Comparative Study of Early Screw Fixation Versus Cast Application on the Treatment of Acute Jones Fracture

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ABSTRACT

INTRODUCTION: Because of circulatory paucity in the zone II of proximal fifth metatarsal bone fractures, it takes longer time to heal. In fact there is high chance that it may go to delayed union and or non-union. There is considerable variability in the literature regarding proper treatment of acute Jones fractures. The purpose of this study is to compare the outcome of cast immobilization versus early intra-medullary screw fixation in the treatment of acute Jones fractures in active patients, irrespective of the level of athletic participation.

OBJECTIVES: To compare the functional outcome between Early Screw Fixation Versus Casting in the treatment of Acute Jones Fractures in term of clinical union, return to normal activity, & associated complications.

METHODE: From May 2008 to February, 2010; total of 31 patients were included in the study, who came to the Department of Orthopaedics, National Academy of Medical Science, Bir Hospital. Out of 31 patients; sixteen patients were allocated to short leg cast treatment and fifteen patients were allocated to early screw fixation. Both groups of patients were evaluated in term of clinical union, return to normal activity, & associated complications.

RESULTS: Mean follow up was 12 months (ranges 6-18 months). Six out of 16 patients (37.5%) in the cast group were considered treatment failure (3 nonunion, 3 delayed union.). All patients who underwent surgery were considered treatment success with some minor complications. In surgery group, the median time to clinical union and return to normal activity were 8 week & 9 weeks respectively; whereas in cast group, the median times to clinical union and return to normal activity were 12 week & 14 weeks respectively.

CONCLUSION: Early screw fixation in acute displaced Jones fracture results in quicker clinical union and allows patients to return to normal activities faster than with cast treatment.

KEY WORDS: Jones Fractures, Screw Fixation, Cast application, Clinical union & complications

Keywords: alcohol intoxication, emergency, medico legal training.

INTRODUCTION

Fractures of the base of the fifth metatarsal bone are commonly seen both in recreational and competitive athletes. This type of fracture is generally referred to as a “Jones Fracture,” named after Sir Robert Jones, who first described this fracture pattern in 1902.

There are three patterns of Jones fractures (Figure-1), according to the actual location of the fracture on the bone. Fractures in Zone I are typically avulsion type fractures, wherein a small fragment of bone is broken off the proximal end of the bone. Zone II fractures involve an area of the bone a little more distal (or toward the toes), and most typically appear as horizontal or transverse fractures. Zone III fractures usually occur in the shaft of the metatarsal bone.
Fractures of the proximal fifth metatarsal bone, at the junction of the diaphysis and metaphysis without extension distal to the fourth-fifth intermetatarsal articulation, present a difficult treatment dilemma in the active patient. This injury seems to occur in athletes as well as non-athletes. In this particular fracture, markedly delayed healing and/or failure to heal are unfortunately common. For the high-performance athlete with an acute Jones fracture, early intramedullary-screw fixation is an accepted treatment option.

According to Torg et al., Type II Jones fractures is the delayed union type where a fracture line involves both the cortices with associated periosteal bone union, a widened fracture line with adjacent radiolucency, and evidence of intramedullary sclerosis.

Many techniques have been advocated for the treatment of this troublesome fracture, including non-weight bearing short leg casting, orthotic management, surgery with or without bone grafting and electric stimulation. The choice of treatment depends on the type of injury and the patient’s overall medical condition. Fractures of the metatarsal shaft distal to the tuberosity heal slowly.

Type II fractures may also be treated conservatively or may be managed surgically, depending on patient preference and other factors. The deleterious effects of continued immobilization of the foot-ankle complex, such as joint stiffness and muscle atrophy, must be considered. The reported rates of nonunion with acute Jones fractures treated with 6 to 8 weeks of non-weight bearing cast immobilization have ranged from 7% to 28%. The time to union in patients successfully treated non-operatively has been reported to be as high as 21.2 weeks. If delayed union or nonunion subsequently develops, the time to union after either intra-medullary screw fixation or bone grafting may be as high as 21 weeks.

