

## ACUTE HAND INJURY PROTOCOLS

### I. FRACTURES OF THE HAND AND DIGITS

#### A. Background

Digital and hand fractures are seen in many settings and more commonly in situations involving machinery and heavy labor. Most fractures are due to local trauma caused by an applied force. The energy of applied force determined the severity of the fracture. Digital fractures are much more common than hand fractures, and may present as open fractures with soft tissue loss.

#### B. Medical History

1. Pain, swelling, and discomfort to the injured digit, thumb, or hand
2. Age, occupation, activities, hand dominance, history of previous hand injury/impairment important to document
3. Date of injury, as well as time interval between injury and treatment
4. Conditions surrounding injury (physical environment)
  - Assists in determination of dirty vs. clean wound
5. Mechanism of injury

#### C. Physical Examination

1. Swelling and tenderness of the affected part
2. Digital range of motion
3. Vascular changes (ischemic, congestion, or cyanosis)
4. Neurologic changes (including two-point discrimination)
5. In digital fractures, notation of the soft tissue “envelope” and the presence of any skin interruption, consistent with an open fracture, should be sought.

#### D. Appropriate Diagnostic Tests and Examinations

1. X-rays, including true lateral views of the involved digit/metacarpal bone. Occasionally advanced imaging (MRI, CTScan) for evaluation of fracture pattern
2. Occasionally, noninvasive/invasive vascular studies may be useful and appropriate, when there is suspicion of circulatory compromise. Such studies include:
  - a. Doppler
  - b. Ultrasound
  - c. Angiogram
  - d. MRA

#### E. Outpatient Treatment: Uncomplicated Fractures

1. Uncomplicated digital fractures are expected to obtain boney union within four to six weeks. OT/PT often can begin at 3 weeks to attempt to avoid stiffness.
2. Indications for Treatment
  - a. Pain
  - b. Limited Motion
  - c. Swelling

3. Treatment Options: Closed Reduction With/Without Anesthesia
  - a. Digital finger splints
  - b. Intrinsic plus splints
  - c. Buddy taping
  - d. Intrinsic plus casting
  - e. Casting
  
4. Rehabilitation
  - a. After initial healing (confirmed by exam/x-ray), active and passive range of motion exercises of the digits, hand and wrist
  - b. Grip strengthening exercises, when indicated
  - c. Activity modification may be necessary.
  
5. Duration of Care
  - a. Generally extends over 6-12 weeks
  - b. Duration depends on severity of wound, complications, and complexity of care required for healing and optimization of functional restoration.
  
- F. Closed Reduction, Internal Fixation/Open Reduction, Internal Fixation/Surgically Treated Injuries
  1. Indications
    - a. Failure to respond to conservative measures
    - b. Failure to correct digital deformity/displacement (seen in AP, lateral, or rotatory x-ray views) or by clinical exam
    - c. Intra-articular joint fracture that cannot be adequately treated by closed measures
    - d. Open fractures requiring irrigation and debridement
    - e. Amputations
  
  2. Treatment Options
    - a. Closed reduction with/without internal fixation
    - b. Open reduction with/without internal fixation
    - c. Irrigation and debridement
    - d. Closed reduction or external fixation
  
  3. Rehabilitation
    - a. Following initial healing, active and passive range of motion exercises of the digits, hand and wrist
    - b. When indicated, grip strengthening exercises
    - c. Activities of daily living modification
    - d. Activity limitations
    - e. Range of motion exercises (after fracture healing)
    - f. Splinting/casting
  
  4. Duration of Care

- a. Operative treatment: 3-6 months following surgery

## II. DIGIT AND HAND DISLOCATIONS

### A. Background

Dislocations require tearing of some of the structures surrounding the joints of the digits, hand, and/or wrist. All injuries of this sort must be reduced to allow for adequate post-injury function. Unduly lengthy immobilization following these injuries can lead to stiffness in the affected part. Often accompanying these injuries is cartilaginous disruption, resulting in eventual joint (traumatic) arthritis.

