Background: Women are not aggressively treated for osteoporosis after hip fracture; the treatment status of men with hip fracture has not been extensively studied.

Objective: To evaluate the outcome and treatment status of men with hip fracture.

Methods: Data from medical records were obtained for 363 patients (110 men and 253 women) aged 50 years and older with atraumatic (low-energy) hip fracture who were admitted to St Luke's Episcopal Hospital between January 1, 1996, and December 31, 2000. Surveys were mailed to surviving patients. Main outcome variables were osteoporosis treatments (antiresorptive or calcium and vitamin D) at hospital discharge, current osteoporosis treatments at 1- to 5-year follow-up, bone mineral density testing, mortality, current disability, and living arrangements (home or institution).

Results: The mean age for men was 80 years vs 81 years for women. Most fractures (89% for men and 93% for women) resulted from falls from a standing height. At hospital discharge, 4.5% of men (n= 5) had treatment of any kind for osteoporosis, compared with 27% of women (n= 69) (P<.001). The 12-month mortality was 32% in men, compared with 17% in women (P = .003). Surveys were usable from 168 (87%) of 194 survivors. At 1- to 5-year follow-up, 27% (12/44) of men were taking treatment of any kind for osteoporosis, compared with 71% (88/124) of women (P<.001). Of those treated, 67% (8/12) of men and 32% (28/88) of women were taking calcium and vitamin D only. At 1- to 5-year follow-up, 11% of men had a bone mineral density measurement, compared with 27% of women. After hospital discharge, the number of men and women who required wheelchairs, walkers, and canes and who lived in institutions increased significantly.

Conclusions: The burden of hip fracture is illustrated by the high incidence of postfracture disability and the high mortality rate in both men and women. Nevertheless, few men receive antiresorptive treatment.
SUBJECTS AND METHODS

SUBJECTS

After study approval by the hospital’s institutional review board, a medical records query identified all patients admitted to St Luke’s Episcopal Hospital for hip fracture between January 1, 1996, and December 31, 2000. Among 456 fracture events that were identified, 363 (80%) met the eligibility criteria. Exclusions consisted of patients whose admitting physician refused to grant consent for medical chart review, patients younger than 50 years, patients with hemiparesis, patients with fractures that were related to a pathologic condition (metastatic disease, tumor, etc) or caused by high-energy traumatic injury (such as a motor vehicle crash), and patients with fractures 2 cm or more below the lesser trochanter. Eleven medical charts were missing or destroyed in the June 2001 flood caused by Tropical Storm Allison.

DATA COLLECTION AND OUTCOME MEASURES

Medical record review confirmed that fractures were intracapsular (29%), trochanteric (3%), or intertrochanteric (68%). Patient demographic information, number of comorbid conditions, cause of the fracture, medication at hospital admission and discharge, and radiology reports were also obtained from the medical record review.

Patients were then contacted via a mailed survey that requested information on prefracture and postfracture living arrangements (ie, home vs institution), disability, degree of independence in activities of daily living, history of new fractures since the incident hip fracture, whether they had a bone mineral density measurement, and current medications. If surveys were not returned within 2 weeks, patients or their next of kin (who were listed in the medical records) were contacted by telephone, and the surveys were completed by telephone interview or were remailed. Deaths were confirmed using the Social Security Death Index available on the Internet (available at: http://ssdi.genealogy.rootsweb.com).

The main outcome measures of interest were the percentage of men with osteoporosis treatment at hospital discharge, the percentage of men with osteoporosis treatment 1 to 5 years after fracture (as determined by the survey data), bone mineral density testing, 12-month mortality, living arrangements, and level of disability after fracture. Data were collected from women to provide a reference benchmark for comparison with men. Treatments were categorized as antiresorptive agents or calcium and vitamin D only. Antiresorptive agents included estrogen (any form of hormone replacement therapy), selective estrogen receptor modulators (eg, raloxifene hydrochloride), bisphosphonates (eg, alendronate sodium), and calcitonin. Testosterone was not considered a conventional treatment for osteoporosis. Although it may conceivably be beneficial in older men, there is little information in the literature to support its use as an osteoporosis treatment. In our cohort, it was administered to treat hypogonadism.

