HELP! MY BONES ARE BREAKING...

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OSTEOPOROSIS
- Most common bone disorder affecting humans

BONE
- Living, growing tissue
- Collagen and calcium phosphate
- 99% of body's calcium is in bones and teeth
- Peak bone density reached at age 30

BONE FORMATION
- Osteoclasts promote bone resorption by stimulating the production of acid and enzymes that dissolve bone mineral and proteins.
- Osteoblasts promote bone formation by creating a protein matrix primarily of collagen that is calcified resulting in mineralized bone.

BONE LOSS
- Occurs when there is an imbalance between bone resorption and bone formation resulting in decreased bone mass and increased risk of fracture

OSTEOPOROSIS
- Low bone mass and structural deterioration of bone tissue leading to bone fragility and an increased risk of hip, spine and wrist fractures
OSTEOPENIA

- Bone mineral density that is lower than normal peak bone mineral density but **not** low enough to be classified as osteoporosis

OSTEOPOROSIS

- 10 million Americans
- 34 million Americans at risk
- By 2020, half of all Americans 50+ are expected to have low bone density or osteoporosis

OSTEOPOROSIS

- $19b in related costs NOW
- By 2025, costs estimated at $25b
- 1 in 2 women; 1 in 4 men

OSTEOPOROSIS

- Each day 10,000 Americans turn 65
- 2030: 71 million Americans will be 65 or older

OSTEOPOROSIS

- **Primary**: Due to bone loss that occurs with aging
- **Secondary**: Result of medication or diseases that affect skeletal health

SECONDARY CAUSES

- Cytotoxic agents
- Heparin
- IM medroxyprogesterone
- Immunosuppressives
- Glucocorticoids
SECONDARY CAUSES

- Vitamin D deficiency
- Cushing’s syndrome
- Hyperthyroidism
- Primary hyperparathyroidism
- Type 1 diabetes mellitus
- Multiple myeloma
- Chronic renal disease

DXA

- Duel energy x-ray absorptiometry
- Measurements taken at hip, spine and radius

RISK FACTORS

- Gender
- Age

RISK FACTORS

- Body size
- Ethnicity
- Family history
MODIFIABLE RISK FACTORS
- Sex hormones
- Anorexia nervosa
- Calcium and vitamin D
- Medication use
- Lifestyle
- Alcohol intake
- Cigarette smoking

SEX HORMONES
- Amenorrhea
- Low estrogen
- Low testosterone

CALCIUM
- Essential nutrient
- Peak bone mass and prevents bone loss

CALCIUM REQUIREMENTS
- 0 - 6 months: 200 mg/day
- 6 - 12 months: 260 mg/day
- 1 - 3 years: 700 mg/day
- 4 - 8 years: 1,000 mg/day
- 9 - 18 years: 1,300 mg/day
- 19 - 30 years: 1,000 mg/day
- 31 - 50 yrs: 1,000 mg/day
- 51 - 70 yrs male: 1,000 mg/day
- 51 - 70 yrs female: 1,200 mg/day
- >70 yrs: 1,200 mg/day

VITAMIN D
- A steroid prohormone and fat-soluble vitamin
- Interaction of ultraviolet rays from sunlight with 7-dehydrocholesterol in the skin
- Essential for physiologic regulation and stimulation of intestinal absorption of calcium
VITAMIN D

- Sunlight
  - Vitamin D3-cholecalciferol

- Food
  - Vitamin D3-cholecalciferol, animal sources
  - Vitamin D2-ergocalciferol, plants

- Supplements
  - Vitamin D2 and Vitamin D3

VITAMIN D REQUIREMENTS

- 1-70 years: 600 IU/day
- >70 years: 800 IU/day

VITAMIN K

- 90 ug/day
- Green leafy vegetables
- Lacking evidence to support its use in prevention or treatment of osteoporosis
- Contraindicated if taking warfarin

MAGNESIUM

- 321 mg/day
- Green leafy vegetables, unpolished grains, nuts
- Data inconclusive

ISOFLAVONES

- Soybeans, soy products, red clover
- Studies suggesting benefit are weak

PHYSICAL ACTIVITY

- Weight bearing and strength training increase bone mass and maintenance by stressing the bone
- 150 minutes of weekly moderate aerobic activity
- 75 minutes of weekly vigorous aerobic activity
PHYSICAL ACTIVITY

