Prevalence of Low Bone Mineral Density in Younger Versus Older Women With Distal Radius Fractures

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Abstract

Although distal radius fractures (DRFs) are the most common fractures among younger women, few studies have examined bone health in this age group.

We compared bone mineral density (BMD) of younger women (35-50 years) and older women (>50 years) treated for DRFs. Between January 2005 and August 2010, our orthopedic service obtained dual-energy x-ray absorptiometry scans from 128 women with DRFs (47 were 35-50 years old; 81 were older than 50 years).

According to the World Health Organization classification system, 43% of the younger patients were osteopenic, and 6% were osteoporotic. Mean femoral neck BMD was 0.91 for the younger group and 0.80 for the older group ($P < .05$); *t* scores were –0.87 and –1.65, respectively ($P < .05$). The difference in femoral neck *z* scores between the younger and older patients was not statistically different: –0.69 and –0.67, respectively ($P = .92$).

A notable proportion of younger patients with DRFs have osteopenia or osteoporosis. The similarity in *z* scores among younger and older women with DRFs and among patient groups differentiated by mechanism of injury suggests that any younger or older woman with a DRF should have her BMD evaluated and treated as appropriate.

Many organizations and work groups have issued recommendations regarding which patients should undergo bone densitometry. In 2004, the US Surgeon General recommended bone mineral density (BMD) evaluation for all women over age 65 years and for women and men with fragility fractures.[1] The Centers for Medicare & Medicaid Services recommended BMD assessment for estrogen-deficient patients, for patients with vertebral abnormalities or hyperparathyroidism, and for patients receiving either steroid therapy or osteoporosis medications approved by the US Food and Drug Administration.[2] The US Preventive Services Task Force and the National Osteoporosis Foundation each recommended screening for all women age 65 years or older and for postmenopausal women (age, 60-64 years) at high risk.[3,4] The International Society for Clinical Densitometry (ISCD) recommended screening for all women age 65 years or older, all men age 70 years or older, and high-risk women under age 65 years.[5]

These current recommendations for BMD evaluation focus on women over age 65 years. More recent studies of postmenopausal women with distal radius fractures (DRFs) have found that both younger women (age, 45-65 years) and older women (age, ≥65 years) can have lower BMD and increased risk for hip and spine fracture.[6,7] The authors of those studies recommended that all postmenopausal women with DRFs be evaluated for low BMD and that fracture prevention treatment be initiated. Earnshaw and colleagues[8] and Oyen and colleagues[9] found that men and women (age, ≥50 years) with DRFs had low BMD and elevated 10-year fracture rates. They concluded that BMD should be evaluated and treated in all DRF patients age 50 years or older. Other studies have shown low BMD in the contralateral distal radius of patients of all ages who presented with Colles fractures.[10,11] These 2 studies did not measure spine or hip BMD.

The literature on BMD of younger women with DRFs is limited, relying solely on data collected for the contralateral distal radius.[10,11] The ISCD recommended measuring both hip and spine BMD in premenopausal women. They also stated that *z* scores, not *t* scores, should be used for premenopausal women.[5] The causes of low BMD in women over age 55 years are primarily nutritional deficiency and normal aging.[1] In younger females, low BMD results from secondary causes, such as diet, medications, medical conditions, and endocrine disorders. When the secondary cause of low BMD can be identified and treated, osteoporosis can be stopped and even reversed in younger patients.[12-14] Low BMD is more amenable to treatment in younger patients than in postmenopausal women. Younger patients with low BMD carry a higher lifetime fracture risk because they have more years of life with low BMD; therefore, early identification and treatment have a more

Authors' Disclosure Statement: The authors report no actual or potential conflict of interest in relation to this article.

significant impact on fracture prevention in these patients.

In the present study, we determined the prevalence of osteoporosis and osteopenia in younger women (age, 35-50 years) with DRFs and compared BMD measurements from younger women (age, 35-50 years) and older women (age, >50 years) with DRFs. The main goal was to determine which patients should be referred for bone densitometry and subsequent treatment.

