ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 09 | September - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

FUNCTIONAL OUTCOME OF ACETABULAR FRACTURE MANAGED BY OPEN REDUCTION AND INTERNAL FIXATION WITH PLATE OSTEOSYNTHESIS

Orthopaedics

Dr Suriya kulothungan K Primary author: Department of Orthopaedics, Final year resident, Sree Balaji Medical College and hospital

Dr Karthik M* Department of Orthopaedics, Assistant professor, Sree Balaji Medical College and hospital*Corresponding Author

Dr Lionel john J Department of Orthopaedics, professor, unit chief, Sree Balaji Medical College and hospital

ABSTRACT

Introduction Acetabular fractures are complex injuries to the hip socket, often resulting from high-energy trauma such as motor vehicle accidents or falls from significant heights. These fractures pose a substantial challenge due to the intricate anatomy of the acetabulum and the necessity for precise reconstruction to restore normal hip function and prevent post-traumatic arthritis. Open Reduction Internal Fixation (ORIF) is the gold standard surgical intervention for displaced acetabular fractures, aiming to achieve anatomical reduction and stable fixation. **Case report:** an observational prospective analysis of both column acetabular fracture patient with a minimum follow-up of 1 year, managed by open reduction and internal fixation with plate osteosynthesis. The functional outcomes were studied using the Harris hip score and range of motion. The final Harris hip score is 90. The range of movements of the hip flexion is 120°, extension 10°, abduction 50°, adduction 30°, external rotation 50°, and internal rotation 40°.**Conclusion:** Optimal functional and radiological outcomes have been achieved with anatomic postoperative reduction. Additionally, a good recovery, prompt surgery, and the competence of the specialist all contribute to an outstanding functional outcome with the fewest difficulties. Proper anatomic reduction with stable surgical fixation and early rehabilitation results in good outcome

KEYWORDS

complex acetabular fracture, both column fracture, Harris hip score, open reduction and internal fixation.

INTRODUCTION:

Acetabular fractures, often resulting from high-energy trauma such as motor vehicle accidents or significant falls, pose a complex challenge in orthopedic trauma care[1]. Pelvic fractures occur in up to 20% of instances of polytrauma and account for 3% to 6% of all adult fractures[2]. Incidence of the posterior wall with the column, posterior column, T-shaped, transverse, transverse with the posterior wall, and anterior column with posterior hemitransverse is 2.7%, 4.1%, 6.6%, 8.6%, 20.7%, and 5.7% respectively[3]. These fractures involve the acetabulum, the concave surface of the pelvis that articulates with the femoral head, forming the hip joint. Due to the intricate anatomy of the acetabulum and its critical role in weight-bearing and mobility, precise management is essential to restore normal hip function and prevent long-term complications such as post-traumatic arthritis[4]. The articular incongruity of the hip joint results from the fragmented bones displacement, and uneven distribution over the articular surface leads to joint arthritis[5]. Open Reduction and Internal Fixation (ORIF) with plate osteosynthesis has emerged as the cornerstone for treating displaced acetabular fractures. This surgical technique aims to achieve anatomical reduction of the fracture fragments and stable fixation, thereby facilitating early mobilization and optimal healing[6]. The procedure involves repositioning the fractured bone segments into their correct anatomical alignment and securing them with plates and screws, which provide the necessary stability for bone healing.

The success of ORIF with plate osteosynthesis depends on a thorough understanding of acetabular anatomy, meticulous surgical technique, and comprehensive postoperative care. This article delves into the principles, methods, and outcomes of managing acetabular fractures using ORIF with plate osteosynthesis. By exploring the detailed aspects of this approach, we aim to highlight its critical role in achieving favorable clinical outcomes for patients suffering from these complex injuries.

MATERIALS AND METHODS:

This is an observational prospective study of an acute acetabular fracture patient who was managed by open reduction and internal fixation(ORIF) with plate osteosynthesis. The procedure was within 1 month of the trauma. A minimum follow-up of 1 year with serial clinical and radiological examinations at 3 months, 6 months, and 1 year was required. The outcomes were studied based on the mean constant Murley sco re, DASH score, and range of motion.

