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# Analysis of the Efficacy of Closed Reduction with Interlocking Intramedullary Nail Internal Fixation Versus Locked Plate Internal Fixation in the Treatment of Tibiofibular Fractures

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## Abstract

**Objective:** To analyze the efficacy of closed reduction with interlocking intramedullary nail internal fixation and locked plate internal fixation in the treatment of tibiofibular fractures. **Methods:** The clinical data of 80 patients with tibiofibular fractures admitted to the hospital from August 2022 to August 2025 were retrospectively analyzed. According to different treatment schemes, they were divided into the intramedullary nail group (40 cases, closed reduction with interlocking intramedullary nail internal fixation) and the plate group (40 cases, locked plate internal fixation). The perioperative indicators, complication occurrence, and joint function were compared between the two groups. **Results:** Compared with the plate group, the intramedullary nail group had a longer operation time, less intraoperative blood loss, shorter hospital stay, lower pain score at 6 hours after operation, lower total incidence of complications, and higher joint function score (all $P < 0.05$). **Conclusion:** Compared with locked plate internal fixation, closed reduction with interlocking intramedullary nail internal fixation has better efficacy in the treatment of tibiofibular fractures. It can reduce intraoperative blood loss, shorten hospital stay, reduce postoperative pain and total incidence of complications, and improve joint function, but the operation time is longer.

## Keywords

Closed reduction with interlocking intramedullary nail internal fixation; Locked plate internal fixation; Tibiofibular fractures; Efficacy

Tibiofibular fracture is a common lower extremity injury in orthopedics, and the choice of treatment directly affects the patient's functional recovery and quality of life [1]. Although traditional open reduction and internal fixation can achieve anatomical reduction, extensive dissection of the periosteum and soft tissues during the operation is likely to damage the blood supply at the fracture end, leading to an increased risk of complications such as delayed bone union and infection. Especially for patients with comminuted fractures or poor soft tissue conditions, the clinical efficacy is limited [2]. With the deepening of the minimally invasive concept and biomechanical fixation principles, closed reduction with interlocking intramedullary nail internal fixation and locked plate internal fixation have gradually become the mainstream surgical methods. Both aim to reduce tissue damage and promote fracture healing, but their mechanisms of action and indications are different. Closed reduction with an interlocking intramedullary nail achieves central fixation through the medullary cavity, and uses titanium alloy material with elastic modulus close to

that of bone tissue to disperse stress, avoiding stress concentration such as shear and torsion, while maintaining limb length and axial stability [3]. Its advantage lies in that closed operation reduces periosteal dissection, and the bone debris generated by reaming can promote the autologous bone grafting effect. In addition, early weight-bearing is allowed after the operation, which is especially suitable for middle shaft and comminuted fractures of the tibia. Locked plate achieves multiplanar fixation and periosteal blood supply protection through angle-stable screws and thin design, and is suitable for complex fractures of the proximal and distal tibia. Its bridging fixation strategy can effectively control rotation and axial displacement [4, 5]. This study compares the efficacy of closed reduction with interlocking intramedullary nail and locked plate internal fixation, aiming to provide an evidence-based basis for individualized treatment of tibiofibular fractures and promote the development of minimally invasive technology towards refinement and functionalization. The report is as follows.

## 1. Materials and Methods

### 1.1 General Information

The clinical data of 80 patients with tibiofibular fractures admitted to the hospital from August 2022 to August 2025 were retrospectively analyzed. According to different treatment schemes, they were divided into the intramedullary nail group (40 cases, closed reduction with interlocking intramedullary nail internal fixation) and the plate group (40 cases, locked plate internal fixation). This study was approved by the Medical Ethics Committee. In the intramedullary nail group, the age ranged from 22 to 65 years (mean 48.58±5.37 years); the body mass index ranged from 18.85 to 26.53 kg/m² (mean 23.64±0.79 kg/m²); there were 23 males and 17 females; AO classification: 18 cases of type A, 16 cases of type B, and 6 cases of type C. In the plate group, the age ranged from 20 to 65 years (mean 48.26±5.42 years); the body mass index ranged from 18.90 to 26.61 kg/m² (mean 23.59±0.82 kg/m²); there were 25 males and 15 females; AO classification: 19 cases of type A, 17 cases of type B, and 4 cases of type C. There were no significant differences in baseline data between the two groups ($P > 0.05$), indicating comparability.

