No Disclosures
Flexor tendon

• Nonoperative partial lacerations < 60% of tendon width
• Operative >60% of width
  • ≥ 50-60% laceration with triggering → epitendinous suture
  • perform repair within three weeks
  • # of suture strands cross the repair site is most important
  • ideal suture purchase 10mm from cut edge
  • Dorsal core sutures stronger
  • epitendinous suture improves tendon gliding, improves strength
• Complications
  • Adhesions (zone 2)
  • 15-25% rerupture rate
Jersey Finger

- Avulsion injury of FDP from distal phalanx
- Ring finger most likely
- More retracted → sooner treatment
- Treatment operative
  - Direct repair
  - ORIF if bone involved
  - DIP fusion if chronic/unstable
  - Two stage recon???
Lumbrical Plus Finger

- paradoxical extension of the IP joints while attempting to flex the fingers
- with FDP laceration, FDP contraction leads to pull on lumbricals

- Treat with lumbrical release, tendon repair if acute
- do NOT suture flexor-extensor mechanisms over bone
Quadrigia Effect

- active flexion lag fingers adjacent to a digit with repaired FDP tendon
- a functional shortening of the FDP tendon
  - >1 cm advancement
  - Adhesions
- FDP MF, RF, SF common belly
  - excursion combined tendons equal to shortest
- Treat
  - Observe
  - Release FDP
Pulley system

• 25% of A2 and 100% of A4 can be incised with little resulting functional deficit

• Blood supply of tendon
  • Indirect
    • diffusion through synovial sheaths
    • tendons located within a sheath, distal to MCP
  • Direct
    • the vincular system, osseous bony insertions
    • Outside of sheath
Extensor tendon

• Odds over joint, Evens in between
  • Zone 1 = mallet
    • Swan neck

• Zone 3 = boutonniere

• Zone 5 = sagittal band
Scaphoid Fractures

- axial load across hyper-extended and radially deviated wrist
- major blood supply dorsal carpal branch (radial artery)
  - proximal 80%
- minor blood supply superficial palmar arch (volar radial artery)
  - Distal 20%
Scaphoid Fracture

- 30 degree wrist extension, 20 degree ulnar deviation
  - Brings scaphoid into extension
- Negative, high suspicion → Repeat 10-14 days
- Bone scan
  - diagnose occult fractures at 72 hours
- MRI
  - most sensitive for diagnosis occult fractures < 24 hours
- CT
  - less effective than bone scan and MRI to diagnose occult fracture
  - progression of union after surgery
- Non-op
  - Short arm thumb spica, non-displaced; union rate of 90%
- Operative
  - Unstable, displaced
  - Dorsal approach --> Proximal pole
  - Volar approach --> distal pole, waist, nonunion or humpback
SNAC wrist

- Predictable progressive degeneration
- Limited with regard to reconstruction
- Stage I
  - Styloidectomy + S-L Stabilization
- Stage II, III
  - PRC
  - 4-corner
  - arthrodesis
Other Carpal fxs - Hamate

- **Hook of Hamate**
  - 2% of fx
  - Direct impact MOI
    - Golf, baseball, racquet sports

- **Imaging**
  - Carpal tunnel view
  - CT scan

- **Treat**
  - Immobilize
  - Excise

- **Associated injury**
  - Ulnar nerve
  - Small finger flexor rupture
Perilunate Injury

• Commonly missed (25%)

• Sequence of injury:
  • scapholunate ligament disrupted -->
  • disruption of capitoluminate articulation -->
  • disruption of lunotriquetral articulation -->
  • failure of dorsal radiocarpal ligament -->
  • lunate rotates and dislocates, usually into carpal tunnel

• Greater arc = Bone involvement
• Lesser arc – Ligament only
Perilunate Injury

• Imaging
  • Gilula’s lines
  • “Piece of pie” lunate
  • Spilled teacup

• Management
  • Early closed reduction, splint
  • ORIF for definitive treatment
Scapholunate Advance Collapse - SLAC

- Progressive instability → Advance degeneration
- Chronic S-L → DISI deformity
- Predictable progression

