, and ball-tipped reduction spikes.

Surgical Approach:

The study subjects underwent surgical procedures using different approaches, including the Kocher Langenbeck approach, ilioinguinal approach, and Stoppa approach, based on the fracture pattern and requirements for reduction and fixation.



Stoppa Approach

Post-operative And Follow-up Protocol:

Post-operatively, patients were administered antibiotics and analgesics. Routine dressing was done, and suture removal was performed after 2 weeks. Patients were kept non-weight bearing for 4-6 weeks, and active range of motion and muscle strengthening exercises were initiated based on radiological alignment and fracture healing.

OBSERVATION AND RESULTS:

Table-1: Demographic distribution of patients

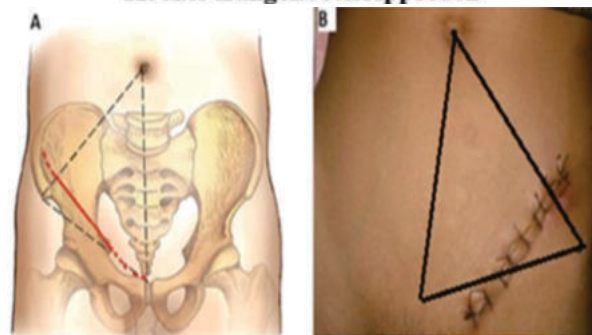
Sex	Frequency (N=31)	Percentage (%)
Male	28	90.32
Female	03	9.67
Total	31	100
Age group		
<20 years	00	00
20 - 29 years	10	32.25
30 - 39 years	09	29.03
40 - 49 years	05	16.12
50 - 59 years	05	16.12
60 - 65 years	02	06.40
Total	31	100 %
Mode of injury		
RTA	27	87.09
Fall	04	12.90
Total	31	100 %
Side of injury		
Right side	17	54.83
Left side	14	45.16
Total	31	100 %

In terms of gender distribution, 28 participants (90.32%) were male, and 3 participants (9.67%) were female. Turning to age groups, no participants were in the "<20 years" category, while "20 - 29 years" encompassed 10 participants (32.25%), "30 - 39 years" accounted for 9 participants (29.03%), "40 - 49 years" included 5 participants (16.12%), "50 - 59 years" covered another 5 participants (16.12%), and "60 - 65 years" consisted of 2 participants (06.40%). The mode of injury analysis revealed that 27 participants (87.09%) experienced injuries due to road traffic accidents (RTA), while 4 participants (12.90%) suffered injuries from falls. Regarding the side of injury, 17 participants (54.83%) sustained injuries on the right side, while 14 participants (45.16%) had injuries on the left side.

Table-2: Distribution of study subjects according to the type of fractures using Letournel and judet classification.

Type of fracture	Frequency	Percentage (%)
Simple n=24		
Anterior column	07	22.58
Anterior wall	01	03.20
Posterior column	04	12.90
Posterior wall	09	29.03
Transverse	03	09.70
Complex n=7		
Posterior wall & posterior column	01	03.20
Posterior wall & transverse	01	03.20
T-shaped	01	03.20
Anterior column & posterior hemi transverse	02	06.40
Both column	02	06.40
Total	31	100

Kocher Langenbeck Approach



Ilioinguinal Approach

The study's focus encompassed the classification of fractures based on their specific types, with the results being systematically presented in a tabular layout, accompanied by corresponding frequencies and associated percentages. The complete participant cohort of 31 individuals underwent scrutiny within this analytical framework. Among the fractures characterized as "Simple" (n=24), distinct subcategories emerged, with 7 instances (22.58%) attributed to "Anterior column" fractures, 1 instance (03.20%) to "Anterior wall" fractures, 4 instances (12.90%) to "Posterior column" fractures, 9 instances (29.03%) to "Posterior wall" fractures, and 3 instances (09.70%) to "Transverse" fractures. Within the "Complex" fracture classification (n=7), an array of unique fracture patterns emerged, which included a solitary occurrence (03.20%) of "Posterior wall & posterior column" fractures, another instance (03.20%) involving "Posterior wall & transverse" fractures, a singular occurrence (03.20%) of "T-shaped" fractures, a presence of "Anterior column & posterior hemitransverse" fractures in 2 instances (06.40%), and 2 cases (06.40%) of "Both column" fractures.

Table-3: Distribution Of Study Subjects According To The Duration Between The Date Of Injury And The Date Of Surgery.

