AMPLIFY

Basic upper limb fracture management in family medicine & UCCs

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Australia

UrgentCare
ForHealth

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Financial Disclosure & Caveat

a) Paid to open the 2026 Australia & NZ Conference

b) Supports plaster & wound care management teaching

c) Paying for the UQ Health Economist for Primary Care Fracture Clinic model study

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This talk shares how I manage basic # in Australia according to local guidelines where I am a licenced medical doctor.

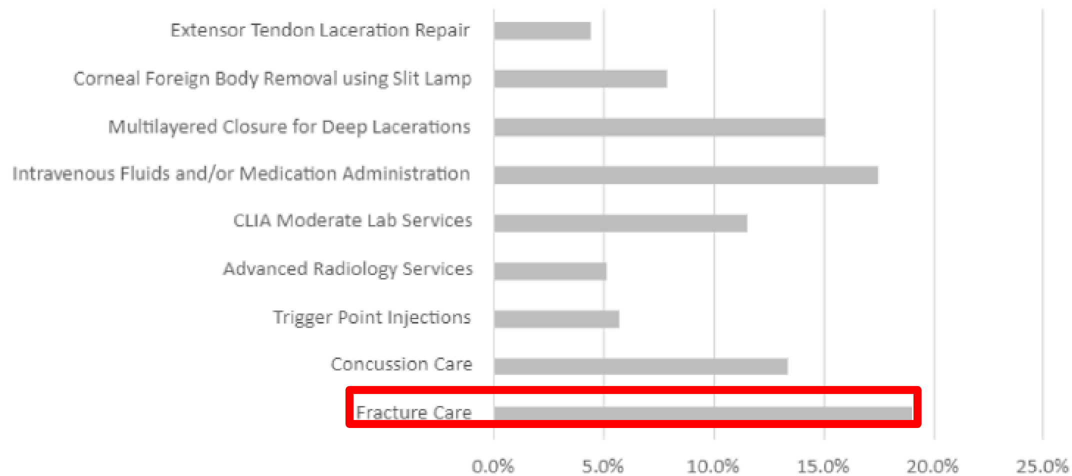
This is not advice about how to manage # in the US where I am not a licenced medical doctor

UCA Benchmarking Report Operations 2022

SERVICES

HIGH ACUITY SERVICES (n = 951)

The 12% that identified as Higher Complexity were then asked to select from a list of services considered to be higher in complexity that were provided in their center. Fracture care topped the list of services provided with 19.1% of the centers offering. Extensor Tendon Laceration Repair had the lowest percentage of offering, at 4.5% of the sample.



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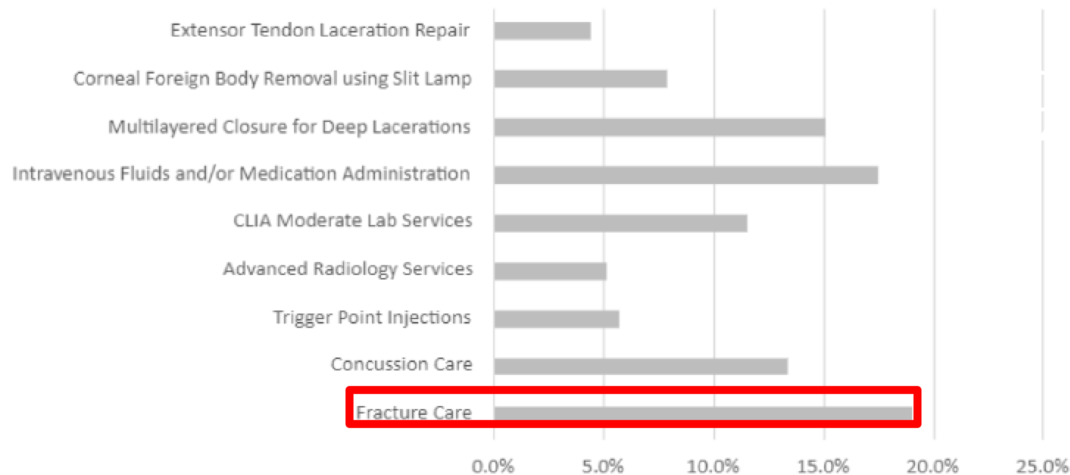
UCCs with # clinics

(Adie et al., in press)

USA	2%
Australia	15%
NZ	100%

HIGH ACUITY SERVICES OFFERED



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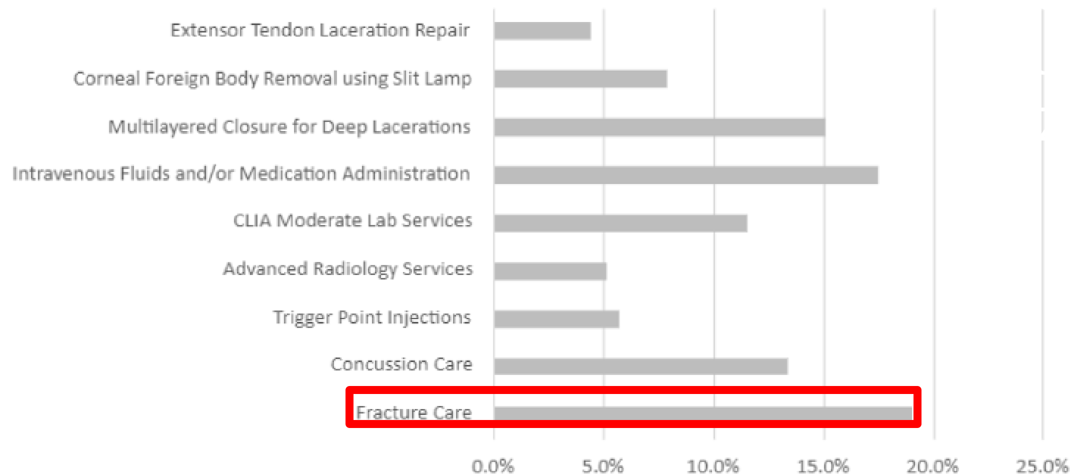

UCCs with # clinics
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USA	2%
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Queensland Health

Clinical Excellence Division

Evaluation Report

Sunshine Coast Hospital and Health Service
Primary Care Fracture Clinic
16 June 2017

23%

- 4111 patients in total, irrespective of location, were seen
  - 23.4% of patients were seen by the Primary Care Fracture Clinic
  - 76.6% of patients were seen by the NGH outpatient fracture clinic.

Models of community fracture clinics I have been associated with

- **IPCC** = Integrated Primary Care Centre
- **UCC** = Urgent Care Clinic
- **PCFC** = Primary Care Fracture Clinic
- **FP** = Family Physician
- **EP** = Emergency Physician
- **NP** = Nurse Practitioner

Sunshine Coast Hospital and Health Service

Primary Care Fracture Clinics

Authors: Gillian Puckeridge, Dr Sandra Peters, Dr John Adie, Dr Hamish Gray

Context

The Sunshine Coast Hospital and Health Service (SCHHS) is located in Queensland, Australia and services a population of about 390,000. The Primary Care Fracture Clinic (PCFC) is an integrated care partnership between the Orthopaedic Department of a regional public hospital and general practice. This is a "hospital alternative" model of care.

Public hospitals in Queensland are dually funded by the state and federal governments. General practice is run as a small business/fee-for-service private enterprise with funding derived from the Australian Government (Medicare) and fees (paid by patients).

This presents challenges for patients needing treatment which require consumables (not provided for in fee for service payment) which the patient cannot afford to fund e.g. casting. This model of care offers right care, right place, right time for patients.

Problem

- Prior to the intervention fracture clinics at SCHHS hospitals were operating over capacity on a daily basis with approximately 400 referrals for fracture management received each month.
- Overflow fracture management appointments were allocated in orthopaedic (non-fracture) clinics and patients waiting for orthopaedic specialist opinion were routinely waiting beyond the clinically recommended time frames.

Assessment of problem and analysis of its causes:

- Review of surgical conversion data identified an increasing number of patients not requiring specialist orthopaedic intervention.
- Primary care providers lacked resources such as direct access to imaging providers and ability/resource to apply plaster casts.

Aims:

1. Reduce demand on specialist services by redirection of non-specialist cases.
2. Improve access for patients requiring non-specialist services with increased conversion to surgery rate at specialist fracture clinics
3. The model offers an opportunity for building skill capacity in primary care in the context of changing health system requirements.

Intervention

Orthopaedic Clinical Nurse Consultant and staff specialist worked with G.P. liaison officer and G.P.s to develop a model of care allowing for management of clinically appropriate patients in a hospital alternative/PCFC by:

- Developing list of "in scope" fractures for primary care
- Circulate EOI for interested practices, evaluation panel and SLA
- Up skilling of general practice nurses by SCHHS plaster technicians
- Ask hospital staff to advise patients of this community alternative model of care
- Development of close working relationship between orthopaedic staff and G.P.s, built confidence in both parties and allowed for timely transfer of care for patients with more complex needs than initially determined.
- Develop process for transfer of images from hospital Department of Emergency Medicine to PCFC should the patient choose to access this model of care.

Study design

Longitudinal observational comparing difference between SCHHS and PCFC

- Effectiveness of treatment - patients seen in clinically recommended timeframe
- Patient experience data routinely collected in SCHHS and was used in comparison with data from primary care already collected as part of the evaluation process
- Efficiency of service (number of patients seen and surgical conversion rate).

Strategy for change

- Key stakeholders engaged
- Processes developed and agreed (referrals, consumables, medical imaging transfers)
- Patient information developed
- Set date for commencement of primary care clinic
- Review meetings with stakeholders to identify/resolve issues.

Measurement of improvement

- Patient experience data evaluated pre and post implementation of the PCFC
- Conversion to surgery rates compared pre and post implementation of the PCFC
- Treatment failure and re-referral was monitored. No cases of non-union or re-referral post discharge from the PCFC to the SCHHS reported to date.
- No clinical incidents reported through external governance quality assurance.

Effects of changes

Patients seen at orthopaedic fracture clinic more appropriate for specialist intervention, 50 per cent increase in conversion to surgery rates post intervention.

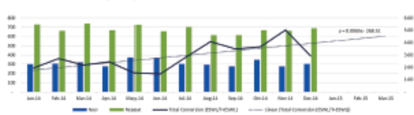
Lessons learnt

- Ensure processes and infrastructure are in place early and test
- Process cannot be "person" specific - single point of failure if key personnel are absent
- Health systems can undergo change even in the face of funding model rigidities.

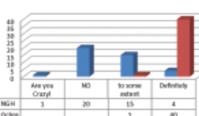
Message for others

- Improved patient access to clinically appropriate quality care in hospital alternative location other without cost to patient.
- Local funding models modified to achieve this outcome within the legislative funding framework in which we operate
- Patients have a choice of location/time/practitioner for treatment - right care, right time, right place = patient-centric integrated model of care.

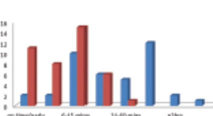
Conversion to theatre (ESWL)



Convenience of parking



Appointment times on schedule



Sunshine Coast Hospital and Health Service

Exceptional people. Exceptional healthcare.

- **Key stakeholders:** ortho clinical nurse consultants, ortho surgeons, GP liaison, GPs
- Practice nurses upskilled to apply fibreglass casts
- 50% increase conversion rate to surgery at hospital specialist orthopaedic service
- Parking more convenient than hospital
- Appoint times on schedule much better than hospital
- A list of 'in scope' fracture for family medicine developed

Optomising fracture care: A comparative analysis of primary care-based models

John Adie* [1,2], Shauna Fjaagesund [3], Sylvia Andrew-Starkey[4], Daevyd Rodda[5], Cindy Richards[6], Kerron Bromfield[6], Hamish Meldrum[7], Anton Pak[8].

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6.Health Operations
7. FRACGP, GAICD Co-founder and owner Ochre Health Group
8. PhD, Senior Lecturer, Centre for the Business and Economics of Health, University of Queensland, Brisbane, Australia,
* Presenting author

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Introduction

Hospital-based fracture clinics in Australia are under increasing strain from growing demand. Musculoskeletal injuries comprise a substantial share of ED presentations (e.g., in Queensland, ~4.65% of 1.5 million annual ED visits (≈70,000 cases)) involve musculoskeletal issues [1]. Most of these patients are referred to hospital fracture clinics for follow-up, contributing to clinical hospital load and long waits. However, a large proportion do not require surgery and could be managed safely outside hospital [2]. A multi-hospital Queensland review found ~40% of adult fracture cases seen in ED could be handled in community settings by general practitioners (GPs), nurse practitioners (NPs) and allied health without hospital clinic review [3]. Consistent with Australian recommendations advocating collaborative models between primary care and specialist services [4,5], shifting appropriate cases to primary care could free specialist capacity for complex care while maintaining safety and quality.

International and local pilots demonstrate feasible alternatives. The Glasgow Royal Infirmary "virtual fracture clinic" (VFC), with specialist triage and GP/community follow-up, reduced unnecessary face-to-face visits and improved satisfaction and outcomes [6]. Similar models across the UK report sustained reductions in hospital attendances and local cost savings, without compromising clinical outcomes. Regionally, New Zealand accredits Urgent Care Clinics (UCCs) with embedded fracture services [7], while in the USA only a small minority of UCCs offer fracture clinics [8], underscoring variability in model uptake. In Queensland, the Sunshine Coast Primary Care Fracture Clinic (PCFC) pilot (2014–2015) offered GP-led follow-up (with additional training and clear escalation pathways) for simple fractures; 23% of fracture patients were managed in primary care [9].

Primary objectives

1. **Model and care pathways characterisation.** Describe scope of practice, triage criteria/eligibility, clinical governance, and care pathways for: (i) GP-led clinic; (ii) UCC; (iii) community orthopaedic specialist clinic (NP-led with consultant oversight).
2. **Clinical and process outcomes.** Estimate (risk-adjusted) 7- and 30-day outcomes captured in primary-care records: unplanned return visits, , referral/escalation to ED or hospital specialist care, time to first review, total visits, imaging utilisation, and guideline-concordant management.
3. **Costs and reimbursement.** Estimate episode-of-care costs from health-system (MBS/PBS where applicable), provider (practice-level resources), and patient perspectives (out-of-pocket fees, bulk-billing rates); identify reimbursement gaps and potential cost-shifting risks.
4. **Determinants of safe primary-care management.** Identify patient, injury, and service factors associated with outcomes and resource use to inform potential scalability of the models of care.

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Most frequenly managed fractures in a Queensland PCFC Model 9

1. Distal radius +/- ulnar
2. Distal fibula +/- tibia
3. Phalanges
4. Patella
5. Scaphoid (and other in carpus)
6. Clavicle
7. Humerus (distal and proximal)

Inclusion and exclusion criteria

- Inclusion: Adults (and adolescents if routinely managed) with fractures typically treated non-operatively.
- Exclusion : Open/complex fractures, neurovascular compromise, clear operative indications, or records insufficient to define the episode.

Setting

Three sites are planned to be engaged each representing distinct models of care:

- **GP clinic with fracture services** (Ochre Health).
- **Urgent Care Clinic** (site to be advised)
- **Community orthopaedic specialist clinic** (Fortius; NP-led with surgeon oversight).

Relevance and potential impact

This project delivers the first multi-site comparison of primary care–led fracture pathways in Australia (GP-led at Ochre Health, UCC (site to be advised), and NP-led community orthopaedics at Fortius). Using real-world data, it will show whether these models provide safe, timely, and efficient care for uncomplicated fractures and will identify the drivers of outcomes (patient, injury, and service factors). The findings will:

- **Guide clinical practice:** clarify triage/eligibility and highlight process improvements (e.g., timely review, appropriate imaging, immobilisation changes) that can be adopted across services.
- **Inform commissioning and funding:** quantify episode costs and revenue streams (MBS/private/OOP) to assess financial viability and identify reimbursement gaps or cost-shifting risks, supporting commissioning by HHSs/PHNs and business planning by primary care / UCC providers.
- **Support hospital demand management:** demonstrate the quantum of cases safely managed outside hospital clinics, helping hospitals prioritise complex trauma and reduce outpatient bottlenecks.

Collectively, mapping how each setting works, detailing outcomes and costs, and explaining why performance differs will support clinicians, planners, and funders with decision-ready evidence to scale safe, efficient alternatives to hospital fracture clinics.

jadie@usc.edu.au A/Prof John Adie

Australian Journal of General Practice

1. Proper set up for # management
2. Understand the # healing process
3. Follow initial examination & management principles
4. Develop a referral network

- Includes acute referrals for open #, comminuted #, acute neuropathy, vascular compromise, compartment syndrome, or skin tenting.
- Includes physio, occupational or hand therapy

Basic fracture management in general practice

John W Adie, Nigel Barr, Daevyd Rodda, Nicole Masters, Nicola Waterreus

Background
Fractures account for approximately 1% of patient presentations in general practice. Uncomplicated, low-risk fractures rarely require orthopaedic intervention and can be treated exclusively in primary care by the general practitioner (GPs).

Objective
The aim of this paper is to improve the skill set of GPs to enable them to manage low-risk fractures in the primary care setting.

Discussion
Three key factors underpin the safe development and deployment of a primary care fracture clinic (PCFC) in primary care practices: (1) understand fracture healing; (2) acquire a deep understanding of initial examination and management principles; and (3) have a referral network. The right referral network includes orthopaedic surgeons; allied health practitioners such as physiotherapists; and appropriate handouts. Additional considerations are having the right medical insurance; online and hard copy academic and clinical references; and adequate consumables.

