



Outcome of Intramedullary Interlocking Nailing in the Management of Gustillo-I Diaphyseal Fracture of Tibia

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SK and FAM were involved in conception of idea and study design. Authors SAB and SAM did data collection and performed bench work. Author IAM performed the statistical analysis. Author AUM managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Objective: To evaluate the outcome of intramedullary interlocking nailing in the management of Gustillo-I diaphyseal fracture of tibia.

Study Design: This is an observational study.

Setting: Study carried out at Orthopaedic Surgery department, Liaquat University of Medical and Health Sciences Jamshoro, from March 2018 to February 2021.

Materials & Methods: 72 consecutive patients of Gustillo Type-I diaphyseal fracture of tibia. All patients age between 18-60 years with traumatic fracture like Gustillo Type-I diaphyseal fracture of tibia were included in this study. Patients reported chest, abdominal and head trauma with neurovascular deficit were excluded. Patients were prepared for surgery after relevant investigation and radiographs.

Results: Out of 72 patients included in this study 11.11% were female (N=8) and 88.88% male (N=64); with mean age was 38.26±8.20 years (Range 18 to 60 years). Road traffic accident was

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common cause of tibia fracture (Gustillo Type-I). Postoperative mean union time of tibial fractures were 9.9 ± 3.2 week. Postoperatively started partial weight bearing associated with help of two axillary crutches. The patients walking with partial weight bearing allowed at 4.1 ± 1.12 weeks. While patients walking with full weight bearing allowed at 10.8 ± 2.4 weeks. Postoperatively 11(15.27%) patients were complaining of pain. Wound infection observed in 7(9.72%) cases. Clinically excellent results were found in 24(33.33%) patients, while good results remained in 30(41.66%) patients and fairs in 18(25%) patients.

Conclusion: We conclude that interlocking intra-medullary nailing may be considered as a suitable option for treatment of Gustillo-I diaphyseal fracture of tibia.

Keywords: Tibia fracture; Gustilo-I diaphyseal fracture; road traffic accident.

1. INTRODUCTION

The tibia is the strongest and largest bone in the body next to the femur. Most of it is subcutaneous, which makes it more vulnerable to injury. One of the most common shaft fractures of long bones is tibial shaft fractures [1,2]. In 1964 Nicoll stated, "Fractures of the tibia are important for two reasons. The first is that they are common and secondly they are controversial – and anything that is both common and controversial must be important" [3]. Tibia is also included in 40% of all long bone fractures. About 25% of tibial fractures are open fractures [4]. The primary causes of those fractures are road traffic injuries and sports injuries. Orthopedic surgeons are facing challenges when patients come with severe bone fractures with severe soft tissue damage. Open fractures should be treated as surgical emergencies [5,6,7]. Complex fractures were more difficult to treat and often led to leg amputation or shortening. Shortening of limb is also responsible for disproportionate gait and posture [8]. There are many types of conservative and operative treatment. In surgical treatment, external and internal fixation methods can be applied [9].

The goals for the treatment of open tibial fractures are prevention of infection, limitation of soft-tissue defects, achieve an anatomically functional extremity which allows early recovery of the patients and a return to the activities which were carried out before the injury. Surgical treatment of open fractures means treatment of the soft tissue injuries and the stabilization and fixation of the Gustillo-I diaphyseal fracture of tibia.

2. MATERIALS AND METHODS

This was a hospital based observational study in which we examined a total no: of 72 consecutive patients of Gustillo Type-I diaphyseal fracture of

tibia, admitted in the Department of Orthopaedic Surgery, Liaquat Medical University Hospital Hyderabad/Jamshoro during 3 years' period from March 2018 to February 2021. All the patients were admitted in the ward either through causality or through out-patient department. Patients fulfilled the inclusion criteria, were enrolled in this study and written informed consent was obtained from the patient or next of kin. All patients age between 18-60 years of either gender, who had Gustillo type I open tibial fractures reported within 2 weeks, whose closed reduction was either not possible or unsatisfactory were included in this study.

