Int. J. Morphol.,
42(4):960-969, 2024.

A Randomized Controlled Study on the Efficacy of Different Approaches of Intramedullary Nailing with Blocking Screws for Proximal Tibial Fractures

Estudio Controlado Aleatorio sobre la Eficacia de Diferentes Enfoques de Clavo Intramedular con Tornillos de Bloqueo para Fracturas Proximal de Tibia

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LI, Z. & WU, K. A randomized controlled study on the efficacy of different approaches of intramedullary nailing with blocking screws for proximal tibial fractures. *Int. J. Morphol., 42(4)*:960-969, 2024.

SUMMARY: The objective of this study was to compare and analyze the clinical efficacy of different approaches of intramedullary nailing with blocking screws for proximal tibial fractures. One hundred cases of proximal tibial fractures treated in the orthopedic department from April 2021 to September 2023 were included in the study and divided into control and treatment groups using a random number table. A control group (n=50) treated with infrapatellar intramedullary nailing with blocking screws, and a treatment group (n=50) treated with suprapatellar intramedullary nailing with blocking screws. We observed the excellent and good rates in both groups, compared various perioperative indicators, changes in joint range of motion (ROM), Visual Analog Scale (VAS) pain scores, Lysholm knee joint function scores, changes in inflammatory factors, and various bone markers before and after treatment, and analyzed postoperative complications. There were no significant differences in baseline data such as age, sex, body mass index, fracture site, concomitant fibular fractures, time from fracture to surgery, injury mechanism, and AO/OTA fracture classification between the two groups (P>0.05). The excellent and good rate in the treatment group after treatment was 90.00 % (45/50), significantly higher than 72.00 % (36/50) in the control group (P<0.05). There were no significant differences in intraoperative blood loss and fracture healing time between the two groups (P>0.05). However, the treatment group had shorter surgical times and fewer fluoroscopy times than the control group (P<0.05). After treatment, both groups showed increased ROM and Lysholm scores, as well as decreased VAS scores. Moreover, compared to the control group, the treatment group had higher ROM and Lysholm scores and lower VAS scores (P<0.05). Inflammatory factors including interleukin-1β (IL-1β), C-reactive protein (CRP), tumor necrosis factor-α (TNF-α), osteocalcin (BGP), and calcitonin (CT) increased in both groups after treatment, while total n-terminal propeptide of type I procollagen (Total-PINP) and b-C-terminal telopeptide of type I collagen (β-CTX) decreased. Compared to the control group, the treatment group exhibited greater increases in inflammatory factors and lower levels of Total-PINP and β-CTX, but higher BGP and CT levels (P<0.05). The incidence of postoperative complications was 8.00 % (4/50) in the treatment group and 24.00 % (12/50) in the control group, with statistically significant differences (P=4.762, X^2=0.029). In the treatment of proximal tibial fractures, intramedullary nailing with blocking screws using the suprapatellar approach achieves significant clinical efficacy. It reduces surgical time, minimizes radiation exposure to healthcare workers and patients, improves knee joint range of motion and function, decreases postoperative pain and complication rates, suppresses inflammatory reactions, and promotes the improvement of bone markers related to fracture healing.

KEY WORDS: Proximal tibial fracture; Infrapatellar intramedullary nailing; Suprapatellar intramedullary nailing; Blocking screws.

INTRODUCTION

Proximal tibial fractures are a common type of lower limb fracture, often resulting from trauma. Particularly under high-energy traumatic forces, the incidence of proximal tibial fractures significantly increases (Thompson *et al*., 2023). Patients may experience severe pain, vascular and nerve damage, and in severe cases, skin rupture leading to an open fracture, greatly affecting the patient's mobility and daily life (Lin *et al*., 2023). Various surgical methods are widely employed for the treatment of proximal tibial fractures, with intramedullary nailing being the primary approach. However, due to the tension from multiple muscle groups and the need for fracture reduction in traditional surgical positions, the placement of intramedullary nails becomes challenging (Gao *et al*., 2023). Intramedullary nailing approaches include the infrapatellar and suprapatellar routes, each with distinct features. The infrapatellar approach

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Received: 2024-01-17 Accepted: 2024-04-06

is more direct but requires splitting the patellar ligament during surgery, and clearing the infrapatellar fat pad is relatively difficult (Lu *et al*., 2022). On the other hand, the suprapatellar approach avoids damage to the patellar ligament, providing a clearer anatomical view during surgery and preserving the joint structures necessary for biomechanical stability. However, in recent years, the introduction of blocking screw technology on the basis of intramedullary nailing has provided a new option for the treatment of proximal tibial fractures. By inserting a blocking screw at the distal end of the tibia, additional stability is provided, effectively preventing rotation and displacement of the fracture ends, thereby better ensuring fracture healing (Stenquist *et al*., 2024). However, there are currently few reports on the treatment of proximal tibial fractures with intramedullary nailing combined with blocking screws, and the clinical efficacy remains uncertain. There is also controversy regarding the efficacy of intramedullary nailing with different surgical approaches for proximal tibial fractures (Tseng & Hoekstra, 2023). Therefore, this study aims to explore the efficacy of intramedullary nailing with additional blocking screws using different approaches for proximal tibial fractures. By comparing the differences in surgical outcomes, postoperative complications, and other aspects between the two approaches, we aim to provide a more scientific and accurate surgical treatment plan for clinical practice.

