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Review

Jones fracture of the fifth metatarsal: Is operative intervention justified? A systematic review of the literature and meta-analysis of results

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HIGHLIGHTS

- Metatarsal fractures occur commonly at 6.7 fractures per 10,000 people.
- There is lack of clarity in classifying and treating the Jones' fractures.
- The natural history of healing of Jones' fractures has been shown to be suboptimal.
- Our meta-analysis showed surgery gives significantly decreased odds of nonunion.
- We found surgery had faster rates of union, return to sports and activity.

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ABSTRACT

Background: This study assesses the outcomes of surgical vs. conservative management in the treatment of the Jones fracture.
Materials and methods: A systematic review using four databases from their inception until September 2014 was undertaken. Six studies were found evaluating operative therapy compared to conservative treatment.
Results: Six relevant studies were included, with a total of 237 patients. Of these, 51% were treated non-operatively, and 49% had surgical intervention. Those in the non-operative group were found to have a significantly higher odds ratio (OR) of fracture non-union (OR 5.74, 95% confidence interval (CI) 2.65–12.40, $P < 0.001$). Studies also reported a prolonged healing time and a longer time to return to sports. Of the trials with time to union as an outcome measure, 3 of 4 trials found favourable results in the operative cohort.
Conclusions: Surgical intervention is recommended for patients presenting with a Jones fracture as it is found to result in a lesser non-union rate and an improved time to union.

1. Introduction

1.1. Epidemiology and classification

Fractures of the metatarsal bones are a common injury presenting to orthopaedic clinics with a reported incidence of 6.7 fractures per 10,000 people. The most frequently fractured metatarsal is the fifth [1]. Sir Robert Jones first described his eponymous fracture of the proximal fifth metatarsal in 1902 [2], and optimal management for this has not gained consensus in the intervening century [3]. There is lack of clarity in the literature surrounding classification and treatment of Jones' fractures [4]. Torg et al. [5] described the most commonly used system of classification of fifth metatarsal fractures, although many other systems are available and used [3,6]. According to the Torg classification [5] the true Jones' fracture involves the proximal part of the diaphysis distal to the tuberosity of the fifth metatarsal. The patterns of

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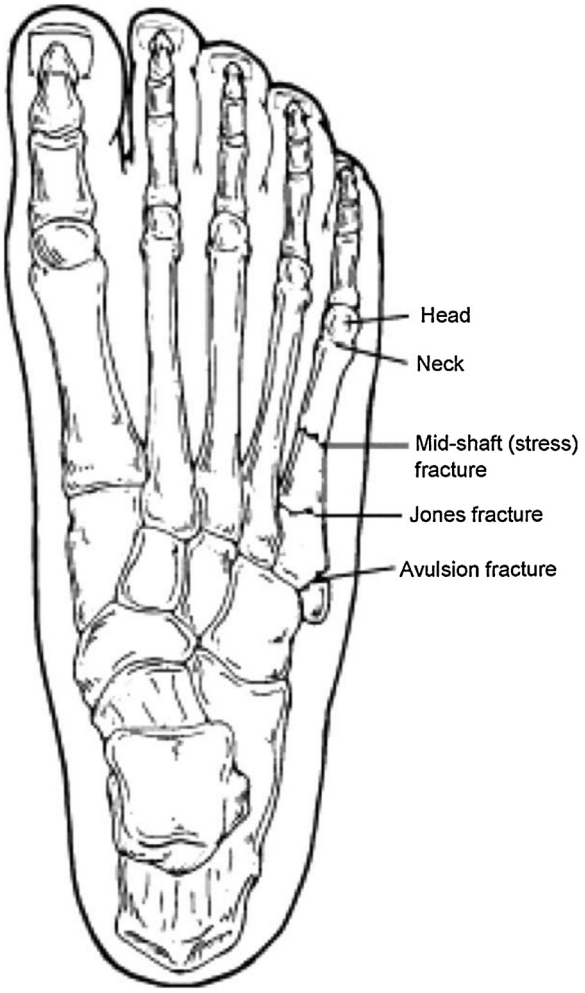

Fig. 1. Artist's impression of fifth metatarsal fractures. Adapted with permission from Zwitser and Breederveld [6].

fifth metatarsal fractures, including the Jones fracture, are shown in Fig. 1 [6].

