

Comparative prospective study of knee pain in medial parapatellar and transpatellar entry for interlocking nail fixation of tibia fracture

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Objective: To compare two insertion techniques of intramedullary interlocking nails (medial parapatellar versus intrapatellar insertion) in patients with tibial fractures.

Methodology: This study was performed at Al-Kindy Teaching Hospital from August 2020 until March 2022. All 32 patients with tibial fractures (29 males and 3 females) were included for tibial closed nail fixation and then followed up for 6 months. We categorized these patients into two groups; Group A (16 patients), those treated by medial parapatellar insertion of an interlocking nail, and Group B (16 patients) with transpatellar tibial nail insertion. All patients were treated by the same surgical team.

Results: The range of movement in two weeks (from extension to flexion) was up to 30°. At the end of the follow-up period, all patients in Group A had

functional flexion greater than 90°, whereas three patients in Group B had limited flexion that necessitated scheduled physical therapy. Regarding the functional outcome, in group A patients and in group B patients, the mean International Knee Documentation Committee score demonstrated a better outcome in patients with medial parapatellar insertion than those in group B. According to the visual analysis score, the transpatellar insertion demonstrated more discomfort than that in the paramedial insertion group, both clinically and statistically.

Conclusion: Medial entry point in intra medullary tibial nailing had less anterior knee pain in post-operative follow up.

Keywords: Tibial fracture, interlocking nail, medial parapatellar, transpatellar.

INTRODUCTION

The tibia is the main weight-bearing bone in the leg, being the largest and strongest.¹ Tibial shaft fractures are open in nature because the medial surface is subcutaneous, and the mechanism of injury can be low or high energy. Spiral type fractures result from low energy trauma by torsional injury, while wedge or oblique-shaped fractures result from high energy trauma due to direct force insult.²

Non-operative management is usually obtained for minimally displaced low energy trauma closed, stable, isolated fractures, whereas most tibial high-energy fractures require operative fixation; these fractures are usually comminuted, unstable, and frequently accompany soft tissue injuries; these fractures are fixed by external fixation, intramedullary nailing, and plate locking.^{3,4}

The primary goals of operative tibia shaft fracture repair are to achieve anatomical consolidation, a healed fracture with pain-free weight bearing, and a good range of motion for the knee and ankle joints, while minimizing complications, particularly infection.⁴ According to Young's modulus of elasticity using the load-displacement compressive strengths for both the

tibia and fibula bones are extreme at their upper parts, while the compressive strength is lowest near the ankle.⁵ The tibia blood supply comes via the nutrient artery, which arises from the posterior tibial artery after arriving at the bone posteriorly below the soleal line, and periosteal vessels arise from the anterior tibial artery.⁶ The patellar tendon extends from the patellar apex, as an extension of the rectus femoris tendon above the patella (distal portion of the quadriceps tendon), and ends at the tibial tuberosity.⁷ The aim of the study was to compare two insertion techniques of the intramedullary tibia interlocking nail (medial parapatellar versus transpatellar insertion) in tibial fractures.

METHODOLOGY

This prospective randomized study was performed at Al-Kindy Teaching Hospital from August 2020 until February 2022 in the emergency department. The study was approved by the scientific unit in Al-Kindy College of Medicine, University of Baghdad and all participants gave an informed consent.

Patients were randomized as every other patient and managed in the orthopedic department by the same

surgical team, then followed up for 6 months. 32 patients (29 males and 3 females) we included with age more than 20 years, closed middle and distal third tibia shaft fractures with and without fibular fractures, and Gustilo grade I and II open fractures. Previous surgery around the knee, peri-articular fractures of the knee and ankle joints, ipsilateral femoral fractures, and proximal third tibia shaft fracture were excluded.

The patients were divided into two groups randomly, by an independent randomized computer application, as follows: Group A (n = 16): medial parapatellar tendon approach and group B (n = 16): the transpatellar tendon method for tibia shaft fractures was taken in intramedullary interlocking nail tibial nail insertion. All patients were followed up regarding freedom of mobility, knee pain anterior, pain in various movements, kneeling and squatting flexibility assessment. Standard surgical steps were used in both groups.

Both groups were followed up for clinical, radiographic and functional scoring at 2 weeks, 1 month, 3 months and 6 months from index surgery including (VAS "Visual analysis score"⁸ and IKDC "International Knee Documentation Committee" score systems⁹ in each follow up period both subjectively and objectively. The score results were calculated online via this link: <https://orthotoolkit.com/ikdc/>

Statistical Analysis: The data were processed with SPSS program to evaluate all results in each follow up periods using the standard deviation, mean, Correlation Coefficient, and T-distribution tests for the significant values. p value cutoff less than 0.05 was regarded as highly significant.

