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EVALUATION OF FUNCTIONAL RESULTS FOR SHAFT OF TIBIA FRACTURE USING DCP AND INTRAMEDULLARY NAIL COMPARISON

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ABSTRACT

Objective: To assess and contrast the outcomes of two distinct treatment approaches—interlocking nail and plating—for tibial shaft fractures. **Study design**: Randomized controlled trial. **Place & Duration of study:** Department of Orthopaedics & Traumatology Gujranwala teaching hospital Gujranwala from January 2023 to February 2024. **Methodology:** Sixty three patients with closed tibial shaft fractures were divided into two equal groups at random and treated with plating or closed interlocking nails. At the one-year follow-up, postoperative outcomes were evaluated using the Ekeland and Thoresen criteria, and they were ranked as excellent, good, fair, or bad. For each group, complications such as knee stiffness, delayed union, nonunion, and infection were measured and compared. **Results:** The interlock group's mean age was 31±8 years, whereas the plating group's was 35.1±9 years. 82% of patients saw good results from interlocking nail, whereas 56% experienced interlocking ($p = 0.04$). There was no postoperative infection, delayed union, knee pain, or screw breakage in the interlocking nail group, whereas there were 24%, 8%, 4%, and 2% (p value = 0.05) in the plating group. **Conclusions:** Tibial shaft fractures treated with interlocking nail gave excellent results with minimal postoperative complications than plating. We therefore recommend interlocking nail as a treatment of choice for treating such fractures.

Introduction

Every year, almost 26 people out of every 100,000 have a tibial shaft fracture. These fractures are typically caused by high-energy trauma, such as car accidents, and strike men more frequently than women.1.
Because of the insufficient blood supply and soft tissues around the tibial shaft, there is an increased risk of infection and nonunion in these fractures, making management of these injuries difficult.2,3
Treatment options for tibial shaft fractures include non-operative care and surgery using external fixators, plates, and interlocking nails.4 While the probability of infection is lowest for tibial shaft fractures treated with casting, there is a higher likelihood of delayed union, nonunion, malunion, and stiffness in the joint.5.

The main disadvantages of Dynamic Compression Plating (DCP) are skin necrosis, infection, and delayed weight bearing. However, DCP is straightforward to perform, even with minimal instruments, has a low learning curve, and delivers direct compression at the fracture side and perfectly minimizes the fracture.3,6

In addition to serving as a load-sharing implant and enabling early weight bearing and fracture healing with the development of peripheral callus, the closed interlocking nail protects the soft tissues surrounding the tibia.4 More expertise, radiation exposure, and expensive equipment are needed for interlocking nails.6. In addition, interlocking nails have been linked to screw or nail breakage, delayed union, nonunion, malunion, and knee joint issues.When a tibial fracture is open, an external fixator is typically used.6

This research was carried out to compare the results of interlocking nail and plating for closed tibial shaft fractures because there are insufficient randomized controlled studies and no agreement on the best course of treatment.

METHODOLOGY

Patients with closed tibial shaft fractures (AO 42 type A1, A2, A3; 8 10 cm from knee joint and 10 cm from ankle joint) who presented within seven days of being admitted through the Accident and Emergency Department or OPD and who were willing to participate in a regular follow-up for at least a year were included in the study. Patients could be of any gender and age. Exclusions from the study included AO 42 type B and C tibial fractures, pathological fractures, open tibial fractures, bilateral tibial fractures, compartment syndrome, neurovascular injury, patients needing abdominoplasty, polytrauma patients needing ossification of other bones, and patients requiring thoracic, abdominal, neurosurgical, and urological interventions. "A" group was made up of interlocking nails, whereas "B" group was distributed by lottery and consisted of plating. Written informed consent was obtained from every research participant. The hospital's Ethical Review Board accepted the study protocol.

A thorough physical examination and history were completed. An AP and lateral X-ray of the tibia fibula was obtained, showing the knee joint and ankle. Under general/spinal anesthesia, all patients underwent either one of the following procedures: plating (narrow DCP 4.5 mm on anteromedial surface with at least 8 cortices above the fracture and 8 below the fracture) or reamed close static interlocking nail (one proximal locking screw and two distal locking screws) under image intensifier in hanging limb position. The standard surgical technique was used in each case. In neither instance was a tourniquet applied. On the second postoperative day, patients were released from the hospital, unless they needed to stay longer due to discomfort, fever, or another complication. All patients received second generation (cefuroxime) antibiotics for five days following surgery.