RESULTS

MEDICAL CHART REVIEW

Demographics

There were 110 men (mean age, 80 years; range, 53-99 years) and 253 women (mean age, 81 years; range, 51-101 years). The mean body mass index (calculated as [weight in kilograms divided by the square of height in meters]) was 24.7 for men and 22.6 for women. Eighty-five percent of men and 92% of women were white. Falls were the main cause of fractures in 89% of men and in 93% of women. The percentages of men with intracapsular fractures (27%) and extracapsular fractures (73%) were not significantly different (P=.45) from those in women (31% and 69%, respectively). The percentages of men having open reduction internal fixation (66%), hemiarthroplasty (15%), and total hip replacement (9%) as treatment for their hip fracture were not significantly different (P=.37) from the percentages for women with these treatments (65%, 17%, and 4%, respectively).

Osteoporosis Treatments

Only 5 men (4.5%) were taking treatment of any kind for osteoporosis at hospital discharge. Of these, 3 men (2.7% of the total) were taking antiresorptive treatment: 1 man was taking a bisphosphonate and 2 were taking calcitonin. Two men (1.8% of the total) were taking calcium and vitamin D treatment only. Table 1 and Figure 1 show the distribution of patients receiving each type of treatment. One man was taking bisphosphonate treatment and another was taking calcium and vitamin D before admission. Two of 5 men with hypogonadism were taking testosterone, but this was not considered as osteoporosis treatment. In contrast, 69 women (27%) were taking treatment of any kind for osteoporosis at hospital discharge. Nine women (3.6% of the total) were taking calcium and vitamin D only at discharge (Table 1 and Figure 1). Fifty-six (93%) of the 60 women taking an antiresorptive agent were taking treatment before the incident hip fracture. The differences between the numbers of men and women receiving treatment at discharge were statistically significant (P<.001) (Figure 1).

Fourteen men (13%) and 34 women (13%) had a previous hip fracture. One man (7%) and 5 women (15%)...
were taking antiresorptive therapy before their second hip fracture.

Eight men (7%) and 66 women (26%) had a history or diagnosis of osteoporosis recorded in their medical records (P < .001, men vs women). Twenty men (18%) and 78 women (31%) had an in-hospital radiograph report noting osteopenia or osteoporosis (P = .01, men vs women).

**Bone Mineral Density Testing**

One man and 3 women had notations in their medical records regarding bone mineral density measurements.

**Comorbid Conditions and Osteoporosis Risk Factors**

Information pertaining to comorbid conditions and osteoporosis risk factors was not uniformly documented in the medical records. Forty-seven men (43%) and 86 women (34%) (this difference was not statistically significant; P = .12) had a history of 5 or more concurrent medical conditions, including osteoarthritis, diabetes mellitus, hypertension, cancer, coronary artery disease, end-stage renal disease, chronic obstructive pulmonary disease, congestive heart failure, systemic lupus erythematosus, Alzheimer disease, other dementias, chronic liver disease, stroke, arrhythmia, thyroid disease, diverticulitis, and peptic ulcer disease. The percentages of men and women with notations regarding corticosteroid medication, smoking, excessive use of alcohol, and dementia were approximately the same. However, these risk factors were not consistently documented; thus, these data were deemed incomplete and statistical analyses were not performed.

**Mortality**

At 12 months after discharge, 32% of men had died, compared with 17% of women (P = .003). Overall mortality in this cohort was 58% for men and 42% for women (P = .004) (Table 2). There was a significant and linear relationship between 12-month mortality and age (r = 0.89, P < .001). There were no differences in mortality rates between patients with intracapsular fractures vs those with extracapsular fractures (P = .45). The cumulative mortality was not significantly higher in men and women with a prior fracture (P = .75). However, men with 5 or more comorbid conditions had a cumulative mortality of 75%, which was significantly higher than that of men with fewer than 5 comorbid conditions (46%) (P = .003). Similarly, women with 5 or more comorbid conditions had a cumulative mortality of 65%, which was higher than that of women with fewer than 5 comorbid conditions (29%) (P < .001). The cumulative mortality rates for men and women with 5 or more comorbid conditions were not significantly different (P = .33).

