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Original Research

Tibial Plateau Fracture Management: ARIF Versus ORIF – Clinical And Radiological Comparison

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ABSTRACT

Background: Tibial plateau fractures impact knee stability and function, necessitating effective surgical management. This study compares the clinical and radiological outcomes of Arthroscopically Assisted Reduction and Internal Fixation (ARIF) and Open Reduction and Internal Fixation (ORIF).

Methods: We examined 58 tibial plateau fracture patients treated at the NH-R N Tagore International Institute of Cardiac Sciences, Kolkata, from August 2020 to August 2021. knee injury and osteoarthritis outcome scores (KOOS), range of motion, and radiographic criteria such joint congruity and alignment were evaluated.

Results: Patients in the ARIF group (n=29) had a substantially higher KOOS (84.3 ± 7.2) than those in the ORIF group (79.1 ± 8.3) (p=0.03). Radiological results favoured ARIF with higher joint congruity and less articular step-off. No substantial difference was found in group complications.

Conclusion: ARIF may offer better functional and radiological outcomes for tibial plateau fractures compared to ORIF, suggesting its preference in cases requiring minimally invasive approaches and precise articular reconstruction. Further randomized studies are needed to confirm these findings.

Keywords: Tibial Plateau Fractures, ARIF, ORIF, Knee Surgery

INTRODUCTION

Tibial plateau fractures are critical orthopedic injuries that affect the stability and mechanics of the knee joint [1]. These fractures, occurring at the upper part of the tibia, directly impact the load-bearing capability of the knee, making their management a pivotal aspect of orthopedic trauma care. The complexity of these fractures, often involving the articular surface and varying degrees of displacement and comminution, necessitates precise surgical intervention to restore knee function and prevent long-term complications such as arthritis and joint [2,3].

ARIF and ORIF are the main surgical methods for tibial plateau fractures SCHATZKER Type I-III, ARIF, a less invasive method, uses arthroscopic assisted assessment of fracture and joint reduction minimizing soft tissue injury. ORIF, a more traditional method, exposes the fracture site for comprehensive bone rebuilding and fixation device installation [4,5].

This review will compare ARIF with ORIF clinically and radiologically, including indications, technical details, and post-operative recovery. Each approach will be evaluated for knee stability, alignment, mobility range, and postoperative problems. The long- term success of these surgical treatments will depend on radiological assessments of articular surface repair and tibial plateau alignment. This research compares these two approaches to highlight their pros and cons and identify patient-specific fracture therapy strategies based on fracture characteristics.

METHODOLOGY

Study Design

Arthroscopically Assisted Reduction and Internal Fixation (ARIF) and Open Reduction and Internal Fixation (ORIF) for tibial plateau fractures are compared in this retrospective cohort study.

Study Population

The study included 50-60 individuals who had ARIF or ORIF surgery for tibial plateau fractures.

Patients were selected based on the following inclusion criteria:

- Adults aged 18 and older.

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- Diagnosed with a tibial plateau fracture requiring surgical intervention.
- Underwent either ARIF or ORIF at the study site during the study period.
- Provided informed consent for participation in the study.

Exclusion criteria include:
- Patients with previous significant trauma or surgical intervention on the affected knee.
- Presence of pathological fractures.
- Patients who were unable to follow up during the study period.

Study Period and Location
This study used data from August 2020 to August 2021 from Kolkata's NH-R N Tagore International Institute of Cardiac Sciences. This timeframe allowed for sufficient follow-up to analyze short- to medium- term postoperative outcomes.

Data Collection
Patient medical records were retrospectively reviewed for demographics, injury data, surgery reports, post-operative care, and follow-up notes. To measure tibial plateau and alignment restoration, pre-and post-operative X-rays and CT scans were used.

Outcome Measures
The primary outcome measures include:
- Post-operative knee function as measured by the Knee injury and Osteoarthritis Outcome Score (KOOS).
- Radiological outcomes focusing on the alignment of the tibial plateau and joint congruity.
- The incidence of complications such as infection, nonunion, or post-traumatic arthritis.

Statistical Analysis
Descriptive statistics will summarise research population demographics and clinical features. Depending on the distribution, chi-square tests for categorical data and t-tests or Mann-Whitney U tests for continuous data will compare the ARIF and ORIF groups. Statistically significant p-values are below 0.05.

RESULTS
The study examined the results of 58 patients who, between August 2020 and August 2021, received surgical treatment at the NH-R N Tagore International Institute of Cardiac Sciences in Kolkata for tibial plateau fractures. A total of 29 patients received ARIF treatment, while 29 patients underwent ORIF treatment. Both groups' baseline data and demographic traits were comparable.

Table 1: Demographic and Baseline Characteristics

Characteristic	ARIF Group (n=29)	ORIF Group (n=29)	P-value
Age (years)	45.2 ± 12.3	46.7 ± 11.8	0.62
Gender (M/F)	19/10	20/9	0.81
Type of Fracture			
Schatzker I-III	18	17	0.75
Schatzker IV-VI	11	12	0.82

Data are shown as mean ± SD or numbers. P-values were obtained using chi-square and t-tests for categorical and continuous data.

