Osteoporosis

Winter Refresher
2/1/2017
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MCW

Osteoporosis and Calcium Disorders Clinic

Potential Conflicts of Interest

• Shire
  – Consultant

OSTEOPOROSIS

• A little about bone
• Definition/Impact
• Bone density
• Risk factors for fracture/FRAX etc
• Secondary cause evaluation
• Treatment
  – Calcium
  – Vitamin D
  – Meds
• What’s coming?

Bone

• Dynamic tissue
• Birth to completion of puberty, bone lengthens and changes shape (modeling)
• Adult skeleton - remodeling to repair damaged areas
• Cortical (compact) bone ~ 80% of skeleton
• Trabecular (cancellous) bone ~20% of bone mass and 80% of surface area (and remodeling)

Normal Bone Remodeling

Process of resorption and formation usually coupled to maintain bone mass
At any given time ~ 10-20% of skeleton active

Normal Bone

Osteoporotic Bone

Bone remodeling unit

Lining cells
Osteoclasts
Osteoblasts

Bone remodeling unit

Lining cells
Osteoclasts
Osteoblasts

Resting Stage
Activation
Resorption
Reversal Phase
Formation
Remodeling Completed

2–4 weeks
3–4 months

Definition of Osteoporosis

• A skeletal disorder characterized by
  – Compromised bone strength predisposing to
  – An increased risk of fracture

Bone strength reflects the integration of factors

Bone Density
Bone Turnover
Bone Architecture
Bone Mineral

2000 NIH Consensus Development Conference

Slide ASBMR Education

Osteoporosis Is a Serious Public Health Problem

- Affects 10 million Americans (80% women)
- 2 million fractures yearly
- Direct cost $17 billion

WHO Criteria for Postmenopausal Osteoporosis

The T-score compares an individual’s BMD with the mean value for young adults and expresses the difference as a standard deviation score.

<table>
<thead>
<tr>
<th>Category</th>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>-1.0 and above</td>
</tr>
<tr>
<td>Low bone mass</td>
<td>Between -1.0 to -2.5</td>
</tr>
<tr>
<td>Osteoporosis</td>
<td>-2.5 and below</td>
</tr>
</tbody>
</table>

Severe osteoporosis: Low BMD and fragility fractures
Do not apply to wrong patients

Relative Risk of Fracture for 1 SD Decrease in BMD (Age-Adjusted)

Meta-analysis 11 prospective cohort studies
90,000 person-years observation
>2,000 fractures

<table>
<thead>
<tr>
<th>Site</th>
<th>Hip Fracture</th>
<th>Vertebral Fracture</th>
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<tbody>
<tr>
<td>Distal radius</td>
<td>1.8</td>
<td>1.7</td>
</tr>
<tr>
<td>Proximal radius</td>
<td>2.1</td>
<td>2.2</td>
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<tr>
<td>Calcaneus</td>
<td>2.0</td>
<td>2.4</td>
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<tr>
<td>Spine</td>
<td>1.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Femoral neck</td>
<td>2.6</td>
<td>1.8</td>
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</table>

Identified Treatment Gap
NCQA HEDIS

<table>
<thead>
<tr>
<th>HEDIS Measure</th>
<th>% Compliance*</th>
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<tbody>
<tr>
<td>Beta-blocker persistence after a heart attack</td>
<td>81.3%</td>
</tr>
<tr>
<td>Breast cancer screening</td>
<td>70.5%</td>
</tr>
<tr>
<td>Colorectal cancer screening</td>
<td>62.4%</td>
</tr>
<tr>
<td>Osteoporosis management after a fracture</td>
<td>22.8%</td>
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</table>

*2011 HMO Rates

Indications for BMD Testing

<table>
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<th></th>
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<tr>
<td>B with risk factors</td>
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<tr>
<td>B with risk factors</td>
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<td>B ≥ 70</td>
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<tr>
<td>Monitor</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

*Based on estimated 10 year risk calculated using FRAX clinical risk factors only
**Postmenopausal or in menopausal transition

Meta-analysis 11 prospective cohort studies
90,000 person-years observation
>2,000 fractures

521 Caucasian women, 65 years. SPA forearm. 138 nonspinal fractures
**FRAX**

- Fracture risk highest in patients with osteoporosis; more fractures occur in patients with osteopenia.
- Goal – identify patients with osteopenia at high fracture risk.
- Calculates estimate of 10 year hip fracture risk and total major osteoporotic fracture risk.
- Considers BMD and other risk factors.
- Applies to patients before treatment.
- Do not use in men <50 or premenopausal women.
- Uses Caucasian female data base for all.

