Osteoporosis - Breaking News!

SCS Annual Osteopathic OBGYN Review Course
April 3, 2018
Director of the Beaumont Endocrine Center
Chief of Endocrinology: William Beaumont Hospital Grosse Pointe
A 54-year-old woman comes to the office for advice regarding maintaining bone health. She has no history of fracture. The patient recently had a lumpectomy and radiation therapy to treat breast cancer, is currently taking tamoxifen, and will begin taking an aromatase inhibitor in 2 months. She underwent menopause at age 52 years and has persistent hot flushes. Her risk factors for osteoporosis include a slim body habitus and a mother who had a hip fracture at age 67 years.

Physical examination findings, including vital signs, are normal. BMI is 20.

Results of routine laboratory studies are normal.

A dual-energy x-ray absorptiometry scan shows T-scores of –2.1 in the lumbar spine, –2.3 in the femoral neck, and –1.9 in the total hip. Her Fracture Risk Assessment Tool (FRAX) score indicates a 22% risk of major osteoporotic fracture and a 2.4% risk of hip fracture over the next 10 years. Optimal calcium and vitamin D supplementation is recommended, and she is encouraged to begin weight-bearing exercise as tolerated.

Which of the following pharmacologic agents can be started in this patient?

- A. Alendronate
- B. Denosumab
- C. Estrogen
- D. Raloxifene
- E. Teriparatide
Question 22 of 84

A 66-year-old woman comes to the office for management of osteoporosis discovered on a screening dual-energy x-ray absorptiometry (DEXA) scan. The patient has no personal history of fractures and no family history of parathyroid disease or low bone mineral density. She has hypertension treated with lisinopril but takes no other medications or supplements.

On physical examination, vital signs are normal; BMI is 22. Dentition is good. Other than mild kyphosis, physical examination findings are unremarkable.

**Laboratory studies:**

<table>
<thead>
<tr>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
<td>4.0 g/dL (40 g/L)</td>
</tr>
<tr>
<td>Calcium</td>
<td>8.7 mg/dL (2.2 mmol/L)</td>
</tr>
<tr>
<td>Creatinine</td>
<td>0.7 mg/dL (61.9 μmol/L)</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>2.9 mg/dL (0.94 mmol/L)</td>
</tr>
<tr>
<td>Parathyroid hormone</td>
<td>176 pg/mL (176 ng/L)</td>
</tr>
</tbody>
</table>

The DEXA scan showed T-scores of −2.1 in the lumbar spine, −3.0 in the femoral neck, and −2.5 in the total hip. Radiographs of the lateral spine show no compression fractures.

Which of the following is the most appropriate next step in management?

A Measurement of 1,25-dihydroxyvitamin D level

B Measurement of 25-hydroxyvitamin D level

C Parathyroidectomy

D Repeat DEXA scan in 1 year
Conflict

- I’m married to a drug representative and she works for Novo Nordisk
  - Makers of liraglutide (victoza), aspart (novolog), detemir (levemir), 70/30 mix insulin (novolog and novolin 70/30), repaglinide (prandin), glucagon (GlucaGen HypoKit), estradiol vaginal tablets (Vagifem), estradiol/norethindrone (Activella), somatropin (Norditropin), coagulation factor VIIIa (NovoSeven)

- I’m an expert on insulin pumps and lead groups for the Insulet Corporation
  - They make an insulin delivery system (pod/pump) called the Omni Pod
Objectives

- To define osteoporosis
- To determine who we should treat based on evidence-based medicine and clinical criteria
- Understand the available treatments for osteoporosis
- Try to obtain a proper duration of therapy and end point
Resources

- National Osteoporosis Foundation
- American Academy of Clinical Endocrinologists
- United States Preventative Task Force
- Endocrine Society
Main Resources
Burden of Osteoporosis

- Osteoporosis is a silent disease until it is complicated by fractures
- These fractures are common, and place an enormous medical and personal burden on aging individuals. It also places a major economic toll on the nation
Burden of Osteoporosis

