

# Osteoporosis Unveiled:



# Answers To Your Questions

**Teri Junge, CST/CFA**

**O**steoporosis is considered an invisible or silent disease affecting approximately 28 million Americans. Osteoporosis has no symptoms until the patient notices a loss of height, changes in posture (dowager's hump or kyphosis, Figure 1), or suffers a fracture. Although any bone is subject to osteoporotic fracture, vertebral body (Figure 2), distal radius, and proximal femur fractures are the most common. Almost all fractures in older adults are blamed at least in part to low bone density. Post fracture outcomes can vary from complete recovery to death with many patients suffering chronic pain and permanent disability.<sup>1</sup>

## **WHAT IS OSTEOPOROSIS?**

Osteoporosis is the condition of (sis) porous (poro) bone (osteo) and is *THE MOST COMMON* bone disease.<sup>1,4</sup> Osteoporotic rarefaction is considered a metabolic bone disease, which may be either idiopathic or secondary to another disease or condition. Osteoporosis has many forms that affect both children and adults. This article focuses on Type I—Postmenopausal Osteoporosis and will include a brief discussion of Type II—Senile Osteoporosis. With all types of osteo-

porosis, the patient experiences low bone mass and deterioration of the microscopic architecture of the bone tissue. Structural defects in the bone lead to fragility, causing an increased risk of fracture (Figures 3 A and B).

Simply put, osteoporosis occurs when there is a disruption in normal bone metabolism. Normally, osteoblastic and osteoclastic activity are equal, thereby maintaining the number and quality of osteocytes. The term remodeling is used to describe bone in its normal state of maintenance. A disruption that causes osteoclastic activity to be greater than osteoblastic activity results in a decrease in density (or mass) of the bone.

## **WHAT CAUSES OSTEOPOROSIS?**

The cause of osteoporosis varies according to the type that affects the patient. Type I osteoporosis is also referred to as “postmenopausal” osteoporosis. It is due to loss of estrogen and affects postmenopausal women. Type II osteoporosis is also referred to as “senile” osteoporosis. It is due to long-term calcium deficiency and affects persons (female and male) over the age of 75.

## HOW IS IT DIAGNOSED?

Bone loss due to osteoporosis is usually asymptomatic until a fracture occurs. Osteoporosis that results from hyperthyroidism is the only type of osteoporosis that is truly reversible. Therefore, hyperthyroidism should be ruled out during the process of diagnosis. In addition, blood levels of patients on thyroid hormone replacement therapy (for hypothyroidism) should be monitored to prevent over medication leading to bone loss similar to that associated with hyperthyroidism.<sup>4</sup>

The patient's level of bone mineral density (BMD) is key to diagnosis. Tests to quantify BMD offer several advantages to:

- Detect osteoporosis prior to fracture
- Determine rate of bone loss
- Predict the likelihood of future fracture
- Allow informed decisions about treatment
- Monitor the effect of treatment

BMD can be measured in several ways, all of which are noninvasive, safe, painless, and readily available.

- Dual Energy X-ray Absorptiometry (DEXA or DXA) is the most commonly used method for measuring bone mass. The patient lies flat on a padded X-ray table while the arm of the instrument passes over a selected area of the body. Specific anatomic sites for DEXA measurement include the pelvis, lumbar spine, proximal femur, forearm, and calcaneus. The exam takes approximately two minutes to complete and is very accurate. The patient is exposed to a very low dose of radiation. The exam is useful in determining the tensile strength of the bone to estimate the risk of fracture and assess treatment results.
- Single Energy X-ray Absorptiometry (SXA) is effective in measuring bone density at the calcaneus or distal radius.
- Peripheral Dual Energy X-ray Absorptiometry (PDXA) is also used to assess the extremities.
- Ultrasonic evaluation uses sound waves to measure bone density of the patella, tibia, or calcaneus without exposure to X-ray.



