

# AMPLIFY

## Basic lower limb fracture management in family medicine & UCCs

Prof John Adie





## John Adie

PhD, FRACGP, FACRRM, FRNZCUC  
Professor in Urgent Care School of Health  
University of the Sunshine Coast

Email: [jadie@usc.edu.au](mailto:jadie@usc.edu.au)

Linkedin: <https://www.linkedin.com/in/john-adie-16080618/>

# Financial Disclosure & Caveat

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- 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

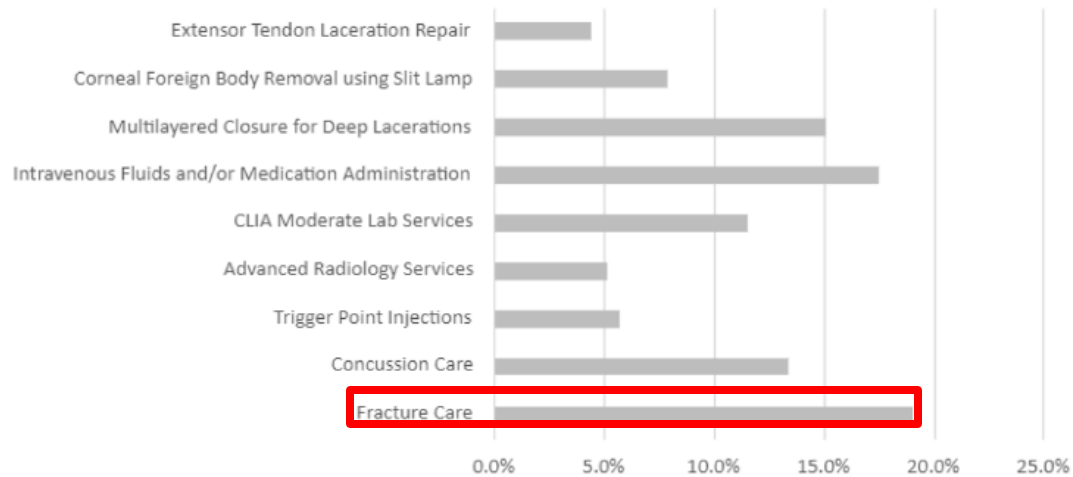
# UCA Benchmarking Report Operations 2022

## 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.

#### HIGH ACUITY SERVICES OFFERED



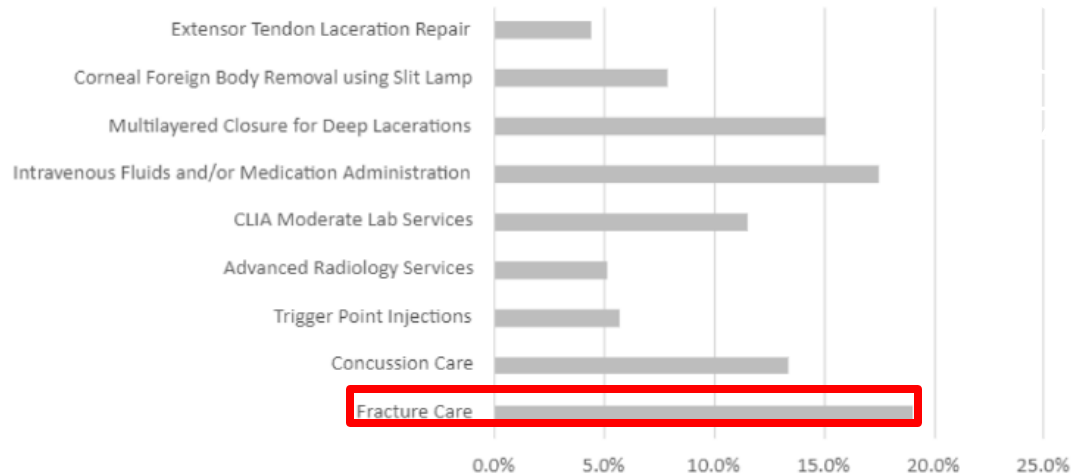
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(Adie et al., in press)

USA	2%
Australia	15%
NZ	100%

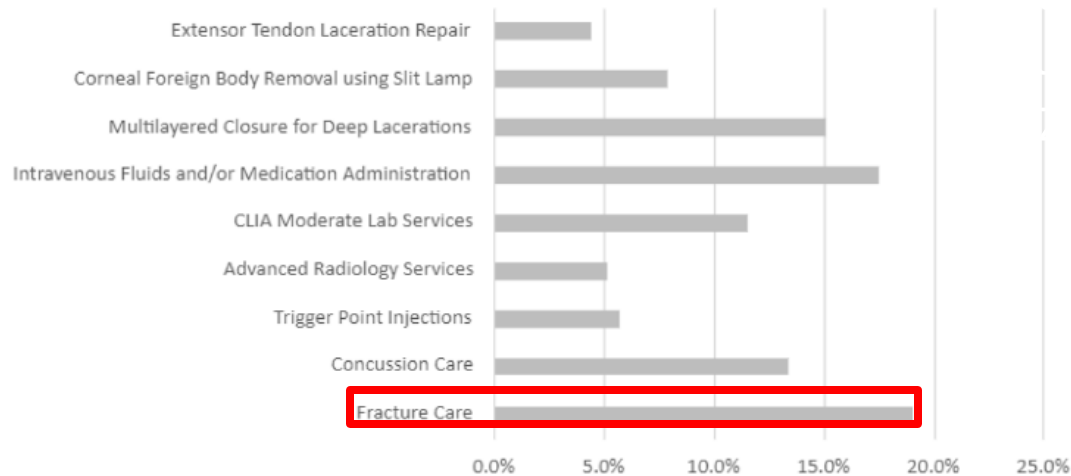
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Clinical Excellence Division

Queensland Health

### 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

# 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

- Reduce demand on specialist services by redirection of non-specialist cases.
- Improve access for patients requiring non-specialist services with increased conversion to surgery rate at specialist fracture clinics
- 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.

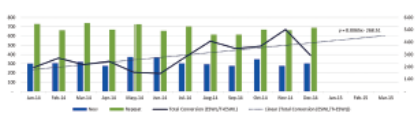
## Lessons learnt

- 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.

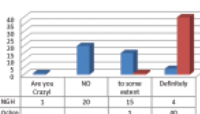
## Message for others

- 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.

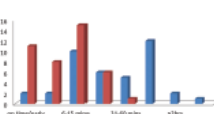
Conversion to theatre (ESWL)



Convenience of parking



Appointment times on schedule



- 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
- Appointment times on schedule much better than hospital
- A list of 'in scope' fracture for family medicine developed

## Optimising fracture care: A comparative analysis of primary care-based models

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

1. A/Prof, PhD, FRACGP, FRNZCOG, FAGRRM, School of Health, University of the Sunshine Coast, Sippy Downs, Australia and presenting author
  2. Senior Research Fellow, University of Queensland Medical School, Herston, Queensland, Australia
  3. MBA, Q.D.I.R. Research and Special Projects Manager, Health Hub Doctors Morayfield, Australia
  4. FACEM, FRNZCOG, Urgent Care Clinic Director, Morayfield Accident and Illness Centre, Morayfield, Australia
  5. A/Prof, FRACGP, School of Health, University of the Sunshine Coast, Sippy Downs, Australia
  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\*. 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<sup>1</sup>. 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<sup>1</sup>. Consistent with Australian recommendations advocating collaborative models between primary care and specialist services<sup>2,3</sup>, 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<sup>4</sup>. 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<sup>5</sup>, while in the USA only a small minority of UCCs offer fracture clinics<sup>6</sup>, 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<sup>7</sup>.

## Primary objectives

1. Model and care pathway 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.

## References

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## Most frequently managed fractures in a Queensland PCFC Model 9

1. Distal radius +/- ulnar
2. Distal tibia +/- fibula
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 only 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 orthopaedic 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/LOP) 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@uco.edu.au

in A/Prof John Adie



Sunshine Coast Hospital and Health Service

Exceptional people. Exceptional healthcare.



AMPLIFY

# 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.<sup>1</sup> Because low-risk fractures rarely require orthopaedic intervention, some Western countries manage these cases within general practice.<sup>2</sup> Limited musculoskeletal education<sup>3</sup> 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'.<sup>4</sup> 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.<sup>4,5</sup>

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,<sup>6</sup> which also has an urgent care clinic (UCC).<sup>7</sup> This PCFC was subsidised by the HHS for consumables and managed 23% of the referrals to the hospital fracture clinic using upskilled GPs.<sup>8</sup> 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.<sup>9</sup> 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.<sup>8</sup> 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<sup>9</sup> (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.

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

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1. Proper
  2. Under
  3. Follow
  4. Deve
- Includes
  - Includes

### Box 1. Seven most frequently managed fractures in the Primary Care Fracture Clinic (non-operative)<sup>6</sup>

#### Item numbers:

Distal radius ± ulnar

Distal fibula ± tibia

Phalanges

Patella

Scaphoid (and other in carpus)

Clavicle

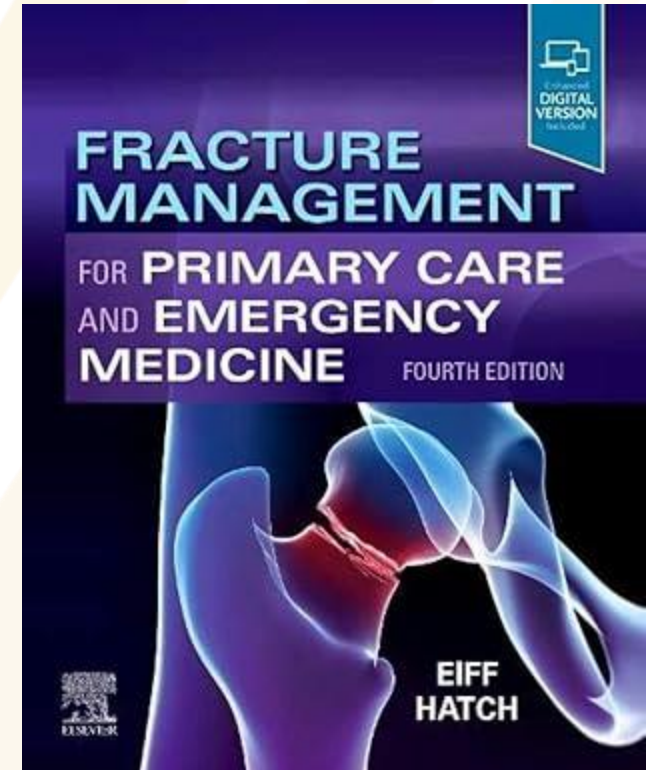
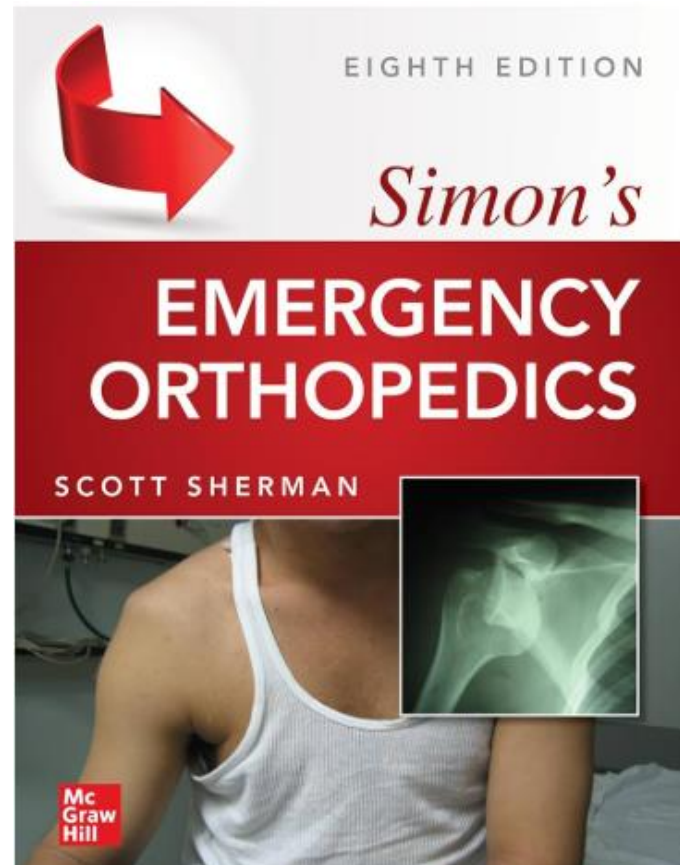
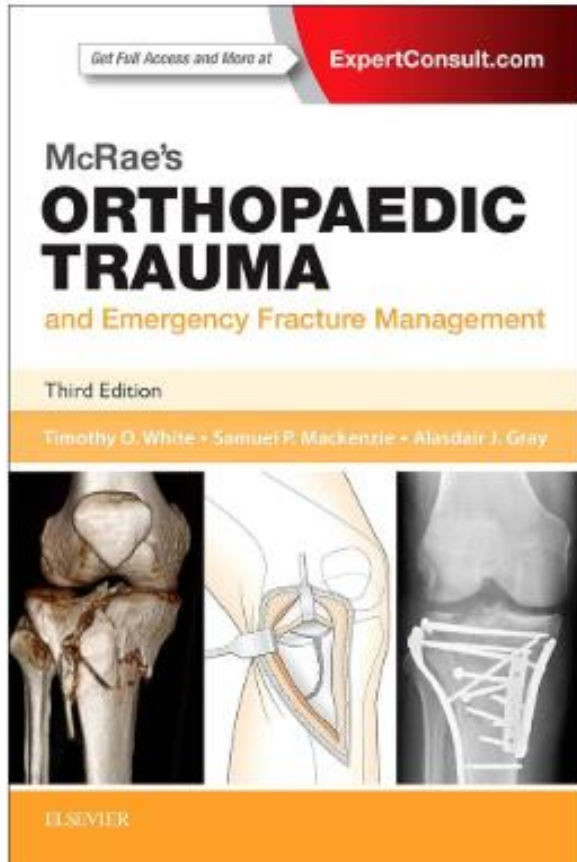
Humerus

