General
- DIP is NOT involved in RA

Connective Tissue Disease (CTD) NB don’t use the term “Collagen Vascular Disease (CVD)” b/c not all of these processes affect collagen and the abbreviation CVD is often confused for CerebroVascular Disease
- Autoimmune
  - SLE
  - RA
  - Sjogren’s
  - Sclerosis
  - Spondyloarthropathis
  - Crystaline Disease
  - PM/DM
  - Vasculitis
  - Undifferentiated Connective Tissue Disease (UCTD) S/S:rheum S/S but they do not fulfill criteria for a specific CTD
  - Mixed Connective Tissue Disease (MCTD) S/S: mixed features of SLE + SS + PM, Dx: anti-U1-RNP
- Acquired
  - Scurvy
  - OA
  - OP
- Genetic
  - Sarcoma
  - Osteogenesis Imperfecta
  - Ehlers-Danlos Syndrome
  - Marfan’s Syndrome

How to Approach Specific MS Problems?
- Vasculitides Inflammation of vessels that causes stenosis, obstruction, or attenuation resulting in ischemia, aneurysms, or hemorrhage, respectively
  - Primary
    - Large Vessel
      - Temporal / Giant Cell Arteritis
      - Takayasu Arteritis
    - Medium Vessel
      - Polyarteritis Nodosa
    - Small Vessel
      - +ANCA
        - Wegener’s
          - Microscopic Polyangitis
        - Churg-Strauss
      - +IC
        - Henoch-Schönlein Purpura
        - Cutaneous Leukocytoclastic Angitis
          - Serum Sickness
          - 2/2 Cryoglobulinemia
          - 2/2 Connective Tissue Disease
    - Other Primary
      - Kawasaki Disease
      - Chilbain’s
      - Buerger’s Disease aka Thromboangitis Obliterans
      - Behçets Disease
  - Secondary (usually skin involvement)
    - Medications: many
    - Infections: Hepatitis, HIV, Rickettsial, Meningococcal, Bacterial Endocarditis, etc
    - Neoplasms: Liquid Tumors
    - Cholesterol Emboli Syndrome
- Myositis (refer to Neuro notes)
- Arthralgia/Arthritis
  - Acute: Trauma, Crystal, Coagulopathy, Infection (bacterial and viral), Reactive, Serum Sickness, Early Chronic Cause
  - Chronic
    - Non-Inflammatory (Arthralgia)
      - OA
      - Avascular Necrosis (infarction of bone b/c of interruption of arterial supply from SCD, usually at hip, 2/2 alcohol, chronic steroids, CTD, SCD, decompression syndrome aka "the bends" and various pediatric syndromes: Legg-Calve-Perthes Dz, Osgood-Schlatter Dz, Kohler Dz)
- Neuropathy
- Tumor
- Hypertrophic Pulmonary Osteoarthropathy
- Hemochromatosis
- Achromia from Alkaptonuria

### Inflammatory (Arthritis)

#### Mono
- Early Oligo/Poly
- Infection (TB, Lyme)

#### Oligo
- Early Poly
- Seronegative

#### Poly
- CTDs

#### Peri-Articular
- Bone: fracture, metastatic/primary cancer, etc
- Tendons: -itis, Strain, Tear, Enthesitis (infl where tendons attach to bone), Tenosynovitis (infl of synovial sheath around tendons where they are subject to great amounts of friction)
- Ligaments: Sprain, Tear
- Cartilage: Tear
- Muscle: Pull, Tear, Spasm
- Menisci: Tear
- Bursa (a total of 150 closed synovial sacs that fxn to facilitate gliding of structures around each other): -itis
- Nerve: Entrapment
- Fascia: -itis
- Other: Ganglion

<table>
<thead>
<tr>
<th>Class</th>
<th>Examples</th>
<th>Look</th>
<th>WBC/mm³</th>
<th>PMN</th>
<th>SS&amp;Cx/Crystal</th>
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<tbody>
<tr>
<td>Non-Inflam</td>
<td>OA, Trauma Clear Yellow</td>
<td>200-2,000</td>
<td>&lt;50%</td>
<td>-</td>
<td></td>
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<tr>
<td>Inflam</td>
<td>CTDs     Cloudy Yellow</td>
<td>2,000-20,000</td>
<td>50-70%</td>
<td>-</td>
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<tr>
<td>Septic</td>
<td>Bacterial Cloudy Yellow</td>
<td>20,000 usually &gt;100,000</td>
<td>70%</td>
<td>-</td>
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<tr>
<td></td>
<td>RA       Purulent</td>
<td>&gt;100,000 usually &gt;100,000</td>
<td>&gt;70%</td>
<td>-</td>
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- NB you never check protein, LDH, glucose, etc

#### Tenosynovitis
- S. aureus infection of tendon
- Usually there is a h/o trauma to the palmar side of a finger with the flexor digital tendon being the most common tendon
- Tx: Emergency b/c delay in Tx will result in tendon necrosis therefore if you suspect immediate iv abx and refer to a hand surgeon for surgical drainage

#### Bursitis
- S. aureus infection of bursa
- distinguished by arthritis b/c (1) FROM and (2) lack of pain during passive extension/flexion
- overlying cellulitis is common
- Tx: oral abx x1-2wks

#### Septic Arthritis
- Mechanism
  - Hematogenous Spread (bacteremia) occurs in rapidly growing bone and vertebra
  - Contiguous Spread (soft tissue infection) refer above
  - Direct Inoculation (surgery/trauma) esp if hardware is present
  - Pre-Existing Rheumatic Conditions
- S/S
  - Acutely Painful (esp at rest w/ no movement or with passive movement)
  - Arthritis (85% Monoarticular vs 15% Polyarticular) with Systemic Systems and
- Diagnosis
  - Arthrocentesis: Septic Synovial Fluid
  - NB crystals do NOT rule out infection
  - Synovial/Blood Gram Stain (60%+)
IVDU
Diabetes
Chronic Renal Disease
Prosthetics

