International Journal of Health Sciences and Research
[Indexed, Peer-Reviewed Journal]
Volume 16; Issue: 7; July 2026
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Functional Outcome of Surgical Management of Anterior Column Acetabular Fractures Using Ilioinguinal Approach: A Prospective Study

Vaibhav Nauriyal[1], Sarthak Tomar[2], Manish Sharma[3]

[1]Assistant Professor, Dept of Orthopaedics, VCSG MS & RI, Srikot, Pauri Garhwal, Uttarakhand 246174, India
[2]Senior Resident, Dept of Orthopaedics, VCSG MS & RI, Srikot, Pauri Garhwal, Uttarakhand 246174, India
[3]Fellow in Joint Replacement Surgery, Belle Vue Clinic, Sir U N Brahmachari Sarani, Near Minto Park, Kolkata 700017, India

Corresponding author: Vaibhav Nauriyal

DOI: https://doi.org/10.52403/ijhsr.20260724

ABSTRACT

Background: Acetabular fractures are high-energy injuries predominantly affecting the working-age population. Anterior column fractures constitute a technically demanding subset. The ilioinguinal approach provides superior access to the anterior column, but prospective Indian data on its outcomes remain limited.
Methods: A prospective observational study was conducted at Tata Main Hospital, Jamshedpur (IEC Approval Ref: TMH/FRM/QMS/ALL/19,). Thirty patients (22 males, 8 females) aged 18-70 years with anterior column acetabular fractures were managed by ORIF via the ilioinguinal approach with 6-month follow-up. Fractures were classified by the Letournel-Judet system. Functional outcome was assessed by Harris Hip Score (HHS).
Results: Mean age was 47.87±12.22 years. Road traffic accidents (80%) were the predominant mechanism. Good-to-excellent HHS outcomes were achieved in 60% of cases (excellent 20%, good 40%). Anatomical reduction was achieved in 66.7%. On univariate analysis, a roof arc angle >45° (Fisher p=0.0024; OR 22.0, 95% CI 2.27–212.87) and anatomical reduction quality (Fisher p=0.0041; OR 16.0, 95% CI 2.40–106.74) were significantly associated with good functional outcome.
Conclusion: ORIF via the ilioinguinal approach for anterior column acetabular fractures yields satisfactory functional outcomes in 60% of patients These associations require confirmation in larger, multivariable studies before they can be considered independently associated with outcome.
Keywords: acetabular fractures; anterior column; ilioinguinal approach; Harris Hip Score; ORIF; Letournel-Judet; roof arc angle; functional outcome

INTRODUCTION

Acetabular fractures represent some of the most complex injuries in orthopaedic traumatology, demanding meticulous pre-operative planning, precise surgical execution, and prolonged rehabilitation. The acetabulum, forming the bony socket of the hip joint, is subjected to high compressive forces during normal gait; disruption of its articular congruity invariably leads to post-traumatic osteoarthritis if not adequately reduced and stabilised [1]. In India, the rapid proliferation of motorised transport has driven a sharp increase in high-energy pelvic trauma, with road traffic accidents accounting for the vast majority of acetabular

fractures encountered in tertiary orthopaedic units [2].

The Letournel-Judet classification remains the gold standard for acetabular fracture characterisation, stratifying injuries into five simple and five associated patterns based on the two-column concept of acetabular anatomy [3]. Anterior column fractures -- whether isolated or combined with posterior hemitransverse or posterior column components -- are optimally addressed via the ilioinguinal approach, first described by Letournel in 1961. This approach provides wide-field access to the entire anterior column from the sacroiliac joint to the pubic symphysis through three working windows, with minimal disruption to hip abductors [4,5]. Recent meta-analyses comparing the ilioinguinal with the modified Stoppa approach confirm comparable functional outcomes, while reaffirming the ilioinguinal approach as the standard reference technique for anteriorly based fractures [6]. Despite a growing body of global evidence, prospective Indian data specifically on anterior column fixation via the ilioinguinal approach remain limited. The present study was designed to address this gap, evaluate clinical outcomes, and identify factors associated with outcome in an Indian tertiary-care setting.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted at the Department of Orthopaedics, Tata Main Hospital, Jamshedpur (a 940-bed tertiary-care institution with a dedicated 100-bed orthopaedic unit) from October 2017 to September 2019. The study was approved by the Institutional Ethics Committee, Tata Main Hospital, Jamshedpur (IEC Approval Ref: TMH/FRM/QMS/ALL/19, Date of Approval: 22.09.2017). All procedures were conducted in accordance with the Declaration of Helsinki (revised 2013). Written informed consent was obtained from all participants prior to enrolment.

