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Original Article

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# The impact of self-efficacy on nonoperative treatment of atraumatic shoulder pain

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**Abstract**

**Context:** Atraumatic shoulder pain is frequently encountered in primary care and surgical clinics. With increased recognition of the biopsychosocial model, there has been an increased emphasis on identifying patient factors associated with less effective coping strategies such as pain catastrophizing. It remains uncertain what impact self-efficacy has on the response to nonoperative treatment of shoulder pain.

**Objectives:** Our purpose is to determine the influence of patient coping strategies (self-efficacy) on the outcome of nonoperative treatment of atraumatic shoulder pain. We hypothesize that higher levels of self-efficacy are associated with increased self-reported function after nonoperative treatment.

**Methods:** We conducted a retrospective case-control study for a consecutive series of patients seen in our clinic with nonoperatively managed atraumatic shoulder pain. Baseline demographics and range of motion were recorded. Patients completed the Simple Shoulder Test (SST), PROMIS Pain Interference (PI), and PROMIS Self-Efficacy for Managing Symptoms (SE). After 3 months of nonoperative treatment, patients were placed into two groups: patients who clinically improved (Group 1) and those that did not (Group 2), with clinical improvement defined as an increase of 2 or greater on the SST.

**Results:** Seventy-eight patients returned for follow-up and completed all questionnaires. There were no statistically significant differences for age, sex, or tobacco use between the two groups. Half of the patients in our series had symptoms for >12 months, with rotator cuff syndrome being the most frequent diagnosis (40.0%). Patients in Group 1 had significantly higher PROMIS SE scores (42 vs. 39, p=0.0094) at initial evaluation. At 3-month follow-up, patients in Group 1 also had significantly lower Numeric Pain Rating Scale (NPRS) scores (4.5 vs. 6.5, p=0.0067), compared to Group 2.

**Conclusions:** Patients who experience clinical improvement with nonoperative treatment of atraumatic shoulder conditions demonstrate higher self-efficacy than patients who fail to improve. Guiding patients with atraumatic shoulder pain and low self-efficacy toward interventions aimed at improving coping strategies, rather than addressing musculoskeletal factors alone, may contribute to the goal of improving outcomes.

Atraumatic shoulder pain (shoulder pain occurring without a known injury or traumatic event) is frequently encountered in both primary care and subspecialty orthopedic surgery clinics. There are a variety of nonoperative treatment options for atraumatic shoulder pain. Conventional treatments have tended to focus on anatomical, biomechanical, and physiological elements of these conditions [1–3]. While there have been mixed results with regard to the efficacy of conventional nonoperative treatment of rotator cuff disease and shoulder osteoarthritis, therapy exercises, corticosteroid injections and anti-inflammatory medications have remained the mainstays of nonoperative treatment [2, 4, 5].

More recently, there has been an increasing focus on psychological factors associated with upper-extremity illness. This shift in focus is reflected in the principles of osteopathic medicine, which emphasize treating the body as a unit. With increased recognition of the biopsychosocial model within upper extremity surgery, there has been an increased emphasis on identifying patient factors associated with less effective coping strategies such as pain catastrophizing, fear of movement, and

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anxiety [6]. Within a single upper-extremity clinic, over 40% of patients had an underlying mental, behavioral, or neurodevelopmental disorder [7]. Additionally, prior systematic reviews have demonstrated that nonanatomic patient factors like treatment expectations and self-efficacy can be predictive of shoulder pain and disability for patients receiving physical therapy [8]. Patient values and preferences are associated with treatment decisions and less effective coping strategies and are associated with poor functional outcomes after upper extremity surgery [9–11].

The purpose of this investigation is to determine the influence of patient coping strategies (self-efficacy) on the outcome of nonoperative treatment of atraumatic shoulder pain. We hypothesize that higher levels of self-efficacy are associated with increased self-reported function after nonoperative treatment.

