


Guideline

Hand Injuries – Emergency Management in Children

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HUMAN RIGHTS

This governance document has been human rights compatibility assessed. No limitations were identified indicating reasonable confidence that, when adhered to, there are no implications arising under the *Human Rights Act 2019*.

PURPOSE

This document provides clinical guidance for all staff involved in the care and management of a child presenting to the Emergency Department at Queensland Children's Hospital (QCH) with a suspected or confirmed hand injury.

SCOPE

This guideline applies to all staff involved in the emergency care and management of children with suspected or confirmed hand injuries.



Queensland
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SUPPORTING DOCUMENTS

Procedures, Guidelines, Protocols

[CHQ-GDL-00721 Emergency management and discharge follow up for minor fractures \(health.qld.gov.au\)](#)

[CHQ-GDL-01202 Children's Health Queensland Paediatric Antibiocard: Empirical Antibiotic Guidelines](#)

[CHQ-GDL-01023 Tetanus Prophylaxis in Wound Management](#)

[CHQ-GDL-60031 Mammalian bites](#)

[CHQ-PROC-17997 Care and preservation of human body parts procedure](#)

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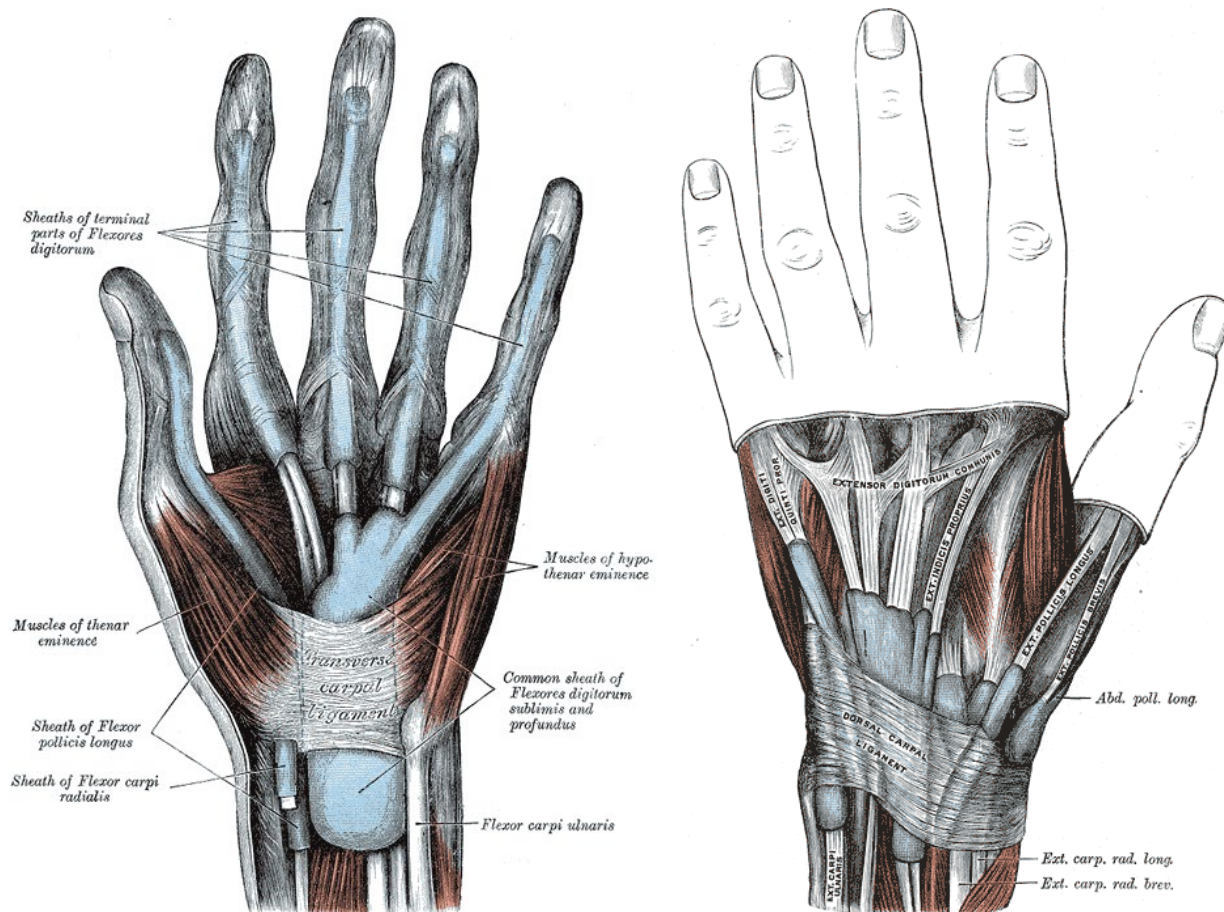


