Characteristics of males over 50 years who present with a fracture

EPIDEMIOLOGY AND UNDERLYING RISK FACTORS

Osteoporosis and fragility fractures in men constitute a considerable burden in healthcare. We have reviewed 2035 men aged over 50 years with 2142 fractures to clarify the epidemiology of these injuries and their underlying risk factors. The prevalence of osteoporosis ranged between 17.5% in fractures of the ankle and 57.8% in those of the hip. The main risk factors associated with osteoporosis were smoking (47.4%), alcohol excess (36.2%), body mass index < 21 (12.8%) and a family history of osteoporosis (8.4%).

Immobility, smoking, self-reported alcohol excess, a low body mass index, age ≥ 72 and loss in height were significantly more common among men with fractures of the hip than in those with fractures elsewhere.

Whereas it is generally believed that osteoporosis is more prevalent in women than in men,1-5 its incidence in men is underestimated; one third of fractures of the hip occur in men.6,7 The incidence of these fractures in men is projected to increase by 310% by 20508 and it has been postulated that approximately 30% of 60-year-old men will suffer a fracture in their remaining years if they do not receive preventative therapy.9 Osteoporotic fractures cause equal morbidity in both sexes and are associated with reduced quality of life.10,11 Although the prevalence of osteoporotic fractures is higher in women, men have a higher rate of mortality.12-15 with a greater economic impact.16 Patients who sustain a low-energy fracture of the wrist, hip, humerus or ankle have a fourfold greater risk for future fractures than those who have not had a fracture.17-23 There is also evidence for the benefits of therapeutic agents in preventing and treating low bone mass.24,25 It is important to identify osteoporosis in men with fractures, as it provides an opportunity to intervene and alter the natural history of the condition and reduce the incidence of further fractures. This paper describes the epidemiology and underlying risk factors of fractures in men over 50 who presented to emergency departments and acute orthopaedic fracture services.

Patients and Methods

Men presenting with new fractures to the North Glasgow Fracture Liaison Services, based at the Western Infirmary, between January 2000 and December 2003, and the Glasgow Royal Infirmary between January 2002 and December 2003, were included in this analysis. The fracture liaison service, established in 1999 and described elsewhere,26,27 provides routine assessment of osteoporosis to all patients over the age of 50 who have sustained low-energy fractures. The aim has been to target treatment of those with low bone mineral density (BMD) for the secondary prevention of osteoporotic fractures, as advocated in the United Kingdom,28 and Scottish National Guidelines.29 The fracture liaison service assumes responsibility for identifying fractures, providing subsequent assessment, including dual-energy X-ray absorptiometry (DEXA) scans, and recommending specific treatment to be undertaken by primary care clinicians. The service is managed by an osteoporosis nurse specialist. Axial DEXA scanning of the hip and spine is performed where the result will influence the use and selection of treatment. Although vertebral fractures can cause artefact by overestimating BMD, they accounted for only 2.5% of our fractures. We excluded these individual fractures from the DEXA analysis.30 If the patient refuses DEXA, bisphosphonates are not prescribed. Other contraindications include renal impairment, dysphagia and moderate to severe dyspepsia. As a pragmatic view, it is considered that if patients have dementia and lack a home carer, it is unlikely they will comply with the complicated regimen for taking bisphosphonates.31,32

S. Sharma,
M. Fraser,
F. Lovell,
A. Reece,
A. R. McLellan

From Western Infirmary, Glasgow, Scotland

©2008 British Editorial Society of Bone and Joint Surgery
doi:10.1302/0301-620X.90B1.18773 $2.00

Received 11 October 2006; Accepted after revision 17 July 2007

THE JOURNAL OF BONE AND JOINT SURGERY
Six weeks after their fracture, eligible patients undergo DEXA using a Hologic Delphi W scanner with Discovery software version 12 (Hologic Inc., Bedford, Massachusetts). Selection of treatment, based largely on the DEXA result and the patients’ age, is facilitated by protocols described previously, using different thresholds for treatment according to whether the fracture is vertebral or non-vertebral. For the latter, treatment with bisphosphonate and calcium with vitamin D is initiated in those over the age of 65 if the lowest T score at the femoral neck or the total hip or total spine is \( \leq -2 \). For patients aged between 60 and 65 years, treatment is initiated if the lowest T score is \( \leq -2.5 \). For those under 60 years treatment is initiated when the T score is \( \leq -3 \), and for patients with at least one vertebral fracture treatment is initiated over 60 years of age if their lowest T score is \( \leq -1.6 \) and under 60 years if it is below \( -2.5 \). The results were analysed using the chi-squared test, and a p-value < 0.05 was considered to be significant.