### B. Diagnostic Criteria

- 1. Precipitating Injury History/Mechanism of Injury
  - a. Usually involves a hyperextension type injury (digits)
  - b. Metacarpal dislocations often involve a direct blow to the “knuckles” hand or digit
  - c. Usually presents with severe pain, swelling, and deformity of the hand or digit
- 2. Physical findings
  - a. Swelling
  - b. Pain
  - c. Limited motion

### C. Appropriate Diagnostic Tests and Examinations

- 1. Digital X-rays: true lateral views of the digits, including AP, lateral, and oblique pre and post-reduction views. Occasionally advanced imaging
- 2. Hand X-rays: true lateral radiographs, including metacarpals, with AP, lateral, and oblique pre and post-reduction views. Occasionally advanced imaging

### D. Outpatient Treatment

- 1. Nonoperative Treatment
  - a. Varies according to injury severity
  - b. Can include closed reduction of digital joints under local anesthesia
  - c. Immobilization after reduction, including digital splints, intrinsic-plus splints of the hand or wrist, and casting
- 2. Rehabilitation
  - a. Can include active/passive range of motion exercises, beginning 2-6 weeks after injury
  - b. Grip strength exercises, when indicated
  - c. Activities of daily living modification
  - d. Activity modification

3. Surgery
  - a. Indications
    - Inability to reduce a dislocation under closed conservative treatment
    - Open digital dislocation
    - Irreducible joint dislocations with extensor and/or flexor tendon involvement
    - Fractures associated with dislocations
  - b. Surgical Options
    - Closed reduction under anesthesia
    - Closed reduction, internal fixation
    - Open reduction
    - Open reduction, internal fixation, with ligament or tendon repair
  - c. Post-operative rehabilitation
    - Although this group may require extended periods of rehabilitation, generally required rehabilitation components approximates that of the nonoperative group
4. Estimated Duration of Care
  - a. Varies depending on severity of tissue damage, complication

occurrence

### III. WRIST FRACTURES AND DISLOCATIONS

#### A. Background

Fractures and dislocations of the wrist are frequently missed emergent musculoskeletal injuries. The intricate anatomy of the carpal bones, along with multiple overlapping shadows on x-rays, make this type of injury difficult to diagnose. Many injuries, therefore, are missed on initial examination. Careful evaluation, therefore, is paramount in recognition of these injuries.

#### B. Diagnostic Criteria

##### 1. Medical History

##### a. Mechanism of injury

- Direct blow to wrist or hand
- Fall onto wrist or hand
- Hypertension or hyperflexion injury

##### 2. Physical Examination

##### a. Swelling, as well as tenderness, are localized to the location of the

injury

##### b. Tenderness to the anatomic snuff box, consistent with scaphoid

fracture

##### c. Swelling, with restricted range of motion, suggestive of serious

ligamentous disruption

- d. Potential scaphoid or carpal fracture, as well as ligament injury, should be ruled out prior to assigning diagnosis of wrist pain.
- e. Difficulty with performance of wrist flexion and extension
- f. Occasional numbness and/or dysesthesias, consistent with median and/or ulnar nerve involvement

When present, further nerve testing (see below) is critical.

3. Diagnostic Tests and Examination
  - a. X-rays: true, AP, lateral, and oblique views, in addition to scaphoid views (when clinically indicated)
  - b. CT or MRI scan indicated for detection of suspected nonunion, dislocation or ligamentous disruption
  - c. Arthrogram, fluoroscopic (CT and MRI arthrogram) may be indicated when physical examination indicates wrist instability
  - d. EMG/NCVS may be indicated to verify presence and of nerve involvement, if clinically suspected

#### C. Nonsurgical Treatment

1. Outpatient/nonoperative treatment
  - a. Treatment is specified and fracture-based
  - b. Variable, diagnosis-specific healing times  
Examples:
    - Triquetral fractures: 4-6 weeks
    - Scaphoid fractures: 3-6 *months*
2. Treatment Options
  - a. Neutral position wrist splint
  - b. Thumb spica splint/short arm cast
  - c. Thumb spica long arm cast
  - d. Wrist neutral cast