According to Carp, there is difficulty in achieving union of proximal fifth metatarsal fractures. Although some have reported excellent results, most authors have reported difficulty in achieving union with nonsurgical treatment. In addition, the Jones fracture is susceptible to re-injury and often is a source of chronic pain despite prolonged cast immobilization. In recent years, surgical management of the acute Jones fracture has been advocated. The clinical studies following intra-medullary screw fixation have reported excellent results, with shortened clinical and radiographic union time as compared to the cast immobilization. Portland et al recently recommended intra-medullary screw fixation for acute Jones fractures in non-athletes as well as in athletes.

The purpose of this study is to prospectively evaluate a randomized trial of cast immobilization versus early intra-medullary screw fixation in the treatment of acute Jones fractures in active patients, irrespective of the level of athletic participation.

**METHODE**

Prospective comparative study of 31 patients from May 2008 to February, 2010 was done at National Academy of Medical Sciences, Department of Orthopaedics, Bir Hospital. An isolated, closed, acute Jones fracture with duration of less than 2 weeks & patient’s age more than 16 years were included in this study. Tuberosity avulsion fractures, mal-united or non-united fractures, comminuted proximal fifth metatarsal fractures more than 2 weeks duration and patients with diabetes mellitus and bleeding disorder were excluded from the study.

Diagnosis was confirmed by the history, clinical findings and radiological examination. All patients were told the nature & purpose of the study and a written consent form was signed by all the included patients. They were asked to quantify their pain on Visual analogue pain score.

Patients were selected using closed unmarked envelopes into group one for cast immobilization and group two for intra-medullary screw fixation. Information sheets were provided for both the groups and the procedures were fully explained to the patients.

A complete blood count, random blood sugar, blood urea, serum creatinine, bleeding time, clotting time,
Chest x-ray and ECG were done for the patients undergoing surgery.

Patients allocated to the cast group were treated in a non-weight-bearing short leg cast for 8 weeks, followed by a walking cast or hard-sole shoe for next four weeks or until clinical & radiological union. Clinical union was defined as a non-tender fracture site, the absence of pain with ambulation, and radiographic evidence of fracture healing. Radiographic union was defined as the presence of new bone formation with bridging trabeculae across the fracture site. Patients were allowed to return to normal activity & sports participation after clinical union of the fracture. Treatment failure was defined as a symptomatic fracture present on radiograph at 26 weeks after the initial injury.

Patients, who underwent to surgery, were kept supine position with internally rotated affected limb. With strict aseptic precaution, Spinal anaesthesia or ankle block given by the Anaesthetist. After Palpation and location of the tuberosity of the fifth metatarsal base, made a one to two cm long incision with a surgical blade. Adduction of the forefoot increases the exposure of the metatarsal base, with protecting the two branches of the sural nerve by observing and isolating them. After identification of tuberosity and the base of the fifth metatarsal we introduce a 3.2 mm drill bit in line with the axis of the metatarsal shaft. Then a 4.0 mm partially threaded cancellous screw with the estimated length was inserted into the pilot hole, making sure that the screw remains intramedullary and that threads completely cross distal to the fracture site. The wound was closed with one or two stitches of non absorbable suture material. Bone graft was not used in any of the cases.

After Treatment: Cast complications were explained to the cast group. In surgery group, patients were immobilized in a non-weight-bearing below knee back slab for 2 weeks, followed by weight bearing as tolerated in a hard-sole shoe until clinical & radiological union. A check x-ray was done in each case on the first post-operative day to confirm the screw being intramedullary. The stitches were removed at seventh post-operative day.

For both the groups, sports or return to normal work will be allowed when the clinical & radiological union was seen. All patients were followed up in the out door department at monthly intervals for 6 months and then at 1 year and 1 ½ year after. Patients were evaluated with a subjective questionnaire, physical...
examination, and radiographs of the affected foot. Data were collected and calculated for each patient with respect to time to clinical union, time returning to normal activity, and complications.¹

Statistical analysis: The selected data were analyzed with the help of SPSS (Statistical package for social science) software windows program. The descriptive statistics was used to calculate mean and median values, SDs, 95% confidence intervals. Because of the relatively small sample size and possible deviations from normality, median values are used instead of means in statistical analyses.

