

Original Research Article

Functional outcome of intramedullary screw fixation of fifth metatarsal Jones fracture

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Received: 08 July 2025

Revised: 22 August 2025

Accepted: 02 September 2025

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ABSTRACT

Background: Management of fractures of the base of 5th metatarsal has long been a topic of debate, particularly regarding the effectiveness of operative and non-operative treatment approaches. This study aimed to evaluate the outcomes of internal fixation using an intramedullary screw in management of Jones fracture.

Methods: Twenty-one patients diagnosed with Jones fracture were surgically fixed with intramedullary screw and were evaluated on the basis of union time and the American Orthopaedic Foot and Ankle Society score at 6 weeks and 12 weeks.

Results: Overall union time of the study patients was 6.76 weeks (SD=0.768). There was a non-significant relationship between age and union time ($r=0.146$, $p=0.528$) in the patients. The overall mean AOFAS score at 6 weeks increased from 87.43 ± 5.005 to overall mean score 94.09 ± 2.364 at 12 weeks after treatment. There was a significant negative correlation between age and AOFAS at 6-weeks ($r=-0.673$, $p<0.001$) and at 12-weeks ($r=-0.542$, $p=0.011$) post treatment.

Conclusions: The treatment with surgical screw fixation is safe and effective method for treatment of acute Jones fracture and can be strongly recommended in those who want to return to normal activity earlier.

Keywords: AOFAS, Jones fracture, Operative treatment, Union time

INTRODUCTION

Foot injuries represent 13.4% of all musculoskeletal injuries. Among these, forefoot injuries are the most prevalent (78.4%), with metatarsal fractures being the most frequent injuries (43.3%). In the midfoot, Lisfranc injuries are more commonly observed in midfoot, while calcaneal fractures are the most frequent in the hindfoot.¹ The 5th metatarsal injury is thought to occur when there is an indirect, large adduction force applied to the forefoot with the ankle in plantar flexion.² Robust soft-tissue attachments to the base of the fifth metatarsal, including the intermetatarsal ligaments and capsular and tendinous attachments act as a tether resisting displacement. If there are significant forces present, a transverse or short oblique fracture (Jones fracture) can occur at the metaphyseal-diaphyseal junction of the metatarsal.³ Various surgical

techniques including crossed K-wire fixation, intramedullary devices and tension band constructs are described for treatment of the Jones fracture. Several systematic reviews conclude that surgery results in shorter union times and lower number of delayed union or non-unions.⁴ Yet, surgical complications include injury to the sural nerve, irritation from a prominent screw head, refracture, delayed or non-union.⁵ This study aimed to evaluate the outcomes and complications, if any, of treatment of Jones fractures through internal fixation using an intramedullary screw.

METHODS

This prospective observational study was conducted at the Orthopaedic department of the MGM Medical College and MY Hospital, Indore, a tertiary care center from July, 2023

to April, 2025. The patients with traumatic fifth metatarsal bone (Jones) fractures who reported to the OPD or emergency at MY hospital were involved in the study. Previous studies, have been performed with 18, 23 and 19 patients respectively to find efficacy of surgical intervention in the treatment of Jones fracture.⁶⁻⁸ Therefore, considering estimated requirement as well as availability of the patients during the study period, twenty-one patients with Jones fracture were included in the present study. Twenty-one patients, aged more than 18 years and less than 60 years, with isolated Jones fracture and those who gave written informed consent for participation in the study were included in the study. Patients with other fractures of ipsilateral limb, compound fractures of 5th metatarsal bone, pathological fractures, immature skeletons, infections like osteomyelitis and those who refused to participate in the study were excluded. Patients were evaluated on basis of history, symptoms, physical examination and by plain radiograph in anteroposterior (AP) and oblique views of the foot. Patients were anaesthetized by spinal anaesthesia and operated on a standard radiolucent orthopaedic table in supine position under image intensifier guidance.

A 60° to 70° flexion was done on the contralateral lower limb. Patient's legs were separated through a padded cushion and a cushion was provided below the injured foot. A stab incision was done about 0.5 to 1 cm proximal to the base of the fifth metatarsal bone. After the incision, a 4.0 mm cannulated screw guide pin was inserted into the space between the plantar fascia and the peroneus brevis tendon under image guidance. A cannulated drill was used to drill across the intramedullary canal of the fifth metatarsal. A partially threaded, 4.0 mm, cannulated screw of 40 mm to 60 mm length was then inserted under image guidance over the guide pin to ensure intramedullary placement of the screw. The guide pin was removed after placement of the intramedullary screw. Care was taken to ensure the intramedullary position and that all the threads were distal to the fracture site. Closure of the wound was done with a single stitch.

