Upper Extremity Injuries: Treatment with Splinting and Casting

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Fractures and dislocations ranks 18th in all diagnoses for adults and 13th for children <17y/o seen in Primary Care.

Common fractures are **Common**. Each requires individual assessment and management, but general principles can be applied.

We will look at fractures common to everyday Primary Care visits to help you become more comfortable in how to manage them in your practice and when to refer.
When to refer...?

* Identify complicated fractures or associated complications
  * Neurovascular injury
  * Open fractures
  * Intraarticular fractures
  * Compartment Syndrome
  * Epiphyseal plate injuries (Salter-Harris Fractures)
  * Displaced fractures requiring reduction
  * Fracture-dislocations

* Avoid managing any fracture or dislocation that is beyond your comfort zone unless you have someone available to guide you.
Immobilization

* All acute dislocations and fractures will benefit from immobilization
  * Maintains functional position
  * Provides pain relief
* Splinting is the preferred method of immobilization whenever there is additional swelling expected or it already exists. Decreases risk of:
  * Iatrogenic compartment syndrome due to increased swelling
  * Loss of fracture position or dislocation if cast loosens due to decreased swelling
* If referred, the consulting specialist will need to remove the cast/splint to appropriately assess the patient
* Casting is the primary treatment for most fractures post-acute. (usually >3-5 days)
Immobilization Materials

- **Plaster**
  - Often less expensive and a longer shelf life
  - Easy to work with

- **Fiberglass**
  - Stronger and lighter
  - Available for splinting in prefabricated cut to length options
  - Requires some level of regular practice to competently apply a well fit cast due to shorter working time and a less forgiving material

- **Off-the-shelf prefabricated splints**
  - Convenient
  - Expensive
  - Not customizable
25 y/o male construction worker gets his fingers caught between two cinder blocks on the worksite.

Exam reveals a subungual hematoma but no other significant soft tissue damage. X-ray reveals a tuft fracture.

How do you proceed?
Distal Phalanx & Tuft Fractures

* **Splinting**
  * Cage splint or Stack splint with DIP in extension.
  * F/U in 1-2 weeks. Then an additional 1-2 weeks in splint until finger is no longer sensitive

* **Subungual hematomas**
  * Decompress
  * If nail is avulsed, repair any nail bed lac and replace the nail.
Antibiotics are controversial with subungual hematomas and nail avulsion associated with a fracture.

1st gen Cephalosporin if:
- Grossly contaminated
- >24 hours old
- Immunocompromised pt

Referral
- Open or intraarticular fractures
- Angulated or displaced longitudinal or transverse fractures
Mallet Finger

36 y/o male playing in an adult soccer league is hit on the tip of the finger by a shot on goal. He makes the save but has pain and cannot extend the DIP joint of his index finger.

He presents to your office the next morning with a classic Mallet finger deformity and the x-ray on the left is obtained.
Mallet Finger

- Boney or soft tissue mallet should be splinted in full extension for 6 weeks then at night for an additional 2 weeks.
- Stack splinting is preferred.
- Avulsions involving >30% of the joint surface, unable to be passively extended, or involving subluxation should be referred
Other finger fractures to refer

* Transverse or oblique fractures are unstable and should be splinted and referred urgently.
* Emergent referral if irreducible or reduction cannot be maintained.
DIP and PIP Finger Sprains & Dislocations

- Urgently refer all
  - Open dislocations
  - Fracture/dislocations
  - Irreducible injuries
- Dorsal dislocations are typically already reduced by the patient or a bystander before seeking treatment.
DIP and PIP Finger Sprains & Dislocations

* DIP injuries are splinted in extension for 2-3 weeks
* PIP injuries can be buddy taped or treated in an extension block splint for 2-4 weeks if a volar plate injury is suspected.
Volar plate injuries involving >30% of the joint surface or involving subluxation should be referred even if there was no dislocation.

PIP injuries with dorsal tenderness and no active PIP extension = **central slip injury** which can then present late as a Boutonniere deformity. Early referral is recommended.
Gamekeeper's/Skier's Thumb

- 35 y/o female fell while skiing last weekend. Her thumb was caught in the strap of her pole.
- She c/o pain, swelling, and bruising at the MP joint. She says it is too painful to grip anything with that hand.
- Exam reveals edema and ecchymosis over the UCL and no loss of sensation.
- What do you do next in your exam?
  - X-ray~ stress testing could displace a fracture
Gamekeeper's/Skier's Thumb

- X-ray reveals no fracture so it is safe to proceed with stress testing.

- Stress testing (preformed with the MP joint in 30° of flexion) reveals 15-20° greater laxity of the UCL compared bilaterally. (digital block may be needed to adequately assess)

- >30° of laxity or >15° compared bilaterally indicates a Grade 3 injury and a Stener lesion should be suspected.
  - This is an indication for urgent referral
  - Surgery before 2-3 weeks has a better result in most cases.
Non-displaced fractures will heal with appropriate immobilization.

Stener lesion: UCL gets flipped over the ADP insertion and cannot heal back to the distal insertion.
**Gamekeeper's/Skier’s Thumb**

- Management: Grade 1 & 2 or Non-displaced Fracture
  - Acutely or with significant edema, a thumb spica splint is used for the first 7-10 days.
  - Post-acutely a thumb-spica cast for 4-6 weeks (wrist in slight ext and thumb in slight abduction)
- Refer
  - Fx displaced > 2mm
  - Intraarticular fx > 20% of joint surface
  - Suspected Stener lesion
  - Symptomatic injury > 3 weeks old
40 y/o male presents following a fall off his mountain bike. He c/o pain, swelling, and bruising over the dorsum of the hand.

