



## RESEARCH ARTICLE

# Fixation of Acetabular Fractures with Quadrilateral Plate Involvement Using Intrapelvic Reduction and Buttress Plate via Modified Stoppa Approach: A Clinico-Radiological and Functional Outcome Evaluation

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## ABSTRACT

**Background:** Acetabular fractures involving the quadrilateral plate represent complex injuries that pose significant challenges in achieving anatomical reduction and stable fixation. The modified Stoppa approach provides excellent visualization of the quadrilateral surface while minimizing surgical morbidity compared with traditional extensile approaches.

**Aim:** To evaluate the clinico-radiological and functional outcomes of acetabular fractures involving the quadrilateral plate treated with intrapelvic reduction and buttress plate fixation through the modified Stoppa approach.

**Methods:** A prospective observational study was conducted in the Department of Orthopaedics, Patna Medical College Hospital (PMCH), from March 2024 to March 2026. Thirty patients with acetabular fractures involving the quadrilateral plate underwent open reduction and internal fixation using buttress plating through the modified Stoppa approach. Clinical outcomes, radiological reduction quality, fracture union, and functional outcomes using the Harris Hip Score (HHS) were assessed over a minimum follow-up period of 12 months.

**Results:** The mean age was  $43.8 \pm 12.4$  years, with males constituting 76.7% of cases. Anatomical reduction was achieved in 70.0% of patients, while satisfactory reduction was obtained in 90.0%. Fracture union was observed in 28 patients (93.3%). At final follow-up, excellent-to-good Harris Hip Scores were achieved in 83.3% of patients. Better radiological reduction significantly correlated with superior functional outcomes ( $p=0.004$ ).

**Conclusion:** The modified Stoppa approach with quadrilateral buttress plating provides excellent exposure, reliable fixation, high union rates, and favorable functional outcomes in acetabular fractures involving the quadrilateral plate.

**Keywords:** Acetabular fracture, Quadrilateral plate, Modified Stoppa approach, Buttress plate, Harris Hip Score.

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## INTRODUCTION

Acetabular fractures are among the most challenging injuries encountered in orthopedic trauma surgery because of their complex anatomy, deep location, and proximity to major neurovascular structures. Because of the acetabular dome's instability and the femoral head's medial displacement, quadrilateral plate fractures are especially challenging to treat. The quadrilateral plate is essential for preserving hip joint congruity and forms the medial wall of the acetabulum. Fractures involving this structure are commonly seen in high-energy trauma in younger people and in elderly patients with osteoporotic bone. Inadequate reduction can lead to chronic pain, functional impairment, post-traumatic arthritis, and persistent hip incongruity[1].

Conventional surgical techniques, such as the ilioinguinal approach, frequently make fracture reduction technically difficult and offer little visualisation of the quadrilateral surface. Because it minimises soft tissue dissection and provides direct intrapelvic access to the quadrilateral plate, pelvic brim, and posterior column,

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the modified Stoppa technique has become more popular in recent years[2]. The insertion of buttress plates along the inner pelvic surface, reduction of medially displaced quadrilateral fragments, and enhanced visualisation of fracture fragments are all made possible by the modified Stoppa technique. When compared to conventional methods, this technique has shown promising results in a number of studies, including better reduction quality, less blood loss, shorter operating times, and lower rates of complications[3].

In order to avoid secondary displacement and preserve acetabular congruity, stable repair of quadrilateral plate fractures is still crucial. To prevent central femoral head migration and support the medial acetabular wall, specialised buttress plates have been created. These implants maintain pelvic architecture while offering biomechanical stability. There is little information from eastern India about the modified Stoppa approach's efficacy in treating acetabular fractures with quadrilateral plate involvement, despite mounting evidence to the contrary. In order to assess clinical, radiological, and functional outcomes after intrapelvic reduction and buttress plate attachment utilising the modified Stoppa technique, the current prospective study was conducted[4].

## MATERIALS AND METHODS

### Study Design

Prospective observational study.

### Study Setting

Department of Orthopaedics, Patna Medical College Hospital (PMCH).

### Study Duration

March 2024 – March 2026 (24 months).

### Sample Size

30 patients.

### Inclusion Criteria

- Age  $\geq 18$  years.
- Acetabular fractures involving the quadrilateral plate.
- Surgical fixation using modified Stoppa approach.
- Minimum follow-up of 12 months.

### Exclusion Criteria

- Pathological fractures.
- Polytrauma patients unable to complete follow-up.
- Previous ipsilateral hip surgery.
- Open acetabular fractures.