Image 2: Tendons of the hand original images taken from Grays Anatomy

Flexor

Flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS) work as a unit assisted by the flexor sheath and pulley ligaments (4 or 5 annular ligaments and 3 cruciate ligaments).

Extensor

There are 8 tendons on the extensor surface of the hand with multiple cross-connections at the level of the MCPJ. These are: four common extensor tendons (extensor digitorum), extensor indices for the 2nd digit, extensor digiti minimi for the 5th digit and extensor pollicis longus and brevis for the 1st digit.

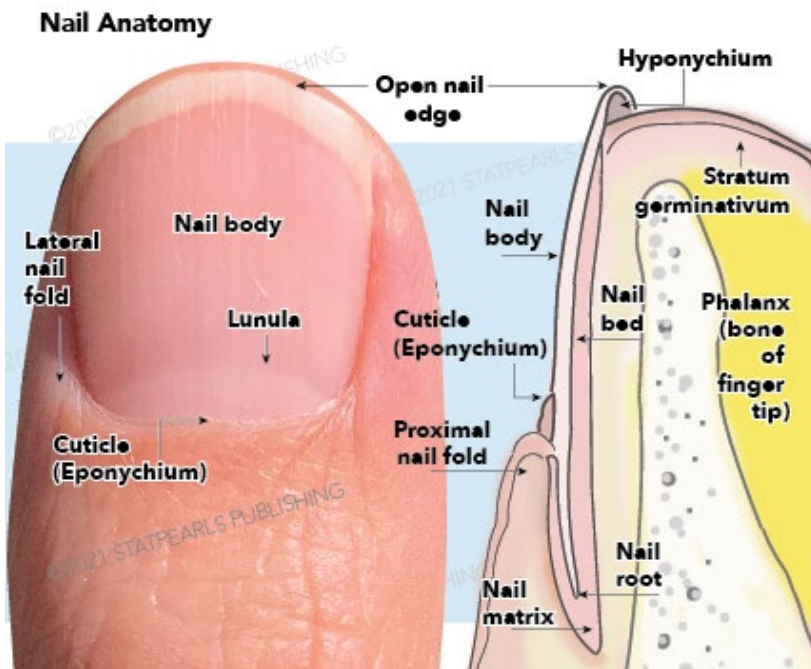


Image 3: Nail anatomy taken from StatPearls: Anatomy, Shoulder and Upper Limb, Nails

ASSESSMENT

Key features: History

- Injury: time, mechanism, associated injuries, bleeding, treatment so far.
- Patient: age, relevant medical history, hand dominance (if established), tetanus status, hobbies.

Key features: Examination



ALERT

Always remember to examine the joints above and below the site of injury



ALERT

Small lacerations can cause severe tendon damage, so every laceration in the hand needs meticulous examination and visualization of the tendon

- Inspection
 - Assess for the presence of deformity, wounds, bruising, swelling and nail bed injury.
- Palpation:
 - Assess for bony tenderness.
- Range of motion:
 - This can be assessed gently prior to imaging but is unlikely to change initial management.

