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Brief Communications

Primary Total Hip Arthroplasty in Hispanic/Latino Patients: An Updated Nationwide Analysis of Length of Stay, 30-Day Outcomes, and Risk Factors

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ABSTRACT

Background: This study explored recent time trends in length of stay (LOS), 30-day outcomes, and risk factors for adverse events (AEs) pertaining to total hip arthroplasty in the Hispanic and Latino population.

Methods: A total of 4107 Hispanic and Latino patients who underwent primary total hip arthroplasty between 2011 and 2017 were identified using the American College of Surgeons National Surgical Quality Improvement Program database. Annual trends in LOS and 30-day outcomes (readmission, reoperation, complications, and mortality) were calculated using univariate mixed-effect regression analyses. Risk factors for AEs were determined using multivariate analyses.

Results: Between 2011 and 2017, there was a significant reduction in LOS >2 midnights (67.6% to 29.5%, $P < .001$) among Hispanic patients, which was similar to that among non-Hispanic white patients and was also accompanied with improvements in comorbidity profiles and shorter operative times. Post-operatively, the annual rates of 30-day outcomes were comparable with those of white patients ($P > .05$). Chronic kidney disease, the American Society of Anesthesiologists score >2, and chronic steroid use were the strongest independent predictors for AEs.

Conclusions: In the context of historically lower arthroplasty outcomes among the Hispanic and Latino population, current evidence suggests a receding tide, with annual trends showing significantly shorter LOS and comparable overall 30-day outcomes with whites. Patients with chronic kidney disease, the American Society of Anesthesiologists score >2, and chronic steroid use are at the highest risk for developing 30-day AEs.

Introduction

Total hip arthroplasty (THA) is one of the most rapidly growing procedures in the United States, with a projected increase of 174% by 2030 [1,2]. The exponential growth in procedure utilization raises the potential for worsened disparities among racial and ethnic minorities who have traditionally experienced lower access to care and worse outcomes for THA [3-5]. For example, minority patients have been shown to experience increased postoperative pain, prolonged hospitalization, and higher rates of emergency department visits, complications, and mortality [6-10].

Our current state of knowledge on racial and ethnic disparities pertaining to THA has a few gaps. First, although evidence exists on persistent disparities in postoperative outcomes, it remains unknown how the rates of these outcomes have evolved over recent years. Second, much of the current literature does not recognize race and ethnicity as distinct entities. For example, Hispanics and Latinos are often grouped with whites, blacks, or other races [11]. It is true that individuals may be genetically linked to a particular race, but their overall health is intimately influenced by myriad environmental and cultural factors specific to their ethnic backgrounds. Third, previous analyses on THA outcomes predated major milestones in arthroplasty care, including advancements in

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preoperative optimization, rapid recovery protocols, and opioid-sparing analgesia. Fourth, much of the current literature has focused on select geographic regions [12], health-care systems [13], payer types [14], or non-Hispanic minorities [15]. Fifth, there is lack of data on risk factors for adverse outcomes in this ethnic group to help guide more specific preoperative risk stratification.

The present study sought to use a recent patient sample drawn from a national database to update the current knowledge of THA outcomes and risk factors as they pertain to the Hispanic and Latino population. We hypothesized that the national cohort data would indicate lower utilization of THA and an increased frequency of postoperative adverse events (AEs) by Hispanic and Latino patients as compared with whites, but with a trend toward equalization in more recent years. The specific study questions were as follows: (1) How are Hispanic and Latino patients compared with their white counterparts in terms of length of stay (LOS) and 30-day outcomes? (2) What are the annual trends in LOS and 30-day AEs (medical complications, surgical complications, readmissions, reoperations, and mortality) in recent years? (3) What risk factors are associated with increased AEs in this ethnic group? This information is important to evaluate the effectiveness of recent policy and arthroplasty-specific advancements in extending improved outcomes to minority patients and to guide more specific risk stratification in this ethnic group.

