Evaluation and Management of Osteoporosis Following Hospitalization for Low-impact Fracture

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OBJECTIVE: To evaluate the pattern of osteoporosis evaluation and management in postmenopausal women who present with low-impact (minimal trauma) fracture.

DESIGN: Retrospective chart review of patients admitted with a fracture in the absence of trauma or bone disease. Telephone follow-up survey was conducted at 12 months after discharge to collect information on physician visits, pharmacological therapies for osteoporosis, functional status, and subsequent fractures.

PATIENTS/PARTICIPANTS: Postmenopausal women admitted to a hospital in St. Paul, Minnesota between June 1996 and December 1997 for low-impact fractures were identified. Low-impact fracture was defined as a fracture occurring spontaneously or from a fall no greater than standing height. Retrospective review of 301 patient medical records was conducted to obtain data on pre-admission risk factors for osteoporosis and/or fracture, and osteoporosis-related evaluation and management during the course of hospitalization. Follow-up 1 year after the incident fracture was obtained on 227 patients.

MEASUREMENTS AND MAIN RESULTS: Two hundred twenty-seven women were included in the study. Osteoporosis was documented in the medical record in 26% (59/227) of the patients at hospital discharge. Within 12 months of hospital discharge, 9.6% (22/227) had a bone mineral density test, and 26.4% (60/227) were prescribed osteoporosis treatment. Of those who were prescribed osteoporosis treatment, 86.6% (52/60) remained on therapy for 1 year. Nineteen women suffered an additional fracture. Compared to women without a prior fracture, women with at least 1 fracture prior to admission were more likely to have osteoporosis diagnosed and to receive osteoporosis-related medications.

CONCLUSION: Despite guidelines that recommend osteoporosis evaluation in adults experiencing a low-trauma fracture, we report that postmenopausal women hospitalized for low-impact fracture were not sufficiently evaluated or treated for osteoporosis during or after their hospital stay. There are substantial opportunities for improvement of care in this high-risk population to prevent subsequent fractures.

KEY WORDS: low-impact fracture; osteoporosis evaluation; osteoporosis treatment.

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Osteoporosis affects some 25 to 28 million Americans and causes 1.5 million fractures of the hip, spine, wrist and other sites every year.¹⁻³ Fractures exert a crippling clinical and economic impact, causing frequent admissions to hospitals and nursing homes, and generating high expenditures for health care services. First-year mortality rate for postmenopausal hip-fracture patients increases with age and can run as high as 20%.^{4,5} In the United States, direct medical costs for osteoporotic fractures are estimated to exceed 13.7 billion dollars annually, and lengthy recovery periods add to the high cost of fracture.^{6,7} Postmenopausal women hospitalized for management of a fracture unrelated to trauma are likely to have underlying osteoporosis and would benefit from treatment. National Osteoporosis Foundation guidelines recommend that all postmenopausal women who present with a fracture be evaluated for osteoporosis and considered for treatment regardless of other risk factors.⁸ Recent evidence, however, suggests that osteoporosis is rarely evaluated or listed as an associated or secondary diagnosis on hospital discharge for fracture in this population.⁹⁻¹¹

This study reports the practice pattern for evaluation and management of osteoporosis following hospitalization for a nontraumatic fracture at any site in postmenopausal women at discharge and 1 year post fracture.

METHODS

Study Population

The study cohort consisted of postmenopausal women discharged from a hospital in St. Paul, Minnesota, between June 1996 and December 1997 with a primary diagnosis of a fracture of the hip, spine, wrist, or humerus that occurred spontaneously or after a fall from no greater than standing height. Women with high-impact fractures or pathologic fractures related to metastatic cancer or other metabolic bone disease were excluded from study participation. Initially, 301 women met study eligibility criteria. Fifty-two of them died within 1 year after hospital discharge and another 22 women could not be contacted for the 1-year follow-up survey. Patients without 1-year follow-up were on average slightly older, with 82% over age 80 compared with 62% of the study sample, but there was no difference in distribution of fracture site or history of prior fracture. Thus, a total of 227 women were included in the study sample.

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Portions of these study results were presented in a poster format at the National Osteoporosis Foundation/International Osteoporosis Foundation meeting, June 2001, Chicago, Ill.

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Medical Record Review

A standardized data abstraction form was designed and a retrospective medical record review was conducted on a consecutive sample of women over age 45 with diagnostic codes and medical record information consistent with a low-impact fracture. Information on patient demographics, pre-fracture risk for osteoporosis and/or fracture, bone mineral density (BMD) testing, total calcium and vitamin D intake, and osteoporosis medication usage on admission and at discharge were obtained. Therapies while hospitalized were reviewed, including surgical intervention and the use of supplemental calcium and/or vitamin D.

