SFO Residency Upper Extremity Emergency Room Workup – Highland Hospitals

Contributors:

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Upper Extremity Fractures/Dislocations:

As general rules:

- obtain and document NV exam before and after any fracture or dislocation reduction
- for any fracture obtain Xray of that fracture and Xray joint **above and below (no exceptions)**
- careful evaluation of skin for possible open fractures/dislocations (if concerning wounds please obtain pictures for the chart, see below for instructions)
- obtain appropriate Xray after fracture or dislocation reduction or after splint placement
- obtain CT scan of the reduced joint in case of joint dislocation
- for any periarticular/intraarticular fractures shoulder, elbow, wrist (distal radius), metacarpal or phalangeal - obtain CT of fracture without contrast
- for any carpal fracture - obtain hand CT without contrast
- for any phalangeal fracture - obtain dedicated finger Xray

Specific splints for fractures:

- Proximal humerus – sling

- Humerus shaft – Sarmiento brace is preferred for awake/alert patient. Obtunded patient can be immobilized in coaptation splint (Pad the axilla extension well with ABD's, carry the shoulder extension high, pad the elbow) or reverse sugartong splint. Place additional posterior slab to protect the skin.
- Distal humerus/elbow/proximal radius/ulna – posterior splint at no more than 90^0 and wrist in neutral. May need (reverse) sugartong for additional support.
- Both bone/distal radius – sugartong splint
- Metacarpal fractures – intrinsic plus splint (with wrist extended 30^0, MCP flex 70-90^0, and PIP/DIP full extension.
- Mallet finger - Place in extension finger splint including only the DIP joint, encourage PIP/MCP range of motion. Instruct that DIP should be kept extended for 6 weeks full time, if DIP flexes the 6-week timetable restarts
- Phalanx fractures – Immobilize particular fracture site and joint above and below only
- Radial head – check range of motion for blocks to rotation (supination/pronation), and flexion/extension. If nondisplaced/minimally displaced place in a sling and encourage range of motion. If displaced, posterior splint as above for elbows and obtain CT scan
- Traumatic distal phalanx amputations – Xrays, pictures in the chart, neurovascular exam, bedside debridement, irrigation, splint with DIP in extension, nonadherent dressing (xeroform or Vaseline over the wound), follow up in 1 week for likely continued wound care with BID Vaseline/koban dressing changes and soaks for 90% of cases

Pictures: all pictures should be taken zoomed out enough that the orientation and location of the wound can be determined without any additional information ie a laceration on the thenar eminence should include the entire hand in the picture and a dorsal forearm laceration should include the entire forearm from wrist to elbow)

Specific Fracture Reduction Techniques:

Distal Radius fracture:

- Acceptable alignments – if these parameters are not present, distal radius fracture will need an attempt at reduction:
    - radial shortening < 3 mm, dorsal tilt < 10 degrees (or 20 degrees from contralateral side), or fracture with intra-articular displacement or step-off < 2 mm.
- Typical Dorsally Angulated Distal Radius:
    - Appropriate pain medication and hematoma block
    - Use kerlix for finger traps

- Traction for at least 10 minutes. Keep in traction until splint and mold complete. Hang weights from arm. ~10lbs. Can use 2-3 IV bags/bottles
- As you perform the mold in Figure 6 – have assistant keep wrist in ulnar deviation

Fig. 1. Traction applied to the distal radius fracture typically is tolerated relatively well by patients, especially after providing a hematoma block.