- Post imaging (if indicated), it is essential to assess for joint stability and associated tendon injuries.
- Rotational deformity (if suspect a phalangeal or metacarpal fracture):
 - Ask the patient to flex the fingers as if making a fist. In the normal hand the fingers should sit next to each other, without overlap. Note that rotation of the fifth finger in towards and beneath the fourth finger can be a normal variant.

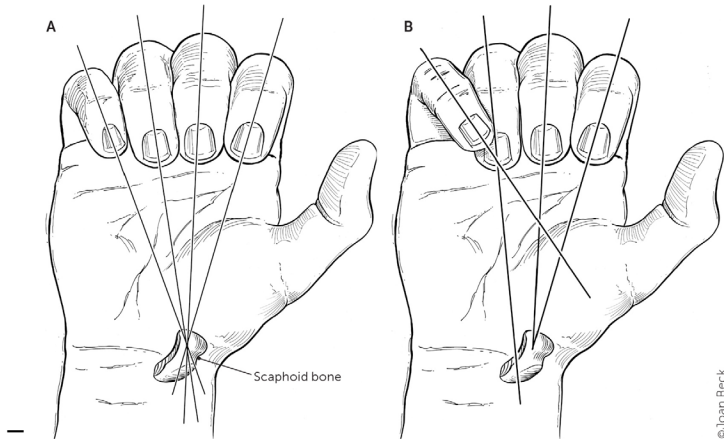


Image 4: Rotational deformity taken from American Family Physician: Common finger fractures and dislocations

- Neurovascular function.

INVESTIGATIONS

- Consider X-ray in all cases
- Tendon Imaging:
 - If assessment of tendon function is normal but history suggests potential tendon injury, such as athletes or forceful blunt trauma against resistance, obtain formal ultrasound

MANAGEMENT



ALERT

If clinical concern of a fracture in the absence of apparent radiological abnormality, consider immobilisation and ensure adequate follow up with recommendation for repeat imaging in 7-10 days if ongoing concerns.

The management of hand injuries can be broken down into a series of steps:

1. Pain management
 - Optimise analgesia on arrival to ED, prior to examination. Analgesia should be given as soon as possible (within 30minutes) of pain assessment at triage and should be appropriate for the patient's pain score and weight.
 - A digital block can be very effective in providing analgesia in cases of finger injury and should be considered at the time of initial assessment.
 - Non-pharmacological therapies such as distraction and cognitive behavioural interventions are effective in reducing pain in children.

- Assessment and documentation of pain and distress scoring (e.g. FLACC behavioural pain assessment scale or the Faces Rating Scale) should be used to document pain before and after analgesia, with analgesic medication titrated accordingly.

| Analgesic dosing for the treatment of pain in children (If considering prescribing narcotic analgesia, check QScript before proceeding) | |
|--|---|
| Mild Pain (score 1-3) | Dose |
| Paracetamol (oral) | 15 mg/kg up to 4 hourly, maximum 4 doses in 24 hours |
| Ibuprofen* (oral) | 10 mg/kg (maximum 400 mg) up to 6 hourly, maximum 3 doses in 24 hours Avoid in children <6 months |
| Moderate Pain (score 4-6) | ADD |
| Oxycodone (oral) | 0.1–0.2 mg/kg (maximum 5mg) 4 to 6 hourly |
| +/- Fentanyl (intra-nasal) | 1.5 mcg/kg (maximum 100 mcg/dose) intra-nasal as initial dose (repeat dose of 0.75 micrograms/kg if required) |
| Severe Pain (score 7-10) | ADD |
| Fentanyl (intra-nasal, unless already given) | 1.5 mcg/kg (maximum 100 mcg/dose) intra-nasal as initial dose (repeat dose of 0.75micrograms/kg if required) |
| Morphine (IV) | 0.1 mg/kg (maximum 2.5 mg) IV as initial dose then titrate in 0.05 mg/kg aliquots |
| Ketamine (IV) | 0.1 mg/kg (maximum 10mg, at > 10 minute intervals) IV as an initial dose and titrate to effect. |

