

# Osteoporosis

May 2019 Learn at Lunch

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# Topics to be covered:

- The mechanism of bones
- Defining Osteoporosis, Osteopenia, and Osteomalacia
- Risk Factors
- Diagnosis
- Prevention and Treatment

# Mechanism of Bones

# Mechanism of Bones

- Bones are made of:
  - Collagen: Structure and Flexibility
  - Calcium: Strength and Support
- Bones are living tissue
- Growth and maintenance is called “Remodeling”

# Osteoclasts

- Prepare bone for remodeling
- Breakdown outermost bone layer
- Help release calcium from bone
- “Demolition Crew”



# Osteoblasts

- Prepare new layer of collagen
- Allow bones to grown bigger
- “Building Crew”



# Osteoblasts to Osteocytes

- Coordinate Osteoclast and Osteoblast activity
- “Project Managers”





# Why is it Important?

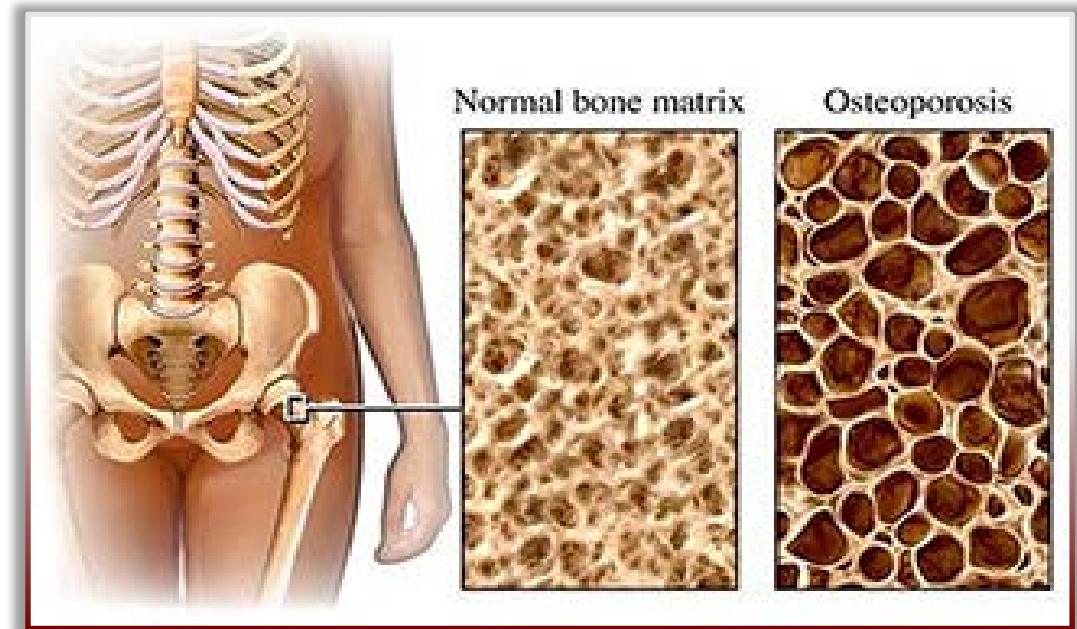
- From birth, osteoblast are more active
- Activity peaks around our early 20's
  - Peak Bone Density
- Osteoclast and Osteoblast activity becomes equal
- At this point it is important to preserve and maintain what bones we have
- As we age, risk factors contribute to bone loss



