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Original Article

Preoperative Predictors of Pain Catastrophizing, Anxiety, and Depression in Patients Undergoing Total Joint Arthroplasty

Thomas J. Wood, MD [a, b], Patrick Thornley, BHSc [c], Danielle Petruccelli, MLIS, MSc [b, d, *], Conrad Kabali, PhD [e], Mitch Winemaker, MD, FRCSC [a, b, d], Justin de Beer, MD, FRCSC [a, b, d]

[a] Division of Orthopaedic Surgery, McMaster University, Hamilton, Ontario, Canada
[b] Hamilton Health Sciences, Juravinski Hospital, Hamilton, Ontario, Canada
[c] Faculty of Health Sciences, Department of Surgery, McMaster University, Hamilton, Ontario, Canada
[d] Hamilton Arthroplasty Group, Hamilton Health Sciences Juravinski Hospital, Hamilton, Ontario, Canada
[e] Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada

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ABSTRACT

Background: The relationship between pain catastrophizing and emotional disorders including anxiety and depression in osteoarthritic patients undergoing total joint arthroplasty (TJA) is an emerging area of study. The purpose of this study was to examine the association of these factors with preoperative patient characteristics.

Methods: A prospective cohort study of preoperative TJA patients using the Pain Catastrophizing Scale (PCS) and Hospital Anxiety and Depression Scale (HADS-A/HADS-D) was conducted. Preoperative measures included visual analog pain scale (VAS), Harris Hip and Knee Society scores, Oxford Score, and Kellgren–Lawrence grade. Logistic and quantile regression were used to assess the relationship between preoperative characteristics and PCS or HADS, adjusting for covariate effects.

Results: We recruited 463 TJA patients. VAS pain (odds ratio [OR] 1.23; 95% confidence interval [CI] 1.04-1.45) and Oxford (OR 1.13; 95% CI 1.07-1.20) were significant predictors for PCS and its subdomains excluding rumination. Oxford was the only significant predictor for abnormal HADS-A (OR 1.10; 95% CI 1.04-1.17). VAS pain (OR 1.27; 95% CI 1.02-1.52) and Oxford (OR 1.09; 95% CI 1.01-1.17) were significant predictors for abnormal HADS-D. The quantile regression showed similar patterns of association, with female gender, younger age, and higher ASA also associated with HADS-A.

Conclusion: The most important predictor of catastrophizing, anxiety and/or depression in TJA patients is preoperative pain and poor subjective function. At-risk patients include those with increased pain and generally good clinical function, as well as younger women with significant comorbidities. Such patients should be identified and targeted psychological therapy implemented preoperatively to optimize coping strategies and adaptive behavior to mitigate potential for inferior TJA outcomes including pain and patient dissatisfaction.

Arthritis is the leading cause of disability in North America with 21 million Americans and 3 million Canadians affected [1]. Total joint arthroplasty (TJA) represents definitive treatment for patients with degenerative joint disease secondary to osteoarthritis (OA) [2]. Total hip and knee arthroplasty are 2 of the most effective surgical interventions for return to predisease function for individuals with OA [3]; however, approximately one quarter of these patients experience prolonged or intense pain, mobility restriction, and reduced quality of life postoperatively [1].

Pain is the most common indication for TJA. Preoperative pain levels have been shown to predict long-term functional outcomes and distress in TJA [1,2,4-6]. However, physiological, psychological, and demographic factors can contribute to a high degree of variability in the overall postoperative experience [1,2]. Pain catastrophizing (CRC) behavior is an important psychosocial factor affecting the ability to cope with the pain experienced by many

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* Reprint requests: Danielle Petruccelli, MLIS, MSc, Hamilton Arthroplasty Group, Hamilton Health Sciences Juravinski Hospital, Hamilton, Ontario, Canada.

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patients who have OA [4,7]. It is defined as a negative emotional state anticipating a painful experience with excessive focus on pain sensations (rumination), exaggeration of the threat value of pain sensations (magnification), and perceiving oneself as incapable of controlling these sensations (helplessness) [1,2,8,9]. Such behaviors have been related to higher osteoarthritic pain scores, disability, longer hospitalizations, depression, higher narcotic use, and increased complications [1,2,7,10-12]. Few studies have evaluated prognostic measures of CRC in the development of chronically painful joint arthroplasties [1,2,9-11,13].

Emotional disorders may also coexist with or manifest secondary to physical disability leading to a complicated clinical presentation and often a poor response to treatment [14,15]. Anxiety is based on the emotion of fear and involves feelings of worry and apprehension, in contrast to depression, which is dominated by sadness and is associated with feelings of sorrow and hopelessness [16]. Evidence supports preoperative anxiety and depression as being predictive of increased rates of persistent postsurgical pain in patients undergoing TJA [2,5,9,17,18]. Given that nearly 25% of patients with OA can be expected to experience clinical anxiety or depression either in isolation or combination, it is important to recognize the role that mood disorders play in patients undergoing TJA [17,18].