Patients reported chest, abdominal and head trauma with neurovascular deficit were excluded. Patients were prepared for surgery after relevant investigation and radiographs. All cases were postoperatively followed-up and assessed clinically and postoperative radiographs. The all patients followed up in OPD weekly and fortnightly after the discharge. The Record of all cases were maintained in the proforma which include all the information regarding the patient's history, status of his/her general condition and wounds and fractures from the time of arrival to discharge. Also, included clinical and radiological assessments in the review clinics with view of healing of wounds, union of fracture, complications, total hospital stay, weight bearing status and functional outcome. In all cases healing assessed by radiological as well as clinical examination. Fracture was labeled united when there was no movement at fracture site clinically and no visible fracture line seen radiologically.

3. RESULTS

Out of 72 patients included in this study 11.11% were female (N=8) and 88.88% male (N=64); with male to female ratio of 9:1. In our study mean age was 38.26 ± 8.20 years (Range 18 to 60 years). Road traffic accident was common

cause of tibia fracture (Gustillo Type-I), so 29(40.27%) patients had tibial fractures due to road traffic accidents. Followed by 23(31.94%) cases and 20(27.77%) cases of tibial fractures were due to assault and fall from height respectively (Table 1).

Postoperative mean union time of tibial fractures were 9.9±3.2 weeks (Range 10 to 24 weeks). Postoperatively started partial weight bearing associated with help of two axillary crutches. The patients were allowed to walk with partial weight

bearing for 4.1±1.12 weeks (Range 2 to 6 weeks). Patients allowed full weight bearing walk at 10.8±2.4 weeks (Range 6 to 12 weeks). Postoperatively 11(15.27%) patients complained of pain. Wound infection observed in 7(9.72%) cases, while delayed union and nonunion observed in 6(8.33%) and 2(2.77%) cases respectively (Table 2). Clinically excellent results found in 24(33.33%) patients, good results in 30(41.66%) patients and fairs in 18(25%) patients (Fig. 1).

Table 1. Patient’s characteristic (n-72)

Variable	Patients	Percentage
Age in years (Means Age 38.26±8.20 years)		
• 18 – 30	21	29.16%
• 31 – 40	25	34.72%
• 41 – 50	18	25.00%
• 51 – 60	8	11.11%
Gender		
• Male	64	88.88%
• Female	8	11.11%
Mode of injury		
• Fall	20	27.77%
• RTA	29	40.27%
• Assault	23	31.94%

Table 2. Postoperative patient’s characteristic (n-72)

Variable	Patients	Percentage
Time to achieve union (Mean 9.9±3.2weeks)		
• 05 - 10 weeks	43	59.72%
• 10 - 15 weeks	29	40.27%
Partial Weight Bearing (Mean 4.1±1.12 weeks)		
• 2-4 weeks	15	20.83%
• 4-6 weeks	41	56.94%
• >6 weeks	16	22.22%
Full Weight Bearing (Mean 10.8±2.4 weeks)		
• 6-9 weeks	49	68.05%
• 9-12 weeks	20	27.77%
• >12 weeks	3	4.16%
Post Operative Complications		
• Pain	11	15.27%
• Wound infection	6	8.33%
• Non Union	2	2.77%
• Delay Union	7	9.72%



Fig. 1. Clinical results

4. DISCUSSION

Tibia fractures are among the most difficult fractures to treat effectively. The soft tissue condition, degree of comminution, and joint damage sustained at the time of injury affect long-term clinical outcome. The goal of surgical treatment is to achieve an anatomical realignment of the articular surface while providing sufficient stability to allow early movement. This should be accomplished using techniques that minimize devascularization to bone and soft tissue in the hope of reducing complications resulting from treatment. Intramedullary nailing is a well-established surgical technique for the treatment of closed and open tibial fractures [10,11].

