

# Anterior Knee Pain after Intramedullary Nailing of Tibial Fractures: Medial Parapatellar versus Transtendinous Approach

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## ABSTRACT

**Objective:** Chronic anterior knee pain has been considered as the most frequent postoperative complication of tibial nailing surgery technique. Surgical approaches used for tibial intramedullary nailing include medial parapatellar, transtendinous, and lateral parapatellar techniques, but lateral parapatellar approach is less preferred. The aim of the present study was to determine the role of medial parapatellar and transtendinous approaches on anterior knee pain of patients with tibial diaphyseal fractures treated with intramedullary nail.

**Methods:** A total of 132 patients who were admitted to our emergency clinic with tibial shaft fracture between January 2015 and January 2017 were evaluated retrospectively. Of the 132 patients, 45 patients who were treated with intramedullary nail were included in the present study. Medial parapatellar approach was used in 20 fractures, and transtendinous approach was used in 27 fractures.

**Results:** The mean follow-up period of the patients was 12 (6–15) months. The mean union time of fractures was 5 (3–15) months. Severity of anterior knee pain was assessed by Visual Analog Scale (VAS). There was no statistically significant difference between the medial parapatellar method and the transtendinous method according to proximal nail entry exposures in anterior knee pain ( $p=0.927$ ).

**Conclusion:** In conclusion, although tibial nailing is a highly successful procedure for fracture healing, anterior knee pain remains the main disadvantage of it. Although our data showed no differences between the groups, the groups were relatively small to accept this null hypothesis with full confidence.

**Keywords:** Anterior knee pain, intramedullary nailing, tibial shaft fractures

## INTRODUCTION

Tibia shaft fractures are mostly caused by high-energy trauma, such as motor vehicle accidents, sports, and falls from a height (1). Intramedullary nailing of tibial diaphyseal fractures has been used frequently and accepted as a superior technique in the treatment of tibial diaphyseal fractures recently due to the high union rates, good functional and predictable results, and low infection and deformity rates (2–5). Chronic anterior knee pain has been considered as the most frequent postoperative complication of this technique (2, 3, 6–10). Anterior knee pain is a commonly reported problem, with an incidence ranging from 10% to 70%, with most series reporting an average incidence of approximately 50% (9, 11). The cause of this complication is still controversial, and it has been argued that it occurs due to the height of the nail, entry point of the nail, heterotopic ossification, infrapatellar branch of saphenous nerve trauma, traumatization of the tendon or the fat pad, postoperative muscle weakness, malalignment, and age (12, 13). Surgical approaches used for tibial intramedullary nailing are

medial parapatellar, transtendinous, and lateral parapatellar techniques, but lateral parapatellar approach is less preferred. Some authors have reported that a transtendinous approach for nail insertion is associated with a higher rate of anterior knee pain than a medial parapatellar approach (14, 15).

The aim of the present study was to determine the role of medial parapatellar and transtendinous approaches on anterior knee pain of patients with tibial diaphyseal fractures treated with intramedullary nail.

## METHODS

One hundred thirty-two patients who were admitted to our emergency clinic with tibial shaft fracture between January 2015 and January 2017 were evaluated retrospectively. Of the 132 patients, 45 patients who were treated with intramedullary nail were included in the study. The study included 14 female and 31 male patients. At the time of surgery, the mean age of the patients was

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33 (17–64) years. Nine patients had type I open fracture according to the Gustilo–Anderson classification, and two of them had bilateral tibial fractures. The types of injury were falls (10 fractures), motor vehicle accidents (28 fractures), sport activity (5 fractures), and gunshot injury (4 fractures). All of the operations were performed by two orthopedic surgeons with the same implants in the same operating room and standard operating table but different surgical exposures (medial parapatellar and transtendinous approaches). Medial parapatellar approach was used in 20 fractures, and transtendinous approach was used in 27 fractures.

