Missing a Therapeutic Window of Opportunity: An Audit of Patients Attending a Tertiary Teaching Hospital with Potentially Osteoporotic Hip and Wrist Fractures

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ABSTRACT. ***Objective.*** To establish the rate of and the predictors for performance of a bone mineral density (BMD) test and the treatment of osteoporosis in an at-risk cohort of patients attending a tertiary teaching hospital with fracture possibly related to osteoporosis.

Methods. A list of all patients between ages 40 and 85 who had been admitted to a tertiary teaching hospital in the last 18 mo with hip fracture or seen in the accident and emergency department with a wrist fracture over the last 30 mo was obtained from computer records; those patients were invited to participate in the audit. In a followup telephone questionnaire, they were queried about potential risk factors for osteoporosis and subsequent fracture, the performance of a BMD test, any information received on osteoporosis and the source of this information, and the prescription of any treatment for osteoporosis.

Results. In total, 218 patients were included in the audit from a potential 374 eligible patients. The majority were female (78%), with hip and wrist fractures in 42% and 58%, respectively; 32% subsequently had BMD measured and 39% were offered treatment for osteoporosis. Ninety-four percent of patients had heard of osteoporosis, with the major source of information being the media (83%) and friends (23%), with little information from the medical profession (34%). The major predictors for a patient to have a subsequent BMD test were female sex (OR 3.4, 95% CI 1.3–9.9), history of a previous fracture after the age of 50 (OR 2.3, 95% CI 1.0–5.6), family history of osteoporosis (OR 3.5, 95% CI 1.3–9.5), or the use of concurrent medications with a potential to cause osteoporosis (OR 2.5, 95% CI 1.1–5.8). The main predictors of treatment for osteoporosis being offered were age (risk increased by 1.04 for every year of life), abnormal result on the BMD test (OR 19, 95% CI 6–60), history of fracture after the age of 50 (OR 2.6, 95% CI 1.1–6.7), and a history of fracture with minimal trauma (OR 2.6, 95% CI 1.1–4.2). There was a range of treatments offered, with calcium supplementation alone accounting for 60% of treatments.

Conclusion. Osteoporosis was overlooked by medical practitioners responsible for the care of this at-risk patient cohort, with little evidence of the medical profession offering information, further investigation, or treatment of patients who presented with a probable osteoporotic fracture of the hip or wrist. This suggests that greater education of the accident and emergency and orthopedic medical staff as well as the general public is required concerning this opportunity to investigate and treat symptomatic osteoporosis. (J Rheumatol 2001;28:2504–8)

Key Indexing Terms:
OSTEOPOROSIS FRACTURES RISK FACTORS TREATMENT

Osteoporosis has been defined as a disease characterized by low bone mass and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk[1]. As patients with established osteoporosis are usually asymptomatic, these patients are most likely to come to the attention of the medical profession when presenting with nonpathological fractures as a result of minimal trauma. The importance of investigating and treating these patients is further emphasized by the increased risk of such patients having further fractures in the future, compared to patients who have not sustained an osteoporotic fracture[2].

To make a presumptive diagnosis of osteoporosis in the absence of fracture a surrogate marker for bone quality and strength is needed. Bone mineral density (BMD) estimated by dual energy x-ray absorptiometry (DEXA) is now routinely used as such a marker[3]. The validity of this

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measurement is based on its ability to predict the risk of fractures in individuals with lowered BMD. A metaanalysis of high quality prospective cohort studies of BMD in women found that a 1 standard deviation (SD) decrease in BMD carried a relative risk (RR) of 1.5 (1.4–1.6) for any fracture, while a 1 SD decrease at the spine carried a RR of 2.3 (1.9–2.8) of vertebral fracture, and a 1 SD decrease at the hip carried a RR of 2.6 (2–3.5) for hip fractures[2]. Based on the ability of BMD measurements to predict fracture, the World Health Organization has proposed that osteoporosis be defined as a BMD > 2.5 SD below the mean for young adults, while a BMD between 1 and 2.5 SD below this mean should be regarded as lowered bone density or osteopenia[3].

