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Suprapatellar Approach for Intramedulary Tibial Nailing in Semi Extended Position of Knee Joint - Case Series Study

Dr. Sudhakar Ramasamy[1], Dr. Suresh Kumar Thirugnanam[2]

[1]Assistant Professor, Government Thiruvannamalai Medical College, Thiruvannamalai, India
Corresponding Author Mail id: *sudhakarmsortho[at]gmail.com*

[2]Assistant Professor, Government Thiruvannamalai Medical College, Thiruvannamalai, India
Mail id: *sureshkumarorthopolur[at]gmail.com*

Abstract: ***One of the recently suggested safe and effective surgical techniques for tibial fractures is suprapatellar nailing in semi extended position. The aim of this study is to understand the clinical, functional and radiological outcome and complication for tibial shaft fractures treated with intramedullary nailing through suprapatellar approach in semi extended position of knee. From October 2015 to October 2017, a prospective study was done among 20 patients to understand the clinical, radiological and functional outcome and complication for tibial shaft fractures treated with intramedullary nailing through suprapatellar approach in semi extended position of knee at a tertiary care center. All results were tabulated in Microsoft Excel and analysed using IBM SPSS v16. The majority of them were males (n=18, 90%). Around 80% (n=16) were open fractures and 20% (n=4) are closed fractures. Out of 16 open fractures, six of them (37.5%) were Grade - I and 10 (62.5%) were Grade - II fractures. Around 90% (n=18) had no complications. The mean duration of surgery is 75 minutes (S. D=15 minutes) while the mean loss of blood is 80 ml (n=20 ml). The mean follow - up period was 10.5 months. The mean duration of union was 16 weeks. The mean LEFS score was 72/80. A correct starting point remains a crucial part of surgical procedure. Suprapatellar approach of intramedullary tibial nailing in semi extended position of knee offers an alternative to traditional infrapatellar approach. Future studies can focus on doing similar studies in multiple centres to increase the reliability of the results.***

Keywords: Suprapatellar approach, Tibial Shaft Fractures, Tibial Nailing, India

1. Introduction

One of the most common long bone fractures is the fracture of the shafts of tibia and fibula. The incidence of these fractures is around 45/100000 population per annum. The fractures of the tibia are associated with a number of mechanisms of injury and severity. The most prone age group is between 19 to 39 years with a high preponderance among males[1]. Among the fractures in the human body, the incidence of malunion and non - union is high among tibial fractures. The most common site is the diaphysis of the tibia which is associated with fibular fractures in around 80% of the cases[1].

Management of these fractures vary depending on the concurrent soft tissue injury. When the fractures are open with a very high severity, then the complication rates are high leading to poor outcomes. Young patients who undergo high energy trauma are the most commonly affected. In adult population, the preferred treatment is the intramedullary nail fixation for both Undisplaced and displaced tibial shaft fractures[2].

The recent advances in the design of the nail and the reduction techniques have made possible the use of intramedullary fixation for more conditions. It is now being used for more proximal and distal tibial fractures that involve the metaphyses. The crucial part is to establish an anatomic starting point in these fractures. One of the recently suggested safe and effective surgical techniques is suprapatellar nailing in semi extended position. In this technique, an appropriate starting point is established as fracture reduction of apex anterior deformity is facilitated from this position.

The aim of this study is to understand the clinical, functional and radiological outcome and complication for tibial shaft fractures treated with intramedullary nailing through suprapatellar approach in semi extended position of knee.

2. Material and Methods

From October 2015 to October 2017, a prospective study was done among 20 patients to understand the clinical, radiological and functional outcome and complication for tibial shaft fractures treated with intramedullary nailing through suprapatellar approach in semi extended position of kneeat The Institute of Orthopaedics and Traumatology, Madras Medical College and Rajiv Gandhi Government general hospital, Chennai.
The inclusion criteria are:

1) Age greater than or equal to 20 years
2) Closed fractures of both bone leg
3) Segmental fractures of tibia
4) Proximal one third of tibia fracture
5) All diaphyseal fracture of tibia
6) Ipsilateral femoral fractures
7) Stiff knee

The exclusion criteria are:

1) Paediatric fractures of tibia
2) Age more than 70 years
3) Associated comorbidities
4) Intra articular extension fracture

All results were tabulated in Microsoft Excel and analysed using IBM SPSS v16.

3. Results

A total of 20 cases were recruited for the study where suprapatellar approach of tibia nail in semi extended position was done. The majority of them were males (n=18, 90%). Rest of them were females (n=2, 10%). Around 80% (n=16) were open fractures and 20% (n=4) were closed fractures. Out of 16 open fractures, six of them (37.5%) were Grade - I and 10 (62.5%) were Grade - II fractures [Figure 1]. Around 60% (n=12) were left - sided fractures while 40% (n=8) were right - sided. Around 90% (n=18) had no complications while 10% (n=2) had complications (delayed union=1; infected proximal screw=1). The time of union was 12 weeks in 35% (n=7), 14 weeks in 30% (n=6), 16 weeks in 30% (n=6) and more than 26 weeks in 5% (n=1) of the cases. Lower extremity functional scale (LEFS) was excellent in 70% (n=14) cases, good in 20% (n=4), fair in 5% (n=1) and poor in 5% (n=1) of the cases.

