Emerging Challenges in Primary Care: 2017

Osteoporosis and Fracture Prevention Strategies
Faculty

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Disclosures

• Nancy R. Berman, MSN, ANP-BC, NCMP, FAANP serves as an advisory board committee member and speaker for Hologic (Self), Bayer (Spouse). Additionally, her spouse serves as a speaker for Smith and Nephew.
Learning Objectives

1. Discuss the diagnosis of osteoporosis and low bone mass
   – Bone density testing
   – FRAX

2. Discuss the role of non-pharmacologic agents in the prevention of bone fracture
   – Calcium
   – Vitamin D: treating deficiency and insufficiency
   – Fall prevention
Learning Objectives

3. Discuss the pharmacologic treatment of low bone mass and osteoporosis
   1. Bisphosphonate therapy including oral and infusion
   2. SERMS
   3. PTH
   4. Rank Ligand Inhibitors

4. Discuss the current controversies in management of osteoporosis
   1. Long term use of bisphosphonates
      1. Osteonecrosis of the jaw (ONJ)
      2. Atypical subtrochanteric fractures of the femur
Osteoporosis Overview
Osteoporosis: Definition

A disease characterized by low bone mass and microarchitectural deterioration of bone tissue leading to enhanced bone fragility and a consequent increase in fracture risk


Photos courtesy of NAMS slide set for clinicians
A Gender Related Condition

> Osteoporosis is the most common bone disorder affecting humans
> The risk of hip fracture doubles for every 5- to 6-year increase in age from ages 65-85
> Of the 10 million Americans estimated to have osteoporosis, 8 million are women (80%)
Vertebral Fractures

Significant consequences for patients
- Acute and chronic pain
- Kyphosis and height loss
- Impaired function
- Increased morbidity and mortality
- Increased fracture risk

Hip and Other Non-Vertebral Fractures Have Significant Consequences

> Hip fracture associated with
  – Loss of ambulatory status in 30% of patients
  – Increased morbidity and mortality
  – Increased fracture risk
  – Major reason for admission to chronic care facilities

> Non-vertebral fractures
  – Pain
  – Increased risk of future fractures
Fewer Than 35% of Hip Fracture Patients Receive Pharmacologic Treatment Within 6 Months

Fracture Liason Service (FLS)
> To identify and treat patients with a recent fragility fracture
> Has been show to be effective and save money
> Multidisciplinary system approach
> Identifies patients at or proximate, to the time they are treated at the hospital for fracture
> Provides easy access to osteoporosis care.

Risk Factors For Osteoporosis

- Genetic factors
- Environmental factors
- Menstrual status
- Disease states
- Medications
Genetic Factors and Osteoporosis Risk

- First-degree relative with osteoporosis or low-trauma fracture
- Caucasian/Asian race
- Slender physical frame
Disease States and Osteoporosis Risk

- Primary hyperparathyroidism
- Thyrotoxicosis
- Cushing’s syndrome
- Rheumatoid arthritis
- Malabsorption syndromes
- Chronic liver/renal disease
- Anorexia nervosa
- Adult nontraumatic fracture
Medications and Osteoporosis Risk

- Corticosteroids
- Anticonvulsants
- Anticoagulants
- Immunosuppressive drugs
- Levothyroxine
- Lithium
- Heparin
Fragility Fractures “BONE ATTACK”\textsuperscript{1}

Over age 40, when a trip or fall from a STANDING HEIGHT leads to FRACTURE

> Defines a bone strength problem
> Impacts future risk for subsequent fracture
  – Bone Density is 70%
  – Bone Quality is 30%
> BMD for 40 and older
> Need to consider therapy
Synopsis of Major Recommendations to the Clinician for Bone Health:

Apply to postmenopausal women and men age 50 and older

> Counsel on the risk of osteoporosis and related fractures
> Check for secondary causes
> Advise on adequate amounts of calcium
  – at least 1,200 mg per day
> Advise on adequate amounts of Vitamin D
  – 800-1,000 IU per day
Synopsis of Major Recommendations to the Clinician:

> Supplements if necessary for individuals age 50 and older
> Recommend regular weight-bearing and muscle-strengthening exercise to reduce the risk of falls and fractures
> Advise avoidance of tobacco smoking and excessive alcohol intake
Who Should Have Bone Density Testing?

