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CORRELATION OF ANTERIOR KNEE PAIN WITH NAIL PROMINENCE AFTER INTRAMEDULLARY TIBIAL NAILING

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Abstract

Background: Tibial diaphyseal fractures have been treated with intramedullary nailing on a regular basis. The most common post-operative consequence of this approach has been identified as chronic anterior knee discomfort. We investigated the connection between anterior knee discomfort and the proximal tibia nail tip position. **Materials and Methods:** June 2021 and October 2023, 52 tibial fractures were treated using locked intramedullary nails. We examined the relationship between postoperative anterior knee pain and age, gender distribution, distance from the tip of the nail to anterior cortex of tibia and height of the nail. Chi-square test was used to assess the incidence of knee pain. **Results:** The two groups were similar with respect to gender and follow up period. Out of 52 patients who had knee pain 32 (61.54%) had nail tip within proximal third distance from plateau to tibial tuberosity. Thirteen patients (25%) among knee pain group had nail prominence of more than 0-3mm from anterior tibial cortex followed by 11 patients (21.15%) within 4-6mm and 8 patients (15.38%) nail tip buried within the anterior cortex. the difference between the zones were found to be statistically significant (P= 0.031). **Conclusion:** A greater incidence of knee pain was found when nail was prominent more than 5mm and when it is in the proximal third distance from tibial plateau to tuberosity. Patients should be aware of high incidence of knee pain when the nail tip is placed in proximal third and prominence of more than 4-6mm.

Keywords: Tibia Nailing, Knee Pain, Tibial Articular Cartilage, Intra Medullary Nail.

1. INTRODUCTION

Intramedullary nailing is the most common treatment used for tibial shaft fracture management (1). Many complications like non-union, infection, malunion, deep venous thrombosis, thermal necrosis and compartment syndrome are reported following tibial nailing, but are relatively low when compared with other procedures (2)

Chronic anterior knee pain at the insertion site is among the most frequently reported complications with an incidence ranging from 10% to 87% and a mean incidence of 47.4% in meta-analysis (3). The cause of such pain remains unknown, but is believed to be multifactorial, with proposed causes being the surgical approach in relation to the patella tendon (1, 4), placement of the incision site, violation of Hoffa's fat pad, violation of intraarticular structures, nail prominence and nail diameter (4-7). In literature, incidence of knee pain after tibia nailing has been reported as skin incision, damage to intra-articular structures, gender, size of tibial plateau, and presence of implant in medullary cavity have been reported to be the cause of anterior knee pain (8). Often combinations of these factors are responsible for pain. Hence, it is difficult to predict based on single factor which patient is going to develop knee pain after tibia nailing (2, 9). Furthermore, several anatomic structures around the knee are prone to damage during nail insertion, including the patellar tendon (3), menisci, articular cartilage, the infrapatellar branch of the saphenous nerve and infrapatellar fat pad (5).

Additionally, the presence of prominent nail and/or screw and the associated muscular weakness have been described as causative factors of pain (10). Some nail designs, with the oblique screw in the proximal aspect, have proven to be biomechanically more stable in tibial fractures. Nevertheless, with this type of fixation, the proximal screw may injure the proximal tibiofibular joint, what may cause knee pain (11). In this study, we conducted a retrospective analysis of patients who had undergone surgery with the insertion of an Intramedullary nailing after tibial shaft fracture. The aim of this study was to evaluate the long-term frequency of anterior knee pain and associated with prominent of tip of tibia nial after treatment with intramedullary nailing.

2. MATERIALS AND METHODS

Between June 2021 and October 2023 in Erbil Teaching Hospital, East and West Emergency Hospital, 52 tibial fractures were treated using locked intramedullary nails. We examined the relationship between postoperative anterior knee pain and age, gender distribution, mechanism of injury, and position of the nails on radiography. The information regarding presence of anterior knee pain was obtained retrospectively from clinical notes. These patients were divided into two groups, Group A with 32 patients having anterior knee pain and Group B consisting of 20 patients without knee pain. A few patients in whom the nail was removed because of anterior knee pain after fracture union were also included in Group A. Mean follow up in group A was 19 months (range 9-28 months) and in group B was 18 months (range 14- 25 months).

In both groups distances from the nail to the tibial plateau and anterior tibial cortex have been evaluated in the final follow-up lateral x-rays according to definition of (12). All x-rays of the patients have been taken from a distance of 90 cm as a standard. In this evaluation; the distance between the line passing through the tibial plateau and the line parallel to this stripe thouching to the apex of the nail in the lateral x-ray is defined as the height of the nail. The so-called (-) values display the burial of the nail and (+) values show the amount of the height of the nail in the tibial plateau as well. On the same lateral x-rays anterior cortex-nail distance is defined as the distance between the lines drawn on the anterior cortex of tibia and anterior tip of the nail (Figure 1).

Statistical analysis was performed using Scatter plot graphing software (GraphPad Prism V.7, CA, USA). Results were represented in percentage and proportion. The association between nail position and anterior knee pain was assessed using Chi-square Test and the probability (P) value less than 0.05 was considered statistically significant.

RESULT

Fifty two patients were included in the study, age ranging between 18 years to 51 years. Among them, 38(73.08%) were males and 14(26.92%) were females. The highest frequency was found in age groups 31-40 years which was 14 (26.92%) followed by 41-50 years 13 (25%) and the lowest frequency was found in age group ≤20 years 6(11.54%). Statistically, there was no significant difference found among age groups (P= 0.3213).