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.


principles


te neuropathy,  
tenting.

# Resources



# Resources


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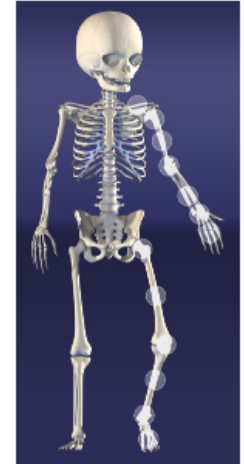
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The following Guidelines are for use in the **Emergency Department**.

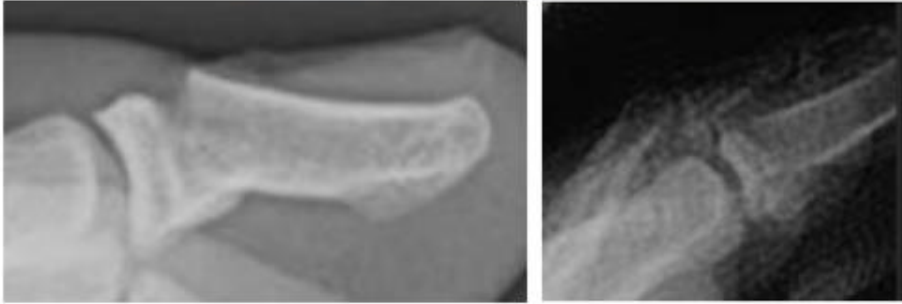
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\* Guideline not yet published.



# 1) Toe #



Suture Stabilisation of Open Physeal Fractures of the Great Toe Distal Phalanx (Seymour Fracture)  
Source: Reid et al., 2020

3 y.o. boy presents after tripping over a curb without shoes on. His first toe is slightly flexed and a subungual hematoma under the whole of his nail bed

## 2) Metatarsal #



Source: [Lumus Radiology](#)

25 y.o. male basketball player rolls his ankle after going up for a jump shot. He is tender over the base of the 5<sup>th</sup> metatarsal.

### 3) Calcaneal #



40 y.o. lady falls from a ladder when she is removing leaves from her gutter. Her feet are 2 m off the ground when she is on the ladder. She is unable to weight bear and has swelling and tenderness over her hindfoot.

## 4) Ankle #



Source: [Lumus Radiology](#)

30 y.o. soccer player twists his ankle when changing direction in a game. He has tenderness and swelling over both malleoli and is unable to weight bear.

---

# 1) Toe fractures

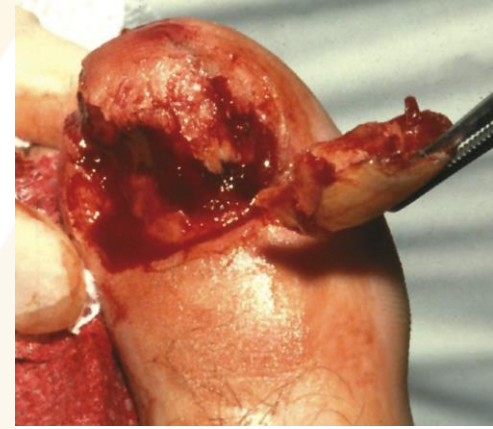
# 1) Toe #: subungual hematomas



- Trephine acute symptomatic subungual hematomas < 48 hours
- Previous recommendations for nail removal and nail bed exploration for hematomas > **50%** of nail or > **25%** of the nail in the presence of a #
- Studies show equal cosmetic outcome & similar complication rates for most cases (Pingel 2022) especially intact nail bed & nail margins

# 1) Toe # (Eiff and Hatch 2020)

Injuries to the nailbed  
Source: doomandbloom.net



1. Ring block, aggressive clean, debride nonviable tissue and irrigate
2. Wound closure so no bone exposed by suturing remaining skin & soft tissue  
Refer ED if needs bony rongeur
3. Antibiotic prophylaxis: oral cephalexin (5 days) +/- initial dose of IV cefazolin despite the effectiveness being unclear
4. Minimal follow-up checking for osteomyelitis:
  - 3 – 5/7
  - 10 – 14/7 for ROS
  - X-ray every 2/52 until healing ? osteomyelitis
5. Refer patients with diabetes, peripheral vascular disease & immunocompromise

# 1) Toe #: to refer

## All toes

- Urgent referral
  - Vascular compromise
  - Open # proximal phalanx
  - Skin compromise
  - Diabetes, immunocompromise, gross contamination



Source: Dermnetnz.org

# 1) Toe #: to refer

## All toes

- Urgent referral
  - Vascular compromise
  - Open # proximal phalanx
  - Skin compromise
  - Diabetes, immunocompromise, gross contamination
  
- **#/ dislocations**



Source: [Lumus Radiology](#)

# 1) Toe #: to refer

## All toes

- Urgent referral
  - Vascular compromise
  - Open # proximal phalanx
  - Skin compromise
  - Diabetes, immunocompromise, gross contamination
  
- **#/ dislocations**



Source: Lumus Radiology

# 1) Toe #: to refer

## All toes

- Urgent referral
  - Vascular compromise
  - Open # proximal phalanx
  - Skin compromise
  - Diabetes, immunocompromise, gross contamination
- #/ dislocations
  
- **Irreducible/ unstable/ unacceptable angulation/ displacement**

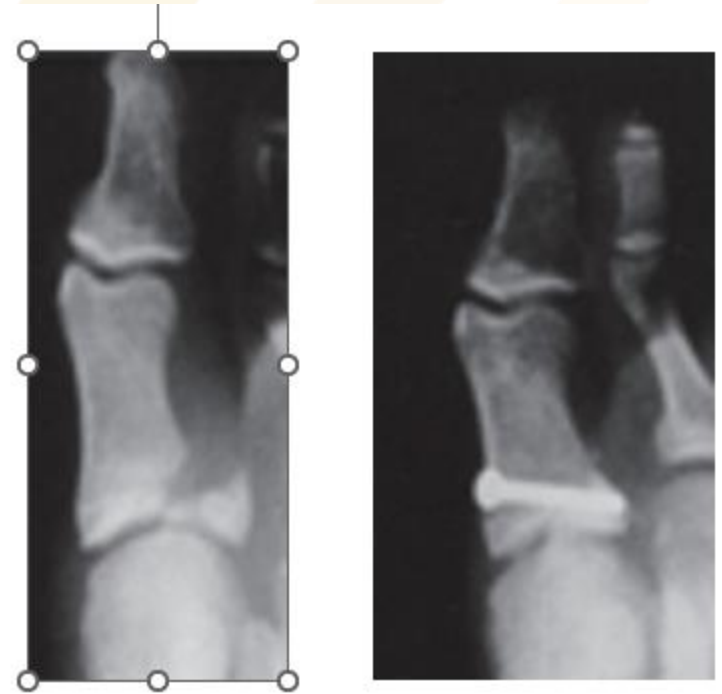


Case courtesy of Samir Benoudina, Radiopaedia.org, rID: 67151

# 1) Toe #: to refer

## All toes

- Urgent referral
  - Vascular compromise
  - Open # proximal phalanx
  - Skin compromise
  - Diabetes, immunocompromise, gross contamination
- #/ dislocations
- Irreducible/ unstable with unacceptable angulation/ displacement
  
- Intra-articular fractures
  - **Displaced**
  - **> 25 % joint surface involved**



Distal and Sesamoid Fractures  
Source: [musculoskeletalkey.com](http://musculoskeletalkey.com)

# 1) Toe #: to refer

1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:

- **Significant Comminution**



Source: [Lumus Radiology](#)

# 1) Toe #: to refer

1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:

- Significant Comminution
- **Unstable #**

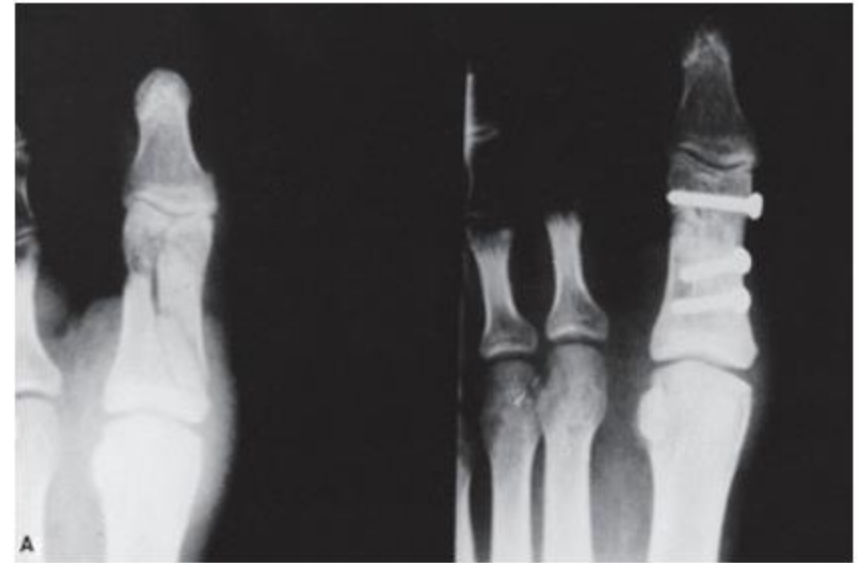


Distal and Sesamoid Fractures  
Source: musculoskeletalkey.com

# 1) Toe #: to refer

1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:

- Significant Comminution
- **Unstable #**

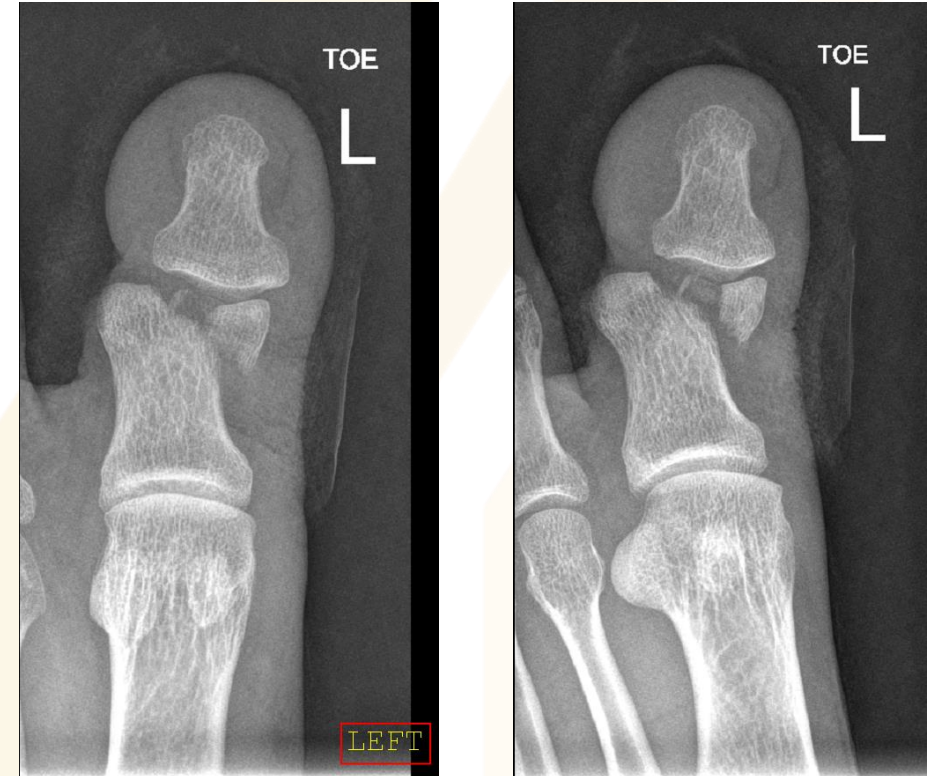


Distal and Sesamoid Fractures  
Source: musculoskeletalkey.com

# 1) Toe #: to refer

**1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:**

- Significant Comminution
- Unstable #
- **Any displacement, angulation, or rotational deformity**

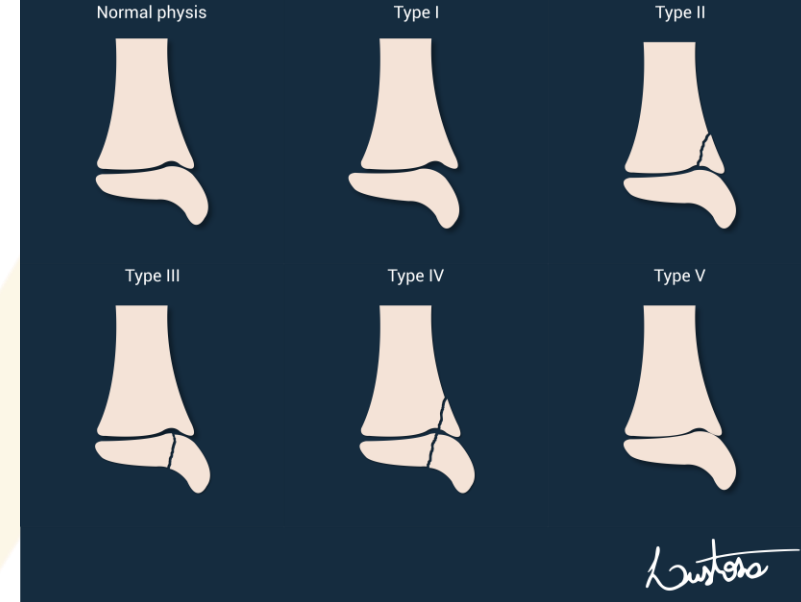


Case courtesy of Mohammad Osama Hussein Yonso, Radiopaedia.org, rID: 95915

# 1) Toe #: to refer

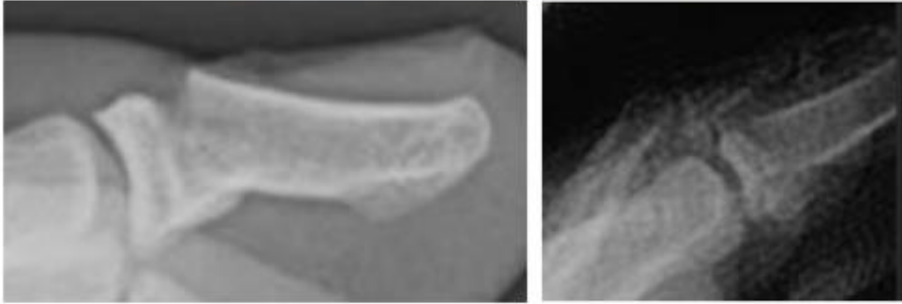
**1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:**

- Significant Comminution
- Unstable #
- Any displacement, angulation, or rotational deformity
  
- **Growth plate # even if un-displaced**



Case courtesy of Leonardo Lustosa, [Radiopaedia.org](https://radiopaedia.org).  
From the case [rID: 97497](https://radiopaedia.org/cases/97497)

# 1) Toe #



Suture Stabilisation of Open Physeal Fractures of the Great Toe Distal Phalanx (Seymour Fracture)  
Source: Reid et al., 2020

3 y.o. boy presents after tripping over a curb without shoes on. His first toe is slightly flexed and a subungual hematoma under the whole of his nail bed

# 1) Toe #: to refer

**1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:**

- Significant Comminution
- Unstable #
- Any displacement, angulation, or rotational deformity
  
- **Growth plate # even if un-displaced**
- **Seymour # - SH1 distal phalanx growth plate # with significant morbidity if missed**



Suture Stabilisation of Open Physeal Fractures of the Great Toe Distal Phalanx (Seymour Fracture)  
Source: Reid et al., 2020

# 1) Toe #: to refer

1<sup>st</sup> toe – all children & most adults due to risk of morbidity especially:

- Significant Comminution
- Unstable #
- Any displacement, angulation, or rotational deformity
- Growth plate # even if un-displaced

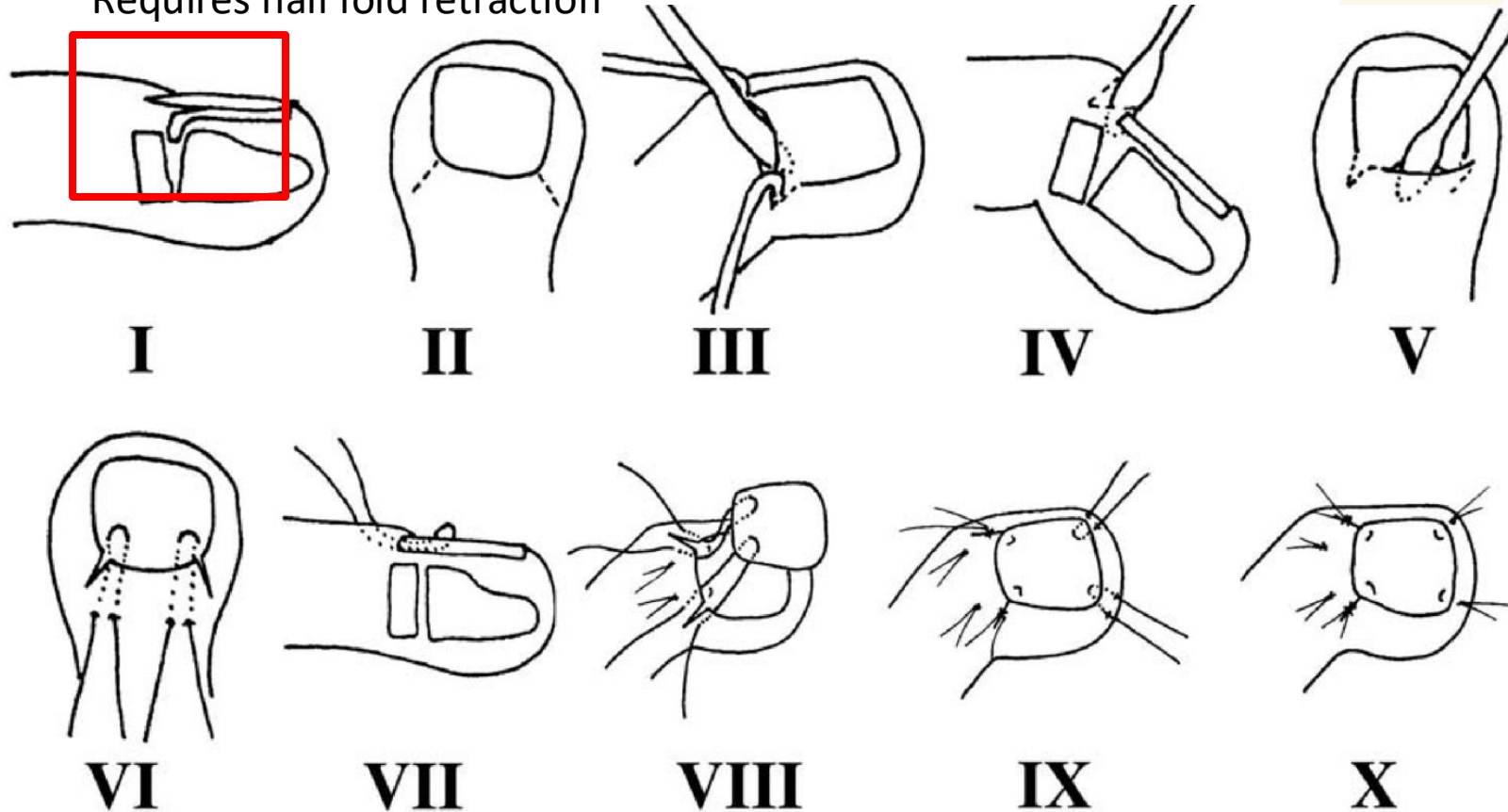
2<sup>nd</sup> – 5<sup>th</sup> toes

- **Angulation > 20 ° (AP)**
- **Angulation > 10 ° (lateral)**
- **Rotational deformity > 20°**
- **Displaced Salter Harris or angulated paediatric # within 7/7 even if successfully reduced**

# Procedure to fix Seymour #

(Reid, Deckey et al. 2021)

