Welcome to UVM ECHO: Osteoporosis Management

Facilitators:
Jennifer J. Kelly, DO (course director)
Liz Cote
“Introduction” to ZOOM

- Please mute microphone when not speaking
- Please use camera as much as possible
- Test both audio & video before joining
- Communicate clearly during clinic:
  - Can use “raise hand” feature to comment
  - Speak clearly
  - Use chat function for technical issues
RECORDING OF SESSION TO BEGIN
Agenda

• Introductions
• Objectives
• Didactic Presentation (20-25 min)
• Case presentation
  • Clarifying questions
  • Participants – then faculty panel
• Discussion
• Recommendations
• Summary
• Closing Announcements
  • Submission of new cases
  • Completion of evaluations
CME Disclosures

University of Vermont (UVM) Office of Continuing Medical and Interprofessional Education (CMIE) is approved as a provider of Continuing Medical Education (CME) by the ACCME. UVM designates this educational activity for a maximum of 1.0 AMA PRA Category 1 Credits. Participants should claim only the credit commensurate with the extent of their participation in the activity.

Interest Disclosures:

• As an organization accredited by the ACCME to sponsor continuing medical education activities, UVMCMIE is required to disclose any real or apparent conflicts of interest (COI) that any speakers may have related to the content of their presentations.
Introduction

Proper management of Osteoporosis: A significant public health need: Primary Care Providers: Front Line.
Other specialties: Endocrinology, Rheumatology, Geriatrics, GYN also actively involved.
This series: a way of sharing specialty expertise through didactics and case-based learning
Series Objectives

• By the end of this series, the participants should be able to:
  - Identify which patients should be screened for fracture risk.
  - Determine who should be considered for treatment.
  - Distinguish between the different medications available to treat osteoporosis and their potential side effects.
DXA Exams, Diagnosis and Screening

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Director of the Metabolic Bone Program
Associate Professor of Medicine
Division of Endocrinology and Metabolism
University of Vermont Medical Center
Burlington, VT
Osteoporosis

- The most common metabolic bone disorder
- Systemic skeletal disease characterized by:
  - Low bone mass
  - Microarchitectural deterioration of bone tissue
  - Increased bone fragility and susceptibility to fracture
  - Not a natural part of aging
  - Increased risk for women, post-menopausal, over age 65
  - All races, sexes, and ages are susceptible
  - Preventable and treatable!
**Table 1. Osteoporosis Statistics**

<table>
<thead>
<tr>
<th>Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 million Americans already have osteoporosis</td>
</tr>
<tr>
<td>18 million more have low bone mass, putting them at high risk for this disease</td>
</tr>
<tr>
<td>More than 2 million American men have osteoporosis</td>
</tr>
<tr>
<td>Osteoporosis causes 1.5 million fractures a year, including:</td>
</tr>
<tr>
<td>• 300,000 hip fractures</td>
</tr>
<tr>
<td>• 700,000 vertebral fractures</td>
</tr>
<tr>
<td>• 250,000 wrist fractures</td>
</tr>
<tr>
<td>• &gt;300,000 other fractures</td>
</tr>
<tr>
<td>1 out of 2 American women and 1 in every 8 American men will experience an osteoporosis-related fracture in her/his lifetime.</td>
</tr>
<tr>
<td>Hospital and nursing home costs directly resulting from osteoporosis and related fractures reach $14 billion every year.</td>
</tr>
</tbody>
</table>
Hip fracture
LOSS OF FUNCTION AND INDEPENDENCE AMONG SURVIVORS

40% UNABLE TO WALK INDEPENDENTLY

60% REQUIRE ASSISTANCE A YEAR LATER

33% DEPENDENT OR IN A NURSING HOME IN THE YEAR FOLLOWING A HIP FRACTURE

Mortality UP TO 20-24% IN THE FIRST YEAR AFTER A HIP FRACTURE

50% OF PEOPLE WITH ONE OSTEOPOROTIC FRACTURE WILL HAVE ANOTHER
Clinical Presentation of Osteoporosis