Fig. 3. Comparative incidences of osteoporosis-related fractures, new strokes, heart attacks, and invasive breast cancer in women in the United States, based on recent statistics (2004 to 2006). Data from Burge et al (11), Rosamond et al (American Heart Association Statistics Committee and Stroke Statistics Subcommittee) (12), and American Cancer Society (13).
Defining Osteoporosis

- Characterized by:
  - Low bone mass
  - Deterioration of bone tissue/architecture
  - Compromised bone strength
  - Increase in the risk of fracture
Osteoporosis

**FIGURE 1. Micrographs of Normal vs. Osteoporotic Bone**

*From: Dempster, DW et al.*

*With permission of the American Society for Bone and Mineral Research.*
Consider Osteoporosis Risks in…

- All women and men age 50 and older
  - Low BMI
  - Current Smoker
  - History of rheumatoid arthritis
  - Glucocorticoid exposure
  - Parent hip fracture
  - Alcohol > 3 drinks per day
  - Secondary Osteoporosis
### Table 9
Some Causes of Secondary Osteoporosis in Adults

<table>
<thead>
<tr>
<th>Endocrine or metabolic causes</th>
<th>Nutritional/gastrointestinal conditions</th>
<th>Drugs</th>
<th>Disorders of collagen metabolism</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acromegaly</td>
<td>Alcoholism</td>
<td>Antiepileptics(^b)</td>
<td>Ehlers-Danlos syndrome</td>
<td>AIDS/HIV</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Anorexia nervosa</td>
<td>Aromatase inhibitors</td>
<td>Homocystinuria due to</td>
<td>Ankylosing spondylitis</td>
</tr>
<tr>
<td>Type 1</td>
<td>Calcium deficiency</td>
<td>Chemotherapy/immunosuppressants</td>
<td>cystathionine deficiency</td>
<td>Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>Type 2</td>
<td>Chronic liver disease</td>
<td>Depo-Provera</td>
<td>Marfan syndrome</td>
<td></td>
</tr>
<tr>
<td>Growth hormone deficiency</td>
<td>Malabsorption syndromes/malnutrition (including celiac disease, Crohn disease, and gastric resection or bypass)</td>
<td>Lithium</td>
<td>Osteogenesis imperfecta</td>
<td>Gaucher disease</td>
</tr>
<tr>
<td>Hypercortisolism</td>
<td></td>
<td>Glucocorticoids</td>
<td></td>
<td>Hemophilia</td>
</tr>
<tr>
<td>Hyperparathyroidism</td>
<td></td>
<td>Gonadotropin-releasing hormone agonists</td>
<td></td>
<td>Hypercalciuria</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
<td></td>
<td>Heparin</td>
<td></td>
<td>Immobilization</td>
</tr>
<tr>
<td>Hypogonadism</td>
<td></td>
<td>Lithium</td>
<td></td>
<td>Major depression</td>
</tr>
<tr>
<td>Hypophosphatasia</td>
<td>Total parenteral nutrition</td>
<td>Proton pump inhibitors</td>
<td></td>
<td>Multiple myeloma and some cancers</td>
</tr>
<tr>
<td>Porphyria</td>
<td>Vitamin D deficiency</td>
<td>Selective serotonin reuptake inhibitors</td>
<td></td>
<td>Organ transplantation</td>
</tr>
<tr>
<td>Pregnancy</td>
<td></td>
<td>Thiazolidinediones</td>
<td></td>
<td>Renal insufficiency/failure</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thyroid hormone (in supraphysiologic doses)</td>
<td></td>
<td>Renal tubular acidosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Warfarin</td>
<td></td>
<td>Rheumatoid arthritis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Systemic mastocytosis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Thalassemia</td>
</tr>
</tbody>
</table>

\(^a\) AIDS = acquired immunodeficiency syndrome; HIV = human immunodeficiency virus.

\(^b\) Phenobarbital, phenytoin, primidone, valproate, and carbamazepine have been associated with low bone mass.
How to Assess Osteoporosis

- Bone Mineral Density (BMD)
- Fracture Risk Assessment Model
- Imaging
- Clinical decision making and lab assessments
- Bone biopsy
Who gets BMD testing?

