

Impact of preoperative mental health status on functional outcome 1 year after total hip arthroplasty

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The preliminary data were presented as a poster at the Canadian Orthopaedic Association annual meeting, June 19–22, 2016, Québec, and the Canadian Arthroplasty Society meeting, Nov. 24–25, 2016, Toronto.

Background: The aim of this prospective cohort study was to determine the effect of preoperative mental health status on functional outcome 1 year after total hip arthroplasty (THA).

Methods: Data were collected for 677 patients from a randomized controlled trial in Alberta who received primary THA between April 2005 and June 2006 (sex, age, body mass index [BMI], comorbidities, back pain and need for another lower limb arthroplasty procedure within 1 yr after surgery). The Western Ontario and McMaster University Osteoarthritis Index (WOMAC) and 36-Item Short Form Health Survey (SF-36) mental health component were administered before surgery and 1 year after. We conducted multiple linear regression to determine the effect of mental health on the WOMAC score at 1 year.

Results: The mean WOMAC and SF-36 mental health scores were significantly increased at 1 year ($p < 0.001$ and $p = 0.01$, respectively). There was a strong correlation between improvement in WOMAC score at 1 year and presurgery SF-36 mental health score (0.13, 95% confidence interval [CI] 0.06 to 0.2). Age (−0.34, 95% CI −0.45 to −0.24), obesity (−2.9, 95% CI −5.32 to −0.4), back pain (−5.75, 95% CI −8.04 to −3.46) and awaiting another joint arthroplasty operation (−6.18, 95% CI −8.9 to −3.47) had a negative impact on the WOMAC score.

Conclusion: There was a strong correlation between presurgery mental health and the resolution of pain and improved functioning 1 year after THA. We recommend that patients receive appropriate counselling and, where appropriate, medical therapy before THA.

Contexte : Le but de cette étude de cohorte prospective était de déterminer l'effet de l'état de santé mentale préopératoire sur les résultats fonctionnels une année après une intervention pour prothèse totale de la hanche (PTH).

Méthodes : Les données concernant 677 patients opérés pour PTH entre avril 2005 et juin 2006 ont été recueillies à partir d'un essai randomisé et contrôlé albertain (sexe, âge, indice de masse corporelle [IMC], comorbidités, dorsalgie et autre arthroplastie d'un membre inférieur requise dans l'année suivant l'intervention). L'indice WOMAC (Western Ontario and McMaster University Osteoarthritis Index) et le volet santé mentale du questionnaire SF-36 (36-Item Short Form Health Survey) ont été administrés avant la chirurgie, puis 1 an après. Nous avons réalisé une analyse de régression linéaire multiple pour déterminer l'effet de la santé mentale sur l'indice WOMAC après 1 an.

Résultats : Les scores WOMAC et volet santé mentale du SF-36 étaient significativement plus élevés après 1 an ($p < 0,001$ et $p = 0,01$, respectivement). On a noté une forte corrélation entre l'amélioration du score WOMAC après 1 an et le score au volet santé mentale du SF-36 préopératoire (0,13, intervalle de confiance [IC] de 95 % 0,06 à 0,2). L'âge (−0,34, IC de 95 % −0,45 à −0,24), l'obésité (−2,9, IC de 95 % −5,32 à −0,4), la dorsalgie (−5,75, IC de 95 % −8,04 à −3,46) et l'attente d'une autre arthroplastie (−6,18, IC de 95 % −8,9 à −3,47) ont eu un impact négatif sur le score WOMAC.

Conclusion : On a observé une forte corrélation entre l'état de santé mentale préopératoire et la résolution de la douleur/amélioration du fonctionnement un an après la PTH. Nous recommandons un counselling approprié et selon le cas un traitement médical avant la PTH.