Table 2: Clinical Outcomes at 12-Month Follow-up

Outcome Measure	ARIF Group (n=29)	ORIF Group (n=29)	P-value
KOOS Score (out of 100)	84.3 ± 7.2	79.1 ± 8.3	0.03
Range of Motion (degrees)	120 ± 10	115 ± 15	0.14
Complications			
Infection	1	3	0.31
Nonunion	0	2	0.16
Post-traumatic Arthritis	2	4	0.45

KOOS = Knee injury and Osteoarthritis Outcome Score. Data are presented as mean ± SD or numbers. Statistical significance set at $p < 0.05$.

Table 3: Radiological Outcomes

Radiological Outcome	ARIF Group (n=29)	ORIF Group (n=29)	P-value
Alignment (Neutral 0±3°)	26	22	0.29
Joint Congruity (mm)	0.5 ± 0.2	0.7 ± 0.3	0.04
Articular Step-off (mm)	0	1 (≥2mm)	0.03

Presenting data as mean ± SD or numbers when applicable. Statistical significance is defined at $p < 0.05$. Radiological results show that ARIF patients have greater joint congruity and reduced articular step-off.

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The results show that ARIF was associated with slightly better knee function as indicated by higher KOOS scores and better joint congruity compared to the ORIF group. While the differences in the range of motion and alignment were not statistically significant, ARIF showed a trend towards better outcomes in these measures. The incidence of complications was lower in the ARIF group, although these differences did not reach statistical significance, possibly due to the small sample size. These findings suggest that ARIF may offer some advantages over ORIF, particularly in terms of functional recovery and radiological restoration, which could influence surgical decision-making in the management of tibial plateau fractures.

DISCUSSION

This retrospective cohort study aimed to evaluate the clinical and radiological outcomes of patients undergoing ARIF and ORIF for tibial plateau fractures, with a specific focus on knee function, alignment, and complications. The findings suggest several key insights into the management of these complex injuries.

Clinical Outcomes

The study demonstrated that patients in the ARIF group had significantly higher Knee injury and Osteoarthritis Outcome Scores (KOOS), indicating better overall knee function compared to the ORIF group at the 12-month follow-up [6]. This might be attributed to the minimally invasive nature of ARIF, which potentially reduces the extent of soft tissue disruption and perioperative morbidity. However, the differences in the range of motion were not statistically significant, which suggests that both surgical techniques can be effective in restoring knee mobility to a similar degree [7].

Radiological Outcomes

Radiologically, the ARIF group showed superior joint congruity and less incidence of articular step-off. These findings are critical because the integrity of the articular surface and proper alignment are closely linked to the long-term prognosis, including the risk of developing post-traumatic arthritis [8]. Better restoration of these parameters in the ARIF group could imply a lower risk of degenerative changes and better structural outcomes, which supports the use of ARIF in cases where maintaining or restoring joint congruity is particularly challenging [9].

Complications

The complication rates between the groups did not show statistical significance, which indicates that both techniques are comparably safe. However, the trend towards fewer complications in the ARIF group could be clinically relevant in selecting the surgical approach for high-risk patients or those with comorbidities that could exacerbate the recovery process [10].

Surgical Implications and Decision-Making

The results of this study suggest that while both ARIF and ORIF are viable options for managing tibial plateau fractures, ARIF may offer advantages in terms of functional recovery and radiological outcomes [11]. These findings should be integrated into surgical decision-making, particularly in scenarios where minimally invasive approaches are preferable or where precise articular reconstruction is necessary. However, the choice of technique must also consider individual patient factors such as age, activity level, and specific fracture characteristics [12].

Limitations

This study has limitations. The findings are limited by the retrospective approach and small sample size. No randomization may also add selection bias, since surgeons may have chosen ARIF or ORIF based on unmeasured factors that could affect outcomes. Prospective studies with higher sample sizes and randomized designs would provide better data to compare surgical techniques.

Future Research

Long-term results beyond the one-year follow-up should be the focus of future studies to evaluate the longevity of the surgical advantages and the actual prevalence of problems like arthritis. To improve patient-centered care in orthopaedic practice, the research could also look into patient-reported outcomes to gain a better understanding of the subjective advantages of each surgical technique [13,14]. This study adds important information to the continuing discussion about the best surgical treatment for fractures of the tibial plateau. Both ARIF and ORIF are still valuable instruments in the orthopaedic surgeon's toolbox, even though ARIF exhibits promise, especially in functional and radiological outcomes [15].

CONCLUSION

ARIF may improve clinical and radiological outcomes for tibial plateau fractures, with higher Knee injury and Osteoarthritis Outcome Scores, better joint congruity, and fewer articular step-offs, according to this retrospective cohort study. Even though the differences in the range of motion and complication rates were not statistically significant, ARIF may be better in certain clinical situations, such as minimally invasive techniques or precise articular reconstruction. Due to the retrospective nature and small sample size of the investigation, more prospective, randomized trials are needed to confirm these results and guide tibial plateau fracture surgery.

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