International Journal of Research and Review
[Indexed, Peer-Reviewed Journal]
Volume 12; Issue: 10; October 2025
Website: www.ijrrjournal.com
E-ISSN: 2349-9788; P-ISSN: 2454-2237

Comparison of Suprapatellar and Infrapatellar Approaches for Tibia Intramedullary Nailing: Meta-Analysis

Putu Bihan Surya Kinanta[1], I Gede Eka Wiratnaya[2], Komang Septian Sandiwidayat[2]

[1]Resident of Orthopaedic and Traumatology Department, Faculty of Medicine, Udayana University, Sanglah General Hospital
[2]Consultant of Orthopaedic and Traumatology Department, Faculty of Medicine, Udayana University, Sanglah General Hospital

Corresponding Author: Putu Bihan Surya Kinanta

DOI: https://doi.org/10.52403/ijrr.20251001

ABSTRACT

Introduction: Tibia fractures, comprising approximately 2% of all fractures, are common diaphyseal fractures. IMN is the standard surgical treatment. Suprapatellar (SP) nailing is advised for proximal fractures to minimize mal-reduction risk and potentially alleviate post-IMN anterior knee pain. This study seeks a comprehensive assessment of the Suprapatellar and Infrapatellar approaches in tibia fracture treatment, evaluating clinical and functional outcomes.

Method: Systematic review and meta-analysis were conducted using PRISMA guidelines. Literature was searched through PubMed, Google Scholar, Science Direct and Cochrane Library using Boolean operators. The outcomes assessed included clinical and functional outcome, namely pain after operation, knee functional score and operation time.

Result: From 108 studies obtained, after full-text review, 9 studies included in the systematic review. Total sample range was 50-190 patients with mean age 30-45 years old. The number of male patients were higher than female.

Discussion: The results of the meta-analysis revealed that suprapatellar IMN reduces the incidence of knee pain and the average malalignment of fracture compared to infrapatellar IMN. There was also compared postoperative function between supra and infrapatellar approaches for antegrade nailing of tibial fractur and found no significant difference and no difference compared to IP IMN with operation time

Conclusion: There is significant difference between the two groups in terms of their knee pain after the surgery and the functional outcome. The decision to perform which surgery relies on the surgeon's preference and the availability of the instruments.

Keywords: *Tibia Fracture, Intramedullary Nailing, Suprapatellar Approach, Infrapatellar Approach*

INTRODUCTION

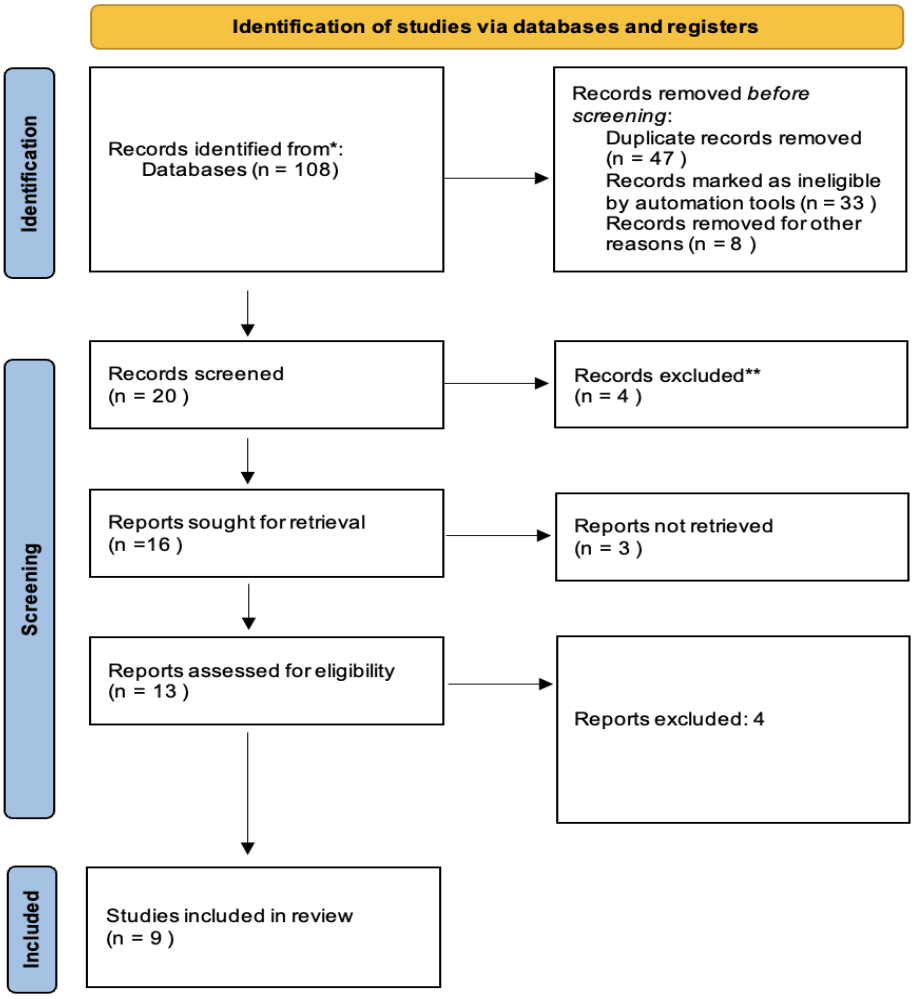
Tibia fractures, comprising approximately 2% of all fractures, are common diaphyseal fractures. IMN is the standard surgical treatment. IMN minimizes soft tissue damage while preserving periosteal blood flow, and allowing for early mobilization and weight bearing.[1]

