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ORIGINAL ARTICLE

Prevalence of osteoporosis in men aged 65–75 in a primary care setting. A practice audit after application of the Canadian 2010 guidelines for osteoporosis screening

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Abstract Current Canadian osteoporosis guidelines recommend routine bone density screening of men at age 65. The purpose of this study is to determine the prevalence of osteoporosis in men aged 65–75 in after application of screening guidelines. All males aged 65–75 years who attended a large primary care clinic were advised of the 2010 Canadian osteoporosis guidelines and advised to obtain a bone density scan at or after their 65th birthday. Those who did not have a bone density scan since their 65th birthday were advised to obtain a scan, unless there was obvious reason not to do so (i.e. known osteoporosis). A record of the results for each patient were kept and tallied to determine the prevalence of osteoporosis. Osteoporosis was defined as a *T*-score of≤−2.5 in either the hip or lumbar spine. Of 574 male subjects in this clinic, between the ages of 65-75, 557 had a bone density scan, either already having done so at the time of being informed of the guidelines or obtaining a scan in the subsequent year after being informed of the guidelines. The prevalence of osteoporosis was 1.6 % (9/557, 95 % confidence interval 0.8–3.1 %) in this sample. The average age of subjects with osteoporosis was 70.5±1.4 years (range 68–75). None of the subjects under 68 years of age were found to have osteoporosis. The prevalence of osteoporosis in unselected male cohorts aged 65 may be too low to justify the routine bone density screening recommended in the 2010 Canadian osteoporosis guidelines.

Keywords Male · Osteoporosis · Prevalence · Primary care

Current American and Canadian guidelines recognize osteoporotic fractures to be a common and serious health problem among elderly men [1, 2]. It has been estimated that nearly 30 % of men over age 60 will have a fracture (related to mild or no trauma) during their remaining lifetimes [3]. Men account for as much as one third of all hip fractures [4–9], and while vertebral fractures are less prevalent [10, 11], they are strongly associated with hip and other fractures [12–14]. In Canada, specifically, guidelines have thus advised that bone densitometry for all men older than 65 years old be done [2]. In the USA, this guideline applies to men over age 70 [2].

However, an analysis published in 2007 indicated that it is not likely cost-effective to routinely screen men over the age of 65 for osteoporosis [15]. In that study, the authors used a prevalence of osteoporosis at the femoral neck as estimated from the Third National Health and Nutrition Examination Survey [16]. The figure used for males over age 65 with no evidence of prior clinical fracture was 7.2 %. Using this prevalence, the authors found that the strategy of screening and treating a population of men at age 65 without a history of clinical fracture was not likely to be cost-effective, but it may be cost-effective in a group of 70 years old, if the society costs could be acceptable at US$100,000 per quality-adjusted years. This dollar figure, however, is not generally considered acceptable.

A key consideration in this modeling of the cost-effectiveness of bone densitometry screening in men, therefore, is the prevalence of osteoporosis in men at a given age, especially in the primary care setting, where most of the screening is likely to take place. Yet, a recently reported primary care study found a prevalence of osteoporosis of only 4.3 %, even though they included men as old as 80 years in their study [17]. They did not provide a prevalence for the age group aged 75 or younger. The overall prevalence, nevertheless, is much less than the 7.2 % utilized in cost-effectiveness modeling [15] and would make routine screening of men at age 65 (or even 70) less likely to be cost-effective.

In order to support the routine use of bone densitometry screening in men at age 65, either the prevalence of

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osteoporosis should be, in the primary setting, at least 7.2 %, or the costs of treatment versus costs of non-treatment (i.e. the model studied by Schousboe et al. [15]) must change substantially to allow for a lower prevalence of osteoporosis and for screening to thus remain cost-effective.

