

OSTEOPOROSIS PATHOPHYSIOLOGY

FLAME LECTURE: 49

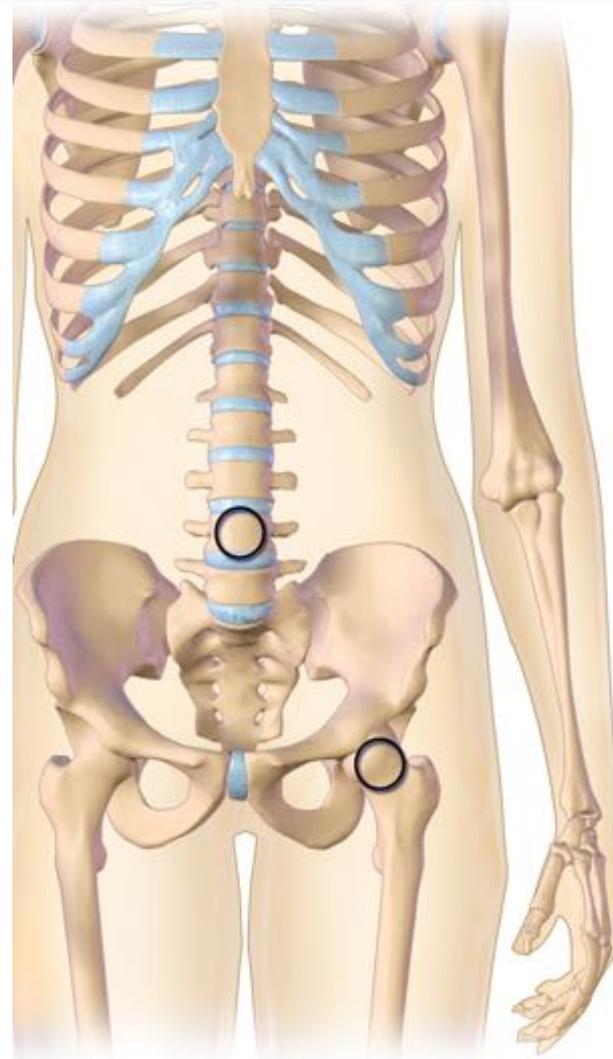
DAVID 9.13.20

LEARNING OBJECTIVES

- ▶ To understand the multiple pathogenetic factors involved in osteoporosis development
- ▶ Prerequisites:
 - ▶ NONE
- ▶ See also – for closely related topics
 - ▶ FLAME LECTURE 48: Overview of Osteoporosis
 - ▶ FLAME LECTURE 50: Secondary Osteoporosis

PATHOPHYSIOLOGY

- ▶ Osteoporosis is a skeletal disorder characterized by compromised bone strength predisposing to an increased risk of fractures
- ▶ Bone continually remodeled in response to microtrauma. Bone resorption always followed by formation



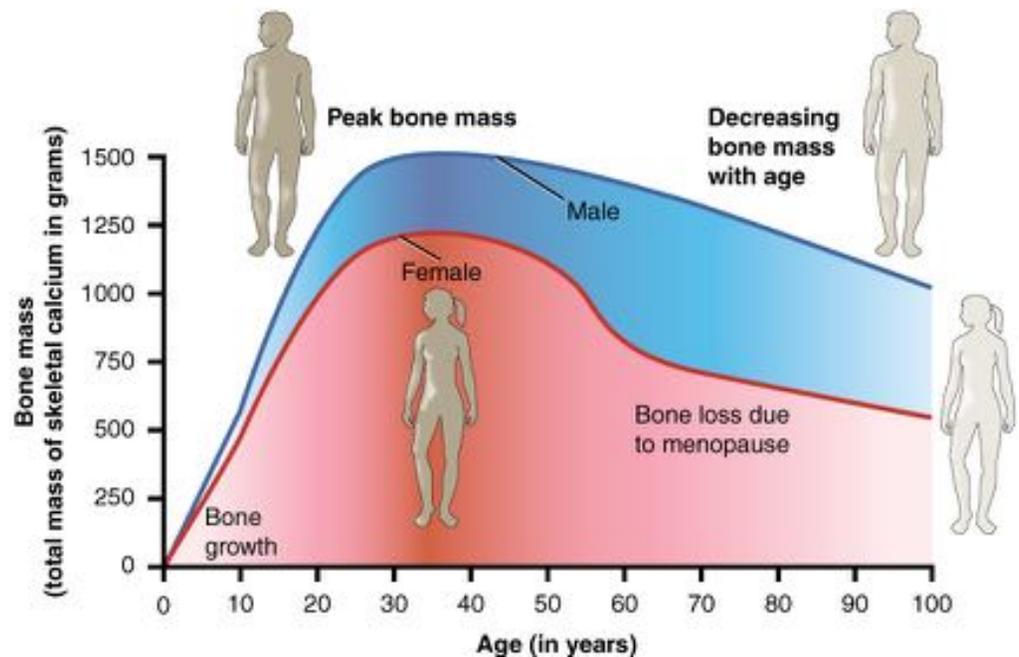
Normal bone



Osteoporosis

PATHOPHYSIOLOGY (CONT'D)

- ▶ After achieving peak bone mass, creation plateaus for about 10y, during which time bone formation roughly equals bone resorption
- ▶ After this, bone loss occurs at a rate of ~ 0.3 to 0.5%/yr
- ▶ Beginning with menopause, bone loss accelerates in women to about 3-5%/yr for ~ 5-7 yrs and then the rate of loss decelerates