**Limitations of FRAX**

- Not valid to monitor patients on treatment
- Only femoral neck BMD is considered
- Risk is “yes/no” – there is no consideration of “dose” (e.g., fractures, glucocorticoids, smoking, alcohol)
- Not all risk factors are included
- Clinical judgment is required
- Do patients with high FRAX scores benefit from medication? (Unknown)

**Trabecular Bone Score (TBS)**

- Uses spine DXA
- Software addition
- Estimates microarchitectural deterioration
- Independent predictor of fracture
- May explain some of increased fx in DM, GIO, PHPT which appears independent of BMD
- May help us better select patients for treatment
- Now in FRAX
Both number and severity predict fractures

Vertebral Fracture Assessment (VFA)

Recognition of vertebral fracture may
1. Change diagnostic classification
2. Change estimate of fracture risk
3. Change treatment decisions

Table 7
Definitions for vertebral imaging

- Consider vertebral imaging for the following individual:
  - All women age 75 and older and all men age 80 and older of BMD T-score at the spine, total hip, or femoral neck is ≤ -2.0
  - Women age 65 to 69 and men age 70 to 79 of BMD T-score at the spine, total hip, or femoral neck is ≤ -1.5
  - Shorter than parental average and men age 18 and older with specific risk factors:
    - Low-trauma fractures during adulthood (age 18 and older)
    - Previous height loss of 1.5 in. or more (2 cm)
    - Recent or ongoing long-term glucocorticoid treatment

Vert imaging, VFA or x-rays
NOF guidelines
Ost Int 2014

OSTEOPOROSIS/Fractures

- Secondary/Contributing Causes
  - Cushing’s syndrome
  - Hypogonadism
  - Multiple myeloma, MGUS
  - GI disease, malabsorption (CELIAc), gastric surgery
  - Bariatric surgery
  - Calcium/vitamin D deficiency
  - Osteomalacia
  - COPD/decreased resp. function
  - Immobilization/SCI/CVA/spaceflight
  - Parkinson’s/dementia
  - CHF
  - HIV/Treatment & Medications

Most important if it changes management

OSTEOPOROSIS/Fx – Medications

- Corticosteroids
  - Suggest Hansen et al, JBMR 2011 for guidelines
- Androgen deprivation therapy
- Aromatase inhibitors
- Thiazolidinediones
- SGLT2 inhibitors
- Proton pump inhibitors
- SSRIs
- Suppressive LT4
- Immunosuppressants
  - Cyclosporine
  - Tacrolimus
- Loop diuretics
- DMPA
- Opiates (hypogonadism)
- GnRH analogues
- Anticonvulsants
- Heparin
- HIV treatment
- Sleep meds

OSTEOPOROSIS/FRACTURES – SECONDARY/CONTRIBUTING CAUSES

- Eating disorders
- Primary hyperparathyroidism
- Hyperthyroidism
- Idiopathic hypercalciuria/kidney stones
- Osteogenesis imperfecta
- Mastocytosis
- DM 1&2
- Rheumatoid arthritis
- Alcoholism
- Thalassemia/hemochromatosis
- Liver disease
- Cystic fibrosis
- Renal insufficiency
- Chronic hyponatremia

Secondary Osteoporosis

664 Post- or Peri-menopausal women >45 with T-score < -2.5

309 with no previous contributing conditions
355 excluded because of contributing condition by history

173 with complete labs
136 excluded because of incomplete labs

Tannenbaum et al. J Clin Endocrinol Metab 2002
Osteoporosis - Secondary Causes

- 173 complete evaluation - mean age 65
- 32.4% secondary/contributing cause

Most common –
- Hypercalcuria (9.8%)
- Hyperparathyroidism (6.9%) (1 primary, 6 secondary, 5 unknown)
- Malabsorption (8.1%) (11 relative calcium malab, 3 sprue)
- Vitamin D deficiency (4.1%)
  - Used conservative definition of D deficiency (<12.5 ng/ml)
  - 21% < 20 ng/ml and 55% < 32 ng/ml

Tannembaum et al. JCEM 2002

Summary DM2 Bone

- Increased fracture risk
  - Despite high BMD/BMI
  - T-score underestimates fx risk
  - FRAX underestimates fx risk
  - “Bad” control (eg HAIC > 9%) may be associated with increased fracture risk
- Abnormal remodeling
- Decreased bone quality