- Usually asymptomatic and undiagnosed
- Signs and symptoms
  - Low-trauma fractures of spine, wrist, or hip
  - Loss of height
  - Kyphosis (rounded back)
  - Acute or chronic back pain
- Diagnostic tests
  - Bone mineral density measurement
  - Lateral spine x-ray

Who to screen? NOF guidelines

- Women starting at age 65.
- Men starting at age 70.
- Can start screening at age 50 if the person has other risk factors for bone loss/fracture.
- Screen those under age 50 only in select situations (atypical fractures, high risk),
- Z-scores are used rather than T-scores.
## Risk Factors for Osteoporosis

<table>
<thead>
<tr>
<th>Uncontrollable Risk Factors</th>
<th>Controllable Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal history of fracture as an adult</td>
<td>Current cigarette smoking</td>
</tr>
<tr>
<td>History of fracture in a first-degree relative</td>
<td>Low body weight (&lt;127 lbs.)</td>
</tr>
<tr>
<td>White race</td>
<td>Low lifelong calcium intake</td>
</tr>
<tr>
<td>Advanced age</td>
<td>Alcoholism</td>
</tr>
<tr>
<td>Female sex</td>
<td>Impaired eyesight despite adequate correction</td>
</tr>
<tr>
<td>Dementia</td>
<td>Recurrent falls</td>
</tr>
<tr>
<td>Poor health/fragility</td>
<td>Inadequate physical activity</td>
</tr>
<tr>
<td></td>
<td>Estrogen deficiency (e.g. early menopause, bilateral ovariectomy prolonged premenopausal amenorrhea)</td>
</tr>
</tbody>
</table>
## Some Causes of Secondary Osteoporosis in Adults

<table>
<thead>
<tr>
<th>Endocrine Disease or Metabolic Causes</th>
<th>Nutritional Conditions</th>
<th>Drugs</th>
<th>Disorders of Collagen Metabolism</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypogonadism</td>
<td>Malabsorption syndromes</td>
<td>Glucocorticoids</td>
<td>Osteogenesis imperfecta</td>
<td>Rheumatoid arthritis</td>
</tr>
<tr>
<td>Hyperadrenocorticism</td>
<td>Malnutrition</td>
<td>Excess thyroid hormone</td>
<td>Homocystinuria</td>
<td>Myeloma and some cancers</td>
</tr>
<tr>
<td>Thyrotoxicosis</td>
<td>Chronic cholestatic liver disease</td>
<td>Heparin</td>
<td>Ehlers–Danlos syndrome</td>
<td>Immobilization</td>
</tr>
<tr>
<td>Anorexia nervosa</td>
<td>Gastric operations</td>
<td>GnRH agonists</td>
<td>Marfan syndrome</td>
<td>Renal tubular acidosis</td>
</tr>
<tr>
<td>Hyperprolactinemia</td>
<td>Vitamin D deficiency</td>
<td>Phenyltoin</td>
<td></td>
<td>COPD</td>
</tr>
<tr>
<td>Porphyria</td>
<td>Calcium deficiency</td>
<td>Phenobarbital</td>
<td></td>
<td>Organ transplantation</td>
</tr>
<tr>
<td>Hypophosphatemia, in adults</td>
<td>Alcoholism</td>
<td>Depo-Provera</td>
<td></td>
<td>Mastocytosis</td>
</tr>
<tr>
<td>Diabetes mellitus, Type 1</td>
<td>Hypercalciuria</td>
<td>Aromatase inhibitors</td>
<td></td>
<td>Thalassemia</td>
</tr>
<tr>
<td>Hyperparathyroidism</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acromegaly</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from AACE Guidelines on Osteoporosis.
Factors Increasing Risk for Osteoporosis

Autoimmune Conditions
- Rheumatoid Arthritis
- Celiac Disease
- Lupus
- Multiple Sclerosis

