

# To Study Outcome of Intramedullary Nailing in Grade I and II (Gustilo- Anderson) Compound Diaphyseal Fractures of Tibia

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## ABSTRACT

**Introduction:** Open fractures of the tibia are among the most common of serious skeletal injuries. They are slow to heal and frequently cause permanent sequelae if not managed timely and with precision. Our work presents the outcome of closed intramedullary nailing in grade I and II (Gustilo Anderson) compound diaphyseal fracture of tibia.

**Material and Methods:** The study group comprised of 28 patients who underwent surgical treatment with closed locked intramedullary nailing. All patients were followed for period of one year from August 2014 to July 2015 in prospective manner. Functional result was compared as per Ketenjian and Shelton Criteria modified by Yokoyama et al.

**Results:** In our study we observed that the mean age of the patients was 28.64±7.917 years, mean time surgery interval was found to be 14.54±6.304 hours. Mean time for full weight bearing was 14.43±3.191 weeks and mean union time was 15.43±3.726 weeks. Infection was found in 10.7% (n=28) of patients in which two (7.14%) patients had superficial infection and in one (3.57%) case deep infection was seen. Final assessment as per Ketenjian and Shelton Criteria modified by Yokoyama et al. done and observed excellent to good result in 89.28% of total patients and fair to poor in 10.72%.

**Conclusion:** Thus it was concluded that in Grade I and Grade II tibial diaphyseal fracture, closed intramedullary interlocked nailing is an excellent procedure, gives satisfactory results with proper alignment, good range of motion, and low infection rate leading to proper union and less patient morbidity.

**Keywords:** open tibial fractures, closed intramedullary interlocked nailing, functional result.

## INTRODUCTION

Open diaphyseal fractures of long bone of lower limb are most complex, challenging and controversial orthopedic injuries. The ultimate aim of open fracture treatment is to prevent infection, achieve bony union and restore function.

Ramon Gustilo<sup>1</sup>, in his landmark study in 1976, has laid down the foundations of open fracture management: thorough debridement and irrigation, fracture stabilization, early soft tissue coverage and rehabilitation.

This management protocol as well as his scheme of open fracture grading revolutionized open fracture treatment, are now accepted internationally and to date, remain to be clearly defined as the core principles and the very essence of current treatment.

The management of diaphyseal fractures is evolving and progressing. New reduction and fixation concepts are emerging based on better understanding of the biology of fracture repair and of the role of the soft tissues in the healing process.<sup>2</sup>

Restoration of length, axial alignment, and rotation is essential,

but anatomical reduction of every fracture fragment is not very essential.<sup>3</sup> Classically open fractures are managed by conservative means and various types of external fixator.<sup>4</sup> External fixators lead to various complications like, infection (pin tract), nonunion, inadequate fixation and these patients generally require secondary surgical procedures.<sup>5-7</sup>

In past few decades intramedullary nailing in open fractures has been advocated and practiced by many surgeons<sup>8-11</sup> but still it remains a matter of debate.

In context of this debate, we conducted a prospective study on intramedullary fixation of grade I and II compound diaphyseal fractures of tibia. Intramedullary nailing has been proven to be the method of choice for fixation of these fractures and as it fulfills the objective of stable fixation with minimal tissue damage resulting in better and quicker fracture union, early rehabilitation and at the same time decreasing hospital stay of patient.<sup>12-14</sup> The present study was aimed to analyze outcome of grade I and Grade II (Gustilo Anderson)<sup>15</sup> open diaphyseal fractures of tibia treated with Intramedullary nailing.

## MATERIAL AND METHODS

A prospective study of 28 patient with compound (Gustilo grade I and II) diaphyseal fractures of tibia were included in study treated at the department of Orthopaedic Surgery, King George's Medical University INDIA, U.P., Lucknow from August 2014 to July 2015.

Data was collected from the patient admitted through Orthopedics OPD and Trauma centre in King George's Medical University, Lucknow and satisfying the inclusion criteria: 1) Open diaphyseal (Gustilo Anderson) Grade 1 and 2 fracture of lower limbs, 2) Age >16 year-<60 year, 3) Injury surgery interval <24 hours, 4) Patient giving informed consent. Patients not giving informed consent and not satisfying above criteria were excluded from study.