Table 1: Analgesia dosing for the treatment of pain in children. Taken from CHQ-GDL-00704 Abdominal pain: Emergency Management in Children Version 4.0

2. Haemostasis and wound care

- Pressure and elevation may be sufficient for minor injuries
- For pulp defects:
 - Consider a digital tourniquet tied and clamped around the digit base. Make sure not to leave this on.
 - Alternatively, dip the tip of injured finger in lignocaine 1% with adrenaline 1:100,000 for 5 minutes³
 - Do not infiltrate adrenaline into the fingertip
- A digital block is necessary if wound exploration or procedures are required to the injured digit
- Irrigate any wounds using sodium chloride 0.9%, noting the literature suggests using 100 mL/cm of wound
- It is often useful to have the parents take a picture before the dressing is applied for future comparison
- Non-adherent dressings (e.g. Mepitel) are recommended for all fingertip wounds^{4,5}

3. Fracture reduction

- A digital block is necessary in cases of finger fractures requiring reduction

- Procedural sedation may be required in the younger or non-compliant child
4. Immobilisation (POP or splinting)
- Varies by injury, see specific injury section below
5. Tetanus immunisation and antibiotic prophylaxis
- Remember [tetanus prophylaxis](#) as per usual guidelines
 - Prophylactic antibiotics are **not** routinely recommended for clean/minimally contaminated fingertip injuries, even with associated fracture.^{5,6,7}
 - Antibiotic prophylaxis is indicated if the wound is heavily contaminated, occurred whilst immersed in water or secondary to an animal bite. Refer to:
 - [CHQ Paediatric Antibiocard for antibiotic recommendations](#)
 - [CHQ Management of water-immersed wound infections in children guideline for antibiotic recommendations](#)
 - [Mammalian bite guideline](#)
6. Referral to on-call hand service and follow up
- To discuss the management of a hand injury, contact the Hand Team via switch (Orthopaedics or Plastic Surgery depending on the on-call roster)
 - Referrals for follow up in clinic should be to either an Orthopaedic Fracture Clinic or Plastic Surgery Hand Clinic depending on the on-call roster

CRITERIA FOR REFERRAL TO ON CALL HAND SERVICE

- Fractures:
 - See specific injury section below
- Tendon injury:
 - All suspected or confirmed tears (partial and complete thickness)
 - Mallet finger
 - Jersey finger
 - Central slip injury
- Nail/nailbed injury:
 - Complicated nail lacerations^{4,9}
 - Any nail bed involvement^{4,9}
 - At QCH, all patients should be discussed with the on-call hand team who will determine the most appropriate treatment on a case-by-case basis.

- In uncomplicated nail bed lacerations presenting <24hrs, with or without a stable undisplaced distal phalanx fracture, the evidence suggests that these may be repaired in the ED with no additional complications compared to repair by the hand team.
 - Unstable underlying distal phalanx fracture⁷
 - Underlying tendon injury
- Fingertip injuries/pulp defects:
 - Complex lacerations
 - Pulp defects >1cm²
- Amputation:
 - All

SPECIFIC INJURIES: FRACTURES

PHALANGEAL FRACTURES (TABLE 2)

| Site of fracture | Key examination features | Management and follow up | Indications for on-call hand team consult |
|--|--|--|---|
| Distal Phalanx <i>Mechanism:</i> <i>Often direct impact or crush injury</i> | Assess for nail involvement Assess tendon function For minor phalangeal fractures, please refer to Emergency Management and discharge follow up of minor fractures | Reduction as required – best done with digital nerve block +/- sedation depending on the patient Immobilisation of the distal interphalangeal joint with buddy strapping Follow up: Undisplaced non-intraarticular fractures do not require follow up unless they remain sore at 3weeks. Displaced fractures should be seen in Hand clinic or OT lead Simple Hand Injury Clinic 1-2weeks Note: Small, undisplaced Salter Harris 2 fractures do not all need to be followed up in hand clinic. If unsure or concerned, refer. | Open fracture Neurovascular compromise Suspected tendon injury (<i>remember partial tendon injuries can have preserved function</i>) Intra-articular involvement (involving over 30% of the joint surface) Significant displacement or angulation which cannot be resolved in ED ¹⁰ Associated nailbed injury |