MATERIAL AND METHOD

One hundred cases of proximal tibial fractures treated in our orthopedic department from April 2021 to September 2023 were selected as the study population. They were randomly divided into a control group (50 cases) and a treatment group (50 cases).

Inclusion Criteria:

1. Patients diagnosed with proximal tibial fractures by radiological imaging (Yu *et al*., 2023), aged between 18 and 65 years.
2. Absence of significant cognitive or psychiatric disorders, with the ability to comprehend and cooperate with the treatment plan.
3. Patients who underwent surgical treatment within 72 hours after injury.
4. Absence of bone-related diseases (such as osteoporosis, osteomalacia, etc.) or malignant tumors.
5. Patients treated with intramedullary nailing combined with blocking screws.
6. Tolerable of surgery and normal knee joint function before surgery.
7. Patients or their family members signed informed consent.

Exclusion Criteria:

1. Patients with clear surgical contraindications.
2. Patients with severe organic diseases of the cardiovascular, pulmonary, liver, kidney, *etc*.
3. Patients with other severe joint injuries or multiple fractures in different locations.
4. Pregnant or lactating women.
5. Patients with severe neurological or psychiatric disorders that hinder cooperation.
6. Patients who had participated in other interventional clinical trials.
7. Patients with allergies to anesthesia or related drugs.

Exclusion Criteria during the Study:

1. Occurrence of severe complications, such as infection, deep vein thrombosis, *etc*., affecting the comparability of the study results.
2. Unexpected intraoperative findings affecting the progress of the surgery.
3. Loss to follow-up or inability to obtain complete postoperative recovery data.

The basic information of the two groups of patients was shown in Table I. The study was approved and authorized by our hospital's Ethics Committee.

Treatment

Control group: Receive intramedullary nailing with additional blocking nails in the infrapatellar approach, the operation was as follows:

1. Anesthesia and patient preparation: the patient receives general anesthesia or subarachnoid block anesthesia, and then was placed in the supine position, and then routinely disinfected and toweled before the operation, and then the pressure of proximal thigh was maintained at 60 kPa using the balloon hemostatic tape.
2. Patellar ligament treatment: through an incision of about 5 cm in length in the middle of the patellar tendon, the patellar ligament was split longitudinally. Splitting the patellar ligament longitudinally. Subsequently, the infrapatellar fat pad was cleared to reveal the slope of the tibial plateau.
3. Fracture reduction: An incision was made to reveal the fracture site and ensure fracture reduction. If the reduction was unsatisfactory, a small incision was made to assist in the reduction, but excessive periosteal stripping was avoided. Reconstruction of the locking plate should be made against the posterior medial aspect of the proximal tibia, and a single cortical screw should be used for

Table I. Comparison of basic information of patients in two groups.

Sports event		Control group (n=50)	Treatment group (n=50)	t/X^2	P
Age (years)		45.63±7.12	44.87±7.05	0.536	0.593
Sex (m/f)		29/21	27/23	0.162	0.687
Body mass index (kg/m^2)		21.86±2.17	22.14±2.25	0.633	0.528
Fracture site (left/right)		22/28	24/26	0.161	0.688
Combined fibula fracture [cases (%)]		25 (50.00)	28 (56.00)	0.361	0.548
Time from fracture to surgery (d)		3.08±0.79	3.15±0.82	0.435	0.665
Causes of injury (cases)	wreck	24	25	0.203	0.977
	fall from a height	9	10		
	bruise	10	9		
	the rest	7	6		
Fracture AO/OTA typing (cases)	Type 42-C	5	7	0.380	0.827
	Type 42-B	19	18		
	Type 42-A	26	25		

temporary fixation to assist in reduction, and then removed after surgery.

4.Positioning of the guide pin: Determine the point of entry at the slope of the tibial plateau in the direction of the axis of the tibial marrow cavity. Using the guide pin and cotter, insert the finger reset.

5. Temporary blocking nail placement: After confirming the positive and lateral position of the fracture end under fluoroscopy, drill in a 2.5 mm Kirschner's needle and use it as a temporary blocking nail. Insert the finger repositioner again and adjust the position of the blocking nail according to the internal and external angulation of the fracture end as well as anterior and posterior angulation under fluoroscopy. 6. Intramedullary nail placement: After the position of the blocking nail was satisfactory, insertion of an intramedullary nail was chosen, especially for cases where the repositioning was unsatisfactory. Under fluoroscopy, the intramedullary nail was passed through the fracture end into the medullary cavity of the distal tibia using a long guidewire, and then interlocking of the interlocking nails between the distal and proximal ends was performed as needed.

