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Comparative Study Of Functional Outcomes Between Locking Compression Plate And Intramedullary Nailing In Distal Tibia Fractures.

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ABSTRACT

Distal tibia fractures are complex injuries that pose challenges due to limited soft tissue coverage and biomechanical demands. Surgical fixation is preferred to achieve stable alignment and early mobilization. Locking Compression Plate (LCP) and Intramedullary Nailing (IMN) are two commonly employed methods, each with distinct advantages and limitations. To compare the functional and surgical outcomes of LCP and IMN in the management of distal tibia fractures. This prospective comparative study was conducted over six months and included 45 patients with closed distal tibia fractures. Patients were divided into two groups: Group A (LCP, n=23) and Group B (IMN, n=22). Data were collected on operative time, blood loss, time to weight-bearing, union time, complications, and functional outcome using the American Orthopaedic Foot and Ankle Society (AOFAS) score. IMN was associated with shorter operative time, less blood loss, earlier weight bearing, and faster fracture union. The mean AOFAS score at six months was significantly higher in the IMN group. Complication rates were lower in the IMN group, though not statistically significant. IMN provides better functional and surgical outcomes compared to LCP in distal tibia fractures, making it a favorable option for suitable cases.

Keywords: Distal tibia fractures, intramedullary nailing, locking compression plate

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INTRODUCTION

Distal tibia fractures present a significant challenge in orthopedic trauma due to their subcutaneous location, limited soft tissue coverage, and complex biomechanics [1]. These fractures are often associated with high-energy trauma and are prone to complications such as malunion, nonunion, and infection [2, 3]. Surgical management aims to restore alignment, achieve stable fixation, and enable early mobilization to minimize functional impairment. Two widely used surgical techniques for treating distal tibia fractures are Locking Compression Plate (LCP) fixation and Intramedullary Nailing (IMN) [4, 5].

Locking Compression Plates provide angular stability and are particularly useful in cases with metaphyseal comminution or osteoporotic bone. However, they require extensive soft tissue dissection, which may increase the risk of wound complications. In contrast, Intramedullary Nailing is a minimally invasive procedure that preserves soft tissue integrity and provides strong load-sharing stability, but concerns remain regarding its ability to maintain alignment in distal fractures due to limited fixation in the metaphyseal region [6-8].

Given the distinct advantages and limitations of both techniques, there is an ongoing debate regarding the optimal surgical approach for distal tibia fractures. This study aims to compare the functional outcomes of patients treated with LCP and IMN, assessing parameters such as union time, complication rates, and postoperative function to guide evidence-based surgical decision-making.

METHODOLOGY

This prospective comparative study was conducted over a period of six months in the Department of Orthopaedics at a tertiary care hospital. A total of 45 patients with distal tibia fractures who met the inclusion and exclusion criteria were enrolled after obtaining informed written consent. The study population was divided into two groups: Group A included patients treated with locking compression plates (LCP), and Group B included those treated with intramedullary nailing (IMN). Allocation into the groups was done alternatively based on the order of admission.

Patients aged between 18 and 65 years with closed distal third tibial fractures without intra-articular extension were included. Open fractures (Gustilo-Anderson Grade II and III), pathological fractures, and fractures associated with neurovascular compromise were excluded. All patients underwent preoperative clinical and radiological evaluation, and the surgeries were performed under spinal or general anesthesia by experienced orthopedic surgeons. Standard surgical techniques for LCP and IMN fixation were followed, and postoperative protocols including antibiotics, analgesics, and physiotherapy were standardized for both groups.

Follow-up was conducted at regular intervals—2 weeks, 6 weeks, 3 months, and at 6 months postoperatively. Functional outcome was assessed using the American Orthopaedic Foot and Ankle Society (AOFAS) score, and radiological union was evaluated using serial X-rays. Data on intraoperative time, blood loss, union time, and complications were recorded and compared between the two groups using appropriate statistical tests.

