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ORIGINAL ARTICLE

Schatzker and Mayo Classification Systems for Olecranon Fractures: Inter- and Intra-Observer Agreement

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ABSTRACT

AIM: Olecranon fracture is a relatively common injury, accounting for approximately 10% of upper limb fractures. Robust classification methods are essential for proper communication between surgeons and for comparing different treatment modalities. The aim of this study was to determine the reliability of two currently used classification systems for olecranon fractures.

METHODS: The study involved examination of inter- and intra-rater agreement for retrospective analysis of radiograph data using existing diagnostic criteria. The lateral elbow radiographs of fifty consecutive patients who were treated operatively for olecranon fractures were included. Olecranon fractures were classified independently by five experienced orthopedic surgeons using the Mayo and Schatzker classification systems. Two of the surgeons also reevaluated the fractures one month following the initial evaluation. Inter-observer and intra-observer variation was assessed using kappa statistics.

RESULTS: For Mayo classification, the mean inter-observer kappa value was 0.23 and the mean intra-observer value was 0.63. For Schatzker classification, the mean inter-observer and intra-observer kappa values were 0.35 and 0.53, respectively.

CONCLUSION: The two accepted classification systems for olecranon fractures revealed moderate inter-observer agreement. This should be taken into consideration when evaluating reports about different treatments for what are considered to be identical or similar fractures.

Key words: Olecranon; Fracture; Classification; Mayo; Schatzker; Reliability

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INTRODUCTION

Olecranon fracture is a relatively common injury, accounting for approximately 10% of upper limb fractures[1]. It can result from indirect trauma, hyperextension of the elbow[2], or a direct hit while on flexion[3]. Due to the intra-articular nature of the fracture, surgical treatment is usually recommended, aiming to reconstruct the articular surface and stabilize the elbow.

Few studies have attempted to compare outcomes following surgical intervention for olecranon fracture[4-6]. Clearly, a robust classification system is essential to performing such comparisons, as effective classification facilitates communication between surgeons, guides treatment plans, and improves evaluation of prognosis[7].

Though various classification systems have been suggested for olecranon fractures, none has been accepted universally or found to be more reliable than others[1-2,7-8].

The purpose of the current study was to evaluate the inter- and intra-observer reliabilities of two existing olecranon fracture classifications. In a reliable system, different individuals should reach similar conclusions when evaluating the same fracture. Likewise, a single assessor should obtain consistent results when classifying the same fracture at different times[9].

The two classification systems we evaluated, Mayo and Schatzker, are commonly accepted in practice. The Mayo system is based on displacement, stability, and comminution of a fracture, while the Schatzker method subdivides fractures based on pattern, defining them as transverse, transverse-impacted, oblique, comminuted, oblique-distal, or fracture-dislocation. While, the OTA/AO classification system was not commonly used at our clinic during the time data was collected for this study, the fractures of the patients included would fall under the categories 21-B1-B3 and 21-C1-C3.

MATERIALS AND METHODS

Between January 2006 and October 2012, 75 patients were treated operatively for olecranon fracture at our department. Of these patients, we included those with sufficient preoperative anteroposterior (AP) and lateral radiographs. Patients with radiographs of inadequate quality were excluded, leaving a total of 50 consecutive patients. Plain AP and lateral radiographs, available for all cases, were organized in a computerized slideshow. All identification markers were deleted and the order of patients in the presentation was randomly selected. The research received approval from hospital ethics committee.

The radiographs were reviewed by five senior, experienced orthopedic surgeons. Each surgeon was given a brief introduction and shown the definitions and simple figures for the Schatzker and Mayo classification systems. They were then asked to independently classify the fractures according to each of the systems. One month following their initial assessment sessions, two of the surgeons evaluated the entire series of radiographs once again.

Inter-observer and intra-observer agreement were evaluated using kappa statistics, which incorporate a correction for chance agreement. Kappa values range from +1, representing perfect agreement, through 0, representing chance agreement, to -1, representing absolute disagreement. According to Landis and Koch,10 values may be interpreted as follows: >0.80, almost perfect agreement; 0.61-0.80, substantial agreement; 0.41-0.60, moderate agreement; 0.21-0.40, fair agreement; 0-0.20, slight agreement; and 0, poor agreement.

Statistical analyses were performed using SAS software version 9.2.

RESULTS

The mean age of the 50 participants (28 female, 22 male) included in the study was 48 (SD = 28). For the Mayo classification system, the mean kappa value for inter-observer agreement was 0.233 (range: -0.02-0.55) and the mean kappa value for intra-observer agreement was 0.63 (range: 0.52-0.75). For the Schatzker classification system, the mean kappa value for inter-observer agreement was 0.35 (range: -0.01-0.53) and the mean kappa value for intra-observer agreement was 0.53 (range: 0.51-0.56) (Tables 1 and 2).

DISCUSSION

The use of accepted classification systems to define fractures is important for good communication between orthopedic surgeons, ensuring that they refer to similar types of fractures when evaluating different treatment methods. Ideally, classification systems should simply and accurately categorize different types of fractures, allowing surgeons understand each other.

A comprehensive review of the relevant literature does not reveal studies examining the classification of olecranon fractures. Indeed, researchers have noted that no single classification system has been accepted universally[1-2,7]. In the current study, we attempted to quantify the reliability of the Mayo and Schatzker classification systems. Our data showed inter-observer kappa values around 0.3 for each of the two systems, reflecting little agreement among the different surgeons. Though intra-observer agreement was somewhat higher (kappa ~0.5-0.6), the low inter-observer reliability suggests that both classification methods require improvement.

Given the lack of reliability studies regarding the classification of olecranon fractures, we examined our results with the context of classification systems for other types of fractures, including the inter-trochanteric fracture. Jin *at al*[11] tested the reliability of the AO, BOYD, KYLE and EVANS systems for classifying pertrochanteric hip fracture. Though they found the AO system to be significantly reliable (inter-observer kappa value 0.75-0.8), the kappa value for classification into AO subgroups was lower (k<0.5), as was the kappa for the other groups. In an additional study, van Embeden *et al*[12] compared the AO/ASIF and Jensen classification systems for pertrochanteric hip fractures, both of which produced kappa values under 0.5. Pervez *at al*[13] also examined the reliability of the AO/ASIF and Jensen classification and found that neither was acceptable for use with inter-trochanteric fractures of the femur.

The kappa values we calculated for the olecranon fracture classification systems in our research were similarly low. Thus, though the classification systems for olecranon fracture require improvement, it should be noted that they are not inferior to available classification systems for other fractures. Our findings emphasize the need for reliable classification and highlight difficulties in comparing the results of different studies, even when identical classification systems are used.

Table 1 Inter-observer agreement.

Classification	K value	
	Mayo	Schatzker
Surgeon 1	0.28326	0.47917
Surgeon 2	-0.01626	-0.00876
Surgeon 3	0.54967	0.37669
Surgeon 4	0.35829	0.40003
Surgeon 5	-0.00806	0.53125
Mean value	**0.233**	**0.3556**

Table 2 Intra-observer agreement.

Classification	K value	
	Mayo	Schatzker
Surgeon 1	0.75	0.51
Surgeon 2	0.52	0.56
Mean value	**0.63**	**0.53**

CONCLUSION

The Mayo and Schatzker classification systems for olecranon fractures were found to show only moderate reliability. This should be taken into account when evaluating the results of studies comparing different treatments for fractures defined similarly based on either of these systems.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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