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Cochrane in CORR®: Intramedullary Nailing for Tibial Shaft Fractures in Adults (Review)

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Importance of the Topic

Tibial shaft fractures are the most common of long bone fractures [7, 13], occurring in 17 per 10,000 persons annually [6] and this rate is growing as low-and middle-income countries become increasingly motorized [11]. Tibial shaft fractures

typically are high-energy injuries, and often are complicated by deep infection, nonunion, malunion, and compartment syndrome [6]. These complications can lead to prolonged pain and disability, and they consume substantial healthcare resources [1, 10].

Current surgical options include external fixation, plate fixation, and intramedullary nailing. Survey data indicate nearly 90% of orthopaedic trauma surgeons prefer intramedullary

nailing for both open and closed tibial shaft fractures, but there is considerable variability regarding the preferred surgical approach, method of interlocking, nail material, and decision to ream the medullary canal [2, 5].

This Cochrane review determined whether different methods and types of intramedullary nailing were associated with unique benefits and harms when treating adults with tibial shaft fractures. Five different comparisons of interventions were assessed across 11 separate trials in 2093 participants (2123 fractures). The authors found insufficient evidence to determine the effects of treatment between most of the comparisons of interest, with the exception of reamed versus unreamed nailing. Reaming was associated with

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(Duan X, Al-Qwbani M, Zeng Y, Zhang W, Xiang Z. Intramedullary nailing for tibial shaft fractures in adults. Cochrane Database of Systematic Reviews 2012, Issue 1. Art. No.: CD008241. DOI: [10.1002/14651858.CD008241.pub2](https://doi.org/10.1002/14651858.CD008241.pub2).)

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Cochrane Reviews are regularly updated as new evidence emerges and in response to feedback, and The Cochrane Library (<http://www.thecochranelibrary.com>) should be consulted for the most recent version of the review.

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a lower risk of implant failure, and incidence of major reoperations related to nonunion in closed compared to open fractures (low-quality evidence).

Upon Closer Inspection

Unreamed nails have been postulated to preserve the intramedullary blood supply, but reaming is thought to deposit autograft bone at the fracture site while improving cortical contact at the bone-nail interface, increasing the stability of the construct [3, 8]. The majority of the trials included in the review compared these two interventions, but the results were dominated by one international, multicenter trial. The Study to Prospectively Evaluate Reamed Intramedullary Nails in Patients with Tibial Fractures (SPRINT) contributed 63% of the overall study review population (1319/2093), and 83% of the population from six trials addressing reamed versus unreamed nailing (1319/1588) [15].

It is important to account for imbalances in sizes of studies when conducting meta-analyses. To do so, the authors performed sensitivity analyses in which they switched from random-effects to fixed-effects statistical models [4]. Fixed-effect models assume constant treatment effects

across each of the studies included, such that studies have effect sizes (and weight) directly proportional to their number of patients, an approach that tends to discount the results of smaller studies relative to large ones. By contrast, random-effect models aim to estimate mean distributions of effects, which minimizes the influence of individual large studies and leads to more conservative summary estimates [4, 12]. The results of this review did not differ between fixed- and random-effect models, indicating that the results are robust and protected from the influence of the larger studies.

Take-home Messages

This Cochrane review found no important differences in rates of reoperations and complications between reamed and unreamed intramedullary nailing. The only prespecified subgroup analysis with sufficient data to be assessed was open versus closed fracture, which suggested that reamed nailing is more likely to reduce the incidence of major reoperations related to nonunion in closed fractures, where as in open fractures there was no difference open. A recent report of prognostic factors from SPRINT published subsequent to the Cochrane review [14]

found that open fractures had a higher risk than closed fractures of requiring a secondary intervention or developing a compartment syndrome when treated with reamed nailing, but not when treated with unreamed nailing.

According to the Grades of Recommendation, Assessment, Development and Evaluation (GRADE) approach [9], there is moderate quality evidence to suggest no substantial difference between reamed and unreamed nailing for rates of reoperation, nonunion, pain, deep-infection, malunion, or compartment syndrome. With respect to the other comparisons (one versus two distal locking screws, interlocking versus expandable nail, paratendinous versus transtendinous approach), the studies included were of low quality and subject to bias, which limited the investigators' ability to confidently pool data and draw meaningful conclusions. Additional large, high-quality studies are needed and to definitively examine the role of locking versus nonlocking implants, type of locking used, the number of locking screws required and the ideal approach for nail insertion. Particularly with the advent of newer nail insertion techniques (infra versus suprapatellar nailing), this evidence will be forthcoming as multicenter, randomized controlled trials are underway.

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Appendix



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Intramedullary nailing for tibial shaft fractures in adults (Review)
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[Intervention Review]

Intramedullary nailing for tibial shaft fractures in adults

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ABSTRACT

Background

Intramedullary nailing is commonly used for treating fractures of the tibial shaft. These fractures are one of the most common long bone fractures in adults.

Objectives

To assess the effects (benefits and harms) of different methods and types of intramedullary nailing for treating tibial shaft fractures in adults.

Search methods

We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register, the Cochrane Central Register of Controlled Trials, MEDLINE, EMBASE and reference lists of articles to December 2009. The search was subsequently updated to September 2011 to assess the more recent literature.

