



ORIGINAL ARTICLE

## Radiological and clinical results of tibia fractures operated with the suprapatellar approach; one center experience

### Suprapatellar Yaklaşım ile Opere Edilen Tibia Kırıklarının Radyolojik ve

### Klinik Sonuçları; Tek Merkez Deneyimi

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#### ABSTRACT

**Aim:** Tibial fractures are the most common fractures in the lower extremity. Intramedullary nailing is a widely used surgical technique for the treatment of tibial fractures. The aim of this retrospective study is to analyse the clinical and radiological outcomes of suprapatellar tibial nailing performed in a single centre.

**Methods:** The study was conducted at a single center between January 2020 and June 2022. Patients treated for tibial fractures at the age of 18 years or older, having acute tibia fractures amenable to suprapatellar nailing, and having available preoperative and postoperative radiographs and clinical follow-up data. Included in this study. Clinical outcomes were assessed by examining range of motion of the knee joint, Visual Analog Score for pain and Lysholm scale for knee joint functions. Radiological outcomes, including fracture healing, alignment, were also evaluated using postoperative radiographs. Complications, such as malalignment, non-union, infection, and knee stiffness, were recorded.

**Results:** 12 patients were included in this study. Mean age was 35,25 and 9 were male. Mean follow up time was 20 month. All the fractures healed during the last examination. The mean VAS Score was 1,33 and Lysholm's score was 92,5. There were no malunion according to the x ray examinations. Range of motion of the knee was between 120 degrees flexion and 180 degrees extension. The maximum shift was 9 degrees.

**Conclusion:** According to the findings of this current study suggest that suprapatellar tibial nailing technique is a viable option for treatment of tibial shaft fractures. This approach is associated with lower rates of anterior knee pain as reported in the literature, alongside excellent union rates and clinical functional scores.

**Keywords:** Intramedullary nailing, suprapatellar approach, tibia fractures

#### ÖZ

**Amaç:** Tibial kırıklar, alt ekstremitede en sık görülen kırıklardır. İntramedüller çivileme, tibial kırıklarının tedavisinde yaygın olarak kullanılan bir cerrahi tekniktir. Bu retrospektif çalışmanın amacı, tek bir merkezde gerçekleştirilen suprapatellar tibial çivilemenin klinik ve radyolojik sonuçlarını analiz etmektir.

**Gereç ve Yöntemler:** Çalışma, Ocak 2020 ile Haziran 2022 tarihleri arasında tek bir merkezde gerçekleştirildi. 18 yaş ve üzeri, suprapatellar çivilemeye uygun akut tibia kırıkları olan ve ameliyat öncesi ve sonrası radyografileri ve klinik takip verileri mevcut olan hastalar çalışmaya dahil edildi. Klinik sonuçlar, diz eklemi hareket açıklığı, ağrı için Görsel Analog Skor ve diz eklemi fonksiyonları için Lysholm skalası incelenerek değerlendirildi. Kırık iyileşmesi, dizilim gibi radyolojik sonuçlar da postoperatif radyografiler kullanılarak değerlendirildi. Dizilim bozukluğu, kaynamama, enfeksiyon ve diz sertliği gibi komplikasyonlar kaydedildi.

**Bulgular:** Bu çalışmaya 12 hasta dahil edildi. Ortalama yaş 35,25 idi ve 9'u erkekti. Ortalama takip süresi 20 ay idi. Tüm kırıklar son muayenede iyileşti. Ortalama VAS Skoru 1,33 ve Lysholm skoru 92,5 idi. Röntgen muayenelerine göre malunion yoktu. Diz hareket açıklığı 120 derece fleksiyon ve 180 derece ekstansiyon arasındaydı. Maksimum kayma 9 derecedeydi.