MUSCULOSKELETAL INJURIES and fractures account for 3.7% and 1% of a general practitioner's (GP) workload in Australia, respectively.[1] Because low-risk fractures rarely require orthopaedic intervention, some Western countries manage these cases within general practice.[2] Limited musculoskeletal education[3] and inadequate remuneration, however, are significant barriers. Medicare item numbers typically allow only a single billing for the entire fracture management, often failing to cover the time and materials required. A common example is the 'treatment of fracture of the distal end of the radius or ulna (or both) by cast immobilisation'.[4] In New Zealand (NZ), where primary care fracture management is more common than in Australia, GPs receive 150% of the Australian remuneration for similar in-hours management of fractures that require two plaster applications, adjusted for exchange rates.[4,5]

Because of high GP referral rates for fractures to hospital, one Queensland hospital and health service (HHS) commissioned a primary care fracture clinic (PCFC) at the Ochre Medical Centre Sippy Downs,[6] which also has an urgent care clinic (UCC).[7] This PCFC was subsidised by the HHS for consumables and managed 23% of the referrals to the hospital fracture clinic using upskilled GPs.[6] There were seven most frequently managed fractures in the clinic (Box 1), with a 5.5% re-referral rate back to the hospital fracture clinic because of clinical complexity, fracture movement or healing impairment.[6] The co-location of the PCFC with an UCC in general practice is ideal. A study compared an UCC, which was co-located with this PCFC, and managed non-life-threatening injuries including basic fractures, to an after-hours general practice and emergency department (ED). The study found that UCCs are well suited to manage non-life-threatening injuries like basic fractures because of the availability of imaging, consumables and doctors with necessary skill sets.[8] The 10 years of operation of the PCFC demonstrates fractures can be managed in primary care. Further studies are being developed on the appropriate management of upper and lower limb fractures in primary care based on the report from the PCFC[6] (Box 1). These studies will outline guidelines for GPs, including inclusion and exclusion criteria for fractures suitable for primary care management, ensuring appropriate case selection and safe practice.

This study describes how fractures can be managed in a PCFC, co-located with an UCC that operates seven days per week. There are several considerations that are important if this model is to be reproduced. In addition to having appropriate imaging facilities preferably onsite, it is important to 'get set up for fracture management', understand 'the fracture healing process', 'learn initial examination and management principles' and have an 'appropriate referral network'. These considerations will be discussed below.

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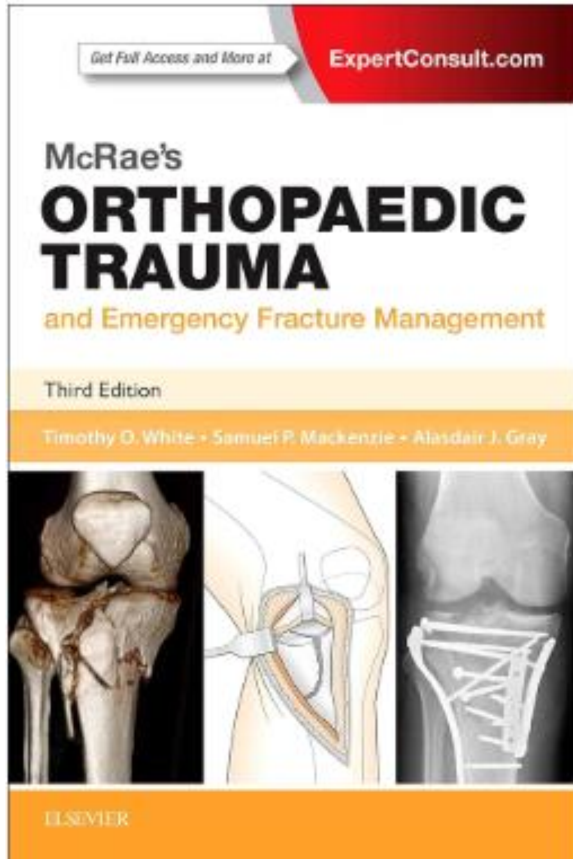
- Includes … te neuropathy, vascular … tenting.
- Includes

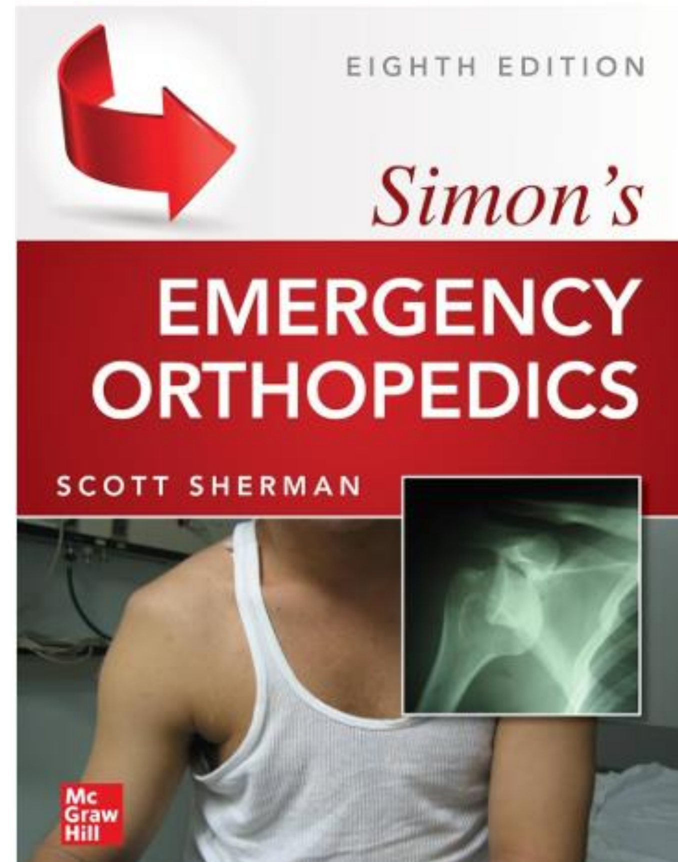
Box 1. Seven most frequently managed fractures in the Primary Care Fracture Clinic (non-operative)[6]

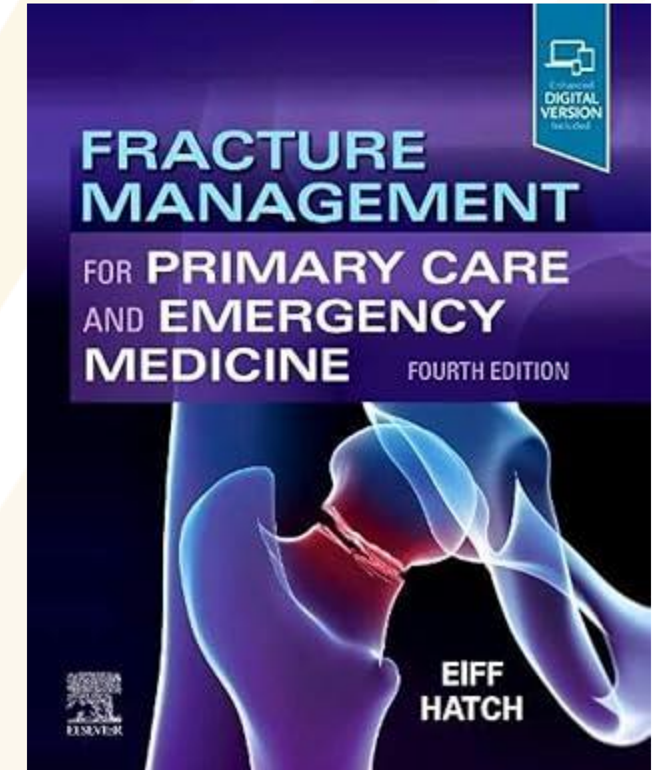
Item numbers:
Distal radius ± ulnar
Distal fibula ± tibia
Phalanges
Patella
Scaphoid (and other in carpus)
Clavicle
Humerus

Adapted from Clinical Excellence Division, Queensland Health. Evaluation report Sunshine Coast Hospital and Health Service Primary Care Fracture Clinic. State of Queensland, Queensland Health, 2017, under a Creative Commons Attribution 3.0 Australia license.

Resources







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Brisbane South

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  - Orthopaedic Requests

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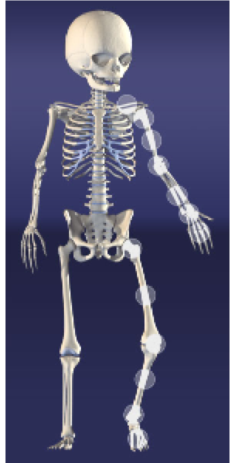
Paediatric Fractures Guidelines

for Emergency Department | for Fracture Clinics | Education | Family resources

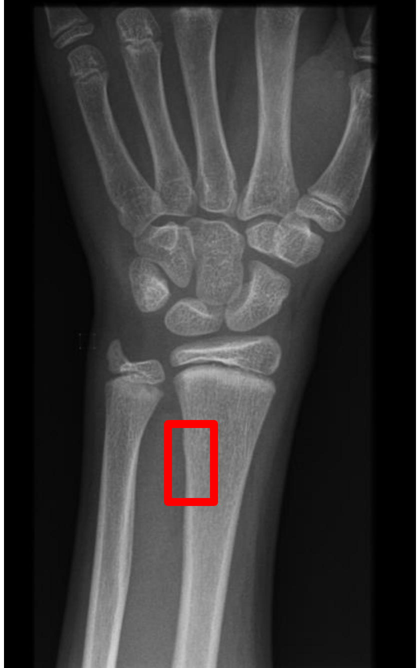
The following Guidelines are for use in the **Emergency Department**.

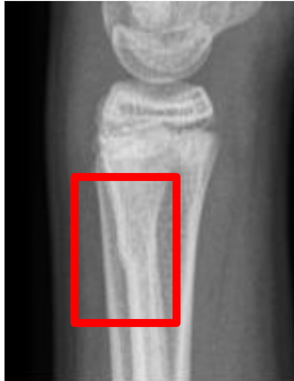
- Clavicle
- Shoulder and Proximal humerus
  - Proximal humerus
  - Shoulder Dislocations
- Humeral shaft (diaphysis)
- Elbow
  - Supracondylar
  - Lateral condyle
  - Medial epicondyle
  - Monteggia fracture-dislocation
  - Olecranon
  - Radial neck
  - Elbow Dislocations
- Forearm
  - Radius and ulna shaft (diaphysis)
  - Monteggia fracture-dislocation
  - Galeazzi fracture-dislocation
- Wrist – distal radius and ulna
  - Metaphyseal
  - Physeal (growth plate)
  - Scaphoid Fractures
- Hand
  - Fingertip and nail injuries
  - Metacarpal Fractures
  - Phalangeal Finger Fractures
  - Thumb Fractures
- Hip and proximal femur
  - Slipped upper femoral epiphysis (SUFE)
  - Hip dislocation
  - Neck of femur
  - Apophysitis of the Pelvis and Hip
  - Fractures of the Pelvic Ring and Acetabulum
  - Pelvic Avulsion Injuries
  - Slipped upper femoral epiphysis SUFE - Emergency Department
- Knee
  - Patellar Dislocation
  - Ankle Sprains - Emergency Department
- Femoral shaft (diaphysis)
- Tibial shaft (diaphysis)
- Ankle
  - Ankle - distal tibial and fibula physeal
  - Acute Knee Injury
- Foot
  - Toe Fractures
  - Metatarsal Foot Fractures
  - Navicular Fractures
  - Talus Fractures
  - Calcaneus Fractures

* Guideline not yet published.



1) Distal radius

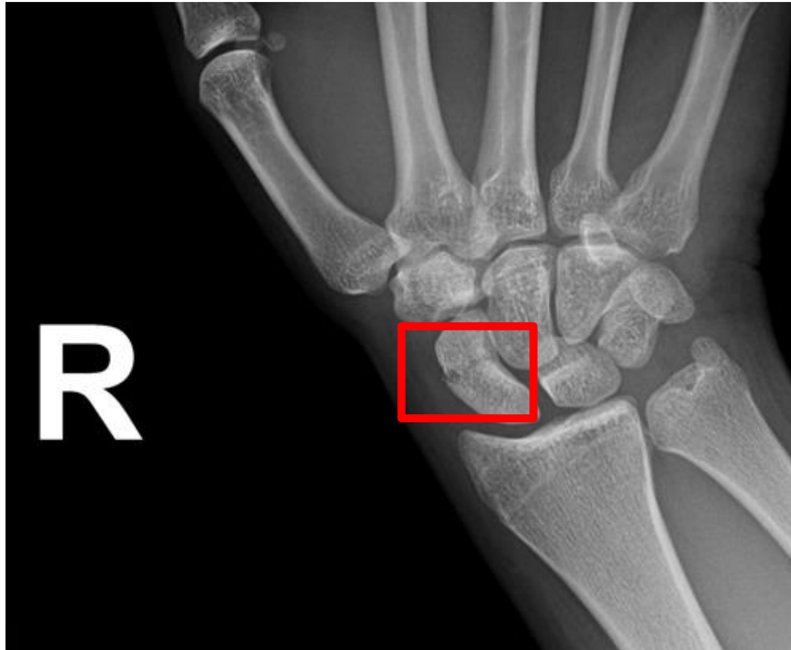




13 y.o. boy fell off bike when stopping suddenly & going over the handlebars.

Case courtesy of Mohammad A. ElBeialy, Radiopaedia.org, rID: 39780

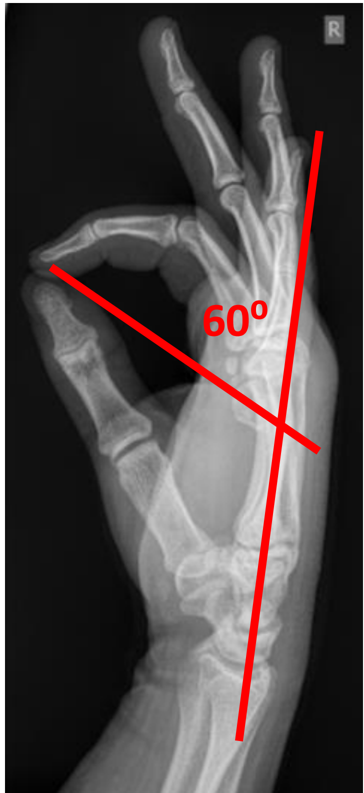
2) Scaphoid

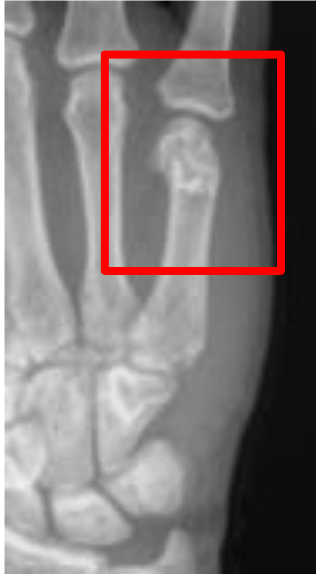


20 y.o. male falls after being hit by a car & falls on his outstretched hand

Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 215363

3) Metacarpal

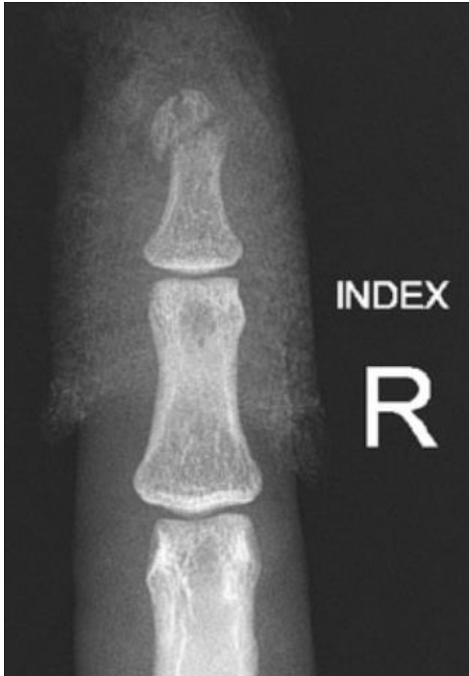


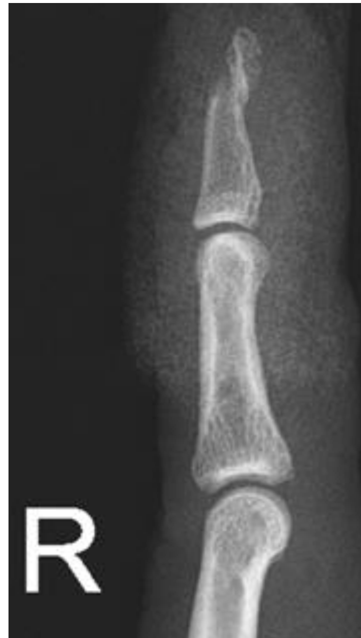


25 y.o. male presents with a painful, swollen hand after punching a wall. Dorsal swelling noted with tenderness over the 5th & 5th metacarpal bones

Case courtesy of Jochemus Johannes Hamman, Radiopaedia.org, rID: 221860

4) Finger





35 y.o. male accidently hit R 4th finger with hammer today at work. On examination: wound & tenderness on the right index finger distal phalanx

