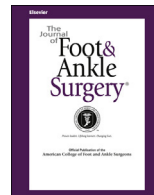




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## Review Article

## Prevalence of Peroneal Tendon Instability in Calcaneus Fractures: A Systematic Review and Meta-Analysis

Karim Mahmoud, MD <sup>1</sup>, Mohamed Maged Mekhaimar, FRCS <sup>2</sup>, Abduljabbar Alhammoud, MD <sup>1</sup><sup>1</sup>Orthopedics Resident, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar<sup>2</sup>Senior Consultant Orthopedics, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar

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## ABSTRACT

Peroneal tendon instability associated with an intraarticular calcaneal fracture is a common injury that still often passes undiscovered by both radiologists and orthopedic surgeons. Timely identification of this injury will guide the choice of surgical technique used and treatment of patients. Using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, several databases were searched through June 2017 for any observational or experimental studies that reported the prevalence/incidence of peroneal tendon subluxation/dislocation with a calcaneus fracture with regard to fracture classifications and the significance of the fleck sign. Nine studies were included, with 1027 patients and 1050 calcaneus fractures. The overall prevalence of peroneal instability (PI) in association with a calcaneus fracture was 29.3%. An increasing prevalence of PI increased the severity of the calcaneus fractures, 5.4% in Sanders I, 19% in Sanders II, 39.4% in Sanders III, and 49.5% in Sanders IV. The presence of a fleck sign is a strong indicator of PI, with a prevalence of 54.7%. The computed tomography findings can overestimate the presence of PI compared with the intraoperative findings. The global reported prevalence of peroneal tendon instability associated with intraarticular calcaneal fractures is high and increases with increasing severity of the calcaneus fracture.

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Peroneal tendon instability associated with intraarticular calcaneal fractures is a significant and commonly missed injury. The calcaneus is the most frequently fractured tarsal bone and constitutes 2% of fractures presenting to the emergency department (1,2). The mechanism of injury is usually an axial load to the heel secondary to high-energy trauma due to a fall from a height or motor vehicle accident. It has been proposed that the peroneal tendon dislocates with the occurrence of a calcaneal fracture because the axial force transmitted blows out the lateral wall causing either impingement of the peroneal tendon or avulsion of the superficial peroneal retinaculum from the distal fibula, allowing the peroneal tendons to dislocate anteriorly (3). To date, peroneal tendon instability with a calcaneal fracture has often passed undiagnosed by both radiologists and orthopedic surgeons owing to the presence of swelling, resulting in difficulties with the physical examination, and the lack of awareness by radiologists.

This can add more sequelae to the devastating nature of calcaneal fractures (4).

The present review aimed to determine the global reported prevalence of peroneal instability (PI) associated with calcaneus fractures, the prevalence of PI according to severity of the calcaneus fracture classification, the significance of a fleck sign as an indicator of PI, and the discrepancy between the radiologic and clinical diagnosis of PI with calcaneus fractures.

## Materials and Methods

## Search Strategy

An electronic search of MEDLINE, Scopus, and Google Scholar was conducted until June 2017 without a date restriction and for English-language reports only in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (5). The search string used was as follows: [{"calcaneus" [MeSH Terms] OR "calcaneus" [All Fields]} AND ("fractures, bone" [MeSH Terms] OR ("fractures" [All Fields] AND "bone" [All Fields]) OR "bone fractures" [All Fields] OR "fracture" [All Fields])] AND (peroneal [All Fields] AND ("tendons" [MeSH Terms] OR "tendons" [All Fields] OR "tendon" [All Fields]) AND (dislocations [MeSH Terms] (subluxation [MeSH Terms]))]. Database searching was augmented by manual searches of common journals in the field (*Journal of Bone and Joint Surgery*, *Foot and Ankle International*, *Foot and Ankle Surgery*, *Journal of Orthopedic Trauma*). The reference lists from the identified studies were also scrutinized for any additional reports.

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Conflict of Interest: None reported.

Address correspondence to: Abduljabbar Alhammoud, MD, Hamad General Hospital, Hamad Medical Corporation, Doha, Qatar.

E-mail address: [aghammoud85@hotmail.com](mailto:aghammoud85@hotmail.com) (A. Alhammoud).

### Study Selection

The studies that reported the prevalence/incidence of peroneal tendon subluxation/dislocation in association with a calcaneus fracture were included as the primary outcome. The secondary outcomes were the prevalence of peroneal tendon subluxation/dislocation with the different classification systems of calcaneus fracture (Sanders and Essex-Lopresti), the significance of a fleck sign radiographically, and any discrepancies found between the radiologic report and the clinical findings. Patients with calcaneus fractures combined with other fractures, extraarticular calcaneus fractures, and old calcaneus fractures were excluded.