Material and methods

Approval of our institutional review board was not required. Data were obtained from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP). The ACS-NSQIP is a national, validated database that collects data from patients' medical charts, beginning with hospital admission up to 30 days postoperatively [16]. Inclusion criteria involved all patients who underwent primary elective THA between 2011 and 2017, as identified via Current Procedural Terminology code 27130. To minimize potential procedural coding inaccuracies, we ensured that assessed patients had received an International Classification of Diseases (ICD-9 and ICD-10) diagnosis code that warranted arthroplasty.

We determined Hispanic and Latino ethnicity based on patient-reported data in the ACS-NSQIP data set. A comprehensive data collection process was carried out to capture demographic variables such as age, sex, body mass index, preoperative living environment, and functional status. Data regarding comorbid conditions including hypertension, diabetes, chronic kidney disease (CKD), chronic obstructive pulmonary disease (COPD), anemia, chronic heart failure, metastatic cancer, bleeding disorders, dyspnea, and ascites were collected. Perioperative variables included surgical diagnosis, length of surgery, laterality (unilateral vs bilateral), and operative time.

The primary study outcomes were the annual trends in LOS and 30-day postoperative AEs, which included readmission, reoperation, complications, and mortality. Complications were further classified as medical or surgical. Surgical complications included wound infection, reintubation, pulmonary embolism, deep vein thrombosis, and ventilator use exceeding 48 hours. Medical complications included sepsis or septic shock, cardiac arrest, myocardial infarction, stroke, acute renal insufficiency, pneumonia, and urinary tract infection. Reoperation was defined as any unplanned operation that was not related specifically to the index surgery. The annual trends in other factors such as comorbidity profiles, perioperative characteristics, and procedure utilization were also assessed. The secondary outcome of the study was determining the risk factors for increased 30-day AEs.

For analysis of the annual trends, P values were determined from a univariate mixed-effect logistic regression, which included an ordinal time variable for admission year. For simplicity, data were presented in aggregates (2011-2013, 2014-2015, and 2016-2017); however, analyses were performed across each individual year. For determination of risk factors for AEs, we first compared the differences in patient factors in 2 groups defined by the presence or absence of 30-day postoperative AEs. For nominal variables, P values were obtained from a chi-squared test. For continuous variables, P values were obtained from Welch's t-test. Patient factors demonstrating significant differences ($P < .05$) or approaching significance ($P < .10$) between the 2 groups were then incorporated into a multivariate logistic regression to yield odds ratios (ORs) for the risk of each patient factor. An α level of 0.05 defined significance for all tests. Data were extracted and analyzed using Stata 16.0 (Stata Statistical Software: Release 16; StataCorp LLC, College Station, TX).

Results

Of 155,870 THA procedures in the ACS-NSQIP data set, 4107 (3.1%) were performed on Hispanic and Latino patients, as compared with 74.5% in non-Hispanic whites and 13.4% in individuals with an unreported race or ethnicity. Over the study period, there were trends toward younger age (61.0 ± 13.2 years vs 59.5±13.0 years, $P = .049$), more male patients (45.3% vs 49.4%, $P = .034$), and higher body mass index (30.5±6.0 vs 31.0±6.0, $P = .0071$) among Hispanic and Latino patients. In addition, there were declining rates in 3 comorbidities: hypertension (55.0% vs 49.8%, $P = .057$), anemia (28.6% vs 18.5%, $P < .001$), and dyspnea (3.3% vs 2.8%, $P = .001$). More patients were operated on for primary osteoarthritis (85.8% vs 87.4%, $P < .001$) than for inflammatory osteoarthritis (2.1% vs 1.2%, $P < .001$) and osteonecrosis (9.6% vs 8.0%, $P < .001$). Fewer patients required operative times >100 minutes (43.6% vs 40.2%, $P = .019$). Table 1 summarizes the annual trends in baseline and perioperative characteristics for the study group.