Overall infection rate in total joint replacement is 1%
- 70% occur before 6mo and are due to intraoperative sources, pts w/ obvious inflammation
- 30% occur after 6mo and are due to hematogenous spread, pts w/ chronic joint pain

b/c bacteria adhere, form a glycocalyx, and coalesce forming a biofilm, bacteria can persist despite abx therapy hence the prosthetic must be removed

if you observe radiographic loosening, lucency, et al (a very non-specific finding) use PCR to detect bacterial 16s ribosomal RNA so as to distinguish it from aseptic loosening (radionucleotide scanning, joint aspiration, etc is not sensitive enough)

overall cure rate following debridement, 6-8wks abx, and prosthetic removal with reimplantation/arthrodesis is still only 70%

Pathogen
- Non-Gonococcal
  - Staph aureus (60%)
  - Beta Hemolytic Strep (15%)
  - GN (15%)
  - Other (5%)
  - SCD pts have Salmonella
  - Dialysis pts have Pseudomonas
- Gonococcal (Disseminated Gonococcal Infection)
  - General
    - Seen in 1% of GC infection, pt is usually younger, female (3F:1M), and otherwise healthy while NON-gonococcal arthritis is usually seen in older, male pts w/ pre-existing joint conditions
  - Mechanism
    - IC Deposition (also seen in Hep B and Bacterial Endocarditis)
  - Symptoms Suggestive of DGI Arthritis
    - Migratory Polyarthritides of Small/Mod-Sized Joints (not NON-Migratory)
    - Monoarthritides of Mod-Large/Large Sized Joints as seen in regular bacterial arthritis
    - Dermatitis (painless, pustular lesions)
    - Tenosynovitis
  - Diagnosis
    - Cultures of Synovial Fluid, All Mucosal Surfaces (oral/genital/rectal), and Blood with Thayer-Martin Medium and Chocolate Agar
  - Treatment
    - 3rd Generation Cephalosporin given IV (ceftriaxone or cefotaxime) x7-14d and don’t forget concurrent Chlamydia infection treatment w/ doxycycline
    - NB pts usually have Asymptomatic mucosal (oral/genital/rectal) infections (so even if the pt does not complain of discharge, dysuria, et al still consider in a young pt)
    - NB DGI tends to occur in women at the time of their menses, during pregnancy, and postpartum

Leukocytosis (but these classic features are only seen in 75% of pts)
- Rule out concurrent fistula, abscess, osteo

Most Common Joints
- Monoarticular (85%)
  - Knee (55%)
  - Large Sized Joints (shoulder/hip) (15%)
  - Mod-Large Sized Joints (elbow) (5%)
  - Mod-Small Sized Joints (wrist/ankle) (5%)
  - Small Sized Joints (hand/foot) (1%)
- Polyarticular (15%)
  - NB pts are typically old, have concomitant RA, lack fever or leukocytosis, and have poorer prognosis otherwise same as monoarticular infectious arthritis

& Culture (70%+)
- Bacteria
  - Ab Titers (Lyme, Virus)
  - Biopsy (Fungal)
  - Dx: PCR of fluid for Gonorrhea, Borrelia, Ureaplasma, Yersinia, Chlamydia

Treatment
- Bacterial arthritis is a medical emergency b/c of significant M/M
- BS IV Abx 2-4wks
- Daily Aspiration +/- Arthroscopic/Surgical Lavage
- NO NSAIDs
- concomitant use of dexamethasone is helpful b/c when you give abx you destroy bacteria releasing even more antigens
- if a prosthesis is in place remove it, place an abx impregnated spacer, and continue IV abx x6wks, then place new prosthesis
Osteomyelitis

**Mechanism**
- Hematogenous Spread (bacteremia) occurs in rapidly growing bone and vertebra, 50% is \(S. \) aureus for all types of osteo, SCD pts have Salmonella, dialysis pts have Pseudomonas
- Contiguous Spread (soft tissue infection) refer above
- Direct Inoculation (surgery/trauma) esp if hardware is present

**Definitions**
- Acute (<10d) and cure is likely possible
- Subacute (10d-3mo)
- Chronic (>3mo) and cure is likely impossible

**Terms**
- sequestrum (bone necrosis)
- involucrum (new bone growth around bone necrosis) collectively acting as a protected sanctuary for bacteria
- nonspecific/vague pain around site and occasionally w/ systemic symptoms but many times not esp the less acute the infection, sometimes inability to bear weight on limb, stiff joints, etc
- sometimes a draining sinus tract is present if not contiguous spread or direct inoculation
- Children: long bones vs Adults: vertebra vs IVDU: sacroiliac/sternoarticular areas

**Diagnosis**
- Xrays show changes after 2wks of infection onset (periosteal reaction, osteolysis, separation of necrotic bone, Brodie’s abscess, demineralization) but remember than a normal Xray does not r/o osteo
- CT has better sensitivity but not as good as MRI
- If hardware then order an Indium/Gallium scan
- Bone Scan (sensitive but not very specific)
- APRs
- MRI is the definitive test
- if one can touch bone with a steel probe thru a skin lesion the sensitivity for osteo is very high
- Bone Cx by surgery or IR w/ imaging guidance
- Bld Cx is only 50% sensitive

**Treatment**
- Surgery: debridement of infected and devitalized bone, obliteration of dead space and placement of wound vac, removal of foreign bodies, prn revascualrization, possible amputation
- Medical: IV abx (often
Bone

