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IMPROVEMENT IN THE UNDERTREATMENT OF OSTEOPOROSIS FOLLOWING HIP FRACTURE

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Background: Osteoporosis is a common disease characterized by decreased bone mass and increased fracture risk in postmenopausal women and the elderly. Hip fractures are among the most common consequences of osteoporosis and unfortunately usually occur late in the course of the disease. When a patient is admitted to the hospital with a fragility hip fracture, a unique opportunity for diagnosis and treatment presents itself. Fortunately, several medications have proven to be effective in lowering the risk of future fractures. The purposes of the present study were to test the hypothesis that most fragility hip fractures go untreated and to determine whether educational efforts to raise physician awareness have led to an improvement in osteoporosis treatment rates.

Methods: A retrospective cohort study was performed with use of the patient databases at two university medical centers and one university-affiliated community hospital. The charts of 300 randomly selected patients were sorted with use of ICD-9 (International Classification of Diseases, Ninth Revision) codes for femoral neck fractures. There were 100 patients from each center, with twenty-five patients from each year between 1997 and 2000. The admitting diagnosis, mechanism of injury, admission medications, procedures performed during hospitalization, and discharge medications were then extracted and analyzed. During this period, the National Osteoporosis Foundation established guiding principles for the treatment of fragility fractures.

Results: Of the seventy-five patients from all centers for each year from 1997 to 2000, 11%, 13%, 24%, and 29%, respectively, were discharged with a prescription for some medication targeting osteopenia, either supplemental calcium or an antiosteoporotic medication (estrogen, calcitonin, a bisphosphonate, or raloxifene). A trended chi-square analysis of this increase revealed a p value of <0.001, indicating that this improvement in treatment was unlikely due to chance alone. Fifty-eight (19.3%) of the 300 patients in the study received a prescription at the time of discharge. However, forty of these patients (13.3% of the overall group) received calcium and only eighteen (6.0% of the overall group) received a medication to actively prevent bone resorption and treat osteoporosis. In addition, no patient underwent a bone density scan while in the hospital.

Conclusions: Elderly patients and postmenopausal women who are admitted to the hospital and diagnosed with a low-energy femoral neck fracture have been undertreated for osteoporosis. However, over the four years of the present study, there was a significant increase in the rate of treatment. It is hoped that treatment rates will continue to increase in the future with continued educational efforts.

Osteoporosis is a pervasive disorder in the elderly population and is characterized by decreased bone mass and microarchitectural deterioration of bone tissue[1]. Increased bone resorption relative to bone formation weakens bone mass and leads to an increased risk of fractures[2,3]. As many as 13% to 18% of women (four to six million women in the United States) have osteoporosis (defined as a bone density of >2.5 standard deviations below the normal peak value) and 37% to 50% of women (thirteen to seventeen million women in the United States) have osteopenia (defined as a bone density between one and 2.5 standard deviations below the normal peak value). An additional 3% to 6% of men (one to two million men in the United States) have osteoporosis, and 28% to 47% of men (eight to thirteen million men in the United States) have osteopenia[4]. If untreated, it is estimated that more than half of all Caucasian white women will sustain an osteoporotic (fragility) fracture during their lifetime[5,6].

The hallmark osteoporotic fractures include femoral neck,

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TABLE I Data on the Treatment of Osteoporosis Following Low-Energy Hip Fracture*

Year	No. of Patients	Average Age *(yr)*	Osteoporosis Treatment During Hospitalization†				Percentage of Patients Being Treated for Osteoporosis at Discharge
			No Change in Treatment	Change in Treatment	New Treatment	Total	
1997	75	78.7	5 (3)	0	3 (3)	8 (6)	11%
1998	75	80.6	3 (1)	0	7 (6)	10 (7)	13%
1999	75	79.7	11 (7)	0	7 (7)	18 (14)	24%
2000	75	78.9	11 (5)	1 (0)	10 (8)	22 (13)	29%
Total	300	79.5	30 (16)	1 (0)	27 (24)	58 (40)	19.3%

*The data are broken down into four groups of seventy-five patients per year (twenty-five patients from each of the three medical centers).
†The data are given as the total number of patients receiving treatment for osteoporosis, with the number of patients treated with calcium in parentheses.

vertebral, and distal radius fractures. The quality of life that follows such a fracture, particularly a hip fracture, is a major public-health concern[5,7]. Osteoporotic hip fractures are associated with substantial morbidity, loss of function, and a one-year mortality rate of as high as 33%[8]. In 1995, health-care expenditures attributable to osteoporotic fractures were estimated to be $13.8 billion[9]. It has been shown that a personal history of an osteoporotic hip fracture is a major risk factor for a future fragility fracture[10-16] and that a second, contralateral hip fracture may occur in as many as 10.6% of patients[17].

