

GUIDELINES FOR ORTHOPEDIC CONSULTATION AND FOLLOW-UP

HAND	Orthopedic Consult	Follow Up	Disability Period
► First Metacarpal Base Fractures			
Extra-articular			
- Angulation <30°	No	Hand	12 weeks
- Angulation >30°	Yes	Hand	12 weeks
Articular	Yes	Hand	12 weeks
► Finger Metacarpal Fractures			
Head (articular)	Yes	Hand	12 weeks
Neck (MC #4 or 5)			
- Angulation <40°	No	Hand	12 weeks
- Angulation >40°	Yes	Hand	12 weeks
Neck (MC #2 or 3)			
- Angulation <10°	No	Hand	12 weeks
- Angulation >10°	Yes	Hand	12 weeks
Shaft			
- Traverse, non-displaced	No	Hand	12 weeks
- Traverse, displaced/angulated	Yes	Hand	12 weeks
- Spiral, oblique, comminuted	Yes	Hand	12 weeks
Base			
- Non-displaced	No	Hand	12 weeks
- Displaced	Yes	Hand	12 weeks

**GUIDELINES FOR ORTHOPEDIC
CONSULTATION AND FOLLOW-UP
(Continued)**

HAND	Orthopedic Consult	Follow Up	Disability Period
► Middle and Proximal Phalanx Fractures			
Extra-articular			
- Transverse, non-displaced	No	Hand	12 weeks
- Transverse, displaced or angulated	Yes	Hand	12 weeks
- Spiral, oblique or comminuted	Yes	Hand	12 weeks
Articular			
- Basal or condylar	Yes	Hand	12 weeks
- Volar plate avulsion			
- No subluxation, small fragment	No	Hand	12 weeks
- Subluxation present or >35% of articular surface involved	Yes	Hand	12 weeks

HAND-

GUIDELINES FOR ORTHOPEDIC CONSULTATION AND FOLLOW-UP (Continued)

HAND	Orthopedic Consult	Follow Up	Disability Period
▶ Distal Phalanx Fractures			
Extra-articular (tuft or shaft)	No	Primary Care	3 weeks
Articular			
- Dorsal (mallet finger)			
- No subluxation, small fragment	No	Hand	16 weeks
- Subluxation present or >35% articular surface involved	Yes	Hand	16 weeks
- Volar (flexor profundus avulsion)	Yes	Hand	16 weeks
Partial amputation with exposed bone	Yes	Hand	12 weeks
▶ Dislocations			
Metacarpophalangeal joint	Yes	Hand	12 weeks
Proximal interphalangeal joint			
- No post-reduction subluxation, small fragment	No	Hand	12 weeks
- Subluxation present or large fragment	Yes	Hand	12 weeks
Distal interphalangeal joint	No	Hand	12 weeks

MANUAL OF EMERGENCY ORTHOPEDICS

GUIDELINES FOR ORTHOPEDIC CONSULTATION AND FOLLOW-UP (Continued)

HAND	Orthopedic Consult	Follow Up	Disability Period
▶ Collateral Ligament Injury			
Fingers			
- Stable (Grade I or II)	No	Primary Care	3 weeks
- Stable with non-displaced avulsion fracture	No	Hand	12 weeks
- Unstable or displaced fracture	Yes	Hand	12 weeks
Thumb (Gamekeeper's thumb)			
- Stable (Grade I or II)	No	Hand	12 weeks
- Stable with non-placed avulsion fracture	No	Hand	12 weeks
- Unstable or displaced fracture	Yes	Hand	12 weeks
▶ Central Extensor Slip Rupture (Boutonniere Deformity)			
	No	Hand	12 weeks

HAND

GUIDELINES FOR ORTHOPEDIC CONSULTATION AND FOLLOW-UP (Continued)

HAND	Orthopedic Consult	Follow Up	Disability Period
▶ Soft Tissue Finger Tip Injuries			
Nail bed laceration (simple)	No	Primary Care	12 weeks
Nail bed laceration (complex) or avulsion	Yes	Hand	12 weeks
Pulp tip avulsion without exposed bone	No	Primary Care	6 weeks
▶ Mammalian Bite Wounds			
No bone, joint or tendon injury	No	Primary Care	6 weeks
Suspicious or obvious bone, joint or tendon involvement	Yes	Hand	12 weeks
▶ Pulp Space Infection (Felon)			
	Yes	Hand	12 weeks
▶ Acute Paronychia			
	No	Primary Care	4 weeks
▶ Deep Space Infections, Septic Arthritis			
	Yes	Hand	16 weeks
▶ DeQuervain's Tenosynovitis			
	No	Primary Care	12 weeks

MANUAL OF EMERGENCY ORTHOPEDICS

First Metacarpal Base Fractures

MECHANISM

- Hyperabduction or hyperflexion of thumb
- Axial loading ("jamming")
- Direct blow