#### D. Nonsurgical Rehabilitation

1. Begins after fracture/injury healed
2. Digital, hand and wrist exercises
3. Active and passive range of motion exercises
4. Grip strengthening exercises, as indicated
5. Activity modifications

#### E. Surgical Treatment

1. Indicated for conditions not amenable to non-surgical means
2. Treatment options
  - a. Open reduction, internal fixation of fracture
  - b. Open reduction and operative repair of ligamentous injury
  - c. Intercarpal fusion
  - d. Radiocarpal fusion
  - e. Wrist arthroscopy
  - f. Wrist arthroplasty

- F. Surgical Rehabilitation
  - 1. Digital, hand and/or wrist active and passive range of motion exercises
  - 2. Grip strengthening exercises
  - 3. Wrist splinting in extension

#### IV. TENDON INJURIES

##### A. Background

The flexor and extensor tendons of the digits lie superficially under the skin and, therefore, are commonly injured. Appropriate care at the point of initial treatment is imperative for a positive outcome. However, due largely to the complexity of the extensor and flexor tendon systems in the upper extremity, accurate diagnosis of injury is often problematic. For example, every hand laceration (regardless of the size) carries with it the potential for tendon laceration. Anticipating a laceration, based on the location of the laceration, therefore, is paramount in the provision of appropriate care of these injuries.

##### B. Medical History

- 1. Open Tendon Injuries
  - a. Most are secondary to sharp objects that cause wounds to skin and soft tissue(s) injury
  - b. Hand position at time of injury determines location of tendon injury
  - c. Usually, patients cannot fully bend or extend the affected finger or hand, as well as noted alteration in function
  - d. Pain in affected digit
  - e. Numbness/dysesthesias suggestive of accompanying nerve injury
- 2. Closed Tendon Injuries
  - a. Complete extensor/flexor tendon rupture can occur without a visible wound
  - b. Spontaneous ruptures can occur secondary to other medical conditions

##### C. Physical Examination

- 1. Includes subtle evaluation of normal stance of the digits in both flexion and extension
- 2. Active motion tests indicate lack of motion in affected digit
- 3. Partial lacerations can be present with pain with resisted motion
- 4. Sensibility should be assessed via light touch, two-point discrimination

##### D. Diagnostic Tests and Examinations

- 1. Radiograph of digit
- 2. Sensibility tests

##### E. Outpatient, Nonsurgical Treatment (Closed Extensor Tendon Injuries)

- 1. Neutral position using intrinsic plus splint

2. Digital splint
3. Buddy taping

F. Nonsurgical Rehabilitation

1. Begins after tendon heals
2. Active and passive range of motion of digits, hand, and wrist
3. Grip strengthening exercises as appropriate

G. Surgical Treatment

1. Indications

- a. All open flexor or extensor tendon injuries with open wounds and limited motion
- b. Open injuries with pain with motion
- c. All expectant tendon injuries (flexor/extensor)
- d. Closed flexor tendon injuries
- e. Failure to respond to nonoperative treatment and rehabilitation after appropriate time to heal (including active/passive range of motion digital exercises)

H. Estimated Duration of Care

1. Nonoperative treatment: 8-12 weeks after injury
2. Operative treatment: 3-6 *months* after injury

V. DIGITAL NERVE INJURIES

A. Background

Most significant digital nerve injuries result in sensation loss distal to the injury level. Most are the result of lacerations that frequently also involve the flexor tendons. Contusions or crush injuries may disrupt nerve function without an actual physical disruption of the nerve.