**Sonuç:** Bu güncel çalışmanın bulgularına göre, suprapatellar tibial çivileme tekniğinin tibial shaft kırıklarının tedavisinde uygulanabilir bir seçenek olduğu düşünülmektedir. Bu yaklaşım, literatürde bildirildiği gibi daha düşük ön diz ağrısı oranlarının yanı sıra mükemmel kaynama oranları ve klinik fonksiyonel skorlarla ilişkilidir.

**Anahtar Kelimeler:** İntramedüller çivileme, suprapatellar giriş, tibia kırığı

## Introduction

Tibial fractures are the most common fractures of the lower extremity.[1, 2] The main causes of tibial fractures have wide range from high energy trauma to low-energy mechanisms.[1] These fractures are important due to the unique anatomy and load-bearing function of the tibia. Early mobilization and return to work are among the main targets of the surgical treatment.[1] In children most of these tibial fractures are treated with cast immobilization while surgery becomes the gold standard in adults. Plate fixation and intramedullary nailing are the most popular techniques for surgical management of tibial fractures in adults.[3]

Intramedullary nailing is a widely used surgical technique for the treatment of tibial fractures, particularly for those located in, but not limited to, the shaft of the bone. Intramedullary nailing offers several advantages over other treatment options such as early mobilization, better alignment of the fracture, and improved biomechanical stability. There are two main types of this surgery: suprapatellar nailing and infrapatellar nailing.[4](Figure 1)

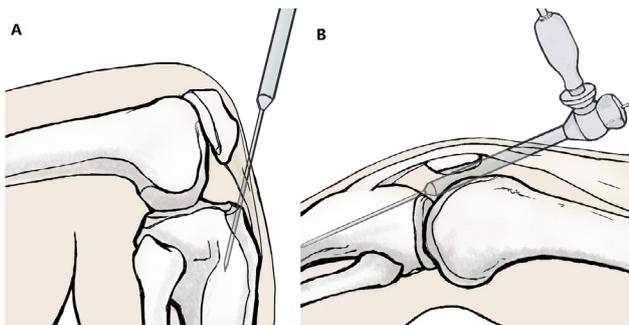


Figure 1. A -Infrapatellar nailing, B-Suprapatellar nailing

The traditional infrapatellar approach for tibial IMN involves placing the nail using a patellar tendon-splitting or patellar tendon-sparing technique. The infrapatellar approach requires the knee to be flexed or hyperflexed to insert the nail. However, when the knee is flexed, the quadriceps muscle force often causes displacement of the proximal fracture fragments, resulting in valgus and procurvatum. [4]. Additionally, postoperative anterior knee pain is a common postoperative complication after intramedullary nail placement, with an incidence ranging from 10% to 80% reported.[5]

The use of suprapatellar nailing in tibia fractures became more popular as an alternative to traditional infrapatellar nailing technique. Suprapatellar (SP) nailing involves inserting the nail through a small incision above the patella and then guiding it down the intramedullary canal of the tibia. This approach offers several potential advantages including better alignment of the nail with the tibial canal and reduced risk of anterior knee pain.[6]

As suprapatellar nailing technique has quite more advantages compared to the other surgical techniques, there are limited number of papers in the literature. So, the aim of this retrospective study is to analyse the clinical and radiological outcomes of suprapatellar tibial nailing performed in a single

centre.

## Material and Methods

The study was conducted at a single center between January 2020 and June 2022. The study was approved by the Selcuk University Ethics Committee with approval number 2024/187. The study was conducted under the principles of the Declaration of Helsinki Patients aged 18 years and over, those with acute tibial fractures suitable for intramedullary nailing due to tibial fractures, those with preoperative and postoperative radiographs and clinical follow-up procedures were included in our study. Pathological fractures, fractures extending to the joint, patients younger than 18 years, polytrauma patients, patients who underwent vascular-nerve repair, and those with a follow-up period of less than 12 months were excluded from the study.