- Components
  - Organic Osteoid (protein = collagen) + Elements (cells)
    - Scurvy (seen in sailors, Vit C deficiency therefore unable to hydroxylate AA (P and K) resulting in deficient collagen synthesis resulting in decreased osteoid deposition resulting in subperiosteal hemorrhage, etc)
    - Osteogenesis Imperfecta (refer below)
  - Inorganic Mineral (hydroxyapppetite = Ca/PO₄/Mg/HCO₃, psuedofractures aka radiolucent zones representing the most dimineralized areas)
    - Childhood Rickets / Adult Osteomalacia Mech: poor mineralization 2/2 dietary VitD deficiency, Sx: fatigue, bone pain, fractures, bowing of legs, “Rachitic Rosary” (thickening of costochondral jxn like a string of beads), “knobby” wrists/knees, pigeon breast, growth failure, “craniotabes” (thinning of skull) in infants, Dx: Looser’s Zone aka Psuedofractures (bilateral/symmetric lucencies perpendicular to bone surface esp at inner femur, pubic rami, outer scapula due to where major arteries cross bone with arterial pulsation causing trauma) also overall bone has a coarsened texture
    - Osteitis Fibrosa Cystica (refer to CKD)
    - Osteopetrosis aka Marble Bone Dz aka Albers-Schonberg Dz (AR/AD mutation of osteoclasts resulting in increased bone mineralization resulting in fractures, BM failure, CN damage)
    - Pagets aka Osteitis Deformans
      - Mech: increased bone turnover/remodeling such that the bone that is laid down has disrupted architecture
      - RFs: Old White Men
      - Cause: unknown but likely 2/2 viral infection w/ genetic predisposition
      - Location: affects exaxial bone but in general not all bones and only part of bones
      - Three Stages: (1) Osteolytic (2) Mixed (3) Osteoblastic w/ sclerosis
    - Osteoporosis (both decreased organic and inorganic components)
  - Other
    - Pagets aka Osteitis Deformans
      - Mech: Increased bone turnover/remodeling such that the bone that is laid down has disrupted architecture
      - RFs: Old White Men
      - Cause: unknown but likely 2/2 viral infection w/ genetic predisposition
      - Location: affects exaxial bone but in general not all bones and only part of bones
      - Three Stages: (1) Osteolytic (2) Mixed (3) Osteoblastic w/ sclerosis
    - S/S: most are asymptomatic w/ Dx obtained after incidental Xray or because of isolated increase in AlkPhos but if symptomatic then dull achy bone pan/deformity/Fx, arthritis, warmth of skin over involved bone and high output CHF 2/2 AV shunting, entrapment neuropathy w/ hearing loss and radiculopathy, cranium is so heavy pt can’t keep it up, obstructive hydrocephalus causing HAs, osteosarcoma
      - Lab: increased alk phos but nl Ca/Phos, high urinary hydroxproline and N-telopeptide then check Bone Scan
      - Dx: advancing wedged shaped resorption front at either end of the long bones or circumscribed osteolytic lesions in skull and then if osteoblastic w/ sclerosis phase then you will see cotton-wool spots representing increased bone density
      - Tx: most cases are asymptomatic therefore no Tx but if Sx, lytic dz, young age, etc then bisphosphonates
    - Fibrous Dysplasia (replacement of bone with fibrous tissue)
    - Avascular Necrosis
      - Physiology
        - Osteoblasts on bone make osteoid and stimulates (via bone specific alkaline phosphatase, osteocalcin, procollagen) secretion of a base which calcifies the osteoid and then the osteoblasts become osteocysts as they are encased in bone and communicate via Haversian cannels
        - Osteoclasts w/in bone break down osteoid and stimulates (via n-telopeptide collage, acid phosphatase, TART, hydroxyproline, pyridinoline, decogenyronilinolne) secretion of an acid which decalcifies the osteoid forming Howship Lacunae
      - Anatomy
        - Epiphysis (ball) and Physis (in b/t ball and shaft and represents growth plate) and when they fuse they form the Metaphysis (ball)
        - Diaphysis (shaft) composed of Cortical Bone and Trabecular Bone w/ BM
    - Basic Treatment
      - 1st Supportive Care and Meds
        - RICE first 5d after an acute injury then MASH for chronic management
          - RICE: Rest, Ice (frozen peas wrapped w/ towel x20min Q6hrs, NB don’t fall asleep), Compression, Elevate (above level of heart)
MASH: Movement exercises (maintain ROM), Alternate activities, Strength exercises, Heat (heat blanket x 20min Q 6hrs, NB don't fall asleep)
- NSAIDS/Tylenol
- OTC NSAIDS Q 6hr vs Rx Mobic Qd

2nd Trigger Point Injections and Joint Injections
- 10cc using 24 Gauge needle
- 5cc 0.5% long acting Marcaine + 4cc 1% short acting Lidocaine + 1cc 40mg/dL Kenalog or use separate injections of each
- remember sugars will rise
- can inject up to 4 times a year
- last resort is hyaluronic acid injection
- Knee: have pt sit in chair w/ knee at 90 degrees, then numb area medial to patella w/ lidocain/marcaine (skin and then deeper towards center of knee w/ needle perpendicular w/ skin, then inject hyaluronic acid the same, it is very viscous so it will take longer)

3rd Ortho Consult
NB some pts have deep MS pain localized to one area where all causes have been excluded, this is called Myofascial Regional Pain Syndrome, Tx: trigger point injection w/ steroids/lidocaine/BoTox or simply “dry needling”

