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Review

The impact of associated injuries and fracture classifications on the treatment of capitellum and trochlea fractures: A systematic review and meta-analysis

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ABSTRACT

Background: Capitellum and trochlea fractures are truly rare and the treatment is not fully appreciated. So we evaluate the impact of associated injuries and fracture classifications on elbow functional outcomes after open reduction and internal fixation.

Materials and Methods: PubMed, Embase, Ovid Medline, and the Cochrane Library were searched from January 1, 1974 to January 1, 2017. All English literature with the treatment of capitellum and trochlea fractures by open reduction and internal fixation were included.

Results: For associated injuries, the results suggested that the MEPI score of patients without associated injuries was higher than that of patients with associated injuries ($P = 0.001$). However, there was no significant difference in the arc of motion between the two groups ($P = 0.052$). For Bryan and Morrey classification, there was no significant difference in the MEPI score ($P = 0.622$) and in the arc of motion ($P = 0.652$) between type-I fractures and type-IV fractures. For Dubberley classification, there was significant difference only in the MEPI score between subtype-A fractures and subtype-B fractures ($P = 0.005$).

Conclusion: The associated injury of fracture may have a negative impact on the functional outcomes of elbow. And Dubberley classification is more suitable to classify this kind of fracture. Furthermore, high-quality studies are required to attain robust evidence.

1. Introduction

Coronal fractures of the distal humerus involving the capitellum and trochlea. And the morbidity of this partial articular fracture is truly rare, accounting for 1% of all elbow fractures and 3%–6% of all distal humeral fractures [1]. Currently, there are two traumatic mechanisms in this fracture. Some result from a low-energy fall with varying degrees of elbow flexion [2]. Others may occur following the spontaneous reduction after posterolateral elbow subluxation or dislocation [2].

Capitellum and trochlea fractures are also associated with ligamentous injuries (lateral or medial collateral ligament lesions) or ipsilateral fractures (radial head fractures or epicondylar fractures of humerus) [3–7]. An inappropriate or delay diagnosis of this fracture will lead to suboptimal results.

Treatment options included closed reduction [8,9], fragment excision [10–12], open reduction and internal fixation (ORIF) [2–8,10,13–29], and prosthetic replacement [30,31]. ORIF is gradually accepted as the adequate treatment for capitellum and trochlea fractures, which can restore the congruity of articular surfaces by a stable reduction and allow early mobilization of the elbow. Some authors have found that associated injuries and types of fracture affect the results of operations [2–4,6,19,23]. However, due to small sample sizes and inherent defects of studies, authors can not draw definite conclusions. Thus, in this systematic review and meta-analysis, we evaluate the impact of associated injuries and fracture classifications on elbow functional outcomes in the treatment of capitellum and trochlea fractures by ORIF.