- Decrease risk of CVD
- Decrease risk of Type II DM
- Decrease risk of some cancers
- Strengthens bones and muscles
- Improve mental health and mood
- Increase chance of living longer
- Improve ability of daily activities

EXERCISE

- Walking, jogging, running
- Tennis
- Field hockey
- Jumping rope
- Stair climbing
- Dancing
- Weight lifting

SMOKING CESSATION

- Smokers lose bone mass more rapidly
- Evidence suggests it impairs calcium absorption and lower estradiol levels

ALCOHOL

- Excess increases risk of bone loss and fractures
- Effect of moderate alcohol use on bone health and osteoporosis risk is unclear

PHARMACOLOGIC APPROACHES

- Bisphosphonates
- Selective estrogen-receptor modulators
- Parathyroid hormone
- Estrogens
- Calcitonin
- Combination therapy

BISPHOSPHONATES

- Inhibits the activity of osteoclasts by shortening their lifespan reducing bone resorption
- No other effects on body other than bone
**ALENDRONATE SODIUM**

- Fosamax
- Treatment and prevention of osteoporosis in postmenopausal women and glucocorticoid osteoporosis in men

**FOSAMAX**

- Adults
  - 10 mg daily or 70 mg weekly
- Supplied
  - 5, 10, 35, 40, 70 mg tablets
  - 70 mg in 70 ml solution

**ADVERSE REACTIONS**

- Nausea
- Acid regurgitation
- Dyspepsia
- Abdominal pain
- Musculoskeletal pain

**DRUG INTERACTIONS**

- Calcium supplements and antacids interfere with absorption
- NSAID use increases GI irritation

**CONTRAINDICATIONS**

- Esophageal stricture or achalasia
- Inability to stand to sit upright for at least 30 minutes
- Hypocalcemia
- Increased risk of aspiration

**NURSING IMPLICATIONS**

- Take with water ½ hour before FIRST food, beverage or other meds in AM
- Do not lie down for at least 30 minutes
- Reduced bioavailability with coffee and orange juice
NURSING IMPLICATIONS

- ONJ
- Esophageal reactions
- Hypocalcemia
- Atypical fractures
- Serum alkaline phosphatase levels

IBANDRONATE SODIUM

- Boniva
- Treatment and prevention of osteoporosis in postmenopausal women

BONIVA

- Adults
  - 150 mg PO once a month on the same day each month
  - 3 mg IV over 15-30 seconds every 3 months

ADVERSE REACTIONS

- Abdominal pain
- Headache
- Arthralgia
- Dyspepsia
- Nasopharyngitis
- HTN

DRUG INTERACTIONS

- Calcium, aluminum, magnesium and iron may interfere with absorption
- May interfere with bone imaging agents
- NSAIDS may increase GI irritation
- Increased bioavailability with ranitidine

CONTRAINDICATIONS

- Hypocalcemia
- Inability to sit upright or stand for > 60 minutes
- Delayed esophageal emptying
NURSING IMPLICATIONS

- Instruct patient to swallow pill whole with water 60 minutes before FIRST food, drink or medication in AM
- Do not lie down for 60 minutes after dose
- Take on the same day every month

ONJ

- Osteonecrosis of the jaw
- Only site reported associated with use of bisphosphonates
- Risk increases if taken for more than 3 years and in presence of co-morbidities

RISEDRONATE SODIUM

- Actonel
  - Treatment & prevention of osteoporosis in postmenopausal women & glucocorticoid-induced osteoporosis in men
  - Treatment
    - To increase bone mass in men
    - Paget’s disease in men and women

ACTONEL

- Adults
  - 5 mg daily
  - 35 mg weekly
  - 150 mg monthly
- Tablets
  - 5 mg, 30 mg, 35 mg and 150 mg
ADVERSE REACTIONS

- Back pain
- Dyspepsia
- Acute phase reaction
- Headache
- HTN
- UTI

DRUG INTERACTIONS

- Calcium supplements and antacids decrease absorption
- Increased risk of femur fractures with glucocorticoids

CONTRAINDICATIONS

- Esophageal stricture or achalasia
- Inability to sit or stand for at least 30 minutes
- Hypocalcemia