7. Fixation and closure: fitting the tail cap, cleaning the wound, suturing layer by layer, and draining.

T**reatment group:** suprapatellar approach intramedullary nailing with additional blocking nails was given. The surgical approach of the treatment group was similar to that of the control group, with the main difference being the surgical approach. Surgical steps:

1. suprapatellar incision: create an incision of about 5 cm long, located in the median position on the patella, in order to insert the intramedullary nails, under the incision, the patellar ligament was treated, and the infrapatellar fat pad was cleaned up, in order to reveal the slope of the tibial plateau.
2. Positioning of guide pins: At the tibial plateau slope, the needle entry point was determined along the direction of the axis of the tibial marrow cavity according to the predetermined position of the intramedullary and blocking nails. Using the guide pin and cotter, insert the finger resetter. 3. Intramedullary nail placement: Under C-arm fluoroscopy, use a long guide wire to drive the intramedullary nail through the fracture end and into the medullary cavity of the distal tibia. Ensure that the tip of the intramedullary nail was as close as possible to the articular surface of the distal tibia. Interlocking of the distal and proximal interlocking nails was then performed as needed, usually using at least 3-4 stranded nails proximally for fixation. In the treatment group, the same general anesthesia or subarachnoid block anesthesia was used, with the patient in the supine position, and the procedure was performed through the suprapatellar approach, which included fracture repositioning and a median suprapatellar incision.

Postoperatively, elevation of the affected limb was implemented in both groups, and a generation of cephalosporin antibiotics was used to prevent infection in conjunction with the incision for a duration of 24 to 48 hours. On the second day, the drains were removed, and full-length anteroposterior and lateral radiographic images of the affected tibia were taken. On the third postoperative day, the radiographic images were rechecked, and the patient was encouraged to perform early knee and ankle exercises. During the second postoperative week, the wound sutures were removed.

Observation indicators.

1. Efficacy criteria Fracture healing (Dobelle *et al*., 2024): no local pressure and percussion pain was considered as excellent; no local abnormal activity was considered as good; lower limbs can walk continuously for at least 3 min without

support of crutches was considered as moderate; X-ray image shows that the fracture line was ambiguous, and it was poor to see continuous bone scabs and bone trabeculae passing through the fracture line. (Excellent+Good)/Total cases×100 %=Total effective rate.

2. Record the perioperative indexes of the two groups of patients: including operation time, intraoperative bleeding, number of intraoperative fluoroscopy, and fracture healing time.
3. The knee extension and flexion mobility (range of motion, ROM) assessment program was adopted before treatment and after 1 month of treatment (Kiel & Kaiser, 2023), ROM was assessed by measuring the degree of extension and flexion of the patient's knee, the maximum extension and maximum flexion of the knee were measured respectively, and the total score of ROM was the absolute value of the maximum extension minus the maximum flexion. For example, if the maximum extension was 0° and the maximum flexion was 135°, then the total ROM score was 135°.
4. A visual analogue scale (VAS) (Åström *et al*., 2023) was taken before treatment and after 1 month of treatment: it was usually a horizontal line with "no pain" and "worst pain" marked at each end. The patient marks the line according to the current level of pain, with a score of 0 indicating no pain and a score of 10 indicating the worst pain.
5. Evaluation of the Lysholm scale of the knee joint (Itthipanichpong *et al*., 2023): It contains several items such as pain, swelling, laxity and functional limitation, and the total score was the sum of the scores of each item, totaling 100 points, with higher scores indicating better knee joint function and less severe symptoms.
6. Detection of inflammatory factor levels: 4 mL of fasting venous blood samples were collected from patients before and after treatment, and centrifuged for 10 min at 3000 r/min with a radius of 10 cm in a centrifuge (Hermle, model Hermle Z206A), and the upper serum layer was taken and frozen in a refrigerator at -20°C for examination, and then enzyme-linked immunosorbent assay (ELISA) was used to determine the level of interleukin-1β (The levels of interleukin-1β (IL-1β), C-reactive protein (CRP) and tumor necrosis factor-α (TNF-α) were measured by enzyme-linked immunosorbent assay (ELISA), and the kits were provided by Shanghai Jianglai Biotechnology Co. Detection of bone markers: Serum was centrifuged, and the method was the same as above, enzyme-linked immunosorbent assay was used to determine the levels of serum osteocalcin (BGP) and calcitonin (CT), and chemiluminescence immunoassay was used to determine the levels of total nterminal propeptide of type I procollagen (Total-ICP, Total-ICP, Total-ICP, Total-ICP). Total nterminal propeptide of type I procollagen (Total-PINP) and β-collagen telopeptide of type I collagen (β-CTX) were determined by chemiluminescence immunoassay, and the kits were purchased from Nanjing Jianjian Institute of Bioengineering, and all the operations were carried out in strict accordance with the instructions. ≤ Postoperative complications were recorded in both groups: incision infection, deformity healing, joint stiffness, and traumatic arthritis, and the follow-up period was from 2021-5-01 to 2023-10-1, and all patients were followed up.