FINDINGS

- Painful and restricted range of motion
- Swelling at base of first metacarpal with local tenderness
- Deformity common (angulation and/or shortening of first metacarpal)

TYPES

- Transverse (extra-articular)
- Articular surface involved (unstable)
 - Bennett's fracture
 - Rolando fracture (comminuted)

MANAGEMENT

- Extra-articular, $<30^\circ$ angulation
 - Thumb spica cast (short arm) with thumb fully abducted
 - Follow-up: hand surgeon - one week
- Extra-articular, $>30^\circ$ angulation; hand surgeon consult
 - Hematoma block, reduction, immobilize as above
- Articular: hand surgeon consult
 - Usually requires open reduction with internal fixation

COMPLICATIONS

- Rotational deformity
- Post-traumatic arthritis (common after articular fracture)

HAND

Finger Metacarpal Fractures

TYPES AND MECHANISMS

- Head (articular; uncommon)
 - Usually comminuted
 - Crush injury
 - Direct blow
- Neck
 - Punching injury (clenched fist impact)
 - Very common at metacarpal #5 ("Boxer's" fracture)
- Shaft
 - Direct blow (transverse or comminuted)
 - Rotational torque (oblique or spiral)
- Base
 - Direct blow or crush injury
 - Longitudinal torque (unusual)

FINDINGS

- Local tenderness and swelling; variable deformity
- Restricted range of motion
- Frequently open (especially head and neck fractures from punching injuries)
- Intrinsic muscles often cause volar angulation of distal fragment (transverse and comminuted neck or shaft fractures) or shortening (spiral or oblique shaft fractures)
- Digital nerve injury possible
- Rotational deformity may be subtle
- Extensor tendon damage possible (head fractures)

Finger Metacarpal Fractures (Continued)

MANAGEMENT

- Head fractures (articular): hand surgeon consult
 - Anatomic reduction is desirable
 - Frequently open with extensor tendon damage
 - Skeletal fixation is often required
- Neck fractures: metacarpal 4 or 5
 - Greater mobility at bases allows greater tolerance for residual volar angulation of distal fragment (up to 40°) without functional loss
 - Angulation 0-40° - reduction optional
 - Ulnar gutter splint (wrist dorsiflexed 20°, metacarpophalangeal joints flexed to 60-70°, interphalangeal joints flexed slightly)
 - Follow-up: hand surgeon within a few days
 - Angulation >40° - reduction required
 - Hematoma block (1% lidocaine into fracture hematoma)
 - Reduction
 - Ulnar gutter splint (as above)
 - Post-reduction exam and x-rays
 - Follow-up: hand surgeon within a few days
- Neck fractures: metacarpal 2 or 3
 - Lesser basal mobility limits angulation tolerance to <10°
 - Angulation 0-10°
 - Radial gutter splint (wrist dorsiflexed 20°, metacarpophalangeal joint flexed to 60-70°, interphalangeal joints flexed slightly, thumb free)
 - Follow-up: hand surgeon within a few days
 - Angulation >10° - hand surgeon consult
 - Usually requires skeletal fixation

HAND.

Finger Metacarpal Fractures (Continued)

- Shaft fractures
 - Transverse (no displacement, angulation or rotation)
 - Metacarpals 4 and 5: ulnar gutter splint
 - Metacarpals 2 and 3: radial gutter splint
 - Follow-up: hand surgeon within one week
 - Transverse (displaced, angulated and/or rotated): hand surgeon consult
 - Hematoma block, closed reduction and gutter splint may be attempted (best results with metacarpals 3 or 4)
 - Skeletal fixation often required
 - Oblique, spiral or comminuted: hand surgeon consult
 - Shortening and rotation must be corrected
 - Skeletal fixation usually required
- Base fractures
 - Frequently missed - oblique films helpful
 - May be associated with carpometacarpal fractures or dislocations
 - Non-displaced
 - Volar or gutter splint (metacarpophalangeal joints flexed to 60-70°; interphalangeal joints slightly flexed)
 - Follow-up: hand surgeon within one week
 - Displaced and/or associated carpal injury: hand surgeon consult
 - Skeletal fixation usually required

Finger Metacarpal Fractures (Continued)

COMPLICATIONS

- Malrotation or shortening unacceptable
- Flexor/extensor tendon imbalance
- Non-union (especially shaft fractures of metacarpal #2)
- Failure to recognize and/or aggressively treat open injury
- Muscle imbalance frequently causes loss of reduction; initial follow-up must be frequent

HAND.