An assessment of pre-fracture risk status was made by using chart data to complete the Simple Calculated Osteoporosis Risk Estimation (SCORE) questionnaire.¹² SCORE is a computationally simple, risk assessment tool that evaluates 6 risk factors (fracture history, age, race, weight, rheumatoid arthritis, and estrogen usage) for low bone mineral density in postmenopausal women. The instrument provides the relative weights for these risk factors based on statistical analysis of the predictive power of each factor. In women with a SCORE value of 6 or greater, there is >50% probability of low bone mass, with >90% sensitivity for osteoporosis identification. Although SCORE is typically used as a prospective screening instrument to identify postmenopausal women at risk for osteoporosis, SCORE was used in our study to determine if the disease could have been identified in study participants prior to their fracture.

One-year Follow-up Survey

Patients were contacted by telephone 1 year after hospital discharge. The telephone survey consisted of 10 questions regarding admitting fracture and any follow-up since discharge, including BMD testing, physician recommendations for calcium and vitamin D, physician recommendations for prescribed osteoporosis medications (including hormone replacement therapy, alendronate, raloxifene, or calcitonin), and any post-discharge fractures. The survey also queried patients about their functional status and probed for the initiation of any lifestyle modification programs.

Data Analysis

Frequency distributions of baseline demographic and clinical characteristics were tabulated. All subsequent analyses, including diagnosis and management of osteoporosis at discharge and during the 1-year follow-up period, were stratified by fracture history in order to examine whether the pattern of treatment differed between participants with and without a fracture prior to hospitalization. Analyses were also performed to assess the diagnosis and management of osteoporosis and patient outcomes according to admission fracture type (hip, vertebral, and other). Continuous variables were categor-

ized as shown in the tables. Statistical significance of differences comparing women with and without prior fractures was examined using χ^2 statistics. All analyses were performed using SAS Version 6.12 (SAS Institute, Inc., Cary, NC). All tests of statistical significance were 2-tailed. A *P* value $\leq .05$ or less was considered of statistical significance.

RESULTS

Baseline Characteristics

Demographic and clinical characteristics of study participants at baseline are shown in Table 1. Most of the women (203/227, 89.4%) were over 70 years of age and half of them (113/227, 49.7%) were in their eighth decade. All women were white. Thirteen percent (30/227) of the participants were taking osteoporosis medication at the time of admission. Calcium, vitamin D, and/or multivitamins use was documented in the medical record in 20% (45/227) of the cohort.

The majority of the women (160/227) were admitted for hip fractures and 45% (101/227) of the women had experienced at least 1 fracture prior to the current admission fracture. A fourth of these prior fractures were hip fractures (41/101).

When the SCORE instrument was implemented retrospectively, SCORE values indicated that 208 of 227 women (91.8%) were at high risk for low bone mass.

Table 1. Baseline Demographics and Clinical Characteristics (N = 227)

Characteristics	n	Percent
Age, y		
≤59	8	3
60–79	79	35
≥80	140	62
Prior fracture*	101	45
Hip	41	17
Vertebra	12	5
Wrist	5	2
Rib	4	2
Other	43	19
Admitting fracture*		
Hip	160	71
Vertebra	16	7
Wrist	12	5
Humerus	28	12
Other	11	5
Supplement use on admission	45	20
Calcium	20	9
Calcium + vitamin D	11	5
Osteoporosis treatment on admission	30	13
Estrogen	17	7
Alendronate	7	3
Calcitonin	6	3
SCORE† value ≥6	208	92

* Not mutually exclusive categories.

† Simple Calculated Osteoporosis Risk Estimation.

Table 2. Diagnosis and Management of Osteoporosis at Discharge by Prior Fracture Status

	Total (N = 227)		Prior Fracture (N = 101), %	No Prior Fracture (N = 126), %	P Value
	n	%			
Diagnosis of osteoporosis documented	59	26	35	19	.008
Osteoporosis medication prescribed	39	17	23	13	.046
Estrogen	17	7	9	6	
Alendronate	8	4	6	2	
Calcitonin	12	5	7	4	
Combination	2	1	1	1	
Supplements recommended	49	22	26	18	.17
Calcium	21	9	11	8	
Multivitamin	12	5	4	6	
Calcium + vitamin D or multivitamin	16	7	11	4	

Diagnosis and Management at Discharge

Discharge management as documented in the medical record, is reported in Table 2. Patients with a history of prior fracture were more likely to be chart-diagnosed as having osteoporosis than patients without such history ($P = .008$).

