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Review

A systematic literature review of tibial plateau fractures: What classifications are used and how reliable and useful are they?

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ABSTRACT

Introduction: Classification systems such as the Schatzker and AO/OTA have been proposed for standardised assessment of tibial plateau fractures and to guide clinical decision making. However, there has been no comprehensive literature review of all classification systems for tibial plateau fractures, including assessment of their reliability. The aim of this systematic review was to identify and appraise previously established classification systems for tibial plateau fractures and determine their reliability for fracture classification.

Methods: Six databases were searched from inception until October 2016. Classification systems for tibial plateau fractures were identified. No restriction was placed on imaging modality (plain film X-ray, CT, MRI). Data synthesis was performed to identify common features of the systems, their prevalence within the literature and studies of intra and inter-rater reliability of fracture classification using Kappa coefficient (κ).

Results: Thirty-eight classification systems were identified, five of which were a sub-classification of a single fracture type from a previous tool. The Schatzker and AO/OTA classification systems were the most commonly reported. Of the tools identified only five have been tested for inter and intra-observer reliability (Schatzker, AO/OTA, Duparc, Hohl and Luo). Reliability of more simplistic classification systems, such as that by Luo et al. (three-column) was typically high (intra-κ = 0.67–0.81, inter-κ = 0.71–0.87), but with the disadvantage of providing less information on fracture patterns and morphology. Intra and inter-observer reliability using plain film X-ray was frequently moderate (κ = 0.40–0.60), with 2D and 3D CT typically improving reliability of classification. Only 11 of the 32 complete classification systems identified association of fracture classification with clinical outcome.

Discussion: Frequently used systems for classification of tibial plateau fractures display moderate intra and inter-observer reliability. More sophisticated imaging modalities such as 2D and 3D CT typically improve reliability estimates. Using fracture classification based on imaging findings to predict clinical outcome was not a commonly reported goal of newly developed systems. More detailed assessment of fracture patterns and morphology, in conjunction with information on surgical fixation, may be desirable for predicting outcomes and to guide clinical decision making.

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Introduction

Tibial plateau fractures are recognised as being amongst some of the most challenging fractures to treat and are associated with a high incidence of posttraumatic osteoarthritis later in life [1,2]. Preventing such disability is of high importance and requires the restoration of optimal joint function by restoring the congruency of the articular surface, overall joint stability and correct load distribution [3].

To achieve this goal, optimal surgical treatment and postoperative rehabilitation are essential. Optimal surgical treatment is dependent on accurate preoperative planning for which adequate understanding of the fracture is necessary. Fractures can be assessed by classification tools and a number of them have been proposed to assess tibial plateau fractures, indicate a treatment strategy and predict the clinical outcomes of the patient [4,5]. These tools provide a system to classify the fracture pattern yet remain highly subjective based on diagnostic experience and the type of medical imaging used [6,7]. Studies comparing the reliability of these classification tools have incorporated different imaging modalities (X-ray, CT and MRI) as a method of assessing changes between intra-observer and inter-observer agreement based on the scans used by the diagnostician [4,6,7]. While advances in medical imaging have served to provide a more accurate representation of the fracture pre-operatively there is still a need to assess if these classification tools are adequate in accurately grouping similar fracture patterns to inform surgical planning and postoperative management.

Audigé et al. [8] propose the validation of a classification system to involve three key criteria; the classification should have face and content validity, be both accurate and reliable and have construct validity relating to how well fracture categories relate to surgical outcomes when considered in conjunction with fracture management plans. Of all the proposed classification systems for tibial plateau fracture, few have been assessed for reliability and even fewer have been compared against other classification systems. The Schatzker [9] and AO/OTA [10] classification tools have been widely reported since their inception and are commonly used by diagnosticians to classify tibial plateau fractures. While these tools appear to be the most prevalent the question remains as to their effectiveness at accurately describing all fracture patterns along with their ability to guide clinical decision making and predict patient outcomes.

To the best of our knowledge, no previous studies have integrated and assessed all the published tools within a single framework. Therefore, the aim of this systematic review was to identify and appraise all previously established classification systems for tibial plateau fractures and determine their intra and inter-observer reliability.

Methods

This systematic review was registered through PROSPERO – International prospective register of systematic reviews (Registration number 42016035955).

Eligibility criteria

All studies developing or utilising a classification tool were eligible for inclusion. Only articles published in peer-reviewed journals were included, there were no date or language restrictions in place. Two independent reviewers used consensus to determine whether articles met the criteria of "developing a classification tool" or "utilising a classification tool". Studies investigating tibial plateau fracture, but not reporting fracture classification, were excluded from the review.

Studies reporting intra-observer and inter-observer reliability associated with fracture classification tools were also identified from the literature search. All studies investigating the reliability of the classification tools, either in isolation (a single classification tool) or head-to-head (multiple classification tools utilising the same data set), were eligible for inclusion in the review.

Definitions

Studies considered to have developed a classification tool were those in which a classification of tibial plateau fracture was initially reported and applied to a patient dataset through the use of medical imaging. Any studies modifying a previously established classification tool were also included as a developed classification tool.

Search

The following electronic databases were searched independently by two reviewers; CINAHL, Cochrane, Embase, Medline, Scopus and SportsDiscus. The search was last updated on October 21st 2016. Keywords and themes relating to tibial plateau fracture were used within the search (see Supplementary material for an example electronic search strategy).

Study selection

Titles and abstracts identified through the search were assessed for eligibility by two reviewers. Full text copies of articles deemed potentially relevant were retrieved and again assessed by two reviewers. A secondary search was undertaken to determine other potentially relevant studies using the reference lists of those articles retained for inclusion in the review.

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