Diagnosis and Treatment of Osteoporosis in High-Risk Patients Prior to Hip Fracture

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Abstract

Purpose: Hip fractures in older adults are common and serious events. Patients who sustain fragility hip fractures are defined as having osteoporosis. Patients with dementia or a history of a prior fragility fracture are at increased risk of a future fracture. This study assesses prefracture osteoporosis diagnosis and treatment in high-risk groups. Methods: A case–control analysis of a database of all patients age $\geq$60 years admitted for surgical repair of nonpathological, low-impact femur fracture between May 2005 and October 2010 was performed. Results: Of 1070 patients, 511 (47.8%) had dementia and 435 (40.7%) had been diagnosed with osteoporosis prior to admission. Patients with dementia were more likely to have a diagnosis of osteoporosis prior to their fracture than those without dementia (43.8% vs 37.7%, $P < .05$). Twenty-five percent of the total study population had been treated with calcium and vitamin D (Cal+D) prior to admission, and 12% with other osteoporosis medications. There was a trend toward patients with dementia being more likely to have been on Cal+D prior to admission (27.6% vs 22.5%, $P = .06$), but no difference in treatment with other agents (10.8% vs 13.1%, $P = .25$). Patients with prior fragility fractures were more likely to be on Cal+D (32.3% vs 25.0%, $P < .02$); however, there was no difference in the use of other osteoporosis medications (12.3% vs 12%, $P = .90$). Conclusion: Fewer than half of patients that presented with hip fractures were diagnosed with osteoporosis prior to fracture and primary preventative treatment rates were low. Although patients with dementia are more likely to be diagnosed with osteoporosis, they were not more likely to be treated, despite having a greater risk. Additionally, those with prior fragility fractures are often not on preventative treatment. This may represent a missed opportunity for prevention and room for improvement in order to reduce osteoporotic hip fractures.

Keywords

dementia, fragility fractures, geriatric medicine, osteoporosis, metabolic bone disorders, hip fracture

Background

Osteoporotic hip fractures in older adults are a common and serious event, affecting approximately 330 000 individuals in the United States yearly.[1] They are accompanied by a high incidence of morbidity and mortality, with 20% or more dying within 1 year,[2] and one-fourth of previously independently living hip fracture patients requiring long-term care.[3] The cost of hip fracture care in 1997 was estimated to exceed 20 billion dollars in the United States and is projected to increase with the aging population.[2] Most hip fractures occur in older adults and result from falls from a standing height. These low-trauma fractures are also known as fragility fractures. Those who sustain fragility fractures are defined as having osteoporosis[4] and are at higher risk of sustaining fractures in the future.[5]

Osteoporosis is one of the strongest predictors of a fragility fracture; yet, many patients are not being identified as being at risk. Commonly, patients with osteoporosis are not treated prior to or after sustaining a hip fracture.[6] In addition to those

with osteoporosis, certain other populations are at increased risk of sustaining hip fractures including those with dementia and those with a history of prior fragility fractures.[5,7,8-10]

Hip fractures and dementia are both conditions which exponentially increase with age.[8,11] Shared risk factors for dementia and hip fractures include decreased activity, smoking, alcohol use, and vitamin D deficiency.[9] In addition, the presence of

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dementia increases hip fracture incidence through intermediate risk factors such as falls and low bone mineral density (BMD).[9] Patients with dementia are 2.7 times more likely to sustain a hip fracture than age- and sex-matched controls without dementia.[10] A recently published study conducted in Sweden looking at 2,610 patients showed that over a 4-year period 16% of those with dementia had a hip fracture compared to only 3% in those without a diagnosis of dementia.[7]

Patients who sustain hip fractures have been shown to be at increased risk of future hip fracture. Both men and women are at between a 2- and 4-fold increased likelihood of having a recurrent hip fracture following their first fragility fracture.[5] In the year following a hip fracture, 12% sustain another fracture, and 5% sustain another hip fracture.[12]

There are many effective medications available for treating osteoporosis. Guidelines strongly recommend treating patients with osteoporosis to prevent further bone loss and reduce risk of initial or subsequent fractures with a combination of calcium, vitamin D, and antiresportive medications.[13] There has been evidence that alendronate, risedronate and zoledronic acid playing a role in preventing nonvertebral and hip fractures.[14] Prior studies have shown low rates of use of osteoporosis medications in adults over the age of 90,[15] in those with dementia,[7] and in secondary prevention of fractures.[6,16]

Dementia and frailty are often associated with other comorbidities and can create competing priorities for physicians. The goal of this study was to assess prefracture osteoporosis diagnosis and treatment in high-risk older adults in the community. By doing this we hoped to identify missed opportunities for fracture prevention and identification of characteristics related to lack of prior treatment to help lay the groundwork for improved prevention efforts.