RADIOLOGICAL INVESTIGATIONS FOR ACETABULAR FRACTURES

Radiological investigations are vital in diagnosing acetabular fractures, determining the fracture pattern, and guiding the surgical treatment plan. Comprehensive radiological evaluation typically includes plain radiography and advanced imaging modalities such as computed tomography (CT) scans.

PLAIN RADIOGRAPHY

Plain radiographs are the initial imaging modality used to evaluate acetabular fractures. They provide a quick and straightforward method to assess the bony anatomy and initial fracture classification.

STANDARD VIEWS:

-Anteroposterior (AP) Pelvis View: The AP view is the primary radiographic projection used in the assessment of acetabular fractures. It provides an overview of the pelvis, showing the alignment and displacement of the acetabulum and femoral head. Key structures to evaluate in the AP view include the iliopectineal line (representing the anterior column) and the ilioischial line (representing the posterior column).

RADIOLOGICAL INVESTIGATIONS FOR ACETABULAR FRACTURES

Radiological investigations are vital in diagnosing acetabular fractures, determining the fracture pattern, and guiding the surgical treatment plan. Comprehensive radiological evaluation typically includes plain radiography and advanced imaging modalities such as computed tomography (CT) scans.

PLAIN RADIOGRAPHY

Plain radiographs are the initial imaging modality used to evaluate acetabular fractures. They provide a quick and straightforward method to assess the bony anatomy and initial fracture classification.

STANDARD VIEWS

-Anteroposterior (AP) Pelvis View: The AP view is the primary radiographic projection used in the assessment of acetabular fractures. It provides an overview of the pelvis, showing the alignment and displacement of the acetabulum and femoral head. Key structures to evaluate in the AP view include the iliopectineal line (representing the anterior column) and the ilioischial line (representing the posterior column).

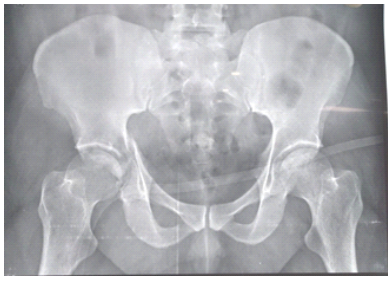


FIGURE 1: Preoperative x-ray

- Judet Views: These are oblique projections that offer additional detail on the acetabular columns and walls:
- Iliac Oblique View: Taken with the patient rotated 45 degrees to the opposite side, this view highlights the posterior column and the anterior wall of the acetabulum.
- Obturator Oblique View: Taken with the patient rotated 45 degrees towards the affected side, this view provides a clear image of the anterior column and the posterior wall of the acetabulum.

COMPUTED TOMOGRAPHY (CT) SCANS

CT scanning is the gold standard for the detailed evaluation of acetabular fractures. It offers a three-dimensional understanding of the fracture, which is crucial for surgical planning and precise assessment of the injury.

ADVANTAGES OF CT SCANS:

- Deailed Fracture Pattern Analysis: CT scans provide clear delineation of fracture lines, comminution, and displacement. This level of detail is particularly useful for identifying complex fracture patterns that may not be apparent on plain radiographs
- Assessment of Articular Surface: CT scans offer a detailed view of the acetabular articular surface, allowing for the identification of intra-articular fragments and impaction injuries.
- 3D Reconstruction: Advanced CT techniques allow for three-dimensional reconstructions, which provide a comprehensive visualization of the acetabular anatomy and fracture morphology. These reconstructions are invaluable for preoperative planning and intraoperative navigation.

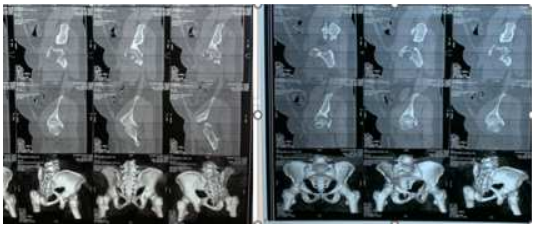


FIGURE 2: CT image of the pelvis

CT PROTOCOL:

- Axial Cuts: Thin-section axial cuts (typically 2-3 mm) through the pelvis provide detailed cross-sectional images.
- Coronal and Sagittal Reformats: These are reconstructed from the axial data and provide additional perspectives on the fracture, highlighting vertical and horizontal displacement.
- Reconstruction: These reconstructions provide a complete, three-dimensional view of the acetabulum, aiding in surgical planning and visualization.