Over the study period, there was an approximate 183% increase in the number of THAs performed in Hispanic and Latino patients. Overall, 1830 (44.6%) patients required LOS >2 days compared with 41.8% in non-Hispanic whites ($P < .0001$). When stratified by the procedure year, there was a significant reduction in LOS >2 days in Hispanic and Latino patients over the study period (67.6% vs 29.5%, $P < .001$). Two hundred one (4.9%) Hispanic and Latino patients suffered AEs, similar to the rate among white patients (4.9%, $P = .915$). Only the rates of medical complications, particularly sepsis and myocardial infarction, demonstrated significant reductions over the study period (0.6% vs 0.2%, $P = .032$ and .3% vs 0.1%, $P = .048$, respectively). No differences were observed with respect to the overall rates of 30-day AEs including readmissions, reoperations, surgical complications, and mortality ($P > .05$). Table 2 summarizes the trends in LOS and 30-day postoperative AEs for the study group.

After controlling for all baseline and perioperative differences, risk factors for AEs were chronic steroid use (OR: 1.87, confidence interval [CI]: 1.14-3.06, $P = .013$), the American Society of Anesthesiologists (ASA) classification >2 (OR: 1.97, CI: 1.41-2.76, $P < .0001$), CKD (OR: 2.10, CI: 1.11-3.96, $P = .023$), and procedure length >100 minutes (OR: 1.48, CI: 1.10-2.00, $P = .010$). Figure 1 summarizes the results of multivariate logistic regression analyses for development of 30-day AEs.

Discussion

The present study examined the annual trends in 30-day outcomes and the risk factors for AEs as they pertain to Hispanic and Latino patients undergoing primary THA. Between 2011 and 2017, there was a 38% reduction in the rates of LOS >2 midnights, which was accompanied with improvements in comorbidity profiles and

Table 1
Time trends in baseline and perioperative characteristics of the study cohort.

Variable	2011-2013	2014-2015	2016-2017	*P* value
N = 4107	973	1352	1782	–
Demographic characteristics				
Age (y)	61.0 ± 13.2	59.8 ± 12.9	59.5 ± 13.0	**.0492**
Sex				**.034**
Female	532 (54.7%)	688 (50.9%)	902 (50.6%)	
Male	441 (45.3%)	664 (49.1%)	880 (49.4%)	
Body mass index (kg/m^2)	30.5 ± 6.0	30.8 ± 5.8	31.0 ± 6.0	**.0071**
Current smoker	144 (14.8%)	174 (12.9%)	235 (13.2%)	.423
Chronic steroid use	51 (5.2%)	83 (6.1%)	84 (4.7%)	.238
ASA classification	2.4 ± 0.6	2.4 ± 0.6	2.4 ± 0.6	.1993
Functional status				.139
Independent	922 (95.8%)	1308 (97.6%)	1729 (97.2%)	
Partially or completely dependent	40 (4.2%)	32 (2.4%)	49 (2.8%)	
Preoperative living environment				.108
Admitted directly from home	971 (99.8%)	1348 (99.7%)	1776 (99.7%)	
Admitted from a facility	2 (0.2%)	4 (0.3%)	5 (0.3%)	
Comorbidity characteristics				
Diabetes	163 (16.8%)	237 (17.5%)	296 (16.6%)	.592
Hypertension	535 (55.0%)	740 (54.7%)	887 (49.8%)	**.057**
Chronic obstructive pulmonary disease	29 (3.0%)	40 (3.0%)	42 (2.4%)	.373
Chronic heart failure	3 (0.3%)	4 (0.3%)	1 (0.1%)	.313
Anemia	268 (28.6%)	284 (22.0%)	314 (18.5%)	**<.0001**
Metastatic cancer	1 (0.1%)	3 (0.2%)	2 (0.1%)	.938
Bleeding disorder	20 (2.1%)	26 (1.9%)	28 (1.6%)	.489
Dyspnea	32 (3.3%)	33 (2.4%)	50 (2.8%)	**.001**
Ascites	0 (0.0%)	0 (0.0%)	0 (0.0%)	–
Chronic kidney disease	21 (2.3%)	38 (3.0%)	41 (2.5%)	.789
Perioperative characteristics				
Diagnosis				**<.0001**
Primary osteoarthritis	835 (85.8%)	1183 (87.5%)	1558 (87.4%)	
Inflammatory arthritis	20 (2.1%)	12 (0.9%)	22 (1.2%)	
Post-traumatic arthritis	6 (0.6%)	10 (0.7%)	26 (1.5%)	
Childhood dysplasia	19 (2.0%)	17 (1.3%)	34 (1.9%)	
Osteonecrosis	93 (9.6%)	130 (9.6%)	142 (8.0%)	
Bilateral procedure	3 (0.3%)	7 (0.5%)	18 (1.0%)	.355
Procedure length (min) > 100	424 (43.6%)	577 (42.7%)	717 (40.2%)	**.019**

