

Hemiarthroplasty or Total Hip Arthroplasty: Is There a Racial Bias in Treatment Selection for Femoral Neck Fractures?

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Abstract

Introduction: Hip fractures in the elderly individuals are associated with significant morbidity and mortality, and outcomes are directly related to prompt surgical intervention with either total hip arthroplasty (THA) or hemiarthroplasty. Minority hip fracture patients have increased delays to surgical intervention and poorer functional outcomes. This study explored racial biases in the surgical treatment decision between THA and hemiarthroplasty for displaced femoral neck fractures as well as racial disparities in postoperative complications, readmission rates, and 30-day mortality. **Methods:** We retrospectively reviewed the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) from 2006 to 2014. Patients were identified using diagnosis code for transcervical femoral neck fractures and Current Procedural Terminology codes for THA or hemiarthroplasty. A multivariable regression analysis was conducted including race, demographic information, and medical comorbidities. **Results:** Of 11 408 patients, race was recorded in 8538 individuals. Most patients were white (88.3%), followed by Hispanic (4.7%), African American (4.1%), and Asian/Native Hawaiian/Pacific Islander/American Indian/Alaska Native (2.9%). No differences were observed in the likelihood of receiving a THA versus hemiarthroplasty among racial groups. Only younger age and steroid use were independent risk factors for receiving a THA. Race was significantly associated with postoperative mortality ($P = .014$) and major postoperative complications for the Asian cohort ($P = .013$). **Discussion:** The NSQIP data do not support a racial bias in the selection of patients for THA versus hemiarthroplasty. However, this study found racial disparities in postoperative mortality and complications. The reasons underlying the differences in postoperative outcomes are uncertain but may be the result of specific challenges to accessing care. **Conclusion:** There was no racial bias in the treatment of femoral neck fractures. However, there were racial disparities in postoperative mortality and complication rates. Further research is warranted to elucidate the true causes of these observed disparities.

Keywords

fragility fractures, geriatric trauma, systems of care, femoral neck fractures, disparity

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Introduction

Hip fractures represent a common yet devastating trauma in the elderly population, with over 250 000 hip fractures annually in the United States.¹ The projected proportion of minorities who experience fragility fractures is projected to increase from 14% to 21% by 2025.²⁻⁵ Surgical intervention, including hemiarthroplasty and total hip arthroplasty (THA), remains the standard of care for nearly all types of hip fracture.^{6,7} The benefits of hemiarthroplasty include shorter operative time, a less complicated operation, and lower cost.^{8,9} Total hip arthroplasty is a more complicated procedure associated with higher costs and longer operative time but improved postoperative functional scores and

decreased pain.⁸⁻¹⁰ The reduction in 30-day mortality observed with prompt surgical intervention underscores the importance of access to prompt and appropriate care.¹¹

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Table 1. Distribution of Patients by Race and Procedure.

Procedure	White, n = 7537	Black, n = 346	Hispanic, n = 405	Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, n = 250	Total, N = 8538
Hemiarthroplasty, n = 7611	88.3%	4.0%	4.7%	3.0%	89.1%
Total hip arthroplasty, n = 927	88.2%	4.3%	4.9%	2.6%	10.9%
Total	88.3%	4.1%	4.7%	2.9%	100%

Table 2. Predictive Factors for Total Hip Arthroplasty Versus Hemiarthroplasty.