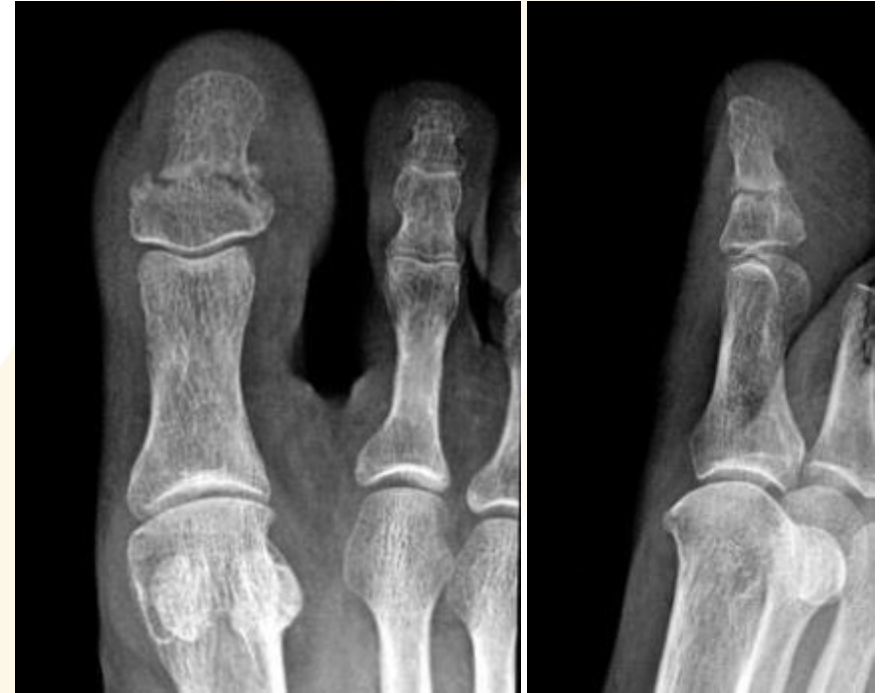
Requires nail fold retraction



# 1) Toe #: conservative management (Bica, A Sprouse et al. 2016)

## ○ 1<sup>st</sup> Toe – non-displaced

- Short moonboot or cast with toe plate 2 – 3/52
- Buddy strapping and rigid sole shoe 3 – 4/52
- Healing usually takes 4 – 6/52
- Return to work (more if high level athlete) 6 – 8/52
- Repeat x-ray:
  - Intra-articular or post reduction: 1/52 then every 2 – 3/52 to monitor # position
  - At the end of the # management episode



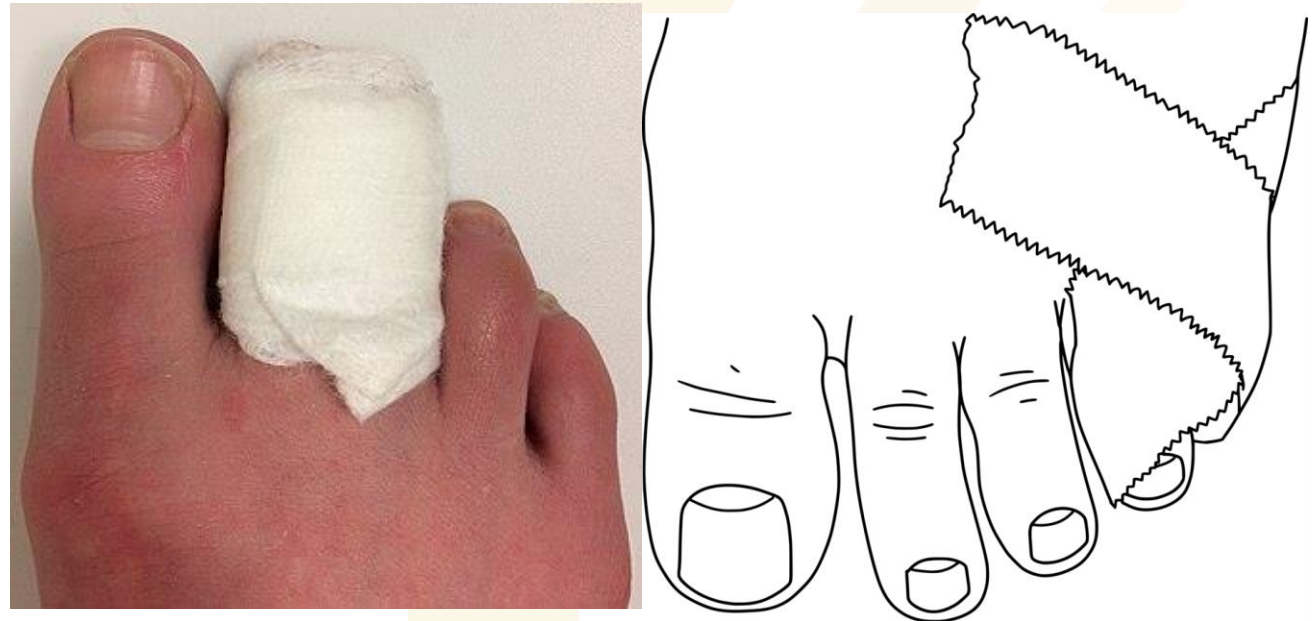
Case courtesy of Bahman Rasuli, Radiopaedia.org, rID: 99237

# 1) Toe #: conservative management (Bica et al. 2016)

## ○ 2<sup>nd</sup> to 5<sup>th</sup> Toe – non-displaced

- Non or minimally displaced
- < 25 % joint space
- Angulation
  - < 20 ° AP view
  - < 10 ° lateral view
  - < 20 ° rotational deformity

- Buddy strapping to the adjacent toe, using a rigid-sole shoe, WBAT
  - Follow-up 1 – 2/52, then every 2 – 4/52 until healed
  - Re x-ray in 7 – 10/7 for # requiring reduction
  - Healing time: 4 – 6/52



Source: [https://en.wikipedia.org/wiki/Buddy\\_wrapping](https://en.wikipedia.org/wiki/Buddy_wrapping)

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## 2) Metatarsal fracture

## 2) Metatarsal #: anatomical considerations (Cakir et al., 2011)

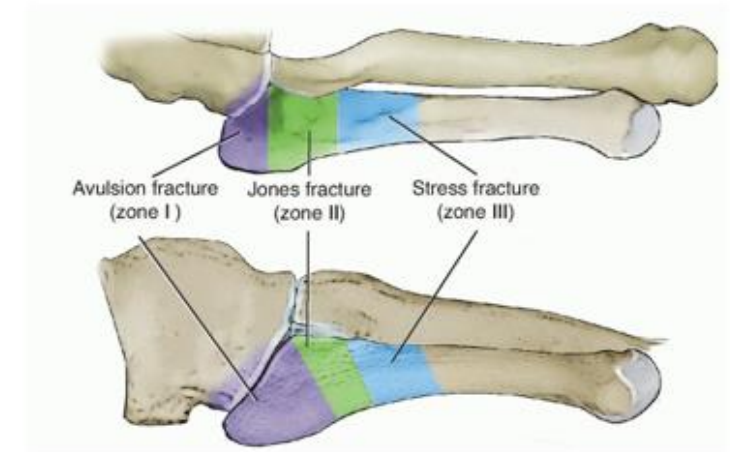
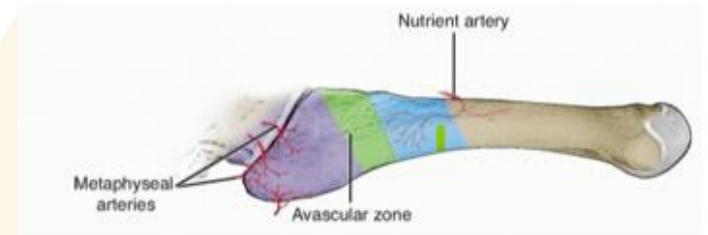
5 <sup>th</sup> MT (56%)	Central MT (39%)	1 <sup>st</sup> MT (5%)
<p>Commonest MT # as:</p> <ul style="list-style-type: none"> <li>- Less cortical thickness</li> <li>- One-sided support</li> <li>- Subject of torsional &amp; tractional forces with strong ligament &amp; capsular attachment</li> </ul>	<p>Stronger as interconnecting transverse intermetatarsal ligament &amp; intrinsic muscle fascia</p>	<p>Wider and shorter MT</p> <p>No interconnecting ligaments so can move independently</p>



[https://wikism.org/Deep\\_Transverse\\_Metatarsal\\_Ligaments](https://wikism.org/Deep_Transverse_Metatarsal_Ligaments)

## 2) Metatarsal #: anatomical considerations

- Zone 1 proximal tuberosity avulsion #
- Zone 2 Jones #
  - Metaphyseal-diaphyseal junction # involving the 4 & 5<sup>th</sup> inter-MT articulation
- Zone 3 #
  - Proximal diaphysis distal to 4 & 5<sup>th</sup> inter-MT articulation



Zones of the base of the fifth metatarsal

Source: musculoskeletalkey.com

## 2) Metatarsal #: Lisfranc joint injuries (Sherman 2018)

- 45% from falls from a height or MVA's & associated with proximal MT #
- Dr Jacques Lisfranc de St. Martin noted # pattern in calvary men & described an amputation through TMTJ
- OE: significant swelling, bruised, midfoot pain worse on abduction/ pronation & difficulty weightbearing
- Imaging – **weightbearing** X-ray or CT often required:
  - X-ray may be normal
    - +/- subtle TMT joint space widening
    - widening between the 1<sup>st</sup> & 2<sup>nd</sup> MT or base of 2<sup>nd</sup> MT #
- Rare but up to 20% misdiagnosis & high morbidity from chronic pain & functional disability
- Immobilise & refer



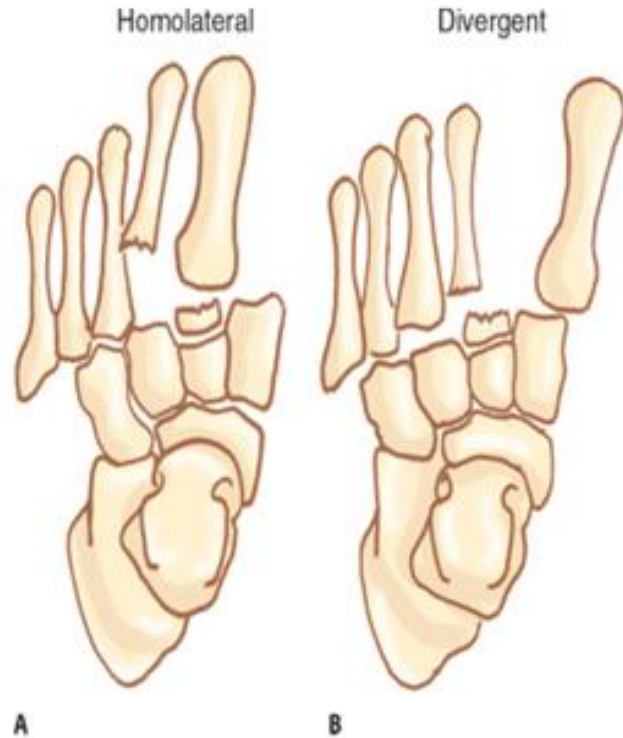
Source: X



Case courtesy of Henry Knipe, Radiopaedia.org, rID: 41630

## 2) Metatarsal #: Lisfranc joint injuries (Sherman 2018)

### Types of Lisfranc fracture – dislocations



Source: Scott C. Sherman  
Simon's Emergency Orthopedics, Eighth Edition  
Copyright © McGraw-Hill Education. All rights reserved.

