Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.47750/jptcp.2023.30.04.006

Comparative study on fixation of Jones fracture using cannulated screws vs tension band

Ali Ahmed Ali Younes[1], MBBCh; Tharwat Mohmed Abd Elrahman[2], MD; Mohamed Ramadan Elfeshawy[3] and Yaser Elsayed Hassan[4], MD
[1]Resident of Orthopedic and Traumatology, Surgery, Faculty of Medicine (for girls) - Al-Azhar University,
[2]professor of Orthopedic and Traumatology, Surgery, Faculty of Medicine (for girls) - Al-Azhar University, Egypt
[3]Lecturer, Department of Orthopedic Surgery, Faculty of Medicine for Girls, Al-Azhar University, Cairo, Egypt
[4]Assistant professor of Orthopedic and Traumatology, Surgery, Faculty of Medicine (for girls) - Al-Azhar University, Egypt

***Corresponding Author:** Ali Ahmed Ali Younes, MBBCh, Resident of Orthopedic and Traumatology, Surgery, Faculty of Medicine (for girls) - Al-Azhar University,
Email: ahortho2020@gmail.com

Submitted: 11 January 2023; Accepted: 14 February 2023; Published: 06 March 2023

ABSTRACT

Background; Currently, there is still debate on how to treat fifth metatarsal jones fractures, particularly those in area II.

Aim and objectives; study aims to evaluate the relative efficacy of tension band vs cannulated screw surgery for fixing fractures of the fifth metatarsal base (Jones fracture).

Patients and methods; Patients with traumatic base fifth metatarsal bone fractures who were admitted to the emergency rooms of the Alzahraa University Hospital and the Sohag General Hospital were the focus of this prospective thesis study. Their follow-up was scheduled to last for four months and would take place in the outpatient clinics of the Alzahraa Orthopedic Center and the Sohag General Hospital between April 2021 and the end of November 2021.

Result; The two groups differed significantly from one another. Assessment of post-operative discomfort at two weeks, six weeks, and twelve weeks (3 months). Every patient was asked to assess his or her level of pain on a scale from 0 to 10, following the most widely used numeric rating scale.

Conclusion; A safe and efficient approach for treating an acute Jones fracture at the base of the fifth metatarsal is early screw fixation or tension banding. The early surgical intervention leads to an earlier clinical union and enables patients to resume their regular daily activities more quickly than cast therapy, which has a significant nonunion rate.

Keywords; conservative treatment, fifth metatarsal fractures, protocol, surgical management, Jones fracture

INTRODUCTION

The Jone's fracture was originally described in detail in a 1902 article titled "Fractures of the Base of the Fifth Metatarsal Bone by Indirect Violence." (1) A Jones fracture is a transverse fracture of the proximal part of the metatarsal, as opposed to the more common and less dangerous avulsion fracture. Fractures of the fifth metatarsal are a source of significant disagreement among radiologists. According to Orthopaedic Radiology, a "real Jones" fracture occurs 1 in. distal to the base of the 5th metatarsal. Jones fractures and dancer's fractures are two common names for the same type of break (more accurately an avulsion fracture). (1)

An excessive amount of stress is often applied to the lateral border of the forefoot and metatarsal heads during vigorous ankle plantar flexion and forefoot adduction, which results in a Jones fracture. (2) Kavanaugh et al. originally proposed surgical fixation as a therapeutic strategy for Jones fractures in 1978. (3) Since then, many studies have found that operation management has a high success rate. It would seem that union rates may be increased, immobilization periods can be shortened, and refracture rates can be lowered with the use of percutaneous fixation. In this study, we compare the effectiveness of tension bands vs cannulated screws for the internal repair of Jones fractures.

PATIENTS AND METHODS

Patient selection and study design: This study involved 40 patients who had been hospitalized at Emergency Hospital Al Zahraa University and Sohag General Hospital with acute traumatic base fifth metatarsal bone (jones) fractures. The patients were divided into two treatment groups using a double-blind randomization process: the first group underwent surgical cannulated screw fixation, while the second group underwent tension band wiring. All research subjects' patients provided written fully informed consent. The Al Azhar Medical Research Ethics Committee authorized the project. Any unknown concerns that surfaced throughout the search were promptly disclosed to the patients and the ethics committee.