RESULTS

A total of 32 patients were divided into two groups of 16 patients each: Group A (15 males and 1 female) and Group B (16 males and 2 females). (P value = 0.231). The mean age was 42.88 years for the medial parapatellar approach and 41.52 years for the transpatellar approach (p = 0.301). In group A, 9 patients had right-side tibia fractures and 7 had left-side tibia fractures, while group B had 6 right-side tibia fractures and 10 left-side tibia fractures. Only two patients in group A and four patients in group B had fibula fractures.

The cause of fractures was primarily motor vehicle accidents in all patients (28 patients, two of whom had Gustillo I open fractures), with other causes including two patients falling on the ground during a sporting activity, one patient suffering a bullet injury (Gustillo II), and another falling from a great height. One patient had a bullet injury with minimal soft tissue loss, which was treated with staged operative debridement with a

temporary posterior slab above the knee, followed by a second definitive fixation with a closed tibial interlocking nail.

The range of movement for 32 patients in 2 weeks (extension to flexion) up to 30° was 14 and 15 patients in both groups A and B, respectively; only 2 patients in group A and one in group B had achieved 60° of flexion arch. At the end of the follow-up period, all patients in Group A had functional flexion greater than 90°, whereas three patients in Group B had limited flexion that necessitated scheduled physical therapy (Table 1).

On a scale of 0 to 10, pain was felt in the anterior aspect of the knee in the operated leg. The p-value was significant because, clinically and statistically, the transpatellar approach caused more discomfort than the paramedial insertion group during the follow-up phase (Fig. 1).

Table 1: The range of motion during each follow-up period.

Range of Motion	Group A (n = 16) (%)	Group B (n = 16) (%)
2 Weeks		
0 – 30°	14 (87.5%)	15 (93.75%)
30 – 60°	2 (12.5%)	1 (6.25%)
> 90°	0 (0)	0 (0)
1 Month		
0 – 30°	6 (37.5%)	14 (87.5%)
30 – 60°	8 (50%)	2 (12.5%)
> 90°	2 (12.5%)	0 (0)
3 Months		
0 – 30°	4 (25%)	8 (50%)
30 – 60°	10 (62.5%)	6 (37.5%)
> 90°	2 (12.5%)	2 (12.5%)
6 Months		
0 – 30°	0 (0)	2 (12.5%)
30 – 60°	0 (0)	1 (6.25%)
> 90°	16 (100%)	13 (81.25%)
p value	0.0485	

According to the IKDC functional score system, there was significant progress of functional outcome in both groups clinically and statistically with positive linear raise at the end of follow up period with better outcome

in group A patients than in B, the mean IKDC score were 88.5 and 73.6, respectively (Fig. 2). There were statistical differences in both groups when compared the results (Fig. 3).

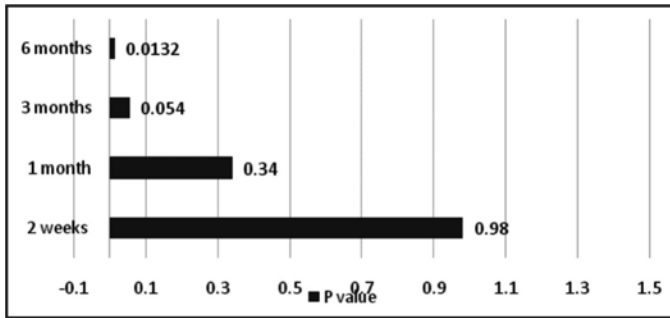


Fig. 1: p Value in each follow up period in both groups according to the IKDC score.

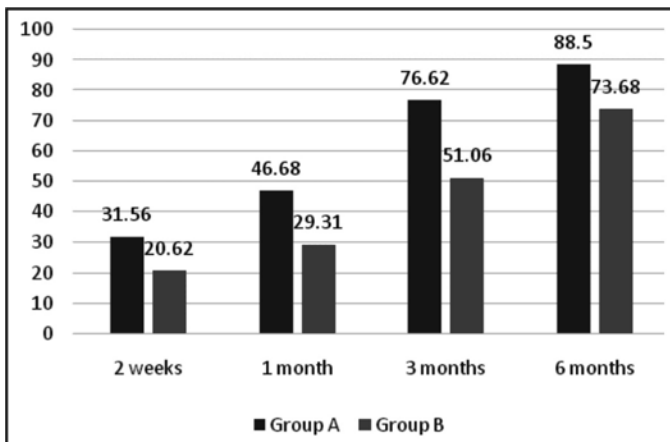


Fig. 2: Mean IKDC score for both groups.

