Psychological Differences between Patients that Elect Operative or Nonoperative Treatment for Trapeziometacarpal Joint Arthrosis

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Abstract Among 44 consecutive patients electing operative treatment of trapeziometacarpal arthrosis, three age- and gender-matched controls that presented during the same time period but had not yet requested operative treatment were selected from billing records. Each patient and control was mailed a survey that included an upper extremity-specific health status measure (Disabilities of the Arm, Shoulder, and Hand questionnaire; DASH) and a set of questionnaires evaluating psychological factors including the Pain Anxiety Symptoms Scale (PASS), the Pain Catastrophizing Scale (PCS) and the Center for the Epidemiological Study of Depression (CES-D) instrument. Seventy-two patients (45%; 31 that elected operative and 41 nonoperative care) returned a completed questionnaire with usable data. Older age was the only significant predictor of choice for nonoperative treatment among survey responders. Arm-specific disability (DASH) correlated with the CES-D, PASS, and PCS scores, and the influence of radiographic severity was near significant ($p=0.06$). Stepwise multiple linear regression resulted in a model including the CES-D and PCS scores and accounting for 51% of the variability in DASH scores for patients from both cohorts. For both the operative and nonoperative cohorts, a model including CES-D alone accounted for 50% of the variability in DASH scores ($p<0.01$). This study suggests that depression, pain anxiety, and pain catastroph-

izing are strong correlates of arm-specific disability but do not predict election of operative treatment in patients with trapeziometacarpal arthrosis.

Keywords Trapeziometacarpal arthritis · Depression · Operative treatment

Introduction

Trapeziometacarpal arthrosis is so prevalent with advanced age that it can be considered a normal and inevitable aspect of human development [15]. It seems reasonable to assume that a limited percentage of patients with severe trapeziometacarpal arthrosis present to the doctor for advice [4–6]. Furthermore, since a substantial percentage of patients are satisfied with education about the nature and management of their illness [3, 4, 11], the cohort of patients that elect surgery is likely to be even smaller. It is plausible that patients that elect operative treatment perceive themselves as more disabled by their arthrosis. It would be worthwhile to know how much of this perceived disability can be ascribed to more advanced objective pathology and how much is related to psychosocial factors such as life stressors, mood, coping skills, and illness beliefs. For instance, there is growing evidence that perceived disability correlates with psychological factors such as depression for many common hand conditions [10, 12–14].

This investigation compares patients that elect operative and nonoperative treatment for trapeziometacarpal arthrosis to test the primary null hypothesis that both cohorts have the same degree of depression on average. Secondary analyses evaluate predictors of treatment choice and perceived disability among patients with trapeziometacarpal arthrosis.

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Materials and Methods

Using a protocol approved by our Human Research Committee, we identified 44 patients age 40 or greater that requested operative treatment for trapeziometacarpal arthrosis (standard ligament reconstruction and tendon interposition using entire flexor carpi radialis longus) between 2001 and 2005. For each patient electing operative treatment, three age- and gender-matched controls (132 patients) that presented to a hand surgeon during the same time period but had not yet requested operative treatment were selected from billing records. Both operative and nonoperative treatments are routinely discussed by the surgeons involved in this study.

Each patient and control was mailed a survey that included an upper extremity-specific health status measure (Disabilities of the Arm, Shoulder, and Hand questionnaire; DASH) [2, 7] and a set of questionnaires evaluating psychological factors including the Pain Anxiety Symptoms Scale (PASS) [8], the Pain Catastrophizing Scale (PCS) [9], and the Center for the Epidemiological Study of Depression instrument (CES-D) [1]. Addressed and stamped envelopes were included with the survey along with opt-out postcards to stop serial mailing and prevent further contact. Completion and return of the survey represented informed consent. The survey was mailed to each patient once a month for 3 consecutive months between January and March 2005, unless the survey was completed or an opt-out postcard was received. The survey confirmed that none of the patients in the nonoperative cohort had elected operative treatment.

From the total of 160 patients, 55 patients (34%) did not respond, 24 (15%) opted out, seven (4%) changed address, and two (1%) returned a questionnaire with unusable incomplete data. Serial mailing increased the initial response rate (58 patients; 36%) by 7% in the second mailing attempt (11 additional patients) and by 2% in the third one (three additional patients). Seventy-two patients (45%) returned a completed questionnaire with usable data. Among these 72 patients, there were 14 men and 58 women with an average age of 65 years (range=31 to 91 years, SD=12.8, 95% confidence interval [CI]=62 to 68 years). Among the patients with usable questionnaire data, 31 (of 72; 43%) requested and received operative treatment, and 41 did not request operative treatment (of 72; 57%).

