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A Study in Management of Fracture Shaft of Tibia by Intramedullary Nailing by Suprapatellar Approach

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Abstract: ***Background: Tibial shaft fractures are common and often result from high - energy trauma. Suprapatellar intramedullary (IM) nailing is increasingly favoured for its ability to facilitate fracture reduction, particularly in proximal tibial fractures. Concerns about anterior knee pain and patellofemoral cartilage damage persist. Objective: To assess the functional outcomes, union times, and complications of suprapatellar IM nailing in tibial shaft fractures. Methods: This prospective study included 20 patients treated with suprapatellar IM nailing at Al Ameen Medical College and Hospital from July 2022 to July 2024. Patients were selected based on age (≥15 years) and fracture type (closed or Gustilo - Anderson Type I open fractures). Functional outcomes were evaluated using the Lysholm Knee Scoring Scale, while the radiological union was tracked via X - rays at regular intervals over an average follow - up period of 11.5 months. Results: The study included 14 males and 6 females, with an average age of 44 years. The radiological union was achieved in 85% of patients within 16 weeks, with a mean union time of 12.5 weeks. One patient experienced delayed union (26 weeks). Anterior knee pain occurred in 2 patients (10%) but did not significantly affect daily activities. No infections or implant failures were noted. Overall, 70% of patients had excellent functional outcomes, and 30% had good results. Conclusions: Suprapatellar IM nailing is effective for treating tibial shaft fractures, particularly in the proximal third, with excellent functional outcomes and minimal complications.***

Keywords: suprapatellar tibial nailing, tibial shaft fracture, functional outcome, complications, intramedullary nailing

1. Introduction

Tibia fractures are one of the most common fractures of long bones constituting about 2% of adult population. [1, 2] Tibial shaft fractures occur with an incidence of 16.9/100, 000/year. [3] The incidence of tibial fracture has a bimodal peak at the age 20 and 50. [4] Adult both bone leg fractures are most common in young males between the ages of 19 and 39. The incidence of non - union and malunion in tibial fractures is relatively high when compared to fractures in other parts of the body. The most frequent location for long bone fractures is the tibia, and about 80% of these injuries involve fibular fractures (1).

The traditional method of infrapatellar nailing technique, which involves splitting the patellar tendon necessitates knee flexion or hyperflexion. Most common issue faced in proximal tibia fracture by is anterior pull of proximal fragment by quadriceps on knee flexion. Procurvatum deformity of proximal tibia is a commonly encountered complication. [7] With wide metaphysis of tibia, it is difficult to control the varus or valgus mal reduction of distal tibial fracture by infrapatellar approach. This also necessitates need of additional procedure of Poller screw technique. [8, 9, 10]. Intramedullary interlocking nail fixation with semi extended position of knee have been used for proximal and distal 1/3rd tibia shaft fractures, as described by Tornetta et al. [6, 11] This technique involved subluxation of patella laterally following a medial parapatellar arthrotomy. A modification of the semi extended knee technique for nailing was done by suprapatellar approach by Dr Dean Cole. [12] The main concern with this technique is the risk of injury to the patellofemoral articulation, which could cause patellofemoral arthritis and anterior knee discomfort following intramedullary nail fixation. [13] Entry of nail by suprapatellar approach creates a parallel plane of entry in line with sagittal axis of tibia, facilitating ease of reduction and nail entry. This technique has lower potential for post - operative malalignment in proximal and distal tibia fracture. [9, 10]

2. Materials and Method

Study Design

This prospective study was conducted at the Department of Orthopaedics, Al - Ameen Medical College and Hospital, on patients with tibial shaft fractures treated via suprapatellar IM nailing. The study period spanned from July 2022 to July 2024.

Inclusion Criteria

- Age ≥ 15 years
- All closed tibial shaft fractures
- Open fractures classified as Gustilo - Anderson Type I

Exclusion Criteria

- Open fractures classified as Gustilo - Anderson Type III
- Intra - articular tibial fractures
- Medically unfit patients or those with immunocompromised statuses

3. Surgical Procedure

All procedures were performed under spinal or general anesthesia using a suprapatellar approach. Patients undergoing suprapatellar intramedullary (IM) nailing were positioned supine on a radiolucent table. A bolster was placed beneath the affected knee to maintain 20 - degree flexion. A tourniquet was applied to the upper thigh to minimize blood

loss, although it was not inflated unless required. Using fluoroscopic guidance, the Skin incision started 2 cm above the proximal pole of patella, extended 5cm proximally. Soft tissue was dissected and the quadriceps tendon was visualized. A full thickness longitudinal incision was made over the substance of the tendon in line with the skin incision (Fig.1).