Total hip arthroplasty (THA) has revolutionized the management of patients with end-stage arthritis. Although it has been claimed to be “the operation of the century,”¹ there are still a subset of patients who are dissatisfied following the procedure. Recent publications have identified impaired mental health as a risk factor for a poorer outcome,² and studies have shown that patients with a diagnosis of anxiety and depression report less improvement following THA than those without this diagnosis.^{3,4} Some studies have shown that preoperative psychiatric conditions correlate with increased adverse events, costs and pain after THA.⁵⁻⁷ Others have indicated suboptimal outcomes in patients with back pain, contralateral hip problems and multiple comorbidities.⁸⁻¹¹

We hypothesized that there is a strong relation between presurgery mental health status and improvement in the Western Ontario and McMaster University Osteoarthritis Index (WOMAC) score 1 year after THA. A worse mental health status has a negative impact on results following THA.

METHODS

We prospectively collected data for 677 patients who had undergone THA between Apr. 1, 2005, and June 30, 2006 in Alberta. This cohort formed part of an ongoing randomized controlled trial organized by the Alberta Bone and Joint Institute. The trial received ethics approval from the ethics review boards of the University of Calgary, the University of Alberta and the College of Physicians and Surgeons of Alberta. The trial was registered with clinicaltrials.gov (NCT00277186). All patients were required to provide written consent to participate in the study. Demographic data collected included age at surgery, sex, body mass index (BMI), comorbidities, the presence of back pain and whether the patient was awaiting a further hip or knee arthroplasty procedure.

Presurgery BMI was grouped into 2 categories: greater than 30, and 30 or less. Comorbidities were calculated with the Charlson Comorbidity Index, which has 16 listed comorbid conditions, each with a designated score depending on the severity of the condition. The index can be used to calculate the 10-year probability of survival and has been validated.¹² Scores were grouped into 4 categories: 0, 1, 2, and 3 or more. Data on back pain were collected from patient self-reported survey and hospital chart review.

The WOMAC is a widely used proprietary scoring method. It is a disease-specific, self-administered questionnaire and comprises 24 items grouped into 3 domains: pain, stiffness and physical function. The WOMAC has been shown to be reliable, valid and responsive to changes in the health status of patients with hip osteoarthritis.¹³

The 36-Item Short Form Health Survey (SF-36) is a generic tool measuring health-related quality of life. The 36 questions cover 8 domains (physical functioning, bodily pain, role limitations due to physical health problems, role limitations due to personal or emotional problems, emotional well-being, social functioning, energy/fatigue and general health perceptions), which can be further summarized into physical and mental scores.¹⁴

The WOMAC and SF-36 scores were transformed to scales, with a score of 0 indicating maximal disability and a score of 100 indicating no disability.

Patient self-reported surveys were collected before surgery, and follow-up surveys were sent to patients 1 year postoperatively. One-year postoperative scores were collected for 578 patients (85.4%). There were no other exclusions.

Outcome of interest

The outcome of interest was the change in the WOMAC score 1 year after THA.

Statistical analysis

Continuous variables were summarized as a mean and standard deviation (SD), and categorical variables were expressed as number and percentages. We used the *t* test to compare continuous variables and the Pearson χ^2 test to compare categorical variables. We performed multiple linear regression to explore the relation between the change of WOMAC at 1 year and the presurgery SF-36 mental health score, while adjusting for the following variables: age, sex, Charlson Comorbidity Index score (0, 1, 2 or ≥ 3 more), obese (BMI > 30) (v. not obese [BMI ≤ 30]), back pain (v. no back pain) and awaiting another lower limb arthroplasty procedure (v. not awaiting another lower limb arthroplasty procedure). All statistical analysis was performed with Stata version 13 software (StataCorp).

RESULTS

The patients' characteristics are summarized in Table 1. Of the 677 patients, 394 (58.2%) were women. The mean age was 67.5 years (SD 12.0, range 23.6–94 yr). Of the 677, 318 (47.0%) had a Charlson Comorbidity Index score of 1 or greater. The mean BMI was 28.4 (SD 5.0, range 18.6–45.1).

The mean WOMAC score was 40.6 (SD 16.5) ($n = 674$) before surgery and 82.9 (SD 15.5) ($n = 577$) 1 year postoperatively, a mean increase of 41.4 (SD 18.8) ($n = 574$) ($p < 0.001$). The corresponding values for the SF-36 mental health score were 72.2 (SD 18.4) ($n = 676$) and 81.1 (SD 15.7) ($n = 577$), a mean increase of 7.9 (SD 16.6) ($n = 576$) ($p = 0.01$).