# Defining the Terms

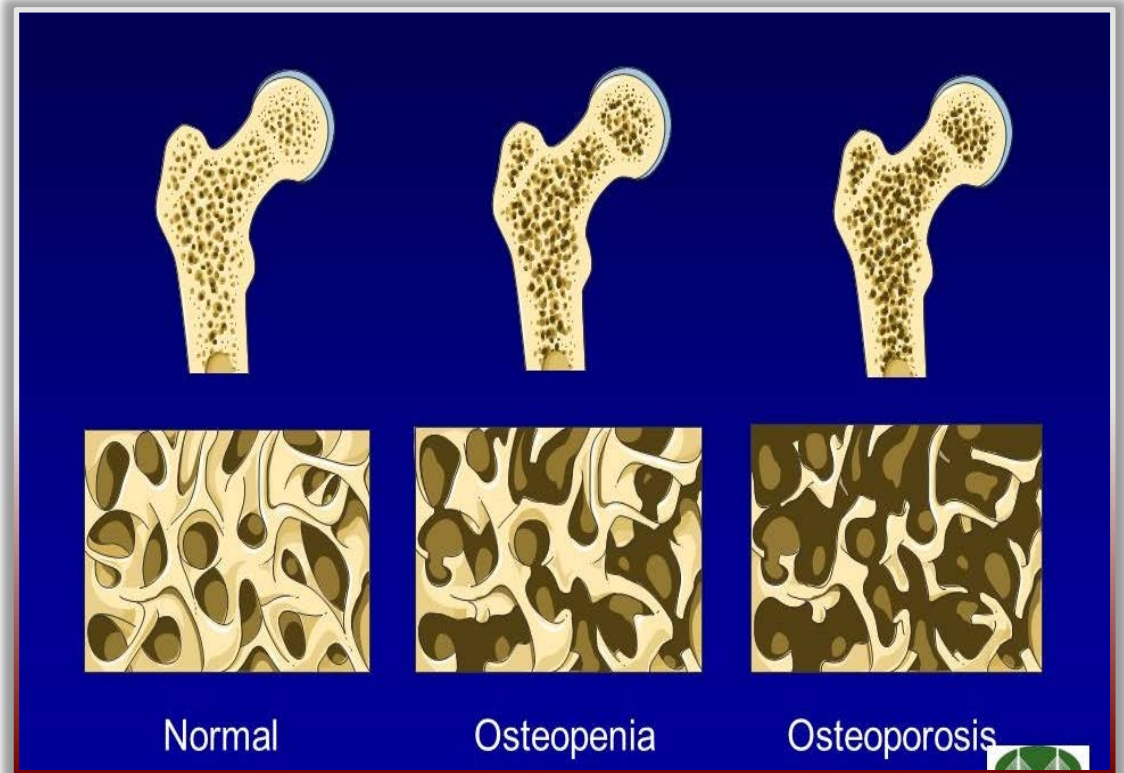
# Osteoporosis

- Osteo – bone
- Porosis – a porous condition
- Reduction in the density of bone
- Increased risk for fractures
  - Hips, spine and wrists at most risk for fractures



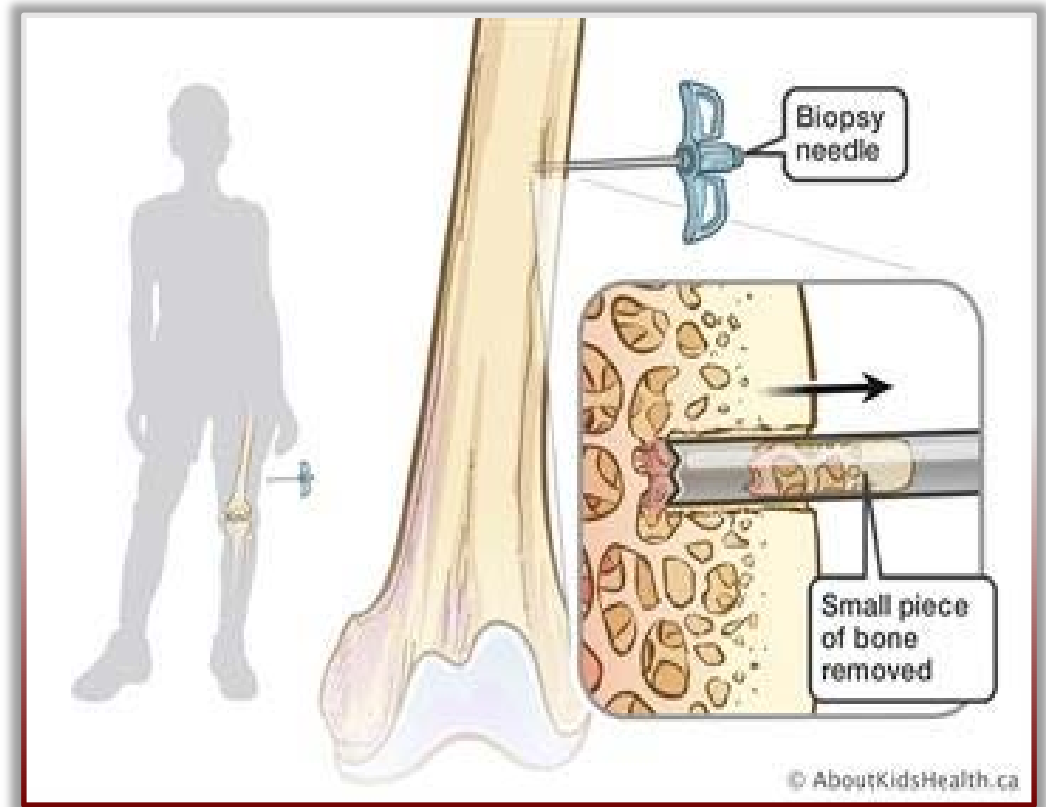
# Osteopenia

- Low bone density score
- Bone loss not as severe as osteoporosis



# Osteomalacia

- Impairment of bone mineralization
- Less common
- Diagnosis by bone biopsy
- Pain, myopathy and fractures
- Commonly caused by vitamin D deficiency in older adults



