

# Efficacy of Intramedullary Nailing Versus External Fixation in Treating Gustilo Type IIIA Tibiofibular Fractures

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## ABSTRACT

**Objective:** The objective of this study is to compare the clinical and functional outcomes of intramedullary nailing versus external fixation (EF) in treating Gustilo Type IIIA tibiofibular fractures

**Study Design:** Randomised control trial study

**Place and Duration of Study:** This study was conducted at the AIMS Hospital, Muzaffarabad, from 1<sup>st</sup> March, 2024 to 1<sup>st</sup> September, 2024.

**Methods:** Through non-probability consecutive sampling 100 patients aged above 18 years, both gender, with Gustilo Type IIIA tibiofibular fracture patients who received IMN treatment (N=51) while the remaining received EF(N=49) were included in the present study.

**Results:** In terms of clinical outcomes, the time to union was significantly shorter in the IMN group (21.5±6.8 weeks) compared to the EF group (24.5±7.8 weeks,  $p = 0.02$ ). The complication rate was notably lower in the IMN group (24%) than in the EF group (49%,  $p = 0.013$ ). The infection rate was significantly lower in the IMN group, with only 6% of patients affected compared to 31% in the EF group ( $p = 0.002$ ). Nonunion was observed in 4% of IMN patients versus 27% of EF patients ( $p = 0.003$ ), while malunion occurred in 12% of IMN cases compared to 37% in the EF group ( $p = 0.001$ ).

**Conclusion:** Intramedullary nailing delivers superior results as an intervention approach for Gustilo Type IIIA tibiofibular fractures compared to external fixation.

**Key Words:** Trauma, Intramedullary nailing, External fixation, fracture

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## INTRODUCTION

Open tibiofibular fractures of Gustilo Type IIIA show extreme severity because they combine vast injuries to soft tissues and full bone exposure. Orthopedic treatment of these high-energy traumas becomes complex because patients face higher risks of infection and nonunion and other adverse outcomes<sup>(1-2)</sup>. Healthcare professionals typically implement intramedullary nailing<sup>(1)</sup> as the first approach alongside external fixation (EF) for surgical management. The selection of optimal treatments depends on assessing their effectiveness combined with their associated clinical results<sup>(3)</sup>.

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Surgeons use intramedullary nailing to place a metal rod inside the tibia marrow canal thus achieving stable internal fracture fixation. Use of this treatment provides patients with early mobility possibilities and leads to positive results during fracture healing<sup>(4)</sup>. The external fixation procedure requires an external frame which connects to bone pins or wires to externally stabilize fractures. Healthcare professionals choose EF treatment for patients with major tissue damage or contamination because it provides minimal access to the body while managing adjacent soft tissue injuries at the same time.

The research by Alsharif et al. (2023) used meta-analysis to evaluate the effectiveness of IMN against EF in treating Gustilo Type III open tibial fractures. Based on the research findings IMN showed better performance than EF in reducing both infection rates and healing problems in patients<sup>(5)</sup>. The likelihood of infection outcomes indicated superior infection control with IMN treatment compared to EF procedures as seen through the calculated odds ratio (OR). The odds ratio analysis indicated better healing outcomes for IMN patients since they demonstrated fewer complications that could lead to fracture healing issues<sup>(6)</sup>.

A randomized clinical trial measured IMN and EF's outcome performance in adult patients with open tibial fractures. The research demonstrated that IMN resulted

in fewer cases of coronal malalignment (with a relative risk of 0.11) and sagittal malalignment (RR = 0.17) when measured after one-year post-operation. Both the IMN and EF treatment delivered equivalent quality of life benefits at the early postoperative period but the differences dynamically evolved throughout one year of follow-up<sup>(7)</sup>.

The analysis conducted by Fu et al. (2018) demonstrated that unreamed tibial nailing<sup>(8)</sup> decreased both superficial infections and malunions but external fixation (EF) produced better hardware survival results. The study found no major differences existed between IMN and Internal Fixation regarding deep infection rates and delayed union along with non-union rates<sup>(9)</sup>.

