Crimson Publishers
Wings to the Research

Research Article

To Evaluate the Outcome of Proximal Tibia Fractures Treated by Intramedullary Nailing Through Supra Patellar Approach: A Retrospective Study of 30 Cases

Dr. Mit Patel[1]*, Dr. Ruchit Vyas[2], Dr. Tarun V Desai[3], Dr. Mukesh S Dwivedi[3] and Dr. Chirag V Thakkar[4]

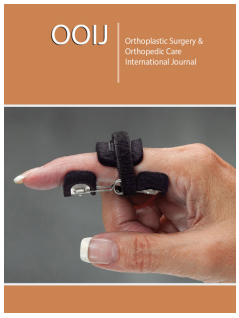
[1]DNB Orthopaedics, GMERS Medical College and Hospital, Gotri, Vadodara, India

[2]MS Orthopaedics, GMERS Medical College and Hospital, Gotri, Vadodara, India

[3]MS Orthopaedics, Associate Professor, GMERS Medical College and Hospital, Gotri, Vadodara, India

[4]MS Orthopaedics, Professor and Head of the Department, GMERS Medical College and Hospital, Gotri, Vadodara, India

ISSN: 2578-0069



***Corresponding author:** Mit Patel, DNB Orthopaedics, Department of Orthopaedics, GMERS Medical College, Gotri, Vadodara, India

Submission: November 21, 2025
Published: December 15, 2025

Volume 3 - Issue 2

How to cite this article: Dr. Mit Patel*, Dr. Ruchit Vyas, Dr. Tarun V Desai, Dr. Mukesh S Dwivedi and Dr. Chirag V Thakkar. To Evaluate the Outcome of Proximal Tibia Fractures Treated by Intramedullary Nailing Through Supra Patellar Approach: A Retrospective Study of 30 Cases. Ortho Surg Ortho Care Int J. 3(2). OOIJ. 000560. 2025.
DOI: 10.31031/OOIJ.2025.03.000560

Abstract

Introduction: Proximal tibia fractures are challenging to treat due to their anatomical complexity and high risk of malalignment. Conventional infrapatellar nailing may lead to poor alignment and anterior knee pain, while Minimally Invasive Plate Osteosynthesis (MIPO) has limitations such as longer surgical time and risk of infection. The suprapatellar approach for intramedullary nailing has emerged as a promising alternative for proximal tibia fractures.

Purposes: The aim of study is to evaluate the functional and radiological outcomes of proximal tibia fractures treated with intramedullary nailing (suprapatellar approach), specifically as: time to union, incidence of malalignment, functional outcomes (Lysholm Knee Scoring Scale), Complications (like, anterior knee pain and infection).

Materials and methods: This retrospective study included 30 patients with proximal tibia fractures treated with intramedullary nailing through the suprapatellar approach. Radiological outcomes were assessed based on union time and malalignment, while functional outcomes were measured using the Lysholm Knee Score. Complications such as anterior knee pain and infection were also recorded.

Result: The mean age was 42.6±12.4 years. The average union time was 16.2±2.8 weeks. Malalignment was observed in 2 cases (6.7%), and the mean Lysholm score at final follow-up was 86.5±8.3. Most patients (73.3%) achieved good to excellent functional outcomes. In 3 patients (10%), Anterior knee pain was reported, and 2 cases of infection (superficial) were noted.

Conclusion: Suprapatellar intramedullary nailing of proximal tibia fractures provides excellent alignment, early union, and satisfactory functional outcomes with minimal complications. This approach is a safe and effective alternative to traditional infrapatellar nailing and MIPO lateral plating techniques, particularly in challenging proximal third fractures.

Keywords: Suprapatellar approach; Proximal tibia fracture; Intramedullary nailing; Lysholm knee scoring scale; Fracture union; Knee function

Introduction

Proximal tibia fractures, especially those involving the metaphyseal region and proximal third region, represent a complex orthopedic challenge due to their anatomical location, limited soft tissue coverage, and a high risk of malalignment. These fractures commonly result from high-energy trauma in young adults or low-energy falls in elderly osteoporotic