Methods

A retrospective case–control analysis using data from a hip fracture database was performed. The program is a co-managed care model based at a 261-bed community teaching hospital and an affiliate of a university medical center. A research nurse, as part of a quality management program, obtained data collected from patient medical records, including review of geriatric consultation and medication lists from transferring nursing homes.

Patients aged 60 and older who were admitted for surgical repair of a nonpathological, low-energy hip fracture between May 2005 and October 2010 were included in the study. Periprosthetic fractures were excluded. Demographic data were collected by chart review including age, gender, race, ethnicity, and place of residence. Comorbid illnesses defined in the Charlson risk index,[17] history of previous fragility fracture, and diagnosis of dementia were also recorded using data from patients' charts. A fragility fracture was defined as a low-energy fracture that occurred as a result of normal activities, such as fall from a standing height. In addition, information was collected regarding previous diagnosis of osteoporosis and whether patients were receiving treatment with calcium and vitamin D (Cal+D), or other osteoporotic medications including bisphosphonate,

Table 1. Demographics

Patient characteristics, n = 1070

Characteristic	Value
Age, mean ± SD	85.2 ± 8.4
Female, %	76.8
Race, %	
White	96.0
Black	1.4
Asian	1.6
Ethnicity, %	
Non-Hispanic	98.7
Hispanic	1.3
Place of residence, %	
Home	48.9
Skilled nursing facility	35.5
Assisted living	13.6
Dementia, %	47.8
Past medical history	
Osteoporosis, %	40.7
Previous fragility fracture, %	14.5
ADL, mean ± SD	3.9 ± 2.4
Charlson score, mean ± SD	3.1 ± 2.1

Abbreviations: ADL, activities of daily living; SD, standard deviation.

Table 2. Percentage of Patients With a Diagnosis of Osteoporosis on Osteoporosis Treatment Prior to Admission

	Overall, n = 1070	Diagnosis of osteoporosis, n = 435	No diagnosis of osteoporosis, n = 635	P value[a]
Cal+D	25.0%	27.4%	23.3%	.13
Other OP Meds	12.0%	11.0%	12.6%	.44

Abbreviations: Cal+D, calcium and vitamin D; OP Meds, osteoporosis medications.
[a]Diagnosis of osteoporosis versus no diagnosis of osteoporosis

calcitonin, teriparatide (synthetic parathyroid hormone), or selective estrogen receptor modulator (SERM). Patient characteristics were described using prevalence for categorical variables and means and standard deviation (SD) for continuous variables. Differences in diagnosis and treatment of osteoporosis by risk category were determined via Chi square analysis. Data were analyzed using StatView software for Windows (SAS Institute, INC, Cary, North Carolina). Institutional review board approval was obtained prior to conducting this study.

A total of 1070 patients were included in the study. The majority of those included were white and female. The average age was 85 years old (range 60.1-108.0, SD 8.4) and 511 (47.8%) of those analyzed had a diagnosis of dementia (Table 1). There were no statistical differences between the dementia and nondementia group, respectively, regarding average age (85.4 vs 85.0, P = .42), gender (75.3% female vs 78.2% female, P = .27), and history of prior fragility fracture

Table 3. Percentage of Patients With Dementia Who Were Diagnosed With Osteoporosis (OP) Prior to Admission and on OP Treatment Prior to Admission

	Total, n = 1070	Dementia, n = 511	No dementia, n = 559	P value[a]
OP diagnosis	40.7%	43.8%	37.7%	.04
Cal+D	25.0%	27.6%	22.5%	.06
Other OP Meds	12.0%	10.8%	13.1%	.25

Abbreviations: Cal+D, calcium and vitamin D; OP Meds, osteoporosis medications.
[a] Dementia versus no diagnosis of dementia.