**SURVEY RESULTS**

**Response Rate**

Complete survey information was obtained from 168 (87%) of 194 surviving patients; 15 surveys were incomplete or internally inconsistent and thus not usable, and

**Table 2. Mortality With Time After Fracture**

<table>
<thead>
<tr>
<th>Years Since Fracture</th>
<th>Men</th>
<th>Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7/17 (41.2)</td>
<td>13/53 (24.5)</td>
</tr>
<tr>
<td>2</td>
<td>13/26 (50.0)</td>
<td>11/47 (23.4)</td>
</tr>
<tr>
<td>3</td>
<td>15/28 (53.6)</td>
<td>28/66 (42.4)</td>
</tr>
<tr>
<td>4</td>
<td>12/17 (70.6)</td>
<td>18/33 (54.5)</td>
</tr>
<tr>
<td>5</td>
<td>17/22 (77.3)</td>
<td>35/54 (64.8)</td>
</tr>
</tbody>
</table>

*Data are given as number of deceased divided by total number of fracture events (percentage). Calculated by chronologic year of study. Overall mortality was 58% for men and 42% for women (P = .004).

11 patients were unavailable for follow-up. The mean age for men and women in this subgroup was 79 years (range, 53-99 years for men and 51-100 years for women). Mean follow-up was 3 years (range, 1-5 years).

**Osteoporosis Treatments**

The number of patients treated for osteoporosis increased with time after fracture. Table 3, Figure 2, and Figure 3 show the distribution of patients receiving each type of treatment. Among the survey respon-
**Table 3. Osteoporosis Treatment at Follow-up**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Men (n = 44)</th>
<th>Women (n = 124)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphosphonate</td>
<td>3 (6.8)</td>
<td>35 (28.2)</td>
</tr>
<tr>
<td>Estrogen</td>
<td>0</td>
<td>17 (13.7)</td>
</tr>
<tr>
<td>Raloxifene hydrochloride</td>
<td>1 (2.3)</td>
<td>5 (4.0)</td>
</tr>
<tr>
<td>Calcitonin</td>
<td>0</td>
<td>16 (12.9)</td>
</tr>
<tr>
<td>Calcium and vitamin D only</td>
<td>8 (18.2)</td>
<td>28 (22.6)</td>
</tr>
<tr>
<td>Total</td>
<td>12 (27.3)</td>
<td>88 (71.0)</td>
</tr>
</tbody>
</table>

*Data are given as number (percentage). The difference in the percentage of men treated vs the percentage of women treated was statistically significant (P < .001).

†Thirteen women were taking combination therapy. That is 60 women were taking estrogen, selective estrogen receptor modulators, calcitonin, or a bisphosphonate either alone or in combination; thus, the total number taking these treatments is 60, not 73 as suggested by summing tables entries. None of the men were on combination therapy.

**Figure 2.** Percentage of 44 men and 124 women taking antiresorptive treatment (estrogen, selective estrogen receptor modulators, calcitonin, or a bisphosphonate alone or in combination, with or without calcium and vitamin D) at hospital admission, discharge, and 1- to 5-year follow-up. These data are for men and women who completed surveys. Asterisk indicates a significant difference (P = .001) in the ratio of the number of men receiving treatment divided by the total number of men vs the number of women receiving treatment divided by the total number of women. The percentage of men taking antiresorptive treatment did not significantly increase from hospital admission to follow-up (P = .36) in contrast to women (P < .001).

P = .04. Thirty percent (13/44) of men and 31% (39/124) of women reported that they were uncertain if they had had such a test.

**Living Arrangements and Level of Disability Before and After Fracture**

**Table 4** summarizes the living arrangements and level of disability before and after fracture. The number of men and women living independently at home and who required walking aids or wheelchairs increased after hip fracture (P < .001). The number of men and women pursuing recreational activities decreased after hip fracture (P < .02 or less). The percentages of men who entered institutions, who required walking aids or wheelchairs, and who could not pursue recreational activities were not significantly different from those of women.

**Comment**

Most previous studies of hip fracture outcomes have focused on women. However, there are known risk factors associated with hip fracture in men. Others have previously reported that mortality after hip fracture is higher in men than in women. Nevertheless, attention to treatment of men for underlying osteoporosis has been minimal. We report herein that osteoporosis treatment after hip fracture for men is uncommon in a large hospital setting and that, during 1- to 5-year follow-up after discharge, few men get treated. Colon-Emeric et al reported similar undertreatment of men with hip fracture at discharge.