Two independent observers rated the radiographic severity of trapeziometacarpal arthrosis at the time of initial presentation using the classification system developed by Sodha et al.: grade I, no more than mild arthrosis changes, grade II, definitive presence of arthrosis, and grade III, severe arthrosis with complete destruction of the joint [15].

Instruments

Disability of the Arm, Shoulder, and Hand Questionnaire

The DASH questionnaire is a 30-item disability/symptom scale concerning the patient's health status during the preceding week [2, 7]. The items ask about the degree of difficulty in performing different physical activities because of the arm, shoulder, or hand problem (21 items), the severity of each of the symptoms of pain, activity-related pain, tingling, weakness, and stiffness (five items), as well as the problem's impact on social activities, work, sleep, and self-image (four items). Items are answered on a five-point Likert scale. The scores for all items are then used to calculate a scale score ranging from 0 (no disability) to 100 (most severe disability). The score for the disability/symptom scale is called the DASH score.

Pain Anxiety Symptoms Scale

The PASS is a 40-question inventory designed to measure anxiety about pain. The PASS contains four different subscales that measure the influence of anxiety on pain response: (1) cognitive anxiety, (2) fear of pain, (3) escape and avoidance, and (4) physiological anxiety. The cognitive anxiety scale measures the frequency of undesirable thoughts in response to pain. The fear-of-pain scale measures the frequency of fear-provoking thoughts and the dread of the negative consequences that can be caused by pain. The escape-and-avoidance scale measures the frequency of behaviors that try to minimize or avoid the strength and duration of pain. Lastly, the physiological anxiety subscale measures the patient's physical responses to pain, like sweating and increased heart rate.

The PASS uses a six-point scale to measure the frequency of each of the items in the questionnaire, with a 0 score corresponding to never and a 5 corresponding to an always occurring situation. Hence, a score on each of the subscales can fall within the range of 0 to 50, with a total range score of 0 to 200, which can assess the evaluation of a generalized pain anxiety [8].

Pain Catastrophizing Scale

The PCS measures the degree to which patients cope with their pain with cognitive activities that exacerbate the fearful aspects of their pain experience. The PCS measures three components of catastrophizing: rumination, magnification, and helplessness. The PCS consists of 13 questions, with responses on a four-point Likert scale, with one corresponding to the feeling occurring "not at all" and four to occurrence "all the time." The total PCS score ranges

from 13 to 52, with lower scores indicating less catastrophizing [9].

Center for the Epidemiological Study of Depression

The CES-D instrument was designed to measure a patient's current level of depressive affect. The 20 items on the questionnaire are used to measure all the different aspects of depression, including feelings of worthlessness, helplessness, depressed mood, lethargy in movement, and other symptoms. Each item is based on a four-point scale from 0 to 3, and the scale measures how often a patient felt the depressive symptom over the course of a week, with 0 being "rarely or not at all" and 3 being "most of the time." The CES-D score is usually based on the overall total, but some analyses include certain cutoff scores to determine the significant level of depression in a patient [1].

Statistical Analysis

Univariate analyses evaluated potential differences between responders and nonresponders and patients electing operative or nonoperative treatment. Chi-square and Fischer's exact test were used to evaluate dichotomous variables (gender, treatment choice, dexterity, and radiographic grade of arthrosis), and Student's *t* test was used to evaluate continuous variables (age, DASH, PASS, PCS, and CES D scores). Predictors of treatment choice (operative vs. nonoperative) were evaluated using stepwise multiple logistic regression, including all factors with significant or near-significant ($p < 0.08$) differences in univariate analyses.

Univariate analysis of predictors of DASH score were sought using Pearson's correlations for continuous variables (e.g., PCS, PASS, and CES-D), Student's *t* test for dichotomous variables (e.g., gender, treatment choice) and one-way analysis of variance (ANOVA) for nominal but not dichotomous variables (e.g., radiographic level of arthrosis). Multivariate analysis of predictors of DASH score consisted of stepwise multiple linear regression including all of the significant or near-significant factors ($p < 0.08$) from the univariate analysis. Separate multivariate analyses

were performed for patients electing operative and nonoperative treatments and for the combination of both cohorts.