Scaphoid and radial styloid
Scaphoid and entire scaphoid facet
Between capitate and lunate
SLAC wrist - Treatment

• Non-operative

• Operative
  • Stage I → styloidectomy, scaphoid stabilization
  • Stage II, III:
    • PRC (stage 2)
      • **RADIOSCAPHOCAPITATE** primary stabilizer
    • 4-corner, scaphoidectomy
    • Wrist arthrodesis
TFCC injury

• Components
  • central articular disc
  • meniscus homolog
  • ulnar collateral ligament
  • ECU subsheath
  • Volar/Dorsal radioulnar ligaments
  • origin of ulnolunate and ulnotriquetral ligaments

• Type 1 = Traumatic
  • Mxn = fall on extended wrist with pronation

• Type 2 = Degenerative
  • Positive ulnar variance, ulnar impaction

• Imaging
  • Xray PA neutral FA rotation
  • MRI with arthrogram (74-100% sens)
  • Arthroscopy
Metacarpal fxs

- Treatment based on which metacarpal involved, location of fracture
- Acceptable angulation varies by location
- No degree of malrotation is acceptable
- **2 mm shortening = 7 degrees of ext lag**
- Polytrauma/multiple MC fxs → surgical
- Beware of hand compartment syndrome
  - Multiple MCs
MCP dislocation

- fall and hyperextension of the MCP joint
- Dorsal dislocations are most common
  - index finger, thumb is most common
- structure preventing reduction
- Reduction:
  - direct pressure over dorsal P1 with the wrist, finger in flexion
Phalanx fxs

- Middle
  - More complex at base
  - “Pilon”
  - Volar
    - > 40% = unstable
  - Dorsal
    - Central slip
- Non-op
  - 3 wks immob, ROM
- Operative
  - Irreducible, unstable
Phalanx fx

- Distal
  - Most common
  - Crush mxn
  - Nailbed injury
- Seymour fx
  - Interposed tissue demands open tx
- Nailbed injury + fx = Open fx
- Proximal
  - Non-op
    - Extraarticular, < 10° angulation or < 2mm shorten
    - No displaced intra-articular
  - Operative
    - extraarticular fractures with > 10° angulation or > 2mm shorten
    - Displaced articular
    - Pins through MCP
    - Lateral lag technique (long oblique)
Phalanx dislocation

- Involve PIP, DIP
- Dorsal > volar
- Dorsal → swan neck
  - Volar plate incompetent
- Volar → boutonierre
  - Central slip injury
- Dorsal fx-dx < 40%
  - Extension block, ROM
- Simple dx
  - Reduce, buddy tape
Thumb CMC dislocation

- Axial load to flexed thumb
- Dorsoradial ligament torn
- Stable after reduction
  - Implies AOL intact
  - Thumb spica
- Operative
  - CMC unstable, AOL torn
  - CRPP vs ligament reconstruction, the reconstruction group had slightly better abduction and pinch strength
Thumb UCL

- Radial CL injury rare
- Ulnar CL
  - +/- bony involvement
  - Proper CL (A) stabilizes flexion
  - Accessory CL (B) stabilizes extension
- Stener lesion
  - Complete ligament avulsion
  - Interposition of adductor aponeurosis
    - Adductor pollicis (ulnar n.)
- Non-op
  - Partial tears
- Operative
  - Stener
  - Complete tears
Pyogenic Flexor Tenosynovitis

- Kanavel’s
  - flexed posturing of the involved digit
  - tenderness to palpation over the tendon sheath
  - marked pain with passive extension of the digit
  - fusiform swelling of the digit
- Staph aureus 40-75%
  - MRSA 29%
- Eikenella – human bites
- Pasteurella – animal bites
- Gram neg – immunocompromised
- Horseshoe abscess
- Treat: Open I&D, IV abx
Animal Bites

- **Pasteurella** most common
- Cat scratch disease
  - Medial elbow swelling
  - Lymphadenopathy
  - Bartonella henselae
    - azithromycin, ciprofloxacin, doxycycline
High-Pressure Injection