| | | | |
|--|--|--|--|
| <p>Middle Phalanx</p> <p><i>Mechanism:</i> <i>Direct impact, twisting or axial load</i></p> | <p>Assess tendon function with specific testing of DIP and PIP joints¹¹ (often associated with tendon injury)</p> <p>Assess for a rotational deformity</p> <p>For minor phalangeal fractures, please refer to Emergency Management and discharge follow up of minor fractures</p> | <p>Reduction as required – best done with digital nerve block +/- sedation depending on the patient</p> <p>Immobilisation – buddy strapping should suffice in stable non-displaced fractures. If the fracture has required reduction, then buddy strap and apply a gutter or POSI slab</p> <p>Follow up: Undisplaced non-intraarticular fractures do not require follow up unless they remain sore at 3weeks</p> <p>All other fractures should be referred to Hand clinic or OT lead Simple Hand Injury Clinic – timeframe will depend on specific fracture and should be included in referral</p> <p>Fractures which have been successfully reduced should be reviewed within the first week if possible as there is a risk of loss of reduction (contact the on-call hand team to ensure they are aware of patient).</p> <p>Note: Small, undisplaced Salter Harris 2 fractures and minor volar plate injuries do not all need to be followed up in hand clinic. If unsure or concerned, refer.</p> | <p>Open fracture</p> <p>Neurovascular compromise</p> <p>Suspected associated tendon injury (<i>remember partial tendon injuries can have preserved function</i>)</p> <p>Intra-articular involvement</p> <p>Unstable fracture</p> <p>Volar plate injuries with more than 30% of the joint surface involvement¹¹</p> <p>Transverse fractures with more than 10% angulation or 2mm shortening or rotational deformity (these generally require operative management¹²)</p> |
|--|--|--|--|

| | | | |
|--|---|--|--|
| <p>Proximal Phalanx</p> <p><i>Mechanism:</i> <i>Direct impact, rotational force or hyperextension injury</i>¹²</p> | <p>Assess for malalignment (often unstable)</p> <p>Assess tendon function</p> <p>Assess for a rotational deformity</p> <p>For minor phalangeal fractures, please refer to Emergency Management and discharge follow up of minor fractures</p> | <p>Reduction as required – best done with digital nerve block +/- sedation depending on the patient</p> <p>Immobilisation – buddy strapping should suffice in stable non-displaced fractures. If the fracture has required reduction, then buddy strap and apply a gutter or POSI slab</p> <p>Follow up: Undisplaced non-intraarticular fractures do not require follow up unless they remain sore at 3weeks</p> <p>All other fractures should be referred to Hand clinic or OT lead Simple Hand Injury Clinic – timeframe will depend on specific fracture and should be included in the referral.</p> <p>Fractures which have been successfully reduced should be reviewed within the first week if possible as there is a risk of loss of reduction (contact the on-call hand team to ensure they are aware of patient).</p> <p>Note: Small, undisplaced Salter Harris 2 fractures do not all need to be followed up in hand clinic. If unsure or concerned, refer.</p> | <p>Open fracture</p> <p>Neurovascular compromise</p> <p>Suspected associated tendon injury (<i>remember partial tendon injuries can have preserved function</i>)</p> <p>Intra-articular involvement</p> <p>Unstable fracture</p> <p>Transverse fractures with more than 10% angulation or 2mm shortening or rotational deformity (these generally require operative management). <u>No rotational deformity is acceptable</u>¹²</p> |
|--|---|--|--|