Undertreatment of women with hip fracture has been recognized. In our study, the difference in the percentage of men and women leaving the hospital with a treatment regimen is misleading, because most of the women who left the hospital with treatment had been receiving treatment at admission. With time after discharge, the number of women eventually commencing treatment increased to 71%. However, with time after discharge, only 27% of men were taking treatment for osteoporosis. Furthermore, a large percentage of men and women were receiving nonaggressive therapy (calcium and vitamin D supplements only), despite the wide acceptance and proven efficacy of potent antiresorptive agents.
Fewer conventional treatments were available to clinicians for treating osteoporosis in men between 1996 and 2000, when these patients presented. This contrasts with the number of treatments that were available for women, most notably estrogen replacement therapy, which has been the mainstay of prevention and management of osteoporosis for many years. In fact, it is the widespread use of estrogen that largely explains the difference in the percentage of women vs men who are treated. However, calcium and vitamin D were available, and although not an aggressive treatment, older women (and presumably men as well) are often vitamin D deficient and have a calcium-deficient diet. In institutionalized patients, calcium and vitamin D treatment may reduce the incidence of fracture. Off-label use of bisphosphonates and calcitonin was also available. However, the approval of alendronate in October 2000 for the treatment of osteoporosis in men made little difference in the immediate aftercare of men with hip fractures: from October 2000 to June 2001, we identified 11 men with hip fracture who met inclusion criteria for this study (patients from 2001 were not included in this study), and none were receiving bisphosphate treatment at hospital discharge.

We suggest that the problem is not a lack of available treatment but rather a lack of physician awareness of the lifetime risk of osteoporosis and fracture in men. Insufficient patient education may also be a problem. If patients are provided with information that helps them understand that their fractured hip was due to osteoporosis, they and their families may be more active in seeking treatment. Nevertheless, it remains enigmatic as to why so few men (and women) receive treatment, as in our study 13% of men had a previous hip fracture, 7% had a diagnosis of osteoporosis recorded in their medical chart, and 18% had a radiology report indicating the presence of osteopenia or osteoporosis. Furthermore, most men and women reported never having had a bone mineral density measurement, a simple yet established method for assessing bone status (as normal, osteopenic, or osteoporotic) and risk for fracture. A substantial number of men (30%) and women (32%) were uncertain if they ever had a test, suggesting that the results and significance were not effectively explained if they had a bone mineral density measurement.

The urgency in addressing osteoporosis treatment and aftercare plans for patients with hip fracture is reflected in the morbidity and mortality associated with hip fractures. Our findings, similar to those of previous reports, show high postfracture mortality rates. Within 12 months of hospital discharge, 32% of men and 17% of women died. These rates are higher than those for age-matched patients without hip fracture. Data from the Centers for Disease Control and Prevention suggest that the mean life expectancy is 7.5 years for an 80-year-old white man and 9.1 years for an 80-year-old white woman. The reasons have been addressed by others and include factors such as medical complications (many of these older patients have serious comorbid conditions) and the negative effects of loss of independence with respect to activities of daily living and increased disability.

Survey results from survivors 1 to 5 years after fracture show a statistically significant loss of mobility, with the number of men requiring a wheelchair tripling and the number needing a walker or cane doubling. The number of men pursuing recreational activities decreased by 50%. The numbers were similar in women. These changes correlated with a significant increase in the number of men and women living in institutions.

Who is responsible for ensuring osteoporosis treatment for the hip fracture patient? Strictly speaking, any physician who evaluates a patient with a history of hip fracture should consider treatment options. Anecdotally, it is often said that recognizing and managing osteoporosis in the patient with hip fracture is the responsibility of the orthopedist who repairs the fracture. However, osteoporosis is a multidisciplinary problem. Older men and women should be evaluated for osteoporosis long before the first fracture event. For many years, osteoporosis was defined as the presence of a fragility fracture. To promote early detection and reduce the incidence of fractures, the World Health Organization redefined osteoporosis, based on bone mineral density: thus, it became possible to identify individuals at high risk for fractures and to initiate treatment in an effort to prevent fractures.