Statistical methods. Measurement data (including age and body mass index, fracture-to-operation time, perioperative indicators, ROM, VAS and Lysholm scores, inflammatory factor indicators, and bony markers) were described as mean ± standard deviation (±S), and comparisons of pre- and post-differences within a group were made using the paired t-test, and comparisons of differences between groups were made using the independent samples t-test; and count data (gender, fracture site, combined fibula fracture, cause of injury, fracture AO/OTA typing, efficacy and postoperative complications) were described as rate and percentage (%), X^2 test. $P<0.05$ indicated statistical differences. Statistical software SPSS23.0 was used for analysis.

RESULTS

Comparison of basic information between the two groups: the two groups of patients in age, gender, body mass index, fracture site, combined fibula fracture, fracture to surgery time, cause of injury and fracture AO/OTA typing and other basic information comparison, the difference was not statistically significant (P>0.05), (Table I).

Comparison of the efficacy situation of the two groups of patients: the excellent rate of the treatment group after treatment was 90.00 %, which was significantly higher than that of the control group of 72.00 %, and the difference was statistically significant (P<0.05), see Table II for details.

Comparison of perioperative indicators between the two groups of patients: intraoperative bleeding and fracture healing time of the two groups were compared, there was no significant difference (P>0.05), and the operative time and the number of intraoperative fluoroscopies of the treatment group were less than that of the control group (P<0.05), see Figure 1 for details.

Comparison of ROM, VAS and Lysholm scores between the two groups: after treatment, ROM and Lysholm scores increased and VAS scores decreased in both groups, and compared with the control group, ROM and Lysholm scores were higher and VAS scores were lower in the treatment group (P<0.05), as shown in Figure 2.

Table II. Comparison of the efficacy of the two groups of patients [n (%)].

Groups	Number of examples	Superior	Very much	Middle	Differ from	Excellence rate
Control subjects	50	21 (42.00)	15 (30.00)	11 (22.00)	3 (6.00)	36 (72.00)
Treatment group	50	26 (52.00)	19 (38.00)	5 (10.00)	0 (0.00)	45 (90.00)
X^2						5.263
P						0.022

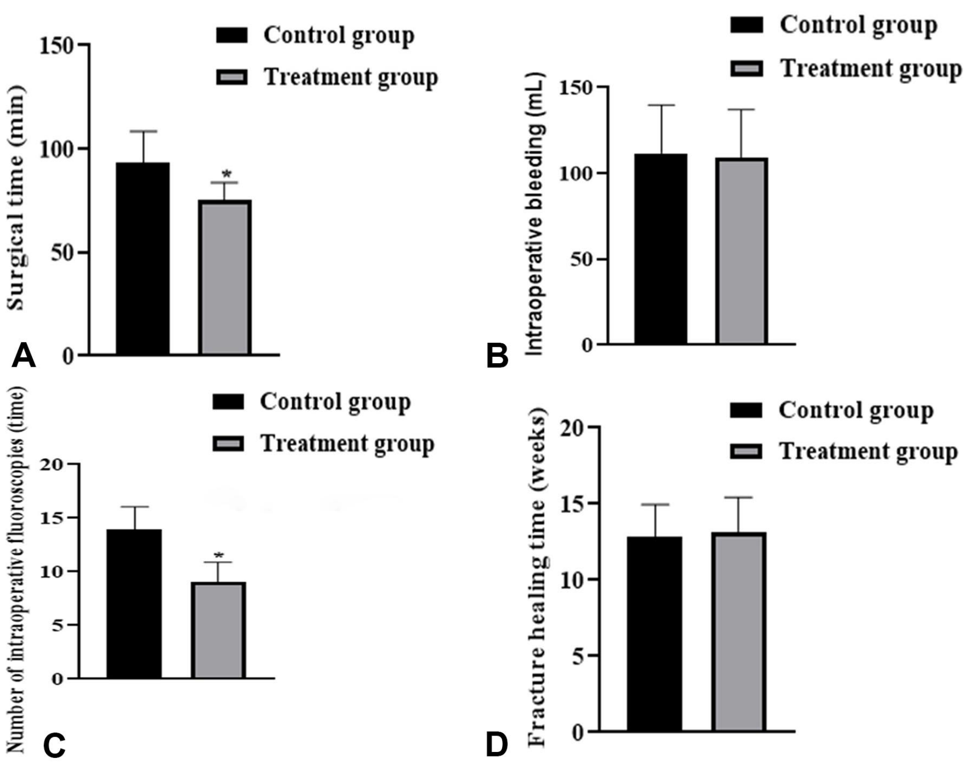

Fig. 1. Comparison of perioperative indicators between the two groups of patients ($\bar{X}$±S). A. Operative time; B. Intraoperative hemorrhage; C. Number of intraoperative fluoroscopies; D. Fracture healing time. Note: Indicates comparison with the control group:* *P*<0.05.

