Osteoporosis: Diagnosis & Treatment

Herbert L. Muncie, Jr., M.D.
Mildred – 72 years old
Osteoporosis – Definition

NIH Consensus development conference

“A skeletal disease characterized by compromised bone strength predisposing to an increased risk of fracture”

- Bone strength reflects bone density and bone quality
  - Density is determined by peak bone mass & amount of bone loss
  - Quality refers to architecture, turnover, damage accumulation and mineralization
Treatment Goal – Prevent Fractures

- Strategies to prevent fractures
  - Reduce occurrence of falls
    - Interdisciplinary interventions
  - Maximize bone strength
    - Diet, exercise & medications
  - Reduce trauma associated with falls
    - Hip pad protectors help reduce fractures but compliance is poor
Pathophysiology of Osteoporosis

- If resorption > formation = osteoporosis
- Formation but not resorption declines with aging
  - Therefore, age is the significant risk factor
  - Reflect microarchitectural changes
- Any imbalance between resorption & formation is magnified when remodeling rate is increased
  - Increased rate in elderly
  - Increased rate at menopause
Risk Factors for Osteoporosis Fractures

- Age
- Low-trauma fracture -
  - Fall from standing height
- Any fx b/e age 20-50
- High trauma non-spine fx elderly is associated with low BMD & risk subsequent fx [Mackey 2007]

- Environment
  - Cigarette smoking
  - Wt < 127 lbs
- Drug therapy
  - Glucocorticoids qd > 3 mos, > 7.5 mg/day
- Endocrine disease
- Hematologic disease
- Rheumatologic
- GI disease
Risk Factors?

- Thiazolidinediones associated with increased risk of fractures in women [Loke 2009]
  - NNH – 21-55 women/year
- Moderate renal impairment (eGFR < 60) associated with hip fracture
- SSRI use associated with 2-fold increased risk fragility fracture
- Daily use for ≥ 2 yrs of PPI increases risk
- Increased homocysteine levels associated with increased risk of fracture
Mildred – 72 years old
Who will sustain a fracture?

- Hip fracture
  - Age is most consistent risk factor
    - Women age \( \geq 65 \) years increased risk
    - Men age \( \geq 75 \) years increased risk
  - Risk associated with reduced balance, unsafe environment (rugs, steps, etc.)
  - Incidence of hip fractures & subsequent mortality are declining
    - However, mortality rates have been level since 1998
Who will sustain a fracture?

- Spine fracture
  - Age > 60
  - Primary morbidity is pain
Who will sustain a fracture?
Who will sustain a fracture?

- **Wrist fracture**
  - Age > 50
  - More frequent healthy elderly
  - Primary morbidity is pain & reduced function
Who will sustain a fracture?

- Most important risk factor for fracture, independent of BMD – *previous fragility* fracture
  - If the patient has had a fracture, especially hip or spine, they should be treated for osteoporosis
  - Any fracture is a marker for increased risk of death
    - Especially 1st 5 years after fracture

[Bliuc 2009]
USPSTF recommends women aged 65 & older be screened once for osteoporosis (SOR – A)

USPSTF recommends screening once women age 60 - 64 at increased risk of osteoporotic fracture

- No recommendation for women < 60 yo or women aged 60-64 not at increased risk
- Number needed to screen (NNS) over 4000 to prevent 1 hip fx & 1300 to prevent 1 vertebral fx
- SOR – B
  - http://www.ahrq.gov/clinic/3rduspstf/osteoporosis/osteorr.htm
Screening for osteoporosis - EBM

- Risk factors that should trigger earlier screening are difficult to specify based upon evidence

- USPSTF makes no recommendation for men
  - ISCD recommends screening men > 70 years old once
  - American College of Physicians (ACP) recommends DXA for men who have risk factors & can take a bisphosphonate at age 65 or sooner
Screening – Does it work?

