

# Comparison of Rate of Delayed Union Between Plaster Cast and Intramedullary Nailing (IMN) Technique in Closed or Grade 1 Open Tibial Shaft Fractures

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## ABSTRACT

**Objective:** To compare the frequency of delayed union in plaster cast and intramedullary nailing technique in the management of closed or Grade 1 open tibial shaft fractures.

**Study Design:** comparative study

**Place and Duration of Study:** This study was conducted at Department of Orthopedics, Chandka Medical College Teaching Hospital, Larkana in collaboration with Ghulam Mohammad Mahar Medical College Hospital, Sukkur from 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2016

**Materials and Methods:** Total 60 patients having age from 20 to 50 years both male or female with closed or type 1 open tibial shaft fractures were selected for this study.

**Results:** The average age of cases in group A was 34.70±7.27 years and in group B was 35.33±8.10 years. Out of these 60 cases, 47 (78.33%) were male and 13 (21.67%) were females with ratio of 3.5:1. Rate of delayed union in Group A (intramedullary nailing) was 20.0% while in Group B (plaster cast) was 63.33% with p-value<0.001.

**Conclusion:** This study concluded that delayed union is less in intramedullary nailing (IMN) technique compared to plaster cast in closed or grade 1 open tibial shaft fractures.

**Key Words:** Tibial, Fractures, Plaster cast, Intramedullary, Nailing

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## INTRODUCTION

The tibia being the most commonly fractured long bone, and its fracture management has changed drastically from conservative to early surgical management.<sup>1</sup> Epidemiological studies suggest that motor vehicle accidents are the most common causes of tibial diaphyseal fractures, followed by sports related injuries.<sup>2</sup> High energy trauma, which imparts more kinetic energy, causes fractures which are often severe with associated soft tissue injury.<sup>3</sup> Treatment options for tibial fractures vary according to the type of fractures, age group, bone density, soft tissue status and associated complications.

utilization of prophylactic preoperative anti-infection agents, contamination at the surgical site remains the second most common adverse event occurring to hospitalized patients and a noteworthy source of morbidity taking after surgical procedures.<sup>4</sup>

Surgical site infection relies on various patient variables, including previous medical conditions, occupant skin bacteria, perioperative glucose levels, center body temperature vacillations, and preoperative, intraoperative and postoperative care. In this way, it is hard to anticipate which wounds will get to be infected.<sup>5</sup>

The relationship of diabetes mellitus with an expanded hazard for SSI has been perceived for a long time. Recently, as showed in the article by Latham et al in this issue, granulocyte capacities, including adherence, chemotaxis, phagocytosis, and bactericidal action, have been appeared to be influenced by hyperglycemia.<sup>6</sup> Others have demonstrated that enhanced glucose control accomplished with an insulin input in the perioperative period can diminish SSI rates in diabetic heart surgery patients when compare to controls.<sup>7</sup> Latham and hi associates tentatively accumulated hemoglobin A1c values on 1,000 diabetic and nondiabetic cardiac patients before coronary artery bypass. They affirmed the previously observed increase in SSI rates in diabetics.

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They likewise found that 4.2% of the patients had undiscovered diabetes, and the disease rate in these patients was equivalent to the rate in analyzed diabetics. All the more strikingly, they showed that the most serious hazard for SSI associated with postoperative hyperglycemia (blood glucose levels more than 200 mg/dL) instead of with the level of hemoglobin A1c or with pre procedure hyperglycemia.<sup>6</sup>

The reason for this study was to determine the frequency of surgical site infection in clean surgical procedures between diabetic and non-diabetic patients.