Inclusion and Exclusion Criteria

Thirty consecutive patients with anterior column acetabular fractures fulfilling the following criteria were enrolled:

Inclusion criteria: (1) Age 18-70 years, either sex; (2) fracture duration <14 days after haemodynamic stabilisation; (3) anterior column fracture of acetabulum with or without associated posterior column component confirmed on clinical examination, plain radiographs, and CT with 3D reconstruction; (4) informed consent provided.

Exclusion criteria: (1) Age <18 or >70 years; (2) pathological fractures; (3) bilateral acetabular fractures; (4) patients unfit for surgery due to comorbidities; (5) fractures >3 weeks old; (6) patients lost to follow-up.

Pre-operative Assessment

All patients underwent anteroposterior, oblique Judet views, and inlet/outlet pelvic radiographs. CT pelvis with 3D reconstruction was performed in all cases to delineate fracture pattern, comminution, and intra-articular fragments. Fractures were classified using the Letournel-Judet system. Medial, anterior, and posterior roof-arc angles were measured on respective radiographic views. Hip dislocations were reduced emergently under general anaesthesia and maintained in skeletal traction pending definitive fixation. Pre-operative antibiotic prophylaxis (third-generation cephalosporin) was administered 30 minutes before incision.

Surgical Technique

All procedures were performed in the supine position under spinal or general anaesthesia. The ilioinguinal approach was employed in all cases, exposing the anterior column through three working windows: (1) lateral window -- between the tensor fascia lata and inguinal ligament, providing access to the iliac wing and sacroiliac joint; (2) middle window -- between the inguinal ligament, iliopsoas, and femoral neurovascular bundle, accessing the pelvic brim; (3) medial window -- medial to the femoral vessels, accessing

the true pelvis and pubic symphysis. Fracture reduction was achieved using reduction forceps, Farabeuf clamps, and ball-spike pushers under direct visualisation supplemented by intraoperative fluoroscopy. Fixation was achieved with 3.5 mm cortical screws and reconstruction plates applied along the pelvic brim and posterior wall as required. All patients received post-operative DVT prophylaxis (low-molecular-weight heparin for 4 weeks) and heterotopic ossification prophylaxis (indomethacin 75 mg daily for 6 weeks). Partial weight-bearing was initiated at 6-8 weeks; full weight-bearing at 12-16 weeks based on radiological healing.

Outcome Assessment

Functional outcomes were assessed at 6 months using the Harris Hip Score (HHS) and graded as Excellent (90-100), Good (80-89), Fair (70-79), or Poor (<70). Reduction quality was evaluated using the Matta criteria as Anatomical (<1 mm), Satisfactory (1-3 mm), or Poor (>3 mm). Fisher's exact test was used for inferential analysis because of the small sample size. Odds ratios (OR) with 95% confidence intervals (CI) were calculated. HHS outcomes were dichotomized into Good-to-Excellent and Fair-to-Poor categories. A p value <0.05 was considered statistically significant. Statistical analyses were performed using MedCalc version 19.0.

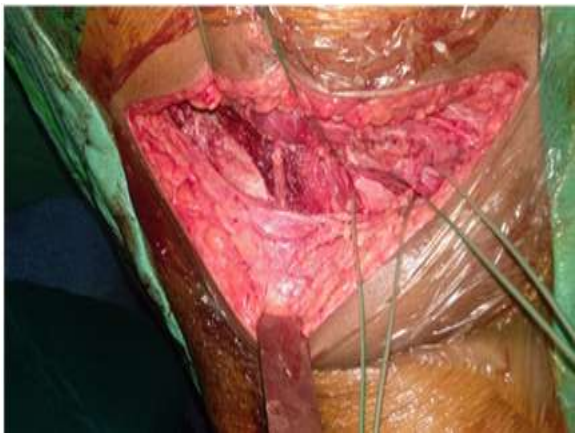

Figure 1. Intraoperative exposure of the anterior column through the three windows of the ilioinguinal approach.