**FIGURE 1**—Dowager's hump—one of the first symptoms of osteoporosis in older adults.

Bone Mineral Density testing is recommended based on the individual's risk profile and is recommended for all postmenopausal women under the age of 65, who demonstrate one or more additional risk factors, and all women over the age of 65.<sup>1</sup>

**COULD I BE AT RISK?**

Theoretically, everyone is at risk for developing osteoporosis; certain factors may accelerate the process (Table 1). Although hereditary risk factors cannot be modified, others are related to lifestyle and can be changed to produce a life-enhancing or life-saving result.

**HOW CAN I PREVENT IT?**

There is no cure for osteoporosis. Although bone density can be increased, the bone can't be fully restored. Prevention is essential and can begin during childhood. The best preventive defenses for osteoporosis include the following:

**Balanced Diet**

A general well-balanced diet using the food pyramid is recommended with special attention to adequate calcium intake (Table 2—Optimal Calcium Intake). Important sources of dietary calcium include low-fat dairy products, leafy dark-green vegetables, and foods fortified with calcium. Calcium supplements may be needed.

Vitamin D is necessary for absorption of calcium. Vitamin D is synthesized in the skin via exposure to sunlight. Sources of dietary Vitamin D include fortified milk and cereals, egg yolks, salt-water fish, and liver. Vitamin D production decreases with aging. Those at risk for deficiency (elderly or house-bound individuals) should consider a supplementary source. Recommended daily intake is 400-800 IU.<sup>1</sup>

**Exercise**

Weight-bearing and resistance exercises are beneficial to increasing muscle mass and bone mass and density. Bone is living tissue that responds to the demands of exercise by

**Table 1—Osteoporosis Risk Factors**

<b>Non-modifiable</b>	<b>Potentially Modifiable</b>
• Gender ( <i>*Female</i> )	• Cigarette Smoking
• Ethnicity <i>(*Caucasian and Asian closely followed by African-American and Hispanic)</i>	• Low Body Weight <i>(*Less than 127 pounds)</i>
• Advanced Age	• Low Levels of Sex Hormones <i>(Female—Estrogen, Male—Testosterone)</i>
• Personal and Family History of Fracture	• Alcoholism
• Dementia	• Poor Nutrition
• Other Medical Conditions—Non-treatable	• Other Medical Conditions—Treatable
• Body Size <i>(* Small framed individuals)</i>	• Inactivity

\* Indicates greatest risk

**Table 2—Optimal Daily Calcium Intake (mg)**

<b>Infant—Child—Adolescent—Young Adult (Male/Female)</b>	
• Birth–6 Months	400
• 6–12 Months	600
• 1–5 Years	800
• 6–10 Years	800-1,200
• 11–24 Years	1,200-1,500
<b>Adult Female</b>	
• 25–50 Years	1,000
• Over 50 Years <i>(Postmenopausal— Without Estrogen Therapy)</i>	1,500
• Over 50 Years <i>(Postmenopausal— With Estrogen Therapy)</i>	1,000
• Over 65 Years	1,500
• Pregnant and Lactating	1,200-1,500
<b>Adult Male</b>	
• 25–65 Years	1,000
• Over 65 Years	1,500

\* Note: Calcium intake of up to 2,000 mg per day appears to be safe in most adults. Adapted from National Institutes of Health.<sup>2</sup>

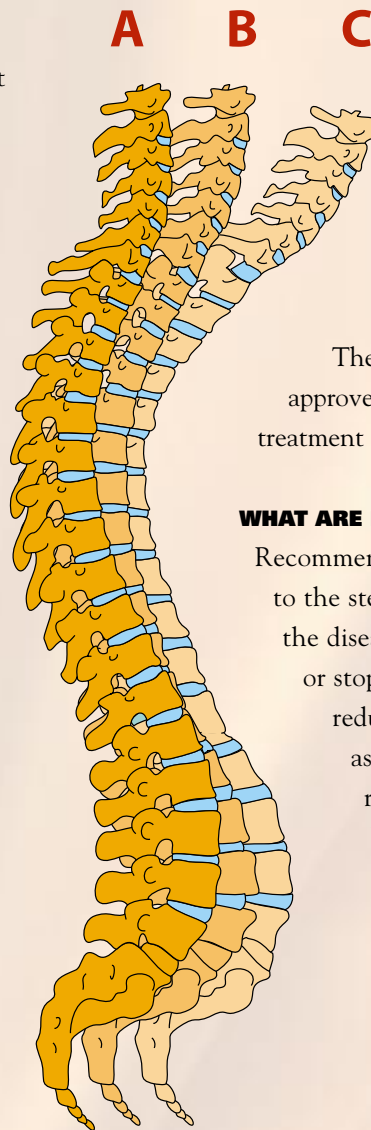
becoming stronger and more dense. Exercises that combine the two types of exercise are ideal.

