

Gender and Race/Ethnicity Differences in Hip Fracture Incidence, Morbidity, Mortality, and Function

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Abstract

Background Hip fracture is an international public health problem. Worldwide, approximately 1.5 million hip fractures occur per year, with roughly 340,000 in the United States in individuals older than 65 years. In 2050, there will be an estimated 3.9 million fractures worldwide, with more than 700,000 in the United States. However, whether there are disparities in morbidity, mortality, and function between men and women or between races/ethnicities is unclear.

Questions/purposes The purpose of this article is to review the gender and racial/ethnicity differences in hip fracture epidemiology, mortality, and function and to ask what more information is needed and how can it be attained.

Methods A PubMed literature review was performed and appropriate articles selected for inclusion in the review.

Where are we now? Overall, men with hip fracture are younger, are less healthy, and have a higher postoperative mortality and morbidity. African American and Hispanics patients with hip fractures are younger than whites and have a higher incidence of fracture in men. Non-Hispanic black, Hispanic, and Asian race/ethnicity were all associated with higher odds of discharge home but a longer stay when discharged to rehabilitation.

Where do we need to go? Expanded knowledge of the influence of gender and race/ethnicity on hip fracture epidemiology, mortality, and outcomes is necessary.

How do we get there? Additional focused research on gender and racial/ethnic differences in patients with hip fractures is needed. Improving database capture of race/ethnicity data will aid in population studies. Finally, journal editors should require authors to include gender and race/ethnicity data or explain the absence of this information.

Introduction

Hip fracture is a global public health concern. In the United States, 25% to 30% of hip fractures occur in men [24]. In 2004, femoral neck fractures occurred in 93,000 men older than 65 years compared to 236,000 in women [5]. While hip fracture rates have decreased for both men and women since 1995, the number of fractures continues to rise as the population ages, and it is estimated the number of hip fractures worldwide will increase from the 1.26 million in 1990 to 2.6 million in 2025 and 4.5 million in the 2050 [3, 12]. Most clinical trials and research on hip fracture outcomes have focused on women, particularly white women, as this is the demographic with the highest incidence of hip fracture [8]. While gender and race/ethnicity are recognized as important variables in the incidence of hip fracture, attention is now focusing on differences in epidemiology, mortality, and outcomes after hip fracture for each of these variables. The available data on gender and race/ethnicity differences in hip fracture remain limited. The prime problem is a lack of awareness of the medical community of the potentially important differences attributable to gender and race/ethnicity. Improved awareness

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will enable broader and higher-quality research initiatives to better elucidate the factors contributing to the differences seen in hip fracture epidemiology, mortality, and outcomes.

This article provides a review of the current literature regarding gender and race/ethnicity differences in (1) epidemiology, (2) morbidity and mortality, and (3) function in patients with hip fracture and discusses critical needs and how to achieve them to help patients with hip fractures of all genders, races, and ethnicities.

Search Strategy and Criteria

I performed a PubMed database search of the National Library of Medicine using the search headings “hip AND fracture AND outcome AND gender,” yielding 251 initial articles; “hip AND fracture AND outcome AND sex,” yielding 133 articles; “hip AND fracture AND outcome AND ethnicity,” yielding 38 articles; and “hip AND fracture AND outcome AND race,” yielding 49 articles. I then examined each article title and reviewed selected abstracts for appropriateness. Only English-language papers were considered. I further reviewed the references of selected articles for appropriate articles not discovered in the initial search.

Gender Differences in Epidemiology

Gender differences in the epidemiology of hip fracture are extensively reported. Men were younger than women by an average of 3 to 6 years in the majority of studies where patients with hip fractures were stratified by gender [2, 14, 17, 20, 32, 34]. In more than 25,000 patients from the Scottish Hip Fracture Audit [15], men were an average of 4 years younger than women at the time of fracture. Men with hip fractures are sicker than age-matched controls and women with hip fractures, based on comorbidity burden or American Society of Anesthesiologists (ASA) score [1, 2, 7, 14, 17, 25, 27]. In more than 41,000 patients from the Danish National Hospital Discharge Register [17], although men were younger than women (78.1 versus 81.7 years), they had more comorbidities, including cerebrovascular disease, any malignancy, congestive heart failure (CHF), chronic obstructive pulmonary disease (COPD), diabetes mellitus (with and without complications), peripheral vascular disease, myocardial infarction, renal disease, and liver disease. Hawkes et al. [14] reported similar findings in 674 hip fracture patients (152 men), with an average comorbidity burden of 2.57 in men and 1.65 in women. Specifically, men had a higher prevalence of cirrhosis/alcohol abuse, COPD, emphysema, asthma,

