The Journal of Foot & Ankle Surgery 57 (2018) 982–986

Contents lists available at ScienceDirect

The Journal of Foot & Ankle Surgery

journal homepage: www.jfas.org

Comparative Outcomes of Cast and Removable Support in Fracture Fifth Metatarsal Bone: Systematic Review and Meta-Analysis

Kwanchai Pituckanotai, MD [1], Alisara Arirachakaran, MD [1], Peerapong Piyapittayanun, MD [1], Harit Tuchinda, MD [2], Ekachot Peradhammanon, MD [3], Jatupon Kongtharvonskul, MD, PhD [4]

[1]Orthopedist, Orthopedics Department, Police General Hospital, Bangkok, Thailand
[2]Orthopedist, Orthopedic Department, Bangkok Metropolitan Administration General Hospital, Bangkok, Thailand
[3]Orthopedist, Orthopedics Department, Phrachomklao Hospital, Pedchburi, Thailand
[4]Orthopedist, Sport and Orthopaedic Department, Samitivej Hospital, Bangkok, Thailand

ARTICLE INFO

Level of Clinical Evidence: 2

Keywords:
bandage
foot score
fracture fifth metatarsal bone
meta-analysis
nonunion
pseudo-Jones
short leg cast
splint
systematic review

ABSTRACT

Fractures of the metatarsals account for 35% of all foot fractures. Conservative management of fractures proximal to the metaphyseal–diaphyseal junction of the fifth metatarsal bone (pseudo-Jones) is protected weightbearing. The methods of protected weightbearing include a short-leg cast and splint (boot cast, Jones bandage, and elastic bandage). However, no consensus has yet been reached regarding which method is most suitable. We conducted a systematic review and meta-analysis to compare the outcomes of a short-leg cast and splint for pseudo-Jones metatarsal fractures. We searched the PubMed and Scopus databases up to October 29, 2016. Five of 104 studies (3 comparative studies and 2 randomized controlled trials; n = 246 patients) were eligible. Of the studies, 3, 5, and 4 were included in pooling of early (within 1 month) and last follow-up foot function scale scores and fracture nonunion, respectively. The unstandardized mean difference of early (within 1 month) and last follow-up foot scores for the short leg cast were –14.58 (95% confidence interval [CI] –24.12 to –5.04) and –3.89 (95% CI –6.30 to –1.49), significantly lower than the scores for the splint (bandage or boot support) for pseudo-Jones fracture of the fifth metatarsal bone. The risk of nonunion of the fifth metatarsal bone fracture of the patients who were treated with short leg cast method was insignificantly greater at 1.57 times (95% CI 0.29 to 8.49) that compared with the splint. The treatment of fracture of the pseudo-Jones fifth metatarsal bone with a splint (boot or bandage) resulted in foot function scale scores better than those with short leg cast treatment and a lower nonunion rate.

Fractures of the base of the fifth metatarsal are a common injury of the foot originally described by Sir Robert Jones in 1902 (1,2). Since then, virtually all fractures involving the proximal aspect of the fifth metatarsal have been classified as "Jones" fractures. Several investigators, however, have recognized the existence of ≥2 major patterns of fracture at the base of the fifth metatarsal: (1) an avulsion fracture of a variably sized portion of the tuberosity or the most proximal part of the metatarsal; and (2) a transverse fracture through the proximal diaphysis of the metatarsal within 1.5 cm of the tuberosity, which has been called a "pseudo-Jones avulsion fracture" (1–11) Several nonoperative treatments have been studied, including elastic bandaging and wearing a hard-soled shoe to immobilization in a cast, focused rigidity casting, or a walking boot (2,4,12–19). Several comparative studies have compared short leg casting and splinting, including elastic or compression bandaging, and a walking boot (2,14,17–19). These included 2 randomized controlled trials (RCTs) (18,19) and 3 cohort studies (2,14,17). However, no consistent results have been reported from these trials. Some studies (2,17,19) have reported advantages to using removable supports over short leg casts, and other studies (14,18) have not. To the best of our knowledge, no meta-analysis or systematic review has compared short leg casting and splinting for treatment of pseudo-Jones avulsion fractures proximal to the metaphyseal–diaphyseal junction of the fifth metatarsal bone. The effect of splinting on nonoperative outcomes for treatment of pseudo-Jones metatarsal fractures has been debated. Therefore, we performed a meta-analysis and systematic review of comparative and randomized clinical studies to establish the best evidence to address this controversy. The present systematic review and meta-analysis compared the outcomes of short leg casting and splinting for treatment of pseudo-Jones