# Risk Factors

# Risk factors: **Non-modifiable**

- Female gender
- Age (menopause)
- Family history
- History of broken bones or height loss
- Small frame/low body weight
- Disease states including:
  - Diabetes
  - Thyroid (hyperparathyroidism, hypothyroidism)
  - Kidney disease and/or kidney stones
  - Arthritis
  - COPD

# Risk factors: **Modifiable**

- Smoking
- Low levels of vitamin D and calcium
- Increased intake of caffeine, protein, or sodium
- Sedentary lifestyle
- Estrogen deficiency
- Increased use of alcohol

# Medication Risks

| Medication Class     | Examples   |
|----------------------|--|
| Glucocorticoid       | Prednisone $\geq$ 5mg for 3 months or longer   |
| PPIs                 | Prilosec (omeprazole), Nexium (esomeprazole), Prevacid (lansoprazole), Protonix (pantoprazole) |
| Loop diuretics       | Lasix (furosemide), Bumex (bumetanide), Demedex (torsemide)                                    |
| Anti-epileptics      | Tegratol (carbamazepine), Dilantin (phenytoin)   |
| Aromatase inhibitors | Arimidex (anastrozole), Femara (letrozole)   |
| Thiazolidinedione    | Actos (pioglitazone), Avandia (rosiglitazone)  |



# Diagnosis

# DEXA Scans

- Dual energy x-ray absorptiometry (DEXA) scan
- The gold standard for determining osteoporosis
- Compares your results to others with similar age, gender, ethnicity, and height
- Results are called T-scores
- Scores can be easily interpreted
  - Normal =  $> -1$
  - Osteopenia =  $-2.4$  to  $-1$
  - Osteoporosis =  $< -2.5$



# What's Accessed

- Achilles or heel ultrasound is another option
- Convenient, portable, less exposure to X-ray
- Provides the same scoring as DEXA scan
- Can help determine if a DEXA scan is needed



<https://www-th.getzhealthcare.com/products/product-speciality/medical-imaging/ultrasound-bone-densitometres---scr-eeeni ng/achilles-expii>

# Criteria for Initiating Treatment

|                                 |   |
|---------------------------------|---|
| <b>Osteoporosis</b>             | <ul style="list-style-type: none"><li>• Post menopausal women or men &gt;50 years of age with a BMD T-score of <math>\leq 2.5</math> at the neck, hip or spine</li><li>• Presence of fragility fracture – regardless of BMD</li></ul>   |
| <b>Osteopenia, if high risk</b> | <ul style="list-style-type: none"><li>• Low BMD (T-score between -1 and -2.5) at the neck, hip, or spine</li></ul> <p style="text-align: center;">AND</p> <ul style="list-style-type: none"><li>• FRAX score indicates a 10-year probability of a major osteoporosis-related fracture <math>\geq 20\%</math> or a 10-year fracture probability of <math>\geq 3\%</math></li></ul> |

# Recommendations for Screenings

- Women =  $\geq 65+$
- Men =  $\geq 70+$
- Women  $<65$  and men 50-69 should have a scan if they
  - Have a history of fractures from a fall
  - Risk for disease or drug induced bone loss
  - Parental history of hip fracture
  - Other risk factors associated with osteoporosis

# Post Diagnosis Recommendations

- Take medication as directed
- Continue to take appropriate action to prevent disease progression with lifestyle modifications
- Take extra precaution to prevent falls
  - Declutter home
  - Install safety handles or railing
  - Avoid activities that may lead to a fall
  - Wear slip resistant shoes

# Prevention and Treatment

# Exercise



<https://www.nof.org/patients/fracturesfall-prevention/exercisesafe-movement/osteoporosis-exercise-for-strong-bones/>

- Weight bearing exercises (strength training or resistance training)
  - Puts stress on bones causing them to become stronger
- Lack of exercise can cause bone tissue deterioration
  - Can result in the loss or breakdown of bone
- Fracture/Fall history influences exercise type
  - No Fractures/Fall = High Impact such as dancing, running, tennis, hiking, jumping
  - Fracture/Fall History = Low Impact such as walking, stair machine, treadmill, yoga
- CDC recommends 150 minutes per week of aerobic exercise with strength training incorporated




