Osteoporosis is “a systemic skeletal disease characterized by low bone mass and micro-architectural deterioration with a consequent increase in bone fragility with susceptibility to fracture.” In simpler terms, it is a reduction in the quantity and quality of bone that leads to increased bone fragility and fractures.

The World Health Organization has an operational definition of osteoporosis in postmenopausal, caucasian women, based on bone density levels, and expressed as “T-scores” (standard deviations above or below the mean measured in healthy young adults) (Table 1). There is no general agreement on the appropriate levels of bone density for the diagnosis of osteoporosis in non-caucasian, postmenopausal women, men, and young individuals; however, osteoporosis can be diagnosed in any individual with one or more fragility fractures and in whom bone mass T-score is a 2.5 standard deviation or more below the mean value of that measured in young caucasian women.

In most people, bone loss begins a decade or two after skeletal maturity. Age-related bone loss averages approximately 0.5% per year. With estrogen deficiency, which occurs at menopause, accelerated bone loss begins (1–2% per year). This accelerated phase of bone loss typically lasts for 5 to 10 years. In the average woman, a 20% loss of bone mass occurs between the ages of 40 and 70 years.

The most common cause of osteoporosis is a combination of estrogen deficiency and advancing age (postmenopausal osteoporosis, sometimes called Type I osteoporosis). In men, osteoporosis may result from advancing age (sometimes called primary, senile, involutional, or Type II osteoporosis). There are a variety of diseases and conditions that may be associated with low bone mass or bone loss (secondary osteoporosis) including endocrine disorders (for example, hyperparathyroidism and hyperthyroidism), digestive diseases (inflammatory bowel disease and gluten-sensitive enteropathy), marrow-based diseases (multiple myeloma), certain medications (corticosteroid agents), and others. In men and women, osteoporosis may occur without a detectable underlying cause (idiopathic osteoporosis).

Typically, years or decades of bone loss are required before an individual becomes at high risk for bone fracture. Corticosteroid agent–induced osteoporosis is an exception; the risk of fracture increases within 3 months of beginning high-dose systemic corticosteroid therapy. Once the patient experiences a fracture, more fractures are likely to occur in the near future. New fractures occur in approximately 10 to 20% of patients in the year following a spinal fracture.

In 1997, it was estimated that approximately 10 million Americans suffered from osteoporosis and an additional 18 million had borderline low bone mass (osteopenia). The number is certainly greater today. Approximately 80% of the cases of osteoporosis occur in postmenopausal caucasian women; however, osteoporosis occurs at all ages, in men as well as women, and in any ethnic group.

OSTEOPOROSIS IN VERTEBRAL FRACTURES

Bone Fractures

Approximately 1.5 million osteoporosis-related fractures occur in the United States each year. The most common are vertebral fractures (approximately 750,000 each year). Annually there are also approximately 250,000
Vertebral Fragments

Vertebral fractures are the most common complication of osteoporosis. In clinical trials of osteoporosis treatment, vertebral fractures are radiographically demonstrated deformities, defined as a 15-20% or more decrease in vertebral body height. Only 25-30% of radiographically observed vertebral deformities are recognized clinically, although even “clinically silent” vertebral deformities may have significant impact on health and quality of life. Vertebral fractures are often followed by chronic pain, deformity (kyphosis, “dowager’s hump”), loss of height, crowding of internal organs, inactivity-induced physical deconditioning, and changes in self-image leading to a significant impact on self-esteem and activities of daily living.

Because patients with vertebral fractures may not seek medical attention, their lesions often go undiagnosed. Gehlbach, et al.8 found radiographic evidence of one or more vertebral fractures on 132 (14%) of 934 chest X-ray films obtained in women age 60 years and older. Many of the fractures were not mentioned in the radiologists’ reports. The presence of a fracture was mentioned in the medical record or discharge summary in only 23 (17%) of these 132 patients.

Vertebral deformities clearly have consequences. Oleksik, et al.,15 assessed quality of life in 751 women in whom prevalent radiographic vertebral deformities were demonstrated and found that the number of deformities had a clear negative effect on quality of life. Nevitt, et al.,17 found that the incidence of radiographically demonstrated vertebral deformities was associated with increased frequency of back pain and limited activity as well as increased duration of bed rest required due to back pain.