The current treatment of choice for fractures of the tibia shaft is intramedullary nailing. Suprapatellar (SP) nailing is advised for proximal fractures to minimize mal-reduction risk and potentially alleviate post-IMN anterior knee pain, a common issue. Using SP nailing can potentially prevent apex-anterior, valgus deformity, and posterior translation in proximal tibial fractures. It also results in less operative fluoroscopy time, possibly prevent cutting the infrapatellar (IP) branch of the saphenous nerve, and decreases postoperative anterior knee pain.[2]

Previous research indicates that Suprapatellar (SP) intramedullary nailing may offer certain benefits compared to Infrapatellar (IP) nailing. Nevertheless, the presence of constraints in the accessible data impedes the capacity to draw conclusive inferences. A recent meta-analysis was undertaken to provide more comprehensive clinical recommendations. The investigation thoroughly examined the literature and assessed the outcomes of suprapatellar and infrapatellar nailing procedures.[1]

MATERIALS & METHODS

Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines were utilized to conduct a systematic review. Literature search was performed comprehensively to gather a full-length, peer-reviewed paper in English on Suprapatellar and Infrapatellar Approaches for Tibia Intramedullary Nailing. Literature was searched through PubMed, Google Scholar, Science Direct and Cochrane Library using Boolean operators with the following keywords: “Tibia Fracture”, “Intramedullary Nailing” and “Suprapatellar and Infrapatellar”.

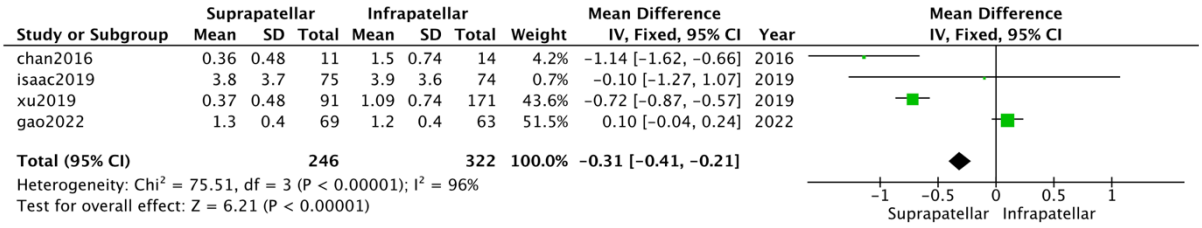


Picture 1. PRISMA Flow Chart

RESULT

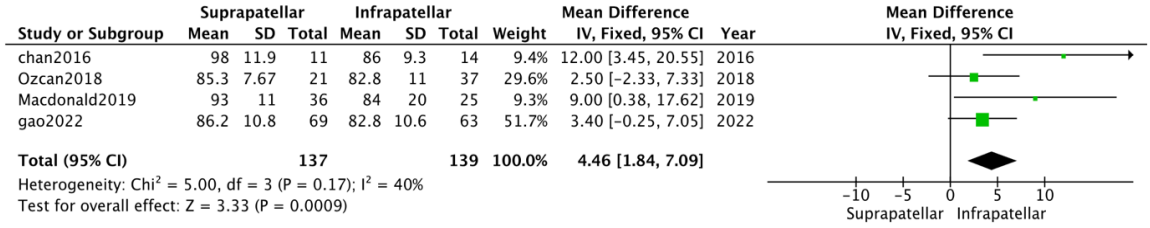
The literature search yielded a total of 108 studies after implementing the search technique. A total of 88 research was removed due to duplication, while an additional 32 papers were excluded based on title screening. After a thorough review, a total of 20 items were subsequently excluded. After conducting a comprehensive analysis of the entire content, a total of 11 articles were deemed ineligible and hence excluded. After completing the final screening process, a total of 9 papers were selected for inclusion in this meta-analysis.