# Calcium and Vitamin D

## Calcium Intake Requirements

|                         |             |
|-------------------------|-------------|
| Women 19 – 50 years old | 1000 mg/day |
| Women 50+ years old     | 1200 mg/day |
| Men 19 – 70 years old   | 1000 mg/day |
| Men 70+ years old       | 1200 mg/day |

## Vitamin D Intake Requirements

|                |              |
|----------------|--------------|
| < 50 years old | 400-800 IUs  |
| > 50 years old | 800-1000 IUs |

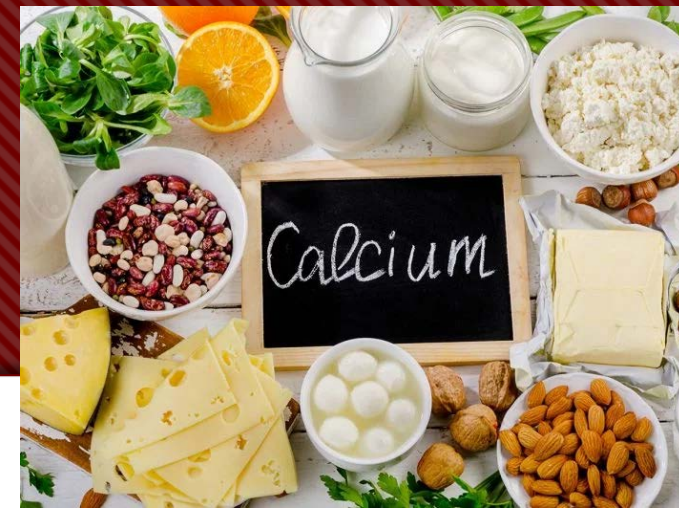


# Why is Calcium Important?

- Roles in bone strength
- Blood clotting, muscle formation, and nerve function

# Food Sources of Calcium

- Dairy
  - Milk (Cow/Nut/Soy), yogurt, cheese
- Produce
  - Collard greens, kale, broccoli, apricots, oranges, raisins, figs, beans (pinto, navy, soy)
- Seafood
  - Sardines, anchovies, salmon, shrimp
- Nuts
  - Almonds, hazelnuts, walnuts
- Seeds
  - Sunflower, chia
- Fortified Foods
  - Pasta, bread, cereal, oatmeal, orange juice, and tofu



<https://www.organicfacts.net/health-benefits/minerals/calcium.html>

# OTC Sources of Calcium



<https://www.tums.com/> : <https://www.citracal.com/>

## Calcium Carbonate

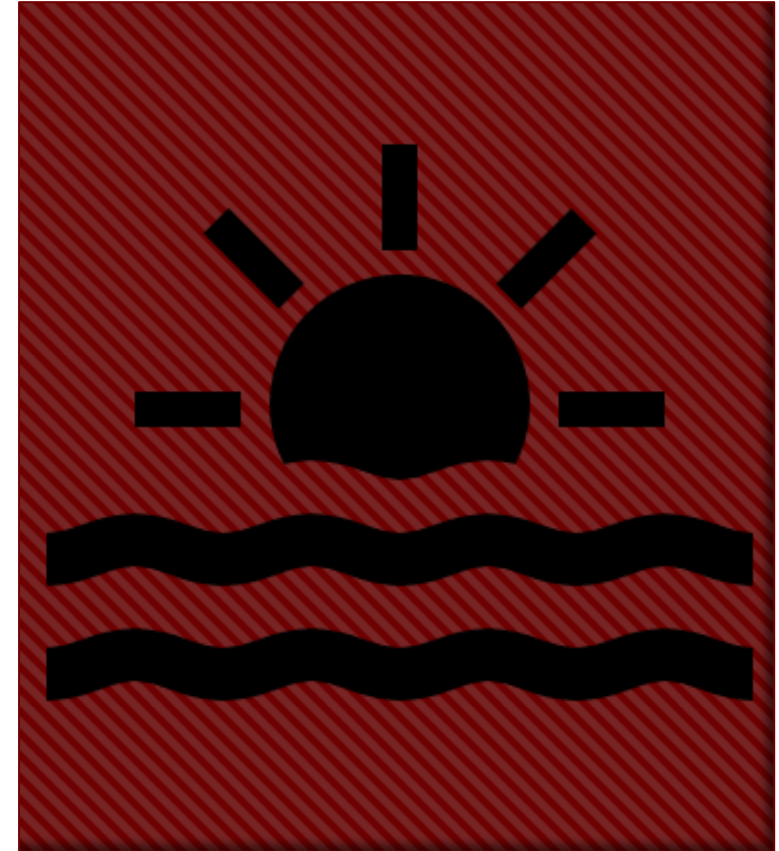
- Tums, Alka-Seltzer chews, Caltrate
- Provides the most calcium
- Must be taken with food