The presence of one or more radiographically documented vertebral fractures has been shown in a number of studies to be associated with a five- to 10-fold increase risk of vertebral fracture22 and an approximately twofold increase risk of hip fracture.1

The increased mortality rate after hip fracture is well documented. Although not as appreciated, the increased mortality rate after vertebral fracture is just as great in the long term. By 5 years after vertebral fracture the mortality rate increases by approximately 10%,3,6,7 and it increases with the ascending number of fractures.10

Pain and Osteoporosis

Osteoporosis is a silent disease—there are no symptoms or signs of low bone mass or bone loss. Complications of osteoporosis such as fractures often cause pain. Osteoporotic fracture-induced vertebral deformity may cause chronic pain due to changes in spinal alignment, spasm of paraspinal muscles, and stretch on ligaments. This chronic pain is typically worse with ambulation and relieved or improved with bed rest. Proper body mechanics should be encouraged along with stretching and spinal resistance exercises.12 Analgesic and muscle relaxant agents may be useful.

Modalities for management of the acute fracture episode include rest, external support devices, analgesics, and calcitonin.19,20,24 The pain is sometimes severe enough to require hospitalization. In 1996 approximately 120,000 patients with vertebral fractures were hospitalized in the United States with total costs of almost $1.5 billion.22 Pain secondary to acute vertebral fracture appears to be caused in part by vertebral instability (nonunion or slow-forming union) at the fracture site.

Relatively new procedures, vertebroplasty and kyphoplasty, have been introduced for the management of unusually severe or persistent pain from vertebral fractures. Both involve percutaneous injection of bone cement into one or more fractured vertebra. Kyphoplasty involves an initial inflation of a bone tamp (balloon) to reexpand the collapsed vertebra. Pain relief has been reported in 60 to 100% of cases in which this procedure was performed.9,13 Serious complications may occur including spinal cord compression. Neither procedure has been studied in controlled trials. Vertebroplasty and kyphoplasty should be offered only to carefully selected patients whose pain cannot be controlled by outpatient measures, when severe pain persists for more than several weeks, or if there is significant disc height loss associated with negative consequences (for example, reduction of vital capacity in patients with pulmonary disease). Rarely, burst fractures occur that require surgical intervention.

Although spinal fusion is not indicated for osteoporotic fractures, it may be required for other reasons in patients with osteoporosis. There is a general impression that nonunion or complications following spinal fusion are more likely to occur in patients with osteoporosis, but this has not been documented. It is also not known if treatment of the underlying osteoporosis will improve the outcome of spinal fusion.

### Table 1

<table>
<thead>
<tr>
<th>Status</th>
<th>T-Score*</th>
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<tbody>
<tr>
<td>normal</td>
<td>−1 or above</td>
</tr>
<tr>
<td>osteopenia</td>
<td>between −1 &amp; −2.5</td>
</tr>
<tr>
<td>osteoporosis</td>
<td>−2.5 or below</td>
</tr>
</tbody>
</table>

*To obtain the T-score, the bone density value measured in a patient is compared with the mean young-adult value, and the difference is expressed as a standard deviation score.
Osteoporotic vertebral fractures

<table>
<thead>
<tr>
<th>Agent</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>bisphosphonates</td>
<td></td>
</tr>
<tr>
<td>alendronate</td>
<td>10 mg daily or 70 mg weekly</td>
</tr>
<tr>
<td>risedronate</td>
<td>5 mg daily</td>
</tr>
<tr>
<td>raloxifene</td>
<td>60 mg daily</td>
</tr>
<tr>
<td>salmon calcitonin nasal spray</td>
<td>200 IU daily</td>
</tr>
</tbody>
</table>

**Medical Management of Osteoporosis**

Calcium, vitamin D, and weight-bearing exercise are important for everyone and particularly for patients with osteoporosis. In patients in whom osteoporotic fractures have already occurred, these measures are not sufficient. Bisphosphonates (alendronate and risedronate), raloxifene, and nasal spray calcitonin (Table 2) have been shown to reduce the incidence of new vertebral fractures by 30 to 50%. Bisphosphonates have also been shown to reduce the risk of hip fractures and other nonvertebral fractures.2,15

**CONCLUSIONS**

Osteoporosis is a significant public health problem. Vertebral fractures are common in patients with osteoporosis. These fractures reduce a patient’s quality of life and shorten life expectancy. Several available medications have been shown to reduce the risk of fracture. Vertebroplasty and kyphoplasty may reduce or relieve pain in selected patients. Although surgery is rarely required in the management of osteoporotic vertebral fractures, it may be indicated for other reasons. No studies have been conducted to determine if the outcome of spinal fusion is different in osteoporotic patient and, whether it is, if management of the patient’s osteoporosis will improve the outcome.

**References**


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