- Women and men age 50 and older with increased risk
- Women age 65 and older (USPSTF Rec)
- Men age 70 and older, regardless of clinical risk factors (NOF, AACE, and Endocrine Society endorsed)
NO BMD t-scores in patient <50yo

- In premenopausal women, men less than 50 years of age and children, the WHO BMD diagnostic classification should not be applied
Bone Mineral Density (BMD)

T-score

- Compares an individual's BMD to the expected BMD of “young normal” adults (approximately 25 years old) of the same sex
- The difference between the patient’s score and the norm is expressed in standard deviations (SD) above or below the mean
# T-Score

## Table 3

<table>
<thead>
<tr>
<th>Category</th>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>-1.0 or above</td>
</tr>
<tr>
<td>Low bone mass (osteopenia)(^a)</td>
<td>Between -1.0 and -2.5</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>-2.5 or below</td>
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</table>

\(^a\) Fracture rates within this category vary widely. The category of “osteopenia” is useful for epidemiology studies and clinical research but is problematic when applied to individual patients and must be combined with clinical information to make treatment decisions.
**Z-score**

- Compares an individual’s BMD to the expected BMD for the patient’s *peers* based on age and sex.
- The difference between the patient’s score and the norm is expressed in standard deviations (SD) above or below the mean.
T-score and Z-score

- T-scores to define a diagnosis
- Z-scores suggest a secondary cause of osteoporosis
Low Bone Mass, a.k.a. Osteopenia

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</table>

\(^a\) Fracture rates within this category vary widely. The category of “osteopenia” is useful for epidemiology studies and clinical research but is problematic when applied to individual patients and must be combined with clinical information to make treatment decisions.
What to do with low bone mass (osteopenia)?

- FRAX it!
Fracture Risk Assessment Model (FRAX)

- FRAX® was developed to calculate the 10-year probability of a hip fracture and major osteoporotic fracture (defined as clinical vertebral, hip, forearm or proximal humerus fracture) taking into account clinical risk factors.
Fracture Risk Assessment Model (FRAX)

- Apply FRAX calculation to any patient with low bone mass (Osteopenia)

- Do NOT apply FRAX with,
  - Women and men age less than 50
  - Patients currently/previous treated for osteoporosis
FRAX Indicates Treatment if

- Major osteoporosis-related fracture probability ≥ 20%
- Hip fracture probability ≥ 3%
http://www.shef.ac.uk/FRAX/
Patient Example

T =-2.3, wt=150#, No Risks
Patient Example
T = -2.3, wt=150#, With Risks
If Fractured, then Osteoporosis
Pharmacological Treatment for the Following:

- T-score ≤ -2.5 at the femoral neck or spine after appropriate evaluation to exclude secondary causes.

- Low bone mass (T-score between -1.0 and -2.5 at the femoral neck or spine) and a 10-year probability of a hip fracture ≥ 3% or a 10-year probability of a major osteoporosis-related fracture ≥ 20% based on the US-adapted WHO algorithm.

- A hip or vertebral (clinical or morphometric) fracture.
Pharmacological Classes

- Calcitonin
- Estrogen
- Selective Estrogen receptor modifiers (SERM)
- Receptor activator of nuclear factor κB (RANK) ligand inhibitor
- Bisphosphonates
- Recombinant human PTH
Denosumab (Prolia)

- Leads to decreased osteoclastogenesis
Denosumab (Prolia)

- Administered by injection every 6 months
- Fracture prevention is comparable to bisphosphonate therapy
- Osteonecrosis of the jaw has been reported
- No known kidney metabolism issues (Can be used in patients with low GFR)
Bisphosphonates

- Bisphosphonates bind to the bone matrix and decrease osteoclast activity.
Bisphosphonates

- Patient should be upright for 30 minutes after taking with water only and on an empty stomach

- Intravenous bisphosphonates, e.g. Zoldronic acid (Reclast), is available for patients with esophagitis, active esophageal disease, or swallowing disorders
Bisphosphonates

