Greater Perceived Helplessness in Osteoarthritis Predicts Outcome of Joint Replacement Surgery

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ABSTRACT. ***Objective.*** To determine if there is a difference between male and female patients in their perceived control of osteoarthritis (OA) symptoms at the time of joint replacement surgery, as measured by the Arthritis Helplessness Index (AHI), and how this helplessness affects surgical outcomes at 1 year.
Methods. From a joint replacement registry, 70 male and 70 female patients were randomly selected and matched for age, body mass index, comorbidity, procedure, and education. Patients completed the AHI prior to surgery. Functional status was assessed at baseline and 1-year followup with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score. Linear regression modeling was used to determine the effect of sex on predicting AHI scores. A second model was constructed to examine the effect of AHI on the 1-year WOMAC change score.
Results. There were no statistically significant differences in demographic data or clinically significant differences in AHI scores between sexes. Linear regression modeling showed that female sex was a significant predictor of a greater AHI score prior to surgery ($p < 0.05$). Moreover, a greater AHI score was an independent predictor of a lower WOMAC change score at 1 year ($p = 0.01$).
Conclusion. Interventions to improve control over arthritis symptoms should be studied with the goal of improving surgical outcomes. (J Rheumatol First Release June 1 2009; doi:10.3899/jrheum.080466)

Key Indexing Terms:
HELPLESSNESS SEX OUTCOMES HIP REPLACEMENT
KNEE REPLACEMENT OSTEOARTHRITIS

Published data from the Framingham study and a comprehensive systematic review demonstrate that the risk of incident hip and knee osteoarthritis (OA) is greater in women than men[1,2]; however, women are utilizing total joint arthroplasty (TJA) at a lesser rate than men[3]. A potential explanation for this differential usage may be that women are less likely than men to be referred for surgical consultation[4]. However, surgical outcomes for women following TJA have been reported by some to be inferior to those of men[5,6]. An explanation for this difference in outcome between sexes has not been elucidated.

The Arthritis Helplessness Index (AHI) was originally designed as a 15-item measure of patients' perception of their ability to predict and control the symptoms of their disease[7]. It was later modified to a 5-item scale and its psychometric properties of validity and reliability have been well established[8,9]. This scale takes its root in the learned helplessness theory, which says a patient may develop performance deficits through a feeling of being unable to control the progress or consequences of their disease[7-10].

The construct of helplessness has been suggested to affect surgical outcomes following spine surgery, breast cancer surgery, and epilepsy surgery. However, it has not been formally evaluated in joint replacement patients[11-13].

The objective of our study was to determine if there is a difference between male and female patients in their perceived control of their OA at the time of joint replacement surgery, as measured by the AHI, and how this helplessness affects functional outcomes at 1 year. We hypothesized *a priori* that women would show poorer control over their disease than men and that greater helplessness would negatively affect surgical outcomes at 1 year.

MATERIALS AND METHODS

Study design. We performed a matched, retrospective analysis of patients undergoing unilateral primary hip or knee replacement surgery at a single Canadian academic institution, the Toronto Western Hospital. Seventy consecutive male patients undergoing surgery during the year 2006 were matched to 70 randomly chosen female patients from our total joint registry having surgery during the same year. Patients were matched for age, body mass index (BMI), comorbidity, procedure, and education. Our inclusion criteria for the study were ages 18 years and above and a diagnosis of primary OA. All patients gave informed consent to participate in the study. All data were collected by an independent assessor not involved in the medical care of the patients. The study protocol was approved by the Human Subjects Review Board.

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Accepted for publication February 17, 2009.

Collection of data. Baseline demographic data of age, sex, BMI, comorbidity, and education were collected within the month prior to surgery by patient self-report. Highest level of education was recorded as either higher education level (university or above) or low education level (high school or below). Comorbidity was defined by the 14 categories of chronic illness adapted from the Cumulative Illness Rating Scale (CIRS)[14,15]. This scale covers the domains of (1) cardiac, (2) vascular, (3) hematological, (4) respiratory, (5) otorhinolaryngological and ophthalmological, (6) upper gastrointestinal, (7) lower gastrointestinal, (8) hepatic and pancreatic, (9) renal, (10) genitourinary, (11) musculoskeletal and integumental, (12) neurological, (13) endocrine, metabolic and breast, and (14) psychiatric systems.