The mean duration of surgery is 75 minutes (S. D=15 minutes) while the mean loss of blood is 80 ml (n=20 ml). The mean follow - up period was 10.5 months. Nineteen patients received clinical and radiographic return visit. The remaining one patient who got difficulty to review at the hospital was followed up through telephone. The radiographic examination showed the callus appeared in all patients at average 6 - 8 weeks after surgery with fracture healing time of 14 - 20 weeks. The mean duration of union was 16 weeks. The mean LEFS score was 72/80. One patient had delayed union of more than 28 weeks and one patient had proximal screw site infection. No patient experienced loosening or breakage of internal fixation and no one complained of knee joint pain and no postoperative anterior knee pain. Satisfactory outcomes and reproducible results were achieved with intramedullary nail fixation of tibial shaft fracture. No reduction loss and aggravating displacement occurred after surgery. The mean knee and ankle range of movement significantly improved at each follow up.

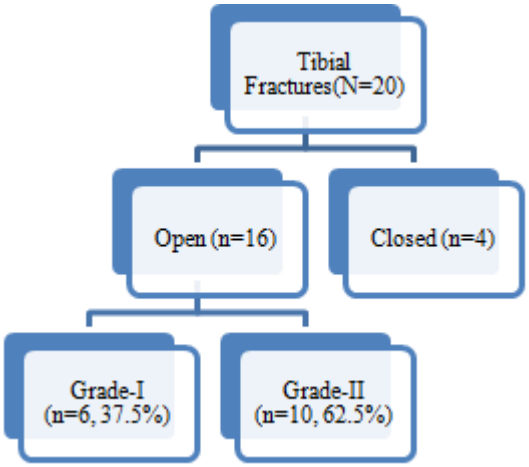

Figure 1: Fracture Classification

Table 1: Time of Union

S. no	Time of union	Frequency (percentage)
1	12 weeks	7 (35)
2	14 weeks	6 (30)
3	16 weeks	6 (30)
4	More than 26 weeks	1 (5)
	Total	20 (100)

4. Discussion

In this study we selected20 patients with fracture tibia from a tertiary care center. All patients underwent operative procedure in the form of intramedullary interlocking tibial nail through suprapatellar approach in semi extended position of knee. Of the 20 patients treated with suprapatellar approach, excellent results with good range of movements were seen in 70% of cases with a mean excellent lower extremity functional scale score. The significant advantage of suprapatellar approach was the extension of knee during surgery which was very useful in the treatment of complex metaphyseal and diaphyseal tibia fractures. In the proximaloblique metaphyseal fracture with posterior cortical extension, the suprapatellar technique reduces the risk of posterior cortex perforation by placing the starting point in line with the medullary canal. It also relaxes quadriceps muscle, preventing mal-reduction. This technique also helps to reduce Varus and Valgus deformity by using the femoraltrochlear groove as a guide to the starting point. This maintains the mechanical axis of the lower extremity. Additionally surgeon can conveniently access through the safe zone on the tibial plateau.

A potential criticism of this approach is intraarticular involvement and the potential for patellar or trochlear chondral injury. Although this approach transverses the patellofemoral joint, the entry sleeve is in the place at all times, protecting the chondral surface during reaming. Furthermore, the sleeve will easily collect the bone debridement that would be rapidly suctioned out.

Patient who received the conventional infrapatellar intramedullary nailing often felt postoperative pain, which was related to the surgery method, patellar ligament and infrapatellar nerve injury, muscle strength changes, protrusion of inserted objects tail and other factors. Gaines et al (2013) also proved that the suprapatellar approach was

associated with a lower overall incidence of damage to the intraarticularstructures[7].

In our study there was also no patient suffering from post operative knee pain which could be explained by several reasons; firstly, the sleeve adjoint tightly to tibial spine and protect patellacartilage from the damage of surgical instruments, followed by less operative time.

5. Conclusion

Reamed locked intramedullary nailing remains the standard treatment for displaced tibial shaft fractures. In this study we described surgical hints in addition to the benefits of suprapatellar approach. A correct starting point remains a crucial part of surgical procedure. Suprapatellar approach of intramedullary tibial nailing in semi extended position of knee offers an alternative to traditional infrapatellar approach. Specific instrumentation with a canula system allows for nail insertion in a safe fashion and minimizes the risk ofiatrogenic damage to intraarticular structures. The semi extended position of knee facilitates fracture reduction particularly in proximal third tibial fracture and all diaphyseal tibial fractures. This approach had excellent outcome for Ipsilateral Femoral Shaft Fractures, Stiff Knee and Proximal 1/3rd of Tibia Fracture. The preliminary data suggested a low rate of post - operative anterior knee pain. Future studies can focus on doing similar studies in multiple centres to increase the reliability of the results.

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