Recommend Bone Mineral Testing (BMD) to:

> Women age 65 and older
> Men age 70 and older
> Post-menopausal women and men age 50-69 when there are concerns regarding risk profile
> Those who have had a fracture, to determine degree of disease severity
> BMD testing should be performed at DXA facilities using accepted quality assurance measures

Clinicians Guide to Prevention and Treatment of Osteoporosis
National Osteoporosis Foundation 2014
After exclusion of secondary cause, treat postmenopausal women and men age 50 and older who have...

- A fracture of the hip or vertebra (clinical or morphometric)
- T-score -2.5 or below in the femoral neck, total hip or spine
- T-score between -1.0 and -2.5 in the femoral neck or total hip or spine if 10-year risk ≥ to 3% for hip fracture or ≥ to 20% for major osteoporotic fractures based on FRAX model
Using FRAX

To find those individuals at high risk for fracture, who are not yet osteoporotic!

If your patient has osteoporosis by T-score, you do not have to look at FRAX. BUT, you may look at FRAX!

More fractures occur in men and women with T-scores from -1.0 to -2.5!
FRAX: Gauging 10 Year Fracture Probability

https://www.shef.ac.uk/FRAX/tool.jsp
Questionnaire:

1. Age (between 40-90 years) or Date of birth
   - Age: 52
   - Date of birth: Y: 1956 M: [ ] D: [ ]

2. Sex
   - Male
   - Female

3. Weight (kg)
   - 58.97

4. Height (cm)
   - 167.64

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 per day
    - No
    - Yes

12. Femoral neck BMD (g/cm²)
    - Hologic
    - 0.610
    - T-score: -2.1

BMI 21.0
The ten year probability of fracture (%)

- Major osteoporotic: 7.5
- Hip fracture: 1.5
Application of FRAX™ In the US

> Intended for post-menopausal women and men age 50 and older

> Has not been validated in patients currently or previously treated with pharmacotherapy for osteoporosis. In such patients, clinical judgment must be exercised in interpreting FRAX scores.

– Patients who have been off osteoporosis medication for 1 to 2 years or more might be considered untreated.

Clinicians Guide to Prevention and Treatment of Osteoporosis
National Osteoporosis Foundation 2014
Application of FRAX™ In the US

- Frax can be calculated with either femoral neck BMD or total hip BMD, but, when available, femoral neck BMD is preferred. Use of BMD from non hip sites is not recommended.

- T scores must be converted to a reference standard to be used. The FRAX patch is available at www.NOF.org to make the calculation.

- FRAX may be calculated by going to the FRAX calculator at the University of Sheffield website.

Clinicians Guide to Prevention and Treatment of Osteoporosis
National Osteoporosis Foundation 2014
Application of FRAX™ In the US

The use of FRAX™ is for clinical guidance only and is not a rule.

Consider intervention strategies for those:

– Who do not have osteoporosis by BMD
– Do not meet the cut points after FRAX
– Are not high enough risk of fracture despite low BMD

Conversely, the recommendations do not mandate treatment

Make decisions to treat on a case-by-case basis.
Obstacles in the Management of Osteoporosis

> Insufficient rates of diagnosis
> Low awareness by practitioners and patients of the imperative to treat
> Global challenge to adherence to therapy in chronic disease
> Uncertainly by practitioner and patients regarding treatment regimens and risk
Treatment

When and How
NOF Guidelines: When to Treat

Pharmacologic Treatment

> Postmenopausal women or men over age 50 with a prior hip or spine fracture
> Postmenopausal women or men over 50 with a BMD T-score of -2.5 or lower at the hip or spine
> Postmenopausal women or men over 50 with T-score between -1 and -2.5 at the femoral neck, total hip, or spine if:
  – 10 year probability (from FRAX) of hip fracture is $\geq 3\%$
  – 10 year probability of a major osteoporosis-related fracture is $\geq 20\%$

Treatment Recommendations

> No pharmacologic therapy should be considered indefinite in duration

> After the initial three to five year treatment period, a comprehensive risk assessment should be performed

> There is no uniform recommendation that applies to all patients and duration decisions need to be individualized
Non-Pharmacologic Interventions

> Goal of non-pharmacologic intervention is to prevent future fractures through lifestyle change

> The role of Vitamin D in osteoporosis
  > May be important as both adjuvant and treatment
  > Might be important in the response to therapy
  > The effect on muscle strength, balance and risk of falls is important

> Exercise

> Fall Prevention
Current Pharmacologic Agents Approved for the Treatment of Osteoporosis

> Anti-resorptive agents

- Bisphosphonates
  - Weekly oral alendronate (Fosamax)
  - Weekly or monthly risedronate (Actonel)
  - Monthly oral or quarterly IV ibandronate (Boniva)
  - Once yearly infusion Zoledronic Acid (Reclast)

