

Suprapatellar Nailing of the Tibia: Indications, Advantages, Disadvantages, Surgical tips and tricks

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Abstract

Extra-articular proximal tibial fractures account for approximately 10% of all tibial fractures. In proximal tibial shaft fractures, surgeons have struggled with inadequate maintenance of reduction, suboptimal reaming, and poor placement of the nail resulting in malalignment and further complications. The primary indication for suprapatellar nailing is probably an extra-articular proximal tibia fracture. Suprapatellar intramedullary nailing is a safe and easy method for treating extra-articular proximal tibia fractures without causing malalignment and without resorting to additional fixation methods.

Keywords: Suprapatellar nailing; Proximal tibia fracture; Nailing techniques.

Introduction

Extra-articular proximal tibial fractures account for approximately 10% of all tibial fractures [1]. Intramedullary nailing is the gold standard for diaphyseal fractures of tibia [2]. The consistent success has ensured that the indications have extended to proximal and distal tibial fractures. In proximal tibial shaft fractures, surgeons have struggled with inadequate maintenance of reduction, suboptimal reaming, and poor placement of the nail resulting in malalignment and further complications. This led Tornetta and Collins to develop a nailing technique that employed a semi-extended position of the knee [3]. This resulted in minimal apex anterior angulation in all patients. Dean Cole was the first person to advocate a suprapatellar approach using a midline quadriceps tendon incision.

The suprapatellar approach in extra-articular fractures of proximal tibia helped minimize complications by ensuring that the reduction could be done in an extended or semi-extended position. This prevented the malalignment at the fracture site by minimizing the strong extensor action of the patellar tendon. It was reasonably pointed out that injury to the patellofemoral cartilage was unavoidable. Yet, the procedure has been gaining acceptance in recent days.

The purpose of this article was to present the technique of suprapatellar nailing of the tibia and essential tips and tricks to improve the ease and results of the surgery.

Indications

The primary indication for suprapatellar nailing is probably an extra-articular proximal tibia fracture. Benefits are also obtained in tibia fractures associated with flexion deficit knees, where proper knee flexion may not be possible. Another important indication of this method is a fracture associated with the poor skin condition of the infrapatellar region. Less commonly cited indications are patella baja, ossified patellar tendon or with additional nerve and/ or blood vessel damage [4]. Further, for patients with vascular and severe soft tissue injuries, pedicle flaps/free flaps, it may be preferable to nail without much manipulating of the involved extremity. This is where further indications may exist.

Advantages and Disadvantages

After the introduction of the suprapatellar nail by Tornetta et al. five and Cole et al. [6], many authors came with good results and substantial advantage over that of infrapatellar nailing. But still, several RCTs results were inconclusive and showed no definite superiority of the suprapatellar approach [7].

The advantages of suprapatellar nailing over infrapatellar nailing are enunciated here: 1) The suprapatellar approach does not injure the patellar tendon, which is one of the strongest extensors of the knee [8]. 2) Suprapatellar approach avoids the risk of infrapatellar nerve damage, which proved to be one of the major causes of postoperative pain in the form of VAS score [9, 10, 11, 12]. 3) One of the studies [13] showed a higher risk of articular structures with the infrapatellar standard nail than the suprapatellar nail, but it was not statistically significant. 4) The range of movement of the knee following surgery was found to be more in the suprapatellar group in one study [14], but it was not significant. 5) Lysholm knee scores describe a validated evaluation of patient activities of daily living. Lysholm knee scores were found to be higher for suprapatellar approach [15, 16]. 6) The fluoroscopic time is significantly decreased in the suprapatellar group due to ease of shooting AP and Lateral radiographic view [16]. 7) In the proximal fracture, easy reduction of fracture can be achieved in



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Figure 1: limb position during surgery



