Gender Differences in Functioning After Hip Fracture

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**Background.** Hip fracture is a significant health problem for men and women; between 25 and 30 percent of all hip fractures are sustained by men. Relatively little is known about gender differences in functional outcomes after hip fracture. The purpose of the current study is to compare post-hip fracture functional recovery of men and women.

**Methods.** A sample of 674 patients age 65 or older were recruited as part of the Baltimore Hip Studies and were followed longitudinally for 1 year following fracture. Information on prefracture status and hospital course of treatment was collected as well as functional data at baseline, 2, 6, and 12 months postfracture. Data were analyzed longitudinally using Generalized Estimating Equations (GEEs).

**Results.** Men in the study were generally younger and suffered greater comorbidity at time of fracture. Men further suffered higher mortality in the year following fracture. Among survivors, little difference between men and women was seen in patterns of recovery of function following fracture.

**Conclusions.** Hip fracture is not a problem affecting just women. Recovery following fracture for men is probably no better than that for women, even after mortality differentially eliminates the frailest male participants. However, psychosocial factors, greater comorbidity, and higher rates of certain complications among men may require adjustments to interventions designed to restore function. Further research into the consequences of hip fracture for men and women is needed.

Hip fracture is an important public health issue which deserves greater attention. At present, although men sustain 25%–30% of all hip fractures (1–3), relatively little is known about the consequences of hip fracture in men. Generalization from the experience of women who fracture their hips may be inadequate because many disease processes and clinical events affect men and women differently (4). For example, one consistent finding has been that mortality rates for men are roughly double those for women, and the magnitude of increase in mortality after hip fracture is greater for men than women even when compared to age-matched and gender-matched rates in the general population (3).

Hip fracture could assume even greater importance as a health concern for older men as life expectancy and secular increases in hip fracture continue. Within the next 20 years, the annual numbers of hip fractures in men will equal what is currently seen in women; by 2050 the incidence will triple from current levels, and men will represent a substantially greater proportion of the hip fracture population worldwide (1,5).

Physical functioning after hip fracture has important implications for health services utilization and quality of life. Gender differences in functional recovery may affect therapeutic and rehabilitative decision making. For example, as many as half of all women who were functioning independently at the time of hip fracture fail to recover; up to 25% remain in nursing homes or other assisted care facilities for a year or more (6,7). Because men who fracture their hips are generally younger and have more comorbidities than women who fracture, physical functioning in men may suffer even more. The few studies that have examined gender differences in functional recovery have reported either no difference (8–11) or a disadvantage for women (12). It is possible that these reports reflect the greater likelihood of mortality in men, which would presumably eliminate the sickest men, leaving a relatively higher functioning group.

In this report, functional recovery after hip fracture in a sample of men and women who were community-dwelling at the time of fracture was examined to evaluate differences in the ability to perform activities of daily living (ADLs) and levels of depression and cognitive functioning.

**METHODS**

**Participants**

Participants in this study were 674 community-dwelling persons (522 women, 152 men) aged 65 years or older admitted with an acute hip fracture (International Classification of Diseases, Ninth Revision [ICD9] code 820) to one of eight Baltimore area hospitals between January 1, 1990 and June 15, 1991. The eight hospitals included treated approximately two thirds of all hip fracture patients aged 65 or older admitted to all Baltimore area hospitals. Hip fracture discharges from these hospitals were similar to hip fracture discharges from other metropolitan hospitals in age, sex, race, and source of admission (home vs nursing home) (13). Patients presenting with pathological fractures or patients residing in a nursing home, hospital, or extended care facility at the time of fracture were excluded from this study.

Personnel trained in medical record abstraction obtained information on demographic and medical characteristics of patients from medical records in each of the study hospitals. Information about comorbid conditions was obtained through medical chart review. Abstractors reviewed the medical chart, including the surgical procedure on the
operative note and the prosthesis labels, to determine surgical procedure, type of fracture, and demographic characteristics of the patients.

Trained interviewers contacted patients in hospital and at 2, 6, 12, 18, and 24 months postfracture. Interviewers conducted retrospective assessment of prefracture ADLs as well as current cognitive status (via the Mini-Mental Status Examination [MMSE]) (14) and depressive symptoms (via the Center for Epidemiological Study Depression scale [CESD]) (15). When unavailable or if the MMSE score was less than 17, proxy interviews were conducted with individuals familiar with the patient. Follow-up interviews were used to determine patients’ functional levels including ADLs, CESD scores, MMSE scores, and performance measures such as time to walk 10 feet or rise from an armless chair.

