

# Arm position and deforming muscular forces in proximal humeral fracture

Yong-Min Chun

*Department of Orthopedic Surgery, Arthroscopy and Joint Research Institute, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea*

Proximal humerus fracture account for 5%–6% of all fractures, and represent one of most common fractures in elderly patients [1,2]. Fortunately, in many cases, they are non-displaced or minimally displaced, and exhibit good outcomes overall with conservative treatment [2,3]. Nonetheless, many of the tendons and muscles around the proximal humerus, including rotator cuff, can work as deforming forces on the proximal humerus, which consists of the articular surface of humeral head, greater tuberosity, lesser tuberosity, and shaft. Thus, fracture patterns can be predicted based on the muscle or tendon insertion, such as supraspinatus, infraspinatus, subscapularis, and pectoralis major. Therefore, management to reduce or minimize these deforming forces is necessary during conservative treatment or during the postoperative period.

A study by Chalmers et al. [4] discussed these deforming forces in proximal humerus fracture depending on arm position, using fresh-frozen cadaveric shoulder specimens. They hypothesized that glenohumeral abduction would mitigate varus deformity driven by the supraspinatus, and internal rotation would mitigate varus deformity by the subscapularis, respectively. Medial wedge osteotomy was performed to simulate a surgical neck fracture. Specimens were mounted on a custom shoulder test system for testing. As varus deformity or progress is not uncommon

during conservative treatment or after surgical fixation, the authors focused on varus deformity. At 0° and 20° glenohumeral abduction and internal rotation, changes in varus were measured following physiologic muscle loading. The authors concluded that shoulder abduction and internal rotation can reduce varus-driven force in surgical neck fracture by decreasing tension from the supraspinatus and subscapularis tendon and muscle. Thus, they recommended use of a sling placing the shoulder in this position.

To mitigate varus deforming force in a sling, abduction and internal rotation seem to be reasonable [4]. However, in terms of tension around proximal humerus fractures, we also feel the tension caused by pectoralis major abduction is a concern, especially in skinny and small persons. In addition, if proximal humerus fracture involves the greater tuberosity, internal rotation can increase the tension of external rotators such as the infraspinatus, leading to displacement.

Thus, in proximal humerus fracture, it is necessary to consider all components, including muscle and tendon insertion. Arm position in any brace or sling during initial conservative treatment or after surgery should seek to decrease the tension on each fracture component and the inserting muscle or tendon.

Received: November 2, 2022      Accepted: November 11, 2022

Correspondence to: Yong-Min Chun

Department of Orthopedic Surgery, Arthroscopy and Joint Research Institute, Severance Hospital, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea

Tel: +82-2-2228-5679, Fax: +82-2-363-6248, E-mail: [osmin120@yuhs.ac](mailto:osmin120@yuhs.ac), ORCID: <https://orcid.org/0000-0002-8147-6136>

Financial support: None.

Conflict of interest: None.

Copyright© 2022 Korean Shoulder and Elbow Society.

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

## ORCID

Yong-Min Chun <https://orcid.org/0000-0002-8147-6136>

## REFERENCES

1. Court-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humeral fractures. *Acta Orthop Scand* 2001;72:365-71.
2. Patel AH, Wilder JH, Ofa SA, Lee OC, Savoie FH 3rd, O'Brien MJ, et al. Trending a decade of proximal humerus fracture management in older adults. *JSES Int* 2021;6:137-43.
3. McLean AS, Price N, Graves S, Hatton A, Taylor FJ. Nationwide trends in management of proximal humeral fractures: an analysis of 77,966 cases from 2008 to 2017. *J Shoulder Elbow Surg* 2019;28:2072-8.
4. Chalmers CE, Wright DJ, Patel N, Hitchens H, McGarry M, Lee TQ, et al. Muscular forces responsible for proximal humeral deformity after fracture. *J Orthop Trauma* 2022;36:e18-23.