

Arthroscopically Assisted Suprapatellar Tibial Nail Removal



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Abstract: Intramedullary nailing remains the most popular and preferred method of fixation for tibial shaft fractures. The infrapatellar approach through the patellar tendon has long been considered the gold standard. However, the suprapatellar approach has gained popularity because of the advantages of being easier to perform when treating proximal shaft and metaphyseal fractures and there being less postoperative anterior knee pain. Despite increased use of this approach, the removal of the implant from the same suprapatellar approach is tricky, and in most cases, the removal is performed through a new transpatellar tendon approach. This article describes arthroscopically assisted suprapatellar tibial nail removal using the same approach and instrumentation of the nail insertion. The technique has the advantage of preserving the patellar tendon without causing secondary damage to it. Through arthroscopy, direct visualization of the patellofemoral joint aids in preventing possible cartilage injury. Moreover, any associated intra-articular lesions can be diagnosed and addressed.

Intramedullary nailing (IMN) remains the gold standard for tibial shaft fracture fixation. The goal of this surgical treatment is to restore the length and alignment of the tibia while maintaining its mechanical stability.¹ IMN is considered the standard of care for fixation because the periosteal blood supply it

preserved, less soft-tissue dissection is needed, and early weight bearing is made possible.²

Classically, the infrapatellar (IP) approach, performed with the knee flexed at 90° to facilitate access through the patellar tendon, was considered the standard procedure.³ The suprapatellar (SP) approach is another option that some surgeons use systematically for tibial shaft fractures. This approach provides some advantages: The patient can be placed with the knee extended, avoiding proximal fragment displacement by the extensor mechanism in some fracture patterns. It is also a good option when soft-tissue swelling or skin injury is present at the proximal third of the tibia because this approach stands far from it. Moreover, in patients with a proximal metaphyseal or proximal shaft fracture, this approach allows a more proximal entry point and a more vertical insertion of the nail to manage the reduction of the fracture. On the other hand, the main disadvantage of this approach is that the nail is introduced through the patellofemoral joint (PFJ).^{4,5}

Another limitation of the SP approach is the more demanding removal of the implant. The proximal end of the nail is slightly medial to the lateral tibial spine, and a bony overgrowth around the tibial nail insertion point can be found in most cases, thus making it more difficult to find the entry point. This article presents an arthroscopically assisted SP tibial nail removal

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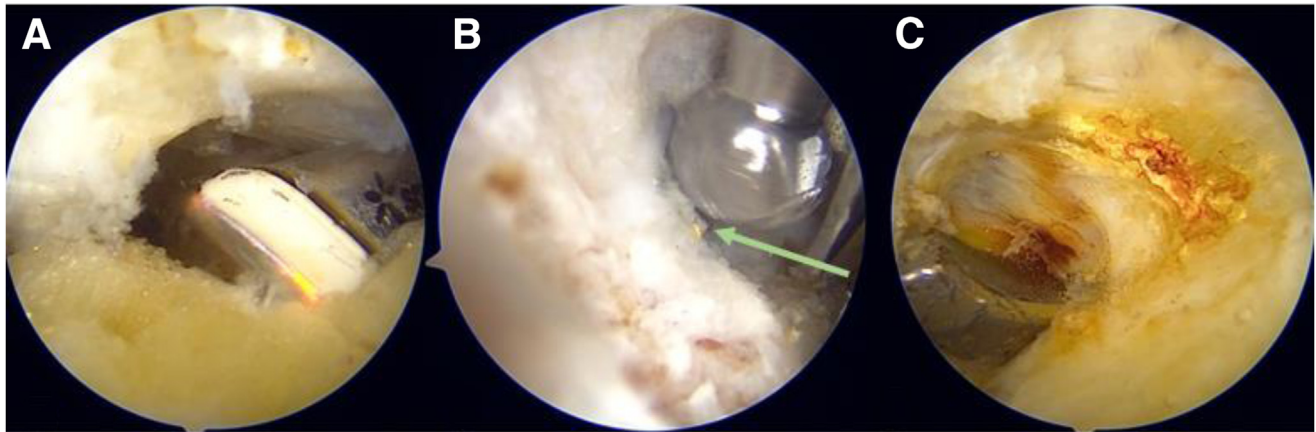


Fig 1. Patient in supine position, right knee; anterolateral viewing portal. After identification of the tibial nail entry site, scar tissue may be debrided. (A) A radiofrequency ablation shaver is used to debride the synovial tissue around the insertion point. (B) An aggressive shaver is used to remove bony overgrowth (green arrow) and allow adequate vision of the tibial nail. (C) View of tibial nail after synovial tissue and bony overgrowth removal.

procedure using the same approach and instrumentation used for the nail insertion.

Surgical Technique

Room Setup

The patient is placed supine on a radiolucent table with the injured leg positioned with a roll under the

knee joint in a semi-extended position (around 20° of flexion). A tourniquet is placed at the proximal third of the thigh, and an arthroscopic leg holder is placed at this level. The arthroscopic tower is placed on the opposite side.