bronchitis, dizziness/balance problems, myocardial infarction, Parkinson’s disease, and stroke. While finding no difference in patient age or the number of comorbidities, Endo et al. [7] found men with hip fractures were sicker than women based on the ASA classification (odds ratio [OR], 1.9; $p < 0.001$).

Race/Ethnicity Differences in Epidemiology

There are some major differences in hip fracture epidemiology when race and ethnicity are examined. The gender ratio differs, with a female to male ratio of 2.9 in American whites and 1.5 in African Americans [4]. Nguyen-Oghalai et al. [23] analyzed 44,684 hip fractures and found major race/ethnicity differences in average age (white, 83.5 years; African American, 83.4 years; Hispanic, 82.6 years) and percentage of men (white, 23.9%; African American, 27.6%; Hispanic, 27%). There were also more whites with no or one comorbidity and more African Americans and Hispanics with two or more than three comorbidities. Becker et al. [2] found ethnic differences in 185 patients (white, 61.6%; Hispanic, 21.1%; African American, 16.2%) with 207 fragility fractures (63% hip fractures). African Americans and Hispanics were younger at the time of fracture, and both populations had more diabetes and hypertension, as well as differences in biochemical markers and dual-energy xray absorptiometry findings. African American patients had the highest bone mineral density (BMD), most severe vitamin D deficiency, and secondary hyperparathyroidism. The authors suggest screening this patient population for vitamin deficiency, rather than BMD, may be more predictive of fracture risk. When compared to white patients with hip fracture older than 65 years in the southwestern United States, Hispanics, African Americans, and Mexican Americans had a higher percentage of fractures occur under the age of 75 years (Mexican Americans, 48.2%; Hispanics, 32.7%; whites, 26.2%; African Americans, 21.3%), had more fractures in men (Mexican Americans, 43.6%; Hispanics, 37.7%; whites, 29.2%; African Americans, 29.4%), and had fewer additional diagnoses at admission (Mexican Americans, 4.41; Hispanics, 5.72; whites, 5.85; African Americans, 5.99) [30].

Native Americans also have an increased incidence of hip fracture. Over a 5-year period, 1991 to 1996, using a database for a single-payer healthcare system in one province of Canada, female Native Americans had an increase in the incidence of hip fracture compared with non-Indians (pooled OR, 1.82; confidence interval, 1.22–2.71) and male Native Americans had an incidence comparable to Native Americans females [31]. Pratt and Holloway [28] found Alaskan Inuit women to have twice the hip fracture incidence of US women for ages 65 to

69 years and 70 to 74 years between 1979 and 1989, and by 1996 to 1999, this was true for women up to age 84 years. Alaskan Inuit men had a lower incidence than Alaskan Inuit women but a higher incidence than US men between 1996 and 1999 for men younger than 85 years.

Gender Differences in Mortality

Mortality after hip fracture is substantially higher in men than women [7, 8, 14–17, 28, 33, 34]. In studies with large numbers of patients, the 1-year mortality for men ranged from 9.4% to 37.1%, compared with a range of 8.2% to 12.4% in women [7, 14, 29]. Differences in incidence, age, and mortality between women and men with hip fractures reported in various studies are summarized (Table 1). At 2 years, mortality in men was reported as high as 42%, compared to 23% for women [34]. In 786,717 patients with hip fractures from the Medicare Provider Analysis and Review (MedPAR) 1985 to 2005, Brauer et al. [3] showed a 20% decrease in 1-year mortality in men (from 40.6% to 32.6%) and an 8.8% decrease in women (from 25% to 21.6%), with the largest decreases occurring between 1985 and 1996. When compared to nonfracture controls, mortality increased for both men and women and continued to increase 10 years postfracture. The excess annual mortality is higher in men at all ages [10, 13]. Roche et al. [29] showed by multivariate analysis men have an increased risk of postoperative heart failure (OR, 1.8) and chest infection (OR, 2), and these patients have an increased mortality risk (OR, 5 and 2.4, respectively). Wehren et al. [34] found, at 1 and 2 years after hip fracture, both genders had an increased rate of observed to expected deaths due to cardiovascular disease, cerebrovascular disease, COPD, pneumonia, and septicemia. The rate ratio for pneumonia and septicemia was dramatically higher than the other causes, with men more likely to die from these causes than women (rate ratio, 23.81 and 87.91 for men, 7.46 and 36.72 for women). The difference in infectious causes of death persisted to 2 years postfracture and accounted for a

