Advancements in classification, treatment and outcome of radial head fractures
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CHAPTER 6
Attitude Towards Stretch Pain of the Elbow After Radial Head Fracture

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Abstract

Hypothesis: This study was designed to test the hypothesis that agreement with the idea that “stretching of the elbow beyond the point were it becomes painful is important in recovery” leads to greater elbow range of motion one month after injury.

Methods: Seventy-one patients with an isolated Broberg and Morrey modified Mason Type 1 or Type 2 radial head fracture seen within 14 days after injury were enrolled prospectively. They completed the Pain Catastrophizing Scale (PCS), Center for Epidemiologic Studies Depression Scale (CES-D) and were asked to rate their agreement with a statement regarding pain and recovery from their injury on a 5-point Likert scale, which were collapsed into 3 categories (disagree, neutral, agree) to facilitate statistical power. One-month later, patients completed the Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire and elbow and forearm motion were measured with a goniometer.

Results: Nine patients (12.6%) disagreed with the role of pain in recovery, 6 (8%) were neutral, and 56 (78.9%) agreed. Patients that disagreed with the role of stretch pain in recovery were older (p = 0.031), had more depressive symptoms (CES-D; p = 0.047), and achieved less elbow extension (p = 0.050) and forearm rotation (p = 0.017) approximately one month after injury.

Conclusions: A negative attitude towards stretch pain during recovery from fracture of the radial head is associated with less elbow motion one month after injury. Future studies should address the ability to improve recovery by encouraging a change in pain paradigm.

Level of Evidence: Prognostic Level I

Introduction

Isolated, stable, minimally displaced fractures of the radial head (Types 1 and 2 of the Broberg and Morrey modification of the Mason Classification) are common fractures that are usually treated non-operatively. The most common sequel of these fractures is elbow stiffness. In our experience, the elbow stiffness may be a result of excessive immobilization or ineffective stretching exercises.

It can be counter-intuitive to intentionally cause pain in the setting of an injury. Vulnerability and protectiveness are enhanced by automatic thoughts such as “pain indicates harm”, “the pain is permanent”, or other aspects of a maladaptive response to nociception that psychologists have termed pain catastrophizing. Research suggests that fear of pain, thinking the worst in response to nociception (pain catastrophizing) and pain anxiety may be important determinants of recovery after an acute fracture. Similarly, depression hinders recovery after fracture. We tested the hypothesis that agreement that painful stretches are an important part in recovery leads to greater motion one month after injury. Secondarily, we tested the hypothesis that depression and pain catastrophizing correlate with lack of agreement that painful stretches are important, as well as less motion and more disability one month after injury.

Materials and Methods

Inclusion and Exclusion Criteria

Under an IRB (Institutional Review Board) approved protocol, we prospectively include patients with a radial head fracture seen at one Level 1 trauma center. Inclusion criteria were: 1) A non-operatively treated fracture of the radial head; 2) Type 1 or Type 2 according to the Broberg and Morrey modification of Mason’s classification; 3) Seen within 14 days of injury, 4) Skeletal maturity; 5) Cognitive and physical ability to follow exercise instructions; 6) Isolated injury and 7) No clinical or radiographic evidence of injury to the medial elbow ligaments. Exclusion criteria were pregnant women and patients unable to give informed consent. Patients with prior elbow injury, disease, or arthritis were not excluded. Eighty-five patients satisfied the inclusion and exclusion criteria. Fourteen patients did not return 1 month after injury resulting in a final cohort of 71 patients.

Among the 71 patients, the average age was 44.4 years (range, 19 to 72 years). There were 18 men (25.4%) and 53 (74.6%) women. Sixty-five fractures were Mason type 1 (91.5%) and six were Mason type 2 (8.5%). Thirty-four patients (47.9%) injured their right elbow and 37 (52.1%) their left elbow. The dominant side was injured in 38 cases (53.5%) and the non-dominant side in 33 cases (46.5%). Fifty-seven patients (80.3%) fractured their elbow in a fall from a standing height, 3 (4.2%) from a greater...
height and 11 (15.5%) patients suffered from a multi-vehicle accident (MVA). Forty-eight patients (67.6%) were white-collar workers. Six doctors participated in the care of these patients, from which one doctor treated 56 (78.9%) patients. The average follow-up was 33.6 days (range, 13 to 70 days).

