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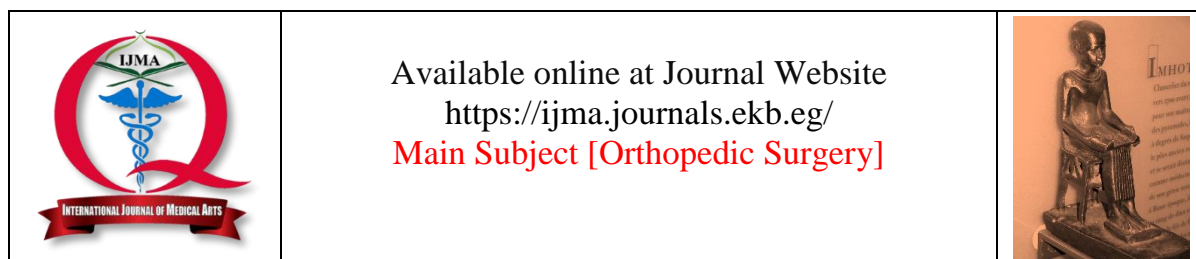


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## Original Article

# Comparative Study Between Intramedullary Screw Fixation and Tension Band Technique in Treatment of Acute Jones Fractures of the Base of Fifth Metatarsal

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## ABSTRACT

### Article information

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**Background:** Jones fractures, one of the most common foot fractures, involve the proximal fifth metatarsal base. The treatment of Jones fractures encompasses a wide range of methods.

**The aim of the work:** The purpose of this research was to evaluate the efficacy of intramedullary screw fixation versus tension band method for the surgical treatment of Jones fractures.

**Patients and Methods:** This prospective interventional study was conducted on 20 patients with acute Jones fractures. Patients were randomly divided into 10 managed by intramedullary screw fixation and 10 managed by tension band technique. Patients were operated on the 2nd and 3rd day of trauma with equal distribution in both groups. After surgery, patients were immobilized in a below-knee cast for 2 weeks and serial radiographs were done during regular follow-up visits until the time of complete radiological union was detected. During regular follow-up visits, patients were assessed with the American Orthopaedic Foot and Ankle Society (AOFAS) score at each visit. Post-operative complications such as infection, delayed union, non-union, and re-fracture were checked and recorded.

**Results:** Both techniques had no effect on gait and pain with movement was only present in one case with intramedullary screw and two cases with tension band. Regarding complications, only one patient in each group had delayed union and one patient complained of infection.

**Conclusion:** Surgical management of acute Jones fractures either by intramedullary screw nail fixation or tension band wiring technique showed good results in healing with minimal postoperative complications.

**Keywords:** Jones; Fifth Metatarsal; Bone Screw; Tension band; AOFAS.



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## INTRODUCTION

One of the most frequent foot fractures is the fifth metatarsal. Numerous proximal fractures have been reported [1]. Tuberosity avulsion fractures, proximal diaphyseal, and Jones fractures are the three types of bases of fifth metatarsal fractures. The radiological presentation of a Jones fracture, which occurs at the metaphyseal-diaphyseal junction, allows for its classification as either acute, delayed union or non-union [2].

Jones fractures are difficult to cure and may cause substantial impairment, particularly for athletes and other physically active people. Non-operative therapy for Jones fractures has been demonstrated to have a high risk of re-fracture and delayed union, whereas surgical care has been shown to have outstanding outcomes in athletes and highly active persons. Increased union rates and shorter immobilization times for Jones fracture patients treated with intramedullary screw fixation. High percentages of successful union have also been reported after using the tension band approach to fixate Jones fractures [3].

## THE AIM OF THE WORK

The aim of this study was to compare the results of surgical treatment of Jones fractures by either intramedullary screw fixation or tension band technique.

## PATIENTS AND METHODS

This is a prospective interventional study conducted at Al-Azhar university hospitals and Beni-Suef health insurance hospital during the period between January 2021 till the end of July 2022. The study was performed on 20 patients with acute Jones fractures: 10 of them managed by intramedullary screw fixation and 10 managed by tension band technique.

### Inclusion criteria

Patients with isolated acute Jones fracture of the base of fifth metatarsal and athletes and active individuals aged between 15 and 60 years old were included in the study.

### Exclusion criteria

Patients were not included if they were younger than 15 or older than 60, if they had delayed union or nonunion of Jones fractures, if

they had peripheral vascular disease, or if they were in poor general health.