Fracture Classification
- Name of Fractured Bone
- Type of Fracture: Closed (skin intact) vs Open/Compound (skin open), Simple (one clean break generating two pieces) vs. Fragmented/Comminuted (one break generating two pieces plus multiple small pieces at the break) vs Segmental (several breaks generating multiple pieces), Complete (cortex to cortex) vs Partial/Incomplete/Hairline
- Geometry of Fracture: Transverse, Oblique, Spiral
- Subgroup Description: Displacement, Angulation, Avulsion, Scissoring
- Callus formation on X-ray in 6wks, woven bone is replaced by lamellar bone in 18mo but strength is 80% after 3mo
- Treatment
  - Immobilization Cast (“Splinting”)
    - Type 1: Plaster
      - Measure length of plaster and fold out 12-15 layers
      - Measure length of padding longer/wider than plaster
      - Submerge plaster into water and strip excess water
    - Type 2: Fiberglass
      - Ulnar/Radial Gutter Splint, Cock-Up Splint (volar surface from midforearm to MCP keeping wrist at partial extension aka neutral position), Thumb Spica Splint (wraps from ulnar side of forearm to radial thumb)
  - Functional Cast
  - Traction Device
  - Open Reduction w/ Internal Fixation (surgery “opens” up wound and uses pins, screws, plates, etc over fracture site to reduce it)
  - Open Reduction w/ External Fixation (surgery “opens” up wound and uses pins, screws, plates, etc above and below fracture site which are attached to bars on the outside to reduce fracture)

Neck Pain
- Chronic Mechanical Neck Disorder: Mech (muscle tension, incorrect posture, etc), S/S (chronic neck pain/stiffness, tension headaches), Tx (most improve in 1-3mo with conservative treatment, MASH w/ NSAIDs, muscle relaxants, don't bed rest just slow down, consider acupuncture/massage/TCAs, PT/OT, back braces, ergonomic chairs, back exercises, posture training, soft cervical collar)
- Acute/Chronic Cervical Radiculopathy: Mech (2/2 foraminal encroachment from degenerative arthritis, spondylosis, osteophyte formation, herniated disc), S/S (usually C5-6, chronic unilateral paresthesia/numbness/pain down arm, Spurling Maneuver: pain elicited when pt rotates/extends neck towards affected side), Tx: (as above and steroid injections but eventually pts need surgery w/ laminectomy and discectomy if herniation is the problem)
- Acute Cervical Strain aka Acute Torticollis aka “Crick”: Mech (sudden spasm of neck muscles from stress, prolonged odd position, or sudden twist but no true trauma), S/S (palpable spasm, TTP on involved side, difficulty moving neck), Tx: (self-limited lasting a few days, MASH, soft cervical collar)
- Acute Whiplash: like torticollis but diffuse TTP and 2/2 trauma esp car accidents, classically occurring 1d after incident, always rule out fracture, dislocation, and spinal cord injury with imaging

Shoulder Pain
- Young: Musculoligamentous Strain, Anterior Dislocation, Fx, Tendon Tear, Labrum Tear all 2/2 acute athletic injury
- Old: “Impingement Syndrome” most common b/c during abduction the rotator cuff and long biceps tendon get impinged, leads to all the problems below, 2/2 chronic repetitive use of shoulder esp overhead use
- Rotator Cuff (posterior pain)
Wrist/Hand Pain

- Tendonitis S/S: posterior shoulder pain, aggravated by reaching overhead aka abduction and lying on shoulder, subacromial TTP, aggravated when lying on shoulder at night, Tx: subacromial steroid injection, PT, Empty Can Maneuver (more pain and less ROM with abduction when shoulder internally rotated and wrist supinated like "emptying a can"), Supraspinatus Test (pain on resisted elevation of arm to 90 abduction/forward flexion w/ wrist supinated), Hawkins Test (at same time elevate and rotate internally at shoulder if pain is elicited then there is impingement), Neer's Test (complicated)
- Tendon Tear S/S: similar to tendonitis above but also weakness, Dx: MRI, Tx: chronic/partial tear conservative Tx but with acute/full tear then surgery, Drop-Arm Test (passively abducted at shoulder than have pt slowly adduct it, if it falls then there is a tear), Shrug Sign (can't shrug shoulders)
- Biceps (anterior pain)
  - Tendonitis S/S: anterior shoulder pain radiation to biceps, TTP over tendon in bicapital groove, Tx: conservative Tx, Yergason Test (flex at elbow to 90 with thumb up then resist the pt as the pt tries to supinate at wrist and flex further at elbow, if pain is elicited than tendonitis), Speed's Test (complicated)
  - Tendon Tear S/S: pain and weakness, Tx: surgical repair, Popeye Sign (bunching up of the lateral half of biceps belly on resisted elbow flexion/supination)

- Subacromial/deltoid Bursitis, local lateral TTP and sometimes bursa distension anterior to acromion, Tx: conservative then steroid injection then surgical excision
- Adhesive Capsulitis aka "Frozen Shoulder" Mech: inflammation occurring after non-use of shoulder b/c of other shoulder injury, S/S: not so much pain but stiffness and progressive global loss of ROM, Dx: clinical/MRI, Tx: conservative Tx esp PT then intra-articular steroid injections then surgery
- GH Instability 2/2 abnormal movement of humeral head relative to glenoid fossa, pts complain of shoulder slipping, Glide's Test (excessive forward and backward motion of humeral head) Sulcus Sign (applying distal traction on the upper arm produces a palpable gap b/t the humeral head and acromion) Tx: conservative Tx then surgery
- GH OA S/S: anterior shoulder pain, Dx: X-ray, Tx: refer vs Acromioclavicular OA local pain and pain with abduction >90degrees, pain when you adduct arm behind back, Tx: conservative the surgery (stabilize joint or resect part of the clavicle), Cross-Arm Test (evaluate at shoulder then cross arm over to their shoulder, if pain is elicited than there is AC arthritis)
- Referred Pain Mech: pleural inflammation, infradiaphragmatic irritation (hepatobiliary, abscess), heart (ACS, pericarditis), UE DVT, cervical radiculopathy, thoracic outlet syndrome, quadrilateral space syndrome, S/S: shoulder movement is normal and does not exacerbate pain