Outcome 1: Pain score after operation



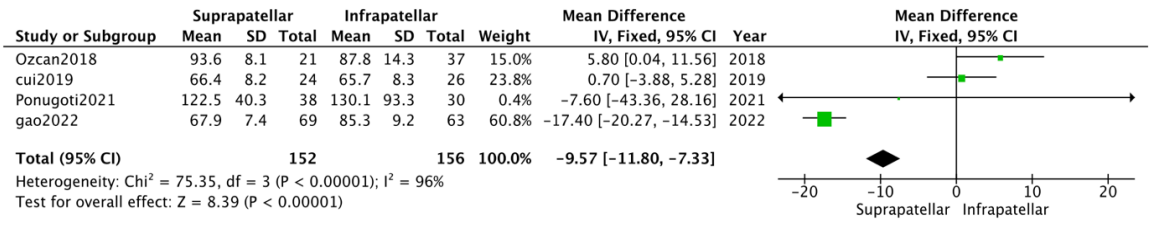
The analysis of pain score after operation from these 3 studies showed that suprapatellar (SP) group is superior to the infrapatellar group (MD: 0.75; 95% CI: -0.89, 0.61; P<0.00001; I^2=48%), this data showed moderate homogeneity (Fig. 1).

Outcome 2: Knee functional score



The postoperative knee function was evaluated using the Lysholm knee score in three investigations. The analysis of these 3 studies showed the Infrapatellar (IP) group has superior functional outcomes at the 12-month mark (MD: 2.50; 95% CI:1.82, 9.38; P=0.004; I^2=54%), and the data showed a moderate heterogeneity. The investigations evaluating the HSS score, Kujala score, and Oxford knee score did not demonstrate any superiority of the SP group. (Fig. 2)

Outcome 3: Surgical time



The operation time was evaluated in these 3 studies; there was no statistically significant difference between the SP and IP groups. (MD: 2.57; 95% CI:1.00, 6.14; P=0.16; I^2=7%) and showed a minimal heterogeneity. (Fig. 3).

DISCUSSION

This meta-analysis is the most recent and comprehensive study that compares the suprapatellar technique to the infrapatellar approach for tibial intramedullary nailing (IMN). Our study data suggests that using the suprapatellar technique results in lower post-operative pain scores compared to using the infrapatellar approach.

Chan et al. found that the SP technique and the IP approach are comparable in terms of alleviating knee discomfort caused by tibial fractures. No evidence of PF joint damage was seen during clinical examination. Additionally, our findings indicate that anterior knee pain was less common with the SP technique compared to the IP approach. It is necessary to do a larger study with a longer duration of observation in order to enhance the statistical strength and determine the presence of any long-term consequences, provided that the process is executed correctly.[3] Yang et al. also stated there is no significant difference in pain level post-surgery, however there is a noticeable inclination towards the SP group, and the reason for the lack of significant difference in VAS remained unclear.[4] This finding was supported by Xu et al. regarding he meta-analysis findings indicate that the use of suprapatellar intramedullary nailing (IMN) lowers the occurrence of knee discomfort and the average misalignment of fractures when compared to infrapatellar IMN.[5] However, our study's findings indicate that the severity of mild knee pain is not a reliable clinical factor for selecting one treatment over another. The SP surgical method offers benefits for the stabilization of proximal tibia fractures; yet, it does not appear to have an impact on the occurrence of knee pain. Hence, while making therapeutic decisions, the primary consideration for choosing between the SP or IP method should not be the long-term occurrence of knee discomfort.[2]

Macdonald et al Comparative analysis of postoperative function following antegrade nailing of tibial fractures using supra and infrapatellar methods. Their findings revealed that there was no statistically significant difference between the two procedures.[6] Chan et al Colleagues conducted a randomized trial in which they compared 11 patients in a suprapatellar group with 14 patients in an infrapatellar group. They observed that there was no statistically significant change in the Lysholm score after one year of follow-up.[3] Courtney et al conducted a retrospective study in which they contacted 21 patients who had undergone tibial nailing using a suprapatellar approach, and 24 patients using an infrapatellar approach, between three and 33 months after the surgery.[7] They found that there was no significant difference in the average Oxford Knee Score between the two groups ($p = 0.221$).[6] Yang et.al stated the Lysholm score of the SP group is superior when comparing SP and IP approach. This might be a result from the anterior knee paint which is significantly better in the SP Group, especially in kneeling position, possibly as a result of patellar tendon or infrapatellar nerve damage, regardless of whether the paratendinous or transtendinous approach is used.[4] This result is contradictory to our study that showed the IP group deemed superior to the SP group in terms of functional outcome assessed using Lynsholm score. This contradictory outcome might be a result of unassessed bias of the data. [4]

