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ORIGINAL ARTICLE

Classifying glenohumeral synovitis: a novel intraoperative scoring system

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Background: Synovitis of the shoulder is a common entity that is poorly described. This study aims to create a simple and reliable classification system for glenohumeral synovitis, which would benefit further research related to synovitis and outcomes.

Methods: Twenty 30-second shoulder arthroscopy videos were distributed to 19 fellowship-trained orthopedic surgeons. The observers responded with their years in practice, fellowship type, whether synovitis affects outcomes, and whether synovitis affects plans. The surgeons then rated the videos based on the following: color of capsule (pale, pink, or red); villous projections (none, few, or extensive); capillaries in capsule (scattered or hypertrophied); and axillary recess (normal or contracted). Scores ranging from 0 to 6 were assigned. The videos were randomized and redistributed at a later date. Statistical analysis used an intraclass correlation coefficient with a mixed-effects model to calculate variability based on observer.

Results: Nineteen observers completing the survey twice resulted in 760 videos being scored. There were 12 shoulder surgeons and 7 sports surgeons. Only 4 surgeons believed that synovitis did not affect outcomes, and the remaining 15 believed that it did. The intraclass correlation coefficient showed that 68% of the variation in measured scores was due to variation among patients and only 4% was due to variation among observers. There was no significant variation seen in scores due to surgeon experience, surgeon specialty, or first and second viewing.

Conclusions: This interclass observer reliability shoulder synovitis study defined a system with excellent reliability among a range of surgeons with diverse training and experience. In addition, there was excellent reliability for the same surgeon between viewings.

Level of evidence: Basic Science Study; Development/Validation of Classification System

Keywords: Glenohumeral synovitis; synovitis classification; arthroscopic grading; interobserver study; shoulder synovitis; shoulder synovitis classification

Shoulder pain is a common musculoskeletal complaint, the treatment of which creates a significant economic impact in the United States.[10] The etiology of pain in the shoulder comes from a variety of diagnoses, including rotator cuff tendinopathy, adhesive capsulitis, and instability.[8] Multiple pathologic conditions of the shoulder are associated with

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significant debilitating pain.[8,10] Rotator cuff tendinopathy and chronic glenohumeral instability have been associated with synovitis.[1,4] Gotoh et al[5] even found that full-thickness tears were associated with greater degrees of synovitis than partial-thickness tears.

Although the presence of glenohumeral synovitis in various pathologic processes has been well documented, intraoperative surgical management as well as potential effects on rehabilitation and outcomes has not been fully evaluated. The primary reason for this may be the absence of an established formal classification system for synovitis as seen during arthroscopy. Microscopic descriptions of synovitis have been reported; however, this is not a practical way to intraoperative assess the degree of synovitis.[12] Jo et al[6] recently reported on the microscopic and macroscopic characteristics of shoulder synovitis. They were able to identify and reliably correlate different microscopic findings with macroscopic features. However, the classification system described seems difficult to replicate efficiently intraoperatively. In addition, the results are limited to just 2 observers.

The presence of shoulder stiffness with concomitant symptomatic rotator cuff tears has been a focus of recent research. Cho et al[2] and McGrath et al[7] have both reported on outcomes of performing a capsular release in the same setting as a rotator cuff repair. Giuseffi et al[3] have also described an arthroscopic technique for this procedure. In all of these studies, the addition of the capsular release was based on changes in range of motion. If there were an accurate scoring system for synovitis to be able to correlate with symptomatic stiffness, this could aid arthroscopic treatment of pathologic shoulders with the addition of releases as necessary.

Currently, synovitis is informally graded on a subjective scale (ie, mild, moderate, and severe). Creating a reliable and simple classification system for glenohumeral synovitis will allow shoulder surgeons to quickly grade the degree of synovitis. This study aimed to create such a system in a more objective fashion than current methods. The degree of synovitis could then be easily translated for further research to examine pain related to synovitis, adjust a surgical plan, guide postoperative treatment plans, and potentially assist in predicting surgical outcomes. The purpose was to create the first phase of a larger project aimed at creating a rating system for synovitis based on the arthroscopic appearance of the glenohumeral joint. Our hypothesis was that the objective appearance of capsular synovitis could be reliably categorized by multiple surgeons into reliable subgroups for classification. Further studies will then be planned to translate the classification into clinical applications.

Methods

Twenty arthroscopic videos were collected during arthroscopic shoulder surgery. The videos were edited into 30-second segments displaying the biceps anchor, the rotator cuff attachment, the axillary recess, and the rotator interval. The videos were then deidentified and distributed to 47 board-certified orthopedic surgeons with subspecialty training in shoulder and elbow surgery or sports medicine. The videos were evenly distributed regarding synovitis ranging from none to severe, based on the 2 senior authors' judgment. Although the senior authors did not formally calculate an objective score as is described in this article, the same criteria (capsule color, villous projections, extent of capillaries, and space of axillary recess) were used to select a range of samples to be scored. Three additional videos were collected and classified by the authors as showing mild, moderate, and severe synovitis to be used as examples in the beginning of the survey (Fig. 1).

In the survey, the observers were asked to respond with their years in training, fellowship type, whether they believe synovitis affects the outcome of surgery, and whether the degree of synovitis causes them to change their plan. To compare our newly defined system with the current standard subjective system, the surgeons were then asked to grade the subjective degree of synovitis as none, mild, moderate, or severe.

Finally, to assess the new grading system, the surgeons were asked to grade each video to define the color, villous projections, capillaries, and axillary recess. The first 3 criteria were selected as these are commonly used and recognized markers of synovial inflammation.[9] The degree of axillary recess contraction was selected through the experience of the senior authors as a factor related to synovitis of the glenohumeral joint. In an effort to create a more objective score from a subjective process, the following questions were asked of the observers:

1. "How would you describe the color of the capsule?" The possible responses were pale (0), pink (1), or red (2) (Fig. 2).
2. "How would you describe the villous projections?" The possible responses were none (0), few (1), or extensive (2) (Fig. 3).
3. "How would you describe the capillaries?" The possible responses were scattered (0) or hypertrophied (1) (Fig. 4).
4. "How would you describe the axillary recess?" The possible responses were normal (0) or contracted (1) (Fig. 5).

The numerical score of each objective criterion was summated, with final values ranging from 0 to 6 (Table I). Two months after the initial survey was completed by each surgeon, the videos were randomized and redistributed to the same group with the same instructions and questions. The hard copy of the survey as seen by the reviewers is shown in Appendix S1.

Statistical analysis of the objective criteria was performed using an intraclass correlation coefficient (ICC) from a mixed-effects linear regression to calculate the percentage of variability due to the observer, video variation, or random error of the total score for each video. This test was chosen as a low percentage of variability from the observers would indicate good agreement on the responses. The Spearman ρ was used to calculate the interobserver reliability of the subjective rating score of the synovitis observed. Finally, the reviewers' subjective ratings (none, mild, moderate, or severe) were compared with the objective scores (0-6) to determine how well the subjective grade would correlate with the objective score.

Results

Of the 47 surgeons contacted, 21 completed the first survey. Of these 21 observers, 19 completed the survey a second time at least 2 months after the first, resulting in 760 videos being scored and a response rate of 40.4%. The fellowship