- No trials of the effectiveness of screening have been reported
- No studies evaluating potential harms from screening have been reported
- Risk assessment instruments have been developed to better target testing
  - No studies have determined the effectiveness of these instruments in improving fracture outcomes
Case finding for osteoporosis

- Best clinical predictor of low BMD – weight < 154 lb (70 kg)
- Physical findings that may increase screening yield – when to consider DXA
  - Inability to place head against wall standing upright
  - Low tooth count (< 20)
  - Self-reported hump back
  - Rib-pelvis distance < 2 fingerbreadths
Ways to Measure BMD

- Central dual-energy x-ray absorptiometry (DXA)
  - Currently the gold standard
  - Reported as g/cm²
Sources of error with DXA

- Osteoarthritis
- Soft tissue calcification
- Overlying metal objects
- Previous fracture
- Severe scoliosis
- Extreme obesity or ascites
- Vertebral deformities
- Osteomalacia
Ways to Measure BMD

- Quantitative computed tomography (QCT)
  - Due to limited availability, high radiation exposure & higher cost - not a screening tool
  - Application of T-scores to predict fracture risk have not been validated
Ways to Measure BMD

- **Peripheral DXA**
  - Appropriate for screening
  - Inadequate for assessing change over time
  - Helpful if patient has metal in hip

- **Bone ultrasonometry (BU) - ultrasound of heel, finger or radius**
  - Lower cost screening method
  - If BU is abnormal – obtain DXA
  - Many false negatives
BMD Report

- g/cm² converted to a ‘T-score’ & ‘Z-score’
- ‘T-score’ is standard deviations above or below BMD healthy young person
- ‘Z-score’ compares patient to someone their own age
  - Score < -2 would indicate more severe osteoporosis
Patient ID: [Redacted]
DOB: November 18, 1933

Sex: Female
Ethnicity: White
Height: 68.0 in
Weight: 142.0 lb
Age: 69

Referring Physician: MUNCIE, HERBERT

Scan Date: March 19, 2003 - [Redacted]

DXA Results Summary:

<table>
<thead>
<tr>
<th>Region</th>
<th>BMD (g/cm²)</th>
<th>T-Score</th>
<th>Z-Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>0.825</td>
<td>-1.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Total BMD CV 1.0%

WHO Classification: Osteopenia
Fracture Risk: Increased

Scan Date: March 19, 2003 - [Redacted]

WHO Classification: Osteopenia
Fracture Risk: Increased
BMD Interpretation

- Assess quality of scan
  - Hip view – lesser trochanter should not be very visible
  - If rotated out will give inaccurate results
BMD Interpretation

Assess quality of scan

- Be sure they used L1- L4
  - Should not see too much of ribs or pelvis
- L1-L4 – verify no artifacts or significant variation for each vertebrae
  - T-score difference for each vertebrae should be < 1
  - If must delete one vertebrae cannot just average the remaining one ask the technician to recalculate T-score
- Some reports give a T-score for different combinations of vertebrae
BMD Interpretation

ISCD guidelines are:

- Look only at femoral neck, total hip and spine T-scores
  - Assessment of smaller units (one vertebrae, Ward’s triangle) are not accurate
- Make treatment decision based upon the lowest of those three scores
- For patients < 30 yo only use the Z-score
  - T-score is not appropriate
### WHO Criteria for Osteoporosis

<table>
<thead>
<tr>
<th>Classification</th>
<th>T Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>-1 SD and above</td>
</tr>
<tr>
<td>Osteopenia</td>
<td>Between -1 SD &amp; -2.5 SD</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>-2.5 SD and below</td>
</tr>
<tr>
<td>Severe Osteoporosis</td>
<td>-2.5 SD and below, with fragility fracture</td>
</tr>
</tbody>
</table>
Osteoporosis and African American Women

- Have higher BMD than comparative white non-Hispanic women
- Experience lower hip fracture rates
  - Probability 50 yo will have a hip fracture during his or her lifetime
    - 14% white female
    - 5-6% white male
    - 6% African-American female
    - 3% African-American male
Testing for Secondary Causes

In a newly diagnosed patient or patient with Z-score < -2 consider:

- CBC & serum calcium
- Parathyroid hormone level
- 24 hour urine calcium
- TSH for hyperthyroidism
- 25-hydroxyvitamin D level
- Testosterone level in men
Testing for Secondary Causes

Evaluate for Celiac disease?

- Especially if 25-hydroxyvitamin D deficiency (2º hyperparathyroidism)
- Measure anti-TTG (tissue transglutaminase); Anti-EMA (endomysial antibodies) [Stenson 2005]
- Dietary treatment improved BMD
Biochemical Markers

Markers can assess either formation or resorption

- **Formation** - Serum bone specific alkaline phosphatase
- **Resorption** - Serum C-telopeptide Type 1 collagen (CTX), N-telopeptide (NTX)

Increased bone turnover is an independent risk factor for fracture
Biochemical Markers

- Cannot be used to diagnosis osteoporosis
- Should not be used to:
  - Gauge response to therapy
  - Evaluate disease severity
  - Select specific therapy
- Are not recommended for routine clinical practice
Prevention & Treatment