individuals, frequently leading to substantial morbidity and functional limitations if not appropriately managed [1,2]. Various surgical techniques have been employed to manage these fractures, with the primary goals being anatomical reduction, stable fixation, early mobilization, and prevention of complications. Intramedullary nailing has become a preferred modality for treating proximal tibia shaft and selected metaphyseal fractures due to its biomechanical advantages, such as load-sharing fixation, preservation of periosteal blood supply, and minimal soft tissue disruption [3]. However, when it comes to proximal third tibia fractures, conventional infrapatellar nailing presents technical challenges. The flexed knee position required during insertion increases the risk of malalignment, particularly apex anterior angulation, due to unopposed quadriceps pull. Additionally, direct manipulation of the patellar tendon may lead to postoperative anterior knee pain [4,5]. To address these problems, the suprapatellar approach has emerged as an effective alternative. By allowing nail insertion in a semi-extended knee position, this technique offers better control of proximal fragments, facilitates reduction by counteracting deforming forces, and avoids direct trauma to the extensor mechanism. Specialized instrumentation minimizes chondral injury during intra-articular access. Several studies have reported improved alignment, reduced anterior knee pain, and favorable functional outcomes using the suprapatellar technique, especially in proximal third fractures [6,7].

Alternatively, Minimally Invasive Plate Osteosynthesis (MIPO) has also gained popularity for managing extra-articular proximal tibia fractures. This technique preserves the soft tissue envelope and periosteal blood supply, while allowing stable fixation with reduced surgical exposure. MIPO is particularly useful in complex metaphyseal patterns or cases with comminution where intramedullary devices may not offer adequate control [8,9]. Although MIPO has demonstrated good union rates and acceptable complication profiles, it often requires longer operative time and poses risks of infection and implant irritation [10]. Despite growing interest in both techniques, comparative data remains limited, especially for functional and radiological outcomes in proximal tibia fractures. While MIPO and suprapatellar nailing each have distinct advantages and indications, more clinical evidence is needed to clarify their roles, especially in terms of union time, malalignment, complication rates, and patient-reported outcomes. In this context, the present study aims to evaluate the radiological and functional outcomes of proximal tibia fractures treated with intramedullary nailing through the suprapatellar approach, focusing on union time, alignment, Lysholm Knee Score, operative time, and complications. Our findings may contribute to the evolving understanding of optimal management strategies for these challenging injuries.

Methods

Study design and setting

This is a retrospective observational study conducted at our institute GMERS Medical college and Hospital, Gotri, Vadodara, evaluating patients with proximal tibia fractures treated using intramedullary nailing through the suprapatellar approach. The study included 30 patients operated between January 2023 to January 2025.

Inclusion criteria:

a. Patients aged 18 years and above

b. Radiologically confirmed proximal tibia fractures (AO/OTA classification 41-A and 41-B1)

c. Closed Fractures

d. No other associated skeletal injuries

e. Medically fit for surgery

Exclusion criteria:

a. Open fractures

b. Pathological fractures

c. Previous knee surgery or infection

d. Medically unfit for anaesthesia or surgery

e. Patients lost to follow-up before 6 months

Surgical procedure

All patients were operated under spinal. With the patient in a supine position, the knee was placed in approximately 15-20° of flexion using a radiolucent leg support. Approximately 2-3cm longitudinal incision was made proximal to the patella, and the quadriceps tendon was split in the midline. The suprapatellar entry portal was established under fluoroscopic guidance, and a specialized cannula system was used to minimize chondral damage. After proper entry point identification and guidewire placement, reaming and intramedullary nailing were performed. Proximal and distal locking were done under fluoroscopy guidance (Figure 1-4).

Figure 1: Trauma x-ray.

Figure 2: Post operative x-rays (Lateral and AP views).

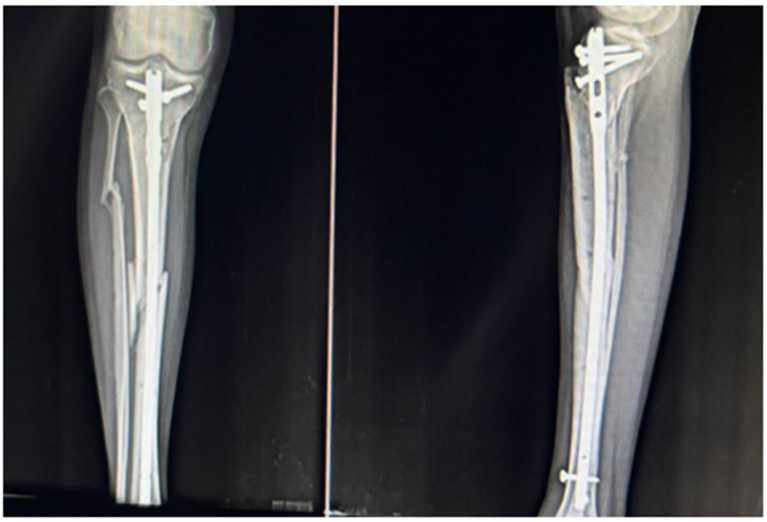


Figure 3: One month follow up X ray.