The operative field demonstrates exposure of the anterior column and pelvic brim through the ilioinguinal approach, allowing visualization of the fracture site for reduction and fixation (Figure 1).

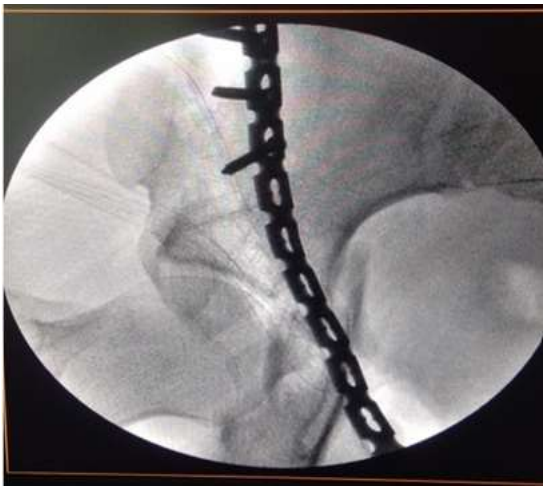

Figure 2: Intra-op post fixation X- ray

The fluoroscopic image demonstrates reduction of the acetabular fracture with reconstruction plate and screw fixation along the pelvic brim, confirming satisfactory implant placement (Figure 2).

RESULTS

Demographic Profile

Thirty patients were included (Table 1). Mean age was 47.87 +/- 12.22 years. The majority (70%) were aged >=45 years. There was a male predominance (22/30, 73.33%). Road traffic accidents accounted for 80% of injuries: two-wheeler RTA 53.33%, four-wheeler RTA 26.67%, and falls from height 20%. Right side was more commonly involved (66.67%) (Figure 3).

Table 1: Demographic characteristics (n=30)

Parameter	Category	n (%)
Sex	Male	22 (73.33%)
	Female	8 (26.67%)
Age (years)	18-44	9 (30.00%)
	45-70	21 (70.00%)
Side	Right	20 (66.67%)
	Left	10 (33.33%)
Mechanism	Two-wheeler RTA	16 (53.33%)
	Four-wheeler RTA	8 (26.67%)
	Fall from height	6 (20.00%)

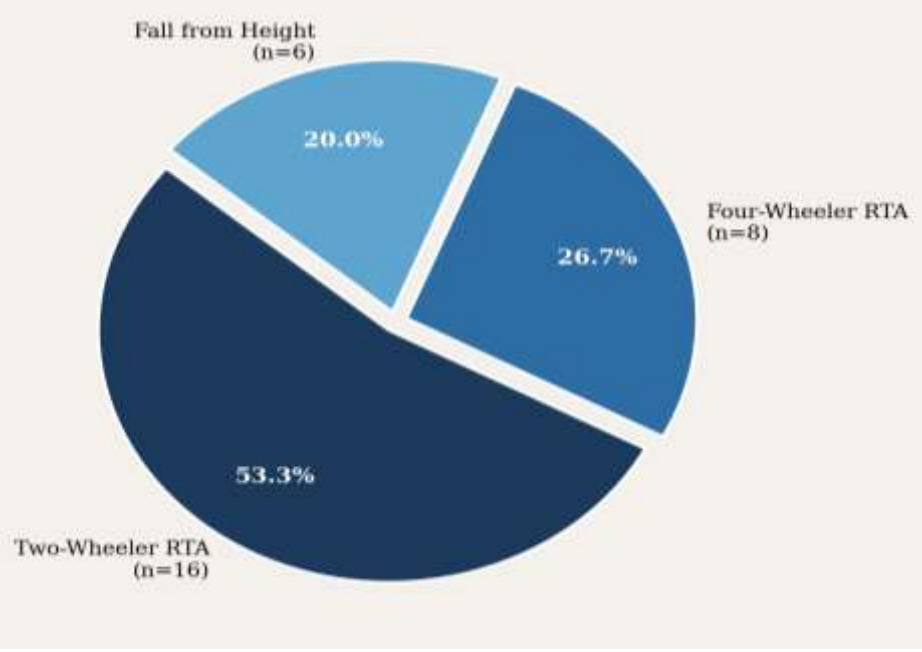

Figure 3: Mechanism of injury distribution

Fracture Pattern and Associated Injuries

Isolated anterior column fractures were most common (76.67%), followed by anterior column + posterior hemitransverse (13.33%), and both-column fractures (10%). Associated injuries included chest injuries in 7 (23.33%), genitourinary in 2 (6.67%), and abdominal in 1 (3.33%). Hip dislocation was noted in 10 patients (posterior 7, central 3), all reduced emergently (Table 2, Figure 4).