OBSERVATIONS AND RESULTS

A total of 35 patients of Acute Jones fracture were included in the study, out of which 4 patients dropped out leaving 31 patients for further analysis. Cast group -16 & Surgery group -15

Table 1: Age distribution (n=31)

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast group</td>
<td>Surgery group</td>
<td></td>
</tr>
<tr>
<td>Cast group</td>
<td>Surgery group</td>
<td></td>
</tr>
<tr>
<td>16 - 25</td>
<td>2</td>
<td>12.50</td>
</tr>
<tr>
<td>26 - 35</td>
<td>6</td>
<td>31.25</td>
</tr>
<tr>
<td>36 - 45</td>
<td>1</td>
<td>6.25</td>
</tr>
<tr>
<td>46 - 55</td>
<td>0</td>
<td>6.66</td>
</tr>
<tr>
<td>56 - 65</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>66 - 75</td>
<td>1</td>
<td>3.33</td>
</tr>
<tr>
<td>75 +</td>
<td>0</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>100.00</td>
</tr>
</tbody>
</table>

The maximum number of patients belongs to the age group 26-35, followed by 36-45 years.

Table 2: VAS score and grade of tenderness before and after the treatment

<table>
<thead>
<tr>
<th>VAS score before treatment</th>
<th>Tenderness grade before treatment</th>
<th>VAS score at 8 weeks of treatment</th>
<th>Tenderness grade at 8 weeks of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast group</td>
<td>Surgery group</td>
<td>Cast group</td>
<td>Surgery group</td>
</tr>
<tr>
<td>Mean</td>
<td>6.44</td>
<td>1.50</td>
<td>0.20</td>
</tr>
<tr>
<td>Median</td>
<td>6.00</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Std Deviation</td>
<td>0.512</td>
<td>0.966</td>
<td>0.680</td>
</tr>
<tr>
<td>Range</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>p-value</td>
<td>0.125</td>
<td>0.0002</td>
<td>0.001</td>
</tr>
</tbody>
</table>

There is no significant differences regarding VAS score and grade of tenderness before treatment (p-value = 0.125), but there is a highly significant difference of VAS score and Grade of tenderness in both the groups after treatment at 8th wk with p-value 0.0002 and 0.0001 respectively.

The median duration of clinical union in cast group is 12 weeks whereas 8 weeks in surgery group which is highly significant (p-value = 0.0028). The mean duration of the clinical union is 13.23 wks with SD +/- 5.747, range 16 (8-24) and confidence interval of 95% in the cast group whereas 8.27 wks with SD +/- 0.961, range 3 (7-10) and confidence interval of 95% in the surgery group.

Similarly, the median duration of return to normal activity is 14 weeks in the cast group whereas 9 weeks in surgery group which is also significant (p-value 0.0009). The mean duration of return to normal activity is 15.15 wks with SD +/- 5.95, range 16 (10-26) and confidence interval of 95% in the cast group whereas 9.67 wks with SD +/- 0.9, range 3 (9-12) and confidence interval of 95% in the surgery group.
The main goal of this study was to find out whether early screw fixation or casting is better and effective treatment modality in case of acute Jones fractures. Intramedullary screw fixation is a popular technique for treatment of proximal fifth metatarsal fractures\textsuperscript{15}. In our perspective there has been no prospective, randomized and comparative study on acute Jones fractures. Early screw fixation can be strongly recommended in those who want to return to normal activity earlier as in competitive athletes, service holders. Our patient population was an active age group with mean age 38.81 years in cast group and 37.20 years in surgery group with maximum number of patients in the age group 26-35 years. This age group is productive that directly influences the economy of a family and indirectly of a nation. Regarding sex distribution male and female are equally affected in both the groups (51.6% male, 48.4% female). In defining our inclusion criteria for acute Jones fracture, we used the original radiographic criteria of Torg et al to define an acute fracture. Torg et al reported that patients with acute fracture may have had prodromal pain or discomfort before the fracture\textsuperscript{6}. In our study we included one patient who reported prodromal pain for 10 days and those patients was randomized to surgical group and resulted in treatment success with clinical union in 8 weeks and return to normal activity in 9 weeks.

