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Factors Associated With Early Improvement in Low Back Pain After Total Hip Arthroplasty: A Multi-Center Prospective Cohort Analyses

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ABSTRACT

This study identified factors associated with an improvement in low back pain (LBP) at six-month follow-up after total hip arthroplasty (THA). Data from a national registry of 3054 patients were analyzed. Factors under analysis included demographics, comorbid conditions, operative and nonoperative joint pain severity, physical function, and mental health. Differences in these factors between patients with and without improvement in LBP were examined. Among patients reporting severe or moderate LBP preoperatively, 56% improved 6 months after surgery. Patients without improvement were more likely to be on Medicare, have a high school education or less, have household income less than $45,000 and have one or more comorbid conditions. Patients with improvement in LBP experienced more resolution of pain in both the operative and nonoperative hip.

Hip-spine syndrome was originally described by Offierski in 1983 as anterior groin and thigh pain that resulted from either lumbar spine disease or osteoarthritis (OA) of the hip [1]. Pain referable to pathology at one or the other location was termed "simple", whereas a combination of pathology at both locations was termed "complex". Furthermore, cases where end-stage hip OA resulted in a fixed flexion deformity and exaggerated lumbar hyperlordosis were considered "secondary" hip-spine syndrome. Not only do these two separate but clinically interrelated pathologies make preoperative diagnosis more challenging [2]; their relationship may complicate outcomes after treatment for primary hip OA [3]. Radiographically significant degenerative joint disease of the hip has been found in up to 12% of patients over age 80 [4]. The prevalence of lower back pain (LBP) in the general population is also quite high, with one study reporting up to 73% [5]. Among patients undergoing primary total hip arthroplasty (THA), the reported prevalence of LBP varies between 21.2% [6] and 60.4% [7], with most reports indicating roughly half of THA candidates experience some degree of LBP [8,9].

The likelihood of LBP to improve following THA has also been variably reported in the literature. In 2007, Ben-Galim et al reported on a prospective cohort of 25 patients with concomitant hip and spinal pathology and found that all patients had some degree of improvement in their back pain following THA as measured by the Oswestry Disability Index (ODI) that persisted at two-year follow-up [10]. Parvizi et al reported a prospective study of 344 patients undergoing THA of which 49.4% had LBP at baseline, and overall 66.4% of those patients experienced resolution of that pain after surgery [8]. In a recent report by Staibano et al, 54% of patients with clinically significant moderate to worst imaginable LBP experienced improvement at one-year follow-up after THA [7].

Although these prior studies describe the probability of improvement in LBP after THA for hip OA, identification of which patient demographic and clinical factors are associated with such improvement remains unknown. This information could help clinicians more accurately counsel patients prior to surgery in terms of the risk of continued LBP postoperatively. Therefore, the purpose of the present study was to utilize a large, multi-center, prospectively collected joint database registry to identify those factors that were associated with an improvement in LBP at early follow-up.

Materials and Methods

Data were obtained from the Function and Outcomes Research for Comparative Effectiveness in Total Joint Replacement (FORCE-TJR) registry, a national registry consisting of more 132 orthopedic surgeons in academic and private centers from across the country [11]. Patients were prospectively enrolled into the registry beginning in 2011 and data for the current study were accessed in February 2014. The FORCE-TJR collects data on sociodemographics, clinical factors as well as patient reported outcomes (PRO) through a self-administered questionnaire. Patients were enrolled at a preoperative visit within three months of undergoing their primary, elective, unilateral total hip arthroplasty. Sociodemographic data included age, sex, race, ethnicity, income, insurance status, educational level. Anthropometrics included

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measured body weight in kilograms and height in meters which are used to calculate body mass index (BMI, kg/m^2). Patient-reported outcome measures included the Mental Component Summary (MCS) score and Physical Component Summary (PCS) score of the Short Form-36 (SF-36) [12,13] and the Hip Disability and Osteoarthritis Outcome Score (HOOS) [14,15]. The HOOS was chosen as it is a joint-specific outcome measure [16] and preoperative and postoperative hip pain in both the operative and nonoperative hip was assessed using the HOOS pain subscale. Medical comorbidities were quantified using the modified Charlson Comorbidity Index (CCI) [17]. Back pain was evaluated using a pain intensity Likert scale from the modified ODI [18,19]. Patients completed the same outcome measures six-months postoperatively.

Patients who reported moderate or severe back pain preoperatively were considered to have clinically significant back pain. These patients were divided into two groups on the basis of improvement or lack of improvement in their low back pain at the six-month follow-up visit. Patients who reported either mild or no back pain at follow-up were considered to have experienced significant resolution of their back pain while those patients reporting moderate or severe back pain postoperatively were regarded as failure to improve.

Descriptive statistics were calculated for continuous variables including the mean and standard deviation. Frequencies were determined for categorical variables including race, ethnicity, income, insurance status, and educational level. Variables with more than two categories were dichotomized; for example, race was considered as either white or nonwhite, and the CCI was analyzed as either a score of 0 or greater than or equal to 1. Independent samples t-tests were used to compare means of continuous variables as needed. Chi-square tests were used to compare frequencies of categorical values. Statistical significance level was set at $P < 0.05$.

