Osteoporosis treatment in older adults undergoing rehabilitation post-hip fracture

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Abstract

Objective

Osteoporosis treatment in patients who have sustained a hip fracture has been reported to be less then 20%. The objective of this study is to determine the current rate of adherence to osteoporosis practice guidelines in elderly patients post-hip fracture who have undergone rehabilitation.

Methods

This was a retrospective chart review of patients over the age of 65 who were admitted to a rehabilitation facility post fragility hip fracture between 2004 and 2005. One hundred and sixty-three patient charts were chosen for review. Treatment rates, reported descriptively, and predictors of guideline adherence, using multi-variant regression models, are reported.

Results

Osteoporosis therapy (any type) was prescribed to 90 (63%) patients, with bisphosphonates prescribed in 90% of these cases. Calcium and vitamin D was prescribed to 130 (90.9%) patients. Of all the study patients, 76 (53%) of patients had at least one contraindication to osteoporosis therapy identified. Having a diagnosis of osteoporosis was the only factor associated with receiving osteoporosis therapy (OR 13.3, $p<0.001$).

Conclusion

In this selected patient population the rates of osteoporosis treatment are higher than previously reported but remain suboptimal.

Key words

Fracture, geriatric, hip, osteoporosis, predictors of treatment.

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Introduction

In Canada, it is estimated that 1 in 4 women and 1 in 8 men have osteoporosis, and this number is expected to increase (1). Osteoporosis is associated with a 40% lifetime risk of fracture in women over the age of 50 (1). Fractures are associated with a reduced functional status, reduced quality of life and an increased mortality rate (1, 2) Hip fractures result in death in up to 20% of women in one year and disability in 50% of those who survive (1). Once patients have sustained a fracture, there is a 1.5-9.5 fold increase in the risk of refracture (1). The financial implications associated with treating osteoporosis and the associated fractures are also significant; it is estimated that in Canada over $1.3 billion is spent each year and this number is expected to increase to over $30 billion by 2018 (1).

The 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada recommends that all patients who have experienced a fragility fracture be treated for osteoporosis (1). Currently available medications can reduce the rate of fracture by 30-50% (3-5). Therefore, it is important that patients who have sustained a fragility fracture be appropriately treated for osteoporosis to reduce the risk of refracture.

Current treatment rates for osteoporosis in patients post fragility fracture are suboptimal, and range from 5 to 50%(6-9). This degree of under treatment of osteoporosis is also evident in the post-hip fracture population with treatment rates reported to be less then 20% (10-15). However, all of these studies have similar limitations that affect the accuracy of their reported rates of treatment. One limitation is that most of these studies have not provided adequate follow up of patients post discharge, which may overestimate treatment gaps. Studies that have used administrative claims data may not be able to account for the use of all osteoporosis therapy, such as the use of calcium and vitamin D. Additionally, none of these studies evaluated whether treatment was appropriate for the sample being studied (*e.g.* the presence of contraindications) which may have a substantial effect on the true treatment gap.

This study focuses on treatment rates for osteoporosis within a rehabilitation population. Approximately 60-70% of hip fracture patients are transferred to a rehabilitation facility (15,16) To date, there have been two studies that evaluated treatment rates in populations admitted to a rehabilitation facility, both of which found a treatment rate of only 10% (15, 16). A rehabilitation facility provides an excellent setting to assess if patients are started on osteoporosis therapy after a hip fracture, as patients are more medically stable as compared to an acute care setting and are exposed to an interdisciplinary team for a longer period of time.

In addition, this study set out to determine the possible predictors associated with receiving osteoporosis therapy after a hip fracture. Few studies have evaluated patient and physician factors associated with receiving treatment for osteoporosis after a hip fracture. Factors that have been identified with a lower probability of being treated for osteoporosis include male gender, extremes of age, non-Caucasian ethnicity, increased number of comorbid conditions, not having an osteoporosis diagnosis documented, being seen by a male physician and seeing a generalist (versus a specialist) (17, 18). Unfortunately, there is no published information evaluating how patient specific factors influence appropriateness of therapy.

