Osteoporosis
Diagnosis and Treatment

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Osteoporosis
Bone disease marked by reduced bone strength leading to an increased risk of fractures.

Bone Strength = Bone Mass(density) + Bone Quality

National Osteoporosis Foundation, www.NOF.org
The Impact of Osteoporosis and Bone Breaks

EVERY YEAR, THERE ARE 2 MILLION BONE BREAKS THAT ARE NO ACCIDENT, BUT SIGNS OF OSTEOPOROSIS.

“Cast Mountain” represents just 1 DAY of fractures caused by osteoporosis in the U.S.
Osteoporosis is the Most Common Bone Disease

Only 23% of women age 67+ who have fractured receive either a BMD test or prescription for an anti-osteoporosis medication (NCQA HEDIS measure)

Human Impact of Osteoporosis and Bone Breaks

Every year, of nearly 300,000 hip fracture patients, 1/4 end up in nursing homes and 1/2 never regain previous function.

Over 1/3 of patients with a hip fracture had a prior fracture.
Human Impact of Osteoporosis and Bone Breaks

50% of osteoporosis-related repeat fractures can be prevented with appropriate treatments.

Osteoporosis fractures will likely cost us $25 billion per year by 2025.
Hip Fractures are Associated with Increased Morbidity and Mortality

One Year after Hip Fracture

- Death: 20%
- Enter Nursing Home: 27%
- Unable to walk Independently: 40%
- Restricted in other activities such as driving and shopping: 80%
Importance of Spine Fractures

- Most common osteoporotic fractures
- 75% are not clinically evident
- Patients with a spine fracture have a 5-fold future risk of a spine fracture and 2-fold risk of a hip fracture
- 9% decrease in lung capacity per vertebral fracture
## Current Diagnosis of Osteoporosis

1. Bone Mineral Density as defined by WHO
2. Fragility fracture of hip or spine

<table>
<thead>
<tr>
<th></th>
<th>T-score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal</strong></td>
<td>Equal to -1.0 or higher</td>
</tr>
<tr>
<td><strong>Low Bone Mass</strong></td>
<td>Between -1.0 and -2.5</td>
</tr>
<tr>
<td>(Osteopenia)</td>
<td></td>
</tr>
<tr>
<td><strong>Osteoporosis</strong></td>
<td>Equal to -2.5 or lower</td>
</tr>
<tr>
<td><strong>Severe Osteoporosis</strong></td>
<td>Equal to -2.5 or lower with fracture</td>
</tr>
</tbody>
</table>

Screening Risk of Advancing Age

Bone mass (total mass of skeletal calcium in grams) vs Age (in years)

- Peak bone mass
- Decreasing bone mass with age
- Bone loss due to menopause

Male
Female
Bone growth
Risk Factors for Osteoporosis

- History prior fracture
- Advancing age
- Low bone density
- Parental history of hip fracture
- Certain medications e.g. glucocorticoids
- Race
- Small frame
- Low estrogen in women
- Low testosterone in men
Risk Factors for Osteoporosis: Diet and Lifestyle

- Low calcium intake
- Vitamin D insufficiency
- High salt or caffeine intake
- Immobilization

- Alcohol (≥3 drinks/day)
- Inadequate physical activity
- Low body mass index
- Smoking (active/passive)
Screening: USPSTF/AAFP and Choosing Wisely

- Screen BMD in **women ≥ 65 years** and younger women whose fracture risk is equal to or greater than that of a 65-year old white woman who has no additional risk factors.
- A 65-year old white woman with no other risk factors has a **9.3% 10-year risk** for any osteoporotic fracture.
FRAX (10-year Fracture Risk Assessment tool)

www.shef.ac.uk/FRAX

International Osteoporosis Foundation. Used with Permission from IOF. All Rights reserved.
Screening: AAFP Clinical Preventive Services Recommendations and Choosing Wisely

• Evidence is insufficient to recommend screening in men.

• Don’t use DXA screening:
  – women ≤ 65 yrs or men ≤ 70 yrs with no risk factors.

• DXA is not cost effective in younger, low-risk patients, but is cost effective in older patients.