Case courtesy of Mohammad Osama Hussein Yonso, Radiopaedia.org, rID: 92332

Source: AdobeStock_272901944.jpeg

1) Distal radius

1) Distal radius: examination

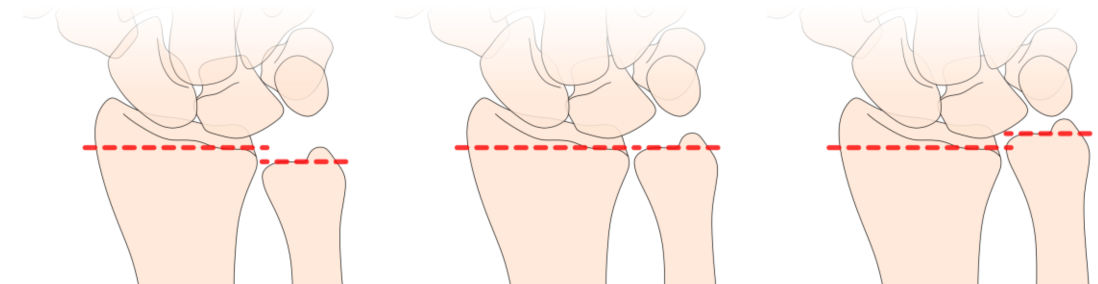
- Intercarpal ligament injuries
  - Scapholunate & lunotriquetral ligament involvement in 1/3

- Nerve pathology – median > ulnar
  - Acute carpal tunnel syndrome

- Tendon complications
  - EPL rupture, ECU or ED entrapment

1) Distal radius (Johnson et al, 2019; Szymanski et al, 2025)

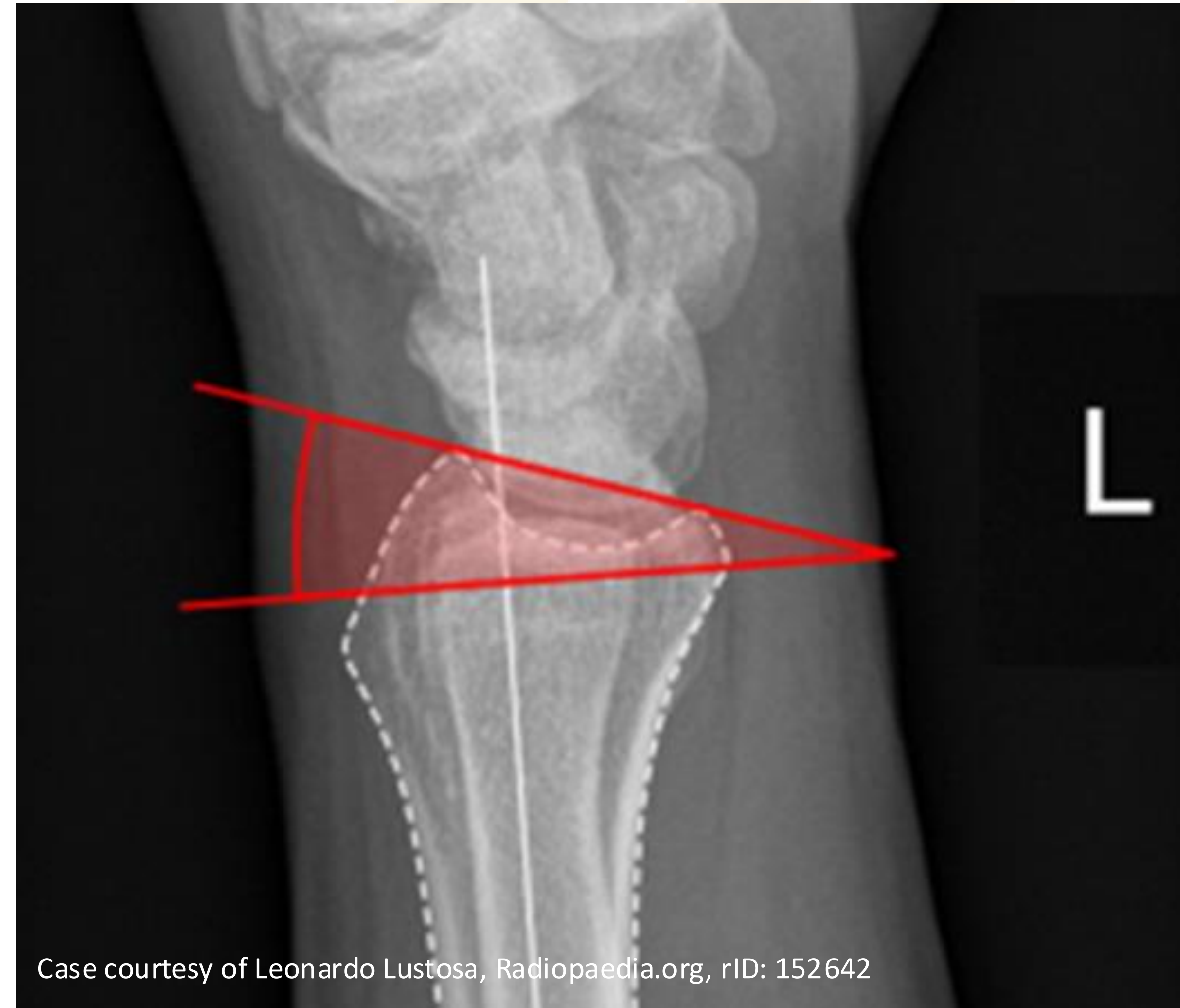
Ranking	Extra-articular		
	Parameter	Normal	Acceptable
1	**Ulnar variance (AP)**	-2 mm to + 2 mm	< 2 mm



Case courtesy of Leonardo Lustosa, Radiopaedia.org, rID: 180779

1) Distal radius (Johnson et al, 2019; Szymanski et al, 2025)

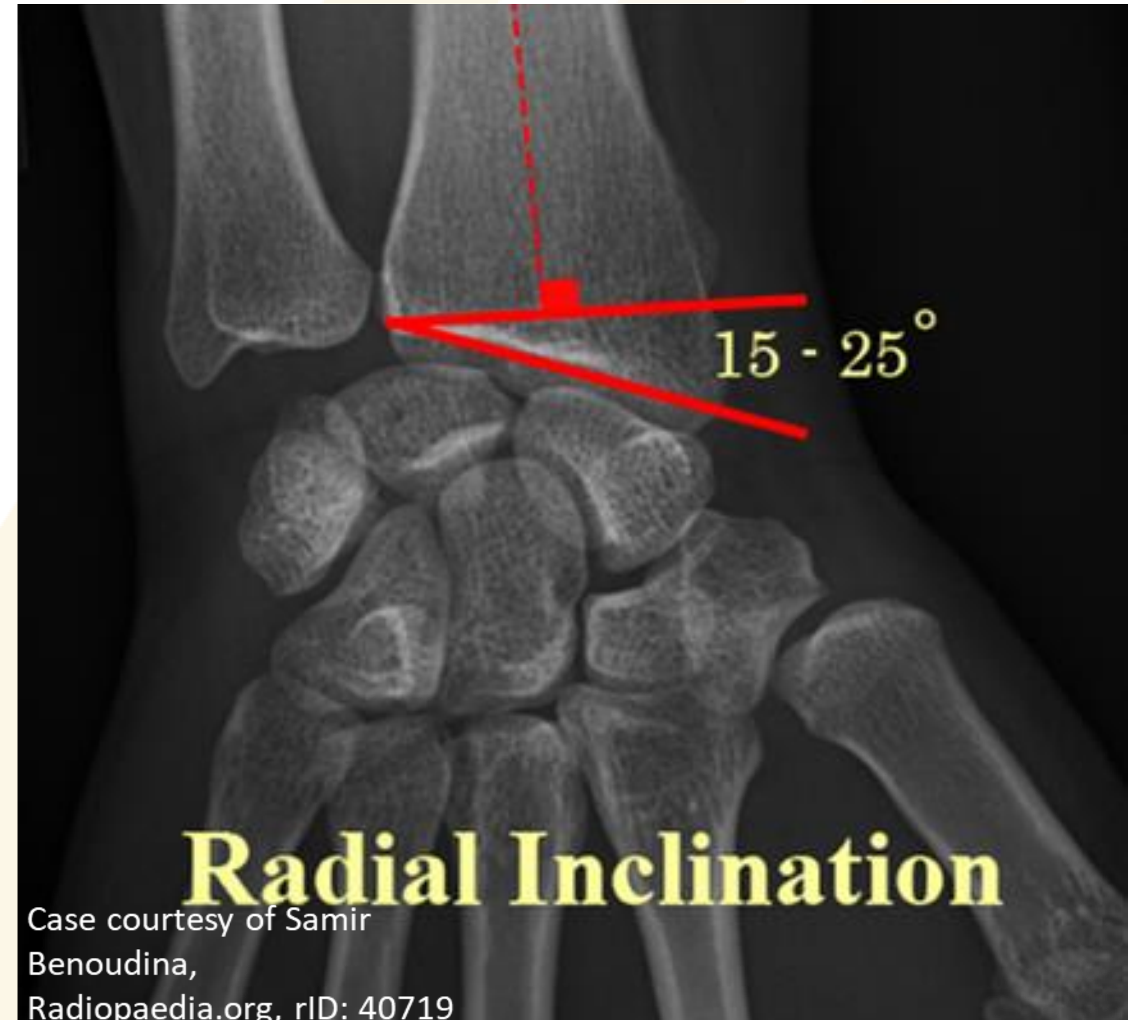
Ranking	Extra-articular		
	Parameter	Normal	Acceptable
1	**Ulnar variance (AP)**	-2 mm to + 2 mm	< 2 mm
2	**Dorsal tilt (lateral)**	11 ^{o}	Dorsal < 10 ^{o}



Case courtesy of Leonardo Lustosa, Radiopaedia.org, rID: 152642

1) Distal radius (Johnson et al, 2019; Szymanski et al, 2025)

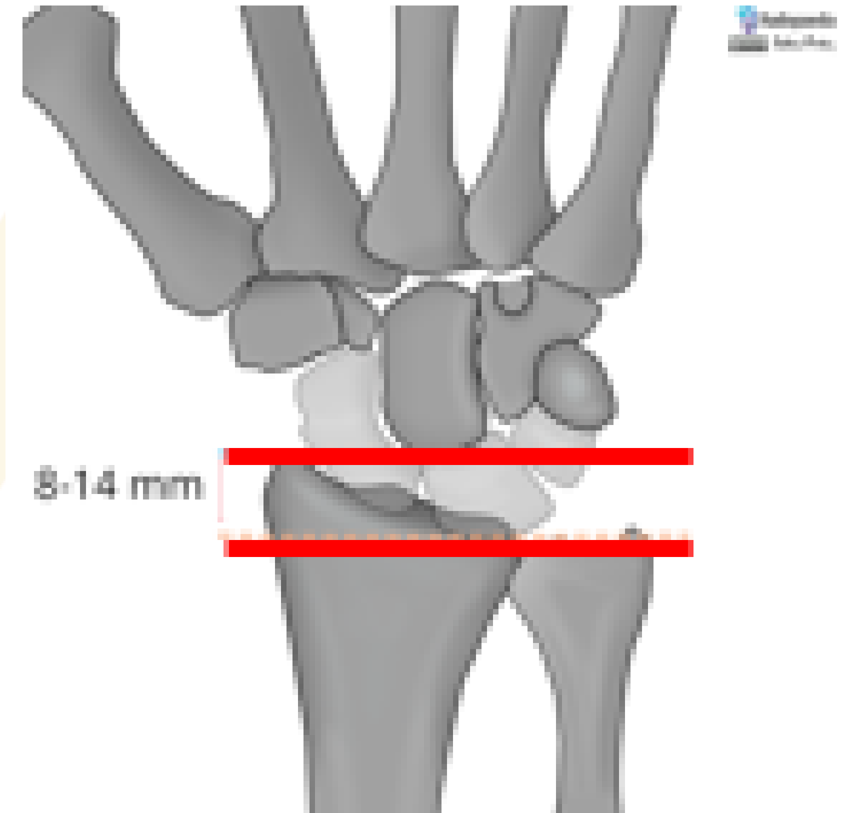
Ranking	Extra-articular		
	Parameter	Normal	Acceptable
1	**Ulnar variance (AP)**	-2 mm to + 2 mm	< 2 mm
2	**Dorsal tilt (lateral)**	11 ^{o}	Dorsal < 10 ^{o}
3	**Radial inclination (AP)**	23 ^{o}	Change < 5 ^{o}



Case courtesy of Samir Benoudina, Radiopaedia.org, rID: 40719

1) Distal radius (Johnson et al, 2019; Szymanski et al, 2025)

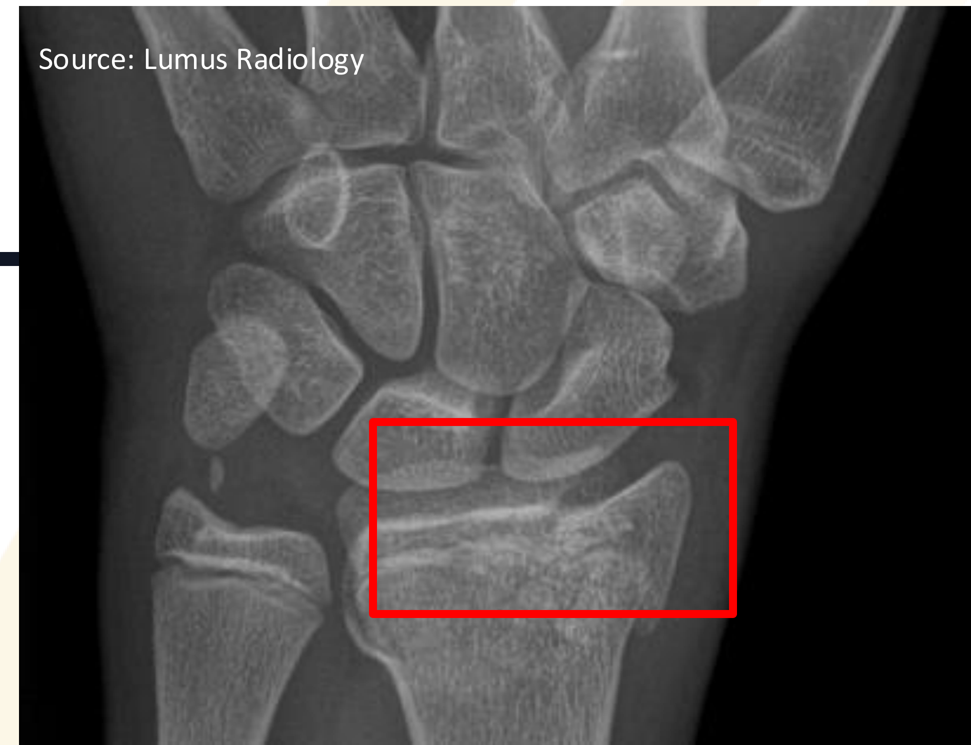
Ranking	Extra-articular		
	Parameter	Normal	Acceptable
1	**Ulnar variance (AP)**	-2 mm to + 2 mm	< 2 mm
2	**Dorsal tilt (lateral)**	11 ^{o}	Dorsal < 10 ^{o}
3	**Radial inclination (AP)**	23 ^{o}	Change < 5 ^{o}
4	**Radial height (AP)**	13 mm	< 5 mm shortening



Case courtesy of Andrew Murphy, Radiopaedia.org, rID: 80973

1) Distal radius (Johnson et al, 2019; Szymanski et al, 2025)

Rank	Intra-articular Parameter	Normal	Acceptable
1	Intra-articular step (AP)	Congruous	Age 38 – 58: 2 mm step-off Age > 75: 3 mm step
2	Intra-articular gap (AP)	Congruous	Age 38 – 58: 3 mm step-off Age > 75: 4 mm gap

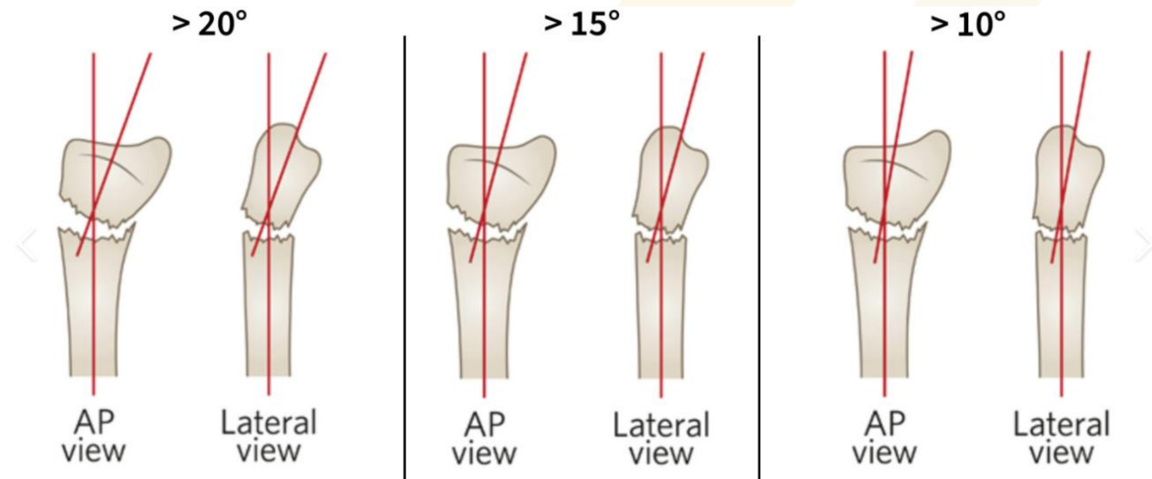


1) Distal radius # management: children

(The Royal Children's Hospital Melbourne Paediatric Fracture Guidelines)