Duration (days)	Frequency	Percentage (%)
<14 days	27	87.09
≥14 days	04	12.90
Total	31	100

The entire participant cohort, consisting of 31 individuals, was analyzed. Among these participants, 27 (87.09%) had a duration of less than 14 days between injury and surgery, while 4 participants (12.90%) had a duration exceeding 14 days.

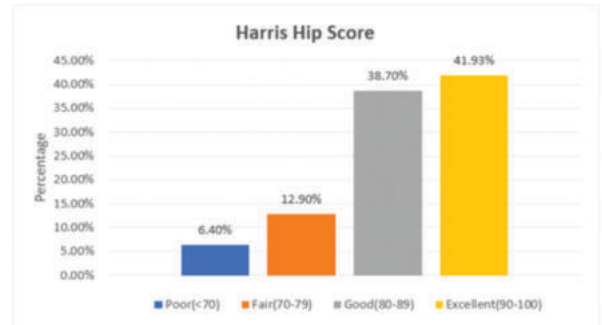
Table-4: Distribution Of Study Subjects According To Postoperative Complications.

Post-operative Complications	Frequency	Percentage (%)
No complications	27	87.09%
Arthritis	00	0%
Superficial Infection	00	0%
Heterotopic Ossification	00	0%
Deep Infection	01	0%
Avascular necrosis of femoral head	01	3.20%
Deep Venous thrombosis	01	3.20%
Posterior dislocation of Hip	00	3.20%
Implant Failure	01	3.20%
Sciatic nerve injury	00	0%
Total	31	100%

A total of 31 participants were evaluated. Notably, the majority of cases (27 participants, representing 87.09%) experienced no complications following the surgical procedure. Specific complications, such as arthritis, superficial infection, heterotopic ossification, and posterior dislocation of the hip, were not observed in any of the participants. However, isolated instances of complications were recorded. One participant (3.20%) encountered deep infection, another participant suffered from avascular necrosis of the femoral head, deep venous thrombosis, and implant failure. In addition, the occurrence of sciatic nerve injury was absent among all participants.

The distribution of the Harris Hip Score was assessed across distinct score ranges, encompassing "Poor" for scores below 70, "Fair" for scores spanning from 70 to 79, "Good" for scores ranging from 80 to 89, and "Excellent" for scores falling between 90 and 100. Within the complete cohort of 31 participants under investigation, categorizations revealed that 2 individuals (6.40%) were categorized as "Poor," 4 individuals (12.90%) as "Fair," 12 individuals (38.70%) as "Good," and 13 individuals (41.93%) as "Excellent." The

cumulative total of the entire participant group equated to 31 individuals (100%).



Graph-1: Harris Hips Score

Table-5: Distribution of study subjects according to the time interval between the date of injury to the date of surgery, surgical approach, and Post-operative complications with functional outcome using Harris hip score at the end of 6 months.

Duration between date of injury to date of surgery	HARRIS HIP SCORE				P value
	Poor	Fair	Good	Excellent	
<14 days	1 (3.23%)	3 (9.68%)	12 (38.71%)	11 (35.48%)	0.12
>14 days	1 (3.23%)	1 (3.23%)	0 (0%)	2 (6.45%)	
Surgical approach					
Kocher Langenbeck Approach (n=17)	0 (0%)	1 (5.88%)	10 (58.82%)	6 (35.29%)	0.01
Ilioinguinal Approach (n=10)	0 (0%)	2 (20%)	1 (10%)	7 (70%)	
Modified Stoppa approach (n=2)	1 (50%)	0 (0%)	1 (50%)	0 (0%)	
Both (n=2)	1 (50%)	1 (50%)	0 (0%)	0 (0%)	
Post-operative complications					
No complications (n=27)	1 (3.70%)	3 (11.11%)	11 (40.74%)	12 (44.44%)	0.34
Post-operative complications (n=4)	1 (25%)	1 (25%)	1 (25%)	1 (25%)	

The study investigated the time span between injury and surgery concerning the Harris Hip Score, a vital hip functionality assessment. Outcomes across "Poor," "Fair," "Good," and "Excellent" categories were examined for intervals <14 and >14 days. Among <14-day cases, 1 (3.23%) "Poor," 3 (9.68%) "Fair," 12 (38.71%) "Good," and 11 (35.48%) "Excellent" results were observed, with non-significant association (P = 0.12). Surgical approaches included Kocher Langenbeck (17), Ilioinguinal (10), Modified Stoppa (2), and combined (2). Kocher Langenbeck saw no "Poor," 1 (5.88%) "Fair," 10 (58.82%) "Good," and 6 (35.29%) "Excellent" outcomes. Ilioinguinal yielded no "Poor," 2 (20%) "Fair," 1 (10%) "Good," and 7 (70%) "Excellent." Statistical significance (P = 0.01) was found between surgical approach and outcomes. Post-op complications analysis among uncomplicated (27) and complicated (4) cases showed non-significant correlation (P = 0.34) between complications and outcomes.