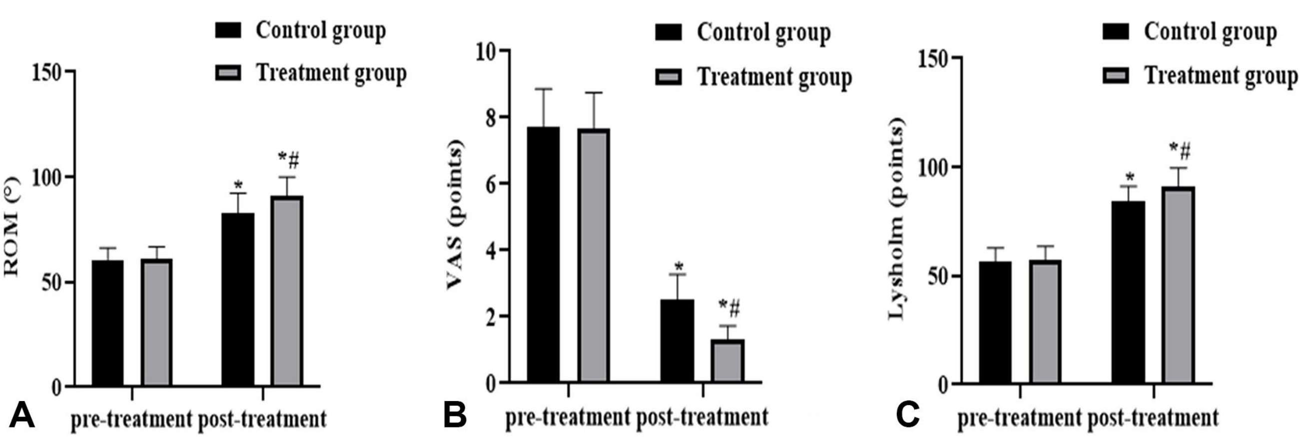

Fig. 2. Comparison of ROM, VAS and Lysholm scores between the two groups ($\bar{X}$±S). A, ROM; B, VAS score; C, Lysholm score. Note: Indicates comparison with the same group before treatment:* *P*<0.05; Indicates comparison with the control group after treatment: # *P*<0.05.

Comparison of the levels of inflammatory factors before and after treatment between the two groups of patients: the levels of IL-1β, CRP, and TNF-α were increased in both groups after treatment, and the increase in IL-1β, CRP, and TNF-α in the treatment group was lower than that in the control group after treatment (P<0.05), as shown in Fig. 3.

Comparison of bony markers between the two groups of patients: after treatment, the levels of BGP and CT were increased and the levels of Total-PINP and β-CTX were decreased in both groups, and compared with the control group, the levels of BGP and CT were higher and the levels of Total-PINP and β-CTX were lower on average in the treatment group after treatment (*P*<0.05). See Figure 4 for details.

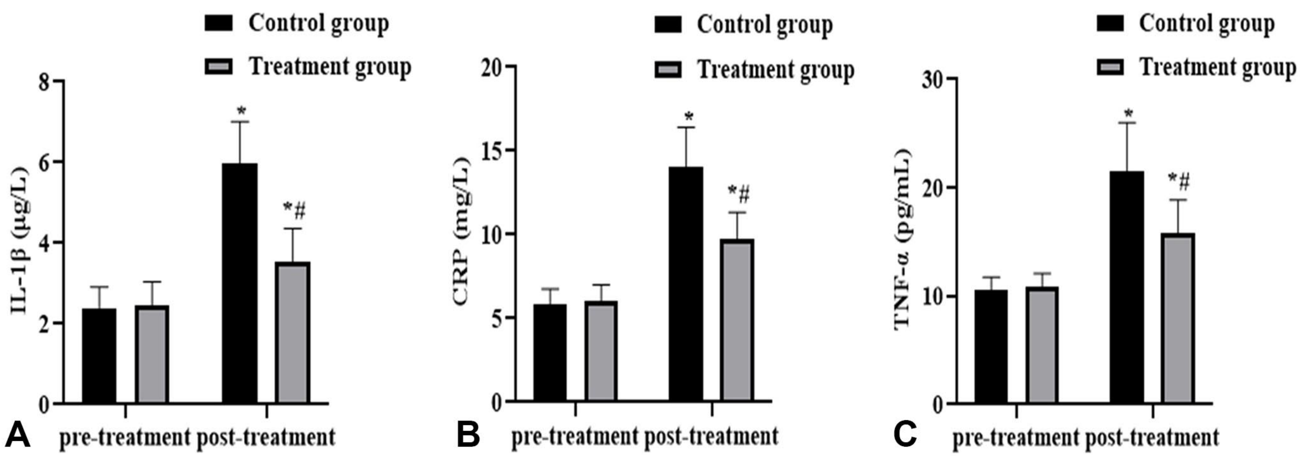

Fig. 3. Comparison of inflammatory factor levels before and after treatment between the two groups of patients ($\bar{X}$±S). A. IL-1β levels; B, CRP levels; C. TNF-α levels. Note: Indicates comparison with the same group before treatment:* P<0.05; indicates comparison with the control group after treatment: *#P*<0.05.