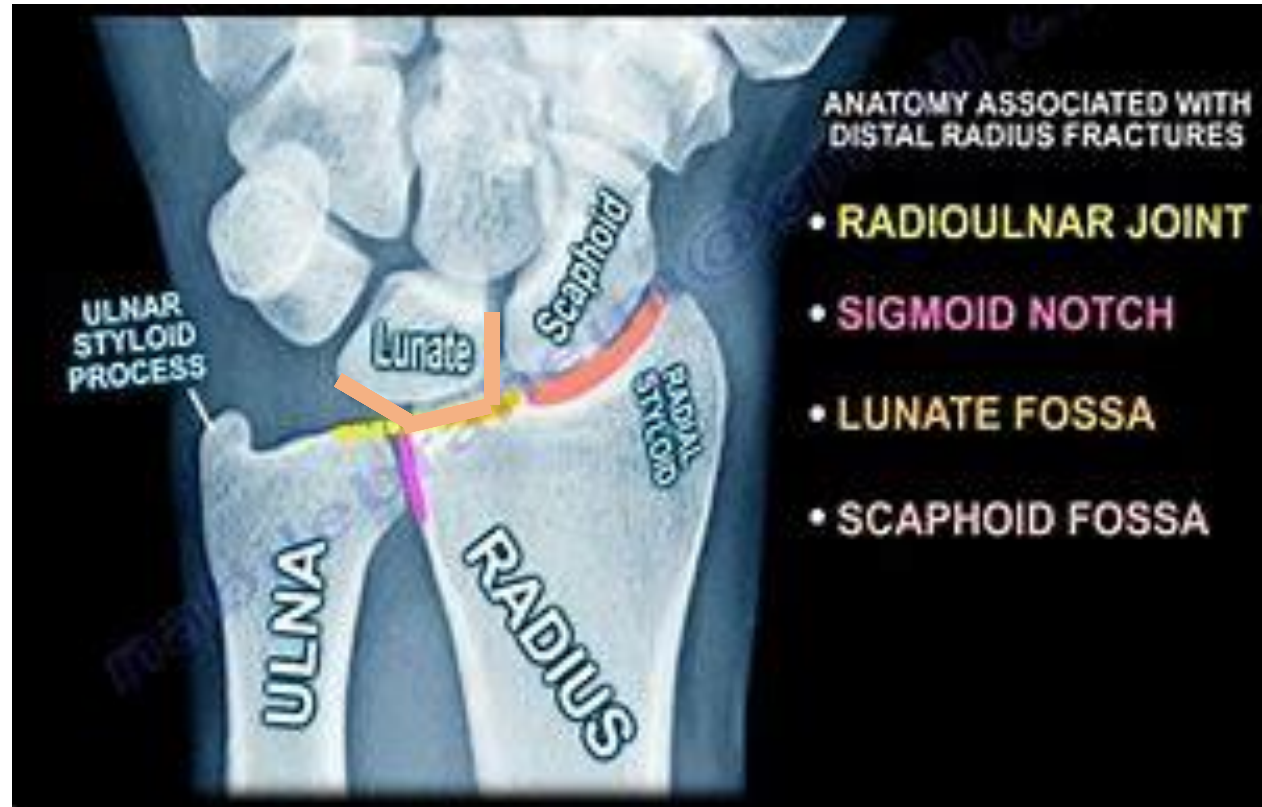
0 – 5 years	< 20 º
5 – 10 years	< 15 º
10 – 15 years	< 10 º *

* less in girls maturing earlier



Distal Radius Fracture Management in the ED – Alfred Emergency Education
Source:Distal Radius Fracture Management in the ED | Alfred Emergency Education

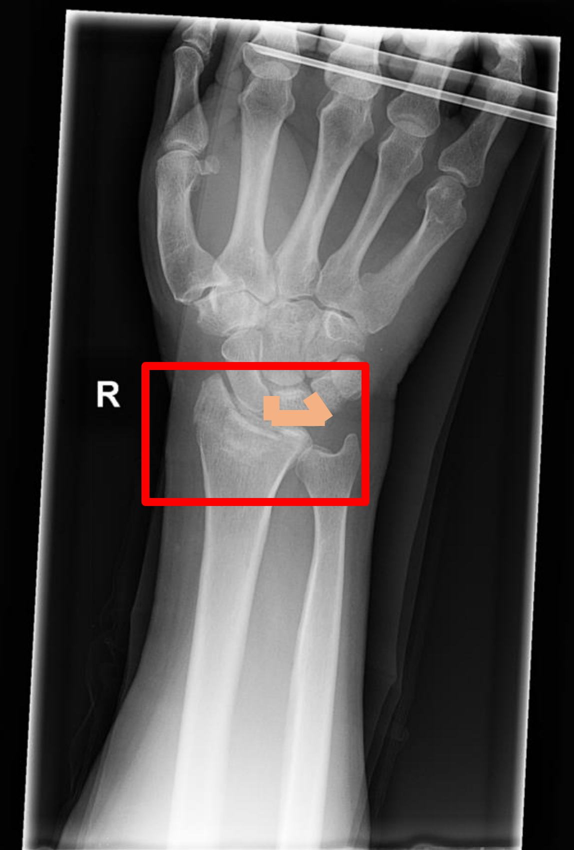
1) Distal radius: # to refer



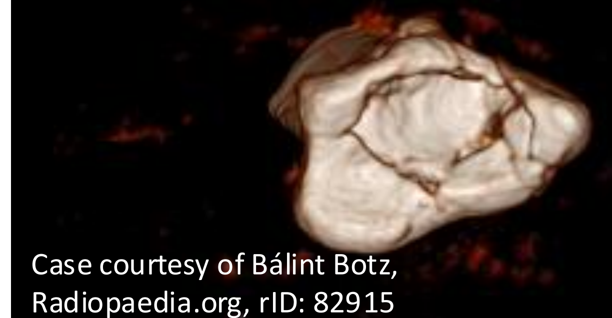
Common types of distal radius fractures
Source: medium.com

1) Distal radius: # to refer

A) Die Punch



Case courtesy of Henry Knipe, Radiopaedia.org, rID: 38847

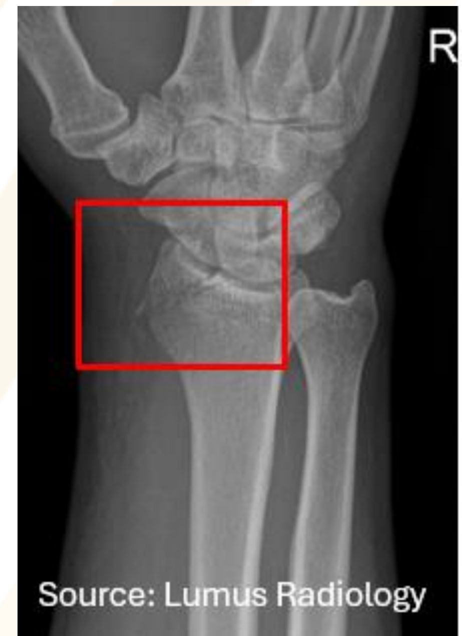


Case courtesy of Bálint Botz, Radiopaedia.org, rID: 82915

1) Distal radius: # to refer

A) Die Punch

B) Radial styloid (Chauffer's, Backfire, or Hutchinson's #)



1) Distal radius: # to refer

A) Die Punch

B) Radial styloid (Chauffer's, Backfire, or Hutchinson'

C) Smith's

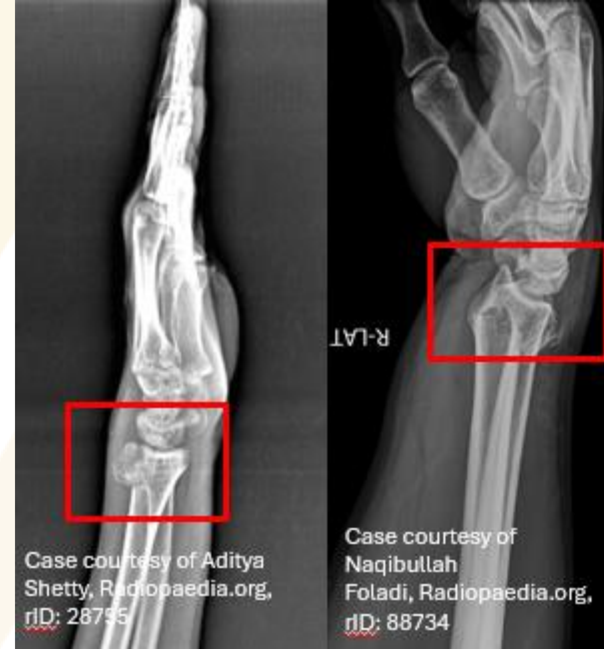
1) Distal radius: # to refer

A) Die Punch

B) Radial styloid (Chauffer's, Backfire, or Hutchinson's #)

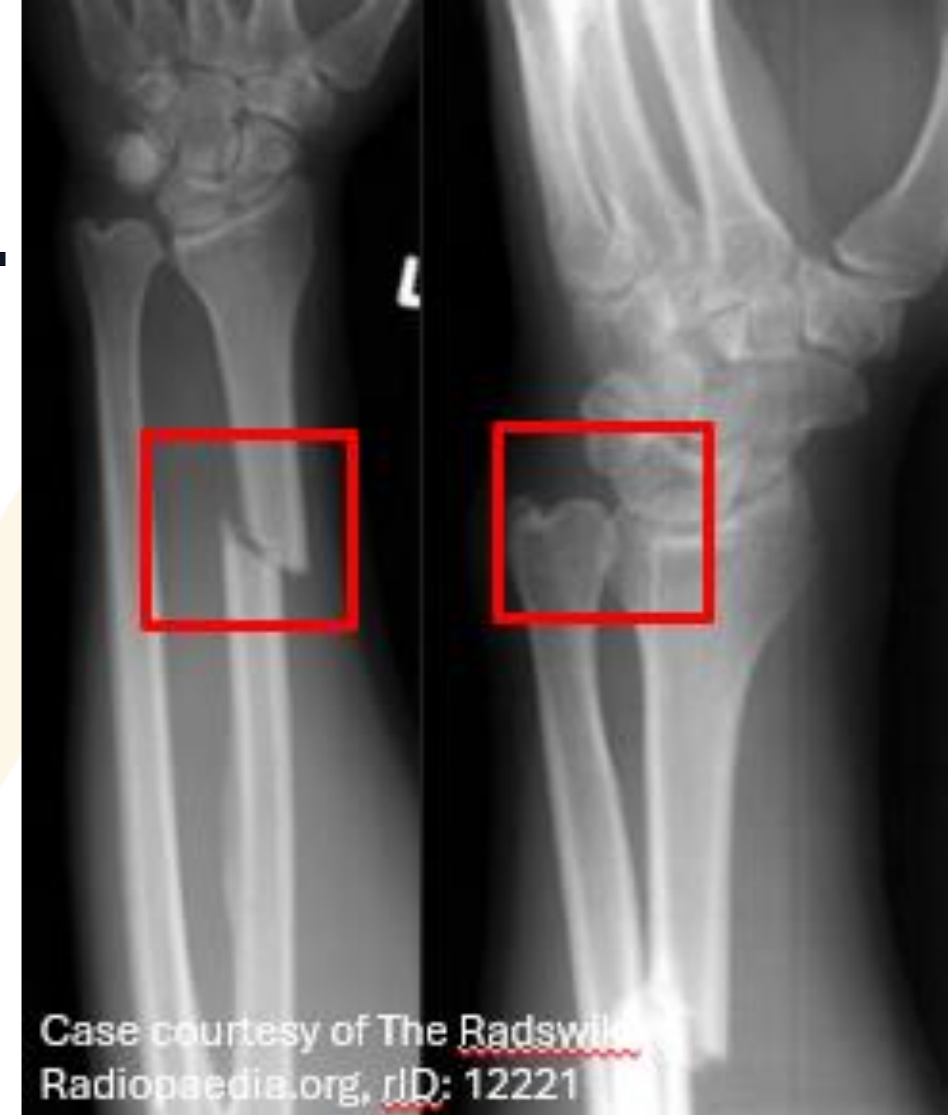
C) Smith's

D) Barton's



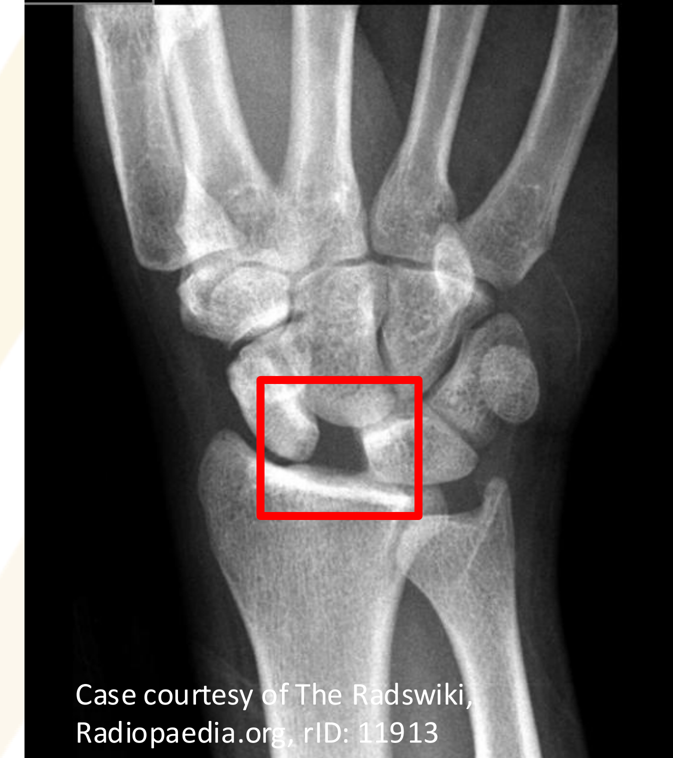
1) Distal radius: # to refer

A) Die Punch
B) Radial styloid (Chauffer’s, Backfire, or Hutchinson’s #)
C) Smith's
D) Barton's
E) Unacceptable angulation, displacement, step or gap e.g. Galeazzi #/dislocation



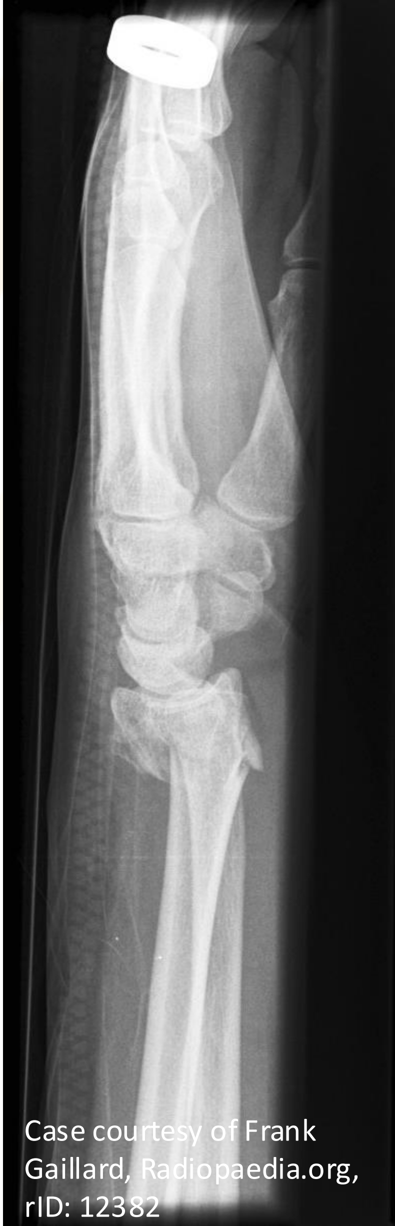
1) Distal radius: # to refer

A) Die Punch
B) Radial styloid (Chauffer’s, Backfire, or Hutchinson’s #)
C) Smith's
D) Barton's
E) Unacceptable angulation, displacement, step or gap
F) Carpal ligament instability, dislocation or loss of radiocarpal alignment


Case courtesy of The Radswiki, Radiopaedia.org, rID: 11913

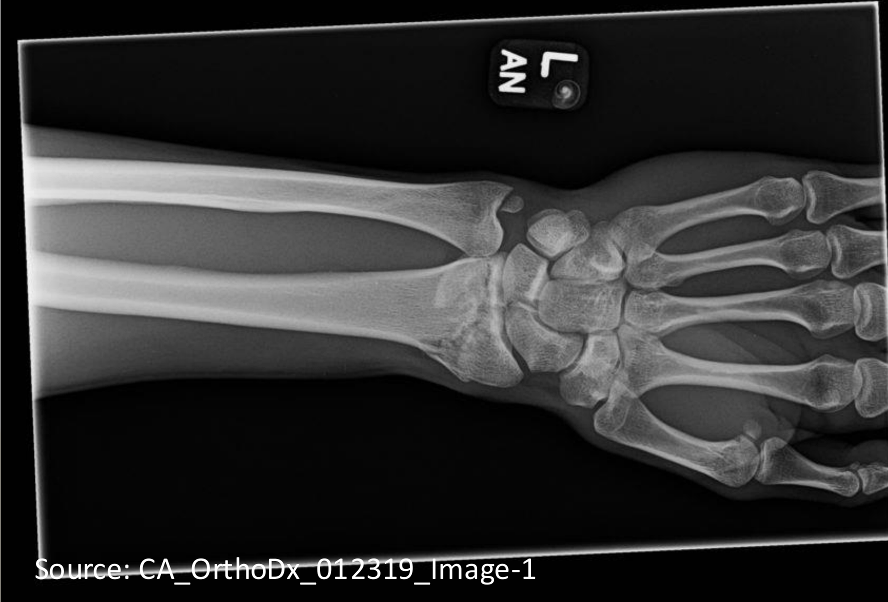
1) Distal radius: # to refer

A) Die Punch
B) Radial styloid (Chauffer's, Backfire, or Hutchinson's #)
C) Smith's
D) Barton's
E) Unacceptable angulation, displacement, step or gap
F) Carpal ligament instability, dislocation or loss of radiocarpal alignment
G) # not maintaining reduction after splinting


Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 12382

1) Distal radius: # to refer

A) Die Punch
B) Radial styloid (Chauffer’s, Backfire, or Hutchinson’s #)
C) Smith's
D) Barton's
E) Unacceptable angulation, displacement, step or gap
F) Carpal ligament instability, dislocation or loss of radiocarpal alignment
G) # not maintaining reduction after splinting
H) Isolated displaced ulnar styloid #



Source: CA_OrthoDx_012319_Image-1

1) Distal radius: # management

- **Adults:**

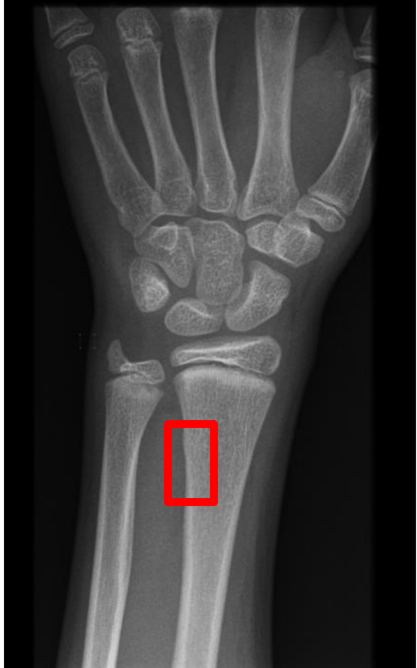
At injury:
- POP back-slab or split cast

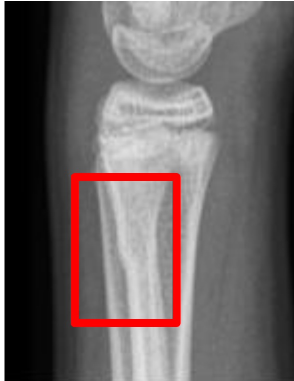
At 7-10/7:
- if no manipulation, apply light weight cast, re X-ray in new cast, review 6/52
- if manipulated, reinforce cast, re X-ray in new cast & review in a week

At 2/52:
- if manipulated, convert to full cast, & re-Xray in full cast

At 6/52:
- remove cast, re-Xray if clinical signs equivocal, & discharge if pain free with rehabilitation exercises

1) Distal radius





13 y.o. boy fell off bike when stopping suddenly & going over the handlebars.

Case courtesy of Mohammad A. ElBeialy, Radiopaedia.org, rID: 39780

1) Distal radius: # management

(The Royal Children's Hospital Melbourne Paediatric Fracture Guidelines)

- **Children:**

<u>Metaphyseal #</u>

Torus # - below elbow **back slab or removeable splint** 3/52

- no follow-up by family physician, # clinic or repeat X-ray needed

Complete, un, or minimally displaced - below elbow cast 4 - 6/52

Koay, J Trauma Treat 2019, 8:1
DOI: 10.4172/2167-1222.1000440

Journal of Trauma & Treatment

Research Article Open Access

Use of EXOS® Thermoplastic Splint in the Treatment of Wrist Fractures: A Retrospective Cohort Study of Use – The Silverdale Medical Experience

Ivan Koay*
Silverdale Medical Centre, Auckland, New Zealand

Abstract

Background: There has been varying and divergent methods in the treatment of paediatric and adult wrist fractures. Current opinion and evidence suggest that in paediatric torus distal radius fractures, management with splinting is as comparable a method of treatment to the traditional plaster or Paris (POP) casting. This is a retrospective look at the safety of using the EXOS® thermoplastic (TP) splint to treat wrist fractures

Methods: A retrospective review of 62 consecutive patients presenting to the Silverdale Medical Centre, Auckland, New Zealand with wrist fractures who were treated in the EXOS® TP splint. Outcomes included safety of use, complications of further fractures and patient satisfaction were measured

Results: A total of 37 female and 25 male patients were treated. Age of patient were from 2.8 years to 72.8 years (mean 13.5 years, median 10 years old). Types of injuries treated with torus fractures (n=28), undisplaced distal radius fracture (n=12), clinical SH 1 (n=11), confirmed scaphoid fracture (=5), clinical scaphoid fracture (n=3), distal ulnar fracture (n=2) and SH2 fracture of distal radius (n=1). Average treatment time in splint was 35 days and average follow up visits was 2. All patients were totally satisfied with the splint treatment

Conclusion: EXOS® is a treatment option that is suitable for paediatric wrist fractures and selected adult distal radius fractures

1) Distal radius: # management

(The Royal Children's Hospital Melbourne Paediatric Fracture Guidelines)

- **Children:**

Metaphyseal #

Non-displaced Salter Harris I & II #

Below elbow **back-slab or removeable splint**

Review - 5/7 post immobilization with X-ray

- 4/52 remove back-slab or splint & re-X-ray

discharge if X-ray satisfactory & clinical exam normal with 2 – 3/12 before return to contact sports

2) Scaphoid

2) Scaphoid

- **Radial artery**
  - 80% retrograde from **dorsal carpal branch**
  - 20% from **superficial palmar arch**
  - 15% single blood vessel supply ↑ risk avascular necrosis

2) Scaphoid

- 3 provocative tests within 24 hours - 87-100% sensitivity/ 74% specificity if all 3 positive

1) **Anatomical snuffbox tenderness**

- 90% sensitive, 40% specific

2) **Scaphoid tubercle tenderness**

- 87% sensitive, 57% specific

3) **Scaphoid axial compression test**

- reproduce pain by thumb pressure on scaphoid tubercle & index finger pressure on proximal pole of the scaphoid

2) Scaphoid

CT	- sensitivity 89-90%, specificity 85-100%
MRI	- sensitivity 97.7%, specificity 99.8%
Bone scan	- most sensitive 3 – 4/ 7 post injury but usually reserved for ongoing pain despite normal serial plain films

Patients with a clinically suspected # have a true #: < 20%

Xray misses 15 – 20% of scaphoid #

2) Scaphoid: suspected

(Brisbane South Community Health Pathways 2026)

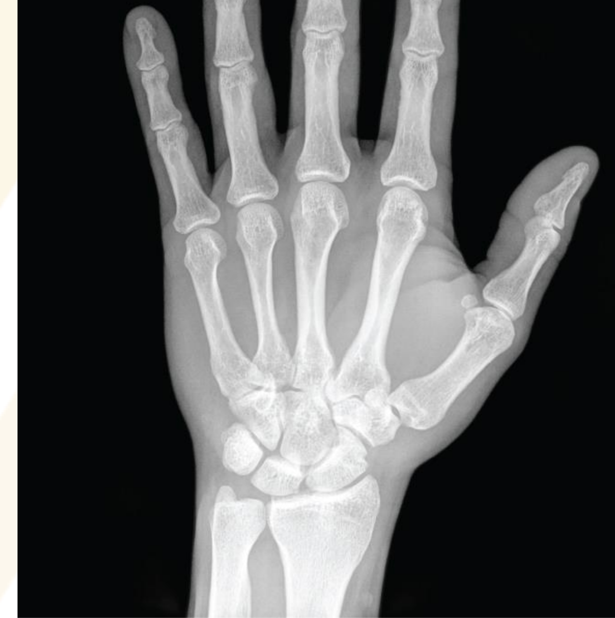
Scaphoid tenderness # but normal X-ray:

- Presumptive cast
- **10 – 14/7** repeat X-ray (91% sensitive)
  - No tenderness or # on scaphoid view – treat as soft tissue injury
  - Ongoing tenderness & normal X-ray – other modalities or reapply cast until 5/52
- **5/52** – ongoing tenderness – request MRI or refer for an ortho opinion

Other options include:

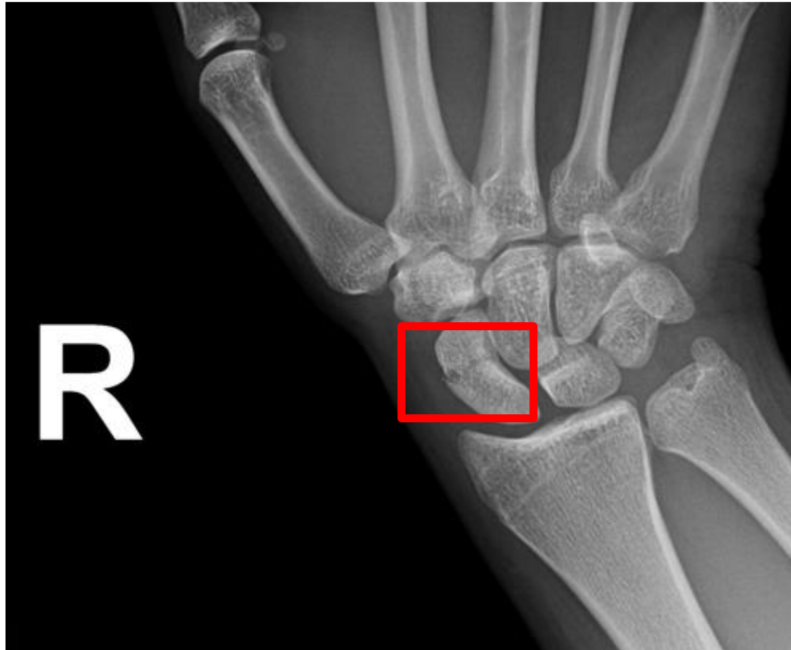
CT scan and if normal, splint and re-evaluate 2 weeks, if still tender MRI

MRI and if normal splint for comfort



By OpenStax - https://cnx.org/contents/FPtK1zmh@8.25:fEI3C8Ot@10/Preface, CC BY 4.0, https://commons.wikimedia.org/w/index.php?curid=30131133

2) Scaphoid



20 y.o. male falls after being hit by a car & falls on his outstretched hand

Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 215363

2) Scaphoid #: non-displaced waist (Brisbane South Community Health Pathways 2026)

Nondisplaced waist # – scaphoid back slab

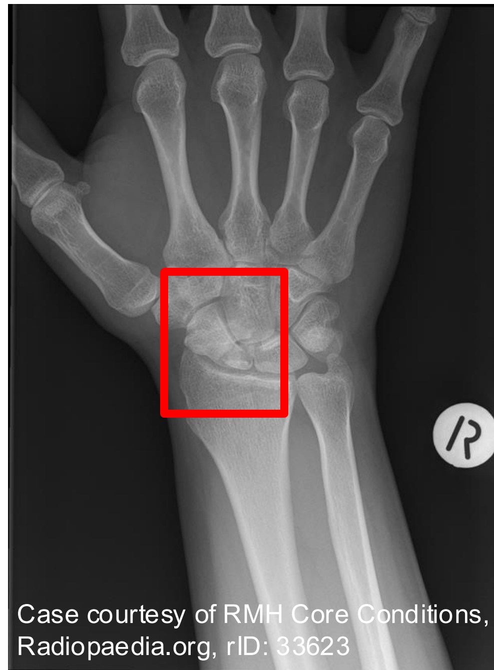
- Scaphoid back slab 10/7
- Full fibreglass scaphoid cast 6/52
  - If pain-free and # united on X-ray, mobilisation with hand therapist & avoid full weightbearing for 3/12
  - If symptomatic or X-ray shows non union – seek orthopaedic advice

Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 21

2) Scaphoid: proximal pole # (Brisbane South Community Health Pathways 2026)

Proximal pole #

- refer acutely for surgical opinion for consideration for ORIF
- If orthopaedic assessment delayed or conservative treatment chosen, long arm cast including thumb proximal phalanx with healing time up to 12 – 23/52

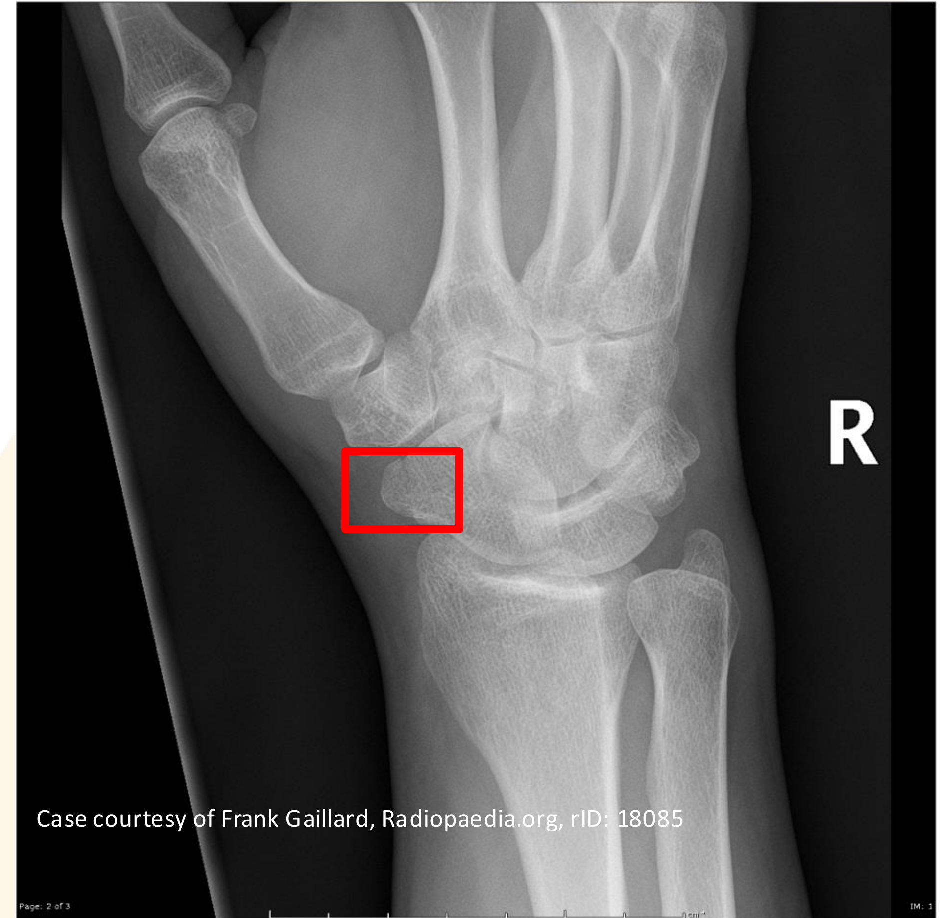


Case courtesy of RMH Core Conditions, Radiopaedia.org, rID: 33623

2) Scaphoid # - non-displaced waist (Brisbane South Community Health Pathways 2026)

Un-displaced distal pole (scaphoid tubercle) #

- Below elbow short arm cast (without thumb immobilisation)
- Remove cast at 6/52 & re-Xray
- If still symptomatic, reapply cast and refer to orthopaedic service



Case courtesy of Frank Gaillard, Radiopaedia.org, rID: 18085

2) Scaphoid #: not clinically healed in suggested periods

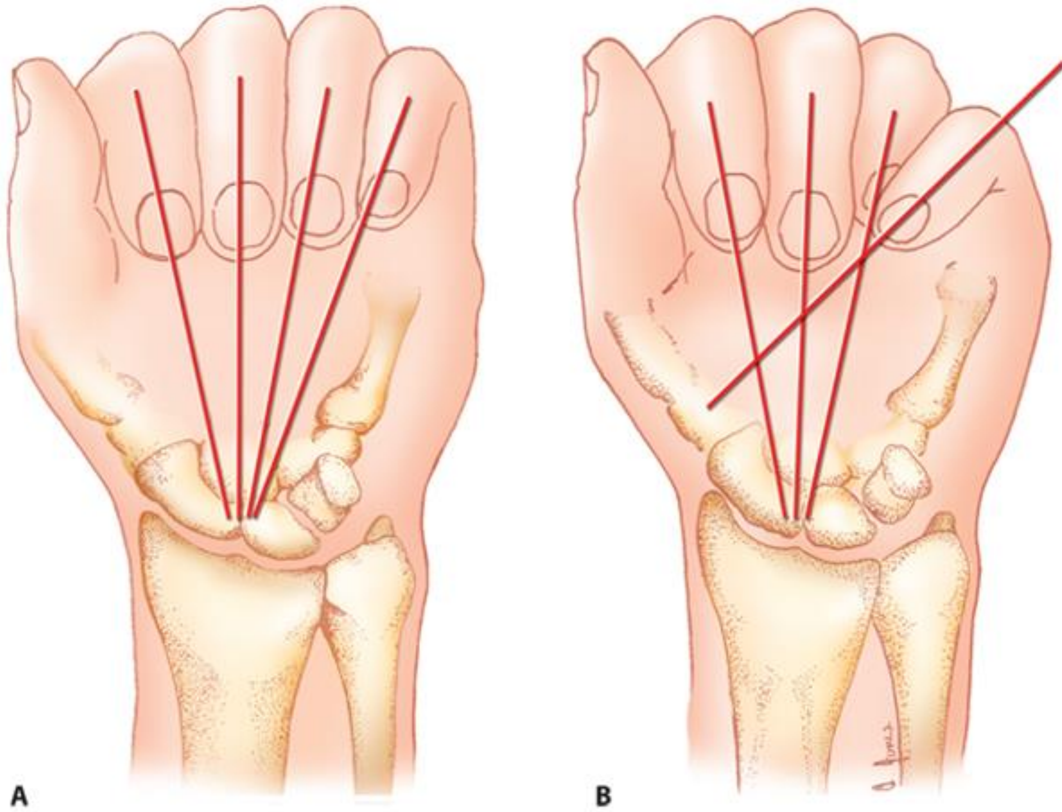
Extra immobilisation in 4/52 periods until union – mostly by 10 – 12/52

For manual workers returning to work some require:

- CT showing > 50% of the trabeculae bridging across the fracture site
- Normal examination clinically
- Grip strength of 20 – 40% of the contralateral side strength

3) Metacarpal fractures

3) Metacarpal: examination



Normal alignment of fingers vs rotational malalignment

Metacarpal #: acceptable non-operative criteria

Digit	Head articular step (mm)	Neck angulation	Shaft angulation	Shaft shortening (mm)	Base articular step (mm)
Thumb	< 1		30 °if bony apposition > 75%		< 2
2nd & 3rd fingers	< 1	10-15°	10°	6	
4th finger	< 1	30°	20-30°	6 4th MC head shortened proximal to 5th as more cosmetically disfiguring	
5th finger	< 1	50-70°	20 - 30°	6	

Source: Poolman, Goslings et al. 2005, Kollitz, Hammert et al. 2014, Bloom and Hammert 2014, White, Mackenzie et al. 2016, Richards, Clement et al. 2018, Carreño, Ansari et al. 2020, Lambi, Rowland et al. 2023, Brisbane South Community HealthPathways, 2026).