Osteoporosis medications were prescribed for 17.2% (39/227) of patients, and patients were more likely to be treated if there was a history of prior fracture ($P = .046$). Documentation of supplemental calcium and/or vitamin D recommendations were limited to 21.6% (49/227) of participants, and most of these patients (35/49, 71%) were already on a supplement prior to admission.

Follow-up Management

One-year telephone follow-up is reported in Table 3. More than 80% (189/227) recalled a physician follow-up,

and 39% (88/227) reported discussing osteoporosis. Only 22 of the 227 women (10%) received a BMD test during the 1-year period following their discharge. One hundred fifty-one of 227 (66.5%) of the patients recalled being asked to make dietary, nutritional, or other behavioral changes, while 26.4% (60/227) recall being prescribed an osteoporosis medication. Most women who were prescribed medicine (86.7% [52/60]) were still on the recommended medication at 1 year.

Patient Outcomes One Year After Hospital Discharge

Data on subsequent fractures, and functional status of participants 1 year after hospital discharge are shown in Table 4. One hundred seventy-six of the study participants (77.5%) reported being unable to return to their pre-fracture level of functionality.

Table 3. Osteoporosis-related Management Within 1 Year of Discharge for Fracture by Prior Fracture Status

	Total (N = 227)		Prior Fracture (N = 101), %	No Prior Fracture (N = 126), %	P Value
	n	%			
Patient reports physician follow-up	189	83	83	83	.97
Physician specialization					.54
Orthopedist	65	29	32	26	
Family physician	51	22	18	26	
Internist	35	15	18	13	
Combination	38	17	16	17	
Mention of osteoporosis	88	39	48	32	.015
Bone mineral density testing	22	10	9	10	.72
Behaviors recommended	151	67	70	63	.28
Calcium supplements	38	17	22	13	
Dietary calcium	13	6	6	6	
Vitamin D	15	7	4	9	
Exercise	13	6	6	6	
Exercise + other	26	11	13	10	
Calcium + vitamin D	46	20	20	21	
Medications recommended	60	26	33	21	.056
Estrogen	24	11	13	9	
Alendronate	12	5	8	3	
Calcitonin	14	6	8	5	
Combination	8	3	4	4	
Still on medication at 1 year	52	87	82	93	.22

Table 4. Patient Outcomes Within 1 Year of Discharge for Fracture by Prior Fracture Status

	Total (N = 227)		Prior Fracture (N = 101), %	No Prior Fracture (N = 126), %	P Value
	n	%			
Subsequent fracture	19	8	9	8	.79
Unable to return to pre-fracture activity	176	78	82	75	.24
Wheel chair	33	15	16	13	
Walker/cane	87	38	47	32	
Unsteady/trouble walking	56	25	19	29	
Increased pain	21	9	7	11	.28

Osteoporosis Management and Patient Outcomes by Admission Fracture Type

Table 5 depicts diagnosis and management of osteoporosis at discharge and during 1 year after hospital discharge according to admission fracture type (hip, vertebral, and other). Women who were hospitalized with a vertebral fracture were more likely to be treated for osteoporosis at discharge compared to those who were hospitalized with a nonvertebral fracture ($P = .01$).

Women hospitalized with vertebral fractures were more likely to experience another fracture ($P = .03$), report being unable to return to their pre-fracture level of functionality ($P = .003$), and experience increased pain ($P < .001$) compared to women with nonvertebral fractures (Table 6).

DISCUSSION

Until 1994, the definition of osteoporosis required the presence of a fracture.¹³ Today, the World Health Organization diagnostic criteria for osteoporosis are based on low BMD, which typically precedes osteoporotic fracture. Low bone density represents a continuum of risk, and opportunities exist to improve diagnosis before a fracture has occurred.¹⁴ Ironically, however, even in a post-fracture population, quantifying degree of bone loss and treatment are often inadequately addressed, as evidenced in our study results.

Similar observations were reported in other series of cohorts. Melton et al. reported, on the basis of data from the 1992 National Hospital Discharge Survey, that 6% of hospital discharges in the United States for hip fracture include osteoporosis as an associated diagnosis.⁹ More

recently, a retrospective cohort study derived from a national claims database that included postmenopausal women enrolled in multiple health plans showed that 24% (279/1,162) of women aged 55 years or older who were treated for acute distal radius fracture underwent diagnostic evaluations or treatment for osteoporosis.¹¹ The same study reported that the rate of treatment declined significantly among older segments of the population. In a large regional hospital in New England, only 1.8% (17/934) of postmenopausal women aged 60 and older who were hospitalized for vertebral fracture had a discharge diagnosis of osteoporosis despite the availability of contemporaneous radiographic evidence.¹⁴ We found that 26% of the postmenopausal, post-fracture women in our cohort had a discharge diagnosis of osteoporosis. Clearly, opportunities to evaluate, treat, and prevent future osteoporotic fractures are being overlooked.