## MATERIALS AND METHODS

This comparative study was conducted at Department of Orthopedics, Chandka Medical College Teaching Hospital, Larkana in collaboration with Ghulam Mohammad Mahar Medical College Hospital, Sukkur from 1<sup>st</sup> January 2016 to 30<sup>th</sup> June 2016. Total 60 patients having age from 20-50 years either male or female with one week duration of fracture and with closed or type 1 open fractures of tibial shaft were selected for this study. Patients with open diaphyseal fractures of tibia Type II & III, tibial fractures with intra-articular extensions, presence of an excessively narrow medullary canal, asptic non-unions, pathological fractures, significant medical co-morbidity like CLD, CRF, chronic steroid use excluded from the study. Fracture is the breach in the continuity of bone and tibial shaft fractures are those in which fracture occurs at the middle third part of the tibia. Tibial shaft fractures are named 42 (4 for tibia; 2 for diaphysis) and subdivided into A, B and C. We were included only 42 A3 fracture type (A for simple and 3 for transverse) in which there was one fracture line and cortical contact between fragments >90% after reduction (assessed on anteroposterior and lateral x-rays). Open grade 1 tibial shaft fractures, those with a skin lesion smaller than 1 cm, the wound is clean, and there is a simple bone fracture on x-ray. Base line investigations like complete blood count, random blood sugar, Urine Complete Examination, Renal functions tests and ECG (where needed) were done in every patient on admission for anesthesia purposes. Antero-posterior and lateral X-rays of the affected leg were done in all patients. All the selected cases were divided into two equal group (A & B) randomly. In groups A patients, intramedullary nailing (IMN) was done for the fractures while in group B, plaster cast was applied. All patients were followed on regular intervals post-operatively and final outcome (delayed union) was noted at the end of 3 months. Delayed union was defined as the delayed healing radiologically (anteroposterior & lateral x-ray) at 3 months after procedure by the absence of bridging of three of the four cortices in standard anteroposterior and lateral radiographs. All this information was collected through pre-designed Performa. Data was analyzed by using SPSS version 20. Mean and SD was calculated

for numerical data and frequencies were calculated for categorical variable. Comparison of delayed union between the both group was done by using chi-square test and p value  $\leq 5\%$  was taken as significant.

## RESULTS

Average age of the cases was  $35.02 \pm 7.64$  years. In study group A & B mean age was  $34.70 \pm 7.27$  and  $35.33 \pm 8.10$  years respectively. Comparison of delayed union was done between the both groups. Delayed union rate in study group A & B was 06 (20%) and 19 (63.33%) respectively. Delayed union rate in study group B was significantly higher as compared to study group A with p value 0.001 (Table 1). Patients of both groups were divided into two groups according to duration of injury i.e.  $\leq 3$  days duration of injury and  $> 3$  days duration of injury. In  $\leq 3$  days of duration of fracture group, delayed union was noted in 4 (19.05%) and 12 (60.0%) patients respectively in study group A & B. Delayed union rate was significantly (P = 0.007) higher in study group B as compared to study group A. In  $> 3$  days duration of fracture group, delayed union was noticed in 2 (22.2%) of study group A and 07 (70.0%) of study group B, significant (p = 0.037) difference for delayed union was noted between the both study groups (Table 2).

Patients were divided into 3 age groups i.e. age group 20 years to 30 years, age group 31 years to 40 years and age group 41 years to 50 years. In patients of age group 20-30 years, delayed union was noticed in 1 (12.5%) of study group A 6 (75.0%) patients of study group B and the difference was significant (P = 0.012). In age group 31-40 years, delayed union was found in 3 (20.0%) and 8 (61.54%) patients of group A and B respectively and the difference was statistically significant (P = 0.025). In age group 41-50 years, delayed union rate was 02 (28.57%) and 05 (55.56%) respectively in both study groups with p value 0.280 which is statistically insignificant (Table 3). Total 4 (17.39%) and 18 (75.0%) male patients of study group A and B found with delayed union and the difference was statistically significant with p value 0.000. While 02 (28.57%) and 01 (16.67%) female patients of study group A & B were found with delayed union with insignificant (P = 0.612) difference (Table 4). In closed fracture group, delayed union was noticed in 03 (17.65%) patients of study group A and in 10 (62.5%) of study group B and the difference was significant with p value 0.008. In open fracture group, delayed union was noted in 3 (23.08%) and 9 (64.29%) patients of study group A & B and the difference was statistically significant with p value 0.031 (Table 5).