- Rank Ligand Inhibitor
  - Denosumab (Prolia)
Current Pharmacologic Agents Approved for the Treatment of Osteoporosis

- Calcitonin
- Selective estrogen receptor modulators (SERMS)
  - Raloxifene (Evista)
- Anabolic agents
  - Parathyroid hormone - Teriparatide (Forteo)
  - Abaloparatide (Tymlos)
Anti-resorptive Therapy

Bisphosphonates
Rank Ligand Inhibitors
SERMS
Calcitonin
Osteoporosis Treatment

Bisphosphonates
Effects of Bisphosphonates

- Decreased bone turnover
- Increased BMD at spine and hip
- Decreased risk of vertebral and hip fractures
- Sustained effects with continued treatment
- Best studied class of agents used in treating osteoporosis
- Long term safety record

ORAL BISPHOSPHONATES

> **Pros**
- Osteoporosis prevention and treatment
- Reduction in risk of vertebral fractures (w/ and w/o pre-existing fx)

> **Cons**
- Require lifestyle change
  - empty stomach
  - water only
  - may lead to non-compliance
- GI adverse effects
- Marginal efficacy in non-vertebral fractures (e.g. hip)
- Long-term safety is unconfirmed
Absorption and Tolerability of Oral Bisphosphonates Are Affected When Dosing Instructions are not Followed

> Coffee or juice can reduce absorption by as much as 60%
> Calcium supplements can interfere with absorption and should not be taken at the same time as oral bisphosphonate therapy
> GI side effects are more likely when dosing instructions are not followed
> Even when complete instructions are given, between 25% and 50% of patients disregard at least one requirement

IV Bisphosphonate
Zoledronic Acid
Zoledronic Acid

HORIZON Fracture Trials: Efficacy Conclusions
>
> Reduces incidence of vertebral fractures by 70% (with significant reduction at 1 year)
> Reduces hip fractures by 41%
> Reduces nonvertebral fractures by 25%, over 3 years in patients with osteoporosis, defined by prevalent vertebral fractures and osteoporosis by BMD of the hip

Bioavailability and High Binding Affinity Allow Zoledronic Acid to be Dosed Once Yearly

> Zoledronic acid bypasses the GI tract, eliminating absorption limitations

> Year long efficacy of zoledronic acid is attributable to the high binding affinity of zoledronic acid to bone

> Bioavailability:
  – approximately 61% directly to bone
  – Approximately 39% eliminated from circulation within 24 hours

Zoledronic acid (prescribing information) East Hanover, NJ: Novartis Pharmaceuticals Corp; June 2008
Rank Ligand Inhibitor

Denosumab
Denosumab

RANK Ligand Inhibitor

> Fully human monoclonal antibody
> Specifically targets a ligand called RANKL (that binds to a receptor called RANK) which is a key mediator of:
  – Osteoclast formation
  – Function
  – Survival
> Improves cortical and trabecular bone density, volume and strength
> Currently being studied across a range of conditions including osteoporosis, treatment induced bone loss, bone metastases, multiple myeloma and rheumatoid arthritis
Denosumab Significantly Reduced Fracture Risk at Key Sites*

Phase 3 Trial
*Key sites: vertebral, hip, and nonvertebral; †includes 7393 patients with a baseline and at least one post-baseline radiograph; ‡composite measurement excluding pathological fractures and those associated with severe trauma, fractures of the vertebrae, skull, face, mandible, metacarpals, fingers, and toes.

> Vertebral: 68% RRR p<0.0001
> Hip: 40% RRR p=0.04
> Non-vertebral: 20% RRR p=0.01

*Key sites: vertebral, hip, and nonvertebral; †includes 7393 patients with a baseline and at least one post-baseline radiograph; ‡composite measurement excluding pathological fractures and those associated with severe trauma, fractures of the vertebrae, skull, face, mandible, metacarpals, fingers, and toes.

