

Predictive Factors of Pain and Functional Outcome 5-years following Total Hip Arthroplasty: A Prospective Cohort Study

David Christopher Ayers¹, Mohamed Yousef², Hua Zheng², Wenyun Yang³

¹Univ of Mass Dept of Ortho, ²University of Massachusetts Medical School, ³Univ of Mass Med School

INTRODUCTION:

Although total hip arthroplasty (THA) effectively improves hip pain and function in patients with end-stage arthritis, up to 11% of THA patients are not satisfied with their outcome due to residual pain and/or limited function at 1-year. Previous reports have identified a number of potential predictors of pain and function after THA. However, most of these studies had a follow up less than 5 years after THA. The purpose of this study is to identify factors predictive of pain and function 5-year after THA.

METHODS:

A prospective, multicenter cohort of 7,934 primary unilateral THA patients were enrolled from 2012-2016. Demographic data, comorbidities, and patient-reported outcome measures (PROMs) were collected preop and postop at 5-years using an internet-based platform including the Hip injury and Osteoarthritis Outcome Score (HOOS) pain and function in daily living (ADL) scores. Multivariate logistic regression model with 95% confidence interval (CI) was used to identify independent predictors of pain and function at 5-years. The regression model was performed after adjusting the following variables: age, gender, body mass index (BMI), Charlson Comorbidity Index (CCI), marital status, smoking, education, and insurance type. Hosmer-Lemeshow goodness of fit test was performed to evaluate the validity of the model.

RESULTS:

Patient dissatisfaction percentage was 8.2% at 5 years after THA. The **multivariate regression identified the following predictor factors (variables with significance at $P < 0.05$) for HOOS pain score at 5-year (Table 1):** age [Regression co-efficient (B) for age ≥ 75 years vs. < 55 years, 4.18; 95% CI (1.96, 6.39)], educational level [B for post high school vs. less, 1.95; 95% CI (0.62, 3.27)], insurance coverage [B for private/HMO vs. Medicare, 2.40; 95% CI (0.67, 4.14)], smoking [B for non-smoker vs. current smoker, 4.61; 95% CI (2.24, 6.98)], race [B for Non-White vs. White, -3.24; 95% CI (-5.67, -0.80)], CCI [B for CCI ≥ 6 vs. 0, -3.58; 95% CI (-5.58, -1.58)], Oswestry disability index (ODI) [B for severe vs. none back disability, -4.28; 95% CI (-6.26, -2.30)], number of other painful joints [B for 3 other painful joints vs. 0, -5.99; 95% CI (-7.73, -4.24)], KOOS pain of ipsilateral knee [B for severe vs. none, -3.39; 95% CI (-5.34, -1.44)], preop SF-36 MCS [B, 0.11; 95% CI (0.06, 0.16)], preop HOOS pain [B, 0.05; 95% CI (0.01, 0.10)]. The **multivariate regression identified the following predictor factors (variables with significance at $P < 0.05$) for HOOS ADL score at 5-years (Table 2):** BMI [B for BMI ≥ 40 vs. < 25 , -4.09; 95% CI (-7.32, -0.85)], insurance coverage [B for private/HMO vs. Medicare, 3.33; 95% CI (1.15, 5.16)], smoking [B for non-smoker vs. current smoker, 4.90; 95% CI (2.39, 7.42)], race [B for Non-White vs. White, -3.53; 95% CI (-6.09, -0.97)], CCI [B for CCI ≥ 2 vs. 0, -5.56; 95% CI (-7.66, -3.45)], ODI [B for severe vs. no back disability, -2.76; 95% CI (-4.83, -0.68)], number of other painful joints [B for 3 other painful joints vs. 0, -6.12; 95% CI (-7.97, -4.28)], KOOS pain ipsilateral knee [B for severe vs. none, -3.35; 95% CI (-5.40, -1.31)], preop SF-36 MCS [B, 0.11; 95% CI (0.06, 0.17)], preop SF-36 PCS [B, 0.10; 95% CI (0.01, 0.19)], preop HOOS ADL [B, 0.08; 95% CI (0.04, 0.12)].

DISCUSSION AND CONCLUSION:

In total, 8.2% of patients were not satisfied (neutral or dissatisfied) 5-years after primary THA. We have identified a number of factors that predict less improvement in pain and function 5-years after THA which might contribute to patient dissatisfaction. While some of the factors are nonmodifiable such as age and race, others may be modifiable. These potentially modifiable factors include BMI, smoking, ODI, preoperative pain, preoperative physical function, and emotional health (mental) status. This supports the use of preoperative patient optimization programs to improve modifiable risk factors to improve long-term patient outcome and satisfaction after primary THA. Knowledge of these factors that predict less improvement in pain and function can assist the surgeon and patient during shared decision making and in setting appropriate patient expectations preoperatively.