All surgeries were performed by ta faculty member surgeon using the technique described by Sanders et al [7]. (Figure 2,3,4,5)



Figure 2. Preoperative XR image

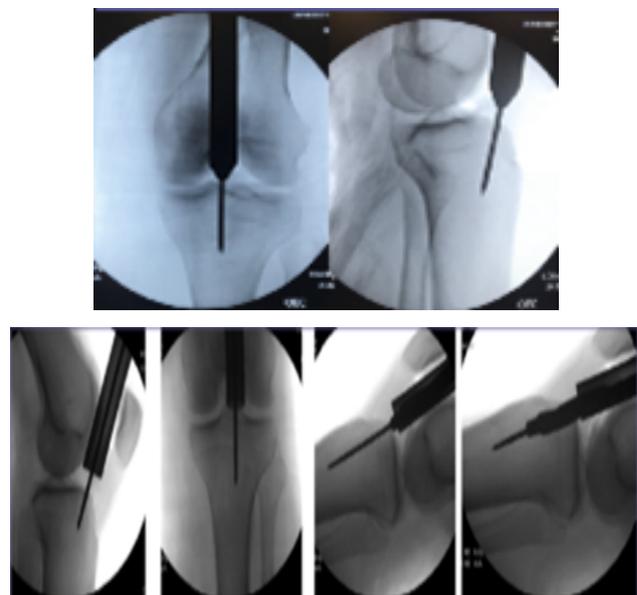


Figure 3. Fluoroscopy image during surgery

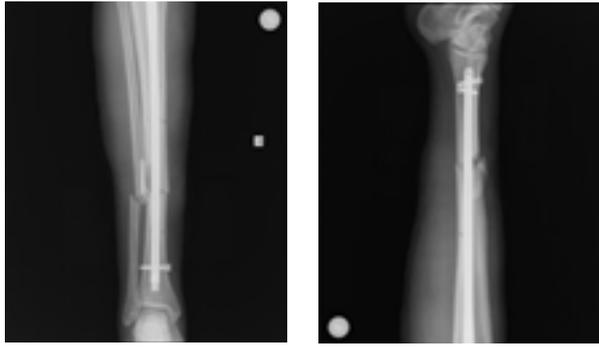


Figure 4. Postoperative XR image



Figure 5. Postoperative 1. year XR image

The primary clinical outcomes were assessed by examining the pain and range of motion of the knee joint. Visual Analog Score was used for pain scoring and Lysholm scale was used for knee joint functions.

Radiological outcomes, including fracture healing, alignment, were also evaluated using postoperative radiographs. Complications, such as malalignment, non-union, infection, and knee stiffness, were recorded.

Radiological and clinical evaluations were conducted at postoperative 15 days, 45 days, 90 days and then at 3 months intervals. Patients were permitted to full weight bearing as tolerated the day after surgery. Ankle and knee range of motion exercises were started immediately after the surgery.

Union of the fracture determined according to visualising of three cortices in X rays. Also, the alignment was examined by the most recent X rays. A shift of the fractured parts greater than 10 degrees in any of the AP and lateral X-rays was considered as malalignment.

Statistical analyses were done using SPSS 22 software programme. Only descriptive analysis was done.

## Results

12 patients were included in this retrospective study. Mean age was 35,25(22-76) and 3 of the patients were female and 9 were male. Mean follow up time was 20,6 month. All the fractures healed during the last examination. The mean VAS Score was 1,33 and Lysholm's score was 92,5. There were no malunion according to the x ray examinations. Range of motion of the knee was between 120 degrees flexion and 180 degrees extension. The maximum shift was 9 degrees. There was no significant difference compared to the uninjured side.(Table 1)

Table 1. Radiological and Clinical Results

Male	9
Female	3
Mean follow up time	20.6 month
The mean VAS Score	1.33
The mean Lysholm's Score	92.5
Maximum shift	9 degrees

## Discussion

According to the results of this study, favourable clinical and radiological outcomes can be achieved with suprapatellar tibial nailing technique. Excellent to good Lysholm's scores, low VAS scores and a full range of motion of the knee joint indicate excellent functional outcomes in patients operated with the aid of suprapatellar exposure. Radiological evaluation also showed satisfactory fracture healing, alignment, and hardware position in all cases. This further indicates the effectiveness of this technique in achieving anatomical reduction and stable fixation.