• Water and latex-based paint least destructive.
• Grease and chlorofluorocarbon-based substances are intermediate
• Oil-based paints are highly inflammatory and can cause chronic inflammation
• Delay in treatment → worse prognosis
Fingertip Amputations

• Goals of treatment
  • Durable, sensate tip
  • bone support for nail growth
• Non-op (wet-dry, ointment dressings)
  • Adults, children < 2cm skin loss
  • Children with exposed bone
• Operative
  • Primary (revision amp) – assure ample bone nail support
  • Full thickness graft
  • Flap coverage
Fingertip coverage options

• V-Y advancement
  • Fingertip
• Cross finger
  • Volar proximal
• Reverse cross finger
  • Dorsal tip (eponychial fold)
  • Dorsal proximal
• 1st Dorsal Metacarpal artery
  • Dorsal thumb
  • Volar thumb >2cm
• Moberg
  • Volar thumb <2 cm
Replantation

• Primary indications
  • Thumb at any level
  • Multiple digits
  • Through palm
  • Proximal to wrist
  • Children

• Relative indications
  • Ring avulsion
  • Single digit distal to FDS
  • Above, through elbow

• Primary contraindications
  • Peripheral vascular disorder
  • Mangled extremity
  • Segmental injury
  • >6 hrs ischemia (muscle)

• Relative contraindications
  • medically unstable patient
  • disabling psychiatric illness
  • tissue contamination
  • >12 hrs ischemia time (no muscle)
  • Single digit proximal to FDS
Peripheral Nerve Injury - Anatomy

- Epineurium
  - cushions externally
- Perineurium
  - covers fascicles, tensile strength
- Endoneurium
  - Covers axons, forms Schwann cell tube
- Compression → Microvascular insult
Peripheral Nerve Injury - Classification

• Neuropraxia
  • Local myelin damage

• Axonotmesis
  • Wallerian degeneration
  • Myelin loss distally
  • Endoneurium intact

• Neurotmesis
  • Endoneurium disrupted
  • Epi & Perineurium may be intact
**Peripheral Nerve Injury - Classification**

<table>
<thead>
<tr>
<th>Seddon Type</th>
<th>Degree</th>
<th>Myelin Intact</th>
<th>Axon Intact</th>
<th>Endoneurim Intact</th>
<th>Wallerian Degen.</th>
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<tbody>
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<th>Sunderland Grade</th>
<th>Myelin Sheath</th>
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<tr>
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</table>
Wallerian Degeneration

- Axoplasm and myelin degraded
- Schwann cell proliferation
- **Proximal** budding after 1 month
  - Distal advancement 1 mm/day
Carpal Tunnel Syndrome

- Most common compressive neuropathy
- Due to repetitive activity, lesions (gout)
- Recurrent motor branch of median nerve
  - 50% extraligamentous
  - 30% subligamentous
  - 20% are transligamentous
- Numbness, tingling, PM pain radial 3.5 digits

EMG/NCV
- Not diagnostic
- NCV prolonged latency
  - >3.5 ms sensory
  - >4.5 ms motor
  - Slowed conduction <52 m/s
Carpal Tunnel Syndrome - Treatment

• Non-op
  • NSAIDs
  • Wrist splints NEUTRAL, PM
  • Activity modification
  • Steroid injection
    • No improvement → Poor surgical outcome

• Operative
  • Open vs. Scope (no difference, long term)
  • pinch strength return in 6 week
  • grip strength to 100% preoperative levels by 12 weeks
  • continued symptoms at 1+ year is 2% in moderate and 20% in severe CTS
  • Incomplete release most common for revision CTR
Pronator Syndrome

- Median n. compression at elbow
- AIN compression
  - FPL, FDP 2,3 weakness
- Mistaken for “recurrent CTS”
- Supracondylar process
  - Ligament of Struthers
- Lacertus fibrosus
- Pronator heads
- FDS aponeurosis
Cubital Tunnel Syndrome

- Ulnar n. compression
  - two heads of FCU/aponeurosis (most common)
  - **arcade of Struthers** (medial intermuscular septum)
  - Osborne's ligament and MCL
  - Worsened with flexion