**Measures**

Self-report measures of recovery as well as performance measures were collected. The self-report measures include Physical Activities of Daily Living requiring lower extremity functioning (or “LPADLs”), measured as a count of the number of activities in which the person required human and/or equipment assistance or was unable to perform. The 11 activities included were walking 10 feet or across a room; walking 1 block on a level sidewalk; climbing five stairs; getting into a car; getting into and out of bed; rising from an armless chair; putting on pants; putting socks and shoes on both feet; getting in/out of a bath or shower; taking a bath, shower, or sponge bath; and getting on and off the toilet. The LPADL scale ranged from 0 to 11, with higher scores representing worse functioning. Two of the individual LPADLs in this summary scale (walk 10 feet; walk 1 block) were also analyzed separately. These two measures were treated as dichotomous outcomes, where all patients unable to perform or requiring human and/or equipment assistance to perform the task were grouped as disabled and contrasted against all completely independent patients.

Instrumental ADLs (IADLs) were measured as the number of the following seven activities in which the person required human assistance or was unable to perform: using the telephone; getting to places out of walking distance; shopping; preparing meals; doing housecleaning; handling money; and taking medications. The IADL scale ranged from 0 to 7, with higher scores representing worse functioning.

Two performance measures were collected. The first, the ability to walk a short distance, was measured by observing patients performing a walk of up to 3 meters. The time to complete the walk was divided by the distance walked to derive a meters per second (mps) speed. Results were categorized using quartiles derived from published sources (16) for normal older patients. The quartile cutoffs were: 0.75–0.90 mps; >0.90–1.05 mps; and >1.05 mps. In addition, a bonus of 1 was added to the final score for patients able to perform without assistance (from a cane, walker, etc.). The scale ranged from 0 to 5, with higher scores representing better walking speed. The mean (and standard deviation [SD]) walking speed observed among patients able to walk at 12 months postfracture was 0.42 (SD = 0.26) mps for women and 0.44 (SD = 0.29) mps for men.

The second performance measure, the ability to rise from an armless chair, was measured by observing patients performing this activity. The time to completely rise (measured in seconds) was categorized using quartiles derived from unpublished sources (The Study of Osteoporotic Fractures; Principal Investigator: S. R. Cummings; Study Sites: Baltimore, Pittsburgh, Portland, and Minneapolis) for normal (no hip fracture) older patients. The quartile cutoffs were: >1.6 seconds; >1.3–1.6 seconds; 1.0–1.3 seconds; and <1.0 second. In addition, a bonus of 1 point was added to the final score for patients able to rise without using their arms. The scale ranged from 0 to 5, with higher scores representing faster rising (7). The mean (and SD) time to rise observed among patients able to rise at 12 months postfracture was 4.6 (SD = 8.8) seconds for women and 4.4 (SD = 5.5) seconds for men.

A modified Charlson comorbidity index (17) was created that reflected patients condition on admission. The index was developed by summing points awarded for each comorbid condition based on the following scheme: 1 point for myocardial infarction, congestive heart failure, deep venous thrombosis (DVT) or peripheral vascular disease, dementia or disorientation/confusion/delirium, chronic obstructive pulmonary disease (COPD), arthritis, ulcers, or diabetes; 2 points for cancer or stroke; 3 points for cirrhosis. The resulting score ranged from 0 to 15, with higher scores indicating poorer health status. Fracture type was classified as intertrochanteric or subcapital.

Cognitive status was assessed using the MMSE (14), a measure ranging from 0 to 30, with higher scores representing better cognitive status. Depressive symptoms were measured using the CESD scale (15). This scale ranges from 0 to 60, with higher scores indicating greater depression. Patients with scores greater than 16 were considered to be depressed.

**Statistics**

Longitudinal analyses were undertaken using Generalized Estimating Equations (GEEs) (18) using the STATA 6 procedure XTGEE (Stata Press, College Station, TX). The use of GEEs allows for robust standard error estimates and explicit modeling of covariance matrices, and is relatively tolerant of missing data. An independent covariance structure was specified to eliminate possible problems resulting from nonrandom patterns of missing data (19); however, the sandwich variance estimator was used to obtain robust standard error estimates. A model of the form:

\[
Y(t) = a + b1(X) + b2(t6) + b3(Xt6) + b4(t12) + b5(Xt12) + b6(t18) + b7(Xt18) + b8(t24) + b9(Xt24)
\]

was used, where \(Y(t)\) is the dependent variable at time \(t\); \(a\) is the intercept; \(X\) is an indicator variable for gender, where 0 = female, 1 = male; \(t6, t12, t18,\) and \(t24\) are time indicator variables for 6, 12, 18, and 24 months postfracture, respectively; and \(b1\) through \(b9\) are empirically derived regression coefficients.
A confounder analysis was undertaken for age, race, comorbidity, fracture type, overall prefracture functioning (the LPADL scale), and prefracture levels of each outcome variable. A rule was used whereby any factor that changed any of the regression coefficients by 20% or more was considered a confounder. To assure comparability across outcomes, factors defined as confounders for any variable were used as control variables in all analyses. The factors which met these criteria included age, race, comorbidity, overall prefracture functional level (LPADL), and the measured prefracture level of each outcome except MMSE and CESD scores (where no prefracture level existed).