1. **Homolateral** - more common with lateral displacement of 4 or 5 MTs in same direction
1. **Divergent** occurs between 1<sup>st</sup> & 2<sup>nd</sup> MT where ligament attachment is weakest

## 2) Metatarsal: # to refer (Bica et al, 2016)

- All open & # dislocations
- Multiple #
- Comminuted

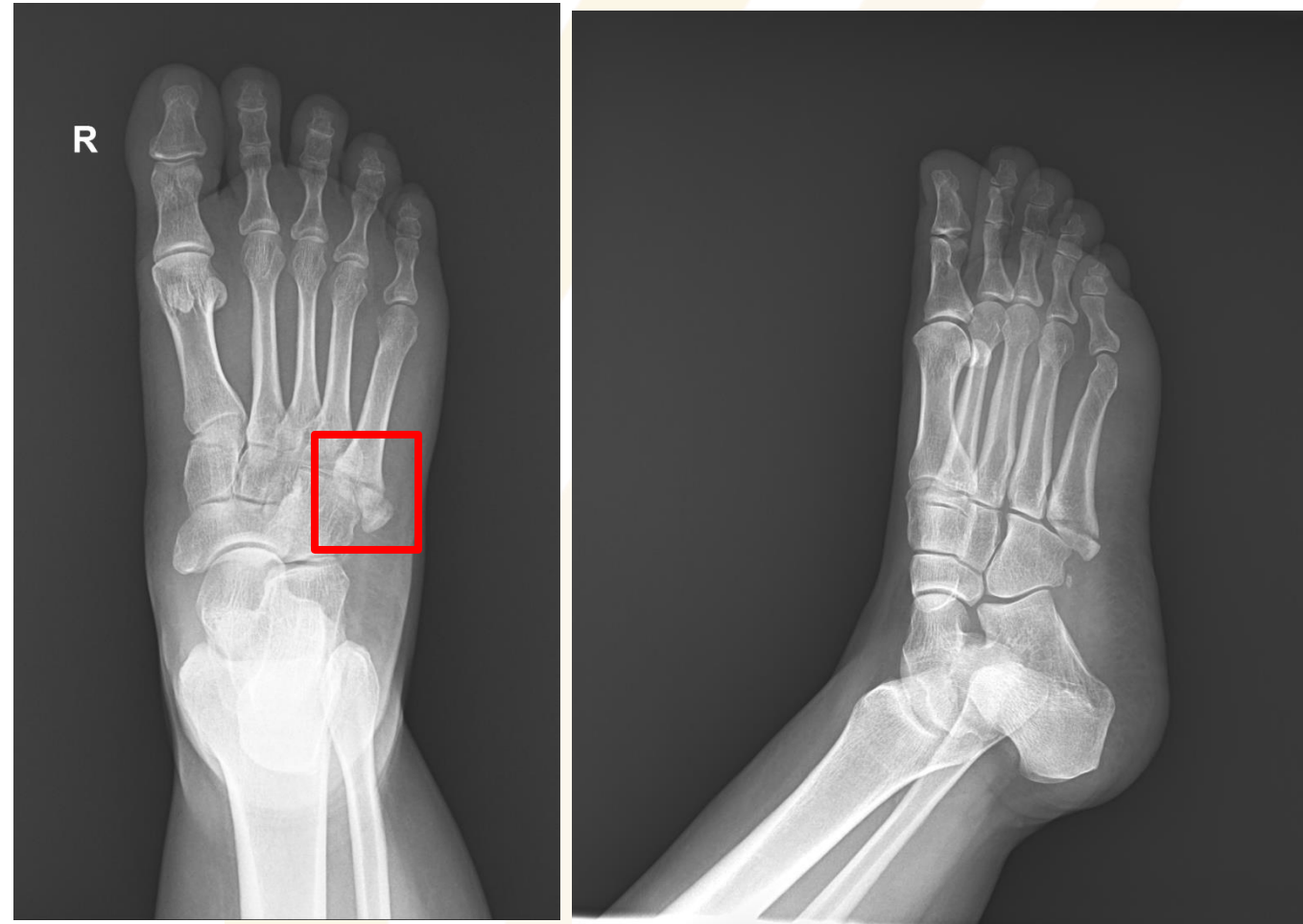
### Zone 1 base of 5<sup>th</sup> MT

#### Displacement:

- Rotational
- > 3 mm

Step-off > 1 -2 mm on articular surface of cuboid

# fragment > 60% MT-cuboid joint surface



Case courtesy of Aayush Agrawal, Radiopaedia.org, rID: 223401

## 2) Metatarsal: # to refer (Bica et al, 2016)

- All open & # dislocations
- Multiple #
- Comminuted

Zone 1 base of 5 <sup>th</sup> MT	Zone 2 base of 5 <sup>th</sup> MT
Displacement: - Rotational - > 3 mm	<b>Displacement &gt; 2 mm</b>
Step-off > 1 -2 mm on articular surface of cuboid	<b>10/52 conservative therapy with non-union on Xray</b>
# fragment > 60% MT-cuboid joint surface	<b>Athletes or those with high levels of activity</b>



Case courtesy of Ammar Haouimi, Radiopaedia.org, rID: 81954

## 2) Metatarsal: # to refer (Bica et al, 2016)

- All open & # dislocations
- Multiple #
- Comminuted

Zone 1 base of 5 <sup>th</sup> MT	Zone 2 base of 5 <sup>th</sup> MT	Zone 3 base of 5 <sup>th</sup> – stress
Displacement: - Rotational - > 3 mm	Displacement > 2 mm	<b>All because of high rates of non union</b>
Step-off > 1 -2 mm on articular surface of cuboid	10/52 conservative therapy with non-union on Xray	
# fragment > 60% MT-cuboid joint surface	Athletes or those with high levels of activity	



Case courtesy of Andrew Dixon, Radiopaedia.org, rID: 36631

## 2) Metatarsal #: conservative (Bica, Sprouse et al., 2016)

- See 0, 1/52, then 4-6/52
- X-Ray at all three encounters

### Non-displaced #1<sup>st</sup> or 2<sup>nd</sup> – 5<sup>th</sup> MT shaft

Moon boot or cast with toe plate 6/52 with **NWB until first review**

See 1 & 6/52

Healing time 6/52



Case courtesy of Derek Smith, Radiopaedia.org, rID: 58068

## 2) Metatarsal #



Source: [Lumus Radiology](#)

25 y.o. male basketball player rolls his ankle after going up for a jump shot. He is tender over the base of the 5<sup>th</sup> metatarsal.

## 2) Metatarsal conservative (Bica, Sprouse et al., 2016)

- See 0, 1/52, then 4-6/52
- X-Ray at all three encounters

### Zone 1 base of 5<sup>th</sup>

#### Non-displaced

- compression bandage 2 – 3/52 as effective as orthoses
- follow-up 4 – 7/7 with exercises & physiotherapy
- orthoses/ hard soled shoe if marked pain

#### Displaced < 3 mm

- orthoses 2/52 then progressive ambulation & physiotherapy
- repeat X-ray 6 – 8/52 & assess healing or sooner if persistent localised pain or pain on walking > 4/52



## 2) Metatarsal #: conservative (Bica, Sprouse et al., 2016)

- See 0, 1/52, then 6 - 7/52
- X-Ray at all three encounters

### Zone 2 base of 5<sup>th</sup>

**NWB** Moonboot/ back slab

At 7-10/7: **NWB cast until 6/52**

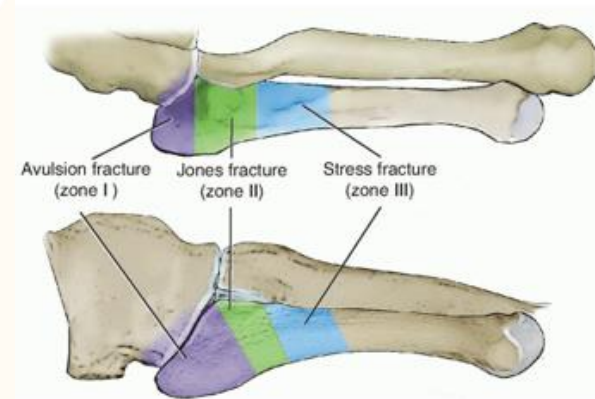
At 7/52: If clinically healed and X-Ray shows healing – gentle mobilisation otherwise 4/52 more in orthoses

Healing time 6 – 12/52

Refer if not healed after 12/52



Case courtesy of Mohammad Osama Hussein Yonso, Radiopaedia.org, rID: 96197



Zones of the base of the fifth metatarsal

Source: musculoskeletalkey.com

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## 3) Hindfoot fractures: Calcaneus & talus

# 3) Hindfoot #

Main messages:

## 1) Refer all hindfoot #'s:

- Poor clinical outcomes whether treated nonoperatively or operatively

## 2) Have a low threshold to request a CT scan

- X-rays are the initial screening tool for foot & ankle injuries but:
  - 74% sensitivity for talar # (Schwartz et al., 2020)
  - 87% sensitivity for calcaneal # (Radiopaedia, 2023)

Case courtesy of Mohammad Osama  
Hussein Yonso, Radiopaedia.org, rID: 90127



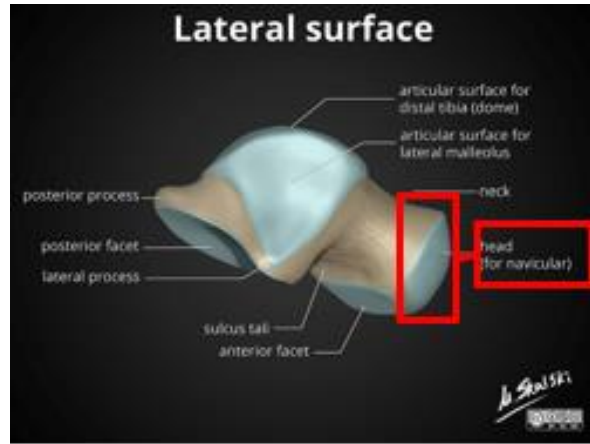
### 3) Hindfoot: Talus #

- **Major talus #**
  - Head, neck, & central body
- **Minor talus # - not involving central body**
  - Lateral & posterior process + talar dome



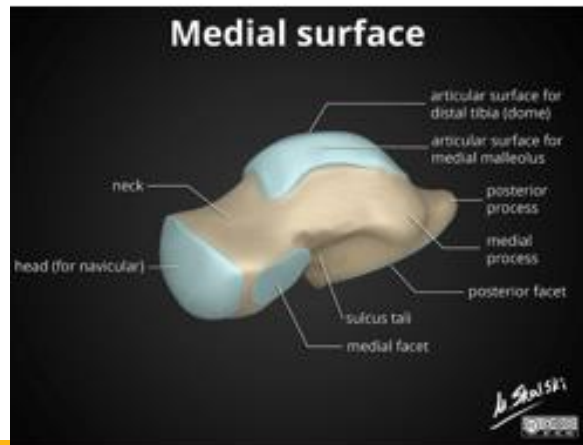
Case courtesy of Samir Benoudina, Radiopaedia.org, rID: 154889

### 3) Hindfoot: Talus - anatomy

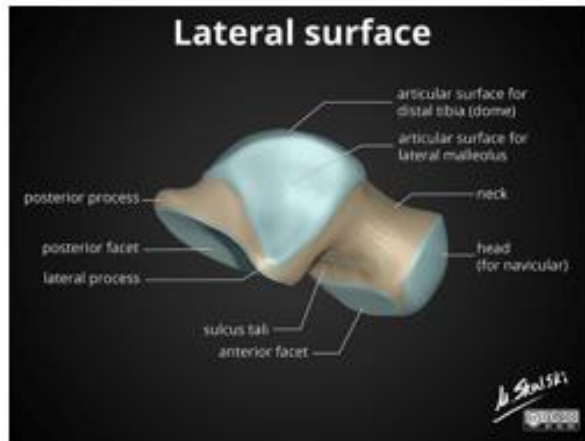


- **Head** – attaches the navicular

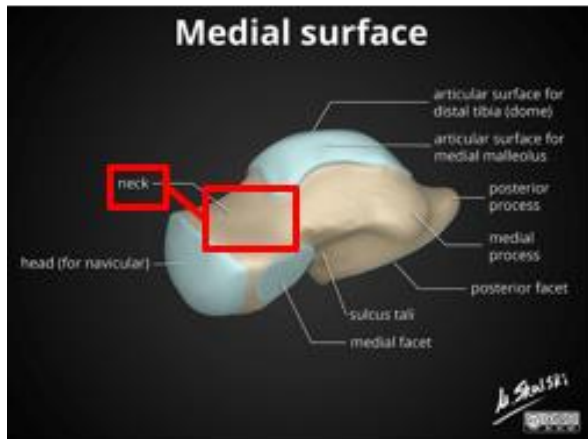
Case courtesy of Matt Skalski, Radiopaedia.org, rID: 31891