Approach

The standard anterolateral portal is used as the viewing portal, and the anteromedial portal is used as the working portal. Diagnostic arthroscopy is performed to address potential cartilage or meniscal injuries ([Video 1](#)).

A 4.2-mm shaver is introduced through the anteromedial portal, and the synovial tissue is debrided to locate the tibial entry point. If needed, a radiofrequency ablation system can be used for soft-tissue resection. The tibial nail footprint should be identified anterior to the intermeniscal ligament. There may be a need to perform bony overgrowth debridement with the shaver, and all the bony and soft tissues should be debrided to precisely identify the nail cap.

A 20-mm longitudinal incision is made through the former SP incision. Then, with arthroscopic guidance, a 3.5-mm screwdriver is inserted to remove the nail's end cap. The end cap is removed and peripheral bone ingrowth is carefully debrided to ensure the correct entrance and threading of the universal rod (Stryker, Mahwah, NJ) into the nail ([Fig 1](#), [Video 1](#)). To avoid injury to the PFJ, it is recommended to pass the extractor rod through the lateral parapatellar space. Once the PFJ has been passed, the extractor is slid medially toward the entry point of the nail ([Fig 2](#), [Video 1](#)).

When the extraction rod is firmly attached to the nail ([Fig 3](#), [Video 1](#)), proximal and distal interlocking screws are removed through stab incisions. We recommend removing the interlocking screws only after the universal rod is attached to prevent nail rotation or migration.

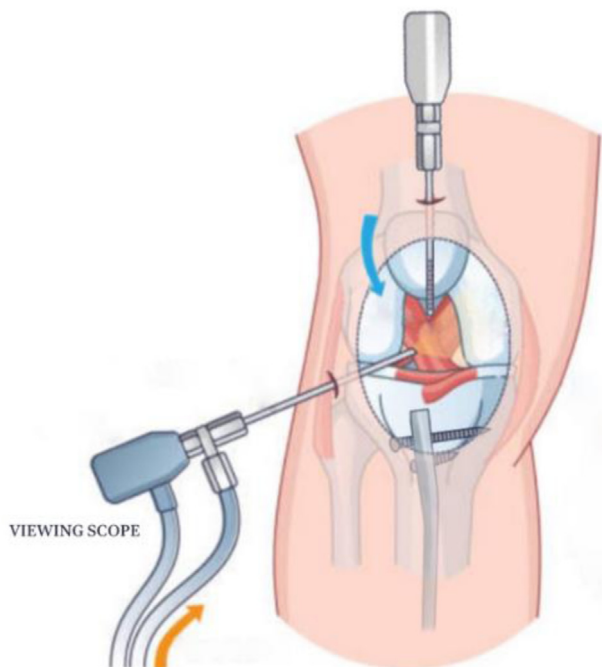


Fig 2. Patient in supine position, right knee; anterolateral viewing portal. A nail extractor is inserted via the supra-patellar wound and is passed via the lateral parapatellar space (blue arrow) to avoid patellofemoral chondral damage, with the viewing scope directed to it (orange arrow). After its entrance, the arthroscope is redirected medially to observe the tibial nail insertion point.

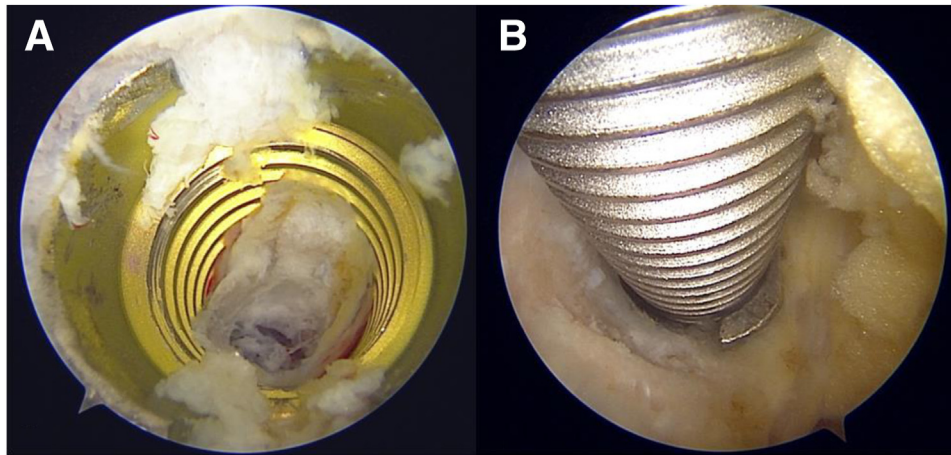


Fig 3. Patient in supine position, right knee; anterolateral viewing portal. (A) After the removal of the nail's end cap, peripheral bone ingrowth is debrided, allowing for the entrance of a universal rod. (B) After the rod is threaded and attached to the nail, removal of the interlocking screws can be performed.