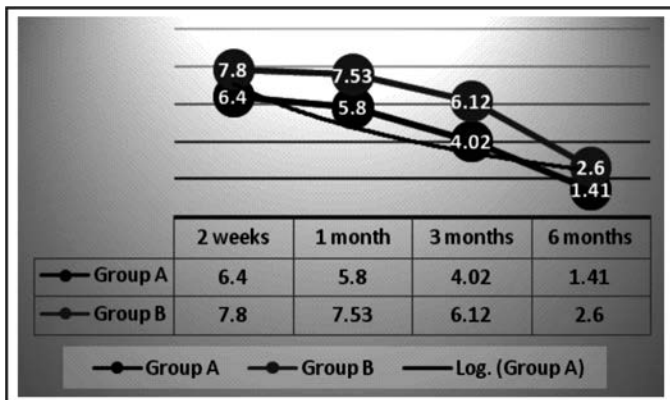


Fig. 3: VAS score in both groups.

DISCUSSION

The interlocking nail fixation for fracture shaft tibia is among primary management strategies for such fractures for several reasons, intramedullary location, loads bearing device and early weight bearing of

involved limb.⁴ The mean age of our patients was 41.52 ± 1.3 years which was slightly higher to Ghadeer et al¹⁰ and Mohammed Al-Sharaa et al,¹¹ with male predominance, similar to above studies.

One of the common complications of interlocking nails is anterior knee pain, which is reported in 18 – 86% of cases. There are several causes for such pain, including nail prominence, type of fracture, tibial plateau girth, fracture union, body mass index, sex, age, surgery time length, point of nail entrance, intra articular structure injury, infra-patellar fat injury, scar size, and site.³

Several authors advise that the medial parapatellar approach has less anterior knee pain when compared to the transpatellar approach for the nail insertion method for tibial shaft fracture fixation.^{12,13} None of our patients broken the hardware, had a patellar tendon rupture, or a scar neuroma, that could have predisposed to the anterior knee pain. Pain was reported via VAS score for our patients' ease of interpretation.

Keating, et al,¹⁴ in their retrospective study, found a clear association between the transtendinous surgical approach and chronic anterior knee pain, and recommended the routine use of the parapatellar approach. They also mentioned that the cause of anterior knee pain is multifactorial like violation of the proximal tibiofibular join by oblique locking screws, use of a transverse or longitudinal incision for tibial nail insertion, Swelling, infection, inadequate rehabilitation, and existing arthritis in the joint.

Another study done by Vaisto et al, listed that chronic anterior knee pain is a common complication after intramedullary nailing and the causes is unknown.¹⁵ Tahririan et al, state that anterior knee pain is related to the projection of the nail from the anterior tibia cortex rather than the type of fracture or surgical nail insertion, whether paratendinous or transtendinous approaches.¹⁶

The anterior knee pain is usually accompanied by the prominence of the nail.¹⁷ In our patients, the nail had been visibly hidden in the proximal tibial cortex at the time of surgery, and the mean impairment scale on kneeling and squatting at 4 weeks and 12 weeks the different between the groups was not statistically significant in both study groups. Also, the functional ability to squat and kneel at 4 weeks and 12 weeks was also not statistically significant.

We agree with Ahmad et al's study from Pakistan, which reported that patients with medial parapatellar nail insertion had less pain than patients with the transpatellar approach; in addition, burying the nail in the tibial metaphysis and avoiding intra-articular structure damage are important to reduce anterior knee pain, and a prominent nail can reduce knee pain.¹³

In our study, we recorded the anterior knee pain through VAS scale. The mean pain in both groups at 2 weeks, 4 weeks, and 12 weeks for the medial parapatellar and transpatellar groups was 5.8, 5.4, 2.6, 2.68, 1.08, and 0.88, respectively, with no statistically significant difference, as the p-value was greater than 0.05. Our result contrasted with the previous studies and was conducted over a long period of follow-up.^{12,17,18}

The main limitation of our study was the short period of follow-up. Thus, further studies with an extended follow up period are needed in order to compare all the possible causes of anterior knee pain, which is multifactorial. More, larger scale studies can be of value.

CONCLUSION

It can be safely concluded in this very small-scale study that medial entry point in intra medullary tibial nailing has less anterior knee pain in post-operative follow-up.

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