By using a code number or letter that refers to the patient's name and address, confidentiality was taken into account. Using their reports and investigations while obscuring the identities and addresses of the patients. Using research findings while publishing in a scientific journal.

Methods:

Patients with traumatic base fifth metatarsal bone fractures who were admitted to the emergency rooms of the Alzahraa University Hospital and the Sohag General Hospital were the focus of this prospective thesis study. Their follow-up was scheduled to last for four months and would take place in the outpatient clinics of the Alzahraa Orthopedic Center and the Sohag General Hospital between April 2021 and the end of November 2021.

Inclusion criteria:

Isolated Jones fracture (zone II), age: more than 18 years and less than 60 years.

Exclusion criteria:

Open fractures, pathological fractures, immature skeletons, Charcot foot, and infections like osteomyelitis are just a few.

Every patient was examined clinically and radiological examination including:

History talking:

Name, sex, age, occupation, date of injury, side injured, mechanism of injury, capacity to bear weight on the injured side, unique behaviors (smoking), history of diabetes mellitus, history of drug use (corticosteroid, addict, etc.), history of prior trauma: general or same foot and fate, history of varicosities in the lower limb, and history of previous trauma.

Local examination:

Tenderness, edema ecchymosis, previous foot scars, varicosities, local neurovascular assessment.

Investigations:

Radiological: anteroposterior, regular laboratory testing, as well as lateral and oblique images of the foot.

Management

Included were base fifth metatarsal fractures with any degree of displacement and avulsion fractures with a 5 mm displacement.

The patients were classified into two groups alternatingly:

Group I: Treated surgically by cannulated screw.

Group II: treated with open reduction and tension band internal fixation.

Type of management: 20 cases (50%) were treated surgically by cannulated screw fixation. 20 cases (50%) were treated surgically by tension band fixation

Follow-up period:

All cases were followed up for 4-8 months till pain at the fracture site completely disappeared. The mean follow-up period was 6 months.

Methods of assessment of the results:

A Modification of the system described by the AOFAS score. [(4)]

Preoperative preparation:

All procedures were done using spinal anesthesia. The patient was placed in a lateral or spinal

decubitus position. Draping was done after disinfection of the skin from the knee to the toes.

The operative technique of cannulated screw fixation: Anesthesia: spinal anesthesia; **Patient position:** lateral spinal decubitus or supine **Patient preparation** included applying a tourniquet and cleaning their skin from knees to toes. **Landmark incision:** a 3- to the 4-cm landmark that starts at the base and extends proximally in line with the fifth metatarsal.
Incision: small incision about 0.5 cm at the base of 5th metatarsal fig. (1).
Technique: The afflicted foot was put on top of the image intensifier while the patient was in a lateral or supine position.
Inserting a wire guide using a cannulated drill and a 4.0 mm intramedullary or bicortical cannulated screw fig(2). To ensure that none of the threads were close to the fracture site fig. (3), care was taken.
Closure of the wound with a single stitch.

Figure (1): landmark incision.

Figure (2): during entry of cannulated screw.

Figure (3): Follow-up cannulated screw on c arm.

The operative technique of tension band wiring fixation:
Anesthesia: spinal anesthesia, **the position of the patient:** supine or lateral spinal decubitus, **preparation of the patient:** tourniquet was done and disinfection of skin from knee to toes.
Landmark of incision: a 3- to the 4-cm-long incision that starts at the base and extends proximally in line with the fifth metatarsal fig (1).
Incision: A 5- to 6-cm slightly curvilinear dorsolateral skin incision from proximal to distal fig (4).
Technique: In each case, a tourniquet was applied while the patient was supine and guided by an image intensifier. Two 1.6 or 1.8 mm K-wires were drilled into the medullary canal beginning at the base and extending across the fracture line fig (5). This was done after making the incision. A hole was drilled 1 to 2 cm distal to the fracture line, and a wire loop (thickness, 0.6-1.0 mm) was passed through the hole and tightened around the K-wires in a figure-of-8 fashion fig (6). The proximal ends of the K-wires were bent and turned medially and sometimes impacted into the base of the proximal fifth metatarsal. The knot was placed away from the skin to avoid irritation the subcutaneous tissue was closed using absorbable sutures and the skin using nonabsorbable sutures.

