Hand Trauma
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Overview
- Hand and upper extremity trauma common
  - MVA’s, PVA
  - GSW’s
  - Work related
    - Table saw
    - Knife
    - Crush

Overview
- Hand Injuries
  - Fingertip and Nail bed injuries
  - Soft-tissue reconstruction
  - Tendon injuries
  - Fractures and dislocations
  - Amputations and replantation
**Evaluation: History**

- Age, handedness, occupation
- Past medical history
- History/Mechanism of Injury
- History of previous injuries/treatment
- Tetanus vaccination status

**Evaluation: Physical exam**

- Skin/Nail bed integrity
- Neurologic evaluation
  - Light touch, 2-point discrimination
- Capillary refill, pulse
- Flexor, extensor tendon function
  - ROM
- Ligaments (laxity)
- Hand/Forearm compartment evaluation

**Defect Assessment**

- Soft-tissue
  - Skin and subcutaneous tissue
- Tendon
- Ligaments
- Nerve
- Vascular
- Bone

**Evaluation: X-ray**

- 3 views of the hand and wrist
- Fracture pattern
- Fracture alignment
**Fingertip and Nail Bed Injuries**

- 6 Million ER visits
- 12 million office visits
- 90 million days restricted activity
- 16 million days lost
- 10 billion dollars

*American Association for Hand Surgery*

**Healing / Secondary Intention**

- Advantage
  - Pulls innervated pulp into wound
- Disadvantage
  - Duration of healing
- Consider for small wounds <1cm,
  - Distal, volar, without bone

**Superficial Pulp Injuries**

- Skin graft
  - Full thickness = less contraction, increased sensibility

**Fingertip Injuries: Goals**

- Preserve sensation
- Maximum functional length
- Prevent joint contractures
- Soft-tissue coverage
- Bony fixation
- Satisfactory appearance
Volar Pulp Injuries

- Cross-finger flap
  - Raise flap from adjacent finger
  - Injured finger flexed and flap sutured to defect
  - Skin graft donor site
  - Flap divided in 10-14 days

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Cross-finger flap

- Excellent color match, sensate, hair-bearing

Volar Thumb Injuries

- Moberg flap (1-2cm defects)
  - Axial incisions
  - Entire volar tissue elevated from flexor tendon sheath
  - Flap advanced, sutured with thumb flexed
  - Good color match, sensate
**Soft-Tissue Reconstruction**

- Local Finger Flaps
- Local Hand Flaps
- Regional flaps
  - Radial forearm flap
- Distant Flaps
  - Microvascular free tissue transfer
  - Toe Transfer

**Methods of Coverage**

![Reconstructive Ladder Image]

**Large Thumb Defects**
First Dorsal Metacarpal Artery Flap

FDMA found between FDMI under fascia

Thick pedicle

Large soft tissue injuries

- Forearm Flaps
  - Radial artery
  - Ulnar artery
  - Posterior interosseous artery
  - Anterior interosseous

- Pedicle Flaps
  - Groin
  - Chest
  - Abdomen
  - Opposite arm

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Radial Forearm Flap

- “Workhorse” for hand injuries
- Pedicle or free flap
- Antegrade/retrograde flow
- Fasciocutaneous, also tendons, bone, nerves, fascia alone
- Not bulky, reliable
- Defect requires STSG

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Radial Forearm Flap

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Radial Forearm Flap

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Radial Forearm Flap

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Distant Flap: Groin Flap

Microvascular Free Tissue Transfer
- Muscle flaps
- Musculocutaneous flaps
- Perforator flaps
- Toe transfer
  - Great toe
  - Second Toe

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Muscle and Musculocutaneous Flaps

- Latissimus dorsi
- Rectus abdominis
- Gracilis

Perforator Flaps

- Anterolateral thigh flap (ALT)
- Thoracodorsal artery perforator flap (TAP)
- Dorsalis pedis flap

Latissimus Dorsi

Anterolateral Thigh Flap (ALT)
Tendon Injuries

- Extensor Tendon
- Flexor Tendons
  - FDP
  - FDS

Flexor Tendons
Flexor Tendon Testing

Normal Flexion Cascade

Pulleys- A2 & A4
Flexor Tendon Injuries

- Timing of repair
  - Primary repair: within 24 hours of injury
  - Delayed primary repair: 24 hrs to 2 wks
  - Similar results for primary and delayed primary
- Splint to prevent proximal retraction
Fractures and Dislocations

Bone Fixation

- Internal Fixation
- Percutaneous fixation
  - K-wire
- External fixation

Begin protected hand therapy POD 5-7

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Internal fixation

- Metacarpal fractures
  - Shaft
- Carpal bone fractures
  - Scaphoid

Percutaneous Fixation

- Phalanx fractures
- Metacarpal head fractures
Percutaneous Fixation

External Fixation
- Comminuted bone fractures
- Poor soft-tissue envelope
**Dislocation**

- 29 year old male s/p MCA presents to ER with R hand pain

**Replantation**

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Evaluation for Replantation Surgery

- History
  - Age, Hand Dominance, Occupation, PMH
- Mechanism of Injury
  - Sharp transection vs. crushing vs. avulsion
- Physical Exam
  - Associated injuries
- X-rays

Criteria for Replantation: Upper Extremity

- Thumb
- Children
- Single digit distal to FDS insertion
  - Controversial
- Multiple digits
- Partial hand
- Wrist and forearm
- Elbow and proximal

Criteria against Replantation: Upper Extremity

- Severe concomitant injuries
- Severely crushed or mangled
- Multi-level amputations
- Significant co-morbidities
- Prolonged warm ischemia time
- Mentally unstable/ self-mutilation
- Single finger proximal to FDS insertion

Types of Injuries

- Sharp “guillotine” type injuries
  - Power saw injuries most common
- Avulsion injuries
  - Ring avulsion
- Crushing injuries
Severe Crush Injury

Viability of Amputated Part

- Fingers have greater tolerance to ischemia than parts containing muscle
- Fingers
  - Warm ischemia: 6-8 hours
  - Cold ischemia: up to 48 hours
- More proximal amputations (muscle mass)
  - Warm ischemia: 6 hours maximum
  - Cold ischemia: 12 hours maximum

Single Digit Replantation

- Controversial
- Informed consent
- Functional and Aesthetic Results are possible
  - PIPJ Arthroplasty
    - Newer biomaterials, increased lateral stability
    - Early Results are promising
  - Extensor Tenolysis
  - Flexor Tenolysis

Structure Identification
Osseous fixation

- Bone shortening essential to provide tension-free vascular anastomoses
  - Preferentially from detached part to preserve option on the proximal side

Vascular Anastomosis

- Arterial anastomosis - 8-0 to 11-0 nylon
  - Debride to undamaged artery
  - If there is tension, further bone shortening or vein graft (distal forearm, dorsal foot, spare parts)
Finger Tip Replantation

Thumb Amputations

- 40% function of the hand
- Requires
  - Sensibility
  - Length for opposition to medial digits
- Even with poor motion and sensation, useful as a post for opposition

Thumb Replantation
Thumb Replantation

Hand Trauma: Summary

- History and physical examination crucial
- Address the soft tissue, tendon, nerve, vasculature and bone individually
- Reconstructive ladder for soft tissue reconstruction
- Immobilize for only as long as you need to
- REHABILITATION is key to a successful outcome

Thank You