Predictive Factor	Odds Ratio	95% Confidence Interval	P Value
Age	0.730	0.625 ~ 0.854	<.001
Female	0.822	0.557 ~ 1.214	.324
Race			
Caucasian	Ref	Ref	Ref
Black	0.716	0.319 ~ 1.609	.419
Hispanic	1.007	0.504 ~ 2.012	.985
Asian, Native Hawaiian/Pacific Islander, American Indian	0.390	0.049 ~ 3.119	.375
Operation year	0.963	0.853 ~ 1.086	.538
Diabetes			
Non-insulin dependent	1.077	0.618 ~ 1.879	.792
Insulin dependent	1.099	0.521 ~ 2.319	.805
Dyspnea			
At rest	0.825	0.444 ~ 1.532	.542
Moderate exertion	0.678	0.219 ~ 2.098	.500
Functional status			
Independent	Ref	Ref	Ref
Dependent	0.941	0.706 ~ 1.255	.681
Chronic obstructive pulmonary disease (COPD)	0.711	0.386 ~ 1.309	.273
Liver disease	2.178	0.191 ~ 24.84	.531
Congestive heart failure	0.957	0.348 ~ 2.627	.931
Coronary artery disease	1.189	0.0751 ~ 1.883	.460
Hypertension	1.593	1.038 ~ 2.445	.033
Peripheral vascular disease	0.135	0.018 ~ 1.007	.051
Renal failure	0.175	0.023 ~ 1.341	.093
Central nervous system disorder	0.925	0.597 ~ 1.434	.728
Spinal cord injury		Omitted	
Surgery within the last 30 days	2.221	0.434 ~ 11.36	.338
Steroid use for chronic condition	1.937	1.056 ~ 3.552	.033

Minorities may be at a disadvantage in both access to and quality of care. In 2001, the Institute of Medicine (IOM) released a report that highlighted extensive health-care disparities among minorities, prompting extensive research and public health initiatives to improve health-care access.¹² This change has been slow to achieve realization. Eight years after the IOM report, Dy et al reported that African American patients in New York State were at greater risk for both delayed surgery and 1-year mortality.¹³ Among minorities, mortality after hip fracture remains higher among African American women compared to white women.¹⁴

No study currently exists that examines racial disparities in the treatment selection for displaced femoral neck fractures. Therefore, the purpose of the current study is to (1) ascertain racial biases in surgical treatment decision for displaced femoral neck fractures, (2) perform a multivariable regression analysis to identify additional independent risk factors for

treatment decision, and (3) identify differences in postoperative outcomes, including complications, readmission rates, and 30-day mortality.

Methods

A retrospective study was performed utilizing data available through the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) from 2006 through 2014. Patients were identified using postoperative diagnosis codes for transcervical femoral neck fractures (*International Classification of Diseases, Ninth Revision*: 820, 820.0, 820.00, 820.01, 820.02, 820.03, and 820.09) and Current Procedural Terminology (CPT) codes for THA (CPT 27130) or hemiarthroplasty (CPT 27236, 27125).

A multivariable regression analysis was conducted including race as well as additional potential independent risk factors

Table 3. Complications and Mortality by Race.

Outcome	White, n = 7537	Black, n = 346	Hispanic, n = 405	Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native, n = 250	P
Infection	1.4%	1.9%	1.7%	2.0%	.209
Cardiopulmonary complication	1.0%	1.2%	0.9%	1.1%	.863
Any major complication	5.2%	5.3%	4.6%	6.7%	.013
Mortality	0.3%	0.4%	0.3%	0.9%	.014
Readmission	4.2%	4.7%	3.9%	4.3%	.588

for treatment decision for THA versus hemiarthroplasty. Additional factors included demographic information (age, gender, and year of operation), medical comorbidities (diabetes, presence of dyspnea, functional status, chronic obstructive pulmonary disease, liver disease, congestive heart failure, coronary artery disease, hypertension, peripheral vascular disease, renal failure, central nervous system disorder, and steroid use), and history of surgery within 30 days of treatment for hip fracture. Postoperative outcomes included complications (any infection, cardiopulmonary, or any major complication), readmission rate, and 30-day mortality.

Statistical Analysis

All statistical calculations were conducted using StataIC Version 14.1 (StataCorp, College Station, Texas). All data were subject to descriptive statistical analysis yielding frequency scores for categorical data and measures of central tendency (mean [standard deviation, SD]) for continuous/interval data. Statistically significant differences between variables were then determined using chi-Square test and the Student *t* test. A *P* value <.05 was considered statistically significant.