Methods

Study objectives

The primary objective of this study was to determine the rate of adherence to osteoporosis practice guidelines in elderly patients post-hip fracture who underwent rehabilitation. More specifically, to determine the extent to which osteoporosis medications are used in accordance with the practice guidelines in the post-hip fracture population. The secondary objective of this study was to characterize the predictors of adherence to these guidelines, including patient factors and physician characteristics.

Study design and participants

This study was a retrospective chart review of patients 65 years of age or

older who had undergone orthopedic rehabilitation care at a regional rehabilitation centre following a hip fracture and were discharged from the facility between the period of January 1st, 2004 and December 31st, 2005. A diagnosis of hip fracture was identified using ICD – 10 codes S72.0, S72.1 and S72.2. Patients were excluded from the study if they had a previous diagnosis and/or received treatment (except for calcium or vitamin D) for osteoporosis prior to sustaining the hip fracture, had coexisting bone disease (osteomalacia, multiple myeloma or Paget's disease) or if the hip fracture was a result of severe trauma.

One hundred and sixty-three patient charts were consecutively selected for review with the first patient as the one with the most recent discharge. The sample size was calculated from previous published data that found on average 20% of patients receive treatment for osteoporosis post-hip fracture. The sample size estimate was performed using EPI INFO version 6.0 (CDC, Atlanta, GA). The confidence interval desired in the study was 95% and the standard deviation was ± 5%. The study period was selected to ensure at least one year had lapsed since the release of the Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada, which were published in November 2002. Ethics approval was obtained through the Health Research Ethics Board at the University of Alberta and Administrative approval was obtained from the Northern Alberta Clinical Trials and Research Center.

Setting

The study population was selected from the largest rehabilitation center in the Capital Health Region, the Glenrose Rehabilitation Hospital, located in Edmonton, Alberta, Canada. The hospital serves the tertiary rehabilitation inpatient and outpatient needs of the northern half of Alberta. Patients admitted to the facility are referred from various acute care hospitals from within and outside the health region. At the rehabilitation facility, board certified family physicians have the role of the attending physician.

Data collection

Data gathered from the patient charts included the following: Demographics and medical history; interventions related to osteoporosis management (osteoporosis medications, calcium and vitamin D, hip protectors); factors required to assess appropriateness of treatment as determined by the contraindications to therapy listed in the product monographs; risk factors for osteoporosis as outlined in the 2002 Clinical Practice Guidelines for the Diagnosis and Management of Osteoporosis in Canada (1) and patient outcomes (length of stay and placement on discharge). Attending physician gender, and the health professional responsible for prescribing or recommending osteoporosis therapy was recorded. Laboratory parameters were collected to measure renal function. Creatinine clearance was calculated using the Cockroft-Gault equation (19).

Outcomes

The primary outcome of the study was to determine the proportion of patients who received a prescription for an osteoporosis medication post-hip fracture. The secondary outcomes included calcium and vitamin D use and the predictors of receiving an osteoporosis medication post-hip fracture such as demographics, medical history, contraindications, and patient characteristics.

Analysis

Simple proportions are reported to

Table I. Characteristics of the study cohort (n=143) admitted to the rehabilitation facility post-hip fracture*.

Characteristic	Male (n=49) n (%)	Female (n=94) n (%)	All (n=143) n (%)
Age on admission			
Mean ± SD (yrs)	81 ± 7.3	84 ± 7.1	83 ± 7.3
65-84	32 (65.3)	41 (43.6)	73 (51.0)
≥85	17 (34.7)	53 (56.4)	70 (49.0)
Ethnicity			
Caucasian	30 (61.2)	72 (76.6)	102 (71.3)
Other	19 (38.8)	22 (23.4)	41 (28.7)
Weight <57 kg	3 (6.1)	42 (44.7)	45 (31.5)
Alcohol use (> 2/day)	9 (18.4)	7 (7.4)	16 (11.2)
Smoking (Current/Ex)	17 (34.7)	19 (20.2)	36 (25.2)
History of prior fracture **	4 (8.1)	26 (27.7)	30 (21.0)
Vertebral	1 (2.0)	9 (9.6)	10 (7.0)
Hip	1 (2.0)	10 (10.6)	11 (7.7)
Wrist	2 (4.1)	9 (9.6)	11 (7.7)
Propensity to fall	5 (30.6)	34 (36.2)	49 (34.3)
Documentation of an osteoporosis risk factor	29 (59.2)	75 (79.8)	104 (72.7)
Number of comorbid conditions	6.4 ± 2.4	6.2 ± 2.4	6.2 ± 2.4
Referring hospital			
Regional Teaching Hospital			133 (93.0)
Regional Community Hospital			10 (7.0)
Residence prior to hip fracture			
Home alone/No assistance			35 (24.5)
Home with spouse/family			55 (38.5)
Home with home care			6 (4.2)
Lodge			24 (16.8)
Assisted living			21 (14.7)
Nursing home			0
Other***			2 (1.4)