Table 4. Percentage of Patients With a History of Fragility Fracture on Osteoporosis Treatment Prior to Admission

	Overall, n = 1070	Prior fragility fx n = 155	No prior fragility fx, n = 915	P value[a]
Cal+D	25.0%	32.3%	23.7%	.02
Other OP Meds	12.0%	12.3%	11.9%	.90

Abbreviations: Cal+D, calcium and vitamin D; OP Meds, osteoporosis medications.
[a] Prior fragility fracture versus no prior fragility fracture.

(14.7% vs 14.3%, $P = .87$). Only 40.7% of the patients carried a diagnosis of osteoporosis on admission (Table 1).

Results

Percentage of Patients Treated for Osteoporosis Prior to Admission

Overall, osteoporosis prevention treatment rates were low. Only 25% of the patients studied were taking Cal+D prior to their hip fracture. Rates were even lower when looking at the use of other osteoporotic medications. Only 12% of patients were taking other medications. Bisphosphonates were most commonly used, with 10.3% using this class of medication, while the rest included SERMs, calcitonin, and teriparatide. In those with a diagnosis of osteoporosis 27.4% were taking Cal+D prior to admission compared to 23.3% of those without a diagnosis of osteoporosis ($P = .13$). There was no statistically significant difference in the percentage of patients receiving other osteoporosis medications (11.0% vs 12.6%, $P = .44$; Table 2).

Percentage of Patients With Dementia Diagnosed and Treated for Osteoporosis Prior to Admission

Patients with a diagnosis of dementia were more likely to be diagnosed with osteoporosis prior to admission than those without (43.8% vs 37.7%, $P < .05$). Additionally, patients with a diagnosis of dementia had a trend toward being more likely to be treated with Cal+D than those without a history of dementia (27.6% vs 22.5%, $P = .06$), although the rates were low for both groups. There was no difference observed with prescription of other osteoporotic medications (10.8% vs 13.1%, $P = .25$; Table 3).

Percentage of Patients with History of Fragility Fracture Treated for Osteoporosis Prior to Admission

There were 155 (14.5%) patients with a history of previous fragility fractures. Those patients with previous fragility fractures were more likely to be on Cal+D than those without a history of fractures (32.3% vs 23.7%, $P = .02$; Table 4). No difference was observed with prescription of other osteoporotic medications.

Discussion

The population described in this study is at high risk of osteoporosis because of advanced age (mean age 85), high prevalence of dementia (47.8%), and history of previous fragility fracture (14.5%); however, only 40% of those with fractures were diagnosed with osteoporosis prior to their hip fracture. This may represent a lack of screening for osteoporosis or a true absence of osteoporosis. A study within a geriatric university-based practice found that physicians were more likely to order BMD screening in younger patients, patients independent with activities of daily living, and those without dementia.[18] By contrast, in our study, patients with dementia were more likely to be diagnosed with osteoporosis prior to their fracture. Current guidelines from the National Osteoporosis Foundation recommend DEXA scans for women over age 65, men over age 70, those who fracture a bone after age 50, younger postmenopausal women with risk factors, or men aged 50 to 69 with risk factors.[19] While, by definition, a person who sustains a hip fracture has osteoporosis, many individuals who sustain hip fractures do not have a T score of less than −2.5. A large community-based study showed that over half of those who sustained fractures did not meet the threshold of a T score below −2.5.[20]

Absence of diagnosis of osteoporosis may also represent poor documentation of this disease. Because osteoporosis is often considered to be a "silent disease" until patients suffer resulting fractures, it is possible that it is underreported as a medical condition.[21] The finding that patients who were diagnosed with osteoporosis were not more likely to be treated supports this explanation. However, undertreatment leads to increased risk, and so this finding reinforces the importance of both recognition and treatment of osteoporosis.