# Methods

Institutional Review Board (IRB) approval was obtained for this study (Geisinger IRB, #2018-0365). There was no funding or grants for this investigation. Due to the retrospective nature of this study, informed consent was not obtained directly from the patients. However, for procedures such as injections, routine written informed consent was obtained in all cases. We conducted a retrospective case-control study for all patients seen in our clinic with atraumatic shoulder pain that were treated nonoperatively. From September 2017 to July 2018, 147 patients presented to a single fellowship trained upper-extremity surgeon with atraumatic shoulder pain. All patients were seen in the outpatient clinic associated with a rural, academic, level I trauma center. We excluded patients that had prior surgery on the involved shoulder. At the time of initial presentation, standardized radiographs were ordered for each patient (anterior–posterior [AP] view of the glenohumeral joint, AP view of the acromioclavicular joint, scapular-Y view, and axillary view). Advanced imaging (MRI or ultrasound) was not obtained at the time of initial presentation. Of these patients, 17 were indicated for operative treatment at the time of the initial visit, resulting in 130 patients managed nonoperatively.

Although atraumatic shoulder pain can encompass a heterogeneous list of diagnoses, patients were treated in a standardized fashion. After clinical evaluation, patients indicated for nonoperative treatment were given a self-directed home therapy program, which was reviewed with them in our clinic by an occupational therapist or an athletic trainer. While exercises for all conditions focused on shoulder stretching and strengthening and were recommended to be performed two to three times a day, the programs could be customized to individual patients. Patients did not record compliance. No formal outpatient physical therapy was utilized, because results for formal therapy and home therapy are similar [12, 13]. Patients without evidence of shoulder instability or scapulothoracic pain as a primary complaint were offered corticosteroid injections. The location of the injection was recorded for each patient. We included patients regardless of their choice to undergo corticosteroid injection, because these injections provide only transient relief and do not alter the natural history of disease [14]. Over-the-counter analgesia, including acetaminophen or anti-inflammatory medications, were recommended when there was no contraindication. All patients were scheduled for follow-up in the clinic 3 months after their initial consultation.

### Data collection

During the initial visit, patients were asked to complete the following questionnaires: Simple Shoulder Test (SST), PROMIS Pain Interference (PI), and PROMIS Self-Efficacy for Managing Symptoms (SE). In addition, patients were also asked to rate their level of pain from 0 to 10 utilizing the Numeric Pain Rating Scale (NPRS). At the 3-month follow-up visit, patients were asked to complete an SST and the NPRS. All questionnaires, including the NPRS, were administered on paper and given to the patients as a packet prior to seeing the physician. These questionnaires were not anonymous. Demographic variables including age, gender, smoking status, and medical comorbidities were collected through a manual review of our electronic medical records system.

### Data analysis

After the completion of 3 months of nonoperative treatment, patients were placed into two groups: Group 1 contained patients who demonstrated clinical improvement, and Group 2 contained patients who did not demonstrate clinical improvement. Clinical improvement was defined as an increase in the SST score of greater than or equal to 2. Recent investigations have demonstrated that the minimal clinically important difference (MCID) for the SST is 2 with respect to nonoperative treatment of rotator cuff disease [15]. The MCID represents the smallest change in a patient-reported outcome measure that a patient would identify as important with respect to treatment (clinically meaningful change).

Descriptive statistics are utilized for all demographics, clinical characteristics, and pain scores. Categorical variables were summarized utilizing percentage and frequency counts. Continuous variables were summarized utilizing means and standard deviations (SD) or median and interquartile range (IQR). Differences between patients in the two groups were analyzed utilizing chi-square or Fisher's exact tests, and the two-sample t-test or Wilcoxon test, where appropriate. The relationship between the pain scales was assessed utilizing the Pearson's correlation coefficient and corresponding p-values testing linear associations. All analyses were performed utilizing SAS v9.4 (SAS Institute Inc., Cary, NC). p values<0.05 were considered statistically significant.