*Because of rounding, not all percentages total 100; **Two patients had more then one documented fracture; ***One patient was from a group home and returned to the group home on discharge. The remaining patients were discharged back to a tertiary or rural hospital.

describe the number of patients who received osteoporosis medications. Receipt of osteoporosis medications was defined as at least 1 prescription for any of the following medications: alendronate, etidronate, risedronate, hormone therapy, nasal calcitonin, raloxifene or parathyroid hormone.

A stepwise logistic regression was completed with the dependent variable being receipt of an osteoporosis medication and independent variables being all demographic and clinical data, including age, gender, ethnicity, presence of contraindications, number of comorbid conditions, number of concurrent medications, number of osteoporosis risk factors, fracture history, receiving a bone density exam, presence of osteoporosis diagnosis post fracture, length of stay, placement on discharge and attending physician gender and specialty. A univariate analysis was initially completed for each variable. Variables that demonstrated significance in the univariate analysis (*p*-value less then 0.20), were then entered into the multivariate analysis. Statistical analysis used SPSS 13.0 for Windows for chi-square analysis, Fisher's exact correction, and logistic regression modeling where appropriate.

Results

Patient demographics

A total of 163 patient charts were reviewed, 20 of which were excluded because the patients had received osteoporosis medications prior to the index fracture. Characteristics of the 143 patients that were included in the study are described in Table I. Sixty six percent of the patients were female. Twenty one percent of the study cohort had documentation of a previous fracture.

Patient outcomes and treatment rates

The average length of stay at the rehabilitation facility was 8.5 weeks. Within the entire study cohort, 76% were diagnosed with osteoporosis and 63% received treatment with an osteoporosis agent on discharge from the rehabilitation facility. Of the patients who started osteoporosis treatment, 60% of them initiated therapy while in the rehabilitation facility. Bisphosphonates were the most commonly used agent, with 90% of patients on medications prescribed one of these agents. Calcium and vitamin D were prescribed in 90% of all patients. Table II describes the disposition of patients on discharge from the rehabilitation facility, while specific treatment interventions are described in Table III.

Table II. Patient disposition on discharge from the rehabilitation facility.

Characteristic	Male (n=49) n (%)	Female (n=94) n (%)	All (n=143) n (%)
Length of stay (wks) at rehabilitation facility	8.2 ± 6.1	8.8 ± 6.8	8.5 ± 6.4
Number of medications on discharge	12.7 ± 3.8	12.1 ± 3.6	12.4 ± 3.7
Osteoporosis diagnosis documented	34 (69.4)	75 (79.8)	109 (76.2)
Osteoporosis treatment prescribed*	29 (59.2)	61 (64.9)	90 (63.0)
BMD exam completed	2 (4.1)	2 (2.1)	4 (2.8)
Hip protectors prescribed	0	14 (14.8)	14 (9.8)
Residence on discharge from the rehabilitation facility			
Home alone/No assistance			4 (2.8)
Home with spouse/family			42 (29.4)
Home with home care			20 (14)
Lodge			16 (11.2)
Assisted living			23 (16.1)
Nursing home			23 (16.1)
Other			11 (7.7)
Deceased			4 (2.8)

*Includes receipt of either a bisphosphonate or calcitonin, (No patient received raloxifene, HRT, PTH).