### Results

Overall descriptive statistics for the 152 men and 522 women in this study are presented in Table 1. Although men were, on average, younger at the time of fracture (79.1 ± 7.4 years vs 81.7 ± 7.4 years, p < .001), they also had a heavier comorbid burden (2.6 ± 2.0 vs 1.7 ± 1.5 on the summary comorbidity scale described above, p < .001.) Men had higher rates of 12-month mortality (12.4% vs 31.1%, p < .001) and 24-month mortality (42.4% vs 20.4%, p = .001). In addition, there appeared to be trends in the data toward higher rates of disability in walking ADL status prefracture and more depression among men during the acute care stay.

Specific comorbidity conditions and symptoms that were more prevalent in men than women included cirrhosis/alcohol abuse (14.5% vs 3.1%, p < .001); COPD, emphysema, asthma, or bronchitis (26.3% vs 15.3%, p < .01); dizziness or balance problems (13.8% vs 8.0%, p < .05); myocardial infarction (18.4% vs 9.8%, p < .01); Parkinson’s disease (10.5% vs 2.3%, p < .001); and stroke.
Other comorbid conditions that were less prevalent in men were arthritis (20.4% vs 30.3%, p < .05); hypertension (34.9% vs 48.5%, p < .01); and diagnosed osteoporosis (4.6% vs 13.6%, p < .01).

After surgery, men were more likely to suffer from postoperative complications such as confusion (46.7% vs 32.8%, p < .01), pressure sores (21.7% vs 13.8%, p < .05), congestive heart failure (11.2% vs 5.8%, p < .05), and renal failure (5.9% vs 1.3%, p < .01).

Differences in eight areas of functional status over time (Table 2) were not statistically significant; however, rates of disability in self-reported ADLs often showed greater disability among men than women. This pattern was observed for walking 10 feet, walking 1 block, and the summary LPADL and IADL scales. No differences were observed for MMSE scores, CESD scores, and performance measures including walking speed and time to rise from a chair. The estimated standardized effect sizes and their 95% confidence intervals are presented in Figure 1. Standardized results are presented to allow comparison of effect sizes across different functional measures.

DISCUSSION

At the time of fracture, men were more likely to have pre-existing walking disability and comorbid illnesses than were women, despite being on average younger. Men were more likely to have a history of cirrhosis/alcohol abuse, chronic respiratory disease (COPD, emphysema, asthma, or bronchitis), myocardial infarction, Parkinson’s disease, peripheral vascular disease, or stroke. Most of these conditions would be expected to increase the likelihood of death and limitations in physical activity, and limit the extent of recuperation and rehabilitation possible, disproportionately affecting men. Mortality rates were approximately twice as high in men as in women, and nearly one third of men had died within 1 year after the fracture; by 2 years, more than 40% of men had died, compared to 20% of women. However, men and women who survived experienced comparable functional recovery after hip fracture, whether the outcome considered was lower extremity function, IADLs, cognitive status, or depression.

Recovery after hip fracture depends in large part on the prefracture health and functional ability of the patient, but not the sex of the patient. Men and women of comparable health status can be expected to experience similar functional recovery; survival after hip fracture depends on patient gender as well as on prefracture health. Earlier work has shown that patients with greater burdens of comorbid illness or functional limitation experience different short- and long-term patterns of mortality (20). Excess mortality among sicker and more impaired patients occurs within the first several months after fracture, whereas healthier patients are less likely to die soon after the fracture but continue to experience excess mortality over the long term. Although mortality is dependent on comorbidity and functional capacity, previous work suggests that gender differences in...
mortality are not explained by differences in comorbidity or functional ability (3).

The current research has important limitations that need to be recognized. Results based on community-dwelling patients may not be generalizable to institutionalized populations. The sample was not drawn solely with the goal of illuminating gender differences and was not powered to do so; real differences may exist which the current study was underpowered to detect. However, as shown in Figure 1, these data are consistent with small to moderate differences (from 0 to 0.5 SDs) in functioning as evidenced by the confidence intervals. Loss to follow-up due to mortality also limits the generalizability of these results to survivors of the acute fracture event. Although self-report and performance measures of a number of functional domains were available on 674 hip fracture patients representing a broad spectrum of fracture in the community-dwelling population, no measures of muscle, bone mineral density, or markers of bone formation and turnover were available, limiting the ability of the current study to examine mechanisms underlying the recovery process.

Further research needs to be conducted to better characterize differences in bone density, formation and turnover, as well as muscle, which may play a key role in recovery. Such differences may help in providing targeted rehabilitative services or pharmaceutical interventions. Differences in compliance with various interventions may exist, with implications for treatment. Finally, barriers to exercise may interfere due to patterns of physical frailty, comorbidity, and psychosocial considerations. All of these factors need to be studied more thoroughly to understand and reduce the impact of hip fracture on survival and functional recovery in men as well as women.

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