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Anterior Knee Pain After Unreamed Intramedullary Nailing of the Tibia

KEYWORDS: Anterior knee pain, Tibia nail complications

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ABSTRACT ***BACKGROUND:*** *Tibial shaft fracture is the most common type of long bone fractures, and intramedullary nailing is the treatment of choice. Anterior knee pain (AKP) is the most common complication of tibial nailing. The exact etiology of AKP is unknown, and the reported incidence is between 10-86%. Since many activities of daily living of Indians need kneeling and squatting, knee pain can effectively limit these activities. We decided to evaluate knee pain in patients with tibial shaft fractures treated with unreamed intramedullary nailing in our hospital.*

METHODS: *We evaluated 60 patients between 20- 65 year old with tibial shaft fractures treated with intramedullary nailing from 2013 to 2014 with six months follow up period.*

RESULTS: *According to visual analogue scale (0-10), 35 (58.8%) patients had no pain. Anterior knee pain was mild in 14 (23.3%) cases; 9 (15%) cases had moderate pain, and 2 patient (3.33%) experienced severe pain. The most severe pain was felt in kneeling position and the mildest pain was felt in resting position.*

CONCLUSION: *The incidence of moderate to severe AKP in patients who had intramedullary nailing for tibial shaft fractures was relatively low.*

Introduction: Tibial shaft fracture is one of the most common types of long bone fractures in orthopedic practice.[1] Tibial nailing is associated with relatively low incidence of nonunion, malunion, infection, and compartment syndrome.[2-4] Anterior knee pain (AKP) is the most common complication after intramedullary nailing of tibia.[5] It has been reported that AKP following intramedullary nailing occurs in 10-86% of the cases[4,5] especially in young and active patients. Patients complain of AKP months after surgery, which is usually within 6 months in about 83% of patients.[6] The pain usually causes limitation of physical activities. Sometimes, the pain is so severe that affects patient's employment, and his/her daily or leisure activities; also, nail removal is indicated.[7] Toivanen et al and Court-Brown et al studied AKP in different daily activities such as kneeling, squatting, sitting, walking, running, jumping, stairs climbing, ladder climbing and resting position.[5,8] The exact etiology of AKP after intramedullary nailing is unknown,[9] but several studies have aimed to identify grounds of pain.[5-7,10] Cartwright et al also designed a scoring system for AKP.[10] Whereas many daily activities of Indians need kneeling, squatting, tailor position, knee pain can limit these activities.

Methods: This was a cross-sectional study conducted on patients above 20 year-old with tibial shaft fractures admitted to our hospital from august 2013 to august 2014. Patients with multiple fractures, knee injuries and knee pain before injury were excluded from the study. Only patients operated with unreamed interlocking nail were included in the study.

Patients were operated using vertical incision, with either midpatellar or parapatellar approaches. Fractures were manually reduced and fixed with unreamed intramedullary nail. The thickness of nails varied from 8 to 11 mm. The nails were fixed with two locking screws proximally and two locking screws distally. Patients were followed up for at least 6 months. A questionnaire was used for data collection, and visual analogue scale (0-10) was used for scoring the severity of pain.

Results: Total 60 patients were studied. The gender distribution included 40 (66.6%) men and 20 (33.3%) females. The age of patients varied from 20 to 65 years (mean, 40 +/- 15). The mean age of males was not significantly different than that of females (males: 30.2 ± 1.5, females: 33.6 ± 16.5; $p > 0.05$). Of 60 patients with tibial shaft fractures treated with intramedullary nailing, 35 (58.8%) cases had no AKP. Of 25 cases that had AKP according to visual analogue scale (0-10), 14 (23.34%) cases had mild (1-3 VAS), 9 (15%) had moderate (4- 6 VAS) and 2 patients (3.33%%) had severe pain (7-10 VAS). There was no significance difference in the severity of pain between two genders (chi-square test, $df = 3$, $p > 0.05$). Fractures of 141 (60.8%) cases were closed, and 91 (39.2%) ones were open. Of 232 patients, 20 (33.3%) cases were operated with parapatellar approach and 45 (66.6%) ones were operated with midpatellar approach. Mean severity of pain in two different approaches was compared but was not significant.