### Results

The fracture liaison service offered assessments to 2037 men with 2142 new fractures (Fig. 1).

During the four years of the service at the Western Infirmary and the first two years of that at the Glasgow Royal Infirmary, 1948 men presented with one fracture, 77 with two, nine with three, two with four, and one with five. Men who presented more than once were not significantly older (chi-squared test, \( p = 0.2 \)). The 89 men with more than one fracture had a mean age of 69.1 years (50 to 89) compared with the 1948 with one fracture with a mean age 67.7 years (45 to 89). The distribution of fractures in men over 50 by site is shown in Table I.

Figure 2 shows the site of fracture as a percentage of the 2142 consecutive presentations. The darker shading shows the proportion who underwent full assessment, including DEXA. Among the 821 patients who attended for DEXA, 755 were scanned as a result of one presentation with a fracture while 31 were scanned at least twice, having presented with two or more fractures during the four years of data collection. Of the latter, 4.8% had osteoporosis compared with 28.2% who had one fracture (chi-squared test, \( p = 0.002 \)).

Figure 3 shows the number of fractures in the men and the proportion of hip fractures, according to age. The prevalence of osteoporosis, defined on the basis of the DEXA scans from the hip and the lumbar spine, ranged between 17.5% (25 of 143) in fractures of the ankle and 57.8% (52 of 90) in those of the hip. Table II shows the prevalence of osteoporosis, osteopenia and normal BMD at all sites. The prevalence of osteoporosis according to age was assessed in those with fractures of the hip and those with other fractures (Fig. 4).

In men \( \geq 80 \) years of age with hip fracture, 72.7% (16 of 22) had osteoporosis, compared with 52.9% (36 of 69) of men aged between 50 and 79 years. In contrast, 26.8%
of those aged between 50 and 79 years with fractures at other sites had osteoporosis. Table III shows the risk factors for osteoporosis in men over 50 with fractures and who were shown to have osteoporosis (30.2%; 248 of 821). The main factors were a history of smoking (47.9%), alcohol intake in excess of 35 units per week (36.7%), BMI < 21 kg/m² (12.9%), and a family history of osteoporosis (8.3%).

The prevalence of risk factors for osteoporosis in men with fracture and who were shown to have osteoporosis as confirmed by DEXA was compared with that of men with fracture whose BMD was either normal or osteopenic. Self-reported alcohol excess (chi-squared test 14.03; degree of freedom (df) = 1, p = 0.0001), smoking (≥ 10 cigarettes per day currently or within the last five years (chi-squared test = 30.7, df = 1, p = 0.0001), BMI < 21 kg/m² (chi-squared test 8.03, df = 1, p = 0.005), and a history of previous fracture (chi-squared test 13.09, df = 1, p = 0.0001) were significantly more common among those with osteoporosis. The prevalence of family history of osteoporosis was similar in those with and without osteoporosis. Chronic liver disease, current glucocorticoid use, hyperparathyroidism, inflammatory bowel disease, coeliac disease, hypogonadism, history of maternal hip fracture, renal transplant, rheumatoid disease and a history of thyrotoxicosis were generally uncommon in these men, and none was more prevalent in the fracture cohort with osteoporosis. The risk factors for osteoporosis and fractures in men over 50 and the prevalence of key risk factors among men with fractures both with and without osteoporosis are shown in Figure 5.