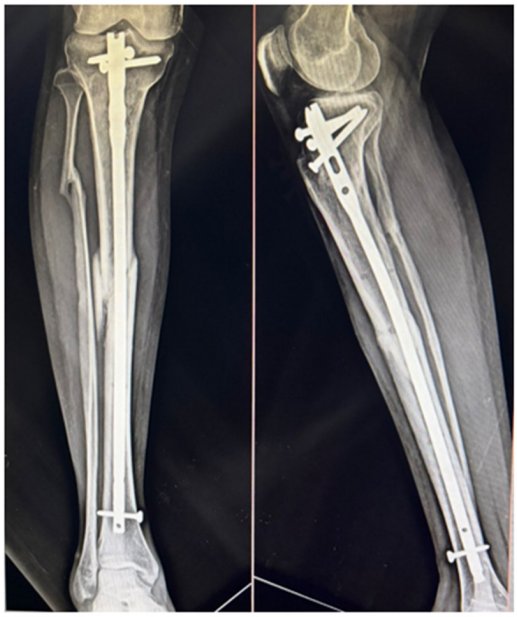


Figure 4: Final follow up X-ray.

Postoperative protocol

a. Immediate postoperative radiographs were taken to confirm implant position, reduction and record purposes.

b. All patients received Postoperative IV antibiotics for 3 days and Oral antibiotics for 10 days.

c. Suture removal on day 15.

d. Passive range-of-motion exercises were initiated on postoperative day 1.

e. Partial weight-bearing was started after 4-5 weeks based on radiological evidence of healing.

f. Full weight-bearing was started after 6-8 weeks based on X-ray assessment.

Outcome measures

a. Radiological outcome was assessed using serial X-rays for fracture union, alignment (varus/valgus or procurvatum/recurvatum >5° considered malalignment), and implant position.

b. Functional outcome was evaluated using the Lysholm Knee Scoring Scale at final follow-up.

c. Complications such as anterior knee pain, infection, hardware failure, or non-union were also recorded.

Results

Demographic and clinical data

A total of 30 patients with proximal tibia fractures were included in the study. The mean age was 42.6±12.4 years (range 21-65), with 21 males (70%) and 9 females (30%). The majority of fractures (60%) occurred due to motor vehicle accidents, followed by falls from height (30%) and sports injuries (10%).

According to the AO/OTA classification, the distribution was as follows:

a. Type 41-A: 18 cases (60%)

b. Type 41-B1: 12 cases (40%)

Operative details

a. The mean surgical time was 82±15 minutes.

b. All patients underwent successful suprapatellar intramedullary nailing without intraoperative complications.

Radiological outcomes

a. The average time to radiological union was 16.2±2.8 weeks.

b. No case of non-union or implant failure was observed.

c. Malalignment (>5° in any plane) was noted in 2 cases (6.7%), one in varus and one in sagittal plane.

Functional outcomes

Functional outcomes were assessed using the Lysholm Knee Scoring Scale at the final follow-up (mean follow-up duration: 9.4±2.1 months) (Table 1).

Table 1: The mean Lysholm score was 86.5±8.3 at final follow-up.

Result	Number
Excellent (≥90)	10 patients (33.3%)
Good (84-89)	12 patients (40%)
Fair (65-83)	6 patients (20%)
Poor (<65)	2 patients (6.7%)

Complications

a. Anterior knee pain was reported in 3 patients (10%), but none required further intervention.

b. Superficial infection occurred in 2 cases (6.7%), both managed successfully with oral antibiotics.

c. No deep infection, compartment syndrome, or hardware-related complications were noted.

Discussion

Proximal tibia fractures present significant challenges in achieving and maintaining alignment due to anatomical geometry and deforming muscle forces. Traditional infrapatellar nailing techniques often face limitations in these cases, including difficulty with reduction and higher rates of malalignment, especially in the sagittal plane [11]. In our study, the mean age was 42.6±12.4 years, with 70% males, reflecting the typical demographic pattern of proximal tibia fractures. These injuries are predominantly observed in middle-aged males due to high-energy trauma, a trend reported by Court-Brown et al. [12] and confirmed in various studies [12]. A similar demographic distribution was observed in a study by Chan et al. [13]. Likewise, plating studies such as Bhattacharyya et al. [14] have reported comparable demographics, emphasizing that both plating and nailing are often used in similar patient populations [14]. In our study, we evaluated the clinical and radiological outcomes of 30 patients with proximal tibia fractures treated using the suprapatellar intramedullary nailing technique. The results provide evidence of favourable union rates, alignment, and effective functional recovery. The mean time to radiological union was 16.2 weeks, comparable to previous studies reporting union within 14-18 weeks using this approach [15]. When compared to Minimal invasive plating, Kfuri et al. [9] emphasized that minimally invasive plate osteosynthesis may help reduce soft tissue trauma but still reported union times around 20 weeks [9].