Figure (4): Approach technique.

Figure (5): Fixation by k-wires.

Figure (6): Fixation by tension band.

Postoperative follow-up:

Each patient's postoperative pain, function, footwear requirements, walking distance, abnormal gait patterns, and alignment were all closely watched. In the first 24 hours following surgery, preventative parenteral antibiotics are administered, and the patient spends the night in the hospital. The American Orthopedic Foot and Ankle Society is used as a clinical grading system to monitor recovery following injury (AOFAS). 4) Statistical Evaluation: IBM SPSS software was used to enter and evaluate the acquired data (version 21). Qualitative information was displayed as an account and a present. To determine whether there were any appreciable differences in the distribution of qualitative data in each research group, a one-sample Chi-square was performed. They were compared to the probabilities that were tabulated (p-value). A P-value less than 0.05 was considered significant.

RESULTS

Except for one patient who had a good outcome, all patients treated with cannulated screw fixation (group 1) were assessed as having good outcomes at the time of the most recent follow-up, whereas all patients treated with tension band wiring (group 2) had exceptional results. According to AOFAS, there were substantial differences between the two groups (Table 1). (4)

Table (1): The overall results of the two groups

Overall	Group I	Group II	Total
Results	**No.**	**%**	**No.**	**%**	**No.**	**%**
Excellent	0	0.0	19	95	19	47.5
Good	20	100	1	5	21	52.5
Fair	0	0.0	0	0.0	0	0.0
Total	**20**	**100 %**	**20**	**100 %**	**40**	**100 %**

X^2 6.9 $P < 0.05$*

Table (2): Correlation between sex and results in each group

Sex	Group I		Group II		Total	X^2
	No.	**%**	**No.**	**%**	**No.**	
Male						
Excellent	0	0.0	11	91.6	11	5.21
Good	8	100.0	1	8.4	9	
Fair	0	0.0	0	0.0	0	
Total	**8**	**100.0**	**12**	**100.0**	**20**	
Female						
Excellent	0	0.0	8	100.0	8	6.9
Good	12	100.0	0	0	12	
Fair	0	0.0	0	0	0	
Total	**12**	**100.0**	**8**	**0.0**	**20**	

There was an insignificant difference between the groups. **Table (2)**

In this study, fractures on the left side had somewhat better outcomes. This difference was present in group II, but it was determined to be unimportant statistically (Table 2, 3). The results as a whole did not significantly differ regarding the side.

Table (3): Correlation of the results of the whole material with side distribution

Side	No.	%
Right		
Excellent	9	50.0
Good	9	50.0
Fair	0	0.0
Total	**18**	**100**
Left		
Excellent	10	45.5
Good	12	54.5
Fair	0	0.0
Total	**22**	**100**

X^2 1.20

Table (4): Correlation between the mechanism of trauma and results in each group

Mechanism of trauma	**Group I**		**Group II**		**Total**	**X^2**
	No.	**%**	**No.**	**%**	**No.**	
Inversion Excellent Good Fair	0 13 0	0.0 100.0 0.0	11 0 0	100.0 0.0 0.0	11 13 0	6.89*
Total	13	100.0	11	100.0	24	
Vertical Loading Excellent Good Fair	0 7 0	0.0 100.0 0.0	8 1 0	88.9 11.1 0	8 8 0	4.86*
Total	**7**	**100.0**	**9**	**0.0**	**16**	

There was a significant difference between the two groups. **Table (4)**

Assessment of pain from immediate postoperative, after two weeks, 6 weeks, and 12 weeks (3 months). According to the numeric rating scale most commonly used persons rate their pain on a scale from 0 to 10 score, every patient was asked to give a score to his degree of pain: **0 = No pain, 1 to 3= Mild pain, 4 to 6 =moderate pain and 7 to 10= Sever pain. Table (5)**