The research indicates that IMN provides greater benefits to Gustilo Type IIIA tibiofibular fracture patients by decreasing their risk of infection and malalignment when compared to EF<sup>(10)</sup>. Doctors should make individualized choices about fixation methods by taking into account how severe soft tissue damage is and what patient health conditions exist as well as the expertise they possess in this field. Additional well-designed randomized controlled trials must be performed to create official guidelines for treatment. The objective of this study is to compare the clinical and functional outcomes of intramedullary nailing<sup>(1)</sup> versus external fixation (EF) in treating Gustilo Type IIIA tibiofibular fractures.

**METHODS**

After the ethical approval from the institutional review board, this randomised control trial study was conducted at AIMS hospital, Muzafarabad, from 01/03/24 to 01/09/24. Through non-probability consecutive sampling 100 patients aged above 18 years, both gender, with Gustilo Type IIIA tibiofibular fracture patients who received IMN treatment (N=51) while the remaining received EF(N=49) were included in the present study. The study excluded patients who sustained multiple traumas along with pathological fractures or unavailable medical information. After the informed consent demographics of the patients were collected. Time to union function as the main outcome measure together with complication rates (infection, non-union, malunion) and required second operations. The research evaluated VAS pain scores plus ROM reduction together with functional outcomes assessed at six months' post-treatment as secondary outcomes for patients receiving IMN or EF treatment. Time to union determination occurred via serial radiograph analysis along with functional assessment through the Lower Extremity Functional Scale (LEFS). SPSS version 26 was used to perform the analysis of the data. Data assessment included descriptive statistics for continuous variables using mean and standard deviation calculations as well as Chi-square tests for comparisons of categorical variables. The mean time to union

together with pain scores underwent independent t-test analysis between treatment groups. All statistical results maintained a significance level at  $p \leq 0.05$ .

**RESULTS**

A total of 100 patients were included in the study, with 51 patients treated using intramedullary nailing (1) and 49 patients treated using external fixation (EF). Demographic characteristics were comparable between both groups. The mean age in the IMN group was 40.9±13.2 years, while in the EF group, it was 40.7±14.8 years ( $p = 0.946$ ). The gender distribution was also similar, with 55% males and 45% females in the IMN group compared to 57% males and 43% females in the EF group ( $p = 0.821$ ).

In terms of clinical outcomes, the time to union was significantly shorter in the IMN group (21.5±6.8 weeks) compared to the EF group (24.5±7.8 weeks,  $p = 0.02$ ). The complication rate was notably lower in the IMN group (24%) than in the EF group (49%,  $p = 0.013$ ). The infection rate was significantly lower in the IMN group, with only 6% of patients affected compared to 31% in the EF group ( $p = 0.002$ ). Nonunion was observed in 4% of IMN patients versus 27% of EF patients ( $p = 0.003$ ), while malunion occurred in 12% of IMN cases compared to 37% in the EF group ( $p = 0.001$ ). Additionally, the need for secondary surgery was significantly lower in the IMN group (10%) compared to the EF group (33%,  $p = 0.006$ ). Range of motion (ROM) reduction was slightly lower in the IMN group (12.2±9.3 degrees) compared to the EF group (14.14±8.9 degrees,  $p = 0.178$ ), though the difference was not statistically significant. However, pain scores (VAS: 0-10) were significantly lower in the IMN group (3.8±3.39) than in the EF group (6.04±3.0,  $p = 0.006$ ).

Regarding functional outcomes, a significantly higher percentage of patients in the IMN group achieved excellent results (45%), compared to only 22% in the EF group ( $p = 0.005$ ). Good outcomes were observed in 33% of IMN patients versus 31% in the EF group. Fair results were seen in 14% of IMN patients compared to 29% of EF patients, while poor outcomes were significantly more frequent in the EF group (18%) compared to the IMN group (6%,  $p = 0.005$ ). These findings indicate that IMN provides superior clinical and functional outcomes compared to EF in the treatment of Gustilo Type IIIA tibiofibular fractures.