Exam reveals dorsal edema and ecchymosis as well as exquisite tenderness and a palpable deformity over the 4th metacarpal. There is no malrotation noted.
Metacarpal Fractures
Metacarpal Fractures

18 y/o male is seen in clinic after punching the wall in his dorm room while intoxicated last night.

Exam reveals deformity with the loss of the 5th knuckle while making a fist. There is a minor abrasion from the wall, edema, and ecchymosis. There is no malrotation.

X-ray findings show a minimally displaced, dorsally angulated 5th metacarpal neck fx. Angle is <30%
Ulnar Gutter Splint
Management:

- Ulnar gutter splint for 4-6 weeks with f/u at 1 week and then every 2 weeks to assess for loss of position and malrotation.
- Protect with orthotic splint or buddy taping for athletic activities for an additional 4 weeks.

Referral

- 1st, 2nd, or 3rd metacarpal fx
- 4th or 5th MC neck with >35° angulation
- Displaced transverse, oblique, and spiral fx tend to be unstable.
Scaphoid Fracture

17 y/o female had a FOOSH injury at basketball practice 6 days ago & c/o continued pain on the radial side of the wrist.

Exam reveals snuffbox tenderness, minimal edema, and pain with both radial wrist deviation and extension.

X-ray is at the left. Dx?

* Fracture until proven otherwise
She was placed in a thumb spica cast and returned for f/u in 10 days.

She had continued snuffbox pain.

Repeat x-rays are negative.

Suspected Fx: short-arm thumb spica until confirmed
  * Watchful waiting until symptom free and neg x-ray
  * MRI vs CT (I recommend MRI)

This patient is a young active athlete and the family elected to move forward with an MRI.
Scaphoid Fracture
MRI is equivical, therefore, we continued in a cast for an additional two weeks.

F/u x-rays were negative and she had resolution of her pain.

She was placed in a thumb spica splint and sent to PT for ROM and strength work for 2 weeks.

She had no interval sx and was released to return to athletic activity.
Scaphoid Fracture
Scaphoid Fracture

- These fx have a high incidence of non-union and avascular necrosis due to distal to proximal blood supply
- Treatment options: short-arm thumb spica cast
  - Distal pole: 4-6 weeks
  - Middle(waist) 12-14 weeks
  - Proximal pole 12-20 weeks
  - Proximal and waist fractures should start in a long-arm thumb spica for 4-6 weeks then finish remaining weeks in short-arm thumb spica cast.
- Refer all displaced, waist, and proximal fractures.
- ORIF may be considered even in non-displaced distal pole fractures in some patients.
Distal Radius Fracture
Distal Radius Fracture

* Treatment will be dependent on:
  * Fracture pattern
  * Bone quality (pediatric, normal adult, osteoporotic)
  * Patient’s functional demand (hand dominance, vocation, age)

* Referral
  * Intraarticular (radio-carpal or DRUJ)
  * Cannot reduce or maintain reduction
Distal Radius Fracture

- Acute Immobilization
  - Non-displaced: short-arm volar splint with f/u 3-5 days.
  - Displaced following reduction: sugar-tong splint and sling with f/u in 2-3 days
Sugar Tong Splint
Sugar Tong Splint
Follow-up Treatment

Non-displaced:
- SAC wrist in neutral 4-6 weeks,
- f/u every 2-3

Displaced- reduced:
- LAC 3-4 weeks then
- SAC 3-4 weeks until healed,
- f/u weekly until stable then every 2 weeks until healed
Torus Fracture

* Most can be treated with a removable volar splint or cock-up splint to encourage early ROM and function.
* Casting can provide better pain relief and offer increased protection for very active children.
* Splint or cast for 2 weeks then re-examine.
  * If no tenderness d/c and start ROM and activity as tolerated.
  * If tender return to splint for 1-2 additional weeks
* Splinting may be continued during vigorous activity for 1-2 weeks.
* Both bone torus fractures should be treated initially in a long-arm splint or cast for 2 weeks then short-arm for 2 more weeks.

Distal Radius Fracture
40 y/o female presents following a FOOSH injury. She c/o pain and swelling over the lateral elbow with limited ROM.

There is point tenderness over the radial head, but no crepitation or blockage of motion.

X-ray at left shows

- A positive fat pad sign
Radial Head Fractures

Treatment

- Long-arm posterior splint 5-7 days then f/u x-ray & exam
- Sling for comfort only for 1 week
- May take 6-8 weeks to return full ROM
- Refer for PT if patient is showing difficulty with ROM after 2 weeks
Radial Head Fractures

Refer

- Displaced >2mm
- Depressed >3mm
- >30% of the articular surface involved
- >30° angulation
- Presence of any mechanical block
Other Elbow Injuries

- Nursemaid’s elbow (radial head subluxation)
  - Commonly seen in children 3 and under due to a traction injury
  - Easily reduced without analgesia
    - Supination/flexion technique
    - No immobilization required post reduction
  - If child has not resumed normal activity within 24 hours the child should be re-evaluated.
- Positive fat pad sign = fracture until proven otherwise.
Occult non-displaced suprachondylar elbow fractures are common. Fat pad sign is present.
* Long-arm splint or cast with repeat radiographs every 7-10 days.
* Non-displaced Fx: long-arm cast for 3 weeks, if adequate callus present on f/u, may move to long arm splint for 3 weeks with supervised ROM activity.
* Other distal humerus and olecranon fractures should be placed in a posterior splint for referral.
Recommended Readings:


Recommendations for casting and splinting technique:

* YouTube: search any casting or splinting for free how-to video
* BSN & 3M offer technique DVDs

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