- Web space atrophy

- Froment’s sign
  - IP flexion during key pinch

- **Wartenberg’s sign**
  - Unopposed EDM
Ulnar Tunnel Syndrome

- Guyon’s canal ulnar n. compression
  - Mass (most common)
  - Repetitive trauma
  - Ulnar a. thrombosis
  - Hook of hamate fracture
- Intrinsic weakness
- Decreased volar sense SF, RF
  - **INTACT** dorsal ulnar skin
PIN Compression Syndrome

1. "Arcade of Fröhse"
   • proximal edge of the supinator
2. fibrous tissue anterior to the radiocapitellar joint
   • between the brachialis and brachioradialis
3. “Leash of Henry”
   • recurrent radial vessels at the level of the radial neck
4. ECRB proximal edge
5. supinator muscle distal edge
PIN Compression Syndrome

- Muscles involved
  - EDC
  - EIP
  - EDM
  - ECU
  - APL
  - EPL
  - EPB
- BR, ECRB/L NOT INVOLVED
- Demonstrate wrist ext w/ radial deviation
Radial Tunnel Syndrome

- PIN compression
- Pain only symptom
- No motor or sensory deficit
- Similar to lateral epicondylitis
- Tender over mobile wad
- Pain with resisted MF extension
  - Maudsley’s test

Tennis elbow tenderness
Radial tunnel tenderness
Resistive extension of middle finger
Provocative tests elicit pain over radial tunnel
Cheiralgia Paresthetica

- **Wartenberg’s syndrome**
- Radial sensory nerve compression at wrist
  - Superficial radial n branch
- Mistaken for deQuervain’s
- SRN compressed by scissoring brachioradialis and ECRL tendons with pronation
- Pain, sensory change in SRN distribution
Basilar Thumb Arthritis

- Postmenopausal female
- Deformity
  - MCP hyperextension
  - IP flexion
  - Adduction contracture
- Radiographic not consistent with clinical complaint

Eaton I
Eaton II
Eaton III
Eaton IV
Basilar Thumb Arthritis

• Treatment
  • Trapeziectomy: HDA vs LRTI
  • No real difference between procedures
  • Expect 25% subsidence
  • Improved grip, pinch post-op

• Be wary of STT OA
  • Distal scaphoid excision
DIP and PIP Joint Arthritis

**DIP**
- Mucoid cyst
  - Surgical excision lower recurrence
  - Nail plate deformity
- Arthrodesis if severe

**PIP**
- Arthroplasty vs Arthrodesis
- Digit dependent
  - Traditional IF, SF fused
  - Stability
  - Recreate cascade index- 30°, long- 35°, ring- 40°, small- 45°
- Silicone implant vs Titanium
  - Less complications in silicone
  - Similar function, pain control
Ulnocarpal Abutment Syndrome

- Positive ulnar variance
  - Increased force onto ulna
    - Normal: 80/20 radius
    - Impaction: 60/40 radius
- TFCC tears
- Ulnar shortening
  - Beware of DRUJ OA
- Hemi-resection, interposition
  - Need intact TFCC
- Sauve-Kapandji
  - Heavy laborers
- Darrach
  - Low demand
Triangular Fibrocartilage Complex (TFCC)

• Ulnar-sided pain
  • Extension, pronation, ulnar-deviation

• Components
  • dorsal and volar radioulnar ligaments
  • central articular disc
  • meniscus homolog
  • ulnar collateral ligament
  • ECU subsheath
    • origin of ulnolunate and ulnotriquetral lig

• Peripheral blood supply
  • Repair peripheral tears
  • Scope debride central, degenerative tears

• Stabilizes DRUJ
• MRI arthrogram help elucidate tear
Depuytren’s Contracture

- Myofibroblast
- Type 3 collagen
- Bands → Cords
- Cleland’s ligament – NO
- NV central, superficial
  - Spiral cord
- Limited vs Radical fasciectomy
- Collagenase
  - Low activity Type 4 collagen
Tendon Transfers