Evaluation
Patients were approached during the initial outpatient visit to an orthopaedic surgeon and informed consent was obtained. The patients completed the Pain Catastrophizing Scale (PCS) and the Center for the Epidemiological Study of Depression Instrument (CES-D). The Pain Catastrophizing Scale (PCS) is a reliable and valid 13-item questionnaire, developed by Sullivan et al. to measure the extent to which people think the worst in response to pain in clinical and nonclinical populations. Each PCS item is rated on a 4-point scale: 1 (not at all) to 4 (all the time). The 13 items are summed to create a total score. The CES-D scale is a reliable and valid 19-item self-report scale designed to measure depressive symptoms in the general population.

Subjects were also asked to rate their agreement with the following statement regarding recovery from their injury: “Do you think that you should perform the exercise beyond the point were it gets painful to reach the best possible recovery following your fracture?” with use of a 5-point Likert scale (5 = strongly agree, 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree).

During the routine one-month follow-up with their treating surgeon, all enrolled subjects completed the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire to measure upper extremity specific disability with a lower score indicating less disability. In addition, the elbow flexion arc and range of forearm rotation was measured with a goniometer by a research fellow that was not involved with the treatment of that patient.

Rehabilitation
During the initial outpatient visit, patients were advised to actively move the elbow into as much flexion, extension, supination and pronation as possible and to self-assist by pushing with the uninjured hand (or a wall or desk as a fulcrum) in order to stretch the elbow to achieve greater motion. Additionally, patients were instructed that weight bearing on the elbow, lifting, and grasping and that pain control either physically e.g. cold application or using pain medication was allowed. They were advised to return to deskwork, but limit forceful activities or risk of another fall. Additionally, patients were instructed that the pain might make them feel protective and cautious, but that it was a false alarm as no harm could come from these stretches and that they were an important and helpful part of recovery. The instructing doctor (blinded) was a hand fellowship trained orthopedic surgeon.

Statistical Analysis
Power analysis indicated that a minimum sample size of 18 subjects (6 in each group) would provide 80% statistical power to detect a significant difference in elbow flexion-extension arc, assuming an effect size of 2.0 or greater (mean difference of 20 degrees, standard deviation of 10 degrees) (alpha = 0.05, beta = 0.20) using one-way ANOVA. Two-tailed p values of <0.05 were considered to be significant.

Frequencies were used to describe demographics, fracture characteristics and outcome variables. Two main sets of analyses were conducted. In the first set, we used analyses of variance to look for differences in depression, pain catastrophizing, disability, elbow flexion and forearm rotation by category of response to the statement about pain. Due to a small number of responses in some of the categories, and in order to achieve statistical power (at least 6 participants per group), we combined the strongly agree and agree categories, as well as the strongly disagree and disagree categories. In the second set, we used Spearman correlations to test the relationship between ranked level of agreement with the pain statement and the outcome variables.

Results
Nine patients (12.6%) disagreed with the role of pain in recovery, 6 (8%) were neutral, and 56 (78.9%) agreed. Demographics, fracture characteristics and outcome variables were compared between patients who agreed, were neutral or disagreed that pain was useful for recovery. Patients who disagreed with the role of pain in recovery were older than those who were neutral or agreed with the role of pain in recovery (F = 3.79, p = 0.034). Patients who were neutral regarding the role of pain had more depressive symptoms than those who agreed or disagreed with the role of pain in recovery (F = 3.12, p = 0.047).

Patients who disagreed that pain is important in recovery had less one-month post-injury pronation (F = 4.29, p = 0.016), elbow extension (F = 3.12, p = 0.050) and combined forearm motion (F = 4.27; p = 0.017). There was no statistical difference between groups in PCS (p = 0.17), DASH (p = 0.20), elbow flexion (p = 0.34), and flexion-extension arc (p = 0.13). There was also no statistical difference in time from injury to final evaluation (p = 0.67) (Table 1).