New Agent: Romosozumab

Not yet FDA approved:

> Monoclonal antibody that binds sclerostin
  - **Increases bone formation**
  - **Decreases bone resorption**
  - Rapid onset of fracture reduction, in the first 6 months

> Adverse events were balanced in the 12 and 24 month studies between placebo and treatment groups

> One atypical fracture and 2 cases of osteonecrosis of the jaw in the treatment group

Osteoporosis Treatment

Anabolic Agents: PTH
Effects of Parathyroid Hormone

> Stimulates osteoblast activity preferentially
> Increases bone turnover and creates a positive bone balance
> Improves trabecular microarchitecture and increases cortical thickness
> Increases bone mass
> Decreases risk of vertebral and nonvertebral fractures
> Requires daily injections

Mode and Amount of Parathyroid Hormone Determines its Predominant Bone Activity

<table>
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<tr>
<th>MODE</th>
<th>EFFECT</th>
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<tr>
<td>Continuous (high dose)</td>
<td>Catabolic</td>
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<tr>
<td>Intermittent (low dose)</td>
<td>Anabolic</td>
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</table>
Parathyroid Hormone

**Pros**
- Osteoporosis treatment
- Reduction in risk of vertebral and nonvertebral fractures
- May be used in conjunction with other OP therapies (e.g. anti-resorptive)

**Cons**
- Osteosarcoma risk?
- Long-term use not established
- Long-term safety not established
- Hip fracture prevention?
- Daily sq injections
- Nausea, headache, etc.
Teraparatide

> FDA approved 2002
> Recombinant human parathyroid hormone analog (1-34), [rhPTH(1-34)] indicated for:
  – Treatment of postmenopausal women with osteoporosis at high risk for fracture
  – Increase of bone mass in men with primary or hypogonadal osteoporosis at high risk for fracture
  – Treatment of men and women with osteoporosis associated with sustained systemic glucocorticoid therapy at high risk for fracture
> Self administered subcutaneous injection for 2 years followed by bisphosphonate therapy
> Carries a label warning regarding osteosarcoma
Abaloparatide

Indicated for:

- Treatment of postmenopausal women with osteoporosis at high risk for fracture defined as:
  - A history of osteoporotic fracture, multiple risk factors for fracture, or patients who have failed or are intolerant to other available osteoporosis therapy

- Lab-made copy of part of the human parathyroid hormone-related protein (PTHrP)

- Daily subcutaneous injection

- Recommended for two years and followed with bisphosphonates for several years

- Carries a label warning regarding osteosarcoma

- Side effects include nausea, dizziness, and vomiting
Raloxifene
Effects of SERMS
(Estrogen agonist/antagonists)

- SERMS exert estrogen like effects on the skeleton
- Decrease bone turnover
- Increase bone density, but to a lesser degree than with bisphosphonates
- Decrease risk of vertebral fracture
- No hip or non-vertebral fracture

Raloxifene

> Pros
> - Osteoporosis prevention
> - No endometrial or breast stimulation
> - LDL reduction

> Cons
> - No current non-vertebral fracture data (e.g. hip)
> - No effect on vasomotor symptoms
> - Thrombosis
> - Effects on cholesterol are modest
> - Leg cramps

Hormone Therapy
Estrogen Therapy

Approved for prevention only
## Hormone Replacement Therapy (HRT, Estrogen)

### Pros
- Osteoporosis prevention
- Cognitive benefits (?)
- Urogenital symptom improvement

### Cons
- Withdrawal bleeding
- Endometrial cancer with unopposed estrogen
- Breast cancer
- Heart attack
- Stroke
- Thrombosis
Addressing Recent Controversies in the Treatment of Osteoporosis
Addressing Recent Controversies

> Treatment decisions require risk and benefit discussions
> What was acceptable risk previously, may no longer be acceptable
> If disease state risk is high: *fracture*
  – Risk of rare complications may be outweighed
Addressing Recent Controversies

> Long term use of bisphosphonate therapy
> Bisphosphonate therapy and the occurrence of fractures of the subtrochanteric or diaphyseal femur
> Osteonecrosis of the jaw (ONJ)
Length of Use of Bisphosphonates

FDA review in the New England Journal of Medicine, May 31, 2012

> Some patients may be able to stop using after 3 to 5 years and still receive benefit of the drug

> Long term risk: still unknown
   – Optimal period of use to maximize effectiveness and decrease risk
   – Is it beneficial to stop drug and start taking again?
Long Term Use of Bisphosphonates

New Guidance: The American Society for Bone and Mineral Research (ASBMR)

> Result of 2 clinical trials found that long-term treatment with the medications reduced the likelihood of fractures in women at high risk

> **Women should be reassessed for risk after 5 years of oral treatment and after 3 years of IV treatment**

> Women at high risk for fractures should continue oral treatment for up to 10 years and IV for up to 6 years with intermittent follow-up

> Women whose risk of fractures decreases after 3 to 5 years should stop treatment for 2 to 3 years

Long Term Use of Bisphosphonates

> “The suggested approach for long term use is based on limited evidence, only for vertebral fracture reduction, in mostly white postmenopausal women, and does not replace the need for clinical judgment”