Endocrine Disorders
- Diabetes
- Hyperparathyroidism
- Hyperthyroidism
- Cushing's Syndrome
- Premature Menopause

Medications
- Aluminum-containing antacids
- Antiseizure medicines like Phenobarbital
- Aromatase inhibitors
- Cancer chemotherapeutic drugs
- Gonadotropin releasing hormone (GnRH)
- Heparin
- Lithium
- Proton pump inhibitors like Nexium®, Prevacid® and Prilosec®
- Selective serotonin reuptake inhibitors (SSRIs) such as Lexapro®, Prozac® and Zoloft®
- Steroids (glucocorticoids) such as cortisone and prednisone
- Thyroid hormones in excess

Breast Cancer
Prostate Cancer

Cancer
- Leukemia and lymphoma
- Multiple myeloma
- Sickle cell disease
- Thalassemia

Blood Disorders

Content from https://www.nof.org/patients/what-is-osteo porosis/
Heel US, OK for population screening, not individuals
Bone Densitometry Scan

This Photo by Unknown Author is licensed under CC BY-SA
Our DXA machine at Tilley Drive Endocrinology
BMD measurements

• **Q1.5.3. BMD Measurement Sites and Techniques**

• DXA of the lumbar spine and proximal femur (hip) provides accurate and reproducible BMD measurements at important sites of osteoporosis-associated fracture. Optimally, both hips should be initially measured to prevent misclassification and to have a baseline for both hips in case a fracture or replacement occurs in one hip. These axial sites are preferred over peripheral sites for both baseline and serial measurements. The most reliable comparative results are obtained when the same instrument and, ideally, the same technologist are used for serial measurements at a high-quality DXA facility (47).
Hip DXA

![Diagram of Hip Bone Density]

**Table:**

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/m²)</th>
<th>Young-Adult (%) T-score</th>
<th>Adj. to age (%) Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>0.992</td>
<td>101</td>
<td>112</td>
</tr>
<tr>
<td>Ward's</td>
<td>0.811</td>
<td>89</td>
<td>110</td>
</tr>
<tr>
<td>Troc.</td>
<td>0.873</td>
<td>111</td>
<td>118</td>
</tr>
<tr>
<td>Diaphysis</td>
<td>1.331</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>1.095</td>
<td>110</td>
<td>117</td>
</tr>
</tbody>
</table>

**Notes:**

- BMD: Bone Mineral Density
- Young-Adult T-score
- Adjusted to age Z-score
Spine DXA: look at picture
DXA reports inaccuracies

- Inaccuracies in BMD readings can result from a variety of factors. These include the following: inadequate training in DXA testing and interpretation; positioning errors (of the patient as well as of the region of interest), inadequate knowledge of how to eliminate fractured vertebrae or vertebrae with more severe osteoarthritis and extra-articular calcification from the field, non-adherence to the guideline published by the ISCD recommending measurement of at least two consecutive vertebrae, inclusion of artifacts in the analysis, errors in use of ethnic- or gender-specific databases, faulty data input to the FRAX® calculator, failure to exclude extraskeletal calcifications, inaccurate reporting of results (e.g., “patient has lost 30% of BMD” or “bones are equivalent to an 80-year-old”), and failure to compare results or comparing results from different machines or following major software changes without appropriate adjustment or recalibration.
Wrist DXA- Use at times
FRAX®: Gauging 10-Year Fracture Probability

- FRAX is a WHO algorithm to determine 10-year fracture risk
- Takes into account BMD and specific risk factors
- Determines patient’s absolute fracture risk as opposed to relative risk
- Identifies the high-risk patients who could benefit from treatment
- FRAX web site at: http://www.shef.ac.uk/FRAX/

Issues with FRAX

• Only hip BMD in calculations (no spine)
• FRAX does not take into account other factors (falls)
• Doses not considered (steroids, # of cigarettes or fractures)
• Patient treatment decisions should be a judgment
• FRAX cannot be used for patients already on treatment
FRAX limitations