Table 1: Demographic data in patients with anterior knee pain

Patient characteristics		No of cases	Percentage (%)	Group A (pain)	%	Group B (no pain)	%	P Value
Gender	Male	38	73.08	22	42.31	16	30.77	0.5237
	Female	14	26.92	10	19.23	4	7.69	
Ages	≤20	6	11.54	3	5.77	3	5.77	0.3213
	21-30	10	19.23	9	17.31	1	1.92	
	31-40	14	26.92	7	13.46	7	13.46	
	41-50	13	25.00	8	15.38	5	9.62	
	≥51	9	17.31	5	9.62	4	7.69	

Figure 1 revealed that, the post-operative x-ray distance from the tip of the nail to anterior cortex of tibia, from tip of nial to tibia plateau and subsidence of nail tip were documented. Furthermore, table 2 showed that, thirteen patients (25%) in Group A had anterior knee pain within 0-3mm, followed by eleven patients (21.15%) within 4-6mm and eight patients (15.38%) more than 7mm. Statistically, there was a significant difference found between two groups with the length of nail tip (P= 0.0068).

Figure 1: radiograph shows measurement of the nail apex distance in a patient after IM nailing (Nots: 1mm=3.78pix)

Table 2: Distribution of Patients With Anterior Knee Pain

Length of tip of nails (mm)	No. of cases	Group A (pain)	(%)	Group B (no pain)	(%)	P Value
0 to 3	30	13	25.00	17	32.69	0.0068
4 to 6	13	11	21.15	2	3.85	
>7	9	8	15.38	1	1.92	
Total	52	32	61.54	20	38.46	

In Group A, 14 out of 30 patients (26.92%) had nail tip in zone I followed by 10 (19.23%) in zone II and 8 (15.38%) in zone III. In Group B, 16 patients (30.77%) had nail tip in zone I followed by 3 patients (5.77%) in zone II and 1 patient (1.92%) in zone III as shown in table 3 and the difference were found to be statistically significant (P= 0.031).

Table 3: Distribution of anterior knee pain patients with respect zones

Zone of tip prominence	No. of cases	Group A (pain)	(%)	Group B (no pain)	(%)	P Value
Zone I	30	14	26.92	16	30.77	0.031
Zone II	13	10	19.23	3	5.77	
Zone III	9	8	15.38	1	1.92	
Total	52	32	61.54	20	38.46	

4. DISCUSSION

Anterior knee pain is a common complication of intramedullary nailing for tibia fractures (13). Many factors like damage to articular surface and meniscus, injury to the infrapatellar branch of the saphenous nerve, infrapatellar fat pad, nail prominence, thigh muscle weakness, and small plateau width contribute to the pain (2). The main limitation of our study is its retrospective, observational design. Prospective studies are ideal for studying factors, but retrospective studies often provide a starting point for future studies. However, given the logic of burying a nail, it may not be ethical to perform a randomized, prospective study of prominent versus non-prominent nails (3). The relatively low response rate might bias patient selection because patients not responding might have either more or less knee pain than the cohort reported (14).

After tibial nailing surgery, prominence of the nail had been reported to be a risk factor of anterior knee pain. Gustilo and Shaw (15)and Keating et al. (16) noted that nail prominence causes anterior knee pain. Bhattacharyya et al. (14) 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 (17).

Thirteen patients (25%) had anterior knee pain within 0-3mm, followed by ten patients (19.23%) within 4-6mm and eight patients (15.38%) more than 7mm. Statistically, there was a significant difference found between two groups with the length of nail tip. The protrusion of nail tip (anterior and superior prominence) has been reported as one of the contributing factors for knee pain (3). Keating et al in their study had observed that anterior knee pain was more related to ACD (of more than 5mm) rather than the height of nail (16). However, Bhattacharyya et al (14) reported that both anterior and superior nail prominence caused pain. In their study the greater incidence of rest pain was seen in anterior nail prominance, whereas superior nail prominence was associated with pain while kneeling (2, 18). Further analysis Zhang et al., (19) has revealed that the incidence of knee pain was significantly greater in patients with a short distance from the tip of the nail to the tibial plateau (<10 mm) and anterior border of the tibia (<6 mm), indicating that the distance from the tip of the nail to the tibial plateau and the anterior border of the tibia played an important role in knee pain. Based on our experience, we posit that the knee pain may be due to the excessive length of the intramedullary nail used in the primary surgery. Specifically, the protruding tip of the nail can easily irritate the surrounding soft tissue, thereby resulting in knee pain. In addition, we found that the tip of the nail did not often enter the knee joint cavity, so the range of knee motion was generally not limited.

In Group A, 14 out of 30 patients (26.92%) had nail tip in zone I followed by 10 (19.23%) in zone II and 8 (15.38%) in zone III. In Group B, 16 patients (30.77%) had nail tip in zone I followed by 3 patients (5.77%) in zone II and 1 patient (1.92%) in zone

III as shown in table 3 and the difference were found to be statistically significant (P= 0.031). The result agreed with Soraganvi et al., (2) which revealed that half of the patients with knee pain in our study had nail tip prominent superiorly 14 (26.92% in zone I) and anterior cortex nail (ACD) was more than 5mm (57%). These correlations were statistically significant. Hence, we recommend burying of the nail tip to avoid knee pain. However, it cannot be concluded that ACD is correlated more with anterior knee pain than superior prominance as there was marginal difference in incidence.

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 (17).

5. CONCLUSION

A greater incidence of knee pain was found when nail was prominent more than 4 mm and when it is in the proximal third distance from tibial plateau to tuberosity. Patients should be aware of high incidence of knee pain when the nail tip is placed in proximal third and prominence of more than 4mm.

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