3) Metacarpal #: General immobilization principles if acceptable position

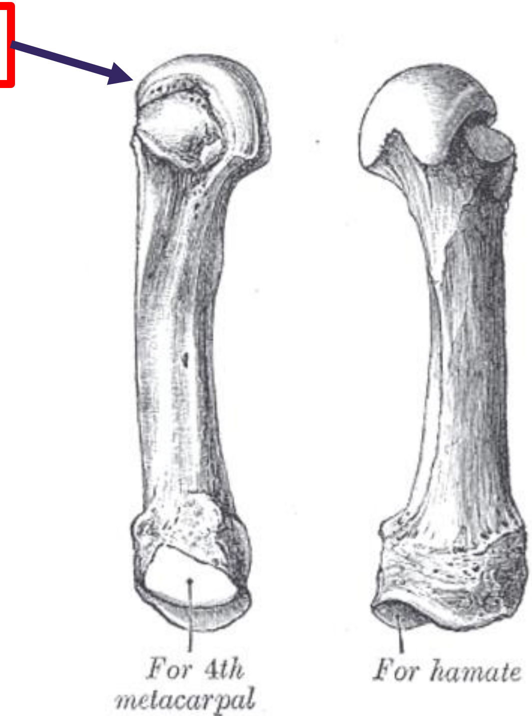
(Brisbane South Community HealthPathways 2026)

- Buddy strap but if very painful use volar slab 1 – 2/ 52
- Consider referral to had therapy for review, splinting & mobilisation

3) Metacarpal #: Conservative management

(Brisbane South Community HealthPathways 2026)

Head
Immobilise as per general immobilisation principles
Review 1/52 with Xray
Refer hand therapist if position acceptable

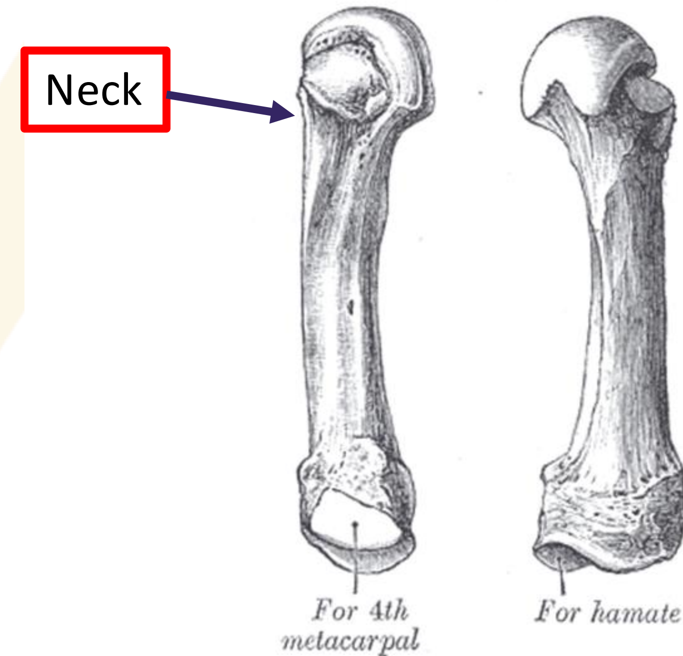


Case courtesy of Craig Hacking, Radiopaedia.org, rID: 83291

3) Metacarpal #: Conservative management

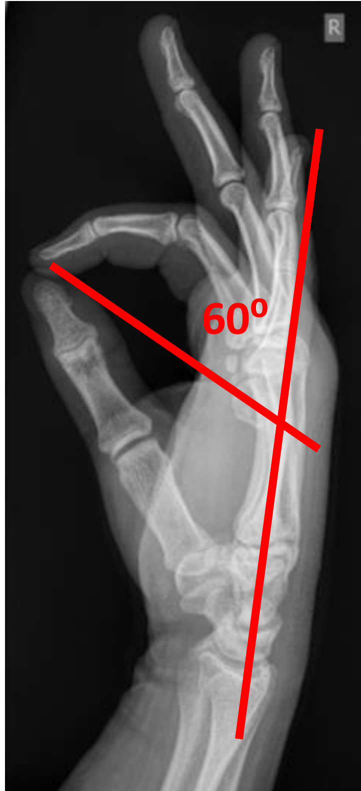
(Brisbane South Community HealthPathways 2026)

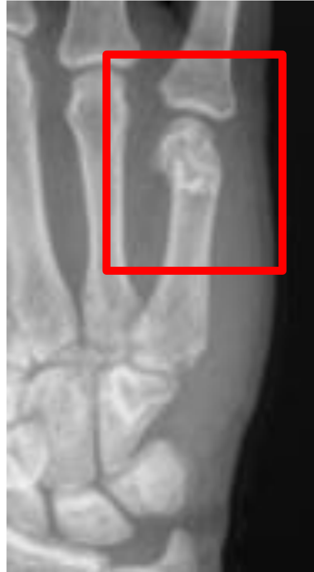
Neck 2 – 4th MC	Neck 5th MC – can extend to neutral	Neck 5th MC – can't extend to neutral
Immobilise as per General Immobilisation Principles	Immobilise as per General Immobilisation Principles If can extend to neutral and no rotational deformity buddy strap 2 – 3/52	Ulnar gutter slab & refer hand therapy
Review 1/52 with X-ray	Review 1/52 with X-ray	Review 1/52 with X-ray
Refer hand therapy if adequate position for custom splinting & rehabilitation	Refer hand therapy if adequate position for custom splinting and rehabilitation	Remove cast 4/52 & mobilise



Case courtesy of Craig Hacking, Radiopaedia.org, rID: 83291

3) Metacarpal fractures





25 y.o. male presents with a painful, swollen hand after punching a wall. Dorsal swelling noted with tenderness over the 5th & 5th metacarpal bones

Case courtesy of Jochemus Johannes Hamman, Radiopaedia.org, rID: 221860

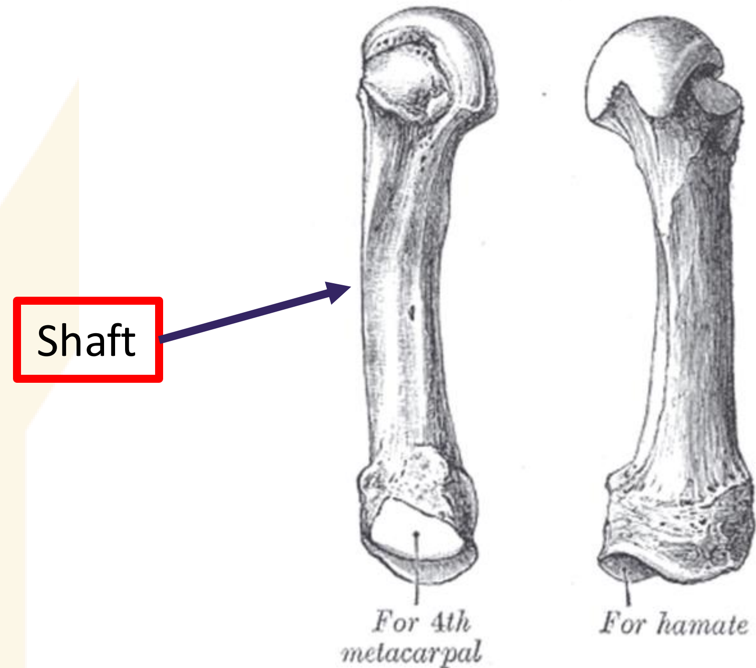
3) Metacarpal #: Conservative management

(Brisbane South Community HealthPathways 2026)

Shaft 2 – 4th MC	Shaft 5th MC
Immobilise as per General Immobilisation Principles	Ulnar gutter POP
Review 1/52 with X-ray	Review 1/52 with X-ray
Remove cast 4/52 & mobilise	Remove cast 4/52 & immobilise

Exception: Transverse # 4th MC

- If 5th MC head more proximal than 5th MC head request acute assessment with ortho or plastics because of risk of disfigurement

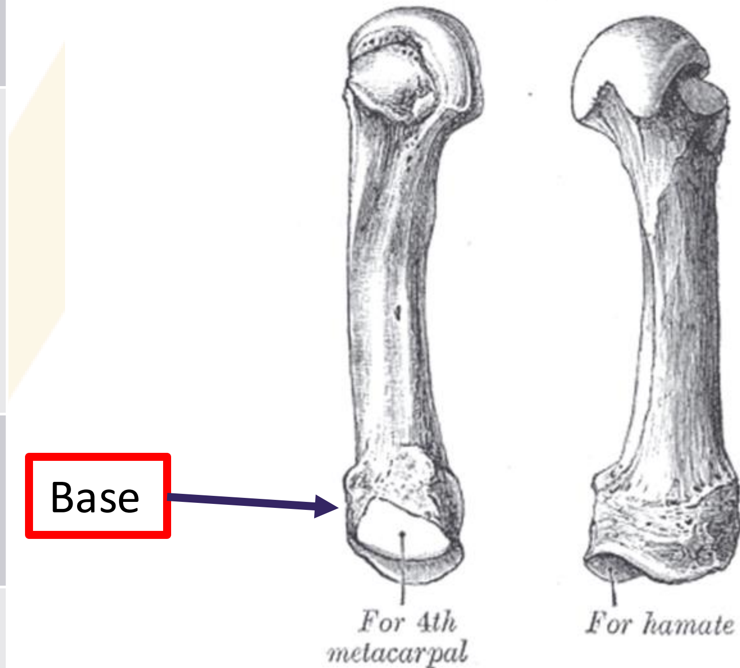


Case courtesy of Craig Hacking, Radiopaedia.org, rID: 83291

3) Metacarpal #: Conservative management

(Eiff et al, 2020; Brisbane South Community HealthPathways 2026)

Base – thumb (Bennett's)	Base – 2 – 4th MC	5th MC
Extra-articular < 30 ° angulation: Thumb spika	Ensure true lateral to check dorsal subluxation of MC or hamate fragment	Ensure true lateral to check dorsal subluxation of MC or hamate fragment
	If no -> volar slab or wrist splint leaving MCPJ free If yes -> volar slab & refer for acute orthopaedic opinion	If no -> volar slab & refer for orthopaedic opinion If yes -> volar slab & refer for acute orthopaedic opinion
Review 1/52 with repeat X-ray	Review 1/52 with X-ray	
Remove cast 4/52 & mobilise	Remove cast 4/52 & mobilise	



Case courtesy of Craig Hacking, Radiopaedia.org, rID: 83291

3) Metacarpal #: Conservative management

(Radiopaedia 2024, Brisbane South Community HealthPathways 2026)

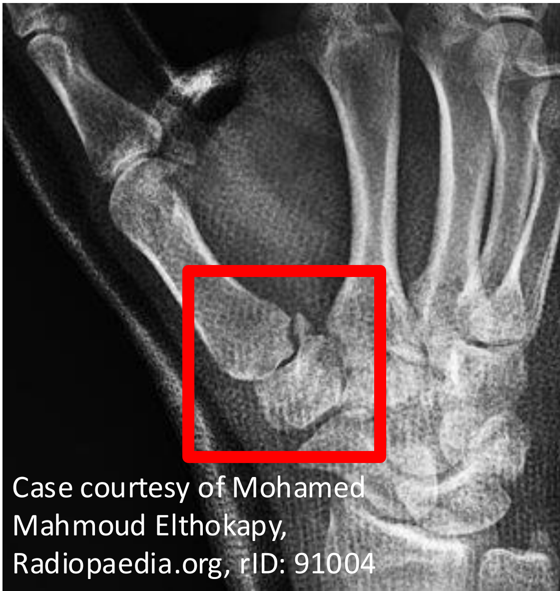
- **Non-acceptable angulation**

- **Head**
  - Uncommon but disabling complications
  - No articular displacement acceptable
  - Most require surgery so splint and refer

- **Base 5th MC** - acute if joint space reduced between hamate & 4th & 5th base & ? subluxation
  - otherwise, volar slab and refer

- **Base of thumb**
  - Bennet # - acute referral
  - Rolando # - acute referral

3) Metacarpal #: refer – Bennett's



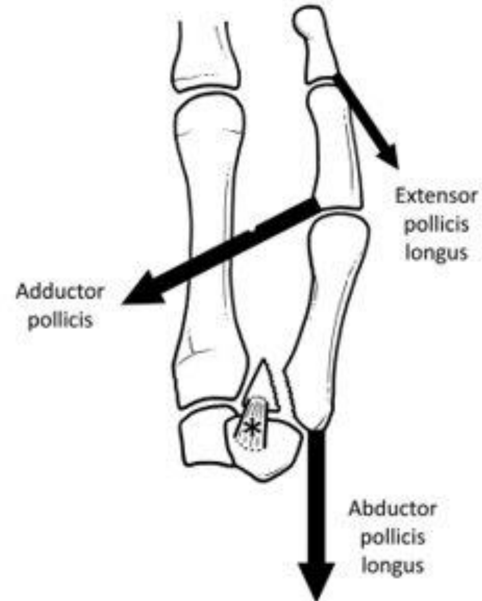
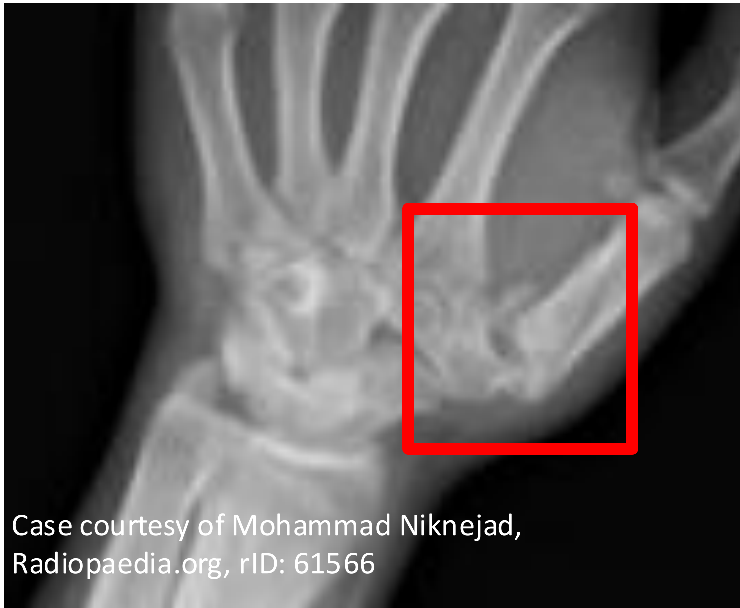


Fig. 2. Deforming forces acting on the thumb metacarpal (Bennett fracture shown) with the intact volar oblique (beak) ligament (asterisk) shown attached to the volar beak fragment. In Rolando fractures, the ligament also remains intact, connecting the trapezium to the volar basal fragment.

