

## Perspective

# How many shoulder fractures are displaced? How a misleading statement became orthopedic knowledge

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Knowledge concerning the prevalence of clinical phenomena in a defined population is a prerequisite for clinical decision-making. We need to know whether we can expect to meet a zebra or a horse. If we expect to meet a zebra, we are more likely to diagnose a zebra. If we examine a soccer player with pain at the back of the thigh, we are more likely to diagnose a muscle strain than a sarcoma. Over- or underestimating the prevalence may lead to cognitive bias and decision-making error.

Several sources of knowledge on the prevalence exist. The prevalence of a certain diagnosis can be established by retrieval of national registry data, and incidences can be calculated by including data on the background population. However, surgical decisions are often based on further classification of the injuries. Classification data is less reliable; partly because of observer variation, partly because data often originates from small and selected populations. The estimation of classification data may have important consequences for patients and healthcare providers.

In the management of proximal humeral fractures, the most fundamental classification is a simple binary distinction between minimally displaced fractures and displaced fractures. Displacement has been roughly defined since 1970 [1]. A fracture is considered displaced if at least 1 of the 4 anatomic segments of the proximal humerus is displaced at least 1 cm or angulated at least 45°. While the treatment of displaced fractures is still under debate, it is widely agreed within the orthopedic community that patients with minimally displaced fractures should not be operated on.

For half a century, it has been stated countless times in the orthopedic literature that:

“Eighty-five percent of these injuries are minimally displaced and amenable to nonoperative treatment.” [2]

or reversely phrased:

“Approximately 15–20% of such fractures are displaced or unstable and require surgical management.” [3]

These statements have been repeated at all academic levels, in introductions for young surgeons, in advanced textbooks for shoulder specialists, and in scientific papers, usually with reference to Charles Neer’s paper from 1970 [1]. This paper has become a classic in the orthopedic literature with 1,637 citations (Scopus, May 5, 2023). Let us trace the origin of this powerful statement and follow how it drifted into the orthopedic literature.

Charles Neer based his observations on a single-center population of 300 patients with displaced fractures collected between 1953 and 1967. No minimally displaced fractures were included and the distribution in the background population was not reported. The patients were relatively young (average 55.6 years) and they were all treated under anesthesia by closed reduction, open reduction, hemiarthroplasty, or removal of the humeral head. Despite the lack of empirical support Neer made his important statement on ‘minimum displacement’:

“This group constitutes over 85 percent of proximal humeral fractures.” [1]

Neer supported his statement with reference to a conference paper by Morbier and Paterson from 1967 [4] published 3 years before his own definition of displacement. A series of 124 adults and 23 children with fractures of the proximal end of the humerus was reported, with 26 patients having closed or open procedures. No information on the fracture morphology was provided. Several indications for open reduction were suggested, but the results after surgery were not reported. If the 23 children are included in the calculation, 18% of the fractures were treated operatively. Consequently, the inclusion of children and the absence of information on displacement make this reference a weak support of Neer’s statement.

Subsequent epidemiological studies have failed to confirm Neer's statement. Court-Brown prospectively classified 1,027 unselected fractures from Scotland and reported 49% minimally displaced fractures [5]. Tamai retrospectively classified 509 unselected fractures from Japan and reported 36% minimally displaced fractures [6]. Roux classified 329 fractures from a French trauma center and reported 42% minimally displaced fractures [7]. In all studies the average age of the population has been about 10 years higher, suggesting that Neer's population was selected.

Interestingly, one of the authors of the French epidemiological study reporting 42% minimally displaced fractures in 2012 [7] repeated Neer's 85% statement in 2015 [3] with no reflections on the contradictory evidence from his own study. The established knowledge seems to have deeper impact than the new evidence [8].

What are the clinical implications of this misleading statement becoming common orthopedic knowledge? The statement is potentially harmful in several ways. First, if only 15% of the fractures are expected by clinical decision-makers to be displaced, a substantial number of fractures may be misclassified as minimally displaced. Second, if all displaced fractures should be treated operatively, more than half of all patients should be operated on. This is against current best evidence [9]. The cost and suffering from such surgery would be substantial.

We have no reason to believe that this is likely to be the only misleading authoritative statement on prevalences drifting into orthopedic folklore.

Prevalence matters in clinical decision-making. Stay curious about the empirical support behind commonly repeated values, even if they originate from our most distinguished colleagues.

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