### 3) Hindfoot: Talus - anatomy

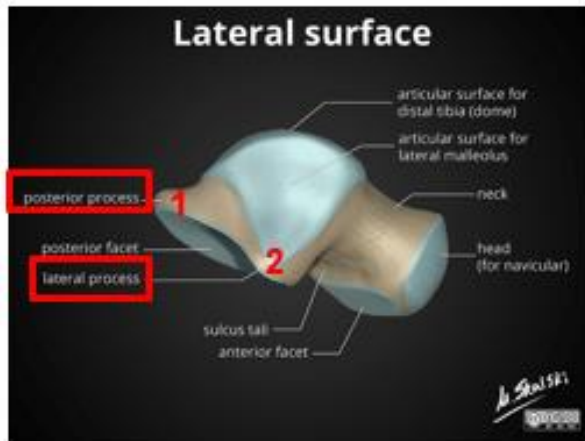


Case courtesy of Matt Skalski, Radiopaedia.org, rID: 31891



- Head
- Neck
  - weakest part
  - 50% of talus #
  - high rate of avascular necrosis d.t. retrograde blood supply
  - Hawkin's Classification correlating with AVN risk

# 3) Hindfoot: Talus - anatomy



Case courtesy of Matt Skalski, Radiopaedia.org, rID: 31891



- Head
- Neck
- **Body** – high rates of OA with intra-articular #
  - 1. Posterior process
  - 2. Lateral process
  - 3. Dome
  - 4. Medial process

# 3) Hindfoot: Talus # - examination & imaging

- **Examination**

- Other orthopedic injuries (48-59%)
- Neurovascular status
- Skin blanching & necrosis in displaced body #

- **X-Ray/ CT for clinical suspicion for talus #**

- 74% sensitivity for talar # (Schwartz et al., 2020)
- CT confirms the fracture is un-displaced with no step-off
- Assesses the 89% incidence of ipsilateral foot injuries



AdobeStock\_1766986374

### 3) Hindfoot: Talar neck # (50%) Hawkin's classification

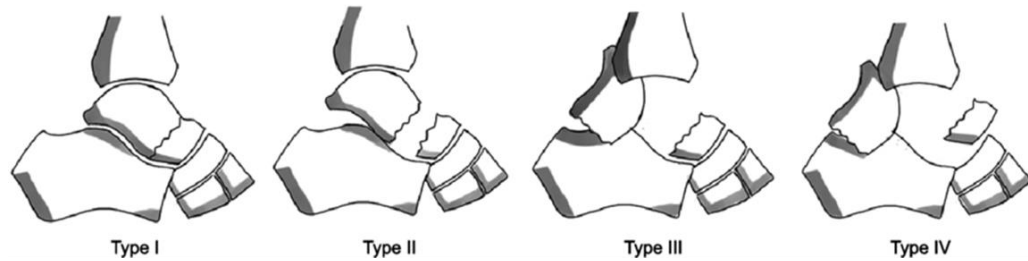


Fig. 1. Hawkin's classification of talar neck fractures.  
Available via license: [CC BY-NC 4.0](https://creativecommons.org/licenses/by-nc/4.0/)

#### AVN Risk:

- Type I (22%) - non-displaced 0 – 13%
- Type II (43%) - subtalar dislocation 20 – 50%
- Type III (31%) - subtalar & tibiotalar dislocation 20 – 100%
- Type IV(4%) - subtalar, tibiotalar & talonavicular dislocation 70 – 100%

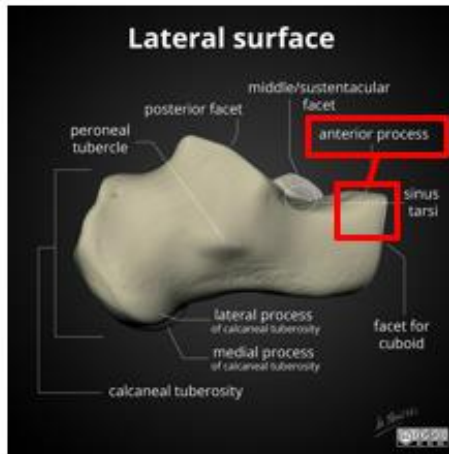
# 3) Hindfoot: Talus # management

- Elevation, non-weightbearing cast & crutches
- **Acute referral**
  - Displaced fragments -> instability of the talonavicular joint
  - Articular step-off or > 50% articular surface
  - Comminuted & displaced body #
- **Otherwise # clinic referral**



Case courtesy of Shervin Sharifkashani, Radiopaedia.org, rID: 148895

### 3) Hindfoot: Calcaneus - anatomy

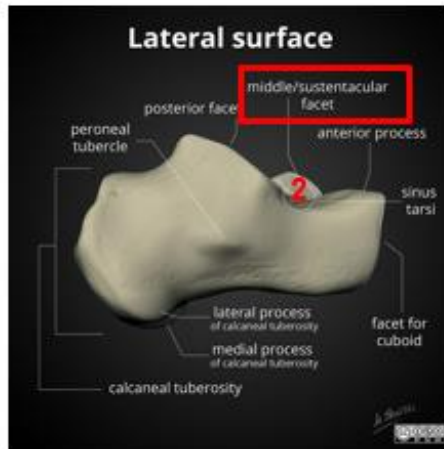


Case courtesy of Matt Skalski,  
Radiopaedia.org, rID: 23709

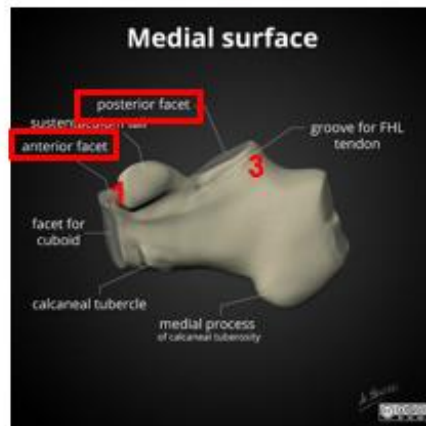


- **Anterior process**
  - articulates cuboid at calcaneocuboid joint

# 3) Hindfoot: Calcaneus - anatomy

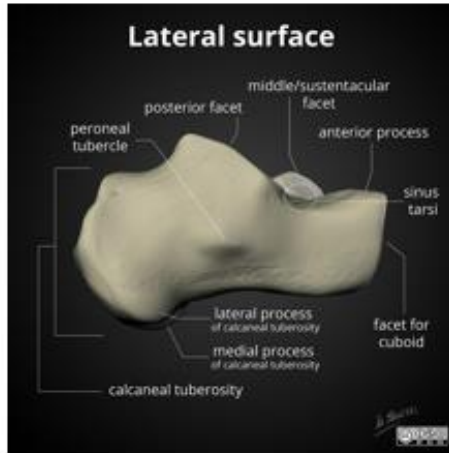


Case courtesy of Matt Skalski,  
Radiopaedia.org, rID: 23709

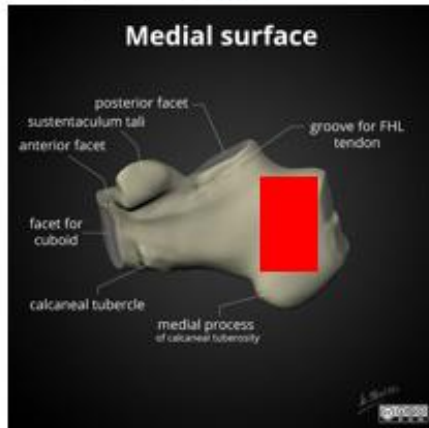


- Anterior process
- **Subtalar joint**
  - main factor in assessing # is involvement of subtalar joint with three facets:
    1. Anterior facet
    2. Medial/ sustentacular facet
    3. Posterior facet - extension into this = intra-articular #

# 3) Hindfoot: Calcaneus - anatomy

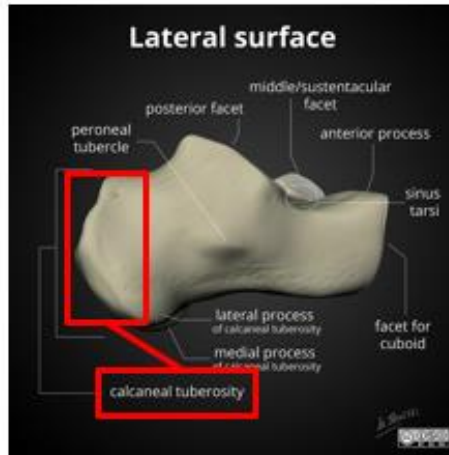


Case courtesy of Matt Skalski,  
Radiopaedia.org, rID: 23709

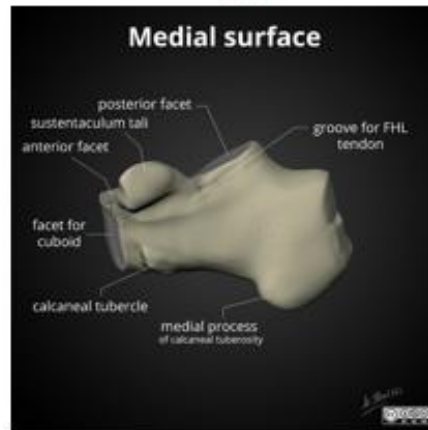


- Anterior process
- Subtalar joint
- **Body**
  - below ankle joint & posterior to talus

# 3) Hindfoot: Calcaneus - anatomy

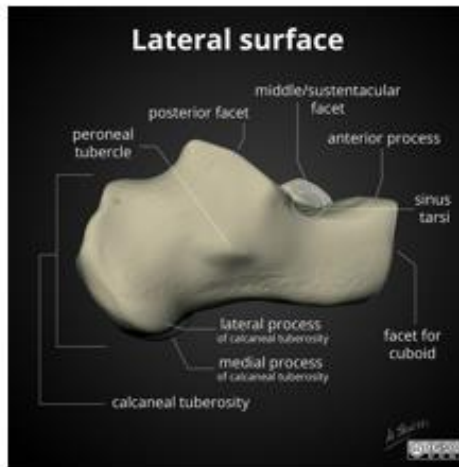


Case courtesy of Matt Skalski,  
Radiopaedia.org, rID: 23709

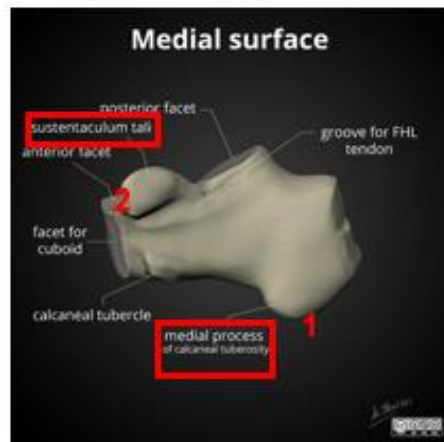


- Anterior process
- Subtalar joint
- Body
- **Tuberosity – posterior**
  - Medial & lateral base – plantar fascia inserts
  - TA inserts into posterior part

