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Understanding Multi-Trauma Hand and Upper Extremity Injuries

Carol Recor, OTR/L, CHT

Learning Objectives

After this course, participants will be able to:

- Recognize the appropriate algorithm or protocol for soft tissue and bony injuries.
- Identify proper orthosis positioning for multi-trauma hand injuries.
- Identify precautions for multi-trauma injuries.
Algorithm vs. Protocol

COMMUNICATE

EVIDENCE

PROTECT

MOBILIZE

ANTICIPATE
My Primary Goals:

1. Don’t screw up the surgery
2. Regain as much passive motion as possible, as quickly as possible

Every degree of motion that we can regain, without sacrificing nerve or vascular function, moves this patient closer to having a functional hand.
“To someone who has nothing, a little is a lot.”
Sterling Bunnell
COMMUNICATE

- Operative Reports
- X-Rays

OPERATIVE REPORT

PREOPERATIVE DIAGNOSIS:
Machete wound to right hand.

POSTOPERATIVE DIAGNOSES:
1. Median nerve laceration of the wrist.
2. Flexor digitorum profundus and flexor digitorum superficialis laceration, index finger, zone IV.
3. Flexor digitorum profundus and flexor digitorum superficialis laceration, middle finger, zone IV.
4. Flexor digitorum superficialis and Flexor digitorum profundus laceration, ring fingers, zone II.
5. Ring finger P1 open fracture.
6. Scapholunate dissociation.
7. Capitohamate dissociation with open capitate fracture.
8. 3rd carpometacarpal fracture dislocation.
9. Flexor pollicis longus laceration, zone IV.
10. Ring finger metacarpophalangeal joint with associated zone V extensor tendon laceration.

PROCEDURES PERFORMED:
1. Irrigation and debridement of skin, subcutaneous tissue, tendon, fascia, and bone.
2. Repair of flexor digitorum profundus tendons to index and middle fingers, zone IV.
3. Flexor digitorum superficialis repair, index and middle fingers, zone IV.
4. Repair of flexor digitorum profundus and flexor digitorum superficialis tendons to ring finger in zone II.
5. Flexor pollicis longus tendon repair in zone IV.
6. Median nerve repair at the wrist.
7. Open reduction and internal fixation of scapholunate dissociation with ligament reconstruction.
8. Open reduction, internal fixation of capitate fracture.
9. Open reduction, internal fixation of ring finger P1 fracture.
• Stability of fixation
• Tendons, nerves or vessels repaired under tension?
  • Confidence of viability?
• Structures absent?

Photos courtesy of: Stephen Kennedy, M.D
PROTECT

Where to Start?

➢ Ask yourself the right questions:
  • What structures MUST be protected?
    • Including flaps or skin grafts
      • Avoid tight circumferential dressings!
  • What structures are safe to move?
Where to Start?

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  • What structures MUST be protected?
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**Where to start?**

<table>
<thead>
<tr>
<th>Fracture or Fusion</th>
<th>Wrist</th>
<th>Thumb</th>
<th>Index</th>
<th>Middle</th>
<th>Ring</th>
<th>Small</th>
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<tbody>
<tr>
<td>Radius Ulna Carpals</td>
<td>MP IP</td>
<td>MP PIP DIP</td>
<td>MP</td>
<td>MP PIP DIP</td>
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<tr>
<td>Flexor tendons</td>
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<tr>
<td>Nerves – Digital or Periph.</td>
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<tr>
<td>Wounds/flaps/grafts</td>
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</tbody>
</table>

Photos courtesy of: Jeff Friedrich, M.D.
Orthosis Position

- Protect fracture/fixation
- No tension on tendon, nerve or vascular repair
- Ligaments on stretch, if possible
- Neutral wrist, with digits in resting position is safest for multi-trauma
COMMUNICATE

EVIDENCE

MOBILIZE

PROTECT

ANTICIPATE

ANTICIPATE
COMMUNICATE

EVIDENCE

MOBILIZE

ANTICIPATE

PROTECT

MOBILIZE
EVIDENCE

WHEN?
~Flexor Tendons~

- Zhao C, et al. Digit resistance and tendon strength during the first week after flexor digitorum profundus tendon repair in a canine model in vivo. JBJS 2004

When?

- Day 1: Too soon
  - edematous
- Day 7: Too late
  - Early scar adhesions

Buonocore S et al. The effects of edema and self-adherent wrap on the work of flexion in a cadaveric hand. JHS 2012

HOW MUCH?

Groth G. Pyramid of progressive force exercises to the injured flexor tendon. JHT 2004

Force and Excursion

Tendon Rupture

Tenolysis
Replantation

- Both flexor and extensor tendons:
  - PASSIVE MOTION ONLY!

- EPM I & II
EPM I: Tenodesis Pattern

EPM II: Finger "tenodesis"
- Passive MP joint flexion with IP's maintained in full extension
- Passive isolated PIP or DIP joint flexion with MP's in full extension
- Use tissue tension as guide for passive motion

CLINICAL PEARLS
Immobilize the joints that DO move, to transfer forces to the joints that don’t.

Correct maladaptive motor patterns

Case Study
Case Study

- 68 y/o right hand dominant male
- Accidental self-inflicted GSW
  - Bone loss
  - Vascular injuries
  - Flexor and extensor tendon injuries
  - Intrinsic muscles gone
Case Study

- 5th ray amputation
- Bone grafting and rigid fixation 4th MC fx
- Tendon graft
- Revascularization
- Secondary wound closure

Case Study

- Resting dorsal blocking orthosis
- Early protected motion of digits
- Wound care
Case Study

- Scar management
- Modalities
- Tendon glide
- Strengthening

Photos courtesy of: Stephen Kennedy, M.D.
Thank you

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References

- Kannas B, Jeardeau TA, Bishop AT. Rehabilitation following zone II flexor tendon repairs. Tech Hand Surg 2015;19:2-10
References


Allied Health Media

OccupationalTherapy.com

Management of Upper Extremity Trauma
http://www.occupationaltherapy.com/hand-therapy

Mon 2/6 Understanding Multi-Trauma Hand and Upper Extremity Injuries Carol Recor, OTR/L, CHT

Tues 2/7 Wrist Detective: Investigating Traumatic Wrist Injuries Rachel Pigott, OTR/L, CHT

Wed 2/8 Management of Upper Extremity Nerve Injury Christine Novak, PhD, PT

Thurs 2/9 Occupational Therapist’s Management of Upper Extremity Burns Nora Barrett, MS, OTR/L, CHT

Fri 2/10 Tendon Trauma: Keys to Optimal Outcomes Rebecca Neiduski, PhD, OTR/L, CHT