Table 2: Fracture pattern distribution (Letournel-Judet classification)

Type	Pattern	n	%
Simple	Isolated anterior column	23	76.67%
Associated	AC + posterior hemitransverse	4	13.33%
	Both-column fracture	3	10.00%
Total		30	100%

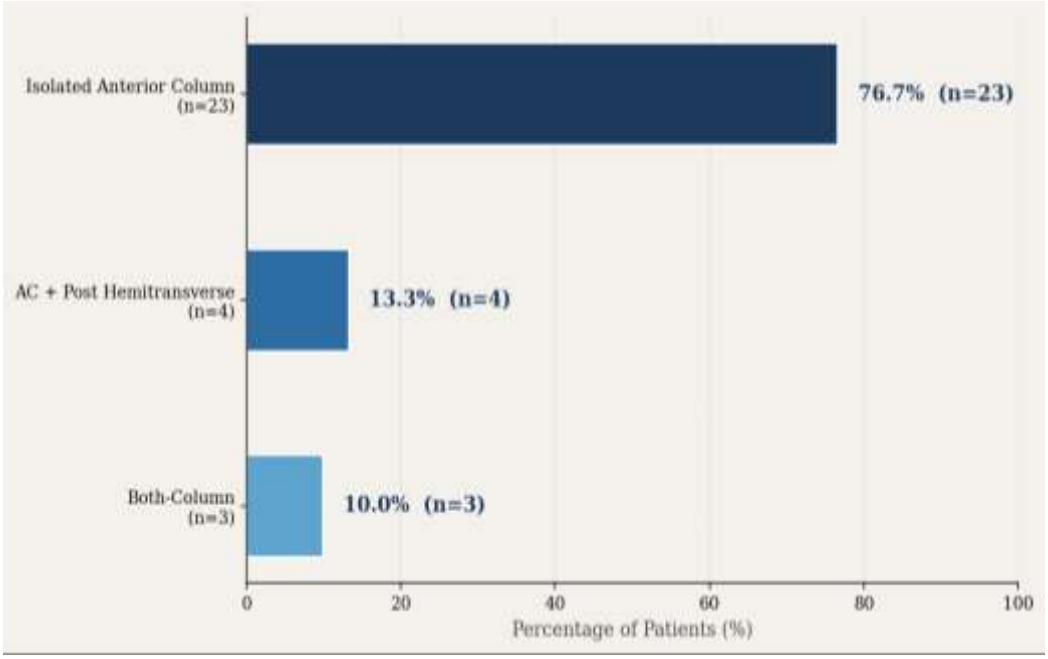

Figure 4: Distribution of fracture patterns (Letournel-Judet classification)

Surgical Details and Reduction Quality

Mean operative time was 187.6 +/- 34.2 minutes. Mean intraoperative blood loss was 820 +/- 240 mL. Anatomical reduction (Matta criteria) was achieved in 20 patients (66.7%), satisfactory in 7 (23.3%), and poor in 3 (10%). Mean time from injury to surgery was 6.4 +/- 2.8 days.

Functional Outcomes (Harris Hip Score)

At 6-month follow-up, 60% of patients achieved good-to-excellent HHS outcomes. Detailed breakdown is provided in Table 3. Outcomes were consistently superior in simple fracture patterns compared with associated patterns (Table 3, Figure 5).

Table 3: Harris Hip Score outcomes at 6 months

HHS Grade	Overall (n=30)	Simple (n=23)	Associated (n=7)
Excellent (90-100)	6 (20.00%)	5 (21.74%)	1 (14.29%)
Good (80-89)	12 (40.00%)	10 (43.48%)	2 (28.57%)
Fair (70-79)	9 (30.00%)	6 (26.09%)	3 (42.86%)
Poor (<70)	3 (10.00%)	2 (8.70%)	1 (14.29%)
Good + Excellent	18 (60.00%)	15 (65.22%)	3 (42.86%)