Because elderly patients who have a hip fracture are often hospitalized for definitive orthopaedic management, they present an excellent, albeit late, opportunity for antiosteoporotic treatment. General guidelines have been elucidated by the National Osteoporosis Foundation[18] but must be tailored to this particular group of hospitalized patients following an osteoporotic fracture. Minimally, patients should be advised on the importance of dietary or supplemental calcium and vitamin-D sources, such as multivitamins. In addition, however, many patients who have sustained an osteoporotic fracture will have severe osteoporosis and will warrant treatment with an antiresorptive agent. Estrogen, calcitonin, bisphosphonates, and raloxifene have been studied extensively recently, and all are options for medical treatment. Specific therapy decisions are patient-specific and beyond the scope of this paper.

Freedman et al.[19] demonstrated that patients with osteoporotic fractures are inadequately treated for osteoporosis in the outpatient setting. Recognizing this deficiency, the National Osteoporosis Foundation and the American Academy of Orthopaedic Surgeons have established guiding principles for the treatment of patients with osteoporotic fractures. The purpose of the present study was twofold. First, we wished to retrospectively assess the rate at which physicians recognized and treated osteoporosis in patients who were admitted to the hospital with typical low-energy osteoporotic hip fractures over a recent four-year period in order to test the hypothesis that osteoporosis treatment was lacking in the majority of cases. Second, we wished to determine if the physician education efforts spearheaded by the National Osteoporosis Foundation and sponsored secondarily by the American Academy of Orthopaedic Surgeons have led to a significant improvement in treatment.

Materials and Methods

Patients who were included in the orthopaedic trauma service databases at three different hospitals (two university medical centers and one university-affiliated community hospital) were sorted by ICD-9 (International Classification of Diseases, Ninth Revision) codes for femoral neck fractures. The first twenty-five patients with an age of more than fifty-five years who were admitted during the calendar year because of a femoral neck fracture and who qualified were included in the study. Patients with a high-energy mechanism of injury (other than a fall at ground level), patients who were less than fifty-five years old, and premenopausal women were disqualified. Twenty-five patients from each center for each year between 1997 and 2000 were included. The medical records and charts were then analyzed with regard to the admitting diagnosis, mechanism of injury, admission medications, procedures performed during hospitalization, and discharge medications.

In the group treated in 1997, the average age was 78.7 years and fifty-five (73%) of the seventy-five patients were female. In the group treated in 1998, the average age was 80.6 years and fifty-three patients (71%) were female. In the group treated in 1999, the average age was 79.7 years and fifty-seven patients (76%) were female. In the group treated in 2000, the average age was 78.9 years and fifty-five patients (73%) were female. The average age of all 300 patients in the study was 79.5 years, and 220 (73%) of the 300 patients were female.

The variables that were examined included the number of patients with a low-energy osteoporotic fracture who were taking antiresorptive medications at the time of discharge and

which of these patients reported having taken such medications prior to admission. There were four possible scenarios: (1) the patient was taking such medication prior to admission and no change was made at the time of discharge, (2) the patient was taking such medication prior to admission and a change was made at the time of discharge, presumably in response to the fracture, (3) the patient was taking no such medication prior to admission and a new medication was prescribed at the time of discharge, and (4) the patient was discharged without having received any treatment for osteoporosis.

In addition, each of these four outcomes was analyzed with regard to whether the medication was supplemental calcium or a prescription antiresorptive medication, such as calcitonin, estrogen, a bisphosphonate, or raloxifene. The overall treatment rates for each year were calculated, and a trended chi-square analysis was performed to evaluate whether the change in treatment over the four years of the study was significant ($p < 0.05$).

