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ORIGINAL RESEARCH

Functional Outcomes in Suprapatellar Nailing for the Treatment of Tibial Shaft Fractures - Preliminary Results

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ABSTRACT

Introduction: The purpose of this study was to evaluate the functional outcomes of suprapatellar intramedullary nailing for the treatment of tibial shaft fractures.

Material and Methods: The present retrospective study included 10 cases aged over 20 years operated on for tibial shaft fractures with suprapatellar tibial nailing over the last three years. Patients were retrospectively followed up with all their previous surgical records and radiographs.

Results: The mean age was 41.57±16.51, with a range of 20-72 years. The mean operating time was 81±10.15 minutes. Mean blood loss was 110±20.5 ml. meantime for a union was 15.15±1.35 weeks. No deep infection was noted. One patient had anterior knee pain. The mean Lysholm knee score was 87.91 ± 5.75.

Conclusion: The suprapatellar approach is a good and safe technique for nailing in tibial fractures.

KEYWORDS: Suprapatellar, Semiextended, Tibia fracture, Intramedullary nail.

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BACKGROUND

Presently intramedullary nailing is the gold standard for the treatment of tibial shaft fractures. Nailing ensures good fracture fixation and stability, prevents fracture malalignments, and allows early mobilization. An infrapatellar with patellar tendon splitting approach to the tibia with the knee joint flexed 90 degrees is the commonly followed entry for intramedullary tibial nailing. [1] Proximal tibial shaft fractures tend to tend anterior malalignment of the proximal fragment due to the pull of the patellar tendon. This pull is increased further when the knee is in a flexed position during the nailing infrapatellar approach. [2] When nailing is done conventionally, there is a risk of poor patient repositioning, suboptimal reaming, and poor nail placement. [3] To overcome these issues, the semi extended suprapatellar approach was developed. It has more straightforward access to the entry point at the proximal tibia, facilitates proper fracture reduction, especially for proximal fractures, and avoids patellar disorders of the knee joint. [4] The purpose of this study was to evaluate the functional outcomes of suprapatellar intramedullary nailing to treat tibial shaft fractures.

MATERIAL AND METHODS

The present retrospective study was conducted in the Department of Orthopaedics, PGIMS Rohtak. It included 10 cases aged over 20 years operated on for tibial shaft fractures with suprapatellar tibial nailing over the last three years. Patients were retrospectively followed up with all their previous surgical records and radiographs. Patients were clinically examined, and functional outcomes were noted. Patients with tibial shaft fractures OTA/AO type 42 based on AO classification were included in the study. Patients with age less than 20 years, having congenital or acquired deformity of the injured limb before surgery, pathological fractures, and open fractures were excluded from the study. Informed and written consent was taken from all the participants before enrolling in the study. On presentation full demographic profile of the patient, necessary investigations and radiographs were taken in two planes, anteroposterior view and lateral view, before planning for surgical fixation.

Surgical Technique

Patients were laid supine with affected knee placed in 20-30° flexion over the operating table with a bolster underneath the knee. A 2-cm longitudinal skin incision is

made 1 cm above the base of the patella. The quadriceps tendon is exposed by blunt dissection, and a longitudinal midline split is performed in the quadriceps tendon along its fibers. The protecting sleeve was inserted now underneath the patella. Guidewire was inserted under image intensifier guidance, and its position was checked. The ideal entry point seen on anteroposterior view was medial to the lateral tibial spine. On the lateral view, the entry point was anterior to the anterior articular margin. In the tibial medullary canal, the guidewire must be directed towards the central position in both planes. The reaming of the channel was performed through the cannula system allowing for appropriate protection of the surrounding soft tissues and intra-articular structures. After reaming nail of the right size was inserted after reducing the fracture, and locking was achieved by screws (Fig 1 and 2). Thorough lavage of the knee joint is done to remove any debris, and closure is done.

Postoperatively vitals were monitored, intravenous antibiotics and analgesics were given. Radiographs were taken to ascertain implant position, and mobilization of the limb was started from 3 to 5 days. Partial weight-bearing was started after confirmation of commencement of healing process till fracture union. Functional outcome was evaluated by Lysholm knee score at the final follow-up. The total range of motion of the knee joint was noted at least six months after the surgery, and patients' satisfaction based on surgical outcomes was assessed individually. Statistical analysis was done with SPSS version 16 using descriptive statistical methods, including the Pearson Chi-squared test and student t-test. A p-value of <0.05 was considered statistically significant.

