Progressive Displacement in Clavicle Fractures

1Plocher, E K; 2Anavian, J; 2Vang, S; +3Cole, P A

+1Buffalo University, Buffalo, NY, 2University of Minnesota, Minneapolis, MN, 3Regions Hospital, St. Paul, MN

Senior author peter.a.cole@healthpartners.com

INTRODUCTION
Historically, minimally to moderately displaced clavicle fractures have been considered stable and managed conservatively [1,2]. Currently, there is no evidence to support the notion that these clavicle fractures are stable and will not displace further. This study was designed to determine if a percentage of operatively managed clavicle fractures initially were managed nonoperatively, but progressively displace in the early post-injury period and thereby went on to meet operative indications.

METHODS
We conducted a retrospective review of all patients who underwent operative fixation for a clavicle fracture between February 2002 and February 2007 at a Level I trauma center. All patients who presented acutely to the emergency room as well as those referred for isolated clavicle fractures or nonunions were included in the analysis. There were 56 patients with 58 clavicle fractures treated operatively with open reduction and internal fixation using plates and screws by 1 of 7 surgeons during this period. Fifteen of 56 patients (27%) who underwent surgical treatment were initially managed conservatively and then subsequently met surgical criteria due to progressive deformity noted at follow-up. In this cohort, none of the patients operated on for a clavicle malunion or nonunion showed progressive fracture displacement from the original injury.

All fractures were classified according to the OTA classification using the initial injury films. Measurements were taken from the radiographs upon which treatment was decided. These included chest, shoulder anteroposterior (Gracey view) and clavicle radiographs that were taken according to standard radiographic protocols. The standard protocol used for an anteroposterior (AP) view of the shoulder at the study institution was well defined.

A standardized method for measuring medialization (shortening) and superior-inferior displacement (translation) was developed and utilized. Measurements for medialization (A) were taken, in millimeters, as an absolute displacement in the coronal plane (Fig. 1). Translation (B/C) was measured as an absolute displacement of the superior or inferior cortex. The superior-inferior displacement was then expressed as a percentage of the diameter of the clavicle at the fracture site (Fig. 1).

RESULTS
Fifteen of the 56 patients (58 fractures, 26%) treated operatively were initially managed conservatively and then later showed progressive fracture displacement on radiographic evaluation (Group II), warranting open reduction and internal fixation (Fig. 2). There were 7 females and 8 males among the patients in Group II, with an average age of 35.5 years (14.5-53). All fractures were the result of high energy mechanisms and were often associated with multiple injuries (73%). Four of these were isolated fractures.

Based on the initial injury films there were 9 simple diaphyseal fractures (15-B1), 3 diaphyseal wedge fractures (15-B2), 2 complex diaphyseal fractures (15-B3) and 1 extra-articular lateral clavicle fracture (15-C1). Average time from injury to surgery was 21.9 days (12-61). Average time from injury to the repeat radiographic evaluation, at which the decision was made to operate, was 14.8 days (9-30). Operative intervention for Group II took place an average of 21.9 days post-injury (12-61).

DISCUSSION
This study has shown that out of 58 fractures treated operatively during the study period, 15 (26%) were managed surgically after they demonstrated progressive and marked displacement. The concept of an unstable clavicle fracture is new, as it has been assumed that these fractures will heal if diagnosed with acceptable alignment. “Instability” is defined as the potential for fracture displacement while in a normal physiologic position.

Thus, while most clavicle fractures are presumed stable and result in uneventful healing with an acceptable degree of deformity, this study demonstrates that there exists a subset of these fractures which are unstable and may displace further. Recognition of this by orthopaedic surgeons treating this injury may alter the post-injury management. We recommend close monitoring of conservatively managed clavicle fractures in the early post-injury period with serial radiographic evaluation to screen for progressive fracture displacement.

REFERENCES

ACKNOWLEDGEMENTS
We acknowledge Zimmer Inc. for research grant support to The Scapula Institute.

Fig. 1

10/56 (18%) progressive medialization
Mean = 14mm (range 6 – 29mm)

56 patients ORIF clavicle fracture

13/56 (23%) progressive translation
Mean = 131% (range 45 – 272%)

15/56 (26%) progressive displacement
- medialization and/or translation

Fig. 2

Ten patients in Group II (66.7%) displayed progressive medialization of the fracture upon evaluation and comparison of initial and repeat radiographs. Average medialization was 0.3mm (-7.0-7.9mm) at the time of injury and 14.6mm (6.8-29.0) at the time of repeat radiography. Average progressive change in medialization between that of the injury radiographs and the repeat radiographs in this group was 14.3mm (6.0-29.0mm). There were 13 patients (86.7%) who displayed progressive superior-inferior displacement. These patients had an average translation of 46.1% (0.0-142.9%) at the time of injury and 177.4% (122.0-272.4%) at the time of repeat radiography. The average progressive change in translation between that of the injury radiographs and the repeat radiographs was 131.3% (45.0-272.4%). Note that 5 patients showed progressive translation without change in medialization and 2 patients showed progressive medialization without change in translation. One patient with a double disruption of the superior shoulder suspensory complex (clavicle fracture with scapula neck fracture) displayed progressive displacement of both the clavicle and scapula fractures. The scapula fracture displayed 12mm of displacement (medialization of the glenohumeral joint with respect to the scapula body) in the coronal plane at the time of injury and 30mm of medialization at repeat radiography.