

Extra-Articular Proximal Tibia Fracture Fixation with Locked Plating versus Intramedullary Nail: A Meta-Analysis

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INTRODUCTION: Proximal tibia fractures are often the result of high energy injuries. Conservative treatment for these injuries can lead to malunion, rotational deformity, stiffness, soft tissue compromise, and infection. Locked plating (LP) and intramedullary nailing (IMN) techniques are the surgical treatment of choice for these injuries but limitations exist to each option. Intramedullary nails in the proximal tibia face challenges due to their canal fit and the deforming forces that routinely act on the fracture site. LP often causes increased soft tissue disruption, which can lead to vascular damage and infection. Improvements in implant design have led to success using both nailing and plating techniques. The purpose of this study was to compare outcomes of LP versus IMN techniques for treatment of extra-articular proximal-third tibia fractures.

METHODS: This was a systematic review and meta-analysis of studies comparing LP versus IMN fixation for extra-articular proximal tibia fractures. The methodology of the search adhered strictly to the PRISMA guidelines. Outcomes of interest included operative duration, postoperative knee range of motion (ROM), union outcomes (time to union, nonunion, malunion, delayed union), and incidence of postoperative complications (superficial and deep infection, secondary surgical intervention, compartment syndrome). A random-effects model meta-analysis was performed using I² to assess for heterogeneity. Standardized mean differences (SMD) and risk ratios (RR) with corresponding 95% confidence intervals were used to compare continuous and categorical variables, respectively.

RESULTS: A total of 7 studies were included for quantitative analysis reporting the outcomes of 319 patients treated with LP and 300 treated with IMN fixation. All studies had a minimum follow-up duration of 1 year. IMN fixation had significantly shorter time to union (SMD: 1.63 [0.003 – 3.25]; I² = 92.6%; p = 0.049) and lower risk for superficial infection (RR: 1.90 [1.10 – 3.27]; I² = 0%, p = 0.028) than LP. However, LP fixation conferred a significantly lower risk for malunion (RR: 0.69 [0.52 – 0.91]; I² = 0%; p = 0.017) and postoperative compartment syndrome (RR: 0.63 [0.44 – 0.89]; I² = 0%; p = 0.018) than IMN. There were no significant differences in operative time (SMD: 0.12 [-0.30 - 0.54]; I² = 28.9%; p = 0.44), postoperative ROM (SMD: -0.02 [-0.24 - 0.19]; I² = 0%; p = 0.78), nonunion (RR: 0.78 [0.36 – 1.70]; I² = 0%; p = 0.47), delayed union (RR: 0.47 [0.06 – 3.51]; I² = 30.1%; p = 0.32), secondary surgical intervention (RR: 1.03 [0.61 – 1.73]; I² = 0%; p = 0.89), or deep infection (RR: 1.06 [0.56 – 2.00]; I² = 0%, p = 0.83) between LP and IMN groups.

DISCUSSION AND CONCLUSION: Plating and intramedullary nailing techniques demonstrated success in treatment of proximal-third tibia fractures. IMN fixation demonstrated significantly shorter time to union and lower risk of superficial infection, while LP fixation demonstrated significantly lower risk for malunion and postoperative compartment syndrome. Although successful results can be achieved with good technique in LP and IMN fixation, a significant complication profile exists with these fractures regardless of implant choice.