Middle and Proximal Phalanx Fractures

MECHANISM AND TYPES

- Direct blow or crush injury (transverse, comminuted, or articular fractures)
- Rotational torque (spiral or oblique shaft fractures)
- Severe levering force (transverse, articular or avulsion fractures)

FINDINGS

- Point tenderness and swelling with limited range of motion
- Variable deformity (dorsal angulation of the distal fragment is common with transverse midshaft fractures)
- May be open
- Rotational deformities are common
- Associated soft tissue injuries (tendons, ligaments, neurovascular)

MANAGEMENT

- Extra-articular (shaft) fractures
 - Transverse (no displacement, angulation or rotation)
 - Volar splint with outrigger: MCP joint flexed to 60-70°; PIP joint flexed to 60°, DIP joint flexed to 10-20°)
 - Follow-up: hand surgeon within one week
 - Transverse (displaced, angulated and/or rotated): hand surgeon consult
 - Metacarpal block and reduction
 - Immobilize as above
 - Skeletal fixation may be required if reduction unsuccessful or lost
 - Spiral/oblique: hand surgeon consult
 - Skeletal fixation is usually required

Middle and Proximal Phalanx Fractures (Continued)

- Articular (condylar or basilar) fractures: hand surgeon consult
 - Small non-displaced articular fractures are usually treated initially with immobilization and close monitoring
 - Large (>35% of articular surface involved), displaced, unstable or irreducible articular fractures will required skeletal fixation

COMPLICATIONS

- Persistent stiffness of adjacent joint(s)
- Commonly open
- Rotational deformity
- Flexor/extensor tendon imbalance and/or adhesions

HAND

Volar Plate Avulsion

MECHANISM

- Forced hyperextension; often with axial compression (jamming)
- Most common at finger PIP joints but may occur at MCP or DIP joints
- Frequently occurs with PIP joint dislocation

FINDINGS

- Painful, swollen PIP joint
- Most tender over the volar aspect of the PIP joint
- Passive PIP joint extension may be excessive
- Avulsed bone fragment may be seen on the lateral x-ray

MANAGEMENT

- PIP joint subluxation (on lateral x-ray or avulsed fragment >35% of articular surface): hand surgeon consult (skeletal fixation usually required)
- No subluxation and <35% articular surface involved:
 - Long finger splint (MCP joint flexed to 45°; PIP joint flexed to 20-30°; DIP joint flexed to 10°) or
 - Extension block splint preventing the last 30° of PIP joint extension but allowing full flexion
 - Either type of splint may be incorporated into a dorsal or volar short arm plaster slab for better stability
 - Follow-up: hand surgeon - one week

COMPLICATIONS

- Persistent residual PIP joint swelling is very common
- Chronic PIP joint stiffness or pain
- Swan neck deformity (PIP joint hyperextends and DIP joint is fixed in partial flexion) may be seen acutely or develop chronically (especially if the PIP joint is splinted in full extension allowing the volar capsule to heal in a lengthened position)

MANUAL OF EMERGENCY ORTHOPEDICS

Distal Phalanx Fractures

MECHANISM

- Crush injury (car door, industrial, etc): most common
- Laceration
- Avulsion

FINDINGS

- Associated soft tissue injury is very common (may create open fracture)
- Often comminuted

MANAGEMENT

- Appropriate soft tissue treatment: see Soft Tissue Finger Tip Injuries
- Articular fractures
 - Dorsal: see Mallet Finger
 - Volar: see Flexor Profundus Avulsion
 - Vertical or comminuted: hand surgeon consult
- Non-articular fractures
 - Tuft and stable shaft fractures
 - Mold or reduce fracture(s) after digital block anesthesia
 - Protective splint (may include DIP joint)
 - Follow-up: primary care - one week
 - Grossly unstable shaft fracture (uncommon): hand surgeon consult (may require skeletal fixation)
- Amputation (exposed bone; open fracture): hand surgeon consult
 - Debridement and soft tissue coverage will be required

COMPLICATIONS

- Overlooked tendon avulsion-fracture
- Delayed necrosis and tendon rupture
- Infection

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Extensor Tendon Avulsion (Mallet Finger)

MECHANISM

- Sudden, forceful passive flexion of the DIP joint against active extension (jamming)
- Late complication of crush injury (delayed necrosis and tendon rupture; uncommon)

FINDINGS

- Inability to fully extend the DIP joint
- Point tenderness over the dorsal DIP joint
- Dorsal marginal avulsion fracture of the distal phalanx is best seen on lateral x-ray

MANAGEMENT

- Large fragment (35% articular surface) or subluxation of DIP joint on lateral x-ray: hand surgeon consult; skeletal fixation may be required
- No subluxation and small (<35% articular surface) fragment
 - Splint DIP joint in hyperextension with PIP joint free
 - Splinting must be uninterrupted for 6-8 weeks
 - Follow-up: hand surgeon - one week

COMPLICATIONS

- Persistent residual swelling ("bump") at the dorsal base of the distal phalanx
- Failed conservative treatment may require operative fixation
- Swan neck deformity (hyperextension of the PIP joint with flexion of the DIP joint) may be apparent acutely or may develop if the DIP joint injury is inadequately treated