Osteoporosis is a major cause of fractures in older people, with considerable morbidity, an excess mortality, and considerable economic costs associated with osteoporotic fractures, especially hip fractures[4]. The annual costs of osteoporosis have been estimated to be at least $100 million in Canada, $US 10 billion in the United States[4], and $A 779 million in Australia[5]. The cost of vertebral and rib fractures is difficult to quantitate, as many are asymptomatic; some cause chronic pain but are less likely to lead to hospitalization. Chronic pain results in costs of frequent medical consultations as well as allied health costs, pharmaceutical costs, and costs of additional supports needed to manage activities of daily living and the notional cost of decreased quality of life.

We undertook this study of a patient group presenting with a potentially osteoporotic fracture to assess the presence of risk factors in this patient group, the amount of education offered to these patients, and the source of this education. We also enquired about the performance of a BMD test and the prescribing of any treatment for osteoporosis, and evaluated possible predictors for the ordering of BMD testing and prescription of treatment for osteoporosis.

MATERIALS AND METHODS

The medical records of an Australian teaching hospital (Flinders Medical Centre) were searched for a coded discharge diagnosis of hip fracture over the preceding 2 years. A list of all patients attending the accident and emergency department of the same hospital over a 30 month period with a wrist fracture was also obtained. These records were then sorted to exclude all patients aged under 40 and over 85 years. The reason for these exclusions was to audit patients likely to be at risk of osteoporosis and to exclude likely cases of trauma (> 40) or patients unable to cooperate with the audit because of comorbidities, dementia, or death (< 85 yrs).

A letter was sent to all eligible patients inviting them to participate in the study, but the specific purpose of the study was not revealed so as not to bias the subject responses to the questionnaire. This was followed by a telephone call one week later by one author (WR), who ascertained that the patient did fulfill the eligibility criteria for the study and was willing to participate in the study and administered a standardized questionnaire by telephone, recording the patient's responses to a series of questions on a standard proforma (Table 1). The average length of each telephone call was 10 min. Attempts were made to contact all eligible patients for the study.

All statistical analyses were performed using SPSS for Windows Release 6.1.3. Descriptive statistics were obtained for all data and then the data were coded to answer 3 main questions: (1) Which variables predict the performance of a BMD test in these patients. (2) Which variables predict the decision to offer any treatment for osteoporosis. (3) Which variables predict the decision to offer treatments for osteoporosis other than calcium supplementation alone.

Initially the relevance of single parameters for each question was assessed using crosstabs for dichotomous variables and T test for continuous variables, selecting all parameters with $p < 0.1$ (Table 2). All relevant predictors were then placed in a logistic regression analysis to obtain the best predictors of each question.

Table 1. Telephone questionnaire administered to patients.

1. Age
2. Sex
3. Age of onset of menopause
4. Use of hormone replacement therapy
5. History of a previous fracture after the age of 50
6. Family history of osteoporosis
7. Use of medications known to be associated with an increased risk of osteoporosis [list of medications obtained and enquiry about the use of specific medications (oral corticosteroids, anticonvulsants, heparin)]
8. Smoking history
9. Exercise history
10. Estimated body weight (individual asked if they had a small, medium, or large build and what height they were)
11. Total number of fractures ever
12. History of fracture with no trauma or following an insignificant event thought unlikely to cause a fracture
13. Have you heard about osteoporosis?
14. What was the source of your information about osteoporosis?
15. Have you had a bone mineral density measurement performed and if so, do you know if it was normal or low?
16. Are you taking any treatment for osteoporosis and what is the name of the medication(s)?
17. Did you receive any information about osteoporosis during your contact with the hospital at the time of your fracture?

Table 2. Factors that predict performance of BMD test or use of treatment for osteoporosis.