majority of the excess mortality of men in this study. Dementia also has a negative impact on mortality, and one cohort found no gender difference in mortality in cognitively intact patients (men, 20%; women, 17%) but a difference in patients with cognitive dysfunction (men, 56%; women, 40%) [31].

Race/Ethnicity Differences in Mortality

Since most studies of patients with hip fractures have focused on white populations (especially women), much less is known about race/ethnicity differences in mortality. Using Medicare claims data from 1986 to 1989, Lu-Yao et al. [21] found no difference between African Americans and whites in 90-day mortality, but African Americans had higher subsequent mortality in 3 years (rate ratio, 1.21). In 712,027 patients with hip fractures from the MedPAR 1984 to 1987, mortality was highest for men, with nearly identical rates for African American and white men, while white women had the lowest mortality rates [16]. Additionally, one study that pooled data from three hip fracture cohorts found higher survival at 6 months for whites compared with nonwhites (OR, 1.74) [26].

Gender Differences in Functional Outcomes

In survivors, functional outcomes between men and women are most often reported as equivalent or favoring men, although men are consistently reported as having more postoperative complications [6, 7, 9, 14, 18, 22, 26]. In 983 patients, a higher percentage of men had postoperative complications (21.4% of men versus 13.8% of women). Postoperative ambulatory status and basic and instrumental activities of daily living (ADL) were no different at 1 year between men and women [7]. Hawkes et al. [14] also reported more postoperative complications in men (confusion, pressure sores, CHF, renal failure) but no differences at 2 years in walking speed, chair rise speed,

Table 1. Summary of differences in hip fracture incidence, age, and mortality

Study	Study country	Years of study	Total number of patients	Percentage of women	Percentage of men	Women's average age (years)	Men's average age (years)	Women's mortality (%)	Men's mortality (%)
Endo et al. [7]	USA (New York)	1987–2000	983	79	21	79.6	80.1	9.4 (1 year)	16.5 (1 year)
Hawkes et al. [14]	USA (Maryland)	1990–1991	674	77	23	81.7	79.1	12.4 (1 year)	31.1 (1 year)
Holt et al. [15]	Scotland	1988–2005	25,649	78	22	81	77	18 (120 days)	27 (120 days)
Kannegaard et al. [17]	Denmark	1999–2002	42,076	73	27	81.7	78.1	26.4 (1 year)	37.1 (1 year)

walking 10 feet, walking one block, lower extremity ADL, instrumental ADL, depression, or Mini-Mental Status Examination. Stratifying by cognitive function, Samuelsson et al. [32] found more men than women walking independently at 2 years when cognitive function was intact but no difference when cognition was impaired. Studies of rehabilitation patients demonstrated no differences in admission and discharge Functional Independence Measure (FIM™) for men and women, although at discharge men were more independent in locomotion, transfers, and sphincter control [1, 19].

Race/Ethnicity Differences in Functional Outcomes

There is a lack of research on race/ethnicity in relation to hip fracture outcomes, and few studies have enough minority patients to draw meaningful conclusions. Graham et al. [11] examined 42,479 inpatient rehabilitation patients (91% non-Hispanic white, 4% non-Hispanic black, 4% Hispanic, and 1% Asian) using the Uniform Data System for Medical Rehabilitation. After adjusting for sociodemographic factors, case severity, and length of stay, non-Hispanic blacks and Hispanics had a lower discharge and followup FIM™ compared to non-Hispanic whites. Non-Hispanic blacks had less FIM™ improvement than non-Hispanic whites. Penrod et al. [26] found whites were more likely to walk independently or with help compared to nonwhites but found no difference in ADL independence at 6 months after injury. Whites had an advantage in mobility (and mortality) after controlling for prefracture mobility, function, age, comorbidity, and fracture type.