The patient remained in the hospital overnight and prophylactic parenteral antibiotics were administered for the first 24 hours postoperatively. Patients were instructed not to weight bear for first 2 weeks and thereafter partial weight bearing with crutches till 6 weeks. Then after 6 weeks, the patient started on full weight-bearing without any aids. However, if we found any loosening over the screw or widening of the fracture gap, then we wait for another 2 weeks till full weight-bearing. After 12 weeks there were no restrictions for the patient for activities. We followed up all the patients for postoperative pain, function, walking distance, gait abnormality and alignment. There was no discomfort due to implant in any of the patients, so it was not removed. Clinical union was evaluated based on plain radiographic evidence of bone healing combined with minimal or no clinical pain.⁹ To differentiate between fractures that were clinically healed, radiographically healed and those that appeared healed

clinically but still showed a faint fracture line despite adequate trabecular bridging, the classification method described by Porter et al was applied.¹⁰ Radiographic healing was considered complete when the fracture line was no longer visible, there was no deformity of the fifth metatarsal and an intact, straight screw could be clearly seen on the imaging.

Follow up X-rays were done to follow up union of the fracture at 6 weeks and 12 weeks. The American Orthopaedic Foot and Ankle Society (AOFAS) score was done at 6 weeks and 12 weeks to evaluate patient's pain and functional outcome. Occurrence of complication, if any, was also noted. Results were analysed using Statistical Package for the Social Sciences (SPSS version 27.0) software. Results were considered significant when p value < 0.05.

RESULTS

Mean age of the patients was 34.7 years. Twenty-one patients were categorized into four age ranges: 18-30 years, 31-40 years, 41-50 years and 51-60 years with 7 (33.3%), 9 (42.9%), 3 (14.3%) and 2 (9.5%) patients respectively. There were 13 males (61.9%) 8 females (38.1%) in the study population. Twisting injuries were the most common, affecting 10 patients (47.6%). Road traffic accidents (RTA) and fall from height accounted for 8 (38.1%) and 3 patients (14.3%) respectively. Right-sided injuries were more common, affecting 57.1% of patients while Left-sided injuries accounted for 42.9% of the total injuries.

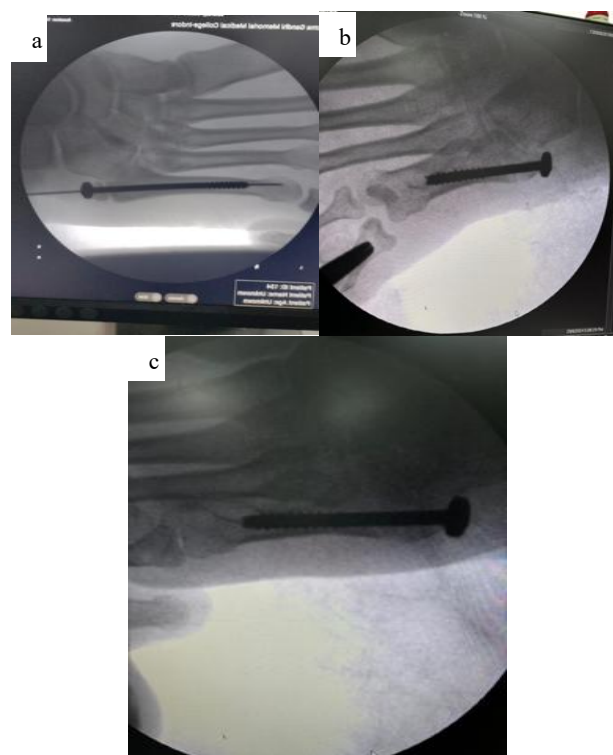


Figure 1 (a-c): Intraoperative introduction of guide wire and CC screw.

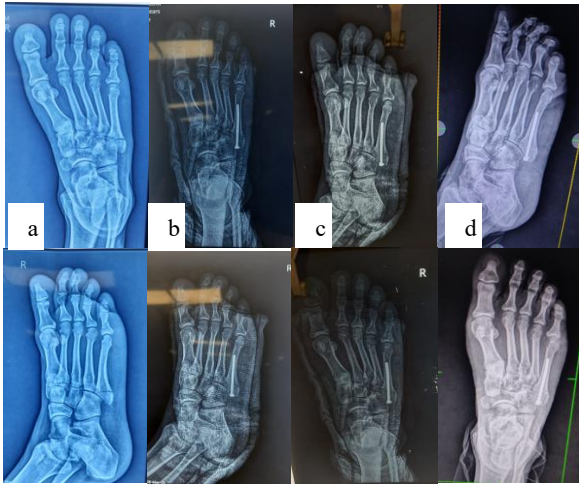


Figure 2: Patient's X-rays. (a) At presentation (b) After Op (c) Post 6 weeks (d) Post 12 weeks.

