OsteoPorosis (OP)

- Epidemiology
  - Normal: people reach peak bone mass at ~20yo and then plateau for 10-20yrs after which one loses ~0.4% of bone mineral density per year (therefore the goal is to reach the highest peak bone mass as possible when young)
  - 50yo white woman has a 50% lifetime r/o an osteoporotic Fx
  - Variable Ratio of F:M depending on Fx (Vertebral 7F:1M, Hip 2F:1M, Arm 1.5F:1M)
- Mechanism
  - (1) inadequate peak bone mass (the skeleton develops insufficient mass and strength during growth)
  - (2) excessive bone resorption
  - (3) inadequate formation of new bone during remodeling (the result is decreased bone density w/ less collagen and mineralization)
- Etiology
  - Primary (Involutional)
    - Female
    - White/Asian > AA/H
    - FHx
    - Small Body Size
    - Decreasing Gonadal Function
    - Sedentary Lifestyle
  - Secondary
    - Medications
      - Systemic Steroids
        - most common secondary cause
        - >5mg/d for >3mo then Qyr DEXA, Ca/VitD supplementation, bisphophonate Tx
      - Other: Heparin, Thyroxine, Anticonvulsants, Methotrexate, Cyclosporine
    - Endocrine
      - Cushings
      - HyperTH
      - Hypogonadism (Athletic Amenorrhea, Late Menarche, Early Menopause, Turner's, Klinefelters)
      - HyperPTH
      - T1DM
      - Hyperprolactinemia
      - Acromegaly
    - Nutritional
      - Alcohol
        - second most common secondary cause
      - Eating Disorders
      - Calcium/VitD Deficiency
      - Malabsorption Disorders
    - Malignancy
      - Multiple Myeloma
      - Lymphoma/Leukemia
    - Connective Tissue Diseases
      - Osteogenesis Imperfecta
      - Ehlers-Danlos Syndrome
      - Marfan's Syndrome
    - Systemic Inflammatory Conditions
      - SLE, IBD, etc
- S/S
  - OP is asymptomatic until there is a Fx at which point pt sometimes p/w pain or other Sx but even then many Fx are asymptomatic
    - Trabecula OP
      - Anterior Compression Fx of Mid-Thoracic to Upper-Lumber Vertebra
        - pain, exaggerated kyphosis with "Dowager's Hump", decreased height
      - Distal Radius Fx
      - Femoral Neck Fx
        - NB 15% mortality within first year and if pt does live morbidity is devastating with most never getting back to their feet
    - Cortical OP
      - Pelvic Fx
      - Tibial Fx
      - Femoral Neck Fx
- Dx
  - Bone Mineral Density (BMD) Measurements

- NB First Exclude Secondary Causes then proceed with BMD Measurements
- DEXA (Dual Energy X-ray Absorptiometry)
  - Uses two x-rays and subtracts the mineralization of surrounding soft tissue from that of bone
  - T Score: how many deviations below the mean for a 35yo pt w/ the same sex and race
    - > -1.0 SD (normal)
    - -1.0 – -2.5 SD (osteopenia)
    - < -2.5 SD (osteoporosis)
    - Usually do spine and hip
    - NB most old people are a little bit below the mean of a 35yo it is when they are really below the mean like <2.5 that osteoporosis is made, if you are concerned about other secondary causes of osteoporosis that are superimposed upon primary osteoporosis then check a Z-score which adjust to not only sex and race but also age
    - NB for every 1 SD below mean there is a 2x increase r/o fracture
    - NB after you measure a central BMD some argue that you might be able to follow up with a peripheral BMD of the distal forearm and middle phalynx of the non-dominant hand
- QCT (Quantitative Computed Topography)
  - Most expensive and higher dose of radiation but most sensitive b/c assess trabecular bone loss much better
- DPA (Dual Photon Absorptiometry)
- NB plain films are not sensitive enough to diagnose OP until a >50% decrease in density has occurred at which a visible lucency, "codfish (biconcave vertebra with expansion of intervertebral disc) vertebra", etc can be appreciated, but even then only reliably assesses the cortex not trabeculae which is the primary form of bone affected
- NB hypertrophy that occurs in OA can actually give you a false negative or at least overestimate bone density (best to take measurements of the hip where this bony change does not occur)
- Indications for DXA Scan ?
  - Women >65yo
  - Women >50yo with ≥1 Fx or RF
  - Pts who have plain X-ray abnormalities
  - Pts who have conditions that can lead to secondary OP
  - Q1-2yrs to monitor efficacy of OP therapy

- Prevention
  - Pre: Ca/VitD
  - Post: " " HRT or Bisphosphonates
- Treatment
  - Indications for Initiating Treatment
    - Osteoporosis OR Osteopenia with ≥1 RF (Fx after 40yo, FHx of Fx after 40yo, smoking, weight <127lbs) = Rx meds
    - Osteopenia = Ca/VitD
  - Supportive Care
    - Educate
    - Maintain Body Weight
    - Strengthening Exercises and Walking increases bone formation, improves balance so you don't fall, etc (excessive exercise where you become amenorrhic also causes osteoporosis)
    - Avoid Stuff that increases r/o fractures like poor vision, benzo, caffeine, etc
    - Fx Tx: Analgesics, Warm Moist Compresses to Prevent Muscle Spasm, Bed Rest, Gentle PT, External Supports (splints, corsets, et al), Assistive Devices (canes, walkers, et al), Muscle Relaxants
  - Primary Care
    - Optimize VitD/Calcium (refer)
    - Estrogen/Testosterone HRT (controversial if anything consider Raloxifen first)
    - Bisphosphanates
      - pyrophosphate analogues that inhibit osteoclasts resorption
      - Tx and Prevention of Osteoporosis:
        - PO Qwk: alendronate (Fosamax), risedronate (Actonel) (Qwk Fosamax has now become generic so use first)
        - PO Qmo: alendronate (Fosamax), risedronate (Actonel), ibandronate (Boneva) (indicated if pt is non-compliant w/ Qwk)
        - IV Qyr: zoledronate (Reclast) (indicated if pt has SEs to ones above)
      - Tx of Metastatic Bone Disease: pamidronate (Aredia), zoledronic acid (Zometa)
      - poor bioavailability therefore take on empty stomach
      - SEs: esophageal irritation (prevent by take in morning, on an empty stomach, with 8oz of water, remaining upright for 30-60min and don't eat until after then), osteonecrosis of the jaw only occurs when pt is on chemo (type?) or undergoing jaw surgery therefore stop as early as possible before chemo/surgery and then restart 1mo after
      - Stop after 5yrs of use
    - Calcitonin
      - Salmon Calcitonin 50IU SC QID or 200IU IN QD

        - SEs: SC (N, flushing) IN (nasal congestion, rhinitis)
        - Problem: (1) only seems to decrease central (spine) bone loss and only mildly while having no effect on peripheral bone loss, (2) expensive, (3) inconvenience of administration
        - Good: there is some evidence that calcitonin has an analgesic effect
        - Overall Usage: most doctors use calcitonin to treat acute significantly symptomatic vertebral fractures for a short period of time
- PTH
    - Recombinant Injectable PTH aka teriparatide (Forteo)
    - Mechanism: pulsatile PTH normally resorbs bone but Forteo which is given SC QD actually stimulates bone formation
    - Problem: (1) expensive (2) can only be used for 2yrs (3) increased r/o osteosarcoma therefore avoid in pts w/ RFs
    - Good: only true anabolic agent stimulating osteoblasts (all of the above are antiresorptive)