Results

In 1997, five patients were receiving antiosteoporotic medication at the time of admission. Three of these five patients were taking calcium, and none of the five had a change in treatment. In addition, three patients who were not taking medication received a prescription for medication (supplemental calcium) before discharge (Table I). Overall, only eight (11%) of the seventy-five patients were being treated for osteoporosis at the time of discharge. In 1998, three patients were receiving medication at the time of admission. One of these three patients was being treated with calcium, and none of the three had a change in treatment. In addition, seven patients who were not taking medication at the time of admission received a prescription for medication at the time of discharge; calcium was prescribed for six of these seven patients. Overall, ten (13%) of the seventy-five patients were being treated for osteoporosis at the time of discharge. In 1999, eleven patients were receiving medication at the time of admission. Seven of these eleven patients were receiving calcium, and none of the eleven had a change in treatment. Seven additional patients who were not receiving medication at the time of admission received a prescription for medication at the time of discharge; calcium was prescribed for all seven. Overall, eighteen (24%) of these seventy-five patients received some form of treatment for osteoporosis following the fragility fracture. In 2000, eleven patients who were receiving medication (including five patients who were receiving calcium) had no change in treatment and one patient had a change to a prescription drug. In addition, ten patients who were not receiving medication at the time of admission received a prescription for medication at the time of discharge; calcium was prescribed for eight of the ten. Overall, twenty-two (29%) of the seventy-five patients were being treated for osteoporosis at the time of discharge.

Overall, for the years 1997 to 2000, the percentage of patients receiving some form of antiosteoporotic therapy at the time of discharge was 11%, 13%, 24%, and 29%, respectively. A trended chi-square test revealed that this increase was significant ($p < 0.001$), indicating that this improvement in the rate of treatment was unlikely to have occurred by chance alone (Fig. 1). The treatment patterns at all three hospitals were similar. Overall, fifty-eight (19.3%) of the 300 patients who had been diagnosed with a low-energy femoral neck fracture were discharged on some agent, either calcium or a prescription medication. Forty of these fifty-eight patients (13.3% of the overall group) were treated with calcium, leaving only eighteen patients (6.0% of the overall group) who received a prescription for an antiresorptive agent at the time of discharge.

Discussion

Osteoporosis often follows a prolonged asymptomatic course as bone mass gradually declines and the risk of

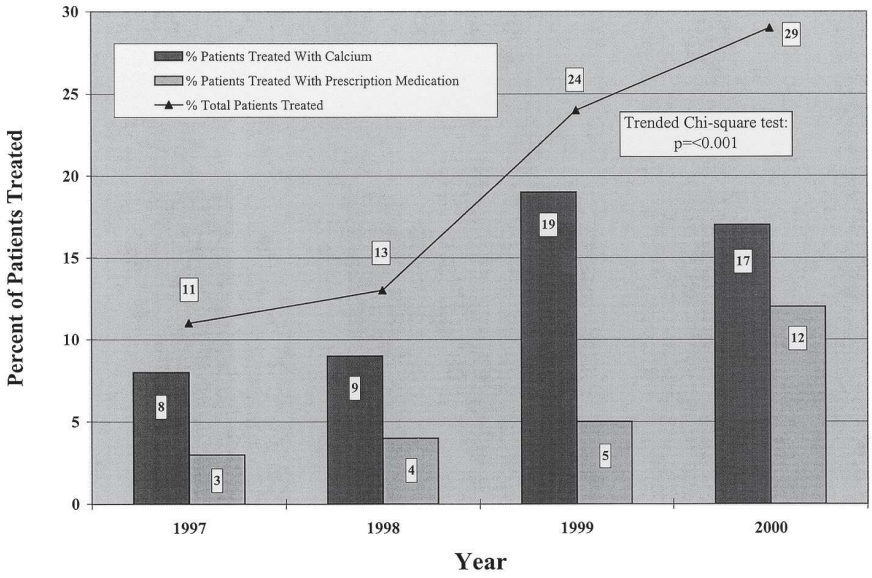

Fig. 1
Graphical representation of the increase in treatment rates from 1997 to 2000 ($p < 0.001$). The bars for each year indicate the percentage of patients treated with calcium and the percentage of patients treated with a prescription antiresorptive medication.

