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Original Research

Suprapatellar Versus Infrapatellar Nail In Distal Tibial Fractures

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ABSTRACT

Background: Infrapatellar (IP) and suprapatellar (SP) surgical methods were used in this study to evaluate and analyse the clinical and functional results of distal tibia fractures treated with intramedullary nailing (IMN).

Methods: 63 patients who received IMN treatment for distal fractures during June 2019-2022 were the subject of a retrospective investigation. The SP and IP procedures were used to perform IMN on a total of 27 and 36 patients, respectively. This study looked at the length of the procedure, blood loss, closed reduction rate, rate of adjuvant reduction technique, fracture healing time, and complications. The visual analogue scale was used to rate the severity of anterior knee discomfort. Clinical evaluations were conducted using the Lysholm Knee Scoring Assessment and the American Orthopaedic Foot and Ankle Society (AOFAS) scale.

Results: A total of 63 patients were assessed, with a follow-up of 12 months. Between the two groups, there were no appreciable differences in terms of the typical operating time, blood loss, rate of adjuvant reduction technique, rate of closed reduction, fracture healing time, or Lysholm Knee Scoring Scale score. But in terms of pain score, AOFAS score, and fracture deformity rate, the SP technique outperformed the IP approach (P <0.05).

Conclusions: The SP IMN technique is superior to the IP IMN technique for the treatment of distal tibia fractures in terms of functional result, reduction in knee discomfort, and reduction in fracture deformity.

Keywords: Distal tibia fracture, intramedullary nail, internal fixation, infrapatellar, suprapatellar

INTRODUCTION

Fracture that typically develops from high-energy accidents is a distal tibia fracture [1, 2]. Treatment for distal tibia fractures often involves open reduction and internal fixation with plates and screws [3-5]. However, the therapy of these fractures with plates has frequently led to problems such infections, slow or non-union healing, and implant failures [6–8]. For distal tibia fractures, minimally invasive percutaneous osteosynthesis (MIPPO) and intramedullary nailing (IMN) have recently gained popularity [9, 10].

In comparison to MIPPO, IMN for distal tibia fractures is related with a decreased risk of wound complications and a quicker time to union, according to a prior research of a meta-analysis based on 13 randomised controlled trials (RCTs) with 924 patients [11]. The classic

infrapatellar (IP) method and the suprapatellar (SP) approach in the semi extended position are both used for IMN insertion. Multiple studies have demonstrated that the SP and IP treatments had comparable functional outcomes for tibial shaft fractures based on the clinical outcomes. However, there isn't enough solid proof to support either method's efficacy in treating distal tibial fractures. This study compared the clinical and functional results of tibial nailing for distal tibia fractures utilising the SP and IP surgical techniques.

MATERIALS AND METHODS

During June 2019-2022, skeletally mature patients with distal tibial metadiaphyseal fractures who received tibial intramedullary nails as a form of treatment were found. The primary fracture line of the distal tibia fracture was determined to be 12 cm above the medial to lateral width of the ankle's articular surface. Based on the initial injury films and computed tomography scans, the distal tibia fracture was rated in accordance with the AO Foundation/Orthopaedic Trauma Association (OTA/AO) classification scheme. Extraarticular tibia fractures (OTA 43-A) and fractures with significant fracture lines within 12 cm of the distal tibial plafond were the inclusion criteria. Old distal tibia fractures, ipsilateral knee injuries, severe ankle disorders including prior rheumatoid arthritis and gouty arthritis, and a lack of chart or radiographic data were the exclusion criteria.

Patients treated with an IP IMN insertion technique and patients treated with an SP IMN technique were separated into the two groups mentioned above. The senior orthopaedic surgeons, who were skilled in both approaches, carried out all of the operations. The patient was positioned in the supine posture with their hip elevated and general anaesthesia or spinal-epidural anaesthesia was administered. Regularly, a pneumatic tourniquet was applied to the thigh area at a pressure of 60 kPa. For patients with complex fibula fractures where the fracture lines were less than 8 cm above the malleolar fossa, the temporary full-thickness suture was employed to maintain skin tension before the locking plate or 1/3 tube plate was adapted using the lateral method to fix the distal fibula.

