



A PROSPECTIVE STUDY - CLINICO-RADIOLOGICAL OUTCOME OF NONUNION OF LONG BONE FRACTURE MANAGED BY DIFFERENT MODALITIES

Orthopaedics

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ABSTRACT

Background: Non-union of long bone fractures is a major challenge in orthopaedics, often leading to significant morbidity and disability. While both external and internal fixation techniques are used, there is limited evidence comparing their outcomes. **Objective:** This study aims to compare the clinico-radiological outcomes of external fixation (Limb Reconstruction System (LRS) and Ilizarov) and internal fixation (plating and nailing) for managing non-union of long bone fractures. **Methods:** A prospective cohort of 33 patients with non-union long bone fractures was treated between June 2022 and July 2024 at the Department of Orthopaedics, G.S.V.M. Medical College, Kanpur. Patients were randomly assigned to receive either external fixation (n=18) or internal fixation (n=15). Functional outcomes were assessed using the ASAMI criteria, while bone healing was monitored radiologically using the modified Radiographic Union Score for Tibia (mRUST). Data were analyzed using ANOVA and Chi-square tests. **Results:** At 12 months follow-up, union rates were 83.33% in the external fixation group and 93.33% in the internal fixation group. Internal fixation yielded better functional outcomes ($p < 0.05$), while complications, primarily infections, were more frequent in the external fixation group (35%). **Conclusion:** Internal fixation provides superior functional recovery and fewer complications compared to external fixation. However, external fixation remains a valuable option for cases where internal fixation is contraindicated. Further studies with larger sample sizes are recommended.

KEYWORDS

Non-union, long bone fracture, external fixation, internal fixation, ASAMI, mRUST.

INTRODUCTION

Fracture non-union is a severe complication of long bone fractures, particularly when complicated by infection or poor bone quality. The diagnosis of non-union is typically made when there is no clinical or radiographic evidence of healing after a prolonged period (generally 9 months post-injury). The management of non-union is challenging, requiring both mechanical stability and biological enhancement to promote healing.

Clinical Context And Rationale:

There are two primary approaches to treating non-union: external fixation (including LRS and Ilizarov techniques) and internal fixation (plating or nailing). However, the optimal choice of fixation depends on several factors including the site of the fracture, infection status, and bone quality. This study aims to fill the gap in evidence comparing these modalities by assessing both functional and radiological outcomes over a 12-month follow-up period.

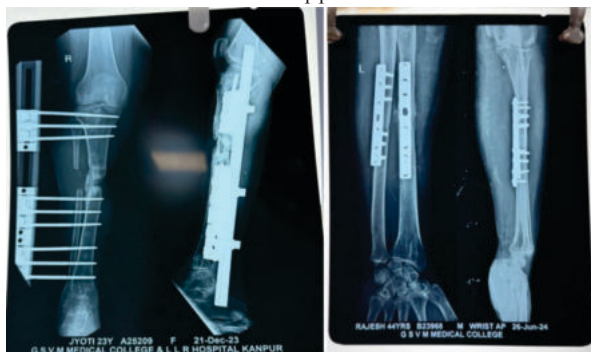


Figure 1: Radiographic images demonstrating external fixation using the LRS technique and internal fixation using plating

MATERIALS & METHODS

Study Design And Setting

This prospective cohort study was conducted at the Department of Orthopaedics, G.S.V.M. Medical College, Kanpur, between June 2022 and July 2024. Ethical approval was obtained from the institutional ethics committee.

Inclusion And Exclusion Criteria

Inclusion Criteria:

- Patients aged 18-60 years with diaphyseal non-union of long bones (tibia, femur, humerus, radius, or ulna).
- Non-unions classified as atrophic, infected, or gap non-unions.

Exclusion Criteria:

- Hypertrophic non union
- Pathological fractures.
- Open grade 3C fractures.
- Skeletally immature patients.
- Polytrauma patients

Study Groups

- Group A (n=18): External fixation (LRS/Ilizarov).
- Group B (n=15): Internal fixation (plating/nailing).

Outcomes And Measures

- Radiological Outcome: Bone healing was evaluated using the modified Radiographic Union Score for Tibia (mRUST).
- Functional Outcome: Functional recovery was assessed using the Association for the Study and Application of the Method of Ilizarov (ASAMI) scoring criteria for bone and functional outcomes.

Statistical Analysis

- Data were analyzed using SPSS Version 25.
- Continuous variables were compared using ANOVA, while categorical variables were analyzed using Chi-square tests. A p-value of < 0.05 was considered statistically significant.

RESULTS

Patient Demographics

A total of 33 patients were included, with 29 males and 4 females. The mean age of patients was 33 years. Most injuries resulted from road traffic accidents (RTA) (79%), followed by falls from height (12%).

Fracture Union Rates

At 12 months, union was achieved in 83.33% of patients in the external fixation group and 93.33% in the internal fixation group. There was a statistically significant difference in union rates between the two groups ($p < 0.05$).

Table 1: Union Rates in External and Internal Fixation Groups

Group	Union Rate (%)	Non-union (%)
External Fixation (n=18)	83.33%	16.67%
Internal Fixation (n=15)	93.33%	6.67%

Functional Outcomes

ASAMI functional scores showed a significant improvement in the internal fixation group compared to the external fixation group ($p < 0.05$).

Table 2: Functional Outcome (ASAMI Criteria)

ASAMI Functional Score	External Fixation (%)	Internal Fixation (%)
Excellent	0	40
Good	27.7	40
Fair	50	13.33
Poor	22.23	6.67

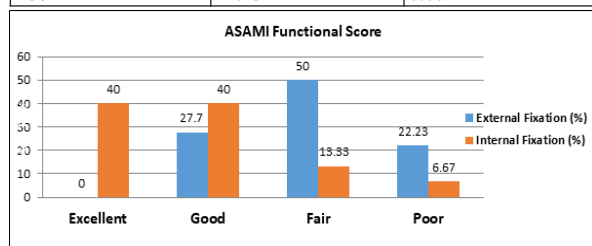


Figure 2:

Bar chart showing ASAMI functional outcomes for external and internal fixation groups.

Complications

Complication rates were higher in the external fixation group, with infections being the most common issue (35%). Internal fixation showed fewer complications, with only one case of post-operative pain.

Figure 3:



X-rays illustrating union progression in external at 6-month and 12-18 month follow-up.



X-rays illustrating union progression in internal fixation at 6-month and 12-18 month follow-up.

DISCUSSION

This study highlights the superior outcomes associated with internal fixation for non-union long bone fractures. While external fixation (LRS/Ilizarov) is an effective modality, particularly in infected or complex cases, it carries a higher risk of complications such as infections. These findings are consistent with prior studies showing better functional recovery and reduced complication rates in patients treated with internal fixation.

Key Findings:

1. Union Rates: Internal fixation demonstrated a higher union rate compared to external fixation, likely due to the direct mechanical stability provided by implants such as plates and nails.
2. Functional Outcomes: Internal fixation offered superior functional outcomes, particularly in mobility and return to daily activities.
3. Complications: The higher infection rates associated with external fixation underscore the need for careful patient selection and infection control measures during the postoperative period.

CONCLUSION

Both external and internal fixation modalities are effective for treating non-union of long bones. However, internal fixation provides better functional recovery and lower complication rates. External fixation remains an essential option in specific clinical scenarios, such as severe infection or large bone defects. Further randomized controlled trials with larger sample sizes and longer follow-up periods are necessary to validate these findings.

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