- Regular exercise
  - 3 RCTs found exercise did not reduce fractures over control in one year (Clinical Evidence BMJ)
  - High impact jumping increases BMD
  - If can’t jump, exercise will only maintain mass, not increase it

- Patients with osteoporosis should:
  - Avoid impact exercise
  - Avoid trunk/spinal bending/flexion, twisting/rotation
Calcium

- Institute of Medicine (1997) recommends 1200 mg daily of elemental calcium adults > 50
  - If no dairy intake in the diet, avg. Ca\(^{++}\) in diet 300 mg
  - Supplements, absorption best with doses \(\leq 600\) mg
    - No clinical difference between citrate or carbonate in fracture reduction
    - Take citrate with or without food; carbonate with food for better absorption
      - Ca Carbonate = 40% elemental Ca\(^{++}\)
      - Ca citrate = 21% elemental Ca\(^{++}\)

- No reduction in hip fracture risk with calcium supplements alone [Bischoff-Ferrari 2007]
Vitamin D

- RDA for vitamin D increases with age
  - Age 51 - 70 400 IU
  - Age > 70 yo 600 IU

- Sunlight is best source of vitamin D
  - 5 – 30 min. 2x/wk adequate
  - During winter @ latitude > 35° N – little vitamin D made due to angle of sun
Latitude 35º N
Vitamin D

- Optimal 25 hydroxyvitamin D level ≥ 30 ng/mL
  - Deficiency is < 20 ng/mL

- Supplement may be helpful for many patients
  - Consider ≥ 700 IU daily for supplementation
    - Rarely hypervitaminosis D can occur with supplements
    - Sun exposure alone cannot cause vitamin D intoxication since excess vitamin D$_3$ is destroyed by sunlight
Vitamin D - Supplements

Supplementing with 700 – 1000 IU daily reduced risk of fall in older patients [Bischoff-Ferrari 2009]

- Serum 25-hydroxyvitamin D level ≥ 24 ng/ml (60 nmol/l) associated with reduced falls
- Active forms of vitamin D had slightly greater reduction in falls
  - However more expensive
Vitamin D - Supplements

- Cholecalciferol (vitamin D3)
  - 400, 1000, 2000, 5000 units

- Ergocalciferol (Drisdol®; vitamin D2)
  - 8000 units daily
Calcium & Vitamin D Supplements

- Randomized trials in women with osteoporosis - no reduction in fractures
  - As primary prevention
  - As secondary prevention in women with prior low trauma fracture
  - Increased risk of nephrolithiasis

- When given together reduce hip fracture & total fractures in non-osteoporotic women [DIPART 2010]
Treatment Decision

- No clear linear relationship between change in BMD & fracture risk
  - Other factors contribute to bone strength & reduced fracture risk
  - Even with minimal or no increase in BMD, fracture risk was reduced

- First confirm osteoporosis
  - Osteoporosis is due to “bone loss” not just low bone mass
  - Low bone mass may reflect family genetics & yet are strong bones
  - Diagnosis is combination of BMD and clinical picture
Treatment & Mortality

- Treatment of osteoporosis clearly reduces the risk of fracture.

- What impact does it have on mortality?
  - Meta-analysis found an approximately 10% reduction in mortality.
  - The reduced mortality was primarily in the older more frail elderly.
  - Absolute reduction of 0.4 - 7 deaths prevented per 1000 patient-years of treatment [Bolland 2010]
Treatment Decision

- **BMD > T-score of -1**
  - Lifestyle advice

- **BMD T-score of -1 to -2.5**
  - Lifestyle advice
  - Consider calcium and vitamin D supplements

- **BMD > T-score of -2.5, hip or vertebral fracture**
  - Lifestyle advice
  - Calcium and vitamin D supplements
  - Pharmacologic treatment appropriate
Fracture Risk Assessment

- For untreated patients > 50 years old with a T-score > -2.5 and < -1.0
- Use a risk calculator to counsel individual patients regarding the need for therapy:
  - FRAX™
    - www.shef.ac.uk/FRAX
FRAX™

- Treatment considered cost-effective if:
  - 10 year risk of hip fracture > 3%
  - 10 year risk of any fracture > 20%

- With FRAX™
  - Femoral neck T-score may substitute for total hip T-score
  - Does not address low spine BMD & normal hip BMD
Case