All the selected patients were treated with debridement and intramedullary interlocking nail. The patient were followed up at regular interval of 4-6 weeks for one year. Check X-rays were taken at every visit and patient was assessed

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clinoradiologically for fracture union. Functional result was compared as per Ketenjian and Shelton Criteria modified by Yokoyama et al.<sup>16,17</sup>

## STATISTICAL ANALYSIS

The results are presented in mean±SD and percentages. Data was evaluated based on the descriptive statistics. Microsoft word 2007 was used to generate tables and graphs.

## RESULTS

In our study 28 patients of Grade I and II open fracture of tibia were followed in prospective manner. Average age for fracture shaft tibia was 28.64±7.917 years (Table-1). Vehicular accident in 21 (n=28) patients was observed to be the main cause of fracture in the study (75%) and more common in males (82.14). Grade II injury 64.28% (n=28) was found to be more common than grade I (35.72%).

In the study mean time injury surgery interval was found to be 14.54±6.304hrs (Table-2). Majority of patients operated by tibial interlocking nail were started with partial weight bearing within 4 weeks and full weight bearing as tolerated by patient. Maximum patient were able to bear full weight between 12-16 weeks with mean (±S.D) of 14.43±3.191 weeks.

The union of the fracture was assessed by standard radiological and clinical criteria.<sup>18,19</sup> Due to presence of nail we could not give stress to the fracture site, hence loss of pain on walking was considered as clinical indicator of union.<sup>20</sup> Mean union time was found to be 15.43±3.726weeks (Table-3). Range of motion of knee was achieved to the normal limits in all the patients with mean of 129.00±3.590 degree. 90% of the patients achieved near normal range of ankle movement, dorsi flexion (>20°) and plantar flexion(>30°). Post operative complications like compartment syndrome, neurovascular deficit, thromboembolism, shortening, stiff knee joint, was not observed in any of the patients. superficial infection was observed in 7.14% (2) patients, while deep infection in 3.57% i.e. 1 patient only. Delayed union was observed in 3 patients. Anterior knee pain was observed in 14.28% (i.e. 4 pat.) of total cases in the study. Implant failure in form of broken nail or screw was not seen in any case.

## DISCUSSION

In our study on 28 patients, the majority of the patients were in the age group of 21-40 years. There were 22 (78.57%) patients in this age group. The mean age of the patient was 28.64±7.917 years. younger age group were more prone as they are the persons who were physically active, engaged in increased various outdoor activities and thus sustaining high-velocity injuries. Our results are supported by study of Bonatus et al<sup>21</sup>, in which the average age was 30.3 years and Court Brown et al.<sup>22</sup> (1990) noted the average age to be 32.4 years. Our study should males predominance with 17 male patients (85%) which is in agreement with the similar study of Hooper et al<sup>23</sup> (male predominance 80%) and the study of Abdelaal et al<sup>24</sup> (80%). The incidence of males is higher because of their more outdoor activities, while women confined themselves to the domestic activities

In our study majority of fractures i.e. 21(75%) occurred due to road traffic accidents. This finding is supported by Lawrence et al<sup>4</sup> study showing 90% incidence. Court Brown et al<sup>22</sup> study,

| Age (Years)  | No. of patients | %     |
|--------------|-----------------|-------|
| 16-20        | 4               | 14.28 |
| 21-30        | 16              | 57.14 |
| 31-40        | 6               | 21.42 |
| 41-50        | 2               | 7.14  |
| 51-60        | 0               | 0.00  |
| Mean (±S.D.) |                 |       |
| 28.64±7.917  |                 |       |

Table-1: Age wise distribution.

| Duration        | No. of patients | %      |
|-----------------|-----------------|--------|
| 0-6hrs          | 04              | 14.28  |
| 6-12 hrs        | 08              | 28.57  |
| 12-24 hrs       | 16              | 57.14% |
| Mean ±SD        |                 |        |
| 14.54±6.304 hrs |                 |        |

Table-2. Injury Surgery interval.

| Time in weeks     | Fracture of Tibia (n=28) | Percentage (%) |
|-------------------|--------------------------|----------------|
| 10-15 weeks       | 11                       | 39.28          |
| 16 -20 weeks      | 12                       | 42.85          |
| >20 weeks         | 3                        | 10.71%         |
| Mean±SD           |                          |                |
| 15.43±3.726weeks. |                          |                |

Table-3: Mean union time for fracture tibia.

also showed that the commonest mode of injury was road traffic accidents. This high incidence in our country can be attributed to the poor road traffic sense and poor quality of roads.