### 3) Hindfoot: Calcaneus - anatomy



Case courtesy of Matt Skalski,  
Radiopaedia.org, rID: 23709



- Anterior process
- Subtalar joint
- Body
- Tuberosity
- **Medial surface**
  - Medial process
  - Sustentaculum tali – supports ant & med facets, post part of talar head & has FHL pass inferiorly

### 3) Hindfoot: Calcaneus # - examination

- Usually, patients are non-weightbearing
- Foot
  - Medially: Swelling and bruising which can spread proximally
  - **Mondor's sign pathognomonic:** Pain, swelling & plantar bruising
  - From behind: Heel wider, flatter, & valgus tilting
- Other injuries
  - Extension to calcaneocuboid joint (63%)
  - Contralateral calcaneal fractures (10%)
  - Wedge compression fractures at the dorsolumbar junction (5-10%)
  - Upper limb injuries e.g. wrist

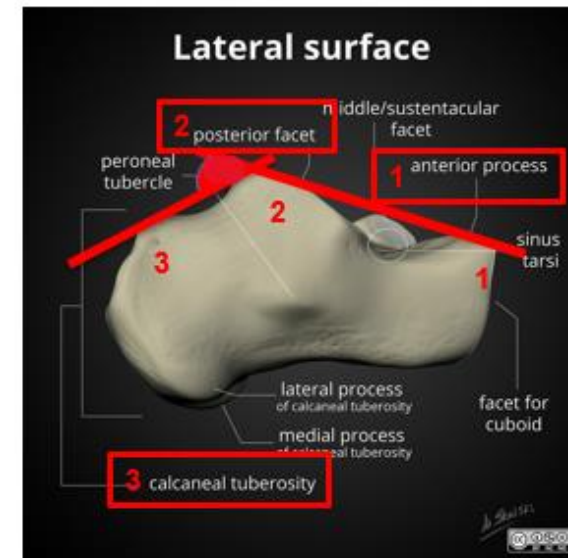


Mondor's sign  
Source: Diane & al, 2025

### 3) Hindfoot: Calcaneus # - imaging – X-ray

#### Bohler's angle

- Between the high points of the anterior process, posterior facet & calcaneal tuberosity
- Normal is  $> 25 - 40^\circ$  (Radiopaedia 2023)
- Reduced in displaced intra-articular # & associated with severity & functional outcome



Case courtesy of Matt Skalski, [Radiopaedia.org](https://radiopaedia.org), rID: 23709

### 3) Hindfoot: Calcaneal #



40 y.o. lady falls from a ladder when she is removing leaves from her gutter. Her feet are 2 m off the ground when she is on the ladder. She is unable to weight bear and has swelling and tenderness over her hindfoot.

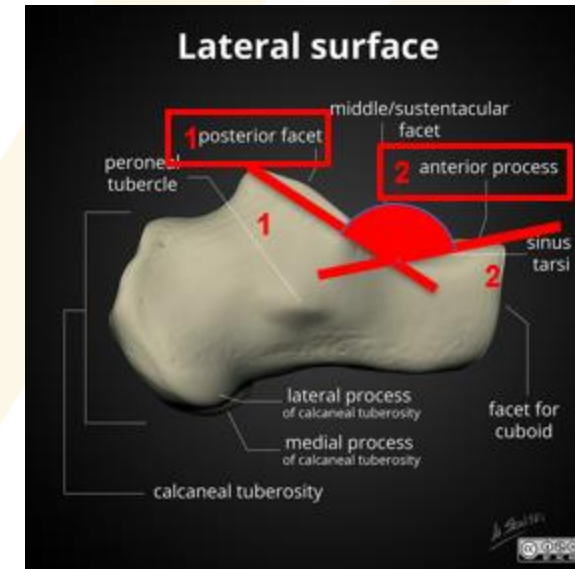
# 3) Hindfoot: Calcaneal #



### 3) Hindfoot: Calcaneus # - imaging – X-ray

#### Gissane's crucial angle

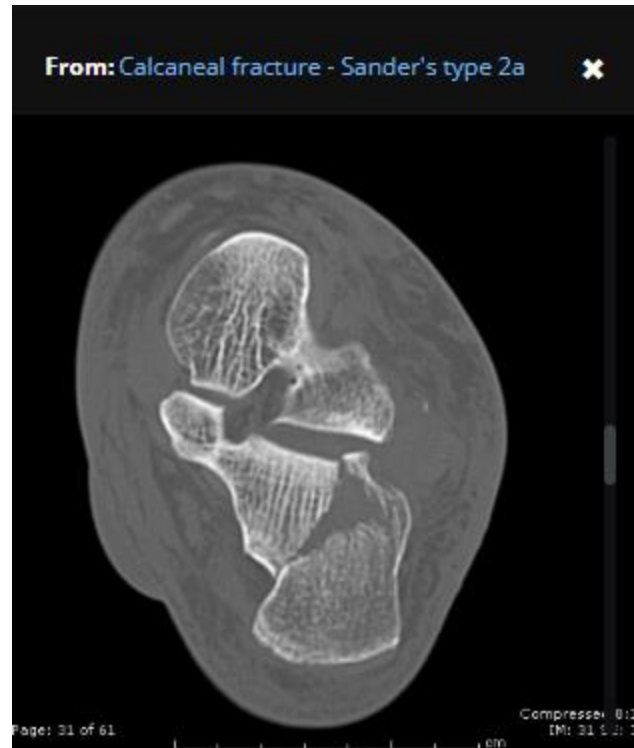
- intersection of lines from the posterior facet & anterior process
- normal <math>< 120 - 145^\circ</math> (Radiopaedia 2025)



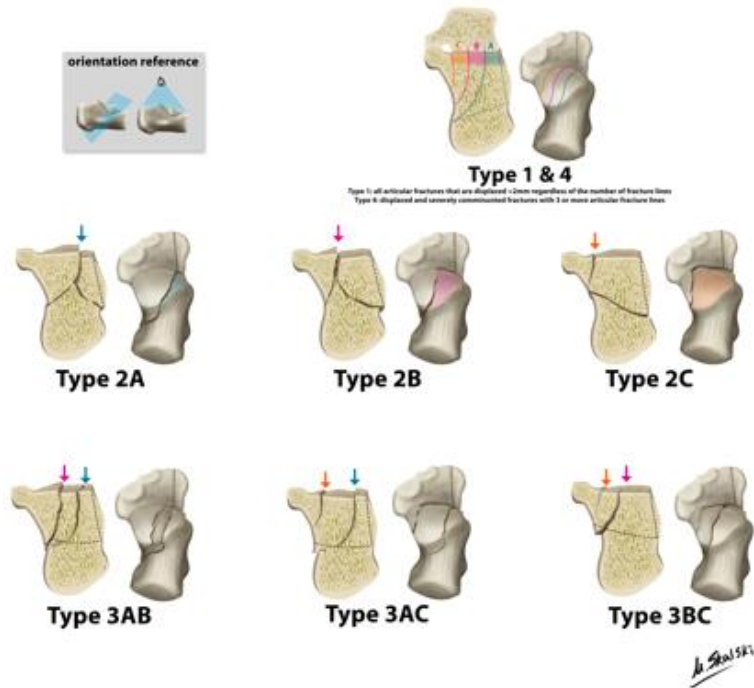
Case courtesy of Matt Skalski, Radiopaedia.org, rID: 23709

### 3) Hindfoot: Calcaneus # imaging – CT – Sander’s classification for intra-articular #

**Based on a coronal slice of a CT at the widest profile of the posterior facet of the calcaneus (White et al. 2016)**



### 3) Hindfoot: Calcaneus # imaging – CT – Sander's classification for intra-articular #



Type 1 – all un-displaced # < 2 mm articular displacement (despite numbers of # lines)

Type 2 – One primary # line with two fragments

Type 3 – Two primary # lines with three fragments

Type 4 – Three or more primary # lines, comminuted (= 4+ fragments)

#### Subclassifications are:

A) # **lateral** posterior facet

B) # **middle** posterior facet

C) # **medially** at neck of sustentaculum tali

Case courtesy of Matt Skalski, Radiopaedia.org, rID: 27026

### 3) Hindfoot #: Calcaneus # - assessment

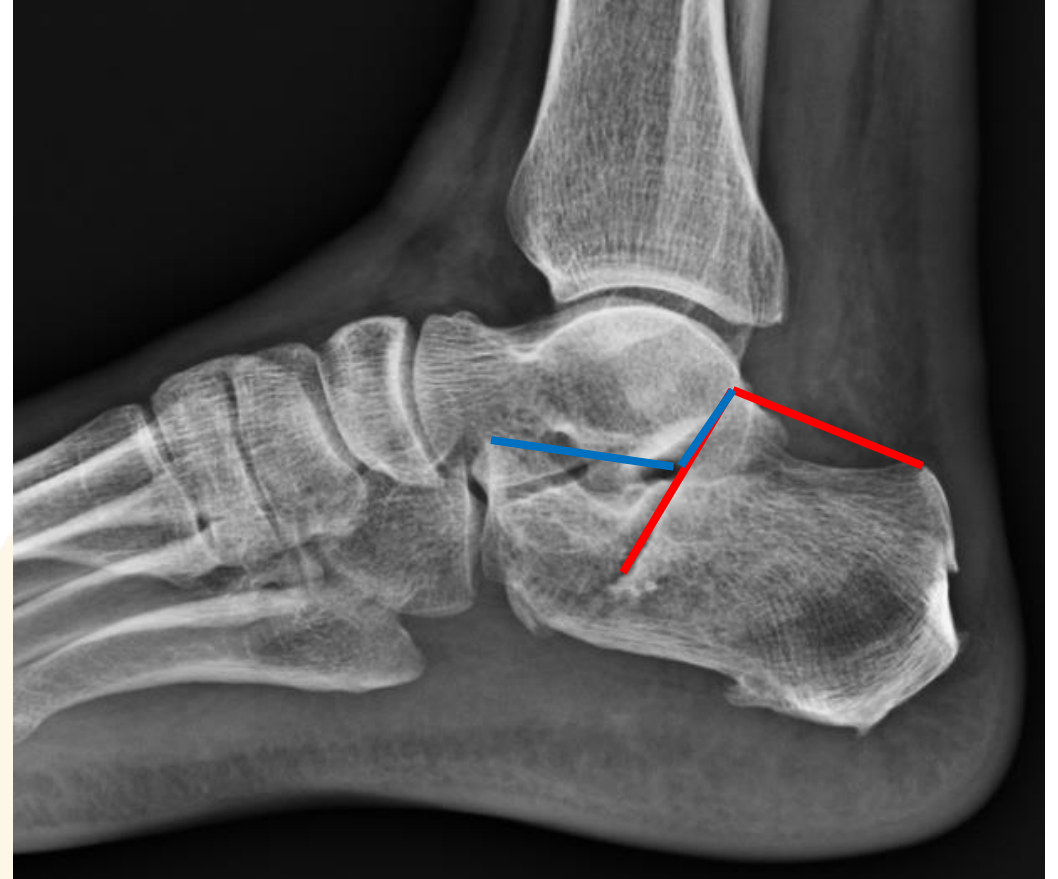
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- **Main factor in assessing fractures is involvement of subtalar joint which has anterior, middle & posterior facets**