During weight-bearing exercise (eg walking, dancing, and tennis), the muscles and bones work against gravity. This kind of exercise has been shown to improve overall health, improve strength and balance (reducing the risk of falls), and modestly increase bone density.

Resistance exercises, such as weight lifting, swimming and bicycling, increase muscle mass and bone strength.

### Healthy lifestyle

Healthy lifestyle not only refers to a balanced diet and a healthy exercise program, but also to avoiding tobacco use and alcohol abuse. Smoking has been shown to speed the rate of bone absorption. Alcohol abuse has not been shown to affect bone density, but increases the propensity to fall.<sup>5</sup> Moderate alcohol use may actually be associated with higher bone density in postmenopausal women.<sup>1</sup>



### Bone Density Testing

BMD testing is the only way to diagnose osteoporosis. Early diagnosis is crucial to a positive treatment outcome.

### Medication

The Food and Drug Administration (FDA) has approved four medications for the prevention and/or treatment of osteoporosis.

### WHAT ARE MY TREATMENT OPTIONS?

Recommended treatments for osteoporosis are similar to the steps used in prevention. Early detection of the disease will allow for early intervention to slow or stop bone loss, increase bone density, and reduce the risk of fracture. Patients may be asked to improve their diets, stop smoking, reduce alcohol intake, and increase weight-bearing exercise. Additionally, four pharmacologic options are currently approved by the FDA for prevention and treatment of osteoporosis.