- Not recommended for patients with
  - Impaired kidney function (creatinine clearance less than 30-35 mL/min)
Risk of Denosumab and Bisphophonate Use

- Osteonecrosis of the jaw
- Atypical Fracture
Atypical Fracture

- A distinct type of fracture that occurs in the femur below the greater trochanter
- Has been associated with a long duration of antiresorptive therapy
- No study has proven the association to be causal
Radiographs of patients diagnosed with atypical femoral fractures.
Duration of Treatment with Bisphosphonates or Denosumab

- Antiresorptive therapy should probably be stopped after 5-10 years for a duration.
- Typically endocrinologists are now treating for 5-7 years, then stop for 2-5 years, and resume if needed.
Bonus case of interest
Real world example over the course of years…
Real world example

OCT-3D PLUS™ Bone Densitometry

Patient ID: [REDACTED]
CT Scanner: Philips CT Aura

Age: 49
Sex: F
Exam Date: Apr 10 2013
Exam ID: [REDACTED]
Referred by: [REDACTED]

T-Score: -3.0
Z-Score: -1.8
Mean BMD (mg/cc): 91.4

Diagnostic Comments:
The patient has a T-Score below -2.5. According to the WHO criteria, the patient has significantly reduced bone density (Osteoporosis) when compared to young normal persons of the same sex.

Fracture risk approximately doubles exponentially for every 1.0 decrease in T-Score. This patient has a significantly higher risk of osteoporotic fractures when compared to young normal persons of the same sex.

Additional Comments:
How should these results be interpreted?

- Not osteoporosis based on WHO BMD.
- How about the Z-score?
- What was the indication for the study?
- Where are the images?
Repeated Test by PCP

**System** at William Beaumont Hospital, Troy.

Patient is a 50.2 y/o Female with a diagnosis of osteoporosis, diagnosis code 733.00, per the referral script.

The following summarizes the results of our evaluation:

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>T-Score</th>
<th>Z-Score</th>
<th>Change from Baseline</th>
<th>Change from Prev.</th>
<th>WHO Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP Spine</td>
<td>L1-L4</td>
<td>0.913</td>
<td>-2.2</td>
<td>-1.3</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L2-L4</td>
<td>0.921</td>
<td>-2.3</td>
<td>-1.4</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Left</td>
<td>0.712</td>
<td>-2.3</td>
<td>-1.2</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Right</td>
<td>0.727</td>
<td>-2.2</td>
<td>-1.1</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Mean</td>
<td>0.720</td>
<td>-2.3</td>
<td>-1.2</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
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<tr>
<td>DualFemur</td>
<td>Total Mean</td>
<td>0.734</td>
<td>-2.2</td>
<td>-1.3</td>
<td>baseline</td>
<td>-</td>
<td>Osteopenia</td>
</tr>
</tbody>
</table>

In order to assist in interpretation of the information in the table above, the following criteria are provided:

- **Osteopenia** (low bone mass): T-value between -1.0 and -2.5.
- **Osteoporosis**: T-value of less than -2.5 (e.g. -3.0)

The relative fracture risk increases 2-3 fold for each 10% decrease in bone mineral density below the young adult values. Matched population is for age (T, young adult; Z, age matched) sex, weight, ethnicity.
BMD 1 Year Later

Patient is a 51.3 y/o Female with a diagnosis of osteopenia per the referral script.

The following summarizes the results of our evaluation:

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>BMD</th>
<th>T-Score</th>
<th>Z-Score</th>
<th>Change from Baseline</th>
<th>Change from Prev.</th>
<th>WHO Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP Spine</td>
<td>L1-L4</td>
<td>0.886 g/cm²</td>
<td>-2.4</td>
<td>-1.4</td>
<td>-3.0%</td>
<td>-3.0%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L2-L4</td>
<td>0.902 g/cm²</td>
<td>-2.5</td>
<td>-1.5</td>
<td>-2.1%</td>
<td>-2.1%</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Left</td>
<td>0.727 g/cm²</td>
<td>-2.2</td>
<td>-1.1</td>
<td>2.1%</td>
<td>2.1%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Right</td>
<td>0.698 g/cm²</td>
<td>-2.4</td>
<td>-1.3</td>
<td>-4.0%</td>
<td>-4.0%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck Mean</td>
<td>0.713 g/cm²</td>
<td>-2.3</td>
<td>-1.2</td>
<td>-1.0%</td>
<td>-1.0%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Total Mean</td>
<td>0.713 g/cm²</td>
<td>-2.3</td>
<td>-1.5</td>
<td>-2.9%</td>
<td>-2.9%</td>
<td>Osteopenia</td>
</tr>
</tbody>
</table>