Elbow Pain (Cubitus Valgus/Varus w/ Carrying Angle of 5-10 males vs 10-15 female, check valgus/varus stress test)

- Lateral Epicondyliitis aka Tennis Elbow (only 10% is from tennis, seen in non-athletes who overuse their arm, 2/2 overuse of the forearm extensor muscles w/ repetitive supination w/ wrist flexed, local TTP, pain when resisting wrist dorsiflexion w/ elbow in extension, pain w/ resisted supination, Tx conservative and tennis elbow bands (placed proximally over forearm applying force over the extensor tendon changing force vector), prevention (stretching the tendon) vs Medial Epicondyliitis aka Golfer’s Elbow (common forearm flexor tendon, not as bad as and less common than tennis elbow, seen in pitching/golfing w/ repetitive pronation, local TTP, pain when resisting wrist palmar flexion w/ elbow in extension, pain w/ resisted pronation, often Cubital Tunnel Syndrome occurs, Tx same as above)
- Olecreanon Bursitis (pain, fluid distension at posterior elbow, can be 2/2 non-traumatic injury to elbow, infection, rheumatologic Tx: conservative, aspiration, compressive elastic band, protect elbow from friction, intrabursal steroids)
- Bicipital Insertional Tendinitis (local pain at insertion into radial tuberosity and with resisted elbow flexion) vs Triceps Insertional Tendinitis (opposite to above)
- Cubital Tunnel Syndrome (ulnar nerve) lies within the groove behind the medial epicondyle 2/2 prolonged elbow flexion, ulnar hand paresthesia when one awakes that is then relieved by extending the elbow, medial elbow pain, TTP, hypotenar muscle atrophy, when you tap ulnar groove during full elbow flexion Sx are reproduced kind of like Tinel/Phalen Test
- Pronator Teres Syndrome (median nerve) entrapment of median nerve as it passes thru the humeral/ulnar heads of pronator teres, anterior elbow pain made worse by resisted pronation, paresthesia
- Spiral Groove Syndrome (radial nerve) entrapment of radial nerve as it passes thru the forearm, lateral elbow and anterior forearm pain
- OA

Wrist/Hand Pain (check for effusions by palpating joints side-to-side, neuro, specific tests below, atrophy)

- Ganglion Cyst (soft-to-firm painless cyst containing clear viscous jelly like fluid attached to joint capsule 2/2 outpouching of synovium, often changes in size w/ wrist flexion/extension, aka "Bible Bump" b/c in the past pts would use the biggest book they had i.e. Bible and smash the cyst!, 65% dorsal wrist at scapholunate joint vs 20% volar wrist at radiocarpal joint, Tx: nothing or if symptomatic then aspiration and steroid/hyaluronidase injection but usually recurs therefore surgical resection is needed)
- Dupuytren's Contracture (nodular thickening, puckering, and contraction of the palmar fascia drawing one or more (usually the 4th) fingers into flexion at MCP, usually no pain, cannot fully extend affected digits, variable course, Etiology: AD, liver dz, DM, COPD, HIV, epilepsy, etc, conservative Tx to steroids to surgical fasciectomy w/ skin grafts)
- Carpal Tunnel Syndrome
  - Mech: entrapment of median nerve in carpal tunnel, (lateral carpal bones and flexor retinaculum
  - Etiology: CTS 2/2 flexor tenosynovitis or deposition from amyloid, hypoTH, urate, DM, obesity, acromegaly, paraplegia resulting in overuse, pregnancy, HD, HD, etc
• S/S: increased tunnel pressure, pain/paresthesia/paresis median nerve distribution, often awakens pts, thenar atrophy, Tinel (tap median nerve with wrist in slight extension reproduces symptoms) & Phalen (flex wrist for 30-60sec reproduces pain)

• Dx: clinical but can be confirmed w/ NCV, US, MRI

• Tx: conservative w/ volar wrist splint to keep wrist in slight extension esp at night b/c pts often sleep on their hand keeping it flexed, steroid injections, then surgical release

• Tenosynovitis (as tendons pass thru tenosynovial sheath inflammation and subsequent fibrosis can occur with repetitive movements resulting in local pain and impaired smooth gliding on tendons ultimately causing ‘catching/triggering/locking/snapping’, below are the most common)

  o “De Quervain’s” (first extensor compartment controlling the thumb, Finkelstein’s Test (make a fist with thumb under flexed fingers and the ulnar deviation aka stretching of the first extensor compartment causes pain), conservative Tx along w/ radial gutter splint immobilizing the wrist in slight radial deviation and extension, the CMC in slight abduction, the MCP in slight extension, the steroids the surgery)

  o “Trigger Finger” (repetitive trauma of any (usually just one) flexor compartment controlling any digit (usually thumb) results in granuloma formation at tendon sheath disrupting tendon movement, conservative Tx along w/ spint to keep MCP in slight flexion but free movement ofPIP/DIP then steroids then surgery)

  o “Infectious” (trauma leading to infection, Tx is surgical I&D and abx)

OA (above)

Back

• Acute Musculoligamentous Strain (70%): Mech (distinct episode esp lifting resulting in tear of lower lumber paraspinal muscle/ligaments), S/S (acute bilateral pain that radiates down but NOT below knee b/c no nerve injury, negative neuro exam), Tx (most improve in 1-3mo with conservative treatment, RICE then MASH, NSAIDs, muscle relaxants, don’t bed rest just slow down, consider acupuncture/massage/TCAs, PT/OT, back braces, ergonomic chairs, back exercises, posture training)

• Degenerative Disk Disease (15%): Mech (age related dehydration/narrowing/thinning of intervertebral disks), S/S (like above but no h/o distinct episode rather chronic pain), Tx (as above)