Table (5): Result of pain

Pain	**Group I**		**Group II**		**Total**	**Percentage**
	No.	**%**	**No.**	**%**		
No pain	0	0.0 %	0	0.0 %	0	0.0%
Mild	15	75.0	3	15.0	18	45.0%
Moderate	5	25.0 %	16	80.0 %	21	52.5%
Sever	0	0.0 %	1	5.0 %	1	2.5%
Total	**20**	**50 %**	**20**	**50 %**	**40**	**100%**

Table (6): Result of radiological union

	Union	**Delayed union**	**Nonunion**
Group I	18	0	2
Group II	19	1	0
Total	37	1	2
Percentage	**92.5%**	**2.5%**	**5%**

Table (7): Result of healing:

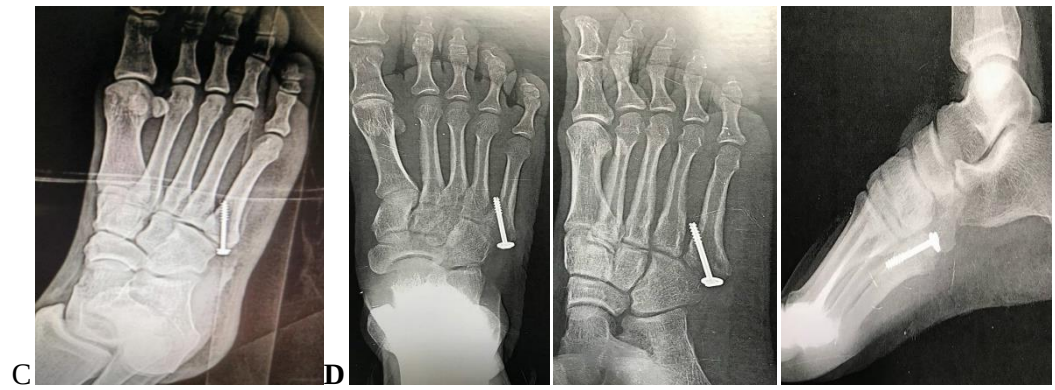
	Healing	**Un healing**
Group	20	0
Group	19	1
Total	39	1
Percentage	97.5%	2.5%

Two complications were encountered in the group treated with cannulated screw (**Group** I), and three cases were treated with a tension band (**Group** II). **Table (8)**

Table (8): Complications

Complication	**Non-complicated cases**	**Complicated cases**
Group I	18	2
Group II	17	3
Total	35	5
Percentage	87.5%	12.5%

A  **B** 



Case (1): 45 years old female with fracture Rt fifth metatarsal in zone II, the mode of trauma was twisting injury after falling into the ground. She was operated on 2nd day.
A: AP and oblique views of the patient pre-operatively in **zone II. B:** AP and Oblique views of the patient immediate post-operative. **C:** AP view after 6 weeks. **D:** AP, Oblique, and Lateral views after 5 months showing complete healing, and the patient is walking full weight bearing.

Case 2: 39 years old male with fracture Lt fifth metatarsal in zone II, the mode of trauma was twisting injury. He was operated on 4th day.
A: AP and lateral view preoperative. **B: AP and Lateral view postoperative. C: AP and Lateral view after 6 weeks postoperative. D:** AP and lateral view follow-up after 5 months showing complete union and patient walking full weight bearing.

DISCUSSION

The youngest patient in the current research was 18 years old, and the oldest was 60 years old, with a mean age of 36. 20 ladies (50%) and 20 guys (50%) made up the 1:1 ratio. Eight men (40%) and twelve women (60%) made up the cannulated screw group (group I), whereas twelve men (60%) and eight women (40%) made up the tension band group (group II). The patients who had the best results were under the age of 40. The significance of this was statistical. Whatever the course of therapy was taken, males have somewhat superior outcomes than females. Statistically speaking, this was inconsequential. Regarding sex, there is no discernible difference in the results as a whole.

