Progressive Displacement of Scapula Fractures

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INTRODUCTION

Historically, minimally-to-moderately displaced extra-articular scapula fractures have been managed conservatively. It is possible that operative criteria could be met for a given patient if progressive displacement in the post injury period were to occur. A retrospective review of an operative cohort of patients was performed to determine if a subset of scapula fractures that initially were minimally displaced and did not meet operative criteria subsequently showed progressive displaced in the post-injury period, thereby meeting operative criteria.

METHODS

This is a retrospective review of 49 patients with displaced, extra-articular scapula neck fractures who underwent open reduction and internal fixation for a scapula fracture between 2003 and 2007. Indications for operative treatment included at least one of the following criteria: >20 mm of medialization of the glenohumeral joint, >25 degrees of angular deformity in the semicoronal plane as seen in the scapula Y view, or displaced (>10 mm) double lesions of the superior shoulder suspensory complex. The patients were screened to select out those who were initially managed conservatively based on the initial clinical and radiographic assessment, but then subsequently were found to meet operative indications due to progressive displacement/deformity noted on evaluation of repeat radiography at their next follow-up visit.

Eight out of 49 patients (16%) who underwent surgical treatment were initially managed conservatively and then subsequently met surgical criteria due to progressive deformity noted at follow-up. Radiographic measurements for deformity, including medialization, angulation, translation, and glenopolar angle (GPA), taken at the initial, post-injury assessment were then compared to those taken at the follow-up assessment, and the difference was calculated for each of these deformities. Medialization in this context is defined as displacement of the proximal fragment (attached to the glenohumeral joint) in relation to the distal fragment (scapula body) resulting in lateral border offset.

To examine inter-observer variability, three physician examiners of different levels of experience were assigned to independently measure radiographs. These included a board-certified orthopaedic surgeon specializing in orthopaedic trauma, an orthopaedic trauma fellow, and a clinical research fellow. Each observer was blinded to the others’ readings. Intraobserver reliability was evaluated by having each of the examiners measure the same set of radiographs on two separate occasions, 16 weeks apart. Subsequently, single-measure intraclass correlation coefficients (ICCs) were used to determine variability within and among measurement groups [1]. According to Shrout and Fleiss [2] an ICC of 0.6-0.74 is considered good and an ICC of ≥0.75 is excellent. Pearson’s r coefficients were also calculated to determine intra-observer variability. Statistical analyses consisted of the mean, range, standard deviation, and t-test. For all analyses, statistical significance was assumed for p<0.01.

All the imaging available including radiographs and 3D-CT scans were evaluated and those views that allowed best visualization of the fracture line were collected for each patient. These views from each patient were imported into Macromedia Fireworks MX software (Macromedia Inc., San Francisco, CA) to overlap and orient fracture patterns onto a template scapula image. Images of each scapula were graphically superimposed to create a compilation of fracture lines on a standard scapula template. The overlap of all fracture lines resulted in a frequency diagram. Once proper anatomical alignment was obtained, fracture lines were identified and were traced on top of the combined 3D-CT and model scapula. Fracture patterns were then confirmed using the original 3D-CT rendering.

RESULTS

Eight out of 49 patients (16%) who underwent surgical treatment were initially managed conservatively and then subsequently met surgical criteria due to progressive deformity noted at follow-up. Three patients were female and 5 patients were male with an average age of 38 (range 19-53). All fractures were a result of high-energy trauma. Overlaying of the fracture patterns yielded an illustration of a fracture map for this cohort (Fig. 1).

<table>
<thead>
<tr>
<th>Mean Change (range)</th>
<th>1Anavian, J; 2Khanna, G; 3Plocher, E K; 4Wijdicks, C A; 5Coy, P A, +1Buffalo University, Buffalo, NY, Senior author <a href="mailto:peter.a.cole@healthpartners.com">peter.a.cole@healthpartners.com</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>GPA Translation</td>
<td>Medialization Angulation Translation GPA</td>
</tr>
<tr>
<td>Mean (range)</td>
<td>+7% (20-45) 6° (absolute) 18% (absolute) 5-50% -5° (absolute)</td>
</tr>
<tr>
<td>STDV</td>
<td>31% 34° 14% (4-13%) +9% (4-13%) 31% 34° 14% (4-13%) +9% (4-13%)</td>
</tr>
<tr>
<td>n=78</td>
<td>Mean (range)</td>
</tr>
<tr>
<td>P-value</td>
<td>p=0.0001 p=0.002 p=0.009 p=0.0001</td>
</tr>
</tbody>
</table>

Fig. 1 Table 1

Table 1: All 8 patients sustained an extra-articular fracture of the scapula, specifically a transverse glenoid neck fracture (OTA Type 14-A3.1, Ada-Miller Type IIC). Three of the 8 patients also sustained ipsilateral clavicle fractures thereby classifying their injury as a double lesion of the superior shoulder suspensory complex. However, neither of these patients initially presented with enough fracture displacement to warrant surgery. The average time interval between the initial assessment and second assessment was 11.1 days. Table 1 lists the mean change in fracture deformity between the initial and second assessment with regards to medialization, angulation, translation, and glenopolar angle measured by all 3 observers, as well as the range, standard deviation, and corresponding t scores. Mean reliability between the three observers’ readings was highest for the translation measure and lowest for medialization (Table 2). Across the 3 observers the trial 1 and trial 2 readings agree most for translation and least for medialization (Table 3). However, there is some variability in trial 1 vs. trial 2 reliability between the initial films (where medialization has the 2nd highest reliability) and the pre-operative films (where medialization has the lowest reliability).

Table 2: Intra-observer reliability examining 3 judges’ ratings in trial 1 vs. trial 2, using interclass correlation coefficients (ICC)

Table 2: Intra-observer reliability examining 3 judges’ ratings in trial 1 vs. trial 2, using interclass correlation (ICC) and Pearson’s r coefficients

DISCUSSION

While most scapula fractures are stable and present with an acceptable degree of deformity, a small percentage of these fracture are unstable and may displace further, which may change the management approach. “Instability” is defined as the potential for fracture displacement while in a normal physiologic position. We recommend close monitoring of conservatively managed scapula fractures in the early post-injury period with serial radiographic evaluation, using the parameters described in this study, to screen for fracture instability and progressive deformity that may warrant operative intervention.

REFERENCES

ACKNOWLEDGEMENTS
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