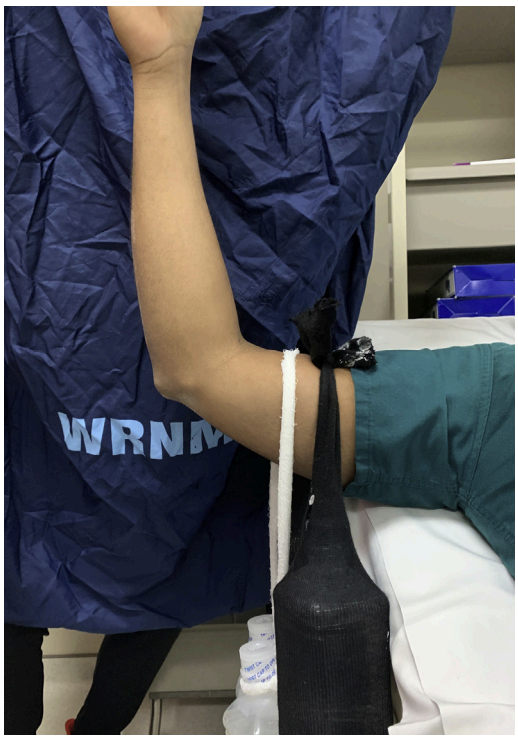

Fig. 2. Weight applied to the arm. Gauze dressing bandage and saline bottles or stockinette and saline bottles make ideal weight for traction on the arm.

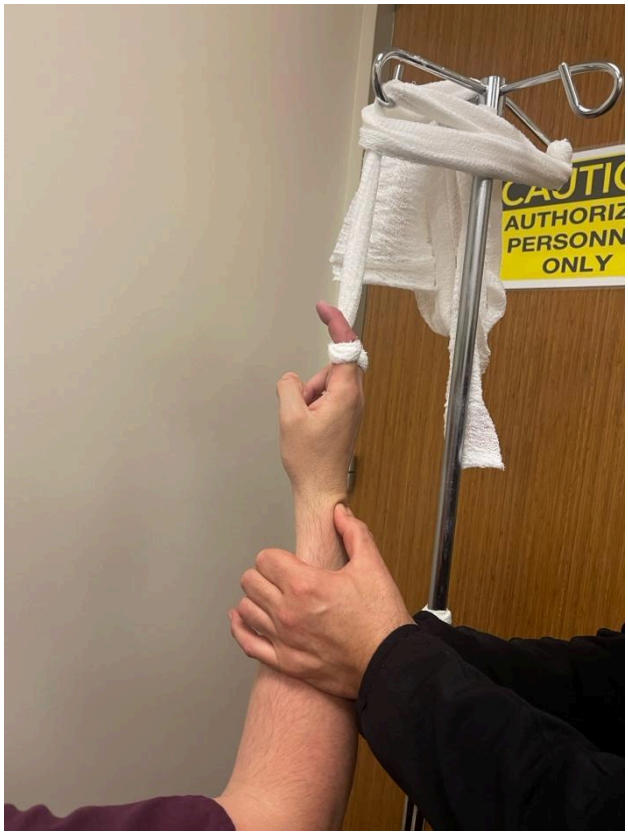
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Fig. 3. This series of photos demonstrates the common maneuver to reduce the standard dorsally displaced distal radius fracture. Careful protection of fragile skin is necessary to prevent skin tears and degloving injuries.

Fig. 5. To perform the reduction then pull traction to aid in carpal translation and push the distal distal fragment from dorsal to volar.

Fig. 4. To prepare for the reduction place one hand over the thenar eminence to pull traction and the thumb of the other hand on the dorsal edge of the distal fracture fragment.

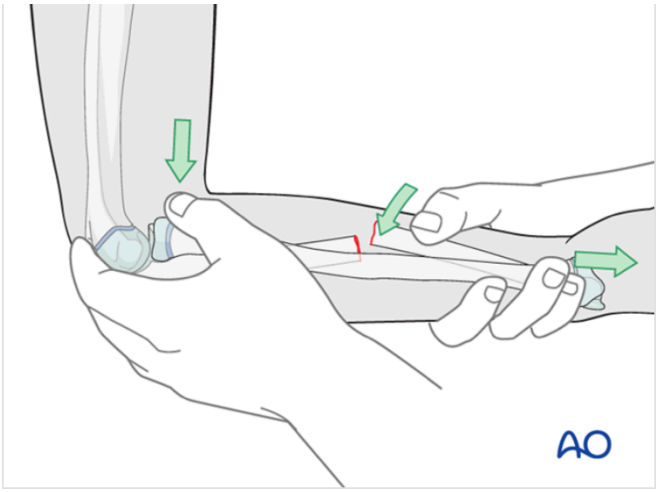
Fig. 6. Application of a 3-point mold. The mold can be applied with the flat part of the palm (see Fig. 5) or over the thigh of the surgeon (see Fig. 6).