According to Bassiooni et al., the patient population was an active group with ages ranging from (18-60) in the cast group and from (18-60) in

the surgical group. Both groups of patients were industrious and engaged. (5)

According to DeVries et al., the mean follow-up period was 128.5 ± 75.2 weeks (within a range of 21.9-283.4). 37 patients (fractures) were included in group I, 20 (54.05%) of whom were male and 17 (45.95%) were female. The age range for group I's mean was 16 to 80 years, or 43.80 ± 16.57. 16 patients (fractures) were in group II, with 7 (43.75%) men and 9 (56.25%) women. The range of group II's age was 27-69 years, with a mean age of 43.90 ± 13.96. To see if the groups were equivalent in age, an unpaired Student's t-test was utilized, and the results revealed that there was no statistically significant difference between the 2 groups (P = 0.483). (6)

Mohammed et al. demonstrated that there were no appreciable variations in the age (median 37 years) or gender of the two groups. (7)

We discovered that in the current study, the left side was impacted in 13 cases (32.5%) and the right side in 27 cases (67.5%). In group, I, 14 instances (70%) included the right side, whereas 6 (30%) involved the left. In group II, 13 occurrences (65%) involved the right side, and 7 (35%), the left. In this study, fractures on the left side had somewhat better outcomes. This difference was seen in group II, although it was determined to be unimportant statistically. The results as a whole did not significantly differ regarding the side.

Orr et al. showed that the typical partly threaded screw group had stronger initial fracture site compression and maintenance of compression during cyclic loading. The use of tapered variable pitch screws, as opposed to standard screw constructions, was also linked with a gradual, statistically significant increase in fracture site angulation; this angulation started only after the tenth cycle and persisted until the end of cyclic loading. (8)

Mohammed et al. demonstrated that fracture type (Weber type B and C) and etiology did not significantly differ between the two groups (twisting, fall, or motor vehicle accident). (7)

Mohammed et al. observed that 90% of group 2 patients and 80% of group 1 patients, respectively, got excellent and good outcomes (P = 0.049). (7)

Ko et al. showed that 89% of cases treated with tension-band wire and 78% of cases treated with screws both had excellent and satisfactory outcomes. (9)

Ostrum et al. have illustrated the tension band's biomechanical benefits over conventional fixation methods for the medial malleolus. Tension bands were four times more powerful than malleolar screws while resisting pronation forces and applying compression forces. (10)

According to Rovinsky et al., the study's tension bands are more technically favorable than other kinds of fixation for fixing tiny fragment fractures of the medial malleolus but are not advised for fixing vertical fractures. (11)

According to Metzl et al., several clinical and biomechanical investigations have examined various screw designs with varied sizes, orientations, and materials. It was determined that a screw with a diameter of 5.5 mm was suitable for treating these fractures. (12)

Five patients in the conservative group had nonunion, and one had Sudeck's atrophy. Except for one patient who received oral antibiotics for a superficial infection, the surgical group revealed union in all patients. (5)

Treatment failures in the cast group were eight out of 18 (44%) patients: five nonunions, one delayed union, and two refractures. In the surgical group, one out of 19 patients was regarded as a therapeutic failure. The median duration to recovery and return to sports for the surgery group was 7.5 weeks. The median time to unionization for the cast group was 14.5 weeks. With a P value of 0.001, the Mann-Whitney test revealed a statistically significant difference in both parameters between the groups. (13)

After bicortical fixation, the average healing time for patients reported by Mahajan et al. was 6.3 weeks (4-10), and their average AOFAS score was 94 before the implant was removed 23 weeks later. Our results are consistent with these studies, which show that intramedullary screw fixation is preferable to external fixation since it eliminates the need for surgical removal. (14)

In line with our results, Wang et al. suggested using surgical treatments to treat fractures of the fifth metatarsal base. The study reports positive effects of surgical interventions compared to non-operative interventions for lowering the rate of non-union, extending union, extending return to activity, extending return to sport, increasing visual analog scale, and raising American orthopaedic foot and ankle scale score. (15)

CONCLUSION

The safest and most efficient way for treating an acute Jones fracture at the base of the fifth metatarsal is early screw fixation or tension banding. The early surgical intervention leads to an earlier clinical union and enables patients to resume their regular daily activities more quickly than cast therapy, which has a significant nonunion rate.