METACARPAL FRACTURES (2ND-5TH) (TABLE 3)

| Site of fracture | Key examination features | Management and follow up | Indications for on-call hand team consult |
|---|---|---|---|
| Subdivided based on location (head, neck, shaft and base) <i>Mechanism:</i> <i>Direct force with enclosed fist (punch injury)</i> | Assess tendon function Assess for rotational deformity | Reduction as required – best done with a metacarpal block or haematoma block +/- sedation depending on the patient Immobilisation – buddy strapping and a gutter slab. Simply buddy strapping which is being trialled in adults is not currently accepted practice in paediatrics. Follow up: Hand clinic – timeframe will depend on specific fracture | Open fracture Neurovascular compromise Suspected tendon injury (<i>remember partial tendon injuries can have preserved function</i>) Intra-articular involvement Significant displacement, angulation or rotational deformity which cannot be resolved in ED ¹⁰ |

THUMB METACARPAL FRACTURES (TABLE 4)

The thumb has significant anatomical differences to the other fingers and is functionally of greater importance so management of first metacarpal fractures varies from the other fingers.

| | Key examination features | Management and follow up | Indications for on-call hand team consult |
|---|--|---|---|
| <i>Mechanism:</i> <i>Axial load to partially flexed thumb¹³</i> | Confirm site of maximal tenderness (often confused with distal radius or scaphoid injury) Assess tendon and ligament function (Ulnar collateral ligament injuries are commonly missed ¹⁴) | Immobilisation – extraarticular fractures are generally managed non-operatively in a thumb-spica cast. Follow up: Hand clinic – timeframe will depend on specific fracture | Open fracture Neurovascular compromise Suspected tendon or ligamentous injury (<i>remember partial tendon injuries can have preserved function</i>) Intra-articular involvement More than 20degrees of angulation or more than 2mm shortening. No malrotation is acceptable Salter Harris injuries (particularly SH type III) |

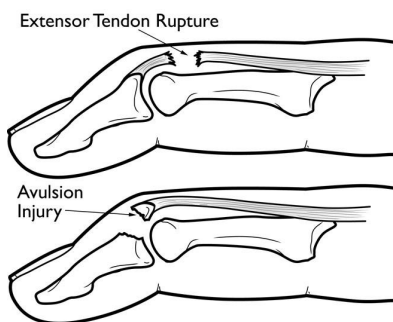
CARPAL FRACTURES (TABLE 4)

Paediatric carpal bone fractures are rare and can be difficult to diagnose. They often present in a non-specific manner and x-rays can be unreliable. The scaphoid is the most fractured paediatric carpal bone¹⁵.

| Scaphoid fracture | Key examination features | Management and follow up | Indications for on-call hand team consult |
|---|---|---|---|
| Mechanism: <i>Scaphoid fractures are often the result of a fall onto an outstretched hand</i> | Assess for significant swelling Assess for bony tenderness or pain on axial load | Immobilisation – Undisplaced scaphoid fractures should be managed in a thumb-spica cast. If despite a normal x-ray there is strong clinical suspicion of scaphoid fracture (snuffbox tenderness with hx of FOOSH and child >10), immobilise in a buckle wrist splint and refer to Hand clinic. The family should be advised to see their GP ASAP to ideally arrange a bulk billed MRI prior to follow up. Follow up: Hand clinic – 1-2weeks | Displaced fracture |

SPECIFIC INJURIES: TENDON INJURIES

MALLET FINGER

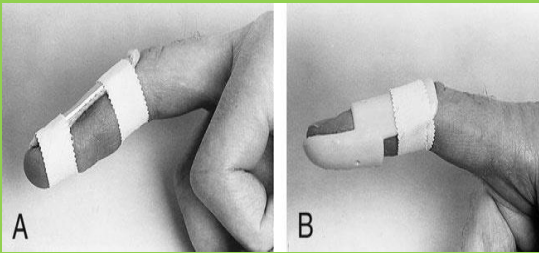


- Flexion deformity of the DIPJ due to disruption of the extensor mechanism
- Two main types: tendinous mallet (extensor tendon pathology) and bony mallet (avulsion fracture of the distal phalanx)⁸
- Due to forced flexion of the DIPJ during active extension^{1,8}. Common mechanism is striking the fingertip when attempting to catch a ball, thus the eponymous name 'baseball finger'.