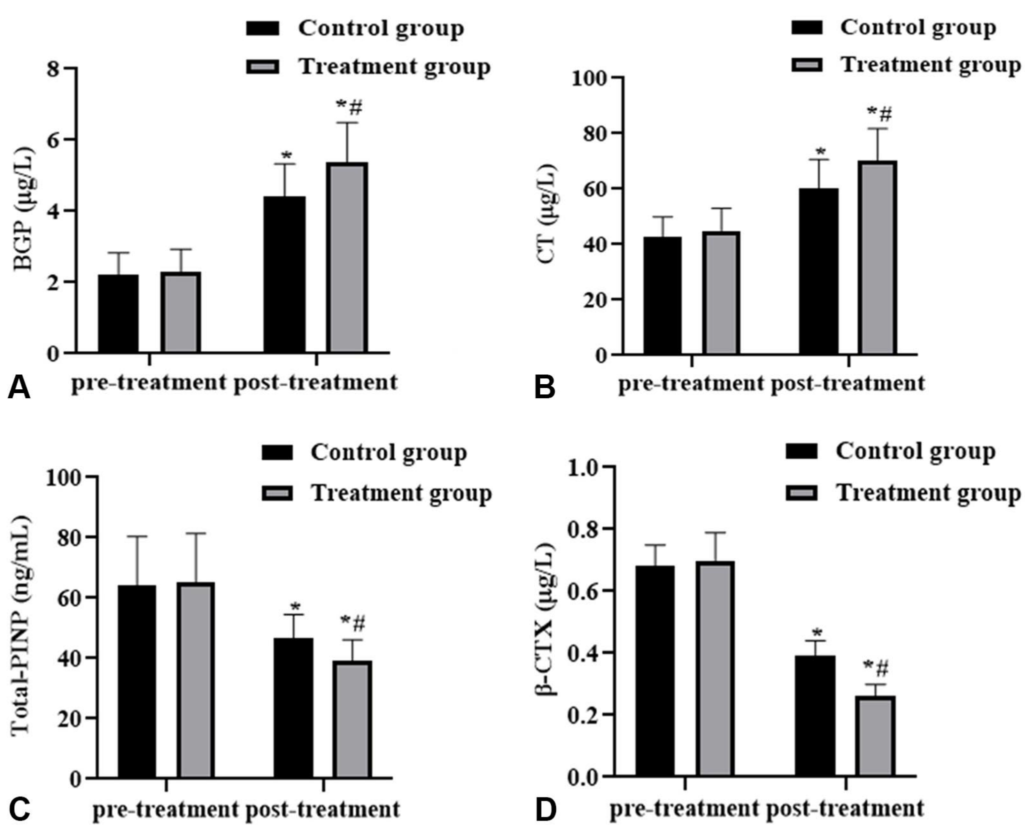

Fig. 4. Comparison of bone markers between the two groups ($\bar{X}$±S). A. Indicates BGP levels; B. CT levels; C. Total-PINP levels; D. β-CTX levels. Note: Indicates comparison with the same group before treatment:* *P*<0.05; indicates comparison with the control group after treatment:# *P*<0.05.

Table III. Comparison of postoperative complications between the two groups of patients [n (%)].

Clusters	Number of examples	Cutaneous infection	Malformation healing	Rigid joint	Traumatic arthritis	Rate of occurrence
Control subjects	50	2 (4.00)	1 (2.00)	6 (12.00)	3 (6.00)	12 (24.00)
Treatment group	50	1 (2.00)	0 (0.00)	2 (4.00)	1 (2.00)	4 (8.00)
t						4.762
P						0.029

Comparison of postoperative complications between the two groups of patients: the incidence of postoperative complications was 8.00 % in the treatment group and 24.00 % in the control group, which was statistically significant when comparing the two groups (P=4.762, X^2=0.029), see Table III for details.

DISCUSSION

In clinical practice, fractures of the tibial shaft are relatively common, accounting for approximately 40 % of all diaphyseal bone fractures in the body. These fractures are often the result of direct or indirectly transmitted significant forces. Proximal fractures are the most common among them and are often accompanied by soft tissue damage around the fracture ends (Amin *et al*., 2023). For clinical management of proximal tibial fractures, prompt surgical anatomical reduction and proper internal fixation should be performed to facilitate the early recovery of lower limb function in patients (Albayrak *et al*., 2023). In recent years, with the continuous development of internal fixation materials, techniques such as blocking screws, assisted reduction, and intramedullary nailing have been employed in the treatment of proximal tibial fractures, considering the biomechanical characteristics of the body (Tan *et al*., 2023). Currently, the primary surgical approach for tibial fractures involves the use of intramedullary nails combined with blocking screws. The most commonly used surgical approaches include the suprapatellar approach and the infrapatellar approach. Among these, the infrapatellar approach is the standard approach for intramedullary nailing fixation of tibial fractures, known for its minimal trauma and significant effectiveness (Coelho *et al*., 2023). However, there are certain limitations to its application in patients with proximal tibial fractures (Chen *et al*., 2023). For instance, during the procedure, it is necessary to maintain a flexed knee position for reduction, which makes it unsuitable for patients with comminuted or multi-segmental tibial fractures. Additionally, intraoperative reduction and nail insertion can be challenging, often requiring multiple attempts and repetitive reductions, which may increase soft tissue damage in the fracture area and postoperative pain.

