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Primary Hip & Knee Arthroplasty

African American Patients Have Improved Functional Gains and Comparable Clinical Outcomes to Caucasian Patients After Total Hip and Knee Arthroplasty

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ABSTRACT

Background: With the increasing popularity of alternative payment models, minorities who use more postacute care resources may face difficulties with access to quality total hip arthroplasty (THA) and total knee arthroplasty (TKA) care. The purpose of this study is to compare differences in perioperative complications and functional outcomes between African American and Caucasian patients undergoing THA and TKA.

Methods: We reviewed a consecutive series of all primary THA and TKA patients at our institution from 2015 to 2018. Demographics, comorbidities, 90-day complications, readmissions, Veterans Rand 12-Item Health Survey (VR-12), Hip disability Osteoarthritis Outcome Score (HOOS), and Knee injury and Osteoarthritis Outcome Scores (KOOS) were compared between African American and Caucasian patients. A multivariate analysis was performed to control for confounding variables.

Results: Of the 5284 patients included in the study, 1041 were African American (24.5%). Although African American patients had lower preoperative HOOS/KOOS (33.5 vs 45.1, $P < .001$) and mental VR-12 scores (37.8 vs 51.5, $P < .001$) compared with Caucasian patients, there was no clinical difference at 1 year in HOOS/KOOS (50.2 vs 50.4), mental VR-12 (55.0 vs 52.6), or physical VR-12 scores (39.5 vs 39.8). When controlling for demographics and medical comorbidities, African American race was associated with increased rehabilitation facility discharge (odds ratio, 1.69; $P < .001$) but no difference in readmissions or complications.

Conclusion: Although African American patients had lower preoperative functional scores, they made improved postoperative gains when compared with Caucasian patients. Although there was no difference in postoperative complications, further studies should assess social causes for the increase in rehabilitation utilization rates in minority patients.

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Prior studies have examined differences in surgical and medical outcomes among patients with different ethnicities [1–3]. African American race has been associated with more medical comorbidities and adverse events after medical procedures compared with

Caucasian patients, particularly after total hip arthroplasty (THA) and total knee arthroplasty (TKA) [4]. For minorities who may be at higher risk for complications and who require more postacute care resources, the increasing popularity of alternative payment models may further disincentivize access to quality arthroplasty care. Currently, most value-based programs for THA and TKA lack adequate risk adjustment for nonmodifiable risk factors, such as race and ethnicity. Concerns exist regarding access to quality arthroplasty care and disparity in the utilization of these successful surgical procedures in minority patients.

There is strong evidence that these racial disparities are present in the total joint arthroplasty (TJA) patient population. The prevalence of osteoarthritis in African Americans is at least as high as

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reported for Caucasians [5,6], and osteoarthritis is among the leading causes of disability in both groups, in the United States [7–10]. However, there is a significant racial variation in the utilization of THA and TKA [11]. African American patients are far less likely to undergo THA and TKA compared with Caucasian patients [9,11,12]. In addition, prior studies have demonstrated inferior outcomes after TJA associated with African American race [13–15]. Causes for adverse outcomes after arthroplasty are multifactorial and may include social and medical risk factors.

The purpose of this study is to determine whether African American patients undergoing THA and TKA have worse perioperative outcomes than Caucasian patients. Our goal was to give surgeons, hospitals, and policymakers an accurate portrayal of racial disparities in an episode of care. Secondary study goals included whether the preoperative medical risk and demographic profiles were different between the groups. Finally, we asked whether African American patients had worse postoperative functional outcome scores when compared with Caucasian patients.

Methods

In this retrospective cohort study, we reviewed the data available in our prospectively collected institutional arthroplasty database identifying all patients undergoing elective primary THA and TKA at our institution from January 2015 to December 2018. We chose this time line to allow for sufficient follow-up (at least 1 year) and to use a relatively recent cohort to reduce confounding factors related to recent advancements in TJA, perioperative medicine, and standardized protocols. Urgent procedures for fracture or oncologic conditions were excluded from the study. Of the 5642 consecutive patients included in the database, 204 identified themselves as other and/or unspecified, 136 as Asian, and 64 as mixed. These patients were all excluded from this study. Of the 5238 patients included in the analysis, 1041 (24%) self-identified as African American and 4457 self-identified as Caucasian patients. Preoperative medical comorbidities and demographic variables were also recorded from the database. This study was approved by and conducted according to regulations set forth by our institutional review board. No outside funding was received for this study.