Flexor Profundus Avulsion

MECHANISM

- Sudden, forceful passive extension of the DIP joint against active flexion
- Common sports injury; especially in football while grasping the jersey of a player who pulls away
- Most common in the third finger (75%)

FINDINGS

- Inability to flex the DIP joint
- Avulsion fracture of the volar marginal aspect of the distal phalanx may be present (best seen on the lateral x-ray); the fragment often retracts to the level of the middle phalanx or PIP joint
- Tenderness over the volar aspect of the DIP joint
- The avulsed tendon (without avulsion fracture) may retract into the palm resulting in a tender palmar mass

MANAGEMENT hand surgeon consult

- Surgical repair required

COMPLICATIONS

- Frequently not recognized initially
- Loss of terminal extension of the DIP joint (flexion contracture)
- Tendon necrosis after severe untreated retraction

HAND.

Metacarpophalangeal Joint Dislocation

TYPES AND MECHANISM

- Lateral dislocation - twisting or adduction/abduction stress while MCP joint is flexed (tight collateral ligaments); occurs most commonly with the thumb (especially in children)
- Dorsal dislocation - forced hyperextension tears the volar plate and allows the proximal phalanx to displace dorsally; most common in the index finger
- Volar dislocation - rare

FINDINGS

- Lateral dislocation - tender swollen MCP joint; variable stability
- Dorsal dislocation - obvious tender deformity with the proximal phalanx displaced dorsally over the metacarpal head
- May include collateral ligament tears and/or avulsion fractures

MANAGEMENT - hand surgeon consult

- Lateral dislocations are usually reducible (closed) using traction plus flexion
- Reduced dislocations should be splinted in 60° of flexion
- Interposed soft tissue may render dorsal dislocations irreducible by closed methods and thus require open reduction
- Persistent instability, displaced or intra-articular fracture fragments will require surgical management

COMPLICATIONS

- Chronic pain or joint stiffness
- Extensor tendon injury

Proximal Interphalangeal Joint Dislocation

MECHANISM

- Forced hyperextension (may include axial loading)
- Most common dislocation in the hand

FINDINGS

- Obvious, tender deformity with middle phalanx displaced dorsally over the head of the proximal phalanx; often includes lateral angulation
- Volar plate is torn (may include avulsion fracture)
- Collateral ligament(s) may be damaged
- May be open

MANAGEMENT

- Digital block
- Reduction (gentle extension followed by axial traction and flexion)
- Post-reduction x-rays to rule out fracture and/or subluxation (best seen on lateral view)
- Splint PIP joint in 20-30° of flexion
- Follow-up: hand surgeon - one week
- Hand surgeon consult should be obtained if the injury is open, irreducible (interposed soft tissue), has subluxation on the post-reduction lateral x-ray, or has large (>35% articular surface) or irreducible fracture fragment

COMPLICATIONS

- Permanent residual periarticular swelling is common
- Swan neck deformity (hyperextension of the PIP joint, flexion of the DIP joint and difficulty initiating PIP joint flexion)
- Flexion contracture of the PIP joint (contracted volar plate) with DIP joint flexion preserved (pseudo-boutonniere deformity)
- Central extensor slip tear (true boutonniere deformity with PIP joint flexed and DIP joint fixed in hyperextension: uncommon)

HAND-

Distal Interphalangeal Joint Dislocation

MECHANISM

- Forced hyperextension (often includes axial loading)

FINDINGS

- Obvious, tender deformity with distal phalanx displaced dorsally over head of middle phalanx (or over the proximal phalanx with a thumb interphalangeal joint dislocation)
- Some degree of lateral angulation is common
- Associated fractures are possible (volar plate avulsion, extensor or flexor tendon avulsion)
- Collateral ligament(s) may be torn
- Frequently open
- May be irreducible (interposed soft tissue)

MANAGEMENT

- Digital block
- Reduction (gentle extension followed by axial traction)
- Post reduction x-rays to rule out fracture and/or subluxation
- Post reduction examination to assess stability and flexor/extensor tendon function
- Splint DIP joint in full extension
- Follow up: hand surgeon - one week
- Hand surgeon consult should be obtained if the injury is open, irreducible, unstable after reduction or associated with tendon disruption/avulsion fracture

COMPLICATIONS

- Persistent residual periarticular swelling
- Overlooked tendon injury

MANUAL OF EMERGENCY ORTHOPEDICS

Collateral Ligament Injuries

MECHANISM

- Forced angulating stress on the joint
- Almost invariable after joint dislocation
- Radial collateral ligament is involved more often than the ulnar collateral ligament
- Common sports injury

FINDINGS

- Local tenderness and swelling
- Variable stability (best assessed during active flexion/extension)
- Digital block (after palpation for tenderness and sensory testing) facilitates function and stability testing
- Avulsion fracture may be present