• Lumbar Disk Herniation (15%): Mech (posterior lateral herniation of nucleus pulposus thru the annulus fibrosis of L4-L5/L5-S1 disks impinging on L5/S1 nerve roots), S/S (acute then chronic unilateral radicular pain aka sciatica w/ pain radiating down past knee, straight leg raise test and sciatic notch TTP, positive nerve exam aka weakness/paresthesia), Tx (as above plus give oral steroids b/c the acute inflammation but if no improvement after 1wk or significant neuro dysex then surgery w/ disectomy, N9 you would think this would be a surgical problem but many times the herniation can reverse w/ conservative Tx)

  o Lying/Sitting Forward/Reverse ipsilateral/Contralateral Straight Leg Raise Test (pt is supine and leg is kept straight at knee and raised which stretches sciatic nerve and if impinging it elicits S/S)

  o Sciatic Notch TTP (deep in cheek lateral to SI joint)

  o L5: can’t dorsiflex big toe, loss of sensation of medial foot, pain below knee down lateral leg to dorsum of foot and then big toe (can’t walk on toes)

  o S1: can’t plantar flex ankle, loss of sensation of lateral foot, pain below knee down back leg to plantar of foot and then little toe (can’t walk on heels)

• Spinal Stenosis/Spondylolisthesis (rare): Mech (acquired or congenital stenosis), S/S (back pain during activity or extension and relief during rest or flexion), Tx: (surgery w/ laminectomy)

• Vertebral Compression Fracture (rare): Mech (acute pathologic fracture that occurs with osteoporosis, steroid use, neoplastic lytic process), S/S (back pain that does not extend down to legs but across around trunk), Tx: (surgery w/ vertebroplasty)

• Tumor (rare): Mech (trauma leading to infection, Tx is surgical I&D and abx)

• Cauda Equina Syndrome (rare): Mech (kind of like a massive disk herniation compressing multiple/bilateral nerve roots usually lower ones specifically S2-4), S/S (instead of unilateral S/S like herniation there is bilateral sciatica, saddle anesthesia, bladder/bowel dysfunction, impotence, etc), Tx: (neurosurgical emergency)

• Other: Rheum (spondyloarthropathy), vascular (AAA, etc), GI (pancreatitis, etc), GU (prostate, etc), Renal (stones, etc)

• Deformity (scoliosis, kyphosis, lordosis, etc)

Hip Pain (limp w/ antalgic gait aka change in walking to avoid pain, X-ray AP/Frog-Leg Lateral)

• Common Stuff (above)

  o OA (global decreased ROM, pain worse w/ weight bearing and better w/ rest, Xray shows spaces narrowing, cysts, osteophytes, subchondral sclerosis)

• Bursitis

  o Trochanteric (most common hip pain, deep/aching/burning pain over lateral hip, worse w/ any type of movement and laying on affected side at night, less w/ rest, 15% have a limp, TTP over the posterior greater trochanter, bursa usually not palpable unless inflamed, can be isolated but often is associated w/ other conditions (hip/knee dz, back dz, leg length inequality, obesity, etc) which cause tension on the bursa, pain w/ resisted hip abduction when lying on unaffected side, X-ray bursal calcifications, Tx: conservative Tx then steroid/anesthetic injection (have pt lay on unaffected side and flex hip to 45degrees the intersection of hip line and back line is usually where pain is at)

  o Illopssoas (painless lump in the groin vs painful inguinal syndrome w/ groin pain that radiates to buttock vs compression of femoral artery/vein/nerve, likely need imaging to make Dx, Psoas Sign: passive hip flexion triggers pain, Tx: same as trochanteric bursitis)
Knee Pain  (general Hx: knee replacement, arthroscopy, trauma, popping sensation b/c seen in meniscal/ligamentous tears, etc general PEx: alignment w/ varus vs valgus, effusions, TTP/Tests below, NB 1° Acute: trauma, infection, crystal vs 2° Chronic: OA (pain w/ activity, relief w/ rest, stiffness, chronic effusion, crepitus, decreased ROM), overuse syndromes)

- **Tendonitis**
  - **Adductor** (groin pain seen in athletes who do a lot of straddling as in horseback riding, gymnasts, dancing, etc, pain worse w/ passive abduction or active adduction against resistance, Tx: conservative Tx w/ stretching exercises then fluoroscopic guided steroid/anesthetic injection)

- **Entrapment Neuropathies**
  - **Meralgia Paresthetica** (compression of lateral femoral cutaneous nerve by obesity, gravid uterus, ascites, wearing a tight belt, etc causing unilateral paresthesia along anterolateral thigh, worse standing/hip-extension/walking, relieved w/ hip-flexion/sitting, Tx: benign often spontaneously regressing but if it doesn’t then Tx underlying cause then steroid/anesthetic injection)

- **Other**
  - **Avascular Osteonecrosis of Femoral Head** (seen in pts w/ trauma, SCD, alcohol abuse, gout, steroid use, hypercoagulable states, idiopathic, can have subsequent neck Fr/dislocations, Tx: analgesics and surgery)
  - **Leg Length Inequality** (Tx: heel lift)
  - **Snapping Hip Syndrome aka Cox Sultans** (hip pain + audible/palpable snapping sensation, sometimes sounds like hip is dislocating but it is not, variable causes including loose bony bodies in joint, taut iliotibial band slipping over the greater trochanter, etc, worse w/ walking up stairs, reproduced w/ flexing and internally rotating hip, Tx: reassurance)
  - **Iliotibial Band Shortening/Contracture** (+Ober’s Test: ?, Tx: stretching exercises)