After the stitches were taken out and the incision was evaluated at the two-week mark, each patient had a monthly follow-up appointment for at least a year. Active exercises for the knee, quadriceps, and ankle were recommended for each patient. Pain, indications of a wound infection, radiographic union of a fracture, misalignment, movement of the knees and ankles, swelling of the limbs, weight bearing, implant failure, or any other . Each group's additional problems were identified and treated appropriately. Either fracture was declared. as healed when there is evident callus on at least three or four cortices on AP and lateral X-rays; as nonunion when there is no healing shown on x-rays six months after surgery; as delayed union when no such healing is seen after three months. 1-0

If the interlocking group's union was delayed, the proximal or distal screws were removed. This process is known as dynamicization. At the final follow-up, the outcomes were evaluated using the Ekeland and Thoresen criterion.9.

SPSS version 18 statistical software was used to examine the data. Age and operation duration were examples of continuous variables for which mean ± standard deviation was computed. For outcome and gender, for example, frequency and percentages were computed. Tables and graphs were used to display each and every result. The outcome answer was compared using the chi-square test. Any p-value below 0.05 was deemed significant.

RESULTS

Two groups, A and B, each with 30 patients, were formed equally and at random from a total of 60 patients. Group B received plating, whereas Group A received interlocking nails. The patients in group A had an average age of 28 ± 9 years. There were 13 (43%) females and 17 (57%) males. Of the patients, 17 (57%) had involvement on the right side, and 13 (43%) on the left. Eight patients (27%) had a fracture as a result of a fall in group A, whereas 22 patients (73%) suffered a fracture as a result of a traffic collision. In group A, there were fractures to the top end of the tibia in 8 (27%) patients, the middle in 12 (40%) patients, and the lower end in 10 (33%)

patients. seven (23%) patients had AO 42 A1 fractures, eight (27%), and fifteen (50%) patients had A2 fractures. In 6 (20%) of the cases, the fibula was intact.

Group B patients had a mean age of 36±10 years, with 18 (60%) females and 12 (40%) men. 17 patients (57%) had fractures to their right tibia, compared to 13 patients (43%). Six patients (20%) had a history of falls, whereas the majority of patients (80%) experienced motor vehicle accidents. In 7 (23%) patients, the middle tibia was broken, in 10 (33%) patients, and in 13 (43%) patients, the lower tibia. In 10 (33%), 11 (37%), and nine (30%), patients had the fracture type A1, A2, or A3. Five (17%) of the patients had intact fibulas. All of interlocking nail procedures were performed under spinal anesthesia.

In the plating group, 25 patients (83%) and 05 patients (17%) received spinal and general anesthesia, respectively. Interlocking took 60 minutes on average to operate, whereas plating took 40 minutes. At 4 weeks postoperatively, the majority of interlock patients (n = 20; 67%) were somewhat weight bearing, whereas only 2 (6%) plating patients were (p = 0.00001) partially weight bearing. All (n=25) of the interlocked patients were observed to be fully weight bearing at 6 weeks. In the plating group, only 13 patients (43%) could bear their entire weight (p=0.0001).For the interlocking nail group, the average hospital stay was three days, whereas for the plating group, it was five days.

Table I displays the postoperative outcome data at the conclusion of a one-year follow-up. In 82% of patients, interlocking nails produced good results; in 65% of cases, plating produced statistically significant results (p=0.04). There were no records of good or bad outcomes for any group. The majority of the plates (n = 11) had 10 holes, followed by 8 holes (n = 10)and 9 holes (n = 4)on narrow DCP. Similarly, 10 mm diameter nails were utilized in the majority of patients (n=15) but 7 mm and 11 mm nails were used in 7 and 3 of the patients, respectively. The tibial nail lengths that were utilized were 28 cm (n = 11) 30 cm (n = 8) and 32 cm (n = 6) Compared to plating, the interlocking nail exhibited a reduced wound size (p=0.001).

one out of ten (10%) interlocking nails had an infection. one at the proximal screw site and two at the distal screw site received the appropriate antibiotic treatment based on culture and sensitivity reports and they recovered. Table II displays the complications that were identified in each group. Six patients (20%) had a delayed union. Dynamization was used to treat it, with 2 (8%) and 4 (16%) patients receiving the removal of the proximal and distal locking screws, respectively.In order to address nonunion in one (3%) patients, interlocking nail removal and bone grafting plating were used. In both instances, there was a transverse fracture in the mid shaft. three patients (11%) had a broken proximal locking screw, whereas four patients (13%), had a distal locking screw; all patients recovered, though. This series had no deaths or neurovascular injuries.