MANAGEMENT

- Grade I (no laxity; good endpoint)
 - Buddy taping to adjacent finger(s) with padding between
 - Follow-up: primary care - one week
- Grade II (minimal laxity [<math><15^\circ</math> lateral deviation]; endpoint may be "mushy"; may include non-displaced fracture)
 - Dorsal or volar splint to injured joint at 15-20° of flexion
 - Follow-up: hand surgeon - one week
- Grade III (unstable; lateral deviation > 15°; may include subluxation, displaced or non-displaced avulsion fracture)
 - Hand surgeon consult
 - Surgical repair may be required

COMPLICATIONS

- Permanent residual periarticular swelling
- Chronic laxity/instability
- Chronic pain and stiffness

HAND

Thumb Collateral Ligament Injury (Gamekeeper's Thumb)

MECHANISM

- Forceful hyperabduction (often with some component of forced hyperextension) tears the ulnar collateral ligament or avulses its attachment at the volar corner of the proximal phalanx
- Very common ski injury

FINDINGS

- Focal tenderness and swelling over the ulnar aspect of the first MCP joint
- Volar marginal avulsion fracture at the base of the proximal phalanx
 - Common (up to 35%); omit stress testing if non-displaced fracture is seen
- Variable stability
 - Stress test; MCP joint is flexed to 15°; thumb is passively abducted; endpoint is measured and described
 - Grade I: pain but no laxity; solid endpoint
 - Grade II: mild to moderate laxity (<35° to abducted endpoint and/or <15° difference between normal and injured thumb abduction endpoints; endpoint may be "mushy")
 - Grade III: unstable (abduction > 35° and/or > 15° beyond uninjured thumb's abducted endpoint); clear endpoint is not obtainable; pain may be minimal

MANAGEMENT

- Clinical Grade I or II with or without non-displaced avulsion fracture; thumb spica cast (or radial gutter splint) with MCP joint flexed to 30°; follow-up: hand surgeon - one week
- Clinical Grade III and/or displaced fracture: hand surgeon consult (surgical repair required)

COMPLICATIONS

- Chronic instability
- Persistent pain and weakness in pinch and grasp

MANUAL OF EMERGENCY ORTHOPEDICS

Central Extensor Slip Rupture (Boutonniere Deformity)

MECHANISM

- Crush injury, laceration or deep abrasion to the region of the dorsal PIP joint
- Forced passive flexion against actively extended PIP joint
- Volar PIP dislocation (unusual)

FINDINGS

- Swollen, tender PIP joint
- Difficulty bringing the PIP joint to full extension
- Positive Elson test
- Classic deformity (PIP flexed; DIP hyperextended) may take weeks to develop

MANAGEMENT

- Volar splint with MCP and PIP joints held in full flexion; DIP joint is free to flex and extend; follow: hand surgeon - one week
- Open injuries and/or associated avulsion fracture required hand surgeon consult and surgical management

COMPLICATIONS

- Frequently missed acutely because of delayed development of the classic deformity
- Deformity will persist (and require surgical repair) if central extensor slip heals in a lengthened state
- Contractures and permanent loss of motion may result from neglected or inadequately treated injuries

HAND

Soft Tissue Finger Tip Injuries

MECHANISM

- Crush injury, laceration, avulsion

TYPES AND FINDINGS

- Small (<50%) nail hematoma
- Large (>50% nail hematoma - high probability of associated nail bed injury
- Nail bed injury (germinal and/or sterile matrix) - laceration, fragmentation, avulsion
- Injury to nail support structures (paronychium, eponychium)
- Associated distal phalangeal fracture - nail hematoma with fracture probably has associated nail bed injury
- Nail avulsion (total, distal or proximal)
- Finger tip pulp injury - crush, laceration, avulsion

MANAGEMENT

- Careful exam to document vascular supply, sensation and tendon function
- X-ray
- Digital block and tourniquet are often required for complete inspection and subsequent treatment
- Small nail hematomas without fracture can be drained using an eye caughtery "pen" to trephine the nail
- Pulp tip avulsions:
 - Exposed bone: hand surgeon consult
 - No exposed bone:
 - Wound preparation (cleansing, irrigation, debridement of devitalized tissue)
 - Non-adherent gauze, tubegauze dressign, protective splint
 - Dressing changes: 3 times in first week, then weekly (primary care follow-up)

Soft Tissue Finger Tip Injuries (Continued)