**Table No.1: Comparison of presence of delayed union between both groups**

Group	Union				P value
	Yes	%	No	%	
A	6	20.0	24	80.0	0.001
B	19	63.33	11	36.67	

**Table No.2: Comparison of delayed union according to duration of injury**

Duration (days)	Group A				Group B				P value
	Yes		No		Yes		No		
	No.	%	No.	%	No.	%	No.	%	
≤ 3	4	19.05	17	80.95	12	60.0	8	40.0	0.007
> 3	2	22.22	7	77.78	7	70.0	2	30.0	0.003

**Table No.3: Comparison of delayed union in relation to age of patients**

Age (years)	Group A				Group B				P value
	Yes		No		Yes		No		
	No.	%	No.	%	No.	%	No.	%	
20 – 30	1	12.5	7	87.5	6	75.0	2	25.0	0.012
31 – 40	3	20.0	12	80.0	8	61.54	5	38.46	0.025
41 - 50	2	28.57	5	71.43	5	55.56	4	44.44	0.280

**Table No.4: Comparison of delayed union according to gender**

Gender	Group A				Group B				P value
	Yes		No		Yes		No		
	No.	%	No.	%	No.	%	No.	%	
Male	4	17.39	19	82.61	18	75.0	6	25.0	0.000
Female	2	28.57	5	71.43	1	16.67	5	83.33	0.612

**Table No.5: Comparison of delayed union in relation to type of fracture**

Type of fracture	Group A				Group B				P value
	Yes		No		Yes		No		
	No.	%	No.	%	No.	%	No.	%	
Closed	3	17.65	14	82.35	10	62.5	6	37.5	0.008
Open	3	23.08	10	76.92	9	64.29	5	35.71	0.031

## DISCUSSION

This randomized controlled study has compared the frequency of delayed union in plaster cast and intramedullary nailing (IMN) technique in the management of closed or Grade 1 open tibial shaft fractures. Average age of cases in study group A was  $34.70 \pm 7.27$  years and in study group B was  $35.37 \pm 8.10$  years. These findings are very much comparable to studies of Walia et al<sup>7</sup> and Kamruzzaman et al<sup>8</sup> who had found a mean age of 34 and 35 years respectively. Similarly, Akhtar et al<sup>9</sup> and Neraaj et al<sup>10</sup> had found mean age of 36 years in their studies which is also comparable to our study. William et al<sup>11</sup> reported age range as 14-70 years in cases of tibial shaft fractures. In our study, out of these 60 patients, 47 (78.33%) were male and 13 (21.67%) were females with ratio of 3.6:1. These findings are comparable with some other studies.<sup>10-12</sup>

In our study, delayed union was seen in 6 patients in group A (intramedullary nailing) and 19 patients in group B (plaster cast). So, rate of delayed union in Group A (intramedullary nailing) was 20.0% while in Group B (plaster cast) was 63.33% with p-value 0.001 which is statistically significant. Karladani et al<sup>13</sup> in their study has shown the rate of delayed union (at 3 months) after plaster cast treatment as 61.54% and after intramedullary nailing (IMN) as 22.22% in closed tibial shaft fractures. In another study by Zaman et al, total 60 patients of tibial fracture were managed with unreamed

nails. On follow up delayed union was noted in 11.66% patients.<sup>14</sup> Sinha et al<sup>15</sup> reported rate of delayed union in 31% patients of tibial fracture managed with IMN. Singh et al<sup>16</sup> found 20% patients of tibial fracture with delayed union after managed with IMN. All these studies are comparable with our findings. Some other studies also documented more delayed union and malunion with cast management as compared to IM nailing in patients of tibial fractures. In addition conservative management of tibial fractures with casting has been shown to result in prolonged joint immobilization, restricted ambulation and extended rehabilitation requirements to regain a preinjury level of function.<sup>17,18</sup>

## CONCLUSION

This study concluded that rate of delayed union is less in intramedullary nailing (IMN) technique compared to plaster cast in closed or grade 1 open tibial shaft fractures. So, we recommend that intramedullary nailing (IMN) technique should be used as a first line treatment for treating these types of fractures in order to reduce the morbidity of these patients.

**Conflict of Interest:** The study has no conflict of interest to declare by any author.

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