Research Article

Clinical and Radiological Outcomes of Acetabular Fractures Treated with Modified STOPPA Approach

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Background: Acetabular fractures are complex intra-articular injuries commonly caused by high-energy trauma. Achieving anatomical reduction is essential for optimal functional recovery. The modified Stoppa approach has emerged as a minimally invasive alternative, offering improved visualization of medial acetabular structures with reduced soft tissue dissection.

Aim: To evaluate clinical and radiological outcomes of acetabular fractures treated using the modified Stoppa approach.

Materials and Methods: This prospective study included 30 patients (18–70 years) with anterior acetabular fractures treated using the modified Stoppa approach between January and December 2024. Clinical outcomes were assessed using VAS, Harris Hip Score (HHS), and Merle d'Aubigné score at 1 and 6 months. Radiological outcomes were evaluated using Matta's criteria. Statistical significance was set at $p < 0.05$.

Results: Mean age was 42.2 ± 13.6 years, with 80% males. Road traffic accidents accounted for 70% of injuries. Anatomical reduction was achieved in 83.3% of cases. Significant improvement was noted in VAS (4.13–2.21), HHS (68.80–86.13), and Merle d'Aubigné score (12.30–15.80) at 6 months ($p < 0.001$). Good to excellent outcomes were observed in 76.7% of patients. Complications occurred in 26.7% but did not significantly affect outcomes.

Conclusion: The modified Stoppa approach is a safe and effective technique for anterior acetabular fractures, providing satisfactory anatomical reduction, improved functional outcomes, and acceptable complication rates.

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Keywords: Acetabular fracture, Modified Stoppa approach, Harris Hip Score, Matta criteria, functional outcome

Introduction

Acetabular fractures are complex intra-articular injuries resulting from high-energy trauma such as road traffic accidents and falls, predominantly affecting young adults.[1,2] Their incidence is increasing in developing countries due to rapid urbanization and rising vehicular density.[3] The primary objective in management is to achieve anatomical reduction and stable fixation to restore hip joint congruity and prevent complications such as post-traumatic osteoarthritis and avascular necrosis.[4] Traditionally, the ilioinguinal approach has been widely used for anterior acetabular fractures; however, it is associated with extensive soft tissue dissection, prolonged operative time, and higher risk of complications.[5,6]

The modified Stoppa approach has emerged as a minimally invasive intrapelvic alternative, providing better visualization of the medial wall and quadrilateral plate while reducing surgical morbidity.[7,8]

It allows effective control of medially displaced fragments and facilitates infrapectineal plating, offering biomechanical advantages in fracture stabilization.[9,10]

Despite these benefits, the approach is technically demanding and requires thorough knowledge of pelvic anatomy. Additionally, evidence from Indian populations remains limited. Therefore, the present study aims to evaluate the clinical and radiological outcomes of acetabular fractures treated using the modified Stoppa approach in a tertiary care setting.

Materials And Methods

This prospective observational study was conducted in the Department of Orthopaedics at a tertiary care teaching

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Figure 1: Pre-op X-ray

Figure 2: Pre-op clinical photo

hospital in Central India from January to December 2024 after obtaining approval from the Institutional Ethics Committee (IEC Ref. No: PG/ORTHOPAEDICS/60/2024). A total of 30 patients aged between 18 and 70 years diagnosed with anterior acetabular fractures were included in the study. Patients presenting with open or pathological fractures, delayed presentation beyond three weeks, previous lower abdominal surgery, isolated posterior acetabular fractures, or those medically unfit for surgery were excluded from the study. Baseline demographic details, mechanism of injury, associated comorbidities, and pre-injury functional status were documented for all patients. A detailed clinical examination was performed to assess soft tissue condition, neurovascular status, and associated skeletal or visceral injuries. Radiological evaluation included anteroposterior pelvis radiographs, Judet views, and a computed tomography (CT) scan with three-dimensional reconstruction. Fractures were classified according to the Letournel-Judet classification system. All patients underwent surgical management using the modified Stoppa approach under appropriate anesthesia (Figures 1 to 4). The procedure involved a suprapubic incision with preperitoneal exposure, careful identification and ligation of the corona mortis when required, fracture reduction under fluoroscopic guidance, and fixation using reconstruction plates and screws. Intraoperative parameters such as duration of surgery, blood loss, and perioperative complications were recorded. Postoperatively, all patients received standardized antibiotic therapy, thromboprophylaxis, and early physiotherapy followed by gradual weight-bearing as tolerated (Figure 5). Clinical outcomes were assessed using the visual analog scale (VAS), Harris Hip Score, and Merle d'Aubigné score, while radiological outcomes included assessment of fracture reduction quality according to Matta's criteria, fracture union, and postoperative complications. Follow-up evaluations were performed at 1