As previous studies have not reported on the prevalence of osteoporosis in an unselected primary care population of men aged 65–75, the purpose of this study was to determine this prevalence using bone densitometry, after applying the 2010 Canadian osteoporosis guidelines. This is a pilot effort to determine if a multi-centre Canadian primary care study may help to further clarify the prevalence and provide further support for current screening guidelines.

Methods

Subjects

Over a period of October 2010 to January 2012, in a large primary care clinic in Edmonton, Alberta, Canada, all males between the ages of 65 and 75 were contacted to advise them of the 2010 Canadian osteoporosis guidelines regarding bone density screening at age 65. This clinic serves a catchment area of 1.5 million persons, and some of the primary care physicians operating the clinic had been in practice for nearly 40 years (i.e. a large and varied clinical spectrum of patients). The patients were contacted, either by phone or mail, or were advised of the need for a bone density scan when they were next seen in the clinic for any reason. Contact was made by primary care physicians, nursing staff or the author (who acted as a consultant in the clinic and provided education and follow-up regarding osteoporosis). Only the patients who attended the clinic in the last 2 years were selected in order to increase the likelihood that patients could be contacted or would be seen for some other reason. Age 75 was taken as a cut-off to provide the highest likelihood of finding osteoporosis without entering into the age range of octogenarians, but at the same time emphasizing that guidelines recommend screening as early as age 65 (i.e. a relatively "younger" group of men at risk). Patients with other diseases were not excluded, even those who may have been on bisphosphonates (see "Results" section).

Those who reported they had a bone density in the last year had this reviewed in the patient record, and if the previous study was done more than a year previously, or before age 65, were advised to consider a repeat bone density study, unless the first study clearly indicated they had osteoporosis. The figure of 1 year was used because there is no data indicating how often men should have a bone density scan, even if they have had a normal bone density on one occasion, and it was considered essential not to assume those subjects with a normal bone density a year ago (or before age 65) would not experience any changes (even if the bone density was normal). This was especially the case as it was discovered that a few patients had, for reasons that are unclear, bone density scans before they were 65 years old. The clinical goal was not to miss any subject who might have osteoporosis at age 65 or older.

Data collection

The radiological centres (four) that conducted bone scans routinely collected data on age, sex, weight, height, medication use, current smoking>20 cigarettes per day, alcohol consumption of greater than two units per day, three or more dairy products per day, history of rheumatoid arthritis, parental history of hip fracture and prior history of any fragility fracture.

Data analysis

The data from the bone densitometry report was then entered into an Excel file and the data was then anonymised and tabulated. All radiologic centres referred to by the clinic used dual X-ray absorptiometry and reported a FRAX. The results reported included hip bone mineral density (BMD), spine BMD, hip *T*-score, lumbar spine *T*-score, hip *Z*-score and lumbar spine *Z*-score. Osteoporosis was defined as a *T*-score of≤ -2.5 in either the hip or lumbar spine. Using this cut-off, the prevalence of osteoporosis was determined.

Ethics

Ethics approval for this study as a practice audit was obtained through the Health Research Ethics Board of Alberta.

Results

The primary care clinic had 574 men who were approximately 65–75 years old and who had attended the clinic in the last 2 years. Of these, 16 could not be contacted to be advised of the osteoporosis screening guidelines nor were they seen by the primary care physicians in the following year. This left 558 subjects. Of these remaining 558 subjects, 336 (60.2 %) had a bone density scan previously (250 within the last year and 86 more than 1 year prior to the audit—these 86 subjects having scans ranging from 22 to 110 months prior, but done after age 64). The remaining 222 subjects had never had a bone density scan.

Of the 222 subjects who had never had a bone density scan, all but one had a scan within the subsequent 16 months. Thus, a total of 557 out of 558 subjects either had a prior bone density scan or had one after being referred for a scan. Of the 86 subjects who had a bone density scan more than

22 months prior to the practice audit, 2 had osteoporosis and 84 did not. The two subjects who had thus already been identified as having osteoporosis had received therapy and were counted as osteoporosis cases, even though it was learned that their subsequent bone density results no longer identified them as being in the osteoporotic range.