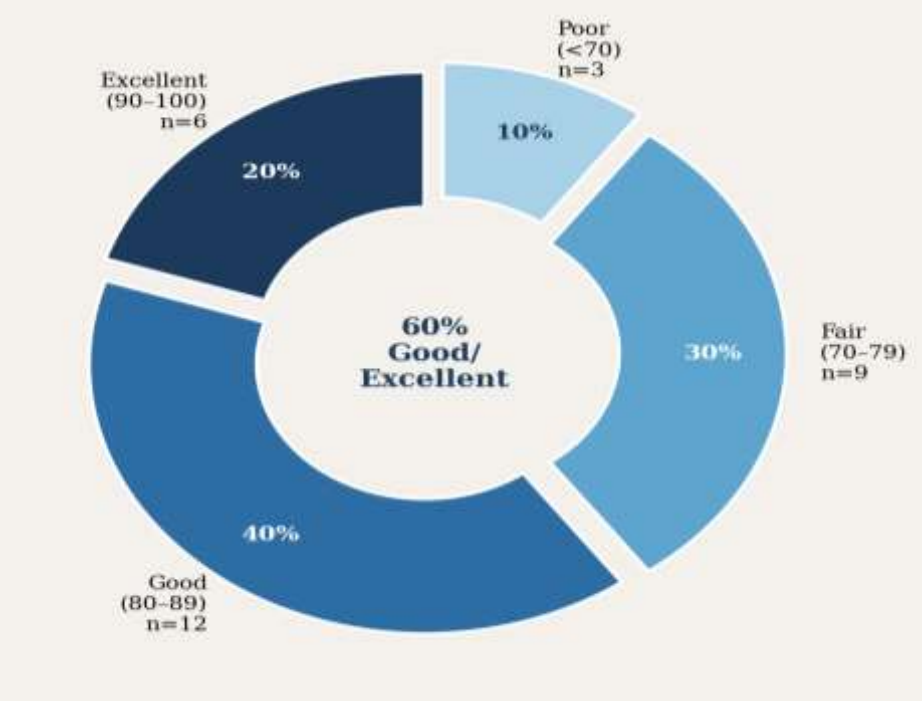

Figure 5: Harris Hip Score functional outcomes (n=30)

Factors Associated with Functional Outcome

A roof arc angle >45° was significantly associated with good-to-excellent functional outcome, with 92.3% of patients achieving favourable Harris Hip Score results (OR 22.0, p=0.0024). Similarly, anatomical reduction was significantly associated with better functional outcome, with 80% of anatomically reduced fractures achieving good-to-excellent scores (OR 16.0, p=0.0041). These findings represent associations observed on univariate analysis and should be interpreted with caution given the small sample size (Table 4).

Table 4. Factors associated with good-to-excellent Harris Hip Score outcome (univariate analysis using Fisher's exact test)

Factor / Subgroup	Good + Excellent Outcome n (%)	Fair + Poor Outcome n (%)	OR (95% CI)	Fisher's Exact p-value
Roof arc angle >45° (n=13)	12 (92.3%)	1 (7.7%)	22.0 (2.27–212.87)	0.0024
Roof arc angle ≤45° (n=17)	6 (35.3%)	11 (64.7%)	Reference	—
Anatomical reduction (n=20)	16 (80.0%)	4 (20.0%)	16.0 (2.40–106.74)	0.0041
Suboptimal reduction (n=10)	2 (20.0%)	8 (80.0%)	Reference	—

OR: Odds Ratio; **CI:** Confidence Interval.

Complications

Overall complication rate was 43.33% (13 events in 30 patients). Heterotopic ossification (Brooker grade I-II) was the most common complication (16.67%), followed by lateral femoral cutaneous nerve (LFCN) paresthesia (16.67%), superficial wound infection managed conservatively (6.67%), and one case of transient sciatic nerve palsy (3.33%) that resolved fully by 6 months. No cases of deep infection, implant failure, avascular necrosis, or secondary arthroplasty were recorded in the study period (Table 5, Figure 6).