Regarding mode of injury there is only one patient having fracture due to direct hit and rest of the injuries were indirect injuries with 15 of 31 patients due to fall from stairs, followed by 5 patients due to fall during playing and 5 due to fall during walking. The time elapsed since injury to treatment is minimum one day to maximum of 10 days with median 3 days in cast group and 2 days in surgery group. In our study out of 31 patients 20 sustained injury to right foot and 11 to left foot in both the groups. Regarding side involvement there is no significant difference between the two treatment groups (p-value = 0.1019).

There is no significant difference of visual analogue pain score and grade of tenderness before treatment between the two groups. The mean VAS is 6.4 & 6.7 for cast and surgery group respectively (p value 0.125), whereas mean of grade of tenderness is 2.00 in both the groups before treatment. But there is a significant difference of the VAS score and grade of tenderness at 8 weeks of treatment. The mean of VAS is 1.5 for cast group where as 0.20 for surgery group (p value 0.0002) at 8 weeks of treatment. Similarly the mean of the grade of tenderness is 1.06 for the cast group and 0.13 for the surgery group (p value 0.0001). This indicates that there is high success rate and quicker union in surgery group compared with that of cast group.

The median duration of cast application in cast group is 9 weeks where as slab application in surgery group is 2 weeks which is highly significant resulting in early mobilization after screw fixation. But the mean duration of application of hard sole shoe after cast or slab removal is longer (5.9 weeks) in surgery group than that of cast group (3.4 weeks) because of earlier application in surgery group. The minimum follow up of patients in both the groups is 6 months and maximum 18 months with mean follow up 12 months.

The complications in the cast group are more severe than that in the surgery group. Cast group showed non union in 3 patients (18.6 %), delayed union in 3 patients (18.6 %), and they were treated surgically finally. One patient treated with cast application showed reflex sympathetic dystrophy (6.3%) landing up into nonunion and another patient also treated with cast application showed non compliance in continuing the cast for 8 weeks. She compelled somebody to remove the cast after 3 weeks of application because of heaviness filling in the leg and also due to negative self image resulting in delayed union.

Jones, in 1902, was the first to describe diaphyseal fractures of the fifth metatarsal, when he reported on...
four such injuries, all of which apparently healed with conservative management. In 1927, Carp recognized that these fractures tend to heal poorly; he found that of twenty–one fractures union was delayed in five. In 1960, Stewart noted that bone grafting was needed to secure union of some of these fractures. Kavanaugh et al. noted that in their series union was delayed in twelve of 18 fractures that were treated conservatively. In their total group of 23 fractures, 13 were eventually treated surgically using an intra-medullary screw for fixation. In 2005, comparative study done by Timothy, 18 patients treated with cast and 19 patients treated with screw fixation, 8 of 18 (44 % ) resulted in treatment failures (5 non-union, 1 delayed union, and 2, re-fractures ) in cast group. 

In our study early screw fixation resulted in clinical union at a mean of 8.3 weeks which is earlier than that of cast treatment (13.2 weeks). In addition, the surgically treated patients returned to normal activity at a mean of 9.7 weeks which is also earlier than that of patients treated by cast (15.15 weeks). Early screw fixation resulted in satisfactory results in all patients (100%) with some minor complications, whereas cast treatment resulted in a nonunion & delayed union in 6 of 16 patients (37.5%).

In the comparative study done by Timothy et al. the mean time to clinical union in cast group is 14.5 weeks and 6.3 weeks in surgery group and in our study the mean time to clinical union in cast group is 13.3 wks and in surgery group is 8.3 weeks respectively , which is comparable. And in another study, only screw fixation done by Kery Resse et al. showed mean time to clinical union is 7.3 weeks and return to normal activity is 7.9 weeks, which is also comparable with our results.

CONCLUSION

Early screw fixation is a safe and effective method of treatment for acute Jones fracture. Early surgical treatment results in quicker clinical union and allows patients to return to normal activities of daily living faster than with cast treatment.

REFERENCE


Comparative Study of Early Screw Fixation Versus Cast Application on the Treatment of Acute Jones Fracture