The prepatellar midline approach with the knee flexed to roughly 90° caused the patellar ligament in the IP approach group to be split along the middle. The surgeon's helper performed traction and reduction while a hole was made using a device at the slope along the intramedullary cavity. After the guide wire was inserted, the fracture alignment and position were also evaluated using the C-arm X-ray imaging equipment. After the fracture reduction was successfully completed, the guide wire was used to implant the appropriate intramedullary nails so that the nail tip was as close as possible to the distal tibia's articular surface. The C-arm Xray imaging system was used to assess the fracture position and alignment. A blocking nail approach and a reduction clamp can be utilised to help reduce fractures that are challenging to reset. Using proximal and distal locking screws, the fracture was repaired after a successful reduction.

At least 12 months after their operation, all patients were contacted for a clinical and radiological follow-up. An orthopaedic surgeon with training and experience evaluated the ankle results for all patients using the American Orthopaedic Foot and Ankle Society (AOFAS) scale [12] and the knee outcomes for all patients using the Lysholm Knee Scoring Scale [13]. The VAS was used to measure the pain levels of the patients. The anatomical axis of the tibia was measured on standard images to assess the coronal and sagittal alignments. Greater than 5 degrees in the coronal or sagittal plane was deemed a fracture deformity [14].

The mean and standard deviation of the data are displayed. The two groups were then contrasted using an unpaired Student's t-test. In order to compare the variations in VAS between the two groups, the chi-squared test was used. P-values below 0.05 were regarded as significant.

RESULTS

The study comprised 63 patients in all who met the inclusion criteria. Additionally, SP IMN and IP IMN procedures were used to treat 27 (42.8%) and 36 (57.2%) of the patients, respectively. Age, sex, fracture type, time to surgery, and follow-up time were all sociodemographic characteristics of the patients that were evenly distributed between the two groups (Table 1).

Table 1 Comparison of sociodemographic data between the two groups.

Variables	Suprapatellar	Infrapatellar	p
Age (years)	42.6 (10.2)	40.6 (11.3)	0.471
Sex (M/F)	11/16	20/16	0.311
Time to surgery (days)	3.2 (1.1)	3.5 (1.2)	0.313
Follow-up (months)	10.9 (4.4)	11.3 (4.6)	0.596

In the SP group and IP group, the mean surgical times were 86.3 ± 14.6 min and 97.1 ± 16.9 min, respectively (P = 0.010). In the SP group and the IP group, respectively, the average blood loss volumes during surgery were 56.3 ± 14.6 ml and 60.5 ± Page 6/14 9.3 ml (P = 0.099). In the SP group and the IP group, the rates of adjuvant reduction approach were 33.3% (9/27) and 38.9% (14/36) respectively (P = 0.819). The closure reduction rates in the SP group and the IP group, respectively, were 92.6% (25/27) and 83.3% (30/36) (P = 0.448). (Table 2).

Table 2: Surgical and prognostic comparison between the two groups.

Variables	Suprapatellar	Infrapatellar	P
Surgical time (min)	86.3 (14.6)	97.1 (16.9)	0.01
Blood loss (ml)	56.3 (10.6)	60.5 (9.3)	0.099
Adjuvant Reduction Technique (cases)	9(27)	14 (36)	0.603
Closed reduction rate	25(27)	30(36)	0.448
Fracture healing (weeks)	12.2 (3.6)	12.8 (4.1)	0.549
Pain score	20.6(3.7)	28.1(3.4)	0.001
Lysholm score	88.6(4.9)	85.7(6.8)	0.061
Fracture deformity(cases)	1(27)	9(36)	0.034
AOFAS score	93.5 (4.2)	87.8 (4.9)	0.001

DISCUSSION

Using external fixators, plates, and nails, various surgical procedures can be used to treat distal tibia fractures. There has been an increase in the use of intramedullary nails (IMN) as a distal tibia fracture therapy because they do little damage to the soft tissues around the fracture site, have a low risk of malunion, and have greater biomechanical strength [15]. The classic IP method and the SP approach in the semiextended position are both used for IMN insertion. The functional results of the SP and IP methods for tibial shaft fractures are comparable, according to several research. However, there isn't enough solid proof to support either method's efficacy in treating distal tibial fractures.