## Outcome Measures

- Quality of reduction (Matta criteria).
- Fracture union.
- Harris Hip Score (HHS).
- Complications.

## Statistical Analysis

Data were analyzed using SPSS version 26. Chi-square test and Student's t-test were applied. A p-value  $< 0.05$  was considered statistically significant.

## RESULTS

The modified Stoppa technique was used to treat thirty patients with quadrilateral plate acetabular fractures. The majority of patients were men who had been hurt in car accidents.

70.0% of cases had anatomical reduction, and 90.0% had good reduction (anatomical plus incomplete reduction). 28 patients (93.3%) experienced fracture union.

In 25 patients (83.3%), functional outcomes measured with the Harris Hip Score showed excellent or good results. When compared to patients with imperfect or poor reductions, patients with anatomical reduction demonstrated considerably better functional outcomes ( $p=0.004$ ).

Heterotopic ossification in two cases and superficial infection in one patient were among the rare complications

**Table 1:** Demographic and Injury Characteristics

| Variable              | Frequency<br>(n=30) | Percentage<br>(%) | p-value |
|-----------------------|---------------------|-------------------|---------|
| Male                  | 23                  | 76.7              | 0.008*  |
| Female                | 7                   | 23.3              |         |
| Road Traffic Accident | 21                  | 70.0              | 0.014*  |
| Fall from Height      | 7                   | 23.3              |         |
| Others                | 2                   | 6.7               |         |

## Interpretation

Road traffic accidents were the most common mechanism of injury.

**Table 2:** Quality of Reduction (Matta Criteria)

| Reduction Quality      | Frequency | Percentage<br>(%) | p-value |
|------------------------|-----------|-------------------|---------|
| Anatomical ( $< 1$ mm) | 21        | 70.0              | 0.003*  |
| Imperfect (1–3 mm)     | 6         | 20.0              |         |
| Poor ( $> 3$ mm)       | 3         | 10.0              |         |

### Interpretation

Anatomical reduction was achieved in the majority of patients.

**Table 3:**Fracture Union and Complications

| Outcome                  | Frequency | Percentage (%) | p-value |
|--------------------------|-----------|----------------|---------|
| Union Achieved           | 28        | 93.3           | 0.001*  |
| Delayed Union            | 2         | 6.7            |         |
| Heterotopic Ossification | 2         | 6.7            |         |
| Infection                | 1         | 3.3            | 0.214   |

### Interpretation

Union was achieved in 93.3% of patients with minimal complications.

**Table 4:** Functional Outcome (Harris Hip Score)

| Functional Outcome | Frequency | Percentage (%) | p-value |
|--------------------|-----------|----------------|---------|
| Excellent (>90)    | 14        | 46.7           | 0.004*  |
| Good (80–89)       | 11        | 36.6           |         |
| Fair (70–79)       | 3         | 10.0           |         |
| Poor (<70)         | 2         | 6.7            |         |

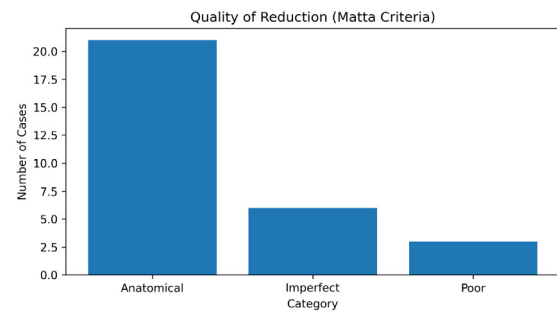
### Interpretation

Excellent-to-good functional outcomes were achieved in 83.3% of patients.

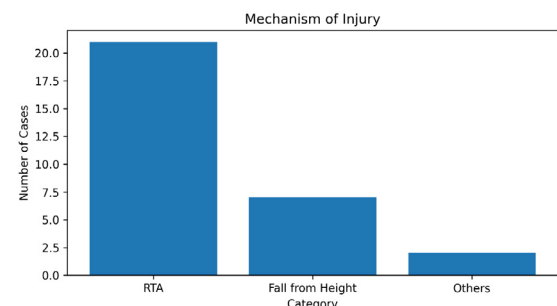
## DISCUSSION

One of the most technically challenging parts of orthopaedic trauma surgery is still managing acetabular fractures affecting the quadrilateral plate. The femoral head's medial displacement, the acetabular dome's instability, and the challenge of obtaining secure fixation are frequently linked to these fractures. This study used the modified Stoppa technique to assess the results of intrapelvic reduction and buttress plate attachment. Males who were hurt in auto accidents made up the bulk of the patients in this series, which is consistent with the global epidemiological pattern of acetabular fractures. In younger groups, high-energy trauma remains the most common method[5].