Values are presented as the mean and standard deviation (continuous variables) or as the frequency and percentage (nominal variables). For nominal variables, overall *P*–values are obtained from the chi-squared test. For continuous variables, overall *P* values are obtained from an overall F-test of one-way analysis of variance (ANOVA). For simplicity, data are presented in time-period cohorts; however, all analyses were performed across each individual year. Significant values are in bold and defined as $P < .05$.

shorter operative times. Interestingly, this reduction in LOS >2 days closely reflected that for non-Hispanic blacks (32%) and whites (35%) over the same time period, which may reflect the growing national trend toward fast-track surgery made possible by enhanced perioperative pathways and promoted by increased emphasis on value-based care [17]. A central premise of value-based care is optimizing outcomes while minimizing costs. Because hospitalization is associated with increased resource

Table 2
Time trends in 30-d measures of the study cohort.

Outcome	2011-2013	2014-2015	2016-2017	*P* value
Mortality	1 (0.1%)	1 (0.1%)	3 (0.2%)	.672
Readmission	24 (3.2%)	60 (4.5%)	49 (2.8%)	.415
Reoperation	12 (1.2%)	30 (2.2%)	24 (1.3%)	.620
Inpatient stay (>2 d)	658 (67.6%)	646 (47.9%)	526 (29.5%)	**<.0001**
Any complication	23 (2.4%)	42 (3.1%)	33 (1.9%)	.103
Any surgical complication	13 (1.3%)	34 (2.5%)	24 (1.4%)	.628
Wound infection	7 (0.7%)	17 (1.3%)	11 (0.6%)	.622
Reintubation	2 (0.2%)	1 (0.1%)	1 (0.1%)	.226
Ventilator >48 h	1 (0.1%)	0 (0.0%)	0 (0.0%)	.216
Pulmonary embolism	4 (0.4%)	8 (0.6%)	8 (0.5%)	.728
Deep vein thrombosis	3 (0.3%)	11 (0.8%)	7 (0.4%)	.703
Any medical complication	11 (1.1%)	11 (0.8%)	12 (0.7%)	.064
Sepsis or septic shock	6 (0.6%)	4 (0.3%)	3 (0.2%)	**.032**
Cardiac arrest	0 (0.0%)	5 (0.1%)	6 (0.1%)	.913
Myocardial infarction	3 (0.3%)	2 (0.2%)	1 (0.1%)	**.048**
Stroke	0 (0.0%)	0 (0.0%)	4 (0.2%)	.098
Acute renal insufficiency	0 (0.0%)	2 (0.2%)	1 (0.1%)	.893
Pneumonia	3 (0.3%)	3 (0.2%)	4 (0.2%)	.414
Urinary tract infection	0 (0.0%)	0 (0.0%)	4 (0.2%)	.098

Values are presented as the frequency and percentage (nominal variables). Overall *P* values are determined from a univariate mixed-effect logistic regression, which included an ordinal time variable for admission year. For simplicity, data are presented in time-period cohorts; however, all analyses were performed across each individual year. Significant values are in bold and defined as $P < .05$.