What evaluation should be done to exclude secondary or contributing causes in patients with:

1. Osteoporosis by densitometry (T-score < -2.5)
2. Bisphosphonate, DMAB or PTH therapy planned
3. Fragility fractures
4. A decrease in BMD > least significant change on therapy
5. ? Low Z-score (< -2.0)

Secondary Osteoporosis Evaluation

- How likely is dx?
- Does dx alter management?
- What evaluation needed?
OSTEOPOROSIS
ADDITIONAL EVALUATION
• SPEP/UPEP (more MGUS than MM)
  — Many patients
• Cushing's screen
  — Cushingoid signs/sx, adrenal mass, vertebral fx, unexplained LE stress fx
• Malabsorption evaluation (eg celiac disease)
  — sx, FH, high risk (eg DM1), unexplained secondary hyperpara, unexplained hypocalciuria, high D requirement
• Bone turnover markers
  — Not sure
• Mastocytosis evaluation
  — If clinical suspicion
• Bone biopsy after TCN labeling
  — Rarely needed

Low T- Score/High Fracture Risk
Treat
Evaluate

Special Risk Groups
• Parkinson’s
  — Meta-analysis RR fx 2.66 (2.10-3.66) (1)
  — Falls important
• Stroke
  — Meta-analysis RR hip fx 2.06 (1.68-2.52) (2)
  — Falls important
• Dementia
  — Meta-analysis RR hip fx 2.58 (2.03-3.14) (3)
• Heart failure
  — RR MOF 2.45 (2.11-2.85) (4)
• HIV
  — RR fx 1.58 (1.25-2.0) (5)
• How should we manage these groups?
  — 2. Luan et al, Ost Int 2016
  — 4. Majumdar et al, JCEM 2012
  — 5. Shiau et al, AIDS 2013

Suggest Cummings et al, JBMR 2016

Osteoporosis Therapy
• Nonpharmacologic
  — Lifestyle
  — PT/OT
  — Fall prevention
  — Hip protectors
  — Vertebral augmentation (vertebroplasty/kyphoplasty)
• Calcium/Vitamin D
• Pharmacologic

Calcium and CV Events
— “Calcium Intake and CV Disease Risk”
  • Systematic Review and Meta-analysis
  • Calcium intake up to 2000-2500 mg daily not associated with CVD risk in generally healthy adults.
  — Is there “U” shaped curve of calcium/fractures?

Total Calcium Intake
Pills are no better than calcium in food
• NOF suggests 1200 mg/d (at least 50% from food)
• Calcium probably a threshold nutrient
• Estimate dietary calcium intake
  — 8 ounces of milk or yogurt, 2 ounces of hard cheese, 8 ounces of calcium supplemented juice ~ 300 mg
  — Non-dairy portion of diet about 250 mg
• Add up dietary calcium intake and supplement to goal
• Calcium supplements – Don’t forget portion size

Suggested reading:
Rauer, NEJM 10/18/2013

Non-pharmacologic strategies:
• Calcium intake to goal
• Diet
• Lifestyle changes
• PT/OT
• Falls prevention
• Hip protectors
• Vertebral augmentation

Pharmacologic strategies:
• Calcium/Vitamin D
• Other medications for osteoporosis

Special risk groups:
• Parkinson’s
• Stroke
• Dementia
• Heart failure
• HIV

How should we manage these groups?
• Meta-analysis results
• Clinical importance of falls
• MOF and hip fracture risk

Calcium and CV events:
• Systematic review
• Dietary calcium intake
• Calcium supplementation

Total calcium intake:
• Pills vs. food
• Calcium as a threshold nutrient
• Dietary intake estimation
• Calcium supplements

Calcium and osteoporosis:
• Additional evaluation
• Assessment of risk factors
• Management of special risk groups

Suggested reading:
Cummings et al, JBMR 2016
Rauer, NEJM 10/18/2013

Calcium and CV events:
• Meta-analysis
• Calcium intake
• Dietary vs. supplemental calcium

Total calcium intake:
• Pills versus food
• Calcium intake goals
• Calcium as a threshold nutrient

Special risk groups:
• Parkinson’s disease
• Stroke
• Dementia
• Heart failure
• HIV

Calcium and osteoporosis:
• Additional evaluation
• Risk assessment
• Special groups

Suggested reading:
Cummings et al, JBMR 2016
Rauer, NEJM 10/18/2013
A Patient

- 4 ounces of calcium supplemented juice every AM 150 mg
- Milk with cereal daily 150 mg
- 8 ounces milk with supper 300 mg
- Non – dairy portion of diet 250 mg
- Total dietary calcium intake 850 mg
- MVI with 300 mg calcium 300 mg
- Total calcium intake 1150 mg

She is already close to NOF goal of 1200 mg daily. Little if any additional calcium needed!