In this study, the treatment group demonstrated a significantly higher rate of excellent outcomes after treatment compared to the control group. This suggests that the use of intramedullary nails combined with blocking screws via the suprapatellar approach has a clear clinical advantage. This may be attributed to the fact that the suprapatellar approach allows for more accurate reduction and fixation of the fracture, reducing the risk of surgical complications and recurrence. This result is consistent with previous research (Sagar *et al*., 2023), indicating that different surgical approaches may significantly impact the treatment outcomes of proximal tibial fractures. Further analysis of intraoperative indicators revealed that the treatment group had significantly shorter surgical times and fewer intraoperative fluoroscopy sessions than the control group. This implies that the use of intramedullary nails combined with blocking screws via the suprapatellar approach can shorten the surgicalduration, reduce radiation exposure for both medical staff and patients. The reason for this may be that the suprapatellar approach in surgery allows for the tibial horizontal axis and the surgical bed to be nearly parallel, simplifying fluoroscopy and reducing its difficulty and frequency, ultimately leading to shorter hospital stays. Research by Baker *et al*. (2022) has shown that intramedullary nailing fixation via the suprapatellar approach can reduce pain in patients with proximal tibial fractures and improve knee joint function. In line with the findings of this study, the treatment group had higher post-treatment range of motion (ROM) and Lysholm scores and lower Visual Analog Scale (VAS) scores compared to the control group. This suggests that the intramedullary nail with blocking screws via the suprapatellar approach not only effectively stabilizes the fracture but also better preserves joint mobility, reduces postoperative pain, and improves knee joint function in patients. The reasons for this may include:

1. The suprapatellar approach causes less damage to the surrounding soft tissues compared to the infrapatellar approach.
2. Through the suprapatellar approach, the fracture site can be more directly addressed, avoiding instability, and aiding in maintaining joint stability and mobility.
3. It eliminates the need to split the patellar ligament and the smaller incision may help reduce postoperative pain.
4. The suprapatellar surgical approach better preserves the integrity of the joint structure, reduces surgical damage to the joint, facilitates early rehabilitation training, and promotes improved joint function.

IL-1β, CRP, and TNF-α are all important inflammatory factors closely related to the extent of trauma in the body (Lin *et al*., 2022). IL-1β is an inflammatory cytokine, and in proximal tibial fractures, tissue damage around the fracture site triggers a widespread inflammatory response. Elevated levels of IL-1β may reflect the presence of inflammation and could be related to the severity and healing process of the fracture (Zhu *et al*., 2023). CRP is an acute-phase protein that typically rises during inflammation or tissue damage. In proximal tibial fractures, increased CRP levels indicate the risk of postoperative infection or complications. Monitoring CRP levels can be used to assess the efficacy of surgery and postoperative recovery (Laggner *et al*., 2023). TNF-α plays a crucial role in inflammation and immune responses. In proximal tibial fractures, high levels of TNF-α may be associated with inflammatory reactions and tissue damage, which could lead to controlled TNF-α levels that may help alleviate postoperative pain and inflammation and promote healing (Patel *et al*., 2023). Monitoring bone turnover markers is clinically significant for assessing the bone metabolic status and fracture healing in patients with proximal tibial fractures (Gam *et al*., 2022). Among them, BGP is a protein produced by bone cells and plays a vital role in bone metabolism. In proximal tibial fractures, BGP levels may reflect the progress of fracture healing (Sattgast *et al*., 2022). CT is a hormone produced by the thyroid gland and has a regulatory effect on bone metabolism. Changes in CT levels in proximal tibial fractures may be related to fracture healing and bone density. Elevated CT levels may help increase bone density and promote bone healing, thus improving patient recovery (Wang *et al*., 2023). Total-PINP is a serum marker, and in the treatment of proximal tibial fractures, elevated Total-PINP levels indicate increased bone formation during the fracture healing process (Nisha *et al*., 2023). β-CTX is a serum marker typically associated with bone resorption. In the treatment of proximal tibial fractures, changes in β-CTX levels are related to post-fracture bone resorption (Zhang *et al*., 2023).

This study found that the treatment group had superior levels of inflammatory factors and bone turnover markers after treatment compared to the control group. This suggests that the treatment method using intramedullary nails combined with blocking screws via the suprapatellar approach can more effectively suppress the inflammatory response, promote improvements in bone turnover marker levels, and facilitate the healing process of the fracture. Analyzing the reasons for this, compared to surgery via the infrapatellar approach, surgery via the suprapatellar approach results in less damage to the patellar ligament and surrounding tissues, resulting in less postoperative pain. In addition, it provides better stability for the fracture, reducing the risk of delayed union, malunion, or nonunion of the fracture due to poor reduction and thus improving bone turnover marker expression. The incidence of complications in the treatment group was significantly lower than that in the control group, at 8.00 % and 24.00 % respectively. This may be attributed to the more precise and effective nature of the treatment using intramedullary nails combined with blocking screws via the suprapatellar approach. The use of blocking screws can provide additional stability, reducing the incidence of postoperative complications. This study has some limitations, including a relatively small sample size, which may limit the statistical power of the study, resulting in some differences not achieving statistical significance. Future research could consider expanding the sample size to increase the reliability of the study. Additionally, this was a single-center study, which means that the applicability of the study results may be limited to other medical institutions. Patient populations and treatment practices may vary among different hospitals, so multicenter or cross-institutional studies are needed to validate the external validity of these results.