- Appropriate 3-point mold for dorsally angulated distal radius

Fig. 9. Lateral radiograph status post–closed reduction with sugar tong splint application 3-point mold.

- For a Volar Barton/Volar Shear distal radius:
    - Reduction is usually traction and application of appropriate mold (see below)
    - Apply minimal volar mold as it may cause carpal tunnel. **Always** check NV exam of patient after reduction.

Monteggia fracture dislocation (radial head dislocation with ulna shaft fracture):

- Before performing a reduction determine the direction of the dislocation of the radial head and also the direction of the apex of the ulnar deformity. Usually, the angulation of the ulnar fracture points in the same direction as the dislocation of the radial head.
- **Reduction maneuver:** Place the thumb on the radial head and the fingers at the epicondyles and grasp the distal ulna to provide longitudinal traction. Simultaneously reduce the ulnar angulation and the radial head dislocation. Direct thumb pressure on the apex of the ulnar deformity may help.
- 

- Place in sugartong splint in position of stability (common in supination) with posterior slab

Galleazzi fracture dislocation (DRUJ dislocation with radial shaft fracture):

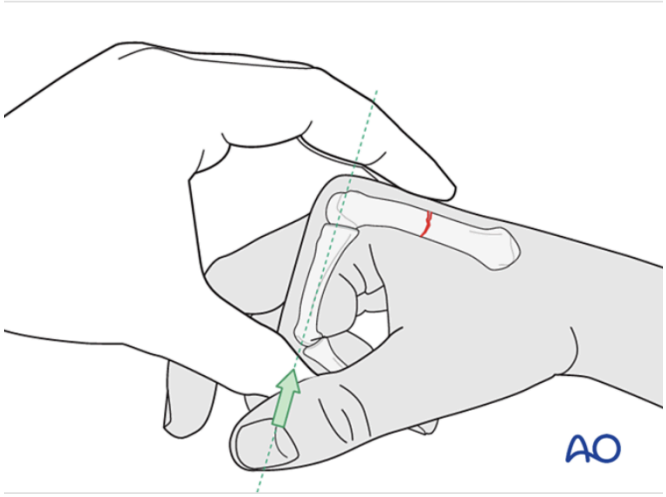
- Traction and mold over DRUJ in sugartong splint in position of stability (usually supination)

Metacarpal Neck/Shaft Fractures:

- Reduction is appropriate if any rotational deformity (scissoring) or if more than 10-20degrees of angulation on appropriate lateral X-ray of index and long finger; Ring finger can tolerate up to 40 degrees; Small finger can tolerate up to 70 degrees.
- Reduction maneuver (Jahss technique – see picture below): After appropriate digital block – flex MCP and PIP joint to 90 degrees and exerting upward pressure through the flexed proximal phalanx while simultaneously exerting

downward pressure on the metacarpal shaft. Particular attention must be had on correcting any rotational deformity by using the flexed proximal phalanx as crank.

- Place in forearm based intrinsic plus splint (ulnar or radial gutter) with wrist in 30 degrees of extension, MCP joint maximally flexed and PIP in extension.
- Of note – fracture alignment can sometimes be hard to maintain or attain with above technique – an alternative is to place in finger traps, reduce the fracture and place in splint/cast with MCP joints extended.



Dislocations:

- If the ER (or ortho resident) attempts reduction make sure there is a documented pre-procedure exam
- Make sure appropriate sedation is given prior to reduction
- Obtain post reduction Xrays in splint and perform and document post reduction neurovascular exam

Shoulder Dislocations:

- Obtain appropriate pre-reduction Xrays (True AP, Y-scapular and axillary or Velpeau views) These are required to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after any fracture or dislocation reduction (including axillary nerve motor and sensation)
- For subacute/chronic dislocations (>3 weeks out from injury) discuss with attending on call prior to reduction attempt
- Reduction:
    - Anterior (most common) – reduce with the patient prone and hang weight off their arm with it forward flexed 90 degrees; OR, you can do it with them supine, and pull forward, and internally rotate them back into the glenoid, so long as someone is pulling countertraction via a sheet wrapped around their torso
    - Posterior (common with electrocution and seizures) – patient is supine and then forward flex the shoulder to 90° then adducts and internally rotate the arm to disengage the humeral head from the glenoid rim. The assistant should maintain cross-body traction while you apply gentle, anteriorly directed pressure to the posterior humeral head. Finally, external rotation can be attempted to complete and confirm reduction.
    - Inferior (least common) – patient is supine and application of axial traction to the arm aids in reduction of an inferior shoulder dislocation. A sheet is wrapped around the upper torso and held in place by an assistant for countertraction. Superiorly directed traction is applied to the arm, and shoulder abduction is gradually decreased. Of note – this sometimes can turn into an anterior shoulder dislocation which will be reduced as above.

    - If it is a fracture dislocation it is imperative to have excellent sedation and muscle relaxation
- Obtain appropriate Xrays after reduction (True AP, Y-scapular and axillary or Velpeau views)
- Obtain post reduction shoulder CT without contrast
- After reduction - patient shoulder be placed in sling.
    - Anterior dislocation – sling with swathe
    - Posterior dislocation – immobilize in slight external rotation (15-30 degrees) with elbow at side

Elbow Dislocations:

- Obtain appropriate pre-reduction Xrays. These are required to determine the direction of dislocation; also evaluate for possible fractures
- Evaluate and document DRUJ joint stability, need to get wrist Xrays
- Obtain and document NV exam before and after dislocation reduction
- Reduction: First correct the medial or lateral displacement followed by traction of the forearm. Firm pressure is then applied posteriorly to the olecranon to bring it distally and anteriorly around the humeral trochlea. A palpable reduction “clunk” is a good sign for joint stability
- After reduction, the elbow must be taken through the full flexion extension arc in neutral, supination and pronation and document the degrees within the arc it tends to sublux.
- Lateral dislocations will be more stable in pronation and medial in supination generally. Check flexion/extension on lateral xray with the hand supinated, then pronated (if possible to get Xray)
- After reduction - splint elbow in 90 degrees of flexion with wrist in neutral (usually) - or pronation/supination if that is a more stable position)
- Obtain appropriate Xrays after reduction. An anteroposterior view of the elbow centered on the proximal ulna and a true lateral view of the elbow joint (the ulno-humeral joint should be a congruent semicircle, if it perches (in extension), it turns into a crescent shape, with sometimes very subtle widening of the joint)
- Obtain post reduction elbow CT without contrast
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Wrist RadioCarpal Dislocations:

- Obtain appropriate pre-reduction Xrays to determine the direction of dislocation; also evaluate for possible fractures

- Obtain and document NV exam before and after any fracture or dislocation reduction
- Obtain appropriate Xrays after reduction and splinting
- Obtain CT wrist without contrast after reduction
- Splint in sugartong splint with appropriate mold

Peri-lunate/Lunate Dislocations:

- Obtain appropriate pre-reduction wrist Xrays to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after dislocation reduction (pay close attention to median nerve exam). Would recommend avoiding use of local for these for this reason given the high rate of acute carpal tunnel with perilunate injuries.
- Reduction:
    - Peri-lunate dislocation (lunate remains located in the fossa, but the remained of the carpus is dorsally dislocated) – place finger traps for 10-15 minutes. With the wrist slightly extended, gentle additional manual traction is applied. Without releasing traction, and while the lunate is stabilized volarly by the thumb, the wrist is flexed until a snap occurs, signifying reduction. Traction is then released, and the wrist is brought back into neutral.
    - Lunate dislocation (Carpus is aligned with the radius, but the lunate is partially or completely displaced - usually volarly) - place finger traps for 10-15 minutes. The wrist is flexed to take tension off the volar ligaments. The lunate is reduced into its fossa, using thumb pressure applied to the volar lunate and the hook of the hamate, followed by wrist extension. The capitate is then reduced onto the lunate with traction and wrist flexion, maintaining volar pressure on the lunate to prevent its redislocation.
- Splint in sugartong splint with appropriate mold
- Obtain appropriate Xrays after reduction and splinting
- Obtain CT wrist without contrast after reduction