NURSING IMPLICATIONS

- Instruct patients to take 30 minutes before FIRST food or drink in AM
- Swallow with 6-8 oz of water
- Do not lie down for 30 minutes after dose

NURSING IMPLICATIONS

- Monitor for dysphagia, esophagitis, ulcers
- Monitor for ONJ
- Discuss dosing instructions and what to do if a dose is missed

FDA WARNING

- Ongoing safety review of oral bisphosphonates and potential increased risk of esophageal cancer
- FDA review ongoing
- Conflicting findings in studies
- www.fda.gov
RALOXIFENE HCL

- Evista
- Selective estrogen receptor modulator
- Treatment and prevention of osteoporosis in postmenopausal women
- Reduction in risk of invasive breast cancer in postmenopausal women at high risk for breast cancer

EVISTA

- Binds to estrogen receptors resulting in activation of estrogen pathways
- Acts as an estrogen agonist in bone which decreases bone resorption and increases bone mineral density

EVISTA

- Adults
  - 60 mg once daily

ADVERSE REACTIONS

- DVT
- PE
- Vaginal bleeding
- Hot flashes
- Leg cramps
- Headache
- Sinusitis

DRUG INTERACTIONS

- Cholestyramine may decrease absorption
- Caution with highly protein bound drugs such as diazepam, diazoxide & lidocaine
- Avoid concomitant use with systemic estrogens

CONTRAINDICATIONS

- Pregnancy
- Nursing
- History of DVT or PE
NURSING IMPLICATIONS

• May take anytime w/o regards to meals
• Asses for DVT
• Renal and hepatic impairment
• Counsel for increased incidence of hot flashes
• Avoid prolonged restrictions in movement

BOX WARNING

• Increased risk of DVT and PE reported
• Increased risk of death due to stroke in postmenopausal women with documented coronary heart disease
• Consider risk-benefit balance in women at risk for stroke

CALCITONIN

• Fortical
• Parathyroid
• Polypeptide hormone secreted by parafollicular cells of thyroid gland
• Acts on bone to lower serum calcium and inhibit bone resorption

CALCITONIN

• Postmenopausal osteoporosis
• Corticosteroid-induced osteoporosis
• Hypercalcemia
• Paget's disease

CALCITONIN

• Subcutaneous or IM injection
• Intranasal

CALCITONIN

• Minimum effective dosage not established
• 100 units every other day SQ or IM
• 200 units (1 spray) daily
**ADVERSE REACTIONS**
- Rhinitis
- Dizziness
- Flushing
- Dyspepsia
- HTN
- Myalgia
- Nasal mucosal irritation

**DRUG INTERACTIONS**
- Lithium

**CONTRAINDICATIONS**
- Known hypersensitivity to calcitonin salmon

**NURSING IMPLICATIONS**
- Instructions on administration
- Discard nasal bottle after 30 doses
- Report nasal irritation

**PROLIA**
- Denosumab
- Human IgG2 monoclonal antibody with affinity for human RANKL (receptor activator of nuclear factor kappa-B ligand)

**PROLIA INDICATIONS**
- Postmenopausal women with osteoporosis at high risk for fracture
- To increase bone mass in men w/osteoporosis
- Treat bone loss in men receiving androgen deprivation therapy for prostate cancer
- Treat bone loss in women receiving adjuvant aromatase inhibitor therapy for breast CA
PROLIA

• 60 mg single subcutaneous injection once every 6 months
• All patients also need to receive 1000 mg calcium and 400 IU vitamin D daily

ADVERSE REACTIONS

• Hypocalcemia
• Hypercholesterolemia
• Arthralgia
• Nasopharyngitis
• Constipation
• ONJ

DRUG INTERACTIONS

• No studies have been conducted

CONTRAINDICATIONS

• Hypocalcemia
• Pregnancy
• Systemic hypersensitivity
• Urticaria

NURSING IMPLICATIONS

• Routine oral exam prior to therapy
• Good oral hygiene
• Maybe present in seminal fluid
• Protection recommended

REFERENCES

• www.ahrq.gov
• www.bones.nih.gov
• http://nccam.nih.gov
• www.iom.edu
• www.pdr.net
• www.menopause.org
REFERENCES