Table III. Proportion of patients who received osteoporosis treatment on discharge (D/C) from the rehabilitation facility and the location of treatment initiation (Acute Care Hospital (ACH) or the Rehabilitation Facility (RF)).

	Initiated at the ACH n (%)	Initiated at the RF n (%)	Total patients treated on D/C n (%)
Any antiresorptive agent	33 (23.0)	57 (51.8)	90 (63)
Bisphosphonate	30 (20.9)	51 (46.3)	81 (56.7)
Alendronate	28 (93.3)	46 (90.2)	74 (51.8)
Risedronate	2 (6.7)	4 (7.8)	6 (4.2)
Etidronate	0	1 (2.0)	1 (0.7)
Calcitonin (Nasal)	3 (2.1)	6 (5.5)	9 (6.3)
Calcium + Vitamin D	66 (46.1)	64 (83.1)	130 (90.9)
Calcium*	70 (49.0)	62 (84.9)	132 (92.4)
Vitamin D*	66 (46.2)	64 (83.1)	130 (90.9)
Calcium + Vitamin D + antiresorptive agent	31 (21.7)	57 (50.9)	88 (61.5)

*Refers only to supplemental calcium and vitamin D (*i.e.* does not account for dietary intake) at any dose. The proportion of patients receiving 1500 mg of supplemental calcium and 800-1000 IU of supplement vitamin D was 90 (63%) and 121(84.6%) respectfully.

Contraindications to treatment

Contraindications to osteoporosis therapy were identified in 76 patients (53%). A creatinine clearance less then 30 mL/min was the most common contraindication identified. The prevalence of specific contraindications to osteoporosis therapy is listed in Table IV. Seventeen patients had contraindications to more than one class of medications and one patient had contraindications to all medications other than PTH.

Physician characteristics

Characteristics of the physicians at the rehabilitation facility for the care of the patients in the study are shown in Ta-

ble V. For patients starting osteoporosis therapy while at the rehabilitation facility, the attending physicians were responsible for prescribing the osteoporosis therapy in these patients.

Predictors of treatment

The results of the step-wise multi-variant logistic regression are reported in Table VI. Having an osteoporosis diagnosis documented on the chart was the only variable that demonstrated significance in favor of receiving osteoporosis therapy (OR 13.3, $p<0.001$). Physician factors were not shown to have any association with receiving osteoporosis therapy.

Discussion

Treatment rates

In this study, the rates of diagnosis and treatment of osteoporosis in accordance with the guidelines was found to be higher then previous reports (10-16). A diagnosis of osteoporosis was made in 74% of the study population and the use of antiresorptive therapy was prescribed to 63% of all patients on discharge from the rehabilitation facility. The use of calcium and vitamin D was even higher with greater than 90% of patients receiving both agents. Although there are differences between this study and previously published studies, such as patient populations and lengths of follow up, this study does show an improvement in the diagnosis and treatment rate of osteoporosis post-hip fracture compared to earlier reports.

Previous literature that has evaluated treatment rates of osteoporosis among the hip fracture population has suggested that the use of osteoporosis medications is sub-optimal (10-16). Gardner *et al*. reviewed the discharge orders for 300 patients who were admitted to one of three tertiary hospitals for a hip fracture between 1997 and 2000, and found that only 19% of patients received a prescription for osteoporosis therapy (estrogen, calcitonin, a bisphosphonate, calcium or vitamin D) on discharge (10). In a chart review by Follin *et al*., only 25% of patients admitted to a university teaching hospital for a low trauma hip fracture had received treatment for osteoporosis at one year (11). A survey of 168 patients who had been admitted to hospital for hip fracture found that 31% of patients received some form of osteoporosis therapy upon discharge from hospital, treatment rates increased to 59% between 1 and 5 years post discharge however, one third of patients were receiving only calcium and/or vitamin D only (12). In another study evaluating the rate of osteoporosis treatment post-hip fracture, only 5% of the 504 patients assessed were receiving calcium and vitamin D, and no patients were receiving antiresorptive therapy. The number of patients taking calcium

Table IV. Prevalence of contraindications to osteoporosis medications identified in study cohort (n=143)*.