Figure 2: Guide wire insertion lateral view

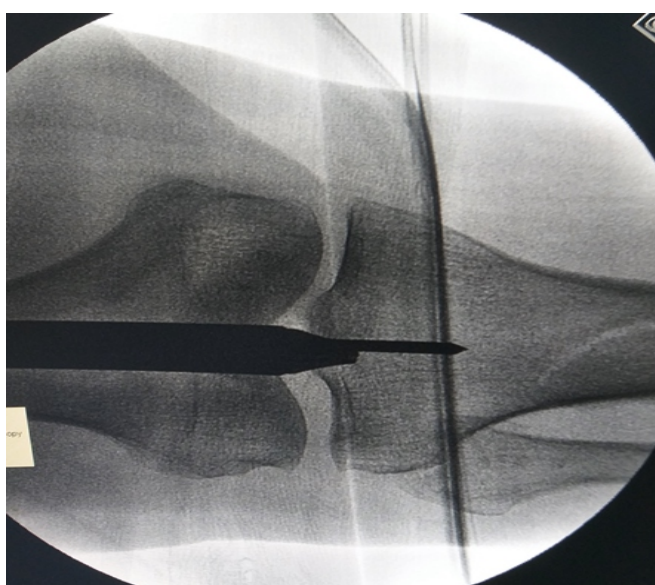


Figure 3: Guide wire insertion AP view

the suprapatellar approach as knee bending increases the proximal fragment extension, leading to difficult reduction [17]. 8) There is a significant decrease in blood loss in the suprapatellar approach than the infrapatellar approach [16]. 9) The HHS and Johnner- Wruhs scores were significantly better in the suprapatellar nailing group, as reported by wang et al. [18]. 10) Rehabilitation is faster in the suprapatellar group due to less postoperative pain [7]. 11) As mentioned in the AAOS annual meeting 2016, Supra patellar nail can reduce the incidence of angular deformity (3.8%) as compared to infrapatellar nail (26.1%) [7].

There are some disadvantages of suprapatellar nailing as well, like 1) As because the suprapatellar nailing involves intra articular procedure, there are chances of damage of intraarticular structures such as cartilage, meniscus, ligaments and other soft tissue [19]. 2) There is an increased chance of knee joint infection as compared to infrapatellar nailing [19]. 3) In implant removal, it may require a different approach, which may be the infrapatellar approach [19].

Surgical Techniques

The patient is positioned supine in a radiolucent table with a bolster below the knee to provide 10 to 20 degrees of flexion (Figure 1). A tourniquet is applied, and the affected limb is painted and draped. Fluoroscopy is positioned on the opposite side for convenience. Boundaries of the patella are marked using a skin marking pen. A 3 cm long longitudinal incision ending 1cm proximal to the superior pole of the patella is made. Quadriceps tendon is incised along the length of the skin incision, following which a protective cannula is inserted through the retro patellar space.

Entry is made at just medial to lateral tibial eminence in AP view and in-line with anterior cortex and intramedullary canal in lateral view (Figure 2, 3). A guide pin is passed and kept in place. Entry reamer/awl is passed through the guide pin, and the medullary canal is opened. The guide pin is exchanged with the ball-tipped guidewire. The guidewire is passed to the distal fragment, ensuring that it is within the medullary canal. The guidewire tip must lie in the centre, both in AP and lateral views. Sequential reaming is done starting from 8.5 mm, holding the fracture in a reduced position. An appropriate nail, preferably 1 to 1.5 mm less than the reamer size, is inserted after adequate reaming. The reduction is checked under c arm. The guidewire is then removed.

Distal locking is done in different axis followed by reverse hammering to achieve compression at the fracture site. Certain manufacturer's implants come with an option for a proximal dynamic screw that can achieve reduction at the fracture site up to 8 mm, and static screws are fixed in different axes.

The jig is then removed. Joint lavage is done with adequate normal saline to wash out any bone debris. A thorough wound wash is given, and the wound site is closed. A sterile dressing is applied. The tourniquet is then released.

Tips and Tricks

For a successful procedure (Figure 4-6), here are some simple tricks and tips like 1) In case of tight knees, it is advisable to release the medial retinaculum to provide easy passage of the sleeve and avoid iatrogenic damage to the knee joint. 2) Protection sleeve ideally fixed after getting the appropriate angle of the guidewire. Intraoperatively



Figure 4: Pre operative X-Ray



Figure 5: Post operative X-Ray AP view



Figure 6: Post operative X-Ray Lateral view

displacement of the protection sleeve may result in intraarticular damage. 3) It should be kept in mind that after reaming, the metal sleeve must be removed, keeping the outer silicone sleeve in place to avoid iatrogenic damage while inserting the nail. 4) After the procedure, one should irrigate the knee joint with a sufficient amount of normal saline to wash out all the bone debris present in the joint to get a favorable result.

Discussion

Supra patellar nailing is a less cumbersome procedure. The surgical time, intraoperative blood loss and the requirement of fluoroscopy devices are much less compared to infrapatellar nailing. Due to all these, the role of an assistant is very much limited in this surgery. It is mainly indicated in extra-articular proximal tibia fractures, though it can be performed in mid and distal shaft fractures. It is particularly preferred in cases with a poor infrapatellar skin condition. The method has notable advantages but also possess possible risks that should be anticipated. The main advantage is that it prevents extensor lag by avoiding damage to the patellar tendon and possible injury to the infrapatellar nerve, common after infrapatellar nailing.

