Four-segment classification of proximal humeral fractures revisited: A multicenter study on 509 cases

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Background: The 4-segment classification of Neer (1970) was revised in 2002 with the inclusion of valgus-impacted fractures. However, the range of possible fracture types covered by this classification is not clear. With the aim to clarify actual fracture patterns of the proximal humerus, a retrospective, multi-center study was conducted..

Methods: We retrospectively reviewed 509 cases for which anteroposterior and trans-scapular lateral views had been taken at the time of injury. Initially, three examiners from three facilities, independently read the radiographs of each case. In the second and third phases, for more difficult cases, consensus opinions were reached.

Results: We found that 501 (98%) of the 509 fractures had an appropriate category in the revised Neer classification. There were 185 cases (36%) of one-part fractures, followed by 156 cases (31%) of 2-part surgical neck fracture, 60 cases (12%) of 2-part greater tuberosity fracture (dislocation included), 45 cases (8.8%) of 3-part fracture involving the greater tuberosity and the surgical neck (dislocation included), 31 cases (6.1%) of 4-part fracture (dislocation included), and 17 cases (3.3%) of valgus-impacted fracture. Eight fractures (1.6%) could not be classified with the revised Neer classification. They were ''3-part'' fractures in terms of the number of displaced segments but had a complete anatomic neck fracture.

Conclusion: We conclude that it would be appropriate to use the revised Neer classification in clinical practice. We would emphasize that, when there are 3 displaced segments, close attention should be paid to the fracture line on the anatomic neck.

Level of evidence: Level 4; Diagnostic study, case series.

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The 4-segment classification has been widely used for the treatment of proximal humeral fractures.[9,10] In this

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system, when there is displacement of 1 cm or more between segments or when there is an angulation of 45° or more, a fracture is defined as a displaced fracture (2-part, 3-part, or 4-part fracture). Once this basic rule is understood, there is nothing to memorize[10] and classification becomes easy. Moreover, the determination of fracture types and

Figure 1   Number of fractures found in database according to revised Neer classification.

therapeutic measures is closely linked so that this classification system has been accepted as clinically useful.

Originally, the Neer classification was made by extracting frequent fracture types from patterns of how fracture lines occur described by Codman[1] and adding the concept of displacement. Subsequently, in 2002, Neer[11] added 4-part valgus-impacted fractures to this classification (hereinafter referred to as the revised Neer classification). Accordingly, it is no longer necessary to forcibly categorize valgus-impacted fractures under other fracture types. There are, however, several case reports showing a fracture anatomy that did not fall into any category of the revised Neer classification.[6,7,12,15,16] Thus, the extent to which the original or revised Neer classification covers actual fracture types has not been verified. Obviously, this is one of the important issues that may affect the clinical validity of a classification system.

Therefore, we conducted a multicenter study to specify the fracture patterns of the proximal humerus that are covered or not covered by the revised Neer classification and thereby to re-evaluate this classification in terms of its usefulness and limitations.

Methods

We retrospectively collected data on 687 proximal humeral fractures that were treated between 2003 and 2006 by a total of 18 active shoulder surgeons in Japan who had assented to this study. Of the 687 fractures, we excluded 17 fractures that occurred in patients aged under 15 years and 5 fractures in which the fracture line extended to the humeral shaft. Of the remaining 665 fractures, 509 fractures for which both anteroposterior and trans-scapular lateral (scapular Y) views had been taken at the time of injury were included in our database, and these 2 views were considered to be essential for the Neer classification.[9,10] Of the 509 fractures, 11 had an axillary view and 133 had computed tomography (CT) scans in addition to the anteroposterior and trans-scapular lateral views. All the images were formatted as digital data. There were