**A**



**B**

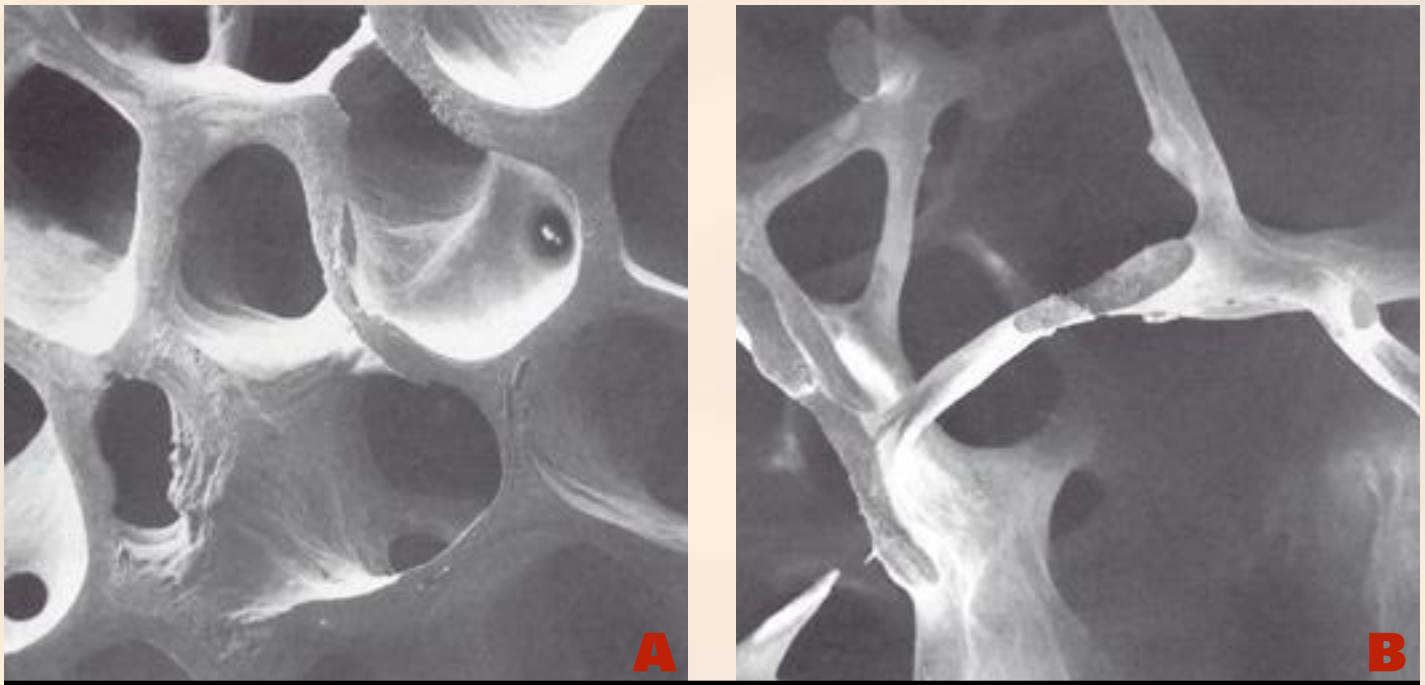


**C**



**Vertebral compression fracture**

**FIGURE 2**—Osteoporotic Changes Affecting the Spine. Normal spine **(A)**, moderately osteoporotic spine **(B)**, severely osteoporotic spine **(C)**.



**FIGURE 3**—Micrographs of Normal **(A)** and Osteoporotic **(B)** Bone. Reproduced from *J Bone Miner Res* 1986; 1:15-21 with permission from the American Society for Bone and Mineral Research.

### **1. Estrogen Replacement Therapy (ERT) and Hormone Replacement Therapy (HRT)**

ERT is approved for both prevention and treatment of Type I osteoporosis. Evidence shows ERT effective in reducing bone loss and increasing bone density in both the spine and hip reducing the risk of fracture. ERT is taken orally or absorbed through the skin from a patch and is effective even if it is started after the age of 70. An increased risk of developing breast cancer and endometrial cancer has been demonstrated. Women with intact uteruses benefit from a combination of cyclic ERT and HRT (using progestin) to reduce that risk.

Additional benefits of ERT/HRT are relief of the symptoms of menopause and increased cardiovascular health. Side effects include bloating, breast tenderness, high blood pressure, and nausea.

ERT/HRT is not recommended for everyone. The risks and benefits of estrogen and hormone replacement therapy must be presented by the health care provider to allow the patient to make an informed decision.

### **2. Alendronate**

Alendronate is a bisphosphonate that is approved for both prevention and treatment of Type I osteoporosis. The preven-

tative dose is 5 mg; the treatment dose is 10 mg. Alendronate is effective in reducing bone loss and increasing bone density in both the spine and hip, reducing the risk of fracture. The drug is taken orally, and the manufacturer recommends that it be taken with a full glass of water on an empty stomach. The individual should then remain in an upright position for at least 30 minutes and wait at least 30 minutes before eating to reduce the side effects of nausea, heartburn, and irritation of the esophagus. Additional side effects include musculoskeletal and abdominal pain.

Alendronate has recently been approved for treatment of osteoporosis induced by long-term steroid use.

### **3. Calcitonin**

Calcitonin is a naturally occurring hormone that regulates calcium and bone metabolism. It is shown to slow bone loss and increase spinal bone density, while possibly relieving pain associated with fractures. Administration of the drug has been approved by the FDA for treatment (not prevention) of osteoporosis and does not show a reduction of non-vertebral fractures. Calcitonin is a protein; therefore, it cannot be taken orally and is available by injection or as a nasal spray. Injectable calcitonin may cause an allergic reaction, flushed

face and hands, skin rash, nausea, and urinary frequency. Runny nose is the only side effect that has been reported with nasal calcitonin.

#### **4. Raloxifene**

Raloxifene is from a new class of drugs called Selective Estrogen Receptor Modulators (SERMs) and is approved for prevention and treatment of osteoporosis. SERMs appear to prevent bone loss throughout the body and to actually increase bone mass. A 50 percent reduction in the risk of spine fractures has been demonstrated following three years of drug therapy. Raloxifene does not appear to negatively affect uterine or breast tissue and side effects, while few, include hot flashes and deep vein thrombosis.<sup>1</sup>

Other pharmaceuticals that are under investigation for use in preventing and treating osteoporosis are sodium fluoride,

vitamin D metabolites, estrogen receptor modulators, parathyroid hormone, and other forms of bisphosphonate and SERMs.

