

## Infection Rate of Reamed versus Unreamed Intramedullary Nailing in Open Tibia Fractures

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### Abstract

**Background:** Intramedullary nailing (IM nailing) is the standard of care for the treatment of most diaphyseal lower extremity fractures. A few studies have assessed and compared the infection rate following reamed and unreamed IM nailing in open long bone fractures. In the present study, we attempted to compare the infection rate between two procedures in open fractures of tibia.

**Methods:** In this prospective study, we included consecutive patients suffering from open fractures of tibia (Gustilo subtypes II or IIIA) who required IM nailing. Patients younger than 16 years old, other Gustilo types (I, IIIB, and IIIC), fractures reaching to the tibial plateau articular surface, and simultaneous fractures of other bones in the extremity were excluded. All patients were followed up for one year to assess the postoperative infection rate.

**Results:** Of 59 patients, 37 underwent reamed IM nailing and 22 underwent unreamed IM nailing. In reamed group, 4 cases (10.8%) experienced an infection requiring reoperation and antibiotic therapy, while in the unreamed group, it was 5 cases (22.7%). The difference between the groups was not statistically significant.

**Conclusion:** Reamed and unreamed IM nailing procedures for fractures of tibia have similar outcome regarding long-term postoperative infections that require reoperation and antibiotic therapy.

**Keywords:** Infection; Fracture Fixation; Intramedullary; Tibia Fractures

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### Background

Fracture of tibia is a common long bone fracture, classified into closed/open and simple/complex (1). Because of its location and soft tissue coverage, the tibia is vulnerable to various types of trauma and serious complications such as delayed bone and soft tissue healing. The main goal of treatment is to achieve stable fixation and to minimize soft tissue injuries. Intramedullary nailing (IM nailing) is a common and accepted method for fixation of tibial shaft fractures and restoring coronal and sagittal alignment while maintaining bone length and rotation abilities (2-4). For distal tibial fractures, proper reduction and fixation of the distal fragment is paramount for a good outcome. To achieve this, serial radiological assessment in all planes is helpful.

IM nailing is now the standard of care for the treatment of most diaphyseal lower extremity fractures and has revolutionized the care of bone fractures (5). Initially, Kuntscher, the designer of the IM nailing technique, inserted a cloverleaf-shaped nail in the medullary cavity to obtain proper fixation in the isthmus through the elastic expansion of the nail (6). The main requirement for the nailing is the proper matching of the medullary canal and the nail (7). In other words, it would either result in appropriate jamming of the nail or iatrogenic fracture. To prevent this technical complication, reaming of the medullary canal was proposed (8). It can effectively increase the diameter of the cavity by removing the inner cortical bone and lead to a stabilized insertion of the nail into the

medullary canal (9,10).

Despite several benefits of reamed IM nailing, this technique may result in serious local and systemic complications. One of the major systemic complications is the increased risk of fat embolism and subsequent respiratory distress syndrome (RDS), particularly in multiple trauma patients (11,12). Other local complications are compartment syndrome, impaired cortical circulation, heat necrosis of the bone cells, and increased risk of local infections (13-15).

Only a few studies have aimed to assess and compare the infection of reamed and unreamed IM nailing in long bones. Hence, the present study aimed to compare the infection rate of reamed and unreamed IM nailing procedures in open tibia fractures.

### Methods

In this prospective cohort study, we recruited consecutive patients suffering from open tibia fractures (Gustilo subtypes II or IIIA) who required IM nailing. The exclusion criteria were as follows: 1) age less than 16 years, 2) Gustilo types of I, IIIB, and IIIC, 3) the fractures reaching to the tibial plateau articular surface, and 4) simultaneous fractures of other bones in the extremity. The study was approved by the Ethical Committee of Shahid Beheshti University of Medical Sciences, Tehran, Iran. Written consent was obtained from each patient.