Sample size was calculated assuming a standard deviation (SD) of ten points for the CES-D score and an expected effect size (*E*) of 0.80. A power analysis determined that at least 26 patients per group were necessary to detect a 10% difference in DASH scores between patients treated operatively and nonoperatively at a power level of 80% at a 0.05 two-sided level of significance. To determine significant correlations between psychological instruments, other variables, and type of treatment at a level greater than 50% (0.50), with a power of 80% and a two-sided significance level of 0.05, power analysis also established that 29 patients were required. Statistical analyses were calculated by SPSS 10.0 computer software program (Statistical Package for the Social Sciences, Chicago, IL, USA).

Results

Responders vs. Nonresponders

There were no statistically significant differences between responders and nonresponders in terms of average age (65 among responders, 67 among nonresponders— $t = -1.3$, $p = 0.18$), gender (58 women and 14 men among responders, 60 women and 26 men among nonresponders— $\chi^2 = 2.41$, $p = 0.09$), hand dominance (50% dominant among responders, 55% among nonresponders— $\chi^2 = 3.2$, $p = 0.31$) or radiographic stage of arthrosis ($\chi^2 = 4.7$, $p = 0.09$). Eighty-five percent of nonresponders and 57% of responders had nonoperative treatment ($\chi^2 = 16.7$, $p < 0.01$; Table 1).

Comparison of Operative and Nonoperative Treatment Cohorts

Demographic comparison between the operative and nonoperative cohorts demonstrated a higher average age in the nonoperative treatment group (68 vs. 61 years, $t = -4$, $p < 0.01$) but no significant difference in gender (Fisher's

Table 1 Demographics responders vs. nonresponders.

Characteristics	Responders group	nonresponders group	Significance
Average age	65 years, range=31 to 91, SD=12.8, 95% CI=62 to 68	67 years, range=46 to 93 years, SD=10.4, 95%CI=46.2–87.8	$t = -1.30$, $p = 0.18$
Gender	58 female/14 male	60 female/26 male	$\chi^2 = 2.20$, $p = 0.09$
Dominant hand involvement	50%, 36 of 72 patients	55%, 47 of 86 patients	$\chi^2 = 3.20$, $p = 0.31$
Radiographic state of arthritis	Grade I=26, grade II=25, grade III=21	Grade I=42, grade II=32, grade III=12	$\chi^2 = 4.70$, $p = 0.09$
Treatment	31 of 72 surgical, 41 of 72 medical	12 of 86 surgical, 74 of 86 medical	$\chi^2 = 16.75$, $p < 0.01$

Table 2 Demographics surgical vs. nonsurgical treatment.

Characteristics	Surgical treatment group	Nonsurgical treatment group	Significance
Average age	61 years	68 years	$t=-4, p<0.01$
Gender	26 female/5 male	32 female/9 male	Fischer's test=2.18, $p=0.1$
Dominant hand involvement	55%, 17 of 31 patients	56%, 23 of 41 patients	$\chi^2=0.01, p=0.55$
Radiographic state of arthritis	Grade I=8, grade II=13, grade III=10	Grade I=17, grade II=13, grade III=21	$\chi^2=1.90, p=0.37$
DASH score	23 points (range=2 to 52), SD=13.7, 95% CI=-4.4 to 50.4	30 points (range=2 to 78), SD=20.5, 95% CI=9 to 51	$t=-1.70, p=0.09$
CES D score	12.2 points (range=0 to 35), SD=9.3, 95% CI=-6.4 to 30.8	11.2 points (range=0 to 32), SD=8.3, 95% CI=-5.4 to 27.8	$t=0.40, p=0.65$
PCS score	21 points (range=13–37), SD=7.3, 95% CI=6.5–35.7	20 points (range=13–38), SD=7.5, 95% CI=5.2–35.2	$t=0.50, p=0.61$
PASS score	47 points (range=8 to 126), SD=24.5, 95% CI=-2.2–95.8	46 points (range=1 to 143), SD=34, 95% CI=11.7 to 79.7	$t=0.15, p=0.87$

test=2.18, $p=0.1$), radiographic grade of arthrosis ($\chi^2=1.9$, $p=0.37$), or involvement of the dominant hand ($\chi^2=0.01$, $p=0.55$; Table 2).

The average DASH score for the entire cohort was 27 points, ranging from 2 to 78 points (SD=10, 95% CI=6.8 to 46.8 points). The average DASH score was 23 points (range=2 to 52 points, SD=13.7, 95% CI=-4.4 to 50.4) in the operated cohort and 30 (range=2 to 78 points, SD=20.5, 95% CI=9 to 51) in the unoperated cohort ($t=-1.7$, $p=0.09$; Table 2).