# Results

Of the patients who underwent nonoperative management of atraumatic shoulder pain, 90/130 returned for follow-up 3 months after their initial consultation (69.0%), with 78 patients completing all of their questionnaires (60.0%).

Table 1 contains baseline demographics and clinical characteristics for patients in Group 1 (Clinical Improvement) and Group 2 (No Clinical Improvement). There were no statistically significant differences for baseline demographics

**Table 1:** Baseline demographics and clinical characteristics for patients in Group 1 (Clinical Improvement) and Group 2 (No Clinical Improvement).

| | Total | Group 1 Clinical improvement n=26 | Group 2 No improvement n=52 | p-Value |
|---|---|---|---|---|
| Patients, n (% of total) | 78 | 26 (33.3) | 52 (66.7) | |
| Age in years, mean (SD) | 58 (15.7) | 56 (16.5) | 59 (15.3) | 0.3888 |
| Age range, years | 19–86 | 19–86 | 25–86 | |
| Male, n, % | 42 (53.9) | 15 (57.7) | 27 (51.9) | 0.8099 |
| Right shoulder involved, n, % | 43 (55.1) | 17 (65.4) | 26 (50.0) | 0.2334 |
| Dominant shoulder involved, n, % | 62 (79.5) | 19 (73.1) | 43 (82.7) | 0.3778 |
| Diabetes, n, % | 16 (20.5) | 6 (23.1) | 10 (19.2) | 0.7690 |
| Tobacco use, n, % | 16 (20.5) | 7 (26.9) | 9 (17.3) | 0.3778 |
| Prior contralateral shoulder surgery, n, % | 13 (16.7) | 3 (11.5) | 1 0 (19.2) | 0.5260 |
| Worker's compensation claim, n, % | 1 (1.3) | 0 (0) | 1 (2.0) | 1.0000 |
| Missing (code=9) | 1 | 0 | 1 | |
| Duration, n, % | | | | |
| <3 months | 17 (21.8) | 5 (19.2) | 12 (23.1) | 0.9750 |
| 3–6 months | 14 (18.0) | 5 (19.2) | 9 (17.3) | |
| 6–12 months | 8 (10.2) | 3 (11.6) | 5 (9.6) | |
| >12 months | 39 (50.0) | 13 (50.0) | 26 (50.0) | |
| Primary diagnosis, n, % | | | | |
| Rotator cuff syndrome | 31 (39.7) | 10 (38.5) | 21 (40.4) | 0.9380 |
| Biceps pathology | 7 (9.0) | 3 (11.5) | 4 (7.7) | |
| AC joint arthritis | 8 (10.3) | 4 (15.4) | 4 (7.7) | |
| Scapular pathology | 1 (1.3) | 0 (0) | 1 (1.9) | |
| Calcific tendonitis | 5 (6.4) | 2 (7.7) | 3 (5.8) | |
| Instability | 1 (1.3) | 0 (0) | 1 (1.9) | |
| Adhesive capsulitis | 3 (3.9) | 1 (3.9) | 2 (3.9) | |
| Rotator cuff tear arthropathy | 13 (16.7) | 4 (15.4) | 9 (17.3) | |
| Osteoarthritis | 9 (11.5) | 2 (7.7) | 7 (13.5) | |
| Corticosteroid injection, n, % | 53 (68.0) | 19 (73.1) | 34 (65.4) | 0.6096 |
| Site of injection (n=53), n, % | | | | |
| AC | 7 (13.2) | 3 (15.8) | 4 (11.8) | 0.8246 |
| Subacromial | 30 (56.6) | 10 (52.6) | 20 (58.8) | |
| Biceps | 1 (1.9) | 0 (0) | 1 (2.9) | |
| Glenohumeral | 15 (28.3) | 6 (31.6) | 9 (26.5) | |

AC, acromioclavicular; SD, standard deviation.

(including age, sex, and tobacco use) between the two groups. Half of the patients in our series had symptoms for >12 months, with rotator cuff syndrome being the most frequent diagnosis (40.0%).