Risk factors for fractures were significantly more common among men with hip fractures than in those with fractures elsewhere. These include immobility defined as on their feet for < 4 hours per day, which was present in 50% (45 of 90) of men with hip fractures compared with 20.7% (151 of 731) of men with fractures at other sites (chi-squared test = 37.7, df = 1, p = 0.0001), smoking (≥ 10 cig-

Table II. The prevalence of osteoporosis, osteopenia and normal bone mineral density (BMD) at all sites in 821 patients who underwent full assessment with dual-energy X-ray absorptiometry

<table>
<thead>
<tr>
<th>Site of fracture</th>
<th>Number of patients (%)</th>
<th>Mean age in yrs (SD)</th>
<th>Osteoporosis (%)</th>
<th>Osteopenia (%)</th>
<th>Normal BMD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radius/ulna</td>
<td>221 (25.9)</td>
<td>65.3 (10)</td>
<td>51 (22.7)</td>
<td>107 (48.6)</td>
<td>63 (28.5)</td>
</tr>
<tr>
<td>Hip</td>
<td>90 (10.9)</td>
<td>72.2 (9.7)</td>
<td>52 (57.8)</td>
<td>31 (34.4)</td>
<td>7 (7.8)</td>
</tr>
<tr>
<td>Humerus</td>
<td>151 (18.4)</td>
<td>66.1 (9.7)</td>
<td>54 (35.8)</td>
<td>73 (48.3)</td>
<td>24 (15.9)</td>
</tr>
<tr>
<td>Ankle</td>
<td>143 (17.4)</td>
<td>62.6 (9.3)</td>
<td>25 (17.5)</td>
<td>69 (48.3)</td>
<td>49 (34.3)</td>
</tr>
<tr>
<td>Hand/foot</td>
<td>91 (11.1)</td>
<td>64.9 (10.2)</td>
<td>24 (26.3)</td>
<td>38 (47.7)</td>
<td>28 (30.7)</td>
</tr>
<tr>
<td>Others</td>
<td>125 (15.3)</td>
<td>66.3 (9.8)</td>
<td>42 (33.8)</td>
<td>48 (38.4)</td>
<td>36 (28.8)</td>
</tr>
</tbody>
</table>
arettes per day, currently or within the last five years), in 45.6% (41 of 90) of men with hip fractures compared with 31.5% (230 of 731) of men with other fractures (chi-squared test = 7.1, df = 1, p = 0.008), self-reported alcohol excess in 37.8% (34 of 90) of men with hip fractures compared with 25.9% (189 of 731) of men with fractures at other sites (chi-squared test = 5.7, df = 1, p = 0.017), low BMI (< 21 kg/m^2) in 11.1% (10 of 90) of men with hip fractures compared with 4% (29 of 731) of men with fractures at other sites (chi-squared test = 9.09, df = 1, p = 0.003), age ≥ 72 in 57.8% (52 of 90) of men with hip fractures compared with 24.6% (180 of 731) of men with fractures at other sites (chi-squared test = 43.7, df = 1, p = 0.0001), difficulty rising from chair in 11.1% (10 of 90) of men with hip fractures compared with 2% (15 of 731) of men with fractures at other sites (chi-squared test = 9.20, df = 1, p = 0.0001) and height loss > 6 cm in 8.9% (8 of 90) of men with hip fractures compared with 4.1% (30 of 731) of men with fractures at other sites (chi-squared test = 4.2, df = 1, p = 0.04). A similar proportion of men with hip fractures had a past history of at least one other fracture (20 of 90; 22.2%) as was seen in men with fractures at other sites (150 of 731; 20.5%). This difference was not significant.

Several risk factors associated with hip fractures in women were uncommon in men with hip fractures compared with those with fractures at other sites. These include a history of recurrent falls, self-reported visual impairment, a history of thyrotoxicosis, use of long-acting benzodiazepines, current and previous glucocorticoid use, family history of osteoporosis, history of rheumatoid disease, and use of sedating anticonvulsants.

Using the treatment thresholds defined above, 330 men were treated with bisphosphonate, typically alendronate and usually with 1000 mg calcium and 800 IU vitamin D/day; in 288 (35% of those undergoing DEXA) this treatment was started as a consequence of DEXA assessment, while 42 were already taking this at the time of their fracture presentation. A total of 548 were treated with calcium and vitamin D; 407 received this without undergoing DEXA, while in 141 this was started following DEXA assessment (17% of those undergoing DEXA). A total of 41% (339) who underwent DEXA were deemed not to require any treatment for secondary fracture prevention. The remainder of those who underwent DEXA were referred for assessment at the consultant-led bone clinic as their comorbidities or circumstances meant that treatment selection required further expertise and assessment.