1.2. Anatomy

The proximal section of fifth metatarsal is a vascular watershed region, resulting in high rates of delayed union or non-union subsequent to fracture [7,8]. An anatomical study by McKeon et al. [8] determined that branches of the dorsalis pedis artery (lateral tarsal branch), posterior tibial artery (lateral plantar artery), and peroneal artery all contribute branches to the blood supply of the fifth metatarsal. A nutrient artery from the fourth plantar metatarsal artery also supplies the area, inserting into the proximal diaphysis, supplying a retrograde branch to the fifth metaphysis.

1.3. Purpose

Conservative or surgical management options are described for a Jones' fracture. The natural history of healing of Jones fractures has been shown to be suboptimal [7,9–16]. Consensus on optimal surgical technique is lacking, although intramedullary fixation is the most popular choice [9]. This study aims to present a systematic review of the literature to assess the evidence for surgical and conservative management. We review the difference in outcomes of surgical and non-operative patients with Jones fractures in terms of non-union rates, time to bone union, and complications of the different treatment options.

Table 1
Boolean phrases used to attain abstracts.

Database	Search strategy
Cochrane Library	Jones OR Jone's OR Jones' OR metatarsal AND fracture
AMED	TX Jones OR Jone's OR Jones' OR metatarsal AND fracture
Embase	Jones OR metatarsal AND ('fracture'/exp OR fracture)
Medline/PubMed	((((Jones) OR Jone's) OR Jones') OR metatarsal) AND fracture

2. Materials and methods

2.1. Study eligibility

All randomized and non-randomized comparative studies assessing both surgical and conservative treatments of Jones fractures were included. In papers that reported on Jones' fractures as well as other metatarsal fractures, these papers were included but only information about the Jones' fractures were used. Studies which did not compare operative and non-operative methods, did not acutely intervene with surgical intervention, or did not focus on Jones' fractures were excluded. Animal and cadaver studies were not included in the review. Studies were also excluded in those papers where conservatively treated acute fractures are compared to surgically treated chronic or stress fractures.

2.2. Search strategy

The following online databases were searched from their inception to September 2014 using a preferred reporting items for systematic reviews and meta-analysis (PRISMA) compliant search strategy [17]: the Cochrane Library, the Allied and Complementary Medicine Database (AMED), Excerpta Medica Database (Embase), and Medline/PubMed. There was no restriction of papers due to language, publication status or publication type. The Boolean operations used Jones, metatarsal and fracture as keywords in all search fields. The search strategy for each database is shown in Table 1.

All titles and abstracts obtained using the search strategy was reviewed by one author. Potential articles were then reviewed by two authors (J.Y. and S.S.) to obtain a list of eligible studies. Any disagreements were resolved by discussion with a third author (I.F.). The PRISMA flow diagram is demonstrated as Fig. 2.

2.3. Data extraction

Relevant data from the eligible studies was extracted by two authors (J.Y. and I.F.) and included in Tables 2 and 3.

2.4. Outcome measures

Original outcomes of interest included non-union rates, delayed union rates, time to radiological union, and complication types and rates of occurrence. Time to sport and duration of sick leave were included as secondary measures. If no clear distinction between non-union and delayed union was stated as an outcome, it was considered non-union [18]. Time to healing is shown in Table 3 as reported in the original studies.

2.5. Statistical analysis

Statistical analysis was carried out using Review Manager (RevMan) Version 5.3 (Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration). A chi-squared test and I^2 statistic were used to measure significant heterogeneity. Where significant