All patients were informed about the types of treatment and the corresponding surgical technique. Patients were treated according to the ethical standards of the Declaration of Helsinki and were invited to read, understand, and sign the written informed consent form. Ethics committee approval was received for this study from the Ethics Committee of Gaziantep University (Research Protocol Code:328).

The mean follow-up period of the patients was 12 (6–15) months. The mean union time of fractures was 5 (3–15) months. Anterior knee pain complaint was assessed by Visual Analog Scale (VAS) while performing rest, walking, squatting, long-term sitting, kneeling, running, stair ascending, and stair descending at the time of 6 months in all patients.

**Surgical Technique**

All patients underwent spinal anesthesia with a tourniquet in the supine position. A longitudinal incision of approximately 4–5 cm was used over the patellar tendon when the knee was at 90° flexion. Medial parapatellar or transtendinous exposure was selected according to the surgeon’s preference.

After first entry with awl and closed reduction of the fracture, with the intramedullary guide, remercization was made in all frac-

tures. After the fluoroscopy control, the nails were placed with two proximal and distal locking screws. The mean operation time was 42 (28–125) min. Partial weight-bearing mobilization was allowed to all patients except two who had bilateral fracture, and isometric quadriceps exercises have been started immediately.

**Statistical Analysis**

Statistical tests were performed using Statistical Package for the Social Sciences version 22.0 software (SPSS IBM Corp.; Armonk, NY, USA). Student’s t-tests were used to compare continuous variables between patients with and without knee pain postoperatively. A p value of <0.05 was considered statistically significant.

**RESULTS**

The mean follow-up period of the patients was 12 (6–15) months. The mean union time of fractures was 5 (3–15) months. Severity of anterior knee pain was assessed by VAS while performing rest, walking, squatting, long-term sitting, kneeling, running, stair ascending, and stair descending (16). According to the scale, a score of 0 means no pain, <33 mild pain, 33–66 moderate pain, and >66 severe pain.

When patients were assessed by VAS for anterior knee pain, no pain was detected in 18 (38.2%) of 47 extremities, including all functional activities. There were 21 (44.6%) patients with mild anterior knee pain, 6 (12.8%) patients with moderate pain, and 2 (4.5%) patients with severe pain according to the mean VAS score (Table 1). Activities that mostly cause anterior knee pain are kneeling and squatting according to the VAS scores.

There was no statistically significant difference between the medial parapatellar method and the transtendinous method according to proximal nail entry exposures in anterior knee pain (p=0.927) (Table 2).

**Table 1.** Distribution of the incidence and severity of anterior knee pain according to the VAS in two surgical approach groups

	Transtendinous approach group (n=27)		Medial parapatellar approach group (n=20)	
	Incidence	Mean VAS	Incidence	Mean VAS
No anterior knee pain	10	0	8	0
Mild pain	13	17.35	8	15.15
Moderate pain	3	49.58	3	49.79
Severe pain	1	71.25	1	70.62

VAS: visual analog scale; n: number of fractures

**Table 2.** Statistical analysis of two approaches according to mean VAS scores

	n	Mean VAS	Standard deviation	Standard error mean
Medial parapatellar approach	27	132.0370	154.67248	29.76673
Transtendinous approach	20	136.5000	174.16039	38.94345

VAS: visual analog scale; n: number of fractures

t=-0.093; p=0.927

## DISCUSSION

The causes of the postoperative knee pain complication, developed after tibia nailing surgery, are thought to be multifactorial, although it is not known exactly today. The cause of this complication is still controversial, and it has been argued that it occurs due to the height of the nail, entry point of the nail, heterotopic ossification, trauma to the infrapatellar branch of the saphenous nerve, traumatization of the tendon or the fat pad, postoperative muscle weakness, malalignment, and age (12, 13).