• NCQA HEDIS measure: Number of women ≥65yr who report ever having a BMD test.
<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendations</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Osteoporosis Foundation</td>
<td>Women: BMD testing for all women ≥65 y and postmenopausal women &lt;65 y, based on risk factor profile.</td>
<td>Men: BMD testing for all men ≥70 y and men aged 50-69 y, based on risk factor profile.</td>
</tr>
<tr>
<td>World Health Organization</td>
<td>Women: Indirect evidence supports screening women ≥65 y, but no direct evidence supports widespread screening programs using BMD testing.</td>
<td></td>
</tr>
<tr>
<td>American College of Physicians</td>
<td>Women: BMD testing for all women ≥65 y and postmenopausal women &lt;65 y who have 1 or more risk factors.</td>
<td>Men: Clinicians should assess older men for osteoporosis risk factors and use DXA to screen men at increased risk who are candidates for drug therapy for osteoporosis.</td>
</tr>
<tr>
<td>American Congress of Obstetricians and Gynecologists</td>
<td>Women: BMD testing for all women ≥65 y and postmenopausal women &lt;65 y who have 1 or more risk factors.</td>
<td></td>
</tr>
</tbody>
</table>
Consider Vertebral Imaging tests for the following:

<table>
<thead>
<tr>
<th>Women ≥ 70 y and Men ≥ 80 y, if BMD T-score spine, total hip or femoral neck is &lt; -1.0.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women 65-69 y and men 70-79 y, if BMD T-score spine, total hip or femoral neck is &lt; -1.5</td>
</tr>
<tr>
<td>Postmenopausal women and men age 50 and older with specific risk factors:</td>
</tr>
<tr>
<td>• Low trauma fracture ≥ 50 y</td>
</tr>
<tr>
<td>• Historical height loss ≥ 1.5 inches (4 cm)</td>
</tr>
<tr>
<td>• Interval height loss ≥ 0.8 inches (2 cm)</td>
</tr>
<tr>
<td>• Glucocorticoid use</td>
</tr>
</tbody>
</table>

www.nof.org
Evaluation

• Detailed history of risk factors
• Calculated calcium intake
• Family History
• Physical examination- Height and Weight
• Estimate 10 yr probability of fracture-FRAX
• Bone Density testing
• Laboratory tests
Medications that Contribute

- Anticonvulsants
- Aromatase Inhibitors
- Cancer chemotherapy
- Depo-medroxy - progesterone acetate
- Glucocorticoids-oral and high dose inhaled
- Heparin
- Lithium
- PPIs(proton pump inh)
- SSRI
- Thyroid hormone in excess
Secondary Osteoporosis

- Genetic Factors
- Hypogonadal States
- Endocrine Disorders
- Gastrointestinal Disorders
- Hematologic Disorders
- Rheumatic and Autoimmune Diseases
- Other Conditions - Spinal cord injury, COPD, CKD
Labs to Consider for Secondary Causes

• Chemistry (calcium, renal, phosphorus, Mg)
• Liver function tests
• CBC
• TSH, PTH
• 25(OH)D
• Testosterone younger men
• 24-hour urinary calcium

Selected cases:
• SPEP/UPEP
• Celiac disease- (tTG)
• Iron and ferritin
• Homocysteine
• Tryptase
• Prolactin
• Bone turnover markers
Universal Recommendations are the same for Prevention and Treatment

• Nutrition- dairy, fruits, vegetables, whole grains, PRUNES

• Tobacco- cessation

• Alcohol- avoid excessive intake

• Exercise and Posture; Fall Prevention
## Institute of Medicine: Dietary Reference Intakes for Calcium and Vitamin D — 2011

<table>
<thead>
<tr>
<th>YEARS</th>
<th>CALCIUM (mg/d) Recommended Dietary Allowance</th>
<th>VITAMIN D (IU/d) Recommended Dietary Allowance</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-50 y M/F</td>
<td>1,000</td>
<td>600</td>
</tr>
<tr>
<td>51-70 y Males</td>
<td>1,000</td>
<td>600</td>
</tr>
<tr>
<td>51-70 y Females</td>
<td>1,200</td>
<td>600</td>
</tr>
<tr>
<td>&gt;70 y M/F</td>
<td>1,200</td>
<td>800</td>
</tr>
</tbody>
</table>
# Calcium Calculator

<table>
<thead>
<tr>
<th>Product</th>
<th>Servings/Day</th>
<th>Calcium</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk (8 oz.)</td>
<td>X 300</td>
<td></td>
<td>=</td>
</tr>
<tr>
<td>Yogurt (6 oz.)</td>
<td>X 300</td>
<td></td>
<td>=</td>
</tr>
<tr>
<td>Cheese (1 oz. or 1 cubic inch)</td>
<td>X 200</td>
<td></td>
<td>=</td>
</tr>
<tr>
<td>Fortified Foods/ Juices</td>
<td>X 80-1,000</td>
<td></td>
<td>=</td>
</tr>
<tr>
<td>Estimated total from other foods</td>
<td></td>
<td></td>
<td>= 250</td>
</tr>
<tr>
<td>Total daily calcium intake, in mg</td>
<td></td>
<td></td>
<td>=</td>
</tr>
</tbody>
</table>