Patients fulfilling the inclusion criteria subjected to surgery inside Al-Azhar university hospitals and Beni-Suef health insurance hospital with preoperatively, patients were immobilized in a below knee slab and were operated on as early as possible. At the time of surgery, all patients were generally stable. Surgery was done under spinal anesthesia.

## Surgical technique

### Intramedullary screw fixation

Percutaneous intramedullary screw fixation was used in all instances with the use of fluoroscopy. At the point where the peroneus brevis tendon meets the tertius tendon at the base of the fifth metatarsal, a little incision was created. A plane through the soft tissues was made by blunt dissection. Guide wire placement at the base of the fifth metatarsal was verified in AP, lateral, and oblique views to be in direct alignment with the intramedullary canal. In order to prevent the wire from penetrating the cortical bone, it was moved over the fracture site and farther down the intramedullary canal.

Drills and taps were used to shape the canal in preparation for insertion of the selected implant, with the intention of ultimately achieving a screw diameter big enough to provide sufficient control of the distal portion. Using the wire's measurement of depth, the longest screw that could be used with variable-pitch screws without damaging the distant cortex was chosen. In the case of solid or cannulated partly threaded screws, the length of the screw was chosen to guarantee that all of the threads would be beyond the fracture site for lag screw fixation to be achieved.

### Tension band technique

On each occasion, a tourniquet was applied. An incision was created in the skin dorsolaterally. The tendon insertion of the peroneus brevis was seen, as was the proximal portion of the fifth metatarsal. The sural nerve's outgrowths were shielded from harm. Beginning at the base of the skull and extending over the fracture line, two 1.6- or 1.8-mm K-wires were bored into the medullary canal.

The peroneus brevis tendon was not broken during the K-wire insertion. It included drilling a hole 1–2 cm distal to the fracture line, passing a wire loop [thickness, 0.6–1.0 mm] through it, and then closing the loop around the K-wires in a figure of 8. To properly place the K-wires, they must be impacted into the proximal fifth metatarsal base after being twisted and rotated medially. To prevent skin discomfort, the knot will be positioned out of the way. Sutures, both absorbable and non-absorbable, were used to seal the skin and the subcutaneous tissue.

**Post-operative care and assessment**

Patients were cast below the knee for two weeks after surgery, after which weight bearing was resumed when pain allowed. Each patient's unique time of clinical union was determined. Serial radiographs were taken at predetermined intervals until radiological union was confirmed. Infection, delayed union, non-union, and re-fracture were among the post-operative problems identified and documented.

To evaluate the functional outcome for each surgical modality and compare them at the end, patients were evaluated using THE AMERICAN ORTHOPEIC FOOT AND ANKLE SCORE at each follow-up visit [4]. The parameters of the score include pain, function and alignment.

**Statistical analysis**

The data was analyzed using SPSS for Windows version 26 [the statistical application for social science]. Mean and standard deviation were used to characterize the quantitative variables. When applicable, frequency and percentages were used to characterize the qualitative characteristics. When comparing groups based on categorical data, we used Chi-squared or fisher exact tests. Groups were

compared using the T test or the Mann Whitney for scale variables, depending on the normality of the data. The AOFAS score was correlated with other factors using a Spearman non-parametric correlation. If the P value was less than 0.05, was considered statistically significant, and if it was more than 0.05, it was considered insignificant.

**Ethical considerations**

The study was designed according to the Declaration of Helsinki. All contributors signed an informed consent form. The data was anonymous and no identifiable information was kept from the participants.

**RESULTS**

These results showed that there was no significant difference between the studied groups regarding their age, sex and diabetes mellitus. There was no significant difference between the studied groups regarding their side of fracture and associated fractures [Table 1].

There was no significant difference between the studied groups regarding the intraoperative and postoperative complications [Table 2]. There was no significant difference between the studied groups regarding outcomes of the operations. Both techniques had no effect on gait and pain with movement was only present in one case [10%] with intramedullary screw and 2 cases [20%] with tension band [P-value=0.541] [Figure 1].

There was no significant difference between the studied groups regarding AOFAS score as shown in Table [3].