MAGNETIC RESONANCE IMAGING (MRI)

While MRI is not typically used for initial fracture assessment, it can be beneficial in specific cases where soft tissue evaluation is necessary.

INDICATIONS FOR MRI:

- Assessment of Hip Dislocation: MRI can provide detailed information on soft tissue damage, including labral tears and ligamentous injuries.
- Evaluation of Avascular Necrosis: In cases of delayed presentation or complex injury patterns, MRI can help assess the vascular status of the femoral head.

FLUOROSCOPY

Intraoperative fluoroscopy is an essential tool used during the surgical fixation of acetabular fractures.

USES OF FLUOROSCOPY:

- Verification of Reduction: Real-time imaging allows for the assessment of fracture reduction and alignment during surgery.
- Implant Placement: Fluoroscopy ensures accurate placement of screws and plates, avoiding intra-articular penetration and ensuring optimal fixation.

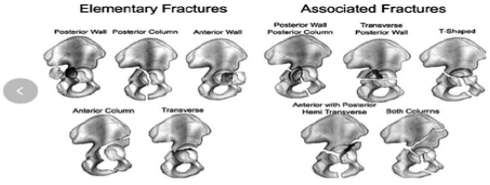
CLASSIFICATION SYSTEMS:

Several classification systems are used to categorize acetabular fractures based on radiological findings, aiding in communication and treatment planning:

Letournel-Judet Classification[7]: This is the most widely used classification system for acetabular fractures, dividing them into elementary and associated types:

- Elementary Fractures: These include isolated fractures of the posterior wall, posterior column, anterior wall, anterior column, and transverse fractures.
- Associated Fractures: These include more complex patterns such as T-type fractures, an anterior column with posterior hemitransverse fractures, and both column fractures.

AO/OTA Classification[8]: The AO/OTA system provides a detailed and comprehensive classification that is particularly useful in research and complex case management.



The Judet and Letournel acetabular fracture classification system

FIGURE 3: The Judet and Letournel acetabular fracture classification

Surgical procedure:

For this patient, we operated in two settings initially, the posterior column was fixed using the Kocher Langenbeck approach, and later after 1 week anterior column was fixed via the ilioinguinal approach.

1.Kocher Langenbeck approach

- Under Strict Aseptic Precautions, under spinal anaesthesia, the patient is in the left lateral position, parts painted and draped
- 15cm curvilinear incision made 5cm below and lateral to PSIS centering over GT directed towards the shaft of the femur.
- Tensor fascia lata incised
- Gluteus maximus muscle split.
- Short external rotators identified and cut.
- Posterior wall of acetabulum identified, fracture site visualized was found to be comminuted, reduced using k wire
- A 8 holed contoured plate is used to fix the fracture with 3 proximal and 2 distal screws
- Reduction checked under C-arm found to be satisfactory
- Through wound wash given
- Vancomycin powder applied
- Drain tube kept in situ.
- Wound closed in layers.

FIGURE 4: Intraoperative image of Kocher Langenbeck approach

ILIOINGUINAL APPROACH:

- Under Strict Aseptic Precaution, under General Anaesthesia, pt in the supine position, parts painted and draped

- Through an ilioinguinal approach a 25cm incision is made starting 3cm above the pubic symphysis and extending laterally along the iliac crest
- Skin, SC tissue cut & retracted
- External oblique aponeurosis cut & retracte
- Iliacus cut & retracted
- Spermatic cord structure, femoral vessels, and iliopsoas muscle identified and tagged
- Fracture site is identified
- The anterior acetabular column is found to be comminuted & unstable
- The fracture is fixed with 14 holed recon acetabular plate & fixed with 2 medial & 2 lateral screws
- The fracture reduction is satisfactory
- Thorough wound wash given
- Drain tube kept in situ
- Wound closed in layers

RESULTS:

The functional outcomes were studied using the Harris hip score and range of motion. The final Harris hip score is 90. The range of movements of the hip flexion is 120°, extension 10°, abduction 50°, adduction 30°, external rotation 50°, and internal rotation 40°.