Patients and Methods

This study received institutional review board approval. During a 5-year period (January 2005–August 2010), we prospectively collected dual-energy x-ray absorptiometry (DXA) scans for 128 women (age, >35 years) who presented with DRFs to our level I trauma center. Age ranged from 35 to 86 years. Data on mechanism of injury, treatment, and body mass index (BMI) were collected. The 128 patients were divided into a younger group (47 women; age range, 35-50 years; mean age, 44 years) and an older group (81 women; age, ≥51 years; mean age, 61 years). Mean BMI was 29.3 in the younger group and 28.8 in the older group ($P = .88$) (**Table**).

BMD was measured with a General Electric Lunar Prodigy Advance scanner that was tested annually for accuracy and precision. BMD of hips and lumbar spines was measured with a 76-Kv x-ray source. All DXA scans were analyzed by the same physician. BMD was omitted in cases of patients with a history of lumbar spine or hip fracture.

Two-sample Student t test was used to compare the 2 groups' data. When multiple groups were being compared, analysis of variance was used. Spearman rank-order test was used to calculate a correlation coefficient for evaluation of the relationships between age and BMD.

Results

Mean lumbar spine (L1–L4) BMD was 1.12 in the younger group and 1.063 in the older group ($P = .02$); t scores were −0.63 and −1.132, respectively ($P = .02$); and mean z scores were −0.69 and −0.61, respectively ($P = .81$). Mean femoral neck BMD was 0.91 in the younger group and 0.80 in the older group ($P < .05$); t scores were −0.87 and −1.65, respectively ($P < .01$), and mean femoral neck z scores were −0.69 and −0.67, respectively ($P = .92$).

To further analyze BMD of specific age groups, we divided patients by decade: 35-39, 40-49, 50-59, 60-69, 70-79, 80-89 years. Among all 6 decades, there were no statistically significant differences between hip z scores ($P = .83$) (**Figure 1**). Spearman rank-order correlation test showed a moderate inverse correlation between age and femoral neck BMD ($R = −0.42$) and t score ($R = −0.43$). There was a weak correlation between increasing age and decreasing spine BMD, t score, and z score ($Rs = −0.27, −0.31, 0.03$). There was no correlation between age and femoral neck z score ($R = −0.04$).

According to the WHO classification system, 11 (23%) of the 47 women in the younger group were osteopenic, and 8 (17%) were osteoporotic, based on spine BMD. Hip BMD values indicated that 20 patients (43%) were osteopenic, and 3 (6%) were osteoporotic. One patient in the younger group had a hip z score of less than –2, and 14 patients (39%) had a hip z score between –2 and –1. Six patients (18%) had a spine z score of less than –2, and 6 patients (18%) had a spine z score between –2 and –1. Of the 81 older patients, 22 (27%) were osteopenic, and 21 (26%) were osteoporotic, according to spine measurements. The femoral neck data indicated that 39 (48%) of the older patients were osteopenic, and 22 (27%) were osteoporotic.

In both groups, mechanisms of injury were identified. Of the 47 younger patients, 26 fell from standing, 7 fell from a height of more than 6 feet, and 14 were injured in motor vehicle collisions (MVCs). Of the 81 older patients, 2 sustained

Table. Demographics and Treatment Types

	Patient Age Group, y	
	35-50	>50
No. of patients	47 (37%)	81 (63%)
Age	44 (35-54)	61 (55-86)
Body mass index	29	29
Fracture		
Open	1 (2%)	2 (2%)
Closed	46 (98%)	79 (98%)
Treatment		
Open reduction and internal fixation	8 (24%)	11 (18%)
External fixation	1 (3%)	5 (8%)
Closed reduction	2 (7%)	4 (6%)
Closed reduction and percutaneous pinning	23 (68%)	42 (68%)