### Methodologic Quality Assessment

The Joanna Briggs Institute Critical Appraisal Checklist (6) was used for quality assessment and critical appraisal of the included articles by 2 independent authors (K.M., A.A.). Any discrepancies or disagreements regarding the critical appraisal were resolved by discussion and consultation with the third reviewer (M.M.).

### Data Extraction

Data from the included studies were extracted independently by 2 of us (K.M., A.A.), and any discrepancies were resolved by discussion. The study characteristics (e.g., name, publication year, design, level of evidence) and subject characteristics (e.g., sample size, age, male/female ratio) were retrieved and recorded. The total prevalence of PI in association with a calcaneus fracture, the prevalence of a calcaneus fracture according to fracture classifications, the presence of the fleck sign, number of PI cases detected on imaging, and number of PI cases detected clinically or intraoperatively were also retrieved and saved using a standardized data collection sheet.

### Statistical Analysis

The data analysis was performed using a comprehensive meta-analysis with a random effects model. The untransformed proportion and 95% confidence intervals (CIs) were calculated to detect the pooled prevalence. Statistical heterogeneity across the studies was tested using  $I^2$ , and the level of evidence was assessed according to the Cochrane Back Review Group.

## Results

### Studies Included

The initial database search revealed 31 studies after removal of the duplicates. Of the 31 studies, 10 were excluded by the title and abstract, and 21 full text studies were reviewed. Of the 21 studies, only 9 met the inclusion criteria, and 12 were excluded because they had not reported any of the outcomes (Fig. 1). The characteristics of the included studies and details of intervention are listed in Table 1.

### Study Characteristic Description

Of 31 initial studies, 9 were included (3,4,7-13). These 9 studies included 1027 patients with 1050 calcaneus fractures. Most of the patients were male, with an average age of 42.03 (range 18 to 79) years. Of the 1050 calcaneus fractures, PI was found in association with 305.

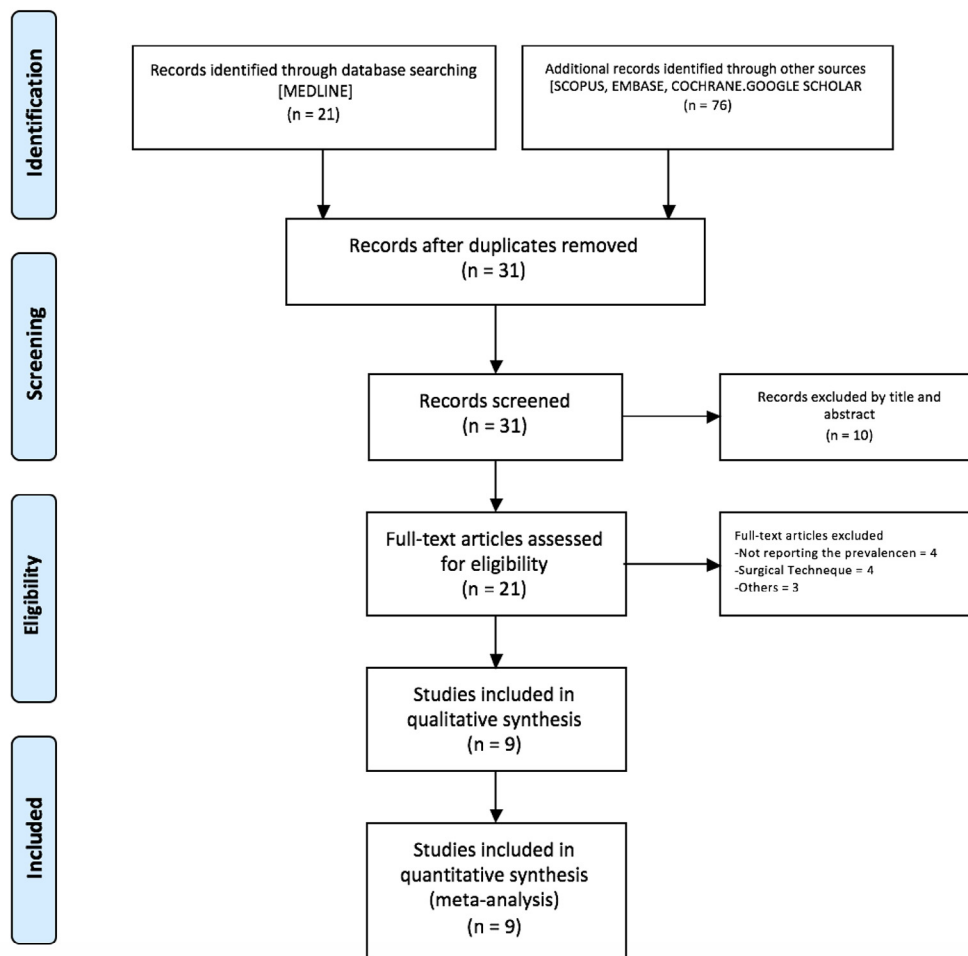


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow chart.

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