Results

Racial Biases in Treatment Selection

A total of 11 408 patients, identified with a diagnosis for femoral neck fracture, were treated with either THA or hemiarthroplasty. Race was recorded in 8538 patients (Table 1). The majority of patients were white (88.28%), followed by Hispanic (4.74%), African American (4.05%), and Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native (2.93%). No differences were observed in the likelihood of receiving a THA versus hemiarthroplasty among different racial groups (Table 2).

Independent Risk Factors for THA

Among predictive factors for THA versus hemiarthroplasty, only younger age and the use of steroids were predicted receiving a THA (Table 2). Age represented a negative predictor to receive a THA (odds ratio [OR] = 0.730, 95% confidence interval [CI]: 0.625-0.854, *P* < .001). Patients reporting steroid use for a chronic condition were almost twice as likely to receive a THA (OR = 1.937, 95% CI: 1.056-3.552,

P = .033). Gender, race, and operation year were not predictive of treatment selection.

Postoperative Outcomes

Analysis of postoperative outcomes revealed that there was an association between race and complications as well as 30-day mortality, but there was no association with readmission rates (Table 3). Among complications, race was significantly associated with a major postoperative complication for patients identifying as “Asian, Native American/Pacific Islander, American Indian/Alaska Native” compared to other groups (*P* = .013). There were no other racial correlations observed, including infection (*P* = .209) or cardiopulmonary complications (*P* = .863). Race was significantly associated with postoperative mortality ($\chi^2 = 10.62$, *P* = .014). There were no significant associations observed between race and readmission rate (*P* = .588).

Discussion

Minimizing disparities in hip fracture care is crucial to reducing morbidity and mortality. This study analyzed a national database for 11 408 patients undergoing THA or hemiarthroplasty to discern racial biases in surgical treatment decision, differences in postoperative outcomes, and independent risk factors for treatment decision. Multivariable analysis did not support a racial bias in the treatment decision of THA versus hemiarthroplasty. However, racial disparities in postoperative mortality persist.

Femoral neck fracture represents a devastating trauma in the elderly population and is most commonly treated with THA or hemiarthroplasty. Nonoperative intervention may be considered for patients too medically ill to undergo surgery but generally results in a painful, functionless hip and resultant immobility.⁷ Despite these poor outcomes, Neuman et al demonstrated that African American patients were 79% more likely to receive nonoperative management than white patients.⁶ In our study, there were no differences in the proportion of minority patients who received a THA versus hemiarthroplasty. In accordance with prior studies, we found that increased postoperative mortality was associated with race (*P* = .014).^{14,15}

Analysis of additional risk factors revealed several interesting results (Table 2). Advanced age was a negative predictive

factor for receiving a THA (OR = 0.730, 95% CI: 0.625-0.854, $P < .001$). This is consistent with general treatment recommendations that hemiarthroplasty is reserved for older, less active individuals. Operation year was not predictive of treatment selection, which is interesting as multiple recent studies have highlighted the benefits and safety of THA in the setting of femoral neck fracture.⁸⁻¹⁰ Since the analysis concluded in 2014, it is possible that the data did not capture this relatively newer trend in hip fracture management. Use of steroids for a chronic medical condition was a significant predictor to receive a THA rather than a hemiarthroplasty (OR = 1.937, 95% CI: 1.056-3.552, $P = .033$). Although patients who are medically ill are generally less likely to receive more invasive procedures, it is possible that many of these patients were on chronic steroids for rheumatoid arthritis. Recent evidence has demonstrated lower complication and reoperations rates with THA in this population compared to alternative methods of fixation.¹⁶ Alternatively, patients with chronic steroid use are at increased risk of fracture at a younger age, leading to preferential treatment with THA in a younger population.