TABLE II Recommendations for the Treatment of Osteoporosis Following a Fragility Fracture*

1. All patients presenting with a low-energy hip fracture should be considered as having primary or secondary osteoporosis.
2. All patients should be placed on 800 IU of vitamin D and 1200 to 1500 mg of elemental calcium (preferably calcium citrate) daily.
3. Before discharge, all patients should be started on alendronate (70 mg per week), risedronate (30 mg per week), or pamidronate (30 mg administered intravenously every three months). Pamidronate is the agent of choice if the patient has a history of gastrointestinal dysfunction.
4. Within six weeks after discharge, all patients should undergo a dual-energy x-ray absorptiometry scan and a metabolic workup to rule out secondary causes of osteoporosis.

*Based on National Osteoporosis Foundation guidelines[30,31].

fracture increases. Often, the first clinical manifestation of osteoporosis is a fragility fracture of the hip, when the osteoporosis is already severe[20]. Following a sentinel fracture, appropriate diagnosis and treatment is critical. Pal[21] administered a questionnaire to ninety-six patients who had sustained a low-energy fracture and found that most of the patients had received inadequate or incomplete advice regarding osteoporosis and that almost none of the patients had received antiosteoporotic medication. Abbasi et al.[22], in a study of patients in a nursing home who had a history of hip fracture, found that 84% of the patients had no mention of osteopenia in their active medical problem list and therefore no intervention plan was in place to improve bone mass or prevent further bone loss. Freedman et al.[19] evaluated patients with distal radial fractures and found little subsequent intervention or treatment for osteoporosis. In a similar study, Torgerson and Dolan[23] found that, following an osteoporotic fracture, only patients with vertebral fractures received antiresorptive medication and that patients with hip fractures did not receive any medication. Postmenopausal women and elderly men who are hospitalized for an acute osteoporotic fracture are easy to target, yet these reports suggest that physicians neglect to treat such patients for osteoporosis even though low-energy fractures are a major risk factor for future fractures[10-12,14,15,17]. In the absence of treatment, a subsequent fragility fracture will occur in 10% of patients within one year and in 17% to 21% of patients within two years[13-15].

In the present study, the percentage of patients with a hip fracture who were treated with medication increased significantly from 11% to 29% between 1997 and 2000, and, while this trend is encouraging, treatment rates remain suboptimal. Furthermore, we did not determine if these patients continued to take the medication after discharge. Many patients in the study had been taking calcium or vitamin D prior to admission. While these agents are recommended for treatment and have been shown to be efficient for decreasing the rate of bone loss and preventing fractures[24-29], patients who are hospitalized with a femoral neck fracture should be treated with a prescription antiosteoporotic agent such as estrogen, calcitonin, a bisphosphonate, or raloxifene. Of the thirty patients in the study who were already taking a medication at the time of admission and for whom no change was made at the time of discharge, sixteen (53%) were taking calcium, although additional treatment with an antiresorptive medication was indicated. Furthermore, in the other fourteen patients who were taking prescription medications at the time of admission, an additional medication or a change in medication or dose may have been justified. Thus, although these patients were considered "treated" in our data analysis, this group may not reflect true physician awareness of osteoporosis as an active problem. Although medical care of the patient may ultimately reside with the primary-care physician, it is the obligation of the orthopaedic surgeon to ensure that osteoporosis has been addressed. The National Osteoporosis Foundation has constructed guidelines regarding the risk factors, diagnosis, and treatment of osteoporosis[30]. We have incorporated these guidelines into specific recommendations for the treatment of osteoporosis following a fragility fracture (Table II)[31].

Calcium supplementation and vitamin-D repletion are crucial aspects of care following an osteoporotic fracture. Calcium citrate is the preferred form of calcium, as it enhances the likelihood of gastrointestinal absorption. A randomized telephone survey of households in the United States demonstrated that only half of adults between the ages of sixty and ninety-four years drink at least one glass of milk per day[32], suggesting that this specific population may be calcium-deficient. Treatment with calcium has been shown to substantially retard femoral neck bone loss in the elderly and to positively affect the total body calcium balance[24,25]. In addition to preserving bone density, supplemental calcium reduces the risk of future osteoporotic fractures in postmenopausal women[26-28]. The National Institutes of Health recommend a daily intake of 1500 mg of calcium[33].