Patient functional status and pain level were assessed preoperatively and at 1-year followup with the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) function and pain scores, respectively[16]. The WOMAC index covers the domains of joint pain (5 questions), joint stiffness (2 questions), and joint function (17 questions). Each question is scored on a Likert scale with 5 response categories ranging from none to extreme. The internal consistency of the WOMAC index ranges from 0.86 to 0.95, while the test-retest reliability ranges from 0.48 to 0.68[16]. A greater score on the WOMAC index represents poorer function or greater pain. The WOMAC change score was calculated by taking the difference between the WOMAC total score at baseline minus that at 1 year. Mental health (MH) status was assessed with the Medical Outcomes Study Short Form (SF)-36 scale preoperatively[17-19]. A greater score represents a better health state on the SF-36 scale.

To evaluate for level of perceived helplessness, all patients completed the AHI 5-item scale prior to joint replacement surgery[8,9]. The scale demonstrates good internal consistency (reliability) with a Cronbach's alpha of 0.68 and a test-retest reliability coefficient of 0.64[10]. The questions of the AHI ask patients how much arthritis controls their life, the importance of others to support them, their ability to find relief from pain, and their own perception of their coping skills. All questions are scored on a 6-point Likert scale and a greater score represents poorer perceived control over their disease.

Statistical analysis. Continuous data such as age, BMI, comorbidity, WOMAC, SF-36 MH, and AHI scores were compared between sexes using t-tests, as all data were normally distributed. Means and standard deviations (SD) are reported for all continuous variables. Categorical data such as education are reported with frequencies, and groups were compared with Fisher's exact test.

Multivariable linear regression modeling was performed to determine the effect of sex on the preoperative AHI score. The relevant covariates entered into the model were age, BMI, comorbidity, education, surgical procedure (hip vs knee), preoperative total WOMAC, and SF-36 MH scores. A second model was constructed to examine the effect of the AHI score on the 1-year WOMAC change score. We created an interaction term between AHI score and sex to determine any effect on predicting the WOMAC change score. All variables were retained in the models, whether reaching statistical significance or not, to maintain face validity of the models.

The sample size was calculated to detect a minimally clinically significant difference of 4.5 points in the preoperative AHI score between men and women. To detect an effect size of 0.5 (mean difference divided by SD) with a type I error of 5% and 80% power we calculated the sample size to be 64 patients per arm.

All statistical analysis was done with SPSS version 13.0 (SPSS, Chicago, IL, USA). Beta coefficients for regression modeling and their 95% confidence intervals (CI) are reported. All p values report nominal significance levels at an alpha of 0.05. Bonferroni's adjustment for type I error for multiple endpoints is provided for the comparison of outcome scores across sexes (Table 2). The corrected alpha level is reported at 0.006.

RESULTS

Our 70 male and 70 female patients were well matched for demographic variables of age, BMI, comorbidity, procedure, and education ($p > 0.05$; Table 1).

Preoperative WOMAC scores and SF-36 MH scores were not clinically or statistically different between sexes after Bonferroni correction. Similarly, 1-year WOMAC scores and WOMAC change scores were not different between men and women. AHI scores were not clinically or statistically different between men and women prior to joint replacement surgery (Table 2).

Linear regression modeling showed that female sex, a younger age, and a greater preoperative WOMAC score were independent predictors of a greater score on the AHI adjusted for BMI, education, surgical procedure, comorbidity, and MH scores ($p < 0.05$; Table 3).

Regression modeling also showed that a greater AHI score independently predicted a lesser improvement in the WOMAC change score, from baseline to 1 year, adjusted for age, sex, BMI, education, comorbidity, surgical procedure, and MH score ($p = 0.02$; Table 4). We tested the interaction of AHI score and sex in separate models but found no significant interaction.