Use of Drug Holidays in Women Taking Bisphosphonates

NAMS Practice Pearl

> Bisphosphonates are the cornerstone of treatment for osteoporosis
> Generally safe and well-tolerated
> For most patients at moderate or high risk: benefits of treatment far outweigh the serious, but RARE risks
> Bisphosphonates accumulate in bone with some persistent protective effect after therapy is stopped
> This makes it reasonable to consider a “drug holiday” from bisphosphonate therapy
Use of Drug Holidays in Women Taking Bisphosphonates

> The duration and length of the holiday should be based on clinical judgment

Individualize based on risk/benefit assessments

Low Risk of Fracture

*Bisphosphonate therapy should be discontinued if it has been prescribed*

Example: 52 yo old woman, menopause at age 50, lowest T-score -1.4, no risk factors, bisphosphonate therapy for 2 years

Treatment was not indicated in the first place. Discontinue

Mild Risk of Fracture

Treat with bisphosphonate for 3-5 years, then offer a drug holiday
Example: 68 yo woman, menopause age age 48, lowest T-score -2.3, parent with a hip fracture, bisphosphonate therapy for 5 years and BMD stable over that time

Treatment was indicated, but a drug holiday might be considered after 5 years of treatment

Moderate Risk of Fracture

> Treat with a bisphosphonate for 5 to 10 years, then offer drug holiday of 3-5 years, no risk factors, bisphosphonate therapy for 8 years and BMD increased over that time with a current lowest T-score -2.4.

> Treatment was indicated but after 8 years of treatment, a drug holiday might be considered.

High Risk of Fracture

Treat with bisphosphonate for 10 years, then offer a drug holiday of 1-2 years. A non-bisphosphonate.

Example: 70 year old woman, menopause at age 45, lowest initial T-score -3.5

Requiring ongoing corticosteroid therapy for rheumatoid arthritis, history of a vertebral fracture, bisphosphonate therapy for 10 years.

Treatment was indicated and she remains at high risk of fracture after 10 years. If a holiday from the bisphosphonate is considered, interval treatment with teriparatide or raloxifene would be prudent

Fractures of the Subtrochanteric or Diaphyseal Femur

FDA Safety Communication - 3/10/2010

> Reports out of the American Academy of Orthopedic Surgeons:
  – Is an increased risk of a rare femur fracture in patients with osteoporosis using bisphosphonates?

> **At this point, the data that FDA has reviewed:**
  – Have not shown a clear connection between bisphosphonate use and a risk of atypical subtrochanteric femur fractures.

> FDA is working closely with outside experts:
  – Recently convened American Society of Bone and Mineral Research Subtrochanteric Femoral Fracture Task Force to gather additional information that may provide more insight into this issue.
Based on information that is currently available, NOF believes that for most people taking bisphosphonate medicines, the benefits outweigh the risks of these unusual, but serious conditions that appear to be associated with them.
Osteonecrosis of the Jaw (ONJ)

> Jaw lesions, usually after dental extraction have been observed with bisphosphonate use
   – Most often in patients treated with large IV doses for cancer-related bone diseases.\textsuperscript{1,2}

> ONJ has been defined as a delay in healing of an oral lesion after surgery or extraction for more than 6 to 8 weeks.

Osteonecrosis of the Jaw (ONJ)

- Cases have also been reported in patients receiving bisphosphonate therapy for osteoporosis.
- The incidence of these lesions is not known and a causal association between bisphosphonates and osteonecrosis has not been documented.
Osteonecrosis of the Jaw (ONJ)

> There are no data to recommend the discontinuation of bisphosphonate therapy before dental extraction (although therapy may be suspended until the oral lesion has healed).

> There are no data to suggest that dental surgery is contraindicated in patients on bisphosphonate therapy.

> Routine dental care is recommended for all patients.