Table 2 includes a comparison of clinical outcomes and pain scores between Group 1 and Group 2 at the time of initial evaluation and at 3-month follow-up. Patients in Group 1 had significantly higher PROMIS SE scores (42 vs. 39, p=0.0094) at initial evaluation. At 3-month follow-up, patients in Group 1 also had significantly lower NPRS scores (4.5 vs. 6.5, p=0.0067), compared to those with no clinical improvement (Group 2).

In assessing the relationship between SST at initial evaluation and other pain scales, we found a statistically significant negative linear association with PROMIS PI (Pearson's=−0.3078, p=0.0061), no linear association with PROMIS SE (Pearson's=0.1579, p=0.1674), and a statistically significant negative linear association with the NPRS score (Pearson's=−0.3264, p=0.0035). The NPRS at the initial evaluation has no association with functional outcome based on the 3-month evaluation of SST (Pearson's=−0.1964, p=0.0848) or the change in SST from initial to 3-month evaluation (Pearson's=0.1276, p=0.2658).

**Table 2:** Comparison of outcomes at time of initial evaluation and at 3-month follow up for patients in Group 1 (Clinical Improvement) and Group 2 (No Clinical Improvement).

| Median (IQR) | Total | Group 1 Clinical improvement n=26 | Group 2 No improvement n=52 | p-Value |
|---|---|---|---|---|
| **Initial evaluation** | | | | |
| PROMIS pain interference | 63.5 (59, 67) | 63 (58, 67) | 64 (60, 68) | 0.2404 |
| PROMIS self-efficacy for managing symptoms | 40 (37, 44) | 41.5 (38, 49) | 39 (36, 42) | 0.0094 |
| Simple shoulder test | 5 (1, 7) | 3 (1, 6) | 5 (2, 7.5) | 0.1620 |
| NPRS score | 7 (5, 8) | 6 (5, 8) | 7 (4.5, 8) | 0.7605 |
| Forward elevation | 160 (120, 170) | 160 (120, 170) | 165 (100, 175) | 0.7887 |
| **3 month follow-up** | | | | |
| Simple shoulder test | 5 (2, 8) | 7.5 (5, 10) | 3.5 (1, 6) | <0.0001 |
| Change in SST score | 0 (−1, 2) | 3 (2, 5) | −1 (−2, 0) | |
| % Change in SST score, % | 0% (−25%, 100%) | 120% (50%, 400%) | −17.4% (−44.2%, 0%) | <0.0001 |
| NPRS score | 6 (4, 7) | 4.5 (3, 6) | 6.5 (5, 7.5) | 0.0067 |
| Change in NPRS score | −1 (−2, 1) | −2 (−3, 0) | 0 (−2, 1) | 0.0142 |
| Forward elevation | 170 (120, 170) | 170 (150, 180) | 170 (105, 170) | 0.2651 |
| Change in forward elevation | 0 (0, 10) | 5 (0, 20) | 0 (0, 0) | 0.0293 |

IQR, interquartile range; NPRS, Numeric Pain Rating Scale; SST, Simple Shoulder Test.

# Discussion

Examining the relationship between patient coping strategies and self-reported function with nonoperative treatment of atraumatic shoulder pain represents a recent shift in focus from addressing anatomical and mechanical sources of pain to recognizing psychological contributors of upper-extremity illness. For patients in a physical therapy clinic with shoulder pain, Chester et al. [16] reported that psychological factors (pain severity, patient expectations, baseline disability) were associated with patient-reported outcomes, whereas objective physical examination findings and structural diagnosis were not associated. In a systematic review of the relationship between self-efficacy and chronic musculoskeletal pain, the authors noted that higher levels of self-efficacy were associated with lower pain intensity and improved physical function [17]. We note similar findings with respect to self-efficacy and atraumatic shoulder pain, because the patients in our series demonstrating clinically significant improvement on the SST had higher levels of self-efficacy.