Table 1. Demographic data compared across men and women.

Characteristic	Men, n = 70	Women, n = 70	p*
Age, yrs (range, SD)	66.2 (43–86, 10.0)	66.7 (43–86, 10.2)	0.78*
BMI, kg/m^2 (SD)	28.4 (3.6)	29.0 (3.7)	0.29*
Mean	2.3 (1.3)	2.4 (1.4)	0.47*
Comorbidity (SD)			
Knees, %	53	60	0.39†
Higher education, %	59.7	50.0	0.25†

* Compared between groups with t-tests; † compared between groups with Fisher's exact test. BMI: body mass index.

Table 2. Preoperative and 1-year WOMAC, SF-36 mental health, and Arthritis Helplessness Index scores compared across men and women.

Measure	Men, n = 70	Women, n = 70	p*
Preoperative WOMAC			
Pain scores	9.9 (3.6)	11.1 (3.3)	0.04
Function scores	39.5 (14.2)	43.9 (11.8)	0.04
Total scores	49.4 (17.2)	55.0 (14.4)	0.04
1-year WOMAC			
Pain scores	4.6 (2.6)	5.2 (2.0)	0.22
Function scores	16.1 (7.3)	17.5 (7.6)	0.30
Total score	20.6 (8.7)	22.6 (8.8)	0.20
WOMAC change score	28.7 (18.4)	32.2 (16.1)	0.27
Preoperative SF-36			
Mental health scores	68.4 (20.6)	60.0 (21.0)	0.02
Arthritis Helplessness Index	10.4 (3.4)	11.9 (3.4)	0.01

* Compare nominal p values to a Bonferonni-corrected alpha of 0.05/9 to achieve significance at $\alpha = 0.006$. WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; SF-36: Medical outcomes Study Short-Form 36.

Table 3. Linear regression model predicting Arthritis Helplessness Index (AHI) by age, sex, BMI, comorbidity, procedure, education, mental health scores, and baseline WOMAC scores. $R^2 = 0.22$, $p < 0.001$.

Feature	Beta Coefficient (95% CI) Arthritis Helplessness Index	p	R^2
Female	1.4 (0.1, 2.5)	0.03	0.035
Age	–0.09 (–0.2, –0.03)	0.006	0.06
Procedure	0.1 (–1.1, 1.3)	0.85	0.004
BMI	–0.01 (–0.2, 0.2)	0.93	0.003
Comorbidity	0.4 (–0.09, 0.8)	0.12	0.02
Education	–0.7 (–1.9, 0.5)	0.26	0.02
Preoperative WOMAC score	0.06 (0.03, 0.1)	0.001	0.08
Mental health	0.004 (–0.03, 0.03)	0.79	0.005

CI: confidence interval; BMI: body mass index; WOMAC: Western Ontario and McMaster Universities OA Index.

Table 4. Linear regression model predicting WOMAC change scores by age, sex, BMI, comorbidity, procedure, education, baseline mental health scores, and Arthritis Helplessness Scores (AHI). $R^2 = 0.16$, $p = 0.017$.

Feature	Beta Coefficient (95% CI) WOMAC Change Scores	p	R^2
Female	2.6 (–4.2, 9.5)	0.77	0.006
Age	–0.05 (–0.4, 0.4)	0.76	0.006
AHI	–1.2 (–2.1, 0.2)	0.02	0.06
BMI	0.7 (–0.2, 1.6)	0.15	0.04
Comorbidity	–0.9 (–3.4, 1.7)	0.50	0.009
Education	2.1 (–4.7, 8.9)	0.54	0.008
Procedure	2.3 (–3.4, 6.7)	0.37	0.02
Mental Health	0.05 (–0.1, 0.2)	0.53	0.009

BMI: body mass index.