In a review of 20 clinical studies, independent of the approach used, Katsoulis et al. (11) reported the incidence of anterior knee pain prevalence as 47.4%. In our study, 39 (83%) extremities had no or mild anterior knee pain, whereas 8 (17%) extremities had moderate or severe anterior knee pain.

Court-Brown et al. (9) and Keating et al. (14) identified younger patients as being at greater risk for chronic anterior knee pain and reported that younger patients are more symptomatic than older patients, probably because they are more active than older patients.

Some studies noted that transtendinous approach was associated with high rates of anterior knee pain and recommended a paratendinous approach for nail insertion. In retrospective studies, Keating et al. (14) reported 50% knee pain with medial paratendinous approach. In a prospective study, Väistö et al. (13) noted that 75% have knee pain when using a medial paratendinous approach. However, some authors noted that there is no any association with surgical approach and severity of knee pain (2, 6, 9, 17). In addition, in a meta-analysis of 11 retrospective and 9 prospective studies, a total of 1469 fractures showed that there was no statistical difference between the approaches with respect to pain. Of the 1460 patients, 629 had symptoms of anterior knee pain independent of the approach used (18). Our analysis also supports this review's results.

After tibial nailing surgery, prominence of the nail had been reported to be a risk factor of anterior knee pain. Court-Brown et al. (9) and Keating et al. (14) noted that nail prominence causes anterior knee pain. Bhattacharyya et al. (17) showed that marked superior nail prominence causes anterior knee pain while kneeling, that anterior nail prominence is associated with pain at rest, and that the nail–apex distance is associated with overall knee pain. In addition, they reported that <2.5 cm of the nail–apex distance reduces anterior knee pain.

In a cadaveric study, Hernigou and Cohen (19) dissected knees after intramedullary nailing of the tibia and revealed that the intra-articular structures that are at risk of damage during tibial nailing are the medial meniscus, the lateral tibial plateau, and the transverse ligament. Results of the study revealed that in some bones, the safety zone is smaller than the size of standard reamers and the proximal part of some nails.

Devitt et al. (20) dissected eight cadaveric knees and showed that intramedullary nailing of the tibia significantly increases contact pressures at the patellofemoral joint. They used the medial paratendinous and transtendinous approaches. With the medial

paratendinous approach, a significant increase in contact pressures was found at the lateral patellar facets. The contact pressure increases were recorded on both facets with the transtendinous approach, suggesting that chondral injury is more likely with this approach.

The etiology of anterior knee pain complication after tibial nailing is unknown and probably multifactorial. Usually, pain begins several months after surgery, and implant removal does not necessarily cure the problem. However, in a study, after removal of the nail, complete resolution of symptoms in 27.4% of patients, with marked improvement in 69.3%, was seen (9).

Leliveld and Verhofstad (21) studied 136 tibia fractures with regard to anterior knee pain, and despite the low number, statistical differences were found, and they provided arguments for their hypothesis that iatrogenic injury to the infrapatellar branch of the saphenous nerve is an important cause.

Our surgical experience has shown that “the transtendinous method” has some advantages, such as easier approach to nail entry point on the tibia and more vertical placement of the nail. Lateralization of the tendon with the “medial parapatellar method” allows for more mobilization of the patella and aids the protection of tendon integrity. At the same time with this exposure, if the skin incision is taken medially, the infrapatellar branch of the saphenous nerve can also be preserved.

Our study has some limitations. First, it is inherently limited by its retrospective design. Second, the relatively less number of patients is the weak points of our study. Although the present study does not detect the exact cause of postoperative anterior knee pain, it has shown that there is no significant difference between two exposures with respect to anterior knee pain.

## CONCLUSION

Although tibial nailing is a highly successful procedure for fracture healing, anterior knee pain remains the main disadvantage of it. Although our data showed no differences between the groups, the groups were relatively small to accept this null hypothesis with full confidence. Future controlled randomized studies with larger populations are required to confirm our results.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the Ethics Committee of Gaziantep University (Research Protocol Code:328)

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

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