The current study demonstrated similar duration of surgery across the SP IMN and IP IMN techniques. The findings are supported by Cui et al., who reported a mean operation time of 71.01 minutes for SP IMN. This is not significantly different from the operating time of 73.26 minutes for IP IMN.[8] Although the outcome did not show a significant difference, there is a growing body of evidence indicating that the SP group has a shorter duration of surgery compared to the IP group. Yang et al. stated that the shorter duration of surgery of the SP group resulted from the knee position during the surgery. The SP IMN enables the surgeon to position the knee

semi-extended, thereby expediting the process of identifying the entry point, reducing fractures, and confirming the location using fluoroscopy.[4]

CONCLUSION

The findings of this meta-analysis indicate that suprapatellar nailing is linked to decreased postoperative pain scores and a lower occurrence of knee pain and average malalignment of fractures as compared to infrapatellar intramedullary nailing. Infrapatellar group has better functional outcome compared to the Suprapatellar group; however, this needs to be investigated further because there was some contradictory statement from other research, and assessment of bias is needed to find a more satisfactory results. Although there appears to be indications of shorter surgical time in the suprapatellar group, there is no statistically significant difference in operative times when compared to infrapatellar procedures. Further research is necessary in order to verify these findings and evaluate the long-term implications.

Declaration by Authors

Ethical Approval: None
Acknowledgement: None
Source of Funding: None
Conflict of Interest: No conflicts of interest declared.

REFERENCES

1. Ponugoti N, Rudran B, Selim A, Nahas S, Magill H. Infrapatellar versus suprapatellar approach for intramedullary nailing of the tibia: a systematic review and meta-analysis. Journal of Orthopaedic Surgery and Research. 2021 Jan 28;16(1):94.
2. Isaac M, O'Toole RV, Udogwu U, Connelly D, Baker M, Lebrun CT, Manson TT, Zomar M, O'Hara NN, Slobogean GP. Incidence of knee pain beyond 1 year: suprapatellar versus infrapatellar approach for intramedullary nailing of the tibia. Journal of orthopaedic trauma. 2019 Sep 1;33(9):438-42.
3. Chan DS, Serrano-Riera R, Griffing R, Steverson B, Infante A, Watson D, Sagi HC, Sanders RW. Suprapatellar versus infrapatellar tibial nail insertion: a prospective randomized control pilot study. Journal of orthopaedic trauma. 2016 Mar 1;30(3):130-4.
4. Yang CY, Tay ST, Kuo LT. Suprapatellar vs infrapatellar approaches for intramedullary nailing of distal tibial fractures: a systematic review and meta-analysis. Journal of Orthopaedics and Traumatology. 2023 Apr 11;24(1):14.
5. Xu H, Gu F, Xin J, Tian C, Chen F. A meta-analysis of suprapatellar versus infrapatellar intramedullary nailing for the treatment of tibial shaft fractures. Heliyon. 2019 Sep 1;5(9).
6. MacDonald DR, Caba-Doussoux P, Carnegie CA, Escriba I, Forward DP, Graf M, Johnstone AJ. Tibial nailing using a suprapatellar rather than an infrapatellar approach significantly reduces anterior knee pain postoperatively: a multicentre clinical trial. The Bone & Joint Journal. 2019 Sep 1;101(9):1138-43.
7. Courtney PM, Boniello A, Donegan D, Ahn J, Mehta S. Functional Knee Outcomes in Infrapatellar and Suprapatellar Tibial Nailing: Does Approach Matter? Am J Orthop (Belle Mead NJ). 2015 Dec;44(12): E513-6.
8. Cui Y, Hua X, Schmidutz F, Zhou J, Yin Z, Yan SG. Suprapatellar versus infrapatellar approaches in the treatment of tibia intramedullary nailing: a retrospective cohort study. BMC Musculoskeletal Disorders. 2019 Nov 28;20(1):573.

How to cite this article: Putu Bihan Surya Kinanta, I Gede Eka Wiratnaya, Komang Septian Sandiwidayat. Comparison of suprapatellar and infrapatellar approaches for tibia intramedullary nailing: meta-analysis. *International Journal of Research and Review*. 2025; 12(10): 1-5. DOI: *https://doi.org/10.52403/ijrr.20251001*

******