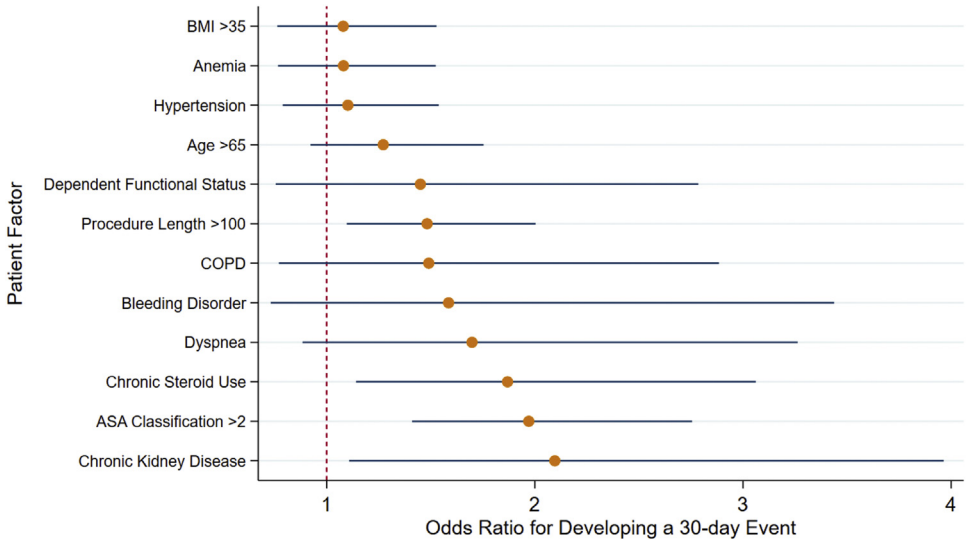

Figure 1. Multivariate logistic regression analysis for development of a 30-d postoperative event. A multivariate logistic regression was used to yield odds ratios for development of a postsurgical event, defined as any combination of a medical complication, surgical complication, mortality, readmission, or reoperation. Patient factors previously demonstrating ($P < .05$) or approaching significance ($P < .10$) between the patient groups (Table 1) were controlled for in the regression analysis. Continuous variables (age, BMI, ASA score) were converted to nominal variables based on Youden's index so as to maximize the discriminative capacity of the cutoff value. BMI, body mass index.

utilization, decreasing LOS can achieve immediate reductions in the costs of care. In a retrospective review of 2.8 million THAs performed using the National Inpatient Sample, Molloy et al. [18] found that the hospital costs for THA increased by an average of $7858 or 49.8% between 2002 and 2013. During the same time, hospital LOS decreased from 4.06 to 2.74 days on average, thereby providing an important cost containment measure against the rising costs of care. Still, when compared with non-Hispanic whites, our study shows persistent disparities in overall LOS in line with previous reports. Johnson et al. [19] retrospectively reviewed 117,389 primary THAs performed between 2008 and 2016 using the ACS-NSQIP database and found that Hispanic patients had longer LOS and were less likely to be discharged to home than whites.

Contrary to previous reports, mortality [6-10] and overall rates of 30-day outcomes were comparable between Hispanic and Latino and non-Hispanic white patients. This finding contributes to the ongoing discussion regarding the role of low socioeconomic status or income (frequently more prevalent in Hispanic/Latino populations) as it relates to THA outcomes. Although lower income has previously been correlated with increased mortality and AEs after THA [20], other recent reports from national cohort data have suggested that socioeconomic and under-represented minority status may not be independently associated with readmission after THA [21]. This may be at least partially explained by the growing prominence of managed health-care systems, which often contain standardized protocols and have recently been shown to equalize reoperation, readmission, and postoperative events after THA among various racial groups [9].

When considering utilization, we found that Hispanic and Latino individuals made up only 3% of all THAs captured by the ACS-NSQIP database over the study period. This is notable considering that Hispanic and Latino individuals make up approximately 18.3% of the U.S. population [22] and that the growth of the Hispanic population through 2050 is projected to be larger than the growth of all other ethnic and racial groups combined [23]. This finding suggests a notable degree of arthroplasty underutilization by Hispanic and Latino patients and is consistent with findings in a prior retrospective review of the National Inpatient Sample database between 1996 and 2005, in which Bang et al. [24] found that racial minorities (especially African Americans and Hispanics) were 23%-64% less likely to undergo joint arthroplasty than their white counterparts.