DISCUSSION:

The present study focuses on analysing various aspects related to the surgical intervention of acetabular fractures and their functional outcomes. The factors such as fracture patterns, patient demographics, surgical approaches, complications, and post-surgery functional outcomes were investigated. The findings were compared with existing studies to provide context and insights.

The study's findings revealed a mean age of 38.67 years, with the largest proportion of participants falling within the 20-29 age group. This is comparable to findings by Shreshtha et al.¹³ (39 years), Briffa et al.¹⁴ (36 years), Faizan Iqbal et al.¹⁵ (44.20 years), George et al.¹¹ (42.6 years), and Doltani et al.¹⁵ (32.21 years).

In the study, the majority of subjects (90.32%) were males. This aligns with the results of studies by Maini et al.¹⁶ (90%), Briffa et al.¹⁴ (76%), Routt et al.¹⁷ (66.7% to 78%), M Oransky et al.¹⁸ (66.7% to 78%), E-Y. Chiu et al.¹⁹ (66.7% to 78%), and Faizan

Iqbal et al.¹⁵ (74%).

Motor vehicle accidents (87.09%) were the most common mechanism of injury in the present study, similar to Almeida et al.²⁰ (78.94%) and Giannoudis et al.²¹ (over 80%).

The most common side of injury was the right side (54.83%), while Faizi et al.²² (43.3%) and Maia et al.²³ (57.7%) reported different proportions of left-side injuries.

Posterior wall (29.03%) and anterior column (22.58%) fractures were most common in the study, similar to findings by Giannoudis et al.²¹ (23.90%) and Faizan Iqbal et al.¹⁵ (28%).

Kocher Langenbeck approach (61.29%) was the most common in the study, while other studies also reported the use of this approach, including Eliezer et al.²⁴ (88.2%), Matta et al.⁹ (43%), Briffa et al.¹⁴ (47.4%), Kumar et al.²⁵ (56%), and Almeida et al.²⁰ (60.5%).

In the present study, the mean duration between injury and surgery was 8.61 days, consistent with Deo et al. (8.6 days), but varying from other studies such as Meena UK et al.¹⁰ (80.5% operated within 14 days) and Faizan Iqbal et al.¹⁵ (mean time of 5 days).

The study identified complications including femoral head avascular necrosis, deep infections, deep venous thrombosis, and implant failure. These complications exhibited differing prevalence rates in comparison to other studies, such as Meena UK et al.¹⁰ (osteoarthritis, 29%), Giannoudis et al.²¹ (nerve palsy and osteoarthritis, 19.8%), and Almeida et al.²⁰ (osteoarthritis, 9.2%).

The study reported a functional outcome of 80.63, which is similar to Ruesch et al.²⁶ (81) and Almeida et al.²⁰ (81.6), and falls within the range of outcomes observed in various other studies.

Overall, the present study's findings are consistent with many previous studies in terms of age, gender distribution, mechanism of injury, surgical approaches, and functional outcomes, while also highlighting unique aspects of fracture patterns and post-operative complications. The comparison with other studies helps contextualize your findings and contributes to the broader understanding of acetabular fracture management.

CONCLUSION:

In conclusion, our investigation centered on the surgical approach to managing acetabular fractures, with the objective of achieving precise restoration of the articular surface and enhancing functional outcomes. The adoption of conservative methods for handling these fractures has demonstrated unsatisfactory outcomes, and the frequency of acetabular fractures is escalating due to a surge in road traffic accidents.

The effectiveness of the surgical strategy relies on a comprehensive comprehension of the fracture's anatomical characteristics, precise preoperative strategizing, and suitable reduction methodologies. The primary goal of employing open reduction and internal fixation on the acetabulum is to establish a functional, pain-free, and mobile joint, ultimately resulting in exceptional and favourable outcomes, while concurrently diminishing the potential for avascular necrosis (AVN) and hip osteoarthritis.

Surgeons must also effectively communicate the potential risks and outcomes of the surgery to patients, especially when the waiting period for the procedure extends beyond two weeks. Taking these factors into account, surgical intervention

holds the potential to considerably enhance functional results and the overall quality of life for individuals grappling with acetabular fractures.

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