- 56 year old white female with femoral neck T-score -2.1
  - Ht – 64 inches (162.6 cm)
  - Wt – 148 lbs (67.3 kg)
  - All negative: smoke; excess alcohol; steroid use; rheumatic disease, any fracture > 45 yo; no FH of osteoporotic fracture; or secondary osteoporosis

- FRAX risk assessment - 10 yr. risk of:
  - Hip fracture – 1.2%
  - Any fracture – 8.6%
Case

- 66 year old white female with femoral neck T-score -2.1
  - Ht – 64 inches (162.6 cm)
  - Wt – 148 lbs (67.3 kg)
  - All negative: smoke; excess alcohol; steroid use; rheumatic disease, any fracture > 45 yo; no FH of osteoporotic fracture; or secondary osteoporosis

- FRAX risk assessment -10 yr. risk of:
  - Hip fracture – 2.0%
  - Any fracture - 12%
Osteopenia

- No absolute T-score cut-offs for fracture risk
  - Women with normal T-score can sustain a fracture

- Treating osteopenia can significantly decrease the relative risk of fracture but with only minimal absolute risk reduction
  - Would need to treat 100 – 200 women with osteopenia for 3 years to prevent 1 vertebral fracture
Women with slightly low BMD

- No evidence for reduction in fracture risk in treated patient with T-score > -1.5
  - No strong evidence for scores > -2.0
- Not clear how to use FRAX™ in African American, Hispanic or Asian patients
- Consider a patient’s view
  - If they have a 10-year risk of hip fracture of 3% they would be told to start treatment
  - However, they may see it as a 97% chance they will not have a fracture
Women with slightly low BMD

- Fracas over FRAX
  - Will identify large number of women eligible for treatment, especially the elderly
    - 93% of white females > 75 years old
  - However, no prospective data treatment significantly reduces fractures over all levels of BMD
  - Consider putting energy into treatment of patients with osteoporosis or prior fracture
Treating Men

- Universal screening and treatment is not cost effective for men > 70 years old
- May be cost effective for men > 65 years old with prior fracture or men > 80 years old without a fracture
- FRAX formula
  - Convert male T-score into female referent T-score
  - \[ fT=\left\{\left[(mT \times 0.137) + 0.934\right] - 0.858\right\}/0.120 \]
Pharmacologic Treatment

- Bisphosphonates
- Selective estrogen receptor modulator (SERM)
- Hormone replacement therapy (HRT)
- Calcitonin
- Parathyroid hormone
- Receptor activator of nuclear factor-κβ ligand (RANKL) inhibitor
Bisphosphonates

- In women with osteoporosis or prior fracture, alendronate, risedronate, ibandronate & zoledronic acid reduced risk of subsequent fractures significantly better than placebo.
- Fracture data for oral bisphosphonates is available only for once-daily formulation.
Bisphosphonates

Pharmacodynamics

- Alendronate (Fosamax®)
  - 70 mg once a week
- Risedronate (Actonel®)
  - 35 mg once a week
  - 75 mg two consecutive days once a month
  - 150 mg once a month
- Ibandronate (Boniva®)
  - 150 mg once a month
Bisphosphonates

- Pharmacodynamics – IV route
  - Ibandronate (Boniva®)
    - 3 mg IV every 3 months
    - For patients who cannot tolerate oral medication
    - No robust evidence for decrease in non-vertebral fractures
Bisphosphonates

Pharmacodynamics – IV route

- Zoledronic acid (Reclast®)
  - 5 mg IV once a year
  - Reduced fracture after initial hip fracture
  - Do not use if Cr Cl < 35 ml/min
  - Should be well hydrated before infusion
- Osteoporosis prevention
  - 5 mg IV every 24 months
Oral Bisphosphonates

- Associated with erosive esophagitis
  - Take after an overnight fast
  - Take with water, without food (any food will markedly decrease absorption)
  - Remain upright for 30 min
  - Eat breakfast 30 - 60 minutes later
- Oral form contraindicated in patient who cannot follow these instructions
Bisphosphonates

- Effect on skeletal growth & development unknown
  - Not for children or women of reproductive age
  - Contraindicated in presence hypocalcemia or osteomalacia
- IV bisphosphonate associated with acute phase reaction within 1-3 days of infusion
  - Low grade fever, myalgias, arthralgias
  - Most common with initial infusion
Bisphosphonates – A Fib