Although individual patient and surgeon preferences may guide arthroplasty decisions, access limitations among Hispanic patients may also play a role. Recent prospective analyses by Borkhoff et al. [25] and Hausmann et al. [26] have established that some orthopaedic surgeons are less likely to recommend arthroplasty for females and non-white patients than for white males with comparable disease severity. Furthermore, African Americans and Hispanics are more likely to be admitted for total joint arthroplasty in emergent settings as opposed to through outpatient centers, further supporting the presence of access limitations [27]. While lower rates of insurance coverage may feasibly diminish surgeon access among minority groups, several recent assessments have supported that this utilization difference exists even among patients with adequate payor coverage [28,29]. Regardless of the exact driver of these utilization differences, it is encouraging that the increase in the number of THAs performed in Hispanic and Latino patients (183%) matched or slightly exceeded that among all patients (169%) during the same time period, potentially reflecting heightened awareness of these limitations by surgeons and hospital networks.

In this study, we found that CKD, an ASA score greater than 2, and chronic steroid use carried the highest probability of experiencing a 30-day AE. Other risk factors in decreasing order were dyspnea, bleeding disorders, COPD, procedure length greater than 100 minutes, dependent functional status, and advanced age. These risk factors are consistent with those from previous reports; in a retrospective review of 927 readmitted patients after primary total joint arthroplasty, DS Sveom and Garvin [30] found a higher risk of readmission with diabetes, advanced age, COPD, and longer LOS. In another retrospective review of 2011 ACS-NSQIP database, AJ Pugely et al. [31] found that obesity, steroid use, bleeding disorders, dependent functional status, and a high ASA class predicted readmission after primary THA.

Preoperative optimization, based on early identification and mitigation of known surgical risk factors, has emerged as a critical strategy to improve arthroplasty outcomes. Broadly speaking, mitigation may include interventions such as counseling, referral to other medical specialists for optimization, extended

hospitalization or close postdischarge follow-up for observation, and even delaying surgery. As related to the specific risk factors identified in this study, a cohort analysis by Kildow et al. [32] suggested that patients with CKD who received a kidney transplant before THA had a lower likelihood of 30-day postsurgical outcomes. This may be particularly relevant in the Hispanic population, which has a higher risk of systemic lupus erythematosus and CKD—both of which independently increase the risk of postoperative events after THA [33]. Similarly, chronic steroid use can significantly increase the risk of postarthroplasty avascular necrosis, and current recommendations advise shared decision-making and close consideration of the potential benefit of arthroplasty procedures in these patients [34].

This study is not without some limitations. First, it is a retrospective review of a large database that may be subject to abstraction errors. Second, the ACS-NSQIP database does not collect socioeconomic data that are known to contribute to health disparities such as community poverty level [35] and insurance status [15]. Third, 13% of patients declined to identify their race/ethnicity and thus were excluded from analysis. Fourth, the outcomes collected by the ACS-NSQIP database are limited to the first 30 postoperative days, which could underestimate the true burden of immediate AEs experienced in our assessed population. Fifth, the ACS-NSQIP database is limited by a disproportionate contribution from larger teaching hospitals.

Conclusions

In the context of historically lower arthroplasty outcomes among the Hispanic and Latino population, current evidence suggests a receding tide with annual trends showing significantly shorter LOS and comparable overall 30-day outcomes with whites. Patients with CKD, an ASA score >2, and chronic steroid use are at the highest risk for developing 30-day AEs. Although outside the scope of this study, further efforts are needed to increase the number of Hispanic and Latino patients undergoing THA.

Conflict of interests

M.A. Harrington is a paid consultant for Zimmer Inc. and is a board member/part of committee appointments for the AAOS, AOA, and J Robert Gladden Orthopaedic Society; M.J. Halawi is a member of the editorial/governing board of *Arthroplasty Today and Journal of Bone and Joint Surgery*; all other authors declare no potential conflicts of interest.

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