TABLE 1

	Interlocking Nail	Plating	Total	P value
Results	Patients (%)	Patients (%)	Patients (%)	
Excellent	18(60%)	13(43%)	31(52%)	0.04
Good	7(23%)	10(33%)	17(28%)	0.04
Fair	5(17%)	7(23%)	12(20%)	
Poor				
Total	30	30	60	

TABLE 2

	Complication	Interlocking nail	Plating
1	Infection	3(10%)	10(33%)
2	Delayed union	6(20%)	7(23%)
3	Non union	1(3%)	3(10%)
4	Knee pain	0	0
5	Screw breakage	0	0

DISCUSSION

In our investigation, the majority (n=25, -83%) of tibial fractures treated with interlocking nails showed great results; however, 77% (n=11), and this was statistically significant, reported outstanding results with plating .. There were no reports of good or bad outcomes in any group. In a comparison study, Sahni found that while plating produced excellent, good, and fair results in 16.6%, 25%, and 8.3% of patients, interlocking nails produced excellent results in 25% of patients, good results in 23.3% of patients, and fair results in 1.6% of patients.3.They came to the conclusion that plating should be used to repair proximal and distal tibial fractures, while interlocking nails should be the preferred implant for diaphyseal fractures. Because in his research, interlocking nails were linked to knee pain. While we had all closed fractures and a one-year follow-up period, 25% of the patients in their study had grade I fractures and had a three-year follow-up period. By treating 35 tibial shaft fractures with interlocking nails and 45 with plating, Haung et al. (2011) compared the two treatment modalities and came to the conclusion that interlocking nails should be the implant of choice for communited tibial shaft fractures and that plating is appropriate for non-communited tibial shaft fractures. Similar to the previous study, which compared 26 interlocking nail tibia and 19 plating over a 23-month follow-up period, the findings indicated that interlocking nails was the best device for communited shaft fractures due to its ability to preserve the periosteal blood supply, albeit with a

few complications. For non-communited tibial diaphyseal fractures, plating achieved satisfactory results.12

Al-Musawi concluded that while cast immobilization or fibula fixation is necessary for distal third tibial fractures, interlocking nails and 25 plating can also be employed to treat tibial shaft fractures.4 Saied and Ostovar found that both implants are appropriate for fixing noncommunicated closed tibial shaft fractures, but that interlocking nails required additional procedures to achieve union and were more frequently linked to knee and limb pain than plating. The study included 69 tibial shaft fractures with intact fibula and was followed for up to a year.13 fractures, along with plating to cover the oblique and transverse fractures.14 3. After treating 147 patients with interlocking nails and 132 with plating for his retrospective observational study, Madadi came to the conclusion that the implant of choice for spiral, connected, and segmental tibial shaft fractures should be interlocking nails, while plating should be used for transverse and oblique fractures.14

In our study, patients with interlocking nails had a statistically significant advantage over patients with plating in previous partial and total weight bearing. Other research also supported this conclusion.3. However, both in our investigation and other studies, the surgical time required to complete interlocking nails was more than that of plating.3,15 In our study, the infection rate was statistically significant, with 20% in the interlocking nail group and 0% in the plating group. This could be because the limb was dangling throughout the procedure and the interlocking nails required a lengthier surgical time. Shen observed a 2.7% infection incidence in plating and a 2% infection rate in interlocking tibia. 15 Al-Musaw reported 14.2% infection in interlocking nails and 12% in plating, compared to Madadi's 9% and 12% infection rates, respectively.4, 14

Six (24%) patients with interlocking nails and none with plating had delayed union at the 12-week mark; this difference was statistically significant. But all were effectively removed or treated with dynamization.

There were two (8%), and four (16%) distal and proximal locking screws. Nonunion in plating was nonexistent at the 24th week, while it was 8% (n=2) in our trial for interlocking nails. Bone grafting and plating were used to address the nonunion in both patients. There have been reports of 10–18% nonunion in interlocking nails and 8–10% in plating tibia in the literature.14, 15

Knee pain was a very significant consequence that our study not reported in patients with interlocking nails but not in any of the plating patients. In terms of statistics, this was noteworthy. After interlocking the nails and plating, Al-Musawai observed an incidence of knee pain of 85.7% and 8%, respectively.4 According to research by Saied and Ostovar, 39.4% of patients reported knee pain during nail interlocking. Thirteen The increased incidence of knee pain in people with interlocking nails may be the cause of their early nail extraction following

union.16, 17 .However, due to the briefness of our follow-up period, we were unable to remove the interlocking nail from these patients; instead, we gave them basic analgesics to relieve their knee pain. The short follow-up time and small sample size were our study's drawbacks. A longer follow-up time could be useful in determining which group—and how frequently—will require implant removal following healing and which will not.

Conclusion

Compared to plating, interlocking nails of uncomplicated tibial shaft fractures yielded excellent postoperative results in the majority of patients. Plating were associated with higher rates of postoperative infection, delayed union and nonunion, than interlocking nails. Additionally, plating requires neither a radiolucent table nor an image intensifier and is theoretically simple to execute in a brief amount of time. For the treatment of closed tibial shaft fractures, we thus advise interlocking nails as the preferred course of action.

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