Variable	Performance of BMD test, p*	Treatment of Osteoporosis, p*
Sex	0.013	0.000
Age	0.629	0.069
Type of fracture	0.291	0.519
Family history	0.010	0.664
Early menopause	0.723	0.736
Use of HRT	0.002	0.172
Previous fracture over age 50	0.001	0.000
Total no. of fractures	0.006	0.015
Smoking history	0.869	0.350
Low body weight	0.505	0.174
Lack of exercise	0.490	0.523
Fracture with minimal trauma	0.117	0.090
Relevant medications	0.031	0.095
Result of BMD test	—	0.037
Total no. of risk factors	0.001	0.000

* p values calculated by T test (continuous variables) and crosstabs (dichotomous variables). HRT: hormone replacement therapy.

RESULTS

There were 374 eligible patients, but only 218 could be included in this audit. The reasons for noninclusion of subjects were inability to contact subject after repeated attempts (79), death (27), mental impairment including dementia (34), language barrier (6), and other reasons (10). There were 170 women and 48 men in the study with a mean age of 69.9 years (range 41–82). There were 91 hip (42%) and 127 wrist (58%) fractures in this group. There were 34 (15.6%) subjects who were currently smoking and 82 (37.6%) who had previously smoked. The majority of this patient group were either low (16.5%) or average (67.4%) in body weight and 89 (40.8%) stated that they undertook regular exercise for at least 20 minutes on at least 3 occasions in a week. Twenty-two percent of patients were taking medications (e.g., corticosteroids) that have been associated with increased risk of osteoporosis. In the female group, 50 (23%) had an onset of menopause earlier than 50 years of age and 49 (22.5%) had been taking hormone replacement therapy at some time. Only 25 (11.5%) could recall a family history of osteoporosis, but 82 (37.6%) had previously had a fracture at an age > 50 years. Only 22 (10%) stated that they had experienced a fracture with minimal or no trauma. A significant number (59%) had had at least one previous fracture.

The data were then analyzed to count the number of potential risk factors for osteoporosis for each patient, and the mean number of risk factors for this group of patients was 2.02. Eighty-four percent of patients stated that they were not given any information about osteoporosis at the time of the fracture, but 94% of the patient group had heard of osteoporosis. The main sources of information on osteoporosis were the media (83%) and friends (23%), while only 34% of patients had received any information from the medical profession, mainly general practitioners after they had been discharged from the hospital. Sixty-nine (32%) of this patient group had had a BMD estimation performed, with 56% of the results indicating osteoporosis (according to the patient), while 17% of patients were unaware of the result of the BMD test. Only 39% of patients were receiving treatment for osteoporosis at the time of this audit (Figure 1).

The factors that predicted the performance of a BMD test were sex, family history of osteoporosis, use of hormone replacement therapy (women), history of a fracture over the age of 50, the total number of fractures, the use of medications associated with osteoporosis, and the number of risk factors for osteoporosis. However, when regression analysis was performed, the only factors predicting performance of a BMD test were use of medications known to be associated with osteoporosis [$p < 0.05$, odds ratio (OR) 2.5, 95% confidence interval (CI) 1.1–5.8], family history of osteoporosis ($p < 0.02$, OR 3.5, 95% CI 1.3–9.5), female sex ($p < 0.02$, OR 3.4, 95% CI 1.3–9.9), and a history of fracture after the age of 50 ($p < 0.05$, OR 2.3, 95% CI 1.0–5.6). Factors that predicted the use of osteoporosis treatments in this patient group were age, sex, the use of medications associated with osteoporosis, history of a fracture over the age of 50, history of fracture with minimal trauma, total number of fractures, result of a BMD test, and the number of risk factors for osteoporosis. However, the only factors that predicted the use of treatment for osteoporosis, by regression analysis, were age (likelihood increases 1.04 for each year of age), history of fracture over the age of 50 ($p < 0.05$, OR 2.6, 95% CI 1.1–6.7), result of BMD ($p < 0.02$, OR 19, 95% CI 6–60),