Image 5: Mallet Finger Taken from Orthoinfo by American Academy of Orthopaedic Surgeons

| Assessment | Management |
|---|--|
| Tender, swollen finger | Tendinous mallet |
| Inability to actively extend the DIPJ | <ul style="list-style-type: none"> ○ Consult on-call hand team ○ Dorsal splint |
| Plain x-ray (AP, lateral, oblique) ⁸ . Lateral view is usually the best to visualize a bony mallet | Bony mallet |
| There may be associated volar subluxation of the distal phalanx in serious injuries | <ul style="list-style-type: none"> ○ Consult on-call hand team ○ Dorsal splint ○ Repeat x-ray to ensure adequate reduction with dorsal splint applied |

Splinting⁸



- DIPJ in neutral extension, PIPJ not immobilized
- DIPJ should never be allowed to drop into flexion. Assistance should ideally be used when changing splints

Image 6: Splinting Taken from Orthoinfo by American Academy of Orthopaedic Surgeons

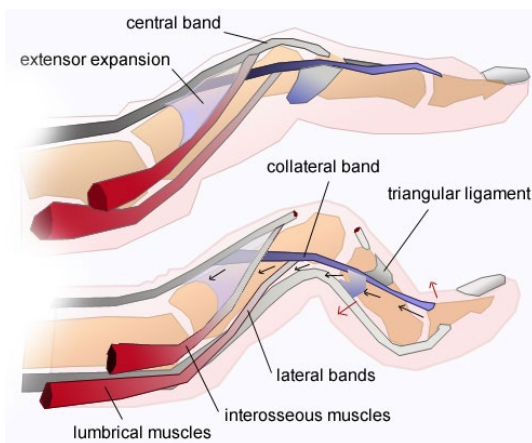
JERSEY FINGER



- Disruption of FDP at the DIPJ
- Due to forced extension of the DIPJ during active flexion. This can happen when the football player grabs the *jersey* of another player during a tackle.

Image 7: Jersey Finger¹⁴

| Assessment | Management |
|---|---|
| <p>Tender swollen finger along the volar surface of the DIPJ</p> <p>Isolate FDP by extending the finger. Inability to actively flex the DIPJ is pathognomonic for an FDP tendon rupture.</p> <p>Plain x-ray (AP, lateral, oblique) to assess for associated bony avulsion</p> | <p>Finger splinted immediately in slight flexion of the DIPJ and PIPJ.</p> <p>Consult on-call hand team for all jersey finger injuries.</p> <p>There is no role for conservative management. Delays in repair can lead to retraction, fibrosis, and resultant functional impairment</p> |

CENTRAL SLIP INJURY

- Disruption of the central tendon of the extensor tendons at the level of the PIPJ with subsequent slip of both lateral tendons leading to hyperflexion at the PIPJ and hyperextension at the DIPJ¹⁶
- Due to either direct severing of the central slip by a laceration or direct trauma to the flexed PIPJ on the dorsal aspect of the joint, e.g. being hit by a ball or bat

Image 8: Central slip (Boutonniere) deformity¹⁶

| Assessment | Management |
|--|---------------------------|
| Obvious deformity may not always be present at time of injury. | Consult on-call hand team |
| Inability to actively extend at PIPJ - Elson's test: <ul style="list-style-type: none"> Place PIPJ in 90degrees of flexion and ask patient to extend PIPJ against resistance Inability to actively extend the PIPJ indicates an abnormal Elson's test¹⁷ | |
| Plain x-ray (AP, lateral, oblique) to assess for additional bony injury | |

SPECIFIC INJURIES: SUBUNGAL HAEMATOMA WITH INTACT NAIL PLATE

These can be managed with trephination using a heated paperclip or needle regardless of their size and even in the presence of a stable undisplaced distal phalanx or tuft fracture^{7,8,18,19}.