- **Referred**
  - **Joint** (SI aka spondylarthropathies w/ TTP over SI joint, SI blurring on X-ray, pain w/ hip hyperextension, Lumbar Spine)
  - **Vascular** (AAA, iliac atherosclerosis)
  - **Ab** (intradominal, retroperitoneal)

**Knee Pain** (general Hx: knee replacement, arthroscopy, trauma, popping sensation b/c seen in meniscal/ligamentous tears, etc general PEx: alignment w/ varus vs valgus, effusions, TTP/Tests below, NB 1° Acute: trauma, infection, crystal vs 2° Chronic: OA (pain w/ activity, relief w/ rest, stiffness, chronic effusion, crepitus, decreased ROM), overuse syndromes)

- **Other: Knee Dislocations** (50% ant vs 50% post)
  - **Common Peroneal Nerve Damage** (trauma to lateral leg at fibular neck b/c nerve runs over bone resulting in no anterolateral lower leg sensation and “foot drop”), *Cartilage Tear*  
    - **Anterior Pain**
      - **Anterior Cruciate Ligament aka ACL Sprain/Tear** (obviously you cannot have a hyperflexion injury rather excessive medial rotation w/ planted foot, PEx: *Anterior Drawer Test* (laxity of knee with anterior movement of lower leg when knee in 90 degree flexion), *Lachman Sign* (similar to anterior drawer test but knee in 30 degree flexion), *Pivot Test* (complicated), Dx: MRI, Tx: arthroscopic repair) NB ACL runs from lateral/posterior femoral head to middle/anterior tibial head
      - **Patellar Bursitis** (recurrent local trauma from kneeling, overlying skin is often thickened/keratotic, Tx: conservative, protective knee pads, steroid injection)
      - **Patella Chondromalacia aka Patellofemoral Pain Syndrome** (degeneration of posterior patellar cartilage that presents with pain after prolonged periods of sitting, PEx: patellar crepitus/TTP, Tx: conservative)

- **Posterior Pain**
  - **Posterior Cruciate Ligament aka PCL Sprain/Tear** (hypereextension injury PEx: *Posterior Drawer Test*, Dx: MRI, Tx: arthroscopic repair) NB PCL runs from medial/posterior femoral head to middle/posterior tibial head
  - **Gastrocnemius/Semimembranosus Bursal Effusion aka Popliteal Cyst aka Baker’s Cyst** (in normal anatomy there is a separation b/t this posterior bursa and the knee joint, in some pts there exists a connection b/t these spaces and when these pts in addition have underlying joint dz which causes effusions like OA, ruptured meniscus, RA, crystal arthropathy, etc this effusion can leak into the bursa causing enlargement in the popliteal fossa, this enlargement can worsen as the underlying joint condition worsens, *Foucher’s Sign* (extending the knee, which closes connection, makes the bursa more firm and less able to decompress manually, this helps distinguish this from other conditions affecting the popliteal fossa), S/S: painful visible lump in the medial aspect of popliteal fossa that sometimes can affect nearby vessels/nerves causing unilateral edema, neuropathy, etc also these bursa can burst open causing pain/swelling/inflammation, etc appearing as a DVT Dx: US and always r/o DVT, Tx: treat underlying condition that is causing build-up of fluid, if tense cyst then immobilize pt in semi-flexion, aspirate, steroid injection)
  - **Popliteal Artery Aneurysm**

- **Medial Pain**
  - **Medial Meniscus aka MM Tear/Cyst** (menisci are shock absorbers, tears w/ subsequent fluid extrusion leads to formation of cysts, twisting of knee while planted and weight bearing, PEx: *McMurray’s Test* (flexing/extending knee while internally/externally rotating tibia causes pain and clicking sound) and *Joint Line TTP* (palpating the joint line medially causes pain) Dx: MRI, Tx: arthroscopic repair)
  - **Medial Collateral Ligament aka MCL Sprain/Tear** (forceful stress/blow to knee while planted and weight bearing, PEx: *Valgus/Lateral Stress Test* (the knee is lax when you bend the knee laterally at full extension and at 30 degrees), Dx: MRI, Tx: arthroscopic repair)
  - **Pes Anserine Bursitis aka “Swimmer’s Knee”** (tendinous insertion of sartorius/gracillis/semimembranosus to anteromedial aspect of proximal tibia, RFs: OA, obesity, genu valgus, DM, pain w/ walking up stairs, TTP classically 4cm below joint on medial side of tibia, Tx: conservative, isometric quadricep exercises, weight loss, bursal aspiration, steroid injection)
Ankle/Foot Pain

- **Lateral Pain**
  - Lateral Meniscus aka LM Tear/Cyst (same as above but a lot more rare)
  - Lateral Collateral Ligament aka LCL Sprain/Tear (same as above but a lot more rare)
  - Iliobial Band Tendonitis aka Runner’s Knee (seen in cyclist, runners, etc, iliotibial band is the thick condensation of the fascia lata that extends from iliac crest to upper tibia, this band acts to stabilize the knee when weight bearing in semiflexed position so that when you come to a stop the varus momentum that occurs during this movement, therefore when there is repetitive flexion/extension causes excessive friction b/t band and femoral epicondyle, RFs: genu varus and pes planus, S/S: lateral knee pain 3cm proximal to joint line w/local TTP (Nober’s Test: TTP and femoral epicondyle when flexing/extension knee) when walking after a vigorous exercise using knees, pain is relieved when b/w knee fully extended, Tx: conservative Tx)

- **Medial Plica Syndrome** (occurs when there is incomplete division of the synovial compartments during embryology leaving remnant “plicas” in the knee that then cause pain when they become inflamed w/repetitive overuse of the knee, RFs: tender, mobile nodularity on medial aspect, Tx: arthroscopic resection)

