Reproducibility of the Gartland classification for supracondylar humeral fractures in children

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ABSTRACT

Purpose. To evaluate the intra- and inter-observer reproducibility of the Gartland radiographic classification for supracondylar humeral fractures in children.

Methods. Anteroposterior and lateral radiographs of 50 supracondylar humeral fractures in children were graded on 2 separate occasions by 4 orthopaedic surgeons according to the Wilkins modification of the Gartland classification. Data were analysed by calculating the Kappa values for intra- and inter-observer agreement to indicate the reproducibility of the classification.

Results. There was moderate inter-observer agreement, except for poor agreement over type I fractures. Type II fractures only showed fair to moderate agreement. Type III fractures and the flexion group showed good to very good agreement. Intra-observer agreement was good to very good.

Conclusion. Surgeons should treat paediatric supracondylar humeral fractures based on an assessment of the degree of displacement rather than by employing the Gartland classification.

Key words: humeral fractures; observer variation; reproducibility of results

INTRODUCTION

In 1959 Gartland noted “the trepidation with which men, otherwise versed in the management of trauma, approach a fresh supracondylar fracture”. Supracondylar fractures of the humerus are notoriously difficult to treat and are the second most common fractures in children, and the most common around the elbow. They are divided into
The first radiological classification system for such fractures was proposed by Felsenreich in 1931 according to the degree of displacement; however, this is generally accredited to Gartland. Wilkins modified the Gartland classification but maintained the basis of the 3 types: Type I where the fracture is undisplaced or minimally displaced, such that the anterior humeral line still passes through the ossification centre of the capitellum. Type II where there is an obvious fracture line with displacement of the distal fragment, but there is still an intact cortex posteriorly. The direction of the displacement may be straight posteriorly, or angulated medially or laterally and there may be a rotary component. Type III where the fracture is displaced with no cortical contact with either posteromedial or posterolateral displacement. Wilkins subdivided type III fractures (often misquoted as type II) into A and B, depending on the absence or presence of rotation. For the purpose of clarity and convention, we subdivided Wilkins type II fractures into A (without rotation) and B (with rotation). Some also classify according to the degree of displacement, while others base it on the site and direction of the fracture line.

The management of these fractures remains controversial. Gartland originally recommended that type I fractures be immobilised in a splint with the elbow flexed to 75° to 80°. Type II and stable type III fractures require manipulation under anaesthesia and then immobilisation as for type I fractures. Unstable type III fractures are managed with skeletal traction with a Kirschner wire through the ulna distal to the olecranon tip. Other methods of internal fixation include bone pegs, Kirschner wires, and periosteal stitches. A protocol for management based on the Wilkins classification suggests that minimally displaced fractures without rotation (type I and IIA) are managed with manipulation under anaesthesia and plaster. When there is a rotational deformity or no posterior cortical contact (type IIB and III), the fractures are managed with reduction and fixation with 2 crossed 1.6-mm Kirschner wires.

We have noticed considerable disagreement between orthopaedic surgeons on the classification of these fractures and management, particularly with regard to the presence or absence of rotational deformity. The rotation does not result in a varus deformity directly, but predisposes to tilt or angulation of the distal fragment, which produces a varus or valgus deformity. The rotation can be reduced and fixed by Kirschner wires. Our null hypothesis was that the Wilkins modification of the Gartland classification was reproducible.

**MATERIALS AND METHODS**

Anteroposterior and lateral radiographs of 50 supracondylar humeral fractures in children were graded on 2 separate occasions by 4 orthopaedic surgeons according to the Wilkins modification of the Gartland classification.
classification, with subdivision of type II fractures into A and B.

Data were analysed by calculating the Kappa values for intra- and inter-observer agreement to indicate the reproducibility of the classification. Kappa represents the proportion of agreement beyond that expected by chance; a kappa of one represents perfect agreement and 0 represents no more agreement than would be expected by chance; a kappa of <0 represents less agreement than would be expected by chance (Table 1).

RESULTS

Tables 2 and 3 show the extent of intra- and inter-observer agreement. Overall there was a moderate inter-observer agreement, except for poor agreement over type I fractures. Type II fractures only showed fair to moderate agreement. Type III fractures and the flexion group showed good to very good agreement. Intra-observer agreement was good to very good.

DISCUSSION

Supracondylar humeral fractures in children are common and treatment is based on their radiographic classification. Displacement with rotation is an indication for Kirschner-wire fixation. The presence of rotation does not directly result in an alteration in the carrying angle and therefore deformity; it does however predispose to tilt and induce cubitus varus/valgus. This is particularly important as anteroposterior displacement will remodel in children, but a rotational deformity will not. Cubitus varus/valgus is a cosmetic deformity causing minimal functional deficit, but it is difficult to correct and has a high complication rate of 33%.

The null hypothesis in this study has been disproved; inter-observer agreement was only moderate. Surgeons should treat supracondylar humeral fractures based on the assessment of the degree of displacement rather than by employing the Gartland classification.