Our primary outcome metric was to compare differences in complication rates, discharge disposition, and 90-day readmission rates. These metrics were prospectively documented by our nurse navigators who contact each patient preoperatively and postoperatively and perform a thorough chart review of inpatient and outpatient records to capture all complications. Claims data were crosschecked to identify any readmission at an outside facility. We also recorded mortality rates and revision surgery for any reason. Complications were defined as any complication occurring during the postoperative inpatient stay or 90 days after discharge, including cardiovascular complications, gastrointestinal complications, wound complications, urinary retention, kidney injury, wound drainage, fracture, infection, venous thromboembolism, and neurologic impairment.

Secondary outcome measures included recording preoperative and postoperative differences in functional, mental, and physical outcome scores between the 2 cohorts, using the Knee injury and Osteoarthritis Outcome Score (KOOS), Hip disability and Osteoarthritis Outcome Score (HOOS), and Veterans Rand 12-Item Health Survey (VR-12) score. The KOOS and HOOS evaluate functional outcomes for the knee and hip, respectively [16,17]. The VR-12 evaluates the overall mental and physical well-being of the patient through 12 questions [18,19]. All patients had a minimum of 1-year follow-up.

Statistical Analysis

Statistical analysis was performed in R Studio (version 3.6.1, Vienna, Austria). Continuous variables such as age and functional outcome scores were compared between the Caucasian and African American groups and analyzed using a Student *t* test, whereas categorical variables were analyzed using a chi-square test. When observed or expected values were less than 5, Fisher exact test was used. We performed a subgroup analysis looking at TKA vs THA. The analysis did not retrieve significant differences, and therefore, data were aggregated. To control for confounding demographic variables and medical comorbidities, a multivariate logistic regression analysis was performed to identify the independent effect of race for outcomes, including 90-day readmissions, 90-day postoperative complications, and discharge to a rehabilitation facility.

Results

When comparing African American vs Caucasian cohorts in univariate analysis, there was no statistically significant differences in American Society of Anesthesiologists score, but surprisingly had a lower mean age-adjusted Charlson comorbidity index (3.59 vs 3.71; $P < .001$). African American patients did have higher rates of pulmonary disease (16% vs 13%; $P = .017$), diabetes (14% vs 9%; $P < .001$) but no differences in rates of other comorbidities (Table 1). African Americans were younger (mean age, 64.2 vs 66.0 years; $P < .001$), had a higher body mass index (32.3 vs 30.8 kg/m²; $P < .001$), more likely to be female (63% vs 51%; $P < .001$), and had higher rates of smoking (11% vs 5%; $P = .002$).

In univariate analysis, there was no difference in complication rate (9% vs 9%; $P = .696$), revision rate (1% vs 1%; $P = .929$), readmission rate (3% vs 3%), or mortality rate (0.1% vs 0.04%; $P = .352$) between the African American and Caucasian cohorts (Table 2). African Americans

Table 1
Demographics and Medical Comorbidities of All Patients Included in the Study.

Variable	Caucasian N = 4243 (SD)	African American N = 1041 (SD)	P
Age (SD)	66.0 (10.5)	64.2 (10.0)	<.001
BMI (SD)	30.8 (5.91)	32.3 (5.99)	<.001
Female gender	2170 (51%)	661 (63%)	<.001
Surgical procedure			<.001
THA	2211 (52%)	455 (43%)	
TKA	2032 (47%)	586 (56%)	
Congestive heart failure	150 (3%)	48 (4%)	.122
Chronic pulmonary disease	554 (13%)	166 (15%)	.017
Cerebrovascular disease	113 (2%)	17 (1%)	.070
Dementia	33 (0.6%)	7 (0.6%)	.879
Diabetes mellitus	389 (9%)	147 (14%)	<.001
Malignancy	62 (1%)	12 (1%)	.541
Metastatic disease	27 (0.6%)	3 (0.3%)	.267
Myocardial infarction	254 (6%)	46 (4%)	.060
Mild liver disease	61 (1%)	15 (1%)	1.000
Moderate to severe liver disease	4 (0.1%)	1 (0.1%)	1.000
Peptic ulcer	27 (0.6%)	2 (0.2%)	.132
Peripheral vascular disease	125 (2%)	19 (1%)	.060
Renal disease	170 (4%)	55 (5%)	.081
Rheumatic disease	159 (3%)	53 (5%)	.059
CCI—age adjusted (SD)	3.71 (1.72)	3.59 (1.56)	.035
ASA class (SD)	2.52 (0.62)	2.51 (0.64)	.681
Smoking	133 (5%)	68 (11%)	.002
History of depression	604 (14%)	141 (13%)	.600
History of anxiety	312 (7%)	57 (5%)	.039
History of mental illness	728 (17%)	163 (15%)	.266

SD, standard deviation; BMI, body mass index; THA, total hip arthroplasty; TKA, total knee arthroplasty; CCI, Charlson comorbidity index; ASA, American Society of Anesthesiologists.

Table 2
Univariate Analysis of Surgical and Patient-Reported Functional Outcomes.