CONCLUSION

The suprapatellar approach to intramedullary nailing with additional blocking nails maintains joint mobility, reduces postoperative pain perception, and improves the patient's knee function mainly because it reduces damage to the periarticular soft tissues, better manages fracture reduction, stabilizes the fracture using blocking nails, reduces postoperative pain, and provides additional stability and reduces the risk of complications. Together, these factors contribute to better patient recovery and improved knee function.

LI, Z. & WU, K. Estudio controlado aleatorio sobre la eficacia de diferentes enfoques de clavo intramedular con tornillos de bloqueo para fracturas de tibia proximal. *Int. J. Morphol., 42(4)*:960-969, 2024.

RESUMEN: El objetivo de este estudio fue comparar y analizar la eficacia clínica de diferentes abordajes de clavo intramedular con tornillos de bloqueo para las fracturas de tibia proximal. Se incluyeron en el estudio 100 casos de fracturas de tibia proximal tratados en el departamento de ortopedia desde abril de 2021 hasta septiembre de 2023 y se dividieron en grupos de control y de tratamiento mediante una tabla de números aleatorios. Un grupo control (n=50) tratado con clavo intramedular infrapatelar con tornillos de bloqueo, y un grupo tratamiento (n=50) tratado con clavo intramedular suprapatelar con tornillos de bloqueo. Observamos excelentes y buenas tasas en ambos grupos, comparamos varios indicadores perioperatorios, cambios en el rango de movimiento articular (ROM), puntuaciones de dolor en la escala visual analógica (EVA), puntuaciones de función Lysholm de la articulación de la rodilla , cambios en factores inflamatorios y varios marcadores óseos, antes y después del tratamiento, y se analizaron las complicaciones postoperatorias. No hubo diferencias significativas en los datos iniciales como edad, sexo, índice de masa corporal, sitio de fractura, fracturas de fíbula concomitantes, tiempo desde la fractura hasta la cirugía, mecanismo de lesión y clasificación de fractura AO/OTA entre los dos grupos (P>0,05). La tasa de excelente y buena en el grupo con tratamiento después del tratamiento fue del 90,00 % (45/50), significativamente mayor que el 72,00 % (36/50) en el grupo control (P<0,05). No hubo diferencias significativas en la pérdida de sangre intraoperatoria y el tiempo de curación de las fracturas entre los dos grupos (P>0,05). Sin embargo, el grupo con tratamiento tuvo tiempos quirúrgicos más cortos y menos tiempos de fluoroscopía que el grupo control (P <0,05). Después del tratamiento, ambos grupos mostraron un aumento de las puntuaciones de ROM y Lysholm, así como una disminución de las puntuaciones de VAS. Además, en comparación con el grupo control, el grupo con tratamiento tuvo puntuaciones ROM y Lysholm más altas y puntuaciones EVA más bajas (P <0,05). Los factores inflamatorios que incluyen interleucina-1β (IL-1β), proteína C reactiva (CRP), factor de necrosis tumoral-α (TNF-α), osteocalcina (BGP) y calcitonina (CT) aumentaron en ambos grupos después del tratamiento, mientras que el total disminuyó el propéptido n-terminal del procolágeno tipo I (Total-PINP) y el telopéptido β-C-terminal del colágeno tipo I (β-CTX). En comparación con el grupo control, el grupo con tratamiento mostró mayores aumentos en los factores inflamatorios y niveles más bajos de Total-PINP y β-CTX, pero niveles más altos de BGP y CT (P <0,05). La incidencia de complicaciones postoperatorias fue del 8 % (4/50) en el grupo de tratamiento y del 24 % (12/50) en el grupo control, con diferencias estadísticamente significativas (P=4,762, X^2=0,029). En el tratamiento de las fracturas de tibia proximal, el clavo intramedular con tornillos de bloqueo mediante el abordaje suprapatelar logra una eficacia clínica significativa. Reduce el tiempo quirúrgico, minimiza la exposición a la radiación de los trabajadores de la salud y los pacientes, mejora el rango de movimiento y la función de la articulación de la rodilla, disminuye el dolor postoperatorio y las tasas de complicaciones, suprime las reacciones inflamatorias y promueve la mejora de los marcadores óseos relacionados con la curación de las fracturas.

PALABRAS CLAVE: Fractura proximal de tibia ; Clavado intramedular infrapatelar; Clavado intramedular suprapatelar; Tornillos de bloqueo.

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