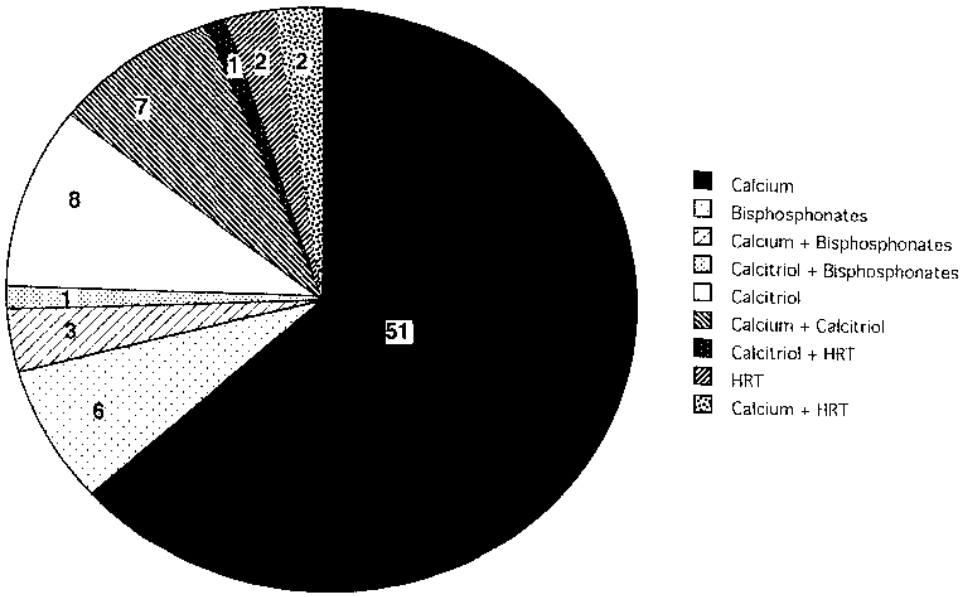

Figure 1. Treatment offered for osteoporosis. HRT: hormone replacement therapy. Numbers refer to number of patients treated.

and history of fracture with minimal trauma ($p < 0.05$, OR 2.6, 95% CI 1.1–4.2).

The major treatment offered to these patients was calcium supplementation alone. When the data were analyzed to see which factors predicted the use of more potent treatments (other than calcium supplementation) for osteoporosis, the only predictors were the number of risk factors ($p < 0.02$) and the result of the BMD test ($p < 0.05$). A logistic regression analysis showed that no factors were strong predictors of use of treatments other than calcium supplementation (95% CI crossed 1.0).

DISCUSSION

Based on a 2 year study of the Barwon statistical division in Victoria, Australia (February 1994 to February 1996; total population 218,000), it has been estimated that there were a total of 83,000 osteoporotic fractures in Australia in 1996, and this is projected to increase to 104,000 by 2006. Hip fractures, which are the main cause of the economic burden of osteoporosis, are expected to increase from 15,000 to 21,000. Population projections suggest hip fractures could quadruple by 2051[6]. This has the potential to impose a considerable economic burden on the community. The Dubbo (New South Wales) Osteoporosis Epidemiology Study found that the median cost for treatment of 151 osteoporotic fractures was $A 10,511 (1992 dollars) for inpatient treatment and $A 455 for outpatient treatment[5]. Femoral neck fractures were the most expensive ($15,984 median cost) and hip fractures accounted for more than 50% of the total cost of osteoporotic fractures. Fractures of the distal radius were the most common type of osteoporotic fracture (36/151), with median treatment costs of $4075 for inpatient treatment and $531 for outpatient treatment[5]. Another study found an increase in mortality after hip fracture, with 13% dead after 6 months and 22% dead one year after hip fracture, while one year mortality in a group of matched controls was only 4.7%[6]. Morbidity associated with osteoporotic fractures includes loss of independence and decreased quality of life. Cumming, *et al*[7], in another Australian study of 131 people who were living in the community at the time of their hip fracture, found that 22% were permanently admitted to a nursing home in the year after their fracture and another 5% were admitted to an aged-care hostel. The relative risk for institutionalization following hip fracture (compared to no fracture) was 5.1 (95% CI 2.2–11.9). Adjusting for other health related factors reduced the contribution due solely to fracture, but the relative risk of institutionalization attributable solely to the fracture was still 4.0 (CI 1.7–9.5).