Overall this method helps in faster rehabilitation and lesser complications. In Tornetta and Collins original series of 25 patients, one patient developed postoperative hemarthrosis, and two patients had minor cartilage abrasion. The disadvantages of these can be easily tackled in the present set up by flexing the knee 20 to 30 degrees and using a protective sleeve during the procedure. Intraarticular infections can be prevented by giving a thorough wash of the joint following insertion of the nail.

Supra patellar nailing is a relatively newer technique compared to the conventional infrapatellar approach. It has lesser complications, and with more recent instrumentation and proper technique, the complication rate has almost become negligible.

Conclusion

Suprapatellar intramedullary nailing is a safe and easy method for treating extra-articular proximal tibia fractures without causing malalignment, without resorting to additional fixation methods.

References

1. Court-Brown CM, McBurnie J. The epidemiology of tibial fractures. *J Bone Joint Surg Br* 1995;77:417–21.
2. Attal R, Hansen M, Kirjavainen M, Bail H, Hammer O, Rosenberger R, et al. A multicenter case series of tibia fractures treated with the Expert Tibia Nail (ETN). *Arch Orthop Trauma Surg* 2012;132:975–84.
3. Tornetta P, Collins E. Semiextended position of intramedullary nailing of the proximal tibia. *Clin Orthop Relat Res* 1996;328:185–9.
4. Franke J, Hohendorff B, Alt V, Thormann U, Schnettler R. Suprapatellar nailing of tibial fractures—Indications and technique. *Injury*. 2016;47(2):495–501.
5. Tornetta P, 3rd, Riina J, Geller J, et al. Intra Articular anatomic risks of tibial nailing. *J Orthop Trauma* 1999;13:247–51
6. Cole JD. Distal tibia fracture: Opinion: intramedullary nailing. *J Orthop Trauma* 2006;20:73–4
7. Chen X, Xu HT, Zhang HJ, Chen J. Suprapatellar versus infrapatellar intramedullary nailing for treatment of tibial shaft fractures in adults. *Medicine (Baltimore)*. 2018;97(32):e11799.
8. Morandi M, Banka T, Gaiarsa GP, Guthrie ST, Khalil J, Hoegler J, Lindeque BG. Intramedullary nailing of tibial fractures: review of surgical techniques and description of a percutaneous lateral suprapatellar approach. *Orthopedics*. 2010;33(3):172–9.
9. Song SY, Chang HG, Byun JC, Kim TY. Anterior knee pain after tibial intramedullary nailing using a medial paratendinous approach. *J Orthop Trauma*. 2012;26(3):172–7.
10. Jang Y, Kempton LB, TO MK, Sorkin AT. Insertion-related pain with intramedullary nailing. *Injury*. 2017;48(Suppl 1):S18–21.
11. Leliveld MS, Verhofstad MH. Injury to the infrapatellar branch of the saphenous nerve, a possible cause for anterior knee pain after tibial nailing? *Injury*. 2012;43(6):779–83.
12. Courtney PM, Boniello A, Donegan D, Ahn J, Mehta S. Functional knee

- outcomes in infrapatellar and suprapatellar tibial nailing: does approach matter? *Am J Orthop*. 2015;44(12):E513–6.
13. Gaines RJ, Rockwood J, Garland J, Ellingson C, Demaio M. Comparison of insertional trauma between suprapatellar and infrapatellar portals for tibial nailing. *Orthopedics*. 2013;36(9):e1155–8.
 14. Chan DS, Serrano-Riera R, Griffing R, Steverson B, Infante A, Watson D, Sagi HC, Sanders RW. Suprapatellar versus infrapatellar tibial nail insertion: a prospective randomized control pilot study. *J Orthop Trauma*. 2016;30(3):130–4.
 15. Lysholm J, Gillquist J. Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale. *Am J Sports Med*. 1982;10(3):150–4.
 16. Yang, L., Sun, Y. & Li, G. Comparison of suprapatellar and infrapatellar intramedullary nailing for tibial shaft fractures: a systematic review and meta-analysis. *J Orthop Surg Res* 13, 146 (2018).
 17. Brink O. Suprapatellar nailing of tibial fractures: surgical hints. *Current orthopaedic practice*. 2016;27(1):107–12.
 18. Wang Z, Li SL, Wang XY, et al. Supra-patellar versus infra-patellar intramedullary nailing in treatment of tibial shaft fractures. *China J Orthop Trauma* 2016;18:283–9.
 19. Hessmann, M.H., Buhl, M., Finkemeier, C. et al. Suprapatellar nailing of fractures of the tibia. *Oper Orthop Traumatol* (2020).

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