#### **NEED FOR AWARENESS**

For a disease that is highly preventable, osteoporosis has a huge impact on Americans and the American health system. Direct medical costs associated with osteoporosis and the ensuing fractures are currently \$38 million per day. For women in this country, the risk of a hip fracture is equal to the combined risk of breast, uterine and ovarian cancers.<sup>1</sup>

The month of May is National Osteoporosis Prevention Month. Take time this month to share this information with family, friends and co-workers who are at risk. For more information about Osteoporosis and the National Osteoporosis Prevention Month, check out the National Osteoporosis Foundation Web site at [www.nof.org](http://www.nof.org).

## **Osteoporosis in Men?**

- **More than 2 million American men are affected by osteoporosis.**
- **Another 3 million or more are at risk for the disease.**
- **80,000 men suffer osteoporotic hip fractures every year (figures on wrist and spine fractures have not been tracked).**
- **Nearly 27,000 (roughly 1/3) of the men suffering osteoporotic hip fractures will die within one year of the fracture.<sup>3</sup>**

Osteoporosis in men is believed to be under-diagnosed and underreported. Unfortunately, research has been focused on Type I postmenopausal osteoporosis. Therefore, information about the disease and treatment decisions for men affected by

osteoporosis have been based on information and treatments that have been developed for women, although the pathogenesis of the disease is thought to differ between the genders.

The limited osteoporosis research that has been done on men shows that the disease differs from osteoporosis in women in the following ways.


- **The bone loss seen in men is more gradual than in women.**
- **Both lose trabecular bone, but in males the loss is attributed to reduced formation, and in females the loss is attributed to increased resorption.**
- **Correlation of low testosterone levels to reduced bone mineral density (BMD)**

**has not yet been determined.<sup>6</sup>**

**Several risk factors have been associated with osteoporosis in men.**

- **Chronic disease (myeloma, alcoholism, adult onset celiac disease or hypogonadism)<sup>6</sup>**
- **Prolonged exposure to certain medications (steroids, anticonvulsants, chemotherapeutics, and antacids that contain aluminum)**
- **Low testosterone levels**
- **Lifestyle (alcohol use, smoking, poor nutrition, inadequate weight-bearing exercise)**
- **Age**
- **Heredity**
- **Race (osteoporosis is found in males of all ethnic backgrounds, but white males appear to be at greatest risk)<sup>1</sup>**