Osteoporosis takes several different forms. The involutional osteoporosis associated with aging affects cortical bone more than trabecular bone and is therefore particularly associated with hip fractures and other fractures of predominantly cortical bone. Postmenopausal osteoporosis and steroid induced osteoporosis affect trabecular bone more than cortical bone, and are therefore particularly associated with vertebral, rib, and distal radial fractures[8] as well as a significant rate of hip fracture.

There is increased mortality associated with low BMD. Browner, *et al*[9] found that in a population of postmenopausal women each standard deviation decrease in proximal radius BMD was associated with a 1.19-fold increase in nontrauma mortality. An individual's BMD at any age is the result of numerous factors, some of which can be affected by the medical and sociological factors related to the person[1,3]. Risk factors that have been associated with an increased risk of osteoporosis and fractures include smoking, low calcium intake, lack of exercise, age, sex, genetics including race, comorbid disease states [e.g., rheumatoid arthritis and the use of certain medications (oral corticosteroids, anticonvulsants, etc[10])]. There are particularly strong associations of osteoporosis with aging and with female sex, but a large part of the variation in incidence of osteoporosis appears to be genetic[11]. There have been advances in the detection, prevention, and management of osteoporosis. Dual energy x-ray absorptiometry (DEXA) is widely available as an accurate technique to assess bone mass[3]. The benefits of hormone replacement therapy, vitamin D analogs, and the newer and more potent bisphosphonates in reducing bone loss have been described[12-15].

Despite these advances, our results suggest that most patients with a high probability of osteoporosis are not being recognized or receive inadequate treatment to prevent bone loss. The reasons for this lie with individuals and the health professionals responsible for their care. Patient compliance is likely to have an effect on the use of treatments due to the delay in onset of effect, the presence of comorbidities, and the use of multiple medications, especially in the age group studied. As well, the results of patient education in this group have been poor, representing a missed opportunity to inform at-risk individuals about osteoporosis, assess the presence of risk factors, and implement treatment programs, including falls assessment, gait control, home environment modifications, and rationalization of medications. Utilization of BMD measurement is low, as well as the initiation of appropriate treatment for osteoporosis in this patient group. It could be argued that this group is at a high risk for further fractures[2] and performance of BMD testing is only necessary to monitor drug treatment for osteoporosis.

There are a number of potential limitations of our study. This was a survey study and our data rely on patient recall, which may be biased or inaccurate. Medical records were not available to verify patient responses or the performance of BMD testing. This survey therefore cannot verify the patients' recall of information provided at the time of hospital attendance for a fracture. Also, a large number of eligible patients could not be contacted for the survey, but it is unlikely that the inclusion of such patients would signifi-

cantly alter the results or conclusions. Similar results were found in a smaller patient survey from the fracture clinics of 3 community hospitals in Ontario, Canada[16]. That study of 108 patients (89% female) revealed a high prevalence of previous fragility-type fractures, a small percentage (18.5%) of patients being diagnosed as having osteoporosis, with very few patients being investigated by bone densitometry (35.2%) or prescribed treatment other than calcium for a potentially osteoporotic fracture (31.5%). Women were more likely than men to be offered bone densitometry or treatment for osteoporosis, which is similar to the predictors identified in our study. These results are very similar to those reported in our study, revealing a deficiency in management in 2 independent studies studying 2 different patient groups, with a failure to intervene when osteoporosis actually comes to the attention of the medical profession.

There is evidence that the speciality of the treating physician is strongly associated with the decision to implement treatment for corticosteroid induced osteoporosis, with primary care physicians and rheumatologists being more likely to arrange a BMD test and initiate treatment[17,18]. Both patient and medical practitioner education about the detection and treatment of osteoporosis will be essential components in the optimal use of preventive measures. This needs to be a broad based educational program involving diverse groups of medical practitioners from both general practice and medical and surgical specialties, as well as other health professionals and patient support groups. Most patients with a potentially osteoporotic fracture will be seen at some stage by accident and emergency and/or orthopedic medical staff or a general practitioner. It is particularly important that these health professionals are aware of the need to recognize the possibility of osteoporosis, and implement an investigation and treatment plan to avoid missing this window of opportunity in the management of osteoporosis.

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