4/5th CMC (carpometacarpal) Dislocations:

- Obtain appropriate pre-reduction Xrays to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after dislocation reduction

- Reduction: Place in finger traps and/or traction and direct pressure (posterior to anterior) over displaced metacarpals to align in appropriate position
- Splint in ulnar gutter intrinsic splint (wrist extended 30^0, MCP flexed 70-90^0 and PIP/DIP in full extension)
- Obtain appropriate Xrays after reduction and splinting
- Obtain CT hand without contrast after reduction

MCP Dislocations:

- Obtain appropriate pre-reduction Xrays to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after dislocation reduction
- Dorsal (most common):
    - Reduction
        - If just subluxation (dislocation is not complete) – do not hyperextend or pull traction, instead flex the wrist to relax the flexor tendons and apply distally and volarly directed pressure to the dorsal base of the proximal phalanx
        - Full dislocation – reduction by hyperextension to recreate the injury deformity followed by sliding the proximal phalanx around the metacarpal head.
    - Splint – Dorsal blocking splint with wrist in neutral, MCP in 30^0 and fingers in extension
- Volar (rare)
    - Reduction – Flex the wrist, hyperflex the MCP with a dorsally directed force applied over the volar base of the proximal phalanx
    - Splint – Wrist in neutral, MCP in extension and fingers in extension
- Obtain appropriate Xrays after reduction
- Obtain CT hand without contrast after reduction

PIP Dislocations:

- Obtain appropriate pre-reduction Xrays to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after dislocation reduction
- Dorsal (most common):

    - Reduction
        - Avoid pure longitudinal traction. Hyperextend middle phalanx and use thumb to hook the base of the middle phalanx back over the head of the proximal phalanx.
    - Splint – if the joint is stable through full ROM after reduction, buddy tape is appropriate. If the joint is not stable – then extension dorsal blocking splint with the PIP flexion at 10^0 deg more of when is started to subluxate
- Lateral
    - Reduction – Extend wrist and flex MCP then middle phalanx is gently rotated back into position.
    - Splint – buddy tape to adjacent uninjured digit
- Volar
    - Reduction – Flex the MCP and PIP joints and with slight traction with dorsally directed force applied over the volar base of the middle phalanx
    - Splint – extension splint volar based
- Obtain appropriate Xrays after reduction
- Obtain CT hand without contrast after reduction

DIP Dislocations:

- Obtain appropriate pre-reduction Xrays to determine the direction of dislocation; also evaluate for possible fractures
- Obtain and document NV exam before and after dislocation reduction
- Obtain appropriate Xrays after reduction
- Splint – extension splint

Mallet finger:

- Obtain Xrays and neurovascular exam
- Place in extension finger splint including only the DIP joint, encourage PIP/MCP range of motion
  Instruct that DIP should be kept extended for 6 weeks full time, if DIP flexes the 6-week timetable restarts

Upper Extremity Exam:

Proper Hand Exam if hand lacerations/concern for NV injury: Do complete hand exam, which includes the following: thumb EPL (IP extension), EPB (extend thumb with IPJ flexed, which takes out EPL activity), APL (thumb abduction), opposition (touching

thumb to small finger - look for circumduction), cross 2-3 (ulnar nerve), pinch (FPL and FDP to IF are Ant Int Nerve – IP flexion of thumb and independent DIP flexion of index finger), and FDS to 2-5 (block other digits), and FDP to 2-5 (block PIP flexion). Check ulnar digital nerve and radial digital nerve to 1-5 digits. If vascularity is in question, check a pulse ox on the digit and record. If there is a zone V injury, do an Allens test (occlude both arteries and exsanguinate the hand with flex/extension. Then release one of the arteries and see if hand perfuses. Do the same for the other artery). If any lacerations/wounds place appropriate clinical photos in the chart.