Table 5: Post-operative complications

Complication	n	%	Management
Heterotopic ossification (Brooker I-II)	5	16.67%	Indomethacin prophylaxis
LFCN paresthesia	5	16.67%	Conservative / resolved
Superficial wound infection	2	6.67%	Antibiotics / dressings
Sciatic nerve palsy (transient)	1	3.33%	Resolved by 6 months
Deep infection / Implant failure	0	0%	--

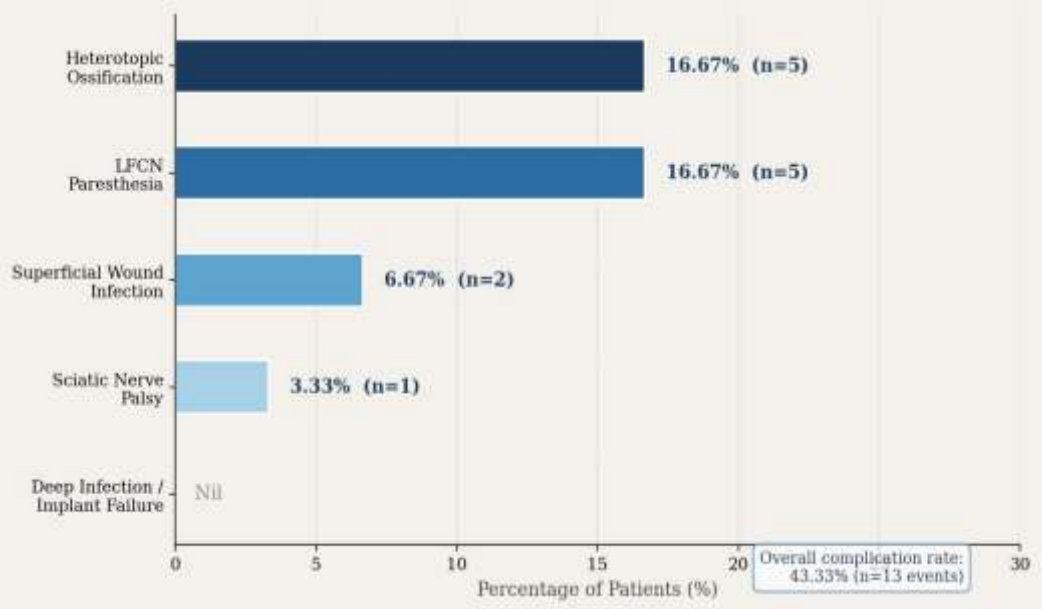

Figure 6: Distribution of post-operative complications

DISCUSSION

The overall good-to-excellent outcome of 60% in our series lies within the range reported in contemporary literature. A systematic review and meta-analysis of four studies (375 patients) comparing the ilioinguinal and modified Stoppa approaches found no significant difference in functional outcomes between the two, supporting the adequacy of the ilioinguinal technique for anteriorly based fractures [6]. A recent prospective single-centre Indian study by Kumar et al. (2024) reported good-to-excellent modified Harris Hip Score outcomes in 89% of 73 patients with T-type acetabular fractures, with anatomical reduction emerging as the principal factor associated with favourable outcome [7]. The lower rate in our series may partly reflect the shorter 6-month follow-up and the inclusion of complex associated fracture patterns.

In our cohort, a roof arc angle >45° was significantly associated with good-to-excellent outcome (Fisher p=0.0024). This is consistent with the long-standing pathomechanical principle that preservation of the weight-bearing dome is important for joint congruity. Verbeek et al. (2018) demonstrated that residual articular displacement is strongly related to long-term hip survivorship after acetabular fracture surgery, with gap displacement ≥5 mm independently associated with conversion to arthroplasty [8]; our findings are consistent with the broader observation that an intact, congruent weight-bearing surface is associated with better outcome.

Anatomical reduction was strongly associated with outcome in our series (Fisher p=0.0041; 16/20 anatomically reduced fractures achieved good-to-excellent HHS). Pascarella et al. (2017) similarly reported

that the quality of surgical reduction was a strong factor influencing functional and radiographic outcome in operatively treated acetabular fractures [9], and long-term survivorship data from Tannast et al. (2012) showed that anatomical reduction is among the most important factors associated with arthroplasty-free hip survival [10]. These observations should be interpreted as associations rather than proof of causation, as no multivariable adjustment was undertaken in the present study.

Complication rates in our series (43.33% overall) are comparable to those in the published literature. Heterotopic ossification and LFCN neuropraxia are well-recognised sequelae of the ilioinguinal approach and were the dominant complications observed. The absence of deep infection or implant failure is reassuring, although the small sample and short follow-up limit firm conclusions.