- Increased risk of atrial fibrillation (AF)
  - Increased risk with alendronate [Heckbert 2008] & zoledronic acid [Miranda 2008]
  - Large case-control study found no increased risk with alendronate [Sorensen 2008]
  - Systematic review found increased risk A. fib [Loke 2009]
    - No increased risk of CVA or cardiac mortality
  - FDA bulletin 11/2/2008
    - Should not alter prescription patterns or have patients stop therapy
    - Decide if risk of fracture > risk of A. fib
Bisphosphonates – Side effects

- Reports of severe joint, muscle & bone pain
  - 2/3 resolve with discontinuation
- Case reports of low-energy femoral shaft fractures after long-term use of alendronate
- Ocular inflammation – blurred vision, pain, conjunctivitis, uveitis & scleritis reported
Bisphosphonates - Osteonecrosis

- Osteonecrosis – transmucosal exposure of necrotic bone with infection & pain
  - Risk primarily with IV bisphosphonate
    - Rare with oral therapy
  - Before IV therapy – complete dental work
  - With oral therapy – most procedures safe
  - No evidence any procedure significantly reduces risk
    - Neither drug holiday (4-6 months)
    - Nor measuring CTX level
When starting therapy, if patient experiences muscle or bone pain:

- May be due to vitamin D deficiency.
- Therapy initially decreases serum $\text{Ca}^{++}$.
- If vitamin D deficient cannot increase absorption to compensate.
- Verify vitamin D status or supplement prior to initiating therapy.
Duration of Therapy

- Optimum duration of therapy unknown
  - For women who have a good response at 5 years (BMD hip increased > 3% & spine > 8%) & their T-score was higher than -3.5
    - Consider 5 year drug holiday since no increase risk of fracture without the medication
  - Concern emerging about increase fracture risk after > 5 - 10 years of therapy
    - FDA March 2010 – “…the data that FDA has reviewed have not shown a clear connection between bisphosphonate use and a risk of atypical subtrochanteric femur fractures.”
Selective Estrogen Receptor Modulators (SERM)

- Raloxifene - estrogen agonist (e.g. bone & lipid) & estrogen antagonist (e.g. endometrium & breast)
- Increases BMD without stimulating endometrial growth
- Lowers total cholesterol, LDL chol, lipoprotein a, and fibrinogen
  - Did not significantly affect the risk of CHD
Raloxifene (Evista®)

- **Proven reduction in vertebral fractures**
  - No proven reduction in hip fractures
- **Reduces risk of estrogen receptor + breast cancer**
  - Benefits in reducing risk of invasive breast cancer & vertebral fx should be weighed against increased risk DVT & fatal stroke
- **Does not treat climacteric symptoms** (may precipitate hot flashes)
Raloxifene (Evista®)

- Consider for postmenopausal women with mild osteoporosis of spine
- Contraindicated with history of thromboembolism or PE
  - Increased risk of thromboembolic events
  - Must be discontinued 72 hours prior to & during prolonged immobilization
Hormone Replacement Therapy

Benefits
- Reduce menopausal symptoms
- Prevents bone loss
- Decreased risk colon cancer [WHI 2002]
- Decreased hip, vertebral & wrist fractures

Risks
- Increased CVD
- Increased strokes
- Increased breast CA
- Migraines
- Increased DVT/PE
- Gallbladder disease
- Increased endometrial cancer (estrogen alone)
HRT or not for osteoporosis

- HRT should not be given to any woman only to treat or prevent osteoporosis
- HRT should not be initiated in the elderly (≥ age 65) to treat osteoporosis
- Perhaps woman soon after menopause with climacteric symptoms could use HRT
  - If used, ≤ 5 years of therapy would be the norm
- Once discontinued protective effect for hip fractures rapidly lost and may increase risk
Calcitonin (Miacalcin®)

- Intranasal spray - 200 IU qd
- Does not prevent bone loss in early post menopausal women
- Reduces new vertebral fractures in women with osteoporosis or prior vertebral fracture
  - No proven reduction in hip fractures
  - No increase in BMD
Calcitonin

- Analgesic effect
  - Much touted but little studied
- For spinal fractures, preferable to use more potent antiresorptive agent & manage pain separately
Teriparatide (Forteo®)

- Reduction in fracture risk similar to bisphosphonates & raloxifene
- Consider in patients with severe osteoporosis
- Especially in patients with multiple fracture history
  - E.g. 2-3 vertebral fractures
Teriparatide (Forteo®)

- **Side effects:**
  - Orthostatic hypotension occurred with first few doses
  - Caution in frail elderly who live alone!