- If concern for extensor tendon injury – place wrist/fingers (MCP and IPs) in extension splint
- If concern for flexor tendon injury – place wrist/fingers (MCP and IPs) in flexion in dorsal blocking splint

Compartment Syndrome of Upper Extremity:

- Go see patient asap
- This is a clinical diagnosis – check skin, compartment swelling/compressibility, and pain to fingers and wrist passive stretch. Check NV exam.
- Once suspected – ice and elevate suspected extremity immediately
- If patient has hemophilia or any blood disorders (make sure you consult hematology immediately for acute management) – in general if patient has hemophilia specific factor should be given immediately
- Confirm objectively with manometry using Stryker.
- If patient is obtunded, intubated or cannot get a reliable physical exam then Stryker patient
    - How to use the Stryker: turn it on, make sure all air is out of the needle. Press the ZERO button. Clean off skin, and stick the needle into the skin down deep, you will feel it pop through the fascia. Ensure needle and monitor are parallel to floor. Once you are under the fascia, inject 0.5 cc of the saline. The pressure will elevate, and then level off at some number, this is the compartment pressure. Make sure you document what your readings are in all compartments. Measure each compartment twice.
    - Make sure you obtain diastolic BP prior to measurement
- Upper Extremity compartments
    - Arm – Anterior; Posterior and Deltoid (not technically a compartment but has a thick epimysium that may require decompression)
    - Forearm – Volar (superficial and deep); Dorsal and Mobile Wad

- Hand – 10 compartments – Thenar; Hypothenar; Adductor Pollicis; Dorsal Interossei (4) and Volar Interossei (3)

Upper Extremity Lacerations forearm/arm:

- Xrays, neurovascular exam, appropriate clinical photos
- If fractures, tendon and/or nerve lacerations, orthopaedics will be primarily managing
- If those injuries are not present, would recommend general surgery as primary for management
- If skin defects/wound closure concerns, would recommend plastic surgery consult

Gun Shot Wounds forearm/arm:

- Xrays, neurovascular exam, appropriate clinical photos
- If fractures, tendon and/or nerve lacerations, orthopaedics will be primarily managing/should be involved
- If those injuries are not present, would recommend general surgery as primary for management. If general surgery explored wound and no obvious nerve injuries, and patient still has palsy after – recommend palsy specific splint to prevent contractures and patient should follow-up in hand clinic for repeat neuro exam

Infection Consults:

- Always order if they don't have infection labs (CBC, ESR, CRP), and get their temperature trends. If concern for septic joint also get uric acid and get good history of previous joint issues/gout/pseudogout.
- History of DM, IVDU, other immunosuppressive conditions
- If there is cellulitis, make sure you rule out a septic joint, and abscess.
- If consult/concern is for osteomyelitis – needs to have MRI confirmation of osteomyelitis
- Place clinical photos in the chart per the criteria above, especially if there are associated wounds

- **Septic joints**

    - Septic joints HURT when you passively move them. If any doubt, TAP the joint and send for **culture with gram stain, crystals, and cell count**. Ok to tap through cellulitis (unless no other non-affected access points exist with appropriate sterile prepping). Do NOT tap through area of possible abscess. DON'T start antibiotics until you have TAPPED. Start antibiotics AFTER you have tapped.
- Where to aspirate joints:
    - **Shoulder** – Posterior with an 18-gauge spinal needle. Feel the postero-lateral edge of the acromion, and go below it 2cm, and medial 1cm to this, in the "soft spot". You can usually go in straight as you are aiming for the coracoid process, and feel the bone (glenoid), and just walk your way laterally, until you pop into the joint.
    - **Elbow** – There is a soft spot laterally between the triangle made by the lateral epicondyle, radial head, and olecranon. Put 21-gauge needle in here and aim towards the center of the elbow. You can also go posterior just proximal to the tip of the olecranon.
    - **Wrist** – Go dorsal about 1 cm distal to listers tubercle. Use a small needle. Remember the distal radius tilts volarly 11 degrees, so tilt your needle accordingly.
- Criteria:
    - No hard WBC cutoff but for infection would expect >50k for aspiration
    - >80% neutrophils on aspirate
    - Pain with passive range of motion
    - Red/swollen joint
    - Elevated WBC/ESR/CRP
    - Negative for crystals (can have superimposed infection but is uncommon <5%)
    - Send fluid for (prioritize in this order for limited volume):
        - Culture with Gram Stain,
        - Crystals
        - Cell count