- **Anterior Foot**
  - Podagra (sudden exquisite inflammation at 1st MTP joint)
  - Hallux Valgus aka Bunion(s) (poorly/tightly fitted footwear leading to 1st toe deviation inward with pressure on head of 1st metatarsal leading to inflammation and bursal formation, orthotics are not effective, the only cure is osteotomy)

- **Posterior Foot**
  - Achilles Tendon Rupture (tear 2-6cm proximal to insertion b/c most vascular is most prone to rupture, usually occurs during a burst of unaccustomed physical activity causing forceful dorsiflexion, RFs: old age, prior tendonitis, FQ abx use, steroid injection, etc, pts report a “popping” sound followed by pain and difficulty walking, tear is often palpable, NB even w/ complete rupture pts can still plantar flex b/c of adjacent tendons, Thompson Test (when the relaxed calf is squeezed there is no plantar flexion), Sphygmonanometer Test (when inflated to DBP, passive dorsiflexion produces no further rise in pressure), unable to do single leg toe raise, NB 30% of pts have incomplete tears and thus are not Dx b/c pt returns later in the day after prolonged walking, PEx: eliciting pain w/ passive dorsiflexion of the toes while everting the foot, use of elevator followed by resection of calcaneal tuberosity)
  - Tarsal Tunnel Syndrome (entrapped posterior tibial nerve resulting in dysesthesia from heel thru sole to toes, aggravated by prolonging weight bearing, walking on hard surfaces, pain at night)

- **Plantar Foot**
  - Plantar Fascitis or Rupture (RFs: obesity, prolonged standing, running, dancing, etc gradual plantar pain esp at calcaneal insertion site when weight bearing esp when initiating walking in the morning that the resolves after walking but the returns later in the day after prolonged walking, PEx: eliciting pain w/ passive dorsiflexion of the toes while everting the foot, Dx: clinical, US/MRI resolves in 80% of pts after 1yr, conservative Tx, don’t walk barefoot and add orthotics to shoes to maintain arch, fascia stretching exercises, steroid injection, extracorporeal shock wave therapy then plantar fasciectomy)
  - Subcalcaneal Bursitis (very similar to plantar fasciitis but toe dorsiflexion while everting foot does NOT reproduce pain)
  - Painful Calcaneal Fat Pad Syndrome (very similar to plantar fasciitis but pain is not across arch and at fascia insertion but rather along heel pat pad)
  - Calcaneal Traction Spurs (very similar to plantar fasciitis)
  - Calcaneal Stress Fracture (very similar to plantar fasciitis)

- **Anterior Foot**
  - Morton’s Neuroma (entrapped digital nerves resulting in anterior foot dysesthesia esp at 3rd web space esp when walking on hard surface, wearing poorly fitted footwear, etc, seen in middle-aged women, PEx: squeezing together metatarsal heads while squeezing the affected web space elicits pain, Tx: broad toed shoes, toe flexion exercises, proximal metatarsal pad, pronator insoles, steroid injection, metatarsal osteotomy, nervectomy)
  - Podagra (sudden exquisite inflammation at 1st MTP joint)

- **Osteogenesis Imperfecta**
  - General: AD
  - Pathology: unable to cleave pro-collagen to collagen
Clinical Features: decreased bone osteoid deposition resulting in fractures w/ minimal trauma, blue sclera, hearing loss b/c of middle ear bone fractures, dental imperfections, easy bruising

- **Ehlers-Danlos Syndrome**
  - General: variable
  - Pathology: unable fuse collagen into fibrils
    - EDS Classic Type I/II: (aut dom) mutations in gene for type 5 collagen resulting in hypermobility, atrophic scars, and easy bruising
    - EDS Hypermobility Type III: (aut dom) unknown resulting in hypermobility, pain, dislocation
    - EDS Vascular Type IV: (aut dom) at least three distinct mutations (synthesis, secretion, structural malfunctions) in type 3 collagen uniquely resulting in spontaneous ruptures in blood vessels, intestines and uterus (MOST DANGEROUS)
    - EDS Kyphoscoliosis Type VI: (most common aut rec) defect in lysyl hydroxylase (hydroxylates lysine residues during collagen synthesis so that collagen fibers cross-link) uniquely resulting in congenital scoliosis and ocular fragility
    - EDS Arthrochalasia Type VII: (aut dom) defect in conversion of type I procollagen to collagen because there is structurally abnormal pro \( \alpha 1 \) (I) or pro \( \alpha 2 \) (I) chains that resist cleavage of N-terminal peptides as a result there is a failure to form normal collagen helices
    - EDS Type IX: (X-linked rec) abnormal copper distribution (high intracellular, low serum) reduces activity of Cu-dependent lysyl oxidase preventing cross-linking of collagen and elastin fibers

- **Marfan Syndrome** ("Abraham Lincoln")
  - General: AD w/ 20% being new mutations, Incidence of 1/5000
  - Pathology: Missense mutations in fibrillin gene (a glycoprotein secreted by fibroblasts that aids in forming microfibrillar network in ECM) that in turn acts as a scaffold for deposition of elastin
  - Clinical Features
    - Skeletal: unusually tall, skinny, lank, ratio of upper body segment to lower is lower than norm for age, race, and sex; arm spans wider than height; long extremities and tapering fingers, arachnodactyly; loose, hyperflexible joints; you can see thumb when making fist; pectus excavatum; kyphosis, scoliosis, or rotation or slipping of dorsal or lumbar vertebrae; head commonly dolichocephali (long headed); frontal eminence bossing & prominent supraorbital ridges
    - Ocular: weakened suspensory ligaments resulting bilateral subluxation (lens dislocation) called ectopia lentis (practically diagnostic because so uncommon)
    - Cardiovascular: loss of medial support results in progressive dilation of aortic valve ring and root of aorta leading to severe aortic incompetence