Summary

- Osteoporosis is under diagnosed and preventative care is under utilized
- Current practice requires dialogue between patient and practitioner in regards to individual risk and benefits of therapeutic options
- Treatment strategies must be individualized to obtain greater compliance to therapy
- Practitioners will need to stay current while treatment recommendations continue to be reviewed and possibly changed
Cases

BMD
FRAX

The Art of Managing Osteoporosis and Fracture Prevention!
Case #1

> 72 year old Caucasian woman
> Non-smoker
> F.H. Osteoporosis in Mother
> Negative for secondary causes of osteoporosis
**Scan Information:**
- **Scan Date:** June 01, 2009 11:57 Version 12.4.5
- **Operator:** PG
- **Model:** QDR 4500C (S/N 48066)

**DXA Results Summary:**

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<th>Area (cm²)</th>
<th>BMC (g)</th>
<th>BMD (g/cm²)</th>
<th>T-Score</th>
<th>Z-Score</th>
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Total BMD CV 1.9%, ACF = 1.022, BCF = 0.985, TH = 7.521
- **WHO Classification:** Osteopenia
- **Fracture Risk:** Increased

**Physician’s Comment:**

---

Source: Hologic
Scan Information:
Scan Date: June 61, 2009 11:56
Scan Type: Left Hip
Analysis: June 61, 2009 11:56
Version 12.4.5
Operator: PG
Model: QDR 4500C (S/N 48066)
Comment: 

DXA Results Summary:

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Total BMD CV 1.6%, ACF = 1.002, ICCV = 0.505, TH = 0.593
WHO Classification: Normal
Fracture Risk: Not Increased

Physician’s Comment:
**Questionnaire:**

1. Age (between 40-90 years) or Date of birth
   - Age: 72
   - Date of birth: Y: 1937 M:  D: 

2. Sex  
   - Male  
   - Female

3. Weight (kg)  
   - 74.84

4. Height (cm)  
   - 165.1

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 per day  
    - No  
    - Yes

12. Femoral neck BMD (g/cm²)  
    - Hologic 0.758  
    - T-score: -0.8

**BMI 27.5**

The ten year probability of fracture (%)

- Major osteoporotic: 19
- Hip fracture: 3.0
Case #2

- 52 year old Caucasian
- Non-smoker
- Negative for secondary causes of Osteoporosis
Refering Physician:  

Scan Information:  
Scan Date: May 20, 2009  
Scan Type: L Lumbar Spine  
Analysis: May 20, 2009 09:03 Version 12.4:5  
Operator: BW  
Model: QDR 4500C (S/N 48066)  
Comment:  

DXA Results Summary:  

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<th>BMD (g/cm²)</th>
<th>T-Score</th>
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<td>50.83</td>
<td>0.886</td>
<td>-1.5</td>
<td>-0.6</td>
</tr>
</tbody>
</table>

Total BMD: CV 1.6%, ACF = 1.022, BCF = 0.988, FH = 6.378  
WHO Classification: Osteopenia  
Fracture Risk: Increased  

Physician's Comment:  

Source: Hologic
Scan Information:
Scan Date: May 20, 2009
Scan Type: Left Hip
Analysis: May 20, 2009 09:47 Version 12.4.5
Left Hip
Operator: BW
Model: QDR 4500C (S/N 48066)

DXA Results Summary:

<table>
<thead>
<tr>
<th>Region</th>
<th>Area (cm²)</th>
<th>BMC (g)</th>
<th>BMD (g/cm²)</th>
<th>T-Score</th>
<th>Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>5.07</td>
<td>3.09</td>
<td>0.610</td>
<td>-2.2</td>
<td>-1.2</td>
</tr>
<tr>
<td>Troch</td>
<td>11.48</td>
<td>6.18</td>
<td>0.538</td>
<td>-1.6</td>
<td>-1.1</td>
</tr>
<tr>
<td>Inter</td>
<td>17.80</td>
<td>14.22</td>
<td>0.799</td>
<td>-1.9</td>
<td>-1.6</td>
</tr>
<tr>
<td>Total</td>
<td>34.35</td>
<td>23.49</td>
<td>0.684</td>
<td>-2.1</td>
<td>-1.5</td>
</tr>
<tr>
<td>Ward's</td>
<td>1.15</td>
<td>0.52</td>
<td>0.452</td>
<td>-2.4</td>
<td>-0.9</td>
</tr>
</tbody>
</table>

Total BMD CV 1.9%, ACF = 1.022, BCF = 0.983, THI = 5.877
WHO Classification: Osteopenia
Fracture Risk: Increased

Physician's Comment:
**Questionnaire:**

1. Age (between 40-90 years) or Date of birth
   - Age: 52
   - Date of birth: Y: 1956 M: [ ] D: [ ]

2. Sex
   - Male
   - Female

3. Weight (kg)
   - 58.97

4. Height (cm)
   - 167.64

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 per day
    - No
    - Yes

12. Femoral neck BMD (g/cm²)
    - Hologic
    - 0.610
    - T-score: -2.1

**BMI 21.0**

The ten year probability of fracture (%)