B. Diagnostic Criteria

1. Medical History and Physical Examination
  - a. History of trauma
  - b. Laceration over the volar digital surface (palm for the common digital nerves)
  - c. Absent sensibility in the distribution of the affected nerve

C. Diagnostic Tests

1. Light touch: diagnostic if deficit is in anatomic distribution consistent with the location of laceration
2. Two-point discrimination (Semmes-Weinstein)
3. Monofilament testing
4. Digital vibration

5. Sensory nerve conduction studies

D. Surgical Treatment

1. Laceration with probable nerve division: operative exploration and repair with magnification
- Healthy nerve: end-to-end repair
  - Other: interposition nerve graft
- a. Immediate repair if suitable operative candidate
- b. Urgent repair if skin wound closed and repair delayed up to 7 days, then repaired primarily
- c. Delayed repair after 7 days if patient is unstable or graft needed
- d. After 7 days, neuroma at divided nerve ends just be resected, with additional nerve length required for closure without tension

2. Laceration with Equivocal Nerve Division

- a. Exploratory surgery
- If patient at surgery for other injuries
  - If wound does not need enlargement
- b. Observation
- With closure of wound and reassessment in 1-3 days
3. No Laceration
- a. Observe for functional return (Tinel's sign) or increase of sensibility
- b. Explore if progression of Tinel's sign is not seen

E. Rehabilitation

1. Splint three weeks to avoid tension on the nerve repair, with elevation to minimize swelling
2. Range of motion exercise after 3 weeks, avoiding stretching or trauma to the nerve repair for additional 3 weeks

F. Duration of Care

1. Activities not requiring stretch or trauma to nerve repair, or sensibility to affected nerve distribution: 6-12 weeks
2. Activity requiring sensibility in the affected nerve distribution:
- Gross sensibility (1mm. / day, or 1 inch/month)
  - Nerve regeneration beyond injury level as indicated by advancing Tinel's sign and return of sensibility
  - Maximum sensibility return occurs at an approximate rate of time equal to twice that required for gross sensibility to return
    - Never returns to 100%
    - Range is zero to near 100% return



- Maximal medical improvement at 6 months to 1-2 years
- If function is unsatisfactory, neuroma resection and nerve grafting may be appropriate

## VI. DISTAL PHALANX/FINGER TIP INJURIES

### A. Background

Injuries to the tips of digits are very common in industry, especially in the manufacturing and construction sectors. Injuries of this type include full thickness soft tissue injuries with soft tissue loss, compound fractures of the distal phalanx of an upper extremity, as well as nail bed injuries requiring repair. Injuries extending proximally to the distal interphalangeal (DIP) joint are considered elsewhere.

### B. Medical History

1. Usually result from crush type injury

### C. Physical Examination and Diagnostic Testing

1. X-rays of affected digit are usually sufficient

### D. Outpatient Treatment: Nonoperative

1. Most often provided in an emergency room setting
2. Debridement and laceration(s) repair
3. Fracture reduction
4. Skin grafting (full/partial thickness)
5. Local Flap
6. Amputation

### E. Outpatient Operative Treatment

1. Fixation of complex or intra-articular fractures
2. Pedicle flaps

### F. Inpatient Operative Treatment

1. Sensory neurovascular island flap (rare)
2. Replantation

### G. Rehabilitation

1. Elevation and protection of fracture(s)
2. Gradual mobilization and desensitization

## VII. ULNAR COLLATERAL LIGAMENT INJURY (THUMB): SPRAIN/TEAR

### A. Background

Injuries to the ulnar collateral ligament (UCL) of the thumb occur in a variety of ways, including a fall from a height, resulting in a radial deviation force to the metacarpophalangeal (MCP) joint, placing the ligament under tension. Partial or complete tear may occur, as well as avulsion of the ligament from its bony attachment (with or without fracture). Skiing and contact sports are frequently associated with this type of injury.