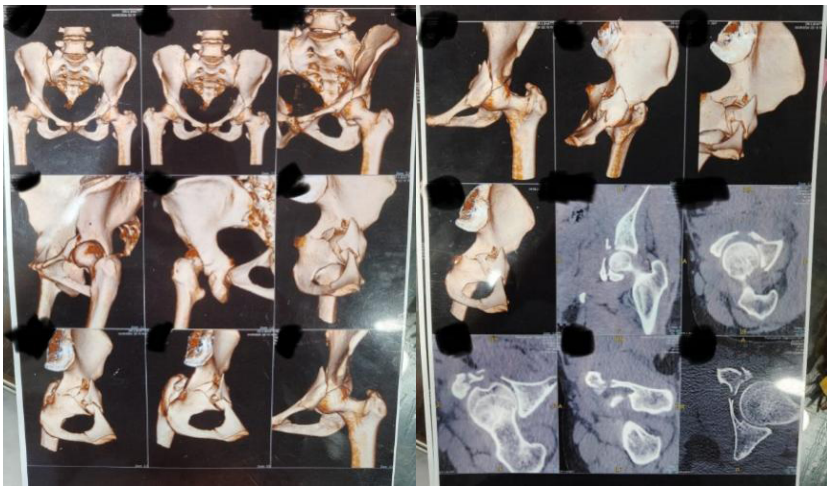

Figure 3 & 4: Pre-op CT scan

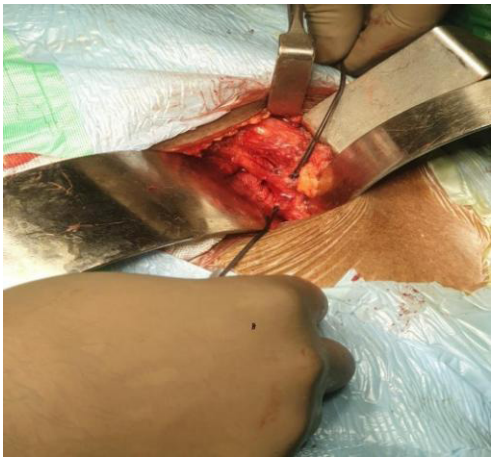

Figure 5: Intra-op photo

Figure 6: Post op Xray

and 6 months, postoperatively (Figure 6). Statistical analysis was carried out using SPSS version 26.0. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as percentages. Appropriate statistical tests were applied, and a *p-value* of less than 0.0 was considered statistically significant.

Observations and Results

A total of 30 patients with acetabular fractures treated using the modified Stoppa approach were analyzed. The results are presented under demographic, perioperative, clinical, radiological, and inferential domains.

The study population predominantly comprised middle-aged individuals (mean age 42.2 ± 13.6 years), with fewer elderly patients, reflecting higher exposure of younger groups to high-energy trauma. A marked male predominance (80%) and road traffic accidents as the leading cause (70%) further support this pattern. Anterior column fractures were slightly more common than combined types, justifying the use of the modified Stoppa approach in this cohort.

The early mean time to surgery (7.13 days) reflects timely intervention, facilitating better fracture reduction. Operative duration and blood loss indicate moderate complexity with acceptable intraoperative morbidity. The relatively short hospital stay (12.4 days) suggests effective perioperative management and recovery.

There was significant improvement in all clinical parameters over time, indicating effective recovery. Marked pain reduction along with improved functional scores reflects substantial gains in mobility and overall hip function between 1 and 6 months (Table 1).