Steps to estimate your calcium intake
www.nof.org/articles/542
Exercise
Intensity based on Bone Strength

Weight-bearing Exercise-Daily
- Walking, Jogging, Stair Climbing
- Tai-Chi, Dancing
- Racquet Sports

Muscle-strengthening Activities- 2-3 times/ wk
- Weight Training
- Yoga, Pilates

Posture- standing, sitting, lying, ADLs
Exercise for Patients with Osteoporosis

- Safe Movement to Protect the Spine
  - Avoid exercises with forward flexion of the spine or bending forward (toe touches, sit-ups)
  - Avoid exercises that twist or jerk the spine
  - Encourage low impact exercise- one foot to remain on the floor

- Physical Therapy
  - To develop a safe and appropriate exercise program improve strength, posture and balance, which may reduce the risk of falls.
Safe Movement for Spinal Protection

National Osteoporosis Foundation
Exercise as Treatment

National Osteoporosis Foundation
Consider Pharmacologic Treatment

Postmenopausal women and men ≥ 50 yrs with a Hip or Vertebral fragility fracture

OR

T-score ≤ - 2.5 Femoral neck, total hip, or spine

OR

T-score between -1.0 and -2.5 and FRAX scores with ≥ 3% (hip) or 20% (major) 10-year fracture risk
Most fractures in Postmenopausal Women have T scores in Low Bone Density range
Expanding the Diagnosis Criteria

NBHA position statement: January 2014. To expand the diagnosis of osteoporosis to include:

- Osteopenia-associated shoulder, pelvis and some wrist fractures.
- FRAX scores with ≥3% (hip) or 20% (major) 10-year fracture risk
Pharmacology

- **Antiresorptive**
  - Bisphosphonates
    - Alendronate
    - Ibandronate
    - Risedronate
    - Zoledronic Acid
  - Denosumab
  - Raloxifene
  - Estrogen
  - Calcitonin

*Anabolic (Bone Forming)*

Teriparatide (PTH 1-34)
### Fracture Data

<table>
<thead>
<tr>
<th>MEDICATION</th>
<th>SPINE</th>
<th>HIP</th>
<th>NON-VERT</th>
<th>DOSE/ADMIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphosphonates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alendronate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>70mg po weekly</td>
</tr>
<tr>
<td>Ibandronate</td>
<td>✓</td>
<td></td>
<td></td>
<td>150mg po monthly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3mg IV every 3 mo.</td>
</tr>
<tr>
<td>Risedronate</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>35mg po weekly</td>
</tr>
<tr>
<td>Zoledronic Acid</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>5mg IV yearly.</td>
</tr>
</tbody>
</table>

Randomized controlled trials indicate:
- Spine fractures reduced ~ 50% in all
- Hip Fractures reduced ~ 40% only with
  - alendronate, risedronate and zoledronic acid
Bisphosphonates

- Oral bisphosphonates- first line due to efficacy, cost, long-term safety data. Alendronate is generic.

- Zoledronic acid IV, if unable to tolerate oral dosing requirements or GI contraindication.

- Adverse: GI, Hypocalcemia, Osteonecrosis of jaw, Atypical femoral fractures.
- Contraindicated GFR<35-30 ml/min

- Short term (3-5 yrs) benefits far exceed risks
- Long term (>5 yrs) benefits smaller, risks higher
Bisphosphonates
Atypical Femoral Fractures


- Rare <0.1% or absolute risk 5 cases/10,000 pt tx yrs

- Inquire about thigh or groin pain

- Evaluate any pain for stress fracture with bilateral x-ray of the femurs- cortical thickness

- Discontinue bisphosphonates if abnormal x-ray or atypical femur fracture
Which patients benefit > 5 years of Bisphosphonate treatment?