Selection criteria

Randomised and quasi-randomised controlled clinical studies evaluating different methods and types of intramedullary nailing for treating tibial shaft fractures in adults were included. Primary outcomes were health-related quality of life, patient-reported function and re-operation for treatment failure or complications.

Data collection and analysis

At least two review authors independently performed study selection, risk of bias assessment, and data collection and extraction.

Main results

Nine randomised and two quasi-randomised clinical trials, involving a total of 2093 participants with 2123 fractures, were included. The evidence was dominated by one large multicentre trial of 1319 participants. Both quasi-randomised trials were at high risk of selection bias. Otherwise, the trials were generally at low or unclear risk of bias. There were very few data on functional outcomes; and often incomplete data on re-operations. The trials evaluated five different comparisons of interventions: reamed versus unreamed intramedullary nailing (six trials); Ender nail versus interlocking nail (two trials); expandable nail versus interlocking nail (one trial);

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interlocking nail with one distal screw versus with two distal screws (one trial); and closed nailing via the transtendinous approach versus the paratendinous approach (one trial).

No statistically significant differences were found between the reamed and unreamed nailing groups in 'major' re-operations (66/789 versus 72/756; risk ratio (RR) 0.88, 95% confidence interval (CI) 0.64 to 1.21; 5 trials), or in the secondary outcomes of nonunion, pain, deep infection, malunion and compartment syndrome. While inconclusive, the evidence from a subgroup analysis suggests that reamed nailing is more likely to reduce the incidence of major re-operations related to non-union in closed fractures than in open fractures. Implant failure, such as broken screws, occurred less often in the reamed nailing group (35/789 versus 79/756; RR 0.42, 95% CI 0.28 to 0.61).

There was insufficient evidence established to determine the effects of interlocking nail with one distal screw versus with two distal screws, interlocking nail versus expandable nail and paratendinous approach versus transtendinous approach for treating tibial shaft fractures in adults.

Ender nails when compared with an interlocking nail in two trials resulted in a higher re-operation rate (12/110 versus 3/128; RR 4.43, 95% CI 1.37 to 14.32) and more malunions. There were no statistically significant differences between the two devices in the other reported secondary outcomes of nonunion, deep infection, and implant failure.

One trial found a lower re-operation rate for an expandable nail when compared with an interlocking nail (1/27 versus 9/26; RR 0.11, 95% CI 0.01 to 0.79). The differences between the two nails in the incidence of deep infection or neurological defects were not statistically significant.

The trial comparing one distal screw versus two distal screws found no statistically significant difference in nonunion between the two groups. However, it found significantly more implant failures in the one distal screw group (13/22 versus 1/20; RR 11.82, 95% CI 1.70 to 82.38).

One trial found no statistically significant differences in functional outcomes or anterior knee pain at three year follow-up between the transtendinous approach and the paratendinous approach for nail insertion.

Authors' conclusions

Overall, there is insufficient evidence to draw definitive conclusions on the best type of, or technique for, intramedullary nailing for tibial shaft fractures in adults. 'Moderate' quality evidence suggests that there is no clear difference in the rate of major re-operations and complications between reamed and unreamed intramedullary nailing. Reamed intramedullary nailing has, however, a lower incidence of implant failure than unreamed nailing. 'Low' quality evidence suggests that reamed nailing may reduce the incidence of major re-operations related to non-union in closed fractures rather than in open fractures. 'Low' quality evidence suggests that the Ender nail has poorer results in terms of re-operation and malunion than an interlocking nail.

PLAIN LANGUAGE SUMMARY

Intramedullary nailing treat tibial shaft fractures in adults

Fractures of the tibial shaft (breaks in the bone situated in the long middle section of the tibia or shin bone) are mostly caused by high-energy trauma, such as motor vehicle accidents. One commonly used method of fixation is intramedullary nailing. This involves the insertion of a metal rod, usually from the upper side of the tibia, into the inner cavity (medulla) of the tibia. The rod is generally held in place by screws. An available and widely used surgical technique of intramedullary nailing is inserting intramedullary nails with reaming (the bone cavity is reamed, before inserting the nail into the bone cavity space) or without reaming. This review looked at the evidence from trials comparing various types of intramedullary nailing.

Eleven studies involving a total of 2093 participants were included. The evidence was dominated by one large multicentre trial of 1319 participants. The methods of two studies were flawed such that their results were likely to be biased. The remaining studies were at a lower risk of bias. The trials evaluated five different comparisons of interventions. Only the two comparisons tested by more than one trial are reported here. These were reamed versus unreamed intramedullary nailing (six trials) and Ender nail versus interlocking nail (two trials). The review found no evidence of a significant difference between reamed and unreamed intramedullary nailing in re-operations for complications, nor in various complications such as nonunion (where the bone fails to heal). However, reamed nailing was more associated with a lower implant failure, such as broken screws, than unreamed nailing. Moreover, there was some weak evidence that reamed nailing may be associated with fewer major re-operations for non-union when used for closed fractures (where

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the skin remains intact) compared with open (where the skin is broken) fractures. The review also found that the Ender nail resulted in more re-operations and deformity (malunion) than an interlocking nail. The review concluded that there is insufficient evidence to draw definitive conclusions on the best type of, or technique for, intramedullary nailing for tibial shaft fractures in adults.

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