CORR Insights

CORR Insights®: Greater Tuberosity Fractures: Does Fracture Assessment and Treatment Recommendation Vary Based on Imaging Modality?

Donald H. Lee MD

Where Are We Now?

After Neer [3] refined his definition of a displaced proximal humeral greater tuberosity fracture as having one centimeter of displacement and 45° of angulation, there has been a debate about the amount of fracture displacement that warrants surgical intervention [5]. Also in question is the intra and interobserver reliability [2, 7, 8] in determining the amount of frac-

ture displacement and therefore our ability to classify these fractures. The implication is that if the ability to determine the degree of fracture displacement is questionable, then recommendations for surgical intervention based on radiographic findings may be unreliable.

Past studies [2, 6–8] using proximal humeral fracture radiographs have shown poor-to-moderate inter and intraobserver agreement in classifying these fractures. Most of these studies

have used a relatively small number of observers. Prior work has been mixed in terms of whether the use of computerized axial tomography scanning may [1] or may not [6] increase this diagnostic accuracy. One cadaveric greater tuberosity fracture study concluded that four radiographic views (anteroposterior in external rotation, anteroposterior, outlet, and axillary) improved the accuracy and reliability in determining greater tuberosity displacement [4].

The current study by Janssen and colleagues, using work done within the Science of Variation Group, sought to clarify this disparity. They found that imaging modality did not influence interobserver fracture assessment reliability nor influence the recommendation for surgical treatment. With the use CT scans, surgeons felt slightly more comfortable in their assessment of fracture displacement in borderline cases and therefore their recommendations for treatment, even though it did not change their recommendations.

This CORR Insights® is a commentary on the article “Greater Tuberosity Fractures: Does Fracture Assessment and Treatment Recommendation Vary Based on Imaging Modality?” by Janssen and colleagues available at: DOI: [10.1007/s11999-016-4706-6](https://doi.org/10.1007/s11999-016-4706-6)

The author certifies that he, or any member of his immediate family, has no funding or commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

All ICMJE Conflict of Interest Forms for authors and *Clinical Orthopaedics and*

Related Research® editors and board members are on file with the publication and can be viewed on request.

The opinions expressed are those of the writers, and do not reflect the opinion or policy of *CORR®* or The Association of Bone and Joint Surgeons®.

This *CORR®* Insights comment refers to the article available at DOI: [10.1007/s11999-016-4706-6](https://doi.org/10.1007/s11999-016-4706-6).

D. H. Lee MD (✉)
Vanderbilt University, Medical Center
East, South Tower, Suite 3200,
Nashville, TN 37232-8828, USA
e-mail: Donald.H.Lee@Vanderbilt.edu

CORR Insights

Janssen and colleagues used a relatively small sample size, nonstandardized radiographs, and the lack of measurement tools. Previous studies [2, 7, 8] provided between 50 to 100 case scenarios, compared to 22 in this series. In this study, only two views of the shoulder were provided in most cases. Half of the cases had an outlet view and the other half had an axillary view. There were no measurement tools available to measure the degree of fracture displacement. Since all patients had CT scans, the case examples may have been towards more severe fractures. The addition of case scenarios including the patient history may have some influence on the observers when recommending surgical treatment.

Where Do We Need To Go?

There are many variables involved in recommending operative or nonoperative treatment of greater tuberosity fractures. The patient age, medical comorbidities, fracture characteristics including the degree of fracture displacement and comminution, time from injury, and surgeon's preferences and capabilities are among these factors. It is doubtful that universal agreement can be obtained among

surgeons. In order to answer the question as to whether fracture assessment and treatment recommendations vary based on imaging modality alone, a large standardized study may help. The study should concentrate on the effect of imaging studies alone and minimize other factors like patient demographics and surgeon's preferences and biases.

How Do We Get There?

The authors are to be congratulated for using a large number of observers, with varying degrees of experience, and from a wide geographic distribution. A more ideal study would include using a larger number of case examples assessed by an equally large or larger number of observers with varying levels of experience and training. Reviews of standardized shoulder radiographs (with a minimum of four radiographic views) and standardized two-dimensional and three-dimensional CT scans should be performed at a minimum of two time points to obtain inter and intraobserver reliability. The reviews should be performed using a standardized imaging system that allows one to measure the degree of fracture displacement. By minimizing the variations in the patient's case

histories or by using imaging studies alone, will help minimize the effect of patient factors when making treatment recommendations.

References

1. Kilcoyne RF, Shuman WP, Matsen FA III, Morris M, Rockwood CA. The Neer classification of displaced proximal humeral fractures: Spectrum of findings on plain radiographs and CT scans. *AJR Am J Roentgenol*. 1990;154:1029–1033.
2. Majed A, Macleod I, Bull AMJ, Zyto K, Resch H, Hertel R, Reilly P, Emery RJH: Proximal humeral fracture classification systems revisited. *J Shoulder Elbow Surg*. 2011;30:1125–1132.
3. Neer CS. Displaced proximal humeral fractures. I. Classification and evaluation. *J Bone Joint Surg Am*. 1970;52A:1077–1089.
4. Parsons BO, Klepps SJ, Miller S, Bird J, Gladstone J, Flatow E. Reliability and reproducibility of radiographs of greater tuberosity displacement. A cadaveric study. *J Bone Joint Surg Am*. 2005;87:58–65.
5. Platzer P, Kutscha-Lissber F, Lehr S, Vecsei V, Gaebler C. The influence of displacement on shoulder function in patients with minimally displaced fractures of the greater tuberosity. *Injury*. 2005;36:1185–1189.
6. Salley PI, Podowitz RA, Mallon WJ, Vandemark RM, Dalton JD, Speer KP. Reliability and reproducibility of

CORR Insights

- radiographic interpretation of proximal humeral fracture pathoanatomy. *J Shoulder Elbow Surg.* 1997;6:60–69.
7. Sidor ML, Zuckerman JD, Lyon T, Koval K, Cuomo F, Schoenberg N. The Neer classification system for proximal humeral fractures. An assessment of interobserver reliability and intraobserver reproducibility. *J Bone and Joint Surg Am.* 1993;75A:1745–1750.
8. Siebenrock KA, Gerber C. The reproducibility of classification of fractures of the proximal end of the humerus. *J Bone and Joint Surgery Am.* 1993;75A:1751–1755.