Variables	Hip injury and Osteoarthritis Outcome Score (HOOS) 5-Year Pain		
	Coefficient (95% CI)	P-value	
Age (vs. <55y)	55-64y	1.53 (-0.20, 3.25)	0.08
	65-74y	3.54 (1.08, 5.99)	0.005 *
	=75y	4.18 (1.96, 6.39)	<0.001 *
Gender (Female vs. Male)		0.54 (-0.61, 1.69)	0.36
BMI (vs. <25)	25-29	-0.74 (-2.11, 0.63)	0.28
	30-39	-0.96 (-2.42, 0.46)	0.18
	=40	-1.29 (-4.32, 1.74)	0.41
Marital status (Unmarried vs. Married)		-0.23 (-1.99, 1.53)	0.28
Number of Adults in house (vs. 1)	2	-0.11 (-1.93, 1.72)	0.91
	3	0.37 (-1.90, 2.64)	0.75
	=4	0.37 (-2.64, 3.38)	0.81
Education (Post high school vs. high school diploma or less)		1.95 (0.62, 3.27)	0.004 *
Insurance (vs. Private/HMO Medicare)	All others	2.40 (0.67, 4.14)	0.007 *
	All others	0.86 (-1.88, 3.66)	0.54
Household income (vs. =\$45,000)		0.67 (-0.72, 2.07)	0.34
Smoking (vs. Former smoker)	Current smoker	3.64 (1.23, 6.05)	0.003 *
	Non-smoker	4.61 (2.24, 6.98)	<0.001 *
Race (Non-White vs. White)		-3.24 (-5.67, -0.80)	0.009 *
Charlson's	1	-0.50 (-1.94, 0.95)	0.50
Comorbidity Index (CCI) (vs. 0)	2-5	-2.26 (-4.04, -0.49)	0.01 *
	=6	-3.58 (-5.58, -1.58)	0.004 *
Oswestry	Mild	-0.71 (-2.04, 0.63)	0.29
Disability Index (vs. None)	Moderate	-1.79 (-3.21, -0.36)	0.01 *
	Severe	-4.28 (-6.26, -2.30)	<0.001 *
Number of other painful hip and knee joints (vs. 0)	1	-1.65 (-4.83, 1.52)	0.30
	2	-5.75 (-7.21, -4.30)	<0.001 *
KOOS pain score of ipsilateral knee (vs. None)	Mild	-3.99 (-7.73, -0.24)	<0.001 *
	Moderate	-0.50 (-1.88, 0.89)	0.47
KOOS pain score of ipsilateral knee (vs. None)	Moderate	-0.47 (-1.85, 0.91)	0.50
	Severe	-3.39 (-5.34, -1.44)	0.001 *
HOOS pain score of contralateral hip (vs. None)	Mild	-0.41 (-2.24, 1.42)	0.66
	Moderate	-0.93 (-2.46, -0.60)	0.23
SF-36 MCS (vs. None)	Severe	-3.57 (-7.42, 0.28)	0.06
	Severe	0.11 (0.06, 0.16)	<0.001 *
SF-36 PCS		0.06 (-0.02, 0.13)	0.13
Preop HOOS pain		0.05 (0.01, 0.10)	0.01 *

Variables	Hip injury and Osteoarthritis Outcome Score (HOOS) 5-Year ADL		
	Coefficient (95% CI)	P-value	
Age (vs. <55y)	55-64y	1.09 (-0.72, 2.91)	0.23
	65-74y	2.10 (-0.22, 4.43)	0.07
	=75y	-1.61 (-4.19, 0.96)	0.22
Gender (Female vs. Male)		0.52 (-0.70, 1.73)	0.41
BMI (vs. <25)	25-29	-0.92 (-2.37, 0.52)	0.21
	30-39	-1.66 (-3.20, -0.16)	0.03 *
	=40	-4.09 (-7.32, -0.85)	0.01 *
Marital status (Unmarried vs. Married)		0.22 (-1.63, 2.08)	0.81
Number of Adults in house (vs. 1)	2	0.23 (-1.69, 2.15)	0.81
	3	0.76 (-1.63, 3.16)	0.53
	=4	0.75 (-2.44, 3.94)	0.64
Education (Post high school vs. high school diploma or less)		1.71 (0.32, 3.11)	0.01 *
Insurance (vs. Private/HMO Medicare)	All others	3.33 (1.51, 5.16)	<0.001 *
	All others	2.54 (-0.36, 5.43)	0.08
Household income (vs. =\$45,000)		1.31 (-0.16, 2.78)	0.08
Smoking (vs. Former smoker)	Current smoker	4.26 (1.71, 6.82)	0.001 *
	Non-smoker	4.95 (2.39, 7.42)	<0.001 *
Race (Non-White vs. White)		-3.53 (-6.09, -0.97)	0.007 *
Charlson's	1	-2.07 (-3.94, -0.20)	0.03 *
Comorbidity Index (CCI) (vs. 0)	=2	-5.56 (-7.66, -3.45)	<0.001 *
	Mild	-0.12 (-1.53, 1.29)	0.86
Disability Index (vs. None)	Moderate	-1.74 (-3.24, -0.24)	0.02 *
	Severe	-2.76 (-4.83, -0.68)	0.009 *
Number of other painful hip and knee joints (vs. 0)	1	-1.19 (-4.52, 2.15)	0.48
	2	-4.60 (-6.13, -3.06)	<0.001 *
KOOS pain score of ipsilateral knee (vs. None)	Mild	-4.12 (-7.97, -0.26)	<0.001 *
	Moderate	-0.28 (-1.76, 1.17)	0.69
KOOS pain score of ipsilateral knee (vs. None)	Moderate	-0.52 (-1.97, 0.94)	0.48
	Severe	-3.35 (-5.40, -1.31)	0.001 *
HOOS pain score of contralateral hip (vs. None)	Mild	-2.45 (-2.38, 1.48)	0.08
	Moderate	-1.54 (-3.16, 0.07)	0.06
SF-36 MCS (vs. None)	Severe	-2.75 (-6.82, 1.32)	0.18
	Severe	0.11 (0.06, 0.17)	<0.001 *
SF-36 PCS		0.10 (0.01, 0.19)	0.02 *
Preop HOOS ADL		0.08 (0.04, 0.12)	<0.001 *