• It is important to note that FRAX® underestimates future fracture risk, as it reports risk for only hip fracture and major fractures, which comprise approximately half of all fragility fractures. Additionally, FRAX® underestimates risk in patients with multiple osteoporosis-related fractures, recent fractures, lumbar spine BMD much lower than femoral neck BMD, those with secondary osteoporosis, and in those at increased risk of falling (37-44). Fall events are not directly captured in the FRAX® tool. Falls magnify the risk due to other factors and are the proximate cause of most fractures in older adults (45).
What can be included in FRAX

• Under secondary osteoporosis: type 1 diabetes, OI, untreated long standing hyperthyroidism, hypogonadism or premature menopause, chronic malnutrition or malabsorption and chronic liver disease.
FRAX Calculation of Risk

- 82 year old Caucasian female.
- Weight 132 pounds, height 63 inches.
- No previous fracture.
- No parental hip fracture, non smoker, no glucocorticoid use, rheumatoid arthritis, or excess use of alcohol.
- T-score FN: -1.8

FRAX 10 year risk: 14.3% for major fracture and 4.2% for hip fracture. (Thresholds, 20% and 3%)
Vertebral Fracture Assessment
VFA assessment

• Women aged ≥70 years or men aged ≥80 years
• Historical height loss >4 cm (>1.5 inches)
• Self-reported but undocumented prior vertebral fracture
• Glucocorticoid therapy equivalent to ≥5 mg of prednisone or equivalent per day for ≥3 months (https://iscd.app.box.com/OP-ISCD-2015-Adult)

• In patients with unexplained height loss or back pain, thoracic and lumbar spine radiography or VFA by DXA is indicated if prevalent vertebral fractures would alter clinical management.

Similarly, if a person is found to have a VF on an x-ray taken for another purpose that was non-traumatic in nature, that is the diagnosis of osteoporosis.
TBS  Trabecular Bone Score
TBS adjusted FRAX

• Adjustment of TBS in FRAX® may have greatest clinical utility in patients whose fracture risk is close to the therapeutic intervention threshold. In patients with low bone mass (osteopenia), TBS-adjusted FRAX®, which can be included with the DXA printout, can sometimes be the deciding factor in making treatment decisions. TBS may be especially useful in clinical situations, such as type 2 diabetes and primary hyperparathyroidism, where FRAX® without TBS may underestimate fracture risk.
Diagnosis of Osteoporosis and Who Warrants Treatment

• Osteoporosis: T-score of -2.5 or less at the spine, hip or distal 1/3 radius.
• Presence of a fragility fracture, falling from standing height. Typical osteoporotic fractures include: vertebrae, hip, wrist, proximal humerus, pelvis, ribs.
• An elevated FRAX score would warrant treatment.
32 year old woman had a DXA performed

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>T-score</th>
<th>Z-score</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP Spine (L1-L4)</td>
<td>0.695</td>
<td>-3.2</td>
<td>-3.1</td>
<td>Osteoporosis</td>
</tr>
<tr>
<td>Femoral Neck (Left)</td>
<td>0.582</td>
<td>-2.4</td>
<td>-2.2</td>
<td>Osteopenia</td>
</tr>
<tr>
<td>Total Hip (Left)</td>
<td>0.608</td>
<td>-2.7</td>
<td>-2.7</td>
<td>Osteoporosis</td>
</tr>
</tbody>
</table>

World Health Organization criteria for BMD impression classify patients as Normal (T-score at or above -1.0), Osteopenia (T-score between -1.0 and -2.5), or Osteoporosis (T-score at or below -2.5).
Least Significant Change

<table>
<thead>
<tr>
<th>Region</th>
<th>Measured Date</th>
<th>Measured Age</th>
<th>WHO Classification</th>
<th>Young Adult T-score</th>
<th>BMD (gm/cm²)</th>
<th>Change vs Previous</th>
<th>% Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mean</td>
<td>10/27/2020</td>
<td>73.0</td>
<td>Normal</td>
<td>-1.0</td>
<td>0.880</td>
<td>-0.074</td>
<td>-7.8%</td>
</tr>
<tr>
<td>Total Mean</td>
<td>4/2/2015</td>
<td>67.4</td>
<td>Normal</td>
<td>-0.4</td>
<td>0.954</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compared to the precision error of the densitometer at our facility, the bone density of the spine and the density of the proximal femur have declined since the last study.

