Assessment of the injured hand

Technical information

- The presentation consists of two PowerPoint files
  - (1) examination of the injured hand.ppt contains a sequence of flow charts that describe the examination. Many slides contain links to:
  - (2) hand exam images.ppt containing further explanation and pictures
- Both files are required to run the presentation. They should be kept in the same folder. The links in (1) are to the titles of slides in (2); the links will fail if the titles are changed.
- Start the presentation by opening (1). Do not open (2) in PowerPoint; the images therein will be called up by (1) as needed. If (2) is open, PowerPoint will not return to the main presentation smoothly.
Examination

- inspect the wound and note its characteristics. Draw a picture or (if available) take a photograph
- cover the wound with a sterile dressing
- assess injury to underlying structures by testing their function, not by exploring the wound
This knife wound is deep but its sharply-incised edges are clean and healthy. It is likely to heal primarily after irrigation, repair of deep structures and direct closure.
Crush

- Crushing causes extensive tissue damage. Infection is likely unless all non-viable tissue is removed.
Shear

• Skin that is sheared off the deep fascia may be deprived of its blood supply. It is easy to underestimate the extent of the injury. Only skin that bleeds freely from the cut edge will survive.

• Here the palmar skin has been sheared off the fascia, leaving a distally-based flap.
Puncture

• Puncture wounds carry organisms deep into the tissues, where thorough cleaning is difficult without extensive exploration

• excise and irrigate the skin wound, rest the part and give antibiotics
Bite

- Human and other animal bites implant multiple bacterial species and can lead to severe infection
- beware the human tooth wound over the metacarpal head, sustained when punching the opponent’s face. The history may not be given. Sustained in flexion but if examined in extension, the shuttering effect of the tissue planes makes the wound appear superficial. Requires debridement in the operating theatre and broad-spectrum antibiotics
Flexor tendon anatomy

Flexor digitorum profundus (FDP) flexes the terminal joint of the finger
Flexor digitorum superficialis (FDS) flexes the proximal interphalangeal joint
Flexor pollicis longus flexes the interphalangeal joint of the thumb
Flexor tendon posture

The normal flexed posture of the relaxed hand reflects the tone and viscoelastic properties of the muscles, which are connected to the digits by tendons.

Mild postural change (A) due to ring FDP tendon rupture.

Extended posture due to laceration of FDP and FDS of ring and little (B).

Posture is a valuable sign in small children and other uncooperative patients.
Flexor tendon active motion

- FDP flexes the distal interphalangeal joint
- FDS flexes the proximal interphalangeal joint, but testing requires inactivation of FDP. FDP is essentially a single muscle with 4 tendons, so holding the other fingers extended prevents FDP shortening. This allows testing of FDS, which has a separate muscle for each digit. Note flexion is at the PIP joint only and the DIP joint is slack.

[Click on the lower image to show video]
Extensor tendon anatomy

• The terminal tendon extends the DIP joint

• The central slip extends the PIP joint

• The dorsal aponeurosis receives tendon fibres from extensor digitorum communis (EDC) and from the intrinsic muscles (interossei and lumbricals)

• EDC extends the MP joints of the fingers
Extensor tendon posture

- tendon division or rupture causes a drop (lag) at the joint that the tendon normally extends
- extensor tendon
- central slip -> boutonniere deformity
- terminal tendon -> mallet finger
Extensor tendon active motion

- Extensor digitorum communis extends at the MP joint
- Central slip extends at the PIP joint
- Terminal tendon extends at the DIP joint
- Extensor pollicis longus extends at the IP joint of the thumb; only EPL can lift the thumb off the table
Nerve - motor anatomy

- median nerve supplies the lateral two lumbricals, abductor pollicis brevis, opponens pollicis and part of flexor pollicis brevis (mnemonic LOAF)
- ulnar nerve supplies all other small hand muscles
Nerve injury - posture

- Wrist drop of radial nerve palsy. The long extensor muscles of the wrist, fingers and thumb are paralysed.
- Claw hand of ulnar nerve palsy. Pull of the long flexors and extensors is not opposed by the paralysed interossei and lumbricals of the ring and little fingers. Median-innervated lumbricals prevent clawing of index and middle fingers.
Nerve injury - wasting

- thenar wasting in chronic median nerve lesion (note trophic ulceration on middle finger tip)
- first dorsal interosseous muscle wasting in ulnar nerve lesion
Nerve injury - weakness