Vitamin D facilitates both absorption of dietary calcium and bone mineralization. Serum vitamin-D levels decrease with age, mainly as a result of restricted exposure to sunlight, a reduced capacity of the skin to produce vitamin D, and reduced dietary vitamin-D intake[29], which ultimately leads to bone loss and an increased risk of fracture. Van der Weilen et al.[34] found vitamin-D deficiency among elderly European women, regardless of geographic location. LeBoff et al.[29] found that 50% of women in the United States who sustained an

acute hip fracture had occult vitamin-D deficiency and recommended a daily intake of 400 IU for patients between the ages of fifty-one and seventy years and of 600 IU for those older than seventy years. To analyze the reduction in the risk of hip fracture among elderly women, Chapuy et al.[27] studied 3270 healthy postmenopausal women who were able to walk and found a 43% decrease in the prevalence of hip fractures among those who were treated with vitamin D. In a similar well-controlled study, Dawson-Hughes et al.[28] reported that 700 IU of vitamin D per day combined with calcium reduced femoral and vertebral bone loss and substantially decreased the prevalence of fracture.

Some studies have shown that calcium and vitamin D, while necessary elements of treatment, should in no way be considered sufficient to prevent future fractures in patients with established osteoporosis[35-39]. Many other agents have been tested extensively, are effective and safe, and are now available for the treatment of osteoporosis. The four categories of available treatment options are hormone replacement, calcitonin, bisphosphonates, and raloxifene.

Estrogen replacement in postmenopausal women is a cornerstone of osteoporosis and fragility fracture prevention[40]. Women taking estrogen (or hormone replacement therapy combined with a progestin) have been shown to have a decreased risk of osteoporotic fractures[41,42] and as much as a 25% decrease in the risk of femoral neck fractures in case-controlled studies[43-46]. However, estrogen therapy causes an increased risk of breast cancer and endometrial carcinoma in women with an intact uterus as well as an increased risk of thromboembolic events[47]. In addition, some women cannot tolerate these exogenous hormones.

Bisphosphonates are selective osteoclast inhibitors and therefore preserve bone mass[48]. Alendronate (Fosamax) has been studied extensively in several prospective five-year trials. Patients treated with alendronate for one year have been shown to have a 50% decrease in the risk of fragility fracture[49-51]. More recently, similar success has been demonstrated with risedronate[38,52]. A study by McClung et al.[53] showed that risedronate substantially reduces the risk of hip fracture in elderly women with established osteoporosis. The most common side effect of alendronate is mild esophagitis. Some studies have shown that this side effect does not occur more often in association with alendronate than in association with placebo[50]. However, when alendronate is used frequently, there is clearly an increased prevalence of dyspepsia, which can be eliminated by early cessation of the drug[54]. Once-a-week dosing is efficacious and is associated with less esophageal irritation.

Calcitonin (Miacalcin) is a hormone, commonly administered intranasally, that has been shown to have a bone-preserving effect and to be clinically efficacious for the treatment of osteoporosis[55]. Compared with a placebo, calcitonin has been shown to reduce the risk of osteoporotic fractures[56,57], and it is also likely to have an analgesic effect in patients who have sustained such a fracture[58].

Raloxifene (Evista) is a selective estrogen-receptor agonist that activates estrogen receptors in bone tissue and inhibits bone resorption without stimulating the uterine endometrium[37]. In a randomized study of 7705 women, Ettinger et al.[59] demonstrated that raloxifene not only inhibits bone resorption but also reduces the risk of fragility fractures in the spine. Although more long-term studies are needed, raloxifene holds promise as an effective antiosteoporotic therapy for postmenopausal women.

In summary, in our series of 300 elderly men and postmenopausal women who were admitted to one of three large metropolitan medical centers because of a low-energy hip fracture between 1997 and 2000, only 6.0% of the patients were discharged with a prescription for antiresorptive therapy. Another 13.3% of the patients were discharged with a prescription for at least 1200 mg of supplemental calcium per day, a necessary but solely inadequate treatment plan following an osteoporotic fracture. The remaining 81% of the patients were discharged without medication targeting osteoporosis. However, the trends in treatment were encouraging and improved significantly over the four years of the study. The low level of treatment for osteoporosis is disturbing, but it is hoped that the treatment rates will continue to increase in the future with ongoing efforts to raise physician awareness. We present some guidelines, based on recommendations from the National Osteoporosis Foundation, for the appropriate management of this patient population. ■

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