Falls/Muscle Strength – Vitamin D

- Controversial
  - ? Threshold level of 25D
  - ? Effect of calcium co-administration
- My guess
  - Vitamin D rx has a beneficial effect on falls when baseline D is low.
  - Provide adequate vitamin D.
- Does high-dose intermittent vitamin D increase falls?
  - Yearly – Sanders et al, JAMA 2010

Vitamin D

- Adequate vitamin D important for skeleton (? falls)
- ? Nonclassical benefits (observational studies).
  - cancers, autoimmune diseases, DM2, CV disease and mortality, etc.
  - observational studies do not prove causality
- Controversy about goal level (20 ng/ml vs. 30 ng/ml)
- My goal level 30-60 ng/ml
  - Dose regimens (1000 IU daily will raise 25(OH)D about 5 -10 ng/ml).
    - Daily dosing
    - Less frequent dosing of pharmacologic doses
  - Vitamin D3 (cholecalciferol) may be better than vitamin D2 (ergocalciferol) because D3 may provide more sustained increase in 25(OH)D.
  - I am moving to more daily dosing

What 25D level is needed for skeleton?

<table>
<thead>
<tr>
<th>Study</th>
<th>Source</th>
<th>25(OH)D (ng/ml)</th>
<th>Outcome</th>
<th>N</th>
<th>Age (yrs)</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melhus 2010</td>
<td>&lt;16</td>
<td>1.71 (1.13-2.57)</td>
<td>Hip fracture</td>
<td>1194</td>
<td>71</td>
<td>men</td>
</tr>
<tr>
<td>Cauley 2008 (WHI)</td>
<td>&lt;19</td>
<td>1.71 (1.05-2.79)</td>
<td>Hip fracture</td>
<td>800</td>
<td>71</td>
<td>women</td>
</tr>
<tr>
<td>Cauley 2010 (Mr. OS)</td>
<td>&lt;19</td>
<td>2.36 (1.08-5.16)</td>
<td>Hip fracture</td>
<td>1665</td>
<td>73</td>
<td>men</td>
</tr>
<tr>
<td>Looker 2008 (NHANES 3)</td>
<td>&lt;16</td>
<td>2.0</td>
<td>Hip fracture</td>
<td>1917</td>
<td>≥65</td>
<td>both</td>
</tr>
<tr>
<td>Gerdhem 2005</td>
<td>&lt;20</td>
<td>2.04 (1.04-4.04)</td>
<td>Hip fracture</td>
<td>986</td>
<td>75</td>
<td>women</td>
</tr>
</tbody>
</table>

“In summary, a convergence of the data suggests that an optimal serum level of 25(OH)D for bone health is above 20 ng/ml…”

Gallagher & Sai, JCEM 2010.

Treatment Guidelines (Pharmacologic)

- NOF
  - PMP women and men >50 with spine, FN, TH T-score ≤ -2.5
  - PMP women and men >50 with vertebral or hip fx
  - If T-score = -1.0 to -2.5
    - Other risk factors
    - Secondary osteoporosis
    - 10 year hip fracture risk ≥ 3% or major fracture risk ≥ 20%
- Guideline not intended to be strict rule. Use clinical judgement and involve patient in decision
FDA-approved Medications

<table>
<thead>
<tr>
<th>Drug</th>
<th>Osteoporosis</th>
<th>Post-menopausal</th>
<th>Glucocorticoid-induced</th>
<th>Male</th>
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<tr>
<td>Estrogen</td>
<td>+/-</td>
<td>+/-</td>
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<td>Calcitonin* (Miacalcin®, Fortical®)</td>
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<td>Raloxifene (Evista®)</td>
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<td>Bazedoxifene/CEE (Duavee®)</td>
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<td>Ibandronate (Boniva®)</td>
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<td>Alendronate (Fosamax®)</td>
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<td>Risedronate (Actonel®, Atelvia®)</td>
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<tr>
<td>Risedronate (Atelvia®)</td>
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<td>Zoledronate (Reclast®)</td>
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<td>Denosumab (Prolia™)</td>
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<tr>
<td>Teriparatide (Forteo®)</td>
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</table>

Adapted from Watts

Bisphosphonates

Solomon NEJM, 2002

- Increase BMD, decrease bone turnover in osteoporosis.
- Prevent bone loss in early PMP women.
- Prevent bone loss associated with corticosteroid therapy.
- Decrease vertebral fractures in patients with osteoporosis.
- Some decrease nonvertebral and hip fractures in patients with osteoporosis.