REMODELING

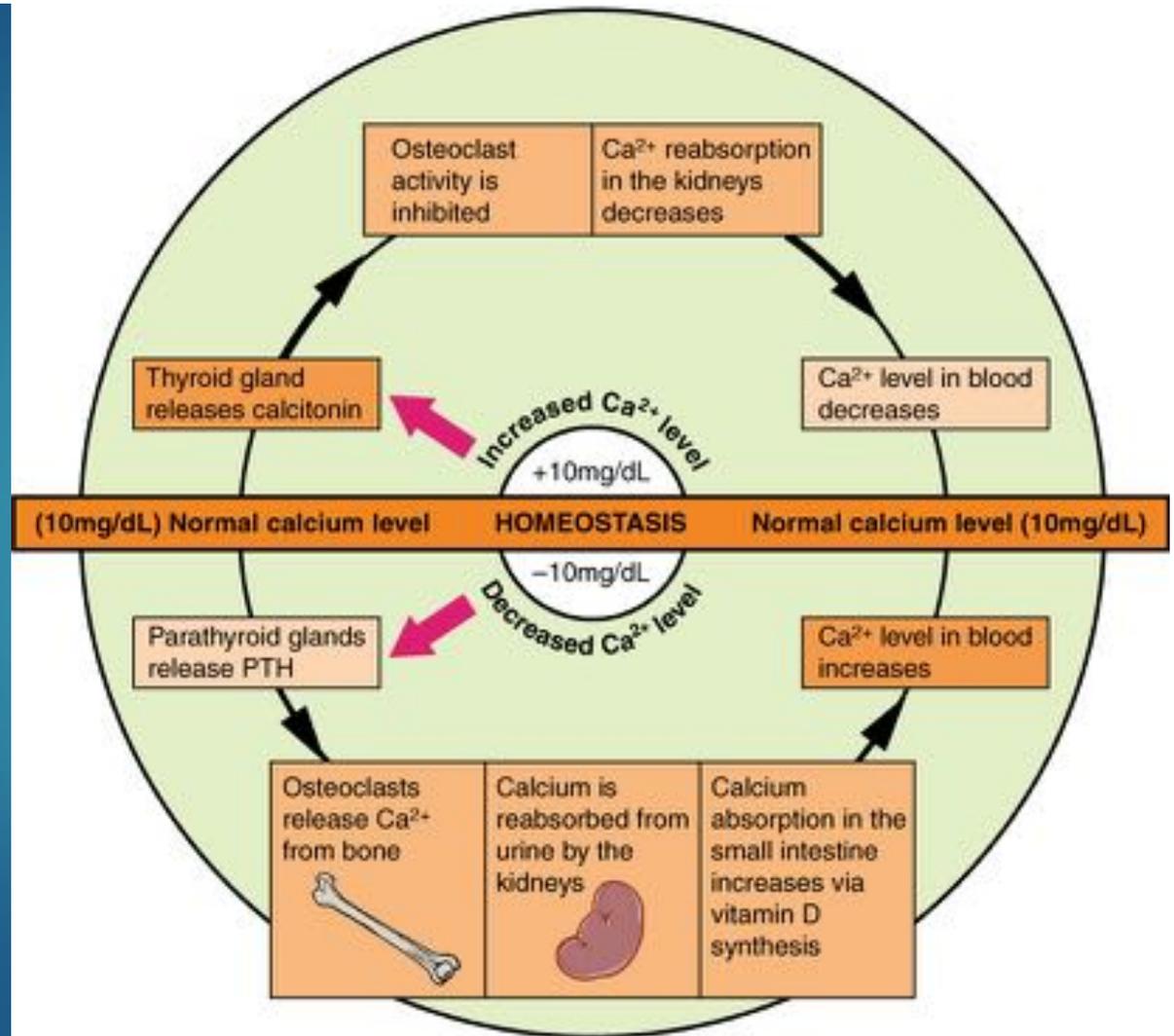
- ▶ Bone strength determined by collagenous protein and mineralized osteoid. The greater the concentration of **calcium**, the greater the compressive strength
- ▶ **Osteoclasts** responsible for bone resorption and osteoblasts for bone formation
- ▶ **Osteoblasts** secrete and mineralize osteoid and control resorption carried out by osteoclasts
- ▶ Osteoclasts need weeks to resorb bone, while osteoblasts need months to produce new bone

FACTORS

- ▶ **Aging** and **loss of gonadal function** are the two most important factors contributing to osteoporosis
- ▶ **Estrogen deficiency** accelerates bone loss in postmenopausal women (and plays a role in men) due to excess osteoclast activity
- ▶ The bone loss related to aging involves a progressive decline in the supply of osteoblasts relative to the demand
- ▶ Vit D deficiency can cause *secondary hyperparathyroidism* via decreased intestinal calcium absorption

CALCIUM

- ▶ Calcium insufficiency or impaired intestinal absorption can lead to secondary hyperparathyroidism
- ▶ PTH increases calcium resorption from bone, decreases renal calcium excretion and increases renal vit D



FACTORS

- ▶ Corticosteroids inhibit osteoblast function and enhance osteoblast apoptosis
- ▶ Collagen abnormalities
- ▶ Lymphocytes and cytokines
- ▶ Prenatal and postnatal factors influence adult bone mass
 - ▶ Mother's health in pregnancy
 - ▶ Infant birth weight and child's weight at 1 year were all predictive of adult bone mass in the 7th decade for men and women

IMPORTANT LINKS / REFERENCES

1. <https://emedicine.medscape.com/article/330598-overview>
2. <https://www.merckmanuals.com/professional/musculoskeletal-and-connective-tissue-disorders/osteoporosis/osteoporosis>
3. <https://www.uptodate.com/contents/pathogenesis-of-osteoporosis#H4206911>