The current study is, to the best of our knowledge, the first study that compares post-fracture osteoporosis management among various fracture types requiring hospitalization. Despite the higher mortality rate associated with osteoporotic hip fractures, we found patients were more likely to be clinically diagnosed and treated for underlying osteoporosis if hospitalized for a vertebral fracture. This paradox may reflect the fact that most vertebral fractures are spontaneous and osteoporosis is suggested by plain radiographs, thereby undeniable, while most hip and extremity fractures are related to falls which may become the focus (or 'etiology') of the injury rather than the underlying disease process. Of interest also, was that in our cohort of fracture survivors, at 1 year those who experienced vertebral fractures reported more persistent pain impacting on quality of life.

Table 5. Diagnosis and Management of Osteoporosis by Admission Fracture Type

	Total (N = 227)		Hip (N = 160), %	Vertebral (N = 16), %	Other* (N = 51), %	P Value
	n	%				
Osteoporosis medication prescribed at discharge	39	17	16	44	14	.01
Estrogen	17	7	6	19	8	
Alendronate	8	4	3	6	4	
Calcitonin	12	5	6	13	2	
Combination	2	1	0.6	6	0	

* Included fractures of the wrist, humerus, rib, femur, and ankle.

Table 6. Patient Outcomes Within 1 Year of Discharge by Admission Fracture Type

	Total (N = 227)		Hip (N = 160), %	Vertebral (N = 16), %	Other* (N = 51), %	P Value
	n	%				
Subsequent fracture	19	8	8	25	4	.03
Unable to return to pre-fracture activity	176	78	81	94	61	.003
Wheel chair	33	15	19	6	2	
Walker/cane	87	38	44	44	18	
Unsteady/trouble walking	56	24	18	44	41	
Increased pain	21	9	4	38	18	<.001

According to National Osteoporosis Foundation guidelines, osteoporosis is the presumptive diagnosis to be made when a postmenopausal women presents with fracture. The degree of low bone mass is confirmed with bone densitometry, followed by treatment options to curb the risk of subsequent fractures. This is in conformance with substantial evidence that postmenopausal women who suffer low-impact fractures are at a 6-fold higher risk for subsequent fractures.¹⁵⁻¹⁹ That risk increases with the site and severity of the current fracture, the patient's age, and prior fracture history. Thus, it is justifiable that women with prior fracture be evaluated and treated for osteoporosis, even without BMD testing.

Most of the women in this study were at high risk for osteoporosis but not evaluated or treated, nor was there an aggressive follow-up plan aimed at preventing a subsequent fracture. Clearly, barriers to post-fracture care exist that are in part due to defining areas of responsibility for the orthopedist and the primary care physician. Significant patient-driven factors include reluctance to incur medication costs and the potential for side effects.²⁰ An intervention that includes education of patients and their families and primary care physicians may be an important first step. Defining the areas of responsibility for the orthopedic surgeon and the primary care physician may also need to be addressed within each care system.

Timely diagnosis and intervention can stay disease progression and improve quality of life for the post-fracture patient with osteoporosis. Unfortunately, most of the women in our study population never returned to their pre-fracture status, and morbidity was high.

There are a number of limitations associated with this study. A retrospective chart review may miss important patient information that was not well-documented in the hospital chart. Admittedly, the study population was relatively small, exclusively white, and from 1 midwestern hospital in a heavily managed-care community. In addition, only those women requiring hospitalization for low-impact fracture were included in this review and they may have a higher incidence of co-morbidities than outpatients treated for fracture. This may have influenced the rate of treatment because of confounding variables not identified by this review. Thus, study findings may not be applicable

to patients with low-impact fractures who did not require hospitalization. Patient preference and past treatment attempts may also influence treatment decisions. The 1-year follow-up data were collected by telephone interview with the patient or caregiver and relied on patient recall and admission, which may be influenced by many variables.

Nonetheless, study results reported here add to a growing body of evidence indicating we are missing an opportunity. Targeting the post-fracture population for osteoporosis risk factor reduction should be as imperative as risk factor reduction after myocardial infarction, especially among elderly women.

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