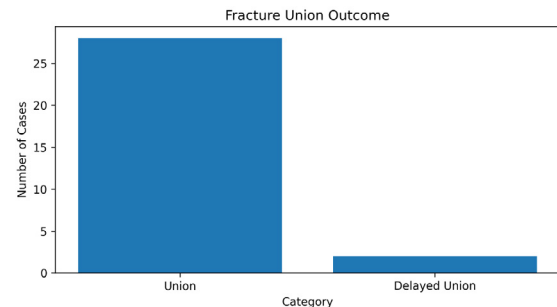
The high rate of anatomical reduction attained with the modified Stoppa method was one of the most significant discoveries. Accurate fracture reduction and plate implantation were made possible by direct viewing of the quadrilateral plate and posterior column. One significant benefit of this method is the capacity to reach the medial



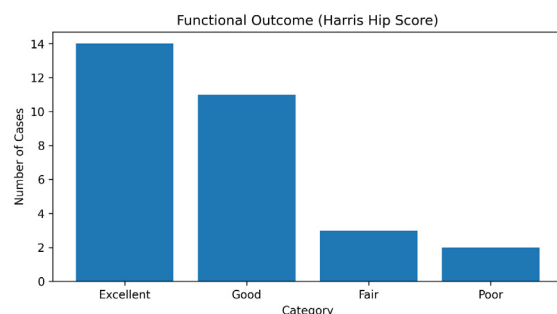
**Figure 1:** Quality of reduction



**Figure 2:** Mechanism of injury



**Figure 3:** Fracture union outcome



**Figure 4:** Functional outcome

acetabular wall via a single intrapelvic window[6]. This study's union rate of 93.3% is in good agreement with earlier findings. The quadrilateral plate's stable buttress attachment probably helped to preserve reduction and promote effective fracture healing. In order to prevent secondary displacement and central movement of the femoral head, the biomechanical principle of medial wall support is very crucial[7].

Over 80% of patients achieved excellent or good Harris Hip Scores, indicating promising functional results. The significance of accurate articular restoration is highlighted by the substantial correlation between superior functional outcome and anatomical reduction. The most significant indicator of long-term hip function is still the restoration of acetabular congruity. The rates of complications were comparatively low. Only one patient experienced superficial wound infection, and a small percentage of patients experienced heterotopic ossification. When compared to extensile surgical techniques, the modified Stoppa approach's decreased soft tissue dissection may help reduce complication rates[8].

Improved visualisation, decreased blood loss, quicker surgical time, and decreased neurovascular risk are among the benefits of the modified Stoppa technique that have been shown by a number of writers. These observations are corroborated by the current study's findings, which also show positive radiological and functional results. The study's prospective design and thorough evaluation of radiological and functional outcomes are among its strong points. Nevertheless, the comparatively limited sample size and lack of a comparison control group using different surgical techniques are drawbacks[9].

Notwithstanding these drawbacks, the current investigation shows that the modified Stoppa technique offers superior access to the quadrilateral plate and promotes stable fixation with positive clinical results. Results in these difficult fractures may be further improved by ongoing improvements in surgical methods and implant design[10].

## CONCLUSION

The current prospective study shows that the modified Stoppa method, which uses intrapelvic reduction and buttress plating to treat acetabular fractures involving the quadrilateral plate, has outstanding radiological and functional results. Anatomical reduction, fracture union, and favourable Harris Hip Scores were all attained at high rates. The method minimised surgical morbidity while providing direct view of the quadrilateral surface, precise reduction, and solid fixation.

The significance of accurate fracture restoration is highlighted by the substantial correlation between improved functional outcome and anatomical reduction. Low rates of complications attested to the technique's efficacy and safety. When treating acetabular fractures affecting the quadrilateral plate, especially when medial wall displacement is present, the modified Stoppa technique should be regarded as a useful surgical option. It is becoming more and more appealing in contemporary acetabular surgery because it offers superior intrapelvic exposure while maintaining soft tissue integrity.

To confirm these results and compare results with alternative surgical techniques, more multicentric studies with bigger patient populations and longer follow-up times are advised. The current study's findings lend credence to the modified Stoppa approach's expanding use as a successful treatment for complicated acetabular fractures involving the quadrilateral plate.

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