The role of pain CRC, depression, and anxiety on influencing postoperative TJA success is poorly understood [1]. Despite the absence of clear clinical and radiographic indications of severe OA in keeping with their overt level of pain and functional limitations, some patients will go on to TJA surgery only to end up with a poor functional outcome, persistent postoperative pain, and ultimately dissatisfaction. The purpose of this study was to determine preoperative patient factors that may be associated with preoperative pain CRC and hospital-related anxiety and/or depression.

Methods

A prospective cohort study of preoperative patients presenting for elective primary hip or knee arthroplasty was conducted to determine the association of pain CRC and hospital-related anxiety and depression with demographic and preoperative clinical profiles (hip and/or knee pain rating, function, and radiographic grading of OA).

All patients scheduled to undergo primary unilateral TJA for a diagnosis of OA performed among 7 orthopedic surgeons at 1 high-volume academic arthroplasty center over a consecutive 12-month period were invited to participate. Patients scheduled for sequential bilateral TJA under 1 anesthetic, revision TJA, and/or presenting with diagnoses secondary to primary OA (ie, rheumatoid arthritis, avascular necrosis) were not considered for inclusion. Once research ethics board approval was received, patients were invited to participate and provided consent at the time of their preoperative TJA assessment, approximately 3-4 weeks before surgery.

Measures

Pain CRC, anxiety and depression, hip and/or knee joint pain, and limitations in physical function were captured at the preoperative assessment. The assessment at 3-4 weeks preoperative served as the optimal interval to afford comparable baseline data capture across the entire sample. Pain CRC was measured using the Pain Catastrophizing Scale (PCS), a validated and widely used instrument for measuring catastrophic thinking related to pain [4]. The PCS is used extensively in clinical practice in both acute and chronic pain populations. Although not specifically validated in the arthroplasty population, the PCS has been shown to be a predictor of postoperative pain after total knee arthroplasty [1,2,10]. The PCS determines clinically relevant levels of CRC, where a higher PCS score corresponds to greater CRC as applied to the total PCS score (PCS-T, CRC $\geq$ 30) and 3 dimensions including rumination (PCS-R, CRC $\geq$ 11), magnification (PCS-M, CRC $\geq$ 5), and helplessness (PCS-H, CRC $\geq$ 13).

Patient level of anxiety and depression was measured using the Hospital Anxiety and Depression Scale (HADS) [15]. The HADS is a reliable and valid tool widely used in outpatient populations including among TJA patients [14,15,19]. The HADS measures anxiety (HADS-A) and depression (HADS-D) according to separate scores ranging from 0 to 21, corresponding to subscales of normal (score 0-7), borderline abnormal (score 8-10), and abnormal (score 11-21) anxiety and/or depression.

Patient-perceived level of hip and/or knee joint pain was measured using a visual analog pain scale (VAS; 0 = no pain, 10 = extreme pain) assessed preoperatively at approximately 3-4 weeks before surgery. Preoperative patient subjective perception of physical function was measured using the Oxford Hip Score and Oxford Knee Score. The Oxford Score is a 12-item measurement tool designed to determine patient-perceived rating of hip and/or knee pain and activity limitations scored from 12 (excellent function) to 60 (poor function) points [20,21]. Clinical assessment of function was measured by a nontreating registered nurse using the Harris Hip Score (HHS) and Knee Society Score (KSS) at the preoperative assessment. Both the HHS and KSS clinical scores are disease-specific tools incorporating pain, stability, and range of motion each rated on a 100-point scale where a score of 100 corresponds to excellent function [22,23].

Preoperative radiographic grading of hip and knee OA was determined using the classification for OA as described by Kellgren and Lawrence (K-L) [24]. Radiographic grading was performed by 2 independent surgeon observers.

Additional patient-level variables abstracted from the patient health record included: operative joint (hip and/or knee), gender, age, and body mass index (BMI, kg/m^2). BMI was further classified according to the Canadian Weight Classification System, which categorizes BMI ranges associated with health risk where a BMI $\geq$ 30 kg/m^2 corresponds to obese [25]. The American Society of Anesthesiologists (ASA) classification rating of physical status [26] as a measure of preoperative comorbidity determined by the attending anesthetist at time of preoperative assessment was also abstracted.

Statistical Analysis

The analysis included descriptive statistics and regression modeling. In the descriptive analysis, categorical variables were summarized as counts and proportions, whereas normally distributed continuous variables were summarized as means and standard deviation. Where the normality assumptions were violated, median and interquartile range (IQR) were reported.

Radiographic K-L grading was assessed by 2 independent surgeon observers. Inter-rater reliability using a 2-way random effects model for absolute agreement was assessed.

As a primary analysis, we fitted a multiple logistic regression model to analyze the association between PCS and HADS with patient preoperative characteristics. PCS and HADS variables were classified into clinically relevant categories [4,15]. Cutoff points for pain CRC were 30 for PCS-T, 11 for PCS-R, 5 for PCS-M, and 13 for PCS-H, with a higher score corresponding to a greater pain. Categories for HADS were 0-7 for HADS-A normal, 8-10 for HADS-A borderline normal, 11-21 for HADS-A abnormal, 0-7 for HADS-D normal, 8-10 for HADS-D borderline abnormal, and 11-21 for HADS-D abnormal. Preoperative characteristics included gender, BMI and obesity, ASA grade, clinical preoperative scores, VAS pain