Primary treatment of osteoporosis overall was infrequent, with only 25.0% receiving Cal+D and 12.0% other osteoporosis medications prior to sustaining a fracture. Furthermore, we have also shown that 2 high-risk populations, those with dementia and those with previous fragility fracture, were not more likely to receive full treatment for osteoporosis when one would suspect that they would be targeted for more intensive intervention. The lack of diagnosis and treatment in all patients, but particularly in specific high-risk populations, indicates that there are missed opportunities to prevent or delay a major osteoporotic fracture that can lead to significant cost,

morbidity, and mortality. By identifying the degree to which patients at highest risk for fragility fractures remain untreated, we hope to lay the groundwork for targeted interventions to improve screening and treatment.

While only 25.0% of the total sample population was prescribed Cal+D on admission and 12.0% were taking other osteoporosis medications, the prescribing nature of physicians in the community was slightly improved from previous published reports. A study looking at 170 patients admitted with hip fractures conducted in the late 1990s, documented that on admission only 6.0% of patients were on calcium, 3.0% vitamin D, and none on alendronate.[22] Treatment following a fracture has previously been shown to be poor as well. In a more recently conducted study of 318 hospitals and 51 386 patients in the United States, in-hospitalization rates of treatment after hip fractures were 6.6% for Cal+D and 7.3% for anti-resorptive and bone forming medications, with only 2.0% prescribed both.[6] In Sweden, those patients with dementia were found to be less likely to use osteoporosis drugs than those without a diagnosis of dementia.[7]

Osteoporosis treatment has been shown to be effective in older adults. Vitamin D with calcium supplementation has been shown to reduce hip fracture risk.[23] Additionally, a study of community dwelling older adults showed a reduction in bone loss at the hip, spine and total body in the first year of treatment with Cal+D and reduction of total BMD loss after 3 years of treatment.[24] Patients prescribed bisphosphonates, who adhere to therapy, reduce their rate of hip fracture by 23.0%.[25]

Treatment of osteoporosis in patients with Alzheimer disease has been shown to be effective in preventing further hip fracture. A randomized double-blind controlled trial of patients with Alzheimer disease, comparing risedronate to placebo in patients who were both treated with Cal+D showed a relative risk reduction of hip fractures of 0.26 (95% CI, 0.10-0.69) in the bisphosphonate group.[26] A recent study has shown that treatment with an oral bisphosphonate therapy for 5 years was cost effective for all women when compared to no treatment regardless of life expectancy.[27]

There are many possible barriers to optimal osteoporosis treatment in patients with dementia. Elderly patients with multiple comorbidities, including dementia, often have competing medical problems, which can make it challenging to manage their osteoporosis. Providers may be concerned about potential or actual side effects,[28] other comorbidities, limited life expectancy and resources, cost-effectiveness, and competing goals of care. Clinical practice guidelines rarely address treatment of patients with three or more chronic medical diseases, or address the burden of comorbid disease.[29]

This study has several limitations. It was a retrospective database review and only looked at medication use, diagnosis of osteoporosis, and diagnosis of dementia at a single point in time. It is possible that there may have been some patients in the nondementia group who had mild cognitive impairment as dementia is often not screened for and is thus diagnosed at later stages. From the information collected, we were unable to know whether the patients had been on medications prior and the reason for no longer taking those medications. For example, those with a diagnosis of dementia might have been in a later stage of their cognitive decline, which would potentially decrease the probability that they would successfully adhere to a treatment program for osteoporosis. In addition, their primary care provider may have felt that their limited life expectancy would decrease the likelihood of benefit from preventative treatment. Similarly, we could not know whether the patient had been previously identified as having osteoporosis, but that a decision had purposely been made not to further manage. This may have underestimated the history of treatment and recognition of osteoporosis. Prospective studies aimed at looking at clinical decision making could help to clarify treatment decisions by primary care providers. Additionally, we did not document dosages of Cal+D patients were taking or have information about the BMDs or vitamin D levels of the patients. Some of the fractures might have occurred in the absence of a diagnosis by BMD of osteoporosis.[30]

This study demonstrates that primary and secondary preventative efforts are still not optimal in a hip fracture population but have improved over the past decade.[22] Further studies are needed to evaluate prescribing habits of physicians in the community to help identify barriers to the screening for osteoporosis and prescription of Cal+D or other osteoporosis medications especially in high-risk individuals. This in turn will help improve osteoporosis prevention efforts and prevent future fragility fractures.

Declaration of Conflicting Interests

Funding

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