In order to assist in interpretation of the information in the table above, the following criteria are provided:
Osteopenia (low bone mass): T-value between -1.0 and -2.5.
BMD 1 Year Later
Significant Hx, PE, and Studies

- PTH – nml
- Calcium – nml
- Vitamin D – nml (77 in fact)
- TSH – nml
- A1c – nml
- BMI = 20
- Mother fractured hip and pelvis
- Reported menopause 46ish
- Estradiol undetectably low, FSH and LH elevated
FRAX or not to FRAX?
FRAX!

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: US (Caucasian)  Name/ID:  

**Questionnaire:**

1. Age (between 40 and 90 years) or Date of Birth
   - Age: 50
   - Date of Birth: M:  

2. Sex
   - Male  Female

3. Weight (kg)
   - 58.97

4. Height (cm)
   - 170.18

5. Previous Fracture
   - No  Yes

6. Parent Fractured Hip
   - No  Yes

7. Current Smoking
   - No  Yes

8. Glucocorticoids
   - No  Yes

9. Rheumatoid arthritis
   - No  Yes

10. Secondary osteoporosis
    - No  Yes

11. Alcohol 3 or more units/day
    - No  Yes

12. Femoral neck BMD (g/cm²)
    - T-Score: -2.3

**BMI:** 20.4

The ten year probability of fracture (%)

- **Major osteoporotic**
  - 9.5

- **Hip fracture**
  - 1.7

Weight Conversion

- Pounds  kg
  - 130  Convert

Height Conversion

- Inches  cm
  - 67  Convert

03461030

Individuals with fracture risk assessed since 1st June 2011
FRAX

- FRAX with risks of positive family history and secondary osteoporosis due to premature menopause (technically not true, but tried to make it seem worse case scenario)
- Worst case
  - 10 yr Major osteoporosis related FRAX risk – 9.5%
  - 10 yr Hip FRAX risk – 1.7%
Treat or not to treat?

- Osteoporosis technically, T-score -2.5 in spine, FRAX says no (mainly because she is so young)
- Why are the bones bad in the mom and the patient, and later we discover the sister has poor BMD as well?..... Hmm
- Any ideas on what to look for effecting the whole family?
# Hypercalciuria

## Component Results

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Ref Range &amp; Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium, Urine</td>
<td>11.7</td>
<td>mg/dL</td>
</tr>
<tr>
<td>Calcium, Urine, Timed</td>
<td>364 (H)</td>
<td>50 - 250 mg/24hr</td>
</tr>
<tr>
<td>Collection Period</td>
<td>24</td>
<td>Hours</td>
</tr>
<tr>
<td>Total Volume</td>
<td>2475</td>
<td>mL</td>
</tr>
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</table>

## Result Date - 12/18/2014

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Ref Range &amp; Units</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium, Urine</td>
<td>18.9</td>
<td>mg/dL</td>
<td>Final</td>
</tr>
<tr>
<td>Comment: Reference ranges for random urines or for collections other than 24 hours have not been established.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine, Urine</td>
<td>68.1</td>
<td>mg/dL</td>
<td>Final</td>
</tr>
<tr>
<td>Comment: Reference ranges for random urines or for collections other than 24 hours have not been established.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium/Creatinine Ratio, Urine</td>
<td>0.28 (H)</td>
<td>0.02 - 0.26</td>
<td>Final</td>
</tr>
</tbody>
</table>
Hypercalciuria

- Now treatment for the underlying cause, hydrochlorothiazide 25mg daily

We will see if the treatment works by getting a BMD next December to see if the rate of loss or change in T/Z – scores has slowed

<table>
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<tbody>
<tr>
<td>Calcium, Urine</td>
<td>9.7</td>
<td>mg/dL</td>
<td>Final</td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creatinine, Urine</td>
<td>107.1</td>
<td>mg/dL</td>
<td>Final</td>
</tr>
<tr>
<td>Comment:</td>
<td></td>
<td></td>
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</table>
Patient is a 53.3 y/o Female with a diagnosis of osteoporosis per the referral script.

