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A new method for classifying distal radius fracture: the IDEAL classification

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Objectives: To describe the new IDEAL method from classifying distal radius fractures. *Methods*: IDEAL classification system is based on the most important literature evidences about clinical and radiographic characteristics that influence in the treatment and prognosis for patients that suffered from a distal radius fractures. In this method, we classify the fracture in patients first consultation, in which we collect demographical (age and trauma energy) and radiographic characteristics (fracture deviation, articular fracture, and associated lesions). For each feature a score is attributed for grouping purposes. Group I – Stable fractures, good prognosis; Group II – potentially unstable fractures, commonly treated by surgical methods. Prognosis depends on surgeons' success after method choice. Group III – complex and instable fractures, poor outcome is expected. *Conclusion*: IDEAL classification staging rationale was presented, which is based on the best available evidence. The evidence of its scientific plausibility will be settled with the assessment of the classification reliability and its capacity to aid in therapeutical decisions and as a tool to predict prognosis. Further studies are under development to support these properties.

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Introduction

Distal radius fractures have an incidence of approximately 1:10,000 individuals and represent 16% of skeletal fractures and 74% of forearm fractures.[1] The most common trauma mechanism is a fall onto the hand, in hyperextension. The characteristics of the fracture (location of the fracture line, presence or absence of joint impairment, degree of comminution and degree of injury to soft tissues) are directly related to the trauma energy, angle of the wrist at the moment of the trauma and bone quality. These are essential for the fracture classification and treatment plan.

Classification systems have been developed with the aim of allowing surgeons to classify fractures into different and clinically useful groupings. During the past century, Colles, Smith, Barton, Pouteau, Goyrand and others started to establish descriptions for fracture morphology with the aim of treating these fractures,[2-3] even using cadavers.[4-7]

With the advent of radiology, descriptions of greater accuracy became possible, including both the degree of displacement and the presence of joint lesions. Nissen-Lie[8] (1939) and Gartland and Werley[9] (1951) based their classifications on the presence or absence of intra-articular involvement, metaphyseal comminution and/or singular deformity. Fragment displacement was not evaluated in any of the systems. In 1959, Lindstrom expanded these criteria into six groups and described the displacement of the fragments in greater detail, along with joint impairment.[10] In 1967, Frykman established a classification system that took into account the impairment of the radiocarpal and/or distal radioulnar joints, along with the presence or absence of fracturing of the ulnar styloid.[11] Nonetheless, this classification system was limited, since it did not take into account factors such as the magnitude of the fragment displacement, presence or absence of comminution and instability factors.

In 1984, Melone[12] published a classification system for intra-articular fractures of the distal radius based on four parts: radial styloid, radial diaphysis, medial dorsal fragment and medial palmar fragment of the radius. This classification is used to define surgical fixation methods, but its accuracy and reproducibility for identifying the four fragments on conventional radiographs have still not been validated in clinical studies, and discrepancies remain.[13]

The AO classification was created in 1986 and revised in 2007.[14,15] It takes into consideration the severity of the bone lesion and serves as the basis for the treatment and for evaluating the results. There are three basic types: extra-articular, partial articular and complete articular. The three groups are organized in increasing order of severity, in relation to morphological complexity, treatment difficulty and prognosis. This is one of the most complete classification systems, but its intra and inter-observed reproducibility has been a problem when groups and subgroups are being evaluated.[15,16]

The universal classification, described by Rayhack and Cooney in 1990,[17] is characterized by its simplicity. It classifies fractures as intra or extra-articular, with presence or absence of displacement, in relation to stability and the possibility of reduction, thus functioning as a guide for approaches towards treatment. The classification proposed by Fernandez and Jupiter is based on the trauma mechanism.[18,19] This classification was produced to be practical, predict stability, identify equivalent lesions in children and provide general recommendations for treatments.

An efficient classification system should be valid, reliable and reproducible. Furthermore, it should standardize reliable communication language, provide guidelines for treatment, indicate the possibilities of complications and fracture stability and allow a reasonable prognosis to be obtained in relation to each fracture. This system should also provide a mechanism that makes it possible to assess and compare the results obtained with treatments implemented on similar fractures in different centers that have been reported at different times in the literature.[20]

Currently, there is no classification system in the literature with adequate reproducibility that would be able to provide elements for the treatment and prognosis. The aim of the present study was to describe a new classification method.

Material and methods

This new classification system for fractures at the distal extremity of the radius (IDEAL) is based on the main evidence in the literature regarding the clinical and radiographic factors that might influence the treatment and prognosis of these fractures.

In this method, we classify the fracture at the time of the patient's first consultation, by means of ascertaining two epidemiological parameters (the patient's age and the energy of the trauma that caused the fracture) and three radiographic parameters, assessed from the initial radiograph on the fracture, in PA and lateral views (displacement of the fragments, joint incongruence and associated lesions), which are the elements that are considered fundamental for grading fracture types.

For each of the five fundamental elements, a score of zero or one is given, according to the absence or presence of these factors. Thus, factors can have gradings from zero to five points and are grouped into three possible types, with increasing severity and complexity:

Grade I – zero to one point;
Grade II – two to three points;
Grade III – more than three points.