- Reanimates hand
- Median $\rightarrow$ opponensplasty
  - EIP $\rightarrow$ APB insertion
- PIN $\rightarrow$ finger, thumb ext
  - FCR $\rightarrow$ EDC
  - PL $\rightarrow$ EPL
- Radial $\rightarrow$ wrist ext
  - PT $\rightarrow$ ECRB
- Tension is key
  - Should be determined by tenodesis
Frostbite Injury

• Deeper injury → more severe
  • 1\textsuperscript{st} degree – central whitish area with surrounding erythema
  • 2\textsuperscript{nd} degree – clear/cloudy blisters within 24h
  • 3\textsuperscript{rd} degree – hemorrhagic blisters / hard black eschars
  • 4\textsuperscript{th} degree – tissue necrosis

• Gentle re-warming initially 40-42 c

• Hemorrhagic blisters drained
  • Leave covered

• Dark eschar/necrosis
  • Allow demarcation
  • Delayed debridement 1-3 months
Hypothenar Hammer Syndrome

- Repetitive trauma/vibrating tools
- Ulnar a thrombosis
- Aneurysm
  - Pulsatile mass
- Guyon’s canal
  - Ulnar n symptoms
- Doppler
- Vessel reconstruction, thrombectomy
- Ligation
Radial deficiency

• Longitudinal deficiency
  • Sonic hedgehog gene

• Thumb deficiency

• Associated
  • TAR (thrombocytopenia absent radius)
  • Fanconi’s anemia (AR)
    • Bone marrow transplant
  • Holt-Oram (AD)
    • Cardiac defects
  • VACTERL/VATER

• Cardiac, Renal disorders
  • US
Thumb Hypoplasia

I. Observe

II. Hypothenar transfer

III. IIIA – CMC stable
     IIIB – CMC unstable

IV. Pouce flottant - pollicization

V. Pollicization
Kienböck’s disease

- AVN lunate
- **Negative** ulnar variance

<table>
<thead>
<tr>
<th>Stage</th>
<th>Description</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>No visible changes on xray, changes seen on MRI</td>
<td>Immobilization and NSAIDS</td>
</tr>
<tr>
<td>II</td>
<td>Sclerosis of lunate</td>
<td>Joint leveling procedure (ulnar negative patients)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radial wedge osteotomy or STT fusion (ulnar neutral patients)</td>
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<tr>
<td></td>
<td></td>
<td>Distal radius core decompression</td>
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<tr>
<td></td>
<td></td>
<td>Revascularization procedures</td>
</tr>
<tr>
<td>IIIA</td>
<td>Lunate collapse, no scaphoid rotation</td>
<td>Same as Stage II above</td>
</tr>
<tr>
<td>IIIB</td>
<td>Lunate collapse, fixed scaphoid rotation</td>
<td>Proximal row carpectomy, STT fusion, or SC fusion</td>
</tr>
<tr>
<td>IV</td>
<td>Degenerated adjacent intercarpal joints</td>
<td>Wrist fusion, proximal row carpectomy, or limited intercarpal fusion</td>
</tr>
</tbody>
</table>
Kienböck’s disease

• Treatment
  • Adolescents – Pin STT
  • Adults – radius core decompression
    • Radial shortening osteotomy
    • Local vascular response
  • PRC, wrist arthrodesis
    • Stage IIIB, IV
Giant Cell Tumor Tendon

- aka PVNS
- Benign, locally aggressive
- May erode bony structure
- High rate of recurrence (5-50%)
- Marginal resection
- Metastatic dz to lungs
Polydactyly

• Pre-axial vs Post-axial
  • Pre: thumb duplication
    • Caucasian > African Am
  • Post: small finger duplication
    • African Am > Caucasian

• Wassel classification
General Congenital Hand

• Poland syndrome
  • Pectoral, forearm hypoplasia
  • Symbrachydactyly

• Syndactyly
  • Complete v. incomplete
  • Complex v. simple
General Congenital Hand

• Camptodactyly
  • PIP contracture

• Clinodactyly
  • Coronal curvilinear deformity
  • Delta phalanx
THANK YOU & GOOD LUCK!

Any questions?

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