- Nail bed injury:
 - Nail removal is required to evaluate and repair nail bed injury
 - Suspect occult nail bed injury with:
 - Distal phalangeal fracture with nail hematoma
 - Nail partially avulsed (>50% of distal or proximal portion)
 - Large (>50%) nail hematoma
 - Lacerations should be repaired with loupe magnification and 6-0 or 7-0 chromic suture after cleansing and debridement of devitalized tissue
 - Nail bed avulsion or fragmentation requires hand surgeon consult
 - Nail should be replaced into the proximal nail fold as a stint to protect the nail bed; if the nail is gone or destroyed non-adherent gauze can be placed in the nail fold over the nail bed; the gauze should be removed in 5-10 days
- Paronychium/eponychium lacerations should be repaired with fine nylon sutures
- Associated fractures: see Distal Phalanx Fractures
- Protective splint for comfort
- Early DIP joint range of motion exercises
- Prophylactic antibiotics are controversial

COMPLICATIONS

- Cold intolerance
- Altered sensation/sensitivity
- Nail deformity (inadequate initial repair of nail bed)
- Chronic stiffness/pain
- Missed tendon avulsion fractures
- Infection

MANUAL OF EMERGENCY ORTHOPEDICS

Mammalian Bite Wounds to The Hand

TYPES

- Dog (80-90%): large punctures, crush, lacerations
- Cat (5-10%): small, deep punctures
- Human (3-5%): mainly clenched fist injury (CFI)
- Others (<2%): mainly rodents

HIGH INFECTION RISK

- Patient factors: Table H-1
- Bite factors:
 - CFI - minimal soft tissue protection of joint spaces, tendon sheaths and deep facial spaces
 - Tissue planes slide when fist is unclenched obscuring injury tract and spreading infection in facial planes
 - Cat bites - small deep puncture wounds (impossible to irrigate); up to 25% infection rate
 - Crush injuries - high infection rate if devitalized tissue is not debrided

LOW INFECTION RISK

- Large, clean lacerations
- Dog bites
- Rodent bites

COMMON PATHOGENS

- Most bite infections are polymicrobial and include anaerobes
- Staph aureus and streptococcus are usually present
- Pasteurella multocida (gram negative rod): very common in cat bites; rapid (<24 hours) progression to clinical infection is common
- Eikenella corrodens (gram negative, facultative anaerobic rod): common in CFI and other human bite wounds
- Other gram negatives; mainly in diabetics

HAND

Mammalian Bite Wounds to The Hand (Continued)

MANAGEMENT

- Careful examination (and x-ray) to rule out associated injury to bone, joint space, ligaments, tendons, deep spaces and/or neurovascular structures; obtain hand surgeon consult if any suspicion of associated injury
- Wound care
 - Do not use providone-iodine scrub in the wound (its detergent may increase the risk of infection)
 - Pressure irrigation using normal saline
 - 12 cc syringe with 19 gauge needle yields > 10 PSI
 - May add dilute (1:10) providone-iodine solution
 - 200 cc is adequate for most wounds
 - Debride devitalized tissue; consider excising margins of puncture wound
 - Wound closure
 - Dog bites can usually be sutured
 - Human and cat bites should be left open
 - Wound cultures of clinically uninfected bites are unreliable
- Prophylaxis
 - Tetanus immunization: Table H-2
 - Rabies: Table H-3
 - Antibiotics are prudent in high risk situations; specific choices are controversial: Table H-4
 - Immobilization: splint or bulky hand dressing
 - Follow-up: all bite wounds should be rechecked in 24 hours

COMPLICATIONS

- Septic arthritis
- Tenosynovitis
- Osteomyelitis
- Sepsis

MANUAL OF EMERGENCY ORTHOPEDICS

Mammalian Bite Wounds to The Hand (Continued)

PATIENT FACTORS THAT INCREASE THE RISK OF BITE WOUND INFECTIONS

- Age over 50
- Intravenous drug abuse
- Asplenia
- Chronic alcoholism and/or malnutrition
- Immunocompromise (malignancy, chemotherapy, AIDS, etc.)
- Diabetes
- Peripheral vascular disease
- Chronic steroid use

TABLE H-1

HAND

Mammalian Bite Wounds to The Hand (Continued)

TETANUS PROPHYLAXIS

History of Immunization	Clean Minor Wounds		Major and Dirty Wounds	
	Toxoid ^a	TIG ^b	Toxoid	TIG
Unknown	Yes	No	Yes	Yes
None-one	Yes	No	Yes	Yes
Two	Yes	No	Yes	No (unless wound older than 24 hours)
Three or more:				
Last booster within 5 years	No	No	No	No
Last booster within 10 years	No	No	Yes	Yes
Last booster more than 10 years ago	Yes	No	Yes	Yes

^aToxoid:

Adult: 0.5 ml dT IM.
 Child less than 5 years old: 0.5 ml DPT IM.
 Child older than 5 years: 0.5 ml DT IM.

^bImmune globulin (TIG): 250-500 units IM in limb contralateral to toxoid.

