Bone, Joint, and Muscle Pathology Summary

1. Bone: Congenital/Hereditary Disorders

Osteogenesis Imperfecta

- Many types
- Mutations in type 1 collagen genes
- Multiple fractures
- Dentinogenesis imperfecta

Achondroplasia

- 20% autosomal dominant; 80% random mutations
- Most common form of inherited dwarfism
- Epiphyseal plates close prematurely
- Cor pulmonale

Osteopetrosis

- Autosomal dominant or recessive
- Osteoclast hypofunction causes very dense bone (“marble” bone)
- AR: severe, with anemia, nerve entrapment, hydrocephalus, infections, fractures
- AD: milder
- Wide metaphyseal and diaphyseal regions (“Ehrlenmeyer flask”)

2. Bone: Inflammatory Disorders

Fracture

- Inflammatory phase (first week; clot and callus formation)
- Reparative phase (months; callus bridge)
- Remodeling phase (weeks-years; remodeling of callus)

Osteonecrosis

- Ischemic death of bone without infection
- Physical event: trauma, embolism, radiation
- Systemic disease: sickle cell, lupus, gout
- Toxic effect: corticosteroids, alcoholism

Myositis Ossificans

- Reactive bone formation within muscle
- Caused by trauma
- Looks like a neoplasm
- Lower limbs

Osteomyelitis

- Bone inflammation caused by infection
- Staph, Strep, E. coli, N. gonorrhea, H. influenzae, Salmonella (esp. in patients with sickle cell disease)
- Results from direct penetration or hematogenous spread
- Sequestrum (necrotic bone fragment) may be surrounded by Brodie abscess (pus and reactive bone) and may have a cloaca (a draining sinus). Involucrum (new periosteal bone) eventually seals off the sequestrum.

3. Bone: Metabolic Disorders

Osteoporosis

- Decreased bone mass per unit volume
- Normal ratio of mineral to matrix
- Primary occurs in elderly women (decreased estrogen, less exercise)
- Secondary occurs with corticosteroid use, alcoholism

Osteomalacia

- Inadequate mineralization of newly-formed bone matrix leads to osteopenia
- In children, called rickets (pectus carinatum, dental abnormalities)
- Vitamin D deficiency

Hyperparathyroidism

- Definition: increased serum parathyroid hormone (PTH)
- PTH causes increased serum calcium/decreased serum phosphate
- Signs/sx: stones (kidney stones), bones (brown tumors), moans (depression), groans (GI problems)
- Can be primary (due to parathyroid adenoma) or secondary (due to chronic renal failure, which makes you retain phosphate/excrete calcium – so the parathyroids respond by secreting more parathyroid hormone!)

Paget Disease

- Disorder of bone remodeling
- Three phases (hot, mixed, cold)
- Bones of skull: cotton wool appearance, hypercementosis of jaws
- Tests: alkaline phosphatase, urine hydroxyproline

4. Bone Neoplasms

Fibrous Dysplasia

- Benign tumor that arises during bone development
- Can be monostotic (involving one bone) or polyostotic (involving multiple bones)
- Ground glass appearance on xray
- McCune Albright syndrome: polyostotic disease plus café-au-lait spots, endocrine abnormalities (precocious puberty)

Other benign bone neoplasms

- Osteoma: occurs in skull in older adults
- Osteoid osteoma: occurs in legs in teenagers
- Chondroma: occurs in hands and feet in young adults
- Osteochondroma: occurs in long bones in teenagers
- Giant cell tumor: occurs around knee in young adults

Osteosarcoma

- Malignant bone-forming tumor
- Most common primary bone tumor
- Distal femur/proximal tibia
- Most occur in 10-20 yo; second peak in elderly (esp. those with Paget disease)

Chondrosarcoma

- Malignant cartilage-forming tumor
- Leg, pelvis in 40-60 yo

Ewing Sarcoma

- Malignant bone tumor of unknown origin
- Most occur in children, most in femur or pelvis
- Composed of small, round, blue cells
- t(11;22) fuses EWS gene to FLI1 gene

V. Joint Disorders

Osteoarthritis

- Chronic degenerative disease affecting articular cartilage
- Primary (due to a cartilage defect) or secondary (due to trauma)
- Typically affects weight-bearing joints and fingers
- Eburnated (very dense, ivory-like) bone, Heberden nodes

Rheumatoid Arthritis

- Chronic, systemic, autoimmune, inflammatory disease
- Initial involvement is symmetrical and in hands
- Begins as a synovial disease (hyperplastic synovium, pannus)
- Rice bodies, rheumatoid nodules

Spondyloarthropathy

- Group of diseases including:
- Ankylosing spondylitis (spine in young men)
- Reactive arthritis (patients also may have conjunctivitis, non-gonococcal urethritis, and oral lesions
- Arthritis occurring in patients with psoriasis or inflammatory bowel disease

Gout

- Increased serum urate leads to urate crystals in joints, kidneys
- Primary or secondary (malignancy, alcoholism)
- Acute gout (podagra), tophaceous gout (tophi in ear, Achilles tendon)
- Histology: granulomas with needle-shaped crystals

Joint tumors and tumor-like things

- Ganglion cyst: wrist
- Synovial cyst: herniation of synovium through joint capsule ("Baker cyst" when it's behind the knee)
- Pigmented villonodular tenosynovitis (ouch)
- Giant cell tumor of tendon sheath (most common tumor of hand; benign)

6. Muscle Disorders

Duchenne Muscular Dystrophy

- X-linked
- Deletion of dystrophin gene
- Degeneration of muscles
- Wheelchair-bound by age 10-15; death from respiratory insufficiency or arrhythmia

Myotonic Dystrophy

- Autosomal dominant
- Atrophy of type I fibers, hypertrophy of type II fibers
- Muscle weakness and sustained muscular contractions
- Gets worse from one generation to next

Myasthenia Gravis

- Autoimmune disease in which autoantibodies bind to and block Ach receptors
- Muscles fatigue quickly
- Extraocular muscles and muscles of extremities
- Most patients have either thymoma or thymic hyperplasia; thymectomy is sometimes curative