Financial Disclosure: None reported.
Conflict of Interest: None reported.
Address correspondence to: Jatupon Kongtharvonskul, MD, PhD, Sport and Orthopaedic Department, Samitivej Hospital, Bangkok 10500, Thailand.
E-mail address: Jatupon_kong@hotmail.com (J. Kongtharvonskul).

1067-2516/$ - see front matter © 2018 by the American College of Foot and Ankle Surgeons. All rights reserved.
https://doi.org/10.1053/j.jfas.2018.03.018

avulsion fractures proximal to the metaphyseal–diaphyseal junction of the fifth metatarsal bone.

Materials and Methods

The Medline and Scopus databases were used to identify relevant studies reported in English since the date of inception to October 29, 2016. The PubMed and Scopus search engines were used to locate studies using the following search terms: "fracture metatarsal bone" AND "clinical trial." References from the reference lists of the included trials were also explored.

Study Selection

The identified studies were first selected according to the titles and abstracts by 2 independent authors (K.P., A.A.). The full report was retrieved if a decision could not be made from the abstract. Disagreements were resolved by consensus and discussion with a third author (J.K.). The reasons for ineligibility or exclusion of the studies were recorded and described.

Inclusion Criteria

RCTs and comparative studies that had compared the clinical outcomes between short leg casting and splinting for the treatment pseudo-Jones avulsion fractures proximal to the metaphyseal–diaphyseal junction of the fifth metatarsal bone were eligible if they had met the following criteria:

- Comparison of clinical outcomes between short leg casting and splinting for treatment of pseudo-Jones avulsion fractures proximal to the metaphyseal–diaphyseal junction of the fifth metatarsal bone
- Comparison of ≥1 of the following outcomes: foot function scales (American Orthopaedic Foot and Ankle Society [AOFAS] ankle-hindfoot scale and visual analog scale [VAS] for the foot and ankle), VAS for pain, and fracture nonunion
- Sufficient data available to extract and pool (i.e., reported mean, standard deviation), the number of subjects stratified by treatment for the continuous outcomes and the number of patients stratified by treatment for the dichotomous outcomes

Data Extraction

Two of us (K.P., A.A.) independently performed the data extraction using standardized data extraction forms. The general characteristics of the study (i.e., mean age, gender, level of evidence, mean follow-up time, and foot function scale scores at baseline) were extracted. The number of subjects and means ± standard deviation for continuous outcomes (i.e., foot function scale scores [AOFAS ankle-hindfoot scale or VAS for the foot and ankle]) between groups were extracted. Cross-tabulated frequencies between treatment and all dichotomous outcomes (nonunion of fracture) were also extracted. Any disagreements were resolved by discussion and consensus with a third author (J.K.).

Quality Assessment

Two of us (J.K., A.A.) independently assessed the risk of bias for RCTs using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (20). Six domains were assessed, including sequence generation, allocation concealment, blinding (participant, personnel, and outcome assessors), incomplete outcomes data, selective outcomes reporting, and other sources of bias. Assessment of the risk of bias for cohort studies was performed using the modified Newcastle-Ottawa scale (21). Five domains were assessed, including representativeness of cohorts, ascertainment of exposure and outcome, adjustment for confounders, and follow-up duration. The risk of bias in each domain was classified as low, high, or unclear (Appendix S1). Disagreements between 2 authors were resolved by consensus and discussion with a third author (J.K.). The level of agreement for each domain and the overall domains was assessed using kappa statistics.

Outcomes of Interest

The outcomes of interests included foot function scores (AOFAS ankle-hindfoot scale or VAS for the foot and ankle) and fracture nonunion. These outcomes were measured as reported in the original studies, including a foot function scale score from 0 to 100, with higher values indicating better outcomes. The rate of fracture nonunion was also considered.