SPECIFIC INJURIES: FINGERTIP PULP DEFECTS

Haemostasis

Often the main problem with these injuries is obtaining adequate haemostasis.

Initial attempts such as tourniquet, pressure, and elevation, or dipping the tip in lignocaine 1% with adrenaline 1:100,000 can be effective but temporary. There is a high chance of re-bleeding.

Superficial, clean, small defects (<1cm² or proportionally smaller in children) with minimal or no bone exposure

Conservative management with serial dressings^{4,19,20}.

Defects more than 1cm² or complex lacerations

Consult on-call hand team

SPECIFIC INJURIES: FINGERTIP AMPUTATIONS

Management of the amputated part (See the [CHQ Care and preservation of human body parts](#) procedure)

- Irrigate the amputated part with sodium chloride 0.9%
- Moisten a sterile combine with sodium chloride 0.9% and wrap around the amputated part. Place the wrapped part in a water-tight plastic bag.

- Create an ice water slurry by mixing ice cubes and water. Place the plastic bag in the slurry, ensuring that the amputated part does not come into direct contact with the slurry
- Place a patient ID label on the container, confirming the patient ID with a second staff member
- Complete the patient tissue/amputated appendages tracking log (found in the [CHQ Care and preservation of human body parts](#) procedure)
- When appropriate, obtain a plain x-ray of the amputated part, as well as the injured finger²¹

**ALERT**

Amputated parts should not be placed in direct contact with water or ice due to the risk of tissue freezing and maceration

**ALERT**

Amputated parts should remain with the patient at all times

Consult on-call hand team in **ALL** cases

Children have a much higher chance of successful re-plantation (~98%) compared to adults^{15,19}. All fingertip amputations in children should therefore be considered for re-plantation^{15,19} and discussed urgently with the hand team.

CONSULTATION

Key stakeholders who reviewed this version:

| | |
|---|--|
| <ul style="list-style-type: none"> • Emergency Department SMOs • Emergency Department NPs | <ul style="list-style-type: none"> • Plastic Surgery SMO • Orthopaedic SMO |
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GUIDELINE REVISION AND APPROVAL HISTORY

| Version No. | Modified by | Amendments authorised by | Approved by | Comments |
|-------------------|--|------------------------------------|--|----------|
| 1.0 27/11/2020 | Senior Medical Officer, Emergency Department | Divisional Director, Critical Care | Executive Director Clinical Services QCH | |
| 2.0 02/11/2021 | Senior Medical Officer, Emergency Department | Divisional Director, Critical Care | Executive Director Clinical Services | |

| | | | | |
|-------------------|--|------------------------------------|--------------------------------------|---|
| 3.0 04/04/2024 | Director, Emergency Department | Divisional Director, Critical Care | Executive Director Clinical Services | |
| 4.0 07/09/2024 | Senior Medical Officer, Emergency Department | Divisional Director, Critical Care | Executive Director Clinical Services | Scheduled review and transition to new template |

| | |
|---------------------------------|--|
| Key words | Hand, fracture, tendon, nail, boutonniere, jersey, mallet, carpal, metacarpal, scaphoid, digit, amputation,00764 |
| Accreditation references | <p>The National Safety and Quality Health Service (NSQHS) Standards (1-8):</p> <ul style="list-style-type: none"> • Standard 1: Clinical Governance, • Standard 3: Preventing and Controlling Healthcare Associated Infections, • Standard 6: Communicating for Safety. |