Variable	Caucasian	African American	P
	N = 4243 (SD)	N = 1041 (SD)	
Surgery duration (min) (SD)	79.8 (46.5)	88.6 (48.3)	<.001
Length of stay (d)	2.33 (2.76)	2.56 (2.51)	.012
Discharge			<.001
Home	3721 (87%)	847 (81%)	
Rehabilitation facility	511 (12%)	189 (18%)	
90-d complications	325 (9%)	77 (9%)	.696
90-d readmissions	114 (2%)	26 (2%)	.816
Revision surgery	37 (0.9%)	10 (0.9%)	.929
Mortality	1 (0.04%)	1 (0.1%)	.352
HOOS/KOOS (preoperative)	45.1 (20.3)	33.5 (16.7)	<.001
HOOS/KOOS (6 wk postoperatively)	53.3 (33.1)	47.6 (27.4)	<.001
HOOS/KOOS (1 y postoperatively)	50.4 (34.5)	50.2 (33.5)	.904
VR-12 mental (preoperatively)	51.5 (16.4)	37.8 (22.5)	<.001
VR-12 mental (6 wk postoperatively)	53.4 (16.9)	51.4 (17.8)	.066
VR-12 mental (1 y postoperatively)	52.6 (17.7)	55.0 (15.2)	.011
VR-12 physical (preoperatively)	31.6 (13.0)	34.5 (14.6)	<.001
VR-12 physical (6 wk postoperatively)	39.9 (15.7)	38.0 (14.2)	.037
VR-12 physical (1 y postoperatively)	39.8 (16.0)	39.5 (15.4)	.796

SD, standard deviation; HOOS, Hip disability Osteoarthritis Outcome Score; KOOS, Knee injury and Osteoarthritis Outcome Score; VR-12, Veterans Rand 12-Item Health Survey.

did have a higher rate of discharge to a rehabilitation facility (18% vs 12%; $P = .006$). The most common complications postoperatively included anemia (6%) and electrolyte imbalance (1%).

Although African American patients had lower preoperative HOOS/KOOS (33.5 vs 45.1; $P < .001$) and mental VR-12 scores (37.8 vs 51.5; $P < .001$) compared with Caucasian patients, there was no clinical difference at 1 year in HOOS/KOOS (50.2 vs 50.4), mental VR-12 (55.0 vs 52.6), or physical VR-12 scores (39.5 vs 39.8) (Table 2). Although some of the differences in these scores reached statistical significance, they were not considered clinically significant. Compared with Caucasians, African American patients made higher improvements in both HOOS/KOOS (5.3, 16.7 increase; $P < .001$) and VR-12 mental (1.1 vs 14.8 increase, $P < .001$) from preoperative to 1-year follow-up but no difference in the changes to VR-12 physical score (8.2 vs 5.0 increase; $P = .4201$). African Americans had a higher number of TKA in our cohort. However, when we did a subgroup analysis in both THA and TKA, there was no significant difference in HOOS/KOOS or VR-12 scores at any time point, preoperatively, at 6 weeks, or at 1 year (all $P > .05$). When controlling for confounding variables, African American race was associated with increased rates of discharge to a rehabilitation facility (odds ratio [OR], 1.69; 95% confidence interval [95% CI], 1.34–2.13; $P < .001$) (Table 3) but no difference in readmissions (OR, 0.92; 95% CI, 0.54–1.51; $P = .754$) (Table 3) and postoperative complications (OR, 0.96; 95% CI, 0.69–1.30; $P = .783$) (Table 3).

Discussion

Identifying areas where racial disparities exist in TJA is essential to improving outcomes and ensuring adequate access to care. Several studies have demonstrated African American race as a risk factor for inferior outcomes after THA and TKA. Importantly, a recent study showed persistence of these disparities up to 2015 [20]. The extent of these disparities in modern value-based health care models and with the use of modern TJA protocols is not well understood. In this large single-institutional study, we examined differences in complications, readmissions, and discharge disposition as a proxy for episode-of-care resource utilization among racial groups after primary THA and TKA. Indeed, higher rehabilitation facility admission is an important part of postcare utilization cost that is associated to traditional and alternative payment models. Similar to other studies,

we did find higher rates of diabetes, obesity, smoking, and pulmonary disease among African Americans; however, African American patients were younger on average compared with Caucasian patients, which can partly explain this. Although we report no significant differences in overall complication rates, we did find a

Table 3
Multivariate Logistic Regression Identifying Independent Risk Factors for Discharge to a Rehabilitation Facility, 90-Days Readmissions, and Complications.