The multiple linear regression model showed a strong correlation between the improvement of the WOMAC score at 1 year and the presurgery SF-36 mental health score (0.13, 95% confidence interval [CI] 0.06 to 0.2) (Table 2). Age (−0.34, 95% CI −0.45 to −0.24), obesity (−2.9, 95% CI −5.32 to −0.4), back pain (−5.75, 95% CI −8.04 to −3.46) and waiting for another joint arthroplasty procedure (−6.18, 95% CI −8.9 to −3.47) had a negative impact on improvement of the WOMAC score at 1 year.

DISCUSSION

The results of this study show that THA is not only effective at decreasing pain and improving function but is also associated with improved mental well-being 1 year after surgery. A diagnosis of back pain, obesity and awaiting

another joint replacement all had a negative effect on hip function as measured by the WOMAC independent of other variables at 1 year.

The preoperative mental health score also correlated strongly with the WOMAC score 1 year after surgery. Quintana and colleagues¹¹ showed a relation between the SF-36 mental health domain and the pain domain of the WOMAC score 6 months after THA in 788 patients after adjusting for similar variables.

In another, smaller randomized study in 102 patients, the SF-12 mental component score and low preoperative WOMAC and Harris Hip scores at a minimum of 2 years after surgery.⁹ Patient medical comorbidities and socioeconomic factors such as income and education adversely affected hip scores. However, the conclusions can be challenged as the statistical analysis incorporated unadjusted odds ratio in a much smaller sample.

Patients taking antidepressants had poorer health-related quality of life scores and higher levels of pain before and after surgery than a control group who had no documented prescriptions of an antidepressant in the year before surgery in the Prescribed Drug Register at the National Board of Health and Welfare in Sweden.³ Furthermore, patients with extreme anxiety and depression had worse postoperative functional scores than those with multiple musculoskeletal comorbidities.^{3,15,16} Patients with depression, especially those taking antidepressants, may experience poorer outcomes owing to inadequate participation in rehabilitation, as it has been shown that depression heightens perception of pain.¹⁷ In addition to heightened pain sensitivity, there may be reduced ability to cope with illness and lower expectations of pain relief and functional recovery.^{18–20} In the present study, the patients with depression had lower WOMAC scores than those without depression. However, there was no statistically significant difference in the mean increase from baseline between the 2 groups, which suggests that patients with depression experience similar benefits following THA as those without depression. This agrees with other studies.^{3,21–23}

An increased risk of infection and increased rates of revision and aseptic loosening leading to revision have been reported following THA in patients with depression.^{24,25} Yao and colleagues²⁶ recently reported a reduced adverse reaction rate in patients receiving selective serotonin reuptake inhibitor therapy in patients undergoing THA and total knee arthroplasty. This supports optimization of mental health issues related to depression and anxiety preoperatively.

Hip and spine arthritis often coexist, and the location of pain as result of these diseases often has different meanings to different patients. In our cohort, 48.6% of patients had back pain, and these patients had significantly lower WOMAC scores postoperatively than patients without back pain. The presence of back pain was an independent

Table 1. Characteristics of patients who underwent primary total hip arthroplasty

Characteristic	No. (%) of patients* n = 677
Age, yr, mean ± SD	67.5 ± 12.0
Sex	
Female	394 (58.2)
Male	283 (41.8)
Charlson Comorbidity Index score	
0	359 (53.0)
1	135 (19.9)
2	102 (15.1)
≥ 3	81 (12.0)
Obese†	208 (30.7)
Back pain (n = 671)	326 (48.6)
Awaiting further lower limb joint replacement (n = 576)	129 (22.4)

*Except where noted otherwise.
†Body mass index > 30.