Medication class	Type of contraindication	Frequency n (%)
Bisphosphonates	Any	66 (46.2)
	Creatinine clearance < 30mL/min	56 (39.1)
	Esophageal problems (strictures/achalasia)	8 (5.6)
	Dysphagia	2 (1.4)
	Hypocalcaemia	0
	Unable to sit/stand ≥30 minutes	0
	Allergy	0
Calcitonin	Any	4 (2.8)
	Fish/salmon allergy	2 (1.4)
	Unable to use nasal spray	2 (1.4)
Raloxifene**		14 (9.8)
HRT§		15 (9.8)
Calcium†		3 (2.1)
Vitamin D◊		3 (2.1)
Proportion of patients with at least one contraindication documented		76 (53.1)

*Presence or absence of contraindications were determined by chart review. Defined contraindications are per the manufacturers product monograph; **HRT contraindications: History of venous thromboembolism (VTE)/pulmonary embolism (PE), Breast cancer, dysphagia, undiagnosed vaginal bleeding, allergy; §Raloxifene contraindications: History of VTE/PE, cervical/uterine cancer, dysphagia, allergy; †Calcium contraindications: hypercalcaemia, dysphagia, renal calculi, allergy; ◊Vitamin D contraindications: hypercalcaemia, dysphagia, allergy.

Table V. Description of physicians responsible for patient care in study cohort.

Physician characteristic	Proportion of patients (n=143) n (%)
Attending physician gender	
Male	33 (23)
Female	110 (77)
Physician consults*	61 (42.7)
Orthopedics	24 (16.8)
Geriatric psychiatry	11 (7.8)
Geriatric medicine	7 (4.9)
General internal medicine	7 (4.9)
Rheumatology	3 (2.1)
Other	39 (27.3)
Physician responsible for making osteoporosis diagnosis**	
Attending physician	60 (42)
Consulting physician§	1 (0.7)
Physician responsible for initiating osteoporosis therapy**	
Attending physician	57 (37.8)
Consulting physician	0

*Refers to the consults that occurred while the patient was at the rehabilitation facility; **Applies to patients that had the diagnosis made or treatment initiated at the rehabilitation facility (*i.e*. excludes patients that were not diagnosed or treated at the acute care hospital); §Diagnosis was made by a Geriatrician.

Table VI. Adjusted odds ratio on the likelihood of receipt of osteoporosis therapy on discharge from the rehabilitation facility*.

Characteristic	Adjusted OR	95% CI	*p*
Length of stay ≤8 wks	.53	0.67-3.50	0.32
No medication contraindications	0.59	0.10-3.64	0.57
No contraindication to bisphosphonate	3.06	0.50-18.6	0.23
Osteoporosis diagnosis made	13.3	4.91-36.1	<0.001

*Multivariant logistic regression model adjusted for all variables listed in the Table.

and Vitamin D had increased to 18% of patients at one year; however, there was no change in the use of antiresorptive agents (14).

Published treatment rates in rehabilitation centers have been even lower. Juby *et al*., in a retrospective chart review of 311 patients over the age of 65 admitted to a tertiary care hospital for a hip fracture, found that only 9.7% of patients received treatment for osteoporosis (15). Of the patients that were subsequently admitted to a rehabilitation facility, 13% were receiving treatment on admission but only 10% of these patients were receiving treatment on discharge. Both our study and the one completed by Juby *et al*. were done within the Capital Health Region and assessed similar patient populations. Comparing treatment rates from Juby's study and our study suggests that there has been an improvement in the recognition of osteoporosis and subsequent treatment of osteoporosis in the last seven years. A diagnosis of osteoporosis improved from 11% to 74% in our study, and treatment rates improved from 10% to 63%.