The current data suggest that a subset of minority patients identifying as “Asian, Native Hawaiian/Pacific Islander, American Indian/Alaska Native” may be at higher risk for major postoperative complications. However, due to the retrospective nature of this study, the exact reason for this remains unknown. This finding aligns with work by Dy et al who found that Asian patients experienced greater delays in surgery for hip fracture relative to white patients.¹³ Although there is a lower hip fracture risk documented among Asian patients, few studies have examined disparities in care for this population.¹⁷ While some researchers hypothesize that differences in bone microarchitecture may underlie differences in fracture risk and postoperative outcomes, it is likely that additional patient characteristics—including comorbid conditions, socioeconomic status, and culture—are influencing treatment outcomes.^{17,18} Among all minority patients, research has shown less preventative screening and treatment of osteoporosis,¹⁹⁻²¹ increased delays to surgical care,¹³ and increased difficulty accessing postoperative care,^{12,22} readmission risk,¹³ and overall mortality.^{14,15} Future research should explore the potential causes of this disparity and specific challenges underlying access to care for the Asian population.

This study has several limitations. First, this is a retrospective study and therefore subject to flaws and biases of data coding, capture, and collection. Second, the decision to perform a THA in the setting of femoral neck fracture is often influenced by discussion with the patient regarding preexisting symptoms of arthritis, including functional and antecedent hip or groin pain. As this study was conducted using an established data set, we were unable to assess these potential patient-related factors. We did attempt to use functional status as a surrogate marker but did not find any differences in treatment decision. Importantly, race was documented in only 8538 (74.8%) of 11 408 patients, potentially biasing our population. The majority of our study population included white patients, with far fewer numbers of minorities. This prevalence is

consistent with prior reports of increased incidence of femoral neck fracture in white patients, particularly women.²

Conclusions

In summary, this study presents an analysis of the NSQIP data set from 2006 to 2014 regarding the influence of race on treatment selection and outcomes following femoral neck fractures. The current data do not support a racial bias in the selection of THA versus hemiarthroplasty in this patient population but did highlight racial disparities in postoperative mortality among all racial minorities as well as postoperative complications in 1 group of minorities. Further research is warranted to elucidate the true causes of these observed disparities.

Declaration of Conflicting Interests

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References

1. Florschutz AV, Langford JR, Haidukewych GJ, Koval KJ. Femoral neck fractures: current management. *J Orthop Trauma*. 2015;29(3):121-129. doi:10.1097/BOT.0000000000000291.
2. Cauley JA. Defining ethnic and racial differences in osteoporosis and fragility fractures. *Clin Orthop Relat Res*. 2011;469(7):1891-1899. doi:10.1007/s11999-011-1863-5.
3. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet*. 2002;359(9319):1761-1767. doi:10.1016/S0140-6736(02)08657-9.
4. Kanis JA, Johnell O, De Laet C, Jonsson B, Oden A, Ogelsby AK. International variations in hip fracture probabilities: implications for risk assessment. *J Bone Miner Res*. 2002;17(7):1237-1244. doi:10.1359/jbmr.2002.17.7.1237.
5. Burge R, Dawson-Hughes B, Solomon DH, Wong JB, King A, Tosteson A. Incidence and economic burden of osteoporosis-related fractures in the United States, 2005-2025. *J Bone Miner Res*. 2007;22(3):465-475. doi:10.1359/jbmr.061113.
6. Neuman MD, Fleisher LA, Even-Shoshan O, Mi L, Silber JH. Nonoperative care for hip fracture in the elderly: the influence of race, income, and comorbidities. *Med Care*. 2010;48(4):314-320.
7. Parker M, Johansen A. Hip fracture. *BMJ*. 2006;333(7557):27-30. doi:10.1136/bmj.333.7557.27.
8. Sharma V. Outcome analysis of hemiarthroplasty vs. total hip replacement in displaced femoral neck fractures in the elderly. *J Clin Diagn Res*. 2016. doi:10.7860/JCDR/2016/18638.7877.
9. SooHoo NF, Farnig E, Chambers L, Znigmond DS, Lieberman JR. Comparison of complication rates between hemiarthroplasty and total hip arthroplasty for intracapsular hip fractures. *Orthopedics*. 2013;36(4):e384-e389. doi:10.3928/01477447-20130327-09.
10. Macaulay W, Nellans KW, Garvin KL, Iorio R, Healy WL, Rosenwasser MP. Prospective randomized clinical trial