Under spinal or general anesthesia, and in a supine position, all of the fractures were manually reduced and

fixed with a parapatellar approach. Two interlocking screws on each side of the fracture were used for fixation. All operations were performed by the same surgeon. IM reaming was conducted over a guide-wire with a cannulated power reamer. First, the surgeon reamed the IM canal until the first detection of "cortical chatter", forming the basis for the nail diameter, and then, the nail diameter was chosen 1-1.5 mm smaller than last reamer diameter. In the unreamed nailing group, the nail was inserted across the fracture site without reaming. Special attention was paid to prevent overdistraction and to achieve cortical contact of the fracture ends. An upper diameter limit of 10 mm and a nail measuring at least 2 mm less than the diameter measured at the isthmus of the tibia on anteroposterior (AP) and lateral radiographs were stipulated. The patients in both groups were followed up for one year to assess the major complications. The study endpoint was to compare the long-term consequences of the two procedures.

The normality of data was analyzed using the Kolmogorov-Smirnov test (K-S test). Categorical variables were compared using chi-square test or Fisher's exact test (when more than 20% of cells with an expected count of less than 5 were observed). For statistical analysis, we used SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA). P-values of 0.05 or less were considered statistically significant.

## Results

Fifty-nine patients were included in the study (37 reamed and 22 unreamed), of whom 51 (86.4%) were men and 8 (13.6%) were women, with a mean age of 29.5 years (range: 16-60 years). The type of trauma was pedestrian-car accident (n = 16), motor-car accident (n = 31), car-car accident (n = 10), and falling from height (n = 2). Of 37 patients who underwent reamed IM nailing, 4 cases (10.8%) suffered from an infection requiring reoperation and antibiotic therapy. The infection rate in the unreamed group was 5 out of 22 patients (22.7%). Although the rate of infection leading to reoperation was higher in the unreamed group, the difference was not statistically significant (P = 0.466).

## Discussion

In a single-center setting, we assessed the risk of infection in reamed versus unreamed IM nailing performed following fracture of tibia during a one-year follow-up period. We found a higher rate of infection requiring antibiotic therapy and reoperation in the unreamed group. However, this difference was not statistically significant. In other words, there was a similar one-year outcome in terms of infection and reoperation. There is a great discrepancy in infection rate between reamed and unreamed IM nailing when reviewing literature. A recent meta-analysis with the aim of comparing the outcome of these two procedures showed no difference in union rate, secondary surgery rate, implant failure rate, osteofascial compartment syndrome, and infection during the postoperative period (16). Similar to our findings, the risk of infection was similar in both types of procedures (relative risk of 1.03) with an acceptable homogeneity across the analyzed studies. However, the rate of infections was lower than our observations. As indicated by Keating et al. (17), the rate of infection in reamed and unreamed procedures was 4.0% and 2.5%, respectively. In another study by Sarmiento and Latta (18), the rate of postoperative infection was shown to be 1.9% and 2.6% in

reamed and unreamed procedures, respectively. A similar study by Finkemeier et al. (3), these rates were respectively 5.3% and 8.3% for reamed and 3.8% and 6.2% for unreamed technique, respectively. The higher infection rate in our study may be due to improper postoperative care, including improper antibiotic therapy or high antimicrobial resistance in our center. Also, our study was limited by the small sample size.

The risk of infection following IM nailing of closed long bone fractures is thought to be similar to the general risk of infection after any orthopedic trauma procedure. However, this risk substantially increases in the setting of open fractures and has been reported to range between 4% and 15% (19). The incidence is considerably higher in open fractures (Gustilo-Anderson type I fractures 5%, type II 10%, and type III over 15%) (20-22).

The main protocol for removing infection includes nail removal and placement with an antibiotic nail or nail retention with extensive soft tissue debridement and administration of proper antibiotics.

## Conclusion

Reamed and unreamed IM nailing in open tibia fracture have similar postoperative infection rate but in reamed nailing, we can use a bigger nail diameter and therefore, quality of fixation will be better.

## Conflict of Interest

The authors declare no conflict of interest in this study.

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