- **Should not be given to patient at risk of osteogenic sarcoma**
  - i.e. Paget’s disease, unexplained elevation Alk-phos, prior skeletal radiation
  - Check PTH level before starting therapy

- **Duration**
  - Maximum 2 years & expensive
Teriparatide (Forteo®)

- Risk of hypercalcemia if combined with supplemental calcium > 1000 mg and vitamin D (unless deficient)
- When discontinued most bone gain is lost if no further therapy
Denosumab (Prolia®)

- Human monoclonal antibody to RANKL:
  - 60 mg SC twice a year
  - Vertebral fractures reduced similar to teriperitide & IV zolendronic acid, perhaps better than bisphosphonate
  - Nonvertebral fracture reduction the same as alternatives
  - Seems at least as efficacious as approved alternatives
## Cost of therapy

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Annual Cost*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alendronate (generic)</td>
<td>70 mg/wk</td>
<td>$105</td>
</tr>
<tr>
<td>Alendronate (Fosamax®)</td>
<td>70 mg/wk</td>
<td>$1033</td>
</tr>
<tr>
<td>Ibandronate (Boniva®)</td>
<td>150 mg/mo</td>
<td>$1174</td>
</tr>
<tr>
<td></td>
<td>3 mg IV/3 mo</td>
<td>$1881</td>
</tr>
<tr>
<td>Risedronate (Actonel®)</td>
<td>150 mg/mo</td>
<td>$1173</td>
</tr>
<tr>
<td></td>
<td>75 mg/ 2 d/mo</td>
<td>$1174</td>
</tr>
<tr>
<td></td>
<td>35 mg/wk</td>
<td>$1187</td>
</tr>
<tr>
<td>Zoledronic acid (Reclast®)</td>
<td>5 mg/yr</td>
<td>$1212</td>
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<tr>
<td>Raloxifene (Evista®)</td>
<td>60 mg/d</td>
<td>$1310</td>
</tr>
<tr>
<td>Calcitonin (Miacalcin®)</td>
<td>200 IU intranasal</td>
<td>$1433</td>
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<tr>
<td>Parathyroid Hormone (Forteo®)</td>
<td>20 mcg SC/d</td>
<td>$8478</td>
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<tr>
<td>Denosumab (Prolia)</td>
<td>60 mg SC/6 mo</td>
<td>???</td>
</tr>
</tbody>
</table>

*As of August 31, 2008
Medications & Morbidity/Mortality

- No medication trials have reported on fracture-related morbidity or mortality
Compliance & Persistence

- The reduction in fracture risk is dependent upon the medication being taken correctly (compliance) & continued use of the medication over a long period of time (persistence).
- After 1 year of therapy, about 50% of patients are compliant & persistent
- No evidence-based answer exists about how to improve this number
Monitoring Therapy – Repeating BMD

- Only central imaging has enough precision for serial measurements
  - Lumbar spine preferred site if plan follow-up
- Peripheral sites do not reflect treatment increases in BMD
Monitoring Therapy – DXA

- Increased BMD confirms treatment effectiveness & continuation of Rx
  - Although may still sustain a fracture

- However, stable or slight reduction not proof of failure
  - Since slowing bone loss is success
  - May substantially underestimate reduction in fracture risk

- NOF recommends repeating DXA q 2-3 yrs
Least Significant Change (LSC)

- For follow-up BMD testing don’t look at T-score changes
- Look at the g/cm\(^2\) and see if the change was greater than the LSC
  - LSC is the change required to be significant
- LSC for each site:
  - Spine – 0.04 g/cm\(^2\)
  - Hip – 0.05 g/cm\(^2\)
  - Femoral neck – 0.06 g/cm\(^2\)
Repeating the BMD?

- Monitoring in first 3 years is unnecessary & may be misleading [Bell 2009]
- Longitudinal data from Canada found few women had significant change in BMD in < 5 years
  - Could safely delay repeat DXA for up to 5 years [Berger 2008]
Repeating the BMD?

- Does repeating the BMD help predict fracture risk further?
- In healthy older women repeating BMD up to 8 years later added little value for predicting fracture risk [Hillier 2007]
  - Unless significant change in clinical situation no need to ever repeat the BMD
Key Points

- Osteoporosis is diagnosed with DXA and clinical information
- Calcium & vitamin D supplements appropriate for everyone but not adequate alone to prevent fractures
- Medication reduces the risk of new fractures in women with osteoporosis
- Once treatment is started, very little if any indication for repeat DXA
What Questions do you have?