Pain in different positions is shown in **Table 1**. Mean severity of pain in open and closed fractures was 0.77 ± 1.5 and 0.7 ± 1.4, respectively. There was no correlation between severity of pain and age (Pearson correlation, $r = 0.01$, $p > 0.05$). Of the 20 patients operated with parapatellar approach, 9 (45%) cases, and of 40 cases operated with midpatellar approach, 7 (17.5%) ones had anesthesia around knee. This difference was found significant (Fisher exact test, $p < 0.001$). Prevalence of neuroma around incisions was higher in parapatellar approach compared with midpatellar approach (24% vs. 8%, respectively) but the difference was not significant (Fisher exact test, $p = 0.06$).

Table 1. Frequency distribution of knee pain by position

Patient's position	Number of patients
Walking	3 (12%)
Kneeling	9 (36%)
Tailor's position	8 (32%)
Climbing upstairs	7 (28%)
Descending downstairs	5 (20%)
Rest	1 (4%)

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Discussion: This study showed that the majority of patients with tibial shaft fractures treated with intramedullary nailing had no AKP. About 81.6% of patients in our study, 83% in Cartwright et al study[10] and 83% in Court-Brown et al study[8] reported no pain or mild AKP. A meta-analysis of 20 studies reported an average incidence of 47.4% of AKP after intramedullary nailing. This difference could be due unreamed nailing technique with narrower nail, and less bone and soft tissue damage at the entry point during surgery, which was applied in our study. The surgical approach, specifically through transpatellar or parapatellar tendons, has been reported as a contributory factor in developing AKP following tibial nail insertion. Many authors reported that AKP is more common in transpatellar approach, because of splitting of the patellar tendon and the generously innervated retrotendinous fat pad and their repeated injuries during the operation.[6] In parapatellar approach, the patellar tendon, the fat pad and the gliding tissues are not divided but are repeatedly traumatized by retractors and reamer. In this study, there was no correlation between the severity of pain and the surgical approach. While two studies showed similar results,[5,9] Keating et al reported that insertion of an intramedullary nail through the patellar tendon, results in significantly less frequent AKP compared with tendon retracting method. Althausen et al[11] demonstrated an anatomical variation in patellar tendon, and believed that the ideal entry point for tibial nailing is just medial to the lateral tibial spine on anteroposterior knee radiograph, and at anterior margin of the articular surface on the lateral knee radiograph. They recommended a preoperative fluoroscopy to guide the surgeon for correct entry point, and not using a single approach for all tibial nailings.

Unlike the current article in which around 36% of patients reported pain during kneeling, in Cartwright et al study, 81% of cases had pain in this position. The prevalence of knee pain during climbing up stairs, descending downstairs, and at rest in our patients were more or less the same as those of Toivanen et al study.[5] Vaisto et al noted that women were more symptomatic than men. The reason was unknown but anthropometric and anatomical differences were suggested as possible causative factors. In our study, there was no relation between severity of pain and sex.[7,9] There was no correlation between severity of pain and types of fractures whether in our study or the similar one.[10] Keating et al[6] also reported that the degree of comminution or fracture morphology had no influence on the development of knee pain. AKP can be an important limitation for patient, affecting his/her employment and daily or leisure activities. Cartwright et al followed 52 patients, 5 changed their occupations and 3 became unemployed.10

At the end, we would like to imply important technical and safety recommendations by Katsoulis et al during surgery to reduce AKP.[12]

1) "The skin incision should be placed away from the area involved in kneeling, particularly in patients who have to kneel daily because of the nature of their work.
2) Since the anatomical position of the infrapatellar branch of the saphenous nerve cannot be known in advance, horizontal incisions or percutaneous approaches should be favored, although in some cases a longitudinal incision is required. Limitedextension incisions could minimize the risk and incidence of injury to this nerve.
3) Protrusion of the nail should be avoided.
4) The length of the locking screws must be carefully checked to avoid protrusion and irritation of the soft tissues.
5) Injury to the patellar tendon, fat pad and gliding tissues should be avoided by the delicate use of the instruments and employing tissue protectors.

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