Table 2. Multiple linear regression model exploring the relation of the presurgery 36-Item Short Form Health Survey mental health score with the improvement in the Western Ontario and McMaster University Osteoarthritis Index score 1 year postoperatively

Variable	Coefficient (95% CI)
Presurgery WOMAC all	0.18 (0.10 to 0.25)
Presurgery SF-36 mental health score	0.13 (0.06 to 0.20)
Age ≥ 18 yr	−0.34 (−0.45 to −0.24)
Female v. male	0.73 (−1.65 to 3.11)
Charlson Comorbidity Index score 1 v. 0	−0.96 (−4.01 to 2.09)
Charlson Comorbidity Index score 2 v. 0	2.49 (−0.82 to 5.8)
Charlson Comorbidity Index score ≥ 3 v. 0	−0.88 (−4.56 to 2.79)
Obese v. not obese	−2.86 (−5.32 to −0.4)
Back pain v. no back pain	−5.75 (−8.04 to −3.46)
Waiting for other lower limb joint replacement v. not waiting for other lower limb joint replacement	−6.18 (−8.9 to −3.47)

CI = confidence interval; SF-36 = 36-Item Short Form Health Survey; WOMAC = Western Ontario and McMaster University Osteoarthritis Index.

predictor of lower WOMAC scores in the multivariate analysis. Parvizi and colleagues⁸ showed lower Harris Hip Scores and SF-36 mental component scores in patients with back pain but did not adjust for confounding variables. They further described the natural history of back pain in the 1-year period after THA. Two-thirds of the patients with back pain preoperatively experienced complete resolution of their symptoms. Furthermore, half the patients with back pain had known spine disorders. Despite the resolution of back pain, the group with back pain had significantly lower Harris Hip Scores.

In the current study, we were unable to show the presence of multiple comorbidities as an adverse prognostic factor (although we did not specifically analyze diabetes as a covariate). Quintana and colleagues¹¹ showed that patients with comorbidities, back pain, contralateral hip osteoarthritis and worse mental health status benefited less from THA 6 months after surgery (as measured by the SF-36 and WOMAC) than did patients without these conditions. However, further scrutiny of their results revealed that comorbidities (as measured by the Charlson Comorbidity Index) had no effect on any of the WOMAC domains but did affect the SF-36 mental health score. Peruccio and colleagues²⁷ reported that comorbidities influenced results following hip and knee arthroplasty. However, that study was a cross-sectional study with a response rate of only 52%. Furthermore, those authors included musculoskeletal conditions such as back pain and the need for another THA procedure or total knee arthroplasty in their generic list of comorbidities. In contrast, the current study shows the importance of separating musculoskeletal conditions from medical comorbidities, as there was a strong negative relation between awaiting another lower limb arthroplasty operation and postoperative WOMAC scores. This relation can probably be explained by the difficulty some patients experience in completing functional questionnaires specific to the operative joint when other degenerative joints are also affecting their activities of daily living.²⁷

We found that a BMI of 30 or more (i.e., obesity) had a negative effect on the postoperative WOMAC score. The influence of obesity on outcome following THA has been extensively studied and is the subject of much debate.^{21–23,28–30} In the current study, obesity was an independent predictor of a poorer functional outcome. Obesity is a potentially reversible risk factor, and the emerging literature suggests that this needs to be addressed before the patient undergoes arthroplasty.³¹

Strengths and limitations

The key strengths of this study are its prospective nature and relatively large sample. Furthermore, the attrition rate was only 15%. Owing to the comprehensive collection of data and large number of patients with 1-year follow-up

data, we were able to assess many confounding variables. The limitation of this study is the relatively short period of follow-up. The biggest improvement following THA tends to occur in the first 6–12 months and is maintained at that level thereafter providing there are no further complications.³²

CONCLUSION

We have shown that there is a strong correlation between presurgery mental health status and the resolution of pain and improved functioning 1 year after THA. Depression, obesity, the presence of back pain and awaiting another lower joint arthroplasty operation had a negative effect on the WOMAC score at 1 year. We recommend that patients be actively counselled regarding inferior results if 1 or more risk factors are present and can be treated. Preoperative treatment of mental health issues is appropriate where possible and may lead to improved outcomes following THA.

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Competing interests: None declared.

Contributors: All authors designed the study. H. Khong and C. Smith acquired the data, which H. Khong analyzed. P. Jaiswal, P. Railton and J. Powell wrote the article, which all authors reviewed and approved for publication.

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