**QUESTIONS FOR FURTHER CONSIDERATION:**

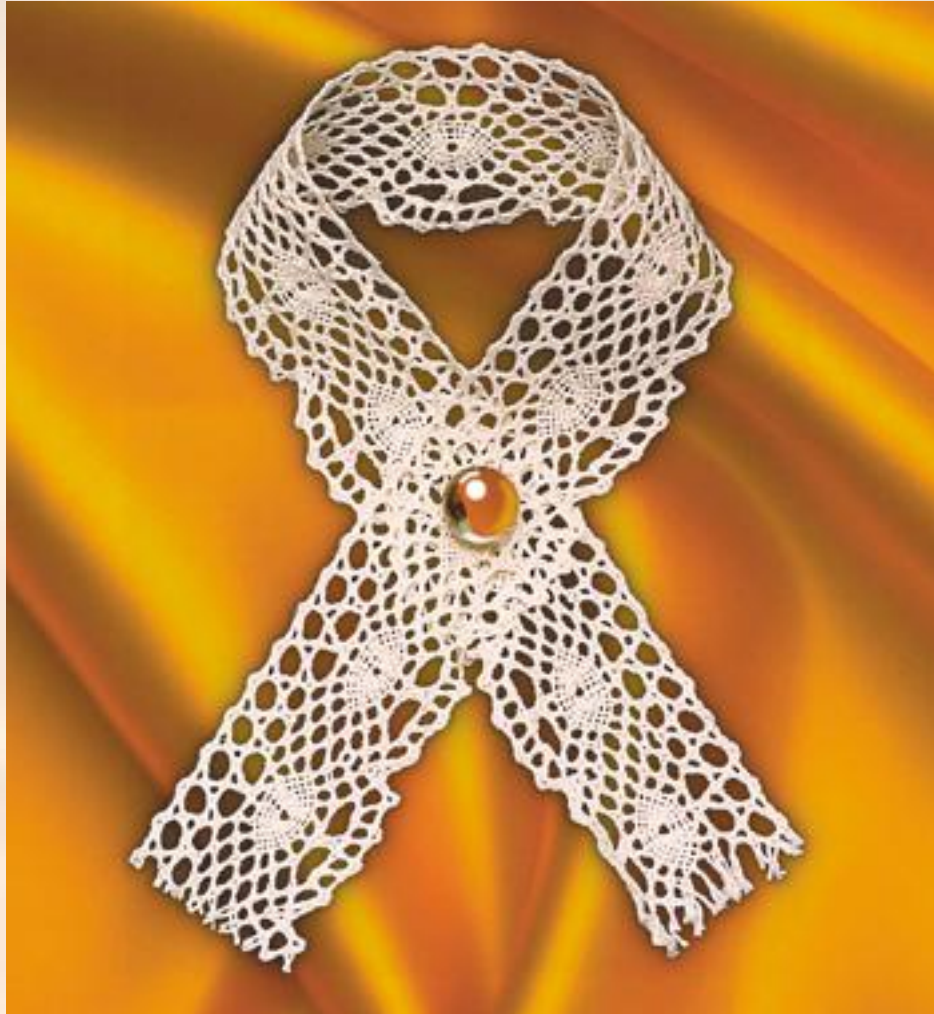
1. Is there a difference between a disease and a condition?
2. Are you at risk for osteoporosis?
3. What steps will you take to protect your bone health? 

**REFERENCES**

1. National Osteoporosis Foundation, 1232 22nd Street NW, Washington, DC 20037-1292, (202) 223-2226, [www.nof.org](http://www.nof.org)
2. National Institutes of Health, Osteoporosis and Related Bone Diseases-National Resource Center, 1150 17th Street, NW, Suite 500, Washington, DC 20036, 202-223-0344 or 800-624-BONE, FAX (202) 223-2237, TTY (202) 466-4315, E-Mail: [orbd-nre@nof.org](mailto:orbd-nre@nof.org)
3. Osteoporosis Overview Revised 3/98 [www.osteoporosis.org/osteoporosis.html](http://www.osteoporosis.org/osteoporosis.html) Accessed 12/28/99
4. Wheelless' Textbook of Orthopaedics [medmedia.com](http://medmedia.com)
5. Osteoporosis [merck.com/disease/osteoporosis](http://merck.com/disease/osteoporosis) Accessed 5/28/99
6. Seeman, E MD, Osteoporosis in Men, Endocrine News, October Issue 1996 [endosociety.org/news\\_g/endonews/october/osteopor.htm](http://endosociety.org/news_g/endonews/october/osteopor.htm)
7. NOF Physician's Guide: Impact and Overview [www.nof.org/physguide/impact\\_and\\_overview.htm](http://www.nof.org/physguide/impact_and_overview.htm)

**ADDITIONAL SOURCES OF INFORMATION**

1. Auker, Lilley. 1999. *Pharmacology and the Nursing Process*. Chapter 31—Women's Health Agents. Mosby, Inc St Louis
2. Avioli, Louis V. 1993. *The Osteoporotic Syndrome Detection, Prevention, and Treatment*. Third Edition. Wiley-Liss. New York
3. Carmichael, Kim A. 1995. *Reservoir Osteoporosis—Prevention and Intervention*. [www.coolware.com/health/medical\\_reporter/osteoporosis.html](http://www.coolware.com/health/medical_reporter/osteoporosis.html) Accessed 1-22-00
4. Geusens, P. 1998. *Osteoporosis in Clinical Practice A Practical Guide for Diagnosis and Treatment*. Springer-Verlag. London.
5. Physiologic Overview. [www.fc.peachnet.edu/floyd/academics/healthsci/nursing/n2204/ortho/sld003.htm](http://www.fc.peachnet.edu/floyd/academics/healthsci/nursing/n2204/ortho/sld003.htm) Accessed 1-22-00
6. What is Osteoporosis? Mayo Clinic Health Oasis. [www.mayohealth.org/mayopted/html/osteopor.htm](http://www.mayohealth.org/mayopted/html/osteopor.htm) Accessed 1-22-00