Bisphosphonates

Side Effects/Safety Concerns

- Oral formulations may cause esophageal irritation
- Can cause acute phase response (IV and high-dose oral)
- Contraindicated in patients with hypocalcemia
- Limited to patients with adequate kidney function (GFR > 30 or 35 mL/min)
- Musculoskeletal pain?
- Osteonecrosis of the jaw?
- Atypical femur fractures?

Case

- 64 yo F
  - Stepped of a step and fractured right femur
  - 6 months of prior right hip/back pain
  - On risedronate 2-3 years after stress fx in foot with normal BMD.
  - On calcium and D
  - PMH/FH/SH/PE - N/C
  - Biochemistry
    - Normal

ASBMR Task Force 2013 Revised Case Definition of AFFs (1)

Femoral diaphysis from just distal to the lesser trochanter to just proximal to supracondylar flare. At least four of five Major Features must be present. None of the Minor Features is required.
ASBMR Task Force 2013 Revised Case Definition of AFFs (2)

**Major Features**
- Minimal or no trauma, as in a fall from a standing height or less
- The fracture line originates at the lateral cortex and is substantially transverse in its orientation, although it may become oblique as it progresses medially across the femur
- Complete fractures extend through both cortices and may be associated with a medial spike; incomplete fractures involve only the lateral cortex
- The fracture is non-comminuted or minimally comminuted
- Localized periosteal or endosteal thickening of the lateral cortex is present at the fracture site ("beaking" or "flaring")

Atypical Femur Fractures

- Increase with exposure to bisphosphonates
- 1.78/100,000 patient-years with exposure 0.1-1.9 years
- 11/100,000 patient-years with exposure 2-4 years
- 113.1/100,000 patient-years with exposure 8-9.9 years
- Hip fractures much more common
  - Placebo arms of bisphosphonate trials (3-4 years) ~750, 833 (Vert fx at baseline), 1390 (age 70-79) and 4200 (older than 80) per 100,000 patient years.
  - Dell et al, JBMR 2012

**Benefits outweigh harms when fracture risk is high**

Atypical Subtrochanteric Femoral Fractures

- Do not treat patients at low risk for fracture
  - Treat as NOF osteoporosis, FRAX High fragility fx.
  - ? Drug holidays
  - When patient on bisphosphonate c/o thigh pain – LISTEN!!!
  - Stress fx
    - Decreased weight bearing
  - ? Rod stress fractures (frail pain)
  - ? PTH 1-34
- Need to evaluate other femur:
  - Bone scan, MRI, CT

Bisphosphonates; How long should we treat?

- Drug effect persists although BT slowly increases and BMD slowly decreases.
- Fracture data a bit confusing to me (post ALN, post ZA)
- Treatment should probably last at least 5-6 years.
- In patient whose BMD has risen to acceptable level could stop and monitor BMD/markers.
- Some consider continued therapy for patients at high risk for fx (eg h/o fragility fractures, ongoing GC therapy).
- ASBMR says up to 6 yrs IV ZA, up to 10 yrs oral (I am more conservative) (1)
- What I do;
  - Stop if patient would not have been started by current guidelines.
  - Stop many patients after 3-4 years ZA and 5-6 years PO and follow but ...
  1. Adler et al, JBMR 2015

How long holiday?