Therefore, intramedullary nailing-especially via the suprapatellar approach-appears to provide faster union compared to plating in many cases. Our study showed only 2 cases (6.7%) of malalignment, which is significantly lower than the 20-28% typically reported in infrapatellar nailing for proximal tibia fractures [16]. Plating has been shown to offer good control over alignment, with malalignment rates of 5-10% depending on surgical expertise and implant choice [17,18]. The use of the semi-extended knee position during suprapatellar nailing allows better control over axial and

sagittal alignment, especially in proximal fractures where flexion deformity is a common issue. Furthermore, no intraoperative complications or implant failures were encountered. The average surgical time in our study was 82±15 minutes, which is within the expected range for suprapatellar nailing. Ryan et al. [19,20] reported operative durations of approximately 80-85 minutes for suprapatellar nailing, slightly shorter than infrapatellar approaches [19,20]. MIPO can reduce this to around 90 minutes, but still tends to be longer than intramedullary nailing, particularly in extra-articular proximal fractures [9]. Functionally, the mean Lysholm knee score at final follow-up was 86.5, with over 70% of patients achieving good to excellent outcomes. These findings are consistent with previously published literature, where Lysholm scores ranged between 83 and 88, and good to excellent outcomes were reported in over 70% of cases following suprapatellar nailing of proximal tibia fractures [21-23]. Anterior knee pain was noted in 10% of our patients, which is lower than some reports with infrapatellar entry, possibly due to avoidance of direct trauma to the patellar tendon during suprapatellar entry. In our study, superficial infections found in 2 cases (6.7%) and no deep infections. These rates are in line with the reported literature. Im et al. [24] noted a 5.8% superficial infection rate for suprapatellar nailing, and Tornetta et al. [25] reported an overall infection rate of 6.2% in similar cohorts [24,25]. Minimally invasive techniques, studies by Kfuri et al. [9] report infection rates between 7-10%, particularly in high-energy injuries with soft tissue compromise [9]. These comparisons support that suprapatellar nailing may offer a lower infection risk than plating, especially in closed fractures, given the less invasive approach and smaller incisions.

Conclusion

This retrospective study of 30 cases demonstrates that intramedullary nailing through the suprapatellar approach is a safe and effective method for the treatment of proximal tibia fractures. The technique resulted in excellent to good functional outcomes in over 70% of patients, with a mean Lysholm Knee Score of 86.5. Radiological union was achieved in all cases within an average of 16.2 weeks, with only 2 cases (6.7%) showing malalignment greater than 5°, which is within acceptable limits and comparable to or better than outcomes reported with infrapatellar nailing or plating techniques. When compared to MIPO plating, the suprapatellar IM nailing technique demonstrated a shorter operative time, smaller incisions, and preservation of soft tissue with fewer infection-related complications. Though MIPO provides good fixation in comminated and osteoporotic bones, its steep learning curve, risk of soft-tissue complications, and longer surgical duration make suprapatellar nailing a more suitable alternative in many scenarios, especially for extra-articular or simple intra-articular proximal tibia fractures. Complication rates in our study were low, with anterior knee pain in 10% of patients and superficial infections in 6.7%, both managed conservatively. The absence of deep infections, hardware failures and non-union points to a favourable safety outcome. Overall, the suprapatellar approach to intramedullary nailing offers several clinical and technical advantages, including better fracture alignment, shorter operative time, and early mobilization, all contributing to faster rehabilitation and satisfactory outcomes. Based on our findings, we recommend considering this technique as a preferred option for the management of proximal tibia fractures, especially those at high risk of malalignment. However, we acknowledge the limitations of our study, including its retrospective design and relatively small sample size. Future prospective randomized controlled trials with longer follow-up are necessary to further validate these results and provide definitive treatment guidelines.