The criteria used for ascertaining the presence (one point) or absence (zero) of the elemental classification factors are defined in the following manner. For all patients aged over 60 years, one point will be credited and zero will be given to those aged up to 60 years. Fractures with displacement, defined as those that need to be reduced (shortening of the radius greater than 3 mm and/or loss of volar inclination greater than 10 degrees and/or loss of radial inclination greater than five degrees), will be credited with one point, while zero will

be given to fractures without displacement. Fractures will be considered to be of high-energy type and will receive one point if they were caused by a fall from a height, traffic accidents, crushing or firearm projectiles. All fractures resulting from falling from a standing position will be considered to be of low-energy type and will receive zero. When a joint is involved with incongruence greater than or equal to 2 mm, one point will be credited, while fractures that do not involve a joint or have incongruence of less than 2 mm will receive zero. Fractures with the following associated lesions will receive one point: radiocarpal dislocation or subluxation, fractures of the carpal bones, carpal instability, ulnar fractures, neurovascular lesions and exposed fractures.

After verification of whether the elemental factors of the score classification (zero to five) are present or not, the fractures will be classified into three types (Figs. 1 and 2):

	Characteristic	0 point	1 point
I	Age	< 60 years	> 60 years
D	Deviation	No	Deviation needing reduction
E	Trauma energy[1]	Low	High
A	Articular fracture	No	Fracture or gap > 2 mm
L	Associated lesions[2]	Absent	Present

1. Low: falling from a standing position/ High - Others.
2. Exposed fracture/ Fractures of the carpal bones, carpal instability/ Ulnar fractures

Fig. 1 - IDEAL classification: epidemiological and radiographic criteria.

Classification	Score	Description	Treatment	Prognostic
I	0-1 point	Stable	Conservative	Good
II	2-3 points	Potentially unstable	External fixation, percutaneous pinning, internal osteosynthesis with plates	Intermidiate
III	4-5 points	Complex	Associated methods, bone grafts	Bad

Fig. 2 - IDEAL classification: stratification according to scoring.

Type I – scores of 0 to 1 point (Fig. 3).

These are stable fractures. They correspond to fractures in elderly people without displacement, or to displaced fractures in younger patients caused by low-energy trauma, without joint incongruence or associated lesions. They are usually treated conservatively, with plaster casts, and have a good prognosis.

Fig. 3 - Fracture grouped into type I of the IDEAL method: age 52 years (0 point); displacement (absent: 0 point); energy – fall from standing position (low energy: 0 point); joint involvement (absent: 0 point); associated lesions (absent: 0 point).

Type II – scores of 2 to 3 points (Fig. 4).

These correspond to fractures with displacement and are potentially unstable. They are fractures with a high potential for loss of reduction and skewed consolidation, caused by poor bone quality (in elderly patients), high-energy trauma (in younger patients) or joint incongruence or associated lesions (both young and old patients). They generally require surgical stabilization using percutaneous pinning methods, external fixation or internal osteosynthesis with plates. These are fractures that present greater potential for complications inherent to the surgical procedure, and their prognosis is dependent on the success of the surgical technique used.

Fig. 4 - Fracture grouped into type II of the IDEAL method: age 39 years (0 point); displacement (present: 1 point); energy – fall from height (high energy: 1 point); joint involvement (1 point); associated lesions (0 point).

Type III – scores of 4 to 5 points (Fig. 5).

These correspond to complex displaced fractures. They are generally caused by high-energy trauma, and they present joint incongruence and associated lesions. Because of their patent instability and potential irreducibility, they require open reduction, associated fixation methods and bone grafts. They present high potential for complications and a guarded prognosis, regardless of the treatment method used.

Fig. 5 - Fracture grouped into type III of the IDEAL method: age 25 years (0 point); displacement (present: 1 point); energy – motorbike accident (high energy: 1 point); joint involvement (present: 1 point); associated lesions (present: 1 point).

Results

Although fractures of the distal extremity of the radius are very frequent, there is currently no classification system in the literature with adequate reproducibility that could provide elements for treatment planning and prognosis. The aim of this study was to describe a new classification method and test its validity and reproducibility in comparison with the classification methods most used in the literature.

Because the IDEAL classification is a mnemonic method and evaluates radiographic and clinical criteria summarized into three possible types of fracture, it is expected to present adequate inter and intra-observer reproducibility rates that are superior to those of other systems currently used. Thus, it may become a tool that enables adequate guidance for planning treatments for these fractures, and may be widely used.

Discussion

The main scientific challenge of this study was to develop and test a classification method that would be useful and reproducible at all levels of medical knowledge, from the physician responsible for the first consultation to the hand surgery specialist, such that it is easy to apply and guides prognoses and treatments for fractures of the distal extremity of the radius.[14,19]

The great virtue of the IDEAL classification is that it has objective parameters, of which two are epidemiological but are not liable to be subjectively evaluated or interpreted. Likewise, the radiographic parameters are clear and described binomially, which provides greater robustness and precision for the fracture classification process.

The classification system that we have developed is based on a mnemonic method and summarizes the fractures into three types, with the aim of providing a reproducible and useful form of classification. Thus, the objective now is to evaluate the reproducibility of this classification, along with its ability to assist in treatment and making the prognosis. These are the next phases, which are being conducted at present. Through this, we believe that we will ratify the propositions that we presented in describing this classification.

The most important reason for proposing a new classification model comes from our experience with clinical studies involving this condition. In these, there is no consensus regarding the fracture classification process, and classifications characterized by low reproducibility are used.[13-15] These factors are due to excessive grouping into subgroups[15] and/or inclusion of fractures in groups that are too heterogenous.[17,18]

Conclusion

We have presented a description of the IDEAL classification method. The parameters for creating it are grounded in the best scientific evidence available. Proof of its scientific and clinical plausibility will be established through analysis on the results from clinical studies that measure its reproducibility and its capacity to determine treatments and infer prognoses for these very frequent fractures. These studies that validate the properties of this classification are currently under development and will be the subject of future papers on this important topic.

Conflicts of interest

The authors declare that there was no conflict of interests in conducting this study.

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