The purpose of this study was to assess the clinical and functional results of distal tibia fractures treated with IMN under the SP and IP surgical methods. The SP IMN and IP IMN groups had comparable surgery times, blood losses, and closure reduction rates, according to the findings. Comparing the SP group to the IP group, the rate of adjuvant reduction strategy was noticeably lower in the SP group. Our findings support those of a prior study that compared the surgical outcomes of the SP and IP techniques. With a minimum follow-up of

15 months, Yiliang Cui [16] examined 24 and 26 patients who underwent SP IMN and IP IMN, respectively, and found no significant differences in the surgical time and blood loss between the two groups.

The blood loss and surgery time between the SP and IP groups did not differ significantly, according to a meta-analysis of RCTs [17]. The different surgical approaches used to treat distal tibia fractures, particularly during fracture reduction or the insertion of the nails and screws, may be to blame for the finding that SP IMN was superior to SP IMN in terms of total blood loss [18], which is possibly explained by the meta-analysis of additional RCTs.

This study showed that the SP group's VAS pain score was considerably lower than the IP groups. This result is consistent with that of a multicentre clinical trial conducted by MacDonald et al. who showed that the SP IMN surgical approach is associated with less postoperative anterior knee pain than the IP IMN surgical approach by comparing the VAS scores between the IP and SP approaches in 95 patients [19]. According to a recent meta-analysis, the SP method was linked to a considerable decline in VAS ratings [17]. After IP IMN, postoperative knee discomfort is a pertinent concern. In between 50 and 70 percent of patients with tibial fractures who received IP IMN [20] reported experiencing anterior knee pain. Only 30% of individuals report pain reduction after the device is removed. Postoperative knee pain is linked to access-related scar formation of the Hoffa fat pad and the patellar tendon as well as iatrogenic injury to the saphenous nerve [21]. The patella tendon can also be preserved using the SP method since the intramedullary nails can be introduced through the quadriceps tendon. As a result, the SP method can substantially lower post-nail knee pain rates [22, 23].

Malalignment was present in the SP group at a rate of 4.8% (2/42) compared to 14.3% (8/56) in the IP group. Our findings are in line with those of an earlier investigation that looked at the radiographic outcomes of the SP and IP techniques used to treat distal tibia fractures [24]. When IMN insertion was carried out using the IP approach, there was a 26.1% incidence of angular deformity higher than 5 degrees, according to Frank R's comparison of the radiographical results following the treatment with IMN using the SP and IP approaches. In contrast, when IMN insertion was carried out utilising the SP method, a 3.8% rate of malalignment was noted. In tibia fractures treated with IMN utilising the SP method, Marco Stella observed a 2.9% malalignment rate [25].

In the IP method, the quadriceps pull and the intramedullary nail's rearward deviation caused the proximal segment to flex, which led to the anterior flexion deformity [26]. In the SP method, the IMN may readily obtain the proper beginning point while keeping a relaxed extensor mechanism given the capacity to keep the leg in a static position and the knee at roughly 15° to 20° of flexion [27]. As a result, when performing IMN, distal tibia fractures were reduced by keeping the leg in a static position during the procedure [28].

This research has several restrictions. First off, this study had a limited sample size and was retrospective and single-centre in nature. To assess the efficacy of the SP method, a sizable prospective, randomised case-control research is necessary. Second, radiography was used to assess the patellofemoral joint. To assess the postoperative cartilage changes and during the final follow-up, an arthroscopy or magnetic resonance imaging examination should be performed. The feasibility and safety of treating distal tibia fractures with IMN utilising the SP method were also validated by our investigation. However, a more thorough comparison between the SP and IP techniques will need to wait for a study with a longer follow-up period.

CONCLUSION

The SP technique and the IP strategy for the management of distal tibia fractures with IMN were contrasted in our study. With the SP strategy compared to the IP approach, the results

showed improved functional outcomes, less knee pain, and a decreased rate of misalignment. Because of this, treating distal tibia fractures with the SP method of IMN has been deemed effective.

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