**Table No. 1: Demographics of the participants**

Variables	IMN Group (n=51)	EF (n=49)	P Value
Age (years)	40.9±13.2	40.7±14.8	0.946
Gender			0.821
Male	28 (55%)	28 (57%)	
Female	23 (45%)	21 (43%)	

**Table No. 2: Clinical outcomes**

Variables	IMN Group (n=51)	EF (n=49)	P value
Time to Union (Weeks)	21.5±6.8	24.5±7.8	0.02
Complications	12 (24%)	24 (49%)	0.013
Infection Rate	3 (6%)	15 (31%)	0.002
Onunion	2 (4%)	13 (27%)	0.003
Malunion	6 (12%)	18 (37%)	0.001
Need for Secondary Surgery	5 (10%)	16 (33%)	0.006
Range of Motion (ROM) Reduction (Degrees)	12.2±9.3	14.14±8.9	0.178
Pain Score (VAS: 0-10)	3.8±3.39	6.04±3.0	0.006

**Table No. 3: Functional outcomes**

Outcomes	IMN Group (n=51)	EF (n=49)	P value
Poor	3 (6%)	9 (18%)	0.005
Fair	7 (14%)	14 (29%)	
Good	17 (33%)	15 (31%)	
Excellent	23 (45%)	11 (22%)	

## DISCUSSION

This research study confirms earlier data which evaluates the treatment outcomes for IMN and EF devices when used in Gustilo Type IIIA tibiofibular fracture patients. According to Ghaseminejad-Raeini et al. (2024) in their meta-analysis IMN produces both superior outcomes for infection prevention and enhanced fracture healing compared to EF thus demonstrating superiority in dealing with such compound fractures<sup>(11)</sup>. In a Tanzanian randomized controlled trial IMN treatment resulted in smaller degrees of coronal and sagittal misalignment at the one-year follow-up. The outcomes from QOL measurements after surgery showed better results with IMN at first but both treatments produced similar results by the one-year point<sup>(12)</sup>. The comparison between EF and UTN based on a meta-analysis by Fu et al. (2018) showed that UTN decreased superficial infection and malunion frequencies yet EF minimized hardware failure rates.<sup>(9)</sup> The analysis revealed no major distinctions in outcomes involving deep infection regardless of the treatment type as well as delayed union or nonunion occurrences<sup>(13)</sup>. Research findings demonstrated that patients in the IMN group healed faster after fracture (21.5±6.8 weeks) than patients in the EF group who reached union at 24.5±7.8 weeks (p = 0.02). Medical nails achieve better outcomes than external fixation according to the medical findings of Jeremic et al.'s meta-analysis<sup>(14)</sup>. The IMN group

showed better complication results than the EF group with lower infection frequency at 6% compared to 31% (p = 0.002) along with decreased non-union rates at 4% compared to 27% (p = 0.003). These reduced complication occurrences match findings from previous research about IMN advantages. Our study detected better functional results for IMN because 45% of patients experienced excellent outcomes instead of 22% from EF fixation (p = 0.005). Early enhancements in postoperative quality of life after surgery became apparent in the Tanzanian trial which used IMN for fixation. The benefits of IMN exist but doctors should choose EF when patients have extensive soft tissue trauma or tissue contamination. The decision between fixing options needs to be patient-specific because medical condition severity and surgeon and tissue damage extent impact selection alongside patient health status.

## CONCLUSION

The current study strengthens scientific evidence demonstrating that intramedullary nailing delivers superior results as an intervention approach for Gustilo Type IIIA tibiofibular fractures compared to external fixation. The research data indicates that IMN represents the most effective treatment approach for suitable clinical applications. The research data indicates that IMN represents the most effective treatment approach for suitable clinical applications.

### Author's Contribution:

Concept & Design or acquisition of analysis or interpretation of data:	Muhammad Arslan Munif
Drafting or Revising Critically:	Maryam Latif
Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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