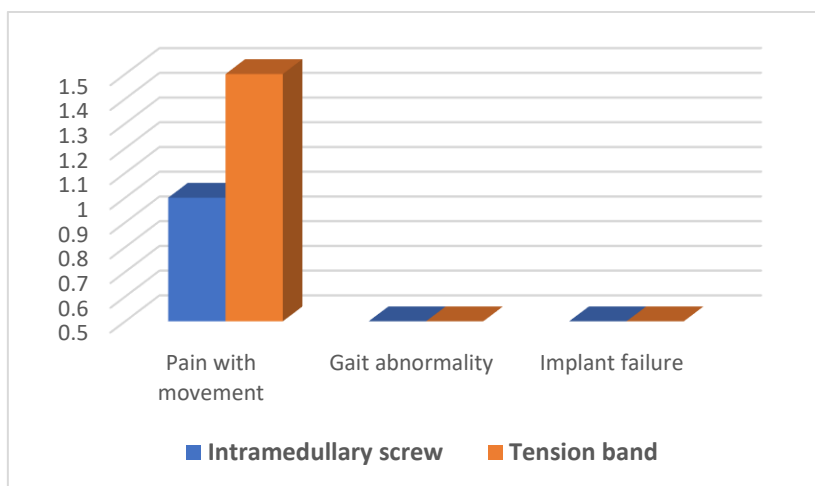
There was no significant linear correlation between patients' age and AOFAS score in both groups as shown in Table [4].

**Table [1]:** Baseline characteristics of the studied groups.

Items	Intramedullary screw [n=10]	Tension band [n=10]	P-value
Sex	Male	7 [70.0%]	0.178
	Female	3 [30.0%]	
Age [mean±SD]	3 1.2±3.6	35.0±5.4	0.080
Diabetes mellitus	1 [10.0%]	1 [10.0%]	>0.999
Side	Left	3 [30.0%]	>0.999
	Right	7 [70.0%]	
Associated fracture	No	9 [90.0%]	0.999
	Yes	1 [10.0%]	

**Table [2]:** Intraoperative and postoperative complications of the studied groups

Items	Intramedullary screw [n=10]	Tension band [n=10]	P-value
<b>Intraoperative complications</b>	0[0%]	0[0%]	>0.999
<b>Delayed or non-union</b>	1 [10.0%]	1 [10.0%]	>0.999
<b>Infection</b>	1 [10.0%]	1 [10.0%]	>0.999



**Figure [1]:** Surgical outcomes of the studied groups

**Table [3]:** Comparison between the studied groups regarding the AOFAS score.

Items	Intramedullary screw [n=10]	Tension band [n=10]	P-value
<b>AOFAS score</b>	86.2 ± 5.2	85.1 ± 7.1	0.538

**Table [4]:** Correlation between the AOFAS score and age in each group.

Type of fixation		AOFAS score	
<b>Intramedullary screw [n=10]</b>	Age	r	-0.515
		P-value	0.128
<b>Tension band [n=10]</b>	Age	r	0.069
		P-value	0.850

## DISCUSSION

The metaphyseal-diaphyseal fracture of the fifth metatarsal base presents a difficult clinical and challenging problem. The rate of delayed union and nonunion in these fractures may be reduced with surgical fixation, hence this treatment option is highly recommended [5].

Although several operational fixation methods have been published, the intramedullary [IM] screw fixation and tension band approach for Jones fractures continues to be the most often used method due to its technical efficacy [6].

The aim of this study was to compare the results of surgical treatment of Jones fractures by either intramedullary screw fixation or tension band technique.

This study showed that there was no significant difference between the studied groups regarding outcomes of the operations. Both techniques had no effect on gait and pain with movement was only present in one case with intramedullary screw and two cases with tension band. Regarding the complications, only one patient [10%] in each group had delayed union and one patient [10%] complained from infection. There was no significant difference between the studied groups regarding the intraoperative and post-operative complications. Similarly, **Looney et al.** found that 20% of Jones fractures treated with intramedullary screws had delayed unions. None of the unions failed, and there were no further issues [7]. Furthermore, John demonstrated in their research that delayed bone healing



occurred in just one patient after screw treatment for a Jones fracture [8].

**Miller *et al.*** found that just one patient experienced a superficial wound infection at the screw entry site, and that this infection cleared completely when oral antibiotics were given [9].