• FLEX alendronate extended 5 →10 yrs. Continued prevention of spine fractures, but no effect on non-spine fracture risk.
• Hip BMD and vertebral imaging are predictive of future fractures.
• Bone turnover markers--not predictive
• Patients who may benefit from continued therapy:
  – Older with low hip BMD and/or vertebral fractures
  – Spinal fracture and T score < -2.0
  – Femoral Neck T score ≤ -2.5

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<th>NON-VERT</th>
<th>DOSE/ADMIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>RANKL inhibitor Denosumab</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>60 mg SC every 6 month</td>
</tr>
<tr>
<td>SERM Estrogen</td>
<td>✓</td>
<td></td>
<td></td>
<td>60mg po daily</td>
</tr>
<tr>
<td>Estrogen</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>Not recommended due to adverse effects</td>
</tr>
<tr>
<td>Calcitonin</td>
<td>✓</td>
<td></td>
<td></td>
<td>100-200 IU nasally / SC daily</td>
</tr>
<tr>
<td>PTH Teriparatide</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>20 mg SC daily for max 2 yrs</td>
</tr>
</tbody>
</table>
Denosumab (Prolia™)

- Human monoclonal antibody, RANKL inhibitor
- Reduces the incidence of vertebral, nonvertebral, and hip fractures
- Can be first line for patients unable to tolerate dosing of Bisphosphonate or GFR<35

- Adverse Effects: Infection-skin; hypocalcemia; ONJ and Atypical Femoral fractures
Raloxifene- (Evista)

• Non-hormonal agent that acts as an estrogen agonist on bone but acts as an estrogen antagonist on both the breast and uterus.

• Reduces spine but not non-spine or hip fractures

• Reduces risk of invasive breast cancer

• Adverse Effects: DVT risk similar to estrogen; Increases hot flashes and causes leg cramps
Estrogen and Hormone Therapy

• Reduce hip fractures and clinical spine fractures by 34%

• *Adverse effects*: stroke, breast cancer, PE, DVT

• Consider all other therapies first. AGS-BEERS list

• Prescribe lowest effective dose for shortest time to treat moderately severe menopausal symptoms, primarily in first few years of menopause
Calcitonin

• FDA-approved for women who are at least five years postmenopausal when alternative treatments are not suitable.
• Reduces vertebral fractures 30% in those with prior vertebral fractures. Not been shown to reduce nonvertebral or hip fractures.
• Administer: 200 IU intranasal spray. SQ available
• Adverse effects: suggested increased risk of malignancies
Anabolic Therapy: Teriparatide (Forteo)

- Teripartide (PTH 1-34) PTH is the only anabolic therapy. Stimulates new bone formation.
- Reduces vertebral and non-vertebral fractures
- **Administration**: 20ug SQ daily injection, limited to 18-24 months due to osteoscarcoma (rats).
- Maintain bone growth at end of treatment with alternative agent.
- **Adverse effects**: contraindicated in patients with increased risk of osteosarcoma (Paget’s disease, prior radiation therapy skeleton, bone metastases, hypercalcemia, or a history of skeletal malignancy)
Ongoing Care of Osteoporosis

• Interval for repeat DXA depends on initial BMD. Minimum of 2 years between DXA.
• Patients taking FDA-approved medications need to be evaluated annually.
• Compliance with bisphosphonates only 45%
• No uniform recommendation applies to all patients, duration decisions need to be individualized.
Prevent Second Fractures

• In adults $\geq 50$ yrs, after a fracture, assess risk

• NBHA (National Bone Health Alliance) is advocating for Fracture Liaison Service (FLS) programs that coordinate post fragility fracture care to ensure assessment and treatment

• NCQA HEDIS measure: number of women $\geq 67$ yrs who suffered a fracture and who had either BMD or a prescription for a drug to treat osteoporosis.
Medical Risk Factors for Falls

- Polypharmacy and Medications causing Sedation
  narcotics, anticonvulsants, psychotropics
- Anxiety, Agitation, Depression
- Arrhythmias, orthostatic hypotension
- Dehydration, malnutrition, Vit D insufficiency
- Previous fall or fear of falling
- Poor Vision
- Urgent urinary incontinence
- Poor balance, kyphosis, sarcopenia
Environmental Factors

- Lack of assistive devices in bathrooms
- Loose throw rugs, low lighting
- Obstacles in walking path
- Slippery conditions
- Provide resource materials
Practice Recommendations

- Actively counsel patients on the prevention of osteoporosis
- Use the FRAX calculator to identify patients for screening and treatment of osteoporosis
- Evaluate and treat adults with fragility fractures for their underlying osteoporosis
- Evaluate patients to decrease their risk factors for falling and prevent fractures.
Centre for Aging and Wellness
Florida Hospital Family Medicine Residency and Geriatric Fellowship
www.seniorhealthmedicine.com

Contact:
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407-599-6060
Robin.Creamer.DO@flhosp.org
References


References


References

http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/overview.asp


• National Osteoporosis Foundation. What Healthcare Professionals need to know. www.NOF.org
References


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