### 1.2 Inclusion and Exclusion Criteria

**Inclusion criteria:** Diagnosed as a tibiofibular fracture by various clinical examinations, and it was a fresh fracture; Unilateral closed fracture; Complete clinical data; No other treatment was received before operation.
**Exclusion criteria:** Pathological fracture; Pregnant or lactating women; Patients with complicated severe cardiocerebrovascular diseases, coagulation disorders; Patients with a history of mental illness or drug abuse.

### 1.3 Methods

All operations were performed under epidural anesthesia by the same team of senior orthopedic surgeons. The patient was placed in a supine position, and a pneumatic tourniquet was used to control bleeding at the proximal end of the affected limb during the operation.

The operation process of closed reduction with interlocking intramedullary nail internal fixation followed the following procedures: First, manual traction was performed. The patient's knee was flexed at about 120°, and a longitudinal incision of about 5-7 cm was made on the medial side of the tibial tuberosity, entering through the patellar ligament to expose the tibial tuberosity. A medullary cavity drill was used to drill a hole at the proximal end of the tuberosity. When approaching the fracture end, precise reduction was performed with the assistance of pointed reduction forceps or manual manipulation. After confirming satisfactory reduction, a guide wire was inserted and passed through the fracture end to the distal epiphyseal region. Then, reaming was performed along the guide wire, and an intramedullary nail of appropriate specification was selected and slowly inserted into the medullary cavity, so that its distal end reached about 2 cm above the ankle joint plane, and the proximal end was buried into the bone by about 1.5 cm. Under C-arm fluoroscopy, after confirming that the fracture alignment and the position of the intramedullary nail were ideal, distal and proximal locking nails were inserted, respectively, and the nail cap was installed. Fluoroscopy was performed again to confirm no error, and passive movement of the affected limb was performed to confirm stable fixation. At the end of the operation, the incision was irrigated with 0.9% Sodium Chloride Injection (Jiangxi Changjiang Pharmaceutical Co., Ltd.; National Drug Approval Number: H36021272; Specification: 100ml:0.9g), a drainage tube was placed at the patellar ligament incision, the incision was sutured layer by layer, and a sterile dressing was applied.

The operation process of locked plate internal fixation followed the following procedures: Taking the fracture area as the core, an arc incision was made along the lateral side of the fracture end to fully expose the fracture end. During the operation, the integrity of the periosteum should be protected to the greatest extent, and only the hematoma and

incarcerated soft tissues at the fracture site were removed. After cleaning, routine fracture reduction was performed. An anatomical plate was placed on the anterolateral side of the fracture, and locking screws were sequentially screwed in for fixation after precise percutaneous drilling. Finally, the incision was closed layer by layer.

### 1.4 Observation Indicators

Perioperative indicators: Record the patient's operation time, intraoperative blood loss, hospital stay, and pain degree at 6 hours after the operation. The pain degree was evaluated by the Visual Analog Scale (VAS), with a score range of 0-10 points. The severity of pain was proportional to the score.

Complications: Record the occurrence of incision infection, poor fracture healing, knee joint pain, internal fixation breakage, malunion, etc. in the two groups.

Joint function: The American Orthopaedic Foot & Ankle Society (AOFAS) scoring system was used to evaluate the ankle joint function 3 months after the operation. The scoring range of this system was 0-100 points, and the higher the score, the better the joint function.

### 1.5 Statistical Analysis

Statistical software SPSS 26.0 was used for data analysis. Measurement indicators (perioperative indicators, joint function scores) were expressed as mean ± standard deviation ($\bar{x}\pm s$) and compared by independent sample t-test; Counting indicators (total incidence of complications) were expressed as cases/percentage (n/%) and compared by $\chi^2$ test. A P value < 0.05 was considered statistically significant.

## 2. Results

### 2.1 Comparison of Perioperative Indicators Between the Two Groups

Compared with the plate group, the intramedullary nail group had a longer operation time, less intraoperative blood loss, shorter hospital stay, and lower pain score at 6 hours after operation (all P < 0.05) (see Table 1).