- B. Medical History and Physical Examination
  1. Pain, swelling, and weakness are frequent complaints
  2. History of a blow or fall involving the thumb (MCP joint)
  3. Palpable lump at site of avulsed ligament
  4. Ulnar stress instability should be documented
  
- C. Diagnostic Tests and Examination
  1. X-rays of the injured thumb are sufficient, possibly stress views
  2. MRI may be appropriate if exam equivocal (rarely)
  
- D. Outpatient Treatment
  1. Nonoperative
    - a. Indications
      - Incomplete ligamentous injury; not disrupted either within its substance, nor at its attachments
      - Nondisplaced fracture at the attachment of the ulnar collateral ligament
    - b. Treatment options
      - Immobilization for 4-6 weeks
      - Elevation and range of motion of all uninvolved joints
    - c. Rehabilitation
      - Active range of motion after cast/splint removal
      - Begin rehabilitation after exam documents healing
  2. Ambulatory (outpatient) Surgery
    - a. Indications
      - Significantly displaced or avulsed fracture with ligament attachment
      - Complete ligamentous disruption
      - Stenner's lesion (displacement of the UCL superficial to the adductor tendon)
      - Joint instability or subluxation
    - b. Treatment Options
      - Exploration with ligament re-approximation, or fracture reduction and/or fixation, with attached ligament, followed by immobilization for 4-8 weeks
      - Primary or secondary reconstruction, including joint subluxation
      - Postoperative elevation and range of motion of all uninvolved joints
    - c. Rehabilitation

Begin rehab with active ROM at 5-8 weeks

## VIII. DIGITAL STENOSING TENOSYNOVITIS (TRIGGER THUMB AND TRIGGER FINGER)

### A. Background

Arising from irritation and inflammation of the flexor tenosynovium at the A-1 pulley of the digital flexor tendon sheath, this injury can be due to trauma during a single event, or secondary to repetitive “microtrauma” (repetitive motion), or an inflammatory process. It is frequently seen in conjunction with other upper extremity tendonopathies or inflammatory conditions, such as carpal tunnel syndrome or DeQuervain’s tenosynovitis.

### B. Medical History and Physical Examination

1. Most often caused by repetitive and/or forceful gripping, or use of vibrational tools
2. Gradual onset of pain and limitation of full digital flexion, with “triggering” or clicking of the digit
3. Can follow a single episode of pain accompanying forceful gripping or digit hyperextension
4. Exam shows point-specific pain/tenderness at the A-1 pulley (distal palmar crease) with/without crepitance with active motion
5. Passive arc of motion exceeds active arc
6. Palpable, sometimes audible click with flexion/extension
7. Finger swelling; morning stiffness/triggering, often diminishing during the day
8. Retinacular (ganglion) cysts may be present

### C. Diagnostic Tests and Examinations

1. Hand x-rays, primarily to rule out associated arthritis or bony lesions
2. Laboratory studies to rule out/in connective tissue disease, if clinically suspected
3. MRI only if atypical cyst or mass is clinically suspected

### D. Nonoperative Treatment

1. Indications
  - Pain
  - Triggering
  - Functional limitations/disability
2. Treatment Options
  - Nonsteroidal anti-inflammatory medications (NSAIDS)
  - Intermittent splinting
  - Tendon sheath steroid injections
  - Activity modification

### E. Operative Treatment

1. Outpatient surgery indications

- Lack of response to nonoperative measures after 4-10 weeks, dependent on symptom complex
2. Options
    - Release of the A-1 pulley, partial excision and partial release of A-2 pulley (proximal margin) under local, regional, or general anesthesia
    - Limited tenosynovectomy and tenolysis of flexor tendon(s)
  3. Rehabilitation
    - a. Progressive active range of motion, strengthening
    - b. Splinting
    - c. Hand therapy may be useful for scar tenderness and/or post-surgical stiffness
    - d. In the case of long term symptoms, postoperative splinting may be indicated to regain full extension
  4. Duration of Care
    - a. Nonoperative treatment: 2-4 weeks, depending on symptom complex
    - b. Operative treatment: 4-8 weeks, may need postoperative splinting

**PROTOCOL HISTORY:**

Passed: 5/24/1994  
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