There were no non-unions, delayed unions, or re-fractures in the follow-up period, and the mean time for union was 12.8 weeks in the research by **Sarimo *et al.*** on tension-band wiring for fifth metatarsal fractures, while the time to return to full activity ranged from 8 weeks to 20 weeks [10].

If there are little pieces that cannot be screw fixed, tension band wiring may be preferred. Twenty-seven zone two fractures treated with tension band wire saw satisfactory outcomes with no problems. At three weeks, patients were allowed to begin weight bearing; the average duration to union was 12.8 weeks [11].

Union rates are much higher after surgical intervention than they are after conservative therapy, and the time it takes for a fracture to heal is also shorter [12].

Inadequate nutritional blood supply may be responsible for delayed union in fractures at the base of the fifth metatarsal. Disruption of the vascular supply entering the bone at the metaphyseal-diaphyseal junction has been linked to high incidences of non-union [13].

In our study, the mean age of patients treated with intramedullary screw nail was  $31.2 \pm 3.6$  and patients treated with tension band was  $35.0 \pm 5.4$ . Most of cases treated with intramedullary screw nail was males [70%] while cases treated with tension band most of them were females [60%]. Only one patient was diabetic in each group. There was no significant difference between the studied groups regarding their age, sex and diabetes mellitus.

All the athletes in the **Miller *et al.*** trial on fixing 5<sup>th</sup> metatarsal stress fractures were male, with a mean age of  $23.4 \pm 4.3\%$ . One possible explanation for this disparity is because they only considered football players [9]. In their research, **Vorlat *et al.*** found that majority of the

victims were women, with a mean age of 32 at the time of injury [14].

Our study also revealed that in each group, 70% of cases had fracture on the right side and only one patient treated with intramedullary screw nail had associated fracture. The mean AOFAS score for patients treated with intramedullary screw nail was  $86.2 \pm 5.2$  and patients treated with tension band was  $85.1 \pm 7.1$ . There was no significant difference between the studied groups regarding AOFAS score. There was no significant linear correlation between patients' age and AOFAS score in both groups.

Right-side Jones fractures treated with screws were successful in curing 23 patients, as reported by **Mahajan *et al.*** Their average AOFAS score was 94, demonstrating the superiority of intramedullary screw fixation over non-operative care [15].

In addition, **Baumbach *et al.*** researches on the functional therapy of 5<sup>th</sup> metatarsal bone fractures showed that the average AOFAS score for all fractures at 20 weeks post-surgery was 93 [16].

High postoperative AOFAS scores [90-94] were similarly related to surgical intervention for Jones fractures, as reported by **Herterich *et al.*** Functional treatment tends to lead to a more rapid recovery and improved functional results in this regard [17].

**Conclusions:** Both the intramedullary screw nail fixation and tension band wiring techniques have been shown to be effective surgical treatments for acute Jones fractures, with excellent healing outcomes and few postoperative problems.

**Recommendations:** Both Intramedullary screw fixation and tension band wiring technique are good surgical techniques for management of Jones fractures. Surgeons should evaluate each case for the proper choice of each technique. More research with a bigger sample size is needed to validate these findings, especially for individuals in the high-risk category. There are a variety of surgical options for treating a Jones fracture; further randomized controlled studies

are needed to establish which approach is most effective. Follow up of the patients for longer duration is recommended to confirm absence of any post-operative complications.