In the hospital setting, during the care of acute hip fracture, the primary concern of the orthopedist is to attain rapid reduction and fixation of the fracture and to restore prefracture mobility. Hip fracture is a serious event, and several issues, including deep venous thrombosis prophylaxis, antibiotic prophylaxis, altered mental status, nutrition, and urinary tract management, demand immediate attention. Low bone mineral density is not a life-threatening problem, and initiating antiresorptive treatment immediately after a hip fracture has secondary importance. Other factors can affect treatment decisions, such as comorbid conditions and extreme age. The

<table>
<thead>
<tr>
<th>Variable</th>
<th>Before</th>
<th>After</th>
<th>P Value</th>
<th>Before</th>
<th>After</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live at home</td>
<td>41/44 (93.2)</td>
<td>30/41 (73.1)</td>
<td>.02</td>
<td>107/123 (87.0)</td>
<td>87/117 (74.4)</td>
<td>.01</td>
</tr>
<tr>
<td>Live in an institution</td>
<td>3/44 (6.8)</td>
<td>11/41 (26.8)</td>
<td>.02</td>
<td>16/123 (13.0)</td>
<td>30/117 (25.6)</td>
<td>.01</td>
</tr>
<tr>
<td>Used wheelchair</td>
<td>6/44 (13.6)</td>
<td>18/41 (43.9)</td>
<td>.003</td>
<td>9/124 (7.3)</td>
<td>46/119 (38.7)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Needed walker</td>
<td>14/44 (31.8)</td>
<td>28/41 (68.3)</td>
<td>.001</td>
<td>24/124 (19.4)</td>
<td>72/117 (60.5)</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Pursued recreation</td>
<td>24/43 (55.8)</td>
<td>12/41 (29.3)</td>
<td>.02</td>
<td>81/124 (65.3)</td>
<td>43/119 (36.1)</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

*Data are given as number divided by the total number of patients (percentage). Percentages between men and women were not significantly different. The urgency in addressing osteoporosis treatment for the hip fracture patient? Strictly speaking, any physician who evaluates a patient with a history of hip fracture should consider treatment options. Anecdotally, it is often said that recognizing and managing osteoporosis in the patient with hip fracture is the responsibility of the orthopedist who repairs the fracture. However, osteoporosis is a multidisciplinary problem. Older men and women should be evaluated for osteoporosis long before the first fracture event. For many years, osteoporosis was defined as the presence of a fragility fracture. To promote early detection and reduce the incidence of fractures, the World Health Organization redefined osteoporosis, based on bone mineral density: thus, it became possible to identify individuals at high risk for fractures and to initiate treatment in an effort to prevent fractures.

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effects of bisphosphonates on bone healing have not been thoroughly studied. Furthermore, orthopedists are appropriately reluctant to initiate treatment for patients whom they are unlikely to follow up long-term. Nevertheless, while the patient is in the hospital, there is a window of opportunity to provide educational materials to patients and their families regarding osteoporosis and to advise the patient’s primary care physician of appropriate antiresorptive treatments.

More attention should be given to older men at high risk for hip fracture before the first fracture event. Hypogonadism, alcoholism, and corticosteroid use are associated with a high risk of osteoporosis and fracture in men. Furthermore, metabolic disorders leading to secondary osteoporosis (hyperthyroidism, inflammatory bowel disease, etc) and disorders of movement or balance leading to falls (parkinsonism, seizures, blindness, etc) are predictors of hip fracture in men. Poor vision, smoking, reduced mental status, overall poor health, and low circulating insulin-like growth factor I are among other risk factors associated with hip fracture in men and women. Therefore, many candidates for hip fracture could potentially be identified during routine medical office visits. Countermeasures could include commencement of antiresorptive therapy to increase bone mineral density and physical rehabilitation to increase muscle strength and improve balance. Treatment for older individuals is cost-effective and increases bone mineral density with a possible reduction in fracture incidence. Increased awareness of risk factors and appropriate countermeasures could decrease the incidence of hip fractures in men, with a consequent reduction in morbidity and mortality and great savings in health care costs to society.

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