The Table 1 presents the union time analysis for patients, categorized by age groups. It indicates that overall union time of the study patients was 6.76 (SD=0.768). There was

weak non-significant relationship between age and union time ($r=0.146$, $p=0.528$). Table 2 present AOFAS (American Orthopaedic Foot and Ankle Society) scores across different age groups at 6 weeks and 12 weeks post-treatment. The overall mean score at 6 weeks increased from 87.43 ± 5.005 to overall mean score 94.09 ± 2.364 at 12 weeks after treatment.

It was observed that at 6 weeks 6 (28.6%) patients and at 12 weeks 20 (95.2%) patients achieved excellent scores (90-100). Fifteen (71.4%) patients at 6 weeks while one (4.8%) patient at 12 weeks were in the good score (75-89). None of the patients were in fair (60-74) or poor (less than 60) score category. There was a significant negative correlation between age and AOFAS at 6-weeks ($r=-0.673$, $p<0.001$) and 12-week ($r=-0.542$, $p=0.011$) post treatment.

Table 3 provides ankle-hindfoot alignment and complications of patients which is categorized as good, fair or poor based on the degree of malalignment and symptoms. Nineteen out of 21 patients (90.5%) had well-aligned ankle and hindfoot post treatment.

Table 1: Comparison of mean union time.

Age group (in years)	No. of pts	Mean union time	SD
18 to 30	7	6.71	0.487
31 to 40	9	6.44	0.527
41 to 50	3	7.97	1.154
51 to 60	2	7.00	1.414
Total	21	6.76	0.768

Table 2: AOFAS scores of patients according to age.

AOFAS scores	Age group	No. of pts	Mean	SD	Range
6 weeks	18-30	7	88.71	2.214	86 93
	31-40	9	90.11	4.013	85 97
	41-50	3	83.0	1.732	81 84
	51-60	2	77.50	2.121	76 79
	Total	21	87.43	5.005	76 97
12 weeks	18-30	7	94.67	2.138	92 98
	31-40	9	94.70	1.732	92 97
	41-50	3	94.33	0.577	94 95
	51-60	2	89.00	1.414	88 90
	Total	21	94.09	2.364	88 98

Table 3: Ankle-hindfoot alignment and complications.

Alignment	No. of patients
Good, Ankle-hindfoot well aligned	19
Fair, some degree of ankle-hindfoot malalignment observed, no symptoms	2
Poor, Severe malalignment, symptoms	0

DISCUSSION

Patients with Jones fracture usually reported acute trauma and presented with pain, localized swelling and

tenderness, difficulty in walking or weight-bearing. Generally, patients were able to localize the pain to the area of the fracture, while foot inversion from 30 to 50° resulted in maximal strain and increased symptoms.

Authors used a screw with a diameter of 4.0 mm of suitable length for treating these fractures and achieved good reduction and compression at the fracture site. Several clinical and biomechanical investigations have examined various screw designs with varied sizes, orientations and materials to avoid complications such as hardware failure and refracture.¹¹ Metzl et al used screw of 5.5 mm diameter and Said et al used screw of 4.00 mm diameter with or without a washer.^{12,13} The diameter of the screw should be no less than 4.0 mm in order to obtain adequate compression across the fracture line and the largest screw possible which will achieve maximal contact interface with the dense cortical bone should always be used.¹⁴ Radiographic studies confirmed that excessive screw length should be avoided by keeping screw length less than 68% of length of fifth metatarsal.¹⁵

There was no discomfort reported by any patients due to implant, so we did not remove it. In the study by Porter et al also none of the 23 athletes, who were surgically treated with 4.5 mm stainless steel cannulated screw, required removal of the screw and no athlete complained of pain at the hardware site.¹⁰ Said et al has also documented that that intramedullary screw fixation is better as it needs no removal.¹³

In our study all patients with operative treatment had 100% union rate and mean union time/healing time of 6.76 weeks (range 6-9 weeks, SD=0.768) was recorded. This is comparable with Portland et al who demonstrated 100% union rate after immediate intramedullary fixation with 4.5 mm cannulated screws in Jones fractures (zone two) with an average time to union of 6.2 weeks.¹⁶ Mahajan et al, observed a mean healing time of 6.33 ± 1.74 weeks following bicortical fixation.⁷ Martina et al, reported that Jones fractures fixed with 4.0 mm cannulated compression screw had a mean healing time of 7.4 weeks after surgery.¹⁷ Analysis of union time for patients categorized by age groups revealed that younger patients had less union time as compared to older patients. The results reveal that younger patients heal faster and more consistently, likely due to better bone metabolism, stronger osteoblast activity and efficient vascularization. However, correlation between age and union time ($r=0.1458$, $p=0.528$, $p<0.05$) suggests non-significant relationship between age and union time.