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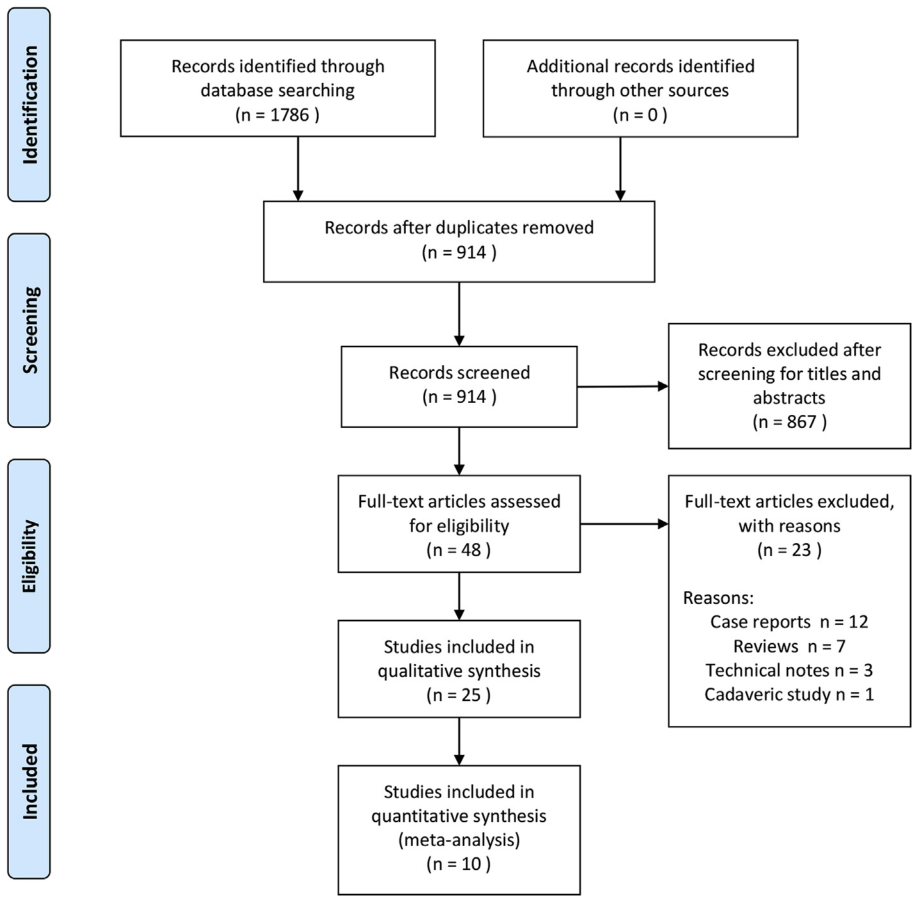

Fig. 1. Flow diagram for study selection.

2. Materials and methods

2.1. Search strategy

We performed a systematic search of the keywords "(((((trochlea) OR trochlear)) AND fracture)) OR ((((capitellum) OR capitellar)) AND fracture)) OR ((distal humeral) AND coronal fracture" in the online databases PubMed, Embase, Ovid Medline, and the Cochrane Library repeatedly from January 1, 1974 to January 1, 2017. Only English literature were included. Unpublished studies were not included. Randomized controlled trials (RCTs), cohort, case control, and case series studies about the treatment of capitellum and trochlea fractures by ORIF were included. Case reports, comments, reviews, technical notes, letters and cadaveric studies were excluded. All references of included studies were manually searched to determine other eligible studies. Potential researches found through database search were reviewed for inclusion by two independent reviewers. Where there was disagreement, a higher reviewer was consulted. All procedures were conducted in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines [32].

2.2. Data extraction and quality assessment

The data extracted from included studies included the name of the first author, year of publication, study design, demographic data, types of fracture, associated injuries, follow-up time, and clinical outcomes. For meta-analysis, we sought individual patient data from all included studies. Every attempt was made to contact the corresponding authors of published studies via email to access data.

Because of the low incidence of this fracture, all of included studies were clinical case series. So, we only performed quality assessment on the 10 studies used in the meta-analysis by using the Methodological Index for Non-Randomized Studies (MINORS) [33]. There were 12 evaluation items in the scale for comparative studies, and the first 8 items specifically designed for non-comparative studies. Items were scored as 0 (not reported), 1 (reported but inadequate) and 2 (reported and adequate).

2.3. Outcome measures

The primary outcome for the first meta-analysis was the Mayo Elbow Performance Index (MEPI) score and the arc of motion of elbow between patients without associated injuries and those with associated injuries. And the primary outcome for the second meta-analysis was also the MEPI score and the arc of motion of elbow between patients diagnosed with different types of fracture by Dubberley classification [3] or Bryan and Morrey classification [8,34].

2.4. Statistical analysis

We carried out a 2-stage meta-analysis of individual patient data based on available data in the 10 studies. In the first step, the parameter estimates and standard errors of the MEPI score and the arc of motion were extracted from different patients groups of the above analyses for each study. In the second step, we used weighted mean difference (WMD) with 95% confidence interval (CI) obtained from the 10 studies to calculate the overall effect size. Heterogeneity was assessed using Cochran's Q test, and the inconsistency index (I^2) statistic was applied to these summary data to describe the percentage of variation across studies [35]. A value of I^2 more than 50 was considered high heterogeneity [35]. Due to low statistical power of heterogeneity tests in the meta-analysis of a few studies, random-effects model was used [36,37].