**Lace Ribbon—A Symbol of the Fight for Bone Strength & Independence**

**“The lace symbol was designed by the National Osteoporosis Foundation to emphasize the importance of the fight against osteoporosis. The ivory color represents the outer appearance of the bones, while the lace symbolizes the intricate lattice-like inner architecture of the bone.”<sup>1</sup>**

**MAKE YOUR OWN!**

- Supplies**
- Seven inch length of 1/2 inch wide ivory-colored lace
  - Straight pin
- Instructions**
- Fashion a loop with the strip of lace
  - Fasten with straight pin, drop of glue, or stitch
  - Embellish if desired (suggestion: pearl or bead placed (glued or sewn)—at the point where lace crosses over itself)

Used with permission of National Osteoporosis Foundation, Washington, DC 20037



### EARN CE CREDIT AT HOME

You will be awarded one continuing education (CE) credit for recertification after reading the designated article and completing the exam with a score of 70% or better.

If you are a current AST member and are certified, credit earned through completion of the CE exam will automatically be recorded in your file—you do not have to submit a CE reporting form. A printout of all the CE credits you have earned, including *Journal* CE credits, will be mailed to you in the first quarter following the end of the calendar year. You may check the status of your CE record with AST at any time.

If you are not an AST member or not certified, you will be notified by mail when *Journal* credits are submitted, but your credits will not be recorded in AST's files.

Detach or photocopy the answer block, include your check or money order (\$6 for members or \$10 for non-

### Continuing Education Examination (April 2000)

### Osteoporosis Unveiled: Answers to Your Questions

181

Category 1

Certified Member

Certified Nonmember

Certification No.

Name

Address

City

State

ZIP

Telephone

Mark one box next to each number. Only one correct or best answer can be selected for each question.

- |    | A                        | B                        | C                        | D                        |     | A                        | B                        | C                        | D                        |
|----|--------------------------|--------------------------|--------------------------|--------------------------|-----|--------------------------|--------------------------|--------------------------|--------------------------|
| 1. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 6.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 7.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 8.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 9.  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | 10. | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |



**CUT ALONG DASHED LINE**

members *per* CE) made payable to AST and send it to Accounting Department,

AST, 6 West Dry Creek Circle, Suite 200, Littleton, CO 80120-8031.

## CE EXAM

- What does the term rarefaction mean?**
  - Calcium deficiency
  - Being or becoming less dense
  - Postmenopausal
  - Unusually poor prognosis
- Idiopathic means:**
  - Low IQ
  - Condition originating from oneself
  - Condition without a known cause
  - Both B and C
- Osteocytes are:**
  - Responsible for bone building
  - Responsible for bone remodeling
  - Mature bone cells
  - None of the above
- Calcium deposits are found:**
  - Within the osteocytes
  - Within the intercellular material
  - At the epiphysis
  - Within the Haversian canals
- Which type of osteoporosis is most common in women?**
  - Type I
  - Type II
  - Juvenile Type
  - Type associated with osteogenesis imperfecta
- What is the maximum safe dose of calcium for most adults?**
  - 1,200 mg
  - 1,000 mg
  - 2,000 mg
  - 500 mg
- What type of drug is Raloxifene?**
  - ERT/HRT
  - ERT
  - HRT
  - SERM
- Deep vein thrombosis is a side effect associated with which osteoporosis drug?**
  - Raloxifene
  - Alendronate
  - Estrogen
  - Calcitonin
- Which diagnostic exam is most commonly used to measure bone mass?**
  - Ultrasonic Densitometry
  - DEXA
  - PDXA
  - SXA
- How many men in the US are affected by osteoporosis?**
  - 2 million
  - 3 million
  - 1 million
  - Osteoporosis does not affect men