Bone mineral density of the radius in patients with Colles’ fracture

From the University of Dundee, Scotland

To ascertain whether patients with Colles’ fracture should be investigated for osteoporosis and the risk of future fractures, we measured the bone mineral density of the distal radius of the other arm in 31 women patients and compared the results with those of a control group of 289 normal women. We divided the patients into two groups, those younger than 66 years and those older. In 25 patients we found values for bone mineral density which were lower than one standard deviation below the mean value for their age. Younger patients had a deficit greater than that expected for their ages. We believe that women with Colles’ fracture should be evaluated routinely for osteoporosis, particularly if they are under 66 years of age.

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The distal radius is the most common site of fractures associated with osteoporosis occurring soon after the menopause. Patients with such injuries often suffer subsequent fractures, mainly of the hip. Lauritzen et al.¹ have shown that women who sustain fractures of the wrist within ten years of the menopause have an eight times greater risk of fracture of hip than the general population, but there is no increased risk in women who sustain such fractures after the age of 70 years.

The degree of damage to the cancellous bone and articular surface correlates with clinical outcomes.² It is possible that, for a given impact, the severity of the damage is partly determined by the quality of bone. There is little information on the measurement of the bone mineral density (BMD) in patients with Colles’ fracture. Some authors have found no difference between the BMD at the distal radius in patients with fractures compared with control subjects,³ while others, who used CT, have suggested that there is a selective decrease in the BMD of cancellous, but not cortical bone.⁴ The numbers of patients and controls in these studies were small.

We know of no published guidelines for the routine measurement of BMD and the treatment of osteoporosis in patients with Colles’ fracture. Our aim was to determine the extent to which this injury is associated with osteoporosis in women.

Patients and Methods

Using a Molsgaard ND 1100A single-photon absorptiometer (Horsholm, Denmark) with an ¹²⁵I source, we measured the BMD of the contralateral distal radius of 31 women aged from 40 to 82 years (mean 65.5; sdm 12.2) who had sustained a Colles’ fracture. All patients gave informed consent. No patient had any other condition or was receiving any treatment which could affect bone mass. All fractures were reported to have been caused by relatively minor trauma, such as a fall on the outstretched hand. We used single-photon absorptiometry because the World Health Organization (WHO)⁵ considers it to be the best single method of assessment. All tests were undertaken within three weeks of the date of injury. We used the mean of four scans to determine the distal bone mineral content. To obtain a value for the BMD, we corrected the results for fat absorption and for the width of the bone.

The control group comprised 289 healthy women aged from 20 to 83 years (mean 47.4; sd 15.4). None had a fracture, neither had they any medical condition or were taking medication which could affect the bone mass. For statistical comparison, we divided this group into age bands. To calculate the mean reference for young adults, we separated out a subgroup of 103 subjects aged from 20 to 40 years (control group 1).

We studied the age-related variations in the values for BMD in the patient and control groups by fitting third-order
polynomials to the scatter plot of BMD against age. The BMD of each patient was compared with the value predicted for the control group. The difference was normalised to the standard deviation of the control group (Z-score). To compare Z-scores and age, a regression line was calculated and plotted.

We divided the patients into a younger group, comprising 16 patients aged up to 66 years, and an older group, the remaining 15 patients. We selected two groups of control subjects in the same age range. Control group 2 had 152 subjects aged from 41 to 66 years, and control group 3 had 34 older subjects. The two-tailed heteroscedastic $t$-test, corrected for unequal variances in the two samples, was used to compare the BMD values in patients and control subjects.

**Results**

All the patients had BMD values lower than the mean reference for young adults. In 18 patients the deficit was greater than one standard deviation (T-score < -1), and in ten it was greater than 2.5 standard deviations (T-score < -2.5).

Figure 1 shows the BMD values in relation to age in the patient and control groups. The longer curve represents the best-fit third-order polynomial calculated for BMD values in the control group, and the shorter, that for the fracture patients. Clearly, the difference between the two curves is greater in the younger patients.

To examine these trends further, we determined the Z-score. The results are plotted against age in Figure 2. Even when revised to age-adjusted levels, the BMD values of the 25 patients were lower than those predicted (negative Z-score).

The overall mean BMD for patients was 0.75 (SD 0.13). In control subjects aged from 41 to 83 years, it was 0.92 (SD 0.19), with $p < 0.05$. The 95% CI for the mean difference was 0.103 to 0.247.

With mean ages of 56.3 years (SD 9.3) in the group of younger patients and 53.6 years (SD 7.4) in the corresponding control group (group 2), the $t$-test was not significant ($p = 0.28$). The mean BMD was 0.8 (SD 0.13) in the younger group and 0.95 (SD 0.19) in the controls ($p < 0.01$). The 95% CI for the mean difference was 0.005 to 0.25.

The mean age was 74.4 years (SD 6.8) in the group of older patients and 71.2 years (SD 3.5) in the corresponding controls (group 3). The $t$-test was not significant ($p = 0.1$). The mean BMD was 0.69 (SD 0.08) in the older patients and 0.82 (SD 0.14) in control group 3 ($p < 0.01$). The 95% CI for the mean difference was 0.002 to 0.149.

**Discussion**

We found that the younger patients with Colles’ fracture had a lower BMD than the control subjects. Lauritzen et al found a higher risk of later hip fractures in these younger patients. We believe that the conflicting reports of previous authors may have arisen because the range of ages of their subjects was more limited than ours.

We believe that patients under 66 years of age with a Colles’ fracture should be fully assessed for osteoporosis, so that informed decisions can be made about their treatment. The WHO advises that a fracture of the distal radius in postmenopausal women is an indication for densitometry. There are other methods which can be used to assess the risk of future fracture but measurement of the BMD is accessible and accurate. Nilsson and Westlin’s measurements of BMD in the forearm showed no differences between the right and left side, and it is reasonable to...
accept that measurements of the BMD of the opposite forearm provide a valid estimate of the BMD at the site of the fracture.

A recent study of a large group of patients with fracture of the wrist and aged under 65 years, showed that these patients had an abnormally low BMD at the hip. This underlines the importance of screening for osteoporosis in younger patients with such injuries. Screening could detect those who would benefit from early treatment such as hormone replacement therapy (HRT).

However, recent advances in the understanding of osteoporosis indicate that structural factors are at least as important to the quality of bone as BMD. While loss of BMD can be stopped and even reversed, structural changes such as loss of connectivity are permanent. Furthermore, in some cases the fracture results from the severity of the trauma rather than from bone fragility. Since the first line of treatment of osteoporosis is usually HRT, both the financial resources and long-term compliance must be considered.

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References