**Table 1. Comparison of Perioperative Indicators Between the Two Groups ($\bar{x}\pm s$)**

| Group | Case Number | Operation Time (min) | Intraoperative Blood Loss (ml) | Hospital Stay (d) | Pain Degree at 6h Postoperation (score) |
|---|---|---|---|---|---|
| Intramedullary Nail Group | 40 | 76.26±8.89 | 120.68±13.87 | 14.37±2.33 | 3.32±0.56 |
| Plate Group | 40 | 68.30±9.19 | 134.12±15.24 | 17.56±2.25 | 4.25±0.63 |
| t Value | - | 3.937 | 4.125 | 6.229 | 6.978 |
| P Value | - | 0.000 | 0.000 | 0.000 | 0.000 |

### 2.2 Comparison of Complications Between the Two Groups

Compared with the plate group, the intramedullary nail group had a lower total incidence of complications (P < 0.05) (see Table 2).

**Table 2. Comparison of Complications Between the Two Groups (n, %)**

| Group | Case Number | Incision Infection (n) | Poor Fracture Healing (n) | Knee Joint Pain (n) | Internal Fixation Breakage (n) | Malunion (n) | Total Incidence (%) |
|---|---|---|---|---|---|---|---|
| Intramedullary Nail Group | 40 | 1 | 0 | 1 | 0 | 0 | 5.00 |
| Plate Group | 40 | 2 | 2 | 4 | 0 | 1 | 22.50 |
| $\chi^2$ Value | - | - | - | - | - | - | 5.165 |
| P Value | - | - | - | - | - | - | 0.023 |

### 2.3 Comparison of Joint Function Between the Two Groups

Three months after operation, the joint function score of the intramedullary nail group was (84.31±4.36) points, which was higher than that of the plate group (80.15±4.28) points (t=4.306, P=0.000).

## 3. Discussion

Tibiofibular fracture is common in orthopedic injuries, which can occur in all age groups, mostly in young and middle-aged adults. There are various causes of this fracture. High-energy injuries, such as traffic accidents, falls from heights, and heavy object crushing, are the main causes, and low-energy injuries, such as sports sprains and slips, are also common. Tibiofibular fracture is harmful. After the fracture, the local pain is severe, the swelling is obvious, the patient's activity is limited, which seriously affects daily life and work. Moreover, the anterior medial side of the tibia has less soft tissue coverage and a poor blood supply. After a fracture, delayed bone union, nonunion, and even osteomyelitis and other serious complications are likely to occur, leading to an increased risk of limb disability [6]. Effective treatment can not only relieve the patient's pain, correct deformity, restore limb function, but also reduce the incidence of complications and improve the quality of fracture healing.

The results of this study showed that compared with the plate group, the intramedullary nail group had a longer operation time, less intraoperative blood loss, shorter hospital stay, lower pain score at 6 hours after operation, lower total incidence of complications, and higher joint function score (all $P < 0.05$). Closed reduction with interlocking intramedullary nail internal fixation achieves closed reduction through a small incision, which maximally preserves the blood supply of the periosteum and surrounding soft tissues, reducing the damage to the blood supply at the fracture end, thereby reducing intraoperative blood loss [7]; The axial fixation mode of the intramedullary nail conforms to the physiological mechanical characteristics of the human body, which can effectively disperse stress, avoid the decrease of bone strength caused by stress shielding, promote fracture healing, and shorten the hospital stay [8]; The elastic design of the interlocking intramedullary nail enables it to recover automatically after deformation, and the fixation of locking nails at both ends can effectively prevent bone shortening, anti-separation and anti-rotational displacement, reducing the postoperative pain degree and total incidence of complications [9]. In addition, this surgical method allows early weight-bearing exercise, which is conducive to the recovery of joint function. Its longer operation time is mainly due to the need for precise positioning of the nail entry point in closed reduction and repeated fluoroscopy to confirm the reduction and fixation effect. Although this process increases the operation time, it ensures the accuracy and safety of the treatment and is more conducive to the patient's prognosis in the long run [10].

In conclusion, compared with locked plate internal fixation, closed reduction with interlocking intramedullary nail internal fixation has better efficacy in the treatment of tibiofibular fractures. It can reduce intraoperative blood loss, shorten hospital stay, reduce postoperative pain and total incidence of complications, and improve joint function, but the operation time is longer.

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