- **Intra-articular #** (75% if avulsion # not included)
  - extends into the **posterior facet joint**
- **Extra-articular #** (25% calcaneal #)
  - not involving **posterior facet joint**
  - Includes # of:
    - Body
    - Tuberosity
    - Medial & lateral calcaneal process
    - Sustentaculum tali
    - Anterior process

# 3) Hindfoot: Calcaneal # management

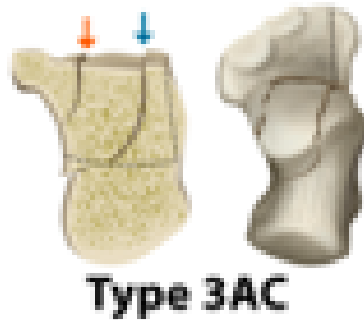
- Below-knee non walking back-slab with crutches
- **Acute referral:**
  - Significant swelling – because of risk of compartment syndrome
  - Displaced #
    - Sanders Type 2 – 4 #
    - Sustentaculum tali #
  - Open #
  - Neurovascular compromise
  - Comminuted
  - Tongue type & tuberosity avulsion #
    - risks skin necrosis
    - Splint in slight plantar flexion
- **Otherwise # clinic referral**



Case courtesy of Hemilianna Hadassa Silva Matozinho, Radiopaedia.org, rID: 82491

# 3) Hindfoot: Calcaneal # management

- Below-knee non walking back-slab with crutches
- **Acute referral:**
  - Significant swelling – because of risk of compartment syndrome
  - Displaced #
    - Sanders Type 2 – 4 #
    - Sustentaculum tali #
  - Open #
  - Neurovascular compromise
  - Comminuted
  - Tongue type & tuberosity avulsion #
    - risks skin necrosis
    - Splint in slight plantar flexion
- **Otherwise # clinic referral**



There are primary intra-articular fracture lines extending through lateral and medial aspects of the calcaneus, consistent with type 3ac of Sanders CT classification.

Case courtesy of Hemilianna Hadassa Silva Matozinho, Radiopaedia.org, rID: 82491

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## 4) Ankle fracture

# 4) Ankle: examination

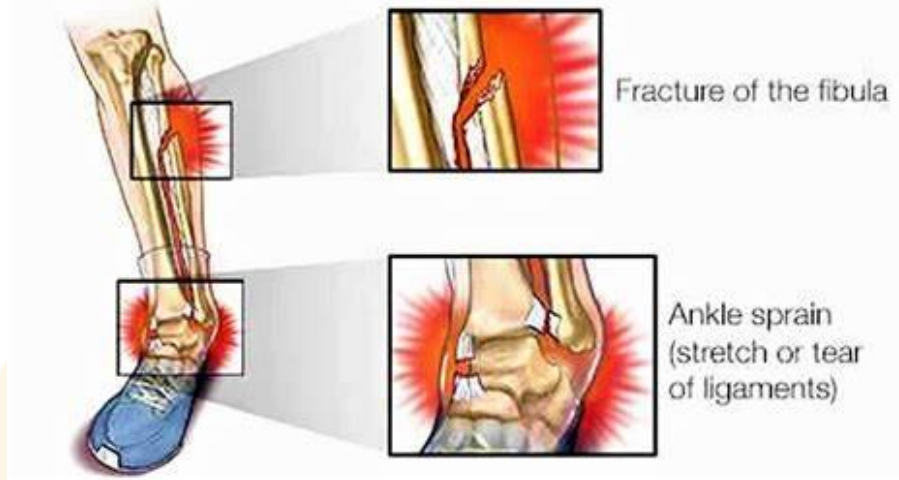
## ○ Inspection

- Skin breaks & blisters ? open # (2%)
- Deformity

## ○ Palpation

- Whole of fibula ? syndesmosis injury or Maisonneuve #  
- Hopkin's squeeze test
- Talar dome ? chondral injury
- Base of 5<sup>th</sup> MT & tarsal bones especially navicular
- Peroneal tendon tears **4%** - pop with dorsiflexion injury to the lateral ankle, instability/ tenderness posterior to lateral malleolus, & positive anterior drawer
- Neurovascular status

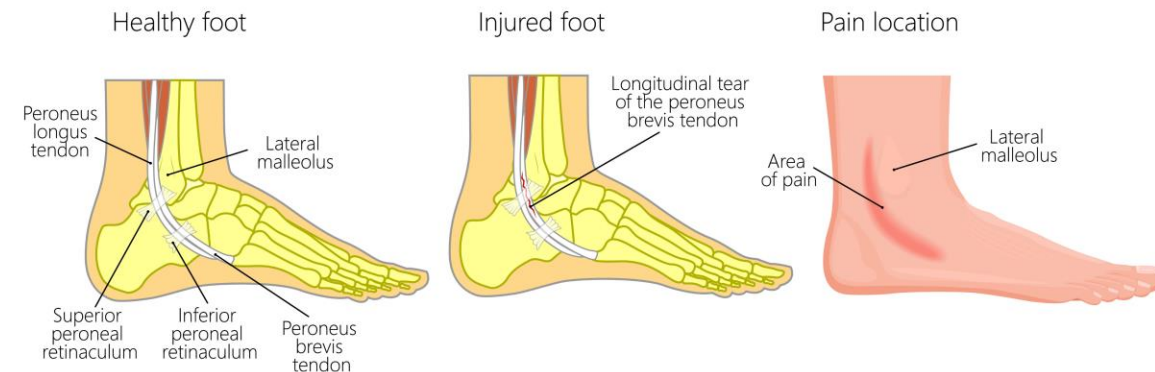
## Maisonneuve Fracture



Source: healthjade.net

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## LONGITUDINAL TEAR OF THE PERONEUS BREVIS TENDON



# 4) Ankle indications for imaging: Ottawa rules - malleolar

Ankle x-ray is only needed if there is:

- Bony tenderness only distal 6 cm posterior edge of the tibia or tip of **medial malleolus**
- Bony tenderness only distal 6 cm posterior edge of the fibula or tip of **lateral malleolus**
- Inability to weight bear both immediately & in ED (four steps)

**Ottawa Ankle Rules** MD-CALC

**Lateral View**      **Medial View**

Posterior edge/tip of lateral malleolus **A**      Malleolar Zone  
Base of 5th metatarsal **C**      Midfoot Zone  
6cm      6cm      Posterior edge/tip of medial malleolus **B**  
Navicular **D**

Stiell IG, McKnight RD, Greenberg GH, McDowell I, Nair RC, Wells GA, Johns C, Worthington JR. Implementation of the Ottawa ankle rules. JAMA. 1994 Mar 16;271(11):827-32.  
© Original Illustration, Ottawa Health Research Institute, adapted for use on MDcalc.com

Location of pain	<input checked="" type="checkbox"/> Malleolar	<input type="checkbox"/> Midfoot
Bone tenderness at A Posterior edge or tip of lateral malleolus	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
Bone tenderness at B Posterior edge or tip of medial malleolus	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes
Inability to bear weight both immediately after injury AND in ED Patient unable to take four steps	<input checked="" type="checkbox"/> No	<input type="checkbox"/> Yes

**Ruled out**  
Ankle x-ray series not indicated.

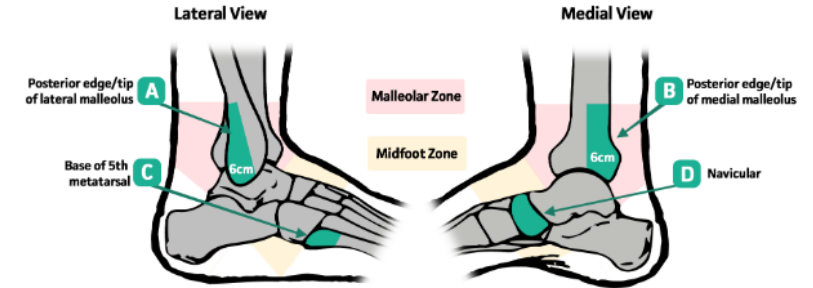
Source: mdcalc.com

# 4) Ankle indication for imaging: Ottawa rules - midfoot

Foot x-ray is only needed if:

- Bony tenderness base of 5<sup>th</sup> MT
- Bony tenderness at navicular
- Inability to bear weight both immediately after injury & in ED

## Ottawa Ankle Rules MD CALC



Stiell IG, McKnight RD, Greenberg GH, McDowell I, Nair RC, Wells GA, Johns C, Worthington JR. Implementation of the Ottawa ankle rules. JAMA. 1994 Mar 16;271(11):827-32.

© Original illustration, Ottawa Health Research Institute, adapted for use on MDcalc.com

Location of pain	Malleolar	
	<b>Midfoot</b>	
Bone tenderness at C Base of 5th metatarsal	<b>No</b>	Yes
Bone tenderness at D Navicular	<b>No</b>	Yes
Inability to bear weight both immediately after injury AND in ED Patient unable to take four steps	<b>No</b>	Yes

Source: mdcalc.com

## 4) Ankle #: Management conservative

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**Ankle # & ligamentous injuries frequency co-exist, so a treatment plan is needed for both**

# 4) Ankle # management: conservative

(Iliopoulos 2014; Kortekangas et al, 2019; Eliff 2020, Stassen et al, 2024)

- Isolated lateral malleolus # without talar shift & <2mm displacement
  - Small nondisplaced avulsion # of tip - early immobilisation like ankle sprain with ankle brace
  - Oblique at or below ankle joint/ Isolated nondisplaced medial or posterior malleolar #
    - Immobilise in Moonboot or cast 4 – 6/52
    - 10-14/7 - Review & repeat X-Ray
    - 4/52 – gradual weightbearing if nontender & X-Ray shows callus otherwise immobilise 2/52 more & re-Xray 6/52
- Nondisplaced # distal 1/3 fibula shaft – as per isolated medial malleolar # but follow-up Xray 7 – 10/7 to check talar shift with 6 – 8/52 immobilisation
  - Recent studies without talar shift & < 2 mm displacement - **WBAT** in Moonboot 6/52 with weightbearing X-ray 1/52 to assess talar shift
- Un-displaced SH 1 & 2 # (RCH Melbourne, 2026)
  - **NWB** bearing cast, review 4/52 for x-ray & review with **WBAT**

## 4) Ankle # management: referral

- Isolated **medial** malleolus # with any talar shift
- Isolated **lateral** malleolus # with any talar shift or > 2 mm displacement
- Tibial plafond #
- Posterior malleolar # - all if can especially if:
  - > 25 % of articular surface
  - > 2 mm articular step-off
  - Syndesmotic instability
  - Posterior subluxation of talus
- Bimalleolar or bimalleolar equivalent
  - (deltoid ligament tear with fibular #)
- Tri malleolar #
- High fibular # - Weber C & Maisonneuve #
- Symptomatic non-unions
- #-dislocations
- Open #
- SH 3 – 5 #

## 4) Ankle #



Source: [Lumus Radiology](#)

30 y.o. soccer player twists his ankle when changing direction in a game. He has tenderness and swelling over both malleoli and is unable to weightbear.

## 4) Ankle # management: referral - bimalleolar #



Same injury 6/52 later with metallic buttons medial distal tibia suggesting syndesmotic repair

Source: [Lumus Radiology](#)

## 4) Ankle # management: referral – Salter Harris III – V #

Un-displaced SH type III # distal tibia = Tillaux #



Source: [Lumus Radiology](#)

# Summary:

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- 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**

# I Need Your Feedback

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Prefer paper?

On the form in front of you, please score me and the content I shared with you today.

**AFTER THE CONVENTION**

You may claim CME here [www.urgentcareassociation.org/learning-center/cme/](http://www.urgentcareassociation.org/learning-center/cme/)



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