TABLE H-2

MANUAL OF EMERGENCY ORTHOPEDICS

Mammalian Bite Wounds to The Hand (Continued)

ALGORITHM FOR HUMAN RABIES POSTEXPOSURE PROPHYLAXIS

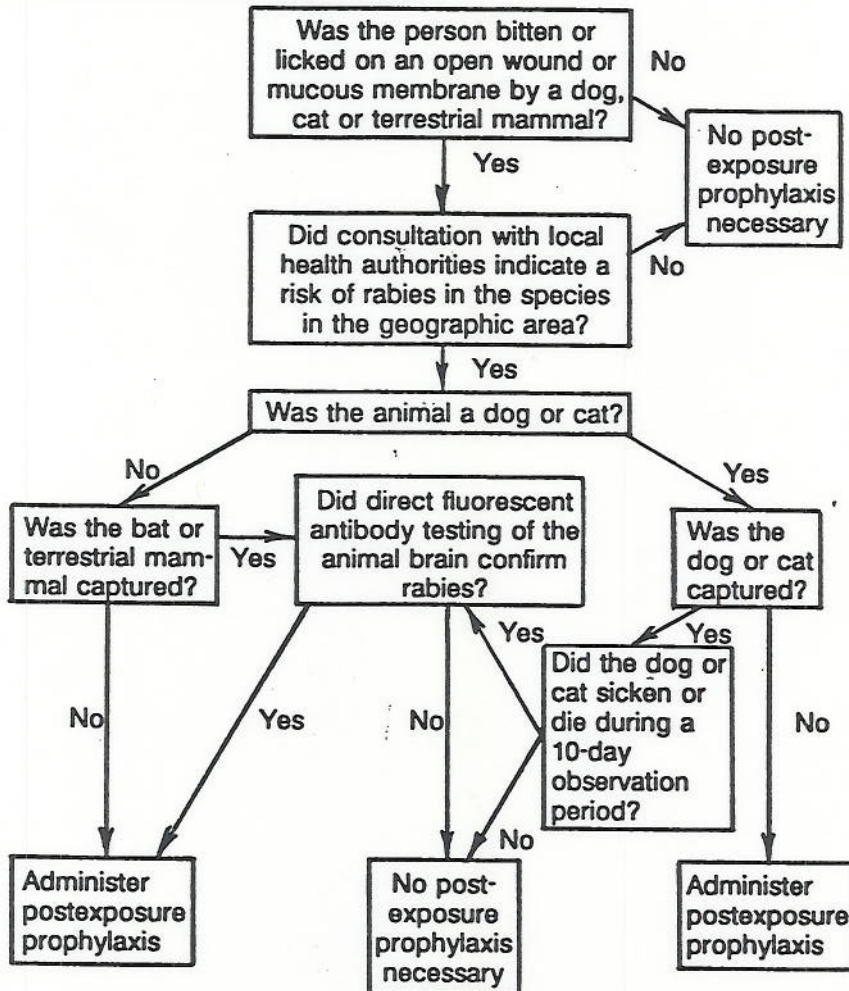


TABLE H-3

MANUAL OF EMERGENCY ORTHOPEDICS

Mammalian Bite Wounds to The Hand (Continued)

PROPHYLACTIC ANTIBIOTICS FOR BITE WOUNDS

Dog bites	- not routinely indicated
Cat bites	- penicillin or dicloxacillin - 500 mg PO QID x 5 days
Human bites	- penicillin plus dicloxacillin - each 500 mg PO QID x 5 days

In the high risk patient, consider parenteral cephasporin for first dose
(Ceftriaxone - 250 mg IV or IM; Cefazolin - 1.0 gm IV or IM)

TABLE H-4

Pulp Space Infection (Felon)

MECHANISM

- Infection in the pulp space of the volar pad of the distal phalanx (closed space with multiple fibrous septa running vertically from tuft periosteum to the subcuticular tissue of the touch pad of the finger tip)
- Portal of entry is often small fissures or cuts at the margin of the nailbed or by puncture of the terminal pulp
- Most common organism is staphylococcus aureus

FINDINGS

- Increasing pressure in closed septal compartments causes intense pain
- Abscess may point in the mid touch pad
- Entire terminal digit may be inflamed and swollen
- Lymphangitis and lymphadenitis may occur

MANAGEMENT

- X-ray to rule out bony involvement or foreign body
- Digital block
- Incision
 - Palmar longitudinal (if abscess points in touch pad); should not cross CIP flexion crease
 - Lateral "hockey stick" (classical incision) or straight lateral
 - Transect and decompress septal spaces
 - Avoid incising the volar (tactile) pad
 - Incision is dorsal to the neurovascular bundle
- "Fishmouth" incision is contraindicated
 - Risks disruption of terminal vascular supply with resultant necrosis
 - Painful scar
 - Unstable touch pad when pinching

HAND -

Pulp Space Infection (Felon) (Continued)