Among all fractures 64.28% belonged to grade II. In cases of compound fracture injury surgery interval plays an important role, as delay beyond golden period can lead to complications.<sup>25</sup> In our study maximum patients had been operated after the golden time period interval of 6 hours with mean time of 14.54±6.304 hours. This delay could be the reason, because our institute is a tertiary referral centre where patients come after a primary management outside and lack of awareness of people for the presence of tertiary centre.

Depending on fracture pattern early partial weight bearing was started as early as tolerated by patient because mechanical loading of injured bone is conducive to its healing.<sup>25</sup> The mean time of full weight bearing was 14.43±3.191 weeks.

In our study we promoted early weight bearing as it promotes healing and early union.<sup>26</sup> In our series of tibial interlocking nail mean union time was found to be 15.43±3.726 weeks and in 1 case sufficient union was not achieved by 20 weeks so secondary procedure was done in form of fibulectomy and bone marrow infusion. Ekeland et al<sup>27</sup> observed average union time of 16 wks and Vaquero et al<sup>28</sup> of 21 weeks. Our study is also supported Puno et al.<sup>29</sup>

Early physiotherapy in form of quadriceps drill exercises, knee and ankle range of motion exercises are key in postoperative management of tibial interlocking nail as they help in achieving near normal range of motion if started as early as possible and this is evident in our study. Range of motion at the knee joint in our study was with the mean of 129.00±3.590 degree as compared to Bluent Daglar et al<sup>30</sup> mean of knee flexion angle (134°) in 90% ankle range of motion was found to be within

| Results   | No.of patient (N=28) | %     |
|---|----------------------|-------|
| Excellent<br>• No notable abnormality   | 21                   | 75    |
| Good<br>• Occasional pain with prolonged use<br>• Joint motion 75% of normal<br>• Trivial swelling<br>• Normal gait     | 4                    | 14.28 |
| Fair<br>• Pain with ordinary activity<br>• Joint motion 50% of normal<br>• Small amount of swelling<br>• Slight limp    | 2                    | 7.14  |
| Poor<br>• Constant pain<br>• Joint motion <50% of normal<br>• Any visible deformity<br>• Limp, gait on cane or crutches | 1                    | 3.57  |
| <b>Table-4:</b> Ketenjian and Shelton Criteria modified by Yokoyama et al.  |                      |       |

normal limit.

In our study early antibiotics were instituted in all patients and incidence of infection was found to be 10.7% (3) of patients. Our study is supported by study of Bone and Johnson which showed infection of 4.7% in grade I and 10.5% in grade II, court Brown et al<sup>20</sup> which showed infection of 3.8% in grade I and 9.5% in grade II, Tenser A et al<sup>31</sup> who also reported 13% infection rate.

In our study 2 had superficial wound infection. This responded to the usual oral broad spectrum antibiotics and daily dressings of the wound. One patient had deep infection. Regular dressing, oral antibiotics and guarded weight bearing was continued till the fracture united (24 weeks) and later patient was managed by exchange antibiotic coated intramedullary nailing.

Anterior knee pain is the common complication in intramedullary tibial nailing. In our study, was seen in four cases (14.28%) as compared to the study of Joshi D et al<sup>32</sup> 10.71%. Toivannen et al<sup>33</sup> also noted anterior knee pain to be common in tibial intramedullary nailing.

In our study Post operative complications like compartment syndrome, neurovascular deficit, thromboembolism, shortening, stiff knee joint, rotational instability, Implant failure in form of broken nail or screw was not observed in any of case.

In our study, final assessment was based on the functional scale of Ketenjian and Shelton, which was modified by Yokoyama et al,<sup>19,20</sup> (Table-4) As per criteria among the 28 patients 89.28% (25) had excellent to good result, and 10.72% had fair to poor results, compared to Joshi D et al<sup>32</sup> which showed 85% of excellent to good and 15% of fair to poor result and Abdelaal et al<sup>24</sup> had 85.4% excellent to good result and 14.6% had fair to poor results using same criteria.

## CONCLUSION

Thus our study proves that in Grade I and II open tibial shaft fracture intramedullary interlocked nailing is an excellent procedure leading to proper union with a slight delay but allowing early weight bearing and less patient morbidity. It provides strong fixation, rotational stability and earliest return to

functional status, as the rate of healing is good with this method.

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