A high rate of anatomical reduction and a majority of good-to-excellent functional outcomes indicate effective surgical management. The relatively low and mostly minor complication rate further supports safety. Lack of significant associations with fracture type, reduction quality, or complications suggests consistent outcomes across subgroups. Importantly, the strong correlation between early and late functional scores highlights early recovery as a key predictor of long-term outcome (Table 2).

Discussion

The present study demonstrates that the modified Stoppa approach yields favourable clinical and radiological outcomes in acetabular fractures, with high anatomical reduction rates and satisfactory functional recovery. The predominance of middle-aged males and road traffic accidents as the primary mechanism of injury is consistent with previous studies, reflecting the epidemiology of high-energy trauma in developing countries.[1,3]

Anatomical reduction was achieved in 83.3% of cases, comparable to reported rates of 75–85% in similar studies.[4,5] This can be attributed to improved visualization of the quadrilateral plate and medial structures, allowing precise reduction and stable fixation.[6]

Table 1: Clinical and functional outcomes (1 *vs* 6 Months)

Outcome	*1 Month (Mean ± SD)*	*6 Months (Mean ± SD)*	*Mean Change*	*p-value*
VAS pain score	4.13 ± 1.14	2.21 ± 1.08	-1.92	<0.001
Harris hip score	68.80 ± 6.26	86.13 ± 6.13	+17.33	<0.001
Merle d'Aubigné Score	12.30 ± 1.53	15.80 ± 1.32	+3.50	<0.001

Table 2: Radiological outcomes, complications, and predictors

Parameter	*Category*	*n*	*%*	*p-value*
Reduction quality	Anatomical	25	83.3	—
	Imperfect	3	10.0	—
	Poor	2	6.7	—
Final functional outcome	Excellent	21	70.0	—
	Good	2	6.7	—
	Fair	6	20.0	—
	Poor	1	3.3	—
Any complication	Present	8	26.7	—
	Absent	22	73.3	—
Reduction vs outcome	—	—	—	0.304
Fracture type vs outcome	—	—	—	>0.05
Complication vs outcome	—	—	—	>0.05
HHS (1 vs 6 months correlation)	—	—	—	<0.001

Operative time and blood loss in this study were within acceptable limits and relatively lower than those associated with the ilioinguinal approach, likely due to reduced soft tissue dissection.[8]

Significant improvements in pain and functional outcomes (VAS, HHS, and Merle d'Aubigné scores) were observed over time ($p < 0.001$), consistent with findings from previous studies.[9] The absence of a significant association between fracture type and outcome suggests that the modified Stoppa approach is effective across various anterior fracture patterns, as also reported by Bastian *et al*.[10]

The complication rate (26.7%) was comparable to existing literature,[3] with most complications being minor. Importantly, complications did not significantly affect functional outcomes, emphasizing the importance of timely management.

Although reduction quality did not show a statistically significant association with functional outcome, likely due to the small sample size, better outcomes were observed with anatomical reduction, supporting existing evidence.[4]

A strong correlation between early and late functional outcomes ($p < 0.001$) highlights the importance of early postoperative recovery and rehabilitation, consistent with previous reports.[6]

Overall, the findings support that the modified Stoppa approach is a safe, effective, and minimally invasive technique for managing anterior acetabular fractures, offering good functional outcomes with acceptable complication rates.

Conclusion

The modified Stoppa approach is an effective surgical technique for acetabular fractures involving the anterior column. It provides high rates of anatomical reduction, significant functional improvement, and low complication rates. Early postoperative functional status is a strong predictor of long-term outcome. The approach can be considered a reliable alternative to traditional methods, especially in appropriately selected patients.

Ethical Approval

Ethical clearance was obtained from the Institutional Ethics Committee (IEC), R.D. Gardi Medical College, Ujjain. All participants provided written informed consent prior to enrollment. The study adhered to the Declaration of Helsinki. (Name of the Ethics Committee: IEC-RDGMC; IEC Ref. No- PG/ORTHOPAEDICS/60/2024)

Conflict Of Interest

The authors declare no conflicts of interest regarding the publication of the study. No financial support, sponsorship, or personal relationships influenced study design, analysis, or manuscript preparation.

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Conflicts of Interest

All authors declare no conflict of interest.

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