Limitations

This study is limited by its relatively small cohort (n=30), single-centre design, and 6-month follow-up, which precludes assessment of post-traumatic arthritis, avascular necrosis, and secondary arthroplasty. Importantly, only univariate analyses were performed; no multivariable adjustment for potential confounders was undertaken, so the reported associations should not be interpreted as independent predictors of outcome. The small subgroups yield wide confidence intervals, and the effect estimates should therefore be interpreted with caution. Larger multi-centre prospective Indian studies with a minimum of 2 years' follow-up and multivariable analysis are warranted.

CONCLUSION

Open reduction and internal fixation via the ilioinguinal approach for anterior column acetabular fractures provides satisfactory functional outcomes in the majority of patients. In this small univariate analysis, a preserved roof arc angle (>45°) and anatomical reduction were significantly associated with good-to-excellent Harris Hip Score outcomes. These associations require confirmation in larger, adequately powered studies with multivariable analysis before they can be regarded as independent prognostic factors. The ilioinguinal approach remains a reliable and reproducible technique for anterior column acetabular fixation in the Indian population.

Declaration by Authors

Author contributions: VN: study conception, patient selection, operative management, data collection, statistical analysis, and manuscript preparation. ST: data collection, follow-up assessment, and manuscript review. MS: literature review, manuscript drafting, and critical revision. All authors read and approved the final manuscript.

Ethical Approval: This study was approved by the Institutional Ethics Committee, Tata Main Hospital, Jamshedpur (IEC Approval Ref: TMH/FRM/QMS/ALL/19; Date of Approval: 22.09.2017). All procedures were conducted in accordance with the Declaration of Helsinki (revised 2013). Written informed consent was obtained from all participants.

Acknowledgement: None

Source of Funding: No funding was received for this study.

Conflict of Interest: All authors declare no competing interests.

REFERENCES

1. M. Tile, D. Helfet and J. Kellam, “Fractures of the Pelvis and Acetabulum,” 3rd Edition, Lippincott, Williams & Wilkins, Philadelphia, 2003.
2. Laird A, Keating JF. Acetabular fractures: a 16-year prospective epidemiological study. J Bone Joint Surg Br. 2005;87(7):969-73. doi: 10.1302/0301-620X.87B7.16017.
3. Letournel E, Judet R. Fractures of the acetabulum. 2nd ed. Berlin: Springer-Verlag; 1993.
4. Letournel E. The treatment of acetabular fractures through the ilioinguinal approach. Clin Orthop Relat Res. 1993;(292):62-76.

5. Matta JM. Operative treatment of acetabular fractures through the ilioinguinal approach: a 10-year perspective. J Orthop Trauma. 2006 Jan;20(1 Suppl):S20-9.
6. Meena S, Sharma PK, Mittal S, Sharma J, Chowdhury B. Modified Stoppa approach versus ilioinguinal approach for anterior acetabular fractures: a systematic review and meta-analysis. Bull Emerg Trauma. 2017;5(1):6-12.
7. Kumar S, Bhambhu V, Goyal R, Gugale S, Choudhary G, Mishra A, et al. Functional outcomes and their influencing factors for the surgical management of T-type acetabulum fractures: a prospective single-centre study of 73 patients. Cureus. 2024 Apr 27;16(4):e59170. doi: 10.7759/cureus.59170.
8. Verbeek DO, van der List JP, Tissue CM, Helfet DL. Predictors for long-term hip survivorship following acetabular fracture surgery: importance of gap compared with step displacement. J Bone Joint Surg Am. 2018 Jun 6;100(11):922-929. doi: 10.2106/JBJS.17.00692.
9. Pascarella R, Cerbasi S, Politano R, Balato G, Fantasia R, Orabona G, et al. Surgical results and factors influencing outcome in patients with posterior wall acetabular fracture. Injury. 2017 Aug;48(8):1819-1824. doi: 10.1016/j.injury.2017.05.039.
10. Tannast M, Najibi S, Matta JM. Two to twenty-year survivorship of the hip in 810 patients with operatively treated acetabular fractures. J Bone Joint Surg Am. 2012 Sep 5;94(17):1559-67. doi: 10.2106/JBJS.K.00444.

How to cite this article: Vaibhav Nauriyal, Sarthak Tomar, Manish Sharma. Functional outcome of surgical management of anterior column acetabular fractures using ilioinguinal approach: a prospective study. *Int J Health Sci Res.* 2026; 16(7):234-242. DOI: *https://doi.org/10.52403/ijhsr.20260724*

******