Discussion

Hip fracture is a public health problem internationally and more can be anticipated with aging populations. Most clinical trials and research focus on women, given they have the highest incidence of hip fracture. However, whether there are disparities in morbidity, mortality, and function between men and women or between races/ethnicities is unclear.

There are a number of limitations of this review. This review was a nonsystematic review by a single author. The articles chosen for inclusion did not meet predetermined explicit inclusion criteria and therefore studies of higher scientific quality may have been left out while others of lesser quality included. Second, only English language articles were considered and most of the articles focused on patients from the United States, limiting the generalizability of the conclusions to populations outside of the United States. The articles chosen were from a search of

only one database (PubMed) and not others (EMBASE, Google Scholar, etc.) that could have expanded the choice of articles for inclusion. The review has not addressed social, economic, or political systems that may have biased the data from individual studies due to differences in access and delivery of healthcare to the populations studied. Finally, because of the limited data available with regards to functional outcome, strong conclusions cannot be drawn that can be universally applied to individual patient populations.

Where are we now? Although the incidence of fracture has decreased for both men and women, the number of hip fractures continues to increase as the population ages and remains a major public health concern. There are substantial gender and race/ethnicity differences among patients with hip fractures. Men are younger (by 3–6 years) and sicker (more comorbidities or higher ASA score) than women who fracture, and African Americans and Hispanics are younger and sicker than whites who fracture. Mortality in men is as much as twice that of women, with excess mortality due to cardiovascular disease, pneumonia, and sepsis. Patients with hip fractures have excess mortality out to 10 years postfracture, and this excess is greater for men than for women. Blacks, Hispanics, Native Americans have higher mortality than whites, but little is understood about the influence of race/ethnicity in this difference. Functional outcomes in survivors favor whites, and men may have a slight advantage. The male advantage may be due to the elevated mortality in men, which leads to selection of the highest-functioning men available for study of function. Non-Hispanic blacks and Hispanics have lower and less FIM™ improvement than whites. Overall, there is a paucity of functional outcome studies addressing gender and race/ethnicity.

Where do we need to go? While our knowledge of gender and race/ethnicity differences and hip fracture epidemiology, mortality, and outcome has dramatically increased over the last 10 years, more research is needed. The large database analyses are from the 1980s, and hip fracture mortality has decreased since these data were captured. Reporting of race/ethnicity has only recently become incorporated into large patient databases and relatively little is known of its relationship to hip fracture. To further elucidate gender and race/ethnicity differences in hip fracture incidence, continued longitudinal study is needed, with improved collection of race/ethnicity data in the databases to better understand these relationships. There is a paucity of data on race/ethnicity, especially for Asians and Native Americans and this must be acknowledged and addressed. Outcome studies demonstrating the influence of gender and race/ethnicity are lacking in the literature and more concentrated study is needed here as well.

How do we get there? Further hip fracture research is the key need to help understand gender and racial/ethnic influence on epidemiology, mortality, and outcomes. The foundation for many of the needed studies has already been laid, but expanding the number of patients and continued longitudinal followup are needed to draw more meaningful conclusions, leading to improvements in prevention and postfracture care delivery. First, more complete inclusion of race/ethnicity data in patient databases will allow us to better understand the relationships existing between gender and race/ethnicity and hip fracture. The reporting of race/ethnicity cannot be an optional data point. Second, large cohort studies comparing patients of different gender and patients of different race/ethnicity must be undertaken with focus on both short- and long-term outcome. Within these studies, study of the biochemical changes occurring in the immediate postoperative period and beyond is needed to better understand the changes in patient physiology after hip fracture and the persistent increase in mortality after the early recovery. We need comprehensive studies of patient characteristics, demographics, biochemical markers, and function outcomes to understand the disparities that exist and to allow us to maximize patients' outcomes. Third, we must also consider the influence of healthcare delivery system as a variable. Most of the studies in this review were based on patients in the United States; however, in other countries with different healthcare delivery systems, the influence of gender and race/ethnicity may be substantially different, and the generalization of any of these studies should be undertaken with caution due to a lack of understanding of both the patient factors and healthcare delivery system factors, which may influence patient treatment and outcomes. Finally, researchers must understand the importance of including these data when reporting on hip fractures (or any osteoporotic fracture) and journal editors should require authors to include this information or provide an explanation for its absence.

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