- Markers increase and BMD decreases.
- This may not translate into increased fx first 1-2 years.
- Risk of atypical fx decreases.
- I may monitor BMD and marker but this is not based on good evidence.
- For me duration of holiday depends on
  - ? Markers/BMD
    - Drug used/duration (ALN/ZOL last longer than RIS)
    - Overall risk of patient
    - In high risk patient, I may advise anabolic therapy with PTH 1-34

Bisphosphonates and Mortality

- Horizon post hip fracture study (RCT ZA) (1)
- Retrospective hospital-based analysis (Australia). Pre admission bisphosphonate use associated with decreased mortality in critically ill RR 0.41 (0.20-0.71)(2)
- Nationwide study Australian patients >50 with hip fx. Antiresorptive (most BP) RR mortality 0.43 (0.36-0.52) after 1 year. (3)

1. Lysek et al, NEJM 2007
2. Lee et al, JCEM 2016
Denosumab (Prolia) is a monoclonal antibody to RANKL.

**PMP Women**
Increased BMD
Decreased spine, hip, non-vert fx

**Denosumab**
- 60 mg SQ every 6 months
- Side effects:
  - 7 Infections (skin)
  - ONJ/Atypical fx issue
  - Hypocalcemia is a contraindication
- Can use in more significant CKD
  - But when CKD more severe have to think about underlying bone process first!!
- Offset of effect is different than bisphosphonates
  - Effect is reversible within 6–12 months of stopping
- What happens when stopped?
  - How long to treat?
- Recent reports of fx clusters after stopping DMAB
  - Probably no drug holiday or give a dose of ZA at end (assuming candidate)

**Effect of PTH on Fracture Risk in Postmenopausal Women**

![Graph showing effect of PTH on fracture risk](image)

- Placebo
  - 20 µg PTH
  - 40 µg PTH

**rhPTH (1-34) Teriparatide (1)**
- PMP women & men at high risk for fracture (up to 2 years)
- Osteosarcomas in rats; Do not use in patients with:
  - Paget’s bone, unexplained elevated AP, XRT to skeleton, bone metastases/skeletal malignancy, other metabolic bone diseases
- 10 years of use. No evidence of increased osteosarcoma risk in humans. (Capriani et al, JBMR 2012)
  - Should not be used with pre-existing hypercalcemia
  - Caution if hypercalciuria, nephrolithiasis.
  - Should be followed by anti-resorptive therapy.
  - ? Prior or concurrent anti-resorptive drugs, ? Intermittent, ? Repeat courses

**Possible New Drugs**
- Cathepsin K inhibitors (odanacatib)
- Anabolic PTHrP analogue
- Patch PTH 1-34
- Antibodies to sclerostin
  - Sclerostin made by osteocytes
  - Sclerostin inhibits bone formation
  - Antibody to sclerostin promising anabolic therapy for osteoporosis

McClung et al, NEJM 2014
What Else?

- Bone - muscle interactions
  - Frailty (osteopenia-sarcopenia)
- Fracture Liaison Services (not new but mostly not implemented)
  - Suggest Eisman et al, JBMR 2012

Case

- 76 y.o. woman recently discharged to NH after a left hip fracture. Had surgery. Hospitalization complicated by pneumonia and c. difficile
- PMH DM2, hypothyroidism, hypertension, GERD
- Meds; omeprazole, ACEI/HCTZ, pioglitazone, LT4
- D- 2000 IU daily, calcium (TC intake 1200-1500 mg daily)
- SH; No tobacco, about 3 drinks weekly
- Exam 64”, 173bs, BMI 29.7
- Otherwise N/C
- What next?

What Next?

- DXA
  - ? VFA or spine films
  - ? TBS
- Evaluate for secondary causes
  - TSH past 2 years 0.05 to 0.2
    - Patient states she feels better on higher doses
- Consider a different DM drug
- ? Significance of PPI
  - PPIs overused and have other adverse issues
- Fall prevention
- Discuss treatment options

Summary (1)

- Consider fracture risk (not just T- score). eg FRAX/Garvan tools. TBS may be clinically useful tool
- Evaluate for secondary causes
- I like
  - 25D 30-60 ng/ml
  - Total calcium intake about 1200 mg daily
- Pharmacologic therapy in appropriate patients
  - BP benefits far outweigh risks when fx risk is high
  - BP Drug holidays controversial (I use them)
    - I base duration on drug/duration used, markers, BMD, and risk of patient; but this is not based on evidence.

Summary (2)

- Novel drugs may be coming
  - Cathepsin K inhibition
  - Antibodies to sclerostin
  - PTHrP analogue
- Sarcopenia/osteopenia/frailty active area of research
- Patients with fragility fractures (e.g. hip) should be evaluated and managed. We need to treat the patients at highest risk!!
  - A fracture is a sentinel event
  - We need a systems fix to get patients with fragility fractures evaluated and treated.

Thank You!!

Osteoporosis and Calcium Disorders Clinic