Risk Factor	OR	95% CI	P
Discharge to a rehabilitation facility			
African American race	1.82	1.41–2.33	<.001
Age	1.05	1.03–1.06	<.001
Male gender	0.52	0.41–0.65	<.001
BMI	1.01	0.99–1.03	.344
TKA	1.33	1.07–1.67	.012
History of depression	1.32	0.97–1.77	.071
History of anxiety	1.26	0.81–1.91	.296
CCI—age adjusted	1.15	1.06–1.25	.001
ASA class	1.73	1.38–2.18	<.001
Smoking history	0.96	0.59–1.51	.869
90-d readmission			
Race	0.97	0.55–1.62	.907
Age	0.95	0.92–0.97	<.001
Gender	0.97	0.62–1.51	.885
BMI	1.00	0.96–1.04	.891
Joint	1.19	0.75–1.87	.464
History of depression	1.63	0.91–2.81	.088
History of anxiety	0.58	0.19–1.42	.272
CCI—age adjusted	1.03	0.84–1.21	.776
ASA class	1.83	1.19–2.84	.006
Smoking	1.17	0.51–2.36	.686
Complications			
Race	1.18	0.87–1.60	.279
Age	0.99	0.98–1.01	.292
Gender	0.83	0.64–1.07	.145
BMI	0.99	0.97–1.02	.513
Joint	0.70	0.54–0.90	.006
History of depression	0.88	0.60–1.27	.508
History of anxiety	1.16	0.68–1.90	.568
CCI—age adjusted	1.46	1.34–1.59	<.001
ASA class	1.44	1.12–1.86	.005
Smoking	0.45	0.45–1.36	.452

OR, odds ratio; 95% CI, 95% confidence interval; BMI, body mass index; TKA, total knee arthroplasty; CCI, Charlson comorbidity index; ASA, American Society of Anesthesiologists.

significantly higher rate of discharge to rehabilitation facilities in the African American population. These results are reassuring and show evidence of a better perioperative management of the TJA patients compared with previous years [20].

In this study, we found that African American patients present to the office before undergoing THA and TKA with a significantly lower joint functionality and mental burden scores compared with Caucasian patients. Mental health, as assessed by VR-12, was our most concerning finding and showed a clinically significant lower presentation in African American patients. Pain and osteoarthritis severity have been shown to affect mental component significantly [21–23] in previous studies, which might explain these lower results. As noted, African Americans are more likely to present to the office with increased pain and disease severity levels. In addition, prior studies have examined depression as playing an important role in the preoperative mental health score [24–26], although our cohort did not show any differences in depression rates between groups. Although the VR-12 score is not joint specific, African American patients also reported lower HOOS/KOOS scores preoperatively as well. A new finding to our study, however, was that African American patients made improved functional gains. Importantly, we found that African Americans demonstrated a significantly greater improvement in VR-12 mental scores and HOOS/KOOS scores at 1-year follow-up, compared with the Caucasian cohort. This demonstrates the efficacy and importance of both THA and TKA as a meaningful and effective treatment strategy in this patient population.

The significantly higher rates of discharge to a rehabilitation facility for the African American cohort may have significant impact on access to care. Implementation of value-based programs for TJA in the United States has increased during the last decade, and it has correspondingly increased concern for reducing cost of care [27]. Reducing rates of discharge to rehabilitation facilities have been identified as critical factors in success with these value-based programs [28]. Although we did not examine this in our study, the higher rates of utilization of rehabilitation facilities in African Americans can translate to increase costs and disincentivize hospitals to care for this population. The reasons for these higher rates associated with this cohort are still not clear, but it is likely because of social factors that were not evaluated in this study. Previous studies report that medical comorbidities may play a role in poorer outcomes for African Americans [29–31], but notably, we did not find any evidence of this, even after adjusting for age on our comorbidity index. In fact, we found an overall lower comorbidity index for the African American patients compared with the Caucasian patients in this study. Even if a specific cause cannot be identified, it may be important for sponsoring programs, such as private insurers and the Centers for Medicare and Medicaid Services, to acknowledge these higher costs and adjust payment models accordingly.

There were several limitations to this study. As with any retrospective database cohort study, there can be baseline differences between the 2 cohorts not identified in the database. We did not evaluate social factors, such as marital status, family help at home, or other variables, which may explain the higher rates of discharge to a rehabilitation facility. Our data were only from 1 institution across 2 hospitals in 1 geographic area, and results cannot be generalized to other facilities and rural centers.

This study further demonstrates disparities in preoperative presentation and postoperative outcomes in TJA. African American race is associated with lower preoperative mental and functional burden scores but similar or greater postoperative improvement in these scores. Although our findings may not be generalizable to all institutions, we show evidence that African American patients should not be denied arthroplasty care based on their ethnicity as

they had improved functional outcomes. Although we demonstrated no significant difference in complication rates, further studies should assess social and economic causes for the increase in rehabilitation utilization rates in minority patients.

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