Results

Included in this analysis were 2820 patients undergoing primary, unilateral, elective total hip arthroplasty who had a preoperative questionnaire and a completed six-month follow-up questionnaire. Table 1 shows the subdivision of this sample on the basis of the severity of their preoperative and postoperative back pain as indicated by the modified ODI score. 60.5% (1707/2820) of the cohort indicated at least mild back pain preoperatively, and 58.4% (997/1707) of these patients experienced improvement in their back pain as indicated by a change of at least one degree of pain severity. The percentage of improvement in low back pain for each grade of preoperative severity is shown in Table 2. Eighty percent of patients with severe back pain showed improvement at follow-up, while less than one quarter (23.7%) of patients who were initially pain-free reported some worsening of their pain.

A total of 992 patients (35.3%) reported moderate or severe back pain preoperatively. These patients were considered for further analysis to identify demographic or clinical factors that may be associated with improvement in low back pain at early follow-up. Among the 992 patients, those reporting mild or no back pain postoperatively were considered to have experienced clinically significant resolution (Table 1, n = 554, [a]) whereas the remainder of the cohort failed to improve (Table 1, n = 438, [b]). Table 3 shows the differences in clinical and demographic data for these two groups. Age, gender, BMI, race, and ethnicity did not differ between groups. However, those patients who had improvement in their LBP were more likely to have a household income greater than $45,000, have private insurance rather than Medicare, have an educational level greater than high school, report pain in fewer nonoperative joints, and have a lower overall chronic disease burden as measured by the CCI (Table 3).

Patient-reported outcome measures are shown in Fig. 1, including the preoperative SF-36 mental and physical component summary scores, and preoperative and postoperative HOOS pain subscale for both the operative and nonoperative hip. Statistically significant differences were found in both component summary scores of the SF-36 with those patients who reported improvement in LBP reporting significantly better mental and physical scores at baseline. Additionally there was a statistically significant difference in HOOS pain scores in both hips. Patients with improvement in LBP experienced more resolution of pain in both the operative hip (90.13 vs 79.51, $P < 0.000$) as well as the nonoperative hip (90.18 vs 80.92, $P < 0.000$). Additionally, patients with improvement in LBP also have a significant difference in the amount of improvement experienced (51.96 vs 44.58, $P < 0.000$).

Table 1
Subdivision of the Total Cohort by Preoperative and Postoperative Low Back Pain Scores as Reported on the Modified ODI.

	Six-Month Postoperative			
Preoperative	None	Mild	Moderate	Severe
None	849	194	59	11
Mild	328	269	97	21
Moderate	177[a]	242[a]	205[b]	58[b]
Severe	60[a]	75[a]	115[b]	60[b]

[a] Patients with significant back pain who were considered to have improvement in their low back pain at follow-up.
[b] Patients with significant back pain who experienced a lack of improvement at final follow-up.

Table 2
Distribution of Patients Who Experienced Either Improvement, No Change, or Worsening in Back Pain at Follow-Up Stratified by Preoperative Pain Severity.

	Six-Month Postoperative		
Preoperative	Improvement	No Change	Worse
None	0	849 (76.3%)	264 (23.7%)
Mild	328 (45.9%)	269 (37.6%)	118 (16.5%)
Moderate	419 (61.4%)	205 (30.1%)	58 (8.5%)
Severe	250 (80.7%)	60 (19.3%)	0

Percentages are indicated in relation to each degree of severity (across each row).

Discussion

In this prospective joint registry study we have identified factors that are associated with improvement in LBP at early follow-up after THA. Demographic factors included greater household income, use of private insurance, and educational level greater than high school. Baseline clinical parameters including a lower chronic disease burden, fewer weight-bearing joints with significant pain, and greater SF-36 mental and physical component summary scores were also associated with improvement in LBP. Overall, 60.5% of our sample reported at least mild back pain prior to surgery, which is in agreement with previously reported data regarding the prevalence of LBP among THA patients [7–9]. Of those with clinically significant moderate to severe back pain, 55.8% (554/992) experienced resolution of their back pain to either mild or none postoperatively. This is in close correlation to the work of Staibano et al who reported 60.4% prevalence of LBP among their hip OA patients and a 54% likelihood of significant improvement in LBP following THA [7].

In the present study, both groups reported improvement in HOOS pain scores in their operative hip; however, those who experienced resolution of LBP also had a significantly greater improvement in HOOS pain score compared to those patients whose back pain failed to resolve (Fig. 1). Postoperative HOOS pain scores for those with improvement in LBP averaged 90.13 compared to 79.51 for those with continued back pain. There was also significant difference in the amount of overall improvement experienced. Based on the work of Paulsen et al, the minimal clinically important difference (MCID) for the HOOS pain subscale is an average of 24 points, which suggests that the difference in the present study may not be clinically relevant [20]. However, the same study also found that the patient-acceptable symptom state, which describes