The results of the clinical items from the bone densitometry questionnaire collected by the radiology centres, the bone densities at the hip and lumbar spine and the FRAX are shown in Table 1. Medication use was not well recorded in many subjects, who did not report all their medications to the radiology centres, and are thus not included in Table 1, but at least 11 subjects had received at least 6 months of daily prednisone in the past. Two subjects receiving bisphosphonates were also receiving concurrent prednisone on a daily basis. Three subjects were on testosterone replacement therapy for pituitary tumour, and four subjects were receiving current chemotherapy or had received chemotherapy in the last 6 months. A total of 8 of the 557 (1.2 %) subjects reportedly had rheumatoid arthritis.

Out of the 557 subjects, 6 subjects were found to have osteoporosis. Included in this group were the two subjects already identified (more than 22 months previously as having osteoporosis and being treated with bisphosphonates). Thus, the total number of subjects with osteoporosis is 6/557 (1.1 %, 95 % confidence interval 0.4–2.4 %). If one includes the subjects found to be on testosterone (three subjects, all with normal bone densities) as osteoporosis subjects (i.e. they are assumed likely to have had an abnormal bone density had their disease not been treated), then the prevalence of osteoporosis in this age group is 9/557 (1.6 %, 95 % confidence interval 0.8–3.1 %).

Table 1 Results of clinical items, bone mineral density (BMD), *T*-scores, *Z*-scores and FRAX (n=557)

Chracteristics	Result
Age (years, mean±sd, range)	70.5±3.3 (65–75)
Weight (kg, mean±sd, range)	93.5±17.8 (67–115)
Height (cm, mean±sd)	171.1 (165.3–187.5)
Body Mass Index (kg/m^2, mean±sd)	31.4±7.8 (22.4–42.2)
Percentage smoking>20 cigarettes per day	14.7
Percentage drinking more than two units alcohol per day	6.2
Percentage consuming three or more dairy products per day	13.1
Percentage with rheumatoid arthritis	1.9
Percentage with prior history of fragility fracture	0.0
Percentage with current glucocorticoid use	0.4
Percentage with parent who fractured hip	1.8
BMD hip (g/cm^2, mean±sd, range)	1.2±0.1 (−2.6–1.5)
BMD lumbar spine (g/cm^2, mean±sd, range)	1.1±0.2 (−2.6–1.4)
T-score hip	0.59 (−2.7–1.7)
Z-score hip	1.4±0.9 (−2.6–2.3)
T-score spine	−0.2±1.9 (−2.5–1.5)
Z-score spine	0.6±1.9 (−2.6–2.4)
Percentage with FRAX (<10 %)	75.3
Percentage with FRAX (10–20 %)	20
Percentage with FRAX (>20 %)	4.7

As a worst-case scenario, if one assumes that all 16 subjects who were eligible for bone density but who could not be contacted and the one subject who did not obtain a bone density scan had osteoporosis, then the prevalence of osteoporosis would be 26/574 (4.5 %, 95 % confidence interval 3.1–6.6 %).

The average age of the six subjects with identified osteoporosis was 71.2±1.4 years (range 68–75). None of the subjects under 68 years of age were found to have osteoporosis.

Discussion

This study shows that, in the primary care setting, applying the 2010 Canadian osteoporosis guidelines, the number of patients found to have osteoporosis is 1.1 %. Even using the worst-case scenario, assuming all missing subjects had osteoporosis, the prevalence would be 4.5 % (with the upper end of the 95 % confidence interval being 6.6 %), though it is very unlikely that all the missing subjects had osteoporosis. Indeed, if one were to simply examine the sample population for those at risk for osteoporosis, using FRAX (>20 %) as the indication for treatment, the figure for the prevalence of this level of FRAX in this study was 4.7 %.