DISCUSSION

Learned helplessness is defined as one's belief that one's actions cannot produce a desired outcome. Our study shows that there was no difference in arthritis helplessness between sexes; however, a greater perceived lack of control of arthritis symptoms negatively affects 1-year outcomes of joint replacement surgery.

Substantial variability exists in patient-reported outcomes following TJA. In many studies, between 15% and 30% of knee replacement patients report minimal functional improvement[20,21] and patient dissatisfaction rates may be as high as 30%[22,23]. Similarly, following hip replacement surgery, up to 30% of patients have reported minimal improvement on the WOMAC index at a minimum 1-year followup[24]. Factors such as comorbidity, age, and mental health have been suggested as predictors of a lesser outcome[25,26]. Our study demonstrates that helplessness as a construct independent of mental health predicts a lesser functional improvement following hip and knee replacement surgery at 1 year. Moreover, the effect did not vary with sex, as the interaction of helplessness and sex was not significant in general linear models.

In our dataset, univariate analysis demonstrated no clinical differences in AHI scores between sexes; however, after adjusting for relevant covariates, female sex was an independent predictor of greater arthritis helplessness prior to TJA. A broad variety of pain-coping strategies have been described such as praying/hoping, diverting attention, reinterpreting pain sensations, coping self-statements, ignoring sensations, and catastrophizing[25]. Sex differences in pain-coping strategies have been examined in a few studies that show women tend to use more emotion-focused coping strategies than men[26-28]. One example involves seeking support from others to vent their emotions related to their pain; this is related to improved pain behavior[26]. Other authors have found that women use a different emotion-focused coping strategy in dealing with knee arthritis[29] and general musculoskeletal pain[30] called pain catastrophizing, which may potentially lead to greater pain and pain-related disability[31]. Pain catastrophizing is a term that comprises the 3 dimensions of magnification, rumination, and helplessness[29,32,33].

Pain catastrophizing has been defined as an exaggerated negative emotional state that arises during pain[32]. The mechanisms by which catastrophizing and helplessness lead to an increased perception of pain are believed to be mediated through a cognitive process model called schema-activation[32,34]. This model says that some patients develop expectancies about the high threat value of painful stimuli and the cognitive interpretation of these signals leads to a heightened pain perception[32,34].

In our study, we found that there were no differences in 1-year outcomes between sexes. Some authors have shown poorer 1-year outcome scores in women following hip arthroplasty[6] and knee arthroplasty[5]. However, not all of these authors accounted for preoperative function. We used the WOMAC change score, as suggested by others, as it represents the relative benefit received from the surgical procedure and accounts for the preoperative functional status[35,36]. Many recent large studies have demonstrated an equal improvement in function for men and women following TJA when evaluated by a relative change score[35,37].

Another interesting finding of our study is that younger patients demonstrated a greater helplessness for their OA symptoms. This finding agrees with that of others who have shown that catastrophizing is greater in younger patients at dental clinics[38] and with women undergoing breast cancer surgery[39]. In contrast, a study in patients with rheumatoid arthritis showed that older patients demonstrated greater catastrophizing as compared to young patients[40]. A recent qualitative review of the literature on this issue concluded that catastrophizing behavior generally decreases with age[32].

One potential limitation of our study is that the AHI scale

was validated for use in a rheumatoid arthritis population and we extrapolate its use to an OA population, as others have[41-43]. The questions of the AHI are generic to coping with arthritis symptoms, so we believe our patients with OA would find these questions relevant to their condition. Second, we performed a retrospective study from our joint replacement database; however, in order to limit the potential selection bias in our study, we had an independent person not involved in the medical care of the patients or the data analysis perform the patient matching. Patients were randomly selected from this prospectively collected dataset of joint replacement patients, and thus we feel our results remain valid and generalizable.

We have shown that there were no clinical differences in AHI scores between sexes prior to TJA, but that a perceived lack of symptom control compromises eventual joint replacement outcome at 1 year for both hips and knees. Future work should be directed towards understanding techniques for improving patients' ability to perceive control over their disease and thus improve surgical outcomes.

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