REFERENCES

1. Carr, G, Grieve, A. W, Greaves, I. (2010). The Jones fracture of the fifth metatarsal. Trauma, 12(1), 51-54.
2. Cheung, C. N, Lui, T. H. (2016). Proximal fifth metatarsal fractures: anatomy, classification, treatment and complications. Archives of trauma research, 5(4).
3. Mostafa, M, Abd Ellah, O, Fathey, M. (2018). Surgical Treatment of Fracture Base of Fifth Metatarsal in Adults. J Clin Case Rep, 8(1078), 2.
4. Baumfeld, T, Fernandes R, Nery, C, Batista, J. P, Baumfeld, D. (2021). Fifth metatarsal fractures in professional soccer players: case series. Foot ankle specialist, 14(3), 213-218**.**
5. Bassiooni, H. A, Ahmed, A. A, Abou Zied, M. S, Elgamal, H. A. (2021). Comparative Study between Primary Surgical Intervention and Conservative Management in Cases of Jones Fracture of Base 5th Metatarsal Bone. Benha journal of Applied Sciences, 6(2), 39-45.
6. DeVries, J. G, Cuttica, D. J, Hyer, C. F. (2011). Cannulated screw fixation of Jones fifth metatarsal fractures: a comparison of titanium and stainless steel screw fixation. The Journal of foot and ankle surgery, 50(2), 207-212
7. Mohammed, A. A, Abbas, K. A, Mawlood, A. S. (2016). A comparative study in fixation methods of medial malleolus fractures between tension bands wiring and screw fixation. Springerplus, 5(1), 1-6.
8. Orr, J. D, Glisson, R. R, Nunley, J. A. (2012). Jones fracture fixation: a biomechanical comparison of partially threaded screws versus tapered variable pitch screws. The American Journal of Sports Medicine, 40(3), 691-698.
9. Ko, S. H, Park, Y. J, Jeong, Y. Y, Kim, W. S. (2002). Comparison between Screw Fixation and Modified Tension Band Wiring for Medial Malleolar Fracture. Journal of Korean Foot and Ankle Society, 6(1), 54-59.
10. Ostrum RF, Listsky AS (2008). Tension-band fixation of medial malleolar fracture. J Orthop Trauma 6:464
11. Rovinsky, D, Haskell, A, Liu, Q, Paiement, G. D, Robinovitch, S. (2000). Evaluation of a new method of small fragment fixation in a medial malleolus fracture model. Journal of orthopaedic trauma, 14(6), 420-425.
12. Metzl, J, Olson, K, Davis, W. H, Jones, C, Cohen, B, Anderson, R. (2013). A clinical and radiographic comparison of two hardware systems used to treat Jones fracture of the fifth metatarsal. Foot Ankle International, 34(7), 956-961.
13. Mologne, T. S, Lundeen, J. M, Clapper, M. F, O'Brien, T. J. (2005). Early screw fixation versus casting in the treatment of acute Jones fractures. The American journal of sports medicine, 33(7), 970-975.
14. Mahajan, V, Chung, H. W, Suh, J. S. (2011). Fractures of the proximal fifth metatarsal: percutaneous bicortical fixation. Clinics in orthopedic surgery, 3(2), 140-146.
15. Wang, Y, Gan, X, Li, K, Ma, T, Zhang, Y. (2020). Comparison of operative and non-operative management of fifth metatarsal base fracture: A meta-analysis. Plos one, 15(8), e0237151.
16. Biswas, S. ., Bhagyasree, V. ., & Rathod, V. N. . (2022). A CHECKLIST OF BIRDS AND DIVERSITY OF AVIAN FAUNA IN MUDASARLOVA RESERVOIR OF VISAKHAPATNAM, INDIA . Journal Of Advanced Zoology, 42(02), 165–175. https://doi.org/10.17762/jaz.v42i02.51
17. Faisal, H. T. ., Abid, M. K. ., & Abed, A. . (2022). Study Of Some Biochemical Parameters in Dose During Pregnancy in Goats. Journal Of Advanced Zoology, 43(1), 01–06. https://doi.org/10.17762/jaz.v43i1.109
18. Wankhade, L. N. . (2022). STUDY ON BUTTERFLY FAUNA OF KARANJA (GHADGE) TAHSIL OF DISTRICT WARDHA (MAHARASHTRA). Journal Of Advanced Zoology, 42(02), 186–193. https://doi.org/10.17762/jaz.v42i02.53