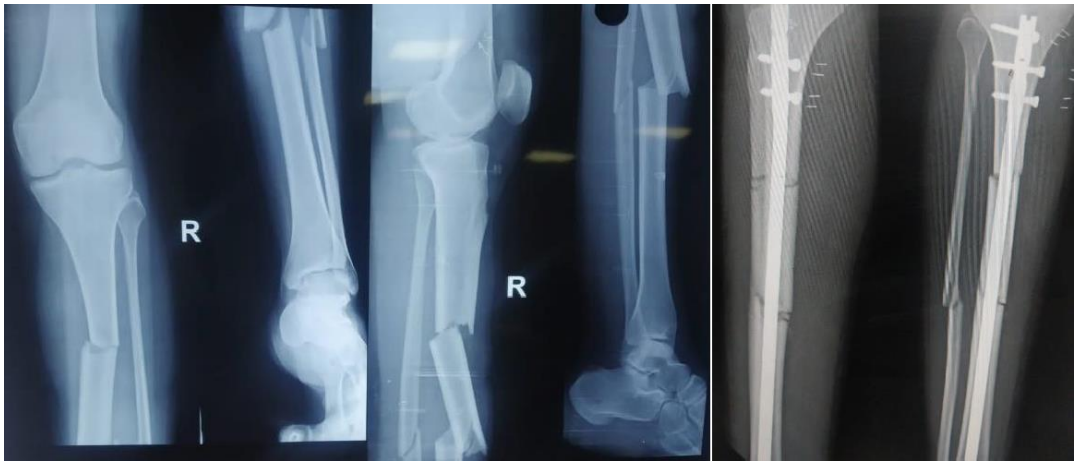

Fig 1: Preoperative and Postoperative Xray Showing Segmental Tibial Shaft Fracture Fixed with Tibial Nailing by Suprapatellar Approach

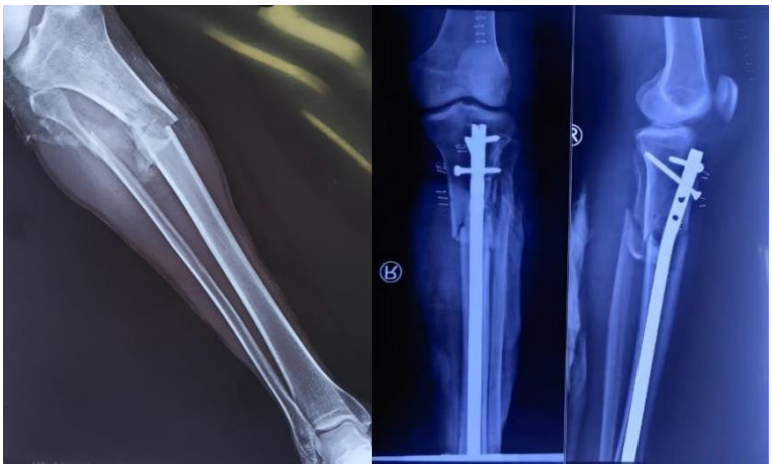

Fig 2: Preoperative and Postoperative Xray Showing Proximal Tibial Shaft Fracture Fixed by Suprapatellar Approach

RESULTS

The mean age was 41.57±16.51, with a range of 20-72 years. There were seven males (70%) and three females (30%). The right side was involved in 7 patients (70%), while the left side was involved in 3 patients (30%). Nine patients (90%) had a Roadside accident (RSA) as a mode of trauma for their fracture, and one patient (10%) had assault as the mechanism of injury for their rupture. The mean operating time was 81±10.15 minutes. Mean blood loss was 110±20.5 ml. The mean time for the union was 15.15±1.35 weeks (Table 1). One patient had decreased ROM due to stiffness at the knee joint due to poor compliance with physiotherapy exercises. One patient had a superficial infection which was managed with intravenous antibiotics. No deep condition was noted. One case of non-union was noted in this study (Table 2). One patient had anterior knee pain. The range of motion at the knee at the final follow-up was 126.35±15.34 degrees. The mean Lysholm knee score was 87.91 ± 5.75 with a range of 80-91.