Statistical Analysis

For continuous outcomes (i.e., foot function scales, including the AOFAS ankle-hindfoot scale and VAS for the foot and ankle), the mean difference between short leg casting and removable support groups for the treatment of acute fifth metatarsal fracture was estimated for each study. The unstandardized mean difference was applied to pool the outcomes across studies. Before pooling, intervention effects were assessed by whether they varied or were heterogeneous across the included studies. Heterogeneity of the mean differences was checked using the Q statistic, and the degree of heterogeneity was also quantified using the I_2 statistic. If heterogeneity was significant or I_2 >25%, the unstandardized mean difference was estimated using a random effects model, otherwise a fixed effects model was applied.

For dichotomous outcomes, the odds ratio (OR) for fracture nonunion was estimated for each study. The heterogeneity of ORs across studies was assessed using the same method stated previously. If heterogeneity was present, the random effects using the Dersimonian and Laird method was applied to pool the ORs, otherwise the fixed effects by inverse variance method was applied.

Metaregression was applied to explore the cause of heterogeneity by fitting a covariable (e.g., mean age, gender, level of evidence, mean follow-up time, and foot function scores at baseline) in the meta-regression model. A subgroup or sensitivity analysis was then performed according to the results of the meta-regression. Publication bias was assessed using contour funnel plots (22,23) and Egger tests (24). Asymmetry of the funnel plot might have resulted from some missing studies in which the negative results might not have been reported and thus could not be identified. The metatrim and fill method was used to estimate the number of studies that might have been missing and to adjust the pooled estimate (25). All analyses were performed using STATA, version 14.0 (26). A p value < .05 was considered statistically significant, except for the test of heterogeneity for which p < .10 was used.

Results

We identified 46 and 81 studies from Medline and Scopus, respectively (Fig. 1). Of the identified studies, 17 were duplicates, leaving 104 studies for review of the titles and abstracts. Of these, 5 studies underwent a full review and data were extracted. The characteristics of the 5 studies (2,14,17–19) are described in Table 1. These 5 studies, including 3 (2,14,17) cohort studies and 2 (18,19) RCTs, reported the foot function scale scores (AOFAS ankle-hindfoot scoring system or VAS for the foot and ankle) and fracture nonunion rates. Foot function was reported using the AOFAS midfoot scoring system in 3 studies (2,14,18) and a VAS for the foot and ankle in 2 studies (17,19). Nonunion was reported in 4 studies (2,14,18,19). The mean age and mean follow-up duration for the participants was 37.5 to 49.7 years and 1 to 2 years, respectively. The proportion of males ranged from 28% to 54%. All 5 studies used short leg casting; the comparator was elastic bandaging in 3 studies (17–19), Jones bandage in 1 study (2), and boot splinting in 1 study (14).

Risk of Bias in Included Studies

The risk of bias in the 5 studies is presented in Table 2.

Outcomes

Early Outcomes (Follow-Up Point Within 1 Month)

Three studies reported the mean function scores within 1 month of follow-up comparing short leg casting and splinting, with 67 and 69 patients, respectively (Table 3). The pooled unstandardized mean difference varied moderately across the studies (χ^2 = 5.14, df = 2, p = .077, I_2 = 61.1%) and was –14.58 (95% confidence interval [CI] –24.12 to –5.04), indicating that the short leg casting group had foot function scores that were significantly worse statistically compared with those from the splinting group, including Jones bandage, elastic bandage, and boot splint; Fig. 2). None of the covariables could explain the heterogeneity. No evidence of publication bias was found using Egger's test or contour funnel plot (coefficient = –0.27, standard error = 2.36, p = .928).

Late Outcomes (Last Follow-Up Point)

Five studies reported the mean foot function scores comparing short leg casting and splinting, with 102 and 107 patients, respectively (Table 3). The pooled unstandardized mean difference was homogenous across the studies (χ^2 = 3.61, df = 0.4, p = .426, I_2 = 0%) and was