POSTOPERATIVE PERIOD:

6 Weeks Postoperative:

- Clinical Evaluation: The patient reported mild pain controlled with analgesics. Hip range of motion was restricted but improving with physiotherapy.
- Radiographic Evaluation: X-rays showed satisfactory alignment and healing progress without any signs of hardware failure or displacement.

FIGURE 5: Postoperative x-ray

FIGURE 6: Post-operative dressing

MONTHS POSTOPERATIVE:

- Clinical Evaluation: The patient was ambulating with partial weight-bearing using crutches. Hip flexion was 90 degrees, and abduction was 30 degrees.
- Radiographic Evaluation: Continued fracture healing with no complications observed.

MONTHS POSTOPERATIVE:

- Clinical Evaluation: The patient progressed to full weight-bearing with minimal discomfort. Hip flexion improved to 110 degrees, and abduction to 45 degrees.
- Radiographic Evaluation: Complete fracture union with no evidence of avascular necrosis or post-traumatic arthritis.

YEAR POSTOPERATIVE:

- Clinical Evaluation: The patient returned to normal activities with occasional mild pain during strenuous activities. Hip range of motion was near normal with flexion 120°, extension 10°, abduction 50°, adduction 30°, internal rotation 40°, and external rotation 50°. The patient reported satisfactory functional recovery, scoring 90 on the Harris Hip Score.

Radiographic Evaluation: Final X-rays confirmed maintained reduction and healing with no hardware-related complications or joint degeneration.

DISCUSSION:

A femur head forced into the pelvis might result in acetabulum fractures[9].

This case is a both-column acetabular fracture managed by open reduction and internal fixation with plate osteosynthesis. As a component of a polytrauma framework, prosthesis procedures for acetabulum anterior column fractures are difficult. The ilioinguinal approach remains the most often used surgical technique for treating these types of fractures to date[10]. Because the K-L method allows for direct access of the entire lateral side of the posterior column of the acetabulum, it is considered the gold standard for open reduction and internal fixation of posterior column acetabular fracture[11]. We used both of these approaches for fixing the anterior and posterior column of the acetabulum. Surgeons generally agree that open reduction and internal fixation is the best therapeutic strategy, although there is currently a lack of research analyzing when intervention should be performed. Patients with acetabulum fractures have been shown to perform worse when surgery is delayed for longer than three weeks after the initial injury[12]. Numerous factors, including the energy level of the injury, understanding of pelvic anatomy, radiographic fracture pattern, scheduling of open reduction and internal fixation, and surgical approach selection, influence the outcome of open reduction and internal fixation[13]. The postoperative complications that can occur are secondary osteoarthritis, myositis ossificans, AVN, sciatic nerve palsy, and infection[14]. Numerous research works have documented the surgical complications associated with acetabulum fractures[15,16]. Osteoarthritis is the most frequent long-term surgical consequence, which typically requires a total hip replacement[17]. The age (more than 40) and related fracture pattern are the risk factors for this[18]. The reported incidence of AVN in literature is around 10-15%[19]. Hip dislocation was the primary cause of AVN in the majority of patients, and posterior fracture patterns were linked to it[16]. The incidence of AVN can be reduced by surgical intervention performed within 2 weeks of the injury and early reduction of the hip joint. The incidence of myositis ossificancs can be reduced by prophylactic treatment with tablet Indomethacin 75mg[14].

CONCLUSION

ORIF of acetabular fractures is a demanding but rewarding procedure that requires a comprehensive understanding of pelvic anatomy, meticulous surgical technique, and diligent postoperative care. When performed correctly, it offers the best chance for restoring hip function and preventing long-term complications in patients with displaced acetabular fractures.

SOURCE OF FINANCE- NIL

CONSENT- Patient consent has been obtained so that his photo and details can be published in the case report.