- comparing hemiarthroplasty to total hip arthroplasty in the treatment of displaced femoral neck fractures. *J Arthroplasty*. 2008; 23(6):2-8. doi:10.1016/j.arth.2008.05.013.
11. Nyholm AM, Gromov K, Palm H, Brix M, Kallemose T, Troelsen A. Time to surgery is associated with thirty-day and ninety-day mortality after proximal femoral fracture: a retrospective observational study on prospectively collected data from the Danish Fracture Database Collaborators. *J Bone Jt Surg-Am Vol*. 2015;97(16): 1333-1339. doi:10.2106/JBJS.O.00029.
 12. Institute of Medicine (US) Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. In: Smedley BD, Stith AY, Nelson AR, eds. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Health Care*. Washington, DC: National Academies Press; 2003. <http://www.ncbi.nlm.nih.gov/books/NBK220358/>. Accessed March 4, 2018.
 13. Dy CJ, Lane JM, Pan TJ, Parks ML, Lyman S. Racial and socioeconomic disparities in hip fracture care. *J Bone Jt Surg*. 2016; 98(10):858-865. doi:10.2106/JBJS.15.00676.
 14. Jacobsen SJ, Goldberg J, Miles TP, Brody JA, Stiers W, Rimm AA. Race and sex differences in mortality following fracture of the hip. *Am J Public Health*. 1992;82(8):1147-1150.
 15. Strong BL, Torain JM, Greene CR, Smith GS. Outcomes of trauma admission for falls: influence of race and age on in-hospital and post-discharge mortality. *Am J Surg*. 2016;212(4):638-644. doi:10.1016/j.amjsurg.2016.06.002.
 16. Cao L, Wang B, Li M, et al. Closed reduction and internal fixation versus total hip arthroplasty for displaced femoral neck fracture. *Chin J Traumatol Zhonghua Chuang Shang Za Zhi*. 2014;17(2): 63-68.
 17. Barrett-Connor E, Siris ES, Wehren LE, et al. Osteoporosis and fracture risk in women of different ethnic groups. *J Bone Miner Res*. 2004;20(2):185-194. doi:10.1359/JBMR.041007.
 18. Walker MD, McMahon DJ, Udesky J, Liu G, Bilezikian JP. Application of high-resolution skeletal imaging to measurements of volumetric BMD and Skeletal Microarchitecture in Chinese-American and white women: explanation of a Paradox. *J Bone Miner Res*. 2009;24(12):1953-1959. doi:10.1359/jbmr.090528.
 19. Cheng H, Gary LC, Curtis JR, et al. Estimated prevalence and patterns of presumed osteoporosis among older Americans based on Medicare data. *Osteoporos Int*. 2009;20(9):1507-1515. doi:10.1007/s00198-009-0835-z.
 20. Curtis JR, Carbone L, Cheng H, et al. Longitudinal trends in use of bone mass measurement among older Americans, 1999-2005. *J Bone Miner Res*. 2008;23(7):1061-1067. doi:10.1359/jbmr.080232.
 21. Curtis JR, McClure LA, Delzell E, et al. Population-based fracture risk assessment and osteoporosis treatment disparities by race and gender. *J Gen Intern Med*. 2009;24(8):956-962. doi:10.1007/s11606-009-1031-8.
 22. Nguyen-Oghalai TU, Ottenbacher KJ, Kuo Y, et al. Disparities in utilization of outpatient rehabilitative care following hip fracture hospitalization with respect to race and ethnicity. *Arch Phys Med Rehabil*. 2009;90(4):560-563. doi:10.1016/j.apmr.2008.10.021.