<table>
<thead>
<tr>
<th>Site of Comparison</th>
<th>Least Significant Change (Precision at 95% confidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral Total Hip Mean</td>
<td>0.018</td>
</tr>
<tr>
<td>Total Hip Single Side</td>
<td>0.027</td>
</tr>
<tr>
<td>Bilateral Femoral Neck Mean</td>
<td>0.033</td>
</tr>
<tr>
<td>Femoral Neck Single Side</td>
<td>0.044</td>
</tr>
<tr>
<td>Lumbar Spine L1-L4</td>
<td>0.032</td>
</tr>
<tr>
<td>Lumbar SpineFewer than 4 Vertebrae</td>
<td>0.037</td>
</tr>
<tr>
<td>Forearm, 1/3 Radius</td>
<td>0.037</td>
</tr>
</tbody>
</table>
First page of DXA report

### Fractures:
None

### Treatments:
- None
- No Pharmacologic therapy.
- Past use of Alendronate (Fosamax).

### RESULTS:

The study has been determined to be of good quality. L3 was excluded due to excessive sclerotic bone.

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>Measured Date</th>
<th>T-score Young Adult</th>
<th>BMD</th>
<th>Z-score Age Matched</th>
<th>Percent Young Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Femur</td>
<td>Total Mean</td>
<td>10/27/2020</td>
<td>-1.1</td>
<td>0.871 g/cm²</td>
<td>1.2</td>
<td>86 %</td>
</tr>
<tr>
<td>Dual Femur</td>
<td>Neck Mean</td>
<td>10/27/2020</td>
<td>-1.5</td>
<td>0.831 g/cm²</td>
<td>0.9</td>
<td>80 %</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L1-L4 (L3)</td>
<td>10/27/2020</td>
<td>-0.1</td>
<td>1.171 g/cm²</td>
<td>1.8</td>
<td>99 %</td>
</tr>
</tbody>
</table>

World Health Organization (WHO) criteria for post-menopausal, Caucasian Women:

- Normal: T-score at or above -1 SD
- Osteopenia: T-score between -1 and -2.5 SD
- Osteoporosis: T-score at or below -2.5 SD
FRAX score high and highlighted
Indications: Osteopenia, Postmenopausal, Special screening for osteoporosis
Fractures: None
Treatments: No Pharmacologic therapy, Past use of Alendronate (Fosamax), Past use of Hormone (estrogen);

RESULTS:
The study has been determined to be of good quality. L3 was excluded due to excessive sclerosis.

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>Measured Date</th>
<th>T-score Young Adult</th>
<th>BMD</th>
<th>Z-score Age Matched</th>
<th>Percent Young Adult</th>
<th>Percent Age Matched</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Femur</td>
<td>Total Mean</td>
<td>10/27/2020</td>
<td>-2.4</td>
<td>0.711 g/cm²</td>
<td>-0.4</td>
<td>71 %</td>
<td>9</td>
</tr>
<tr>
<td>Dual Femur</td>
<td>Neck Mean</td>
<td>10/27/2020</td>
<td>-1.7</td>
<td>0.804 g/cm²</td>
<td>0.4</td>
<td>77 %</td>
<td>10</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L1-L4 (L3)</td>
<td>10/27/2020</td>
<td>-1.9</td>
<td>0.947 g/cm²</td>
<td>-0.1</td>
<td>80 %</td>
<td>9</td>
</tr>
</tbody>
</table>