- Xeroform wick ("hockey stick" or straight lateral incisions only)
- Antibiotics (anti-staphylococcal; e.g., Dicloxacillin or Cephalexin - 500 mg QID x 7 days)
- Follow-up: primary care in 48 hours - wound check and wick removal

COMPLICATIONS

- Bony involvement: osteomyelitis, ischemic necrosis
- Painful scar if volar touch pad violated
- Neurovascular injury if lateral incision is too volar
- Flexor tenosynovitis or septic arthritis (DIP joint): rare

Acute Paronychia

MECHANISM

- Cellulitis of the eponychium/paronychium (cuticle) progressing to pus formation between nail fold and nail
- Usually caused by staphylococcus aureus but may be polymicrobial
- Frequently related to nail biting, hangnail or manicuring

FINDINGS

- Usually localized but may involve entire cuticle ("runaround" abscess)
- Lymphangitis may develop

MANAGEMENT

- Cellulitis only
 - Frequent warm soaks
 - Antibiotics (anti-staphylococcal; e.g., dicloxacillin - 500 mg QID x 7 days)
 - Follow-up: primary care - 24 to 48 hours
- Fluctuance
 - Digital block is helpful
 - Radial incision between the cuticle and the nail into site of maximum pus accumulation; "runaround" abscess will require two incisions
 - Blunt dissection to break loculations and lift nail fold off nail
 - Frequent warm soaks
 - Antibiotics (as for cellulitis)
 - Follow-up: primary care - 48 hours

COMPLICATIONS

- Subungual abscess (requires excision of proximal nail overlying the abscess)
- Destruction of the nail bed and/or nail matrix
- Neglected acute paronychia may progress to chronic paronychia which often includes superinfection with yeast or fungus

HAND-

Space Infections of The Hand

MECHANISM

- Suppuration from direct penetration, hematogenous spread or spread from adjacent structures
- Contributing factors
 - Compromised host (diabetes, AIDS, malignancy, alcoholism, poor nutritional status)
 - Peripheral vascular disease
 - Fissures
 - Neglected wounds or burns
 - Bite injury (especially clenched fist injury)
 - Foreign bodies
 - Crush injury with devitalized tissue

TYPES

- Tendon sheaths: tenosynovitis
 - Flexors are more commonly affected than extensors
- Dorsal spaces
 - Subcutaneous
 - Subaponeurotic
- Palmar spaces
 - Thenar
 - Hypothenar
 - Midpalmar
- Web spaces
- Joint spaces: septic arthritis

Space Infections of The Hand (Continued)

FINDINGS

- Swelling (may be massive), erythema and tenderness
- Fluctuance or spontaneous drainage may be present
- Lymphangitis/lymphadenopathy are common
- Fever/systemic symptoms may be present
- X-ray may reveal bony destruction or foreign body
- Exquisite pain with slight passive motion suggests tenosynovitis and/or septic arthritis
- Flexor tenosynovitis usually produces a symmetrically swollen finger held in flexion that is very tender volarly over the tendon and cannot be passively extended because of pain
- Organisms:
 - Most space infections are polymicrobial; may include anaerobes
 - Staphylococcus aureus and streptococcus are usually present
 - Pasteurella multocida (animal bites, especially cats)
 - Eikenella corrodens (clenched fist injury and human bites)
 - Gram negatives (especially in diabetics)

MANAGEMENT - hand surgeon consult

- Tetanus prophylaxis
- Surgical drainage, debridement and irrigation are required
- Operative (deep) cultures and blood cultures are much more reliable than surface cultures
- Parenteral antibiotics (based on etiology and gram stain)
- Immobilization and elevation

COMPLICATIONS

- Local spread to adjacent structures, spaces or tendons
- Osteomyelitis (may necessitate amputation)
- Necrotizing fasciitis
- Sepsis
- Permanent functional loss or stiffness

HAND

DeQuervain's Tenosynovitis

MECHANISM AND ANATOMY

- Abductor pollicis longus and extensor pollicis brevis share a common tendon sheath at the radial styloid (volar border of the "anatomic snuff box")
- Repetitive activity (especially of the thumb) produces tenosynovitis
- More common in middle aged women

FINDINGS

- Tenderness over the radial styloid
- Pain in the radial wrist and thumb exacerbated by movement
- Pain and/or paresthesias along the dorsum of the thumb, index and middle finger (digital branches of radial nerve irritated)
- Swelling and/or crepitance distal to radial styloid is common
- Positive Finkelstein's test
- X-ray may show localized osteopenia over the radial styloid

MANAGEMENT

- Non-steroidal anti-inflammatory drugs
- Local heat
- Radial gutter splint to immobilize thumb and wrist
- Corticosteroid injection into the tendon sheath if conservative therapy fails
- Follow-up:
 - Primary care at intervals of one to two weeks
 - Orthopedist if still symptomatic after six weeks (may require surgical decompression)

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