- Major osteoporotic: 7.5
- Hip fracture: 1.5
Case #3

> 63 yo woman has a family history of breast cancer in her Mother.
> Bone density test
  – LS: T-score -2.4
  – Hip: -1.6 at femoral neck
> Does she have osteoporosis?
> Is it important to look at her FRAX score?
> What are her options for therapy?
Case #3

- Pt prefers to take Raloxifene and starts the medication
- What risk factors are important to identify for this patient?
- The patient has her bone density repeated in 2 years and stays on her Raloxifene
- 2 years later her BMD shows a T score of -2.5 in the femoral neck
- What will you do about her treatment plan?
- Will she stay on Raloxifene?
Case # 4

82 yo woman
LS: normal with -0.9
Hip: Moderate low bone mass (Osteopenia) -2.0

Patient has never been treated with pharmacologic therapy. She denies problem with swallowing, GERD or known esophagus problem. She has mild CKD and is being followed by a nephrologist.
### USA (Combined NHANES/Lunar) AP Spine: L1-L4 (BMD)

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>Young-Adult T-score</th>
<th>Age-Matched Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>0.946</td>
<td>-1.6</td>
<td>0.4</td>
</tr>
<tr>
<td>L2</td>
<td>1.045</td>
<td>-3.4</td>
<td>0.6</td>
</tr>
<tr>
<td>L3</td>
<td>1.142</td>
<td>-0.8</td>
<td>1.2</td>
</tr>
<tr>
<td>L4</td>
<td>1.246</td>
<td>-0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>L1-L2</td>
<td>0.595</td>
<td>-1.5</td>
<td>0.5</td>
</tr>
<tr>
<td>L1-L3</td>
<td>1.041</td>
<td>-1.1</td>
<td>0.8</td>
</tr>
<tr>
<td>L1-L4</td>
<td>1.087</td>
<td>-0.9</td>
<td>1.1</td>
</tr>
<tr>
<td>L2-L3</td>
<td>1.085</td>
<td>-1.1</td>
<td>0.9</td>
</tr>
<tr>
<td>L2-L4</td>
<td>1.126</td>
<td>-0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>L3-L4</td>
<td>1.155</td>
<td>-0.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

### USA (Combined NHANES/Lunar) Left Femur: Total (BMD)

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>Young-Adult T-score</th>
<th>Age-Matched Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck Left</td>
<td>0.766</td>
<td>-2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>Ward's Left</td>
<td>0.596</td>
<td>-2.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Troch Left</td>
<td>0.599</td>
<td>-2.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>Shaft Left</td>
<td>0.553</td>
<td>-2.5</td>
<td>-1.8</td>
</tr>
<tr>
<td>Total Left</td>
<td>0.703</td>
<td>-1.8</td>
<td>0.5</td>
</tr>
</tbody>
</table>

### USA (Combined NHANES/Lunar) Right Femur: Total (BMD)

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>Young-Adult T-score</th>
<th>Age-Matched Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck Right</td>
<td>0.775</td>
<td>-1.9</td>
<td>0.5</td>
</tr>
<tr>
<td>Ward's Right</td>
<td>0.693</td>
<td>-2.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Troch Right</td>
<td>0.592</td>
<td>-2.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>Shaft Right</td>
<td>0.943</td>
<td>-1.1</td>
<td>-1.8</td>
</tr>
<tr>
<td>Total Right</td>
<td>0.777</td>
<td>-1.8</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Would you treat this patient?  
What would you prescribe?

<table>
<thead>
<tr>
<th>Major Osteoporotic Fracture:</th>
<th>22.5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Fracture:</td>
<td>6.4%</td>
</tr>
<tr>
<td>Population:</td>
<td>USA (Caucasian)</td>
</tr>
<tr>
<td>Risk Factors:</td>
<td>History of Fracture (Adult)</td>
</tr>
</tbody>
</table>

*FRAX is a trademark of the University of Sheffield Medical School’s Centre for Metabolic Bone Disease, a World Health Organization (WHO) Collaboration Centre.*
Case #5

85 yo woman
BMD shows:
LS: Mild low bone mass with T score of -1.4
Hip: Osteoporosis with T score of -2.8

Patient has been on oral bisphosphonate therapy for 8 years and is not having any problem.
Would you continue her therapy?
Is she at high risk for fracture?
Would her FRAX calculation make any difference in your treatment decision?
Is the FRAX calculation always correct when based on the patient answers to the questionnaire?
What does her FRAX calculation look like? Was the demographic data entered correctly?
FRAX is only as accurate as the information that is entered. Recalculation can be done if there is any question.