## Calcium citrate

- Citracal
- Provides less calcium than calcium carbonate
- Can take with/without food or on empty stomach
- Preferred for patients on PPI or H2RA

# Why is Vitamin D Important?

- Needed for calcium absorption
- Low levels lead to softer bones
- Excessively increasing sun exposure is not recommended due to risk of skin cancer



# Common Sources of Vitamin D

- Sunshine
- Food:
  - Fatty Fish (salmon, tuna), eggs, and liver
  - Fortified foods (cereal, milks, orange juice, etc)
- Supplementation
  - $D_2$  vs  $D_3$  = equally effective

# Diet

- Salt
  - Contributes to excessive calcium loss
  - Limit to 2,300 mg or 1 Teaspoon of salt per day
- Caffeine
  - MAY contribute to excessive calcium loss
  - Limit to 330 mg per day (3 servings of coffee/tea/soda)
- Cola
  - Contains phosphoric acid
  - Contribute to excessive calcium loss

# Alcohol

- Excessive alcohol impairs our ability to process vitamin D which affects calcium absorption
- Negatively affects women's estrogen levels
- May also increase cortisol levels
- Increases risk for falls and fractures
- Limit alcohol use to less than 2 to 3 servings / day
- Serving sizes of alcohol:
  - 12 oz of regular beer
  - 7.5 oz of malt liquor
  - 5 oz of wine
  - 5 oz of ciders
  - 1.5 oz of spirits





# Medication Use

- Bisphosphonates
- Estrogen Containing Products
- Calcitonin
- Parathyroid Hormone 1-34
- RANKL Inhibitor



# Bisphosphonates

- 1<sup>st</sup> line therapy for osteoporosis
- Used for prevention or treatment of the disease
- Oral medication requires staying upright for 30 minutes and drinking 6-8 ounces of water
- Treatment duration of 3 – 5 years due to rare risk of femur fractures and osteonecrosis of the jaw (ONJ)
- Common side effects – reduced calcium levels in body, esophagus issues, and

# Bisphosphonates

| Drug Name                                      | Side Effects/Safety   |
|--|---|
| Fosamax or Binosto (Alendronate)               | <ul style="list-style-type: none"><li>• Low Calcium levels</li><li>• Renal impairment</li><li>• Difficulty swallowing – must sit upright for at least 30 minutes to reduce risk</li><li>• Abdominal Pain</li></ul> <p>* Comes as injectable form – preferred if issues with esophagus</p> |
| Fosamax Plus D (Alendronate + cholecalciferol) |   |
| Actonel or Atelvia (Risedronate)               |   |
| Boniva (Ibandronate)*                          |   |
| Reclast (Zoledronic Acid)*                     |   |

# Estrogen Containing Products

- Used for treatment or prevention
- Decreases risk of breast cancer but can cause vasomotor symptoms (hot flashes)
- Increase risk of venous thromboembolism (VTE) and stroke

# Estrogen Containing Products

| Drug Name                                  | Side Effects/Safety   |
|--|---|
| Evista (Raloxifene)                        | <ul style="list-style-type: none"><li>• Increased risk of VTE (DVT or PE)</li><li>• Increase risk of stroke</li><li>• Hot flashes</li><li>• Swelling in lower extremities</li><li>• Cancer risks (breast cancer, endometrial cancer)</li><li>• Not recommended for women ages 75 years or older</li></ul> |
| Duavee (Conjugated Estrogens/Bazedoxifene) |   |

# Calcitonin

- Brand name: Miacalcin
- Comes as nasal spray and injection
- Risk of low calcium levels
- Nasal spray must be refrigerated
- Side effects include flushing, nausea, dizziness, and back pain

# Parathyroid Hormone 1-34

- **Forteo (Teriparatide)**
- **Tymlos (Abaloparatide)**
- Stimulates osteoblast activity and increase bone formation
- Used when there is a high risk of fracture
- Treatment duration is restricted to 2 years
- Risk of bone cancer, high levels of calcium, leg cramps, dizziness

# RANKL Inhibitor

- **Prolia (Denosumab)**
- Risk of ONJ, femur fractures, and low calcium levels
- Side effects: high blood pressure, fatigue, edema, headaches



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