**Discussion**

According to our data the prevalence of osteoporosis varies between 17.5% for fractures of the ankle and 57.8% for those of the hip. In men with fractures of the hip the prevalence of osteoporosis increases with age. Surprisingly the impact of age on prevalence is less apparent in men with other fractures. Although the most common cause for
osteoporosis is idiopathic, secondary causes of diminished BMD are also frequently found in osteoporotic men. These include hypogonadism, malabsorption, glucocorticoid excess, alcoholism, hypercalciuria and hyperthyroidism. However, in our cohort of men with osteoporosis, chronic liver disease, glucocorticoid usage, hyperparathyroidism, inflammatory bowel disease, coeliac disease, hypogonadism, history of maternal hip fracture, renal transplant, rheumatoid disease and history of thyrotoxicosis were generally uncommon. Our main risk factors for osteoporosis were a history of smoking (47.9%), alcohol excess (36.7%) BMI \(<\ 21\ \text{kg/m}^2\) (12.9%) and a family history of osteoporosis (8.3%).

Patients who have had a low-energy fracture of the wrist, hip, humerus or ankle have a fourfold greater risk for future fractures than individuals who have not had a fracture. Patients who have sustained a fracture of the radius/ulna have almost twice the relative risk of a future fracture of the hip. Fractures of the radius/ulna start to occur approximately 15 years earlier than those at the hip, and warn of a high risk of the latter. Also, several risk factors were significantly more common among men with hip fractures than in those with fractures elsewhere and are good indicators for investigation of osteoporosis.

The reference standard for the diagnosis of BMD is based on DEXA measurement because of its reliability, accuracy, speed, ease of use, and relatively low levels of ionising radiation. There is controversy about the cut-off point of BMD for the definition of male osteoporosis. We assessed the prevalence of osteoporosis using the manufacturer’s male reference dataset, and for the purposes of confirming the presence of osteoporosis we used the same threshold of T score \(\leq -2.5\) as is used in women. Research suggests that men and women sustain fractures at the same absolute BMD. In addition to diagnosing osteoporosis, axial DEXA is unique in its ability to help clinicians target treatment for the secondary prevention of osteoporotic fractures.

In our cohort of 2142 fractures, 43% did not have a DEXA assessment; 21% declined the opportunity to undergo assessment or were too unwell. More education targeted at men is essential to raise awareness of osteoporosis and the opportunities to treat it, to prevent further fractures and improve the rate of post-fracture assessment.

The bisphosphonate, alendronate, usually with calcium and vitamin D supplementation is the first choice of treatment to reduce the incidence of secondary fractures in men. Using our local treatment protocols, 330 men received alendronate, in addition to calcium and vitamin D. A total of 548 received calcium with vitamin D. While there are other potential treatment options, all have their limitations.

Calcitonin is ineffective in reducing fractures at sites other than the vertebrae and is not licensed for men with osteoporosis in the United Kingdom. Teriparatide has only recently gained a license for the treatment of men in the United Kingdom but was not licensed for men at the time of this assessment. Testosterone has not been shown to reduce fracture risk in eugonadal men.

One limitation of our study is the sampling bias, as not all men had DEXA and its allocation was not randomised. However, as DEXA is a radiological procedure, albeit with a low-dose of radiation, in common with all radiological investigations it would be unethical to subject patients to DEXA without their consent. The high rate of refusal to undergo assessment highlights an important practical aspect for services striving to prevent secondary fractures and emphasises an important opportunity for education that addresses the needs of males with osteoporosis and fractures. Our study is likely to reflect the same inherent errors that any clinician will face in managing cohorts of men with fractures. Nevertheless, it would be interesting and important if this assessment could be performed in a larger number of patients, thereby allowing more accurate analysis.

The strengths of our study are that our results emphasise two important issues in relation to fractures in men. First, we show several risk factors which were significantly more common for those with hip fractures than with fractures elsewhere. Secondly, several risk factors for hip fractures in women were rarely seen in men. Osteoporosis is, however, common among men with fractures and presents the key opportunity to intervene to reduce the risk of further fractures.

No benefits in any form have been received or will be received by a commercial party related directly or indirectly to the subject of this article.

References

1. Seeman E. During aging, men lose less bone than women because they gain more periosteal bone, not because they reabsorb less endosteal bone. Calcif Tissue Int 2001;69:205-8.