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<tr>
<td>AP Spine</td>
<td>L1-L4</td>
<td>0.866g/cm²</td>
<td>-2.6</td>
<td>-1.4</td>
<td>-5.1%</td>
<td>-2.3%</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L2-L4</td>
<td>0.869g/cm²</td>
<td>-2.8</td>
<td>-1.5</td>
<td>-5.6%</td>
<td>-3.7%</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck</td>
<td>0.731g/cm²</td>
<td>-2.2</td>
<td>-0.9</td>
<td>2.7%</td>
<td>0.6%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td></td>
<td>Left</td>
<td>g/cm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck</td>
<td>0.689g/cm²</td>
<td>-2.5</td>
<td>-1.2</td>
<td>-5.2%</td>
<td>-1.3%</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td></td>
<td>Right</td>
<td>g/cm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DualFemur</td>
<td>Neck</td>
<td>0.710g/cm²</td>
<td>-2.4</td>
<td>-1.0</td>
<td>-1.4%</td>
<td>-0.4%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>g/cm²</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DualFemur</td>
<td>Total</td>
<td>0.700g/cm²</td>
<td>-2.4</td>
<td>-1.4</td>
<td>-4.6%</td>
<td>-1.8%</td>
<td>Osteopenia</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
A 54-year-old woman comes to the office for advice regarding maintaining bone health. She has no history of fracture. The patient recently had a lumpectomy and radiation therapy to treat breast cancer, is currently taking tamoxifen, and will begin taking an aromatase inhibitor in 2 months. She underwent menopause at age 52 years and has persistent hot flushes. Her risk factors for osteoporosis include a slim body habitus and a mother who had a hip fracture at age 67 years.

Physical examination findings, including vital signs, are normal. BMI is 20.

Results of routine laboratory studies are normal.

A dual-energy x-ray absorptiometry scan shows T-scores of −2.1 in the lumbar spine, −2.3 in the femoral neck, and −1.9 in the total hip. Her Fracture Risk Assessment Tool (FRAX) score indicates a 22% risk of major osteoporotic fracture and a 2.4% risk of hip fracture over the next 10 years. Optimal calcium and vitamin D supplementation is recommended, and she is encouraged to begin weight-bearing exercise as tolerated.

Which of the following pharmacologic agents can be started in this patient?

- A  Alendronate
- B  Denosumab
- C  Estrogen
- D  Raloxifene
- E  Teriparatide
Which of the following pharmacologic agents can be started in this patient?

A. Alendronate
B. Denosumab
C. Estrogen
D. Raloxifene
E. Teriparatide

Answer & Critique  (Correct Answer: A)

Educational Objective: Treat a woman with low bone mass.

The most appropriate medication for this patient is alendronate. She has osteopenia, and her major osteoporotic fracture risk by the Fracture Risk Assessment Tool (FRAX) is in a range for which the National Osteoporosis Foundation (NOF) guidelines favor treatment with antisteoporotic therapy. The NOF recommends antisteoporotic therapy for persons whose risk of major osteoporotic fracture over the next 10 years is 20% or greater or whose risk of hip fracture over the next 10 years is 3% or greater. Given her current FRAX score and the expectation that she will lose bone mass more rapidly after an aromatase inhibitor is started, it is reasonable to initiate therapy with alendronate now. Alendronate is approved for both osteoporosis prevention and treatment by the FDA.