This value of 1.1 % is considerably lower than the 7.2 % used by Schousboe et al. [15] to assess the feasibility of a guideline advising routine screening with bone density of all men over age 65. It may be that screening of men over age 75 would yield a higher prevalence. The current study results are similar to that of Cass et al. [17], who found a 4.3 % prevalence of osteoporosis, even though they included men up to age 80 in their sample. Even after Cass et al. used the Male Osteoporosis Risk Estimation Score (MORES) for identifying men at increased risk of osteoporosis before bone density screening, they still found only 15 cases of osteoporosis in 259 subjects, a prevalence of 5.8 %, again including men older than 75 in their study. Again, in the current study, if one were to use FRAX (>20 %) as the indication for treatment, the figure in this study was 4.7 %. That is, even if one used the guidelines to merely detect subjects at risk for fracture, not necessarily having osteoporosis, the prevalence found in this study would still not be high enough to justify routine screening. In other words, until economic studies are done on the cost-effectiveness of screening based on FRAX, it is unclear that the numbers observed in this study would be sufficient to justify screening at age 65.

There are a number of limitations to the current study. First, one must consider whether the sample was representative of

male patients in this primary care clinic and in the geographic region. There were no fragility fractures prevalent. It is not clear whether the radiologists looked for evidence of these fractures, though they did ask patients about a history of fracture. Still, based on published incidence rates, there should have been three to four fragility fractures. Yet, even if one were to include this in the data analysis, it would not appreciably change the results. It may be, for example, that some males with osteoporosis were not included in this study because they had inactive charts (i.e. no attendance in the last 2 years) due to having hip or vertebral fractures leading to death or not actively attending the clinic as a result (i.e. in nursing home care). According to 2011 census data [18], males aged 65–75 years account for approximately 3–4 % of the regional population. In this clinic, with 19,881 charts, 558 males aged 65–75 represents 2.8 % of the clinic population. Considering that females generally utilize health care more than males [19] and bias the clinic proportions away from the regional census, 2.8 % likely reflects the fact that these 558 males adequately represent the male patients aged 65–75 years attending this clinic.

Another limitation is that the study was conducted in a single primary care centre and the sample may have been biased towards a lower prevalence of osteoporosis. Considering the clinical characteristics of the sample, however, the proportion of smokers [20], the mean body mass index [21] and the number of subjects with rheumatoid arthritis are above national averages, which is expected for a sample comprised of patients. Finally, there are technical issues. It is not known to what extent each radiologist followed the current guidelines for bone density analysis and it is clear that not all the centres had the same bone densitometer manufacturer/model. They may have used different databases to generate the *T*-scores. In some obese patients or patients with extensive spine sclerosis, the forearm is measured, but this was not done to the authors' knowledge. However, all of these technical issues are part of the real-world application of the 2010 guidelines. The results of this study reflect what happens when the guidelines are applied, and primary care physicians will receive the results, technical issues aside, and be obligated to make clinical decisions based on them.

The 1997 figures, from which the prevalence of osteoporosis in men were first estimated in the USA [16], may not reflect the current prevalence or the prevalence in Canada. It is well known that the average body mass index of men has increased since 1997 [21] and there is data indicating that cigarette smoking is less prevalent today than it was in 1997 [20]. These changes may, in turn, reduce the prevalence of osteoporosis compared to 1997 because increased body mass index and less smoking are protective. Indeed, the largest prevalence of osteoporosis in a sample of men reported in Canada is 11.3 %[22], based on a much older sample population (10 years older in mean age) than the current study, with more bias introduced in sample selection compared to the current study.

To the author's knowledge, there are no multi-centre studies evaluating this particular osteoporosis guideline. It is apparent that population-based studies are required to assess more accurately the prevalence of osteoporosis in the men in the age range of 65–75 to inform models of cost-effectiveness of routine screening and to support the current 2010 Canadian osteoporosis guidelines of routine bone density screening in men at age 65.

Disclosures None

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