- test abductor pollicis brevis (median nerve)
- test abduction of the little finger (ulnar nerve)
- feel the muscle's force, look for and feel contraction of the muscle belly

[click on the videos to start]
• With the patient’s eyes closed, touch the finger pulp lightly with a wisp of wool.
• Compare with a normal digit
Two-point discrimination

- Bend a paper clip as shown
- Ask the patient to close the eyes
- Apply lightly to finger pulp in longitudinal axis
- Repeat 1 or 2 points in random order. If cannot appreciate 2, increase separation and repeat
- Points are normally felt as separate stimuli when distance > 3-5mm
- TPD is a sensitive test of nerve injury
Sweating

- denervated skin does not sweat and feels dry
- a useful sign in small children and patients who cannot cooperate with other tests

- Although seldom needed clinically, can be shown by the starch/iodine reaction. Hand is painted with starch/iodine/oil mixture. Water in sweat initiates starch-iodine reaction in territory of ulnar nerve (little and medial half of ring) but not in territory of the divided median nerve
Arterial anatomy

• numerous arches connect the digital arteries - a finger can survive on one digital artery

• superficial and deep palmar arches connect radial and ulnar arteries - most hands can survive on a single forearm artery
Colour

- the normal digit is pink
- occlusion of both digital arteries, as in this ring avulsion injury, causes pallor initially but later the finger may be dusky due to vascular stasis
Temperature

• fingers have a large surface area and small volume. They are kept warm by a high blood flow
• finger temperature drops if both digital arteries are occluded
• feel the temperature of the finger tip and compare with an uninjured digit
Capillary refilling

- Blanch the skin proximal to the nail by gentle pressure and release quickly
- Note the rate of capillary refilling
- Compare with an uninjured digit
Allen’s test

- A test of patency of radial and ulnar arteries
- Ask to patient to make a firm fist, to exanguinate the hand
- Occlude radial and ulnar arteries by pressure above the wrist
- Ask the patient to open the hand. The palm and fingers should be white
- Release the radial artery and time the return of pink colour - normal is < 7 seconds.
- Repeat for the ulnar artery
- A similar method an be used for digital arteries
Wound over joint

- any wound over a joint is presumed to have entered the joint until proved otherwise by exploration
- untreated joint penetration may cause septic arthritis, with permanent cartilage loss and joint destruction
Test stability

- testing for rupture of the ulnar collateral ligament of the thumb MP joint - “Skier's thumb”
- the metacarpal is stabilised
- pressure is applied to stress the ligament under test - this one is lax
- compare with the opposite hand
- [local anaesthesia may be needed to overcome pain and muscle spasm before the test can be performed]
Deformity

- lateral/medial angulation is obvious
- dorsal/palmar angulation is less obvious
- rotational deformity is easily missed on examination and on radiographs - B. If pain prevents finger flexion (when deformity is obvious - A) look at the plane of the fingernail - C
Tenderness

- Local tenderness may be due to bruising or to fracture.
- If you are suspicious of an undisplaced fracture but cannot see it on the radiograph, apply gentle axial compression to the end of the finger. Pain at the site of bruising indicates a probable undisplaced fracture; oblique radiographs may show it.
Xray

• Xray should comprise **two views at right angles**. In the hand, PA and oblique views are adequate for diagnosis of metacarpal fractures (a true lateral view is required to assess angulation).

• In the digits, **true PA and lateral views are essential**. Important tendon and ligament insertion fractures are easily missed on oblique views.
Exploration

- The palmar surface is tough, deep and bleeds if disturbed. Its wounds can only be explored adequately in an operating theatre with digital, arm block or general anaesthesia as appropriate and a tourniquet. They cannot be explored properly in Emergency departments.

- The dorsal soft tissues are thin and shallow; they can be explored under local anaesthesia in Emergency departments if appropriate skills and sterile facilities are available.
Recording your findings

- the note should indicate that each structure has been examined
- partially-divided tendons can move the finger but rupture later. Your note should convince the judge that the tendon was intact when you examined it!
- “tendons ✋” is not sufficient; “FDP intact” or “active DIPJ flexion present” is safer
- record two-point discrimination of digits distal to a laceration. “TPD = 4mm” is much more valuable than “neurol ✋”