**Disclosure:** None to be disclosed

## REFERENCES

- Cheung CN, Lui TH. Proximal Fifth Metatarsal Fractures: Anatomy, Classification, Treatment and Complications. *Arch Trauma Res.* 2016 Jun 13;5[4]: e33298. doi: 10.5812/at.33298.
- Bowes J, Buckley R. Fifth metatarsal fractures and current treatment. *World J Orthop.* 2016 Dec 18;7 [12]:793-800. doi: 10.5312/wjo.v7.i12.793.
- Goodloe JB, Cregar WM, Caughman A, Bailey EP, Barfield WR, Gross CE. Surgical Management of Proximal Fifth Metatarsal Fractures in Elite Athletes: A Systematic Review. *Orthop J Sports Med.* 2021; 9 [9]. doi: 10.1177/23259671211037647.
- Van Lieshout EM, De Boer AS, Meuffels DE, Den Hoed PT, Van der Vlies CH, Tuinebreijer WE, Verhofstad MH. American Orthopaedic Foot and Ankle Society [AOFAS] Ankle-Hindfoot Score: a study protocol for the translation and validation of the Dutch language version. *BMJ Open.* 2017 Feb 27;7 [2]: e012884. doi: 10.1136/bmjopen-2016-012884.
- Duplantier NL, Mitchell RJ, Zambrano S, Stone AC, Delgado DA, Lambert BS, *et al.* A Biomechanical Comparison of Fifth Metatarsal Jones Fracture Fixation Methods. *Am J Sports Med.* 2018; 46 [5]:1220-1227. doi: 10.1177/0363546517753376.
- Bucknam RB, Scanaliato JP, Kusnezov NA, Heida KA Jr, Dunn JC, Orr JD. Return to Weightbearing and High-Impact Activities Following Jones Fracture Intramedullary Screw Fixation. *Foot Ankle Int.* 2020; 41 [4]:379-386. doi: 10.1177/1071100719898278.
- Looney AM, Renehan JR, Dean DM, Murthy A, Sanders TH, Neufeld SK, Cuttica DJ. Rate of Delayed Union with Early Weightbearing Following Intramedullary Screw Fixation of Jones Fractures. *Foot Ankle Int.* 2020;41[11]: 1325-1334. doi: 10.1177/1071100720938317.
- John R. Comparison of internal fixation with hollow two-way compression screw and double Kirschner pin for the treatment of Jones fracture. *Foot Ankle Orthop.* 2018 Sep 14; 3[3]: 2473, doi: 10.1177/ 2473011418S00271.
- Miller D, Marsland D, Jones M, Calder J. Early return to playing professional football following fixation of 5<sup>th</sup> metatarsal stress fractures may lead to delayed union but does not increase the risk of long-term non-union. *Knee Surg Sports Traumatol Arthrosc.* 2019; 27 [9]:2796-2801. doi: 10.1007/s00167-018-5104-2.
- Sarimo J, Rantanen J, Orava S, Alanen J. Tension-band wiring for fractures of the fifth metatarsal located in the junction of the proximal metaphysis and diaphysis. *Am J Sports Med.* 2006 Mar;34[3]:476-80. doi: 10.1177/0363546505281803.
- DeSandis B, Murphy C, Rosenbaum A, Levitsky M, O'Malley Q, Konin G, Drakos M. Multi-planar CT Analysis of Fifth Metatarsal Morphology: Implications for Operative Management of Zone II Fractures. *Foot Ankle Int.* 2016 May;37[5]: 528-36. doi: 10.1177/1071100715623041.
- Yates J, Feeley I, Sasikumar S, Rattan G, Hannigan A, Sheehan E. Jones fracture of the fifth metatarsal: Is operative intervention justified? A systematic review of the literature and meta-analysis of results. *Foot [Edinb].* 2015;25[4]: 251-7. doi: 10.1016/j.foot.2015.08.001.
- Tracey J, Gross CE, Arora D, Parekh SG. Jones Fractures—Plating and IM Screws: Technique of ORIF Jones Fractures, Reduction, Deciding Proper Screw Size, and Plating Options. *Operative Techniques in Orthopaedics.* 2018 Jun 1;28[2]: 67-72. doi: 10.1053/j.oto.2018.01.004.
- Vorlat P, Achtergael W, Haentjens P. Predictors of outcome of non-displaced fractures of the base of the fifth metatarsal. *Int Orthop.* 2007; 31[1]:5-10. doi: 10.1007/s00264-006-0116-9.
- Mahajan V, Chung HW, Suh JS. Fractures of the proximal fifth metatarsal: percutaneous bicortical fixation. *Clin Orthop Surg.* 2011 Jun;3[2]:140-6. doi: 10.4055/cios.2011.3.2.140.
- Baumbach SF, Prall WC, Kramer M, Braunstein M, Böcker W, Polzer H. Functional treatment for fractures to the base of the 5th metatarsal - influence of fracture location and fracture characteristics. *BMC Musculoskelet Disord.* 2017 Dec 16;18[1]:534. doi: 10.1186/s12891-017-1893-6.
- Herterich V, Baumbach SF, Kaiser A, Böcker W, Polzer H. Fifth Metatarsal Fracture—A Systematic Review of the Treatment of Fractures of the Base of the Fifth Metatarsal Bone. *Dtsch Arztebl Int.* 2021; 118 [35-36]: 587-594. doi: 10.3238/arztebl. m2021.0231.



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