There were no significant differences in psychological measures between cohorts. The average CES-D score for all patients was 11.6 points, ranging from 0 to 35 points (SD=8.7, 95% CI=5.8 to 29 points). The average CES-D score was 12.2 points (range=0 to 35 points, SD=9.3, 95% CI=-6.4 to 30.8) in the operated cohort and 11.2 points (range=0 to 32 points, SD=8.3, 95% CI=-5.4 to 27.8) in the unoperated cohort ($t=0.4$, $p=0.65$).

The average PCS score was 20.6, for all patients ranging from 13 to 38 points (SD=7.4, 95% CI=5.8 to 35.4). The average PCS score was 21 points (range=13–37 points, SD=7.3, 95% CI=6.5–35.7) in the operated cohort and 20 points (range=13–38 points, SD=7.5, 95% CI=5.2–35.2) in the unoperated cohort ($t=0.5$, $p=0.61$).

The average PASS score was 46.1 points, ranging from 1 to 143 points (SD=29.9, 95% CI=14.7 to 96.9). The average PASS score was 47 points (range=8 to 126 points, SD=24.5, 95% CI=-2.2–95.8) in the operated cohort and 46 (range=1 to 143 points, SD=34, 95% CI=11.7 to 79.7) in the nonoperated cohort ($t=0.15$, $p=0.87$; Table 2).

Predictors of Treatment Choice

In univariate analyses, older age was the only significant predictor of choice for nonoperative treatment among survey responders. Therefore, no multivariate analysis was performed.

Predictors of DASH Score

In univariate analyses, DASH correlated with the CES-D score ($r=0.47$, $p<0.01$), the PASS score ($r=0.54$, $p<0.01$), and the PCS score ($r=0.36$, $p<0.01$). The influence of radiographic severity (preoperative in the operative cohort) was near significant ($p=0.06$) and was therefore included in the multivariate analysis (Table 3).

Stepwise multiple linear regression resulted in a model including the CES-D and PCS scores and accounting for 51% of the variability in DASH scores for patients from both cohorts ($R=0.50$, $F=10$, $p<0.01$). A model including CES-D scores alone accounted for 47% of the variability in DASH scores.

The best model for patients in the operated cohort included the CES-D and preoperative radiographic severity and explained 56% of the variability in postoperative DASH scores ($R=0.56$, $F=8.6$, $p<0.01$). The best model for patients in the nonoperated cohort included the CES-D and PCS scores and also explained 56% of the variability in DASH scores ($R=0.56$, $F=8.1$, $p<0.01$). For both the operative and nonoperative cohorts, a model including CES-D alone accounted for 50% of the variability in DASH scores ($p<0.01$).

Table 3 Predictors of DASH score.

Predictor	Statistical test	Significance
Age/DASH	Pearson's	$r=0.60, p=0.62$
Gender/DASH	t test	$t=1.7, p=0.09$
Radiographic grade of arthritis/DASH	ANOVA	$F=2.8, p=0.06$
PCS/DASH	Pearson's	$r=0.36, p<0.01$
PASS/DASH	Pearson's	$r=0.54, p<0.01$
CES-D/DASH	Pearson's	$r=0.47, p<0.01$
Treatment (surgery/medical)/DASH	t test	$t=-1.6, p=0.10$

Discussion

Our analysis is limited by its retrospective nature and the high number of nonresponders. On the other hand, we were able to account for many of the potential differences among the cohorts by first matching and then by using multivariate statistics, and there were no significant differences between responders and nonresponders except that operated patients were more likely to respond to the survey.

The null hypothesis was not rejected: Patients that elected operative and nonoperative treatments had no difference in depression or any other psychological measure. Patients that elected operative treatment were younger on average but did not have worse radiographic arthrosis according to the very simple rating system of Sodha et al. [15].

The predictors of perceived disability (DASH) were consistent with prior work: Depression was the most important—indeed dominant—factor [13]. Depression was a more important determinant of DASH scores than ineffective coping skills as measured using the PCS. It is not clear why preoperative radiographic severity was a predictor of DASH scores in postoperative patients but not in patients electing nonoperative treatment. The latter group deserves emphasis: There was no correlation between radiographic severity of the arthrosis and DASH scores among patients electing nonoperative treatment.

Within the limitations of the study, we conclude that perceived disability due to trapeziometacarpal arthrosis correlates with depression and ineffective coping skills and that patients with trapeziometacarpal arthrosis who elect operative treatment are younger on average but otherwise comparable to patients that elect nonoperative treatment in terms of demographics, psychological factors, and objective pathology. When considering a common degenerative condition that most patients apparently accept and adapt to, the factors that lead some patients to request elective surgery remain unexplained and merit further study.

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