World Health Organization (WHO) criteria for post-menopausal, Caucasian Women:
- Normal: T-score at or above -1 SD
- Osteopenia: T-score between -1 and -2.5 SD
- Osteoporosis: T-score at or below -2.5 SD
Lowest T-score of all sites measured

**10-year Probability of Fracture**

<table>
<thead>
<tr>
<th>Major Osteoporotic Fracture</th>
<th>Hip Fracture</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.7% (Rx threshold = 20%)</td>
<td>3.8% (Rx threshold = 3%)</td>
</tr>
</tbody>
</table>

**Population:**
USA (Caucasian)

**Risk Factors:**
None

**ASSESSMENT:**
Of the sites measured the lowest bone density is at the Femur Total Right with a density of 0.669 and a T-score of -2.7. This patient is considered to have osteoporosis. At this level of bone density without treatment the risk of fracturing is considered greater than would be acceptable.

**RECOMMENDATIONS:**
All patients should have an adequate intake of dietary calcium (1200-1500 mg/day) and vitamin D (800 IU daily). If not already on therapy, an individual with a bone density of -2.5 or less may be a candidate for pharmacologic therapy.

**FOLLOW UP:**
Distal third forearm density added

### RESULTS:

The study has been determined to be of good quality.

<table>
<thead>
<tr>
<th>Site</th>
<th>Region</th>
<th>Measured Date</th>
<th>T-score Young Adult</th>
<th>BMD</th>
<th>Z-score Age Matched</th>
<th>Perc Young</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual Femur</td>
<td>Total Mean</td>
<td>10/27/2020</td>
<td>-2.3</td>
<td>0.716 g/cm²</td>
<td>-0.5</td>
<td>71%</td>
</tr>
<tr>
<td>Dual Femur</td>
<td>Neck Mean</td>
<td>10/27/2020</td>
<td>-2.4</td>
<td>0.704 g/cm²</td>
<td>-0.4</td>
<td>68%</td>
</tr>
<tr>
<td>AP Spine</td>
<td>L1-L4</td>
<td>10/27/2020</td>
<td>-1.4</td>
<td>1.021 g/cm²</td>
<td>0.4</td>
<td>86%</td>
</tr>
<tr>
<td>Left Forearm</td>
<td>Radius 33%</td>
<td>10/27/2020</td>
<td>-2.9</td>
<td>0.621 g/cm²</td>
<td>-0.5</td>
<td>71%</td>
</tr>
</tbody>
</table>

World Health Organization (WHO) criteria for post-menopausal Caucasian Women:
- Normal: T-score at or above -1 SD
Isolated Low Wrist T-score

• Is this worth treating and does it correlate with global fracture risk?
• Experts in the field debate this topic.
• If the person has primary hyperparathyroidism, it is an indication for surgery.
• Would take into account the person as a whole and their other risk factors in regards to considering treatment.
• Another issue, the wrist does not correlate well with treatment response.
Questions prior to patient case?

- Can use raise hand option or chat for questions/comments.
- Also can unmute and chime in!
• RECORDING TO BE STOPPED FOR CASE PRESENTATION
Cases/HIPAA

- Names
- Address
- DOB
- Phone/Fax #
- Email address
- Social Security #
- Medical Record #

The discussion and materials included in this conference are confidential and privileged pursuant to 26VSA Section 1441-1443. This material is intended for use in improving patient care. It is privileged and strictly confidential and is to be used only for the evaluation and improvement of patient care.
Conclusion

• Volunteers to present cases (this is key to the Project ECHO model)
  • Please submit cases to Jennifer.Kelly@uvmhealth.org
• Please complete evaluation survey after each session
• Claim your CME at www.highmarksce.com/uvmmmed
• Please contact us with any questions, concerns, or suggestions
  ahec@uvm.edu
  Jennifer.Kelly@uvmhealth.org

**During the time that the UVMMC emails are not working well, can also contact me at JJKDO@yahoo.com