There may be several reasons for the increase in osteoporosis diagnosis and treatment rates in this study as compared to studies that evaluated treatment rates in non-rehab patient populations. One potential reason may be the culture of the rehabilitation environment in contrast to the acute care setting, with the focus on improving function, and preventing subsequent fracture and function decline. Additionally, there is a greater duration of exposure with the health care team in a rehabilitation facility which may influence the assessment for osteoporosis. Patients may also be perceived to be medically stable and able to tolerate medications, compared to patients immediately post-fracture. Another potential factor for the increased treatment rates may be the timing of the study which followed the publication and dissemination of the 2002 Osteoporosis Canada treatment guidelines, and this may be particularly relevant when looking at the change in diagnosis and treatment rates between our study and that completed by Juby *et al*.

The under treatment of osteoporosis and the impact of appropriate therapy on decreasing the risk of refracture have been well documented. Interventions to improve osteoporosis treatment rates are being investigated. Among patients with hip fractures the use of a Fracture Liaison Service or Case Manager has been shown to improve treatment of osteoporosis (20, 21). In a randomized study looking at the use of a nurse case manager, a statistically significant increase in the rate of osteoporosis treatment post-hip fracture was demonstrated. Rates of osteoporosis treatment in the usual care group versus the intervention group were 22% and 51% respectively (20). Looking at resources required for this service, the study investigators estimated that 70 minutes were required per patient at a cost of $50.00 per patient (20). In a study from the United Kingdom, the use of a Fracture Liaison Service was evaluated to determine their impact on osteoporosis treatment rates. Patients who had sustained a fragility fracture were eligible to receive care from the Facture Liaison Service. Of those patients whose fragility fracture was of the hip, only 38% received a bisphosphonate following the fracture. Of these patients, treatment rates increased to only 42% after they sustained a second fragility fracture (20). Our study was a retrospective chart review, with no specific intervention for osteoporosis, yet treatment rates were similar to the results of these two interventions. Perhaps the environment of a rehabilitation facility is a determinant in increasing the appropriate treatment of osteoporosis following a fracture, however, further studies are required.

Predictors of guideline adherence

Although previous literature has described several predictors of osteoporosis treatment, the prevalence of contraindications to osteoporosis medications has not been assessed. In this study, 57% of patients had documentation of at least one contraindication to an antiresorptive agent. However, no association was found between the presence of contraindications and receiving osteoporosis therapy. Nineteen patients, who were not on osteoporosis treatment, also had no documented contraindications to osteoporosis medications. On the other hand, 25 patients who had a documented contraindication to bisphosphonates were given bisphosphonates.

In our study, having a diagnosis of osteoporosis documented on the patient chart was the only factor found to have an association with receiving therapy. These results are in contrast to previous publications (17, 18). Male sex, extremes in age, non-Caucasian ethnicity or multiple comorbid conditions have been associated with a lower likelihood of osteoporosis treatment (17, 18). However, this study was not designed or powered to look at these associations and may explain the discrepancy in our results and those found previously.

Study limitations

This was a retrospective chart review; therefore the accuracy of data collected is limited by the documentation in the patient chart. As well this type of study is unable to capture clinical judgment. It was also difficult to extract interventions from other health care disciplines because there was no chart documentation specific to osteoporosis care from other team members. Lastly, this study did not evaluate patient compliance to prescribed drug therapy on discharge

from the rehabilitation facility. Reports suggest that 35% of women stop osteoporosis treatment within 6 months of starting therapy, evaluating compliance rates in our population would have been beneficial in further defining the osteoporosis care gap (22).

Conclusion

Although this study found an increase in treatment rates compared to previous studies, there is still a treatment gap with 37% of hip facture patients not receiving osteoporosis therapy. This highlights the need for targeted interventions to improve the osteoporosis treatment rates in the hip fracture population. Since the treatments rates in this rehabilitation setting were higher than reported for other settings and comparable to intervention programs, the use of inpatient rehabilitation programs may be a very efficient method of improving treatment rates, especially since a significant number of patients already receive this service. Although we attempted to identify reasons why patients may or may not receive osteoporosis therapy, no clear explanation could be found in this study. It remains unknown at this time whether similar improvement has been gained in the treatment of osteoporosis among other patient populations including those not referred to a rehabilitation facility and those who experience other types of fragility fractures.

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