Suprapatellar tibial nailing technique is a valuable approach for the treatment of tibial shaft fractures, offering several advantages over traditional infrapatellar nailing approach. As published before, the suprapatellar approach provides better alignment of the nail with the tibial canal and causes better results in terms of malalignment and non-union. One of the most important advantages of this technique is the low risk of anterior knee pain which is a common distressing complication associated with classic infrapatellar nailing. Additionally, as published in the literature, the suprapatellar approach allows easy access to the fracture site, which can be better for proximal tibial fractures.[3]

Anterior knee pain is a one of the major problems after the surgical treatment for tibial fractures treated with intramedullary nails. The main cause considered is the nail entry point. The fat pat injury, patellar tendon injuries and the damage of these structures during the reaming are believed to be responsible for this situation. Ryan et al reported similar knee pain results when comparing the suprapatellar entry to infrapatellar entry. [8]

Serbest et al also reported a mean VAS score of 1,0. Also they reported no statistically difference between uninjured sides and the extremities treated with suprapatellar tibial nails.[9] Sun et al also reported similar results, with a mean VAS score of 0,21 and no difference in terms of Lysholm clinical score, VAS score and ROM measurements. [10]

Sanders et al also reported a mean 124,4 degrees of ROM, 82,14 for Lysholm score which were not significantly different compared to the healthy extremities. Also they reported no anterior knee pain in their patients operated with suprapatellar technique. [7] According to our results, our mean VAS score was a mean of 1,33. This score seems to be high compared to the previous studies. We think that this is secondary to the our elderly patients who have degenerative arthritis. Also, our relative short term follow-up time can be a factor for this situation. Nevertheless,

there was no significant difference between two extremities of our patients (operated and uninjured sides).

The main concern associated with suprapatellar tibial nailing is the potential chondral damage to the patello femoral joint (PFJ). This technique involves reaming and nail insertion within the patellofemoral joint, closely adjacent to both chondral surfaces. There are cadaver studies addressing this situation in the literature. Gelbke et al and Gaines et al compared this approach and parapatellar approach in terms of chondral damages. Both of these cadaver studies showed no significant difference between the two approaches.[11] This point was also studied in the clinical studies by Jakma et al reporting that. The distal femoral trochlear cartilage is under the risk of chondral damage.[12] However this situation did not cause anterior knee pain in any of the patients included in their paper.

Also arthroscopic evaluation has also been conducted for SP nails. Sanders et al performed post operative arthroscopy and also performed MRI after one year of surgery. They reported no correlation between early post-operative arthroscopic findings and one year's post-operative MRI results[7]. Serbest et al performed diagnostic arthroscopy to the PF joint before and immediately after nail insertion and reported that 81 % of the patients, out of 31 included in their paper, were evaluated with grade 0 chondromalacia.[9] In our study we did not detect any problem about PF joint. Although we did not performed any diagnostic arthroscopy or MRI, none of the patients complaint about PF joint problems.

Main limitations of this current study include a small patient cohort and lack of a comparison with a group of patients who underwent tibial nailing by traditional infrapatellar approach. Additionally, the absence of postoperative MRI or diagnostic arthroscopy examination constitutes a limitation of this study. It is noteworthy that none of the patients reported complaints related to the PFJ.

In conclusion, the findings of this current study suggest that SP tibial nailing technique is a viable option for treatment of tibial shaft fractures. This approach is associated with lower rates of anterior knee pain as reported in the literature, alongside excellent union rates and clinical functional scores.

**Conflicts of interest:** The authors declare that they have no conflicts of interest regarding their articles.

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