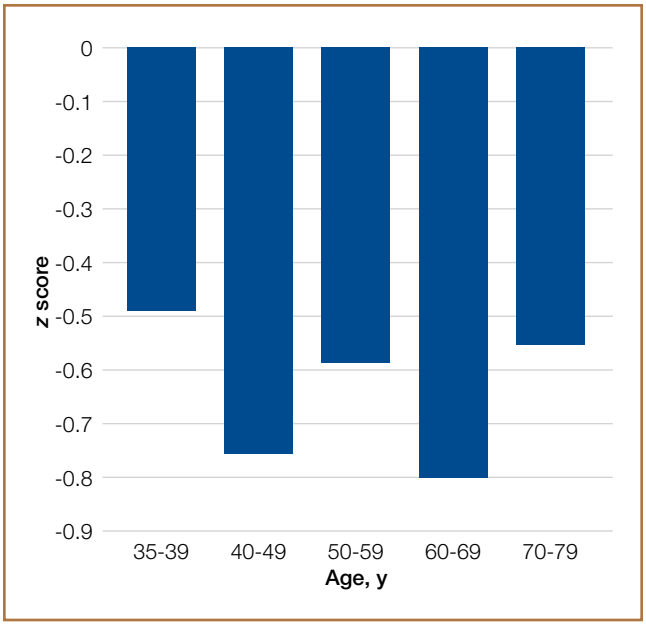

Figure 1. Mean *z* score of patients with distal radius fractures by age (4th-8th decades).

a direct blow, 64 fell from standing, 4 fell from a height of more than 6 feet, and 11 were injured in MVCs. The differences in *z* scores based on mechanism of injury were not statistically significant ($P = .22$) (**Figure 2**).

Discussion

Several studies have shown that older women with DRFs have low BMD in the spine and femoral neck.[8,9] These studies focused on older women who sustained low-energy fractures caused by a fall from a standing height. Studies of younger women with DRFs focused on BMD of the contralateral distal radius, not the spine or femoral neck.[10,11] Those study groups also had low BMD. Findings from a multitude of studies have established that patients who are older than 50 years when they sustain distal radius fragility fractures should be referred for bone densitometry studies, and there is increasing evidence that younger patients with fragility fractures should undergo this evaluation as well.

The present study was designed to expand the range of patients and mechanisms of injury. Women in this study were 35 years or older. In addition to collecting data from patients injured in a fall from standing, we examined the medical records of women injured in MVCs, in falls from heights of more than 6 feet, and from direct trauma to the wrist. We measured the BMD of the spine and femoral neck and of the contralateral distal radius.

For this discussion, several key points should be made about BMD evaluation in younger versus older women. Most organizations caution against using spine BMD in older women. The ISCD, however, recommended measuring both hip and spine BMD; whereas BMD can be falsely elevated by spine osteoarthritis in older patients, spine BMD measurements are accurate in younger patients not affected by osteoarthritis. The ISCD also stipulated that *z* scores should be used in examining BMD in younger patients. The *z* score is a value of how many standard deviations BMD differs from a matched population of the same age, sex, ethnicity, and weight. The *t* score, which is useful in evaluating older patients, compares a patient's BMD with that of an average 30-year-old.[12]