COMPETING INTERESTS- Authors declare that there is no competing interest.

ACKNOWLEDGEMENTS- NIL

REFERENCES:

1. Hill RM, Robinson CM, Keating JF. Fractures of the pubic rami: epidemiology and five-year survival. The Journal of Bone & Joint Surgery British Volume. 2001 Nov 1;83(8):1141-4.
2. Templeman DC, Olson S, Moed BR, Duwelius P, Matta JM. Surgical treatment of acetabular fractures. Instructional course lectures. 1999 Jan 1;48:481-96.
3. Letournel E. Acetabulum fractures: classification and management. Clinical Orthopaedics and Related Research®. 1980 Sep 1;151:81-106.
4. Gänsslen A, Pohlemann T, Paul CH, Lobenhoffer P, Tscherne H. Epidemiology of pelvic ring injuries. Injury. 1996 Jan 1;27:13-20.
5. Kim HT, Ahn JM, Hur JO, Lee JS, Cheon SJ. Reconstruction of acetabular posterior wall fractures. Clinics in orthopedic surgery. 2011 Jun;3(2):114.
6. Chiu FY, Chen CM, Lo WH. Surgical treatment of displaced acetabular fractures—72 cases followed for 10 (6–14) years. Injury. 2000 Apr 1;31(3):181-5.
7. Beaulé PE, Dorey FJ, Matta JM. Letournel classification for acetabular fractures: assessment of interobserver and intraobserver reliability. JBJS. 2003 Sep 1;85(9):1704-9.
8. Journal of Orthopaedic Trauma, January 2018, volume 32, number 1
9. MATTA JM, ANDERSON LM, EPSTEIN HC, Hendricks PI. Fractures of the Acetabulum: A Retrospective Analysis. Clinical Orthopaedics and Related Research (1976-2007). 1986 Apr 1;205:230-40.
10. JD C. Acetabular fracture fixation via a modified Stoppa limited intrapelvic approach. Clin Orthop & R. R. 1994;305:112-23.
11. Tosounidis TH, Giannoudis VP, Kanakaris NK, Giannoudis PV. The Kocher-Langenbeck approach: state of the art. JBJS essential surgical techniques. 2018 Jun

27;8(2):e18.
12. Matta JM. Fractures of the acetabulum: accuracy of reduction and clinical results in patients managed operatively within three weeks after the injury. JBJS. 1996 Nov 1;78(11):1632-45.
13. Anizar-Faizi A, Hisam A, Sudhagar KP, Moganadass M, Suresh C. Outcome of surgical treatment for displaced acetabular fractures. Malaysian orthopaedic journal. 2014 Nov;8(3):1.
14. Kumar D, Kushwaha NS, Tiwari PG, Sharma Y, Srivastava RN, Sharma V. Outcome of acetabulum fractures treated with open reduction and internal fixation through Kocher-Langenbeck Approach: A retrospective study. Journal of Clinical Orthopaedics and Trauma. 2021 Dec 1;23:101599.
15. Giannoudis PV, Grotz MR, Papakostidis C, Dinopoulos H. Operative treatment of displaced fractures of the acetabulum: a meta-analysis. The Journal of Bone & Joint Surgery British Volume. 2005 Jan 1;87(1):2-9.
16. Ziran N, Soles GL, Matta JM. Outcomes after surgical treatment of acetabular fractures: a review. Patient safety in surgery. 2019 Dec;13:1-9.
17. Petsatodis G, Antonarakos P, Chalidis B, Papadopoulos P, Christoforidis J, Pournaras J. Surgically treated acetabular fractures via a single posterior approach with a follow-up of 2–10 years. Injury. 2007 Mar 1;38(3):334-43.
18. Ensrud KE. Epidemiology of fracture risk with advancing age. Journals of Gerontology Series A: Biomedical Sciences and Medical Sciences. 2013 Oct 1;68(10):1236-42.
19. Magu NK, Gogna P, Singh A, Singla R, Rohilla R, Batra A, Mukhopadhyay R. Long term results after surgical management of posterior wall acetabular fractures. Journal of Orthopaedics and Traumatology. 2014 Sep;15:173-9.