In our series, majority of the patients were male. Eight were female (11.11%) and 64 males (88.88%). This can be attributed to our Pakistani setup where the female population mainly works indoors or in the agricultural field and does not travel much. The higher rate of fractures in men were clearly correlated with the lifestyle of men, especially in our part of the world. Men are more involved in outdoor activities, and young men are more enthusiastic about life and reckless. International study conducted by Camacho [12] and Ozturkmen Y [13] were reported male to female ratio 4:1 and 2.1:1 respectively. Tibial fractures were frequently observed in the 2nd and 3rd decades (means 38.26±8.20 years). Some other research also reported higher incidence of tibial fractures in younger age groups. While international study conducted by Kataria H [14] and Shrestha BK [15] were reported means age 32 years and 37 years respectively.

The fracture of tibia commonly has observed due to road traffic accident. Because of middle class family has low income monthly and motor bike is the main transportation. The low fracture rate was observed in farmers, housewives, retired people, because of not frequently travel. While violent injuries were occurred in workers and laborers because of industrial accidents, automobile accidents. housewives sustaining fractures through fall from height when they climb up ladder or stool to pick up objects from the shelves [16,17]. Our study had observed commonly road traffic accident 29(40.27%) main cause of tibial fractures, followed by assault in 23(31.94%) cases. International study conducted by Ngim NE [18], reported road traffic accident was major reason of limb injury 76.8% of cases (53 patients). Motorcycles was major contribution involved in 52.8% RTA. While assault was the cause of injury in 10.1% (7 patients), fall in 4.3% (3 patients).

Weight bearing is very necessary for callus formation throughout fracture healing. Weight bearing increases the formation of bone in fracture healing and lack of weight bearing decreases the amount of woven bone that is formed in healing of fractures [19]. Weight bearing is crucial for articular cartilage regeneration. Weight bearing is additionally useful in stopping deep vein thrombosis. Movements of the ankle and weight bearing enhance venous peak velocity and useful in thromboprophylaxis. Some factors have adversely affected the stability of fixation, include the degree of initial communication and displacement of the fracture, failure to adequately reduce or fix the fracture, and severe demineralizing of bone [20]. Our study observed partial weight bearing walking was mean

4.1±1.12 weeks, while full weight bearing walking was 10.8±2.4 weeks.

Some systemic and local factors are associated for fracture healing. Multiple patients related factors have been contributing to delayed union and nonunion of fractures. One of them is malnutrition, which is often unknown. Adequate protein is required for healing, and they have shown inadequate caloric intake to contribute to delayed union and nonunion. Smoking has been shown in many medical and clinical studies to have a negative effect on the healing process of fractures. Although the exact mechanism remains unclear [21]. The soft tissue dissection and, disruption of the bone blood supply by the plate-screw-bone construct should be minimized to promote callus formation. Stable fixation is essential for fracture healing. The implant used must resist physiological loads to allow fracture union by limiting fracture gap stress, provide sufficient stability to permit early limb motion, and not fail before fracture union occurs [22]. In our study we observed nonunion 2(2.77%) cases. Comparable with study by Yograj M Rathwa [23] which reported 4 patients had mal-union (8%), 1 patient had non-union (2%). In our study majority of postoperative complications were pain during walking and pain site osteolysis was occurred in majority of cases. Out of 11(15.27%) cases of pain during walking. However in the study of Ali Akhtar [20] was reported in eight patients had significant pain at 6 weeks post-operative and encountered infection in three patients while in our study observed wound infection in 7(9.72%) patients.

In Asian inspite with all these associated bone fractures and complication we able to achieve excellent results in 24(33.33%), good 30(41.66%) and fair in 18(25%) cases. However, Ranganatha Babu kurupati [24] showed results were excellent in 33(61.11%) cases, good in 12(22.23%) cases and fair in 5(9.25%) cases.

5. CONCLUSION

We conclude that intramedullary interlocking nailing in Gustillo-I diaphyseal tibial fracture allows earlier weight-bearing and help to rapid fracture healing with less morbidity. Closed interlocking nailing is the best treatment method regarding high union rate and low infection rate.

CONSENT AND ETHICAL APPROVAL

The study was being performed after the permission of ethical review committee of Liaquat

University of Medical & Health Sciences, Jamshoro. Informed consent was obtained from all patients before the surgical procedure.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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