RESULTS

Table 1: Demographic and Baseline Characteristics of Patients

Parameter	Group A (LCP) (n=23)	Group B (IMN) (n=22)	p-value
Mean Age (years)	42.1 ± 10.5	40.8 ± 11.2	0.63
Male : Female Ratio	15 : 8	14 : 8	0.92
Side of Fracture (Right/Left)	12 / 11	11 / 11	0.88
Mechanism (RTA/Fall)	16 / 7	15 / 7	0.95

Table 2: Surgical and Clinical Outcome Parameters

Parameter	Group A (LCP)	Group B (IMN)	p-value
Mean Surgery Duration (min)	85 ± 12	65 ± 10	<0.001
Mean Blood Loss (ml)	180 ± 30	120 ± 20	<0.001
Time to Full Weight Bearing (wks)	12 ± 2	8 ± 1	<0.001
Mean Union Time (weeks)	18 ± 3	16 ± 2	0.02

Table 3: Functional and Complication Outcomes

Outcome Parameter	Group A (LCP)	Group B (IMN)	p-value
Mean AOFAS Score at 6 months	82.4 ± 7.5	86.1 ± 6.8	0.04
Superficial Infection (%)	3 (13.0%)	1 (4.5%)	0.28
Malalignment >5° (%)	1 (4.3%)	2 (9.0%)	0.48
Implant-related Complaints (%)	4 (17.4%)	1 (4.5%)	0.18

DISCUSSION

The present study aimed to compare the functional and surgical outcomes of two commonly employed fixation methods—Locking Compression Plate (LCP) and Intramedullary Nailing (IMN)—in the management of distal tibia fractures. A total of 45 patients were enrolled and divided into two groups, with 23 patients undergoing LCP fixation and 22 patients treated with IMN. The study duration was six months, and outcomes were measured using clinical, radiological, and functional parameters.

Demographically, both groups were comparable in terms of age, gender, side of injury, and mechanism of injury. This indicates effective randomization and ensures that the results are not confounded by baseline differences. The majority of cases in both groups resulted from road traffic accidents, highlighting the high-energy nature of these injuries.

In terms of intraoperative parameters, IMN demonstrated superior outcomes with significantly reduced operative time and blood loss. The mean surgery duration for the IMN group was 65 ± 10 minutes compared to 85 ± 12 minutes in the LCP group ($p < 0.001$), and the mean blood loss was also notably lower in the IMN group (120 ± 20 ml vs. 180 ± 30 ml; $p < 0.001$). These results can be attributed to the minimally invasive nature of intramedullary nailing, which requires less soft tissue dissection than plating. Weight-bearing and union time are critical for early mobilization and functional recovery. Patients treated with IMN were able to bear full weight earlier (8 ± 1 weeks) compared to those with LCP fixation (12 ± 2 weeks), and they also achieved fracture union faster (16 ± 2 weeks vs. 18 ± 3 weeks, $p = 0.02$). These findings are consistent with literature suggesting that IMN offers a more load-sharing construct that permits earlier rehabilitation.

Functional outcomes, as assessed by the American Orthopaedic Foot and Ankle Society (AOFAS) score, were also slightly better in the IMN group (mean score: 86.1 ± 6.8) compared to the LCP group (82.4 ± 7.5), with statistical significance ($p = 0.04$). This difference, though modest, underscores the clinical advantage of IMN in enhancing patient mobility and comfort in the early postoperative period [10].

Complication rates were relatively low in both groups. The incidence of superficial infection was slightly higher in the LCP group (13%) compared to the IMN group (4.5%), although not statistically significant. Implant-related discomfort was more commonly reported in the LCP group, which may be due to hardware prominence or irritation due to subcutaneous positioning. Malalignment rates were low and comparable in both groups, suggesting that both methods are technically sound when performed with precision.

CONCLUSION

In conclusion, while both LCP and IMN are effective in managing distal tibia fractures, IMN appears to have several advantages in terms of reduced operative time, less intraoperative blood loss, earlier weight bearing, faster union, and slightly better functional outcomes. However, selection of the fixation method should also consider fracture pattern, soft tissue condition, and surgeon expertise. A larger sample size and longer follow-up may further validate these findings.

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