After retracting soft tissue, a longitudinal incision was made through the quadriceps tendon to expose the patellofemoral joint. Blunt dissection allowed access to the anterior tibial surface, and a protective sleeve was inserted to prevent damage to the patellofemoral cartilage. The optimal entry point was identified under fluoroscopy—just medial to the lateral tibial spine, aligned with the tibial shaft (Fig.2). A guidewire was inserted into the tibial canal, confirming the position in both anteroposterior and lateral views.

Serial reaming of the medullary canal is done in increments of 0.5cm to a diameter of 1.5mm more than the diameter of the desired nail. Reaming should not be done more than 2mm once cortical contact or clutter of reamer is heard. After reaming, an appropriately sized IM nail was inserted over the guidewire. The fracture was reduced, and both proximal and distal interlocking screws were inserted (Fig.3). Fluoroscopic imaging was used throughout to ensure proper alignment and fixation. The quadriceps tendon and surrounding soft tissues were closed in layers, followed by wound closure.

Figure 1: Image shows the incision for suprapatellar approach

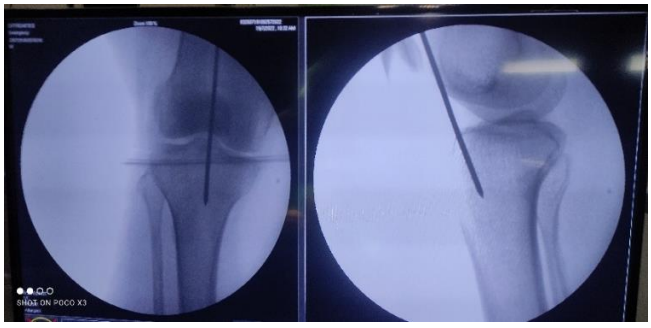

Figure 2: Image shows ideal entry point in AP and lateral radiograph

Figure 3: Image shows proximal locking of the nail

Postoperative Protocol

- Intravenous antibiotics were administered for 5 days postoperatively.
- Early range - of - motion exercises and weight - bearing were initiated based on fracture type and stability.
- Patients were followed up at intervals of 6 weeks, 3 months, 6 months, and 1 year.

Outcome Measures

Clinical and radiological assessments were made at each follow - up. Functional outcomes were assessed using the Lysholm Knee Scoring Scale. Radiological union was defined by the appearance of callus on X - rays, and any complications were recorded.

4. Results

Demographics

The study included 20 patients, with 14 males and 6 females, and an average age of 44 years. The majority of injuries were caused by road traffic accidents, with 60% of fractures classified as open (Gustilo - Anderson Type I).

Time to Union

Radiological signs of union were observed at a mean of 12.5 weeks. One case of delayed union (26 weeks) was noted, and this patient had associated diabetes and a history of smoking.

Functional Outcome

Out of 20 patients, 14 (70%) had excellent functional outcomes with a mean Lysholm score of 95. The remaining 6 patients (30%) showed good results. Only two patients reported anterior knee pain, but this did not restrict daily activities.

Complications

Complications occurred in 3 patients (15%). Two patients experienced anterior knee pain, and one patient had delayed union, likely related to diabetes and smoking.

5. Discussion

Suprapatellar nailing in a semi - extended position has proven to be an effective method for managing tibial shaft fractures, particularly in the proximal third of the tibia. The technique minimizes malalignment and facilitates fracture reduction while reducing exposure to fluoroscopy. Although anterior knee pain is a known risk, the use of protective sleeves during the procedure helps mitigate this complication.

Previous studies have shown that this approach yields excellent radiological and functional outcomes. Our findings align with studies by Sanders et al. (2014), which demonstrated superior healing rates with a suprapatellar approach, and MacDonald et al. (2019), which noted reduced anterior knee pain compared to infrapatellar methods.

6. Conclusion

Suprapatellar IM nailing in the semi - extended position offers significant advantages over traditional infrapatellar techniques, particularly for fractures in the proximal tibia. With minimal complications and excellent functional outcomes, this technique is a valuable addition to the orthopedic armamentarium for treating tibial shaft fractures.

Further research is necessary to evaluate long - term outcomes, particularly the risk of developing patellofemoral arthritis.

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