There was a significant correlation between 5-point Likert ranked agreement with the role of pain in recovery and PCS (r = -0.26, p = 0.031), and agreement with DASH (r = -0.10, p = 0.39), one month post-injury elbow flexion (r = -0.027, p = 0.82), extension (r = 0.13, p = 0.28), pronation (r = 0.12, p = 0.30), supination (r = -0.053, p = 0.66), flexion-extension arc (r = -0.12, p = 0.32) or arc of forearm rotation.
There was a significant correlation between CES-D score and PCS score ($\rho = 0.47$, $p < 0.001$). There was also a significant correlation between the agreement with stretch pain and the CES-D score ($\rho = 0.216$, $p = 0.070$) and PCS score ($\rho = 0.256$, $p = 0.031^*$).

Discussion

In our experience, many health care providers—occupational and physical therapists in particular—advise patients to work to pain, but not beyond. They often further admonish that painful activities may cause “inflammation”, which they feel would be counterproductive. There does not appear to be a scientific basis for these recommendations and they amount, more or less, to a culture or tradition. Our observation has been that patients recover greater motion and do so more rapidly after injury when they are confident and feel good about stretching their arm. In our opinion, according to this paradigm, stretches to gain motion are the same as athletic stretches—both are an intentional tearing of tissue. We believe pain indicates that one is doing the exercise correctly.

Maladaptive responses to nociception are associated with greater pain intensity and arm-specific disability. Advising patients that pain during stretching exercises may be harmful risks reinforcing these maladaptive coping strategies. The current study was designed to evaluate the association of attitude towards stretch pain with recovery of elbow motion after a minimally displaced fracture of the radial head.

The strengths of this study include the prospective design and enrollment of patients from 6 different surgeons’ practices. Limitations include: 1) Enrollment after diagnosis, reassurance, and coaching with motion exercises, all of which are therapeutic interventions that may affect attitudes towards pain (and may explain why the majority of patients agreed with the importance of pain for recovery); 2) Ceiling effects since most patients with minimally displaced radial head fractures regain near normal motion regardless of their paradigm; 3) Meaningless variation (or “noise”) added to the data by virtue of the fact that the measurement error of a hand-held goniometer is comparable to the small differences in elbow flexion contractions observed; 4) The measure of agreement with a statement regarding the role of pain in recovery is an indirect measure of confidence with exercises—a more direct and objective measure would be preferable; patients may state agreement on a questionnaire, but still have a hard time performing stretches beyond pain; 5) Wide range in the time that people returned for the “one-month” follow-up (although this did not correlate with any of the outcome measures); and 6) Limited power due to unequal distribution of patients among agreement groups.
In spite of these shortcomings, we did find that a patient’s paradigm with respect to the role of pain in recovery predicted motion one month after injury and that a patient’s paradigm had small but significant correlation with pain catastrophizing. The lack of correlation between attitude and disability might be due to the small number of patients in the neutral (9) and disagree (6) categories versus the agree category (55). There is a nearly 11 point difference in the means DASH score in patients that agree (17.4) or are neutral (17.3) about the role of pain and those that disagree (28.0), which seems clinically important. Of note is that the mean DASH for patients that disagree is higher than what has been reported in patients with fractures, while the mean DASH for the other categories is lower (21).

A small subset of patients get stiff after radial head fractures and we probably need a larger study to adequately study these issues. If additional studies corroborate the role of automatic thoughts and beliefs (intuition, “gut feelings”) in recovery from injury, as well as the correlation of these thoughts with maladaptive responses to nociception or depression, then there is room for improvement in our teaching and coaching of post-injury exercises. As revered hand surgery pioneer Paul Brand noted in his book “The Gift of Pain”, nociception exists for our protection. It’s no surprise that pain after injury can make us feel vulnerable and protective. The key may be to help our patients change their mindset from vulnerability to recovery, seeing a painful exercise more as a useful stretch exercise and the post-exercise pain more as that rewarding ache after a great work out.

**Conclusion**

This study found that a negative attitude towards stretch pain during recovery from fracture of the radial head is associated with less elbow motion one month after injury. Future studies should address the ability to improve recovery by encouraging a change in pain paradigm.

**References**