References

1. Court BCM, Birnie JM (1995) The epidemiology of tibial fractures. J Bone Joint Surg Br 77(3): 417-421.
2. Marsh JL, Slongo TF, Agel J (2002) Tibial plateau fractures: Classification, treatment and outcomes. J Bone Joint Surg Am 84(9): 1459-1479.
3. Bhandari M, Audige L, Ellis T, Hanson B (2003) Operative treatment of extra-articular proximal tibial fractures: IM nailing vs. plating. J Orthop Trauma 17(8): 591-595.
4. Katsoulis E, Court-Brown CM, Giannoudis PV (2006) Malunion after tibial intramedullary nailing. J Orthop Trauma 20(7): 475-480.
5. Vaisto O, Toivanen J, Kannus P, Markku J (2008) Anterior knee pain after intramedullary nailing of fractures of the tibial shaft: an eight-year follow-up of a prospective, randomized study comparing two different nail-insertion techniques. J Trauma 64(6): 1511-1516.
6. Ryan SP, Tornetta P, Creevy WR (2016) Suprapatellar versus infrapatellar approach for tibial nailing: A randomized prospective study. J Orthop Trauma 30(3): e77-e81.
7. Sanders RW, DiPasquale TG, Jordan CJ (2014) Techniques in the management of proximal tibial fractures with IM nailing. J Orthop Trauma 28(1): e1-e5.
8. Krettek C, Miclau T, Schandelmaier P (2001) The minimally invasive percutaneous plate osteosynthesis (MIPO) technique for proximal tibial fractures. Injury 32(Suppl 1): SD33-SD43.
9. Kfuri M, Schatzker J (2018) Treatment of proximal tibial fractures: New concepts. J Knee Surg 31(3): 211-218.
10. Egol KA, Weisz R, Hiebert R (2007) Minimally invasive plate osteosynthesis of proximal tibia fractures: Surgical technique and early results. Bull NYU Hosp Jt Dis 65(3): 224-229.
11. Ricci WM, Boyle MO, Borrelli J, Sanders R, Bellabarba C (2001) Fractures of the proximal third of the tibial shaft treated with intramedullary nails and blocking screws. J Orthop Trauma 15(4): 264-270.
12. Court CMB, Birnie JM (1995) The epidemiology of tibial fractures. J Bone Joint Surg Br 77(3): 417-421.
13. Chan DS, Leung F, Yau WP (2019) Suprapatellar nailing of proximal tibia fractures: Prospective evaluation of anterior knee pain and functional outcomes. Injury 50(3): 595-600.
14. Bhattacharyya T, Mehta P, Smith RM (2014) Clinical outcomes of plate fixation for proximal tibial fractures: A prospective study. J Orthop Trauma 28(4): 214-220.
15. Courtney PM, Boniello AJ, Bergeron SG (2021) Radiographic and clinical outcomes of proximal tibia fractures treated with intramedullary nails using a suprapatellar approach. J Orthop Trauma 35(7): 347-352.
16. Zhao J, Li Y, Wang C (2018) Comparison of suprapatellar and infrapatellar intramedullary nailing for tibial shaft fractures: A systematic review and meta-analysis. J Orthop Surg Res 13: 146.
17. Dendrinos GK, Katsenis D, Kontos S, Dalas A (1996) Treatment of high-energy tibial plateau fractures by the Ilizarov circular fixator. J Bone Joint Surg Br 78(5): 710-717.

18. Barei DP, Nork SE, Mills WJ (2004) Comminuted tibial plateau fractures: Evaluation and treatment. J Am Acad Orthop Surg 12(6): 359-370.

19. Ryan SP, Tornetta P, Sirkin M (2016) Tibial intramedullary nailing: Suprapatellar versus infrapatellar approach. J Am Acad Orthop Surg 24(11): 776-781.

20. Courtney PM, Boniello AJ, Bergeron SG (2019) Operative efficiency in suprapatellar tibial nailing: A comparative analysis. Injury 50(6): 1221-1224.

21. Serbest S, Tiftikçi U, Çay T, Uludag A (2020) Suprapatellar versus infrapatellar approach for intramedullary nailing of tibial fractures: A prospective comparative study. Eur J Trauma Emerg Surg 46(1): 121-127.

22. Jones M, Parry M, Whitehouse MR (2022) Functional outcomes following suprapatellar nailing of tibial shaft fractures: A prospective cohort study. Bone Joint J 104-B (6): 742-748.

23. Chan DS, Leung F, Yau WP (2019) Anterior knee pain after suprapatellar intramedullary nailing: A prospective cohort study. J Orthop Surg (Hong Kong) 27(3): 1-7.

24. Im GI, Tae SK (2005) Infection after intramedullary nailing of tibial shaft fractures. Clin Orthop Relat Res 431: 279-285.

25. Tornetta P, Riina J, Geller J (2018) Clinical outcomes of suprapatellar versus infrapatellar tibial nailing: A multicenter retrospective cohort study. J Orthop Trauma 32(6): 308-313.