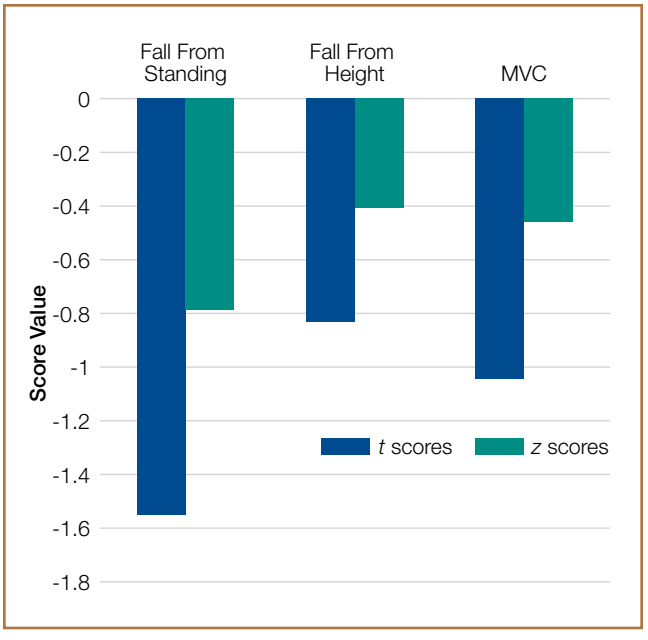

Figure 2. Mean *t* scores and *z* scores of patients with distal radius fractures by mechanism of injury. Abbreviation: MVC, motor vehicle collision.

According to the WHO classification system (intended for older women), osteopenia is indicated by a *t* score between −1.0 and −2.5, and osteoporosis is indicated by a *t* score of less than −2.5. In the present study, about 43% of the younger patients (age, 35-50 years) with DRFs were osteopenic, and 6% of these patients were osteoporotic. In concert with previous studies,[9] 48% of our older women (age, >50 years) with DRFs were osteopenic, and 27% were osteoporotic. The difference in mean spinal *z* scores between the younger and older groups was not statistically significant ($P = .81$).

As mentioned, when examining BMD of younger patients, it is imperative to use spine *z* scores. About 18% of our younger patients had a *z* score of less than −2, and 18% had a *z* score between −2 and −1. In our comparison of patients from 5 different age decades (range, 35-79 years), there was no statistically significant difference in *z* scores ($P = .83$). In addition, there was no correlation between increasing age and decreasing *z* score ($R = -0.04$).

Secondary causes of osteoporosis have been documented in 30% of premenopausal women and 55% of men with vertebral fractures.[13-15] Primary osteoporosis results from the normal aging process; secondary osteoporosis results from reversible causes, including medications, gastrointestinal disorders, renal disease, endocrine disorders, and sedentary lifestyle.[15,16] When a secondary cause of osteoporosis is identified, treatment can be initiated to increase BMD. As younger patients can reverse bone loss and even increase BMD, it is important to identify reversible causes of osteopenia and osteoporosis in this age group. It is well documented that both younger and older patients with DRFs are at increased risk for subsequent fractures.[6] Preventing further bone loss at a younger age may drastically decrease lifetime fracture risk.[12,17]

Most previous studies of BMD in women were limited to patients with DRFs caused by a low-energy mechanism or by a fall from standing. Current recommendations for BMD testing focus on postmenopausal women who have sustained a fragility or low-energy DRF. When an osteoporotic or osteopenic patient's distal radius is subjected to a high-energy force, a fracture is likely. Therefore, we expanded our study to include high-energy mechanisms of injury. Our analysis of BMD in patients with DRFs sustained in MVCs indicated that 12% of this group were osteoporotic, and 44% were osteopenic. Forty-three percent of our younger patients with a DRF fractured in a MVC were osteopenic, and 6% were osteoporotic. Among 4 mechanisms of injury for DRFs, there was no statistically significant difference in *z* scores ($P = .22$) (Figure 2). This provides evidence that a significant portion of patients with DRFs from both high- and low-energy

mechanisms are osteoporotic or osteopenic. Patients with DRFs sustained in MVCs or in falls from heights of more than 6 feet should be referred for BMD evaluation.

Conclusion

A significant proportion of younger patients with DRFs are osteopenic or osteoporotic (43% and 6%, respectively), and their z scores are comparable to those of older patients with DRFs. There was no statistically significant difference in BMD z scores between younger and older patients and no difference in mechanisms of injury. This is evidence that younger patients with DRFs caused by a high- or low-energy mechanism of injury should undergo both DXA scan and BMD evaluation. If osteoporosis or osteopenia can be diagnosed at an earlier age, and if these patients can be properly treated, subsequent fractures could be prevented. The present study provides evidence supporting a simplification of the current recommendations for BMD evaluation: All women with DRFs should undergo bone densitometry.

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Am J Orthop. 2015;44(12):E493-E496.

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