Once all screws are removed, nail removal may proceed (Fig 4). All wounds are irrigated to prevent infection. A suction drainage tube is inserted to avoid postoperative hematoma. The quadriceps tendon is closed with resorbable sutures. The wound is then closed per the surgeon's preference.

Discussion

IMN using the SP approach has come into greater use among orthopaedic surgeons as the standard of care for

tibial shaft fractures. Reduced total blood loss, a decrease in anterior knee pain, and better functional outcomes are among the potential advantages of the SP approach when compared with the IP approach.⁶⁻⁸ In fact, the potential benefits of using the SP approach in the treatment of proximal and distal tibial fractures have also been described in the literature. According to Chen et al.,⁹ SP nailing reduces the incidence of malalignment or angular deformity by neutralizing deforming forces.

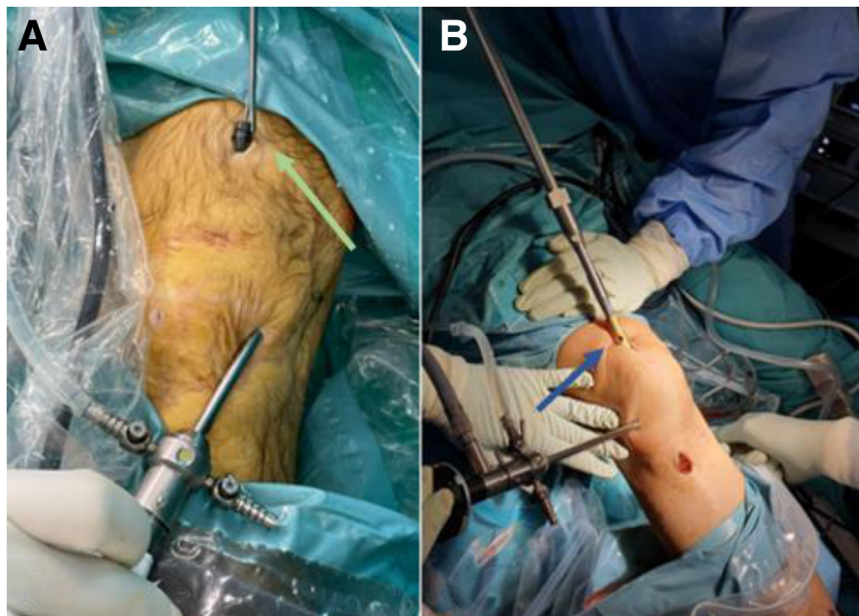


Fig 4. Patient in supine position, right knee; anterolateral viewing portal. (A) A 20-mm incision (green arrow) is performed after anteromedial and anterolateral portals are placed. (B) After distal and proximal interlocking screw removal, the nail may be extracted (blue arrow).

Table 1. Advantages and Disadvantages of Arthroscopically Guided Tibial Nail Removal

Advantages	
The technique avoids the use of an incision in native tissue.	
The patellar tendon is not involved in the removal of the nail.	
There is no need for fluoroscopic guidance for tibial nail removal.	
Fluoroscopic views may only be needed in case of difficulty in finding interlocking screws.	
Diagnostic arthroscopy may be performed to address intra-articular injuries.	
Visualization of the patellofemoral joint is possible during nail removal, avoiding contact between surfaces.	
Disadvantages	
The technique may be more challenging for surgeons with limited experience performing arthroscopy.	
In osteoarthritic knees, the patellofemoral space may be decreased, thus making nail removal difficult.	

Reoperation rates after tibial nailing have been reported to range between 17% and 44%.^{10,11} According to Hendrickx et al.,¹² the most common causes of tibial nail removal include pain, malunion, nonunion, and deep infection. One of the disadvantages of SP nailing is the need for a second incision with native soft-tissue dissection. Others include intraoperative blood loss and potential scarring that may lead to increased anterior knee pain.⁷ The suggested mechanisms for the development of knee pain after an IP approach include longitudinal division of the patellar tendon, IP nerve injury, and intra-articular structural damage.¹³ Although the SP approach may prevent these, surgeons may bring on articular and structural damage using the standard IP approach in the case of nail removal (Table 1).

One of the major concerns around the SP approach is the risk of damaging the PFJ during nail guide insertion. According to Gelbke et al.,⁴ PFJ contact pressures remain below the threshold reported to cause chondral damage during nail insertion. Arthroscopy also allows the surgeon to see whether there is any chondral damage produced on either nail insertion or removal and to treat any possible injuries that may have occurred.

To our knowledge, there is only 1 cadaveric study on SP removal of tibial nails with a percutaneous guide reported in the literature.¹⁴ Recently, in a cohort of 12 patients who underwent open SP removal, the authors reported the absence of complications and found excellent functional results assessed with the Lysholm score after the removal procedure.¹⁵

The described technique lays out an arthroscopically assisted procedure using iterative incisions. Although several benefits of inserting tibial IMN with an SP approach have been reported, nail removal and potential damage to the PFJ remain concerns for its

application. The use of arthroscopy makes it possible to identify the tibial nail footprint, as well as guide tibial nail removal, thus avoiding chondral damage.

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