It appears that psychological factors associated with less functional improvement after upper-extremity surgery are also implicated in the failure to improve with nonoperative treatment of atraumatic shoulder conditions. Dekker et al. [18] demonstrated that patients with high levels of anxiety and depression had worse outcomes after subacromial decompression. In addition, Werner et al. [19] noted similar findings for patients with depression undergoing shoulder arthroplasty. As the association between less effective coping strategies and decreased functional outcomes after upper-extremity surgery becomes clearer, surgeons may be more hesitant to offer elective, discretionary operative treatment for these chronic conditions for this subset of patients. However, these data suggest that less effective coping strategies (in this case self-efficacy) are also associated with worse outcomes after nonoperative treatment. This results in a difficult clinical scenario for both patients and surgeons, with both operative and nonoperative treatment resulting in less functional improvement than expected. For patients with lower levels of self-efficacy and less effective coping strategies, treatments aimed at psychological health and mindfulness may be more beneficial than more conventional musculoskeletal treatments alone [20]. In this context, multidisciplinary musculoskeletal clinics may be beneficial when considering the impact of psychological factors on functional outcomes for treatment of upper-extremity conditions.

While decreased levels of self-efficacy are associated with less functional improvement with nonoperative treatment of atraumatic shoulder conditions, self-efficacy can be difficult to assess. Although infrequently administrated in orthopedic clinics, a number of questionnaires are available to measure coping strategies and resilience [21]. In our series, patients who met the MCID for the SST did not demonstrate higher numeric pain scores at the time of initial presentation. It does not appear that high pain level (or pain interference) can be utilized to predict clinical improvement at the time of initial presentation. Physicians can assess for both verbal and nonverbal signs of distress

and pain catastrophizing [22, 23]. Utilization of formalized questionnaires may aid in the identification of patients with less effective coping strategies and allow for improved expectation setting at the time of initial evaluation. This is of particular importance considering that in the absence of formalized patient-reported outcome measures, physicians may have difficulty identifying levels of patient function and self-efficacy [24].

The limitations of this study include those inherent to retrospective investigations. Only 60.0% of the patients initially evaluated for atraumatic shoulder completed their entire 3-month follow-up, and it is still uncertain whether patients who decided not to return did so due to improved shoulder pain and function. Additionally, 3 months represents a short follow-up period. An *a priori* sample size calculation was not performed for this investigation, which limits the analysis of study power. We included a heterogeneous group of shoulder conditions and defined clinical improvement as an increase of greater than or equal to 2 on the SST, which represents the MCID for nonoperative treatment of rotator cuff disease [15]. Although it is possible that the MCID for other nonoperatively managed conditions may differ, the MCID for the SST after shoulder arthroplasty is also between 2 and 3 [25, 26]. Health literacy was not assessed. We did not ask patients to document their compliance with self-directed therapy protocols, and it is possible that some patients did not perform the exercises. In addition to possible variations in therapy compliance, some patients received corticosteroid injections whereas others did not, which can potentially impact early pain scores. Furthermore, while low levels of self-efficacy may be suggestive of other less effective coping strategies, we did not specifically measure levels of pain catastrophizing, anxiety, or depression. While the PROMIS instruments are widely utilized, we only assessed self-efficacy with a single instrument, and it is unclear if the results would have differed with other assessments of self-efficacy.

## Conclusions

Patients who experience clinical improvement with nonoperative treatment of atraumatic shoulder conditions demonstrate higher levels of self-efficacy than patients who fail to improve. Guiding patients with atraumatic shoulder pain and low self-efficacy toward interventions aimed at improving coping strategies, rather than addressing musculoskeletal factors alone, may contribute to the goal of improving shoulder comfort and function. Physicians treating musculoskeletal conditions should recognize that patients with atraumatic shoulder pain and low levels of self-efficacy may be less likely to experience clinical improvement with nonoperative management.

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**Competing interests:** None reported.
**Ethical approval:** Institutional Review Board approval was obtained by the Geisinger Institutional Review Board (#2018-0365) for this retrospective study.

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