- **Necrotizing Fasciitis**
    - Go see the patient asap
    - Obtain appropriate Xrays of the affected extremity
    - This is a clinical exam diagnosis supported by lab values.
    - Be sure appropriate labs ordered: CBC, CRP, Chem panel
    - Document LRINEC score (controversial use, but appropriate to document)

- Examine skin/wound. Look for induration beyond erythema. Look for blisters, dishwater fluid, hyponatremia, low bicarb, sepsis, gas on Xray
- Obtain CT scan of upper extremity. To visualize gas usually CT without contrast is sufficient
- If infection/spread gets to shoulder level need to contact general surgery for potential chest wall spread
- Absolutely needs clinical photos in the chart
- Document exam

- **Upper Extremity Abscess**
  - Obtain appropriate Xray of the affected extremity
  - Obtain either US or CT scan to evaluate location/size/extension of the abscess
  - If patient is not septic, hold antibiotics until after I&D and culture was sent
  - **These can and should be I&D in the ED (unless special circumstances)**
  - ED I&D
    - Incision should be right over the abscess. Incise **just skin** and then use blunt instrument to access and decompress abscess. Do not make a small incision! You can be pretty aggressive with the blunt instrument.
    - Incisions should be longitudinal (proximal to distal) whenever possible. Avoid transverse incisions.
    - Send culture! (aerobic, anaerobic, TB and fungal)
    - Irrigate wound
    - Pack wound with iodoform and leave wound open; patient should be admitted for TID soapy soaks and dressing/packing changes.
  - Special cases:
    - Paronychia: incision between lateral nail plate and lateral nail fold (if extends to eponychia need additional incision here), can remove nail if needed. Incise with blade away from nail bed to reduce injury to matrix.
    - Felon: incision overlying infection but do not make fishmouth incision and avoid incision over DIP flexion crease – oblique, midsagittal are preferred or midline longitudinal is acceptable
    - Collar button abscess in web space: volar and dorsal incisions in area of web space
  - In all of these cases encourage patient to range their fingers after procedure.

- **Flexor Tenosynovitis**
    - Look for Kanavels Signs:
        - Fusiform swelling (sausage digit)
        - Pain with passive stretch (extension)
        - Pain on the flexor sheath
        - Finger held in flexion
    - Early FTS does not need to go to the OR. Can admit for IV antibiotics and serial exam with elevation and encouraging range of motion

- **Dog/Cat/Human Bites**
    - Neurovascular exam, Xrays and pictures of the wound
    - Bedside debridement and packing of bites/scratches
    - Augmentin for oral, Unasyn IV. Alternative regimens such as clindamycin plus a fluoroquinolone (or clindamycin plus sulfamethoxazole and trimethoprim in a pediatric patient) can be used if there is a penicillin allergy.
    - For most wounds we do not close to reduce risk of secondary infection
    - Cautious of fight bites with human wounds – evaluate joint/tendons/tendon sheaths
    - Risk of secondary infection lower with dogs than human/cats but commonly more tissue damage
    - Special cases:
        - **Snake Bites** (Northern Pacific RattleSnake present in Bay Area) – give CroFab antivenom and broad spectrum IV abx (vancomyicin and zosyn).
        - **Wounds with marine exposure** – Ancef + fluoroquinolone + doxycycline
    - In all of these cases encourage patient to range their fingers after procedure.

- **High-Pressure Injection Injury**
    - Obtain appropriate Xray of the affected extremity
    - Get information about the material injected (oil-based and industrial solvent produce greater degree of tissue necrosis than water-based paints and grease)

    - Perform I&D in the ED to decompress wound
    - Broad spectrum IV antibiotics
    - Place pictures in the chart of the finger
    - Functionally can behave like a finger compartment syndrome and should be discussed with the attending on call

Considerations when booking a patient for surgery from the ED or as an inpatient:

- Make sure you communicate appropriately with attending about case request details
- Include the dot phrase .preopinfo in your note
- When you book patient make sure therapy (OT or PT) order is placed as urgent so patient can receive immediate outpatient therapy postop and note the start date and location in the order
- Surgical schedulers should be messaged to confirm appropriate follow up and therapy (Wendy Hoang and Joji Lizardo)