<table>
<thead>
<tr>
<th>Country: US (Caucasian)</th>
<th>Name/ID:</th>
</tr>
</thead>
</table>

**Questionnaire:**

1. Age (between 40 and 90 years) or Date of Birth
   - Age: 85
   - Date of Birth: ...

2. Sex
   - Male

3. Weight (kg)
   - 61.23

4. Height (cm)
   - 157.5

5. Previous Fracture
   - No

6. Parent Fractured Hip
   - No

7. Current Smoking
   - No

8. Glucocorticoids
   - No

9. Rheumatoid arthritis
   - No

10. Secondary osteoporosis
    - No

11. Alcohol 3 or more units/day
    - No

12. Femoral neck BMD (g/cm²)
    - Select BMD: 0.656

T-score: -2.8

**Calculation:**

- Major osteoporotic: 31
- Hip Fracture: 11

For USA use only

*Recalculation is removed steroid.*

Consider FDA-approved medical therapies in postmenopausal women and men aged 50 years and older, based on the following:
Case #6

84 yo woman
> On alendronate: length of time unknown
> History of right hip fracture
> LS T-score -1.8
> Hip -3.0
<table>
<thead>
<tr>
<th>Height:</th>
<th>64.0 in.</th>
<th>Sex: Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight:</td>
<td>125.0 lbs.</td>
<td>Ethnicity: White</td>
</tr>
</tbody>
</table>

**USA (Combined NHANES/Lunar) AP Spine: L1-L4 (BMD)**

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>Young-Adult T-score</th>
<th>Age-Matched Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>0.906</td>
<td>-1.9</td>
<td>0.3</td>
</tr>
<tr>
<td>L2</td>
<td>1.047</td>
<td>-1.3</td>
<td>0.8</td>
</tr>
<tr>
<td>L3</td>
<td>1.021</td>
<td>-1.6</td>
<td>0.6</td>
</tr>
<tr>
<td>L4</td>
<td>0.902</td>
<td>-2.5</td>
<td>-0.3</td>
</tr>
<tr>
<td>L1-L2</td>
<td>0.979</td>
<td>-1.6</td>
<td>0.6</td>
</tr>
<tr>
<td>L1-L3</td>
<td>0.997</td>
<td>-1.5</td>
<td>0.7</td>
</tr>
<tr>
<td>L1-L4</td>
<td>0.975</td>
<td>-1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>L2-L3</td>
<td>1.032</td>
<td>-1.5</td>
<td>0.7</td>
</tr>
<tr>
<td>L2-L4</td>
<td>0.993</td>
<td>-1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>L3-L4</td>
<td>0.972</td>
<td>-2.0</td>
<td>0.2</td>
</tr>
</tbody>
</table>

**USA (Combined NHANES/Lunar) Left Femur: Total (BMD)**

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>Young-Adult T-score</th>
<th>Age-Matched Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neck</td>
<td>0.624</td>
<td>-3.0</td>
<td>-0.4</td>
</tr>
<tr>
<td>Wards</td>
<td>0.415</td>
<td>-3.8</td>
<td>-1.0</td>
</tr>
<tr>
<td>Troch</td>
<td>0.572</td>
<td>-2.4</td>
<td>-0.2</td>
</tr>
<tr>
<td>Shaft</td>
<td>0.790</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total</td>
<td>0.676</td>
<td>-2.6</td>
<td>-0.2</td>
</tr>
</tbody>
</table>
Major Osteoporotic Fracture: 51.3%
Hip Fracture: 39.5%
Population: USA (Caucasian)
Risk Factors: Family Hist. (Parent hip fracture), History of Fracture (Adult)

FRAX is a trademark of the University of Sheffield Medical School's Centre for Metabolic Bone Disease, a World Health Organization (WHO) Collaborating Centre.
Case #6

> Will you keep this patient on Alendronate?
> Is she taking the medication correctly and consistently?
> What is her fall risk?
> What is her preference?
> Is she an active 84 yo old?
> Will her insurance cover once a year infusion, twice a year injection or daily PTH?
Case #7

84 yo on long term oral bisphosphonate therapy for over 10 years.

BMD:
LS: Severe osteoporosis T score -4.6
Hip: Severe osteoporosis T score -3.7

I referred the patient to the endocrinologist for an opinion.
Have you ever seen a FRAX this high??
What are the options for treating this patient?
Case # 7

> What would you recommend for this patient who has been on long term bisphosphonate therapy?
> She is at very high risk for fracture!!

> What are your options?
> What did the endocrinologist recommend?
Bibliography


Bibliography