The findings indicate that age shows a slight trend toward influencing healing time, though this relationship is not statistically significant, suggesting that age is not a strong determinator of union time. While some earlier studies have proposed a potential association between increasing age and prolonged healing in Jones fractures, the evidence remains inconsistent as other studies have not found age to be a significant factor influencing healing outcomes. Yoho et al analyzed 14 cases treated with intramedullary screw fixation and reported moderate correlations between age and bone healing time.¹⁸ In contrast, Bucknam et al found no significant impact of patient age on either radiographic healing or functional outcomes.¹⁹ The mean AOFAS score

for patients was 87.43 (SD=5.005) and 94.09 (SD=2.364) points respectively at 6 and 12 weeks follow up. Jiri reported mean AOFAS at 6 and 12 weeks follow up as 96.9 and 100 respectively.²⁰ In the study by Bassiooni et al patients treated with percutaneous screw fixation had AOFAS score ranged from 91 to 98 at end of follow up at 12 weeks.²¹ Kim et al, found average AOFAS score of 96.7 while Mahajan et al reported an average AOFAS score as 94 ± 2.34 (range, 90 to 99) at 6 months in operatively treated patients.^{7,22}

The results are comparable with Jiri et al who found 2 patients in good (75-89) and rest 13 patients in excellent category (90-100) of AOFAS at 6 weeks post treatment.²⁰ He found all patients in the excellent category at 12 weeks postop in operative patients.

Analysis of AOFAS in patients across different age groups shows that overall higher mean AOFAS score is recorded in the younger patients as compared to older patients. The results are comparable with Said who recorded higher AOFAS in operative patients with the age group of 29-38 years and 49-60 years at the end of follow up at 12 weeks.¹³ A correlation between age and AOFAS in patients shows that there is a significant negative correlation at 6-weeks ($r=-0.673$, $p<0.001$) and 12 weeks ($r=-0.542$, $p=0.011$) post treatment. The results of the present study align with the findings of Abdelsalam et al, who reported that both age and union time had a statistically significant impact on the AOFAS score at final follow-up.⁶ This contrasts with earlier studies, which found no significant effect of patient age on functional outcomes.²³⁻²⁵

In the present study, no major complications such as delayed union, non-union or refracture were observed by the end of the follow-up period. The most common complication reported was chronic pain, which resolved by the final follow-up. Two patients exhibited some ankle-hindfoot malalignment, though this was asymptomatic. Additionally, one participant developed a superficial infection at the suture site, which was successfully treated with oral antibiotics.

Abdelsalam et al reported that all patients achieved full scores in areas related to walking surface, gait and alignment, with no complications observed in any of the cases.⁶ Mostafa used 4.0 mm and Massada et al used 4.5 mm cannulated screw with no reports of delay union, non-union or refracture.^{26,27} Glasgow et al, reported six failures when performing intramedullary fixation, with three refractures and three delayed unions.²⁸ Kavanaugh et al found screw breakage and a screw missing the medullary canal while Wright et al reported refractures after screw fixation of the fracture.^{29,30} They concluded that larger diameter screw for fracture fixation should be used and fracture site should be protected for longer period by using bracing, shoe modification, or an orthosis. Although surgical outcomes are widely successful, possible complications include hardware failure and refracture, sural nerve injury, malunion, delayed union/non-union,

prominence of the screwhead, chronic low-level pain and iatrogenic fractures.^{11,24,31,32} Nonoperative management of Jones fractures often necessitates prolonged activity restriction, which can lead to symptomatic nonunion or refracture.³³ As a result, surgical intervention for fifth metatarsal fractures is increasingly favored. Rammelt et al and Zwitter et al emphasized the need for surgery when the fracture gap exceeds 2 mm or when more than 30% of the joint surface is involved.^{34,35}

CONCLUSION

Surgical screw fixation is safe and effective method for treatment of Jones fracture of base of 5th metatarsal. This treatment can be recommended in those who want to return to normal activity earlier as it results in earlier clinical union and improved patient-reported outcomes with a reduced rate of complications.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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- Cite this article as:** Kushwah K, Rajput DS, Kumar MM. Functional outcome of intramedullary screw fixation of fifth metatarsal jones fracture. *Int J Res Orthop* 2025;11:1467-72.