Key Point
- In a patient with osteopenia and a history of radiation therapy, alendronate is the most appropriate drug to use for osteoporosis prevention.
Question 22 of 84

A 66-year-old woman comes to the office for management of osteoporosis discovered on a screening dual-energy x-ray absorptiometry (DEXA) scan. The patient has no personal history of fractures and no family history of parathyroid disease or low bone mineral density. She has hypertension treated with lisinopril but takes no other medications or supplements.

On physical examination, vital signs are normal; BMI is 22. Dentition is good. Other than mild kyphosis, physical examination findings are unremarkable.

<table>
<thead>
<tr>
<th>Laboratory studies:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albumin</td>
</tr>
<tr>
<td>Calcium</td>
</tr>
<tr>
<td>Creatinine</td>
</tr>
<tr>
<td>Phosphorus</td>
</tr>
<tr>
<td>Parathyroid hormone</td>
</tr>
</tbody>
</table>

The DEXA scan showed T-scores of −2.1 in the lumbar spine, −3.0 in the femoral neck, and −2.5 in the total hip. Radiographs of the lateral spine show no compression fractures.

Which of the following is the most appropriate next step in management?

A. Measurement of 1,25-dihydroxyvitamin D level  
B. Measurement of 25-hydroxyvitamin D level  
C. Parathyroidectomy  
D. Repeat DEXA scan in 1 year
Which of the following is the most appropriate next step in management?

A) Measurement of 1,25-dihydroxyvitamin D level
B) Measurement of 25-hydroxyvitamin D level
C) Parathyroidectomy
D) Repeat DEXA scan in 1 year

Answer & Critique  (Correct Answer: B)

Educational Objective: Diagnose vitamin D deficiency.

This patient’s serum 25-hydroxyvitamin D level should be measured. Results of her recent bone mineral density screening showed osteoporosis of the hip, and laboratory studies showed a high parathyroid hormone (PTH) level in the setting of low serum calcium and phosphorous levels. These findings collectively suggest secondary hyperparathyroidism. In this patient with normal kidney function, secondary hyperparathyroidism is likely due to vitamin D deficiency, a common problem in older adults. Therefore, screening her for vitamin D deficiency by measuring the 25-hydroxyvitamin D level would be the most appropriate next step.

A measurement of the 25-hydroxyvitamin D level is more informative in most patients with hypocalcemia than a measurement of the 1,25-dihydroxyvitamin D level because vitamin D deficiency causes hypocalcemia and stimulates PTH secretion, which in turn stimulates conversion of 25-hydroxyvitamin D to 1,25-dihydroxyvitamin D in the kidneys. Therefore, this patient's serum 1,25-dihydroxyvitamin D level may be normal in the setting of vitamin D deficiency and is not useful to check in this setting.

Parathyroidectomy also would be inappropriate in this patient because the elevation in the PTH level is an appropriate physiologic response to the low calcium (and presumed low vitamin D) level.

Repeat dual-energy x-ray absorptiometry testing in 1 year should not be recommended because this patient already has indications for medical management of her osteoporosis after the high PTH and low calcium levels have been evaluated and treated.
When to Refer for Osteoporosis?

- Young people (50-65) with unexpectedly low bone mineral density
- Extremely low bone density (T-score <-3.5)
- Concerns before age 50
- Contemplating teriparatide
- Fractures despite therapy
- Patient contemplating or receiving organ transplant
- Atypical fracture
Remember

Treat women and men age 50 and older if;

- T-score ≤ -2.5 at the femoral neck or spine
- FRAX calculator score:
  - major osteoporosis-related fracture ≥ 20%
  - hip fracture ≥ 3%
- A hip or vertebral (clinical or morphometric) fracture
In Conclusion

- Osteoporosis is a frequent and silent disease
- T-score values help diagnose, Z-score reveal concern for secondary causes of osteoporosis
- Get a BMD in every woman 65 or older (USPSTF GL)
- Consider BMD in people >50yo with risk factors and all men >70yo
- Treat!
- Remember to take a break (ha-ha) from anti-resorptive therapy after 5-7 years, and then reassess every few years with BMD
Thank You!

Questions?
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  **Phone:** 586-447-8021
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- Call Beaumont Health system and ask to have him paged
  248-898-5000