Table 1: Showing demographic profile and results

Parameter	Number
Mean Age	41.57±16.51
Sex	M=7 F=3
Side	R=7 L=3
Mode of Injury	RSA-9 Assault- 1
Mean time of fracture healing (weeks)	15.15±1.35
Mean Range of Motion (degrees)	126.35±15.34
Mean operating time (minutes)	81±10.15
Mean blood loss (ml)	110±20.5

Table 2: Complications

Complication	No of patients
Superficial infection	1
Deep infection	0
Non union	1
Knee stiffness	1
Knee Pain	1

DISCUSSION

Intramedullary nailing has been the preferred treatment for tibia shaft fracture, offering advantages of stable fixation, reduced damage to the vascularity of fracture site and soft tissue compared to plating techniques. Two techniques have been described in the literature for tibial nailing. However, a consensus has not been achieved over the optimal approach for nail insertion. [5] With the Suprapatellar process, it has become simpler to perform nailing of proximal tibial fractures. This technique has been extended to tibial shaft fractures and distal metaphyseal fractures with various advantages over the infrapatellar approach. [6,7]

The main advantages are the simplified positioning of the patient on the operating table, which eases fracture reduction. [8] When the leg is positioned stretched on the table, it also is easier to position the C-arm during the surgery, especially during locking, without much rearrangement. This suprapatellar method also reduces the need for an assistant and also has a shorter operating time. [9,10] The mean operative time was 81±10.15 minutes in our study, comparable to Sun et al. (71.01 ± 5.98). [5] The semi extended position of the limb during the suprapatellar tibial nailing requires fewer adjustments for the C arm positioning, and ease of fracture reduction in this position decreases the operating time compared to infrapatellar tibial nailing. The mean Lysholm knee score in our study (87.91 ± 5.75) was comparable to the study done by Křivohlávek et al. (93.4 ± 8.39) [11], showing that good functional outcome is achieved with suprapatellar tibial nailing. In the study done by Sun et al. [5], four cases (4.9 %) of patellofemoral changes were observed and confirmed by MRI in the suprapatellar nailing group.

Gelbke et al. [12] in their study found that although the mean contact pressure of the patellofemoral joint was higher in a suprapatellar group than in infrapatellar during nail insertion, however, the highest recorded peak pressure (3.83 MPa) was not strong enough to induce the death of articular chondrocytes as it was below the threshold level. They further concluded that there is no risk to the cartilage surface of the knee joint when using the suprapatellar nailing approach. Injuries to intra-articular structures of the knee joint during tibial nailing have been observed with both the infrapatellar and suprapatellar approaches. [13,14] To prevent the risks of intra-articular damage and fracture-dislocation during nail insertion, it is essential to achieve the correct entry point for intramedullary nailing in both views, whatever may be the approach used for surgery. As fluoroscopy is much easier to perform in a semi-extended position, the correct entry point may be more reliably achieved by the suprapatellar approach than the intramedullary approach.

Supplementary procedures such as additional plating or poller screws for guiding intramedullary nails help achieve good postoperative fracture malalignment. Still, these techniques involve other difficulties complications and require expertise and consume additional time during the surgery. Anterior knee pain is the most common complication of tibial nail insertion reported in the literature; however, its etiology is multifactorial. In our study, one patient had anterior knee pain at the final follow-up. Chan et al. [15] reported that the VAS score in the suprapatellar group was equivalent to the infrapatellar group, and Jones et al. [16] made a similar conclusion in their study. One of the causes of knee pain is the iatrogenic damage to the infrapatellar nerve during nailing. The limitation of our study was that no arthroscopic examination was performed to identify the knee joint injury or cartilage changes before and after the surgery. Finally, a long-term prospective randomized study with a larger scale is needed to further evaluate the efficiency of suprapatellar approach for tibial nailing.

CONCLUSION

The suprapatellar approach is a safe and effective alternative nail insertion technique for tibial diaphyseal fractures. The process allows for an easy reduction of proximal tibial fractures and decreased surgical time. Good functional results of the knee joint are achieved when comparing to the infrapatellar approach.

AUTHORS' CONTRIBUTIONS

All the authors have actively participated in the redaction, the revision of the manuscript, and provided approval for this final revised version.

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COMPETING INTERESTS

The authors declare no competing interests with this study.

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