- Partial avulsion # of the MC base
- Avulsion fragment stays in anatomical position attached to the trapezium
- Remaining MC & thumb displaced proximally by APL and into adduction/ supination by AddP

3) Metacarpal #: refer – Rolando


Case courtesy of Mohammad Niknejad, Radiopaedia.org, rID: 61566

Comminuted 3-part Bennett # base of thumb

- Male to female 10:1
- Usually 20 – 40 y.o. from fist fight
- Usually unstable & require surgery

4) Finger fractures

4) Finger: examination (Sherman, 2019)

- Angular & rotational deformity

- Nail bed injuries

- Neurological status
  - 2-point discrimination most sensitive indicator of deficit
  - Start 1 cm & decrease until 2 points not felt
    - Normal 2 – 5 mm fingertips & 7 – 10 mm dorsum of hand

- Motor & sensory function

Motor function movement	Nerve	Sensory area
Rock	Medial n	2 & 3rd fingers
Paper	Radial n	Dorsum of thumb webspace
Scissors	Ulnar n	5th finger
OK	Anterior interosseous n	Nil, motor only

- Vascular status – especially lacerations – Allen test

4) Finger: Proximal phalanx # - intra-articular (Sherman 2018)

I) Intra-articular head/ base

A) Head

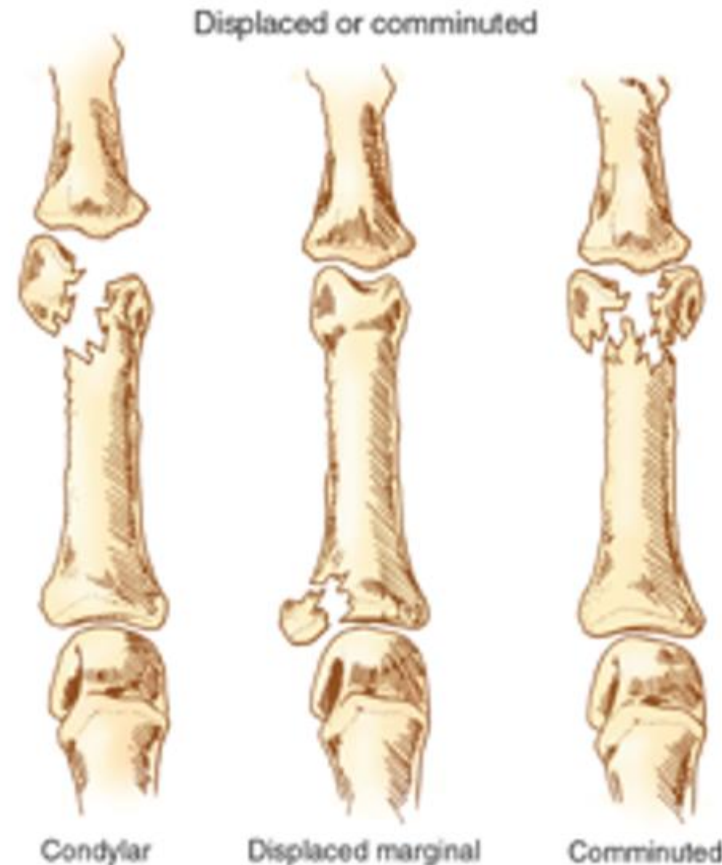
Type I – stable no displacement

Type II – unstable uni-condylar

Type III – unstable bicondylar or com

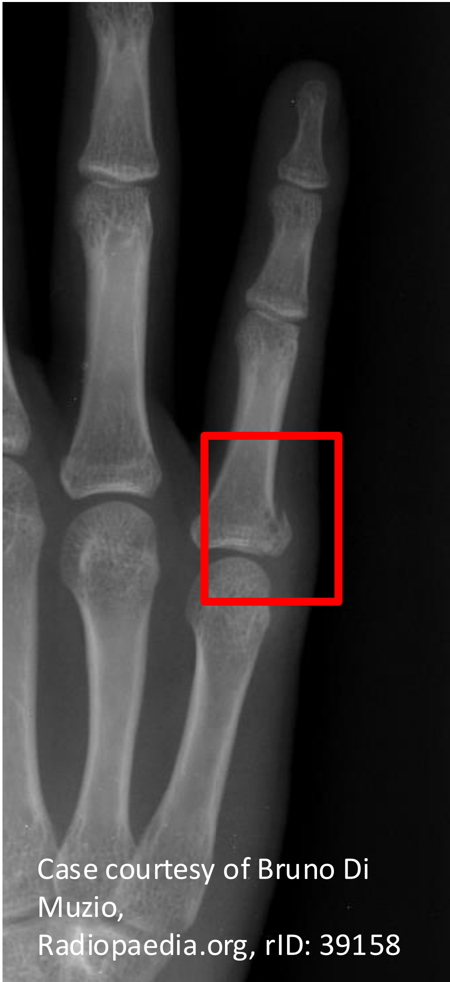
B) Base – Lateral

II) Extra-articular neck/shaft



- **Non-displaced fractures involving < 20% joint surface**
  - Buddy strap 3 – 4/ 52
- **Displaced, comminuted, or non-displaced involving > 20% joint surface**
  - Refer as often require surgery

4) Finger: Proximal phalanx intra-articular # displaced < 20 % joint space



Case courtesy of Bruno Di Muzio, Radiopaedia.org, rID: 39158

Conservative management with buddy strap 3 – 4/52

Source: Scott C. Sherman
Simon's Emergency Orthopedics, Eighth Edition
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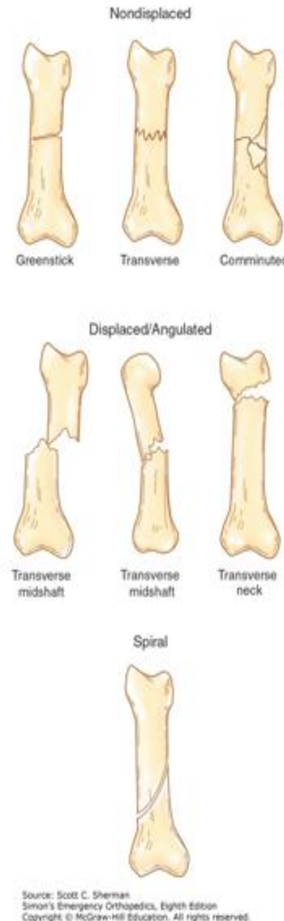
4) Finger: Proximal phalanx # - Extra-articular

(Sherman 2018, Brisbane South Health Pathways 2026)

I) Intra-articular head/ base

II) Extra-articular - neck/ shaft

- **Short oblique (30 - 60⁰ angle)**
- **Long oblique (< 30⁰ angle)**
- **Spiral**
- **Transverse**



- Extra articular # with:
  - < 10 ⁰ angulation
  - < 2 mm shortening
  - least 50% (+) bony contact without rotational deformity

- Immobilise:
  - Undisplaced – buddy strap or Zimmer splint up to 4/52
  - Mildly displaced – Lat X-ray – Zimmer splint up to 4/52
  - Mildly displaced – AP X-ray – buddy strap +/- Zimmer splint
  - Re-X-ray 1/52

4) Finger: Proximal phalanx # - Extra-articular

(Sherman 2018, Brisbane South Health Pathways 2026)

Zimmer splint:

Source: Horton, 2014

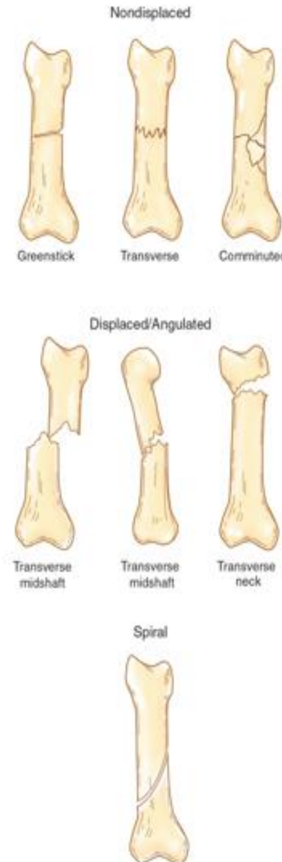
4) Finger: **Proximal phalanx #** - Extra-articular – refer after volar slab:

(Sherman 2018; Brisbane South Health Pathways 2026)

I) Intra-articular head/ base

II) Extra-articular - neck/ shaft

- **Short oblique (30 - 60^0 angle)**
- **Long oblique (< 30^0 angle)**
- **Spiral**
- **Transverse**



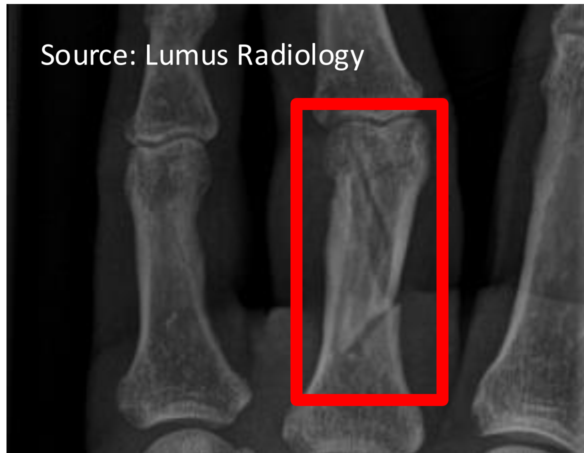
- Rotated spiral & some oblique
- Comminuted
- Severely displaced # with:
  - > 10^0 angulation
  - > 2 mm shortening
  - < 50% bony contact
  - Rotational deformity
- Multiple #
- Neck

Tendency to underestimate disability with these #

No tendon attachment but angulate in volar direction from traction from IO m & extensor tendons

4) Finger: **Proximal phalanx #** - Extra-articular – refer after volar slab:

(Sherman 2018)



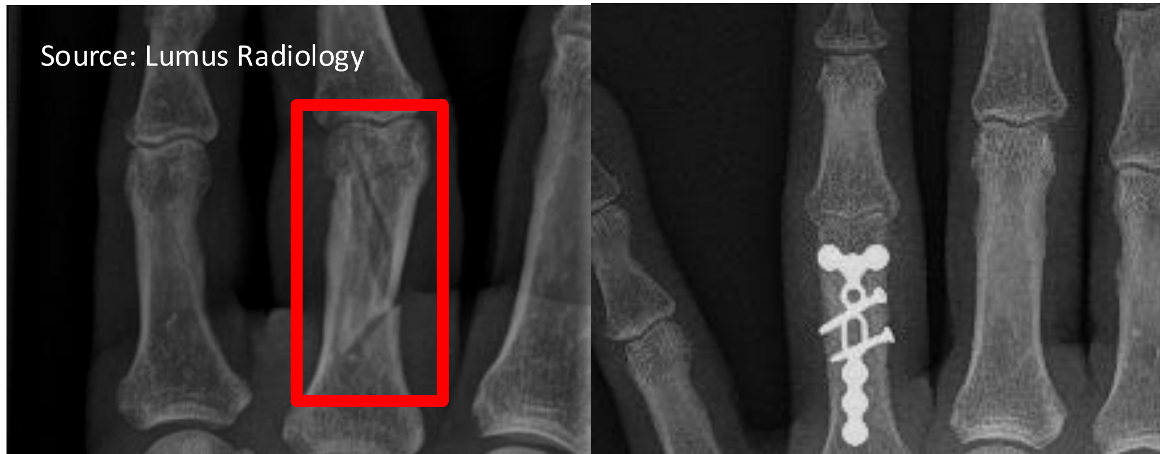
Comminuted intra-articular # proximal phalanx L ring finger extending to PIPJ with mild angulation

- Refer as comminuted

4) Finger: **Proximal phalanx #** - Extra-articular – refer after volar slab:

(Sherman 2018)

- 2nd X-ray after fixation plate & screws



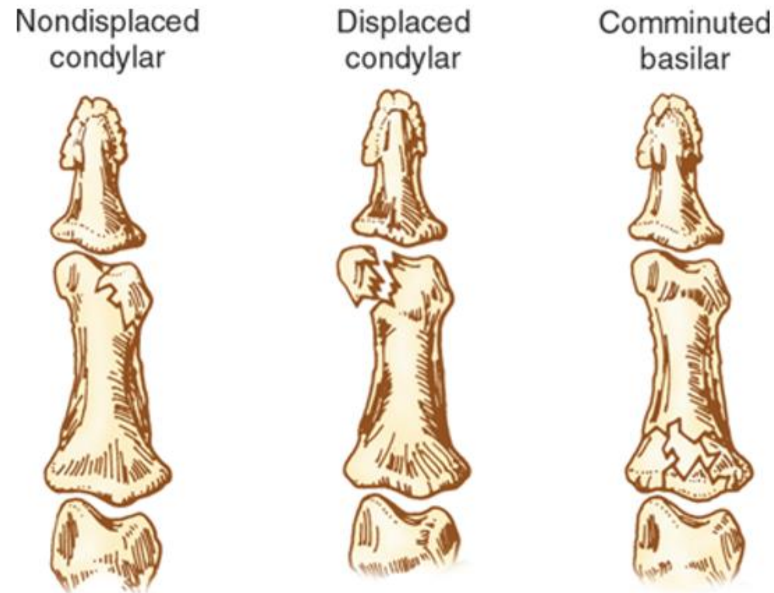
4) Finger: **Middle phalanx #** - Intra-articular: (Sherman 2018)

I) Intra-articular head & base

- **Type I – stable no displacement**
- **Type II – unstable uni-condylar**
- **Type III – unstable bicondylar or comminuted**

II) Extra-articular neck/ shaft

III) Avulsion



Source: Scott C. Sherman
Simon's Emergency Orthopedics, Eighth Edition
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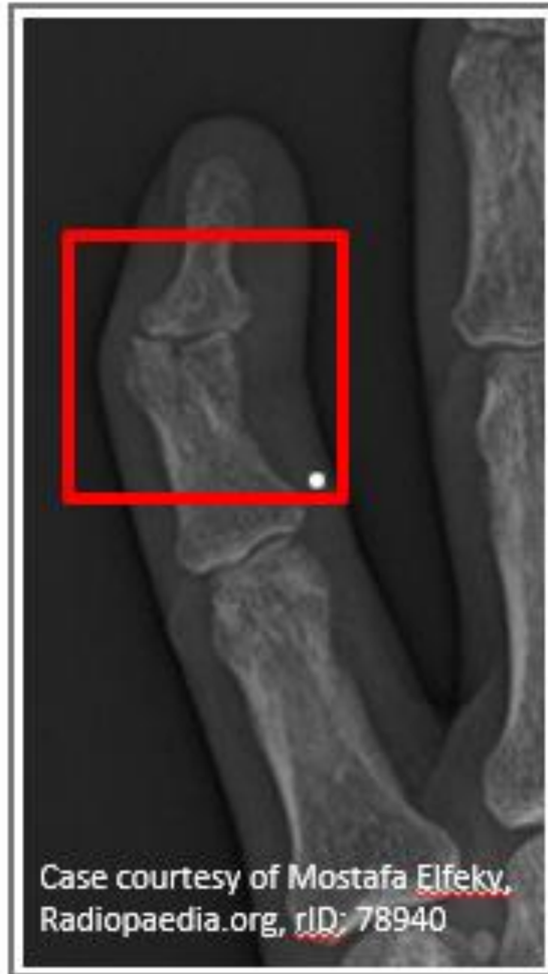
- **Non-displaced condylar**
  - Dynamic splinting with buddy strap & early motion exercises
- **Displaced condylar (>20% of joint surface)**
  - Plaster immobilisation & refer
- **Comminuted fracture**
  - Plaster immobilisation & refer

4) Finger: **Middle phalanx #** - Intra-articular: (Sherman 2018)



Type II unstable unicondylar #

- Un-displaced intra-articular # middle phalanx 5th finger
- Refer for an orthopaedic opinion as involves > 20% joint space

4) Finger: **Middle phalanx #** - Extra-articular:

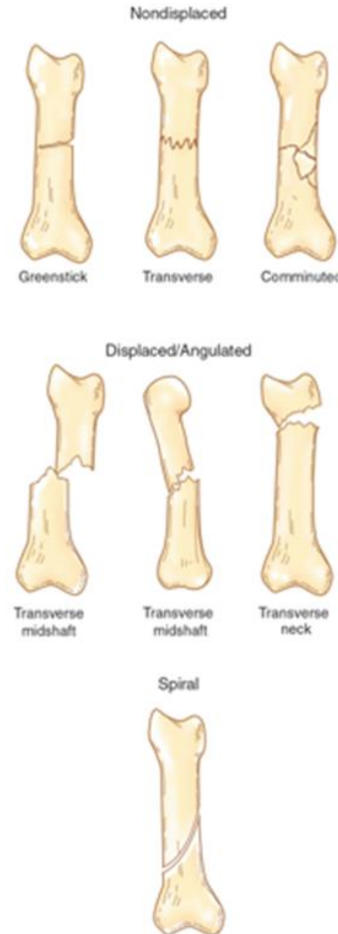
(Sherman 2018: Brisbane South Health Pathways 2026)

I) Intra-articular head & base

II) Extra-articular neck/ shaft

- **Short oblique (30 - 60⁰ angle)**
- **Long oblique (< 30 ⁰ angle)**
- **Spiral (from twisting/ torsion**
- **Transverse (horizontal)**

III) Avulsion



Conservative

- Extra articular # with:
  - < 10 ⁰ angulation
  - < 2 mm shortening
  - > 50% bony contact without rotational deformity
- Immobilise:
  - Undisplaced – buddy strap or Zimmer splint up to 4/52
  - Mildly displaced – Lateral X-ray – Zimmer splint up to 4/52
  - Mildly displaced – AP X-ray – buddy strap +/- Zimmer splint
  - Re-X-ray 1/52

4) Finger: **Middle phalanx #** - Extra-articular:

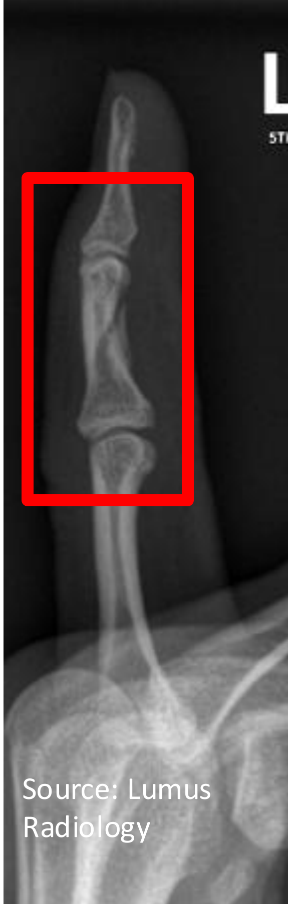
(Sherman 2018: Brisbane South Health Pathways 2026)

Zimmer splint:

Source: Brownmed USA Plastalume Zimmer Padded Aluminium Finger Strip Splints With White Foam

4) Finger: **Middle phalanx #** - Extra-articular:

(Sherman 2018)



Spiral # middle phalanx with minimal displacement

- Conservative management
  - < 10 ^{o} angulation
  - < 2 mm shortening
  - > 50% bony contact without rotational deformity

4) Finger: **Middle phalanx #** - Extra-articular – refer after volar slab:

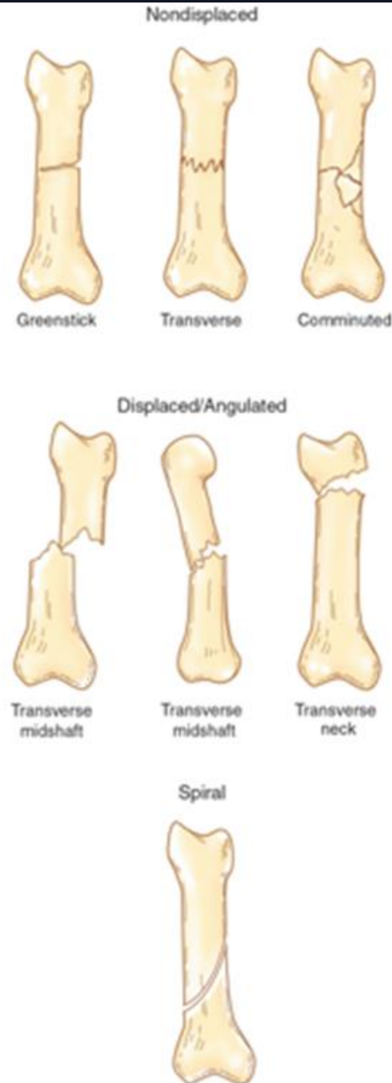
(Sherman 2018)

I) Intra-articular head and base

II) Extra-articular - neck/ shaft

- **Short oblique (30 - 60⁰ angle)**
- **Long oblique (< 30⁰ angle)**
- **Spiral**
- **Transverse**

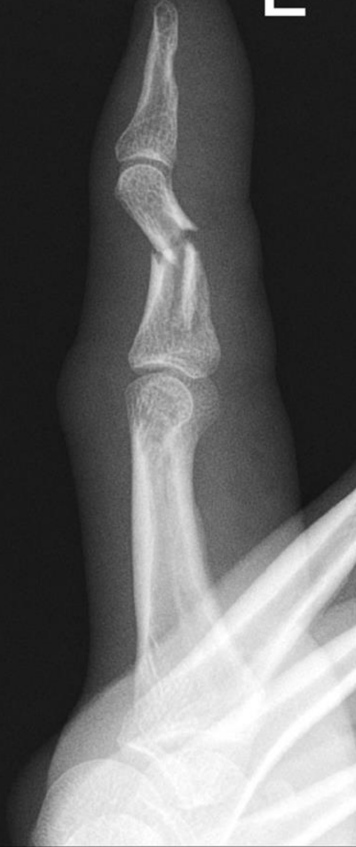
III) Avulsion



- Rotated spiral & some oblique
- Comminuted
- Severely displaced # with
  - > 10 ⁰ angulation
  - > 2 mm shortening
  - < 50% bony contact
  - rotational deformity
- Multiple #
- Neck

4) Finger: **Middle phalanx #** - Extra-articular – refer after volar slab:

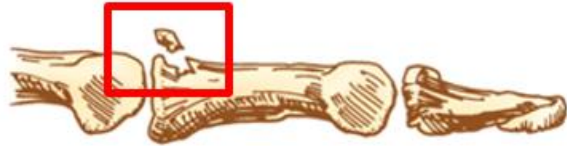
(Sherman 2018)



Comminuted angulated # middle phalanx L index finger

- Refer as transverse & angulated > 10 º

4) Finger: **Middle phalanx #** - Avulsion (Sherman 2018)


Avulsion fracture extensor surface

Source: Scott C. Sherman
Simon's Emergency Orthopedics, Eighth Edition
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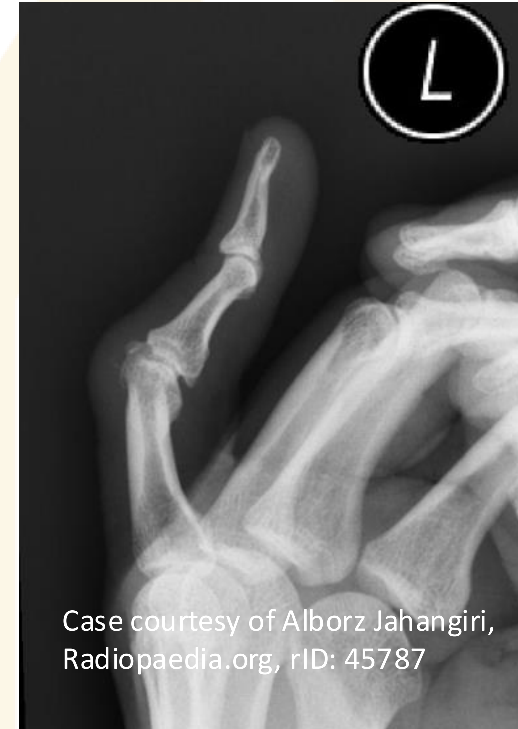
- **Dorsal base**
  - Avulsion of the **central slip of the extensor tendon**
  - Urgent referral for internal fixation – risk Boutonniere deformity



Case courtesy of Alborz Jahangiri, Radiopaedia.org, rID: 45787

4) Finger: **Middle phalanx #** - Avulsion (Sherman 2018)

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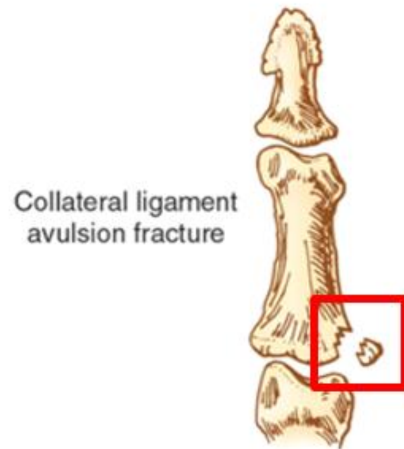
- **Dorsal base**

- **Volar base (Wilson fracture)**
  - From avulsion of the volar plate
  - If > 30% joint surface involved - unstable
  - If < 30% of joint surface involved & no subluxation:
    - Daytime buddy strapping
    - Nighttime volar splinting of PIPJ & DIPJ at night
    - Return to sport 6/52

4) Finger: **Middle phalanx #** - Avulsion (Sherman 2018)

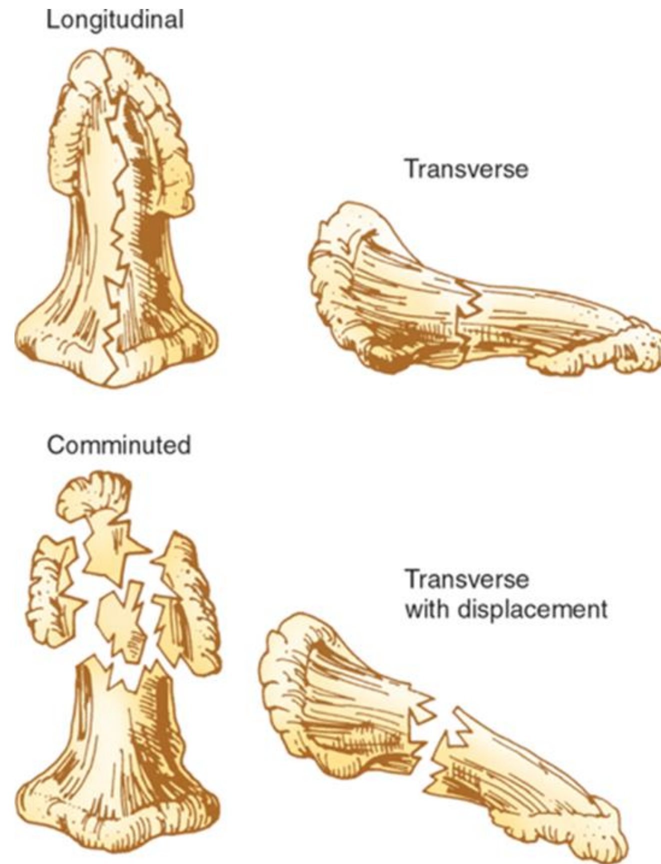


- **Dorsal base**
- **Volar base (Wilson fracture)**
- **Lateral base**
  - From avulsion of collateral ligaments
  - Most surgeons recommend early fixation

4) Finger: Distal **phalanx #** - Extra-articular (Sherman 2018, Brisbane South Community HealthPathways 2026)

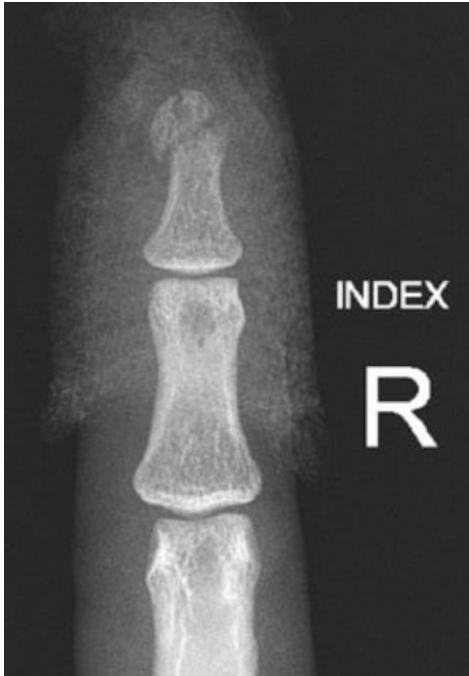
I) **Extra-articular**

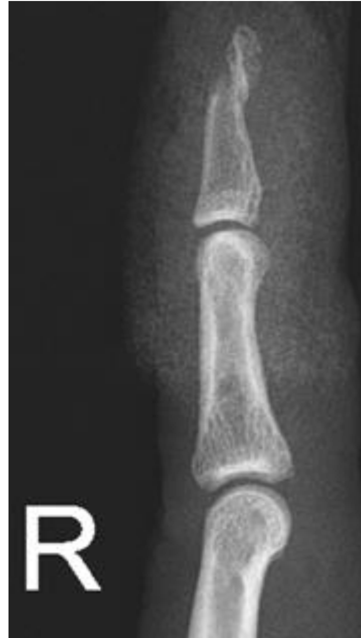
II) Intra-articular – dorsal



- **Non-displaced**
  - Rx Mallet splint 3 – 4 weeks
  - Comminuted – may remain painful for months
- **Displaced transverse fractures**
  - Require reduction +/- K wire
  - If unable to reduce urgent referral as nail bed may be caught in #

4) Finger fractures





35 y.o. male accidently hit R 4th finger with hammer today at work. On examination: wound & tenderness on the right index finger distal phalanx

Case courtesy of Mohammad Osama Hussein Yonso, Radiopaedia.org, rID: 92332

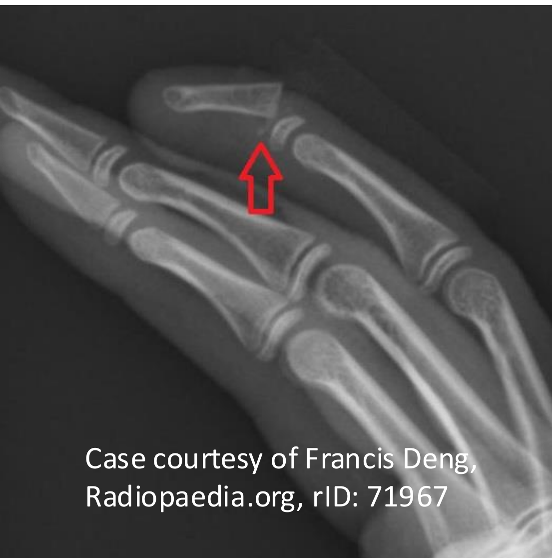
4) Finger: Distal **phalanx #** - Extra-articular (Sherman 2018)

I) **Extra-articular - Seymour**

II) Intra-articular – dorsal

Extra-articular transverse SH I or II # base of distal finger

- Mallet Deformity with terminal extensor tendon attaching proximal epiphyseal fragment & FDP attaching distal fragment
- Refer for an orthopaedic opinion
- Also occurs on toes



Case courtesy of Francis Deng, Radiopaedia.org, rID: 71967

4) Finger: Distal **phalanx #** - Extra-articular (Sherman 2018)

I) **Extra-articular - Seymour**

II) Intra-articular – dorsal

Case courtesy of Francis Deng, Radiopaedia.org, rID: 71967

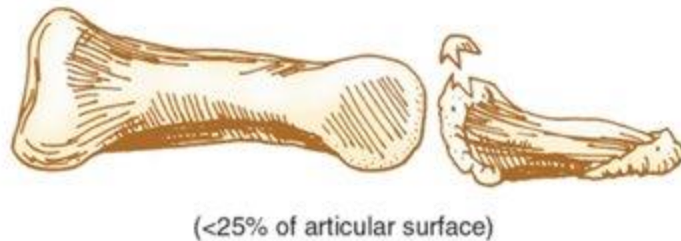
Extra-articular transverse SH I or II # base of distal finger

- Mallet Deformity with terminal extensor tendon attaching proximal epiphyseal fragment & FDP attaching distal fragment
- Refer for an orthopaedic opinion
- Also occurs on toes

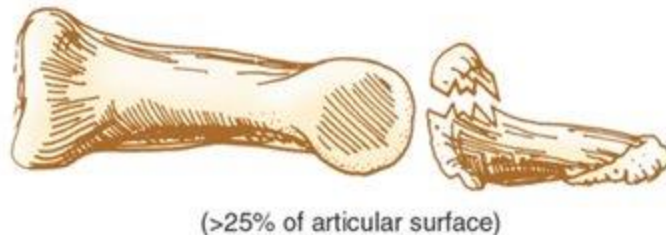
4) Finger: Distal **phalanx #** - Intra-articular – avulsion (Sherman 2018)

I) Extra-articular

II) Intra-articular – dorsal



(<25% of articular surface)



(>25% of articular surface)

Source: Scott C. Sherman
Simon's Emergency Orthopedics, Eighth Edition
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- **Non-displaced**
  - Mallet splint 6 – 8/52 without flexion otherwise risk chronic flexion deformity.
  - Remove splint during daytime & caution against finger flexion for 4 more weeks

- **Displaced & > 25% of articular surface**
  - Mallet splint & refer for an opinion

4) Finger: Distal **phalanx #** - Intra-articular – avulsion (Sherman 2018)

Displaced intra-articular avulsion # dorsal 4th distal phalangeal base at the insertion of the common extensor tendon

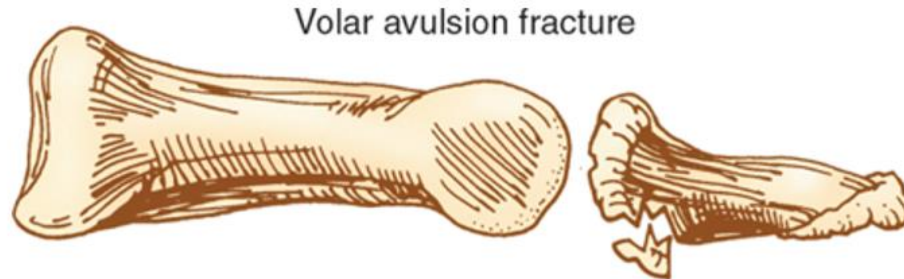
- Refer for an orthopaedic opinion as displaced

4) Finger: Distal **phalanx #** - Intra-articular – avulsion (Sherman 2018)

I) Extra-articular
II) Intra-articular – dorsal

III) Intra-articular - volar

- **Intra-articular distal avulsion fracture – volar surface**
  - Refer for early surgical fixation



Source: Scott C. Sherman
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4) Finger: Distal **phalanx #** - Intra-articular – avulsion (Sherman 2018)

Commuted # L ring finger distal phalanx with large # fragment displaced 11 mm proximally and rotated 90 ^{o}
distally in palmar direction & 1.5 mm dorsal displacement of distal phalanx

- Referral to the orthopaedic service for management

Summary:

- Community # clinic models
- 23% of our local hospital's # were managed by our UCC # clinic
- Common upper limb # managed discussed today:
  1) Distal radius
  2) Scaphoid
  3) Metacarpal
  4) Finger

Great opportunity for US UCCs to serve patients & help the healthcare system

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